Designation: C 1325 – 04

Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets[1]

This standard is issued under the fixed designation C 1325; 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 *non-asbestos fiber-mat reinforced* cement substrate sheets manufactured to be dimensionally stable and suitable as either an unfinished substrate (see Note 1) or as a substrate for decoration such as natural stone or tile on walls, floors, or decks in wet and dry areas.

NOTE 1—When used as an unfinished substrate, consult the manufacturer's written installation literature for proper application details.

1.2 This specification is not applicable to asbestos-cement flat sheets (Specification C 220); non-asbestos fiber cement flat sheets for exterior applications such as claddings, facades, curtain walls, and soffits (Specification C 1186); gypsum backing board, coreboard, and shaftliner (Specification C 442); water-resistant gypsum backing board (Specification C 630); glass mat gypsum backing board (Specification C 1178); particle boards (Definitions D 1554); and discrete non-asbestos fiber cement interior substrate sheets (Specification C 1288).

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units which are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 220 Specification for Flat Asbestos-Cement Sheets
C 442 Specification for Gypsum Backing Board, Coreboard, and Shaftliner Board
C 473 Test Methods for Physical Testing of Gypsum Panel Products
C 630 Specification for Water-Resistant Gypsum Backing Board
C 666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing
C 947 Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam with Third-Point Loading)[2]
C 1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products
C 1178 Specification for Glass Mat Water-Resistant Gypsum Backing Panel
C 1185 Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards
C 1186 Specification for Flat Non-Asbestos Fiber-Cement Sheets
C 1288 Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets
D 1037 Methods for Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials
D 1554 Definitions of Terms Relating to Wood-Base Fiber and Particle Panel Materials
D 2394 Method for Simulated Service Testing of Wood and Wood-Base Finish Flooring
E 84 Test Method for Surface Burning Characteristics of Building Materials
G 21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
G 22 Practice for Determining Resistance of Plastics to Bacteria

2.2 *ANSI Standards:*[3]

A118.1 Specification for Dry-Set Portland Cement Mortar
A118.4 Specification for Latex-Portland Cement Mortar
A136.1 Standard for Organic Adhesives for Installation of Ceramic Tile

3. Terminology

3.1 *Definitions: Refer to Terminology C 1154.*

4. Classification

4.1 *Flat sheets covered by this specification are divided into two types, according to their intended application.*

4.1.1 Type A—Sheets are intended for exterior applications as a substrate for other cladding materials, or as an unfinished

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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.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

substrate for decoration such as natural stone, tile, or coatings. Type A products are also suitable for interior use.

4.1.2 Type B—Sheets are intended for covered exterior applications such as soffit areas, or for interior dry or wet area applications as a desired unfinished substrate or an unfinished substrate for decoration such as natural stone or tile, where substrate dimensional stability is required.

NOTE 2—Flat sheets may be supplied coated or uncoated.

5. Composition and Manufacture

5.1 *Composition*—This specification is applicable to *fiber-mat reinforced* non-asbestos cement substrate sheets consisting essentially of an inorganic hydraulic binder or a calcium silicate binder formed by the chemical reaction of a siliceous material and a calcareous material, reinforced by *fiber-mat* made of organic fibers, inorganic non-asbestos fibers, or both.

NOTE 3—Process aids, fillers, pigments, and other fibers that are compatible with the fiber-mat cement may be added.

5.2 *Manufacture*—These products are formed either with or without pressure and cured, either under natural or accelerated conditions, to meet the property requirements of this specification.

6. Mechanical and Physical Properties

6.1 Mechanical and physical properties shall be determined on an uncoated product wherever practical. Where the products are supplied coated, this material shall also be tested with the results identified as applying to coated material.

6.2 *Sampling*—Obtain 5 samples of the particular cement substrate sheet to be tested from a commercial lot of not less than 50 000 ft^2 to conduct the tests described in this specification.

6.3 *Mechanical Properties*:

6.3.1 *Flexural Strength*—When tested in accordance with Test Method C 947, flexural strength shall be not less than 750 psi (5170 kPa).

6.3.2 Sheets shall be tested and specified in both the wet and equilibrium conditions and shall meet the minimum wet and minimum equilibrium flexural strength requirements.

NOTE 4—When sampled from continuous production, these tests may be conducted on dry, equilibrium, or saturated specimens, provided a relationship can be established between this testing and the specified values.

6.4 *Physical Properties*:

6.4.1 *Density*—Nominal values and tolerances for density shall be stated by the manufacturer for each of the products. When tested in accordance with the test method specified in Test Methods C 1185, the value for the density shall comply with the value stated by the manufacturer.

6.4.2 *Modulus of Elasticity*—Values for the modulus of elasticity shall be stated by the manufacturer for each of the products. When tested in accordance with Test Method C 947, the value for modulus of elasticity shall comply with the value stated by the manufacturer. Calculate the modulus of elasticity for each sample specimen by the following equation:

$$E = 5(P_2 - P_1) \times L^3/27bd^3(y_2 - y_1) \quad (1)$$

where:

E	=	modulus of elasticity, psi (MPa),
P_2 and P_1	=	loads, lb (N), taken from two points within the linear section of the plot,
y_2 and y_1	=	deflections, in. (mm) corresponding to the loads selected,
b	=	width of specimen, in. (mm),
d	=	thickness of specimen, in. (mm), and
L	=	span, in. (mm).

7. Dimensions and Tolerances

7.1 *Method of Measurement*—The method of measurement shall be in accordance with Test Methods C 473.

7.2 *Nominal Length and Width*—Fiber-mat reinforced substrate sheets are typically supplied in nominal lengths of 48 in. (1219 mm), 60 in. (1524 mm), 72 in. (1828 mm), 84 in. (2134 mm), 96 in. (2438 mm) and nominal widths of 48 in. (1219 mm), 36 in. (914 mm), and 32 in. (811 mm).

7.3 *Nominal Thickness*—Fiber-mat reinforced substrate sheets are normally available in thicknesses of ¼ in. (6 mm) to ⅝ in. (16 mm), although thicknesses outside of this range are not prohibited from being supplied.

7.4 *Length and Width Tolerance*—The tolerance from the nominal value shall be ±⅛ in. (3 mm).

7.5 *Thickness Tolerance*—The maximum difference between extreme values of the thickness measurement within a sheet shall not exceed 0.03 in. (0.8 mm). Thickness variation from sheet to sheet shall not exceed 0.03 in. (0.8 mm).

7.6 *Squareness Tolerance*—The length of the diagonals shall not vary by more than 1⁄32 in./ft (2.6 mm/m) of the length of the sheets. Opposite sides of the sheet shall not vary in length by more than 1⁄32 in./ft (2.6 mm/m).

7.7 *Edge Straightness Tolerance*—The sheet edges shall be straight within 1⁄32 in./ft (2.6 mm/m) of length or width.

8. Workmanship

8.1 *Workmanship*— Sheets shall be free of defects that will impair erection, use, or serviceability.

9. Inspection and Acceptance

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

9.2 Third party certification, either continuous or at regular intervals, shall be recognized as an alternative to lot inspection.

9.3 Failure to conform to any one of the requirements of this specification shall constitute grounds for nonacceptance.

10. Product Marking

10.1 *Identification*—Product marking shall include trademark, type of product (A or B), or other means of identification that ensures that the manufacturer and product type can be identified. The method of marking shall be stated in the manufacturer's catalog.

11. Packaging and Storage

11.1 *Commercial Packaging*—Flat sheets shall be packaged so as to prevent damage during shipment.

11.2 *Storage*—Flat sheets shall be stacked on supports that will keep the sheets level and flat. The sheets shall be stacked with the edges square and flush and covered to provide protection from the weather until used.

12. Keywords

12.1 acceptance; air cured; appearance; density; edge straightness; finish; flexural strength; glass mat cement sheet; inspection; interior wet area application; length and width tolerance; mechanical properties; minimum equilibrium strength; minimum wet strength; moisture content; moisture movement; nominal length; nominal thickness; nominal width; non-asbestos fiber-mat; packaging; physical properties; pressure cured; sampling; shipping; squareness tolerance; storage; supplementary requirements; supplementary tests; surface burning characteristics; thickness requirements; thickness tolerance; third party certification; tolerance; type tests; warm water resistance; workmanship

SUPPLEMENTARY REQUIREMENTS

S1. Supplementary Tests

S1.1 Supplementary tests for fiber-mat reinforced substrate sheets shall consist of once only supplementary test, with the manufacturer's statement of results provided upon customer's request. Fundamental changes in formulation or methods of manufacture, or both, shall require the subsequent retesting of the supplementary tests.

S1.2 Supplementary tests shall be determined on uncoated product wherever practical. Where fiber-mat reinforced substrate sheets are supplied coated, this material shall also be tested with the results identified as applying to coated material.

S1.3 *The following supplementary tests shall be required:*

Moisture Content
Moisture Movement
Warm Water Resistance
Surface Burning Characteristics
Shear Bond Strength (Dry-Set Portland Cement Mortar)
Shear Bond Strength (Latex-Portland Cement Mortar)
Shear Bond Strength (Organic Adhesive Type 1)
Nail-Head Pull-Through (roofing nail)
Modulus of Elasticity
Mold Resistance
Compression Indentation
Falling Ball Impact
Bacteria Resistance
Freeze Thaw Resistance

S1.3.1 *Moisture Content*—State the percentage of moisture content of the fiber-mat reinforced cement substrate sheets when conditioned at 50 ± 5 % relative humidity and a temperature of 73 ± 4°F (23 ± 2°C) in accordance with Test Method C 1185.

S1.3.2 *Moisture Movement*—The linear variation with change in moisture content shall be stated as the percentage change in length based on a relative humidity change from 30 % to 90 % in accordance with Test Method D 1037. The linear variation with change shall be less than or equal to 0.07 %. For the purpose of this test, obtain 5 samples of the particular cement substrate sheet to be tested from a commercial lot of not less than 50 000 ft^2 .

S1.3.3 *Warm Water Resistance*—The specimens, when tested in accordance with Test Method C 1185, shall not show visible cracks or structural alteration such as to affect their performance in use. The ratio of the average strengths as calculated from test results shall not be less than 70 %.

S1.3.4 *Surface Burning Characteristics*—When utilized as a finished substrate without decoration, fiber-mat reinforced cement substrate sheets shall have a reported flame spread index of 10 or less and a smoke developed index of not more than 5 when tested in accordance with Test Method E 84. Tests shall be conducted on samples that have been cured for 28 days in a controlled atmosphere of 73 ± 4°F (23 ± 2°C) and 50 ± 5 % relative humidity.

S1.3.5 *Shear Bond Strength (Dry-Set Portland Cement Mortar)*—Fiber-mat reinforced cement substrate sheets tested in accordance with ANSI A118.1 fiber-mat reinforced cement substrate sheet to fiber-mat reinforced cement substrate sheet) shall demonstrate a minimum shear bond strength at 7 day curing of 50 psi (345 kPa).

S1.3.6 *Shear Bond Strength (Latex-Portland Cement Mortar)*—Fiber-mat reinforced cement substrate sheets tested in accordance with ANSI A118.4 (fiber-mat reinforced cement substrate sheet to fiber-mat reinforced cement substrate sheet) shall demonstrate a minimum shear bond strength at 7 day curing of 50 psi (345 kPa).

S1.3.7 *Shear Bond Strength (Organic Adhesives Type 1)*—Fiber-mat reinforced cement substrate sheets tested in accordance with ANSI A136.1 (fiber-mat reinforced cement substrate sheet to fiber-mat reinforced cement substrate sheet) shall demonstrate a minimum shear bond strength at 7 day curing of 50 psi (345 kPa).

S1.3.8 *Nail-Head Pull Through*—Fiber-mat reinforced cement substrate sheets of ½ in. (13 mm) thickness shall have a minimum saturated nail-head pull through resistance of 125 lb (560 N), when tested in accordance with Test Method D 1037 utilizing a roofing nail with a 0.375 in. (10 mm) diameter head and a shank diameter of 0.121 in. (3 mm).

S1.3.9 *Mold Resistance*—When tested in accordance with Practice G 21, samples shall show an observed growth rating of 0.

S1.3.10 *Compression Indentation*—When tested in accordance with Test Method D 2394, samples shall show a value greater than 1250 psi (8620 kPa) at less than 0.05 in. (1.3 mm).

S1.3.11 *Falling Ball Impact*—When tested in accordance with Test Method D 1037, samples shall show no damage to top or bottom surfaces at a 12 in. (305 mm) drop.

S1.3.12 *Bacteria Resistance*—When tested in accordance with Practice G 22, samples shall show an observed growth rating of 0.

S1.3.13 *Freeze Thaw Resistance*—When tested in accordance with Test Method C 666 (Procedure B) samples shall show no disintegration at 50 cycles for Type A and 25 cycles for Type B.