



Standard Test Method for Weather Resistance of Slate¹

This standard is issued under the fixed designation C 217; 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 test method covers two procedures for weather resistance of slate in all outdoor installations by determining the depth of softening by an abraser or by hand scraping.

NOTE 1—The test is based on the fact that slates containing pyrite, calcite, and carbon undergo a chemical weathering which results in the conversion of the calcite particles to gypsum. The swelling action that results causes disintegration of the slate. The extent of this action on various slates in the test has been found to correlate with the durability of the materials in actual weathering.

1.2 *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:

C 119 Terminology Relating to Dimension Stone²

3. Terminology

3.1 *Definitions*—All definitions are in accordance with Terminology C 119.

4. Significance and Use

4.1 This test method is useful in indicating the differences in weather resistance between various slates. This test method also provides one element in the comparison of slates.

5. Apparatus

5.1 Either one of the following shall be used:

5.1.1 *Shear/Scratch Tester*, Taber Model 203 or 502,³ with the shear hardness tool, Model S-20, or its equivalent.

5.1.2 *Hand Scraping Tool*—The scraping tool shall be made by grinding down the blade of a putty knife to a length of 3 in. (76.2 mm) and a width of 3/4 in. (19.05 mm). The end of the

blade shall be ground to a plane surface perpendicular to the length of the tool to form a sharp edge with either side of the blade. These sharp edges will be referred to as the “cutting edges.”

6. Sampling

6.1 The samples shall be selected by the purchaser or his authorized representative so as to be truly representative of the consignment under consideration. Six shingles of roofing from each carload or fraction thereof or similar quantities from other kinds of slate shall constitute a sample.

NOTE 2—Six shingles 10 in. (254 mm) or more in length and of any standard width are sufficient for this test and also for modulus of rupture and absorption tests.

7. Test Specimens

7.1 Prepare at least three specimens, each 2 by 4 in. (50.8 by 101.6 mm) measured along the cleavage faces, for determining the depth of softening in a 1 % solution of sulfuric acid. The 2 by 4-in. faces shall be ground smooth and finished with No. 80 abrasive. Specimens cut from sheared or punched slate shall have no saw cut nearer than 1 in. (25.4 mm) from the edges or nail holes.

8. Procedure with Shear/Scratch Tester

8.1 In this procedure determine the depth of softening in acid with the shear/scratch tester (described in 5.1.1). The test involves measuring the depth of a groove made by the shearing tool in fresh specimens and also in the same specimens after soaking 7 days in 1 % sulfuric acid.

8.2 Draw with a pencil compass, on at least three of the 2 by 4-in. (50.8 by 101.6-mm) specimens, an arc of a circle of the same radius as that made by the shearing tool. Mark each arc at four points for thickness measurements, as indicated in Fig. 1. Measure the thickness at each point to the nearest 0.0001 in. (0.0025 mm). With a 2.2-lbf (9.8-N) load on the shearing tool, groove each specimen along the penciled arc by rotating the turntable slowly and steadily by hand in a counter clockwise direction. Then repeat the thickness measurements at the same four points to determine the depth of groove made by the shearing tool in fresh specimens.

8.3 Then put the specimens in a glass vessel and completely cover with 1 % sulfuric acid solution. Space the specimens in the container so that the acid has free access to the 2 by 4-in.

¹ This test method is under the jurisdiction of ASTM Committee C-18 on Dimension Stone and is the direct responsibility of Subcommittee C18.01 on Test Methods.

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² *Annual Book of ASTM Standards*, Vol 04.07.

³ Described in the 1962 Bulletin 62203–502 of the Taber Instrument Co., North Tonawanda, NY.

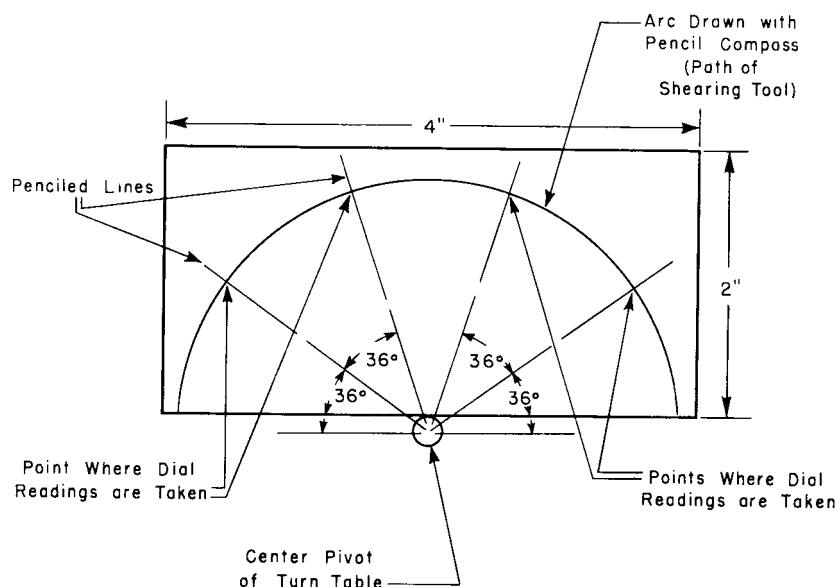


FIG. 1 Diagram of Slate Specimen Prepared for Test with Taber Shear/Scratch Tester

(50.8 by 101.6-mm) faces. Pour off the acid solution each day and replace with fresh solution. At the end of 7 days remove the specimens from the acid, thoroughly wash with water, and dry for 24 h at $105 \pm 2^\circ\text{C}$.

NOTE 3—*Example*—A convenient means of determining the amount of H_2SO_4 required for the test is as follows: Suppose one has 96 % H_2SO_4 (sp gr 1.84) and the volume of diluted acid necessary for the test is 2000 mL. Let X equal the weight of 96 % H_2SO_4 required. Then:

$$0.96X/(X + 2000) = 0.01 \quad (1)$$

From this equation, X is determined as 21.05 g. The volume of this weight of 96 % H_2SO_4 is $21.05/1.84 = 11.4$ mL. (The error due to assuming the weight of 1 mL of water as 1 g is not appreciable.)

8.4 When the specimens have cooled, repeat the same procedure as outlined in 8.2 on the faces opposite to those scored before the treatment.

8.5 Record the depth of softening for the specimen as the average depth of groove for each specimen after the acid treatment minus that for the specimen before the treatment.

9. Procedure by Hand Scraping

9.1 In this procedure the depth of softening in acid is determined by hand scraping. The scraping shall be done with the “cutting edges” of the tool.

9.2 Apply approximately a 3-lbf (13-N) pressure on the “cutting edge” (Note 4). Hold the blade on the top surface of the specimen at an angle of approximately 30° . Move the cutting edge forward about $1\frac{1}{2}$ in. (38.1 mm) for each stroke, and let each stroke follow the same path. Make eight strokes with one cutting edge and eight with the other. Before each specimen is scraped, sharpen the cutting edge.

NOTE 4—In this test the pressure on the blade is estimated but not definitely controlled. The following guide in applying the proper pressure is suggested: Grasp the handle of the tool in the same way as in scraping a specimen. Press a “cutting edge” on the weighing table of a small platform scale when the weighing beam is loaded for 3 lbf (13 N). The pressure on the tool and also the amount of bending of the blade required to raise the beam are used as criteria in judging the pressure to apply in the

test. This seemingly crude test gives reasonably concordant results for the reason that the softened layer of slate is easily scraped off but the sound slate underneath is removed very slowly. Since the specified number of strokes is considerably more than necessary to remove the softened layer, it is more important to apply a constant pressure than one of a definite amount.

9.3 Scrape three or more specimens of each sample (as described in Section 6) in the original condition at the center of one 2 by 4-in. (50.8 by 101.6-mm) face. Locate the center by drawing the diagonals of the rectangle, and do the thickness measurements before and after scraping to the nearest 0.0001 in. (0.0025 mm). After soaking the specimens for 7 days in acid (as described in 8.3), measure the thickness before scraping, then scrape the other faces of the specimens to determine the depth of softening. Reduce the second depth of scraping by the depth scraped off before the acid treatment. Record the average of all specimens of each sample as the depth of softening of the sample.

9.4 The depth of softening is the depth of scraping after the acid treatment minus the depth of scraping before the acid treatment. Record the average of all specimens of each sample as the depth of softening of the sample.

NOTE 5—Thickness measurements are required before scraping in the acid soak condition because in some cases, there is swelling of the specimen that could result in an erroneous depth of softening.

10. Report

10.1 The report shall include the following:

10.1.1 The procedure used,

10.1.2 The average depth of softening of all individual specimens of each sample reported as the depth of softening of that sample,

10.1.3 Identification of each sample, including name and location of the quarry, name and position of the ledge, date when sample was taken, and trade name or grade of the slate,

10.1.4 Size and shape of the test specimens, and

10.1.5 Description of the way in which the specimens were prepared.

11. Precision and Bias

11.1 Individual variations in a natural product may result in deviation from accepted values. A precision section will be added when sufficient data are available to indicate acceptable tolerances in repeatability and reproducibility.

12. Keywords

12.1 dimension stone; slate; stone; weather resistance

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