22 07 16 - Plumbing Equipment Insulation

1. Introduction

   A. This Design Guideline covers insulation systems for building plumbing systems, including, but not limited to: domestic hot water, domestic (potable and non-potable) water and mechanical equipment.

   B. Building Insulation Guidelines are listed in Division 07, Section 07 21 00 of the Duke University Design Guidelines

   C. Designers should coordinate with Duke University FMD to coordinate selection and execution requirements for insulation systems.

2. References

   A. ASHRAE Standard 90.1 – 2007

   B. NC State Energy Code, 2012

   C. NC State Plumbing Code, 2012

   D. NC State Mechanical Code, 2012

   E. USGBC LEED v3.0

   F. Duke University LEED+ Standard

3. Design Standards

   A. The following table illustrates desired insulation standards for different mechanical systems:

Service	Marker	Size	Location	Material	Thickness	Finish	Color
Continuous Vent	VENT	2" and smaller	all	fiberglass or mineral wool	1-1/2"	Aluminum jacket	none
		2-1/2" and larger	all		2"	Aluminum jacket	
Relief Vent	VENT	All	all	none	n/a	enamel paint	gray
Domestic (city) water	DW	2" and smaller	all	fiberglass or mineral wool	1"	Color-coded PVC	green
		2-1/2" and larger	all		1-1/2"	Color-coded PVC	
Non-potable water (NPW)	NPW	2" and smaller	all	fiberglass or mineral wool	1"	Color-coded PVC	brown
		2-1/2" and larger	all		1-1/2"	Color-coded PVC	

Service	Marker	Size	Location	Material	Thickness	Finish	Color
Heating Hot Water	HHW	2" and smaller	all	fiberglass or mineral wool	1"	Color-coded PVC	red
		2-1/2" and larger	all		2"	Color-coded PVC	
Domestic Hot water	DHW	2" and smaller	all	fiberglass or mineral wool	1"	Color-coded PVC	light green
		2-1/2" and larger	all		1-1/2"	Color-coded PVC	
Reclaim/re-use/gray water	RECLAIM	All	all	none	n/a	enamel paint	gray
Fire Protection	FP	all	all	none	n/a	none	none
Drain	DRAIN	All	all	none		enamel paint	gray
Gas (natural or syn.)	GAS	All	all	none	n/a	enamel paint	safety yellow
Gas vent	GAS VENT	All	all	none	n/a	enamel paint	safety yellow

B. Insulation thickness should comply at minimum with requirements of ASHRAE Standard 90.1-2007. Increased insulation thickness should be utilized if justifiable per project Life Cycle Cost Analysis.

C. Removable / Reusable Insulation

1. Components requiring frequent maintenance should be covered with re-usable insulation jackets. Jackets should be fabricated of non-porous Teflon-impregnated woven Nomex cloth, with double wove stitching. Blankets should contain fiberglass mat suitable for service temperature range. Thermal conductivity ratings should be sufficient to maintain a surface temperature of no more than 120°F with an ambient temperature of 80°F.

   Applications for removable insulation jackets may include:

   a. Control valves
   b. Small-volume receiver and flash vessels
   c. Other components or equipment for which pre-formed insulation block shapes are not available.

2. Removable jackets should be equipped either with Velcro fasteners or wire draws. Jacket must draw tight when installed, leaving no gaps.

D. Specific installation situations

1. Any insulation installed outdoors must be jacketed and sealed to prevent moisture penetration.

2. Outside ductwork must be installed with EPDM rubber covering and sealed for weather protection.

3. Generally, interior ductwork and piping must be concealed in finished spaces. Flexible HVAC ducts must always be concealed. Exposed interior piping and rigid ductwork are permissible only when specified by the Architect for aesthetic effect and approved by the Owner.

4. Closed-cell elastomeric insulation must be mitered at changes of direction in piping or tubing. Do not bend insulation.

5. All piping, ductwork and equipment jacketing must adhere to Duke University Design Guideline regarding Identification of Mechanical Systems (See line item 3A of this section).

6. Underground utility piping insulation is not covered in this Design Guideline, as insulation of those systems is typically integral to an engineered piping system and must be coordinated and engineered on a project-specific basis.

E. Documentation and Review Requirements

1. Analysis of the thermal systems insulation should be considered in the Life Cycle Cost analysis required for project approval.

2. Provide estimated energy usage calculation for all considered insulation systems. This calculation should compare energy usage and estimated costs for baseline (ASHRAE 90.1-compliant) insulation versus proposed higher efficiency models.

3. Insulation selection and specification must be reviewed by Duke University FMD and the Commissioning Agent (when applicable) on a project-by-project basis.

F. Installation and Performance Requirements

1. Confirm installation responsibilities at outset of project. Installation services will be provided in-house or contracted out.

2. Coordinate all required tie-in points with Duke Utilities and Engineering Services.

3. Coordinate all commissioning efforts with Duke Utilities and Engineering Services.

G. As-Built Requirements

1. Designer must provide drawings showing all as-built piping, equipment and manhole locations. Drawings must include final site plan layout and elevation profile, details of pertinent equipment (such as typical steam trap stations, manhole layouts, etc.), details of all building connection points, as well as anchorage points, cross-over/under of other utilities, obstructions and other pertinent data. USGS

coordinates for all major pipe intersections, elevation changes and manhole locations are required.

2. Provide identifying list for all manholes. Coordinate with Duke Utilities and Engineering Services for formatting and compliance with existing recordkeeping.

3. Provide identifying list for all valves. Coordinate with Duke Utilities and Engineering Services for formatting and compliance with existing recordkeeping.

4. Provide identifying list for all steam traps. Coordinate with Duke Utilities and Engineering Services for formatting and compliance with existing recordkeeping.

H. Piping Insulation

1. The Consultants shall evaluate thermal insulation properties and moisture migration to prevent surface condensation. Piping that carries chilled water is often subject to surface sweating. To decrease vapor permeability for chilled water piping, polystyrene or polyisocyanurate insulation shall be used for piping 2 inches in diameter and larger. Piping under 2 inch diameter shall be insulated with Armaflex or equal or polyisocyanurate. Fiberglass insulation is not acceptable for chilled water piping.

2. Insulation of underground piping shall receive special attention. Adequate protection against groundwater and electrolytic/galvanic corrosion shall be provided.

3. All valves and fittings shall be insulated with preformed fitting insulation. Also provide preformed insulation for all cold and hot surfaces of equipment when available from the manufacturer. Extensions should be installed on small ball valves so that the handle is extended beyond the insulation and is visible and operational.