



Designation: C 1631 – 05

Standard Specification for Cellular Polypropylene Thermal Insulation¹

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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 and standards that address fire performance.

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

1.4 *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 165 Test Method for Measuring Compressive Properties of Thermal Insulations
- C 168 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 272 Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
- C 303 Test Method for Dimensions and Density of Preformed Block-Type Thermal Insulation
- C 390 Practice for Sampling and Acceptance of Preformed Thermal Insulation Lots
- C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- C 870 Practice for Conditioning of Thermal Insulating Materials

- C 1045 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 1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
- D 1600 Terminology for Abbreviated Terms Relating to Plastics
- D 2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- D 3575 Test Methods for Flexible Cellular Materials Made from Olefin Polymers
- D 1622 Test Method for Apparent Density of Rigid Cellular Plastics
- E 84 Test Method for Surface Burning Characteristics of Building Materials
- E 96 Test Methods for Water Vapor Transmission of Materials
- E 176 Terminology of Fire Standards

3. Terminology

3.1 *Definitions:*

3.1.1 Terms used in this specification are defined in Terminology C 168.

3.1.2 Terms used in this specification that relate to fire standards are defined in Terminology E 176.

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.

3.2.2 *PP*—used in this specification to represent polypropylene in accordance with Terminology D 1600.

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.

¹ This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C 16.22 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.

TABLE 1 Physical Property Requirements of XPP Thermal Insulation

Property	Unit	Result
Density, min.	lb/ft ³ (kg/m ³)	0.90 (15)
Thermal resistance of 1.00-in. (25.4-mm) thickness, R-Value, 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 1.00-in. (25.4mm) thickness, 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	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

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 (Rvalue/ 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 [C 177](#), [C 518](#), [C 1114](#), [C 1363](#) or Practice [C 1045](#).

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 1](#)), 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.

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 1—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 [C 390](#)).

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 2—For lots of 150 units or less, the tightened inspection sampling plan in Practice [C 390](#) 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 [C 390](#)). 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 [C 390](#).

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 *Combustibility Characteristics*—XPP thermal insulation is an organic material and is, therefore, combustible. It shall not be exposed to flames or other ignition sources. [E 84](#) / [UL 723](#) is a useful reference laboratory test data that is required by codes. 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.

8.2 *Dimensional Tolerances*—Unless otherwise specified, the length tolerance shall not exceed ± 3 % of the total length, the width tolerance shall not exceed ± 15 % of the total width.