Designation: C 533 – 04

Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation[1]

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.

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 Broad-Type Thermal Insulation

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

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

C 390 Criteria for Sampling and Acceptance of Preformed 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 Thermal Insulation

C 446 Test Method for Breaking Load and Calculated Modulus of Rupture of Preformed Insulation for Pipes[3]

C 450 Practice for Prefabrication 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 Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)

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

E 84 Test Method for Surface Burning Characteristics of Building Materials

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 to 1200°F (649°C).

4.1.2 *Type I*—Pipe for use on surfaces at temperature from 140°F (60°C) to to 1200°F (649°C).

4.1.3 *Type IA*—Block for use on surfaces at temperatures from 140°F (60°C) to 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).

[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 June 1, 2004. Published July 2004. Originally approved in 1964 to replace C 344 and C 345. Last previous edition approved in 2003 as C 533 – 03.

[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] Withdrawn.

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. (419 mm). Individual dimensions shall conform to those specified by the manufacturer.

7.1.3 *Grooved Block*—Grooved block shall be furnished in lengths of 36 in. (914 mm), widths of 12 or 18 in. (305 or 458 mm), and thicknesses from 1 to 6 in. (25 to 152 mm) in ½-in. (13-mm) increments. Size and spacing of grooves shall be as specified by the manufacturer.

7.2 *Calcium Silicate Pipe Insulation*—Calcium silicate pipe insulation shall be supplied either as hollow cylindrical shapes split in half lengthwise (in a plane including the cylindrical axis) or as curved segments. The pipe insulation shall be furnished in sections or segments in a length of 36 in. (914 mm) , unless otherwise agreed upon by the Purchaser, to fit standard sizes of pipe and tubing, and in nominal wall 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 between the purchaser and the manufacturer. Inner and outer diameters shall be in accordance with those standard dimensions specified in Practice C 585.

NOTE 1—When multilayer sectional pipe insulation is required, it is necessary to consider the inside and outside diameters of each layer to ensure proper nesting of materials when installed. Necessity of furnishing multilayer pipe insulation nested from the manufacturer shall be based on manufacturer's ability to control outside diameters on inner layers to not

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
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
As shipped 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.