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AMERICAN SOCIETY FOR TESTING AND MATERIALS  
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## Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)<sup>1</sup>

This standard is issued under the fixed designation C 592; 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 Department of Defense. This specification replaces HH-I-558B in part.*

### 1. Scope

1.1 This specification covers the composition, dimensions, and physical properties of metal-mesh covered mineral fiber (rock, slag, or glass) blanket and blanket-type pipe insulation (typically on 24 in. (610 mm) diameters or larger) for use on cooled surfaces and on heated surfaces operating at temperatures up to 1200°F (649°C). For specific applications, the actual use temperatures shall be agreed upon between the manufacturer and purchaser.

1.2 The orientation of the fibers within the blanket is primarily parallel to the heated surface. This specification does not cover fabricated pipe and tank wrap insulation where the insulation has been cut and fabricated to provide fiber orientation that is perpendicular to the heated surface.

1.3 For satisfactory performance, properly installed protective vapor retarders shall be used in low temperature applications to prevent movement of water vapor through or around the insulation towards the colder surface.

1.4 See Supplementary Requirements for modifications to paragraphs in this standard when using Specification C 592 in lieu of the United States Department of Defense, Department of Navy, Naval Sea Systems Command, in Washington, DC, Military Specifications No.(s) MIL-I-2818B and MIL-I-2818C.

1.5 The values stated in inch-pound units are to be regarded as the standard. The System International (SI) equivalents of inch-pound units are given in parentheses for information only and may be approximate.

1.6 *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>1</sup> This specification is under the jurisdiction of ASTM Committee C-16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.23 on Blanket and Loose Fill Insulation.

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C 167 Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations<sup>2</sup>

C 168 Terminology Relating to Thermal Insulating Materials<sup>2</sup>

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus<sup>2</sup>

C 356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat<sup>2</sup>

C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots<sup>2</sup>

C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation<sup>2</sup>

C 447 Practice for Estimating the Maximum Use Temperature of Thermal Insulations<sup>2</sup>

C 518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus<sup>2</sup>

C 665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing<sup>2</sup>

C 680 Practice for Determination of Heat Gain or Loss and the Surface Temperatures of Insulated Pipe and Equipment by the Use of a Computer Program<sup>2</sup>

C 1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions<sup>2</sup>

C 1104/C 1104M Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation<sup>2</sup>

C 1114 Test Method for Steady-State Thermal Transmission Properties by means of the Thin-Heater Apparatus<sup>2</sup>

C 1304 Test Method for Assessing the Odor Emission of Thermal Insulation Materials<sup>2</sup>

C 1335 Test Method for Measuring the Non-Fibrous Content of Man-Made Rock and Slag Mineral Fiber Insulation<sup>2</sup>

E 84 Test Method for Surface Burning Characteristics of Building Materials<sup>3</sup>

### 3. Terminology

3.1 Terminology C 168 shall be considered as applying to

<sup>2</sup> Annual Book of ASTM Standards, Vol 04.06.

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.07.

the terms used in this specification.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 mean temperature—the sum of the cold surface temperature and the hot surface temperature divided by two.

3.2.2 metal-mesh covered blanket—mineral fiber thermal insulation held together by metal-mesh facings on one or both sides with heat-resistant metal ties attached through the blanket from one face to the other.

3.2.3 metal-mesh covered blanket-type pipe—mineral fiber thermal insulation sized to fit around a large Nominal Pipe Size (NPS) and held together by metal-mesh facings on one or both sides with heat-resistant metal ties attached through the blanket from one face to the other.

4. Classification

4.1 Mineral fiber metal-mesh covered blanket insulation covered by this specification shall be classified into the two types shown in Table 1. The classification is based upon the maximum use temperature and apparent thermal conductivity.

- Type I—For use on surfaces operating up to 850°F (454°C)
- Type II—For use on surfaces operating up to 1200°F (649°C)

5. Ordering Information

5.1 The type, dimensions, maximum use temperature, and facings for one or both sides shall be specified by the purchaser. Shot content and density may also be specified by the purchaser. A product certification may be specified in the purchase order.

TABLE 1 Physical Requirements

Properties	Type I	Type II
Maximum use temperature °F (°C) (see Note 1) (Excluding metal-mesh facings and tie wires/stitching)	850 (454)	1200 (649)
Apparent Thermal Conductivity <sup>A</sup> (Excluding metal-mesh facings and tie wires/stitching) max. Btu, in/h ft <sup>2</sup> °F (W/m K)		
Mean Temperature, °F (°C)		
75 (24)	0.25 (0.036)	0.25 (0.036)
100 (38)	0.27 (0.039)	0.27 (0.039)
200 (93)	0.34 (0.049)	0.34 (0.049)
300 (149)	0.43 (0.062)	0.42 (0.060)
400 (204)	0.55 (0.079)	0.53 (0.076)
500 (260)	0.70 (0.101)	0.64 (0.092)
600 (316)		0.75 (0.108)
700 (371)		0.86 (0.124)
Linear Shrinkage, max % at maximum use temperature	4.0	4.0
Water Vapor Sorption, <sup>B</sup> max % by weight	5.0	5.0
Surface Burning Characteristics		
Maximum-flame spread index	25	25
Maximum smoke developed index	50	50
Density maximum, <sup>C</sup> lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	10 (160)	12 (192)

<sup>A</sup>Values for apparent thermal conductivity are for insulation and do not include mesh and wire through insulation thickness. Therefore, Practice C 680 or other heat loss analysis using these data are not possible without accounting for heat losses through attaching media.

<sup>B</sup>Water sorption characteristics may change after the product is subjected to elevated temperatures within normal service conditions.

<sup>C</sup>The maximum density specified is for the weight design purpose only and includes an approximate weight for the facings. Additional density requirements including the density for the blanket without facing(s) may be specified by agreement between the purchaser and the manufacturer or seller.

6. Materials and Manufacture

6.1 Composition—Mineral fiber metal-mesh covered blanket shall be composed of rock, slag, or glass processed from the molten state into fibrous form, bonded with or without an organic binder, and secured with metallic supporting facings(s). Asbestos shall not be used as an ingredient or component part of the product.

6.2 Facings:

6.2.1 Types of facings for one or both sides of blanket units shall be specified. When both sides are to be faced, units may have the same or different types on the two sides.

NOTE 1—**Caution:** The user of this specification is advised that the maximum use temperature of the facings and adhesives may be lower than the maximum use temperature of the insulation. For example, usually galvanized hexagonal wire-woven netting and tie wires or stitching perform well under continuous exposure to temperatures up to 392°F (200°C). Exposure to temperatures above this limit can cause the outer free zinc layer to peel. Though there are potential or occasional concerns for corrosion conditions at various temperatures, galvanized wire, stitching, or facings generally are not recommended for temperatures above 500°F (260°C). In addition, the user of this specification shall ensure that sufficient insulation thickness is installed so that none of the accessory items (facings, adhesive, coatings, and lagging) are exposed to temperatures above their maximum use temperature. Practice C 680 can be used to determine surface temperatures.

6.2.2 Standard Types of Metal Mesh Used as Facings:

6.2.2.1 Woven netting, approximately No. 20 to 22 gage (approximately 0.88 to 0.73 mm) diameter, galvanized wire mesh, approximately 1 in. (25 mm) hexagonal shaped.

6.2.2.2 Woven netting, approximately nonferrous No. 20 to 22 gage (approximately 0.82 to 0.64 mm) diameter, 300 series stainless steel wire mesh, approximately 1 in. (25 mm) hexagonal shaped.

6.2.2.3 Stucco expanded metal lath, (painted finish, not flattened, not galvanized) having approximately 1.5 in. (38 mm) diamond-shaped openings, No. 18 gage (1.2 mm) thickness, weighing 1.8 lb/yd<sup>2</sup> (1010 g/m<sup>2</sup>).

6.2.2.4 Expanded metal lath, (painted finish, not flattened, not galvanized) having diamond-shaped openings, weighing 2.5 lb/yd<sup>2</sup> (1400 g/m<sup>2</sup>).

6.2.3 Other kinds or compositions of facings may be specified.

6.3 Manufacture/Fabrication:

6.3.1 Metallic facing(s) or wire mesh(s) shall be secured to the insulation face on one or both side(s) with minimum (diameter) No. 28 gage (0.32 mm), 300 Series alloy, non-ferrous stainless steel tie wires or stitching no greater than 12 in. (305 mm) apart passing vertically through the blanket. Spacing (attachment pattern) for vertical steel tie wires and stitching must include rows within 2 in. (51 mm) from all edges of the blanket.

6.3.2 Minimum (diameter) No. 28 gage (0.41 mm) galvanized steel tie wires or stitching may be used for securement with most types of galvanized steel facings.

7. Physical Requirements

7.1 Handling and Transporting—Each piece of metal-mesh covered insulation shall be sufficiently coherent to permit handling/transportation and installation as a unit.

7.2 The blanket insulation type shall conform to the following requirements in Table 1: maximum use temperature, density (for weight design purposes only), apparent thermal conductivity, water vapor sorption, and surface burning characteristics.

7.3 *Odor Emission*—A detectable odor of objectionable nature recorded by more than two of the five panel members shall constitute rejection of the material when tested in accordance with 11.6.

7.4 *Corrosiveness to Steel, Copper, Aluminum*—When tested and evaluated in accordance with 11.7, the corrosion resulting from the unfaced insulation blanket in contact with metal plates shall be judged to be no greater than comparative plates in contact with sterile cotton.

7.5 *Non-Fibrous (Shot) Content*—The averaged maximum shot content of mineral fiber rock or slag type products shall not exceed 30 % by weight as defined in 11.3.

7.6 *Maximum Use Temperature*—When tested in accordance with 11.1, the blanket insulation shall not warp, flame, or glow during hot surface exposure. No evidence of melting or fiber degradation shall be evident upon post-test inspection.

7.7 *Maximum Exothermic Temperature*—When tested in accordance with 11.1, the blanket mid-point temperature shall not at any time exceed the hot surface temperature by more than 100°F (55.5°C). The 100°F (55.5°C) criterion applies during heat-up as well as steady state conditions. Exceeding this limit constitutes noncompliance to specification.

**8. Dimensions and Permissible Variations**

8.1 *Dimensions*—Standard sizes of metal-mesh blanket insulation shall be as follows:

Length	= 48 in. (1219 mm) and 96 in. (2438 mm) (except for Nominal Pipe Sizes (NPS) system)
Width	= 24 in. (610 mm) and 36 in. (914 mm)
Thickness	= 1 to 6 in. (25 mm to 152 mm) <sup>A</sup> in ½ in. (13 mm) increments

<sup>A</sup>Thickness over 2 in. (51 mm) may be composed of two or more blankets plied together to establish total thickness before facings applied.

8.2 *Dimensional Tolerances*—The average measured length, width, and thickness shall differ from the manufacturer’s standard dimensions by not more than the following:

	Blanket	Blanket-Type Pipe
Length	= ± ½ in. (13 mm)	± ¼ in. (6 mm)
Width	= ± ¼ in. (6 mm)	Not applicable
Thickness	= ± ¼ in. (6 mm), -½ in. (3 mm)	+¼ in. (6 mm), -½ in. (3 mm)

8.2.1 *Pipe Diameters (Fit and Closure)*—When fitted around the appropriate size pipe, by banding on 9-in. (229 mm) centers, the longitudinal seams on both sides of the pipe insulation shall close along the entire length of the section or piece.

**9. Workmanship**

9.1 The insulation blanket shall have good workmanship and shall not have defects that adversely affect its installation and performance qualities.

**10. Sampling**

10.1 Inspection and qualification of the insulation shall be in accordance with Criteria C 390 or as otherwise specified in the purchase order or contract as agreed upon between the pur-

chaser, supplier, or the manufacturer, or a combination thereof.

**11. Test Methods**

11.1 *Maximum Use and Exothermic Temperature Rise*—The insulation shall be tested in accordance with Test Method C 411 and the hot surface performance section of Practice C 447 at the insulation’s maximum use temperature and at the manufacturer’s maximum recommended thickness for that temperature. The test surface shall be at the intended surface temperature when test begins. No special requirements for heat up shall be specified by the manufacturer.

11.2 *Density*:

11.2.1 The thickness and density of insulation shall be tested in accordance with Test Methods C 167.

11.2.2 The maximum density of a rock, slag or glass type of insulation shall not exceed that shown in Table 1. When density is part of the purchase contract, the delivered product density shall be calculated on the basis of single package units excluding the container and metal mesh facing weights and with a tolerance of not more than -10 % on the individual package.

11.3 *Non-Fibrous (Shot) Content*:

11.3.1 The maximum non-fibrous (shot) content that would be retained on all screens (sieves) up to and including 100-mesh (150µm) screen (sieve) as determined by the test method and calculation procedure in Test Method C 1335.

11.3.2 A minimum of three specimens per lot (shipment) shall determine the averaged non-fibrous (shot) content. The manufacturer shall furnish certification of the shot content of the delivered product if so specified at time of purchase.

11.4 *Apparent Thermal Conductivity*:

11.4.1 Blankets and blanket-type pipe insulation, shall be tested unfaced at thickness(s) up to 2 in. (51 mm) in accordance with Test Method C 177, C 518, or C 1114.

11.4.1.1 Blanket-type pipe insulations are typically used for 24 in. (610 mm) or larger diameter surfaces. Treat thermal calculations as a flat surface.

11.4.1.2 Test Method C 518 shall not be used at temperatures or thermal resistance values other than those in the range of the calibration.

11.4.1.3 Test Method C 1114 shall not be used at temperatures or thermal resistance ranges other than those with comparable results to Test Method C 177. In case of dispute, Test Method C 177 is recognized as the final authority.

11.4.2 Apparent thermal conductivity versus mean temperature calculations shall be guided by using the techniques described in Practice C 1045. Determination shall be made at four or more mean temperatures. Two of the test mean temperatures shall be within 50°F (28°C) of the highest and lowest mean temperatures specified in Table 1 for the appropriate insulation type. The two other determinations shall be made at temperatures spaced within the specified mean temperature range. The results of these tests shall be extended, through reasonable curve fitting techniques, to establish the apparent thermal conductivity at the specified mean temperature.

11.5 *Surface Burning Characteristics*—The insulation shall be tested in accordance with Test Method E 84. The test shall