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Standard Specification for Glass Fiber Mechanically Bonded Felt Thermal Insulation¹

This standard is issued under the fixed designation C 1086; 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.*

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only. ~~Note 1—This standard is a consensus standard to provide a substitute for military specification MIL-I-16411E~~

1.4 See Supplementary Requirements for modifications to paragraphs in this standard when using Specification C 1086 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.

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 Insulation

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

C 335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation

C 390 Practice for Sampling and Acceptance of Thermal Insulation Lots

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

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

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

D 123 Terminology Relating to Textiles

D 578 Specification for Glass Fiber Strands

2.2 U.S. Federal Standard:

FED-STD-191 Textile Test Methods³

2.3 U.S. Military Standards:

~~MIL-I-16411E~~

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 C 168 and D 123 shall be considered as applying to the terms used in this specification.

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.

³ Available from Standardization Documents; Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, ATTN: NPODS-19111-5098, <http://www.dodssp.daps.mil>.

3.1.2 Definitions in Specification D 578 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 yarns—needled into insulation felts without the use of binders. No organic fibers and no glass or mineral shot shall be included in the product. ~~The~~ It is acceptable for the insulation felt may 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 D 578 (see ~~Note 2~~ Note 1).

6.2 The fiber diameter of the glass fiber yarns—used in the final product, when determined in accordance with the Filament Diameter section of Specification D 578 shall conform to the requirements of Table 1. ~~The certification of the fineness of fiber may be either by the felt manufacturer or by certification of the glass yarn supplier and documentation by the manufacturer as to sources of supply.~~

~~6.3 All materials used shall be asbestos-free. 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 2—The 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 Needled felt glass fiber insulation may be damaged if any of the following conditions are encountered: 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.

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 may be 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 Weight/Mass per Area*—The insulation shall be furnished in the weight/mass per area shown in Table 4.

TABLE 1 Requirements for Fineness of Fiber

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

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-Combustible	Pass
Non-Combustibility	Pass

^AIt is possible that the thermal transmission properties of felted glass fiber thermal insulation may 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 may do not represent the installed performance of the insulation under use conditions of the insulation differing substantially from the test conditions.

TABLE 3 Standard Dimensions

Nominal Thickness, in. (mm)	Insulation Length, ft (m)
0.3 (7.6)	150 (45.2)
0.3 (7.6)	150 (45.2)
0.5 (12.7)	75 (22.9)
0.5 (12.7)	75 (22.9)
1.0 (25.4)	45 (13.7)
0.75 (19.1)	45 (13.7)
0.75 (19.1)	55 (16.8)
1.0 (25.4)	45 (13.7)

TABLE 4 Standard Parameters

Nominal Thickness, in. (mm)	Mass per Area oz/ft ² (kg/m ²)
0.3 (7.6)	3.5 (1.07)
0.3 (7.6)	3.5 (1.07)
0.50 (12.7)	6.0 (1.83)
0.5 (12.7)	6.0 (1.83)
1.0 (25.4)	15.0 (4.58)
0.75 (19.1)	12.25 (3.74)
0.75 (19.1)	12.25 (3.74)
1.0 (25.4)	15.0 (4.58)

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 weight 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. ~~A roll may either~~ 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 Qualification Requirements

13.1 The following requirements are generally employed for the purpose of initial material or product qualification in accordance with ~~Criteria C 390~~ Practice C 390: