~~Designation:C552–07~~ Designation: C552 – 12

Standard Specification for Cellular Glass Thermal Insulation[1]

This standard is issued under the fixed designation C552; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers the composition, sizes, dimensions, and physical properties of cellular glass thermal insulation intended for use on surfaces operating at temperatures between −450 and 800°F (−268 and 427°C). ~~Special~~ It is possible that special fabrication or techniques for pipe insulation, or both, ~~may~~will be required for application in the temperature range from 250 to 800°F (121 to 427°C). Contact the manufacturer for recommendations regarding fabrication and application procedures for use in this temperature range. For specific applications, the actual temperature limits shall be agreed upon between the manufacturer and the purchaser.

1.2 It is anticipated that single-layer pipe insulation in half sections or the inner layer of a multilayer system ~~may~~ have the potential to exhibit stress cracks above 250°F (122°C).

1.3 The values stated in inch-pound units are to be regarded as ~~the~~ standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and ~~may be approximate.~~ 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C165 Test Method for Measuring Compressive Properties of Thermal Insulations
C168 Terminology Relating to Thermal Insulation
C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
C203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
C240 Test Methods of Testing Cellular Glass Insulation Block
C302 Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation
C303 Test Method for Dimensions and Density of Preformed Block and BoardType Thermal Insulation
C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
C390 Practice for Sampling and Acceptance of Thermal Insulation Lots
C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
C450 Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
C585 Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing
C692 Test Method for Evaluating the Influence of Thermal Insulations on External Stress Corrosion Cracking Tendency of Austenitic Stainless Steel
C795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
C871 Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions
C1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation

[1] This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.20 on Homogeneous Inorganic Thermal Insulations.

Current edition approved ~~Dec.~~May 1, ~~2007.~~2012. Published ~~December 2007.~~July 2012. Originally approved in 1965 to replace C381 – 58 and C343 – 56. Last previous edition approved in ~~2003~~2007 as C552 – ~~03~~7. DOI: ~~10.1520/C0552-07.~~10.1520/C0552-12.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus
C1617 Practice for Quantitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals
C1639 Specification for Fabrication Of Cellular Glass Pipe And Tubing Insulation
D226 Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
D312 Specification for Asphalt Used in Roofing
E84 Test Method for Surface Burning Characteristics of Building Materials
E96/E96M Test Methods for Water Vapor Transmission of Materials
2.2 *ISO Document:*
ISO 3951 Sampling Procedure and Charts for Inspection by Variables for Percent Defective[3]

3. Terminology

3.1 For definitions used in this specification, see Terminology C168.
3.2 *Definitions of Terms Specific to This Standard:*
3.2.1 *board*—fabricated sections of cellular glass adhered and together covered with a facing such as a laminated kraft paper adhered to both faces.

4. Classification [4]

4.1 Cellular glass insulation is furnished in the following types:
4.1.1 *Type I*—Flat block manufactured,
4.1.2 *Type II*—Pipe and tubing insulation fabricated from Type I,
4.1.3 *Type III*—Special shapes fabricated from Type I,
4.1.4 *Type IV*—Board fabricated from Type I,

NOTE 1—Types not listed here may not be commercially available. These would be considered special order items.

5. Ordering Information

5.1 Purchase orders for cellular glass insulation furnished to this specification shall include the following information:
5.1.1 Type designation (see 4.1),
5.1.2 Dimensions according to type (see Section 9), and
5.1.3 Jacketing when required.
5.2 Any special requirements, such as, type, fabrication combinations not listed in accordance with Section 4, nonstandard dimensions in accordance with Section 9, inspection requirements in accordance with Section 13, or certification requirements in accordance with Section 16 shall be agreed upon between the purchaser and the supplier and stated in the purchase contract.

6. Materials and Manufacture

6.1 The block material shall consist of a glass composition that has been foamed or cellulated under molten conditions, annealed, and set to form a rigid noncombustible material with hermetically sealed cells. The material shall be trimmed into blocks of standard dimensions that are rectangular or tapered.
6.2 Special shapes and pipe covering shall be fabricated from blocks in accordance with Practices C450, C585 and Specification C1639.
6.3 Board, tapered or flat, shall be fabricated from blocks.

7. Physical Properties

7.1 The cellular glass insulation shall conform to the physical requirements in Table 1. Contact the manufacturer for specific design recommendations for all material types.

8. Qualification Requirements

8.1 The following requirements are generally employed for the purpose of initial material or product qualification for Type I, Block Material:
8.1.1 Compressive strength.
8.1.2 Flexural strength.
8.1.3 Water absorption.
8.1.4 Water vapor permeability.
8.1.5 Thermal conductivity.
8.1.6 Hot-surface performance.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[4] Type and grade designations are in accordance with *Form and Style for ASTM Standards*, Part B, 10th ed., Section B8., January 1996.

TABLE 1 Physical Requirements[A]

TYPE I BLOCK	
Properties	
Density, lb/ft^3(kg/m^3)	
Minimum	6.12 (98)
Maximum	8.62 (138)
Compressive strength, capped,[B] min, psi (kPa) (Capped material in accordance with Test Methods C240)	60 (415)
Compressive resistance, uncapped, min, psi (kPa) (Uncapped at 0.2-in. deformation)	35 (242)
Flexural strength, min, psi (kPa)	41 (283)
Water absorption, max, volume %	0.5
Water vapor permeability, max, per·in. or grains·in. of thickness/h·ft^2·in. Hg (ng·Pa^{-1}·s^{-1}·m^{-1})	0.005 (0.007)
Hot-surface performance warpage, in. (mm), max	0.125 (3)
Cracking	see 12.8.1
Behavior of materials in a vertical tube furnace	passed
Surface burning characteristics[C]	
Flame spread index, max	5
Smoke developed index, max	0
Mass Loss Corrosion Rate	≤ DI
Apparent Thermal Conductivity[D,E]: flat block, max (Btu-in./h·ft^2°F) (W/m·K) mean temperature, °F (°C)	
400 (204)	0.58 (0.084)
300 (149)	0.48 (0.069)
200 (93)	0.40 (0.058)
100 (38)	0.33 (0.048)
75 (24)	0.31 (0.045)
50 (10)	0.30 (0.043)
0 (–18)	0.27 (0.039)
–50 (–46)	0.24 (0.035)
–100 (–73)	0.22 (0.032)
–150 (–101)	0.20 (0.029)
TYPE II PIPE AND TUBING	
Apparent thermal conductivity[D,F,G,H]	
Pipe insulation, max, (Btu·in./h·ft^2°F) (W/m·K) at mean temperature° F (°C)	
400 (205)	0.69 (0.099)
300 (149)	0.56 (0.081)
200 (93)	0.46 (0.066)
100 (38)	0.37 (0.053)
Hot-surface performance warpage, in. (mm), max	0.125 (3)
Cracking	see 12.8.1

[A] Physical property requirements shown are for the materials in the as-manufactured condition. They ~~may~~ do ~~or may~~ not necessarily represent the values of these properties under certain in-service conditions, depending on the type of installation and the ultimate temperature exposure.

[B] For information on higher density and compressive strength material, contact the manufacturers.

[C] For Types II and III, smoke developed index and flame spread index will remain constant with some fabrication techniques and will change with other fabrication techniques. For applications requiring a flame spread index of 25 and a smoke developed index of 50, contact fabricator or manufacturer.

[D] Thermal transmission properties of insulation will vary with temperature, temperature gradient, thickness, and shape. Note the apparent thermal conductivity values in the table are based on samples tested under conditions specified in 12.3 These are comparative values for establishing specification compliance. They ~~may~~ do not necessarily represent the installed performance for the insulation under use conditions differing substantially from the test conditions.

[E] Evaluated at a small temperature difference in accordance with Practice C1058.

[F] Evaluated at a large temperature difference in accordance with Practice C1058.

[G] Single layer or inner layer on a multilayer system piping insulation fabricated in half sections ~~m~~ hays the potential to exhibit stress cracks above 250°F (122°C). The thermal performance in this range is characterized with cracks present.

[H] At this time, pipe insulation cannot be tested below ambient temperatures. See 12.3, Note 2.