



Designation: C 1393 – 00a

Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks¹

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1. Scope

1.1 This specification covers the composition, dimensions, and physical properties of compression-resistant, perpendicularly oriented mineral fiber (rock, slag, or glass) roll and sheet insulation intended for use on flat, curved, or round surfaces up to 1000°F (538°C). This product (pipe and tank insulation) is typically used on nominal 24 in. (610 mm) or greater diameter surfaces. For specific applications, the actual use temperatures and diameters shall be agreed upon between the manufacturer and the purchaser.

1.2 The orientation of the fibers within the roll or sheet insulation is essentially perpendicular to the heated/cooled surface (parallel to heat flow). This specification does not apply to flat block, board, duct wrap, or preformed pipe mineral fiber insulation where the insulation fiber orientation is generally parallel to the heated/cooled surface (across the heat flow).

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

1.4 The values stated in inch-pound units are to be regarded as standard. The SI equivalents of inch-pound units are given in parentheses for information only and may be approximate.

1.5 When the installation or use of thermal materials, accessories, and systems may pose safety or health problems, the manufacturer shall provide the user-appropriate current information regarding any known problems associated with the recommended use of the company's products and shall also recommend protective measures to be employed in their safe utilization. The user shall establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.

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.*

¹ This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.20 on Homogeneous Inorganic Thermal Insulation.

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2. Referenced Documents

2.1 ASTM Standards:

- C 165 Test Method for Measuring Compressive Properties of Thermal Insulations²
- C 168 Terminology Relating to Thermal Insulation Materials²
- C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus²
- C 303 Test Method for Density of Preformed Block-Type Thermal Insulation²
- C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots²
- C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation²
- C 447 Practice for Estimating the Maximum Use Temperature of Thermal Insulations²
- C 518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus²
- C 665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing²
- C 680 Practice for Determination of Heat Gain or Loss and the Surface Temperatures of Insulated Pipe and Equipment Systems by the Use of a Computer Program²
- C 795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel²
- C 1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions²
- C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation²
- C 1104/C 1104M Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation²
- C 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus²
- C 1136 Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation²
- C 1335 Test Method for Measuring the Non-Fibrous Content of Man-Made Rock and Slag Mineral Fiber Insulation²

² Annual Book of ASTM Standards, Vol 04.06.

TABLE 1 Physical Property Requirements^A

Properties	Type I	Type II	Type IIIA	Type IIIB	Type IVA	Type IVB
Maximum Use Temperature, ° F (°C) See Caution in 6.2.1	Up to 450 (232)	650 (343)	850 (454)	850 (454)	1000 (538)	1000 (538)
Apparent thermal conductivity Maximum Btu in./h-ft ² °F (W/m·K) Mean temperature, ° F (°C)						
75 (24)	0.27(0.039)	0.27(0.039)	0.27(0.039)	0.27(0.039)	0.27(0.039)	0.28(0.040)
100 (38)	0.29(0.042)	0.29(0.042)	0.29(0.042)	0.29(0.042)	0.29(0.042)	0.30(0.043)
200 (93)	0.38(0.055)	0.38(0.055)	0.38(0.055)	0.36(0.052)	0.36(0.052)	0.36(0.052)
300 (149)	0.48(0.069)	0.48(0.069)	0.48(0.069)	0.45(0.065)	0.45(0.065)	0.43(0.062)
400 (204)	0.61(0.088)	0.61(0.088)	0.61(0.088)	0.54(0.078)	0.54(0.078)	0.50(0.072)
500 (260)		0.81(0.117)	0.81(0.117)	0.66(0.095)	0.66(0.095)	0.58(0.084)
600 (316)					0.82(0.118)	0.67(0.097)
Category 1—Greater compressive resistance, minimum load required to produce a 10 % reduction in thickness, lb/ft ² (kPa)	120 (5.7)	120 (5.7)	120 (5.7)	120 (5.7)	120 (5.7)	200 (9.6)
Category 2—Lesser compressive resistance, minimum load required to produce a 10 % reduction in thickness, lb/ft ² (kPa)	25 (1.2)	25 (1.2)	25 (1.2)	25 (1.2)	25 (1.2)	25 (1.2)
Water vapor sorption, max % by weight	5.0	5.0	5.0	5.0	5.0	5.0
Density, maximum lb/ft ³ (kg/m ³) ^B	6 (96)	6 (96)	6 (96)	6 (96)	6 (96)	8 (128)
Surface burning characteristics:						
Maximum flame spread index	25	25	25	25	25	25
Maximum smoke developed index	50	50	50	50	50	50

^ARefer to Section 7 for additional physical property requirements.

^BThe maximum density specified is for weight design purposes only. Additional density requirements may be specified as agreed upon between the purchaser and the manufacturer.

E 84 Test Method for Surface Burning Characteristics of Building Materials³

2.2 Other Referenced Documents:

CAN/ULC-S102-M88 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies⁴

3. Terminology

3.1 *Definitions*—Definitions pertaining to insulation are in accordance with Terminology C 168.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *delivered density*—the actual density of the product shipped by the manufacturer or the seller and received by the purchaser.

3.2.2 *facing*—a layer or foundation of thin material which is adhered to the insulation to form a continuous roll or sheet of insulation.

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

4. Classification

4.1 Mineral fiber roll or sheet insulation covered by this specification is classified into the six types and two categories shown in Table 1. This classification is based upon the maximum use temperature, maximum apparent thermal conductivity, and compressive resistance properties.

4.1.1 Types:

4.1.1.1 *Type I*—Maximum use temperature up to 450°F (232°C).

4.1.1.2 *Type II*—Maximum use temperature up to 650°F (343°C).

4.1.1.3 *Type IIIA*—Maximum use temperature up to 850°F (454°C).

4.1.1.4 *Type IIIB*—Maximum use temperature up to 850°F (454°C).

4.1.1.5 *Type IVA*—Maximum use temperature up to 1000°F (538°C).

4.1.1.6 *Type IVB*—Maximum use temperature up to 1000°F (538°C).

4.1.2 Categories:

4.1.2.1 *Category 1*—Greater minimum compressive resistance properties are required.

4.1.2.2 *Category 2*—Lesser minimum compressive resistance properties are required.

5. Ordering Information

5.1 The type, category, dimensions, and facing shall be specified by the purchaser. Shot content and delivered density certification may be requested by the purchaser after consulting with the supplier or the manufacturer.

6. Materials and Manufacture

6.1 *Composition*—Mineral fiber roll or sheet shall be composed of rock, slag, or glass processed from the molten state into fibrous form, bonded with an organic binder, and the orientation of the fibers within the roll or sheet insulation is essentially perpendicular to the heated or cooled surface (parallel to heat flow).

³ Annual Book of ASTM Standards, Vol 04.07.

⁴ Available from Underwriters Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario, Canada M1R 3A9.