

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. Installer qualifications: Three years minimum successful installation experience on projects with mechanical insulation similar in scope and nature to that required for the project.

1.02 PERFORMANCE CRITERIA

- A. Insulation and accessory materials shall meet the following criteria:
 - 1. Insulation Materials: Non-combustible as defined in National Fire Protection Association Pamphlet 220 and Underwriters' Laboratory Listed or Labeled.
 - 2. Flame/Smoke Ratings: Composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) flame-spread rating 25 or less, smoke-developed rating 50 or less, as tested by ANSI/ASTM E-84 (NFPA 255) method.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Armstrong
- B. Certain-Teed
- C. Knauf
- D. Manson
- E. Owens Corning
- F. Schuller (Johns-Manville)

2.02 MATERIALS

- A. Insulation:
 - 1. Fiberglass.
 - 2. Flexible Closed-Cell.
- B. Adhesives, Sealers, Facings and Vapor Barrier Coatings must be able to accept paint where painting is required.

2.03 JACKETS

- A. Puncture resistance rating based on ASTM D781 test method.
- B. Permeance ratings based on ASTM E96, Procedure A.
- C. Type AA-1 jacket:
 - 1. Material: T3003, H14 to H19 aluminum alloy.
 - 2. Thickness: 0.016" (0.4mm), minimum.
 - 3. Factory applied to insulation with 1 mil thick polyethylene moisture barrier continuously laminated across full width of jacketing.
 - 4. Seal: Integral longitudinal Pittsburgh seam with butt joint strips and weatherproof mastic.
 - 5. Approved manufacturer: Insul-Coustic "Alcorjac" or equivalent.
- D. Type GFR-1 jacket:
 - 1. Material: Heavy-duty, fire-retardant, glass fiber reinforced material with self-sealing lap.

2. Factory applied to insulation.
 3. Finish: White vinyl or white kraft suitable for painting.
 4. Bench puncture resistance: 50 units minimum.
 5. Permeance: 0.02 perms, maximum
 6. Vapor barrier: 0.001" aluminum foil adhered to inner surface of jacket.
 7. Approved manufacturer: Owens Corning Type ASJ or equivalent.
- E. Type GFR-2 jacket:
1. Material: Heavy-duty, fire-retardant, glass fiber reinforced material.
 2. Factory applied to insulatio.
 3. Finish: White vinyl or white kraft suitable for painting.
 4. Bench puncture resistance: 25 units minimum.
 5. Permeance: 0.02 perms, maximum.
 6. Vapor barrier: 0.001" aluminum foil adhered to inner surface of jacket.
 7. Approved manufacturer: Owens Corning type ASJ or equivalent.
- F. Type GFR-3 jacket:
1. Material: Glass fiber reinforced.
 2. Factory applied to insulation.
 3. Finish: White kraft.
 4. Bench puncture resistance: 15 units, minimum.
 5. Permeance: 0.01 perms, maximum.
 6. Vapor barrier: Aluminum laminated to inner surface of jacket.
 7. Approved manufacturer: Owens Corning type FRK or equivalent.
- G. Type GF-1 jacket:
1. Material: 20 x 20 mesh glass fabric.
 2. Embed in coat of lagging adhesive; finish with second coat of lagging adhesive.
 3. Approved manufacturers: Manville "Duramesh" Type 205 or equivalent.
- H. Banding:
1. Over aluminum jacketing with insulation less than 13" diameter: Stainless steel, 1/2" x 0.020.
 - a) Approved manufacturer: AJ Gerrard & Co., No. 305-SS with No. 202-SS seals.
 2. Maximum spacing 12" on center.

2.04 PIPING INSULATION MATERIALS

- A. Fire-retardant, moisture- and mildew-resistant, and verminproof.
- B. Suitable to receive jackets, adhesives, and coatings as indicated.
- C. Glass fiber insulation: Inert inorganic material, noncorrosive to mechanical surfaces, preformed into flexible or rigid board as indicated, suitable for temperatures to 450°F.
- D. Insulation blankets shall be the same surface temperature as the rest of the pipe.
- E. Jackets shall have all seams turned under, double stitched.
- F. Insulating cement:
 1. Dry density 34 lb/cu ft, thermal conductivity 0.91 Btu-in/hr-sq ft-°F at 400°F.

2. Approved manufacturers:
 - a) PK “Super Stick”.
 - b) Ryder “GP”.
- G. Filling and finishing cement:
 1. Dry density 40 lb/cu ft, thermal conductivity 0.89 Btu-in/hr-sq ft-°F at 400°F.
 2. Approved manufacturers:
 - a) PK “Quick Cote”
 - b) Ryder “MW”
- H. Rigid fiberglass insulation (RFG):
 1. ASTM C547, Class 1.
 2. Temperature rating: -20 to 850°F only for pipe insulation.
 3. Density: 3 lb/cu ft.
 4. Conductivity: Not more than 0.24 Btu-in/hr-sq ft-°F at 75°F.
 5. Approved manufacturers: Owens Corning “Fiberglas 25” or equivalent.
- I. Mineral wool fiber pipe insulation (MW):
 1. ASTM C547.
 2. Temperature rating: 1,200°F.
 3. Density: 10 lb/cu ft.
 4. Conductivity: Not more than 0.45 Btu-in/hr-sq ft-°F at 450°F.
 5. Approved manufacturers: Roxul 1200 or equivalent.
- J. Cellular glass pipe insulation (CG):
 1. ASTM C552, Type II, Class 2.
 2. Temperature rating: -450°F to 900°F.
 3. Density: 7.5 lb/cu ft.
 4. Conductivity: Not more than 0.29 Btu-in/hr-sq ft-°F at 75°F.
 5. Approved manufacturers: Pittsburgh Corning Foamglas or equivalent.
- K. Elastomeric thermal insulation (ET):
 1. ASTM C534, Type 1 for piping materials; Type II for sheet materials.
 2. Temperature rating: -40 to 220°.
 3. Density: 5.5 lb/cu ft.
 4. Conductivity: Not more than 0.27 Btu-in/hr-sq ft-°F at 75°F.
 5. Permeance: 0.19 perms per inch.
 6. Approved manufacturers: Armstrong “Armaflex II” or equivalent.
- L. Expanded urethane insulation (EU):
 1. ASTM C591.
 2. Temperature rating: -100°F to 220°F.
 3. Conductivity: Not more than 0.16 Btu-in/hr-sq ft-°F at 75°F.

2.05 HVAC DUCTWORK INSULATION

- A. Fire-retardant, moisture- and mildew-resistant, and verminproof.
- B. Suitable to receive jackets, adhesives, and coatings as indicated.
- C. Flexible fiberglass insulation (FFG)
 - 1. ASTM C553, Type I.
 - 2. Density: 3/4 lb/cu ft.
 - 3. Conductivity: Not more than 0.31 Btu-in/hr-sq ft-°F at 75°F.
 - 4. Vapor transmission rating shall not exceed 0.02 perms.
 - 5. Approved manufacturers: Owens Corning Type 75P “Ductwrap” or equivalent.
- D. Rigid Duct Liner (RDL):
 - 1. Use of duct liner is prohibited except in short, open-ended air transfer ducts.
 - 2. ASTM C1071, ASTM G 21, and ASTM G 22.
 - 3. Meet requirements of NFPA 90A and 90B.
 - 4. For service at internal air velocities not to exceed 4,000 fpm.
 - 5. Dimensions indicated on the drawings shall be finished inside dimensions.
 - 6. Fabrication and installation shall conform to manufacturer’s recommendations and to the requirements of the latest edition of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standard, HVAC Duct Construction Standards – Metal and Flexible (hereinafter referred to as SMACNA HVAC DCS).
 - 7. 1" thick.
 - 8. Duct liner shall have a pigmented coating on the air stream side to resist damage during installation and in service. Edges shall be factory coated with the same pigmented coating to comply with SMACNA HVAC DCS.
 - 9. Density: 3 lb/cu ft.
 - 10. Approved manufacturers: Owens Corning “Duct Liner Board” or equivalent.

2.06 FLUE GAS DUCTWORK AND EQUIPMENT INSULATION

- A. Fiberglass insulation (EFG):
 - 1. ASTM C553, Type I.
 - 2. Density: 3/4 lb/cu ft.
 - 3. Conductivity: Not more than 0.45 Btu-in/hr-sq ft-°F at 75°F.
 - 4. Vapor transmission rating shall not exceed 0.02 perms.
 - 5. Approved manufacturers: Owens Corning “High Temperature Flexible Batt Insulation” or equivalent.
- B. Ceramic fiber insulation (CF):
 - 1. Temperature rating: 1000°F to 2700°F.
 - 2. Density: 8 lb/cu ft.
 - 3. Conductivity: Not more than 0.5 Btu-in/hr-sq ft-°F at 500°F.
 - 4. Approved manufacturers: Unifrax Corporation “Fiberfrax Durablanker 2600” or equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not insulate cleanouts, access openings or identification plates.
- B. Neatly bevel insulation and finishes up to edges of openings, and seal edges.

- C. Hangers shall be plumb and tight against the pipe or insulation saddle with adjustment nuts and lock nuts installed. If hangers are found to be out of plumb or not properly adjusted, the contractor shall be responsible for the cost of removal and reinstallation of the ceiling in order to inspect and correct the hanger installation.
- D. Provide saddles and shields under pipe hangers.
- E. Prepare a schedule of mechanical insulation showing systems insulated, types, thickness for various sizes, temperatures and special conditions. Include saddles and shields per standard Section 23 05 00. Include schedule on drawings or include in specifications.
- F. Heating system insulation:
 - 1. Heating water supply and return.
 - 2. Heat exchangers, converters, air separators, storage tanks and receivers.
 - 3. Low, medium, and high pressure steam piping.
 - 4. Steam condensate and boiler feed water (Exception: When good engineering practice precludes insulation where cooling of condensate is desirable to avoid cavitation of condensate return pumps. Also refer to standard Section 23 21 23 hydronic pumps.).
 - 5. Fittings.
 - 6. Valves (Exception: Specify factory-made removable insulation covers on high and medium pressure steam applications on all valves, strainers, and bucket traps.).
- G. Chilling system insulation:
 - 1. Chilled, dual temperature and heat recovery water supply and return.
 - 2. Heat reclaim coil header.
 - 3. Fittings.
 - 4. Valves.
 - 5. Cold condensate drain piping (first 10 feet).
 - 6. Chiller water boxes.
 - 7. Refrigerant and brine piping below 40 degree F.
 - 8. Refrigerant hot gas piping (only within buildings or where exposure is likely to cause accidental burn injury)
 - 9. Cold water thermal storage tanks.
- H. Air distribution system insulation:
 - 1. Exterior surfaces of outside air, combustion air, mixed air, and recovery coil discharge.
 - 2. Exterior surfaces of supply and return air ducts.
 - 3. Exterior surfaces of exposed supply ductwork.
 - 4. Concealed supply ductwork.
 - 5. Rigid spiral supply air ductwork.
 - 6. Kitchen exhaust ductwork or chase, whichever is more viable.
- I. Other system insulation:
 - 1. Engine exhaust and muffler inside building.
 - 2. Piping with heat tracer exposed to freezing.
- J. Protective jackets:
 - 1. Provide protective jackets where piping insulation is exposed to weather and where abrasion is likely.

3.02 INSULATION SCHEDULE

A. Minimum insulation thicknesses shall comply with IECC 2015.

3.03

Item	Insulation Type	Jacket Type	Insulation Thickness
Heating Water Return Piping (125°F)	RFG	GFR-1	1-1/2"
Heating Water Supply Piping (190°F)	RFG	GFR-1	2"
Steam Heating Piping (<400°F) (<6" dia.)	CS	AA-1	5"
Chilled Water Piping (45°F)	RFG	GFR-1	1"
Condenser Water Piping (65°F)	RFG	AA-1	1"
Refrigerant Suction Piping	ET	---	1"
Outside Air Ductwork Exposed	RFG	GFR-2	1-1/2"
Outside Air Ductwork Concealed	FFG	GFR-3	1"
Mixed Air Ductwork and Plenum	FFG	GFR-2	1"
Exposed Supply Ducts in Equipment Room	FFG	GFR-2	1"
Concealed Supply Ducts	FFG	GFR-3	1-1/2"
Return and Relief Ducts in Equipment Room	FFG	GFR-2	1"
Air Separators	RFG	GF-1	2-1/2"
Expansion Tanks	RFG	GF-1	1"
Make-up Tanks	RFG	GF-1	1"
Heat Exchangers	CS	GF-1	3-1/2"
Condensate Receivers	CS	GF-1	3-1/2"
Flash Tanks	RFG	GF-1	3-1/2"
Storage Tanks	RFG	GF-1	2"
Chiller Evaporator Shell	ET	---	1-1/2"
Chilled Water Boxes	RFG	GF-1	1-1/2"
Evaporative Humidifier	RFG	GFR-2	1"

END OF SECTION 23 07 00