



# Standard Specification for Flat Fiber-Cement Sheets<sup>1</sup>

This standard is issued under the fixed designation C1186; 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 either untextured or surface textured fiber-cement flat sheets intended for exterior applications such as claddings, facades, curtain walls, soffits, and so forth.

1.2 This specification is not applicable to asbestos-cement flat sheets (Specification C220), gypsum-based boards (Specifications C1396/C1396M, C1177/C1177M, C1178/C1178M), or particle boards (Terminology D1554) discrete non-asbestos fiber-cement interior substrate sheets (Specification C1288), fiber-mat reinforced non-asbestos cement interior substrate sheets (Specification C1325), or cement-bonded particleboards (Specification BS 5669: Part 4) and (ISO 8335).

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 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- C220 Specification for Flat Asbestos-Cement Sheets
- C1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products
- C1177/C1177M Specification for Glass Mat Gypsum Substrate for Use as Sheathing
- C1178/C1178M Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
- C1185 Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C17 on Fiber-Reinforced Cement Products and is the direct responsibility of Subcommittee C17.02 on Non-Asbestos Fiber Cement Products.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

### Shingles, and Clapboards

- C1288 Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets
- C1325 Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
- C1396/C1396M Specification for Gypsum Board
- D1554 Terminology Relating to Wood-Base Fiber and Particle Panel Materials
- E84 Test Method for Surface Burning Characteristics of Building Materials

### 2.2 British Standards:<sup>3</sup>

- BS 5669: Part 4 Specification for Cement Bonded Particle-board

### 2.3 International Standards:<sup>3</sup>

- ISO 8335 Cement-bonded Particleboards—Boards of Portland or Equivalent Cement Reinforced with Fibrous Wood Particles

## 3. Terminology

- 3.1 *Definitions*—Refer to Terminology C1154.

## 4. Classification

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

4.2 *Type A*—Sheets are intended for exterior applications, subjected to the direct action of sun, rain, or snow. They are supplied coated or uncoated.

4.3 *Type B*—Sheets are intended for exterior applications, not subjected to the direct action of sun, rain, or snow.

NOTE 1—If sheets of Type B are used in an exterior application, where they are directly exposed to the weather, but are protected by impregnation or coatings, the weather resistance of the product may be altered by the quality of the protection. Specification of this protection, as well as the method for control and test, are outside the scope of this specification.

4.4 The sheets are further classified into four grades according to their flexural strengths. The manufacturer shall declare the type and grade of a given product in the literature for that product.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

## 5. Composition and Manufacture

**5.1 Composition**—This specification is applicable to fiber cement flat 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 organic fibers, inorganic non-asbestos fibers, or both. Process aids, fillers, and pigments that are compatible with fiber cement are not prohibited from being added.

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

## 6. Mechanical and Physical Requirements

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

**6.1.1 Sampling and inspection for mechanical and physical properties** shall be conducted in accordance with Test Method C1185.

### 6.2 Mechanical Requirements:

**6.2.1 Flexural Strength**—When tested in accordance with Test Method C1185, the flexural strength shall not be less than the corresponding value for the appropriate grade in Table 1. Where manufacturers state minimum product strength, this shall be at the 4 % acceptable quality level (AQL) as are the values of Table 1.

**6.2.2 Type A sheets** for exterior applications shall be tested and specified in both the wet and equilibrium conditions. Type A sheets shall meet the minimum wet and minimum equilibrium flexural strength requirements for the appropriate grade specified in Table 1. In addition, the average wet flexural strength of the sample shall not be less than 50 % of the mean equilibrium strength of the sample.

**6.2.3 Type B sheets** shall be specified and tested in the equilibrium condition only.

NOTE 2—When sampling 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.

### 6.3 Physical Requirements:

**6.3.1 Density**—Nominal values and tolerances for density shall be stated by the manufacturer for each product. When tested in accordance with the method specified in Test Method C1185, the value for density shall comply with the value stated by the manufacturer.

**TABLE 1 Flexural Strength Requirements**

NOTE 1—The values of Table 1 are lower limit values based on an acceptable quality level (AQL) of 4 % at a 90 % confidence level.

Grade	Wet Strength, psi (MPa) min	Equilibrium Strength, psi (MPa) min
I	580 (4)	580 (4)
II	1015 (7)	1450 (10)
III	1885 (13)	2320 (16)
IV	2610 (18)	3190 (22)

## 7. Dimensions and Tolerances

**7.1 Method of Measurement**—The method of measurement shall be in accordance with Test Method C1185.

**7.2 Nominal Length and Width**—Fiber-cement sheets are typically supplied in nominal lengths of 96 in. (2438 mm), 120 in. (3048 mm) and nominal width of 48 in. (1219 mm). Greater or lesser nominal lengths and widths are not prohibited from being supplied.

**7.3 Nominal Thickness**—Fiber-cement sheets are normally available in thickness of 1/8 in. (3.5 mm) to 1 in. (25 mm), although thickness outside of this range is not prohibited from being supplied. Refer to Table 2.

**7.4 Length and Width Tolerance**—The tolerance from the nominal shall be  $\pm 0.5$  % with a maximum variation of  $\pm 1/4$  in. (6 mm). A tolerance of  $\pm 1/8$  in. is acceptable for dimensions less than 24 in. (609 mm).

**7.5 Thickness Tolerance**—The maximum difference between extreme values of the thickness measurement within a sheet shall not exceed 15 % of the maximum measured value. Thickness variation from sheet to sheet shall not exceed the tolerances shown in Table 2.

**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 sheet. 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, Finish, and Appearance

**8.1 Workmanship**—Sheets shall have a commercially uniform surface on one side, and be free of major defects that will impair appearance, erection, use, or serviceability.

**8.2 Finish**—The surface of the sheet to be exposed shall be smooth, granular, or otherwise textured.

**8.3 Color**—The surface of the sheet shall be the natural color of the product or colored by the addition of mineral pigments, chemical impregnation, pigmented coating, veneer, or embedded mineral granules.

## 9. Inspection

**9.1 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. The purchaser shall be afforded all reasonable and available facilities at the point of shipment for sampling and

**TABLE 2 Thickness Requirements**

Nominal Thickness, in. (mm)	Tolerance, in. (mm)
1/8 – 3/16 (3.5–5)	$\pm 0.02$ (0.5)
> 3/16 – 3/8 (>5–10)	$\pm 0.04$ (1.0)
> 3/8 – 5/8 (>10–16)	$\pm 0.05$ (1.3)
> 5/8 – 3/4 (>16–20)	$\pm 0.06$ (1.5)
> 3/4 (>20)	$\pm 10$ % thickness

inspection of the material, which shall be conducted 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 batch inspection.

## 10. Rejection

10.1 If the sampling 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 shall be combined with the results of the original test, according to the sampling procedure, to determine compliance with this specification.

10.2 Failure to conform to any one of the requirements of this specification, upon retest as prescribed above, shall constitute grounds for rejection.

## 11. Product Marking

11.1 *Identification*—Product marking shall include trademark or other means of identification that ensures that the manufacturer and product category can be identified. The method of marking shall be stated in the manufacturer's catalog.

## 12. Packaging and Storage

12.1 *Commercial Packaging*—Flat sheets shall be so shipped as to ensure acceptance by common carrier. There is no standard package. The material is usually in bulk or crated when so specified by the purchaser.

12.2 *Storage*—Flat sheets must be piled on sufficient firm supports that will keep the sheets level and flat. The sheets must be piled with the edges square and flush and covered to provide protection from the weather until used.

## 13. Keywords

13.1 air cured; appearance; autoclaved cured; cellulose fiber; density; edge straightness; exterior application; finish; flexural strength; frost resistance; heat/rain resistance; inspection; 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; packaging; physical properties; polyethylene fiber; polyvinyl alcohol fiber; pressure cured; rejection; sampling; sheet grading; shipping; squareness tolerance; storage; supplementary requirements; supplementary tests; surface burning characteristics; thickness requirements; thickness tolerance; third party certification; tolerance; Type A; Type B; type tests; warm water resistance; water absorption; water tightness; workmanship

## SUPPLEMENTARY REQUIREMENTS

S1. Supplementary requirements for Type A and B 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.

S1.1 The following supplementary tests shall be required for Type A and B sheets:

Supplementary Test	Type A	Type B
Moisture Movement	yes	yes
Water Absorption	yes	yes
Moisture Content	yes	yes
Water Tightness	yes	no
Surface Burning Characteristics	yes	yes
Frost Resistance	yes	no
Warm Water Resistance	yes	no
Heat/Rain Resistance	yes	no

S1.2 Supplementary requirements shall be determined on uncoated product wherever practical. Where products are supplied coated, this material shall also be tested with the results identified as applying to coated material.

S2. *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 **C1185**.

S3. *Water Absorption*—Calculate the amount of water absorbed from the increase in weight of the dried specimen during submersion for a period of 48 h. Express the water

absorptions as the percentage by weight when tested in accordance with Test Method **C1185**.

S4. *Moisture Content*—State the percentage of moisture content of the fiber-cement sheet when conditioned at  $50 \pm 5$  % relative humidity and a temperature of  $73 \pm 4^{\circ}\text{F}$  ( $23 \pm 2^{\circ}\text{C}$ ) in accordance with Test Method **C1185**.

S5. *Water Tightness*—The specimens, when tested in accordance with Test Method **C1185**, are not prohibited from showing traces of moisture on the underside of the sheet, but in no instance shall there be any formation of drops of water.

S6. *Surface Burning Characteristics*—Fiber cement sheets of  $\frac{1}{4}$  in. (6 mm) shall have a reported flame spread index of 0 and a smoke developed index of not more than 5, when tested in accordance with Test Method **E84**. Sheets of thickness greater than  $\frac{1}{4}$  in. (6 mm) shall meet this specification or shall be formed at  $\frac{1}{4}$  in. (6 mm) thickness with the same formulation for test purposes.

S7. *Frost Resistance (Freeze/Thaw)*—The specimens, when tested in accordance with Test Method **C1185** (Section 12 on Freeze/Thaw—Cladding Products), for 50 cycles, shall not show visible cracks or structural alteration such as to affect their performance in use. The ratio of retained strength as calculated from the test results shall be at least 80 %.

S8. *Warm Water Resistance*—The specimens, when tested in accordance with Test Method **C1185**, shall not show visible cracks or structural alteration, such as to affect their performance in use. The ratio of strengths as calculated from test results shall be reported.



S9. *Heat/Rain Resistance*—The specimens, when tested in accordance with Test Method **C1185** (Section 14 on Heat/Rain—Wall Structures), for 25 cycles, shall not show visible

cracks or structural alteration of the sheets and frame assembly such as to affect their performance in use.

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