



## **SECTION 22 07 00 - PLUMBING INSULATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Plumbing piping insulation, jackets and accessories.
  - 2. Plumbing equipment insulation, jackets and accessories.

#### **1.2 REFERENCES**

- A. Comply with appropriate standards.
  - 1. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - 2. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
  - 3. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - 4. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

#### **1.3 SUBMITTALS**

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness and jackets for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

#### **1.4 QUALITY ASSURANCE**

- A. Mockup: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by LAWA. Use materials indicated for the completed Work.
  - 1. Piping Mockups:
    - a. One 10-foot section of NPS 2 straight pipe.
    - b. One each of a 90-degree threaded, welded, and flanged elbow.
    - c. One each of a threaded, welded, and flanged tee fitting.



- d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
  - e. Four support hangers including hanger shield and insert.
  - f. One threaded strainer and one flanged strainer with removable portion of insulation.
  - g. One threaded reducer and one welded reducer.
  - h. One pressure temperature tap.
  - i. One mechanical coupling.
2. Equipment Mockups: One tank or vessel.
  3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
  4. Notify LAWA seven days in advance of dates and times when mockups will be constructed.
  5. Obtain LAWA's approval of mockups before starting insulation application.
  6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless LAWA specifically approves such deviations in writing.
  7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  8. Demolish and remove mockups when directed.

## **1.5 WARRANTY**

- A. Furnish one-year minimum.
- B. Furnish five-year manufacturer warranty for manmade fiber.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER**

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
  1. **Knauf Insulation**
  2. **Johns Manville.**
  3. **Owens-Corning.**

### **2.2 PIPE INSULATION**

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
  1. Thermal Conductivity: 0.23 at 75 degrees F.



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2. Operating Temperature Range: 0 to 850 degrees F.
  3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
  4. Jacket Temperature Limit: minus 20 to 150 degrees F.
- B. TYPE P-2: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.23 at 75 degrees F.
  2. Operating Temperature Range: 0 to 850 degrees F.
- C. TYPE P-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.27 at 75 degrees F.
  2. Operating Temperature Range: 0 to 650 degrees 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 degrees F.
- D. TYPE P-4: ASTM C612; semi-rigid, fibrous glass board noncombustible. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.27 at 75 degrees F.
- E. TYPE P-5: ASTM C534, Type I, Grade 2, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
  2. Operating Temperature Range: Minus 70 to 180 degrees F.
- F. TYPE P-6: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.30 at 75 degrees F.
  2. Maximum Service Temperature: 300 degrees F.
  3. Operating Temperature Range: Minus 58 to 300 degrees F.
- G. TYPE P-7: ASTM C534, Type I, flexible, non-halogen, closed-cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
  2. Maximum Service Temperature: 250 degrees F.
  3. Operating Temperature Range: Minus 58 to 250 degrees F.
- H. TYPE P-8: ASTM C547, Type I or II, mineral fiber preformed pipe insulation, noncombustible.
1. Thermal Conductivity: 0.23 at 75 degrees F.



2. Maximum Service Temperature: 1200 degrees F.
  3. Canvas Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric treated with fire retardant lagging adhesive.
- I. TYPE P-9: ASTM C591, Type IV, ASTM C1289, polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.
1. Density: 4.0 pounds per cubic foot.
  2. Thermal Conductivity: 180 day aged value of 0.19 at 75 degrees F.
  3. Operating Temperature Range: Minus 297 to 300 degrees F.
  4. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 4 mils thickness and water vapor permeance of 0.02 perms.
- J. TYPE P-10: ASTM C578, Type XIII, extruded polystyrene insulation, formed into shapes for use as pipe insulation.
1. Thermal Conductivity: 180 day aged value of 0.259 at 75 degrees F.
  2. Operating Temperature Range: Minus 297 to 165 degrees F.
  3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 4 mils thickness and water vapor permeance of 0.02 perms.
- K. TYPE P-11: ASTM C533; Type I, hydrous calcium silicate pipe insulation, rigid molded white; asbestos free.
1. Thermal Conductivity: 0.45 at 200 degrees F.
  2. Operating Temperature Range: 140 to 1200 degrees F.

### **2.3 PIPE INSULATION JACKETS**

- A. Vapor Retarder Jacket:
1. ASTM C921, ASTM C1136, white Kraft paper with glass fiber yarn, bonded to aluminized film.
  2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
- B. PVC Plastic Pipe Jacket:
1. Product Description: ASTM D1785, one piece molded type fitting covers and sheet material, off-white color.
  2. Thickness: 30 mil.
  3. Connections: Brush on welding adhesive with VOC content of 50 g/l according to CFR 59, Subpart D (EPA Method 24).
- C. ABS Plastic Pipe Jacket:
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
  2. Minimum service temperature: -40 degrees F.



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3. Maximum service temperature of 180 degrees F.
  4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
  5. Thickness: 30 mil.
  6. Connections: Brush on welding adhesive.
  7. Connections: Brush on welding adhesive with VOC content of 50 g/l according to CFR 59, Subpart D (EPA Method 24).
- D. Aluminum Pipe Jacket:
1. ASTM B209.
  2. Thickness: 0.020 inch thick sheet.
  3. Finish: Smooth Embossed.
  4. Joining: Longitudinal slip joints and 2 inch laps.
  5. Fittings: 0.2 inch thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 1/2 inch wide; 0.015 inch thick aluminum. 0.020 inch thick stainless steel.
- E. Stainless Steel Pipe Jacket:
1. ASTM A240 / A240M OR ASTM 666 Type 304 stainless steel.
  2. Thickness: 0.016 inch thick.
  3. Finish: Smooth.
  4. Metal Jacket Bands: 1/2 inch wide; 0.020 inch thick stainless steel.
- F. Field Applied Glass Fiber Fabric Jacket System:
1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
  2. Glass Fiber Fabric:
    - a. Cloth: Untreated; 9 oz/sq yd weight.
    - b. Blanket: 1.0 lb/cu ft density.
  3. Indoor Vapor Retarder Finish:
    - a. Cloth: Untreated; 9 oz/sq yd weight.
    - b. Vinyl emulsion type acrylic, compatible with insulation, white color.

## **2.4 PIPE INSULATION ACCESSORIES**

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.



- D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449 / C449M.
- H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

## **2.5 EQUIPMENT INSULATION**

- A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
  - 1. Thermal Conductivity: 0.24 at 75 degrees F.
  - 2. Operating Temperature Range: 0 to 450 degrees F.
  - 3. Density: 1.65 pound per cubic foot.
- B. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft reinforced aluminum foil jacket.
  - 1. Thermal Conductivity: 0.24 at 75 degrees F.
  - 2. Operating Temperature Range: 0 to 450 degrees F.
  - 3. Density: 3.0 pound per cubic foot.
  - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.
- C. TYPE E-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.
  - 1. Thermal Conductivity: 0.27 at 75 degrees F.
  - 2. Operating Temperature Range: 0 to 650 degrees 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 degrees F.
- D. TYPE E-4: ASTM C612; semi-rigid, fibrous glass board noncombustible.
  - 1. Thermal Conductivity: 0.27 at 75 degrees F.
  - 2. Operating Temperature Range: 0 to 650 degrees F.
- E. TYPE E-5: ASTM C612 manmade mineral fiber, noncombustible, Classes 1-4.
  - 1. Thermal Conductivity: 0.25 at 100 degrees F.



2. Maximum Service Temperature: 1200 degrees F.
3. Density: 4 pound per cubic foot.

## **2.6 EQUIPMENT INSULATION JACKETS**

### **A. PVC Plastic Equipment Jacket:**

1. Product Description: ASTM D1785, sheet material, off-white color.
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 150 degrees F.
4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
5. Thickness: 30 mil.
6. Connections: Brush on welding adhesive with VOC content limits per agency having jurisdiction.

### **B. Aluminum Equipment Jacket:**

1. ASTM B209.
2. Thickness: 0.020 inch thick sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.02 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum. 0.020 inch thick stainless steel.

### **C. Canvas Equipment Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.**

### **D. Vapor Retarder Jacket:**

1. ASTM C921, ASTM C1136, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

### **E. Field Applied Glass Fiber Fabric Jacket System:**

1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
2. Glass Fiber Fabric:
  - a. Cloth: Untreated; 9 oz/sq yd weight.
  - b. Blanket: 1.0 lb/cu ft density.
3. Indoor Vapor Retarder Finish:
  - a. Cloth: Untreated; 9 oz/sq yd weight.
  - b. Vinyl emulsion type acrylic, compatible with insulation, black white color.



## **2.7 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
  - 1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-97.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 81-27/81-93.**
    - c. **Marathon Industries / Eagle Bridges Company; 290.**
  - 2. For indoor applications, use adhesive that has a VOC content limits per agency having jurisdiction.
- C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
  - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-96.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 81-33.**
  - 2. Calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flexible Elastomeric & Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Manufacturers:
    - a. **Aeroflex USA Inc.; Aeroseal.**
    - b. **Armacell LLC; 520 Adhesive.**
    - c. **Foster / H.B. Fuller Construction Products, Inc; 85-75.**
  - 2. For indoor applications, use adhesive that has a VOC content limits per agency having jurisdiction.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-82.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 85-20.**
    - c. **Marathon Industries / Eagle Bridges Company; 225.**
  - 2. For indoor applications, use adhesive that has a VOC content limits per agency having jurisdiction.
- F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.





1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-82.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 85-20.**
    - c. **Marathon Industries / Eagle Bridges Company; 225.**
  2. For indoor applications, use adhesive that has a VOC limits per agency having jurisdiction.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Manufacturers:
    - a. **Dow Chemical Co.; 739, Dow Silicone.**
    - b. **Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.**
    - c. **Speedline Corporation; Speedline Vinyl Adhesive.**
  2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.8 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content that meets the requirement of the South Coast Air Quality Management District Rule #1168. VOC limits per agency having jurisdiction.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-35.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 30-90.**
    - c. **Marathon Industries / Eagle Bridges Company; 590.**
  2. Water-Vapor Permeance: ASTM E96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-30.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 30-35.**
    - c. **Marathon Industries / Eagle Bridges Company; 501.**



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2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 35-mil dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F.
  4. Solids Content: ASTM D1644, 44 percent by volume and 62 percent by weight.
  5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; Encacel.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 60-95/60-96.**
    - c. **Marathon Industries / Eagle Bridges Company; 570.**
  2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 30-mil dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F.
  4. Solids Content: ASTM D1644, 33 percent by volume and 46 percent by weight.
  5. Color: White.
  6. For outdoor aluminum finish, use 60-39 mastic.

## **2.9 SEALANTS**

- A. Joint Sealants:
1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products - Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-76.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 30-45.**
    - c. **Marathon Industries / Eagle Bridges Company; 405.**
  2. Joint Sealant for Polystyrene Products - Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-70.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 30-45/30-46.**
    - c. **Marathon Industries / Eagle Bridges Company; 405.**
  3. Materials shall be compatible with insulation materials, jackets, and substrates.
  4. Permanently flexible, elastomeric sealant.
  5. Service Temperature Range: Minus 100 to plus 300 deg F.
  6. Color: White or gray.
  7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- B. FSK and Metal Jacket Flashing Sealants:
  - 1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-76-8.**
    - b. **Foster / H.B. Fuller Construction Products, Inc; 95-44.**
    - c. **Marathon Industries / Eagle Bridges Company; 405.**
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
  - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; CP-76.**
    - b. **Or approved equal.**
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: White.
  - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.10 FIELD APPLIED FABRIC – REINFORCING MASH**

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
  - 1. Manufacturers:
    - a. **Vimasco Corporation; Elastafab 894.**
    - b. **Or approved equal.**
  
- B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
  - 1. Manufacturers:
    - a. **Childers / H.B. Fuller Construction Products, Inc; Chil-Glas No. 5.**
    - b. **Or approved equal.**
  
- C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.



1. Manufacturers:
  - a. **Foster / H.B. Fuller Construction Products, Inc; Mast-A-Fab.**
  - b. **Vimasco Corporation; Elastafab 894.**
  - c. **Or approved equal.**

## **2.11 FIELD-APPLIED CLOTHS**

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and prezized a minimum of 8 oz./sq. yd..
  1. Manufacturers:
    - a. **Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.**
    - b. **Or approved equal.**

## **2.12 SECUREMENTS**

- A. Bands:
  1. Manufacturers:
    - a. **Childers Metals / ITW Insulation Systems / Illinois Tool Works, Inc.; Bands.**
    - b. **PABCO Metals / ITW Insulation Systems / Illinois Tool Works, Inc.; Bands.**
    - c. **RPR Products, Inc.; Bands.**
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.
  4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
  5. Copper clad annealed steel wire having a minimum 16 gauge thickness.
- B. Insulation Pins and Hangers:
  1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
    - a. Manufacturers:
      - 1) **AGM Industries / a JORDAHL GmbH Company; CWP-1.**
      - 2) **GEMCO; CD.**
      - 3) **Midwest Fasteners, Inc.; CD.**
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.



- a. Manufacturers:
  - 1) **AGM Industries / a JORDAHL GmbH Company; CWP-1.**
  - 2) **GEMCO; Cupped Head Weld Pin.**
  - 3) **Midwest Fasteners, Inc.; Cupped Head.**
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers:
    - 1) **AGM Industries / a JORDAHL GmbH Company; RC-150.**
    - 2) **GEMCO; R-150.**
    - 3) **Midwest Fasteners, Inc.; WA-150.**
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers:
    - 1) **GEMCO.**
    - 2) **Midwest Fasteners, Inc.**
    - 3) **Or approved equal.**
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.

### **2.13 CORNER ANGLES**

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240 / A240M, Type 304 or 316.



## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - PIPING SYSTEMS**

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. For penetrations of assemblies with fire resistance rating greater than one hour. See all sections in Division.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
  - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
  - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
  - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Glass Fiber Board Insulation:
  - 1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
  - 2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
  - 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Polyisocyanurate Foam Insulation Extruded Polystyrene Insulation:
  - 1. Wrap elbows and fitting with vapor retarder tape.
  - 2. Seal butt joints with vapor retarder tape.
- F. Hot Piping Systems 140 degrees F or less:
  - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
  - 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.



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- G. Inserts and Shields:
  - 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
  - 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
    - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
    - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
  - 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- H. Insulation Terminating Points:
  - 1. Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the control valve.
  - 2. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- I. Closed Cell Elastomeric Insulation:
  - 1. Push insulation on to piping.
  - 2. Miter joints at elbows.
  - 3. Seal seams and butt joints with manufacturer's recommended adhesive.
  - 4. When application requires multiple layers, apply with joints staggered.
  - 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
- K. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.
- L. Buried Piping: As per insulation Manufacturer's recommendation.
- M. Heat Traced Piping Interior to Building: As recommended by Heat Trace System Manufacturer.
- N. Heat Traced Piping Exterior to Building: As recommended by Heat Trace System Manufacturer.
- O. Prepare pipe insulation for finish painting.



### **3.2 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 Containing Fluids Below Ambient Temperature:
  - 1. Insulate entire equipment surfaces.
  - 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
  - 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
  - 4. Finish insulation at supports, protrusions, and interruptions.
- E. Equipment Containing Fluids 140 degrees F Or Less:
  - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
- G. 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.
- H. Cover insulation with aluminum jacket.
- I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- K. Prepare equipment insulation for finish painting.





### **3.3 PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies.

### **3.4 SCHEDULES**

- A. Water Supply Services Piping Insulation Schedule:



PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller	1.5
		1-1/2 inches and larger	2.0
Domestic Hot Water Supply and Recirculation systems with domestic water temperature maintenance cable	P-1	1 inch and smaller	1.0
		1-1/4 inches to less than 4 inches	1.5
		4 inches and larger	2.0
Domestic Cold Water (Exposed)	P-1 or P-5	1-1/4 inches and smaller	0.75
		1-1/2 inches and larger	1.0
Deionized Water	P-1 or P-5	All sizes	1.0

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Storm Piping (horizontal above ground within building)	P-1 or P-5	All sizes	1.0
Sanitary Sewer Piping (Exposed)	P-1 or P-5	All sizes	1.0

C. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS inches
Roof Drain Bodies	E-2	1.0
Domestic Hot Water Storage Tanks	E-1 E-2	2.0
Domestic Water Storage Tanks	E-1, E-2,	2.0
Domestic Water Booster Pump Bodies	E-5	1.0
Water Softeners and Tanks	E-1, E-2,	2.0



### **3.5 DOMESTIC WATER HEAT EXCHANGER INSULATION SCHEDULE**

- A. Round, exposed or concealed breeching and connector insulation shall be the following:
  - 1. Calcium Silicate: 4 inches thick.
  - 2. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
  - 3. High-Temperature Mineral-Fiber Board: 3 inches thick and 6-lb/cu. ft. nominal density.
  
- B. Rectangular, exposed or concealed breeching and connector insulation shall be the following:
  - 1. Calcium Silicate: 4 inches thick.
  - 2. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
  - 3. High-Temperature Mineral-Fiber Board: 3 inches thick and 6-lb/cu. ft. nominal density.

### **3.6 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE**

- A. Grease Waste Piping, All Sizes, where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

### **3.7 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET**

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 00