

## SECTION 336017 – INSULATION FOR UTILITY DISTRIBUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

#### 1.2 SUMMARY

- A. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the Drawings and as specified herein.
- B. This section includes the furnishing and installation of insulation of steam and condensate piping for steam and condensate utility distribution.
- C. Related sections include the following:
  - 1. Division 33 Section "Utility Distribution General Requirements."
  - 2. Division 33 Section "Hangers and Supports for Utility Distribution."
  - 3. Division 33 Section "Piping Specialties for Steam Utility Distribution."
  - 4. Division 33 Section "Steam and Condensate Utility Distribution."

#### 1.3 REFERENCES

- A. MICA, National Commercial & Industrial Insulation Standards.
- B. ASHRAE/IES 90.1-2007, Energy Efficient Design Of New Buildings Except Low-Rise Residential Buildings.
- C. ASTM E84, Surface Burning Characteristics of Building Materials.

#### 1.4 SUBMITTALS

- A. Product Data for each type of insulation identifying k value, thickness, and accessories.
- B. Drawing and Product Data for expansion joint insulation blankets.

#### 1.5 QUALITY ASSURANCE

- A. Insulation shall have a flame-spread rating of 25 or less and smoke-developed rating of 50 or less as tested by ASTM E84.

#### 1.6 SEQUENCING AND SCHEDULING

- A. No insulation shall be applied before required tests have been run. Schedule insulation application after system testing.

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Owens-Corning, Johns-Manville, Schulle, Knauf, Armstrong, IMCOA, Dow Chemical, Pittsburgh Corning; or approved equal.

## 2.2 FIBER GLASS PIPE INSULATION

- A. Fiber glass pipe insulation shall have a thermal conductivity k of 0.23 BTU-in/hr-sq. ft.-degree F or less at 75 degree F mean temperature, a reinforced vapor retarder jacket, and a factory-applied longitudinal adhesive closure system. Section joints shall be sealed with butt strips. Maximum jacket permeance shall be 0.02 perm.
- B. Equal to Owens-Corning "Fiberglas SSL II" or Johns Manville "Micro-Lok AP-T Plus."

## 2.3 CALCIUM SILICATE PIPE AND BLOCK INSULATION

- A. Calcium silicate pipe and block insulation shall be asbestos-free, molded, high temperature insulation composed of hydrous calcium silicate with a density of 14.5 lb./cu. ft., and thermal conductivity k of 0.41 BTU-in/hr-sq. ft.-F or less at 200 degrees F mean temperature.
- B. Equal to Johns Manville "Thermo-12 Gold".

## 2.4 RIGID MOLDED CELLULAR GLASS

- A. 8 lbs./cu. ft. minimum density.
- B. k factor of 0.33 maximum at 75 degrees F.
- C. 0.00 water vapor permeability.
- D. 900 degree F service temperature.
- E. Laminated aluminum foil/vinyl/kraft paper jacketing except where aluminum laminated jacketing is specified.
- F. Pittsburgh Corning "Foamglas;" or equal.

## 2.5 POLYURETHANE INSULATION

- A. A continuously molded foam insulation having:
  - 1. Nominal density of 2.0 lbs./cu. ft.
  - 2. k factor of 0.14 at 75 degrees F mean.
  - 3. Flame spread rating of 25 or less when tested in accordance with ASTM E84.
  - 4. Closed cell content of 90% to 95%.
  - 5. Complies with ASTM C591.

## 2.6 POLYISOCYANURATE INSULATION

- A. High temperature polyisocyanurate insulation shall have the following properties:
1. Minimum Density: 2.0 pcf in accordance with ASTM D1622.
  2. Closed Cell Content: 90% in accordance with ASTM D2856.
  3. Compressive Strength: 30 psi in accordance with ASTM D1621.
  4. k Factor:
    - a. Initial at 75 Degrees F Mean Temperature: 0.113.
    - b. At 200 Degrees F Mean Temperature: 0.235.
    - c. Aged at 400 Degrees F for 28 Days: 0.220.
    - d. At 400 Degrees F Service Temperature and 75 degrees F Ambient: 0.240.
- B. Dimensional Stability: % Change in accordance with ASTM 2126:
1. 400 Degrees F Exposure of 2-Inch Cube Foam Sample:
    - a. 1 day plus 1.3% length, plus 0.1% volume.
    - b. 7 day plus 2.3% length, minus 2.3% volume.
  2. 450 Degrees F Exposure of 2-Inch Cube Foam Sample:
    - a. 1 day plus 10.31% length, plus 14.6% volume.
    - b. 7 day plus 7.1% length, plus 1.5% volume.
- C. Insulation must be rated for exposure to a continuous temperature of 400 degrees F and capable of handling intermittent temperature spikes to 450 degrees F for 8 to 12 hours.

## 2.7 MINERAL-FIBER INSULATION

- A. Preformed Pipe Insulation:
1. Type I, 850 Degrees F (454 Degrees C) Materials:
    - a. Mineral or glass fibers bonded with a thermosetting resin.
    - b. Comply with ASTM C547, Type I, Grade A, without factory applied jacket.
  2. Johns Manville "Micro-Lok;" or equal.
- B. Pipe and Tank Insulation:
1. Mineral or glass fibers bonded with a thermosetting resin.
  2. Semirigid board material complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB.
  3. Nominal density is 2.5 lb./cu. ft. (40 kg/cu. M) or more.
  4. Thermal conductivity (k-value) at 100 degrees F (55 degrees C) is 0.29 BTU x in./h x sq. ft. x degrees F (0.042 W/m x K) or less.

5. Johns Manville; MicroFlex; or equal.

## 2.8 SILICA AEROGEL INSULATION

- A. High temperature blanket formed of silica aerogel reinforced with non-woven glass fiber.
- B. Silica aerogel insulation shall have following properties:
  1. Minimum Density: 11.0 pcf.
  2. Compressive strength: 26.6 psi at 25% strain in accordance with ASTM D165.
  3. K Factor:
    - a. Initial at 32 Degrees F Mean Temperature: 0.14.
    - b. At 212 Degrees F Mean Temperature: 0.16.
    - c. At 392 Degrees F Mean Temperature: 0.19.
- C. Dimensional Stability: % Change in accordance with ASTM C 356:
  1. 1,200 Degrees F Exposure: 1.3% maximum.
- D. Insulation must be rated for exposure to intermittent temperature spikes to 1,200 F for 8 to 12 hours.
- E. Water resistant.
- F. Pyrogel XT as manufactured by Aspen Aerogels, Inc.; or approved equal.

## 2.9 INORGANIC GRANULAR INSULATION

- A. Provide engineered inorganic non-toxic, non-flammable, sodium potassium aluminum silicate insulation with calcium carbonate filter.
- B. Insulation shall be chemically treated to render it hydrophobic.
- C. Insulation shall be free of asbestos.
- D. Approved Product: GILSULATE 500.
- E. Provide insulation with the following properties:
  1. Density: 40 to 42 lb/cu ft consolidated use density.
  2. Load Bearing: 12,000 psf at consolidated density.
  3. Prior to backfill, insulation must support a person's weight.

4. Thermal Conductivity:  $K = 0.60$  BTU/hr/sq ft/degrees F/inch at consolidated density and at mean temperature of 176 degrees F.
5.  $K = 0.65$  BTU/hr/sq ft/degrees F/inch at 300 degrees F.
6. Temperature Range: 35 degrees F to 800 degrees F.
7. Electrical Resistivity: Greater than 10 to the 12th Ohm-cm.

F. Protective Coatings:

1. Provide a bitumastic self-priming, heavy duty, cold-applied, waterproof coating made from pitch derived from tar and solvents.
2. Approved Product: Carboline "Bitumastic Super Service Black;" or equal. Up to 400 degrees F.

- G. Expansion Cushions: Provide 3 to 5 pound density mineral fiber cushion to accommodate thermal expansion at expansion loops and elbows as required by the insulation manufacturer's design and installation manual.

## 2.10 JACKETS

- A. Aluminum jackets shall be field or factory applied, sealed, and made of 0.016-inch thick sheet, smooth finish, with longitudinal slip joints and 2-inch laps, die shaped fitting covers with factory attached protective liner.

## 2.11 INSULATION INSERTS

- A. Insulation inserts shall be made of calcium silicate treated with water repellent.
- B. Inserts shall be preformed for the pipe size, same thickness as adjoining pipe insulation, same length as shield, and 180 degree-minimum segments.
- C. Insulation inserts shall not be less than the following lengths:

2-1/2-inch pipe size and less	10 inches long
3-inch to 6-inch pipe size	12 inches long
8-inch to 10-inch pipe size	16 inches long
12-inch pipe size and larger	22 inches long

## 2.12 EXPANSION JOINT INSULATION

- A. Provide removable insulation blanket over both the body and slip end of the expansion joint.
- B. Comply with the requirements of Division 33 Section "Piping Specialties for Steam Utility Distribution."
- C. Manufacturer: Advanced Thermal Systems; or pre-approved equal.

2.13 PIPING INSULATION SCHEDULE

MINIMUM INSULATION THICKNESS						
SERVICE TYPE	INSULATION MATERIAL *	*** VAPOR BARRIER REQ'D	NOMINAL PIPE DIAMETER (in Inches)			
			1 & less	1-1/4 to 1-1/2	2 to 4	5 & up
Steam	Fiber glass	No	3	3	3.5	4
	Cal. Silicate	No	4	4	4 **	4 **
Pumped Condensate	Fiber glass	No	2.5	2.5	2.5	3.5
	Cal. Silicate	No	3	3	4	4 **

\* Calcium silicate insulation shall be used in all vault locations. Refer to Division 33 Section "Steam and Condensate Utility Distribution" for pre-insulated piping insulation materials and thickness.

\*\* 5-inch used inside of buildings.

\*\*\* Aluminum jacketing required for steam utility distribution piping. [ PVC jacketing is required elsewhere in buildings. ]

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards except as modified or specified in these Specifications.
2. Verify that surfaces are clean, dry and free of foreign materials.
3. Continue insulation through penetrations.

B. Testing of Pipe:

1. Prior to installing insulation, inspect welds and pressure test pipe as required by other sections of this these Specifications.
2. Clean pipe of dirt, scale and foreign materials.

C. Installation of Piping Insulation in Tunnels, Vaults, and Buildings:

1. Verify that piping has been tested and cycled before applying insulation materials.
2. Sectional pipe covering shall be neatly and tightly applied with unbroken lengths and with the ends of the sections firmly butted together. Longitudinal joints shall be on the least conspicuous side of the pipe and slightly staggered. Fiberglass cloth or other coating shall be lapped over joints and well pasted or cemented down in a neat and inconspicuous manner.
3. The insulation on piping shall be extended through sleeves, anchor points and supports in order to produce a continuous application, and shall be installed to conform to a uniform diameter.

4. Fittings, flanges, end caps, etc. on lines, except where otherwise noted, shall be covered with insulated fitting covers. Thickness of insulation, jackets and finishes shall also match adjacent piping.
  5. Secure calcium silicate pipe insulation with stainless steel bands.
  6. Insulation for piping shall be continuous through hangers and supports.
  7. Provide insulation inserts and insulation protection shields at hanger or support locations.
  8. Valve bodies to the bonnet flange or union, drip legs, and pipes at anchor points shall be insulated. Terminate insulation into a finished end.
  9. Steam traps shall not be insulated.
  10. Terminate insulation into a finished end.
  11. Provide aluminum jacketing on insulated piping.
- D. Expansion Joint Insulation:
1. Install removable insulation blanket over both slip end and body of the expansion joint. Ensure packing cylinders are properly aligned with blanket openings
  2. Packing gland cylinders are to remain exposed and accessible for service.
- E. Installation of Granular Insulation:
1. Installation of Expansion Cushions:
    - a. Wrap mineral fiber cushions around pipe elbows on expansion elbows and expansion loops as indicated on the Drawings and as specified herein.
    - b. Ensure there is sufficient space or flexibility between cushions to allow insulation to pour and be consolidated under piping.
    - c. Secure cushion to pipe with strapping.
  2. Installation of Forms:
    - a. Provide gypsum board forms with support posts as indicated in manufacturer's design and installation manual.
    - b. Posts must be located on the outside of the forms and spaced to prevent bowing of the gypsum board.
    - c. After forms are in place, partially backfill outside of form to height of pipe.
  3. Testing of Pipe:

- a. Prior to installing insulation, inspect welds and pressure test pipe as required by other sections of this these Specifications.
  - b. Clean pipe of dirt, scale and foreign materials.
4. Pouring of Insulation:
- a. Pour insulation in short sections along the pipe axis.
  - b. Apply bitumastic to structural steel surfaces and fill trench to center line of pipe.
  - c. Consolidate insulation using a rod-type concrete vibrator pulled along the sides and between the pipes.
  - d. Pour and consolidate additional layers of insulation until the design coverage has been achieved.
  - e. Backfill first 6 inches of soil (no stones) by hand.
  - f. Complete backfilling and mechanically compact in layers to grade level.

END OF SECTION 336017