

SECTION 23 25 00 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Manufacturer data. Schedule of insulation applications

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation, Jackets, Adhesives, And Coatings, Shall Comply With The Following:
 - 1. Treatment of jackets or facings for flame and smoke safety must be permanent. Water soluble treatments not permitted.
 - 2. Insulation, including finishes and adhesives on the exterior surfaces of ducts, pipes, and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
 - 3. Asbestos or asbestos bearing materials are prohibited.
 - 4. Latest edition of the New York State Energy Code.

2.2 PIPE INSULATION

- A. Fiberglass:
 - 1. Preformed rigid sectional pipe covering, 4 lb. nominal density fiberglass. Maximum thermal conductivity (k), on a flat surface, shall be 0.23 Btu/ft²•hr. • F/in. at 75°F mean temperature. White Kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn.
- B. Flexible Closed Cell Type
 - 1. Insulation material shall be flexible, cellular elastomeric, molded, ozone resistant, 6pcf density, and shall comply with ASTM C534. Thermal conductivity "k" shall be 0.28 at 75F, ASTM C177 and C158. Minimum service temperature shall be -40F. Maximum service temperature shall be 220F.
 - 2. Maximum moisture absorption shall be 1.0% by volume, ASTM D1056. Moisture vapor transmission shall be 0.20 perm inches, ASTM E96.

3. Maximum flame spread shall be 25 per ASTM E84. Maximum smoke developed shall be 50 (2" thickness and below) per ASTM E84.
4. For all exterior piping and for piping exposed to ultraviolet radiation, provide a protective insulation coating (Rubatex 374 or equal). Apply with waterproof vapor barrier adhesive.

2.3 CALCIUM SILICATE

- A. Asbestos free, hydrous calcium silicate, 12 lbs/cu. ft. density minimum. Maximum thermal conductivity (k) shall be 0.42 Btu/Sq. Ft. Hr. °F/In. at 200°F.

2.4 ENGINE EXHAUST AND ENGINE EXHAUST EQUIPMENT INSULATION

- A. High temperature ceramic fiber insulation with a minimum operating temperature range of 0°F to 1800°F, 6 lb.cu.ft nominal density, and thermal conductivity (k) shall be 0.47 Btu/ft²•hr. • F/in. at 500°F mean temperature.
- B. High Temperature Flexible Blanket Type: Long glass fiber blanket, factory applied, fiberglass yarn, reinforced aluminum foil faced vapor seal. Vapor barrier shall be aluminum foil reinforced with fiberglass yarn mesh laminated to 40-pound fire-resistant kraft paper. Facing shall have a maximum permeance of 0.02 perms. Density shall be 1.0#/cu.ft.. Maximum operating temperature shall be 1500 °F. Thermal conductivity (k) shall be 0.51 Btu/ft²•hr. • F/in. at 500°F mean temperature.
- C. Provide 0.016" embossed aluminum jacket to cover insulation. Jacket shall NOT have paper liner.

2.5 DUCT INSULATION

- A. Conductivity: Maximum thermal conductivity (k) shall be 0.2 Btu/ft²•hr. • F/in. excluding air film at 100°F mean temperature.
- B. Rigid Board Type - Concealed: 3 lb./ft³ minimum density, glass fiberboard, 1 in. minimum thickness. Factory applied vapor barrier finish consisting of aluminum foil reinforced with fiberglass yarn; seams and joints taped.
- C. Rigid Board Type - Exposed: 6 lb./ft³ minimum density, glass fiberboard, 1 in. minimum thickness. Factory applied white Kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn joints finished with corner beading and fiberglass tape.
- D. Flexible Blanket Type: Long glass fiber blanket, 2" (R-7.4), factory applied, fiberglass yarn, reinforced aluminum foil faced vapor seal. Vapor barrier shall be aluminum foil reinforced with fiberglass yarn mesh laminated to 40 pound fire-resistant kraft paper. Facing shall have a maximum permeance of 0.02 perms. Density shall be 1.0#/cu.ft.. Maximum operating temperature shall be 250°F. Thermal conductivity "k" shall be 0.27.

- E. Flexible Closed Cell Type:
1. Insulation material shall be flexible, cellular elastomeric, sheet and roll, ozone resistant, 6pcf density, and shall comply with ASTM C534. Thermal conductivity "k" shall be 0.28 at 75F, ASTM C177 and C158. Minimum service temperature shall be -40F. Maximum service temperature shall be 220F.
 2. Maximum moisture absorption shall be 1.0% by volume, ASTM D1056. Moisture vapor transmission shall be 0.20 perm inches, ASTM E96.
 3. 2" thickness and below: Maximum flame spread shall be 25 per ASTM E84. Maximum smoke developed shall be 50 per ASTM E84.
 4. For all exterior piping and for piping exposed to ultraviolet radiation, provide a protective insulation coating (Rubatex 374 or equal). Apply with waterproof vapor barrier adhesive.
- F. Acoustic Thermal Lining: See Specification Section 238900.

2.6 EQUIPMENT INSULATION

- A. Segmented board, sheets, blocks, size, shape, and material as called for.

2.7 MAKES

- A. Fiberglass: Certainteed, Knauf, Manville, Owens-Corning.
- B. Calcium Silicate: Manville, Owens-Corning.
- C. Flexible Elastomeric: Armstrong, Rubatex.
- D. High Temperature Ceramic Fiber: Fiberfrax
- E. High Temperature Fiberglass: Certainteed, Knauf, Manville, Owens-Corning.
- F. Adhesives: Benjamin Foster; (BF) numbers designate quality of adhesive.

2.8 MATERIALS AND SCHEDULES

- A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Provide Thermal Insulation:
1. Insulation is required on piping, ductwork, and equipment unless otherwise called for.
 2. Only on clean, dry surfaces and after piping, ductwork, and equipment have been tested.
 3. Continuous through hangers, openings and sleeves on cold water, chilled water, refrigerant, and high-pressure steam piping.

4. On cold surfaces with continuous unbroken vapor seal. Do not cover inspection stampings, openings, petcocks, handholes, manholes, access doors, plugged outlets, air vents, plugged openings or petcocks.

3.2 PIPE INSULATION

- A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed except within radiation enclosures.
- B. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing. Insulate pipe with double the thickness called for. Piping In Wall Chases: In addition to the above, pack chase with loose glass fiber insulation.
- C. Hanger Shields: Refer to Section "Piping Systems and Accessories."
 1. Pre-insulated type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
 2. Field insulated type: Provide 1-1/2" calcium silicate insulation between pipe and shield.
- D. Joints In Section Pipe Covering Made As Follows:
 1. Standard: Longitudinal laps and butt joint sealing strips cemented with BF 85-20, or factory applied pressure sensitive adhesive lap seal.
 2. Vapor barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white BF 85-20. Seal ends of pipe insulation at valves, flanges, and fittings with white BF 85-20.
- E. Fittings, Valves And Flanges:
 1. Chilled water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation. Vapor sealed with BF 30-35 "Tite-Fit".
 2. Hot services and domestic cold water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation.
 3. 0.020" thick white PVC jacketing.
 4. Equal to Zeston or Proto System.
- F. Flexible Pipe Insulation:
 1. Split longitudinal joint and seal with adhesive.
 2. Fittings made from miter-cut pieces properly sealed with adhesive, or ells may be continuous.
 3. Where exposed outdoors, apply UV resistant coating as recommended by

manufacturer.

3.3 DUCTWORK INSULATION

- A. Provide external thermal insulation for duct. Not required where ducts have internal acoustical insulation and are located inside the conditioned space (All exterior ductwork must be insulated compliant with external insulation requirements of this specification). Make special provisions at dampers, damper motors, thermometers, instruments, and access doors. Apply As Follows:
 1. Rigid board type: Impale board over mechanical fasteners, welded pins or adhered clips, 12 in. to 18 in. centers; minimum of two rows per side. Secure insulation with washers on clips. Seal breaks and joints in vapor barrier with 4 in. wide matching tape or 4 in. glass-fab applied with BF 35-00. Apply tape over corner beading where exposed.
 2. Flexible blanket type: Joints and seams made with 2 in. lap of vapor barrier. Round ducts: Apply BF 85-20 adhesive to ducts in 6 in. brush widths at 1 ft. intervals and at each facing edge. Square ducts: Fasten by impaling insulation on adhered or welded clips. Secure insulation with washers on clips. Seal joints and breaks with 4 in. wide matching tape or 4 in. glass-fab applied with BF 35-00.

3.4 EQUIPMENT INSULATION

- A. Equipment insulation surfaces shall be a hard, smooth, uniform finish. Install Work ready for painting.

3.5 RECOVERING

- A. Field apply 6 oz. white glass cloth, cemented and applied over standard jacket. Properly cut at fittings to avoid wrinkles and coat with BF 30-36. Leave ready for painting.

EXHIBIT "I" - PIPE INSULATION MATERIALS
 (Notes are at end of Exhibit I)

SERVICE	INSULATION MATERIAL	PIPE SIZE	THICKNESS	REMARKS
Hot water (below 250°)	Glass fiber	1-1/2" and smaller 2" and larger	1" 2"	SEE NOTE 2
Refrigeration	Elastomeric		1"	SEE NOTE 1 SEE NOTE 5
AC unit drains and overflows	Glass fiber [Elastomeric]	All sizes	1/2 in.	

NOTES FOR EXHIBIT "I"

NOTE 1: Outdoor use - provide "flexible" insulation 1-1/2 in. thick (1/2" thick for refrigeration piping) with two coats of recommended finish. Apply insulation over heat tracing. Cover with aluminum jacket. Install in accordance with manufacturer's recommendations.

NOTE 2: Suction lines shall be insulated indoors and outdoors. For Air condition only units, Liquid lines and hot gas lines shall not be insulated, except where they run exposed in occupied or transient use spaces. When piping serves a refrigerant heat pump system or VRF system, all pipes shall be insulated indoors and outdoors.

EXHIBIT "II" - DUCT INSULATION MATERIALS
 (Notes are at end of Exhibit II)

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Air conditioning supply and Supply Ventilation Ductwork	Exposed: Rigid fiberglass Concealed: Flexible fiberglass	1-1/2"	SEE NOTE 1
Air conditioning return		Not insulated	
Space neutral conditioned ventilation (OA)		Not insulated	
Heating supply	Exposed: Rigid fiberglass Concealed: Flexible fiberglass	1 in.	SEE NOTE 1
Outside air ducts and plenums, connections, and mixing boxes	Rigid fiberglass	2 in.	Provide neat fit at intake plenum
Exhaust, relief, or vent ducts and plenums	Exposed: Rigid fiberglass Concealed: Flexible fiberglass	1-1/2"	Insulate 15 ft. from exterior opening and plenums

NOTES FOR EXHIBIT II

NOTE 1: Ductwork indicated to be lined shall not be insulated.

EXHIBIT "III" - EQUIPMENT INSULATION MATERIALS
(Notes are at end of Exhibit III)

<u>SERVICE</u>	<u>INSULATION MATERIAL</u>	<u>THICKNESS</u>	<u>REMARKS</u>
Air removal assembly	Same as water piping.	Same as water piping.	SEE NOTE 1
Filter assembly housings and sound attenuators	Rigid fiberglass	1 in.	SEE NOTE 1

NOTES FOR EXHIBIT III

NOTE 1: Insulate per machine manufacturer's installation instructions, match colors, materials and methods as much as practical. Allow for parts removal.

END OF SECTION

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