

## SECTION 230700 – HVAC INSULATION

## PART 1 - GENERAL

## 1.01 BUY AMERICAN REQUIREMENTS

- A. Provide certificates to show that all products meet the following requirements.
  - 1. American Iron and Steel (AIS)
  - 2. Build America, Buy America Act
- B. See Supplementary Conditions for details.

## 1.02 SUMMARY

- A. Section Includes:
  - 1. HVAC equipment insulation, jackets and accessories.
  - 2. Ductwork insulation, duct liner, jackets, and accessories.

## 1.03 REFERENCES

- A. ASTM International:
  - 1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
  - 4. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - 5. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
  - 6. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - 7. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - 8. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  - 9. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - 10. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - 11. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - 12. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
  - 13. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
  - 14. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

15. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
16. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
19. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors’:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
2. UL 1978 - Standard for Safety for Grease Ducts.

#### 1.04 SUBMITTALS

- A. Section 013300 “Submittal Procedures”: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

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

#### 1.07 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.08 WARRANTY

- A. Section 017700 "Closeout Procedures": Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for manmade fiber.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
  - 1. CertainTeed.
  - 2. Knauf.
  - 3. Johns Manville.
  - 4. Owens-Corning.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
  - 1. Aeroflex. Aerocell.
  - 2. Armacell, LLC. Armaflex.
  - 3. Nomaco. K-flex.
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
  - 1. Dow Chemical Company.
- D. Manufacturers for Extruded Polystyrene Insulation Products:
  - 1. Dow Chemical Company.

#### 2.02 EQUIPMENT INSULATION

- A. TYPE D-1: ASTM C612; glass fiber, rigid board, noncombustible with factory applied aluminum foil jacket.
  - 1. Thermal Conductivity: 0.24 at 75 deg F.

2. Operating Temperature Range: 0 to 450 deg F.
  3. Density: 3.0 pound per cubic foot.
  4. Jacket Temperature Limit: minus 20 to 150 deg F.
- B. TYPE D-2: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.
1. Thermal Conductivity: 0.27 at 75 deg F.
  2. Operating Temperature Range: 0 to 650 deg F.
  3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
  4. Jacket Temperature Limit: minus 20 to 150 deg F.
- C. TYPE D-3: ASTM C612; glass fiber, semi-rigid board, noncombustible.
1. Thermal Conductivity: 0.23 at 75 deg F.
  2. Maximum Operating Temperature: 850 deg F.
  3. Density: 3.0 pound per cubic foot.

## 2.03 EQUIPMENT INSULATION JACKETS

- A. Aluminum Equipment Jacket:
1. ASTM B209.
  2. Thickness: 0.016 inch thick sheet.
  3. Finish: Embossed.
  4. Joining: Longitudinal slip joints and 2 inch laps.
  5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
- B. Canvas Equipment Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.
- 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.

## 2.04 Type E-1: HYDROUS CALCIUM SILICATE

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

## 2.05 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.
- D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- E. Adhesives: Compatible with insulation.

## 2.06 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
  - 1. Thermal Conductivity: 0.29 at 75 deg F.
  - 2. Maximum Operating Temperature: 250 deg F.
  - 3. Density: 1.0 pound per cubic foot.
- B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied metalized polypropylene scrim kraft facing meeting ASTM C1136, Type II.
  - 1. Thermal Conductivity: 0.24 at 75 deg.
  - 2. Density: 6.0 pound per cubic foot.

## 2.07 DUCTWORK INSULATION JACKETS

- A. Aluminum Duct Jacket:
  - 1. ASTM B209.
  - 2. Thickness: 0.016 inch thick sheet.
  - 3. Finish: Embossed.
  - 4. Joining: Longitudinal slip joints and 2 inch laps.
  - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
  - 6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
- B. Vapor Retarder Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film; 0.0032 inch vinyl.
  - 2. Moisture vapor transmission: ASTM E96; 0.02 perm.
  - 3. Secure with pressure sensitive tape.
- C. Canvas Duct Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

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2.08 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof type.
- D. Liner Fasteners: Galvanized steel, welded with integral press-on head.
- E. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.
- F. Lagging Adhesive: Fire resistive to ASTM E84.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Section 013100 "Project Management and Coordination": Coordination and project conditions.
- B. Verify equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.
- D. Prepare surfaces and install insulation, jacketing, and accessories in accordance with manufacturer's recommendations, building codes, and industry standards.

## 3.02 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.
- E. Cover glass fiber insulation with aluminum jacket.
- F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

- G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- H. Prepare equipment insulation for finish painting. Refer to Section 099123 "Interior Painting".

### 3.03 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. 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.
- C. 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.
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces below 10 feet above finished floor: Finish with aluminum jacket.
- E. External Glass Fiber Duct Insulation:
  - 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.
- F. External Elastomeric Duct Insulation:
  - 1. Adhere to clean oil-free surfaces with full coverage of adhesive.
  - 2. Seal seams and butt joints with manufacturer's recommended adhesive.
  - 3. When application requires multiple layers, apply with joints staggered.
  - 4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
  - 5. Lift ductwork off trapeze hangers and insert spacers.
- G. Prepare duct insulation for finish painting. Refer to Section 099123 "Interior Painting".

## 3.04 SCHEDULES

## A. Ductwork Insulation Schedule:

| DUCTWORK SYSTEM                                 | INSULATION<br>TYPE | INSULATION<br>THICKNESS<br>inches |
|-------------------------------------------------|--------------------|-----------------------------------|
| Combustion Air                                  | D-2                | 1.5                               |
| Outside Air Intake                              | D-2                | 1.5                               |
| Ducts Within 10 feet (3 m) of Exterior Openings | D-1, D-2           | 1.5                               |

END OF SECTION