



Designation: C1639 – 17

## Standard Specification for Fabrication Of Cellular Glass Pipe And Tubing Insulation<sup>1</sup>

This standard is issued under the fixed designation C1639; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers fabrication techniques for cellular glass block into billets to fabricate pipe and tubing insulation. All materials shall be in accordance with Specification **C552**.

1.2 The purpose of this specification is to optimize the thermal performance of installed cellular glass insulation systems. This is best achieved by limiting the number of joints, in particular through joints.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

**C168** Terminology Relating to Thermal Insulation

**C450** Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

**C552** Specification for Cellular Glass Thermal Insulation

**C585** Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **C16** on Thermal Insulation and is the direct responsibility of Subcommittee **C16.40** on Insulation Systems.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

#### D312 Specification for Asphalt Used in Roofing

#### 2.2 ASTM Adjuncts:<sup>3</sup>

**ADJC0450A** ASTM Recommended Dimensional Standards for Fabrication of Thermal Insulation Fitting Covers

### 3. Terminology

3.1 Terminology **C168** shall be considered as applying to the terms in this specification.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *billet / bun*—a single piece of insulation made up from a number of smaller blocks held together with an adhesive.

3.2.2 *lags*—pieces of insulation typically curved or tapered used for insulating pipes, tanks and other cylindrical equipment.

3.2.3 *precision cut V-grooved pipe insulation, n*—rigid insulation pieces cut into 4-sided polygons, of two parallel surfaces and two non-parallel surfaces of equal angles =  $180^\circ / N$ , such that when  $N$  number of these sections are assembled, they form an approximate circle and can be installed around a pipe.

3.2.3.1 *Discussion*—The adjective precision refers to the fact that when these  $N$  sections are installed onto a pipe, they fit exactly with no appreciable gaps between sections.

3.2.4 *bond joint, n*—the joint formed by the adhered mating surfaces of several thicknesses of cellular glass block or fabricated cellular glass insulation pieces that are used to create a cellular glass insulation billet, bun, or pipe and tubing insulation segments. See **Fig. 1**.

3.2.4.1 *Discussion*—A bond joint is created during the fabrication of cellular glass pipe and tubing insulation and is made with a full depth (100 % coverage) of an approved adhesive. (See **3.2.1** and **8.4**).

3.2.5 *fabrication joints* – see *bond joint, n*—the joint between adhered mating surfaces of cellular glass pipe and tubing insulation segments formed by fabricated segments or sections of cellular glass insulation that are assembled in the fabrication shop, facility, or jobsite, to produce the cellular glass pipe and tubing insulation. See **Figs. 2-4**.

<sup>3</sup> Available from ASTM International Headquarters. Order Adjunct No. **ADJC0450A**.

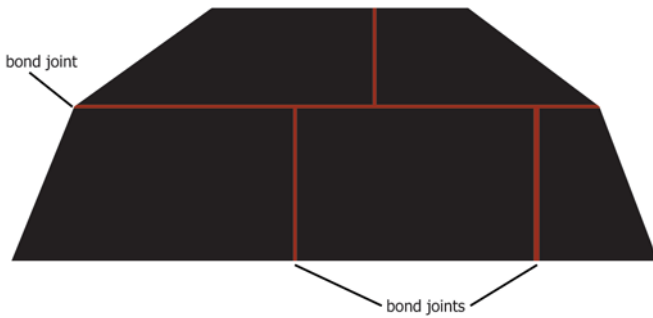


FIG. 1 Cellular Glass Insulation Billet

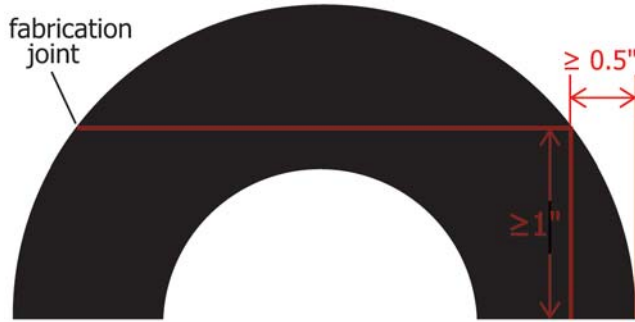


FIG. 2 Non-through Joints

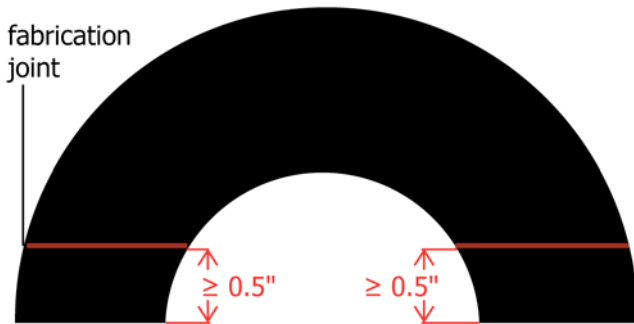


FIG. 3 Through Joints

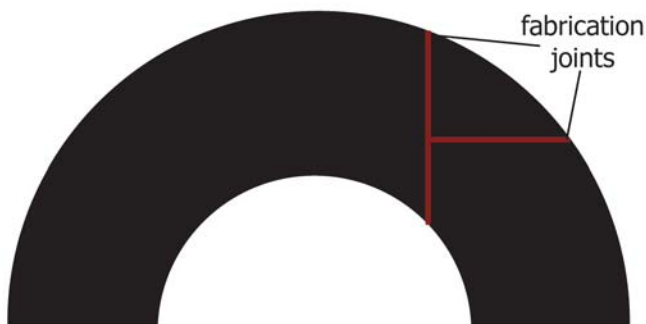


FIG. 4 90° Joint Intersection

3.2.6.1 *Discussion*—Field joints shall be formed with full depth adhesive, full depth of sealant or from the mating surfaces of the cellular glass insulation.

3.2.7 *non-through joints, n*—bond or fabrication joints that start at the outside circumference of fabricated insulation and run continuously in a straight line to the opposite side terminating at the outside circumference of the pipe insulation. (See Fig. 2.)

3.2.7.1 *Discussion*—Non-through joints do not intersect the pipe insulation's inside diameter (ID).

3.2.8 *through joints, n*—bond or fabrication joints that start at the outside circumference of fabricated insulation and run continuously in a straight line through the fabricated piece and terminates at the pipe insulation's inside diameter (ID) (See Fig. 3.)

3.2.8.1 *Discussion*—Through joints intersect the pipe/insulation interface.

3.2.9 *beveled lag, n*—rigid insulation pieces cut into isosceles trapezoid shape used to form a 360° circle that is installed around pipe or tubing.

3.2.9.1 *Discussion*—Beveled lags differ from precision cut V-grooved in that pieces are a minimum of 8 in. (203 mm) wide and are not bonded to a scrim, fabric or jacketing.

## 4. Classification

4.1 Specification C552 defines Type I and Type II materials. The same classifications shall be used in this standard.

## 5. Workmanship, Finish, and Appearance

5.1 The insulation shall have no visible defects that will adversely affect its performance.

## 6. Standard Sizes, Dimensions, and Fabrication Configurations of Cellular Glass Pipe and Tubing Insulation

6.1 Cellular glass pipe and tubing insulation shall be fabricated in lengths as agreed to by the purchaser and the supplier. Typical lengths are 23½ in. (597 mm), 23⅝ in. (600 mm), 24 in. (610 mm), 35½ in. (902 mm), or 36 in. (914 mm).

6.2 Cellular glass pipe and tubing insulation with outer diameters that are ≤ 6⅝ in. (≤168 mm) shall be made to a minimum thickness of 1-in. (25 mm). Pipe insulation with outer diameter that is >6⅝ in. (>168 mm) shall be made to a minimum 1½-in. (38 mm) thickness. Sizes shall conform to Practice C585.

6.3 Cellular glass pipe insulation with outer diameters that are <15¾ in. (<400 mm) shall be provided in half sections. Half sections shall consist of hollow cylindrical sections split lengthwise in a plane that includes the cylindrical axis.

6.4 Cellular glass pipe insulation with outer diameters that are ≥15¾ in. (≥400 mm) and ≤ 30 in. (≤762 mm) shall be provided in half-sections, quarter-sections or curved sidewall segments, as agreed upon by the fabricator and purchaser.

6.5 Cellular glass pipe insulation with outer diameters that are >30 in. (>762 mm) shall be furnished as curved sidewall segments (see Fig. 5) which shall be fabricated in equal size

3.2.5.1 *Discussion*—A fabrication joint is created at a fabrication shop or facility and is made with a full depth (100 % coverage) of an approved adhesive.

3.2.6 *field joints, n*—mating surfaces of cellular glass insulation created during the installation process.

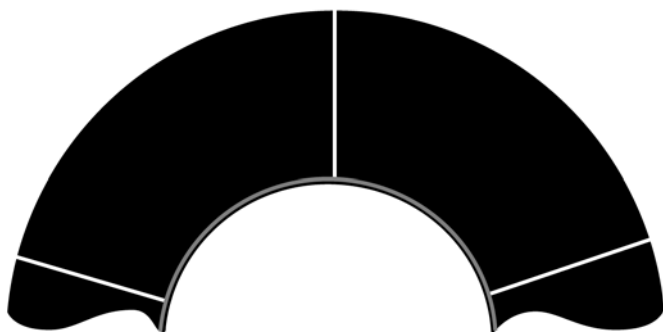


FIG. 5 Circular Cut Segmented Pipe Insulation

segments with the exception of the final or key piece which will be field trimmed if needed to ensure proper fit and closure.

6.6 For operating temperatures above ambient, circular cut segmented fabrication as shown in Fig. 5, beveled lags, or precision cut V-grooved pipe insulation, as shown in Fig. 6, specifically cut to fit the required diameter, are acceptable alternatives.

## 7. Dimensional Tolerances

7.1 Fabrication tolerances for the bore diameter and wall thickness shall be as specified in Practice C585.

7.2 Cellular glass pipe and tubing insulation shall be edged-trimmed in at the fabrication site to provide flat mating surfaces for optimal field joint closure.

7.3 Tolerance for length of pipe and tubing insulation shall be  $\pm 1/4$  in. ( $\pm 6$  mm).

7.4 The following dimensional tolerances apply only to cellular glass pipe and tubing insulation applied in half sections:

7.4.1 *Fit and Closure*—When fitted to the appropriate size pipe by banding on 9 in. (230 mm) centers, the longitudinal joints on both sides of the pipe insulation shall close to within  $1/16$  in. (1.6 mm) along the entire length of the section.

7.4.2 *Concentricity*—The inner bore of the pipe insulation shall be concentric with the outer cylindrical surface. Deviation from concentricity shall not exceed  $1/8$  in. (3.2 mm) at all points.



FIG. 6 Precision Cut V-Grooved Segmented Pipe Insulation

7.4.3 *Half-Section Balance*—the plane formed by the slit between half sections shall include the cylindrical axis. Deviation of the split plane from the cylindrical axis over a 24-in. (610-mm) length shall not exceed  $1/8$  in. (3.2 mm).

7.4.4 Multi-layer cellular glass pipe and tubing insulation shall be fabricated to the tolerances in 7.4.1 – 7.4.3 so that layers nest and close to within  $1/16$  in. (1.6 mm) along the entire length of the sections.

## 8. Fabrication Standards

8.1 Cellular glass pipe and tubing insulation shall be fabricated from the minimum number of insulation blocks that is practical.

8.2 Bond joint and fabrication adhesive for below ambient temperatures  $\geq -297^\circ\text{F}$  ( $-183^\circ\text{C}$ ) shall be hot asphalt, Specification D312, Type II, III, or IV, or manufacturer approved low permeability  $\leq 0.01$  perm-in. (0.015 ng/Pa·s·m) alternative.

8.3 Fabricating adhesive shall be applied such that there is 100 % coverage of adhesive on the mating surfaces.

8.4 There shall be no visible voids in the adhered joint nor shall any adhered joint exceed  $1/16$  in. (1.6 mm) in width.

8.5 Insulation blocks or sections shall be hand rubbed if necessary and the dust removed to fit cellular glass insulation block together prior to bonding.

8.6 For operating temperatures at or below  $-297^\circ\text{F}$  ( $-183^\circ\text{C}$ ), the potential for oxygen condensation exists. In such situations, when required by the client, the use of inorganic fabrication adhesives is acceptable for bond joints, fabrication joints, and field joints of the inner layer insulation of these systems. The bond joints, fabrication joints, and field joints of the outer insulation layer shall be hot asphalt, Specification D312, Type II, III, or IV, or manufacturer approved low permeability  $\leq 0.01$  perm-in. (0.015 ng/Pa·s·m) alternative.

8.7 For operating temperatures above ambient, fabrication adhesive shall include but not be limited to gypsum-based cement of the type and grade specified by the cellular glass insulation manufacturer. Adhesives shall be suitable for specified design conditions.

8.8 Fabrication joints on the inside and outside diameter of fabricated pieces shall be smooth and consistent with the shape of the fabricated pieces. Care shall be taken that adhesive is not recessed or extended from the dimension of the fabricated half-section or segment more than  $1/32$  in. (0.8 mm).

8.9 Bond or fabrication joints which meet other bond joints must meet at  $90^\circ$  angles, must be a minimum of 1 in. (25.4 mm) in length and shall not cross. (See Fig. 4).

8.10 Fabricated sections of insulation shall be a minimum of  $1/2$  in. (12.7 mm) thick. (See Fig. 2 and Fig. 3).

8.11 *Beveled Lags and Precision Cut V-Groove Considerations:*

8.11.1 Beveled lags and precision cut V-groove shall not be used for below ambient applications.

8.11.2 Beveled lags shall contain no more than one non-through bond joint per lag.

8.11.3 Beveled lags shall be a minimum of 8 in. (203 mm) wide when measured at the outer insulation face.

#### 8.12 *Segmented Pipe Insulation Considerations:*

8.12.1 Segmented pipe insulation shall be fabricated in equal widths with the exception of the final or key piece which will be field trimmed if needed to ensure proper fit and closure.

8.12.2 Segmented pipe insulation shall be a minimum of 8 in. (203 mm) wide when measured at the outer insulation face.

8.13 *Quarter Section Considerations*—Quarter section insulation fabricated to have an installed outer diameter that is  $\geq 15 \frac{3}{4}$  in. ( $\geq 400$  mm) and  $\leq 30$  in. ( $\leq 762$  mm) shall have no more than two through-joints per quarter section.

#### 8.14 *Fitting Insulation Considerations:*

8.14.1 Fittings for all sizes shall be either factory ground or factory mitered.

8.14.2 Fittings shall be fabricated to meet the dimensional standards of [ADJC0450A](#) Adjunct<sup>3</sup>.

8.14.3 Acceptable adhesive for fittings shall be as specified in [8.2 – 8.6](#).

#### 8.15 *Multiple Layer Insulation Considerations:*

8.15.1 Cellular glass pipe and tubing insulation fabricated for multiple layer systems shall be fabricated using the same configuration requirements in Section [6](#).

8.15.2 Cellular glass fitting insulation fabricated for multiple layer systems shall be fabricated so that joints of each insulation layer are offset from the previous insulation layer when agreed to by the fabricator and purchaser.

## 9. Packaging and Marking

9.1 *Packaging*—Unless otherwise agreed and specified between the purchaser and the manufacturer or supplier, the cellular glass insulation shall be packaged in the manufacturer/fabricator's standard commercial containers. Pipe and tubing half sections, segments, fittings, etc. must be separated from each other (prevent contact with other pieces) using kraft paper or equal when packaged.

9.2 *Marking*—Unless otherwise specified, each container shall be plainly marked as follows:

9.2.1 *Pipe and Tubing Insulation*—The name of the cellular glass manufacturer, the name, location, and address of the fabricator, the product name, pipe size, grade, quantity, nominal thickness, and jacket if applicable shall be included on the container. In addition, container markings shall include the fabricator lot number or code date identification of the material in the container. When specified in the purchase order or contract and when agreed to by the seller, each container shall also be marked with appropriate ASTM specification alphanumeric number, type, category, and grade when applicable.

9.2.2 *Special Shapes*—The name of the cellular glass manufacturer, the name, location, and address of the fabricator, the product name, pipe size, shape, grade, quantity, nominal thickness, and jacket if applicable shall be included on the container. In addition, container markings shall include the fabricator lot or code date identification of the material in the container.

## 10. Keywords

10.1 bond joints; cellular glass; fabrication; fabrication joints; pipe insulation; tubing insulation

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