



Designation: C 1151 – 91

Standard Test Method for Evaluating the Effectiveness of Materials for Curing Concrete¹

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1. Scope

1.1 This test method covers laboratory determination of the efficiency of liquid membrane-forming compounds and sheet materials for curing concrete. This test method can also be useful in research work where the effect of different variables on the curing of concrete is studied.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for informational purposes only.

1.3 *This standard does not purport to address all of the safety problems, 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 Mortar²

C 150 Specification for Portland Cement³

C 511 Specification for Moist Cabinets, Moist Rooms and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes³

C 670 Practice for Preparing Precision and Bias Statements for Test Methods of Construction Materials²

C 778 Specification for Standard Sand³

3. Summary of Test Method

3.1 Three slabs of a standard mortar are molded and after 4 h, one is covered with the curing material to be tested, the second is tightly sealed with an impermeable lid, and the third is left uncovered. All three molds are stored in a test environ-

ment for 3 days. The test environment may be any set of conditions selected by the tester, provided only that a minimum rate of evaporation from a free-water surface of 0.4 kg/m²/h be maintained.

3.2 At the conclusion of the storage period, the slabs are demolded and three 25-mm (1-in.) diameter cores are cut at random from each of the slabs and stored under methanol for at least 24 h to stop the hydration of the cement and displace water. Using a diamond-blade saw and ethanol as coolant, the top surface of each core is then sliced off, and from the remaining core, 1-cm (0.39-in.) thick disks are cut from the top and the bottom, then placed in a vacuum desiccator for 24 h.

3.3 The absorptivity of each dried disk is determined by weighing it before and after a 60-s contact of its top surface with a water-saturated stack of filter paper. The difference in absorptivity of the top and bottom disks is a measure of the effectiveness of the curing.

4. Significance and Use

4.1 This is an end result oriented test method. The effectiveness of a given curing material at a given environmental condition is determined by comparing the quality of the surface region of a 90.0-mm (3.5-in.) thick mortar specimen with the quality of the well-protected bottom region of the same specimen. The underlying assumption is that the bottom region of a 90.0-mm (3.5-in.) thick specimen is little affected by the environmental conditions at the surface that can cause rapid evaporation of water. The quality of the mortar is determined by the degree to which the pore structure of the cement paste has become less open due to proper hydration of the cement as indicated by the absorptivity of the mortar.

5. Apparatus

5.1 *Mortar Mixer*, power-driven, capable of thoroughly mixing batches of the prescribed size (approximately ½ ft³ for 3 test slabs) at the prescribed consistency. A revolving drum tilting mixer, a revolving pan or a revolving paddle mixer may be satisfactory.

¹ This test method is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.22 on Curing Materials.

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² *Annual Book of ASTM Standards*, Vol 04.02.

³ *Annual Book of ASTM Standards*, Vol 04.01.



5.2 *Molds and Lid*, watertight, made of metal, glass, hard rubber, or plastic. The molds shall be approximately 310 by 165 mm (12¼ by 6½ in.) in horizontal cross-section and 90 ± 3 mm ($3\frac{1}{2} \pm \frac{1}{8}$ in.) deep. For a set of three molds, one lid shall be available.

5.3 Balances:

5.3.1 The balance or scale for determining the mass of the test specimens shall have a capacity of 50 g or more, sensitive to 0.0001 g or less, and accurate within 0.01 % of the test mass at any point within the range of use for this test.

5.3.2 The balance or scale used for determining the mass of the curing compound, where curing compounds are involved, shall have a capacity of 1 kg or more, be sensitive to 0.1 g or less, and be accurate within 0.1 % of the test mass at any point within the range of use for this test.

5.4 *Tamper*, non-absorptive, smooth and rigid rod 120 to 150 mm (5 to 6 in.) long having a cross section of 13 by 25 mm (0.5 by 1 in.).

5.5 *Screed*, 25-mm (1-in.) diameter, rigid rod, 200 to 300 mm (8 to 12 in.) long.

5.6 *Moist Cabinet or Room*, as specified in Specification C 511.

5.7 *Brush*, with soft bristles of nylon or other suitable material for removing laitance from the test slabs.

5.8 *Drilling Machine*, with a 25-mm (1-in.) inside diameter water cooled diamond-core drill bit.

5.9 *Diamond Blade Saw*, low speed (300 rpm maximum) with 100-mm (4-in.) diameter blade.⁴

5.10 *Desiccator*, vacuum, large enough to accommodate the test specimens.

5.11 *Vacuum Pump*, of sufficient capacity to maintain an absolute pressure of approximately 2500 Pa or less (133 Pa = mm Hg). An aspirator may be sufficient.

6. Reagents and Materials

6.1 *Cement and Sand*—Portland cement meeting Type I of Specification C 150 and graded standard sand conforming to Specification C 778.

6.2 *Methanol and Ethanol*—The alcohols used for dehydrating the cores and cooling the saw blade shall initially contain <1 % water.

7. Test Environment

7.1 The environment in which the molds containing the test slabs are kept during the curing period shall be described by its temperature, relative humidity, and wind velocity, and the rate of evaporation from a free-water surface shall be given in terms of rate of evaporation of water per unit surface area. The minimum rate of evaporation shall be 0.4 kg/m²/h.

NOTE 1—The minimum required rate of evaporation can be obtained by using a variable speed fan in a room that is maintained at approximately 50 % relative humidity and 23°C (73°F).

7.2 The rate of evaporation in the test environment can be determined by placing two water containers with a known

cross-sectional area next to the test specimens. Sufficient amount of water at room temperature to last through the duration of the curing period shall be put in the containers and weighed at regular intervals. The mass losses in terms of kilograms per square metre-per-hour from the two containers shall be averaged.

8. Number of Test Slabs

8.1 Make a set of three test slabs for a test of a given curing material. If either two or more curing materials, or the same material at different coverage rates are evaluated at the same time, it is necessary to make only one set of the control slabs, that is, one covered with a lid and the second left uncovered as described in 9.4.3 and 9.4.4.

NOTE 2—The data from the control slabs are to be used as references representing the best and worst conditions. If, for example, the test indicates a given curing material under evaluation is not effective but the test result is not significantly different from that of the sample covered with a lid, this would imply that something is wrong with the test. On the other hand, if a curing material is found to be effective but the test result is similar to that of the uncovered sample, this would indicate that the storage environment during curing did not cause sufficient drying.

9. Procedure

9.1 Proportioning and Mixing Mortar:

9.1.1 *Proportioning*—Determine the proportions of cement and sand by adding dry sand to a cement paste having a water-cement ratio of 0.44 so as to produce a flow of 65 ± 5 . Perform the flow test in accordance with Test Method C 87 using 10 drops in 6 s.

NOTE 3—It is recommended that a trial batch be made to determine the mix proportions needed to achieve the required flow.

9.1.2 *Mixing*—Mix the mortar at room temperature, preferably $23 \pm 1.7^\circ\text{C}$ ($73.4 \pm 3^\circ\text{F}$) with a relative humidity of 40 to 60 %. Mix the mortar as follows: place the cement and water in the mixer and allow the cement to absorb water for 1 min and then mix for 1 min. Add the sand to the paste and mix for 2 min.

9.1.2.1 The mortar temperature, when determined immediately after mixing, shall be $23 \pm 1.7^\circ\text{C}$ ($73.4 \pm 3^\circ\text{F}$).

9.2 *Molding Test Slabs*—Place the mortar in a mold in three approximately equal layers and tamp each layer 75 times with the tamper. The third layer of mortar shall be of sufficient quantity to overfill the mold. After the third layer of mortar is tamped, fill the indentations made by the tamping by gently pressing down the mortar using the tamper turned on its side so that the 13 by 120 to 150-mm (0.5 by 5 to 6-in.) surface is in contact with the mortar. Press the entire surface down 18 times with the tamper, moving along the long dimension of the mold. Next, screed the slab off level with the top of the mold using the screed. Make only three passes in the direction of the long dimension of the test slab.

9.3 *Storage of Test Slabs*—Place the molds containing the test slabs in the moist cabinet or room immediately after casting is completed. Keep the molds there for 4 h protected from dripping water.

9.4 Application of Curing Materials:

⁴ Model 11-1180, Isomet™ Low-Speed Saw with Model 11-4255 Diamond Wafering Blade by Buehler, Ltd., 41 Waukegan Rd., P.O. Box 1, Lake Bluff, IL 60044 has been found to be satisfactory.