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 such 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:

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

B. ASTM C 533 – Calcium Silicate Block and Pipe Thermal Insulation

C. ASTM C 547 – Mineral Fiber Preformed Insulation

D. ASTM C 552 – Cellular Glass Block and Pipe Thermal Insulation

E. ASTM C 553 – Mineral Fiber Blanket and Felt Insulation

F. ASTM C 612 – Mineral Fiber Block and Board Thermal Insulation

G. ASTM C 1126 – Rigid Cellular Phenolic Thermal Insulation

H. ASTM C 921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

I. MSS SP-69 Pipe Hangers and Supports – Selection and Application

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 E 84 (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.

F. Provide aluminum jackets, 0.016" thick, for exterior pipe, ductwork, and equipment insulation covers, as well as for exposed piping in mechanical rooms subject to wear or abuse. Locate seams on bottom side of horizontal pipe

G. Jackets for Piping Insulation shall conform to requirements of ASTM C 921, 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.

[LEED EQ Credit 4.1 Low-Emitting Materials – Specify materials that qualify as low-emitting VOC compounds as defined in the LEED Reference Guide]

K. Provide flexible reusable insulation blankets for equipment requiring access such as pumps, strainers, etc.

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.

PART 2 - PRODUCTS

2.01 Piping Insulation Materials:

A. Rigid Phenolic Insulation: Shall be CFC free and meet or exceed requirements of ASTM C 1126, Type III, Grade 1 to 250 deg 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 C 547, 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 C 534, Type I, tubular grade. Provide finish coating.

E. Foam Glass: Shall meet or exceed requirements of ASTM C 552, 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, Types I, II or III. Provide with factory-applied jacket.

B. Calcium Silicate: Shall meet or exceed the requirements of ASTM C 533, Type I or II. Provide insulation with manufacturer's recommended jacket.

C. Flexible Elastomeric Cellular: Shall meet or exceed the requirements of ASTM C 534, 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:

A. Flexible Fiberglass: Shall meet or exceed requirements of ASTM C 553. Provide insulation with a density of 1 pound per cubic foot and thermal conductivity (k value) of 0.29 @ 75^{O}F mean temperature. Provide with vapor barrier facing of an aluminum foil and kraft paper lamination sandwiching a fiberglass scrim for reinforcing.

B. Flexible Closed-Cell Elastomeric: Shall meet or exceed requirements of ASTM C 534, Type II. Provide with finish protective coating.

PART 3: EXECUTION

3.01 Piping System Insulation:

A. 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, and expansion joints.

B. Steel piping insulated with rigid phenolic shall be coated with epoxy finish prior to insulation installation.

C. Insulate piping systems per table 23.07.1

Table 23.07.1

SERVICE	MATERIAL	VAPOR

		BARRIER
CHW supply/return, Fin water	Rigid Phenolic	Yes
Existing wet pipe (tunnel piping)	Foam Glass	Yes
Heating Hot Water supply/return (max 250°F), Condensate	Mineral Fiber / Calcium Silicate	No
Low Pressure Steam (max 250°F)	Calcium Silicate	No
Potable Cold Water, makeup water, drinking fountain drain	Flexible Elastomeric Closed Cell	No
Potable Hot Water supply/recirculating (max 200°F)	Calcium Silicate	No
Refrigerant Suction	Flexible Elastomeric Closed Cell	Yes

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 degrees F.

Table 23.07.2

EQUIPMENT HANDLING MEDIA AT INDICATED TEMPERATURE	INSULATION MATERIAL	THICKNESS
1 to 34 degrees F	Flexible Elastomeric Cellular	1.5 inches
35 to 60 degrees F	Flexible Elastomeric Cellular	1.0 inches
61 to 250 degrees F	Mineral Fiber Calcium Silicate	2.0 inches 2.0 inches
251 to 400 degrees F	Mineral Fiber Calcium Silicate	3.0 inches 4.0 inches
401 to 600 degrees F	Mineral Fiber Calcium Silicate	4.0 inches 6.0 inches
> 600 degrees F	Thickness necessary to limit external	

	insulation temperature to 120 degrees F.

3.03 Duct System Insulation:

A. Except as otherwise indicated, omit insulation on ductwork 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. Cant insulation on top of ductwork to promote drainage.

END OF STANDARD