

Designation: C 578 – 95

Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification² covers the types, physical properties, and dimensions of cellular polystyrene intended for use as thermal insulation for temperatures from -65 to $+165^{\circ}\text{F}$ (-53.9 to $+73.9^{\circ}\text{C}$). This specification does not cover cryogenic applications. Consult the manufacturer for specific recommendations and properties in cryogenic conditions.

1.2 The use of thermal insulation materials covered by this specification may be regulated by building codes that address fire performance. For some end uses, specifiers should also address the effect of moisture. Guidelines regarding these end use considerations are included in Appendix X1.

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:

- C 165 Test Method for Measuring Compressive Properties of Thermal Insulations³
- C 168 Terminology Relating to Thermal Insulating Materials³
- C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus³
- C 203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation³
- C 236 Test Method for Steady-State Thermal Performance of Building Assemblies by means of a Guarded Hot Box³

¹ This specification is under the jurisdiction of ASTM Committee C-16 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 This specification is similar to ISO 4898-1984, "Cellular Plastics—Specification for Rigid Cellular Materials Used in the Thermal Insulation of Buildings," in title only. The scope and technical content are significantly different.

ISO standards are available from ANSI, 11 W. 42nd St., 13th Floor, New York, NY 10036.

³ *Annual Book of ASTM Standards*, Vol 04.06.

- C 272 Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions⁴
- C 303 Test Method for Density of Preformed Block-Type Thermal Insulation³
- C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots³
- C 518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus³
- C 550 Practice for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation³
- C 870 Practice for Conditioning of Thermal Insulating Materials³
- C 976 Test Method for Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box³
- C 1045 Practice for Calculating Thermal Transmission Properties from Steady-State Heat Flux Measurements³
- C 1058 Practice for Selecting Temperatures for Reporting and Evaluating Thermal Properties of Thermal Insulation³
- C 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus³
- D 1600 Terminology Relating to Abbreviated Terms Relating to Plastics⁵
- D 1621 Test Method for Compressive Properties of Rigid Cellular Plastics⁵
- D 1622 Test Method for Apparent Density of Rigid Cellular Plastics⁵
- D 2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging⁵
- D 2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)⁶
- E 84 Test Method for Surface Burning Characteristics of Building Materials⁷
- E 96 Test Methods for Water Vapor Transmission of Materials³
- E 176 Terminology Related to Fire Standards⁷

3. Terminology

3.1 Definitions:

⁴ *Annual Book of ASTM Standards*, Vol 15.03.

⁵ *Annual Book of ASTM Standards*, Vol 08.01.

⁶ *Annual Book of ASTM Standards*, Vol 08.02.

⁷ *Annual Book of ASTM Standards*, Vol 04.07.

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 RCPS—letter designations for the rigid cellular polystyrene thermal insulation classified by this specification that identifies the product as rigid cellular polystyrene.

3.2.2 PS—used in this specification to represent polystyrene in accordance with Terminology D 1600.

4. Classification

4.1 This specification covers types of RCPS 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 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 RCPS thermal insulation may vary with thickness. Therefore, when ordering, specify the R-value or the thickness, or both. For additional information, see Test Methods C 177, C 518, C 236, C 976, and C 1114 or Practice C 1045.

5.1.4 Density, if other than specified in Table 1,

5.1.5 Tolerance, if other than specified (see 8.2),

5.1.6 Length and width required (see Table 2),

5.1.7 If other than straight edges are required (see 8.3),

5.1.8 If either ship-lap or tongue-and-groove edges are required (see 8.6),

5.1.9 Tapered Insulation—special ordering information. In addition to other applicable requirements in Section 5 (Note 1), acquisition documents for tapered RCPS thermal insulation shall specify the following:

5.1.9.1 Minimum starting thickness,

5.1.9.2 Slope, in./ft (mm/m),

5.1.9.3 Average R-value,

5.1.9.4 Minimum thickness,

5.1.9.5 Shop Drawings—The tapered insulation supplier shall provide shop drawings to illustrate installation patterns and dimensions for each tapered module,

5.1.10 Sampling, if different (see 10.1),

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

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

NOTE 1—Physical properties of tapered insulation should be determined on blocks of RCPS thermal insulation before the insulation is tapered.

6. Materials and Manufacture

6.1 RCPS thermal insulation shall be formed by the expansion of polystyrene resin beads or granules in a closed mold, or by the expansion of polystyrene base resin in an extrusion process. RCPS thermal insulation shall be of uniform density and have essentially closed cells. All RCPS thermal insulation shall contain sufficient flame retardants to meet the oxygen index requirements of Table 1.

7. Physical Requirements

7.1 Inspection Requirements:

7.1.1 The physical requirements listed in this section are defined as inspection requirements (refer to Criteria C 390).

7.1.2 All dimensional requirements are described in Section 8.

TABLE 1 Physical Property Requirements of RCPS Thermal Insulation

NOTE 1—The values for properties listed in this table may be affected by the presence of a surface skin which is a result of the manufacturing process. Where boards are tested with skins-in-place, this condition shall be noted in the test report.

NOTE 2—Type III has been deleted because it is no longer available.

NOTE 3—Classifications are used to cross-reference Fed. Spec. HH-I-524C (see X1.6.1).

Property	0.70 (12)	0.90 (15)	1.15 (18)	1.20 (19)	1.30 (21)	1.35 (22)	1.60 (26)	1.80 (29)	1.80 (29)	2.20 (35)	3.00 (48)
Density, min, lb/ft ³ (kg/m ³)											
Thermal resistance of 1.00-in. (25.4-mm) thickness, min, F-ft ² -h/Btu (K-m ² /W)											
Mean temperature:											
25°F (-3.9°C)	3.45 (0.61)	4.20 (0.74)	4.40 (0.77)	5.20 (0.92)	5.60 (0.99)	4.60 (0.81)	5.60 (0.99)	4.80 (0.84)	5.60 (0.99)	5.60 (0.99)	5.60 (0.99)
40°F (4.4°C)	3.30 (0.58)	4.00 (0.70)	4.20 (0.74)	5.00 (0.88)	5.40 (0.95)	4.40 (0.77)	5.40 (0.95)	4.60 (0.81)	5.40 (0.95)	5.40 (0.95)	5.40 (0.95)
75°F (23.9°C)	3.10 (0.55)	3.60 (0.63)	3.80 (0.67)	4.60 (0.81)	5.00 (0.88)	4.00 (0.70)	5.00 (0.88)	4.20 (0.74)	5.00 (0.88)	5.00 (0.88)	5.00 (0.88)
110°F (43.3°C)	2.90 (0.51)	3.25 (0.57)	3.45 (0.61)	4.30 (0.76)	4.65 (0.82)	3.65 (0.64)	4.65 (0.82)	3.85 (0.69)	4.65 (0.82)	4.65 (0.82)	4.65 (0.82)
Compressive resistance at yield or 10 % deformation, whichever occurs first (with skins intact), min, psi (kPa)	5.0 (35)	10.0 (69)	13.0 (90)	15.0 (104)	15.0 (104)	15.0 (104)	25.0 (173)	25.0 (173)	40.0 (276)	60.0 (414)	100.0 (690)
Flexural strength, min, psi (kPa)	10.0 (70)	25.0 (173)	30.0 (208)	40.0 (276)	40.0 (276)	40.0 (276)	50.0 (345)	50.0 (345)	60.0 (414)	75.0 (517)	100.0 (690)
Water vapor permeance of 1.00-in. (25.4-mm) thickness, max, perm (ng/Pa-s-m ²)	5.0 (287)	5.0 (287)	3.5 (201)	1.1 (63)	1.1 (63)	3.5 (201)	1.1 (63)	2.0 (115)	1.1 (63)	1.1 (63)	1.1 (63)
Water absorption by total immersion, max, volume%	4.0	4.0	3.0	0.3	0.3	3.0	0.3	2.0	0.3	0.3	0.3
Dimensional stability (change in dimensions), max, %	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Oxygen index, min, volume%	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Classification	Type XI	Type I	Type VIII	Type XII	Type X	Type II	Type IV	Type IX	Type VI	Type VII	Type V