SECTION 22 10 16
PLUMBING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulation.
B. Covering.

1.2 RELATED REQUIREMENTS

A. Section 22 00 00 - Plumbing Common Work Results; for administrative requirements
B. Section 22 00 00 - Plumbing Common Work Results; for product requirements
C. Section 22 00 00 - Plumbing Common Work Results; for closeout requirement
D. Section 22 00 00 - Plumbing Common Work Results
E. Section 09 90 00 - Painting and Coating.
F. Section 22 05 53 - Plumbing Identification for Piping and Equipment
G. Section 22 10 05 - Plumbing Piping

1.3 REFERENCE STANDARDS

A. ASHRAE 90.1- Energy Standard for Buildings except Low-Rise Residential Buildings.
B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2010.
E. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
F. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.
G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.
I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2013.
J. ASTM C547 - Standard Specification for Mineral Fiber Pipe, Insulation.
K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2013.
L. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
M. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
N. ASTM C656- Standard Specification for Structural Insulating Board, Calcium Silicate, ASTM International.
O. ASTM C795- Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel, ASTM International.
P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.
Q. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2013.
R. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

1.4 SUBMITTALS

A. See Section 22 00 00 - Plumbing Common Work Results; for submittal procedures.
B. Listed manufacturers and series are for reference only and do not promote any single product. Series are provided for reference, and should not be used as an ordering model number. Accessories and options may be custom components purchased separately.
C. Product Data: Provide manufacturer's most current catalog data sheet for equipment indicating rough-in size, finish, and accessories. Manufacturer's data sheets on each item of equipment and device, shall be clearly marked up to identify the items, accessories and options to be used on the project.
    1. Furnish detail cross section of insulation assembly. Indicate pipe type, fluid, vapor barriers, insulation and cover. Indicate two sections for each system, one section at typical section, one section at hanger or support location.
    2. Furnish schedule indicating insulation assembly for system type, insulation thickness, thermal characteristics and overall assembly dimensions. Manufacturer shall validate and provide documentation indicated that schedule thickness meets ASHRAE 90.1 insulation requirements.
    3. Submit products grouped by system type. (22 10 16 - 001 - A)
D. Submit a Certificate of Compliance, Section 00 62 33.14, together with supporting data, from the materials supplier(s) attesting that valves, accessories, and specialties meet or exceed specification requirements and are designed for the system specified.
    1. Submit products grouped by System Type (22 10 16 - 001 - A)
E. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

PART 2 PRODUCTS

2.1 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 NFPA 255.
B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C795.
C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 GLASS FIBER

A. Insulation: ASTM C553; flexible, noncombustible.
    1. 'K' Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
    2. Maximum Service Temperature: 450 degrees F.
    3. Maximum Water Vapor Sorption: 5.0 percent by weight.
B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
    1. 'K' Value: 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. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

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

F. Outdoor installation shall have white EPDM covering.

G. Manufacturers:
   1. Knauf Insulation.
   2. Johns Manville Corporation.
   3. Owens Corning Corp.
   4. CertainTeed Corporation.
   5. Or equal.

2.3 ELASTOMERIC

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 2, in sheet form.
   1. Minimum Service Temperature: -70 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft.

C. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

D. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

E. Manufacturer:
   1. Aeroflex USA, Inc.
   2. Armacell LLC.
   3. K-Flex USA LLC.
   4. Or equal.

2.4 CELLULAR GLASS

A. Insulation: ASTM C552, Type 1.
   1. Apparent Thermal Conductivity; 'K' Value: Grade 6, 0.33 at 100 degrees F.
   2. Service Temperature: Up to 800 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch.
   4. Water Absorption: 0.5 percent by volume, maximum.

B. Manufacturer:
   1. Pittsburgh Corning Corporation.

2.5 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
B. Comply with ASTM E84 for 25 flame and 50 smoke rating.
C. For outdoor installations, insulation jacket shall be 0.016 inch aluminum.

2.6 CALCIUM SILICATE INSULATION

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
B. Insulation: ASTM C533; rigid molded, asbestos free, gold color.
   1. 'K' Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or C518.
   2. Maximum Service Temperature: 1200 degrees F.
   3. Density: 15 lb/cu ft.
C. Jacket shall be 0.016 inch aluminum.
D. Manufacturer:
   1. Johns Manville Corporation.

2.7 JACKETS

A. PVC Plastic:
   1. Jacket: Sheet material in color as indicated.
      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 E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   2. Manufacturers:
      a. Johns Manville Corporation.
B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
C. Aluminum Jacket: ASTM B209 (ASTM B209M) 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.
D. Stainless Steel Jacket: ASTM A666, 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

3.1 EXAMINATION

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

3.2 INSTALLATION

A. Install in accordance with the following:
   1. Manufacturer's instructions.
   2. Local codes.
   3. Contract documents.
   4. ASHRAE 90.1.
B. Items Not Insulated:
   1. Factory-insulated equipment.
C. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
D. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
E. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
F. Locate insulation and cover seams in least visible locations. Locate seams on bottom of piping, duct and equipment.
G. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
H. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
I. Fiber glass insulated products containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied.
J. 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: Calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
K. Finish insulation at supports, protrusions, and interruptions.
L. 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.
M. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
N. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 SCHEDULE

A. Acceptable insulation materials and thicknesses are identified for each system. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
B. Refer to piping and duct schedule on drawings.

C. Equipment Insulation Type Thickness, Inches
   1. Tank, Cold Glass Fiber, Elastomeric, and Cellular Glass 1-1/2
   2. Tank, Hot Glass Fiber and Cellular Glass 2
   3. Cold is less than 80 degrees Fahrenheit, hot is greater than 80 degrees Fahrenheit.
   4. Equipment and products shall be insulated with same type and thickness of associated piping system.

END OF SECTION 22 10 16