Designation: C 1506 – 08

Standard Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters[1]

This standard is issued under the fixed designation C 1506; 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 provides for the determination of water retention of hydraulic cement-based mortars and plasters.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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.* (**Warning**—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.)[2]

2. Referenced Documents

2.1 *ASTM Standards:* [3]

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

C 185 Test Method for Air Content of Hydraulic Cement Mortar

C 230/C 230M Specification for Flow Table for Use in Tests of Hydraulic Cement

C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency

C 511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C 1437 Test Method for Flow of Hydraulic Cement Mortar

3. Summary of Test Method

3.1 The flow of the mortar or plaster is determined. The mortar or plaster is then subjected to a controlled vacuum suction for 60 s, after which the flow is again determined. The water retention is the final flow divided by the initial flow expressed as a percentage.

4. Significance and Use

4.1 This test method provides a means for determining the ability of mortars and plasters to retain water under suction. Test results may be used to determine compliance with specifications.

4.2 The results obtained using this test method can be used to compare the relative ability of mortars and plasters to retain water under suction.

4.3 The results obtained using this test method for masonry mortars do not necessarily indicate the degree of water retention when used with masonry units, since the amount of water absorbed by the unit depends on the rate of absorption of the masonry unit.

4.4 The results obtained using this test method for plasters (stucco) do not necessarily indicate the degree of water retention when the plaster is applied as a second coat on the surface of a previously applied plaster base coat, since the amount of water absorbed from the second coat of plaster depends on the rate of absorption of the base coat. This is also true when a plaster is applied as a coating on masonry units.

5. Apparatus

5.1 *Tamper*, conforming to Test Method C 109/C 109M.

5.2 *Straightedge*, conforming to Test Method C 185.

5.3 *Flow Table*, conforming to Specification C 230/C 230M.

5.4 *Mixing Apparatus*, conforming to the requirements prescribed in Practice C 305.

5.5 *Filtration Assembly*, an apparatus essentially as shown in Fig. 1 shall be used. This apparatus consists of a perforated dish resting on a funnel, which is connected by a three-way stopcock to a vacuum flask, to which a controlled vacuum is applied. The perforated dish shall be made of metal not attacked by masonry mortar or plaster (Note 1). The metal base

[1] This test method is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.22 on Workability.

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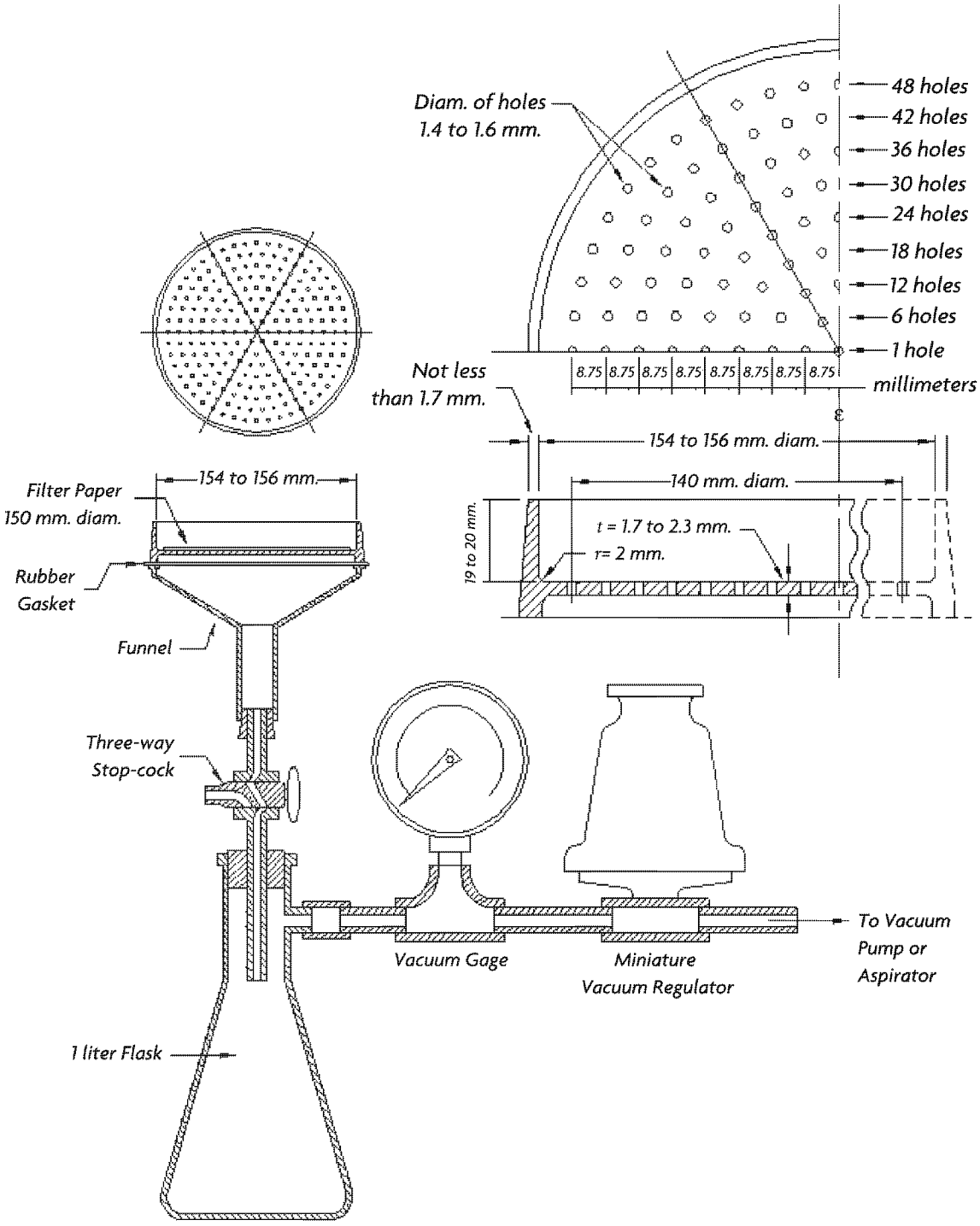
[2] Section on Safety, Manual of Cement Testing, *Annual Book of ASTM Standards*, Vol 04.01.

[3] 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.

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



NOTE—The gasket is to be synthetic rubber. The stopcock and the bore of the tubing shall be at least 4-mm. A check valve or water trap, or both, is suggested for the connection to the vacuum source.

FIG. 1 Apparatus Assembly for the Water-Retention Test

of the dish shall have a thickness of 2.0 ± 0.3 mm and shall conform to the requirements given in Fig. 1. The stopcock bore shall have a 4.0 ± 0.5-mm diameter, and the connecting glass tubing shall have a minimum inside diameter of 4 mm. The length of the tubing projecting into the 1-L flask from the stopcock shall extend at least 25 mm below the center line of the vacuum connection. The contact surfaces of the funnel and perforated dish shall be plane and may need to be lapped to ensure intimate contact. An airtight seal shall be maintained between the funnel and the dish during the test. This shall be accomplished by either of the following procedures. (*1*) A synthetic (grease-resistant) rubber gasket may be permanently

sealed to the top of the funnel using petrolatum or light grease to ensure a seal between the gasket and dish. (2) The top of the funnel may be lightly coated with petroleum or light grease to ensure a seal between the funnel and dish. Care should be taken to ensure that none of the holes in the perforated dish become clogged. Hardened, smooth, not rapid filter paper shall be used. It shall be 150 mm in diameter and be placed so as to completely cover the perforations in the dish.

NOTE 1—Stainless steel, brass, and bronze are suitable metals for this purpose.

5.6 *Controlled Vacuum Source*:

5.6.1 A vacuum gage capable of reading at least 9-kPa pressure in 0.1-kPa increments (Note 2 and Note 3), connected to a miniature vacuum regulator having a maximum 55-kPa capacity, which is then connected to a vacuum pump or water aspirator as shown in Fig. 1. Connection is made between the vacuum flask and the vacuum gage.

NOTE 2—Vacuum values are all given as pressure relative to atmospheric pressure.

NOTE 3—Gages reading pressure in other units are acceptable as long as their capacity and scale increments comply with the levels specified here. (For example, a vacuum gage with a minimum capacity of 70 mm of Hg in 1-mm increments is acceptable. To convert mm of Hg to kPa, multiply by 0.1333. Thus the 7.0-kPa starting pressure is equivalent to 53-mm Hg.)

6. Temperature and Humidity

6.1 The temperature of the mixing room and the room containing the water retention apparatus shall conform to the requirements of Specification C 511.

7. Materials

7.1 The composition of the mortar or plaster to be tested for water retention shall be that described in the specification of the material being considered, or that desired.

8. Mixing of Mortar and Plaster

8.1 The mortar or plaster to be tested for water retention shall be mixed as specified in the section on Procedure for Mixing Mortars of Practice C 305, or as described in the specification for the material being considered.

9. Procedure

9.1 *Preparation of Apparatus*—Adjust the vacuum to 7.0 ± 0.4 kPa (Note 2). Seat the perforated dish on the greased gasket or greased rim of the funnel. Place a wetted filter paper in the bottom of the dish. Turn the stopcock to apply the vacuum to the funnel and check the apparatus for leaks and to determine that the required vacuum is obtained. Then turn the stopcock to shut off the vacuum from the funnel.

9.2 *Determination of Flow*—Determine the flow in accordance with Test Method C 1437.

9.3 *Preparation of Mortar or Plaster Bed*—Immediately after making the flow test, return the mortar or plaster on the flow table to the mixing bowl and remix the entire batch for 15 s at medium speed. Immediately after remixing, fill the perforated dish with the material to slightly above the rim. Tamp 15 times with the tamper. Apply ten of the tamping strokes at approximately uniform spacing adjacent to the rim of the dish, and with the long axis of the tamping face held at right angles to the radius of the dish. Apply the remaining five tamping strokes at random points distributed over the central area of the dish. Use just enough tamping pressure to fill the dish with the top of the material extending slightly above the rim. Smooth off the material by drawing the flat side of the straightedge (with the leading edge slightly raised) across the top of the dish. Strike-off the material to a plane surface flush with the rim of the dish with the straightedge held in a perpendicular position; using a sawing motion, draw the straightedge across half of the surface of the dish; repeat the procedure on the other half of the unfinished surface. If the material is pulled away from the side of the dish during the process of drawing the straightedge across the dish, gently press the material back into contact with the side of the dish using the tamper. Complete the entire filling and strike-off operation in not more than 2 min.

9.4 *Application of Vacuum to Mortar or Plaster*—Turn the stopcock to apply the vacuum to the funnel. After suction for 60 s, quickly turn the stopcock to expose the funnel to atmospheric pressure.

9.5 *Determination of Flow After Suction*—Immediately slide the perforated dish off the funnel, touch the bottom of the dish momentarily on a damp cloth to remove droplets of water. Set the dish on a work table, plow and mix the mortar or plaster for 15 s, with the rubber scraper prescribed in Practice C 305. Determine the flow in accordance with Test Method C 1437. Remove the vacuum and complete the flow test in less than 2 min.

10. Calculation

10.1 Calculate the water retention value for the mortar or plaster as follows:

$$\text{Water retention, \%} = (A/B) \times 100$$

where:

A = flow after suction, and
B = flow immediately after initial mixing.

Report to the nearest 1 %.

11. Precision and Bias

11.1 *Precision*—The following precision values were calculated from results of tests reported to Cement and Concrete Reference Laboratory (CCRL) for masonry cement proficiency samples Number 3 through 42 (Note 4). Within- and among-laboratory standard deviations were calculated by CCRL for each sample pair. Values were pooled over all 40 samples for purposes of this analysis. Water retention test results (excluding outliers) ranged from 72 to 88 %. The average number of laboratories reporting was 69.

NOTE 4—These tests utilized a slightly different test pressure, 6.7 ± 0.4 kPa (50 ± 0.3 mm Hg).

11.1.1 *Single-laboratory Precision*—The single-laboratory standard deviation has been found to be 3.5 % (Note 5). Therefore, the results of two properly conducted tests in the same laboratory on the same material should not differ by more than 9.8 % (Note 5) in 95 % of such pairwise comparisons.

11.1.2 *Multilaboratory Precision*—The multilaboratory standard deviation has been found to be 5.1 % (Note 5). Therefore, the results of two properly conducted tests in different laboratories on the same material should not differ by more than 14.3 % (Note 5) in 95 % of such pairwise comparisons.

NOTE 5—These numbers represent, respectively, the 1s and d2s limits as described in Practice C 670.

11.2 *Bias*—Since there is no accepted reference material suitable for determining bias in this test method, no statement on bias is being made.

12. Keywords

12.1 hydraulic cement; mortar; plaster; water retention

SUMMARY OF CHANGES

Committee C01 has identified the location of selected changes to this test method since the last issue, C 1506 – 03, that may impact the use of this test method. (Approved July 1, 2008)

(*1*) Revised 6.1.