



# Standard Test Method for Weather Resistance of Slate<sup>1</sup>

This standard is issued under the fixed designation C217/C217M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 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 shear/scratch tester 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 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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:<sup>2</sup>

C119 Terminology Relating to Dimension Stone

C1799 Guide to Dimension Stone Test Specimen Sampling and Preparation

## 3. Terminology

3.1 *Definitions*—All definitions are in accordance with Terminology C119.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C18 on Dimension Stone and is the direct responsibility of Subcommittee C18.01 on Test Methods.

Current edition approved Nov. 1, 2015. Published November 2015. Originally approved in 1948. Last previous edition approved in 2015 as C217/C217M–15. DOI: 10.1520/C0217\_C0217M-15A.

<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.

## 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*, (see Fig. 1) with the shear hardness tool, Model S-20<sup>3</sup>, or its equivalent. The apparatus includes a removable scale beam that is mounted on a pivotal shaft projecting from an adjustable gage block that can be raised or lowered, corresponding with the thickness of a test specimen up to 0.5 in. [12.7 mm]. The scale beam is set at an angle of 70° referencing the shaft it pivots on. A calibrated weight and sliding weight are mounted on the scale beam to achieve the desired load. Operated by an on/off switch, the motorized turntable rotates counter clockwise at a constant speed of 0.6 r/min.

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. [75 mm] and a width of ¾ in. [20 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. [250 mm] or more in length and of any standard width are sufficient for this test.

NOTE 3—Refer to Guide C1799 for additional information on selecting, preparing, and conditioning test specimens.

## 7. Test Specimens

7.1 Prepare at least three specimens, each 2 by 4 in. [50 by 100 mm] measured along the cleavage faces, for determining

<sup>3</sup> The sole source of supply known to the committee at this time is Taber Industries, North Tonawanda, NY. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

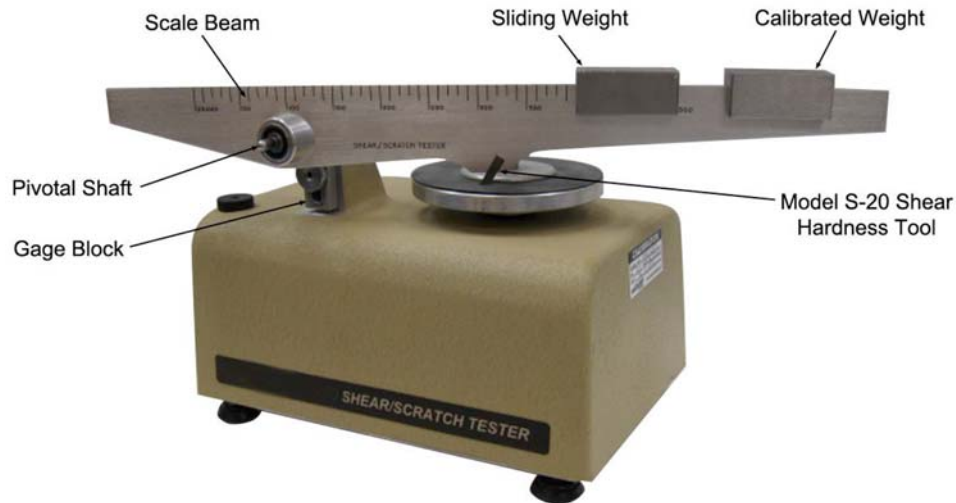


FIG. 1 Shear/Scratch Tester

the depth of softening in a 1 % solution of sulfuric acid. The 2 by 4 in. [50 by 100 mm] 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 mm] from the edges or nail holes.

NOTE 4—While the minimum of three specimens is acceptable, evaluating six specimens per sample will provide greater confidence in your test results.

## 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 by 100 mm] specimens, an arc of a circle of the same radius as that made by the shearing tool. Mark the arc at four points to identify the position for taking thickness measurements, as indicated in Fig. 2. Measure the thickness at each point to the nearest 0.0001 in. [0.002 mm].

NOTE 5—All measurements are to be taken normal to the surface of the specimen. In lieu of measuring specimen thickness before and after scraping, groove depth may be measured directly using surface metrology equipment.

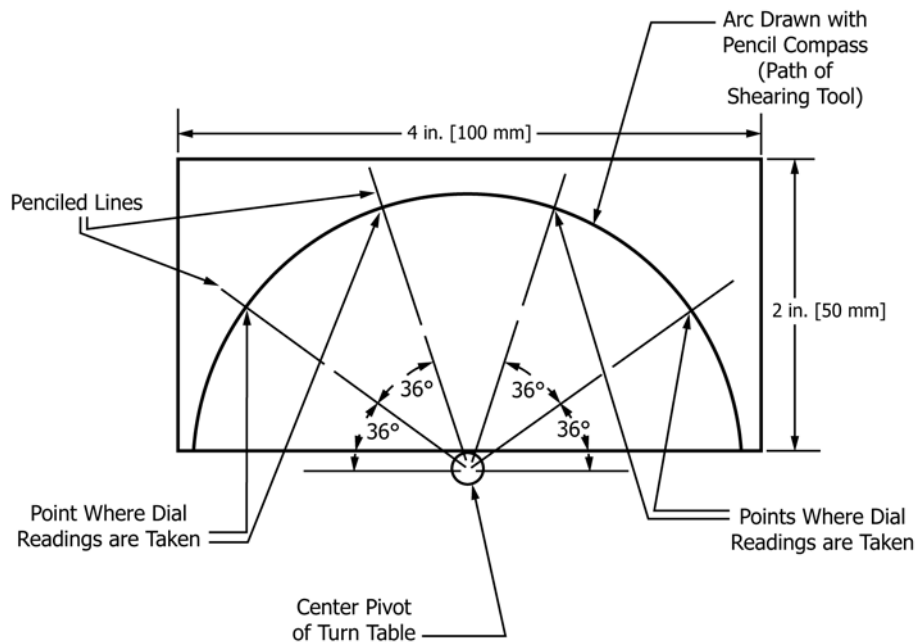


FIG. 2 Diagram of Slate Specimen Prepared for Test with Shear/Scratch Tester

8.3 With a 2.2 lbf [10 N] load on the shearing tool, groove each specimen along the penciled arc by rotating the turntable in a counter clockwise direction.

8.4 Repeat the thickness measurements at the same four points to determine the depth of groove made by the shearing tool.

8.5 Place 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. [50 by 100 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  $221 \pm 4^\circ\text{F}$  [ $105 \pm 2^\circ\text{C}$ ].

NOTE 6—*Example*—A convenient means of determining the amount of  $\text{H}_2\text{SO}_4$  required for the test is as follows: Suppose one has 96 %  $\text{H}_2\text{SO}_4$  (sp gr 1.84) and the volume of diluted acid necessary for the test is 2000 mL. Let  $X$  equal the weight of 96 %  $\text{H}_2\text{SO}_4$  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 %  $\text{H}_2\text{SO}_4$  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.)

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

NOTE 7—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.

8.7 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 test involves measuring the depth of a scrape made by the cutting edges of a hand scraping tool in specimens of original condition and also on the same specimens after soaking 7 days in a 1 % sulfuric acid.

9.2 Before each specimen is scraped, sharpen the cutting edges of the hand scraping tool. See 5.1.2.

9.3 On at least three specimens, locate the center by drawing the diagonals of the rectangle. Measure the thickness before scraping to the nearest 0.0001 in. [0.002 mm].

9.4 Hold the blade on the top surface of the specimen at an angle of approximately  $30^\circ$ . Apply approximately a 3 lbf [15 N] pressure on the “cutting edge” (Note 8) and move the cutting edge forward about  $1\frac{1}{2}$  in. [40 mm] for each stroke.

NOTE 8—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 [15 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.

9.5 Following the same path, make eight strokes with one cutting edge and eight with the other.

9.6 Measure the thickness at the same point to determine the depth of the scrape made by the hand scraping tool.

9.7 After soaking the specimens for 7 days in acid (as described in 8.5), measure the thickness (Note 5 and Note 7).

9.8 When the specimens have cooled, repeat the same procedure as outlined in 9.2-9.6 on the faces opposite to those scraped before the treatment.

9.9 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.

## 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, in inches [mm].

10.1.3 Identification of each sample, such as 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 if different than 7.1, 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; durability; slate; stone; test; weather resistance



APPENDIX

(Nonmandatory Information)

X1. HISTORICAL INFORMATION

X1.1 This test method was originally approved in 1948 and utilized a manually operated version of the Taber Shear/Scratch Tester, Shear Hardness Attachment E-3720, which was an accessory for Taber Rotary Abraser Model E-4010.

which was motorized as described in 1962 Bulletin 62203-502.

X1.2 Previous instruments referenced in this test method include Model 203 (see Fig. X1.1) which was a stand-alone, manually operated instrument and Model 502 (Fig. X1.2)



FIG. X1.1 Taber Shear/Scratch Tester Model 203



FIG. X1.2 Taber Shear/Scratch Tester Model 502



## **C217/C217M – 15a**

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