



Designation: ~~C533-09~~ Designation: C533 - 11

Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation¹

This standard is issued under the fixed designation C533; 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 calcium silicate block and pipe thermal insulation for use on surfaces with temperatures between 80 and 1700°F (27 to 927°C), unless otherwise agreed upon between the manufacturer and the purchaser.

~~1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.~~

1.2 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.

1.3 The following safety hazards caveat pertains only to the test method (Section 12) described in this specification: *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

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 Board-Type Thermal Insulation

C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation

C356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C421 Test Method for Tumbling Friability of Preformed Block-Type and Preformed Pipe-Covering-Type Thermal Insulation

~~C446 Test Method for Breaking Load and Calculated Modulus of Rupture of Preformed Insulation for Pipes~~

~~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

C795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

C870 Practice for Conditioning of Thermal Insulating Materials

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

C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus

C1616 Test Method for Determining the Moisture Content of Organic and Inorganic Insulation Materials by Weight

C1617 Practice for Quantitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals

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 April 1, 2009; Sept. 15, 2011. Published June 2009; September 2011. Originally approved in 1964 to replace C344 and C345. Last previous edition approved in 2007/2009 as C533 - 07 ϵ . DOI: ~~10.1520/C0533-09~~; 10.1520/C0533-11.

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.

E84 Test Method for Surface Burning Characteristics of Building Materials
 E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750C

3. Terminology

3.1 *Definitions*—For definitions used in this specification, see Terminology C168.

4. Classification

4.1 Thermal insulation shall be of the following types:

- 4.1.1 *Type I*—Block for use on surfaces at temperature from 140°F (60°C) to 1200°F (649°C).
- 4.1.2 *Type I*—Pipe for use on surfaces at temperature from 140°F (60°C) to 1200°F (649°C).
- 4.1.3 *Type IA*—Block for use on surfaces at temperatures from 140°F (60°C) to 1200°F (649°C).
- 4.1.4 *Type II*—Block for use on surfaces at temperatures from 140°F (60°C) to 1700°F (927°C).

5. Description

5.1 *Composition*—Calcium silicate thermal insulation shall consist principally of hydrous calcium silicate usually with the incorporation of fibrous reinforcement. Asbestos shall not be used as a component in the manufacture of the material.

6. Physical Requirements

6.1 The insulation shall conform to the physical requirements of Table 1.

TABLE 1 Physical Requirements

NOTE 1—The physical requirements are based on the properties of samples dried or conditioned, or both, as specified in the referenced test methods. Calcium silicate insulation tends to absorb moisture to varying degrees depending on exposure conditions. It can absorb up to 4 times its dry weight if placed in direct contact with water through improper storage or application.

NOTE 2—The user is advised that some applications could require the knowledge of the thermal conductivity of the insulation material at mean temperatures above those shown. Consult the manufacturer for data at mean temperatures exceeding those listed.

	Type I	Type I	Type IA	Type II
	Block	Pipe	Block	Block
	Block and Pipe	Pipe	Block	Block
Use temperature, max, °F (°C)	1200 (649)	1200 (649)	1200 (649)	1700 (927)
Density (dry), max, lb/ft ³ (kg/m ³)	15 (240)	15 (240)	22 (352)	22 (352)
Flexural strength, min, psi (kPa)	50 (344)	50 (344)	50 (344)	50 (344)
Compressive strength, min, at 5 % deformation, psi (kPa)	100 (688)		100 (688)	100 (688)
Mass loss by tumbling, max, %				
after first 10 minutes	20	20	20	20
after second 10 minutes	40	40	40	40
Soaking heat linear shrinkage, max,%	2	2	2	2
Hot surface performance:				
warpage, max, in. (mm)	¼ (6)	¼ (6)	¼ (6)	¼ (6)
cracking	No cracks completely through the insulation thickness. Surface cracks on hot face are acceptable			
Apparent thermal conductivity ^A (see Note 2)				
Btu-in./h-ft ² -°F (W/m-K)max at mean temperature of:				
100°F (38°C)	0.41 (0.059)	0.41 (0.059)	0.50 (0.072)	0.50 (0.072)
200°F (93°C)	0.45 (0.065)	0.45 (0.065)	0.54 (0.078)	0.54 (0.078)
300°F (149°C)	0.50 (0.072)	0.50 (0.072)	0.58 (0.084)	0.58 (0.084)
400°F (204°C)	0.55 (0.079)	0.55 (0.079)	0.61 (0.088)	0.61 (0.088)
500°F (260°C)	0.60 (0.087)	0.60 (0.087)	0.64 (0.092)	0.64 (0.092)
600°F (316°C)	0.66 (0.095)	0.66 (0.095)	0.67 (0.097)	0.67 (0.097)
700°F (371°C)	0.71 (0.102)	0.71 (0.102)	0.70 (0.101)	0.70 (0.101)
800°F (427°C)	...			0.73 (0.105)
900°F (482°C)	...			0.75 (0.108)
1000°F (538°C)	...			0.77 (0.111)
Surface burning characteristics:				
Flame spread index, max	0	0	0	0
Smoke density index, max	0	0	0	0
Non-Combustibility	Pass	Pass	Pass	
Mass Loss Corrosion Rate	≤ DI	Pass	Pass	
Stress Corrosion Performance	Pass			
Mass Loss Corrosion Rate	≤ DI			
Stress Corrosion Performance	Pass			
Moisture content, by weight, max %	20	20	20	20

^A The thermal transmission properties of calcium silicate block and pipe insulation vary with temperature, temperature gradient, moisture content, thickness, and shape. Note that the apparent thermal conductivity requirements in the table are based on samples tested under the conditions specified in 12.1.2. These are comparative values for establishing specification compliance. They do not represent the installed performance of the insulation under use conditions differing substantially from the test conditions.