



Designation: C1139 – 14

# Standard Specification for Fibrous Glass Thermal Insulation and Sound Absorbing Blanket and Board for Military Applications<sup>1</sup>

This standard is issued under the fixed designation C1139; 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.

## 1. Scope

1.1 This specification covers unfaced flexible fibrous glass blanket and faced board used for thermal and sound absorbing insulation at temperatures up to 450°F (232°C) for military applications as a replacement for MIL-I-22023D.

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 This specification measures and describes 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.

1.4 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.

1.5 The following hazard caveat pertains only to the test method section 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:<sup>2</sup>

- C167 Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations
- C168 Terminology Relating to Thermal Insulation

<sup>1</sup> 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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<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.

- 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
  - C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
  - C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - C665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
  - C1101/C1101M Test Methods for Classifying the Flexibility or Rigidity of Mineral Fiber Blanket and Board Insulation
  - C1335 Test Method for Measuring Non-Fibrous Content of Man-Made Rock and Slag Mineral Fiber Insulation
  - D1448 Test Method for Micronaire Reading of Cotton Fibers
  - E70 Test Method for pH of Aqueous Solutions With the Glass Electrode
  - E84 Test Method for Surface Burning Characteristics of Building Materials
  - E176 Terminology of Fire Standards
  - E2231 Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
- ### 2.2 U.S. Military Standards:<sup>3</sup>
- MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment (Type I Environmental and Type II Internally Excited)
  - MIL-Y-1140 Yarn, Cord, Slewing, Cloth and Tape-Glass
  - MIL-A-3316 Adhesives, Fire Resistant, Thermal Insulation
  - MIL-E-17970 Enamel, Non-Flaming Semi-Gloss White
  - MIL-C-20079 Cloth, Glass; Tape, Textile Glass And Thread, Glass And Wire-Reinforced Glass

<sup>3</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

### 3. Terminology

3.1 Definitions—Terminology **C168** and Terminology **E176** shall apply to the terms used in this specification.

### 4. Classification

4.1 The fibrous glass felt shall be of the following types and grades:

Type I, Unfaced Thermal Blanket	Nominal Density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )
Grade 1	0.75 (12)
Grade 2	1.00 (16)
Grade 3	1.50 (24)
Grade 4	2.00 (32)
Grade 5	2.50 (40)
Grade 6	3.00 (48)
Type II, Unfaced Sound Absorbing Blanket	Nominal Density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )
Grade 1	0.75 (12)
Grade 2	1.00 (16)
Grade 3	1.50 (24)
Grade 4	2.00 (32)
Grade 5	2.50 (40)
Grade 6	3.00 (48)
Type III, Faced, Thermal and Sound Absorbing Board	Density shall be 2.8 (45) lb/ft <sup>3</sup> (kg/m <sup>3</sup> )

### 5. Ordering Information

5.1 The type, dimensions, density, maximum use temperature, and facing (if required) shall be specified by the purchaser. A product certification (if required) shall be specified in the purchase order.

### 6. Materials and Manufacture

#### 6.1 Composition:

6.1.1 The insulation shall be composed of glass, processed from a molten state into a fibrous form, bonded with a chemical binder.

6.1.2 The facing shall be a polyester film reinforced with glass yarns (MIL-I-1140). The laminating adhesive shall conform to the requirements of MIL-A-3316.

### 7. Physical Requirements

7.1 A 1-in. (25-mm) thick sample of the insulation shall be flexible when tested in accordance with **11.1**.

7.2 The insulation shall be of the nominal density specified for its grade with a tolerance of  $\pm 10\%$ . Density shall be determined in accordance with **11.2**.

7.3 *Maximum Temperature of Use*—When tested in accordance with **11.10** at the insulation's maximum use temperature

of 450°F (232°C), the insulation shall not crack, warp, flame, glow, smolder, or show evidence of fused fibers.

7.4 The nonfibrous material (shot) content shall not be greater than 1.5 % by weight when tested in accordance with **11.3**.

7.5 *Binder Content*—When tested in accordance with **11.4**, the binder content shall not exceed 30 % by weight.

7.6 *Corrosiveness to Steel*—When tested in accordance with **11.6**, steel plates in contact with the insulation shall show no corrosion greater than comparative plates in contact with sterile cotton.

7.7 *Surface Burning Characteristics Type I and II*—The insulation shall have a flame spread index not greater than 25 and a smoke developed index not greater than 50 when tested in accordance with **11.7**.

7.8 *Quarter Scale Room Fire Test of Type III*—Type III shall meet the requirements of the Quarter-Scale Room-Fire Test Method described in **11.12**.

7.9 *Apparent Thermal Conductivity*—The thermal conductivities for Type I, Grade 1 through 6 and Type III materials shall not exceed the values shown in **Table 1**. Thermal conductivity shall be determined by Test Methods **C177** or **C518**.

7.10 *Vibration Resistance of Type II Materials*—There shall be a maximum of 0.50 % weight loss and the insulation shall not settle and lose thickness when subjected to the vibration test described in **11.9**.

7.11 *Acoustical Performance of Type II Materials*—The coefficients of absorption shall be not less than those shown in **Table 2** when Type II material is tested in accordance with **11.8**.

7.12 *Kerfing*—Type III panels shall be capable of being kerfed with a 90° V-groove to facilitate bending when the panel is folded to a right angle. The facing material shall be flexible to form a neat square corner at the kerfed joint (see **11.11**).

7.13 *Flashover Time*—Flashover time shall not occur within 10 min when tested in accordance with **11.12.4.5**.

### 8. Dimensions and Permissible Variations

8.1 The standard sizes and tolerances of Types I, II, and III materials are listed in **Table 3**.

**TABLE 1 Type I and Type III Thermal Insulation Blanket Physical Requirements**

Type I	Type I Grade 1	Type I Grade 2	Type I Grade 3	Type I Grade 4	Type I Grade 5	Type I Grade 6	Type III
Nominal Density (lb/ft <sup>3</sup> )	0.75	1.0	1.5	2.0	2.5	3.0	2.8
Thermal Conductivity, max Btu-in./h ft <sup>2</sup> ·°F (W/m·K)							
Mean Temperature, ° F (°C)							
25 (−4)	0.27 (0.039)	0.26 (0.037)	0.24 (0.035)	0.22 (0.032)	0.22 (0.032)	0.22 (0.032)	0.22 (0.032)
50 (10)	0.29 (0.042)	0.28 (0.040)	0.26 (0.037)	0.24 (0.035)	0.23 (0.033)	0.23 (0.033)	0.23 (0.033)
75 (24)	0.32 (0.046)	0.30 (0.043)	0.27 (0.039)	0.25 (0.036)	0.24 (0.035)	0.24 (0.035)	0.24 (0.035)
100 (38)	0.35 (0.050)	0.32 (0.046)	0.29 (0.042)	0.27 (0.039)	0.26 (0.037)	0.25 (0.036)	0.26 (0.037)
200 (93)	0.49 (0.071)	0.43 (0.062)	0.38 (0.055)	0.34 (0.049)	0.31 (0.045)	0.30 (0.043)	0.31 (0.045)
300 (149)	0.70 (0.101)	0.58 (0.083)	0.50 (0.072)	0.44 (0.063)	0.38 (0.055)	0.37 (0.053)	0.38 (0.055)

**TABLE 2 Coefficients of Sound Absorption Minimum, Using a Type “A” Mounting (Types II and III)**

NOTE 1— Data on Type “A” Mounting is for comparison only and not meant to indicate characteristics in service.

Nominal Insulation Thickness, in. (mm)	Frequency, Hz						Noise Reduction Coefficient (NRC)
	125	250	500	1000	2000	4000	
Type II, All Grades							
0.75 (19)	0.04	0.10	0.20	0.40	0.55	0.55	0.31
1.0 (25)	0.06	0.20	0.45	0.65	0.65	0.65	0.49
2.0 (51)	0.15	0.40	0.75	0.75	0.75	0.70	0.66
3.0 (75)	0.20	0.60	0.90	0.80	0.80	0.75	0.77
4.0 (100)	0.25	0.65	0.95	0.85	0.85	0.80	0.82
Type III							
2 (51)	0.43	0.96	1.00	0.70	0.51	0.35	0.80

**TABLE 3 Type I, II, III Tolerances for Standard Sizes**

	Standard Sizes Types I and II	Tolerances
Length ft (m)	4 (1.22), 8 (2.43)	±¼ in. (0.64 cm)
	50 (15.24), 75 (22.86), 100 (30.49), 150 (45.73), 200 (61)	±6 in. (15.24 cm)
	24 (61.68), 36 (91.44), 48 (122), 72 (183)	±¼ in. (0.64 cm)
Width in. (cm)	0.75 (1.9), 1.0 (2.54), 1.5 (3.8), 2.0 (5.1), 2.5 (6.35), 3.0 (7.62), 3.5 (8.9), 4.0 (10.2)	±½ in. (0.32 cm)
	Standard Sizes Types III	
	36 (91.44), 48 (122)	±¼ in. (0.64 cm)
Width, in. (cm)	24 (61.68)	±¼ in. (0.64 cm)
Thickness, in. (cm)	0.75 (1.9), 1.0 (2.54), 1.5 (3.8), 2.0 (5.1)	±½ in. (0.32 cm)

## 9. Workmanship, Finish, and Appearance

9.1 The insulation units shall indicate good workmanship and shall not have defects that adversely affect their installation and service qualities.

## 10. Sampling

10.1 Inspection and qualification shall be in accordance with Practice C390. Other provisions for sampling can be agreed upon between the purchaser, seller, and manufacturer.

## 11. Test Methods

11.1 *Flexibility—Rigidity*—Test in accordance with Test Method C1101/C1101M.

11.2 *Density*—Test in accordance with Test Methods C167.

11.3 *Nonfibrous Shot Content*—Test in accordance with the Annex in Specification C1335.

11.4 *Test Method for Determining Binder Content:*

11.4.1 *Scope*—This test method provides a test to determine the amount of organic binder present in the insulation.

11.4.2 *Summary of Test Method*—The percent binder by weight is measured by determining the weight lost by the insulation after it is placed in a 1000°F (538°C) furnace for 1 h.

11.4.3 *Significance and Use*—There is a susceptibility of the product to have an exothermic reaction at high temperature.

11.4.4 *Apparatus:*

11.4.4.1 *Furnace*, capable of maintaining a 1000°F (538°C) temperature.

11.4.4.2 *Scales*, accurate to 0.1 % of specimen weight.

11.4.5 *Test Specimen:*

11.4.5.1 Three test specimens shall be tested.

11.4.5.2 The test specimen shall be between 0.17 lb (75 g) and 0.33 lb (150 g).

11.4.6 *Procedure:*

11.4.6.1 Weigh the specimens; then place the specimens in the 1000°F (538°C) furnace for 1 h.

11.4.6.2 Remove the specimens from the furnace and let them cool to room temperature in the same laboratory atmosphere (temperature and relative humidity) as they were previous to placing them in the furnace.

11.4.6.3 Weigh the specimens when they have cooled to ambient temperature. The percent binder is the average of the following calculation for the three specimens:

$$B, \% = \frac{W_I - W_F}{W_I} \times 100$$

where:

$B$  = percent binder,

$W_I$  = initial weight, and

$W_F$  = final weight after 1 h.

11.4.7 *Precision and Bias*—The precision of this test method is not known because interlaboratory data are not available. This test method is not be suitable for use in specifications or in case of disputed results as long as these data are not available.

11.5 *Thermal Conductivity*—Test in accordance with Test Methods C177 or C518.

11.6 *Corrosiveness to Steel*—Test in accordance with the corrosiveness method of Specification C665.

11.7 *Surface Burning Characteristics*—Test in accordance with Test Method E84, using the specimen preparation and mounting method of Practice E2231.

11.8 *Acoustical Performance*—Test in accordance with Test Method C423 using an “A” mounting.

11.9 *Test Method for Determining the Vibration Resistance of Fibrous Glass Insulation:*

11.9.1 *Scope*—This test method provides a test to determine the effect of vibration, at ambient temperature, on fibrous glass insulation.

11.9.2 *Summary of Test Method*—A 12-in. (30.5-cm) square specimen is subjected to a 0.13-in. (3-mm) amplitude vibration with a 12-Hz frequency in a horizontal plane for a period of 100 h. After the 100 h of vibration, the specimen is examined for weight loss and loss of thickness due to settling.

11.9.3 *Significance and Use*—This is a test method to test products that are installed in an above ambient temperature and vibrating environment.

11.9.4 *Apparatus:*

11.9.4.1 *Pin Probe*, as described in Test Methods C167.

11.9.4.2 *Sheet Metal Box, 12-in. (30.5-cm) Square*, with a 16-mesh wire screen tightly stretched over one open side.