



Designation: C 659 – 90 (Reapproved 1998)

## Standard Specification for Asbestos-Cement Organic-Foam Core Insulating Panels<sup>1</sup>

This standard is issued under the fixed designation C 659; 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 ( $\epsilon$ ) 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 asbestos-cement plastic-foam core panels consisting of a core of insulating cellular plastic sandwiched between and bonded to two sheets of asbestos-cement facing board. Asbestos-cement plastic-foam core panels are normally nonload-bearing panels designed for exterior and interior walls, partitions, curtain walls, and other insulation and decorative purposes.

1.2 All measurements and tests necessary for determining the conformity of asbestos-cement plastic-foam core panels with this specification are made in accordance with the methods covered in Sections 10 and 6.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in parentheses are provided for information only.

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 limitations prior to use. See 10.1.2 for a specific hazard warning.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 220 Specification for Flat Asbestos-Cement Sheets<sup>2</sup>

C 236 Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box<sup>3</sup>

C 355 Test Methods for Water Vapor Transmission of Thick Materials<sup>4</sup>

D 2341 Specification for Rigid Urethane Foam<sup>4</sup>

E 96 Test Methods for Water Vapor Transmission of Materials<sup>3</sup>

#### 2.2 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>5</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-17 on Fiber-Cement Products and is the direct responsibility of C17.03 on Asbestos-Cement Products.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.05.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.06.

<sup>4</sup> Discontinued—Replaced by E96, See *Annual Book of ASTM Standards*, Vol 08.02.

<sup>5</sup> Available from Standardization Documents, Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094. Attn: NPODS.

#### 2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage<sup>5</sup>

### 3. Terminology

#### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *flexural strength, n*—the average breaking load in newtons (or lbf) of specimens conditioned seven days at  $23 \pm 2^\circ\text{C}$  and  $50 \pm 10\%$  relative humidity, loaded as simple beams with the load applied equally and simultaneously at both one-third points of the span.

3.1.2 *thermal resistance, R*—of a panel, the difference in temperature which will develop under a given steady state heat flow between two parallel unit area surfaces for a given material thickness.

### 4. Materials and Manufacture

4.1 Asbestos-cement plastic-foam core sandwich panels shall be composed of a plastic-foam core sandwiched between and bonded to two asbestos-cement facing sheets. The sheets may be supplied with a factory-applied finish, a factory prime coat, or uncoated. In order to provide a balanced panel and prevent field warpage, the two asbestos-cement facings should have essentially equal vapor transmission rates.

### 5. Physical Properties

5.1 *Facings*—Asbestos-cement facing sheets shall conform to the requirements for Type F of Specification C 220 for 3.2-mm ( $1/8$ -in.) thickness.

5.2 *Core*—The plastic-foam core as well as pertinent grade or type classification shall be as agreed upon by the purchaser and seller. If Urethane is used, it shall conform to the requirements of Specification D 2341.

5.3 *Strength Properties*—The average breaking load for panel specimens conditioned for seven days at  $23 \pm 2^\circ\text{C}$  ( $70$  to  $77^\circ\text{F}$ ) and  $50 \pm 10\%$  relative humidity shall not be less than that shown in Table 1.

5.4 *Vapor Permeability*—The vapor permeance of the composite panel is dependent not only on the foam core, but on the adhesive, facing sheets, and the coating on such facings. The vapor permeabilities shown in Table 2 are typical values for the core materials and are not restrictive values for the composite panel.

5.5 *Thermal Resistance, R*—The average thermal resistance,  $R$ , =  $5^\circ\text{F}\cdot\text{ft} = 2\cdot\text{h}/\text{Btu}$  ( $\text{K}\cdot\text{m} = 2/\text{W}$ ) = 6 of the panel

**TABLE 1 Flexural Strength Requirements For Panels With Third-Point Loading**

Nominal Thickness		Minimum Flexural Load	
mm	(in.)	N	(lbf)
25	(1)	1330	(300)
40	(1 <sup>5</sup> / <sub>16</sub> )	1870	(420)
40	(2)	2270	(510)

**TABLE 2 Vapor Permeability**

	Permeability of Core perm-in. (kg/Pa·s·m)
Polystyrene	5.0 (7.3 × 10 <sup>-12</sup> )
Urethane	2.0 (2.9 × 10 <sup>-12</sup> )

shall not be less than the requirements in Table 3.

5.6 *Adhesive Line Bond*—The bond of the glue line shall withstand weather exposure and have such quality that specimens in the flexural strength test fail within the core board and not at any of the glue lines.

## 6. Dimensional Measurements

6.1 *Significance*—These are routine measurements for the purpose of determining whether the length and width of the individual units are as ordered, to ensure that they fit together properly in application, and to determine the uniformity of the specified thickness.

6.2 *Procedure*—Measure each test specimen for thickness, using a micrometer caliper having flat anvils approximately 6.4 mm (¼ in.) in diameter and reading to 0.0254 mm (0.001 in.). Make four measurements on each specimen at the approximate midpoint of each edge of the specimen, and at least 12.7 mm (½ in.) in from the edge. Average the four measurements, and record as the specimen thickness.

## 7. Dimensions, Mass, and Permissible Variations

7.1 Asbestos-cement plastic-foam core panels are normally supplied in the commercial dimensions given in Table 4. However, because of the frequent use of other thicknesses, the scope of this specification is not limited to only the more common thicknesses.

### 7.2 Permissible Variation in Dimensions:

7.2.1 *Thickness*—The permissible variation of any individual panel from the nominal thickness shall be ±1.2 mm (3/64 in.).

7.2.2 *Width and Length*—The permissible variation of any individual panel from the nominal length and width shall be ±3.2 mm (1/8 in.) and ±1.6 mm (1/16 in.), respectively, as measured after 48 h at 23 ± 2°C (70 to 77°F) and 50 ± 5 % relative humidity.

7.2.3 *Squareness*—The deviation from squareness shall not exceed 1.3 mm/m (1/64 in./ft) of width or length. The recom-

**TABLE 3 Thermal Resistance, R**

Nominal Thickness, in.		R value at 75°F, (24°C), mean Temperature, min. [°F·ft²·h/Btu (K·m²/W)]	
Panel	Core	Polystyrene	Urethane
1	3/4	2.70 (0.48)	4.35 (0.76)
1 <sup>5</sup> / <sub>16</sub>	1 <sup>5</sup> / <sub>16</sub>	4.76 (0.84)	7.69 (1.35)
2	1 <sup>3</sup> / <sub>4</sub>	6.25 (1.10)	10.0 (1.75)

**TABLE 4 Standard Sizes**

Length, ft (m) 6, 8, 9, 10, 12	(1.83, 2.44, 2.74, 3.05, 3.66)
Width, ft (m) 4	(1.22)
Thickness, in. (mm) 1, 1 <sup>5</sup> / <sub>16</sub> , 2	(25, 40, 51)

mended tools for measuring squareness are a feeler gage and metal carpenter square.

## 8. Workmanship, Finish, and Appearance

8.1 *Workmanship*—Panels shall have a commercially acceptable surface on both sides and be free of major defects that will impair appearance, erection, use, or serviceability.

8.2 *Finish*—The surface on both sides of the panel may be smooth, grained, granuled, coated, or otherwise textured as specified by the purchaser.

8.3 *Color*—Both surfaces of the panel will be the natural color of the asbestos-cement product or may be colored by the addition of mineral pigments, chemical impregnation, pigmented coatings, veneers, or embedded mineral granules as specified by the purchaser.

## 9. Sampling

9.1 Select at random a number of panels from each shipment or fraction thereof representing a product of the same kind. The following table shows the number of panels to be selected from shipments of various sizes:

Number of Panels in Shipment	Number of Samples
500 and under	3
501 to 1000	5
1001 to 1728	6
1729 to 2744	7
2745 to 4096	8
4097 to 5832	9
5833 to 8000	10

## 10. Test Methods

### 10.1 Flexural Strength:

10.1.1 *Procedure*—Cut two specimens 305 by 760 mm (12 by 30 in.), from each panel to be tested, with the long dimension of the samples parallel to the long dimension of the panel. Condition each specimen for seven days at 23 ± 2°C (70 to 77°F) and 50 ± 10 % relative humidity. Determine the flexural strength of each specimen by placing the specimen on supports that do not exert longitudinal constraint (rocker-type bearing edges or rollers with a 3 mm (1/8 in.) minimum and a 13 mm (½ in.) maximum radius) and applying the load equally and simultaneously at both one-third points of the span through similar edges bearing against either surface of the specimen. The test span shall be 610 ± 1.6 mm (24 ± 1/16 in.) and the load line and supports shall be parallel. Increase the load applied at a uniform rate to produce a failure of the specimen in 1 to 2 min. The error in the load reading shall not exceed 1 % of the maximum load. Report the flexural strength as the average breaking load, in newtons (or pounds-force), for all the specimens tested.

10.1.2 **Caution**—When cutting asbestos-cement products, minimize the dust that results. Prolonged or frequent breathing of significant airborne concentrations of silica or asbestos dust



is hazardous. When such dusts are generated, effective measures shall be taken to prevent inhalation. Refer to approved techniques.<sup>6</sup>

#### 10.2 Vapor Permeability:

10.2.1 *Significance*—The purpose of this test method is to obtain, by means of simple apparatus, reliable values in uniform units of measurement for the rate of water-vapor transmission of insulating and related materials. These values are for use in design, manufacture, and marketing. Correlation of test values with any given use must be determined by experience.

10.2.2 *Procedure*—Test asbestos-cement plastic-foam core insulating panels in accordance with the Desiccant Method given in Test Methods C 355.

#### 10.3 Thermal Resistance, R:

10.3.1 *Procedure*—Test asbestos-cement plastic-foam core insulating panels in accordance with Test Method C 236.

<sup>6</sup> Available from Asbestos Information Association, 1745 Jefferson Davis Highway, Crystal Square 4, Suite 509, Arlington, VA 22202.

Thermal resistance is calculated as the reciprocal of thermal conductance.

### 11. Inspection and Certification

11.1 Inspection and certification of the material shall be as agreed upon by the purchaser and seller as part of the purchase contract.

### 12. Packaging and Package Marking

12.1 *Commercial Quantities*—The commercial unit for marketing flat panels is the square foot. Table 4 lists sizes generally available commercially.

12.2 *Commercial Packaging*—Asbestos-cement plastic-foam core panels shall be so shipped as to ensure acceptance by common carrier. There is no standard package. The material is usually shipped in bulk, but may be crated when so specified by the purchaser.

12.3 *Storage*—Asbestos-cement plastic-foam core panels should be piled on sufficiently firm supports that will keep the panels level and flat. The panels shall be piled with the edges square and flush, and covered to provide protection from the weather until used.

## SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply when material is supplied under this specification for U.S. Government procurement.

### S1. Packaging

S1.1 Unless otherwise specified in the contract, the material shall be packaged in accordance with the producer's standard practice which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification Rules<sup>7</sup> or National Motor Freight Classification Rules.<sup>8</sup> Marking for shipment of such material shall be in accordance with Fed. Std. No. 123 for civil agencies and

<sup>7</sup> Available from The Uniform Classification Commission, Room 1106, 222 S. Riverside Plaza, Chicago, IL 60606.

<sup>8</sup> Available from National Motor Freight Inc., 1616 P. St., N.W., Washington, DC 20036.

MIL-STD-129 for military agencies.

### S2. Responsibility for Inspection

S2.1 Unless otherwise specified in the contract or purchase order, the producer is responsible for the testing of all material to assure compliance with the requirements specified herein. Except as otherwise specified in the contract or order, the producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

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