



## Standard Specification for Asbestos-Cement Fiberboard Insulating Panels<sup>1</sup>

This standard is issued under the fixed designation C 551; 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 asbestos-cement insulating panels consisting of a core of insulating fiber board sandwiched between, and bonded to, two sheets of asbestos-cement facing board. Asbestos-cement insulating panels are designed for exterior and interior walls, partitions, curtain walls, roof decks, and for decorative purposes.

1.2 All measurements and tests necessary for determining the conformity of asbestos-cement insulating panels with this specification are made in accordance with the methods covered in Section 9.

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 The following safety hazards caveat pertains only to the test method portion, Section 9, of this specification. *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 9.2.3.1 for a specific hazard warning.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 150 Specification for Portland Cement<sup>2</sup>

C 208 Specification for Cellulosic Fiber Insulating Board<sup>3</sup>

C 220 Specification for Flat Asbestos-Cement Sheets<sup>4</sup>

C 236 Test Method for Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box<sup>5</sup>

C 458 Test Method for Organic Fiber Content of Asbestos-Cement Products<sup>4</sup>

C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus<sup>3</sup>

C 595M Specification for Blended Hydraulic Cements<sup>6</sup>

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete<sup>7</sup>

D 2946 Terminology for Asbestos and Asbestos-Cement Products<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>8</sup>

#### 2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage<sup>8</sup>

#### 2.4 Other Standards:

Uniform Freight Classification Rules<sup>9</sup>

National Motor Freight Classification Rules<sup>10</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *dimensions*—for the purpose of this specification, include the length, width, thickness, and squareness (defined hereunder) of asbestos-cement insulating panels as measured under specified conditions.

3.1.2 *flexural strength*—the average breaking load in newtons per meter of width (or lbf/ft of width) of dried specimens loaded as simple beams on a 762 mm (30 in.) span with the load applied equally and simultaneously at both one-third points of the span.

NOTE 1—The flexural performance is defined as the moment capacity in N·m/m (or ft·lbf/ft) of width, obtained from the product of flexural strength and span divided by 6.

3.1.3 *lot*—shipment, or part thereof, of a quantity of product of identical type produced during a single production run.

3.1.4 *squareness*—deviation from squareness is defined as the percent difference in the length of the two diagonals of a

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.01.

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

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.05.

<sup>5</sup> Discontinued and replaced by C 1363. See 2000 *Annual Book of ASTM Standards*, Vol 04.06.

<sup>6</sup> Discontinued and replaced by C 595. See 1993 *Annual Book of ASTM Standards*, Vol 04.01.

<sup>7</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>8</sup> Available from Standardization Documents, Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

<sup>9</sup> Available from the Uniform Classification Commission, Room 1106, 222 S. Riverside Plaza, Chicago, IL 60606.

<sup>10</sup> Available from National Motor Freight Inc., 1616 “P” St. NW, Washington, DC 20036.

panel. Panels with perfect squareness have zero difference between the length of their diagonals.

3.1.5 Additional terminology is presented in Terminology D 2946.

#### 4. Materials and Manufacture

4.1 Asbestos-cement insulating panels shall be composed of an insulating core sandwiched between, and bonded to, two facing sheets of asbestos-cement. The insulating core shall be manufactured from wood, fiber, or other suitable vegetable fiber, by a felting or molding process, with suitable sizing material incorporated into the product to render it water resistant. The material shall be subjected to such drying temperatures as to effect complete destruction of rot producing fungi. The asbestos-cement facing boards shall be composed of a combination of asbestos fiber and portland cement prescribed in Specification C 150, or portland slag or pozzolan cements meeting Specification C 595M, with or without the addition of curing agents or additives meeting Specification C 618, water-repellent substances, mineral fillers, coatings, pigments, or mineral granules, formed under pressure and cured to meet the physical requirements of this specification. Sheets may contain not more than mass percent of non-deleterious organic components as determined by Test Method C 458. The bonding adhesive shall cover essentially 100 % of the bonding surfaces.

#### 5. Dimensions, Mass, and Permissible Variations

##### 5.1 Physical Requirements:

5.1.1 Asbestos-cement facing sheets shall conform to the requirements for Type F or U of Specification C 220.

5.1.2 The insulating core board shall conform to the requirements for Class C or E of Specification C 208.

5.1.3 *Flexural Strength*—The average breaking load, obtained by loading equally and simultaneously at both one-third points of the span, for panel specimens dried for 24 h at  $70 \pm 3^\circ\text{C}$  ( $160 \pm 5^\circ\text{F}$ ) shall not be less than shown in Table 1.

5.1.4 *Vapor Permeability*—The average vapor permeability of any panel board thickness shall not exceed  $0.35 \text{ g/MPa}\cdot\text{s}\cdot\text{m}^2$  (6 perms, or grains of water vapor per square foot per hour per inch mercury vapor pressure differential) when tested according to the wet cup method of Test Methods E 96.

5.1.5 *Thermal Resistance, R*—The average thermal resistance,  $R$ ,  $\text{K}\cdot\text{m}^2/\text{W}$  ( $\text{deg F}\cdot\text{h}\cdot\text{ft}^2/\text{Btu}$ ) of the panel shall not be less than the requirements in Table 2 when tested in accordance with Test Method C 236 or Test Method C 518.

5.1.6 *Adhesive Line Bond*—The glue shall be suitable for outdoor use and have such adhesion that specimens resist the shear stress generated during flexural testing with all failures occurring within the core board and not at any of the glue lines.

##### 5.2 Dimensions:

**TABLE 2 Thermal Resistance,  $R$**

Nominal Thickness		$R$ Value at $24^\circ\text{C}$ ( $70^\circ\text{F}$ )	
mm	(in.)	$\text{K}\cdot\text{m}^2/\text{W}$	( $^\circ\text{F}\cdot\text{h}\cdot\text{ft}^2/\text{Btu}$ )
17	( $11/16$ )	0.23	(1.3)
29	( $1\frac{1}{8}$ )	0.44	(2.5)
40	( $1\frac{3}{8}$ )	0.59	(3.3)
51	(2)	0.71	(4.0)

5.2.1 This specification is applicable only for panels of the dimensions shown in Table 3 and Table 4.

##### 5.2.2 Permissible Variation in Dimensions:

5.2.2.1 *Thickness*—The average thickness of all panels supplied under this specification shall be as prescribed in Table 4. The average thickness of any one sheet shall not differ from the average of all sheets by more than 10 percent.

5.2.2.2 *Width and Length*—The permissible variation from the nominal width shall be  $-3 \text{ mm}$  ( $0.12 \text{ in.}$ ) and  $+1.5 \text{ mm}$  ( $0.06 \text{ in.}$ ) and, from the nominal length,  $-3 \text{ mm}$  ( $0.12 \text{ in.}$ ) and  $+1.5 \text{ mm}$  ( $0.06 \text{ in.}$ ) as measured after 48 h at  $25 \pm 5^\circ\text{C}$  ( $70 \pm 10^\circ\text{F}$ ) and 50 % relative humidity.

5.2.2.3 *Squareness*—The deviation from squareness shall not exceed 0.2 % of width or length.

#### 6. Supplementary and Finishing Pieces, Accessories

6.1 Fasteners of suitable size and type for securing asbestos-cement insulating board to metal or wood supporting members of all sizes and types shall be furnished when specified. The fasteners shall be corrosion-resistant and complete information regarding the supporting structure must be supplied by the purchaser.

#### 7. Workmanship, Finish, and Appearance

7.1 *Workmanship*—The surfaces on both sides of the panel shall be free of major defects that will impair appearance, erection, use, or serviceability.

7.2 *Finish*—The surfaces of the panel shall be smooth, grained, granuled-coated, or otherwise textured.

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

7.4 *Efflorescence*—Efflorescence that sometimes may appear on asbestos-cement insulating panels is not a defect and should not result in a permanent change in color.

#### 8. Rejection and Retesting

8.1 If one of the samples fails to conform to any one of the requirements of this specification, a second sample from the same lot shall be prepared and tested. The results of the retest

**TABLE 1 Flexural Strength Requirements for Panels**

Nominal Thickness		Minimum Breaking Load	
mm	(in.)	N	(lbf)
17	( $11/16$ )	1300	300
29	( $1\frac{1}{8}$ )	2700	600
40	( $1\frac{3}{8}$ )	4000	900
51	(2)	5300	1200

**TABLE 3 Dimensions**

Nominal Thickness		Nominal Width		Nominal Length	
mm	(in.)	m	(in.)	m	(ft)
17	( $11/16$ )	1.2	(48)	1.8, 2.4, 2.7, 3.0, 3.6	(6, 8, 9, 10, 12)
29	( $1\frac{1}{8}$ )	1.2	(48)	— 2.4 — — 3.6	(— 8 — — 12)
40	( $1\frac{3}{8}$ )	1.2	(48)	— 2.4 — — 3.6	(— 8 — — 12)
51	(2)	1.2	(48)	1.8, 2.4, 2.7, 3.0, 3.6	(6, 8, 9, 10, 12)

**TABLE 4 Thickness Requirements**

Nominal Thickness		Thickness Limits			
mm	(in.)	minimum		maximum	
		mm	(in.)	mm	(in.)
17	( <sup>11</sup> / <sub>16</sub> )	16	(0.62)	20	(0.81)
29	(1 <sup>1</sup> / <sub>8</sub> )	27	(1.06)	31	(1.22)
40	(1 <sup>5</sup> / <sub>16</sub> )	38	(1.50)	42	(1.66)
51	(2)	49	(1.94)	52	(2.06)

shall be averaged with the results of the original test to determine compliance with this specification.

8.2 Failure to conform to any one of the requirements of this specification, upon retest as prescribed above, shall constitute grounds for rejection. In case of rejection, the seller shall have the right to reinspect the rejected shipment and resubmit the lot after removal of the portion of the shipment not conforming to the specified requirements, provided this is done within 20 days after receipt of written notice of the specific cause for rejection.

## 9. Test Methods

### 9.1 Sampling:

9.1.1 Select at random a number of panels from each shipment or lot, representing a product of the same kind. Table 5 shows the number of panels to be selected from shipments of various quantities.

9.1.2 Additional panels may be taken at the discretion of the inspector.

### 9.2 Flexural Strength:

9.2.1 *Definition*—*Flexural strength*, for the purpose of this specification, is the average breaking load, in newtons (or pounds-force) of test specimens dried as specified, loaded as simple beams with the load applied equally and simultaneously to both one-third points of the span, and tested by the method prescribed in 12.3.

9.2.2 *Significance*—This is a routine test method to indicate the strength of the product.

9.2.3 *Procedure*—Cut two specimens 70 × 30 cm (30 × 12 in.) from each panel to be tested, with the long dimension of the samples parallel to the long dimension of the panel. Dry each specimen for 24 h in a ventilated oven at a temperature of 70 ± 3°C (160 ± 5°F), then cool to room temperature. Determine the flexural strength of each specimen by placing the specimen on supports that cannot exert longitudinal constraint (rocker-type bearing edges or rollers with a 3-mm (<sup>1</sup>/<sub>8</sub>-in.) minimum and a 13-mm (<sup>1</sup>/<sub>2</sub>-in.) maximum radius) and applying the load equally and simultaneously to both one-third points of the span through similar edges bearing against either surface of the specimen. The test span shall be 609.6 ± 1.6 mm

(24 ± <sup>1</sup>/<sub>16</sub> in.) and the load lines 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 possible error in the load reading shall not exceed 1 % of the load. Report the flexural strength as the average load, newtons (or pounds force), for all the specimens tested.

9.2.3.1 (**Warning**—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>11</sup>)

### 9.3 Vapor Permeability:

9.3.1 *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.

9.3.2 *Procedure*—Test asbestos-cement insulating panels in accordance with Test Methods E 96.

### 9.4 Thermal Resistance, R:

9.4.1 *Significance*—The thermal resistance, *R*, of a panel is a measure of the time rate heat flow through a unit area of the panel in a direction perpendicular to the face of the panel, per unit thickness of the panel, per unit temperature gradient across the panel.

9.4.2 *Procedure*—Test asbestos-cement insulating panels in accordance with Test Method C 236. Thermal resistance is calculated as the reciprocal of thermal conductance.

### 9.5 Dimensional Measurements:

#### 9.5.1 Significance of Dimensional Measurements:

9.5.1.1 *Significance*—These are routine measurements for the purpose of determining whether the length, width, thickness, and squareness 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.

9.5.2 *Thickness*—Measure each test specimen for thickness, using a micrometer caliper having flat anvils approximately 5 mm (0.25 in.) in diameter and reading to 0.02 mm (0.001 in.). Make four measurements on each specimen at the approximate midpoint of each edge of the specimen, and at least 1 cm (0.5 in.) in from the edge. Record average of the four measurements and record as the specimen thickness.

## 10. Inspection

10.1 Inspection of material shall be made at the point of shipment. The inspector representing the purchaser shall have free access to the carriers being loaded for shipment to the purchaser. He shall be afforded all reasonable and available facilities at the point of shipment for sampling and inspection of the material, which shall be so conducted as not to interfere unnecessarily with the loading of the carriers.

**TABLE 5 Sample Panel Selection**

Quantity of Panels in a Lot	Quantity of Panels Selected as 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

<sup>11</sup> Available from Asbestos Information Assoc., 1745 Jefferson Davis Highway, Crystal Square 4, Suite 507, Arlington, VA 22202.



## **11. Packaging and Shipping**

11.1 *Commercial Quantities*—Table 3 lists sizes generally available commercially.

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

11.3 *Storage*—Asbestos-cement insulating panels should be piled on sufficiently firm supports that will keep the sheets

level and flat. The sheets shall be piled with the edges square and flush, and covered to provide protection from the weather until used.

## **12. Keywords**

12.1 asbestos; asbestos-cement; asbestos-cement fiberboard; fiberboard; fiberboard insulating panels; fiberboard panels; panels

## **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 or National Motor Freight Classification Rules. Marking for shipment of such material shall be in accordance with Fed. Std. No. 123 for civil agencies and 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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