Designation: C 592 – 04

Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)[1]

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 (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. 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 at temperatures operating below ambient to 0°F (−18°C) and on heated surfaces operating at temperatures up to 1200°F (649°C). Specific applications outside the actual use temperatures shall be agreed upon between the manufacturer and purchaser.

1.2 For satisfactory performance, properly installed protective vapor retarders or barriers shall be used on below ambient temperature applications to reduce movement of moisture through or around the insulation to the colder surface. Failure to use a vapor barrier when insulating below ambient systems creates conditions that, unless otherwise treated will lead to insulation and system damage. Refer to Practice C 921 to aid material selection. Although vapor retarder properties are not part of this specification, properties required in Specification C 1136 are pertinent to applications or performance.

1.3 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.

1.4 This standard does not purport to provide the performance requirements of hourly-rated fire systems. Consult the manufacturer for the appropriate system.

1.5 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.

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

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 and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 167 Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations

C 168 Terminology Relating to Thermal Insulating Materials

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

C 356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat

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

C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C 447 Practice for Estimating the Maximum Use Temperature of Thermal Insulations

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

C 665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

C 680 Practice for Determination of Heat Gain or Loss and the Surface Temperatures of Insulated Pipe and Equipment

[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] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Physical Requirements

Properties	Type I	Type II	Type III
Maximum use temperature °F (°C) (see 6.2.1) (Excluding metal-mesh facings and metal tie wires/stitching)	850 (454)	1200 (649)	1200 (649)
Apparent Thermal Conductivity[A] (Excluding metal-mesh facings and metal tie wires/stitching) max Btu, in./h ft²°F (W/m K)			
Mean Temperature, °F (°C)			
25 (–4)	0.21 (0.030)	0.21 (0.030)	0.23 (0.033)
75 (24)	0.25 (0.036)	0.25 (0.036)	0.24 (0.035)
100 (38)	0.27 (0.039)	0.27 (0.039)	0.26 (0.038)
200 (93)	0.34 (0.049)	0.34 (0.049)	0.31 (0.045)
300 (149)	0.43 (0.062)	0.42 (0.060)	0.37 (0.053)
400 (204)	0.55 (0.079)	0.53 (0.076)	0.44 (0.063)
500 (260)	0.70 (0.101)	0.64 (0.092)	0.52 (0.075)
600 (316)		0.75 (0.108)	0.60 (0.087)
700 (371)		0.86 (0.124)	0.70 (0.101)
Linear Shrinkage, max % at maximum use temperature	4.0	4.0	4.0
Water Vapor Sorption,[B] max % by weight	5.0	5.0	1.25
Surface Burning Characteristics			
Maximum-flame spread index	25	25	25
Maximum smoke developed index	50	50	50
Density maximum,[C] lb/ft³ (kg/m³)	10 (160)	12 (192)	8 (128)

[A] 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.

[B] Some water sorption characteristics will change after the product is subjected to elevated temperatures within normal service conditions.

[C] The maximum density specified is for the weight design purpose only and includes weight for the facings. Additional density requirements including the density for the blanket without facing(s) are permitted to be specified by agreement between the purchaser and the manufacturer or seller.

by the Use of a Computer Program

C 921 Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

C 1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions

C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation

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

C 1114 Test Method for Steady-State Thermal Transmission Properties by means of the Thin-Heater Apparatus

C 1136 Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C 1304 Test Method for Assessing the Odor Emission of Thermal Insulation Materials

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

E 84 Test Method for Surface Burning Characteristics of Building Materials

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

2.2 *Other Document:*

CAN/ULC-S102–M88 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies[3]

3. Terminology

3.1 Terminology C 168 shall be 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 three types shown in Table 1. The classification is based upon the maximum use temperature and apparent thermal conductivity.

5. Ordering Information

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

[3] Available from Underwriters Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario, Canada M14 3A9.

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 facing(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 are permitted to have the same or different types on the two sides. (**Warning**—The user of this specification is advised that the maximum use temperature of some facings and adhesives will 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 will 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 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 shall be used to determine surface temperatures.)

6.2.2 *Standard Types of Metal Mesh Used as Facings*:

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

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

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

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

6.2.3 Other kinds or compositions of facings are permitted to 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, nonferrous 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 are permitted to be used for securement with galvanized steel facings.

7. Physical Requirements

7.1 *Handling and Transporting*—Each piece of metal-mesh covered insulation shall be 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.

7.8 *Non-Combustibility*—When tested in accordance with 11.10, shall not exceed the recorded temperature rise more than 54°F (30°C) with no flaming and weight loss exceeding 5 %.

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)[A] in ½ in. (13 mm) increments

[A] 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), –⅛ in. (3 mm)	+¼ in. (6 mm), –⅛ 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.