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Designation: C 1403 – ~~99a~~00

Standard Test Method for Rate of Water Absorption of Masonry Mortars[1]

This standard is issued under the fixed designation C 1403; 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.

1. Scope*

1.1 This test method covers a standardized laboratory procedure for determining the relative water absorption by capillary uptake (wicking) characteristics of masonry mortars. This test method is not applicable for determining the effectiveness of water repellent coatings.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units 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:*

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)[2]

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[1] This test method is under the jurisdiction of ASTM Committee C-12 on Mortars and Grouts for Unit Masonry and is the direct responsibility of Subcommittee C12.02 on Research and Methods of Test.

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***A Summary of Changes section appears at the end of this standard.**

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C 270 Specification for Mortar for Unit Masonry[3]
C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency[2]
C 511 Specification for Moist Cabinets, Moist Rooms and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes[2]
C 778 Specification for Standard Sand[2]
C 1437 Test Method for Flow of Hydraulic Cement Mortar[2]

3. Significance and Use

3.1 This test method provides a laboratory procedure for determining the relative water absorption properties over time of mortars used for masonry construction. Because the samples are made under laboratory conditions and do not take into account the effect of the masonry substrate or field mixing procedures, this method is not intended for field use. Data generated from this test method may be useful for determining the relative effectiveness of water repellent admixtures or the effect of other admixtures or mortar components on the water repellency of a mortar. However, use caution in interpreting the results. While the resistance of masonry to water penetration may be related to the water absorption of the mortar, it also depends on other factors, such as the workmanship, extent of bond, and the properties of the masonry units and mortar.

4. Apparatus

4.1 *Balance*—A balance sensitive to 0.1 g.

4.2 *Immersion Tank*—A watertight container with a minimum cross section of 300 by 300 mm (12 by 12 in.) and a minimum depth of 75 mm (3 in.) and with a suitable cover to minimize evaporation. Provide specimen supports that allow a minimum of 3 mm (0.12 in.) clearance from the bottom of the container and that cover a maximum of 10 % of the specimen surface area. Provide a flat tank so that when a specimen is set on the supports the water level as specified in 6.4 shall not vary by more than 1 mm (0.04 in.) from one end of the specimen to the opposite end.

4.3 *Specimen Molds*—Metal 50-mm or 2-in. cube specimen molds with removable plastic water tight disposable liners. The plastic liners shall be rigid enough to retain their shape when free standing and filled with mortar.

4.4 *Spoon*—A metal spoon approximately 230 mm (9 in.) in length and with a bowl approximately 100 mm (4 in.) in length.

4.5 *Straightedge*—A steel straightedge not less than 150 mm (6 in.) long and approximately 1.5-3.0 mm (1⁄16 to 1⁄8 in.) thick.

4.6 *Tamper*—A tamper made of a nonabsorptive, nonabrasive, nonbrittle material such as a rubber compound having a Shore A durometer hardness of 80 ± 10, or seasoned oak wood rendered nonabsorptive by immersion for 15 minutes in paraffin at approximately 200°C (392°F), and having a cross section of 13 by 25 mm (0.5 by 1.0 in.) and a convenient length of 127 to 152 mm (5 to 6 in.). The tamping face of the tamper shall be flat and at right angles to the length of the tamper.

4.7 *Trowel*, having a steel blade 100 to 150 mm (4 to 6 in.) in length, with straight edges.

4.8 *Tapping Stick*—A hardwood rod, having a diameter of 16 mm (5⁄8 in.) and a length of 150 mm (6 in.).

4.9 *Timing Device*—A suitable timing device capable of indicating elapsed time up to 24 h to the nearest 1 min.

4.10 *Calipers*—Suitable calipers with parallel jaws for measuring the dimensions of the hardened specimens to the nearest 0.5 mm.

5. Specimen Preparation

5.1 Prepare mortar according to Practice C 305, adjusting the water as necessary to obtain a flow of 110 ± 5 as determined by ~~the flow section of~~ Test Method ~~C 109/C 109M.~~ C 1437. Record the flow. If a modifier is being added to the mortar, the dosage rate, time of addition, and mixing sequence shall follow the manufacturer's recommendation. If there is no manufacturer's recommendation, add a liquid modifier with the water and add a dry modifier with the cementitious components. Record the type and amount of each material by weight used in the mortar. In addition, record the type and amount by weight or volume of any modifier used and when it was added to the mix. If applicable, record the kind of mortar (cement-lime, mortar cement, or masonry cement), the type (O, N, S, or M), and whether the mortar is made to the proportion or property specification of Specification C 270.

5.1.1 To test the behavior of mortar components independent of the qualities of the masonry sand use a blend of equal parts by weight of graded standard sand and standard 20 - 30 sand conforming to Specification C 778.

5.2 Prepare 50-mm or 2-in. cube specimens according to Test Method C 109/C 109M except the mortar shall be the mortar prepared in 5.1 and the molds shall be as specified in 4.3. Make a minimum of three replicate specimens from each mortar batch.

5.3 Immediately upon completion of casting, place the test specimens in a moist closet or moist room conforming to the requirements of Specification C 511. Keep all test specimens in their molds and in the moist closet or moist room for 24 ± 1 h with their upper surfaces exposed to the moist air but protected from dripping water.

5.4 At 24 ± 1 h from the time of mixing remove the specimens from the molds. Mark the side of each specimen indicating which surface is top, as cast. Cure the specimens in a moisture tight plastic bag at 24 ± 8°C (75 ± 15°F) for a total 28 days from the time of casting.

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[2] *Annual Book of ASTM Standards*, Vol 04.01.
[3] *Annual Book of ASTM Standards*, Vol 04.05.

5.5 At the age of 28 days ± 12 h from the time of casting, remove the specimens from the plastic bag and dry in a ventilated oven at 110 to 115°C (230 to 240°F) for a minimum of 24 h and until the weight change is not greater than 0.2 % over a one hour period. Remove the specimens from the oven and cool in ambient conditions (24 ± 8°C (75 ± 15°F)) for a minimum of 2 h and until the specimens reach ambient temperature. Begin testing within 48 h after reaching ambient temperature.

6. Procedure

6.1 Calculate the area of the test surface for each specimen from the length and width of the test surface. The test surface is the top face of the cube, as cast. Using calipers, measure the length of the cube test surface to the nearest 0.5 mm at three locations along its height and record as L_1 the average length in millimetres to the nearest 0.5 mm. Using calipers, measure the width of the cube test surface to the nearest 0.5 mm at three locations along its height and record as L_2 the average width in millimetres to the nearest 0.5 mm.

6.2 Record as W_0 the initial weight in grams to the nearest 0.1 g of each individual specimen immediately prior to testing.

6.3 Place the immersion tank on a flat level surface. Place all specimens in the immersion tank(s) with their top faces, as cast, in contact with the specimen supports as illustrated in Fig. 1.

6.4 Add water to the immersion tank(s) so that the specimens are partially immersed in 3.0 ± 0.5 mm (0.12 ± 0.02 in.) of water. Cover the immersion tank(s) to minimize evaporation.

6.5 At 0.25, 1, 4, and 24 h, measure the weight in grams to the nearest 0.1 g of each specimen and record as W_T where T is the measurement time in hours. Wipe off surface water from each specimen with a damp cloth prior to each weighing. Complete the wipe within 10 s of removal from contact with the water and complete weighing within 1 min.

6.6 After each weighing, replace the specimens into the immersion tank(s) and add water as necessary to maintain the immersion depth specified in 6.4. Re-cover the immersion tank(s).

7. Calculation

7.1 Calculate and record as A_T the water absorption in grams/100 cm^2, at each time period, T, for each specimen, as follows:

$$A_T = (W_T - W_0) \times 10\,000 \,/\, (L_1 \times L_2) \quad (1)$$

where:

W_T = the weight of the specimen at time T in grams to the nearest 0.1 g,
W_0 = the initial weight of the specimen in grams to the nearest 0.1 g,
L_1 = the average length of the test surface of the mortar specimen cube in mm to the nearest 0.5 mm, and
L_2 = the average width of the test surface of the mortar specimen cube in mm to the nearest 0.5 mm.

7.2 Calculate and record as, A_T (avg), the average A_T for each set of three or more replicate specimens at each time interval.

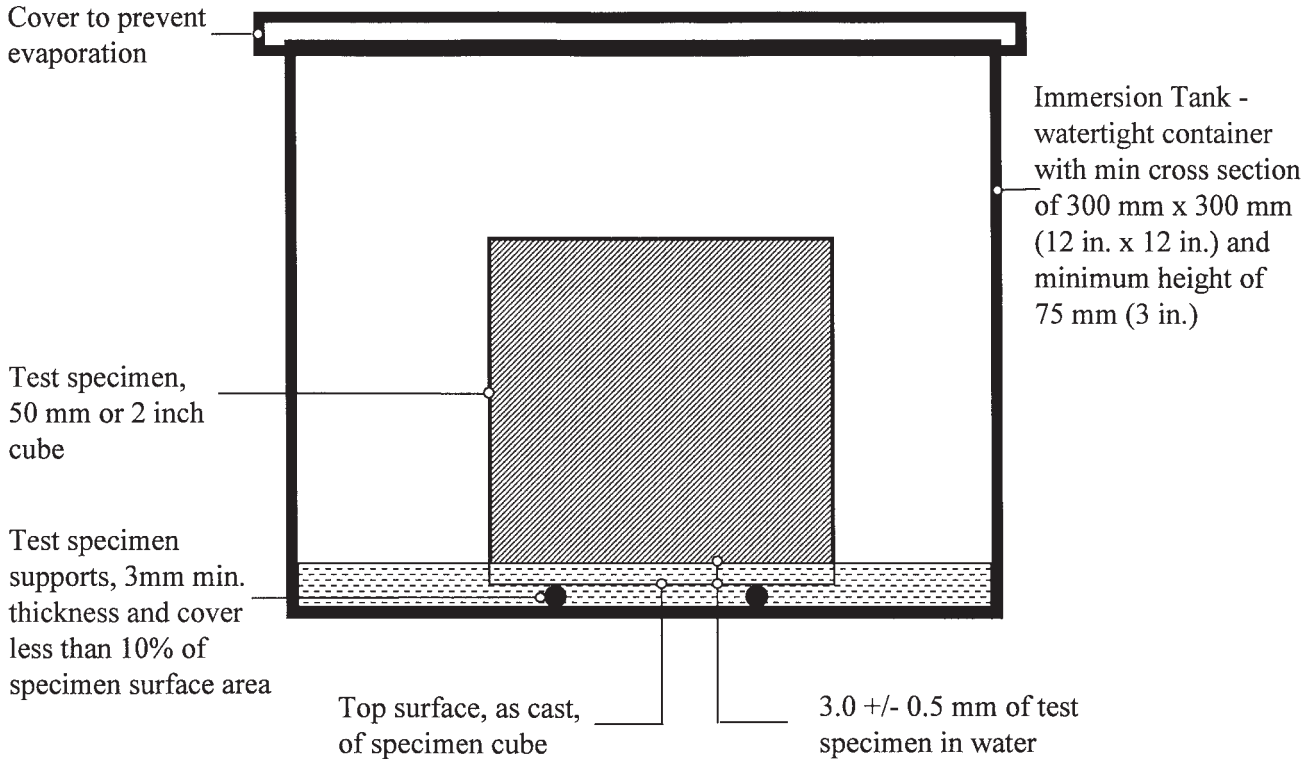

FIG. 1 Specimen Configuration During Testing

8. Report

8.1 Report the mortar mixture, as follows:
8.1.1 The type and amount of each material by weight used in the mortar,
8.1.2 The type and amount by weight or volume of any modifier used in the mortar and when it was added to the mix,
8.1.3 The actual flow of the mortar batch(es), and
8.1.4 If applicable:
8.1.4.1 The kind of mortar (cement-lime, mortar cement, or masonry cement),
8.1.4.2 The type (O, N, S, or M) used, and
8.1.4.3 Whether the mortar was made to the proportion or property specification of Specification C 270.
8.2 Report the water absorption test results, as follows:
8.2.1 For each specimen, report:
8.2.1.1 L_1, the average length of the test surface of the mortar specimen cube in mm to the nearest 0.5 mm,
8.2.1.2 L_2, the average width of the test surface of the mortar specimen cube in mm to the nearest 0.5 mm,
8.2.1.3 W_0, the initial weight of the specimen in g to the nearest 0.1 g,
8.2.1.4 W_T, the weight of the specimen at each time T in g to the nearest 0.1 g, and
8.2.1.5 A_T, the water absorption of the specimen at each time T in g/100 cm^2.
8.2.2 For each set of three or more replicates, report:
8.2.2.1 A_T(avg), the average water absorption at each time T in g/100 cm^2,

9. Precision and Bias

9.1 A precision and bias statement is not available for this test method.

10. Keywords

10.1 absorption; absorption rate; masonry mortar; water repellent

SUMMARY OF CHANGES

(1) Changed the reference test method for determining flow to Test Method C 1437 from Test Method C 109/C 109M in Section 2 and Paragraph 5.1.

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