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Standard Test Methods of Flexure Testing of Slate (Breaking Load, Modulus of Rupture, Modulus of Elasticity)[1]

This standard is issued under the fixed designation C 120/C 120M; 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.

~~ε[1] NOTE—To correct 10.1, the words "by centering the specimen" were added to the fourth sentence editorially in June 2006.~~

INTRODUCTION

Due to the unique properties of slate, the flexure test is better adapted to use for strength and elasticity determinations than either compression or tension tests. Furthermore, several uses of slates are such that these determinations are of special interest and value, besides furnishing comparative data.

The property of slate termed "grain" causes a slab of the material to break transversely in one direction somewhat more readily than at right angles to this direction. For this reason it is desirable to test the strength and elasticity both parallel and perpendicular to the grain.

Breaking load test results for samples of roofing slate are only valid for the commercial supply of slates of that thickness or greater. For the commercial supply of thinner roofings slates, testing on samples of the minimum specified thickness must be conducted.

When comparing slates of equal thickness, but from various sources, slates which meet the required breaking load at the lowest specimen thickness will yield the best performance on the roof in terms of resistance to impact damage.

1. Scope

1.1 These test methods cover determination of the breaking load, modulus of rupture and modulus of elasticity of slate by means of flexure tests.

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:*[2]

C 99 Test Method for Modulus of Rupture of Dimension Stone

C 119 Terminology Relating to Dimension Stone

3. Terminology

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

4. Significance and Use

4.1 These test methods are useful in indicating the differences in flexure (breaking load, modulus of rupture, modulus of

[1] These test methods are under the jurisdiction of ASTM Committee C18 on Dimension Stone and are the direct responsibility of Subcommittee C18.01 on Test Methods.
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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.

elasticity) between various slates. These test methods also provide one element in the comparison of slates.

5. Sampling

5.1 Select the sample to represent a true average of the type or grade of stone under consideration and of the quality supplied to the market under the type designation to be tested. The sample may be selected by the purchaser or his authorized representative from the quarried stone or taken from the natural ledge and shall be of adequate size to permit the preparation of the desired number of test specimens. When perceptible variations occur, the purchaser may select as many samples as are necessary for determining the variations in flexure (breaking load, modulus of rupture, modulus of elasticity).

MODULUS OF RUPTURE

6. Test Specimens

6.1 *Structural or Electrical Slate*— Six representative specimens, 12 by 1½ by 1 in. ~~(305~~[300 by ~~38.1~~40 by ~~25.4 mm)~~25 mm] in size, of the particular slate under consideration shall be tested.

6.2 *Roofing Slate*—At least ten specimens 4 in. ~~(101.6 mm)~~[101.6 mm] in width, 5 in. ~~(127.0 mm)~~[125 mm] or greater in length and minimum 3⁄16 in. ~~(4.8 mm)~~[5 mm] thick.

7. Preparation of Specimens

7.1 *Structural or Electrical Slate*— Split the slate for the test to a thickness of approximately 1¼ in. ~~(31.8 mm)~~[30 mm] and then saw into strips 12 in. ~~(304.8 mm)~~[300 mm] in length by 1½ in. ~~(38.1 mm)~~[40 mm] in width. Cut half of these with the length parallel to the grain and half with the length perpendicular to the grain. Plane or rub down the 12 by 1½-in. ~~(304.8~~[300 by ~~38.1-mm)~~40-mm] faces to a thickness of approximately 1 in. ~~(25.4 mm),~~[25 mm], taking care to have the finished surfaces as nearly parallel as practicable.

7.2 *Roofing Slate*—Cut one 4 by 5-in. ~~(101.6~~[100 by ~~127.0-mm)~~125-mm] specimen from each of a minimum 10 shingles. The saw blade shall be a continuous rim, diamond impregnated type, mounted to a water-cooled sliding bed saw capable of making a clean cut with no lacerated edges. Cut no part of the specimen nearer than 1 in. ~~(25.4 mm)~~[25 mm] to a sheared edge or nail hole. The 5 in. ~~(127.0 mm)~~[125 mm] or longer dimension is to be measured and cut parallel with the long dimension of the slate shingle. Do not resurface the split faces.

8. Conditioning

8.1 Dry the specimens for 48 h in a ventilated oven at a temperature of ~~60~~140 ± ~~2°C (140~~4°F [60 ± ~~4°F).~~2°C]. At the 46th, 47th and 48th hour, weigh the specimens to ensure that the weight is the same. If the weight continues to drop, continue to dry the specimens until there are three successive hourly readings with the same weight.

9. Marking and Measuring

9.1 On structural or electrical slate, rule the center lines with a try-square perpendicular to the edges of the specimens. Likewise, rule the span lines, parallel to, and 5 in. ~~(127 mm)~~[125 mm] from, the center lines. On specimens of roofing slate rule the center lines perpendicular to an edge that is parallel to the length of the shingle. Rule span lines parallel to, and 1 in. ~~(25.4 mm)~~ [25 mm] from, the center lines. Measure the specimen thickness at three points along the center line to the nearest 0.01 in. ~~(0.254 mm)~~[0.1 mm] and record the average as the specimen thickness.

10. Procedure

~~10.1The~~10.1 The testing machine shall be accurate to 1 % within the range from 100 to 2000 lbf ~~(444.8~~[500 to ~~8896 N).~~10 000 N]. Place the specimens flat on the rocker type knife-edges as shown in Fig. 1 of Test Method C 99. Apply the load at the center span through a rocker or fixed type knife-edge. When a load of ~~10 lbf (44 N)~~ 10 lbf [50 N] has been applied, stop the loading and make all knife edges coincide with the marks on the specimen by centering the specimen under the loading edge and moving the supporting edges under the span marks. Apply loads at rates not exceeding 1000 ~~lbf (4448 N)/min~~lbf/min [5000 N/min] until failure, and record the breaking load to the nearest 5 lbf ~~(22.2 N).~~ [20 N].

NOTE 1—When all three knife edges are of the rocker type, care must be taken to adjust all three until the top face of the specimen is horizontal when loaded.

11. ~~Calculation - Structural or Electrical Slate~~ Calculation—Structural or Electrical Slate

11.1 Calculate the modulus of rupture as follows:

$$R = (3Wl/2bd^2) \quad (1)$$

where:

R = modulus of rupture, psi ~~(MPa),~~ [MPa],
W = breaking load, lbf ~~(N),~~ [N],