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Standard Specification for Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form[1]

This standard is issued under the fixed designation C 1427; 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

~~1.1This specification covers extruded preformed flexible cellular polyolefin thermal insulation with operating temperatures from –150°F to 200°F (–101°C to 93°C). For specific applications, the actual temperature limit shall be agreed upon between the manufacturer and the purchaser.~~

~~1.2The use of thermal insulation materials covered by this specification are governed by codes and standards that address fire performance.~~ Scope

1.1 This specification covers two grades of extruded preformed flexible cellular polyolefin thermal insulation. Grade 1 is for operating temperatures from –150°F to 200°F (–101°C to 93°C). Grade 2 is for operating temperatures from –297°F to 250°F (–182°C to 121°C). For specific applications, the actual temperature limit shall be agreed upon between the manufacturer and the purchaser.

1.2 The use of thermal insulation materials covered by this specification are governed by codes and standards that address fire performance. Contact manufacturer for specific performance of product at the intended use thickness.

1.3 This specification covers the physical properties of preformed flexible cellular polyolefin thermal insulation, which have been deemed mandatory for thermal design. Physical properties such as density and coefficient of thermal expansion (CTE) have been deemed nonmandatory for thermal design. Nonmandatory physical properties have been included in Appendix X1 for information purposes only.

1.4 The values stated in inch-pound units are to be regarded as the standard. The metric unit equivalents of inch-pound units, given in parentheses, are approximate.

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 11, of this specification. *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:* [2]

C 168~~Terminology Relating to Thermal Insulating Materials~~ 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 209 Test Methods for Cellulosic Fiber Insulating Board

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

C 390 Practice 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

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[1] This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.22 on Organic and Nonhomogeneous Inorganic Thermal Insulations.

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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.

C 534 Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
C 585 Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)
C 1045~~Practice for Calculating Thermal Transmission Properties From Steady-State Heat Flux Measurements~~ 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 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus
C 1303~~Test Method for Estimating the Long-Term Change in the Thermal Resistance of Unfaced Rigid Closed Cell Plastic Foams by Slicing and Sealing Under Controlled Laboratory Conditions~~ Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
C 1304 Test Method for Assessing the Odor ~~Emissions~~Emission of Thermal Insulation Materials
D 883 Terminology Relating to Plastics
D 1622 Test Method for Apparent Density of Rigid Cellular Plastics
D 1667~~Specification for Flexible Cellular Materials- Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)~~ Specification for Flexible Cellular MaterialsPoly (Vinyl Chloride) Foam (Closed-Cell)
D 3575 Test Methods for Flexible Cellular Materials Made ~~from~~From Olefin Polymers
E 84 Test Method for Surface Burning Characteristics of Building Materials
E~~96~~ 96/E 96M Test Methods for Water Vapor Transmission of Materials
E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
E 228 Test ~~Methods~~Method for Linear Thermal Expansion of Solid Materials ~~with Vitreous Silica~~With a Push-Rod Dilatometer
E 456 Terminology ~~for~~ Relating to Quality and Statistics
E 670 Test Method for Side Force Friction on Paved Surfaces Using the Mu-Meter
E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
E 2231~~Standard Practice for Specimen Preparation and Testing of Pipes and Duct Insulation Systems to Access Surface Burning Characteristics~~ Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics

2.2 *Other Standards:*
CAN/ULC-S102.2–03 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

3. Terminology

3.1 *Definitions*— Terms used in this specification are defined in Terminology C 168 and in Terminology D 883.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *polyolefin*—polymers made by the polymerization of olefins, such as ethylene or propylene or copolymerization of olefins with other monomers.

3.2.2 *cellular polyolefin*—a cellular plastic composed primarily of olefin material, processed to form a flexible foam with a closed cell construction.

3.2.2.1 *Discussion*—These materials are considered foam plastics.

3.2.3 *natural skin*—continuous polymer surface or skin naturally occurring as a result of the extrusion or production process, also referred to as “integral skin.”

3.2.4 *flexible cellular*—a flexible cellular organic polymeric material will not rupture within 60 s when a specimen 8 by 1 by 1 in. (200 by 25 by 25 mm) is bent around a 1-in. (25-mm) diameter mandrel at a uniform rate of one lap in 5 s in the form of a helix at a temperature between 65 and 85°F (18 and 29°C).

4. Classification

4.1 The preformed flexible cellular ~~non-crosslinked~~ polyolefin thermal insulation shall be of the following types:

4.1.1 *Type I*—tubular.

4.1.2 *Type II*—sheet.

4.2 The preformed flexible cellular polyolefin thermal insulation shall be of the following grades:

4.2.1 *Grade 1 (non-crosslinked)*—Use temperature –150°F to 200°F (–101°C to 93°C).

4.2.2 *Grade 2 (crosslinked)*—Use temperature –297°F to 250°F (–182°C to 121°C).

5. Material

5.1 These products shall be extruded flexible cellular polyolefin materials.

5.2 These products are expanded with hydrochlorofluorocarbon gases, hydrofluorocarbon gases, hydrocarbon gases, chemical blowing agents, atmospheric gases, or combinations thereof. These gases will diffuse from the insulation with time after production.

5.3 Extruded flexible cellular polyolefin materials shall be of uniform density. Even though these materials will have a smooth skin surface on one or both sides, they are to be considered homogeneous for the purposes of determining thermal performance.

6. Physical Requirements

6.1 *Qualification Requirements* :

6.1.1 Thermal conductivity, water vapor permeability, and linear shrinkage, physical properties listed in Table 1 are defined as qualification requirements (refer to Practice C 390, Section 5).

6.2 *Inspection Requirements*:

6.2.1 The requirements for water absorption listed in Table 1 is defined as inspection requirements (refer to Practice C 390, Sections 5 Classification of Requirements and Section 7, Acceptance for Inspection Requirements.)

6.2.2 All dimensional requirements shall be as described in Section 7 and Table 2.

6.2.3 All workmanship, finish and appearance requirements shall be as described in Section 8.

6.2.4 Compliance with inspection requirements shall be in accordance with Practice C 390.

~~6.2.5Both Type I and Type II insulations shall conform to the physical property requirements listed in~~

6.2.5 Both Grade 1 and Grade 2 of Type I and Type II insulations shall conform to the respective physical property requirements listed in Table 1.

6.3 The material shall be free of objectionable odors at all temperatures within the recommended use range when tested according to C 1304.

6.4 *Surface Burning Characteristics* :

6.4.1 Surface burning characteristics shall be tested for the thickness supplied in accordance with Test Method E 84~~and the results shall be reported. See Section 1 of Test Method E84~~ . For applications in Canada test to CAN/ULC-S102.2–03. The results shall be reported. See Section 1 of Test Method E 84 for information regarding the applicability of this test method for use with cellular plastics and Practice E 2231 for specimen mounting methods. This test does not always define the hazard that may be presented by preformed flexible cellular polyolefin thermal insulation under actual fire conditions. It is retained for reference in this specification as laboratory test data required by some building codes.

TABLE 1 Physical Property Requirements (Type I—Tubular and Type II—Sheet)

NOTE 1—The values stated in Table 1 are not always appropriate as design values. For specific design recommendations using a particular product and for supporting documentation, consult the manufacturer.

~~Property~~ Property	~~Unit~~ Unit	~~Requirement~~ Grade 1 Requirement	Grade 2 Requirement
~~Use temperature, max~~	~~°F (°C)~~	~~200 (93)~~	
Use temperature, max	°F (°C)	200 (93)	250 (121)
Use temperature, min	°F (°C)	–150 (–101)	-297 (-182)
Thermal conductivity, max.			
At a mean temperature of:			
–250°F (–157°C)			0.25 (0.036)
~~–120°F (–84°C)~~	~~Btu-in./hr-ft^2-°F~~	~~0.29 (0.042)~~	
–120°F (–84°C)	Btu-in./hr-ft^2-°F	0.29 (0.042)	0.29 (0.042)
~~0°F (–18°C)~~	~~(W/m K)~~	~~0.33 (0.048)~~	
0°F (–18°C)	(W/m K)	0.33 (0.048)	0.33 (0.048)
~~75°F (24°C)~~		~~0.35 (0.050)~~	
75°F (24°C)		0.35 (0.050)	0.35 (0.050)
~~120°F (49°C)~~		~~0.37 (0.053)~~	
120°F (49°C)		0.37 (0.053)	0.37 (0.053)
			~~0.38 (0.055)~~
150°F (66°C)			0.38 (0.055)
200°F (93°C)			0.40 (0.058)
~~Water-vapor permeability, max.~~	~~perm-in (g/Pa s m)~~	~~0.05 (7.29 × 10^{-9})~~	
Water-vapor permeability, max.	perm-in (g/Pa s m)	0.05 (7.29 × 10^{-9})	0.05 (7.29 × 10^{-9})
~~Water absorption, max.,~~	~~% by volume~~	~~0.2~~	
Water absorption, max.,	% by volume	0.2	0.2
~~linear shrinkage, at maxiumum use temperature.~~	~~% linear change~~		~~7.0~~
linear shrinkage, at maxiumum use temperature.	% linear change	7.0	7.0