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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Methods for Resistance of Dried Films of Varnishes to Water and Alkali[1]

This standard is issued under the fixed designation D 1647; 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.

ε[1] NOTE—Keywords and the unit measurement statement were added editorially in October 1996.

1. Scope

1.1 These test methods cover the determination of the resistance of dried varnish films to immersion in water and dilute alkali at room temperature.

1.2 The values stated in inch-pound 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:*

D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products[2]

D 1193 Specification for Reagent Water[3]

D 3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquers, and Related Materials[2]

3. Summary of Test Methods

3.1 *Test Method A*—The material under test is flowed onto tinplate panels and dried for 48 h. The panels are then immersed to half their length in reagent water for 18 h, or other agreed upon time, removed, and examined visually.

3.2 *Test Method B*—The material under test is applied to glass test tubes by dipping and dried for 72 h. The tubes are then suspended in dilute sodium hydroxide for periods ranging from 1 to 24 h, removed, rinsed, and after drying for 30 min, examined visually.

4. Significance and Use

4.1 Dried Varnish Films are a source of primary protection for surfaces. Exposure to water and dilute alkali solutions are two factors which tend to break down this protective coating. This test method can be used as a comparison basis between manufacturer and consumer to determine the ability of the varnish to resist water and dilute alkali.

5. Reagents

5.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[4]

5.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type IV of Specification D 1193.

TEST METHOD A—WATER RESISTANCE OF DRIED FILMS

6. Apparatus and Materials

6.1 *Beaker,* glass, 600 mL or larger.

6.2 *Tinplate Panels,* 3 by 5 in. (75 by 125 mm) cut from commercial No. 31 gage (0.225-mm) bright tin plate, weighing 0.4 to 0.5 lb/ft^2 (1.90 to 2.50 kg/m^2) and carefully cleaned and dried before use in accordance with Methods B or C of Practice D 609.

7. Procedure

7.1 Flow the varnish onto the tin panels, allow to drain in a nearly vertical position, and dry for 48 h in the standard atmosphere described in Specification D 3924.

7.2 Place the panels in a beaker containing about 2.5 in. (65 mm) of water at room temperature, immersing the ends that were uppermost during drying, and allow to remain in the water for 18 h, or other suitable period as agreed upon between the purchaser and the seller.

7.3 Remove the panels from the water, wipe carefully, and allow to dry at room temperature. Note the time required for whitening, if any, to disappear. Blooming, which sometimes

[1] These test methods are under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee D01.33 on Polymers and Resins.

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[2] *Annual Book of ASTM Standards,* Vol 06.01.

[3] *Annual Book of ASTM Standards,* Vol 11.01.

[4] *Reagent Chemicals, American Chemical Society Specifications,* American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals,* BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary,* U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

occurs on immersion, is considered a type of whitening.

8. Report

8.1 Report the results of the water test as follows:

8.1.1 Not visibly affected,

8.1.2 Whitening disappears within 20 min,

8.1.3 Whitening does not disappear within 20 min, but disappears within 2 h,

8.1.4 Whitening does not disappear within 2 h, but disappears within 24 h, or

8.1.5 Whitening does not disappear within 24 h.

TEST METHOD B—DILUTE ALKALI RESISTANCE OF DRIED FILMS

9. Reagent

9.1 *Sodium Hydroxide Solution* (30 g/L)—Dissolve 30 g of sodium hydroxide (NaOH) in water and dilute to 1 L.

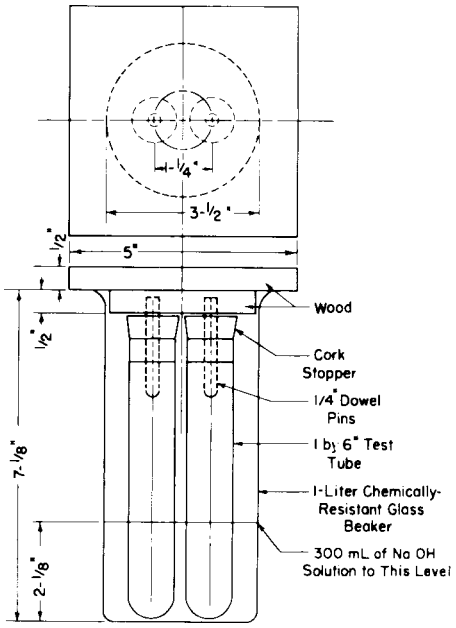
10. Procedure

10.1 Thoroughly clean and dry twenty 1 by 6-in. (25 by 150-mm) test tubes in toluene. Dip the tubes into the varnish under test, remove immediately, invert the tubes, and allow the varnish to dry for 72± 1 h in the standard atmosphere described in Specification D 3924. A suggested test schedule to fit into normal working hours is shown in Table 1.

10.2 Into each of ten 1000-mL, tall-form lipless, chemically resistant plastic or glass beakers, place 300 mL of the NaOH solution. Suspend a set of two varnish-coated tubes in each beaker so that the tubes do not touch the bottom or sides of the beaker and are immersed for a distance of approximately 2 in. (50 mm). As a suspending device (see Fig. 1), use a wooden cover plate and two dowels, and two one-hole cork stoppers,

TABLE 1 Suggested Test Schedule

Day	Hour	Operation
Monday	8:30 a.m.	coat 16 tubes
	4:00 p.m.	coat 4 tubes dry tubes for 72 h
Thursday	8:30 a.m.	start alkali immersion on first 16 tubes
	9:30 a.m. and each hour thereafter to 4:30 p.m.	remove one set of tubes from alkali, rinse, and air-dry for 30 min
	10:00 a.m. and each hour thereafter to 5:00 p.m.	examine varnish film on set of tubes removed ½ h earlier
	4:00 p.m.	start alkali immersion on last 4 tubes
Friday	8:00 a.m.	remove one set of tubes from alkali, rinse, and air dry for 30 min
	8:30 a.m.	examine varnish film on set of tubes removed and rinsed ½ h earlier
	4:00 p.m.	remove last set of tubes, rinse, and air-dry for 30 min
	4:30 p.m.	examine varnish film on last set of tubes



NOTE 1—1 in. = 25.4 mm.

FIG. 1 Apparatus for Alkali Resistance Test

the dowels and the corks fitting into the tubes and the cover plate fitting the beaker as tightly as possible. Maintain the NaOH solution at a temperature of 23 ± 2°C.

10.3 Remove a set of two varnish-coated tubes after immersion for each of the following time periods: 1, 2, 3, 4, 5, 6, 7, 8, 16, and 24 h. Rinse the tubes under a gentle stream of water, allow to air-dry for 30 min, and examine for film whitening, blistering, or removal. The end point of the test is the number of hours immersion at which the first signs of film whitening, blistering, or removal are noted on the vertical sides of the tubes or on the spherical bottom portion of the tube. The results may be compared with those from materials known to give acceptable performance. For referee work, the test on materials known to be acceptable should be made simultaneously.

11. Report

11.1 Report the results of the alkali test as follows:

11.1.1 Type of varnish, and

11.1.2 End point of the test, h.

12. Precision

12.1 Precision has not been determined due to the multiplicity of ambient test conditions.

13. Keywords

13.1 dilute alkali; dried varnish films; varnishes; water resistance