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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 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.*

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 BoardType 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

[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.

C728 Specification for Perlite Thermal Insulation Board
C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions
C1058 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 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
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 *ANSI Standard:*

Voluntary Product Standard PS 2–04 Performance Standard for Wood Based Structural Use Panels Performance Standard for Wood Based structural Use Panels [3]

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

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 core foam.

4.1.2 *Type II*:

4.1.2.1 *Class 1*—Faced with glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat 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. (12.7mm).

(1) Grade 1—80 psi (551 kPa), min, compressive strength

(2) Grade 2—100 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 or waferboard 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.

[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. 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),
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 and Waferboard*—The oriented strand board and waferboard shall conform to the material and physical properties requirements specified in U.S. Voluntary Product Standard PS 2–04.

6.2.8 *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. 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

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	Oriented strand board or wafer-board	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 4.1.2.1	See 4.1.2.1	See 4.1.2.1	See 4.1.2.1
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)~~		~~16 (110)~~	~~16 (110)~~	~~16 (110)~~	~~16 (110)~~
	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~~
–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~~		~~4.0~~	~~4.0~~	~~4.0~~	~~4.0~~
158°F (70°C)/ 97 % RH	4.0	4.0	4.0	4.0	4.0	4.0	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~~
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~~		~~2.0~~	~~2.0~~	~~2.0~~	~~2.0~~
–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~~		~~2.0~~	~~4.0~~	~~4.0~~	~~4.0~~
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~~		~~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)										
~~psi (kPa), min~~ psi (kPa), min	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)	400 (2750)	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)	~~40 (275)~~ 40 (275)
~~(Break load) lbf (N), min~~ (Break load) lbf (N), min	~~8 (35)~~ 8 (35)	~~8 (35)~~ 8 (35)	~~17 (75)~~ 17 (75)	~~17 (75)~~ 17 (75)	~~17 (75)~~ 17 (75)	20 (89)	~~17 (75)~~ 17 (75)	~~17 (75)~~ 17 (75)	~~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)~~ 500 (24)	~~500 (24)~~ 500 (24)	~~500 (24)~~ 500 (24)	2000 (95)	~~500 (24)~~ 500 (24)	~~500 (24)~~ 500 (24)	~~500 (24)~~ 500 (24)	~~500 (24)~~ 500 (24)
Water absorption 2h percent by volume, max										