



Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone¹

This standard is issued under the fixed designation C 97; 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 the tests for determining the absorption and bulk specific gravity of all types of dimension stone, except slate.

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 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 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 absorption between the various dimension stones. These test methods also provide one element in comparing stones of the same type.

5. Sampling

5.1 The sample shall be selected to represent a true average of the type or grade of stone under consideration and shall be

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.

Current edition approved Oct. 1, 2008. Published December 2008. Originally approved in 1930. Last previous edition approved in 2002 as C 97 – 02.

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.

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 at least five test specimens. When perceptible variations occur, the purchaser may select as many samples as are necessary for determining the range in properties.

6. Test Specimens

6.1 The specimens may be cubes, prisms, cylinders, or any regular form with least dimension not under 50 mm (2 in.) and greatest dimension not over 75 mm (3 in.) but the ratio of volume to surface area shall not be less than 8 nor greater than 12.5 when measuring in millimetres (0.3 and 0.5 when measuring in inches). All surfaces shall be reasonably smooth. Saw or core drill surfaces are considered satisfactory, but rougher surfaces shall be finished with No. 80 abrasive. No chisels or similar tools shall be used at any stage of preparing the specimens.

6.2 Prepare at least five specimens from each sample.

6.3 The same specimens may be used to determine both water absorption and bulk specific gravity. In this case, follow the procedures in 7.1-7.3 and 10.1, and issue a single report containing all information required in 9 and 13. Alternatively, separate specimens may be prepared from the same or different samples. In this case, follow the applicable procedure for separate determination and reporting of water absorption or bulk specific gravity, or both.

7. Procedure

7.1 Dry the specimens for 48 h in a ventilated oven at a temperature of $60 \pm 2^\circ\text{C}$ ($140 \pm 4^\circ\text{F}$). 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.

7.2 After drying, cool the specimens in the room for 30 min and weigh. When the specimens cannot be weighed immediately after cooling, store them in a desiccator. Determine the weights to the nearest 0.01 g (0.0005 oz).

7.3 Immerse the specimens completely in filtered or distilled water at $22 \pm 2^\circ\text{C}$ ($72 \pm 4^\circ\text{F}$) for 48 h. At the end of this period remove them from the water bath one at a time, surface dry with a damp cloth, and weigh to the nearest 0.01 g (0.0005 oz).

8. Calculation and Report

8.1 Calculate the weight percentage absorption (Note 1) for each specimen as follows:

$$\text{Absorption, weight \%} = [(B - A)/A] \times 100 \quad (1)$$

where:

A = weight of the dried specimen, and

B = weight of the specimen after immersion.

NOTE 1—If the percentage of absorption by volume is desired it will be necessary to determine the bulk specific gravity and multiply each value of percentage absorption by weight by the corresponding bulk specific gravity value.

8.2 Calculate the mean water absorption of the sample as the average of the weight percentage absorption for all specimens.

9. Report

9.1 The report shall contain the following information:

9.1.1 Identity of party providing the sample.

9.1.2 Name of stone.

9.1.3 Identity of sample.

9.1.4 Mean water absorption of sample.

9.1.5 Any variations to the procedure, including specimen dimensions, given in this standard

9.2 The report shall also contain the following information for each specimen:

9.2.1 Weight of dried specimen

9.2.2 Weight of soaked and surface-dried specimen in air.

9.2.3 Percentage water absorption by weight of specimen.

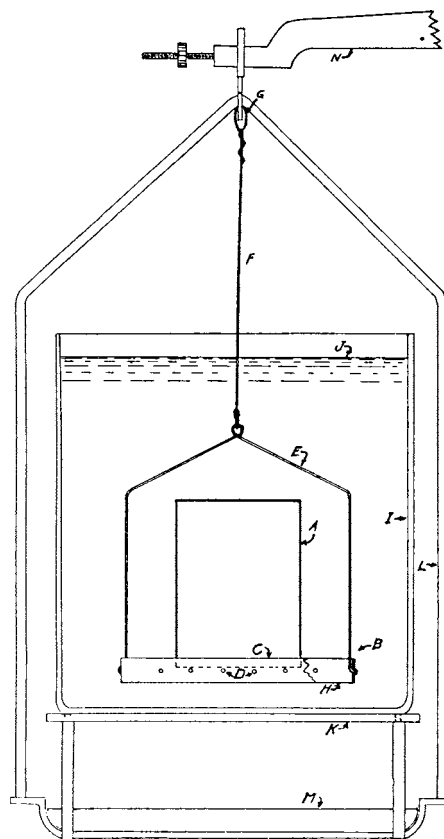
BULK SPECIFIC GRAVITY

10. Procedure

10.1 When both absorption and bulk specific gravity are to be determined on the same specimens, weigh the saturated specimens suspended in filtered or distilled water at $22 \pm 2^\circ\text{C}$ ($72 \pm 4^\circ\text{F}$) immediately after the absorption tests are completed. Determine the suspended weights to the nearest 0.01 g (0.0005 oz).

10.2 A satisfactory means of weighing specimens in water is to use a wire basket similar to that illustrated in Fig. 1 to suspend the specimen in a vessel of water. The water vessel shall be large enough so that only the suspending cable of the basket passes through the water surface. Ensure air bubbles are removed from the basket and specimen before recording the weight.

10.2.1 The water vessel can be supported on the balance pan with the basket suspended from a frame also supported on a balance pan, as illustrated in Fig. 1. Determine the weight of the basket when suspended in water to the same depth as when weighing specimens therein. Subtract the weight of the basket to the nearest 0.01 g from the combined weight of the specimen and basket.



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|---|--|
| A—Specimen. | G—Loop for attachment to stirrup of balance. |
| B—Suspension basket. | H—Cutaway section of basket. |
| C—Brass ring. | I—Water jar. |
| D—Bottom of basket of 1.83 mm (No. 13 B & S gage) brass wire (all joints soldered). | J—Water level. |
| E—Bail of basket of 1.83 mm (No. 13 B & S gage) brass wire. | K—Water jar support. |
| F—Suspension wire of 0.812 mm (No. 20 B & S gage) brass wire. | L—Balance pan suspension rod. |
| | M—Balance pan. |
| | N—Beam of balance. |

FIG. 1 Bulk Specific Gravity Test Assembly: Water Vessel on Balance Pan

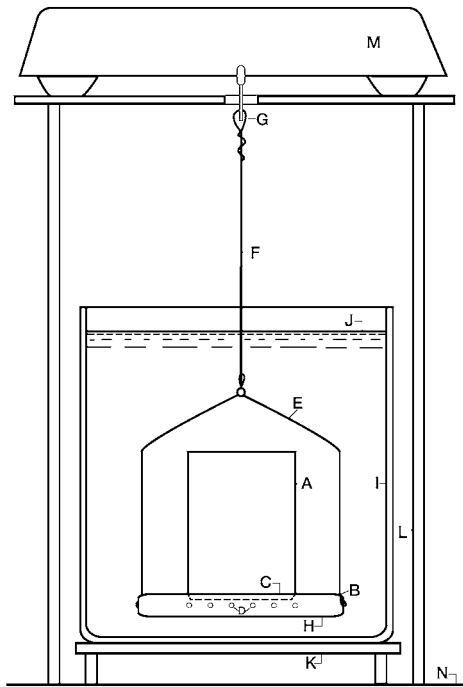
10.2.2 The basket can be suspended beneath an electronic balance with the water vessel supported independently, as illustrated in Fig. 2. Zero the balance with the basket suspended in water to the same depth as when weighing specimens.

10.3 When the bulk specific gravity test is made on specimens other than those used for absorption, determine the dry weights as in 7.1 and 7.2. Immerse the specimens in filtered or distilled water at $22 \pm 2^\circ\text{C}$ ($72 \pm 4^\circ\text{F}$) for at least 1 h or until air bubbles do not form on the specimens within 5 min. Surface dry the specimens as in 7.3, weigh to the nearest 0.01 g (0.0005 oz), and return to the water bath. Determine the weights of the specimens suspended in water in accordance with 10.2 before the specimens have stood in the water more than 5 min.

11. Calculation

11.1 Calculate the bulk specific gravity as follows:

$$\text{Bulk specific gravity} = A/(B - C) \quad (2)$$



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|--|---|
| A—Specimen. | G— Loop for attachment to stirrup of balance. |
| B—Suspension basket. | H—Cutaway section of basket. |
| C—Brass ring. | I—Water jar. |
| D— Bottom of basket of 1.83 mm (No. 13 B & S gage) brass wire (all joints soldered). | J—Water level. |
| E— Bail of basket of 1.83 mm (No. 13 B & S gage) brass wire. | K—Water jar support. |
| F— Suspension wire of 0.812 mm (No. 20 B & S gage) brass wire. | L—Balance support. |
| | M—Balance. |
| | N—Benchtop. |

FIG. 2 Bulk Specific Gravity Test Assembly: Water Vessel Below Balance

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where:

- A = weight of the dried specimen,
- B = weight of the soaked and surface-dried specimen in air, and
- C = weight of the soaked specimen in water.

11.2 Calculate the mean bulk specific gravity of the sample as the average of the bulk specific gravity for all specimens.

NOTE 2—The bulk specific gravity gives a convenient and accurate means of calculating the unit weight of the stone; for example, drystone weight per cubic metre (cubic foot) = bulk specific gravity × 1000 (62.4).

12. Report

12.1 The report shall contain the following information:

12.1.1 Identity of party providing the sample.

12.1.2 Name of stone.

12.1.3 Identity of sample.

12.1.4 Bulk specific gravity of sample.

12.1.5 Any variations to the procedure, including specimen dimensions, given in this standard.

12.2 The report shall also contain the following information for each specimen:

12.2.1 Weight of dried specimen.

12.2.2 Weight of soaked and surface-dried specimen in air.

12.2.3 Weight of soaked specimen suspended in water.

12.2.4 Bulk specific gravity of specimen.

13. Precision and Bias

13.1 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 in repeatability and reproducibility.

14. Keywords

14.1 absorption; bulk specific gravity; dimension stone; stone; test