



Designation: C 1427 – 99a

Specification for Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form¹

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

1.1 This specification covers two grades of preformed flexible cellular non-crosslinked 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 -40°F to 158°F (-40°C to 70°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 may be governed by building codes that address fire performance.

1.3 This specification covers the physical properties of preformed flexible cellular non-crosslinked 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, may be 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:

C 168 Terminology Relating to Thermal Insulating Materials²

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of

the Guarded Hot Plate Apparatus²

C 209 Test Methods for Cellulosic Fiber Insulating Board²

C 335 Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe 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 585 Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)²

C 1045 Practice for Calculating Thermal Transmission Properties From Steady-State Heat Flux Measurements²

C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation²

C 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus²

C 1303 Test Method for Estimating the Long-Term Change in the Thermal Resistance of Unfaced Rigid Closed Cell Plastic Foams by Slicing and Scaling Under Controlled Laboratory Conditions²

C 1304 Test Method for Assessing Odor Emissions of Thermal Insulation Materials²

D 883 Terminology Relating to Plastics³

D 1622 Test Method for Apparent Density of Rigid Cellular Plastics³

D 1667 Specification for Flexible Cellular Materials- Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)³

D 3575 Test Methods for Flexible Cellular Materials Made from Olefin Polymers⁴

E 84 Test Method for Surface Burning Characteristics of Building Materials⁵

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² Annual Book of ASTM Standards, Vol 04.06.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Annual Book of ASTM Standards, Vol 08.02.

⁵ Annual Book of ASTM Standards, Vol 04.07.

E 96 Test Methods for Water Vapor Transmission of Materials²

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.”

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 non-crosslinked polyolefin thermal insulation shall be of the following grades:

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

4.2.2 *Grade 2*—Use temperature— 40°F to 158°F (–40°C to 70°C).

5. Material

5.1 These products shall be extruded flexible cellular non-crosslinked polyolefin materials.

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

5.3 Extruded flexible cellular polyolefin materials shall be of uniform density. Even though these materials may 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 dimensional stability;—physical properties listed in Table 1 are defined as qualification requirements (refer to Criteria C 390, Section 5).

6.2 *Inspection Requirements:*

6.2.1 The requirements for water absorption and flexibility, physical properties listed in Table 1 are defined as inspection requirements (refer to Criteria C 390, Sections 5 and 6).

6.2.2 All dimensional requirements are described in Section 6 and Table 2.

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

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

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

Property	Unit	Grade 1	Grade 2
Use temperature, max	°F (°C)	200 (93)	158 (70)
Use temperature, min	°F (°C)	–150 (–101)	–40 (–40)
Thermal conductivity, max.			
At a mean temperature of:			
–120°F (–84°C)	Btu-in./hr-ft ² -°F	0.29 (0.042)	
0°F (–18°C)	(W/m K)	0.33 (0.048)	0.33 (0.048)
75°F (24°C)		0.35 (0.050)	0.35 (0.050)
120°F (49°C)		0.37 (0.053)	0.37 (0.053)
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	0.2
Flexibility (mandrel bend)			
At –120°F (–84°C)		Shall not crack	
At 32°F (0°C)		Shall not crack	
At 75°F (24°C)		Shall not crack	Shall not crack
Dimensional stability, max. % linear change			
at –150°F (–101°C)		5.0	
at 0°F (–18°C)		5.0	5.0
at 158°F (70°C)		5.0	5.0
at 200°F (93°C)		5.0	

TABLE 2 Dimensional Tolerances, in. (mm)

<i>Type I</i>		
Inside diameter:		
Up to 5/8 (16) incl.	+1/8 (+ 3)	–0 (–0)
3/4 (19) to 1-1/2 (38) incl.	+3/16 (+ 5)	–0 (–0)
1-5/8 (41) to 2-3/8 (60) incl.	+1/4 (+ 6)	–0 (–0)
Over 2-3/8 (60)	+3/8 (+ 10)	–0 (–0)
Wall thicknesses:		
Up to 3/4 (19)	+1/8 (+ 3)	–0 (–0)
3/4 and over (19)	+3/16 (+ 5)	–0 (–0)
Length:	+3 (+ 75)	–1 (–25)
<i>Type II</i>		
Thickness:		
Up to 1/2 (13) incl.	+ 1/16 (+ 2)	– 1/16 (– 2)
Over 1/2 (13)	+ 3/32 (+ 3)	– 3/32 (– 3)
Length and width:	+ 3 (+ 75)	–3 (– 75)

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

6.2.5 Both Type I and Type II of Grade 1 and Grade 2 insulations shall conform to the 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 are to be tested for the thickness supplied in accordance with Test Method E 84 and the results are to be reported. See Section 1 of Test Method