

**PART 1: GENERAL**

1.01 Purpose:

- A. This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section so that the University may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

1.02 References:

1.03 Requirements:

- A. Provide insulation and associated accessories with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- B. Provide piping and ductwork insulation thickness and thermal conductivity in conformance with the latest edition of ASHRAE 90.1.
- C. Provide duct and pipe insulation continuous through walls, partitions, ceiling openings and sleeves.
- D. Provide UL-approved assemblies for pipes and ducts passing through fire-rated floors, walls, or partitions as required.
- E. Provide a continuous, unbroken, vapor seal on all cold pipe surfaces. Guides and anchors secured directly to cold surfaces shall be adequately insulated and vapor sealed to prevent condensation. . Pipe Insulation shall run continuously through supports and hangers. Use high compression strength insulation section at support hanger and cover with galvanized steel shield.
- F. For interior piping in mechanical rooms or exposed locations, provide aluminum jackets , 0.016” thick for all piping below 6 feet above finished floor. Locate seams on bottom side of horizontal pipe.
- G. Jackets for Piping Insulation shall conform to requirements of ASTM C921, Type II for piping with temperatures above ambient.
- H. Provide insulation protection shields fabricated from galvanized steel at all pipe hangers in accordance with MSS SP-69.
- I. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations.
- J. Provide staples, bands, wires, cement, adhesives, sealers, and protective finishes as recommended by insulation manufacturer for applications indicated.
- K. All equipment requiring insulation, the insulation jacket shall be designed to be removable and reused
- L. Insulate valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut units.

- M. For main loop chilled water piping insulation, utilize the Utilities and Energy Management specifications. The scope of this piping insulation is for the main chilled water loop through the discharge valve of the primary chilled water pumps.

## **PART 2: PRODUCTS**

### 2.01 Piping Insulation Materials:

- A. Rigid Phenolic Insulation: Shall be CFC free and meet or exceed requirements of ASTM C1126, Type III, Grade 1 to 250 °F service. Provide with factory-applied jacket suitable for the installation location.
- B. Calcium Silicate: Shall meet or exceed the requirements of ASTM C533, Type I. Provide insulation with manufacturer's recommended jacket.
- C. Fiberglass Piping Insulation: Shall meet or exceed requirements of ASTM C552, Class 1, noncombustible, with factory applied white kraft foil vapor barrier unless otherwise indicated.
- D. Flexible Elastomeric Closed Cell: Shall meet or exceed requirements of ASTM C534, Type I, tubular grade. Provide finish coating.
- E. Cellular Glass: Shall meet or exceed requirements of ASTM C552, Type II. Provide factory cover and vapor retarder finish.

### 2.02 Equipment Insulation Materials:

- A. Mineral Fiber: Shall meet or exceed requirements of ASTM C 547, C553, Types I, II or III or C612, whichever applies. Provide with factory-applied jacket
- B. Calcium Silicate: Shall meet or exceed the requirements of ASTM C533, Type I or II. Provide insulation with manufacturer's recommended jacket.
- C. Flexible Elastomeric Cellular: Shall meet or exceed the requirements of ASTM C534, Grade 1, Type I or II. Provide Type II with vapor retarder skin on one or both sides of insulation.

### 2.03 Ductwork Insulation Materials:

**NOTE: NO INTERNALLY LINED / INSULATED DUCT WORK. EXTERNAL/ INSTALLATION ON ALL SUPPLY AIR DUCT WORK.**

#### A. Fiberglass Ductwork Insulation:

1. Fiberglass Blanket insulation with a density of 1 pound per cubic foot and thermal conductivity (k value) of 0.29 @ 75 °F mean temperature. The blanket shall have a h vapor barrier facing of an aluminum foil and kraft paper lamination sandwiching a fiberglass scrim for reinforcing.
2. Rigid Fiberglass Board: Three pound per cubic foot minimum density glass fiber rigid board insulation with factory applied white foil reinforced All Service Jacket (ASJ).
3. Semi-Rigid Fiberglass Board: Three pound per cubic foot minimum density glass fiber semi-rigid board insulation with fiber perpendicular to the surface and with factory applied white foil reinforced vapor barrier jacket (ASJ).

- B. Flexible Unicellular: Flexible Unicellular insulation blanket, protected by Armaflex finish protective coating (minimum 2 coats).
- C. Ductwork Insulation Accessories; Provide Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Sealing: Blanket insulation with a thermal conductivity of 0.27 or less similar in construction to Owens-Corning Fiberglass Series one pound per cubic foot minimum density with foil reinforced Kraft(FRK) vapor barrier facing. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal points overlapped a minimum of 2". Adhere insulation to metal with 4" strips of insulation bonding adhesive at 8" on center. On circumferential and longitudinal joints, the 2" flange of the facing shall be secured 9/16" flare door staples applied 6" on center and taped with 4" wide fiberglass tape embedded in Childers CP-10 white vapor barrier emulsion and covered with Childers CP-10 until the tape is completely covered. All pin penetrations or punctures in facing shall also be taped. Vapor sealing of joints is not required on hot duct application where concealed.

### **PART 3: EXECUTION**

#### 3.01 Piping System Insulation:

- A. Plumbing System Omissions: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, pumps, and pre-insulated equipment.
- B. HVAC Piping System Omissions: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, pumps, and expansion joints.
- C. Steel piping insulated with rigid phenolic shall be coated with epoxy finish prior to insulation installation.
- D. Insulate piping systems per table 23.07.1

**Table 23.07.1**

<b>SERVICE</b>	<b>MATERIAL</b>	<b>BARRIER</b>
CHW supply/return	Rigid Phenolic, Cellular Glass	Yes
Fin Water	Rigid Phenolic Flexible Elastomeric Closed Cell	Yes No
Existing wet CHW piping, tunnel CHW piping, primary CHW piping in machine rooms.	Cellular Glass	Yes
Heating Hot Water supply/return (max. 250 °F), Steam Condensate	Mineral Fiber, Calcium Silicate	No
Potable Cold Water, make-up water, drinking water fountain drain, roof drain piping	Flexible Elastomeric Closed Cell or Phenolic Foam	No Yes
Potable Hot Water supply/return (max. 200 °F)	Calcium Silicate, Fiberglass or Phenolic Foam	No
Refrigerant Suction	Flexible Elastomeric Closed Cell	No

3.02 Equipment Insulation:

- A. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around nameplates.
- B. Insulate the following equipment per Table 23.07.2: Cold refrigeration equipment not factory insulated, drip pans under chilled equipment, cold and hot water storage tanks, water softeners, duct mounted coils, cold and chilled water pumps, air handling equipment not factory insulated, expansion and air separator tanks, heat exchangers, hot water generators, and pumps handling media above 130 °F, except pumps on steam condensate return units. This requirement would include condensate receivers. If there is not a flash tank upstream of the receiver, then a leaking low-pressure trap would heat the condensate receiver well above the 212 °F. This temperature causes the condensate pumps to fail. Leave the condensate receivers uninsulated to help protect the pumps.
- C. Do not insulate HOT WATER pumps.

**Table 23.07.2**

EQUIPMENT HANDLING MEDIA AT INDICATED TEMPERATURE	INSULATION MATERIAL	THICKNESS
1 to 34 degrees F	Flexible Elastomeric Closed Cell or Cellular Glass	2 inches
35 to 60 degrees F	Closed Cell or Cellular Glass	1.5 inches
100 to 200 degrees F	Mineral Fiber Calcium Silicate	1.5 inches 1.5 inches

3.03 Duct System Insulation:

- A. Double-wall ductwork shall be provided where internal insulation or sound absorbing linings have been provided.
- B. Hot and cold interior ductwork shall be insulated with Flexible Fiberglass insulation. Provide thickness to achieve minimum R-value requirements per ASHRAE 90.1.
- C. Exterior ductwork shall be insulated with Flexible Closed-Cell Elastomeric insulation. Provide with aluminum jacketing sealed water tight. Slope insulation on top of ductwork to promote drainage.

END OF STANDARD