



Designation: C 549 – 02

Standard Specification for Perlite Loose Fill Insulation¹

This standard is issued under the fixed designation C 549; 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 approval. 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 the composition and physical properties of expanded perlite loose fill insulation. The specification also includes the testing procedures by which the acceptability of the material may be 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°F (1 to 1033 K). For specialized applications, refer to the manufacturer's instructions.

1.2 The specification also covers the composition and properties of perlite that has been surface-treated to produce water repellency and dust suppression for installations where liquid moisture and dust may be a factor.

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 user shall establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.* For additional precautionary statements, see Section 11.

1.4 The following precautionary caveat pertains to the test methods portion, Section 8, 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:

¹ This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.23 on Blanket and Loose Fill Insulation.

Current edition approved June 10, 2002. Published August 2002. Originally published as C 549 – 64 T. Last previous edition C 549 – 81(1995) ^{ϵ 1}.

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates²

C 168 Terminology Relating to Thermal Insulation³

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus³

C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots³

C 518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus³

C 520 Test Methods for Density of Granular Loose Fill Insulations³

E 84 Test Method for Surface Burning Characteristics of Building Materials⁴

E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C ⁴

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁵

2.2 Federal Specification:

HH-I-515D Insulation Thermal (Loose Fill for Pneumatic or Poured Application) Cellulosic or Wood Fiber⁶

3. Classification

3.1 Perlite loose fill insulation shall be specified by four type designations as follows:

3.1.1 *Type I*—The product that results from the expanding of natural perlite ore by grading and heating to meet the requirements of this specification.

3.1.2 *Type II*—Expanded perlite that has been surface-treated to produce water repellency and limited absorption of moisture from both liquid and vapor phase.

3.1.3 *Type III*—Expanded perlite that has been surface-treated to limit the amount of dust generated during application.

² Annual Book of ASTM Standards, Vol 04.02.

³ Annual Book of ASTM Standards, Vol 04.06.

⁴ Annual Book of ASTM Standards, Vol 04.07.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

3.1.4 *Type IV*—Expanded perlite that has been surface-treated to produce water repellency and to limit the dust generated during application.

4. Ordering Information

4.1 All purchase orders should designate the type of insulation desired. The type and grade classification in this specification differ from the classification in earlier issues. Purchasers referencing this specification should include the date of issue.

5. Materials and Manufacture

5.1 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/ft³ (960 to 1200 kg/m³), is expanded in high-temperature furnaces to densities in the range from 2.0 to 11.0 lb/ft³ (32 to 176 kg/m³). As a naturally occurring mineral, it is classified as an elementary building material. It is noncombustible as determined by Test Method C 136.

6. Physical Requirements

6.1 The physical requirements listed in this section are defined as Inspection Requirements (see Criteria C 390). The insulation shall conform to the following requirements:

	All Types 2–11 (32–176)	
Bulk density, lb/ft ³ (kg/m ³)		
Grading (particle size):		
Cumulative percentage retained, maximum (by weight), Sieve No. 4 (4.75 mm), %	5	
	Types I and III	Types II and IV only
Water repellency, min mL of water repelled	N.A.	175
Small-scale fire test	no sparking or ignition	

6.2 The physical requirements listed in this section are defined as Qualification Requirements (see Criteria C 390). The insulation shall conform to the following requirements:

	All Types See Table 1	
Thermal resistance, h-ft ² ·°F/Btu (m ² ·K/W)	1.0	
Moisture absorption, weight %/14 days, max, %	1.0	
	Types I and III	Types II and IV
Wickability, max g wicked in 5 min	N.A.	1.0
Combustibility (by Test Method E 136)	noncombustible	N.A. ^A
Surface burning characteristics:		
Flame spread, max	0	25
Smoke developed, max	0	50
Dust suppression:		
Weight of collected material, max, mg	N.A.	85

^AFederal Standards for attic floor insulation require conformance to two non-ASTM tests for combustibility: Critical Radiant Flux (HH-I-515D, 4.8.7) and Smoldering Combustion (HH-I-515D, 4.8.8). Types III and IV perlite insulation, when tested for Critical Radiant Flux, showed no ignition or flame front advance at a flux of 1.07 W/cm². When tested for Smoldering Combustion, Types III and IV perlite insulation showed no flaming combustion and 0 % weight loss.

7. Sampling

7.1 For purposes of standard tests, sampling shall be in accordance with Criteria C 390.

8. Test Methods

8.1 *Bulk Density*—Test Methods C 520, Method A.

8.2 *Grading*—Test Method C 136, except that when a mechanical sieving device is used, the sieving time shall be 5 min and the test sample shall be 50 g of material.

8.3 *Water Repellency* (Types II and IV only):

8.3.1 *Apparatus*:

8.3.1.1 *Rigid Plastic Tube*, 50 mm inside diameter by 300 mm long with a 150- μ m (100-mesh) screen covering firmly fastened or adhered to the bottom. The tube shall be marked at 400 mL from the screen-covered end.

8.3.1.2 *Rubber Stopper*, No. 15.

8.3.1.3 *Graduated Cylinder*, 250-mL.

8.3.1.4 *Beaker*, 500-mL.

8.3.2 *Sample Preparation*:

8.3.2.1 Spoon a representative sample into the test cylinder to a level slightly above the 400-mL mark.

8.3.2.2 Compact it by dropping the tube from a height of approximately 75 mm on a large rubber stopper (No. 15 recommended) for a total of ten drops. As the sample compacts to a level below the 400-mL mark, add additional material so that after the tenth drop the level of the sample is within 3 mL of the 400-mL mark.

8.3.3 *Procedure*:

8.3.3.1 With the tube supported in a vertical position and a beaker positioned under the tube, pour 250 mL of cold tap water rapidly onto the perlite. Take care while pouring, that the stream hits the middle of the surface of the bed of perlite and does not merely slide down the side of the test cylinder.

8.3.3.2 Allow the water to drain through the bed of perlite for exactly 3 min. Tilt the tube at approximately 45° to drain water collected on the screen. Tilt it only momentarily for this purpose.

8.3.3.3 Measure the collected water in the 250-mL graduate.

8.3.4 *Calculations*:

8.3.4.1 Report the amount of collected water in millilitres as “millilitres repelled.”

8.3.4.2 Report results as the mean of three independent tests.

8.3.5 *Precision and Bias*—The purpose of this test is to confirm that the intended degree of surface treatment has been accomplished to achieve water repellency. The specified characteristic is a minimum (no range or maximum). Quantitative values for conforming products exceeding the limit have no commercial significance.

8.4 *Small-Scale Fire Test*:

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

8.4.2 *Significance*—This test is intended as a means to determine the resistance of the material to heat and flame under controlled conditions and should not be used to describe or appraise the fire hazard or fire risk under actual conditions.

8.4.3 *Procedure*—Hold a small sample (such as 10 to 20 gr) of the perlite insulation in a suitable fixture (such as 6 by 6 by 2-in. deep wire mesh basket constructed from (150 μ m 100-mesh) 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 6.1