

University Contact: Energy & Engineering Group
(302) 831-1744

SECTION 23 07 00_ HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Piping system insulation.
 - 2. Equipment insulation.
 - 3. Pipe insulation jackets.
 - 4. Equipment insulation jackets.
 - 5. Ductwork insulation.
 - 6. Ductwork insulation jackets.
 - 7. Insulation accessories including vapor retarders and accessories.

- B. The intent of these standards are to provide input to the design team on the University's preference of manufacturers, design, material options and quality assurance to maintain the longevity of its assets.

1.2 REFERENCES

- A. Common Work for HVAC Systems 23 05 00
- B. Common Requirements for HVAC Systems 23 05 01
- C. Identification for HVAC Piping & Equipment 23 05 53
- D. Steam and Condensate Piping Systems Above Grade 23 22 13
- E. Steam and Condensate Piping Systems Below Grade 23 22 13.1
- F. Hydronic Piping Systems Above Grade 23 22 23
- G. Hydronic Piping Systems Below Grade 23 22 23.2
- H. Refrigeration Piping & Specialties 23 23 00
- I. Air Distribution Systems 23 30 00

1.3 ENGINEERING AND DESIGN REQUIREMENTS

- A. It is the responsibility of the consulting engineer or design build contractor to calculate the required thickness of the insulation. The insulation thickness must also conform to the latest version of the International Energy Conservation Code and to ASHRAE standard 62.1. The insulation thickness must conform to the most stringent requirement whether it be the calculated thickness or the code requirement.
- B. All insulation shall have a maximum flame spread index of 25.
- C. All insulation shall have a maximum smoke developed index of 50.
- D. Duct liner is not an acceptable method to insulate duct. Duct liner shall not be used on Campus.
- E. Plenums shall be fabricated from double wall insulated materials in lieu of insulation installed on the exterior of the plenum.

1.4 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics, flame spread index, smoke developed index and list of materials and thickness for each service, and location.
- B. Written certification that insulation materials do not contain asbestos.

1.5 CLOSE OUT SUBMITTALS

Not Applicable

1.6 QUALITY ASSURANCE

- A. Insulation shall be installed to provide an impenetrable vapor barrier around the object insulated. The insulation contractor shall fully adhere insulation to all surfaces so that there are no gaps between the insulation and the surface of the object insulated.
- B. Insulation shall not be compressed when installed upon objects. Insulator shall install insulation so that it maintains its original (specified) thickness.
- C. Insulation jacketing must maintain a continuous barrier around insulation. Insulation jacketing that has cuts, rips or breaks will not be accepted.
- D. Insulation jacketing must be clean and having its original reflectivity.

- E. Maintain temperature before, during and after installation for a minimum of 24 hours.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MAN MADE MINERAL FIBER: **Insulation Code I-1**

- A. Insulation: ASTM C457, Type I - pipe and tubing insulation
 1. Temperature ranges 0F to 850F
 2. 'K' factor: ASTM C177, 0.24 at 75 degrees F
 3. ASJ Vapor Retarder Jacket
 4. Moisture Vapor Transmission: 0.002 perm

2.2 MAN MADE MINERAL FIBER: **Insulation Code I-2**

- A. Insulation: ASTM C1393, Type I – semi rigid fibrous glass board, Class 2
 1. Temperature ranges 0F to 850F
 2. 'K' factor: ASTM C177, 0.27 at 75 degrees F
 3. ASJ Vapor Retarder Jacket
 4. Moisture Vapor Transmission: 0.002 perm

2.3 MAN MADE MINERAL FIBER: **Insulation Code I-3**

- A. Insulation: ASTM C612, Type IA – rigid board insulation
 1. Temperature ranges 0F to 1000F.
 2. 'K' factor: ASTM C177, 0.23 at 75 degrees F.
 3. Kraft paper bonded to aluminized film

4. Moisture Vapor Transmission: 0.004 perm

2.4 MAN MADE MINERAL FIBER: Insulation Code I-4

- A. Insulation: ASTM C553, Type I – batt insulation
 1. Temperature ranges 0F to 250F.
 2. 'K' factor: ASTM C177, 0.30 at 75 degrees F.
 3. FRK Vapor Retarder
 4. Moisture Vapor Transmission: 0.002 perm

2.5 FOAM GLASS: Insulation Code I-5

- A. Faced Rigid Cellular Phenolic Pipe Insulation, ASTM C1126, Type II and Type III

2.6 CELLULAR POLYISOCYANURATE INSULATION: Insulation Code I-6

- A. Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation: ASTM C591, Type III, compressive strength 50 psi
 1. Temperature ranges -297F to 250F
 2. 'K" factor: 0.19 at 75 degrees F.
 3. Fasteners: Fasten with fiber reinforced masking tape. For sizedover 6" fasten with18 gage stainless steel wires over fiber reinforced masking tape.

2.7 ELASTOMERIC CELLULAR FOAM: Insulation Code I-7

- A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form.
- B. Elastomeric Foam Adhesive:
 1. Air dried, contact adhesive, compatible with insulation.

2.8 EXPANDED PERLITE: Insulation Code I-8

- A. Molded Expanded Perlite Pipe Insulation conforming to ASTM C610 for temperatures up to 1200F

2.8 PIPE INSULATION AND EQUIPMENT JACKETS:

- A. PVC Plastic Jacket: **Insulation Jacket Code J-1**
 1. Product Description: Sheet material, color coded to match piping service.
 2. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.

3. Thickness: 30 mil.
 4. Connections: Brush on welding adhesive.
 5. Compatible with insulation.
- B. VentureClad: **Insulation Jacket Code J-2**
1. VentureClad model 1579CW-E insulation jacketing tape with and aluminum stucco embossed finish.
- C. Stainless Steel Pipe Jacket: **Insulation Jacket Code J-3**
1. ASTM A167 Type 304 stainless steel
 2. Thickness: 0.18 inch thick
 3. Finish: Smooth
 4. Metal Jacket Bands: 3/8" wide; 0.010 inch thick stainless steel

2.9 PUMP INSULATION:

A. All pumps insulation shall be formed into a box surrounding the pump and fabricated from polystyrene board (engineer to determine required thickness). Polystyrene board shall be covered VentureClad model 1577CW-WM tape. Edges and corners of the box shall be connected via wooden skewers and shall be sealed with and adhesive similar to Childers CP-97 Fibros Adhesive. Tape all seams and joints with FSK tape. See attachments A and B for more detail.

2.10 Valve Insulation:

A. Gate and globe valves in heating water and steam systems shall be insulated with a prefabricated removable blanket with Velcro fasteners with the following characteristics:

1. Jacket: 17oz silicone impregnated fiberglass fabric
2. Liner: 17oz silicone impregnated fiberglass fabric
3. Insulation: 1" Type E Glass Mat
4. Fastening: 2" Nomex Velcro
5. Thread: Kevlar/Stainless Steel Threads

All steam and heating water butterfly valves shall be insulated as per steam and heating water systems insulation requirements.

All chilled water valves shall be insulated per chilled water systems insulation requirements.

2.11 APPROVED INSULATION MANUFACTURERS:

1. Armstrong
2. Certain-Teed
3. Dow Chemical
4. Fab-Rite
5. HiTherm
5. Johns Manville
6. Owens Corning
7. Pittsburg Corning
8. Specialty Products & Insulation
7. Techna-Duct
8. Venture Products

3.0 EXECUTION

2.1 EXAMINATION

- A. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

2.2 INSTALLATION

- A. Verify field measurements prior to fabrication.
- B. Insulate entire piping system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints:
 1. 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.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with fitting covers.
- C. Inserts and Shields:
 1. Application: Piping or Equipment
 2. Shields: Minimum 12inches Long Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under finish jacket.

4. Inserts (Chilled Water): Armaflex Ultima (Wood Dowels or Wood Blocking are not allowed)
 5. Inserts (Steam & Heating Water): 12" long minimum Calcium Silicate (Wood Dowels or Wood Blocking are not allowed)
- D. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent fire stopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.
- E. All vapor barrier and jacket seams shall be located at 3 or 9 o'clock position on side of horizontal piping and with overlap facing down to shed water or on bottom side of horizontal duct.
- F. Heat Traced Piping: Size insulation large enough to enclose pipe and heat tracer.
- G. Factory Insulated Equipment: Do not insulate.
- H. Exposed Piping, Duct and Equipment: Locate insulation and cover seams in least visible locations.
- I. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- J. Finish insulation at supports, protrusions, and interruptions.
- K. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- L. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- M. All duct and piping routed interior to the building and in concealed spaces does not require a jacket.
- N. Fasten insulation to duct using spot welded pins or pins fastened with an adhesive. Self-sticking pins are not allowed.
- O. All fiberglass batt insulation shall be secured with wire at 2'-0" intervals.
- P. On ducts over 24" wide fiberglass batt insulation shall be pinned.
- Q. Do not insulate pressure relief valves.

2.3 SCHEDULES

A. Pipe Insulation Schedule:

Piping System	Insulation Code	Jacket Code
Heating Water Supply and Return – Interior to Building Exposed	I-1	J-1 J-3*
Heating Water Supply and Return – Interior to Building Concealed	I-1	None Required
Heating Water Supply and Return – Exterior to Building	I-6	J-2
Heating Water Supply and Return – Inside of Manholes	I-5	J-3
Glycol Heat Recovery Piping – Interior to Building	I-1	J-1 J-3*
Glycol Heat Recovery Piping – Exterior to Building	I-6	J-2
15 PSIG Steam – Interior to Building	I-1	J-1 J-3*
15 PSIG Steam – Exterior to Building	I-8	J-3
Steam Condensate – Interior to Building	I-1	J-1
Steam Condensate – Exterior to Building	I-7	J-3
Steam Condensate – In Manholes	I-5	J-3
45 PSIG Pressure Steam – Interior to Building	I-1	J-1 J-3*
45 PSIG Pressure Steam – Exterior to Building	I-8	J-3
45 PSIG Pressure Steam – In Manholes	I-5	J-3
Chilled Water Supply and Return – Interior to Building	I-7	J-1 J-3*
Chilled Water Supply and Return – Exterior to Building	I-6	J-2
Chilled Water Supply and Return – In Manholes	I-5	J-3
Condensate Drains from Cooling Coil – Interior to Building	I-7	J-1 J-3*
Condensate Drains from Cooling Coil – Exterior to Building	I-6	J-2

Condenser Water – Interior to Building	I-7	J-1 J-3*
Condenser Water – Exterior to Building	I-6	J-2
Humidifier Piping – Interior to Building	I-1	J-1 J-3*
Humidifier Piping – Exterior to Building	I-8	J-2
Refrigerant Suction - Interior to Building Exposed	I-7	J-1
Refrigerant Suction - Interior to Building Concealed	I-7	None Required
Refrigerant Suction - Exterior to Building	I-7	J-2
Refrigerant Liquid – Interior to Building	I-7	J-1
Refrigerant Liquid – Interior to Building Concealed	I-7	None Required
Refrigerant Liquid – Exterior to Building	I-7	J-2

B. Equipment Insulation Schedule:

Equipment	Insulation Code	Jacket Code
Shell & Tube Heat Exchanger	I-2	J-1 J-3*
Plate Heat Exchanger – Heating Systems	I-3	J-1 J-3*
Heating Air Separator	I-2	J-1 J-3*
Heating Expansion Tank	I-2	J-1 J-3*
Plate Heat Exchanger – Cooling Systems	I-7	J-1 J-3*
Chilled Water Air Separator	I-7	J-1 J-3*

Chilled Water Expansion Tank	I-7	J-1 J-3*
Chiller Surfaces not Factory Insulated	I-7	None Required

C. Duct Insulation Schedule:

Duct System	Insulation Code	Jacket Code
High Temperature Rectangular Exhaust Ducts – Interior to Building and Exposed	I-3	J-1 J-3*
High Temperature Rectangular Exhaust Ducts – Interior to Building and Concealed	I-4	None Required
High Temperature Round Exhaust Ducts – Interior to Building and Exposed	I-1 I-2	J-1 J-3*
High Temperature Round Exhaust Ducts – Interior to Building and Concealed	I-4	None Required
High Temperature Round Exhaust Ducts – Interior to Building and Exposed	I-2	J-1 J-3*
High Temperature Rectangular Exhaust Ducts – Exterior to Building	I-6	J-2
High Temperature Round Exhaust Ducts – Exterior to Building	I-5	J-2
Outside Air Intake Ducts	I-2	J-1 J-3*
Supply Air Ducts – Interior to the Building and Exposed	I-7	J-1 J-3*
Supply Air Ducts – Interior to the Building and Concealed	I-4	None Required
Supply Air Ducts – Exterior to the Building	I-6	J-2

Return/Relief Ducts in Mechanical Room	I-2	J-1 J-3*
Return Air Ducts – Exterior to the Building	I-4	J-2

*** Use stainless steel jacket if room temperature exceeds 120F and where volatile or corrosive chemicals are stored.**

ATTACHMENT A – PUMP INSULATION PHOTOGRAPH



ATTACHMENT A – PUMP INSULATION DETAIL

