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Standard Specification for Cellular Polypropylene Thermal Insulation[1]

This standard is issued under the fixed designation C1631; 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 the types, physical properties, and dimensions of cellular polypropylene intended for use as thermal insulation for temperatures from - 150 to + 240°F (-101 to + 116°C).

1.2 The use of thermal insulation materials covered by this specification is regulated by codes that, when adopted by an authority having jurisdiction, address fire properties for specific applications.

NOTE 1—Both fire properties and specific fire-test-response characteristics may be addressed by specifications, where codes or government regulations do not apply.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that provided for information only and are not considered standard.

1.4 The physical properties addressed by this specification are impacted by end use conditions. For design purposes, obtain physical properties from the manufacturer.

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]

C165 Test Method for Measuring Compressive Properties of Thermal Insulations

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

C272 Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions

C303 Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

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

C870 Practice for Conditioning of Thermal Insulating Materials

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

C1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1622 Test Method for Apparent Density of Rigid Cellular Plastics

D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging

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

E176 Terminology of Fire Standards

2.2 *Underwriters Laboratories Standard*[3]

UL 723 Test for Surface Burning Characteristics of Building Materials

3. Terminology

3.1 *Definitions:*

3.1.1 Terms used in this specification are defined in Terminology C168.

3.1.2 Terms used in this specification that relate to fire standards are defined in Terminology E176.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *XPP*—letter designations for the extruded cellular polypropylene thermal insulation classified by this specification that identifies the product as extruded cellular polypropylene.

[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.

[3] Available from Underwriters Laboratories (UL), 333 Pfingsten Rd., Northbrook, IL 60062-2096, http://www.ul.com.

3.2.2 *PP*—used in this specification to represent polypropylene in accordance with Terminology D1600.

4. Classification

4.1 This specification covers types of XPP thermal insulations currently commercially available as described by the physical property requirements in Table 1.

5. Ordering Information

5.1 Acquisition documents shall specify the following:

5.1.1 Title, number, and year of this specification,

5.1.2 Type (see Table 1),

5.1.3 *R*-value or profile / thickness required (see Tables 1 and 2),

5.1.3.1 *Thermal Resistance/Thickness Relationship*—The thermal resistance (*R*-value) and the thermal resistivity (*R*value/ inch) of XPP thermal insulation varies with profile / thickness. Therefore, when ordering, specify the *R*-value or the profile / thickness, or both. For additional information, see Test Methods C177, C518, C1114, or C1363.

5.1.4 Density, if other than specified in Table 1,

5.1.5 Tolerance, if other than specified,

5.1.6 Length and width required (see Table 2),

5.1.7 Edges, if other than straight edges are required,

5.1.8 *Profiled/Tapered Insulation*—special ordering information. In addition to other applicable requirements in Section 5 (Note 2), acquisition documents for profiled/tapered XPP thermal insulation shall specify the following:

5.1.8.1 *Shop Drawings*—When ordering a specific profile shaped foam, the initial engineer design drawings shall be provided, including tolerances.

5.1.9 Sampling, if different (see 10.1),

5.1.10 If a certificate of compliance is required (see 14.1), and

5.1.11 If marking is other than specified (see 15.1).

NOTE 2—Physical properties of profiled/tapered insulation shall be determined on blocks of XPP thermal insulation before the insulation is tapered.

6. Materials and Manufacture

6.1 XPP thermal insulation shall be formed by the expansion of polypropylene base resin in an extrusion process. XPP thermal insulation shall be of uniform density.

7. Physical Requirements

7.1 *Inspection Requirements*:

TABLE 2 Common Dimensions of XPP Thermal Insulation

Width	in. (mm)	24 (610) 27 (689)
Length	in. (mm)	120 to 154 (3048 to 3912)
Thickness	in. (mm)	1.8 (46)

7.1.1 The physical requirements listed in this section are defined as inspection requirements (refer to Practice C390).

7.1.2 All dimensional requirements are described in Section 8.

7.1.3 All workmanship, finish, and appearance requirements are described in Section 9.

7.1.4 Density shall be in accordance with Table 1.

NOTE 3—For lots of 150 units or less, the tightened inspection sampling plan in Practice C390 will be followed.

7.2 *Qualification Requirements*:

7.2.1 The physical properties listed in this section of the specification are defined as qualification requirements (refer to Practice C390). Thermal resistance, compressive resistance, water vapor permeance, water absorption, and dimensional stability, shall be in accordance with Table 1.

7.2.2 The mean thermal resistance of the material tested shall not be less than the minimum value identified in Table 1. The thermal resistances of individual specimens tested shall not be less than 90 % of the minimum value identified in Table 1.

7.2.3 Compliance with qualification requirements shall be in accordance with Practice C390.

7.3 Table 1 describes types of XPP thermal insulation. However, it does not cover all available products on the market. The values stated in Table 1 shall not be used as design values. It is the buyer's responsibility to specify design requirements and obtain supporting documentation from the material supplier.

7.4 *Surface Burning Characteristics*—XPP thermal insulation is an organic material and is, therefore, combustible. It shall not be exposed to flames or other ignition sources. Test Methods E84 or UL 723 are useful reference laboratory tests. One or the other of these tests is required for certain applications. These tests do not define the hazard that can be presented by XPP thermal insulation under actual fire conditions.

8. Dimensions and Permissible Variations

8.1 The materials covered by this specification are commonly available in the sizes shown in Table 2. Other sizes shall be agreed upon between the supplier and the user.

TABLE 1 Physical Property Requirements of XPP Thermal Insulation

Property	Unit	Requirement
Thermal resistance , R-Value/in., min. at mean temperature:		
75°F ± 2°F (24± 1°C)	F·ft^2·h/Btu (K·m^2/W)	3.6 (0.63)
Thermal conductivity of , k-factor, max. at mean temperature:		
75°F ± 2°F (24± 1°C)	Btu /F·ft^2·h (W/ K-m)	0.28 (0.040)
Compressive resistance at yield or 10 % deformation, whichever occurs first (extrusion direction), min.	psi (kPa)	6 (41.4)
Water vapor permeance of 1.00-in. (25.4-mm) thickness, max[A]	perm (ng/Pa·s·m^2)	2 (115)
Water absorption by total immersion, max	Volume %	1.0
Dimensional stability (change in dimensions), max	% change	3.0

[A]Products manufactured at greater than 1 in. shall report permeance of the minimum thickness available.