Designation: C1289 – 17

Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board[1]

This standard is issued under the fixed designation C1289; 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 U.S. Department of Defense.

1. Scope

1.1 This specification covers the general requirements for faced thermal insulation boards composed of rigid cellular polyisocyanurate surfaced with other materials. The insulation boards are intended for use at temperatures between −40 and 200°F (−40 and 93°C). This specification does not cover cryogenic applications. Consult the manufacturer for specific recommendations and properties in cryogenic conditions. For specific applications, the actual temperature limits shall be agreed upon by the manufacturer and the purchaser.

1.2 This standard is intended to apply to rigid cellular polyurethane-modified polyisocyanurate thermal insulation board products that are commercially acceptable as non-structural panels useful in building construction. The term polyisocyanurate encompasses the term polyurethane. For engineering and design purposes, users should follow specific product information provided by board manufacturers regarding physical properties, system design considerations and installation recommendations.

NOTE 1—See Appendix X1 for guidance on determining wind pressure resistance of panels when required for wall sheathing applications.

1.3 The use of thermal insulation materials covered by this specification is typically regulated by building codes, or other agencies that address fire performance. Where required, the fire performance of the material shall be addressed through standard fire test methods established by the appropriate governing documents.

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.

NOTE 2—For conversion to metric units other than those contained in this standard, refer to IEEE/ASTM SI 10.

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.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The following documents, of the issue in effect on the date of material purchase, form a part of this specification to the extent specified herein:

2.2 *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

C203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation

C208 Specification for Cellulosic Fiber Insulating Board

C209 Test Methods for Cellulosic Fiber Insulating Board

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

C550 Test Method for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation

C728 Specification for Perlite Thermal Insulation Board

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

[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.

Current edition approved July 1, 2017. Published July 2017. Originally approved in 1995. Last previous edition approved in 2016 as C1289 – 16a. DOI: 10.1520/C1289-17.

[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.

C1058/C1058M 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
C1177/C1177M Specification for Glass Mat Gypsum Substrate for Use as Sheathing
C1303/C1303M Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
C1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
C1763 Test Method for Water Absorption by Immersion of Thermal Insulation Materials
D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
E84 Test Method for Surface Burning Characteristics of Building Materials
E96/E96M Test Methods for Water Vapor Transmission of Materials
IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): (The Modernized Metric System)

2.3 *Voluntary Product Standard:*[3]
Voluntary Product Standard PS 1–09 Structural Plywood
Voluntary Product Standard PS 2–10 Performance Standard for Wood Based Structural Use Panels

2.4 *CAN/ULC Standard:*[4]
CAN/ULC-S770-09 Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

2.5 *CAN/CSA and CSA Standards:*[5]
CAN/CSA O325-07 (R2012) – Construction Sheathing
CSA O121-08 (R2013) Douglas Fir Plywood
CSA O151-09 Canadian Softwood Plywood

3. Terminology

3.1 For complete descriptions of terms used in this specification, refer to Terminology C168.

3.2 The term polyisocyanurate encompasses the term polyurethane (see 1.2).

4. Classification

4.1 The faced thermal insulation boards composed of rigid cellular polyisocyanurate covered by this specification are classified as follows:

4.1.1 *Type I*—Faced with aluminum foil on both major surfaces of the core foam.

4.1.1.1 *Class 1*—Non-reinforced core foam.

4.1.1.2 *Class 2*—Glass fiber reinforced or non-reinforced core foam.

4.1.2 *Type II:*

4.1.2.1 *Class 1*—Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

(1) Grade 1—16 psi (110 kPa), min, compressive strength.
(2) Grade 2—20 psi (138 kPa), min, compressive strength.
(3) Grade 3—25 psi (172 kPa), min, compressive strength.

4.1.2.2 *Class 2*—Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of the core foam.

4.1.2.3 *Class 3*—Faced with uncoated polymer-bonded glass fiber mat facers on both major surfaces of the core foam.

4.1.2.4 *Class 4*—Faced with coated or uncoated polymer-bonded glass fiber mat facers on both major surfaces of the core foam. This product is used at a maximum thickness of ½ in. (12.7 mm).

(1) Grade 1—80 psi (551 kPa), min, compressive strength
(2) Grade 2—110 psi (758 kPa), min, compressive strength
(3) Grade 3—140 psi (965 kPa), min, compressive strength

4.1.3 *Type III*—Faced with a perlite insulation board on one major surface of the core foam and a glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on the other major surface of the core foam.

4.1.4 *Type IV*—Faced with a cellulosic fiber insulating board on one major surface of the core foam and a glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on the other major surface of the core foam.

4.1.5 *Type V*—Faced with oriented strand board (OSB) or plywood on one major surface of the foam and a glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on the other major surface of the core foam.

NOTE 3—These general statements refer to generic composition descriptions of facer materials, bonded fibrous felts, and mats that are currently commercially accepted in the marketplace for these products, using terms common to these competing products. Felts are made with organic fibers, inorganic fibers, or mixtures of organic and inorganic fibers. Glass fiber mats are used uncoated, or coated.

4.1.6 *Type VII*—Faced with glass mat faced gypsum board on one major surface and glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on the other major surface of the core foam.

5. Ordering Information

5.1 Orders shall include the following information:
5.1.1 Title, designation, and year of issue of C1289,
5.1.2 Quantity of material being ordered,
5.1.3 Product name and manufacturer's name, address, and telephone number,
5.1.4 Type or Class, or both, if Type 1; type, class, and grade or type and class, if Type II, (see Section 4),
5.1.5 R-value and specific thickness, as required (see 7.2),
5.1.6 Tolerance if other than specified (see 8.1),
5.1.7 Size(s) required (see 8.6),
5.1.8 Type of edge (see 8.3 and 8.4),
5.1.9 Sampling, if different (see 10.1),
5.1.10 If a certificate of compliance is required (see 10.2, 10.3, 10.4, Table 1 and Table 2),

[3] United States Department of Commerce, National Institute of Standards and Technology, Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
[4] Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, http://www.ul.com.
[5] CSA Group, 178 Rexdale Blvd., Toronto, ON, Canada M9W 1R3, http://www.csagroup.org/ca.

TABLE 1 Physical Properties[A]

Product Type	Type I Class 1	Type I Class 2	Type II Class 1	Type II Class 2	Type II Class 3	Type II Class 4[B]	Type III	Type IV	Type V	Type VII
Facer covering one surface	See 4.1.1	See 4.1.1	See 4.1.2.1	See 4.1.2.2	See 4.1.2.3	See 4.1.2.4	Perlite insulation board	Cellulosic fiber insulating board	OSB or plywood	Glass mat faced gypsum board
Facer covering opposite surface	See 4.1.1	See 4.1.1	See 4.1.2.1	See 4.1.2.2	See 4.1.2.3	See 4.1.2.4	See 4.1.3	See 4.1.4	See 4.1.5	See 4.1.6
Physical Property										
Compressive Strength, psi (kPa), min										
	16 (110)	16 (110)	Grade 1 16 (110) Grade 2 20 (138) Grade 3 25 (172)	Grade 1 16 (110) Grade 2 20 (138) Grade 3 25 (172)	Grade 1 16 (110) Grade 2 20 (138) Grade 3 25 (172)	Grade 1 80 (551) Grade 2 110 (758) Grade 3 140 (965)	16 (110)	16 (110)	16 (110)	16 (110)
Dimensional Stability, Percent Linear Change, Thickness, max										
–40°F (–40°C)/ amb, RH	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
158°F (70°C)/ 97 % RH	4.0	4.0	4.0	4.0	4.0	4.5	4.0	4.0	4.0	4.0
200°F (93°C)/ amb RH	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Dimensional Stability, Percent Linear Change, length and width, max										
–40°F (–40°C) / amb RH	2.0	1.5	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0
158°F (70°C)/ 97 % RH	2.0	1.5	2.0	2.0	2.0	1.0	2.0	4.0	4.0	4.0
200°F (93°C)/ amb, RH	4.0	1.5	2.0	2.0	2.0	1.0	2.0	4.0	4.0	4.0
Flexural Strength (modulus of rupture) or Yield Strength										
psi (kPa), min	40 (275)	40 (275)	40 (275)	40 (275)	40 (275)	For ½ in. (12 mm) product: 400 (2750) For ¼ in. (6 mm) product: 800 (5500)	40 (275)	40 (275)	40 (275)	40 (275)
Break Load or Load at Yield, lbf (N), min	8 (35)	8 (35)	17 (75)	17 (75)	17 (75)	For ½ in. (12 mm) product: 20 (89) For ¼ in. (6 mm) product: 14 (62)	17 (75)	17 (75)	17 (75)	17 (75)
Tensile strength, psf (kPa), min Perpendicular to board surface										
	500 (24)	500 (24)	500 (24)	500 (24)	500 (24)	2000 (95)	500 (24)	500 (24)	500 (24)	500 (24)
Water absorption 2h percent by volume, max										
	1.0	1.0	1.5	1.5	2.0	4.0	2.0	2.0	1.0	1.0
Water vapor permeance, perm (ng/Pa·s·m^2), max										
	0.3 (17.2)	0.3 (17.2)	1.5 (85.8)	4.0 (228.8)	8.0 (457.6)	1.5 (85.5)	8.0 (457.6)	C	C	C

[A] See 7.1 about the product thicknesses covered by this table. Consult manufacturers for other thicknesses. When appropriate, physical property values as agreed between buyer and seller shall replace those listed in Table 1 as qualification requirements described in 10.3.
[B] Products made at a maximum thickness of 0.5 in. (12.7 mm).
[C] Not applicable.

TABLE 2 Thermal Resistance Properties [A,B]

Product Type	Type I Class 1	Type I Class 2	Type II Class 1 Grades 1, 2, 3	Type II Class 2	Type II Class 3	Type II Class 4[C]	Type III	Type IV	Type V	Type VII
Facer covering one surface	See 4.1.1	See 4.1.1	See 4.1.2.1	See 4.1.2.2	See 4.1.2.3	See 4.1.2.4	Perlite insulation board	Cellulosic fiber insulating board	OSB or plywood	Glass mat faced gypsum board
Facer covering opposite surface	See 4.1.1	See 4.1.1	See 4.1.2.1	See 4.1.2.2	See 4.1.2.3	See 4.1.2.4	See 4.1.3	See 4.1.4	See 4.1.5	See 4.1.6
Minimum Thermal Resistance @ 40 ± 2°F (4 ± 1°C) Mean temp.°F ft^2 h/Btu (Km^2/W) [D]										
1 in. (25.4 mm) product	6.6 (1.16)	6.6 (1.16)	6.2 (1.10)	5.8 (1.02)	5.5 (0.97)	For ¼ in. (6.4mm) product: 1.1 (0.19) For ½ in. (12.7mm) product: 2.2 (0.39)	Product Not Available	Product Not Available	Product Not Available	Product Not Available
1.5 in. (38.1 mm) product	9.9 (1.74)	9.9 (1.74)	9.2 (1.62)	8.7 (1.53)	8.25 (1.45)		7.6 (1.34)	7.5 (1.32)	6.8 (1.32)	7.7 (1.36)
2 in. (50.8 mm) product	13.2 (2.232)	13.2 (2.232)	12.3 (2.17)	11.7 (2.06)	11.0 (1.94)		10.6 (1.85)	10.5 (1.85)	9.8 (1.73)	10.8 (1.90)
Minimum Thermal Resistance @ 75 ± 2°F (24 ± 1°C) Mean temp. °F ft^2 h/Btu (Km^2/W)										
1 in. (25.4 mm) product	6.0 (1.06)	6.0 (1.06)	5.6 (0.97)	5.3 (0.93)	5.0 (0.88)	For ¼ in. (6.4mm) product: 1.0 (0.18) For ½ in. (12.7mm) product: 2.0 (0.35) N/A	Product Not Available	Product Not Available	Product Not Available	Product Not Available
1.5 in. (38.1 mm) product	9.0 (1.59)	9.0 (1.59)	8.4 (1.48)	8.0 (1.41)	7.5 (1.32)		7.0 (1.23)	6.9 (1.22)	6.2 (1.09)	7.0 (1.23)
2 in. (50.8 mm) product	12.0 (2.11)	12.0 (2.11)	11.2 (1.97)	10.6 (1.87)	10.0 (1.76)		9.8 (1.73)	9.7 (1.71)	9.0 (1.59)	9.8 (1.73)
Minimum Thermal Resistance @ 110 ± 2°F (43 ± 1°C) Mean temp.°F ft^2 h/Btu (Km^2/W) [D]										
1 in. (25.4 mm) product	5.4 (0.95)	5.4 (0.95)	5.0 (0.88)	4.8 (0.85)	4.5 (0.79)	For ¼ in. (6.4mm) product: 0.9 (0.16) For ½ in. (12.7mm) product: 1.8 (0.32) N/A	Product Not Available	Product Not Available	Product Not Available	Product Not Available
1.5 in. (38.1 mm) product			7.6 (1.34)	7.2 (1.26)	6.75 (1.19)		6.4 (1.13)	6.3 (1.10)	5.6 (0.99)	6.3 (1.11)
2 in. (50.8 mm) product			10.1 (1.78)	9.5 (1.67)	9.0 (1.59)		9.0 (1.59)	8.9 (1.57)	8.2 (1.44)	8.9 (1.57)

[A] Because core foam thickness and facer type, thickness, and permeance can all influence product R-values, three faced product thicknesses have been described for referee purposes (except for Type II, Class 4). Consult manufacturers regarding specific foam-facer composite products and other thicknesses. When appropriate, thermal resistance values as agreed between buyer and seller shall replace those listed in Table 2 as qualification requirements described in 10.3.
[B] Determined in accordance with conditioning procedures in 11.1.2. Values for composite products are based on calculation using Type II Class 1 R-values and the R-value of the specific composite product used.
[C] Products made at a maximum thickness of 0.5 in. (12.7 mm).
[D] The minimum thermal resistance values at 40°F and 110°F are not required to establish compliance with this material specification. See 11.2.

5.1.11 If packaging is other than specified (see 13.1), and
5.1.12 If marking is other than specified (see 13.2).

6. Materials and Manufacture

6.1 *Cellular Material*—Rigid polyisocyanurate thermal insulation boards shall be based upon the reaction of an isocyanate with a polyol, or the reaction of an isocyanate with itself, or both, using a catalyst and blowing agents to form a rigid closed-cell-structured polyisocyanurate foam. The insulation foam core shall be homogeneous and of uniform density.

6.2 *Facing Materials*—The facing material incorporated into the design of the faced thermal insulation board shall be as follows:

6.2.1 *Aluminum Foil*—Aluminum foil is plain or coated aluminum foil, or foil laminated to a supporting membrane.

6.2.2 *Glass Fiber Reinforced Cellulosic Felt*—This felt shall consist of a cellulosic fiber felt containing glass fibers.

6.2.3 *Coated Polymer-Bonded Glass Fiber Mat*—The polymer-bonded glass fiber mat shall consist of fibrous glass mats bonded with organic polymer binders and coated with organic polymer, clay, or other inorganic substances.

6.2.4 *Uncoated Polymer-Bonded Glass Fiber Mat*—The polymer-bonded glass fiber mat shall consist of fibrous glass mats bonded with organic polymer bonded binders.

6.2.5 *Perlite Insulation Board*—The perlite insulation board shall conform to the material and physical property requirements specified in Standard Specification C728, either type 1 or type 2 may be used. The perlite insulation board may be either the ½-in. board listed in Specification C728, which has a *higher* core density and *modified* formulation (as agreed upon between buyer and seller) than the thicker products, or may be a ½-in. thickness (available only to manufacturers of laminated rigid foam products) of the ¾ to 3 in. formulation perlite board listed in Specification C728.

6.2.6 *Cellulosic Fiber Insulation Board*—The cellulosic fiber insulating board shall conform to the material and physical properties requirements specified in Specification C208.

6.2.7 *Oriented Strand Board*—The oriented strand board (OSB) shall conform to the material and physical properties requirements specified in U.S. Voluntary Product Standard PS 2–10 or Canadian Standard CAN/CSA O325–07.

6.2.8 *Plywood*—The plywood shall conform to the material and physical properties requirements specified in U.S. Voluntary Product Standard PS 1-09 or PS 2–10 or Canadian Standard CSA O121-08 or CSA O151-09.

6.2.9 *Glass Mat Faced Gypsum Board*—The glass mat faced gypsum board shall be ¼ in. (6.4 mm) thickness and shall conform to the material and physical properties requirements in Specification C1177/C1177M.

7. Physical Properties

7.1 The thermal insulation board shall conform to the properties stated in Table 1. Foam thickness and facer type, thickness and permeance can all influence the magnitude of values measured for physical properties listed in Table 1. For Type I and II (except Type II, Class 4), a 1 in. (25.4 mm) product with the facers on has been described in Table 1 to establish compliance with this specification. For Types III, IV, V and VII, a product with 1 in. (25.4 mm) foam has been described in Table 1 to establish compliance with this specification. The average value of the tested specimens shall be used to determine compliance with the requirements. For information about the number of specimens and the precision of the results, consult the specified standard test method used.

7.1.1 The physical properties stated in Table 1 shall not be used as design or engineering values unless this recommendation is made in writing by the product manufacturer. It remains the buyer's responsibility to specify design requirements and obtain supporting physical properties documentation from each product manufacturer and supplier.

7.2 *Thermal Resistance (R-value)*—When ordering, specify the R-value; thickness shall be specified if there is a specific thickness requirement and R-value is not specified. The values specified shall be for the faced insulation product only, and shall not include any additional thermal resistances from reflective facer surfaces and adjacent air spaces or from other components of the building system. The mean thermal resistance of the material tested shall not be less than the minimum relevant value prescribed in Table 2. The thermal resistances of individual specimens tested shall not be less than 90 % of the minimum value identified in Table 2. Values in Table 2 determined in accordance with Section 11.

NOTE 4—Thermal resistance of cellular plastics may be significantly influenced by installation and service-related variables such as age, encapsulation within gas barrier materials, environmental conditions, mechanical abuse, etc. and may be reduced from measured values after exposure to conditions of use. For specific design recommendations, consult the manufacturer or qualified professionals, such as architects or engineers.

7.2.1 *Long-Term Thermal Resistance (LTTR)*—Determine, and report values, in accordance with practice and details in CAN/ULC-S770-09[6] or Test Method C1303/C1303M. For Test Method C1303/C1303M, use the prescriptive test method and core slices only. If the core slices are prepared from 1.75 in. (45 mm) to 2.25 in. (55 mm) material to predict 0.9 in. (22 mm) to 4.1 in. (103 mm) thick products, the homogeneity qualification test and the alternate product thickness qualification tests are not required. If the slices are prepared from other material thickness, follow the instructions for stack composition in Test Method C1303/C1303M. LTTR shall apply to Type II through Type VII, inclusive.

NOTE 5—The results of a ruggedness test program for Test Method C1303/C1303M completed in 2011[7] has established good agreement between full-thickness aged values and the accelerated aging predictions for polyiso foam when a product with an original thickness between 1.75 and 2.25 in. (45 and 55 mm) is used to predict the long term aged value for products between 0.9 and 4.1 in. (22 and 103 mm), using stack of core slices with a thickness of 8 to 12 mm.

7.3 *Fire Characteristics*—Polyisocyanurate thermal insulation boards are combustible. They shall not be exposed to open flames or other ignition sources. The fire performance of the material shall be addressed through fire test requirements established by the appropriate governing authority, which are specific to the end use and occupancy.

7.3.1 *Surface Burning Characteristics*—Determine, if required, in accordance with Test Method E84.

8. Dimensions

8.1 *Dimensional Tolerances*—Measure in accordance with Test Method C303. The length and width tolerances shall not exceed ± ¼ in. (6.4 mm); the thickness tolerance shall not exceed 1/16 in. (1.6 mm) for ¼ in. (6.4 mm) product and ⅛ in. (3.2 mm) for all other thicknesses; and the thickness of any two boards shall not differ more than 1/16 in. (1.6 mm) for ¼ in. (6.4 mm) product and ⅛ in. (3.2 mm) for all other thicknesses.

8.2 *Edge Squareness*—The thermal insulation boards shall not be out of square more than 1/16 in./ft (5.2 mm/m) of width or length, when examined in accordance with Practice C550.

8.3 *Edge Trueness in the x/y Direction*—Unless otherwise specified, the thermal insulation board shall be furnished with straight edges and edges shall not deviate more than 1/32 in./ft (2.6 mm/m) when examined in accordance with Practice C550.

8.4 *Shiplap Edges*—When specified, the insulation board shall be fabricated with shiplap edges along its longest dimensions.

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:C16-1035.

[7] Supporting data can be found in Oak Ridge National Lab Report number ORNL/TM-2012/214, Evaluation of Experimental Parameters in the Accelerated Aging of Closed-Cell Foam Insulation, December 2012.

8.4.1 The nominal depth of each shiplap shall be the sum of its thickest facer dimension plus one half the thickness of its core foam dimension.

8.4.2 For boards 2 in. (50.8 mm) or greater in nominal thickness, the width of the shiplap shall be 1 in. (25.4 mm). For boards less than 2 in. (50.8 mm) in thickness, the nominal width of the shiplap shall be one half the thickness of the faced board product.

8.4.3 All fabrication tolerances shall provide for a dimensionally stable, smooth, and uniform shiplap joint in installation and in service.

8.5 *Face Trueness*—The thermal insulation boards shall not depart from absolute flatness more than ⅛ in./ft (10 mm/m) of length or width when examined in accordance with Practice C550.

8.6 *Available Sizes*—The thermal insulation boards are normally supplied in sizes of 4 by 4 ft (1.22 by 1.22 m), and 4 by 8 ft (1.22 by 2.44 m) for use in roofing applications. For sheathing applications the thermal insulation boards are normally supplied in sizes of 4 by 8 ft (1.22 by 2.44 m), 4 by 9 ft (1.22 by 2.75 m), 4 by 10 ft (1.22 by 3.05 m) and 4 by 12 ft (1.22 by 3.66 m). Other sizes shall be agreed upon between the manufacturer and purchaser.

8.7 *Crushings and Depressions*—The thermal insulation boards shall have no crushed or depressed areas on any surface exceeding ⅛ in. (3.2 mm) in depth on more than 10 % of the total surface area.

9. Workmanship

9.1 The thermal insulation boards shall have no defects that will adversely affect their service qualities. The boards shall be of uniform texture and facer integrity, free from the accumulation of unexpanded materials, foreign materials, broken edges and corners, slits, delaminations, and objectionable odors.

10. Sampling

10.1 Unless otherwise specified, the product shall be sampled and inspected for acceptance of material in accordance with Criteria C390.

10.2 The following physical requirements are defined as inspection requirements in accordance with Criteria C390:

10.2.1 All dimension requirements as described in Section 8.

10.2.2 All workmanship, finish, and appearance requirements as described in Section 9.

10.3 The following physical properties are defined as qualification requirements in accordance with Criteria C390.

10.3.1 Thermal resistance as described in Section 11.2 and Table 2.

10.3.2 Compressive strength as described in Section 11.3 and Table 1. Five equally spaced specimens are to be taken for testing along a cross-machine board traverse (perpendicular to the machine direction.

10.3.3 Dimensional stability as described in Section 11.4 and Table 1.

10.3.4 Flexural strength as described in Section 11.5 and Table 1.

10.3.5 Tensile strength perpendicular to board surface as described in Section 11.6 and Table 1.

10.3.6 Water absorption as described in Section 11.7 and Table 1.

10.3.7 Water vapor permeance as described in Section 11.8 and Table 1.

10.4 For lots of 150 units or less not subject to tightened inspection, the supplier's certificate of compliance or third-party's certificate of compliance shall be sufficient basis for acceptance of the lot. The certificate shall state that compliance to inspection requirements has been verified by actual inspection of material of the same type, class, size, and thickness manufactured within the same production period as the material offered.

11. Test Methods

11.1 *Conditioning:*

11.1.1 Sample boards shall be conditioned at 73 ± 4°F (23 ± 2°C) and 50 ± 5 % relative humidity for a minimum of 24 h prior to the start of tests or as specified in the applicable test procedure.

11.1.2 *Thermal Resistance Conditioning:*

11.1.2.1 Thermal insulation boards to be tested for thermal resistance shall be conditioned for 180 ± 5 days at 73 ± 4°F (23 ± 2°C) and 50 ± 5% relative humidity prior to testing or at least 90 days at 140 ± 2°F (60 ± 1°C) dry heat prior to testing.

11.2 *Thermal Resistance*—After conditioning in accordance with 11.1.2, insulation boards will be further conditioned in accordance with Test Method C518 and shall be tested in accordance with Test Methods C177, C518, C1114, or C1363 and Practices C1045 and C1058/C1058M. The mean reference testing temperature shall be 75 ± 2°F (24 ± 1°C). In addition, thermal resistance values shall be provided at 40 ± 2°F (4 ± 1°C), or 110 ± 2°F (43 ± 1°C), or both, at the buyer's request, but shall not be required to establish compliance with this specification. All thermal resistance testing shall be conducted with a minimum temperature differential of 40°F (22°C). Cut samples for testing after the conditioning period.

NOTE 6—The thermal transmission properties of closed-cell insulation products vary with temperature, temperature gradient, moisture content, thickness, age, and shape. Apparent thermal transmission properties contained herein are based upon specimens tested under laboratory conditions specified herein. These thermal transmission properties are comparative values for establishing specification compliance. These thermal transmission properties may not represent the installed performance of the insulation under use conditions differing substantially from test conditions.

11.3 *Compressive Strength*—All material covered by this specification shall be conditioned and tested in accordance with the Cross-Head Motion procedure in Test Method D1621 to 10 % thickness deformation or yield, whichever occurs first on a full-thickness faced specimen. Faced product compressive strength shall be determined across the thickness dimension of the board product.

11.4 *Dimensional Stability*—The thermal insulation boards shall be tested in accordance with Test Method D2126 except that each specimen shall be 12 by 12 in. (300 by 300 mm) by the full-faced thickness.

11.4.1 The standard environmental schedule shall be as follows:

Temperature		Relative	Exposure Time,
°F	°C	Humidity	days
+200 ± 4	(93 ± 2)	ambient	7
−40 ± 6	(−40 ± 3)	ambient	7
+158 ± 4	(70 ± 2)	97 ± 3 %	7

11.5 *Flexural Strength*—Insulation boards shall be tested in accordance with Test Method C203, Method 1, Procedure B, at a moving head speed of 0.1 in./min/in. (2.5 mm/min/25.4 mm) of thickness with facings intact, on 3 by 12 in. (76.2 by 304.8 mm) by full thickness replicate specimens conditioned in accordance with 11.1.1. Report strength and load values at break point or at yield, whichever occurs first. Six specimens (three from each direction, in other words, cross-machine and machine direction) shall be tested; the mean for each direction shall be reported and compared to the requirements in Table 1.

11.6 *Tensile Strength Perpendicular to Board Surface*—Tensile strength perpendicular to the major board surfaces of the faced board product shall be tested in accordance with Test Method C209, Tensile Strength Perpendicular to Surface, utilizing a 250°F (121°C) hot melt adhesive system for sample preparation. Molten adhesive shall be uniformly applied over each faced sample surface and allowed to cool in 73°F (23°C) laboratory air for 24 h before testing.

11.7 *Water Absorption*—Insulation boards shall be tested in accordance with Test Method C209, Water Absorption or Test Method C1763, Procedure B.

11.8 *Water Vapor Permeance*—Insulation boards shall be tested in accordance with Test Method E96/E96M, desiccant method at 73 ± 2°F (23 ± 1°C), with facings intact.

12. Rejection and Resubmittal

12.1 Failure to conform to the requirements in this specification shall constitute cause for rejection. Rejection shall be promptly reported to the manufacturer.

12.2 The manufacturer shall have the option to reinspect rejected shipments and resubmit the entire lot for inspection and resampling after the removal and replacement of nonconforming portions.

13. Packaging and Marking

13.1 *Packaging*—Unless otherwise specified, the insulation shall be supplied in the manufacturer's standard commercial packages.

13.2 *Marking*—Unless otherwise specified, each package or board shall be marked with the ASTM designation number; type; class and grade when applicable; manufacturer's name or trademark, address, and telephone number; lot number; and thermal resistance (R-value).

14. Keywords

14.1 cellular plastic insulation; cellulosic fiber insulating board; composite foam insulation board; faced foam board; foam plastic insulation; oriented strand board; perlite board; polyiso board; polyisocyanurate; polyisocyanurate foam; polyurethane; polyurethane foam; thermal insulation; waferboard

APPENDIX

(Nonmandatory Information)

X1. WIND PRESSURE RESISTANCE FOR POLYISOCYANURATE THERMAL INSULATION BOARDS USED AS WALL SHEATHING

X1.1 When required, the wind pressure performance of polyisocyanurate thermal insulation boards used as sheathing in exterior above-grade wall covering assemblies shall be properly addressed through appropriate end-use standards or addressed through appropriate test methods with results reviewed and reported for compliance with building code requirements by an approved agency. Flexural strength values determined in accordance with 11.5 or reported in Table 1 are not appropriate for calculation of wind pressure performance because test conditions are not representative of actual end use conditions.

X1.2 Exterior wall assemblies and components must be capable of adequately resisting wind pressure acting on the wall system as a whole and on particular layers, assemblies, or components of the wall system. The required design wind pressure resistances are specified in the applicable building code, standards, or by user specification for special circumstances. In general, there are two installation or use conditions which dictate the need to consider wind pressure resistance for thermal insulation boards (panels) when used as wall sheathing:

X1.2.1 *Condition 1*—Wind pressure resistance not needed. In this installation case, thermal insulation boards are placed over another wall sheathing material or solid wall and covered with a cladding material, both of which are capable of resisting the full applicable design wind pressure.

X1.2.2 *Condition 2*—Wind pressure resistance needed. When Condition 1 is not met, thermal insulation boards will need to resist wind pressure acting in the inward direction (positive wind pressure), outward direction (negative wind pressure), or both directions if it is not constrained by another material in either direction.