



# Standard Test Method for Determining the Water Absorption of Hardened Concrete Treated With a Water Repellent Coating<sup>1</sup>

This standard is issued under the fixed designation D 6489; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method provides a procedure for the determination of the water absorption by a core of concrete taken from a surface treated with a water repellent.

1.2 The intended use of the water repellent coating is to reduce the amount of water that absorbs into the substrate.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete<sup>2</sup>

D 1193 Specification for Reagent Water<sup>3</sup>

D 1763 Specification for Epoxy Resins<sup>4</sup>

D 3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials<sup>5</sup>

E 145 Specification for Gravity Convection and Force Ventilation Ovens<sup>6</sup>

E 898 Test Method of Testing Top Loading, Direct Reading Laboratory Scales and Balances<sup>6</sup>

## 3. Summary of Test Method

3.1 The specimen is dried to a constant weight and the portions of the specimen not treated with the water repellent are sealed with an impervious sealing material. The specimens are weighed and immersed in water. The specimens are removed from the water, weighed, and a percent water absorption is calculated.

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications, and is the direct responsibility of Subcommittee D01.47 on Masonry Treatments.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 11.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 06.01.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 14.04.

## 4. Significance and Use

4.1 Researchers in the field of water repellent coatings have recognized the need for a standardized test for determining the performance of water repellents applied to structures in the field. Many coating manufacturer's supply warranties for their products based on maintaining a specific water repellency on concrete. This test method can be used to determine the effective water repellency of the coating by comparing its performance to a control uncoated specimen.

## 5. Apparatus and Materials

5.1 *Balance*, having a capacity of not less than 4000 g (8.81 lb) and a sensitivity of 0.1 g, (0.0002 lb) as tested in accordance with Test Method E 898.

5.2 *Hot Plate*, capable of at least 149°C (300°F).

5.3 *Metal Pan*, at least 20.3 cm long by 15.2 cm wide and 5.1 cm deep (8 in. long by 6 in. wide and 2 in. deep), suitable to melt the wax or mix the epoxy.

5.4 *Brush, Duck Tape*.

5.5 *Container*, suitable for holding the water to immerse the specimens.

5.6 *Forced Draft Oven*, Type IIA or IIB, as defined in Specification E 145.

5.7 *Reagent Water*, as defined by Type IV of Specification D 1193.

5.8 *Sealing Material*, having very low permeability to water. Sealing material must meet the requirements of Section 6.

NOTE 1—Sealing materials that in general meet the requirements that are defined in Specification D 1763, Type I, Grade 1, (two component epoxies, epichlorohydrin/Bisphenol A and polyamine + Bisphenol A) or waxes used in the investment casting industry. Paraffin waxes are not acceptable.

## 6. Sealing Material

6.1 Use hardened concrete specimens as described in 7.1.

6.2 Follow the procedures of Section 8, except for 8.4 and 8.5. Instead use the sealing material to completely seal the specimen, top, bottom and sides.

6.3 Follow the procedures of Section 9, except completely submerged the specimens so that the water level is 25.4 mm (1.0 in.) over the top of the specimen.

6.4 After the specimens have been submerged in water for

48 h, acceptable sealing materials shall have a percent absorption of less than 0.1 %.

NOTE 2—It is recommended to recheck the sealing material if a new batch is used or if the formulation of the sealing material has changed.

## 7. Test Specimen

7.1 Typical test specimens are hardened concrete cores, approximately 7.0 cm (2.75 in.) in diameter and 7.5 cm (2 to 3 in.) in length. A minimum of three cores for each test shall be used. Cores should be pulled in such a manner as not to damage the integrity of the surface. See Test Method C 42 for guidance.

## 8. Preparation of Specimens

8.1 Clean the sides and both faces of the specimens of all loose dust or cement paste from the core drilling process. Use compressed air or water and a soft brush only, more vigorous cleaning methods may damage some water repellent coatings.

8.2 Dry the specimens in a forced draft oven for 24 h at  $75^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ( $167^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ) until two successive weighings at intervals of 2 h show an increment of loss not greater than 0.2 % of the last previously determined weight.

8.3 After drying, remove the specimens from the oven and allow them to cool to room temperature under ambient conditions (see Specification D 3924). Weigh each specimen to the nearest 0.1 g and record weight as  $W_A$ .

8.4 Prepare sufficient wax or epoxy material to adequately coat all the specimens. If using wax, melt enough in a suitable container or if using a two-component coating, mix quantities that can be applied during the pot-life of the coating.

8.5 To keep the sealing material from contaminating the treated top surface and the bottom untreated surface of the specimen, place duct tape over these areas and cut the tape around the circumference so that there is no overlap on the longitudinal sides of the core.

8.6 Apply the sealing material to the specimens by either placing the longitudinal side of the specimen in the sealing material (place enough sealing material in the container so it is at least to a depth of 6.4 mm (0.25 in.)) and roll the specimen two to three revolutions, or brush on the sealing material. Be careful not to get any of the sealing material on the treated face.

8.7 Remove the specimen from the sealing material and place treated specimen face up on a firm surface.

8.8 Repeat 8.5 and 8.6 after 3 min have elapsed.

8.9 Carefully remove the duct tape from the specimen.

8.10 Using a brush apply sealing material to any pin holes or holidays that appear in the coating. Allow some of the

sealing material to overlap the specimen's top edge.

NOTE 3—Specimens removed by core drilling may have top surfaces that are chipped. These areas should be coated with the sealing material since some or all of the water repellent may of been removed in these areas.

8.11 Allow the specimens to cool to room temperature.

8.12 When specimens are cooled to room temperature recheck for any pin holes and apply sealing material if necessary.

## 9. Procedure

9.1 Weight each specimen to the nearest 0.1 g and record weight as  $W_1$ .

9.2 Place specimens treated or exposed side of specimens face down in container. Specimens should be placed on glass rods that are in the bottom of container so water is free to circulate under the specimens.

9.3 Fill container with reagent grade water until level is 6.4 cm (2.5 in.) from the top of the glass rods. Water shall not come in contact with opposite face of the core.

9.4 Soak the cores for 48 h. At the 24 and 48-h immersion period, remove the specimens from the water and wipe with a damp cloth and weight to the nearest 0.1 g and record as  $W_2$ .

9.5 Determine the percent of water absorbed by each specimen as follows:

$$\text{Percent Absorption} = \frac{100 \times (W_2 - W_1)}{W_A} \quad (1)$$

## 10. Report

10.1 Report the following information:

10.1.1 Type and size of concrete specimens.

10.1.2 Water repellent treatment used, application rate and method of application.

10.1.3 Percent water absorption of each specimen, and

10.1.4 Any deviation from this procedure.

## 11. Precision and Bias

11.1 *Precision*—Precision for this test method has not been determined at this time.

11.2 *Bias*—Bias for this test method cannot be determined since there is no reference standard available for comparison.

## 12. Keywords

12.1 field treatment evaluation; water absorption; water repellent

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