

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART I - GENERAL

1.1 SECTION INCLUDES

- A. HVAC Equipment Insulation
- B. HVAC Equipment Insulation Jackets
- C. HVAC Equipment Insulation Finishes
- D. HVAC Equipment Lagging

1.2 RELATED SECTIONS

- A. *Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment*
- B. *Section 23 07 19 - HVAC Piping Insulation*

1.3 REFERENCES

- A. *National Commercial and Industrial Insulation Standards Manual, maintained by the Midwest Insulation Contractors Association (MICA)*

[Note to PSC: Any experienced insulation contractor should be familiar with this manual. It provides a comprehensive guide of installation practices for the mechanical insulation industry. By referencing this standard it becomes unnecessary to identify exhaustive and detailed installation procedures. These standards are to insulation what SMACNA standards are to ductwork.]

- B. *ASHRAE Standard 90.1 – Energy Standard for Buildings*
- C. *ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials*
- D. *IECC - International Energy Conservation Code*
- E. *Illinois Energy Conservation Code*
- F. *IMC – International Mechanical Code*

1.4 QUALITY ASSURANCE

- A. Products and execution shall be in compliance with applicable codes and standards including those referenced above in paragraph entitled *REFERENCES*.
- B. Installation shall be in compliance with Manufacturer's recommendations and installation instructions.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Type R: Rigid Fiberglass Board, 3.0 lb./cu. ft., ASTM C612 Type IA
- B. Type E: **EPDM** Cellular Flexible Elastomeric Foam Tube and Sheet, 300 deg. F maximum service temperature, ASTM C534 Grade 1

1. Not allowed: NBR/PVC blend

2. Approved Products

- a. Aeroflex Aerocel
- b. Armacell
 - (a) AP Armaflex FS
 - (b) UT Solaflex

[Note to PSC: The University has experienced widespread failure of NBR/PVC blend insulation in recent years. This problem has been addressed by specifying EPDM elastomeric material exclusively in lieu of NBR/PVC blend. NBR/PVC blend is disallowed for all applications including piping, equipment and ductwork.]

[Note to PSC: Aeroflex and Armacell, the primary manufacturers of elastomeric insulation, both offer complete lines of EPDM elastomeric insulation products. However, standard AP Armaflex, given that it is NBR/PVC blend, is not allowed.]

2.2 JACKETS, FACTORY APPLIED

- A. ASJ: (All Service Jacket): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil vapor barrier backing
- B. FSK: Aluminum-foil vapor barrier, fiberglass-reinforced scrim with kraft-paper backing

2.3 FINISHES, FIELD APPLIED

- A. FM: Woven glass fabric with two coats of mastic approved for insulation type

2.4 TAPES, ADHESIVES, COATINGS, FASTENERS

- A. Provide in accordance with insulation manufacturer's specifications and requirements.
- B. Sheet metal screws installed outdoors shall be stainless steel with rubber washers. Galvanized screws shall not be used outdoors.

2.5 LAGGING, FIELD INSTALLED

- A. ALUM: Aluminum, .016" thick, stucco embossed finish
 - 1. For protecting or securing insulation only, not for vapor barrier
- B. FMAS (Flexible Metallic Adhesive System): Self-adhesive embossed aluminum foil sheet, 6.0 mil minimum total thickness. Basis of design: VentureClad 1577CWE

[Note to PSC: FMAS appears to be a proven product in the industry. The University now approves it although the jury is still out to some degree. If it proves to be problematic in any manner its approval will be revisited.]

2.6 REMOVABLE COVERS, CUSTOM MANUFACTURED

- A. Standard Applications, Less than 450 Degrees F.
 - 1. Jacket and liner: 17oz Silicone Impregnated Fiberglass Fabric
 - 2. Insulation: 2" Type E Glass Mat
 - a. 1" allowed for constructability if approved by PSC
 - 3. Fastenings:
 - a. 2" Nomex Velcro and/or Lace Hooks with Braided Kevlar Drawstrings
 - b. Stainless Steel Lace Hooks and Quilt Pins
 - 4. Thread: Kevlar/Stainless Steel Thread
- B. Acoustical Applications, Less than 450 Degrees F.
 - 1. Additionally Provide 2 lb. Mass Loaded Vinyl
- C. Locations: Provide where shown on drawings or otherwise indicated in documents.

[Note to PSC: Clearly indicate location and type of custom covers on drawings and/or elsewhere within documents. Use sparingly; custom covers are costly and typically have long lead times.]

2.7 MATERIAL PROPERTIES

- A. Insulation material shall satisfy material property requirements of referenced ASTM standard. For convenient summary of referenced ASTM standards see *Insulation*

Specification Materials Guide as presented by National Commercial and Industrial Insulation Association (NIA).

- B. All insulation materials including jackets, tapes, adhesives and coatings shall meet *ASTM E84 25/50 Flame Spread/Smoke Development* requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Requirements.

1. Install insulation after equipment has been inspected and tested unless otherwise authorized by the PSC.
2. Fit and secure insulation tightly to equipment.
3. Insulate all equipment surfaces not factory insulated and with media design temperature above 105 deg. F, below 60 deg. F or below dew point of ambient air. When fluid is below dew point of ambient air, insulation shall have uninterrupted vapor barrier.
 - a. Exceptions: Steam traps, steam condensate pump bodies, coil headers, CHW components above drain pans (e.g. fan coil units), instrumentation/piping beyond 24" from main. Other appropriate exceptions may be presented to PSC for approval prior to proceeding with work.
4. Do not apply insulation on equipment in cold active piping systems.
5. Do not allow insulation to remain unsealed, vulnerable to entrance of moisture.
6. Do not add insulation to factory-insulated surfaces.
7. Do not insulate over nameplates or ASME stamps. Bevel and seal insulation around such, unless omitting insulation would cause condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items.
8. Provide field fabricated removable covers on equipment as required to provide ready access to components requiring periodic maintenance or repair.
9. Provide custom manufactured removable covers as indicated in Application Schedule.

[Note to PSC: Hot water pumps are the primary application for custom manufactured removable covers.]
10. Provide sheet metal corner protection angles where insulation extends to floor or is similarly vulnerable to damage.

B. Specific Requirements for Insulation Type

1. Type R - Rigid Fiberglass Board
 - a. Mechanically fasten to equipment
2. Type E - Cellular Flexible Elastomeric Foam
 - a. Form fit insulation tightly to equipment.
 - b. Fully adhere insulation to non-cylindrical equipment (e.g. pumps).
 - c. Generously adhere insulation to cylindrical equipment (e.g. expansion tanks).

C. Additional Requirements for Outdoor Installations.

1. Ensure insulation jacket is sealed waterproof, vapor tight.
2. Provide tightly fitted metal lagging with overlapped sections properly oriented for prevailing weather.
3. Mechanically attach lagging sections. Seal all seams and penetrations watertight.

4. With approval of PSC: In lieu of metal lagging provide flexible metallic adhesive system (specification provided above) with overlaps oriented and located as indicated for metal lagging. Apply pressure with spreading tool to ensure maximum adherence.

[Note to PSC: Edit text above as required to ensure clarity of lagging requirements. If metal lagging is required delete references to FMAS or vice-versa. Or, allow FMAS as an approved option as stated/indicated. Discuss with Owner prior to finalizing design.]

3.2 APPLICATION SCHEDULE

[Note to PSC: Edit Schedules as appropriate for project.]

| SERVICE | INSULATION TYPE | JACKET TYPE | LAGGING | FINISH | MINIMUM THICKNESS |
|---|-----------------|--------------------------|--------------|-----------------------------|--------------------------|
| Steam to Hot Water Heat Exchanger (Converter) including Head | R | ASJ or FSK | None | FM | 3" (as clearance allows) |
| Steam Condensate Flash Tank | R | ASJ or FSK | None | FM | 3" |
| Steam Condensate Receiver Tank | None | NA | NA | NA | NA |
| Steam Condensate Pump | None | NA | NA | NA | NA |
| Steam Expansion Joint - Provide custom manufactured removable cover | Per Spec. | Integral | None | None | 2" |
| Hot Water Pump including Suction Diffuser - Provide custom manufactured removable cover | Per Spec. | Integral | None | None | 2" |
| Hot Water Air/Dirt Separator | R | ASJ or FSK | None | FM | 2" |
| Hot Water Expansion Tank | None | NA | NA | NA | NA |
| Hot Water Bypass Filter | None | NA | NA | NA | NA |
| Outdoor Hot Equipment | E or R | E: None R: ASJ or FSK | ALUM or FMAS | None | 2" Default |
| Chiller Evaporator including Heads/Water Boxes, Compressor Suction Inlet/Piping, Liquid Line, Economizer - Provide field fabricated removable cover on heads/water boxes, economizer | E | None | None | Paint to match equip. color | 2" |

| SERVICE | INSULATION TYPE | JACKET TYPE | LAGGING | FINISH | MINIMUM THICKNESS |
|---|-----------------|-------------|--------------|--------|-------------------|
| Chilled Water Pump including Suction Diffuser - Provide field fabricated removable cover on suction diffuser | E | None | None | None | 1 1/2" |
| Double Suction Chilled Water Pump | E | None | None | None | 1 1/2" |
| Chilled Water Air/Dirt Separator | E | None | None | None | 1 1/2" |
| Chilled Water Expansion Tank | E | None | None | None | 1" |
| Chilled Water Bypass Filter - Leave eye bolts exposed | E | None | None | None | 1" |
| Chilled Water Heat Exchanger including Head | E | None | None | None | 1 1/2" |
| Chilled Water Buffer Tank | E | None | None | None | 1 1/2" |
| Cold Outdoor Equipment | E | None | ALUM or FMAS | None | 2" |

Note to PSC: Where multiple options are indicated for insulation type, thickness, jacket and/or lagging type, edit as appropriate for project.]

[Note to PSC: Scheduled insulation thickness may exceed requirements of ASHRAE Standard 90.1.]

Note to PSC: Thicknesses indicated are minimum values. Use Manufacturer's thickness calculation tool to determine required insulation thickness for project-specific temperature and humidity conditions. Increase scheduled insulation thickness as required.]

[Note to PSC: If deemed inappropriate to require custom manufactured removable covers on hot water pumps, insulation may be deleted. System size, pump size, location and water temperature shall be taken into account. Edit Application Schedule accordingly.]

Notes:

1. Provide lagging where required to protect insulation from physical damage. Discuss with PSC prior to bidding.
2. Manufacturer's thickness guide or calculation shall be used to determine required minimum insulation thickness for ambient temperature and humidity conditions. Applied insulation thickness shall meet or exceed this value. Thickness may exceed scheduled value. Discuss with PSC prior to bidding. *[Note to PSC: Perform required calculations, edit schedule accordingly and delete this note. Note is provided for projects with no PSC.]*
3. Insulation thickness and R value shall satisfy ASHRAE Standard 90.1 at a minimum. Insulation thickness may be reduced only as required to accommodate tight clearances and other practical limitations.

For repairs, insulation thickness shall match existing.

END OF SECTION 23 07 16

This section of the *U of I Facilities Standards* establishes minimum requirements only. It should not be used as a complete specification.