Designation: C 1482 – 00ε1

Standard Specification for Polyimide Flexible Cellular Thermal and Sound Absorbing Insulation[1]

This standard is issued under the fixed designation C 1482; 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.

ε[1] NOTE—The title of Table A4.3 was editorially revised in September 2001.

1. Scope

1.1 This specification covers the composition and physical properties of lightweight, flexible open-cell polyimide foam insulation intended for use as thermal and sound-absorbing insulation for temperatures from -328 up to +572° F (-200 and +300° C) in commercial and industrial environments.

1.1.1 Annex A1 includes faced polyimide foam as specified by the U.S. Navy for marine applications.

1.1.2 This standard is designed as a material specification and not a design document. Physical property requirements vary by application and temperature. No single test is adequate for estimating either the minimum or maximum use temperature of polyimide foam under all possible conditions. Consult the manufacturer for specific recommendations and physical properties for specific applications.

1.1.3 The use of an appropriate vapor retarder is required in all applications where condensation could occur and cause a decrease in thermal performance or affect other system properties.

1.2 The values stated in inch-pound units are to be regarded as the standard. The System International equivalents of the inch-pound units are given in parentheses for information only and may be approximate.

1.3 *This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

NOTE 1—The subject matter of this material specification is not covered by any other ASTM specification. There is no known ISO standard covering the subject of this standard.

2. Referenced Documents

2.1 *ASTM Standards:*

C 165 Test Method for Measuring Compressive Properties of Thermal insulations[2]

C 168 Terminology Relating to Thermal Insulating Materials[2]

C 177 Test Method for Steady-State Heat-Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus[2]

C 302 Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation[2]

C 335 Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation[2]

C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots[2]

C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation[2]

C 423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method[2]

C 447 Practice for Estimating the Maximum Use Temperature of Thermal Insulations[2]

C 518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus[2]

C 634 Terminology Relating to Environmental Acoustics[2]

C 665 Specification for Mineral-Fiber Blanket Insulation for Light Frame Construction and Manufactured Housing[2]

C 1045 Practice for Calculating Thermal Transmission Properties From Steady-State Heat Flux Measurements[2]

C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation[2]

C 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus[2]

D 395 Test Method for Rubber Property - Compression Set[3]

D 543 Test Method for Resistance of Plastics to Chemical Reagents[4]

D 638 Test Method for Tensile Properties of Plastics[4]

D 2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging[5]

D 2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)[5]

[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 Non-homogenous Inorganic Thermal Insulations.

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[2] *Annual Book of ASTM Standards*, Vol 04.06.

[3] *Annual Book of ASTM Standards*, Vol 09.01.

[4] *Annual Book of ASTM Standards*, Vol 08.01.

[5] *Annual Book of ASTM Standards*, Vol 08.02.

D 3574 Test Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams[6]
D 3675 Test Method for Surface Flammability of Flexible Cellular Materials Using A Radiant Heat Energy Source[6]
E 84 Test Method for Surface Burning Characteristics of Building Materials[7]
E 96 Test Method for Water Vapor Transmission of Materials[2]
E 176 Terminology of Fire Standards[7]
E 662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials[7]
E 795 Practices for Mounting Test Specimens During Sound Absorption Tests[2]
E 800 Guide for Measurement of Gases Present or Generated During Fires[7]
E 1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter[7]

2.2 *U.S. Federal Standards:*

FAR 25.853(a), Appendix F, Part 1, (a) (1) (i) Test Criteria and Procedures for Showing Compliance with Sec. 25.853, or 25.855[8]
MIL-C-20079 Cloth, Glass; Tape, Textile Glass; and Thread, Glass[9]
MIL-A-3316 Adhesive, Fire-Resistant, Thermal Insulation[9]
MIL-PRF-24688A Performance Specification Insulation, Thermal and Acoustic Absorptive[9]
DOD-E-24607 Enamel, Interior, Nonflaming (Dry), Chlorinated Alkyd Resin, Semigloss (Metric)[9]

2.3 *Private Sector Standards:*

Boeing BSS 7239 Test Method for Toxic Gas Generation by Materials on Combustion[10]
TAPPI T 803 Puncture and Stiffness Test of Container Board[11]
TM-232 Vertical Pipe-Chase Test to Determine Flame-Propagation Characteristics of Pipe Covering[12]

3. Terminology

3.1 *Definitions*—Terms used in this specification are defined in Terminology C 168, Terminology C 634, and Terminology E 176. In the case of a conflict, Terminology C 168 shall be the dominant authority.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *flexible cellular product*—a cellular organic polymeric material that will not rupture when a specimen 8 by 1 by 1 in. (200 by 25 by 25 mm) is bent around a 1 in. (25 mm) diameter mandrel at a uniform rate of one lap in 5 sec. at a temperature between 64 and 85°F (18 and 29°C), in accordance with the description of a flexible cellular product (currently Subsection 3.1.3) in Test Methods D 3574.

3.2.2 *slab*—a rectangular section, piece, or sheet of foam that is cut from a bun, or block of foam.

3.2.3 *polyimide foam*—a flexible cellular product in which the bonds formed between monomers during polymerization are imide or amide bonds. The theoretical mole fraction of imide bonds must be greater than the theoretical mole fraction of amide bonds.

4. Classification

4.1 The flexible polyimide cellular insulations of this specification are classified into Types I through VI as listed in Tables 1 and 2(Note 2). Type I is further subdivided into two Grades based on maximum allowable thermal conductivity at 75° F (24° C). . The Types II and III are subdivided into Classes (Note 3).

NOTE 2—Although all types find application in a wide variety of markets, the current primary market for each type is as follows:

Type I—marine and industrial applications.

Type II—Type II is Type I foam faced and used in specific marine applications, as specified for the U.S. Navy in Annex A1.

Type III—Type III is Type I foam pipe shaped and used in specific marine applications, as specified for the U.S. Navy in Annex A1.

Types IV and V—aerospace applications depending on density.

Type VI—applications requiring improved high temperature and fire performance.

NOTE 3—The Type II and Type III designations as well as the subdivision of Types into Classes is to maintain uniformity with existing U.S. Navy nomenclature (Annex A1).

5. Materials and Manufacture

5.1 Polyimide foam shall be manufactured from the appropriate monomers, and necessary compounding ingredients to conform to 3.2.3. This is not intended to imply that foam products made using different materials are equivalent with respect to all physical properties.

6. Physical Properties

6.1 The insulation shall conform to the requirements in Tables 1 and 2 for each type, unless specifically stated otherwise by agreement between the supplier and the purchaser. Tests shall be made in accordance with the methods specified in 11.1-11.20.

6.1.1 *Upper Temperature Limit*—Upper temperature limit shall be determined according to 11.4 at the application's intended maximum use temperature or at a temperature determined by agreement between the purchaser and manufacturer.

6.1.2 *Burning Characteristics*—The uncoated and unfaced foam shall conform to the requirements in Tables 1 and 2 for each type, when tested in accordance with 11.12-11.19, without the use of flame/smoke or heat suppressant barriers or coatings.

6.1.3 *Sound Absorbing Performance*—Unless specifically otherwise agreed to between the supplier and the purchaser, all tests shall be made in accordance with the methods specified in 11.20.

6.2 The values stated in Tables 1 and 2 should not be used as design values. It is the buyer's responsibility to specify

[6] *Annual Book of ASTM Standards*, Vol 09.02.
[7] *Annual Book of ASTM Standards*, Vol 04.07.
[8] Federal Aviation Regulations Part 25 (Airworthiness Standards, Transport Category Aircraft, and Section 25.853. Procedure in appendix F, Part I, (a) (1) (i) and (ii). Available from Superintendent of Documents, U.S. Government Printing Office P.O. Box 371954, Pittsburgh, PA 15250-7954.
[9] Available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.
[10] Available from Boeing Commercial Airplane Group, Material Division, P.O. Box 3707, Seattle, WA 98124-2207.
[11] Available from the Technical Association of the Pulp and Paper Industry, P.O. Box 105113, Atlanta GA 30348.
[12] Available from Armstrong World Industries, Inc., Research and Development, P.O. Box 3511, Lancaster, PA 17604.