

## **SECTION 23 0716 - HVAC EQUIPMENT INSULATION**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Equipment insulation.
- B. Covering.

#### **1.02 RELATED SECTIONS**

- A. Drawings and General Provisions of the Contract apply to this section.

#### **1.03 REFERENCES**

- A. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- D. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- E. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- F. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- G. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- H. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- I. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- J. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation.
- K. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

- L. ASTM C 592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
- M. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- N. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- O. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials.
- P. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.
- Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
- B. Samples: Submit two samples of any representative size illustrating each insulation type.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

#### **1.06 DELIVERY, STORAGE, AND PROTECTION**

- 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.

#### **1.07 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

- B. Maintain temperature during and after installation for minimum period of 24 hours.

## **PART 2 - PRODUCTS**

### **2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION**

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

### **2.02 GLASS FIBER, FLEXIBLE**

- A. Manufacturers:

1. Knauf Fiber Glass
2. Johns Manville Corporation
3. Owens Corning Corp
4. CertainTeed Corporation

- B. Insulation: ASTM C 553; flexible, noncombustible.

1. 'K' Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 177 or ASTM C 518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent by weight.

- C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film or vinyl.

1. Moisture Vapor Permeability: 0.02 perm inch when tested in accordance with ASTM E 96/E 96M.
2. Secure with self-sealing longitudinal laps and butt strips.
3. Secure with outward clinch expanding staples and vapor barrier mastic.

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

- E. Vapor Barrier Lap Adhesive:

1. Compatible with insulation.

F. Insulating Cement/Mastic:

1. ASTM C 195; hydraulic setting on mineral wool.

**2.03 GLASS FIBER, RIGID**

A. Manufacturer:

1. Knauf Fiber Glass
2. Johns Manville Corporation
3. Owens Corning Corp
4. CertainTeed Corporation

B. Insulation: ASTM C 612 or ASTM C 592; rigid, noncombustible.

1. 'K' Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C 177 or ASTM C 518.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent by weight.
4. Maximum Density: 8.0 lb./cu. ft.

C. Vapor Barrier Jacket:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film or vinyl.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Facing: 1 inch galvanized or stainless steel hexagonal wire mesh stitched on one face of insulation, onto both faces of insulation, or on one face of insulation with expanded metal lath on other.

E. Vapor Barrier Lap Adhesive:

1. Compatible with insulation.

F. Insulating Cement/Mastic:

1. ASTM C 195; hydraulic setting on mineral wool.

**2.04 CELLULAR GLASS**

A. Manufacturer:

1. Pittsburgh Corning Corporation

B. Insulation: ASTM C 552, Grade 2.

1. 'K' Value: 0.41 at 100 degrees F.
2. Service Temperature: Up to 900 degrees F.
3. Water Vapor Permeability: 0.005 perm inch.
4. Water Absorption: 0.2 percent by volume, maximum.
5. Density: Minimum 6.80 lb./cu. ft.

**2.05 HYDROUS CALCIUM SILICATE**

A. Manufacturer:

1. Johns Manville Corporation

B. Insulation: ASTM C 533; rigid molded, asbestos free, gold color.

1. 'K' Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C 177 or C518.
2. Maximum Service Temperature: 1200 degrees F.
3. Density: 15 lb./cu. ft.

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

D. Insulating Cement:

1. ASTM C 449/C 449M.

**2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

A. Manufacturer:

1. Armacell International
  2. Rubatex.
  3. Halstead.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3, in sheet form.
1. Minimum Service Temperature: -40 degrees F.
  2. Maximum Service Temperature: 220 degrees F.
  3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

## **2.07 JACKETS**

- A. PVC Plastic:
1. Manufacturers:
    - a. Johns Manville Corporation
  2. Jacket: Sheet material, off-white color.
    - a. Minimum Service Temperature: -40 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.
    - d. Thickness: Minimum 10 mil.
    - e. Connections: Brush on welding adhesive or Pressure sensitive color matching vinyl tape.
  3. Covering Adhesive Mastic:
    - a. Compatible with insulation.
- B. Canvas Jacket: UL listed 6 oz./sq. yd. plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:
  - a. Compatible with insulation.
- C. Aluminum Jacket: ASTM B 209 (ASTM B 209M) formed aluminum sheet.
  1. Thickness: 0.016 inch sheet.
  2. Finish: Smooth.
  3. Joining: Longitudinal slip joints and 2 inch laps.
  4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
  5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.
- D. Stainless Steel Jacket: ASTM A 666, Type 304 stainless steel.
  1. Thickness: 0.010 inch.
  2. Finish: Smooth.
  3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

- F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- G. Fiber glass insulated equipment containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- J. Fiber glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- K. Inserts and Shields:
  - 1. Application: Equipment 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between hangers and inserts.
  - 3. Insert location: Between support shield and equipment 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: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- L. Finish insulation at supports, protrusions, and interruptions.
- M. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting, PVC jacket and fitting covers, aluminum jacket, or stainless steel jacket.
- N. Exterior Applications: Provide 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.
- O. Cover glass fiber, cellular glass, hydrous calcium silicate, or cellular foam insulation with metal mesh and finish with heavy coat of insulating cement, aluminum jacket or stainless steel jacket.
- P. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.



- Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.
- R. Existing insulation damaged by new work shall be repaired and finished to match original new condition.

### **3.03 SCHEDULE**

#### **A. Cooling Systems:**

- 1. Equipment Exposed to Freezing with Heat Tracing: Rigid board, 3 inches thick

**END OF SECTION 23 0716**