Designation: C1482 – 09

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

This standard is issued under the fixed designation C1482; 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.

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°F up to +572°F (-200°C 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 standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire-hazard or fire-risk assessment of the materials, products, or assemblies under actual fire conditions.

1.4 *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:*[2]

C165 Test Method for Measuring Compressive Properties of Thermal Insulations
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
C302 Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation
C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
C390 Practice for Sampling and Acceptance of Thermal Insulation Lots
C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
C447 Practice for Estimating the Maximum Use Temperature of Thermal Insulations
C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
C634 Terminology Relating to Building and Environmental Acoustics
C665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
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
D395 Test Methods for Rubber Property—Compression Set
D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents
D638 Test Method for Tensile Properties of Plastics
D2126 Test Method for Response of Rigid Cellular Plastics

[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.

to Thermal and Humid Aging
D3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams
D3675 Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source
E84 Test Method for Surface Burning Characteristics of Building Materials
E96/E96M Test Methods for Water Vapor Transmission of Materials
E176 Terminology of Fire Standards
E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
E795 Practices for Mounting Test Specimens During Sound Absorption Tests
E800 Guide for Measurement of Gases Present or Generated During Fires
E1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
E2231 Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics

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[3]
FAR 25.856(a), Appendix F, Part VI, Test Method to Determine the Flammability and Flame Propagation Characteristics of Thermal/Acoustic Insulation Materials
MIL-C-20079 Cloth, Glass; Tape, Textile Glass; and Thread, Glass[4]
MIL-A-3316 Adhesive, Fire-Resistant, Thermal Insulation[4]
DOD-E-24607 Enamel, Interior, Nonflaming (Dry), Chlorinated Alkyd Resin, Semigloss (Metric)[4]

2.3 *Private Sector Standards:*

Boeing BSS 7239 Test Method for Toxic Gas Generation by Materials on Combustion[5]
TAPPI T 803 Puncture and Stiffness Test of Container Board[6]
TM-232 Vertical Pipe-Chase Test to Determine Flame-Propagation Characteristics of Pipe Covering[7]

3. Terminology

3.1 *Definitions*—Terms used in this specification are defined in Terminology C168, Terminology C634, and Terminology E176. In the case of a conflict, Terminology C168 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 D3574.

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.

[3] 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.

[4] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

[5] Available from Boeing Commercial Airplane Group, Material Division, P.O. Box 3707, Seattle, WA 98124-2207.

[6] Available from Technical Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Norcross, GA 30092, http://www.tappi.org.

[7] Available from Armstrong World Industries, Inc., Research and Development, P.O. Box 3511, Lancaster, PA 17604.

TABLE 1 Polyimide Foam Classification (inch-pound)

	TYPE I Grade 1	TYPE I Grade 2	TYPE IV	TYPE V	TYPE VI
Density, max, lb/ft^3	0.48	0.48	0.37	0.55	0.50
Maximum Apparent Thermal Conductivity Btu-in./h ft^2–°F					
–238° F	0.14	0.14	0.14	0.14	0.14
–58° F	0.23	0.22	0.23	0.23	0.23
75° F	0.32	0.29	0.34	0.30	0.34
212° F	0.51	0.47	0.54	0.47	0.50
356° F	0.74	0.70	0.81	0.70	0.74
572° F	NA[A]	NA[A]	NA[A]	NA[A]	1.15
Upper Temperature Limit – test temperature for C411, °F	400	400	400	400	572
High Temperature Stability – % of initial tensile strength retained after 336 hours in air oven at 400° F, min, %	60	60	NA[A]	NA[A]	NA[A]
High Temperature Stability – % of initial tensile strength retained after 336 hours in air oven at 572° F, min, %	NA[A]	NA[A]	NA[A]	NA[A]	70
Tensile Strength, min, lb/in.^{2}	8.5	8.5	2.8	8.5	3.9
Compressive Strength, min, lb/in.^{2} at 25% deflection	0.5	0.5	NA[A]	NA[A]	0.5
50% Compression Deflection, min, lb/in^2	1.2	1.2	NA[A]	NA[A]	NA[A]
Compression Set, max, %	NA[A]	NA[A]	40	40	NA[A]
Steam Aging					
Change in Tensile Strength, max, %	25	25	NA[A]	NA[A]	25
Dimensional and weight changes, max, %	10	10	NA[A]	NA[A]	10
Corrosiveness	pass	pass	pass	pass	pass
Chemical Resistance	pass	pass	pass	pass	pass
Surface Burning Characteristics, 2 in. thickness					
Flame Spread Index, max	10	10	15	15	10
Smoke Development, Index, max	15	15	20	20	15
Radiant Panel Surface Flammability, Flame Spread Index, max	5	5	5	5	2
Vertical Burn[B]					
Burn Length, max, in.	NA[A]	NA[A]	2	2.4	NA[A]
After Flame Time, max, sec	NA[A]	NA[A]	1	1	NA[A]
Total heat release (2 min), max, Btu/ft^2	79	79	NA[A]	NA[A]	NA[A]
Maximum heat release rate, max, Btu/min-ft^2	106	106	NA[A]	NA[A]	NA[A]
Specific Optical Smoke Density, D_m, max					
non-flaming mode	5	5	5	5	5
flaming mode	10	10	10	10	5
Total Hydrogen Halide (HCl, HBr, and HF) Gases in Smoke, Flaming Exposure, max, ppm (Above background for empty chamber)	10	10	10	10	10
Toxic Gas Generation: max, ppm					
CO	300	300	300	300	300
HCN	5	5	5	5	5
HF	5	5	5	5	5
HCl	10	10	10	10	10
HBr	5	5	5	5	5
SO2	5	5	5	5	5
NOx	10	10	10	10	10
Acoustical Absorption Coefficient 2 in. thickness, min Noise Reduction Coefficient (NRC)	0.75	0.70	0.75	0.85	0.70

[A] NA = not applicable
[B] The material shall not melt, drip, or flow when tested as required.

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 11.19.

6.2 The values stated in Tables 1 and 2 are not to be used as design values. It is the responsibility of the buyer to specify design requirements and obtain supporting documentation from the material supplier.

7. Workmanship and Appearance

7.1 The slab offered as saleable material shall be free of foreign materials and defects that will adversely affect its performance in service.

7.2 *Voids and Surface Damage*—Surface damage due to handling, and voids that are between 0.24 in. (6 mm) and 1.4 in. (35 mm) in diameter, and extend through the entire slab, may be repaired by gluing, plugging, or cutting and splicing. Voids greater than 1.4 in. (35 mm) in diameter shall be cause for rejection of the affected material. Plugging may be achieved using compression fit or by using adhesives. Adhesives used for repair shall not affect the overall smoke, fire, or acoustic performance required for the material in this specification. Material used for repairs shall be of the same composition and quality as undamaged material. The acceptance of type and amount of repair shall be as agreed upon by the supplier and the user.

8. Sampling

8.1 *Sampling*—The insulation shall be sampled in accordance with Practice C390. Otherwise, specific provisions for sampling shall be as agreed upon between the user and the supplier.

8.2 *Specimen*—For polymide foam insulation, specimens of dimensions 12 in. by 12 in. by 1 in. (300 mm by 300 mm by 25 mm) are sufficient for purposes of acceptance inspection of samples.

TABLE 2 Polyimide Foam Classification (SI units)

	TYPE I Grade 1	TYPE I Grade 2	TYPE IV	TYPE V	TYPE VI
Density, max, kg/m^3	7.7	7.7	5.9	8.8	8.0
Maximum Apparent Thermal Conductivity W/m-K					
–150° C	0.020	0.020	0.020	0.020	0.020
–50° C	0.033	0.032	0.033	0.033	0.033
24° C	0.046	0.042	0.049	0.043	0.049
100° C	0.074	0.068	0.078	0.068	0.072
180° C	0.107	0.101	0.117	0.101	0.107
300° C	NA[A]	NA[A]	NA[A]	NA[A]	0.166
Upper Temperature Limit – test temperature for C411, °C	204	204	204	204	300
High Temperature Stability – % of initial tensile strength retained after 336 hours in air oven at 204° C, min, %	60	60	NA[A]	NA[A]	NA[A]
High Temperature Stability – % of initial tensile strength retained after 336 hours in air oven at 300° C, min, %	NA[A]	NA[A]	NA[A]	NA[A]	70
Tensile Strength, kPa	60	60	18	60	27
Compressive Strength, min, kPa at 25% deflection	3.4	3.4	NA[A]	NA[A]	3.4
50% Compression Deflection, min, kPa	8	8	NA[A]	NA[A]	NA[A]
Compression Set, max, %	NA[A]	NA[A]	40	40	NA[A]
Steam Aging,					
Change in Tensile Strength, max, %	25	25	NA[A]	NA[A]	25
Dimensional and weight changes, max, %	10	10	NA[A]	NA[A]	10
Corrosiveness	pass	pass	pass	pass	pass
Chemical Resistance	pass	pass	pass	pass	pass
Surface Burning Characteristics, 50 mm thickness					
Flame Spread Index, max	10	10	15	15	10
Smoke Development, Index, max	15	15	20	20	15
Radiant Panel Surface Flammability, Flame Spread Index, max	5	5	5	5	2
Vertical Burn[B],					
Burn Length, max, mm	NA[A]	NA[A]	50	60	NA[A]
After Flame Time, max, sec	NA[A]	NA[A]	1	1	NA[A]
Total heat release (2 min), max, kW-min/m^2	15	15	NA[A]	NA[A]	NA[A]
Maximum heat release rate, max, kW/m^2	20	20	NA[A]	NA[A]	NA[A]
Specific Optical Smoke Density, D_m, max					
non-flaming mode	5	5	5	5	5
flaming mode	10	10	10	10	5
Total Hydrogen Halide (HCl, HBr, and HF) Gases in Smoke, Flaming Exposure, max, ppm (Above background for empty chamber)	10	10	10	10	10
Toxic Gas Generation: max, ppm					
CO	300	300	300	300	300
HCN	5	5	5	5	5
HF	5	5	5	5	5
HCl	10	10	10	10	10
HBr	5	5	5	5	5
SO2	5	5	5	5	5
NOx	10	10	10	10	10
Acoustical Absorption Coefficient 50.8 mm thickness, min Noise Reduction Coefficient (NRC)	0.75	0.70	0.75	0.85	0.70

[A] NA = not applicable
[B] The material shall not melt, drip, or flow when tested as required.

9. Qualification Requirements

9.1 The following requirements are generally employed for initial material or product qualification:

9.1.1 Upper Temperature Limit

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9.1.2 Tensile Strength

9.1.3 Compressive Strength

9.1.4 Compression Set

9.1.5 Chemical Resistance

9.1.6 Apparent Thermal Conductivity at 75° F (24° C)

9.1.7 Specific Optical Smoke Density

9.1.8 Hydrogen Halide Gases in Smoke

9.1.9 Surface Burning Characteristics

9.1.10 Radiant Panel Surface Flammability

9.1.11 Heat Release Rate

9.1.12 Sound Absorption Coefficients

10. Inspection

10.1 The following requirements are generally employed for acceptance sampling of lots or shipments of qualified polyimide foam insulation:

10.1.1 Density

10.1.2 Apparent Thermal Conductivity at 75° F (24° C)

10.1.3 Vertical burn—Type IV and V only

10.1.4 Workmanship

10.2 As agreed to by the purchaser and the manufacturer, the inspection of the material shall be made at either the point of shipment or point of delivery.

11. Test Methods

11.1 *Sample Preparation*

11.1.1 In cases where the material is cut into pipe insulation and other shapes without further treatment, slab foam test results are generally representative. If other processes are used

for specific applications, it is recommended that qualification testing be conducted using slab specimens, and that inspection testing be on the processed material.

11.1.2 Tests for physical and mechanical properties shall be carried out at a temperature of 73.4 ± 3.6° F (23 ± 2° C) and at a relative humidity of 50 ± 5%. Sound absorbing, thermal, and flammability tests shall be carried out at conditions specified in the applicable test methods.

11.1.3 All test specimens for testing of physical and mechanical properties in Tables 1 and 2 shall be preconditioned by twice mechanically reducing (flexing) their thickness to a 25 percent deflection of their original thickness. In cases where a specified test method itself contains this requirement, additional flexing is not to be performed. If required, other preconditioning and physical property test limits shall be determined by agreement between the purchaser and manufacturer (Note 4).

NOTE 4—Because the flexing of polyimide foam has an impact on the measured physical properties, a standard preconditioning procedure is given. If the products performance cannot be adequately discerned using the specified preconditioning method, then a more applicable preconditioning method may be used as determined by agreement between the purchaser and manufacturer with appropriately modified physical property limits.

11.2 *Density*—Test Method D3574, Test A.

11.3 *Apparent Thermal Conductivity*— Test Methods C177, C1114, and C518 in conjunction with Practice C1045. Test Method C518 shall not be used at temperatures or resistances other than those in the range of the calibration. Test temperatures shall be chosen in accordance with Table 3 of Practice C1058. Use the large temperature difference recommended in Table 3 of Practice C1058 for temperatures between 25 and 110°F (-4 and 43°C); for mean temperatures under 25° F (-4°C) and over 110F (43°C) use the smaller temperature difference.

11.4 *Upper Temperature Limit*—Test Method C411 and Practice C447 shall be used at the insulation's maximum use temperature and at maximum design thickness. No special requirements for heat-up shall be specified by the manufacturer. The foam shall not flame, glow, smolder, smoke, soften, collapse, melt, or drip during hot surface exposure.

11.5 *High Temperature Stability*—Test Method D2126 incorporating Test Method D638. Use Test Method D2126, with a modified test temperature of 400°F (204°C) or 572°F (300°C) as shown in Tables 1 and 2. Test before and after aging using Test Method ASTM D638, type III specimens.

11.6 *Compressive Strength*—Test Method ASTM C165, Procedure B.

11.7 *50% Compression Deflection*—Test Method ASTM D3574, Test C.

11.8 *Compression Set*—Test Method ASTM D395, test temperature is 158° F (70° C) and aging time is 22 hours.

11.9 *Steam Aging*—Test Method D3574, Procedure J1 and Test E.

11.10 *Corrosiveness*—Test Method in C665.

11.11 *Chemical Resistance*—Test Method D543, practice A, procedure I at room temperature with reagents 6.3.8, 6.3.40, 6.3.46, 6.3.50, aviation turbine fuel grade JP-5 and ethylene glycol antifreeze from Table 1, and SKYDROL hydraulic fluid. Final weight and dimensions are to be determined 24 hours after removal from immersion.

11.12 *Surface Burning Characteristics*— Test Method E84 and for material used in pipe and duct applications use Test Method E84 with Practice E2231.

11.13 *Radiant Panel Surface Flammability*— Test Method D3675.

11.14 *Vertical Burn*—Test Method FAR 25.853(a), Appendix F, Part 1, (a) (1) (i).

11.15 *Flame Propagation*—Test Method FAR 25.853(a), Appendix F, Part VI.

11.16 *Heat Release Rate*—Test Method E1354 with a heat flux of 185 BTU/min-ft^2 (35 kW/m ^{2}) and using external ignition.

11.17 *Specific Optical Smoke Density*— Test Method E662.

11.18 *Hydrogen Halides in Smoke*—Test Method E662, with integrated sampling, and anion detection using ion chromatography, in accordance with Guide E800.

11.19 *Toxic Gas Generation*—Boeing BSS 7239, Flaming mode.

11.20 *Sound Absorption Coefficients*— Test Method C423, using the Type A Mounting described in Practices E795.

12. Certification

12.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished. For the purpose of this specification, a lot consists of all material of the same type manufactured in one unchanged production run and offered for delivery at the same time.

13. Packaging and Marking

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

13.2 *Marking*—Unless otherwise specified, each container shall be plainly marked with the manufacturer's name, the product name, trademark, and the manufacturer's address, with dimensions or volumes, or both, expressed in units agreed upon by the supplier and customer.

14. Keywords

14.1 flexible cellular insulation; pipe insulation; polyimide; ship insulation; sound absorbing; thermal insulation

ANNEXES

(Mandatory Information)

SUPPLEMENTAL REQUIREMENTS TO POLYIMIDE FLEXIBLE CELLULAR THERMAL AND SOUND ABSORBING INSULATION FOR U.S. NAVY SPECIFIED MARINE APPLICATIONS

A1. SCOPE

A1.1 This annex gives the requirements for fire resistant thermal and acoustic absorptive polyimide foam insulation panels and for preformed thermal insulation for use on pipes at surface temperatures from 100 to 400°F (38 to 204°C) for use in U.S. Navy shipboard applications.

A2. CLASSIFICATION

A2.1 Flexible polyimide foam shall be furnished in the following Types and Classes as specified.

A2.1.1 *Type I*—Unfaced (thermal and acoustical absorptive)

A2.1.2 *Type II*—Faced

A2.1.2.1 *Type II Class 1*—Fibrous glass cloth faced (thermal)

A2.1.2.2 *Type II Class 2*—Slotted base board faced with perforated fibrous glass cloth. (acoustical absorptive)

A2.1.2.3 *Type II Class 3*—Vapor resistant film faced.

A2.1.3 *Type III*—Preformed pipe insulation.

A2.1.3.1 *Type III Class 1*—Unlagged

A2.1.3.2 *Type III Class 2*—Prelagged

A3. MATERIALS AND MANUFACTURE

A3.1 The backing foam material shall be flexible, polyimide foam generally of Type I.

A3.2 The Type II Class 1 panel or shape shall consist of the backing foam material, laminated with non-perforated fibrous glass cloth facing.

A3.3 The Type II Class 2 panel or shape shall consist of the backing foam material, laminated with perforated fibrous glass cloth facing. One face of the foam shall be slotted, 3⁄16 in. (4.76 mm) wide by 3⁄16 in. (4.76 mm) deep, ½ in. (12.7 mm) centers, in one direction only. The perforated glass cloth facing shall be bonded to the slotted side of the foam, installed so that the perforations in the cloth facing are centered over the slots in the foam. A ⅞ in. (22 mm) border of cloth facing without perforations shall be maintained.

A3.4 The Type II Class 3 panel or shape shall consist of the backing foam material, combined with a vapor resistant film composed of reinforced aluminized polyester/aluminum foil with prime coated surface or polyester film bonded to a fiberglass scrim, (Note A3.1).

NOTE A3.1—Type II Class 3 does not apply to anti-sweat pipe covering applications.

A3.5 The Type III Class 1 material shall be flexible, polyimide foam generally of Type I and shall be formed into pipe insulation. The insulation may be split or slit lengthwise.

A3.6 The Type III Class 2 material shall consist of material conforming to Type III Class 1, laminated with lagging cloth. The lagging shall conform to the requirements of MIL-C-20079, and be free of wrinkles and other irregularities.

A3.7 Fibrous glass cloth facing shall conform to the requirements of Type I, Class 2 of MIL-C-20079, and shall be free of wrinkles and other irregularities. For Type II Class 2, the facing shall be perforated with nominal 3⁄16 in. (4.76 mm) diameter holes on ½ in. (12.7 mm) centers.

A3.8 The adhesive for bonding the facer or lagging shall conform to the fire resistance requirements of MIL-A-3316.

A3.9 Panels or shapes shall be furnished unpainted, unless otherwise specified. Painting when required shall conform to DOD-E-24607 with color as specified.