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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Water Retention by Concrete Curing Materials[1]

This standard is issued under the fixed designation C 156; 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 This test method covers laboratory determination of the efficiency of liquid membrane-forming compounds and sheet materials for curing concrete, as measured by their ability to reduce moisture loss during the early hardening period.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes 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 87 Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar[2]
C 150 Specification for Portland Cement[3]
C 230 Specification for Flow Table for Use in Tests of Hydraulic Cement[3]
C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency[3]
C 778 Specification for Standard Sand[3]
D 1475 Test Method for Density of Paint, Varnish, Lacquer, and Related Products[4]
D 1653 Test Method for Water Vapor Transmission of Organic Coating Films[4]
D 2369 Test Method for Volatile Content of Coatings[4]
E 178 Practice for Dealing with Outlying Observations[5]

3. Significance and Use

3.1 The moisture retaining ability of a product as determined by this test method is used to assess the suitability of materials for contributing to an appropriate curing environment for concrete. The laboratory test method is used both in formulating and in specifying or qualifying curing products. This test method gives the user a measure of the ability of tested curing materials to impede the escape of moisture from a hydraulic cement mortar. Since it is desirable to retain moisture in fresh concrete to promote the hydration process, failure of the product to minimize the escape of moisture may lead to loss of strength, cracking, shrinkage, or low abrasion resistance of the hardened concrete, or a combination thereof.

3.2 Many factors affect the laboratory test results. Test results obtained may be highly variable as indicated by the precision statement. Critical factors include the precision of the control of the temperature, humidity and air circulation in the curing cabinet, preparation and sealing of the mortar specimens, the age and surface condition of the mortar specimen when the curing product is applied, and the uniformity and quantity of application of the curing membrane.

4. Apparatus

4.1 *Mechanical Mortar Mixer*, similar to that described in Practice C 305, but of sufficient size to mix enough mortar in one batch to prepare at least three specimens. The paddle and bowl shall be of stainless steel.

4.2 *Flow Table*, as described in Specification C 230.

4.3 *Molds*—Molds shall be made of metal, glass, hard rubber, or plastic, and shall be watertight, and rigidly constructed to prevent distortion. They shall be rectangular, and approximately 150 by 300 mm (6 by 12 in.) at the top, 145 by 295 mm (5¼ by 11¾ in.) at the bottom, and 50 mm (2 in.) deep measured on the inside. They shall have a flat rim at the top, and shall be approximately 6 mm (¼ in.) wide on all sides. Thoroughly clean the molds before each use.

NOTE 1—Take care to avoid use of an excessive amount of oil, grease, or mold release compound on molds, particularly along the top rim where sealing compound will be applied. Use of masking tape on the top rim during application of release compound to prevent contamination has been found expedient.

4.4 *Gloves*, of rubber or plastic, to be worn while molding the specimens.

4.5 *Tamper*, of a nonabsorptive, nonabrasive material such as medium-hard rubber or seasoned oak rendered nonabsorptive by immersion for 15 min in paraffin at approximately 200°C. The tamper shall be rectangular with a 25 by

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[2] *Annual Book of ASTM Standards*, Vol 04.02.
[3] *Annual Book of ASTM Standards*, Vol 04.01.
[4] *Annual Book of ASTM Standards*, Vol 06.01.
[5] *Annual Book of ASTM Standards*, Vol 14.02.

50-mm (1 by 2-in.) cross section and it shall be a convenient length (150 to 300 mm (6 to 12 in.)).

4.6 *Wood Float*, approximately 75 by 280 by 20 mm thick (3 by 11 by ¾in.).

NOTE 2—A commercial wood float equipped with a substantial handle can be readily reduced to these dimensions. The float shall be resurfaced or replaced when there is noticeable wear to the floating surface.

4.7 *Brush*, medium-soft bristle 50-mm (2-in.) paint brush to brush the surface of the specimens prior to sealing.

4.8 *Curing Cabinet*, maintained at a temperature of 37.8 ± 1.1°C (100± 2°F) and a relative humidity of 32 ± 2 %. The curing cabinet shall be of a design that allows movement of conditioned air such that the solvent from the curing compound will be readily evaporated and eliminated from the system. Air flow over the specimens shall be adjusted to provide an evaporation rate of 2.0 to 3.4 g/h as measured by the procedure of Annex A1. The evaporation rate shall initially be measured for each position in the cabinet in which a sample will be placed, and shall be verified annually and whenever any changes are made to the cabinet. The range of evaporation rates for all specimen positions in the test cabinet shall be reported.

4.9 *Balance*, having a capacity of 10 kg or more, sensitive to 0.1 g or less.

4.10 *Applicator*—For spray application, any apparatus that can be used to apply the curing compound uniformly and with minimum overspray is acceptable. For brush or roller application, use the equipment recommended by the curing compound manufacturer.

5. Materials

5.1 *Portland Cement*, conforming to the requirements for Type I of Specification C 150.

5.2 *Graded Standard Sand*, conforming to the requirements of Specification C 778.

5.3 *Sealing Compound*, that will not be affected by the curing material and which effectively seals against moisture loss between the boundary of the specimen and the edge of the mold.

NOTE 3—Tissue embedding wax, readily available from scientific supply houses, is a convenient and reliable sealant.

6. Conditioning

6.1 The temperature of the room and of all materials when used in this test shall be 23 ± 2°C (73 ± 4°F) unless otherwise specified, and the room humidity shall be 50 ± 10 %.

7. Number of Specimens

7.1 A set of three or more test specimens shall be made in order to constitute a test of a given curing material.

NOTE 4—When more than one set of specimens is to be prepared, each set should be handled as a group throughout the preparation to make the elapsed time between molding and application of the curing product as uniform as possible. This may require mixing the mortar for each set separately.

8. Proportioning and Mixing Mortar

8.1 *Proportioning*—Determine the sand content of the mortar by adding dry sand to a cement paste having a water-cement ratio of 0.40 by weight, to produce a flow of 35 ± 5 in 10 drops of the flow table, following the procedure described in Test Method C 87. Discard the mix used to determine the proportion of sand to cement.

NOTE 5—The sand:cement ratio required varies with the source of the cement. A ratio of 2.5:1 is suggested as a starting point. Flow may be determined on a 3 to 4 kg batch of mortar which is conveniently mixed in the mixer described in Practice C 305. Approximately 5 kg of mortar is required to fill each specimen mold, so that 15 kg must be mixed to fill three molds.

The mixture used to establish the sand: cement ratio is discarded because it is thought that the age and mixing history of the mortar affect the final moisture loss results and must be controlled.

8.2 *Mixing*—Combine the components of the mortar in a mortar-mixing machine to produce a homogeneous mortar not more than 6 min from the time the water and the cement are combined.

NOTE 6—A generally effective sequence is to add the cement to all of the water in the mixing bowl and allow it to stand for 30 s. Then, mix at low speed for 30 s and, without stopping the mixer, add the sand within 30 s and continue mixing for 1 min. Stop the mixer for 1 min. During the first 15 s, scrape down the sides of the bowl. Finish by mixing for an additional 1 min, and promptly begin molding the specimens.

9. Preparing Specimens

9.1 Place a layer of mortar in a mold to a depth of approximately 25 mm (1 in.) and tamp 50 times with the tamper. Place a second layer of mortar, sufficient in amount to slightly overfill the mold and tamp in a similar manner. Using the 25-mm (1-in.) wide edge of the tamper, fill the indentations made by the tamping and level the surface by pressing down firmly, 18 to 20 times, moving along the long dimension of the mold. Strike off the specimen level with the top of the mold using a wood float with one pass only in the direction of the long axis of the specimen using a sawing motion of the float. Keep the 75-mm (3-in.) face of the float firmly in contact with the mortar and edges of the mold so that the float creates a uniformly dense surface free of voids and cracks.

9.2 Immediately after molding, wipe the outside surfaces of the molds clean, and place the specimens in the curing cabinet maintained at the conditions specified in 4.8. The specimens shall be level and not subject to vibration. The spacing between the individual specimens and between the specimens and the side walls of the cabinet shall be between 50 and 175 mm (2 to 7 in.). Within these limits the spacing shall be the same for all specimens. Use dummy specimens to fill any empty spaces in the cabinet.

10. Surface Preparation and Edge Sealing

10.1 Remove the specimens from the cabinet immediately upon disappearance of the surface water and lightly brush the surface using just sufficient force to remove the laitance and glaze without scarifying the mortar surface. If surface water appears after brushing, return the specimen to the cabinet but immediately remove the specimen upon the disappearance of the surface water brought to the surface by the brushing operation, and brush again. The mortar shall be free of surface water but shall not be dry below the surface. The proper surface condition will be attained when brushing does not bring free