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Standard Test Methods for Asbestos-Cement Flat Products[1]

This standard is issued under the fixed designation C 459; 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 These test methods cover only asbestos-cement flat sheets, roofing shingles, siding shingles, and clapboards.

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

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *deflection*—the linear distance that a test specimen bends at the center from no load to maximum breaking load when loaded as a beam with the load applied equally and simultaneously at both one-third points of the span.

3.1.2 *flexural strength*—the average breaking load in newtons (or lbf) of dried specimens loaded as simple beams on a span of 254 mm (10 in.) with the load applied equally and simultaneously at both one-third points of the span.

4. Sampling

4.1 From each shipment or fraction thereof representing a product of the same kind, a number of sheets or units shall be selected at random. Table 1 and Table 2 show the number of sheets or units to be selected from shipments of various sizes.

TABLE 1 Sampling Plan for Flat Sheets

Number of Sheets in Shipment	Number of Sheets to Be Selected as Samples[A]
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

[A] Additional sheets may be taken at the discretion of the inspector.

5. Preparation of Test Specimens

5.1 *Flat Sheets*—Cut a pair of specimens, each 6 ± 1⁄16 in. (152 ± 1.6 mm) in width and 12 ± 1⁄16 in. (305 ± 1.6 mm) in length, from the interior area of each sample sheet in such a manner that no edge of a specimen is less than 3 in. (76 mm) from the original edges of the sheet. The longer dimension of one of the specimens of each pair shall be parallel to the length of the sheet (that is, parallel with the fiber lay), and that of the other shall be at right angles to it. (**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.)

TABLE 2 Sampling Plan for Roofing Shingles, Siding Shingles, and Clapboards

Number of Units in Shipment	Number of Units to Be Selected as Samples[A]
8 000 and under	10
8 001 to 64 000	20
64 001 to 216 000	30
216 001 to 512 000	40
512 001 to 1 000 000	50

[A] Additional units may be taken at the discretion of the inspector.

5.2 *Roofing Shingles, Siding Shingles, and Clapboards*—Cut a single specimen 6 ± 1⁄16 in. (152 ± 1.6 mm) in width and 12 ± 1⁄16 in. (305 ± 1.6 mm) in length from each unit. Cut one half of the specimens in such a manner that the 12-in. (304.8-mm) dimension of each specimen is parallel to one edge of the shingle or clapboard unit; cut one half of the specimens at a right angle thereto. Where the shingle or clapboard units have one dimension less than 12 in., cut all specimens with the

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[2] *Annual Book of ASTM Standards*, Vol 14.02.

12-in. dimension of each specimen parallel to the long dimension of the shingle or clapboard unit.

5.3 Do not test cracked or otherwise damaged specimens, but obtain substitute specimens.

6. Flexural Strength and Deflection Tests

6.1 *Significance and Use*:

6.1.1 *Flexural Strength*—This is a routine test. The values recorded are applicable only to the product being tested. The breaking loads specified should be maintained or exceeded to ensure successful use.

6.1.2 *Deflection*—This is not commonly a routine test, but is a reference or referee test. The values recorded are not relative, but are applicable only to the product being tested. The greater the deflection, provided the flexural strength is satisfactory, the lower the breakage hazard will be in use. The limits chosen in the material specifications are arbitrary, and are based upon experience.

6.2 *Procedure*:

6.2.1 Dry each specimen to constant weight in a ventilated oven at a temperature of 100 to 105°C (212 to 220°F), and cool to room temperature in a desiccator or desiccator-type cabinet. Record the dry weight of each cooled specimen. 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 (⅛-in.) minimum and 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 the finished surface of the specimen. The test span shall be 254 ± 1.6 mm (10 ± 1⁄16 in.), and the load lines and ups shall be parallel. Mount a dial micrometer reading to 0.25 mm (0.01 in.), or an equally sensitive apparatus, to bear on the specimen at midspan, to determine the deflection of the specimen at the center of the test span. Increase the load applied at a uniform rate such as will result in failure of the specimen in approximately 1 min. The error in the load reading shall not exceed 2.2 N (0.5 lbf) for loads up to 200 N (50 lbf); for greater loads, the error shall not exceed 1 % of the maximum load.

6.3 *Calculation and Report*—Report flexural strength and deflection as required by the appropriate specification.

6.4 *Precision and Bias*:

6.4.1 *Flexural Strength*:

6.4.1.1 *Precision*—The single-apparatus multi-operator precision is ±6.1 % (two sigma limits) as defined in Practice E 177 over the range from 150 to 702 N.

6.4.1.2 *Bias*—Results averaged 9 % lower than those obtained with mid-span loading methods.

6.4.2 *Deflection*:

6.4.2.1 *Precision*—The single-apparatus multi-operator precision is ±7.3 % (two sigma limits) as defined in Practice E 177 over the range from 2 to 8 mm.

6.4.2.2 *Bias*—Results averaged 3.9 % lower than those obtained by mid-span loading methods.

7. Water Absorption Test

7.1 *Significance and Use*:

7.1.1 This is a routine test. The values are relative. The test is made to determine uniformity of the product. The material specification values are arbitrarily chosen to describe the product. While there may be a relationship between water absorption and the ability of the product to resist deterioration resulting from freezing and thawing, the material specification values have not been based upon such data.

7.2 *Water Absorption Determination*:

7.2.1 Submerge the specimens that have been used in the flexural strength test for 24 ± ½ h in clean water at 60 to 80°F (15.5 to 26.5°C).

7.2.2 Remove each specimen from the water, wipe with a damp cloth, and weigh separately on a scale accurate to 0.5 %.

7.2.3 Report the water absorption as the average value for all specimens tested. Calculate the water absorption value for each specimen as follows:

$$\text{Water absorption, weight \%} = [(W_s - W_d)/W_d] \times 100 \quad (1)$$

where:

W_s = saturated weight of specimen, and
W_d = dry weight of specimen.

7.3 *Precision and Bias*:

7.3.1 *Precision*—The multi-apparatus multi-operator precision is ±4.9 % (two sigma limits) as defined in Practice E 177 over the range from 11 to 36 % moisture.

7.3.2 *Bias*—No significant bias is observed when average results are compared with those of another test method using Archimedes' principle.

8. Dimensional Measurements

8.1 *Significance and Use*:

8.1.1 These are routine measurements for 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. In determining the thickness of siding shingles, many of which have a textured or granuled surface, a metal plate is placed adjacent to the textured surface, and the micrometer readings are taken on the combined thickness of the shingle and the metal plate. The purpose is to obtain a more accurate overall thickness measurement of the textured or granuled shingle. This would be rather difficult to do, in many cases, because of surface irregularities were the plate not used.

8.2 *Procedure for Thickness Measurements*:

8.2.1 *Flat Sheets*—Measure each test specimen for thickness, using a micrometer caliper having flat anvils approximately ¼ in. (6.3 mm) in diameter and reading to 0.001 in. (0.0254 mm). Make four measurements on each specimen at the approximate mid-point of each edge of the specimen, and at least ½ in. (13 mm) in from the edge.

8.2.2 *Roofing Shingles, Siding Shingles, and Clapboards*—Measure the thickness of each test specimen by placing a smooth metal plate of uniform thickness with dimensions approximately 1⁄64 by 4 by 4 in. (0.4 by 102 by 102 mm), against the finished, textured, or weather-exposed surface of the specimen. Using a micrometer caliper reading to 0.001 in. (0.025 mm), measure the overall thickness of the metal plate and specimen at the approximate mid-point of each edge of the specimen and at least ½ in. (12.7 mm) from the edge of the specimen.

8.3 *Calculation and Report*:

8.3.1 *Flat Sheets*—Average the four measurements and record as the specimen thickness.

8.3.2 *Roofing Shingles, Siding Shingles, and Clapboards*—Subtract the measured thickness of the metal plate from each measurement and average four measurements to give the specimen thickness.

8.4 *Precision and Bias*:

8.4.1 *Precision*—The multi-apparatus multi-operator precision is ±2.2 % (two sigma limits) as defined in Practice E 177 over the range from 3.9 to 11.1 mm.

8.4.2 *Bias*—No significant bias is observed when compared against other procedures that make use of metal plates to seat the micrometer anvils.

9. Keywords

9.1 asbestos; asbestos-cement; clapboards; flat sheets; sheeting; shingles; siding; siding shingles