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Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation¹

This standard is issued under the fixed designation C 533; 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.

1.3 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

C 165 Test Method for Measuring Compressive Properties of Thermal Insulations

C 168 Terminology Relating to Thermal Insulation

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C 203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation

C 302 Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation

C 303 Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation

C 335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation

C 356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat

C 390 Practice for Sampling and Acceptance of Thermal Insulation Lots

C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C 421 Test Method for Tumbling Friability of Preformed Block-Type and Preformed Pipe-Covering-Type Thermal Insulation

C 446 Test Method for Breaking Load and Calculated Modulus of Rupture of Preformed Insulation for Pipes

C 450 Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

C 585 Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing

C 795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

C 870 Practice for Conditioning of Thermal Insulating Materials

C 1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions

C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation

C 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus

C 1616 Test Method for Determining the Moisture Content of Organic and Inorganic Insulation Materials by Weight

E 84 ~~Test Method for Surface Burning Characteristics of Building Materials~~ Test Method for Surface Burning Characteristics of Building Materials

E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750C

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.

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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.

3. Terminology

3.1 *Definitions*—For definitions used in this specification, see Terminology C 168.

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.

7. Standard Shapes, Sizes, and Dimensions

7.1 Calcium silicate block-type thermal insulation shall be supplied in the form of pipe insulation, flat block or curved blocks as specified. Standard sizes of the block type insulation shall be as follows:

7.1.1 *Flat Block*—Flat block shall be furnished in lengths of 36 in. (458 or 914 mm), widths of 6 to 36 in. (152 to 914 mm), and thicknesses from 1 to 6 in. (25 to 152 mm) in ½-in. (13-mm) increments. Thicknesses greater than 3 in. (76 mm) shall be furnished in one or more layers as agreed upon by purchaser and manufacturer.

7.1.2 *Curved Block*—Curved block shall be furnished in lengths of 36 in. (914 mm), widths of approximately 6 to 12 in. (152 or 305 mm), thicknesses of 1½ to 4 in. (38 to 101 mm) in ½-in. (13-mm) increments, and curved to inside radii of over 16½ in.

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 Block	Type I Pipe	Type IA Block	Type II 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	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.