



Designation: **C1086 – 09 (Reapproved 2016) C1086 – 20**

Standard Specification for Glass Fiber Mechanically Bonded Felt Thermal Insulation¹

This standard is issued under the fixed designation C1086; 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.

1. Scope

1.1 This specification covers glass fiber unsupported needled felt (mechanically bonded) binder-free insulation for thermal insulation. This material is used as the thermal insulation component in the fabrication of insulation systems for use on machinery and equipment, such as steam turbines, boilers, boiler feed pumps, and piping at temperatures from ambient up to 1200°F (650°C).

~~1.2 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.~~

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.

~~1.4 See Supplementary Requirements for modifications to paragraphs in this standard when using Specification C1086 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-16411F.~~

~~1.3 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.~~

~~1.4 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.~~

2. Referenced Documents

- 2.1 *ASTM Standards*:²
- C167 Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations
 - C168 Terminology Relating to Thermal Insulation
 - C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
 - C390 Practice for Sampling and Acceptance of Thermal Insulation Lots
 - C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 - C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions
 - C1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation
 - D123 Terminology Relating to Textiles
 - D578 Specification for Glass Fiber Strands
 - E136 Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C

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.

2.2 ~~U.S. Federal Standard: Other Standards:~~

~~FED-STD-191 Textile Test Methods³~~

~~46 CFR 164.009 Non-Combustible Materials⁴~~

~~IMO 1182:1990 per FTP Code Annex, Part 1⁵~~

2.3 ~~U.S. Military Standards:~~

~~MIL-I-16411F Insulation Felt, Thermal, Glass Fiber³~~

~~MIL-STD-1623 Fire Performance Requirements and Approved Specifications for Interior Finish Materials and Furnishings (Naval Shipboard Use)³~~

3. Terminology

3.1 *Definitions:*

3.1.1 Terminology **C168** and **D123** shall be considered as applying to the terms used in this specification.

3.1.2 Definitions in Specification **D578** shall be considered as applying to the terms used in defining glass fiber composition code, process, and fiber diameter.

4. Classification

4.1 Thermal insulation shall be glass fiber, unsupported needled felt insulation, for use on surfaces with temperatures up to 1200°F (650°C).

5. Ordering Information

5.1 The purchase order or contract shall specify the following:

5.1.1 Quantity of each thickness (**10.1**).

5.1.2 Any special requirements for nonstandard sizes or dimensions (**10.2 and 10.3**).

5.1.3 Any requirements for certification (**19.1**).

5.1.4 Any special requirements for supplementary testing requirements (**9.1**), and

5.1.5 Any special packaging information.

6. Materials and Manufacture

6.1 The material shall consist of 100 % glass fiber needled into insulation felts without the use of binders. No organic fibers and no glass or mineral shot shall be included in the product. It is acceptable for the insulation felt to be composed of laminates formed without the use of binders. The glass fibers shall meet the designation C, Continuous Filament Yarns, in accordance with Specification **D578** (see **Note 1**).

6.2 The fiber diameter of the glass fiber used in the final product, when determined in accordance with the Filament Diameter section of Specification **D578** shall conform to the requirements of **Table 1**. The certification of the diameter of the fiber is to be provided in one of two ways: either by the felt manufacturer or by certification of the glass fiber supplier and documentation by the manufacturer as to sources of supply.

6.3 All materials used shall be asbestos and ceramic (refractory) fiber-free.

NOTE 1—The fibers from glass composition designated as “E” glass (electrical glass) in the range from D through G meet the requirements of **Tables 1 and 2**.

7. Physical Properties

7.1 When tested in accordance with Section **16**, the insulation shall conform to the physical requirements listed in **Table 2**.

8. Performance Characteristics

8.1 Any of the following conditions can result in damage to the needled glass fiber insulation:

8.1.1 Direct exposure to hydrofluoric acid.

8.1.2 Prolonged direct exposure to strong caustics.

8.1.3 Prolonged exposure to boiling water.

TABLE 1 Requirements for Diameter of Fiber

Diameter of Fiber	Inch (Millimetre)
Average diameter shall not exceed	0.00036 (0.009)
90 % shall be less than	0.00040 (0.102)

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

⁴ Available from U.S. Government Publishing Office, 732 N. Capitol Street NW, Washington, D.C. 20401, <https://www.gpo.gov/>.

⁵ Available from International Maritime Organization (IMO), 4, Albert Embankment, London SE1 7SR, United Kingdom, <http://www.imo.org>.

TABLE 2 Physical Requirements

Thickness, length of roll	See Table 3
Mass per unit area	See Table 4
Apparent Thermal Conductivity, Max ^A	
Btu in./h ft ² F (W/mK) at mean temp. of:	
75°F (24°C)	0.29 (0.042)
300°F (149°C)	0.40 (0.058)
500°F (260°C)	0.50 (0.072)
700°F (371°C)	0.65 (0.094)
Hot Surface Performance at 1200°F (650°C)	no melting, no significant shrinkage (max 5 %)
Tensile strength: psi (kPa)	
Minimum	5 (34.5)
Non-Combustibility	Pass

^AIt is possible that the thermal transmission properties of felted glass fiber thermal insulation will vary with temperature, temperature gradient, thickness and shape. Note that the apparent thermal conductivity requirements specified in the table are based on samples tested under conditions specified in **16.1.3**. These are comparative values for establishing specification compliance and it is possible that they do not represent the installed performance of the insulation under use conditions of the insulation differing substantially from the test conditions.

8.2 Conditions outlined in **8.1** are mentioned only to make the user aware of such applications that require special consideration. Contact the insulation manufacturer for recommendations when the above conditions are anticipated.

9. Other Requirements

9.1 Supplementary requirements include qualification tests and acceptance tests to special standards. These supplementary requirements are made by agreement to the supplier and the purchaser only when specified in the purchase order or contract.

10. Standard Sizes and Dimensions

10.1 *Thickness*—The insulation shall be furnished in the thicknesses shown in **Table 3**.

10.2 *Insulation Length*—Unless otherwise specified, the insulation shall be furnished in rolls of the lengths given in **Table 3**.

10.3 *Insulation Width*—Unless otherwise specified (**5.1.2**), the width of the insulation shall be 60 in. (1.52 m).

10.4 *Nominal Mass per Area*—The insulation shall be furnished in the mass per area shown in **Table 4**.

11. Dimensional Tolerances

11.1 *Thickness Tolerance*—The average thickness as determined in accordance with **16.1.1** shall be within ± 0.125 in. (3.2 mm) of the specified thickness.

11.2 *Mass per Area Tolerance*—The average mass per area shall be within ± 10 % of that specified in **Table 4**.

11.3 *Insulation Length/Tolerance*—The tolerance on the lengths, listed in **Table 3**, shall be -6 in. (-152 mm), with excess permitted. It is acceptable for a roll to contain either a maximum of one full thickness splice or consist of a maximum of two pieces.

11.4 *Width*—The width shall be within -0.5 in. (13 mm), to $+1.0$ in. (25 mm) of the specified width.

12. Workmanship, Finish, and Appearance

12.1 Since some requirements for this material are not easily defined by a numerical value, the insulation shall not have visible defects that will adversely affect its service qualities.

13. Qualification Requirements

13.1 The following requirements are generally employed for the purpose of initial material or product qualification in accordance with Practice **C390**:

13.1.1 Standard sizes and dimensions,

TABLE 3 Standard Dimensions

Nominal Thickness, in. (mm)	Insulation Length, ft (m)
0.3 (7.6)	150 (45.2)
0.5 (12.7)	75 (22.9)
0.75 (19.1)	45 (13.7)
1.0 (25.4)	45 (13.7)