Designation: C 578 – 04

Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation[1]

This standard is issued under the fixed designation C 578; 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.

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

1. Scope

1.1 This specification[2] covers the types, physical properties, and dimensions of cellular polystyrene intended for use as thermal insulation for temperatures from −65 to +165°F (−53.9 to +73.9°C).

1.1.1 For Type XIII only, this specification covers the physical properties, and dimensions of cellular polystyrene intended for use as thermal insulation for temperatures from −297 to +165°F (−183 to +73.9°C).

1.2 Consult the manufacturer for specific recommendations and properties in cryogenic conditions.

1.2.1 This specification does not cover cryogenic properties except for the k-factors for Type XIII in Appendix X1. For Type XIII in specific cryogenic applications, the manufacturer and purchaser shall agree upon the actual temperature limits and physical property requirements in addition to the k-factors in Appendix X1.

1.3 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.

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

1.5 *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:* [3]

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 203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation

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- and Broad-Type Thermal Insulation

C 335 Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe

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 550 Test Method for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation

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 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 Conditions

C 1363 Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus

[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] 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, 25 W. 43rd St., 4th Floor, New York, NY 10036.

[3] 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.

D 1600 Terminology for Abbreviated Terms Relating to Plastics
D 1621 Test Method for Compressive Properties of Rigid Cellular Plastics
D 1622 Test Method for Apparent Density of Rigid Cellular Plastics
D 2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
D 2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)
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 *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 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 and 8.1),

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),

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. The values for Type XIII properties listed in this table must be generated on material with the surface skin removed. Where products 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 X1.7.1).

NOTE 4—In addition to the thermal resistance values in Table 1, values at mean temperatures of 25 ± 2°F (-4 ± 1°C), 40 ± 2°F (4 ± 1°C), and 110 ± 2°F (43 ± 1°C) are provided in X1.8 for information purposes.

NOTE 5—For Type XIII, in addition to the Thermal resistance property requirements shown in Table 1, there are Apparent Thermal Conductivity property values shown for informational purposes in Table X1.2 of Appendix X1.

Classification	Type XI	Type I	Type VIII	Type XII	Type X	Type II	Type XIII	Type IV	Type IX	Type VI	Type VII	Type V
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)	20.0 (138)	25.0 (173)	25.0 (173)	40.0 (276)	60.0 (414)	100.0 (690)
Thermal resistance of 1.00-in. (25.4-mm) thickness, min, $F \cdot ft^2 \cdot h/Btu$ ($K \cdot m^2/W$)												
Mean temperature:												
75 ± 2°F (24 ± 1°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)	3.86 (0.68)	5.00 (0.88)	4.20 (0.74)	5.00 (0.88)	5.00 (0.88)	5.00 (0.88)
Flexural strength, min, psi (kPa)	10.0 (70)	25.0 (173)	30.0 (208)	40.0 (276)	40.0 (276)	35.0 (240)	45.0 (310)	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 ($ng/Pa \cdot s \cdot m^2$)	5.0 (287)	5.0 (287)	3.5 (201)	1.1 (63)	1.1 (63)	3.5 (201)	1.5 (86)	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	0.5	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	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	24.0
Density, min, lb/ft^3 (kg/m^3)	0.70 (12)	0.90 (15)	1.15 (18)	1.20 (19)	1.30 (21)	1.35 (22)	1.60 (26)	1.55 (25)	1.80 (29)	1.80 (29)	2.20 (35)	3.00 (48)

TABLE 2 Common Dimensions of RCPS Thermal Insulation

Type	XI, I, VIII, II, IX	X, IV, XII	VI, VII	V	XIII
Width, in. (mm)	12 to 48 (305 to 1219)	16, 24, 48 (406, 610, 1219)	24 (610)	16 (406)	14 to 20 (356 to 508)
Length, in. (mm)	48 to 192 (1219 to 4877)	48, 96 108 (1219, 2438, 2743)	48, 96, (1219, 2438)	96 (2438)	36 to 112 (914 to 2845)
Thickness, in. (mm)	⅜ to 24 (9.5 to 610)	½ to 4 (13 to 102)	1 to 4 (25 to 102)	1 to 4 (25 to 102)	7 to 10 (178 to 254)

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.

5.1.13 *Type XIII*—Special ordering information. In addition to other applicable requirements in Section 5, acquisition documents for Type XIII thermal insulation shall specify if presence of surface skins is required.

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 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, flexural strength, water vapor permeance, water absorption, dimensional stability, and oxygen index 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 RCPS thermal insulation. However, it does not cover all available products on the market. The values stated in Table 1 are not intended to 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*—RCPS thermal insulation is an organic material and is, therefore, combustible. It shall not be exposed to flames or other ignition sources. The values obtained by the oxygen index test (see Table 1 and 11.10) do not necessarily indicate or describe the fire risk of the materials and are used in this specification primarily to distinguish between insulations formulated with flame retardants and those not so formulated.

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 ±0.03 in./ft (±2.5 mm/m) of length; the width tolerance shall not exceed ±0.06 in./ft (±5.0 mm/m) of width; and the thickness tolerance shall not exceed ±0.06 in./in. (±59.5 mm/m) of thickness. For products less than 1.00 in. (25.4 mm) in thickness, the thickness tolerance shall not exceed ±0.06 in. (1.5 mm).

8.2.1 Dimensional Tolerances for RCPS Type III - the length tolerance shall not exceed +1, −0 in (+25.4, −0 mm); the width tolerance shall not exceed +0.5, −0 in (+12.7, −0 mm); and the thickness tolerance shall not exceed +0.5, −0 in (+12.7, −0 mm).

8.3 *Edge Trueness*—Unless otherwise specified, RCPS thermal insulation shall be furnished with true edges. Edges shall not deviate more than 0.03 in./ft (2.5 mm/m) of length or width.

8.4 *Face Trueness*—RCPS thermal insulation shall not deviate from absolute trueness by more than 0.03 in./ft (2.5 mm/m) of length or width.

8.5 *Squareness*—RCPS thermal insulation shall not deviate from squareness by more than 0.06 in./ft (5.0 mm/m) of length or width.

8.6 *Ship-Lap and Tongue-and-Groove Edges*—When specified, RCPS thermal insulation shall be furnished with either ship-lap or tongue-and-groove edges.

8.6.1 For RCPS thermal insulation manufactured with ship-lap edges, the depth of the ship-lap cut shall be one half the board thickness +0.06, −0 in. (+1.5, −0 mm). The minimum width of the cut for RCPS thermal insulation of 1.00-in.

(25.4-mm) thickness or greater shall be 0.50 ± 0.06 in. (12.7 ± 1.5 mm). For RCPS thermal insulation less than 1.00 in. (25.4 mm) in thickness, the minimum width of the cut shall be 0.25 ± 0.06 in. (6.4 ± 1.5 mm). The ship-lap cut shall be made on opposite faces of the board for both length and width. The resulting joint shall be smooth and uniform.

8.6.2 For RCPS thermal insulation manufactured with tongue-and-groove edges, the tongue of one shall fit snugly into the groove of a second. The resulting joint shall be smooth and uniform.

9. Workmanship, Finish, and Appearance

9.1 *Defects*—RCPS thermal insulation shall have no defects that will adversely affect its service qualities. RCPS thermal insulation shall be of uniform texture and free of foreign inclusions, broken edges and corners, slits, and objectionable odors.

9.2 *Crushing and Depressions*—RCPS thermal insulation shall have no crushed or depressed areas on any surface exceeding 0.13 in. (3.3 mm) in depth on more than 10 % of the total surface area.

9.3 The total number of voids on the board surface shall not exceed an average of 1 per square foot with dimensions larger than 0.13 by 0.13 by 0.13 in. (3.3 by 3.3 by 3.3 mm).

10. Sampling

10.1 Unless otherwise specified in the purchase order or contract, the material shall be sampled in accordance with Practice C 390.

11. Test Methods

11.1 *Conditioning and Aging*:

11.1.1 Samples shall be conditioned as required by the test method to either preconditioned moisture equilibrium or conditioned moisture equilibrium, using procedures defined by Practice C 870. Samples shall be held at equilibrium conditions until they are transferred into the testing equipment. Samples to be used for density test, dimensional stability test, and water vapor transmission test shall be conditioned at 73.4 ± 4°F (23 ± 2°C) and 50 ± 5 % relative humidity for a minimum of 40 h prior to the start of tests. Samples to be used for the compressive resistance test, oxygen index test, water absorption test, flexural strength test, and thermal resistance test shall be conditioned as specified in the applicable test procedure.

11.1.2 RCPS thermal insulations that incorporate a blowing agent other than air or pentane shall be aged for either 90 days at 140 ± 2°F (60 ± 1°C) or six months at 73.4 ± 4°F (23 ± 2°C) and 50 ± 5% relative humidity prior to conditioning and thermal resistance testing. Air circulation shall be provided so that all surfaces of the insulation are exposed to the surrounding environmental conditions.

11.1.3 Where boards are tested with skins-in-place, this condition shall be noted in the test report.

11.2 *Dimensions and Density*—Test in accordance with Test Method C 303 or Test Method D 1622.

11.3 *Trueness and Squareness*—Test in accordance with Test Method C 550.

11.4 *Thermal Resistance*—Test in accordance with Test Methods C 177, C 518, C 1114, C 1363 or Practices C 1045 or C 1058. Tests shall be conducted with a temperature differential of 40 ± 2°F (22 ± 1°C). In case of dispute,Test Method C 177 shall be the referee method. The mean temperature for thermal resistance testing shall be 75 ± 2°F (24 ± 1°C).

NOTE 3—Thermal resistance values in Table 1 establish the basis for determining compliance with this specification and are tested under the laboratory conditions specified herein. However, when an estimate of the long term thermal resistance (LTTR) value of a cellular plastic insulation manufactured with a blowing agent (other than air) intended to be retained for a period longer than 180 days is desired, Test Method C 1303 may be used. The LTTR value depends on material thickness. Therefore, when requested by a purchaser and agreed to by the seller, the LTTR value shall be determined and reported for a specific product thickness.

11.4.1 Test Method C 335 may be applicable to insulation used in pipe applications.

11.5 *Compressive Resistance*—Test in accordance with Test Method C 165, Procedure A, at a crosshead speed of 0.1 in./min/in. of thickness (100 mm/min/m) at yield or 10 % deformation, whichever occurs first (with skins intact), or test in accordance with Test Method D 1621. Five Specimens are to be tested. For anisotropic materials (for example, extruded insulation), specimens are to be equally spaced specimens in the cross machine direction of the board. The average compressive resistance for the five specimens tested is to be reported.

11.6 *Flexural Strength*—Test in accordance with Test Methods C 203, Method I, Procedure A. All test specimens shall be 1.00 ± 0.06 in. (25.4 ± 1.5 mm) or less in thickness. For samples less than or equal to 1.00 ± 0.06 in. in thickness (Note 2), cut test specimens from samples keeping both original major surfaces intact. If skins are present on only one major surface, test specimens with that surface in tension. For samples of greater thickness, trim test specimens to 1.00 ± 0.06 in. thickness retaining one original major surface. Specimens shall be tested with the original major surface in tension. For anisotropic products run the tests for both the length and cross directions of the sample. Report the average of these two series of tests as the value for flexural strength.

11.6.1 Specimens less than 1.00 ± 0.06 in. (25.4 ± 1.5 mm) in thickness are capable of continuing to flex without specimen failure (break). In such cases, flexural strength testing shall be performed using thicker specimens and the thickness shall be noted in the test report.

11.7 *Water Vapor Permeance*—Test in accordance with Test Methods E 96, using anhydrous calcium chloride as the desiccant at 73.4 ± 4°F (23 ± 2°C).

11.8 *Water Absorption*—Test in accordance with Test Method C 272. The immersion time shall be 24 h and the test specimens shall be 12 by 12 by 1 in. (305 by 305 by 25 mm).

11.9 *Dimensional Stability*—Test in accordance with Test Method D 2126 for 7 days (168 h) using the following conditions:

Temperature, °F (°C)	Relative Humidity, %
158 ± 4 (70 ± 2)	97 ± 3
−40 ± 6 (−40 ± 3)	ambient

11.10 *Oxygen Index*— Test in accordance with Test Method D 2863.

12. Inspection

12.1 Unless otherwise specified, Practice C 390 shall govern the inspection of material for conformance to inspection requirements. Exceptions to these requirements shall be stated in the purchase contract.

13. Rejection and Rehearing

13.1 Failure to conform to the requirements of this specification shall be cause for rejection. Rejection shall be reported to the producer or supplier promptly and in writing.

13.2 In the case of rejection of a shipment, the producer shall have the right to resubmit the lot for inspection after the removal and replacement of that portion not conforming to requirements.

14. Certification

14.1 Unless otherwise specified in the purchase order or contract, Practice C 390 shall be the basis for the certification. When specified in the purchase order or contract, a report of the test results shall be furnished.

15. Product Marking

15.1 The following shall be marked on each shipping container, bundle, or board:

15.1.1 Insulation specification number,
15.1.2 Type,
15.1.3 Manufacturer's name or trademark, and
15.1.4 Thermal Properties
15.1.4.1 R-value for all Types except XIII
15.1.4.2 k-factor for Type XIII.

15.1.5 Instructions governing the *R*-value at 75°F (23.9°C) mean temperature for the thermal insulation thickness supplied, as follows: *R* means the resistance to heat flow; the higher the value, the greater the insulation power. This insulation must be installed properly to get the marked *R*-value. Follow the manufacturer's instructions carefully. If a manufacturer's fact sheet is not provided with the material shipment, request this and review it carefully.

15.1.5.1 For Type XIII, instructions governing the k-factor at 75°F (23.9°C) mean temperature for the thermal insulation thickness supplied, as follows: k means the apparent thermal conductivity; the lower the value, the greater the insulation power. This insulation must be installed properly to get the marked k-factor. Follow the manufacturer's instructions carefully. A manufacturer's fact sheet is not required for Type XIII.

16. Keywords

16.1 block/board; cellular polystyrene; foam plastic; polystyrene; RCPS; rigid cellular polystyrene; thermal insulation

APPENDIX

(Nonmandatory Information)

X1. END-USE CONSIDERATIONS

X1.1 Combustibility Characteristics

X1.1.1 The fire performance of the material should be addressed through standard end-use fire test methods established by the appropriate governing documents.

X1.2 Test Method E 84/UBC Standard No. 8-1/UL 723

X1.2.1 These tests do not define the hazard that may be presented by RCPS thermal insulation under actual fire conditions. It is retained for reference in this specification as laboratory test data required by some building codes.

X1.3 Water Vapor Transmission

X1.3.1 Most thermal insulations function where there is both a temperature and moisture vapor pressure differential across the insulation. The water vapor permeability of RCPS thermal insulation may be a significant element to be considered when developing the specification for the vapor retarder component of the thermal package for a specific end use condition.

X1.4 Water Absorption

X1.4.1 This characteristic may have significance when this specification is used to purchase material for end uses requiring extended exposure to water. The water absorption of thermal insulations is an important property to the degree that significant content can degrade thermal performance.

X1.5 Freeze/Thaw Exposure

X1.5.1 RCPS insulating boardstock is sometimes used in applications that may subject the insulation to various types of freeze/thaw exposure conditions. These conditions may vary significantly in service. Exposure conditions to be considered include actual temperatures, liquid water availability, and freeze/thaw cycle frequency and duration. Boardstock integrity, as well as thermal/physical property retention may be affected by actual end-use conditions. Consult the manufacturer for specific product, insulation system, and application recommendations.

X1.6 Apparent Thermal Conductivity Values for Type XIII

X1.6.1 Apparent Thermal Conductivity (k-factor) is the inverse of the thermal resistance (R-value) of a 1-inch thick specimen.

X1.6.2 Determine in accordance with Sections 11.1 and 11.4 but report Apparent Thermal Conductivity (k-factor) rather than Thermal Resistance. The thickness of the specimen shall be 1 inch (25.4 mm) for both the aging described in Section 11.1 and the testing described in Section 11.4.

X1.6.3 For Type XIII, the mean apparent thermal conductivity of the material tested shall not be greater than the maximum value identified in Table X1.1. The apparent thermal

TABLE X1.1

PROPERTY	Type XIII
Apparent Thermal Conductivity, max, BTU-in/hr-ft^2-°F (W/m-°C)	
Mean Temperature:	
110°F (43.3°C)	0.277 (0.040)
100°F (37.7°C)	0.272 (0.039)
75°F (23.9°C)	0.259 (0.037)
50°F (10.0°C)	0.246 (0.035)
40°F (4.4°C)	0.241 (0.035)
25°F (−3.9°C)	0.234 (0.034)
0°F (−17.8°C)	0.221 (0.032)
−25°F (−31.7°C)	0.212 (0.031)
−50°F (−45.6°C)	0.203 (0.029)
−75°F (−59.4°C)	0.195 (0.028)
−100°F (−73.3°C)	0.181 (0.026)
−150°F (−101.1°C)	0.152 (0.022)
−200°F (−128.9°C)	0.124 (0.018)

conductivity of individual specimens tested shall not be greater than 110 % of the maximum value identified in Table X1.1.

X1.7 Specification C 578/HH-I-524C Cross Reference

X1.7.1 Federal Specification HH-I-524C was cancelled on Jan. 17, 1985. For the convenience of specifiers who may have contracts written in terms of HH-I-524C, the following is a cross-reference table. The letters N\A indicate that the type designation has been deleted because products meeting the requirements are no longer available.

(note to reader; table in this section was not changed, only the section numbering was modified)

HH-I-524C Type Designation	Specification C 578 Type Designation
I	I
II	II
III	N\A
IV	IV
V	V

X1.7.2 Additional type designations have been established since the cancellation of HH-I-524C to better define the variety of RCPS thermal insulations available.

X1.8 Thermal Resistance Values at Additional Mean Temperatures

X1.8.1 *Thermal Resistance*—The thermal resistance values below are provided for information purposes in addition to the thermal resistance values at a mean temperature of 75 ± 2°F (24 ± 1°C) provided in Table 1 of this standard.

(note to reader: table in this section was not changed, only the section numbering was modified)

TABLE X1.2 Thermal Resistance Values at Additional Mean Temperatures

Property											
Density, min, lb/ft^3 (kg/m^3)	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)
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) ±2°F (±1°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) ±2°F (±1°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)
110°F (43.3°C) ±2°F (±1°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)
Classification	Type XI	Type I	Type VIII	Type XII	Type X	Type II	Type IV	Type IX	Type VI	Type VII	Type V