~~Designation:C 610–99~~ Designation: C610 – 10

Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation[1]

This standard is issued under the fixed designation C610; 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 molded expanded perlite block, fittings, and pipe thermal insulation intended for use on surfaces with temperatures between 80 to 1200°F (27 to 649°C).

~~1.2The 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 When the installation or use of thermal insulation materials, accessories, and systems may pose safety or health problems, the manufacturer shall provide the user appropriate current information regarding any known problems associated with the recommended use of the company's products and shall also recommend protective measures to be employed in their safe utilization. The following safety caveat applies only to the test methods portion of 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 Insulating Materials[2]~~ 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 Density of Preformed Block-Type Thermal Insulation[2]~~ Test Method for Dimensions and Density of Preformed Block and BoardType Thermal Insulation

C335 Test Method for Steady-State Heat Transfer Properties of ~~Horizontal~~ Pipe ~~Insulations[2]~~Insulation

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

C390 ~~Criteria~~Practice for Sampling and Acceptance of ~~Preformed~~ 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 Thermal Insulation[2]~~

~~C446Test Method for Breaking Load and Calculated Modulus of Rupture of Preformed Insulation for Pipes[2]~~ Test Method for Tumbling Friability of Preformed Block-Type and Preformed Pipe-Covering-Type Thermal Insulation

C450 ~~Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments[2]~~ Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

C518 Test Method for Steady-State ~~Heat Flux Measurements and~~ Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

C585 ~~Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)[2]~~

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[1] This specification is under the jurisdiction of ASTM Committee ~~C-16~~ C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.20 on Homogeneous Inorganic Thermal Insulations.

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Current edition approved Nov. 1, 2010. Published January 2011. Originally approved in 1967. Last previous edition approved in 2009 as C610 – 09 $^{\varepsilon 1}$. DOI: 10.1520/C0610-10.

[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* ~~, Vol 04.06.~~volume information, refer to the standard's Document Summary page on the ASTM website.

C692 ~~Test Method for Evaluating the Influence of Thermal Insulations on the External Stress Corrosion Cracking Tendency of Austenitic Steel[2]~~ 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
C1045 ~~Practice for Calculating Thermal Transmission from Steady-State Heat Flux Measurements[2]~~ Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions
C1058 ~~Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation[2]~~ Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation
C1616 Test Method for Determining the Moisture Content of Organic and Inorganic Insulation Materials by Weight
E84 ~~Test Method for Surface Burning Characteristics of Building Materials~~ 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 *General*—~~Terminology C 168~~C 168 —Terminology C168 shall be considered as applying to the terms used in this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *composition*—molded expanded perlite block, fitting, and pipe thermal insulation shall be composed principally of expanded perlite and silicate ~~binders. It~~ binders may ~~also~~ contain reinforcing fibers.

4. Standard Shapes, Sizes, and Dimensions

4.1 Molded expanded perlite block, fitting, and pipe thermal insulation shall be as follows:

4.1.1 *Block*—Block shall be furnished in lengths of either 36 or ~~39.37~~39.4 in. (914 or 1000 mm), widths of 6 in. (152 mm), 12 in. (305 mm), 18 in. (457 mm), or 24 in. (610 mm), and in thickness from 1½ to 6 in. (38 to 152 mm) in increments of ½ in. (13 mm).

4.1.2 *Pipe Insulation*—Molded expanded perlite 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 lengths of either 36 or ~~39.37~~39.4 in. (914 or 1000 mm) to fit standard sizes of pipe and tubing, and in nominal thickness from 1 to 4 in. (25 to 102 mm) in ½-in. (13-mm) increments. Inner and outer diameters of multilayer construction may be specified. Inner and outer diameters shall be in accordance with those standard dimensions specified in Practice ~~C 585~~C585. Since outside diameter tolerances may be different under individual manufacturing processes, it may be necessary to have pipe insulation furnished in two or more layers nested by the manufacturer. The purchaser shall consult the manufacturer for specific requirements.

4.1.3 *Fittings*—Molded (expanded insulation fittings shall conform to the inner and outer diameters in accordance with ~~those standard dimensions specified in~~ Practice ~~C 585~~C585. Mitered fittings shall be in accordance with Practice ~~C 450~~C450.

5. Dimensional Tolerances

5.1 *General*—The average tolerances for length, width, and thickness shall comply with the requirements shown in Table 1.

5.2 *Pipe Insulation*—The following additional tolerances apply to perlite pipe insulation supplied as half sections:

5.2.1 *Fit and Closure*—When fitted to the appropriate size pipe, the longitudinal seam of the pipe insulation shall close to within 1⁄16 in. (1.6 mm) along the entire length of the section.

5.2.2 *Concentricity*—The inner bore of the pipe insulation shall be concentric with the outer cylindrical surface. The deviation from concentricity shall not exceed ⅛ in. (3.2 mm) or 5 % of the wall thickness, whichever is greater.

5.2.3 *Half-Section Balance*—The plane formed by the split between half sections shall include the cylindrical axis. Deviation of the split plane from the cylinder axis over the 36 or ~~39.37-in.~~39.4-in. (914 or 1000-mm) length shall not exceed ⅛ in. (3.2 mm).

6. Workmanship, Finish, and Appearance

6.1 Since some requirements for this material are not easily defined by a numerical value, the insulation shall not have visible defects that will adversely affect its service qualities.

7. Physical Requirements

7.1 The insulation shall conform to the physical requirements in Table 2.

TABLE 1 Dimensional Tolerances

	Block	Pipe
Length	± ⅛ in. (3.2 mm)	± ⅛ in. (3.2 mm)
Width	± ⅛ in. (3.2 mm)	...
Thickness	± ⅛ in. (3.2 mm)	± ⅛ in. (3.2 mm)
Inner Diameter	...	in accordance with Practice C585
Outer Diameter	...	in accordance with Practice C585

TABLE 2 Physical Requirements[A]

			Pipe	Block	
~~Density, lb/ft³(kg/m³)~~		~~min~~	~~10.0 (192)~~	~~10 (160)~~	
	Density, lb/ft³(kg/m³)		min	10 (160)	10 (160)
~~max~~			~~14.0 (224)~~	~~14 (224)~~	
max		14 (224)	14 (224)		
~~Flexural Strength, lb/in. (kPa)~~					
~~Flexural Strength, lb/in.² (kPa)~~		~~min~~	~~...~~	~~45.0 (310)~~	
Flexural Strength, lb/in.² (kPa)		min	...	45 (310)	
~~Stress Corrosion Cracking of Austenitic Stainless Steel~~					
Stress corrosion Cracking of Austentic Stainless Steel		pass	...	...	
~~Compressive Strength at 5 % Deformation, lb/in.²(kPa)~~		~~min~~	~~60. (483)~~	~~70 (414)~~	
Compressive Strength at 5% Deformation, lb/in.²(kPa)		min	70 (483)	70 (483)	
~~Weight Loss by Tumbling, % Loss in Weight after 10 minutes~~					
Weight Loss by Tumbling, % loss in Weight after 10 minutes		max	70	70	
~~Moisture Content[B],% by weight~~		~~max~~	~~10~~	~~10~~	
Moisture content,[B]% by weight		max	10	10	
~~Linear Shrinkage, % at 1200°F (649°C) for 24 h, max~~			–		
~~Linear Shrinkage,% at 1200°F (649°C) for 24 h max~~		~~length~~	–	~~2~~	
			~~2~~		
	Linear Shrinkage,% at 1200°F (649°C) for 24 h max		length	2	2
			width	2	2
thickness			8	8	

~~Apparent Thermal Conductivity[C], Btu-in./h-ft²-°F (W/m/K), max~~	~~Mean Temperature~~	~~App. Thermal Conductivity~~
Apparent Thermal Conductivity[C] Btu-in./h-ft²—°F (W/m/K), max	Mean Temperature	App. Thermal Conductivity by Test Method C335 / App. Thermal Conductivity by Test Method C177 or C518
	~~200°F (93°C)~~	0.55 (0.079)
	~~200°F (93°C)~~	100°F (38°C) 0.48 (0.069)
	~~300°F (149°C)~~	0.60 (0.086)
	300°F (149°C)	0.48 (0.069)
	~~400°F (204°C)~~	0.66 (0.095)
	~~400°F (204°C)~~	200°F (93°C) 0.53 (0.095)
	~~500°F (260°C)~~	0.74 (0.106)
	500°F (276)	0.53 (0.076)
	~~600°F (316°C)~~	0.80 (0.111)
	~~600°F (316°C)~~	300°F (149°C) 0.59 (0.111)
	~~700~~°F (371°C)	0.88 (0.126)
	7085)	0.59 (0.085)
~~Water Absorption of Thermal Insulation After Heat Aging and Insulation After Heat Aging and moisture gain, % by weight, max~~	400°F (204°C)	0.64 (0.092) / 0.64 (0.092)
	~~600°F (316°C)~~	50 48 h Water Immersion,
	~~600°F (316°C)~~	500°F (260°C) 0.69 (0.099) / 0.69 (0.099)
	600°F (316°C)	0.75 (0.108) / 0.75 (0.108)
	700°F (371°C)	0.80 (0.115) / 0.80 (0.115)
~~Surface Burning Characteristics~~		~~50~~
Water Absorption of Thermal Insulation after heat aging and 48 h Water Immersion, moisture gain , % by weight	600 °F (316°C)	50 / 50
Surface Burning Characteristics		
~~Flame Spread, max~~		~~0~~
Flame spread, max		0 / 0
~~Smoke Developed, max~~		~~5~~
Smoke Developed, max		5 / 5
Non Combustible		
~~Hot-surface Performance~~		~~...~~
Non Combustible	Pass	... / ...
Hot-surface Performance		
~~Warpage, in. (mm), max~~		~~¼ (6)~~
Warpage, in. (mm), max		¼ (6) / ¼ (6)
~~Cracking~~	~~No cracks completely through the insulation thickness. Surface cracks on hot face are acceptable~~	
Cracking	No cracks completely through the insulation thickness. Surface cracks on hot face are acceptable.	