Designation: C 547 – 03

Standard Specification for Mineral Fiber Pipe Insulation[1]

This standard is issued under the fixed designation C 547; 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.

1. Scope

1.1 This specification covers mineral fiber insulation produced to form hollow cylinders for standard pipe and tubing sizes. The mineral fiber pipe insulation may be molded or precision v-grooved, with one or more walls split longitudinally for use on pipe temperatures up to 1200°F (650°C).

1.2 For satisfactory performance, properly installed protective vapor retarders or barriers should be used on sub-ambient temperature applications to reduce movement of moisture through or around the insulation to the colder surface. Failure to use a vapor barrier can lead to insulation and system damage. Refer to Practice C 921 to aid material selection.

1.3 Flexible mineral fiber wrap products such as perpendicular-oriented fiber insulation rolls, non-precision or manually scored block or board, or flexible boards or blankets used as pipe insulation, are not covered by this specification.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 The following safety hazards caveat applies to the test methods portion, Section 11, only: *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:*

C 167 Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations[2]

C 168 Terminology Relating to Thermal Insulating Materials[2]

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

C 302 Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation[2]

C 335 Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation[2]

C 356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat[2]

C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots[2]

C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation[2]

C 447 Practice for Estimating the Maximum Use Temperature of Insulations[2]

C 585 Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)[2]

C 612 Specification for Mineral Fiber Block and Board Thermal Insulation[2]

C 795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel[2]

C 921 Practice for Determining the Properties of Jacketing Materials for Thermal Insulation[2]

C 1045 Practice for Calculating Thermal Transmission Properties from Steady-State Heat Flux Measurements[2]

C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation[2]

C 1104/C1104M Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation[2]

E 84 Test Method for Surface Burning Characteristics of Building Materials[3]

2.2 *Other Standards:*

UL 723 Tests for Surface Burning of Building Materials, available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062–2026

NFPA 255 Method of Tests of Surface Burning Characteristics of Building Materials, available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

CAN/ULC-S102–M88 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies, available from Underwriters Laboratories of

[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 Insulations.

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[2] *Annual Book of ASTM Standards*, Vol 04.06.

[3] *Annual Book of ASTM Standards*, Vol 04.07.

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3. Terminology

3.1 The definitions in Terminology C 168 shall apply to the terms used in this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *molded*—refers to products preformed via a molding process to yield full-round cylindrical pipe insulation sections.

3.2.2 *precision v-groove*—refers to products fabricated from machined board via a precision cutting process. Machined segments are adhered to a backing to form a full-round cylindrical pipe insulation section. Due to the precision of the process, the product has no gaps when installed.

4. Classification

4.1 Products covered by this specification are classified according to maximum use temperature as follows:

4.1.1 *Type I*—Molded, for use to 850°F (454°C).

Grade A—Requires no heat-up schedule

Grade B—Heat-up schedule is required

4.1.2 *Type II*—Molded, for use to 1200°F (650°C).

Grade A—Requires no heat-up schedule

Grade B—Heat-up schedule is required

4.1.3 *Type III*—Precision v-groove, for use to 1200°F (650°C).

Grade A—Requires no heat-up schedule

Grade B—Heat-up schedule is required

4.1.4 *Type IV*—Molded, for use to 1000°F (538°C).

Grade A—Requires no heat-up schedule

Grade B—Heat-up schedule is required

NOTE 1—**Warning:** Grade B may not be suitable for applications requiring hot installation capability at the maximum temperature indicated. Products having a Grade B designation are designed to be used with a heat-up schedule. Failure to use a heat-up schedule with Grade B products may lead to an exothermic reaction. This is dependent on thickness and temperature. Consult the manufacturer or manufacturer's literature for special heat rate considerations.

4.2 Binder decomposition at elevated temperature may be a limiting factor in certain applications. Consult the manufacturer regarding special heat rate considerations.

5. Materials and Manufacturer

5.1 *Composition*— The mineral fiber insulation for pipes shall be manufactured from mineral substance such as rock, slag, or glass, processed from a molten state into fibrous form with binder. Asbestos shall not be used as an ingredient or component part. Some products may also contain adhesive.

5.2 *Jackets (Facings)*—The user of this specification has the option to specify that the insulation be jacketed.

NOTE 2—The user is advised that the maximum use temperature of factory-applied facings and adhesives may be lower than the maximum use temperature of the insulation. The specifier shall ensure that sufficient insulation thickness is installed so none of these accessory items (facings and adhesives) are exposed to temperatures above their maximum use temperature. The products covered by this standard are predominantly inorganic in nature. Organic facings, adhesives and binders are also used in the construction of these products. The resulting composite therefore could have increased combustibility.

6. Physical Requirements

6.1 The product shall conform to the following requirements in addition to those specified in Table 1.

6.2 *Hot Surface Performance*:

6.2.1 The product shall not crack, warp, flame, or glow during hot surface exposure. No evidence of melting or fiber degradation shall be evident upon post test inspection.

6.2.2 The insulation's internal temperature rise (exotherm) shall not exceed the pipe temperature by more than 200°F (111°C).

TABLE 1 Requirements of Mineral Fiber Pipe Insulation (Grades A & B)

Property	Type I (Grades A & B)	Type II (Grades A & B)	Type III (Grades A & B)	Type IV (Grades A & B)
Use temperature, max, °F (°C)	850 (454)	1200 (650)	1200 (650)	1000 (538)
Sag resistance, max, % thickness change	5	5	5	5
Linear shrinkage (length), max, % change after change after soaking heat at maximum use temperature	2	2	2	2
Water vapor sorption, max, % by weight	5	5	5	5
Surface burning characteristics, max				
Flame spread index	25	25	25	25
Smoke developed index	50	50	50	50
Apparent thermal conductivity, max, Btu.in./h,ft^2, °F(W/m.K)				
Mean temperature[A] °F (°C)				
100 (38)	0.25 (0.036)	0.25 (0.036)	0.25 (0.036)	0.25 (0.036)
200 (93)	0.31 (0.045)	0.31 (0.045)	0.31 (0.045)	0.31 (0.045)
300 (149)	0.40 (0.058)	0.37 (0.053)	0.37 (0.053)	0.37 (0.053)
400 (204)	0.51 (0.074)	0.45 (0.065)	0.45 (0.065)	0.45 (0.065)
500 (280)	0.64 (0.092)	0.54 (0.078)	0.54 (0.078)	0.54 (0.078)
600 (316)		0.65 (0.094)	0.65 (0.094)	0.65 (0.094)
700 (371)		0.77 (0.111)	0.77 (0.111)	0.77 (0.111)

[A] The user is advised that retrofit applications (where new insulation is being applied over existing) could require knowing the thermal conductivity of the existing layer at mean temperatures above those shown. Consult a manufacturer for data at mean temperatures exceeding those listed.