



V. APPLICATION

A. General

1. Care shall be taken to insure that all working parts of valves, turbines, or other mechanical equipment are protected when insulation is applied. Until all insulation materials, such as cement or mastic have been removed from parts such as valve stems or governor linkages, the performance of insulation work shall be considered incomplete.
2. Small turbines or other equipment having short radius curved surfaces may be insulated with insulating cement as for small fittings and valves.
3. For large irregular surfaces such as large turbine casings, block or blanket insulation material may be used as for heads of vessels. However, it is important that the materials used, methods of attachment, and extent of coverage have no effect upon the performance of equipment or the manufacturer's guarantee. For this reason it is preferred that insulation for large mechanical equipment be furnished complete with weather-proofing by the equipment vendor except when it is uneconomical or impractical.
4. All projections and attachments to insulated pipe, vessels, and other equipment such as pipe nozzles or branches, shall be insulated at least six inches beyond the pipe or equipment insulation surfaces, unless this requirement is exempt under Paragraph II, c. of this standard or is superseded by specific job requirements.
5. At operating temperatures above 600°F differential expansion becomes a significant factor. To prevent opening of the joints and excessive heat loss two layer staggered joint construction shall be used.
6. Insulation shall be beveled and weatherproofed at all terminal points where it is required to remove bolts, studs, nuts, etc.
7. For straight run portions of pipe and equipment, methods of application of insulation and weatherproofing shall be as listed on Table "B" and as described in Sections V-B & C. The complete description of the materials specified in Table B shall be as indicated in Section III of the specification.

TABLE "B"

APPLICATION OF INSULATION & ALUMINUM JACKETS

Size Range		Equip. & Pipe 24" Dia. & Smaller	Equip. & Pipe Larger Than 24" to 60" Dia.	Equip. Over 60" Dia.
Insulation Holding Device	Material: Block Blanket	Tie Wire (iron) --	Band & Seal (SS) Weld Pins & Clips	Band & Seal (SS) Weld Pins & Clips
	Size: Block	#16 ga (8" & smaller)	1/2" Wide	3/4" Wide
	Blanket	#14 ga (10" to 24") --	#12 ga.	#12 ga.
	Spacing: Block Blanket	9" --	9" 12" x 16" C-C	9" 12" x 16" C-C
Aluminum Jacket (d)	Thickness	0.010"	0.016"	0.016"
	Corrugations: Pipe (all sizes) Horiz. Equip. Vert. Equip.	Smooth Smooth Smooth	-- 3/16" 1-1/4"	-- 3/16" 1-1/4"
	Seam Overlap (a) Longitudinal Circumferential	2" 2"	2" 2"	2-1/2" 3" (horiz. equip.) 4" (vert. Equip.)
Jacket Holding Strip	Material Size Spacing (b) Seam Securement	Band & Seal (SS) 1/2" Wide 12" --	Band & Seal (SS) 3/4" Wide 18" Alum. Screws 6" C-C	(c) Band & Seal (SS) 3/4" Wide 18" Alum. Screws 6" C-C

- All seams shall be arranged to shed water.
- As a minimum, provide one band at each circumferential seam and one band in the middle of each course, one edge of the band shall coincide with the seam.
- For vertical equipment over 60" dia., "Z" clips shall be added on circumferential joints on 24" maximum centers and bands shall be tightened with a ratchet tool.
- Smooth aluminum jacketing shall be used for the top heads of vertical vessels. Heads of horizontal vessels and the bottom heads of vertical vessels unprotected by a skirt shall be weatherproofed with mastic per Section V-6.
- All openings through insulation finish shall be flashed weather tight.



V. APPLICATION (cont.)

B. Piping, Vessels & Cylindrical Equipment. 24" O.D. and Smaller

Insulation

1. It shall be the insulation contractor's responsibility to insure that the outside surface of all piping is to be dry and reasonably clean prior to the application of the insulation.
2. Apply half-sections of insulation material, starting, where possible, with a full length piece and a half length piece so as to stagger the circumferential joints.
3. Secure the sections or segments of insulation to the pipe with loops of tie wire. Center to center spacing of the loops shall not exceed nine inches. The ends of the loops are to be twisted together, then imbedded into the surface of the insulation.
4. Butt the adjoining sections of insulation material firmly together and fill any cracks or voids with insulating cement.
5. When preformed sections are available for pipe elbows, these should be used and applied with tie wire as for pipe insulation.
6. Fittings and valves, smaller than 3" size, may be insulated by applying insulating cement in layers to the total thickness of the adjacent pipe insulation. The thickness of the individual layers and time allowed for drying shall be in accordance with the manufacturer's recommendations.
7. Insulation for weld tees or welded branch connections shall be field fabricated from preformed pipe insulation, mitered at the tee joints, and secured in place with tie wire as for pipe insulation.
8. Flanges, valves (where required) and fittings 3" size and larger shall be covered with field fabricated sections of pipe insulation or block of the same material and thickness. The blocks and segments of insulation are to be securely wired on the outside to hold the insulation against the metal surfaces. All voids and cracks shall then be filled with insulating cement leaving a smooth outside surface.

A. APPLICATION (cont'd)B. Piping (24" O.D. and Smaller) (cont'd)Weatherproofing1. Valves and Fittings

- a. Apply two (2) coats, each 1/8" minimum thickness (when dry) of mastic, to cover insulation on all valves and fittings smaller than 3" nominal size. Extend the mastic coats beyond the valve or fitting onto adjacent pipe covering so that aluminum jacketing, when installed, will overlap the mastic at least 3".
- b. For valves and fittings, 3" size and larger, apply a smooth layer of glass fabric when the first coat of mastic is still wet. Finish with a second coat of mastic as for smaller valves and fittings.

2. Straight Pipe

- a. Straight pipe shall have aluminum jacketing wrapped around with 2" minimum overlap on longitudinal seams.
- b. A 2" minimum overlap shall also be used on circumferential seams.
- c. All horizontal seams shall be installed with upper section overlapping the lower one to shed water.
- d. Vertical seams or circumferential seams on horizontal pipe shall be waterproof, or alternately shall be coated with mastic before assembly.
- e. Jacketing shall be held in place with metal bands and seals on 12" maximum centers, with a minimum of one band at each circumferential joint and one band in the middle of each course.
- f. Joints at pipe tees and branches should be fitted with aluminum flashing and made weathertight.
- g. Where a fitting at the top of a vertical line is weatherproofed with mastic, the mastic shall overlap the aluminum jacket by two (2) inches. Use (and remove) masking tape to effect an even termination of the mastic.

V. APPLICATION (cont'd)

C. Vessels and Pipe Larger Than 24" O.D. & Irregular Surfaces

Insulation

1. For vessel heads and cylindrical sections of equipment larger than 24" O.D., curved blocks of calcium silicate shall be used as described below. Blanket insulation shall be used where preformed insulation is not available.
 - a. To secure block insulation to the heads of vertical vessels, attach tie wire on 12" minimum spacing to the insulation ring angle which is welded at the tangent line by the vessel fabricator. The other end of each tie wire may then be attached to loose ring made of 1/4" steel rod which is centered at the vessel head to hold the insulation block. The blocks are to be cut to fit firmly together and the wires tightened to hold the insulation material against the surface of the vessel.
 - b. For horizontal vessels without an attached ring angle at the tangent line, a ring angle may be tack welded near the vessel tangent line, or preferably use two loops of 3/8" diameter or larger steel wire rope around the vessel near each tangent, drawn tight, and then securely clamped. Before tightening, radial bands or tie wires on 12" centers shall be slipped under the 3/8" diameter ropes. They shall be looped over the inner ropes and under the outer rope. The free end of the radial bands shall be tied to a loose centering ring and drawn up tight once the insulation is in place.
 - c. For the bottom head under skirts of vertical vessels, the tie wire for supporting insulation block may be looped through nuts welded to the surface of the head by the vessel fabricator.
 - d. For cylindrical equipment sections the insulation blocks shall be held against the metal surface with 1/2" wide stainless steel bands (or 3/4" wide bands if the diameter is greater than 60") spaced on 9" centers. The blocks are to be firmly butted together. Vertical joints between blocks on vertical vessels and circumferential joints on horizontal vessels shall be staggered. Use the floating ring and radial pattern of tie wire as described in V c. 2. a.
 - e. The use of a fibrous adhesive equal to Eagle-Pitcher "Insula-Stic" is approved for temporary securement of block insulation until permanent attachments are in place. On vessel heads and irregular surfaces where an adhesive cannot be used, the blocks shall be held in place by impaling over #9 gauge weld pins then secured with speed clips.
 - f. Fill all voids and cracks with insulating cement.

V. APPLICATION (cont'd)C. Vessels (24" O.D. and Irregular) (cont'd)Insulation (cont'd)

2. For blanket insulation the method of application shall be as follows:

- a. Number 12 gauge, or larger, weld pins shall be attached to the wall of steel equipment by means of a welding gun.
- b. Pins are normally spaced on 12" x 16" centers to suit a standard blanket width and length.
- c. Blankets are then impaled over the pins, pressed firmly against the metal surfaces, and the speed clips attached.
- d. Blanket edges shall be butted firmly together, then laced with tie wire at 6" intervals.
- e. Loose mineral wool shall be packed into all void spaces where the blanket has been cut to fit around equipment projections such as pipe nozzles.

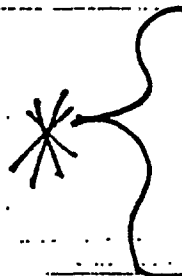
Weatherproofing1. Irregular Surfaces and Vessel Heads

- a. For the upper surfaces of small irregular equipment such as small turbines, mastic weatherproofing reinforced with glass fabric shall be used. One coat of mastic shall be applied. The glass fabric shall be embedded in this coat and covered with a second coat of mastic to give a final total thickness of 1/4" when dry.
- b. For heads of horizontal vessels, the bottom heads of vertical vessels when not protected by a skirt, and irregular bottom or vertical surfaces, poultry netting or wire lath shall be laced and fastened to the insulation support angles and wires. This netting or lath material shall provide support for a succeeding 1/4" minimum thick coat of insulating cement and two (2) 1/8" coats of mastic. Bottom heads of vertical vessels protected by a skirt do not require weatherproofing.
- c. For blanket insulation the stainless steel poultry netting or metal lath is an integral part of the blanket. Apply a 1/4" minimum thick coat of insulating cement and two (2) 1/8" thick coats of mastic.
- d. Smooth jacketing shall be used for weatherproofing the top heads of vertical vessels. The jacketing shall be applied directly over the block or blanket insulation.

V. APPLICATION (cont'd)C. Vessels (24" O.D. & Irregular) (cont'd)Weatherproofing (cont'd)2. Cylindrical Surfaces

- a. On vertical vessels the lower course of aluminum jacketing may be supported from the ring angle on the vessel, using stainless steel angle clips or rings designed to support the weight of the aluminum sheets.
- b. Aluminum shall not contact the steel surfaces of the vessel.
- c. Longitudinal seams should overlap as noted in Table "B".
- d. The aluminum sheets shall be held against the insulation by means of stainless steel bands drawn tight enough to prevent sagging but allowing for expansion of the vessel when heated to operating temperatures. A spacing as close as possible to 18" is required with a minimum of one band at each circumferential joint, plus one in the middle of each course.
- e. Succeeding courses of aluminum jacketing on vertical surfaces larger than 60" diameter shall be supported with suitable "Z" clips.
- f. Circumferential joints should overlap as noted in Table "B".
- g. All horizontal seams shall have the upper course overlapping the lower one to shed rain water.
- h. All longitudinal seams shall be joined together by means of sheet metal screws on 6" maximum centers.
- j. Mastic weatherproofing on horizontal vessel heads shall overlap the aluminum jacketing at least 6". Ring angle on vertical vessels precludes this construction.
- k. All equipment projections, such as pipe nozzles, shall have the jacketing sealed using aluminum flashing cut to fit the projection and extending under the jacket at least 3". The seal between flashing and jacket shall be made tight using sheet metal screws and mastic.

VI. APPROVED MATERIALS AND MANUFACTURERS

DESCRIPTION	TRADE NAME	MANUFACTURER
 1. Calcium Silicate Pipe Covering or Block	Calcium Silicate	Philip Carey Co. (Mfg'd. by Keasbey & Mattison Co.)
	Kaylo	Owens-Corning Fiberglass Corporation
	Thermobestos	Johns-Manville
2. Fiberglas 7 $\frac{1}{4}$ lb. ** Density; 10 lb. Density	Fiberglas	Owens-Corning Fiberglass Corporation
3. Blanket Insulation	<u>TYPES</u> With With Metal Poultry Lath One Mesh, Face & Both Poultry Faces Mesh on Other	
a. Mineral Wool Blanket	200 201 200 201-A 102 112	Philip Carey Co. Eagle Pitcher Co. Johns-Manville
b. Fiberglass Blanket*	HH HL	Owens-Corning Fiberglass Corporation

* (Fiberglass material has 1,000°F. temperature limit.)

** 7 $\frac{1}{4}$ lb. density fiberglass has a temperature limitation of 450°F.

10 lb. density fiberglass has a temperature limitation of 1,000°F.

	TRADE NAME	
4. Insulating Cement	No. 450	Johns-Manville
5. Mastic	Vi-Ac (Vinyl-Acrylic)	Insul-Coustic
	Sealfas Mastic	Benjamin Foster Co.
	31-49 (Aluminum Grey)	

Note: Mastic shall be provided in a color to match the aluminum jackets on piping and equipment

6. Glass Fabric	Mast-A-Fab	Benjamin Foster Co.
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