



Designation: C 516 – 02

Standard Specification for Vermiculite Loose Fill Thermal Insulation¹

This standard is issued under the fixed designation C 516; 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 the composition and physical properties of expanded or exfoliated vermiculite 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 -119 to 850°F (-84 to 454°C). For specialized applications, refer to manufacturer's instructions.

1.2 The specification also covers the composition and properties of vermiculite that has been surface-treated to produce water repellency for installations where liquid moisture 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 with 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.

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 9, 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.* For specific hazard statements, see Section 12.

2. Referenced Documents

2.1 ASTM Standards:

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

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.

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² Annual Book of ASTM Standards, Vol 04.02.

- 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 Practice for Sampling and Acceptance of Preformed Thermal Insulation Lots³
- C 518 Test Method for Steady-State 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

3. Terminology

3.1 The terms used in this specification are defined in Terminology C 168.

4. Classification

4.1 Vermiculite insulation shall be specified by two type designations and five classes, as follows:

4.1.1 *Vermiculite Loose Fill Insulation—Type I*—The product that results from the expanding or exfoliating of natural vermiculite ore by grading and heating to meet the requirements of this specification.

4.1.2 *Vermiculite Loose Fill Insulation—Type II*—Expanded vermiculite that has been surface-treated to produce water repellency and limit absorption of moisture from both liquid and vapor phase.

4.1.3 Vermiculite loose fill insulation has five grade designations established by range of particle size distribution as shown in Table 1.

5. Ordering Information

5.1 All purchase orders should designate both type and grade of insulation desired. If type designation is omitted, Type I will be furnished. The type and grade classifications in this

³ Annual Book of ASTM Standards, Vol 04.06.

⁴ Annual Book of ASTM Standards, Vol 04.07.

TABLE 1 Density Specifications

Grade Designation	Bulk Density, lb/ft ³ (kg/m ³)	
	min	max
0—Premium	3.0 (48)	5.0 (80)
1—Large	3.7 (59)	5.5 (88)
2—Medium	4.0 (64)	6.0 (96)
3—Fine	4.5 (72)	7.0 (112)
4—Super Fine	5.5 (88)	8.0 (128)

specification differ from the classifications in earlier issues. Purchasers referencing this specification should include the date of issue.

6. Materials and Manufacture

6.1 Vermiculite is a micaceous mineral which is mined and processed to produce a high-purity concentrate. The concentrate, in the form of flakes of varying size and thickness weighing 55 lb/ft³ (880 kg/m³), is expanded in high-temperature furnaces to densities in the range from 3.0 to 8.0 lb/ft³ (148 to 128 kg/m³). As a naturally occurring mineral, it is classifiable as an elementary building material. It is noncombustible as determined by Test Method E 136. Material must pass combustion test criteria of Test Method E 136.

7. Physical Requirements

7.1 The physical requirements listed in this section are defined as Inspection Requirements (see Practice C 390, 5.1.2; see also Terminology C 168). The insulation shall conform to the following requirements:

Bulk density, lb/ft ³ (kg/m ³)	Type I See Table 1	Type II See Table 3
Grading (particle size)	See Table 3	
Water properties, max g wicked in 5 min	N.A.	3

7.2 The physical properties listed in this section of the specification are defined as Qualification Requirements (see Practice C 390, 5.1.1). The insulation shall conform to the following requirements:

Thermal resistance, °F-h-ft ² /Btu (K-m ² /W)	See Table 2	
Moisture absorption, max, % by weight/14 days	3.5	3.5
Combustibility	No flaming, glowing, or smoking	
Surface-burning characteristics (Test Method E 84):		
Flame spread, max	0	0
Smoke developed, max	0	0
Water properties, min, mL of water repelled	N.A.	175

8. Sampling

8.1 For purposes of standard tests, sampling shall be in accordance with Practice C 390.

9. Test Methods

9.1 The physical properties, as enumerated in Section 7, shall be determined in accordance with the following methods:

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

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

9.1.3 *Thermal Resistance*—Tests for thermal resistance may be made in accordance with Test Methods C 177 or C 518. Test at the design density. The thermal resistance of the various types shall not be lower than the values listed in Table 2, except that the average thermal resistance of any four specimens may fall up to 5 % below the value in the table. Determine the thermal resistance (*R*-value) at mean temperature of 75°F (24°C) and 40°F (4°C), at design density and in accordance with the current editions of Test Methods C 177 or C 518. Report the direction of heat flow. Thermal resistance at other mean temperatures may be determined if required.

9.1.4 *Moisture Absorption*—The test specimen shall be a sample of approximately 50 g. Loose fill the sample and level into a sample holder 9 by 9 by 5 in. (228 by 228 by 127 mm) deep.

9.1.4.1 Condition with minimum air movement across the sample surface. Condition at 50 ± 2 % relative humidity and

TABLE 2 Nominal Thermal Resistance Values

Mean Temperature		Thermal Resistance ^A °F-h-ft ² /Btu (K-m ² /W)				
°F	(°C)	0—Premium	1—Large	2—Medium	3—Fine	4—Super Fine
-119	(-84)	...	...	...	...	3.4 (0.59)
-58	(-50)	...	...	...	...	3.0 (0.52)
-13	(-25)	...	...	...	...	2.7 (0.48)
75	(24)	2.3 (0.40)	2.3 (0.40)	2.3 (0.40)	2.3 (0.40)	2.3 (0.40)
212	(100)	...	...	...	...	1.8 (0.32)
302	(150)	...	...	...	...	1.6 (0.28)
392	(200)	...	...	...	...	1.4 (0.25)
482	(250)	...	...	...	...	1.2 (0.22)
572	(300)	...	...	...	...	1.1 (0.19)
662	(350)	...	...	...	...	0.94 (0.17)
752	(400)	...	...	...	...	0.84 (0.15)
850	(454)	...	...	...	...	0.73 (0.13)

^A The nominal thermal resistances in this table are for 1.0 in. (25.4 mm) of thickness.