
USACE / NAVFAC / AFCEA / NASA UFGS-22 07 10.00 20 (April 2006)

Preparing Activity: NAVFAC Replacing without change
UFGS-15081N (August 2003)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UML dated 18 July 2006

Latest change indicated by CHG tags

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EXTERIOR PIPING INSULATION 04/06

NOTE: This guide specification covers the requirements for field-applied insulation requirements for exterior steam piping, exterior condensate piping including aboveground piping, piping on piers, piping under piers, piping in trenches on piers, piping in tunnels, and piping in manholes.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of [technical proponents](#), including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a [Criteria Change Request \(CCR\)](#).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: The insulation thickness in this guide specification is suitable for most geographical regions. However, if the project is located in a region where extreme annual temperatures occur, the design engineer should evaluate the insulation thickness requirements for the particular region and change the insulation thickness based on an economical analysis, with the approval of the Engineering Field Division, Naval Facilities Engineering Command, Mechanical Engineering Branch.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 240/A 240M	(2004ae1) Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels for General Applications
ASTM B 209	(2004) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2004) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 533	(2004) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 547	(2003) Mineral Fiber Pipe Insulation
ASTM C 552	(2003) Cellular Glass Thermal Insulation
ASTM C 59/C 59M1	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM D 226	(2005) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

1.2 SYSTEM DESCRIPTION

Provide [field-applied insulation](#) for exterior steam piping[, existing insulated piping affected by Contractor's operation,] and exterior condensate piping.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[SD-03 Product Data](#)

[Insulation](#)

[Jacket](#)

SD-08 Manufacturer's Instructions

Installation manual for field-applied insulation

1.4 RECYCLED MATERIALS

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool - 75 percent slag by weight
Fiberglass - 20-25 percent glass cullet by weight
Phenolic Rigid Foam - 5 percent recovered material
Plastic Rigid Foam - 9 percent recovered material
Polyisocyanurate/Polyurethane - 9 percent recovered material
Rigid Foam - 9 percent recovered material

PART 2 PRODUCTS

2.1 PIPING INSULATION

Products containing asbestos will not be permitted.

2.1.1 Fibrous Glass Pipe Insulation

ASTM C 547.

2.1.2 Mineral Fiber Pipe Insulation

ASTM C 547.

2.1.3 Calcium Silicate Pipe Insulation

ASTM C 533.

2.1.4 Cellular Glass Pipe Insulation

ASTM C 552.

2.1.5 Polyurethane and Polyisocyanate Pipe Insulation

ASTM C 59/C 59M1, minimum density of 27.20 kilograms per cubic meter (kg/cu m) 1.7 pcf.

2.1.6 Mineral Fiber Pipe Wrap Insulation

ASTM C 547 for material, minimum density of 36.80 kg/cu m 2.3 pcf.

2.2 MINIMUM THICKNESS OF INSULATION FOR STEAM PIPING

2.2.1 Fibrous Glass Pipe Insulation

Nominal Pipe Sizes (mm)	Aboveground Piping Insulation Thickness (mm)	Piping in Trenches on Piers Insulation Thickness (mm)
less than 80	88.90	63.50

Nominal Pipe Sizes (mm)	Aboveground Piping Insulation Thickness (mm)	Piping in Trenches on Piers Insulation Thickness (mm)
80 thru 100	101.60	76.20
125 thru 150	114.30	88.90
200 and larger	127.00	101.60

Nominal Pipe Sizes (Inches)	Aboveground Piping Insulation Thickness (Inches)	Piping in Trenches on Piers Insulation Thickness (Inches)
less than 3	3.5	2.5
3 thru 4	4.0	3.0
5 thru 6	4.5	3.5
8 and larger	5.0	4.0

2.2.2 Mineral Fiber Pipe Insulation

Mineral fiber pipe insulation having an insulating efficiency not less than that of the specified thickness of fibrous glass pipe insulation may be provided in lieu of fibrous glass pipe insulation.

2.2.3 Calcium Silicate Pipe Insulation

Nominal Pipe Sizes (mm)	Piping in Tunnels Piping in Manholes Insulation Thickness (mm)	Piping Under Piers (Not in Trenches) Insulation Thickness (mm)
less than 80	101.60	127.00
80 thru 100	114.30	152.40
125 thru 150	127.00	177.80
200 and larger	152.40	203.20

Nominal Pipe Sizes (Inches)	Piping in Tunnels Piping in Manholes Insulation Thickness (Inches)	Piping Under Piers (Not in Trenches) Insulation Thickness (Inches)
less than 3	4.0	5.0
3 thru 4	4.5	6.0
5 thru 6	5.0	7.0
8 and larger	6.0	8.0

2.2.4 Cellular Glass Pipe Insulation

Cellular glass pipe insulation having an insulating efficiency not less than that of the specified thickness of calcium silicate pipe insulation may be provided in lieu of calcium silicate pipe insulation.

2.2.5 Mineral Fiber Pipe Wrap Insulation

Mineral fiber pipe wrap insulation having an insulating efficiency not less than that of the specified thickness of fibrous glass pipe insulation may

be provided in lieu of fibrous glass pipe insulation for pipe sizes 250 mm 10 inches and larger.

2.3 MINIMUM THICKNESS OF INSULATION FOR PUMPED CONDENSATE RETURN PIPING

Minimum thickness of insulation for pumped condensate return piping shall be as follows.

2.3.1 Mineral Fiber Pipe Insulation

Nominal Pipe Sizes (mm)	Piping in Tunnels Piping in Manholes Insulation Thickness (mm)	Aboveground Piping Insulation Thickness (mm)
less than 80	38.10	63.50
80 thru 100	50.80	76.20
125 and larger	63.50	88.90

Nominal Pipe Sizes (Inches)	Piping in Tunnels Piping in Manholes Insulation Thickness (Inches)	Aboveground Piping Insulation Thickness (Inches)
less than 3	1.5	2.5
3 thru 4	2.0	3.0
5 and larger	2.5	3.5

2.3.2 Fiber Glass Pipe Insulation

Fiber glass pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation for aboveground piping.

2.4 MINIMUM THICKNESS OF INSULATION FOR GRAVITY CONDENSATE (STEAM) PIPING

Provide 25 mm one inch thick fibrous glass pipe insulation for aboveground piping. Provide 25 mm one inch thick mineral fiber, calcium silicate, or cellular glass pipe insulation for piping in manholes and tunnels.

2.5 ALUMINUM JACKET

NOTE: Use bracketed sentence for Naval Base Norfolk.

ASTM B 209MASTM B 209, Temper H14, minimum thickness of 0.40 mm 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 200 mm 8 inches. Provide corrugated surface jackets for jacket outside diameters 200 mm 8 inches and larger. Provide stainless steel bands, minimum width of 13 mm 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.[Aboveground jackets and bands shall have factory-applied baked-on semigloss brown color conforming to Federal Standard FED-STD-595, "Colors," color chip number 20062.]

2.6 ASPHALT-SATURATED FELT

ASTM D 226, without perforations, minimum weight of 0.49 kilograms per square meter 10 pounds per 100 square feet.

2.7 STAINLESS STEEL JACKET

ASTM A 167 or ASTM A 240/A 240M; Type 304, minimum thickness of 0.25 mm 0.010 inch, smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 13 mm 0.5 inch. Provide factory prefabricated stainless steel covers for insulation on fittings, valves, and flanges.

PART 3 EXECUTION

3.1 INSTALLATION

Obtain Contracting Officer's written approval of piping systems prior to the application of insulation. Insulation shall be clean, dry, and installed prior to the application of insulation jacket. Do not use short pieces of insulation and jacket materials where a full length section will fit. Provide insulation materials and jackets with smooth and even surfaces, with jackets drawn tight, and secured on longitudinal and end laps. Insulate fittings and piping accessories with premolded, precut, or field-fabricated pipe insulation of the same pipe insulation material and thickness as the adjoining pipe insulation. Provide unions, flanges, valves, and piping accessories with removable (snap-on) sections of insulation. Provide insulation continuous through pipe hangers and pipe supports. Do not step on or walk on insulation or jacket.

3.2 PIPING INSULATION

3.2.1 Fibrous Glass Pipe Insulation

Install in accordance with the manufacturer's recommendations.

3.2.2 Mineral Fiber Pipe Insulation

Install in accordance with the manufacturer's recommendations.

3.2.3 Calcium Silicate Pipe Insulation

Install in accordance with the manufacturer's recommendations, except as modified herein. Secure with not less than 9.50 mm 0.375 inchwidth fibrous glass reinforced waterproof tape or stainless steel bands spaced not more than 200 mm 8 inches on centers. Provide one layer of asphalt-saturated felt over the insulation prior to installing aluminum jacket. Factory-applied polyethylene and kraft paper moisture barrier will not be permitted as a substitute for the asphalt-saturated felt.

3.2.4 Cellular Glass Pipe Insulation

Install as specified for calcium silicate pipe insulation.

3.2.5 Polyurethane and Polyisocyanate Pipe Insulation

Install only on aboveground pumped condensate (hot water) return piping in accordance with the manufacturer's recommendations.

3.2.6 Mineral Fiber Pipe Wrap Insulation

Install in accordance with the manufacturer's recommendations.

3.3 INSULATION JACKET

Provide new piping insulation and existing piping insulation affected by Contractor's operations with aluminum jacket. Machine cut the jacket to produce a straight, smooth edge. Lap longitudinal and circumferential seams not less than 50 mm 2 inches. Install jackets on horizontal piping with the longitudinal seam approximately midway between horizontal centerline and the bottom side of pipe. Install with the top edge of jacket overlapping the bottom edge of jacket and with the seam of each jacket offset from the seam of the adjacent jacket. Install jackets on vertical piping and on piping pitched from the horizontal from low point to high point so that the lower circumferential edge of each jacket overlaps the jacket below it. Provide factory prefabricated covers for insulation on fittings, valves, and flanges. Finish jackets neatly at pipe hangers and pipe supports. Terminate jackets neatly at the ends of unions, valves, traps, and strainers. Secure jacket with stainless steel bands spaced not more than 200 mm 8 inches on center.

3.3.1 Additional Requirements for Insulated Piping Under Piers

Provide one layer of asphalt-saturated felt over the insulation prior to installing stainless steel jacket.

3.3.2 Under Pier Stainless Steel Jacket

In addition to the above requirements for aluminum jackets, secure longitudinal and circumferential seams with stainless steel screws spaced not more than 100 mm 4 inches on centers. At approximately every 6 linear meter 20 linear feet of piping, lap the circumferential seams not less than 150 mm 6 inches; omit the screws.

3.4 ASPHALT-SATURATED FELT

Apply felt with longitudinal and circumferential seams lapped not less than 150 mm 6 inches. Secure with not less than 13 mm 0.5 inch width stainless steel bands spaced not more than 200 mm 8 inches on center.

-- End of Section --