INSULATION - MATERIALS

A. Material for Chilled Water Piping (Base Bid): Inorganic, foamed or cellular glass, annealed, rigid, hermetically sealed cells, incombustible manufactured in accordance with ASTM C 552 - "Standard Specification for Cellular Glass Thermal Insulation" and meeting the requirements of ISO 9002.

B. Material for Heating Water Piping (Alternate No. One): Preformed Glass-Fiber Pipe Insulation: ASTM C 547, Class 1, with factory-applied, all-purpose, vapor-retarder jacket.

C. Warranty Requirements: 20 years.

D. Jacketing/Facing: ASTM C 921, Type 1, factory-applied, laminated foil, flame-retardant, or vinyl facing of the following:

1. Outdoor Applications: PVC jacketing with matching seals. Refer to "Insulation Schedules" for specific application.
2. Weather Barrier Mastic: PITTCOTE 404 coating by Pittsburg Corning, Foster "CI" Mastic (60-25 or 60-26) or Childers "Chil-Pruf" CP22/23/24
3. Joint Sealant: "PITTSEAL" 444N or "PITTSEAL" 727 Sealant, Foster 95-50 "Flextra" sealant or Childers Chyl-Byl CP-76.
4. Tape: 0.75" wide fiber reinforced tape such as Scotch #880, Foster "MAST-A-FAB", Childers "Ak-Cryl CP-9, or equal.
5. Insulation adhesive: Foster 81-84 or Childers CHIL-GLAS #10
6. Fabrication adhesive: U.S. Gypsum "Hydrocal" B-11 Powder or Hot asphalt, ASTM D312, Type III,
7. Metal Bands: ½" x 0.015 stainless steel placed 12" on center, 6" each side of 24" long pipe covering.

E. Foam: The following as indicated:

1. Blocks: ASTM C 552, Type I.
2. Boards: ASTM C 552, Type IV.
3. Preformed Pipe: ASTM C 552, Type II, Class 2 (jacketed).
4. Special Shapes: ASTM C 552, Type III, in shapes and thicknesses as indicated.

F. Properties:

1. Thermal Conductivity: 0.32 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.
2. Compressive Strength: 100 psi
3. Flexural Strength: 80 psi
4. Perms: 0.00 perm-in
5. Temperature Limits: -450 to +800 deg F.
8. Coefficient of Expansion: ASTM E228 - 6 4.8x10^6/deg F
9. Water Vapor Absorption: ASTM C 209 @ 3.8% over 24 hours maximum.

PIPE INSULATION - INSTALLATION

A. Insulation: Installation of insulation shall as a minimum, comply with manufacturer's written instructions for that particular application. Join sections of insulation with vapor barrier compound. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.

B. Outdoor Application: This section is applicable for piping in all outdoor areas including concealed spaces, mechanical rooms, attics, and inhabited areas.

1. As a minimum, comply fully with manufacturer's published recommendations.
2. All piping shall be cleaned of foreign substances and free of surface moisture prior application of insulation.
3. All insulation materials shall be stored in an area protected from weather and kept dry before and during installation.
4. Insulation shall be applied to piping with all joints sealed full depth with joint sealant. All Joints shall be tightly filled with, no voids. Joint sealer shall not be used to fill voids or cracks. Insulation shall be secured with reinforced tape when jacketing is applied separately, two strips of tape per section of insulation. The tape shall overlap by 50%.
5. Apply jacketing in accordance with jacket manufacturer's written instructions insuring a minimum 2" lap at all joints, both circumferential and longitudinal. Laps shall be either adhesive faced (self-seal) or sealed by field application of appropriate adhesive, **Staples shall not be used.** Additionally, secure insulation and jacket with two (2) bands per insulation section evenly spaced.
6. Application of insulation with shop-applied jacket shall proceed as above, except tape securing of insulation is not required. All joints in the insulation shall be sealed as above.
7. Fittings shall be insulated in a manner similar to that for piping.
10. Finishing: Apply PVC or metal jacket over manufacturer’s recommended vapor barrier mastic. Refer to pipe application schedule for type of field-installed jacket to be utilized.
C. Flanges, Fittings, and Valves:

1. Exterior Exposed:
   a. Coat pipe insulation ends with vapor barrier coating.
   b. Apply pre-molded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings.
   c. Make joints tight.
   d. Bond with adhesive.

### EXTERIOR EXPOSED HYDRONIC WATER PIPING ABOVE LOADING DOCK:

<table>
<thead>
<tr>
<th>PIPE SIZES (NPS)</th>
<th>MATERIALS</th>
<th>THICKNESS IN INCHES</th>
<th>VAPOR BARRIER REO'D</th>
<th>FIELD-APPLIED JACKET</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHILLED WATER</td>
<td>CELLULAR GLASS</td>
<td>3</td>
<td>YES</td>
<td>(P)</td>
</tr>
<tr>
<td>HEATING WATER</td>
<td>GLASS FIBER</td>
<td>2 ½</td>
<td>NO</td>
<td>(P)</td>
</tr>
</tbody>
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