Designation: C 450 – 99

Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments[1]

This standard is issued under the fixed designation C 450; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice provides tables of dimensions of preformed insulation that may be used in fabricating covers for use on valves, ells, tees, flanges, and vessels in the pressure range from 150 to 1500 psi (1 to 10 MPa). These tables, which are part of this standard, are published separately as the ASTM Recommended Dimensional Standards for Prefabrication and Field Fabrication of Thermal Insulation Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments. The tables provide dimensions for use in forming pipe fitting covers for NPS pipe operating at high temperature and low temperature and NPS pipe heat traced with tubing up to ⅝ in. (16 mm) in outside diameter. The tables also include dimensions for use in forming thermal insulation into curved segments, lagging, and dished heads for application on vessels. This practice does not apply to reflective-type insulation.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

2. Referenced Documents

2.1 *ASTM Standards:*

C 585 Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)[2]

3. Significance and Use

3.1 This system of dimensions provides a guide for forming thermal insulation in advance of field application. Forming may be done by cutting, grinding, milling, or molding, depending upon the method most suitable for the thermal insulation being fabricated. It is equally applicable for all temperature ranges.

4. Apparatus

4.1 Thermal insulation can be formed into shapes by numerous methods. In general, insulations may be cut by circular or band saws, shaped by grinders or millers, or molded. Each method has certain advantages and disadvantages, depending upon the material to be formed, number of cuts required, material waste permissible, and quantity of fittings being produced. Adhesives and fabrication cements can be applied from dip pots, rollers, doctor blades, brush, or trowel, depending upon the materials being used. For these reasons, although standardized equipment may be devised for certain forming functions, no completely standardized equipment recommendation can be suggested.

5. Basis of Design

5.1 All dimensions presented are based on the use of pipe insulation manufactured to Practice C 585 and to the Basic Dimensional Standards for Pipe Insulation as given in Tables 1 and Tables 2 of the ASTM Recommended Dimensional Standards for Prefabrication and Field Fabrication of Thermal Insulation Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.[3]

5.2 The tables provide dimensions for insulation fitting covers for installation on nominal pipe size (NPS) pipe operating at high and low temperatures. Due to differences in application requirements in high and low temperature installations, it is necessary that fabrication of covers be different for each.

5.3 An additional set of tables are provided for nominal pipe size (NPS) pipe that is heat traced with parallel tubing or conduit attached to the pipe. This set of dimensions provides space for either air convection method or high conductive cement method or installing heat tracing tubing, pipe, or conduit not exceeding ⅝ in. (16 mm) in outside diameter to the NPS process pipe.

5.4 Dimensions given for fabrication of dished head covers are based on the use of 12 in. (305 mm) wide by 18 in. (457

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[2] *Annual Book of ASTM Standards*, Vol 04.06.

[3] Available at a nominal cost from ASTM Headquarters. Order Adjunct: ADJC0450.

mm) long block insulation, with thickness as required. Not all dished heads are manufactured to identical dimensions. The dimensions listed are based on the dished head radius being equal to the diameter of the tank. Head cover insulation is not expected to fit the radius of the knuckle but should fit tightly over the vessel wall insulation with a slight void at the knuckle.

5.5 Dimensions presented for cutting beveled blocks from preformed thermal insulation (lags) are based on blocks 6 in. (152 mm) wide by the thickness required.

5.6 Dimensions given for flanged pairs, flanged fittings, and flanged valves do not allow for flange bolt removal. When bolt removal is required, the covering length over the flange shall be increased as specified by the purchaser.

6. Fabrication

6.1 The main body of the insulation fitting may be cut from standard pipe size pipe covering of the proper size and same thickness tolerance as the pipe insulation.

6.2 Where two insulations of different temperature ratings are required, each should be placed in its proper location in the fitting in double layer construction.

6.3 Where only one insulation is required, and it can be obtained in sufficient thickness, multiple layers as indicated are not essential.

6.4 Flat block, cut to proper curvature, may be used in place of preformed pipe insulation.

6.5 Any method of forming may be used if the resulting fitting conforms to inside and outside dimensions listed.

6.6 Where the body of the flange cover extends over adjacent pipe insulation, the portion of the cover can be made by using the pipe insulation as the body and adding an insert collar. It can also be done by adding an insert or section, commonly called a "dutchman," made of block.

6.7 Valves manufactured by various companies for the same pressure and nominal pipe size may not have like bonnet dimensions, nor height of bonnet flange above centerline of valve. Because of this, the valve insulation is designed to fit the largest valve of a size, type, and pressure. In some instances, additional insulation may be required to fill or build up the insulation for proper fitting around the bonnet. In other instances it may be necessary to cut back insulation around the bonnet to provide access to the packing gland. Cutout for hand wheel assembly and packing gland should be done at time of application.

7. Assembly

7.1 All formed pieces should fit tightly together so that both sides and length of the insulation joint can close within a maximum of 1⁄16 in. (1.6 mm).

7.2 Low-temperature pipe insulation fabricated from block or board stock should contain no more than four cemented "through" joints per full section of insulation, excluding the half section mating plane.

7.3 Finished pieces should be identified by tags, attached strip, etc. for ease of field installation.

8. Fabricating Cements

8.1 Cements to be used in the fabrication of fitting covers must be specified for each insulation material.

8.2 The method of applying the insulation cement will vary with the type of insulation cement used. For most low-temperature work, employing cellular glass, hot asphalt or a catalyst type cement is used. Asphalt is usually heated in a pot located near or in a work bench. The pot is equipped with rollers that pick up and deposit hot asphalt on the surfaces to be adhered, when passed over and in contact with the rollers. Other types of cement may be applied to the insulation with a trowel or brush.

9. Insulation Fabrication Shop Requirements

9.1 Insulation can be shop fabricated by several methods. Each method has certain advantages and disadvantages, depending on the number of pieces to be cut, cuts required, material properties, and resultant material waste. Fabrication may be by sawing, grinding, routing, or combination thereof. Grinding and routing are generally limited to fabrication of block or board into threaded and socketwelded fittings, such as elbows and tees. Selection of fabrication method should consider any resulting reduction in material physical properties.

9.2 Equipment in ships is commonly improvised, as grinders for fabrication of insulation are not commercially available. The most essential piece of equipment is a band saw. Almost any band saw that can be set at the proper blade speed and has a minimum cutting depth of 22 in. (559 mm) can be used. Essential details are as follows:

9.2.1 *Cutting Blade Speeds*—The proper speed of the band saw blade for cellular glass is approximately 1040 ft/min (317 m/min). Calcium silicates and perlite silicate insulation may be cut at a speed of 1040 ft/min (317 m/min), but somewhat higher speeds will also work satisfactorily.

9.2.2 *Blades for Cutting Cellular Glass*—Band saw blades should be 1 in. (25 mm) wide by 0.035 in. (0.9 mm) thick, flexible-back, three-pitch, raker-tooth blades. These blades have special teeth designated as "P.A."

9.2.3 *Blades for Cutting Calcium Silicate or Perlite Silicate Fiber Insulation*—Blades should be ½ in. (13 mm) wide by 0.035 in. (0.9 mm) thick, skip-tooth blades, 5 teeth/in.

9.2.4 *Abrasives for Grinders*—Grinders are sometimes used to form insulation into various shapes. This can be done by hand or machine, by coating a tool (wood or steel) with an abrasive consisting of grit in glue. The recommended grit sizes are No. 16 and No. 24. The finer grit is used for power-driven equipment, and the heavier grit for hand-powered equipment.

10. Field Application Sequence

10.1 Insulation coverings for welded or screwed fittings should be applied before the pipe insulation.

10.2 Pipe insulation should be installed up to all flanges, flanged fittings, and flanged valves. Provide sufficient space for future bolt removal where required.

10.3 Covers for flanges, flanged fittings, and flanged valves should be installed so as to extend, not less than specified thickness, over adjacent pipe insulation.

10.4 Where required, junction of pipe insulation and flanged fittings covers can, by use of nonsetting cements or other methods, be used as an expansion or contraction joint.

11. Keywords

11.1 thermal insulating materials; thermal insulating materials—fabrication; thermal insulating materials—fittings; thermal insulating materials—pipe

TABLE 1 Number of Mitered Segments for 90 Welded Ells[A]

Pipe Size NPS	Asbestos Workers Manual	MICA[B]	Existing C450	Recommended C450
½	-	-	4	4[C]
¾	-	-	4	4[C]
1	4	-	4	4[C]
1 ¼	4	-	4	4[C]
1 ½	4	-	4	4[C]
2	4	-	4	4 (2 × 3 ½ and greater - 6 miters)
2 ½	4	4	4	4 (2 ½× 2 and greater - 6 miters)
3	4	4	4	6
3 ½	4	4	4	6
4	4	6	4	6
5	6	6	6	6
6	6	6	6	6 (6 × 5 and greater - 8 miters)
8	8	8	8	8
10	8	8	8	8
12	10	8	10	8
14	10	8	12	8 (14 × 4 ½ and greater - 10 miters)
16	10	8	12	10
18	10	8	16	10
20	12	8	16	10
24	12	10	20	12

[A]Compatible for long and short radius ells.
[B]Midwest Insulation Contractors Association and endorsed by the National Insulation Contractors Association.
[C]To prevent insulation cut away at the throat of the tube turn on smaller sizes, extend the ends of the cover with a 1-in. long leg.