



Standard Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Absorbing Liner for Duct Systems¹

This standard is issued under the fixed designation C1534; 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, dimensions, and physical properties of flexible unfaced foam sheet, used to insulate interior surfaces of HVAC ducts, plenums and equipment used for the distribution of conditioned air with a temperature of up to 250°F (121°C).

1.2 HVAC ducts, plenums and equipment systems typically operate between a temperature range of 50°F to 150°F (10°C to 65°C) and are designed to meet building code requirements of maximum temperatures of 250°F (121°C).

1.3 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.

1.4 *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 requirements prior to use.*

2. Referenced Documents

2.1 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

C209 Test Methods for Cellulosic Fiber Insulating Board

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

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

C1071 Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

C1104/C1104M Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation

C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus (Withdrawn 0)³

C1304 Test Method for Assessing the Odor Emission of Thermal Insulation Materials

C1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings

E84 Test Method for Surface Burning Characteristics of Building Materials

E176 Terminology of Fire Standards

E795 Practices for Mounting Test Specimens During Sound Absorption Tests

E2231 Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics

G21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

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 Feb. 1, 2014. Published March 2014. Originally approved in 2002. Last previous edition approved in 2012 as C1534–12. DOI: 10.1520/C1534-14.

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.

³ The last approved version of this historical standard is referenced on www.astm.org.

2.2 Other Standards:

CAN/ULC-S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

3. Terminology

3.1 The definitions of terms used in this specification shall be in accordance with Terminologies **C168**, **C634**, and **E176**. In case of any conflicts, Terminology **C168** shall be the authority.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *closed cell foam*—a foam comprised of predominately individual non interconnecting cells.

3.2.2 *flexible cellular*—a cellular material that will not rupture within 60 s when a specimen 1 × 1 × 8 in. in length (25 × 25 × 200 mm) is bent around a 1 in. (25 mm) diameter mandrel at a uniform rate of one lap in 5 s in the form of a helix at a temperature between 65 and 85°F (18 and 29°C).

3.2.3 *open cell foam*—a foam made porous by interconnecting cells.

4. Classification

4.1 The flexible polymeric insulations of this specification are classified into Types I and II. Type I is a closed flexible foam. Type II is an open cell flexible foam.

NOTE 1—The primary difference between Type I and Type II materials are: Type I materials exhibit lower water absorption properties and Type II materials have greater acoustical properties as noted in **Tables 1 and 2**.

5. Materials

5.1 These products shall be made of a homogeneous blend of natural or synthetic polymeric materials. Modifications with various thermoplastic or thermosetting resins, plasticizers, modifiers, antioxidants, curatives, blowing agents and other additives are allowed. These products do not melt when exposed to heat and are considered to be thermoset materials.

5.2 Flexible, polymeric cellular thermal insulations shall be of uniform core density. These insulation materials are available with a smooth skin surface or coating on one or both sides, and they are to be considered homogeneous for the purposes of determining thermal performance.

6. Ordering Information

6.1 Specific installation, insulation type, thickness, length, and width suited for the intended use shall be agreed upon by the purchaser and supplier.

7. Physical Properties—See **Tables 1 and 2** for Summary of Requirements

7.1 *Apparent Thermal Conductivity*—The material shall be tested for apparent thermal conductivity at 75°F (24°C) mean temperature in accordance with **12.1**. The thermal conductivity for the average of any four randomly selected samples, shall not be more than 0.30 Btu-in./h-sq ft°F (0.043 W/m-K) when tested in accordance with **12.1**. See **Table 1**.

NOTE 2—Consult the local or state building codes for the minimum installed thermal resistance, R-value, required to be installed.

7.2 *Surface Burning Characteristics*—Shall be in accordance with **12.2**. See **Table 1** for requirements.

7.3 *Hot Surface Performance*—The insulation shall have no evidence of flaming, glowing, smoldering, visible smoke, delamination, cracking, warpage, melting, dripping or reduction in thickness when tested in accordance with **12.3** at the temperature specified in **Table 1**.

NOTE 3—*Hot Surface Performance Characteristics for Type I Material*—When this type of material is used on hot applications, the material's characteristics will change and should be considered when selecting the material for an application. Heat will cause the elastomeric insulation to harden. As the temperature approaches the stated high temperature limit, the process occurs faster. This hardening will not negatively effect the thermal performance or water vapor transmission properties of the product. The hardening will be most noticeable closer to the heat source. This effect is based on time and temperature.

7.4 *Water Vapor Sorption*—Shall be tested in accordance with **12.4**. See **Table 1**.

7.5 *Water Absorption*—Shall be tested in accordance with **12.5**. See **Table 1**.

7.6 *Dimensional Stability*—Shall be tested in accordance with **12.6**.

7.7 *Odor Emission*—There shall be no detectable odor of objectionable nature when tested in accordance with **12.7**.

TABLE 1 Physical Properties

	Type I	Type II
Maximum Apparent Thermal Conductivity Btu-in./h-ft ² -°F) max. (W/m-K) max.	0.30 (0.043)	0.30 (0.043)
Surface Burning Characteristics (at maximum total installed thickness):	(See ^A)	(See ^A)
Flame Spread Index, (max) ≤	25	15
Smoke Developed Index, (max) ≤	50	15
Water Vapor Sorption wt % gain by vol. (max.)	0.75	0.1
Water Absorption, wt % gain by vol. (max.)	0.2	4.0
Dimensional Stability % change (max.) length, width or thickness	7.0	1.0
Odor Emission	Pass	Pass
Corrosiveness	Pass	Pass
Fungi Resistance	No Growth	No Growth
Erosion Resistance	Pass	Pass
Hot Surface Performance at not less than 250°F (125°C) (See 7.3 for requirements)	Pass	Pass ^B

^AConsult manufacturer regarding maximum thickness approved for surface burning characteristics Type 1 is typically tested at 1 in. thickness. Type 2 is typically tested at 2 in. thickness. Product should be tested at the thickness to be used in the application.

^BActual product properties may exceed requirements listed in **Table 1**, consult manufacturers for specific applications.

TABLE 2 Sound Absorption Coefficients (min) Using Test Method C423 Type “A” Mounting^A Practice E795.

Frequency, Hz	125	250	500	1000	2000	4000	NRC ^A
Type I							
½ in. (13 mm)	0.03	0.04	0.06	0.20	0.40	0.15	0.20
1 in. (25 mm)	0.15	0.10	0.30	0.30	0.20	0.20	0.25
Type II							
½ in. (13 mm)	0.07	0.10	0.25	0.60	0.98	0.85	0.50
1 in. (25 mm)	0.14	0.20	0.45	0.80	0.98	0.85	0.60
2 in. (50 mm)	0.25	0.58	1.00	0.98	1.00	0.90	0.90

^ANRC—Noise Reduction Coefficient

7.8 *Corrosiveness*—No corrosion shall be noted when tested in accordance with 12.8.

7.9 *Fungi Resistance*—When tested in accordance with 12.9, the test specimens shall show no fungal growth.

7.10 *Erosion Resistance*—The product shall show no evidence of delamination or continued erosion when air is passed through typical duct sections when tested in accordance with 12.10.

7.11 *Sound Absorption Coefficient*—When tested in accordance with Test Method C423 using an “A” mounting in accordance with Practice E795, the insulation shall have sound absorption coefficient and NRC not less than that indicated in Table 2.

8. Qualification and Inspection Requirements

8.1 *Qualification Requirements*—The following requirements shall be used for purposes of initial material qualification:

- 8.1.1 Apparent thermal conductivity,
- 8.1.2 Surface burning characteristics,
- 8.1.3 Hot surface performance,
- 8.1.4 Water vapor sorption,
- 8.1.5 Water absorption,
- 8.1.6 Odor emission,
- 8.1.7 Corrosiveness,
- 8.1.8 Fungi resistance,
- 8.1.9 Erosion resistance, and
- 8.1.10 Sound absorption coefficient.

8.2 *Inspection*—The following requirements shall be used for purposes of acceptance sampling of lots or shipments of qualified thermal insulation:

- 8.2.1 Dimensional tolerances, and
- 8.2.2 Workmanship.

9. Dimensional Tolerances

9.1 After conditioning for a minimum of 24 h at 70 ± 3°F (21 ± 1.6°C) and 50 ± 5 % relative humidity, the insulation shall conform to the dimensional tolerances listed in Table 3.

TABLE 3 Dimensional Tolerance, in. (mm)

Dimension	Tolerance
Width	+0.250 in./-0 in. (+6 mm/-0 mm)
Length	-0/excess permitted
Thickness	±10 %

All dimensions shall be measured at the conditioning temperature.

10. Workmanship and Finish

10.1 The insulation shall indicate good workmanship in fabrication and shall not have visible defects that adversely effect service performance.

11. Sampling

11.1 Sampling of the insulation shall be in accordance with Practice C390. Specific provisions for sampling shall be agreed upon between the purchaser and the supplier.

12. Test Methods

12.1 *Apparent Thermal Conductivity*—Test in accordance with Test Method C177 or Test Method C518 or Test Method C1114 at 75°F (24°C) mean temperature (see also Practice C1045).

12.2 *Surface Burning Characteristics*—Determine the surface burning characteristic for the material in accordance with Test Method E84. In Canada use Test Method CAN/ULC-S102. The results shall be reported. See Section 1 of Test Method E84 for information regarding the applicability of this test method for use with cellular plastics and Practice E2231 for specimen mounting methods.

12.3 *Hot Service Performance*—The maximum hot surface temperature of the material shall be tested in accordance with Test Method C411.

12.4 *Water Vapor Sorption*—Test the water sorption of the material in accordance with the Test Method C1104/C1104M.

12.5 *Water Absorption*—Determine the amount of water absorption of the test specimen in accordance with Test Method C209 (24 h immersion time).

12.6 *Dimensional Stability*—Determine length, width and thickness change when tested in accordance with C356 after aging 24 h at a minimum of 250°F (125°C) or the maximum use temperature whichever is higher.

12.7 *Odor Emission*—Determine the odor emission in accordance with Test Method C1304 except test at 200°F (92°C).

12.8 *Corrosiveness*—The corrosiveness of the material shall be determined in accordance with the corrosiveness test method defined in Specification C665.

12.9 *Fungi/Resistance*—The fungi resistance of the material shall be determined in accordance with Practice **G21** and Test Method **C1338**.

12.10 *Erosion Resistance*—The air erosion properties of the material shall be as determined in accordance with the erosion resistance test methods and requirements defined in Specification **C1071**. The air velocity for the test is dependent upon the use of the product. The air velocity for the test shall be 2.5 times the maximum rated velocity of the product.

12.11 *Sound Absorption Coefficient*—Test in accordance with Test Method **C423** using an “A” mounting in accordance with Practice **E795**.

13. Inspection

13.1 Inspection of the insulation shall be as agreed upon by the purchaser and the manufacturer as part of the purchase agreement.

14. Rejection

14.1 Material that fails to conform to the requirements agreed upon in the purchasing agreement is subject to rejection. Rejection shall be reported to the producer or supplier promptly and in writing.

15. Certification

15.1 When specified in the purchase order or contract, a producer’s, supplier’s, or independent third party’s certification shall be furnished to the purchaser indicating that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of test results shall be furnished.

16. Product Marking

16.1 The air stream surface of the liner shall be marked according to the purchaser’s requirements, for example: product name, thickness, manufacturer, surface burning characteristics and nominal R-value.

17. Packaging and Package Marking

17.1 *Packaging*—Unless otherwise specified, the insulation shall be packaged in the manufacturer’s standard containers.

17.2 *Package Marking*—The markings shall be clear and legible. The package shall be marked with the manufacturer’s name, address, product name, lot number, material width, length, thickness, and nominal R-value.

18. Keywords

18.1 closed cell; ducts; flexible; foam; HVAC; insulation; open cell; sound absorbing; thermal insulation

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