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# Standard Test Method for Evaluation of the Effect of Clear Water Repellent Treatments on Water Absorption of Hydraulic Cement Mortar Specimens[1]

This standard is issued under the fixed designation D6532; 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 evaluates the effectiveness of clear water repellents on hydraulic cement mortar specimens based on water absorption after a water soak.

1.2 The values stated in SI units are to be regarded as the standard. The values 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:*[2]

C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

D1475 Test Method For Density of Liquid Coatings, Inks, and Related Products

D3924 Specification for Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials

E145 Specification for Gravity-Convection and Forced-Ventilation Ovens

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *clear water repellent, n*—a coating formulated for the purpose of protecting porous substrates by reducing the penetration of liquid water.

## 4. Summary of Test Method

4.1 The masonry unit is immersed in a clear water repellent, removed and allowed to cure at ambient condition for 7 days. Any deviations should be noted in 10.1.2. After cure, the masonry unit is weighed and placed in water to a depth of 6.3 mm (¼ in.) for 3 days. After the immersion period, the masonry unit is removed and reweighed. The water repellency value of the treatment is then calculated using a comparison to untreated control specimens.

## 5. Significance and Use

5.1 Siliceous alkaline substrates are subject to water damage that may result in deterioration. Water repellents can provide protection of siliceous alkaline substrates exposed to water. This test method is used to evaluate the efficacy of clear water repellents on alkaline substrates.

## 6. Apparatus

6.1 *Forced Draft Oven,* Type 1B, in accordance with the Type Section of Specification E145.

6.2 *Balance,* having a capacity of not less than 400 g, and sensitivity of 0.01 g.

6.3 *Reservoir Water Pan,* capable of maintaining the water level at 6.3 mm (¼ in.) in depth with noncorroding rods for the specimens to sit off the bottom.

6.4 *Stiff Bristle Brush,* to brush the masonry units.

6.5 *Pressurized Air Source,* to blow residual material off the brushed masonry units.

6.6 *Stopwatch.*

## 7. Reagents and Materials

7.1 *Masonry Units,* 51 by 51 by 51 mm (2 by 2 by 2 in.) masonry units prepared in accordance with procedures outlined in Test Method C109/C109M with the form release oil removed can be used.

## 8. Procedure

8.1 Select substrates needed, brush, and blow off dust with pressurized air. The specimens must be free of loose material

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.47 on Concrete, Stone and Masonry Treatments.

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[2] 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.

that may be lost and alter the weight. They also must be free of material that will alter the absorption characteristics.

8.2 Label each piece. Run triplicate samples for each water repellent treatment. Also include three untreated control samples for each series. All specimens in one series of testing should come from the same lot of masonry units.

NOTE 1—To make comparison between test series, a positive control needs to be included. For example, when using mortar cubes, 40 % isobutyltrimethoxysilane in solvent can be used as a positive control in each series.

8.3 For the specimen to be treated, measure the surface area of each test specimen to the nearest 5 $mm^2$ (0.1-$in.^2$) and weigh to the nearest 0.1 g. Record the weight and area of the uncoated test specimens.

8.4 Dry the required number of specimens in a forced draft oven, as specified in Specification E145, at a temperature of 80 ± 5°C until a constant weight has been reached. A constant oven weight shall be assumed when the specimen weighed to the nearest 0.1 g loses not more than 0.1 % in any 4-h period.

8.5 Allow specimens to cool at standard room temperature and humidity as specified in Specification D3924, weigh specimens, and allow to reach a constant weight under standard conditions. A constant weight at standard conditions shall be assumed when the specimen weighed to the nearest 0.1 g loses not more than 0.2 % in any 24-h period.

8.6 Calculate the amount of material to apply to obtain the specified coverage based on manufacturer's instructions after determining the density as g/mL = Kg/L (weight/gal) in accordance with Test Method D1475. Then use the following equation:

$$G = \frac{454 \times D \times A}{144 \times \text{coverage rate } (\text{in m}^2/\text{L } (\text{ft}^2/\text{gal}))} \quad (1)$$

where:

$D$ = density of the water repellent test material, kg/L (lb/gal),
$A$ = area of the test specimen, $mm^2$ ($in^2$), and
$G$ = weight of water repellent test material needed to obtain the desired coverage rate, g.

8.7 Totally immerse the specimen in the water repellent treatment to be tested until appropriate coverage rate is reached. Actual coverage rate and variation from manufacturer's suggested coverage rate should be reported in 10.1.2. Remove from treatment and allow to drain for 1 min. Select a bottom and top face of the cube. Place cube top face down on the rack to cure. Allow cubes to cure at standard room temperature and humidity, as specified in Specification D3924, for 7 days to ensure a constant weight is reached. If laboratory conditions are different than those specified, ensure laboratory conditions are constant and record laboratory conditions every day throughout test period and report in 10.1.2.

8.8 After 6 days, weigh cubes to nearest 0.1 g. Allow one more day to cure and weigh again. Compare weights at Day 6 and Day 7 to ensure that a constant weight is reached. If a constant weight is not reached, repeat every day until a constant weight is reached. A constant weight at standard conditions shall be assumed when the specimen weighed to the nearest 0.1 g loses not more than 0.2 % in any 24-h period.

8.9 Record weight of dry treated specimens as $W_{td}$ and dry untreated specimens as $W_d$. Place specimens in the water reservoir, top face up, on noncorroding rods or any method that allows the specimens to sit off the bottom of the pan and be in contact with the water on all sides. The water level in the reservoir or pan should be keep constant at 6.3 mm (¼ in.) with tap water at room temperature, as specified in Specification D3924, for 3 days. The 6.3 mm (¼ in.) is measured from the bottom of the specimens. Do not cover or put a lid on the pan, but ensure that the water level is kept at 6.3 mm (¼ in.).

8.10 Remove the specimens from the water after 3 days, blot with damp cloth to remove excess water, and weigh immediately. Record weights of saturated treated specimens as $W_{ts}$ and saturated untreated specimens as $W_s$. Calculate water exclusion and water absorption.

## 9. Calculation

9.1 Calculate the mean weight gain for the untreated controls and record as $W_c$.

$$W_c = (W_{g1} + W_{g2} + W_{g3})/3 \quad (2)$$

where:

$W_s$ = weight of untreated masonry unit after water immersion,
$W_d$ = weight of untreated masonry unit before water immersion, and
$W_g$ = $W_s - W_d$.

9.2 Calculate water exclusion (*WE*) value in percent, for each specimen as follows:

$$WE, \% = ((W_c - (W_{ts} - W_{td})) \times 100/W_c) \quad (3)$$

where:

$W_c$ = average weight gain for the untreated controls,
$W_{ts}$ = weight of treated masonry unit after water immersion, and
$W_{td}$ = weight of treated masonry unit before water immersion.

9.3 Calculate the mean percent *WE* value for each three-specimen set.

9.4 Calculate the water absorption (*WA*, %) value in percent, for each three-specimen set as follows:

$$WA, \% = ((W_{ts} - W_{td}) \times 100/W_{td}); \quad (4)$$

or

$$((W_s - W_d) \times 100/W_d) \quad (5)$$

9.5 Calculate the mean percent *WA* value for each three-specimen set.

## 10. Report

10.1 Report the following information:

10.1.1 Report the mean water exclusion and water absorption of each coating, and

10.1.2 Report any significant deviations from the test method as described herein.

## 11. Precision and Bias

11.1 The precision and bias of this procedure have not yet been determined.

## 12. Keywords

12.1 hydraulic cement mortar specimens; water absorption; water repellent effectiveness; water repellent treatments