



Designation: C549 – 23

# Standard Specification for Perlite Loose Fill Insulation<sup>1</sup>

This standard is issued under the fixed designation C549; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope

1.1 This specification covers the composition and physical properties of expanded perlite loose fill insulation. The specification includes the testing procedures by which the acceptability of the material is determined. These testing procedures deal primarily with material performance in the temperature range associated with the thermal envelope of buildings; however, the commercially usable temperature range for this insulation is from  $-459$  to  $1400^{\circ}\text{F}$  ( $1$  to  $1033$  K). For specialized applications, refer to the manufacturer's instructions.

1.2 The specification covers the composition and properties of perlite that has been surface-treated to produce dust suppression for installations where dust is a factor.

1.3 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.

1.4 *The following applies to Test Methods E84 and E136*—This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.

1.5 *The following applies to Test Methods E84 and E136*—Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.

1.6 *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 user shall establish appropriate*

*safety and health practices and determine the applicability of regulatory requirements prior to use. For additional precautionary statements, see Section 12.*

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

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

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

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

C520 Test Methods for Density of Granular Loose Fill Insulations

E84 Test Method for Surface Burning Characteristics of Building Materials

E136 Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at  $750^{\circ}\text{C}$

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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 Terms used in this specification are defined in Terminology **C168**.

### 4. Classification

4.1 Perlite loose-fill insulation shall conform to the physical requirements of **7**. Expanded perlite that has been treated to limit the amount of dust generated during application shall be identified on the product label.

### 5. Ordering Information

5.1 All purchase orders shall designate the density of insulation desired or required for conformance with the properties in **7.1**. The purchase order shall identify surface-treated products when included.

### 6. Materials and Manufacture

6.1 Perlite is a generic term for a naturally occurring siliceous mineral which is mined, crushed, sieved and dried to produce a crude perlite ore. The crude ore, in the form of particles of varying size, weighing 60 to 75 lb/ft<sup>3</sup> (960 to 1200 kg/m<sup>3</sup>), is expanded in high-temperature furnaces to densities in the range from 2.0 to 11.0 lb/ft<sup>3</sup> (32 to 176 kg/m<sup>3</sup>). As a naturally occurring mineral, it is classified as an elementary building material. It is noncombustible as determined by Test Method **E136**.

### 7. Physical Requirements

7.1 The physical requirements listed in this section are defined as inspection requirements (see Practice **C390**). The insulation shall conform to the following requirements:

Bulk density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	2–11 (32–176)
Grading (particle size):	
Percentage retained, maximum (by weight), Sieve No. 4 (4.75 mm), %	5
Small-scale fire test	no sparking or ignition

7.2 The physical requirements listed in this section are defined as Qualification Requirements (see Practice **C390**). The insulation shall conform to the following requirements:

Thermal resistance, h-ft <sup>2</sup> ·°F/Btu (m <sup>2</sup> ·K/W)	See <b>Table 1</b>	
Moisture absorption, weight % during 14 days, max, %	1.0	
Combustibility (by Test Method <b>E136</b> )	noncombustible	
Surface burning characteristics:		
Flame spread, max	0	25
Smoke developed, max	0	50
Dust suppression: (for surface treated product)		
Weight of collected material, max, mg		85

### 8. Sampling

8.1 For purposes of standard tests, sampling shall be in accordance with Practice **C390**.

### 9. Test Methods

9.1 *Bulk Density*—Test Methods **C520**, Method A.

9.2 *Grading*—Test Method **C136**, except that when a mechanical sieving device is used, the sieving time shall be 5 min and the test sample shall be 0.11 ± 0.02 lb (50 ± 9 g) of material.

#### 9.3 Small-Scale Fire Test:

9.3.1 *Scope*—The purpose of this quality control test is to confirm that excessive coating or organic material has not been added during processing.

9.3.2 *Significance*—This specification measures and describes the response of materials, products, or assemblies to heat and flame under controlled condition, but does not by itself incorporate all factors required for fire risk assessment of materials, products or assemblies under actual conditions.

9.3.3 *Procedure*—Hold a 0.02 to 0.03 lb (9 to 14g) specimen of the perlite insulation in a suitable fixture (such as 6 by 6 by 2-in. (152 by 152 by 51-mm) deep wire mesh basket constructed from 100-mesh (150 μm) stainless steel woven wire cloth) and positioned in direct contact with the flame of a Bunsen burner for about 20 s. Sparking or ignition indicates failure to conform to the requirements of **7.1**.

9.3.4 *Precision and Bias*—No statement is made about either the precision or the accuracy of the small-scale fire test for determining resistance of the perlite insulation to heat and flame since the result states whether there is conformance to the criteria for success specified in the procedure.

9.4 *Thermal Resistance*—Tests of thermal resistance shall be determined in accordance with Test Method **C177** or **C518**. Testing shall be done at the design density and representative thickness. The arithmetic average thermal resistance of four specimens shall exceed 95% the value in **Table 1**. The thermal resistance (*R*-value) shall be determined at mean temperature of 75 ± 1°F (24 ± 0.5°C) and a temperature difference of 40°F (22°C). Report the direction of heat flow. Thermal resistance at other mean temperatures shall be determined if required.

9.5 *Moisture Absorption*—The test specimen shall be 0.11 ± 0.05 lb (50 ± 23 g) of product. Fill and level the product into a specimen holder 9 by 9 by 5 ± 0.1 in. (228 by 228 by 127 ± 3 mm) deep.

9.5.1 Precondition in accordance with Test Method **C177** or **C518**. Conditioning shall be with minimum air movement across the specimen surface. Condition at 50 ± 2 % relative humidity and 120 ± 2°F (49 ± 1°C) to constant weight and record. State the density of the specimen conditioned to constant weight in the report of results.

9.5.2 Increase the relative humidity to 90 ± 2 %. Condition to constant weight by weighing at 24-h intervals. Determine the moisture pickup as a percent of conditioned weight determined in **9.5.1** at 50 ± 2% relative humidity and 120 ± 2°F (49 ± 1°C).

9.5.3 *Precision and Bias*—This test establishes a typical property of perlite. The test is intended to indicate sorption under high humidity conditions which are known to be characteristic of its usual end use as a thermal insulation.

9.6 *Surface Burning Characteristics* of perlite insulation shall be determined in accordance with Test Method **E84** at a thickness that is representative of end use with the material artificially supported in the test apparatus. Perlite with surface