



Designation: **C1427—12 C1427 – 13**

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

This standard is issued under the fixed designation C1427; 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 extruded preformed flexible cellular polyolefin thermal insulation 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.

1.2 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 standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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

C168 Terminology Relating to Thermal Insulation

C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C209 Test Methods for Cellulosic Fiber Insulating Board

C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C447 Practice for Estimating the Maximum Use Temperature of Thermal Insulations

C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

C534 Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C585 Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions

C1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation

C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus

C1303 Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation

C1304 Test Method for Assessing the Odor Emission of Thermal Insulation Materials

D883 Terminology Relating to Plastics

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.

[D1622 Test Method for Apparent Density of Rigid Cellular Plastics](#)
[D1667 Specification for Flexible Cellular Materials—Poly \(Vinyl Chloride\) Foam \(Closed-Cell\)](#)
[D3575 Test Methods for Flexible Cellular Materials Made From Olefin Polymers](#)
[E84 Test Method for Surface Burning Characteristics of Building Materials](#)
[E96/E96M Test Methods for Water Vapor Transmission of Materials](#)
[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)
[E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer](#)
[E456 Terminology Relating to Quality and Statistics](#)
[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)
[E2231 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 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 [C168](#) and in Terminology [D883](#).

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 polyolefin thermal insulation shall be of the following types:

4.1.1 *Type I*—tubular.

4.1.2 *Type II*—sheet.

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 [C390](#), 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 [C390](#), 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 [C390](#).

6.2.5 Both Type I and Type II insulations shall conform to the respective physical property requirements listed in [Table 1](#).

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	Unit	Requirement
Use temperature, max	°F (°C)	200 (93)
Use temperature, min	°F (°C)	–150 (–101)
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)
75°F (24°C)		0.35 (0.050)
120°F (49°C)		0.37 (0.053)
Water-vapor permeability, max.	perm-in (g/Pa s m)	0.05 (7.29 × 10 ^{–9})
Water absorption, max.,	% by volume	0.2
linear shrinkage, at maximum use temperature.	% linear change	7.0

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)	
Over 1/2 (13)	± 3/32 (3)	
Length and width:	± 3 %	

6.3 The material shall be free of objectionable odors at all temperatures within the recommended use range when tested according to C1304.

6.4 Surface Burning Characteristics:

6.4.1 Surface burning characteristics shall be tested for the thickness supplied in accordance with Test Method E84. For applications in Canada test to CAN/ULC-S102.2. When the referenced Canadian document in this specification is referred to in applicable Canadian building codes, the editions, referenced by those building codes shall govern. The results shall be reported. See Section 1 of Test Method E84 for information regarding the applicability of this test method for use with cellular plastics and Practice E2231 for specimen mounting methods. This test does not always define the hazard potentially resulting from burning of preformed flexible cellular polyolefin thermal insulation under actual fire conditions. It is retained for reference in this specification as laboratory test data required by applicable codes and regulations.

6.4.2 Preformed flexible cellular polyolefin thermal insulation is an organic material and is combustible. Do not expose it to flames or other ignition sources. The fire performance of the material shall be addressed through fire test requirements established by the appropriate governing documents.

6.4.3 It is possible the surface burning characteristics of the materials are different in the vertical orientation from those in the horizontal orientation.