Designation: D6900 – 10 (Reapproved 2015)

Standard Test Method for Wet Adhesion of Latex Paints to a Gloss Alkyd Enamel Substrate[1]

This standard is issued under the fixed designation D6900; 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 method covers a procedure for measuring by scrubbing the adhesion of latex paints to glossy alkyd enamel substrates after exposure to wet conditions.

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]

D523 Test Method for Specular Gloss

D714 Test Method for Evaluating Degree of Blistering of Paints

D2486 Test Methods for Scrub Resistance of Wall Paints

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

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *wet adhesion, n*—the ability of a coating to resist removal by scrubbing from the surface beneath it after exposure to wet conditions and abrasion.

4. Summary of Test Method

4.1 Test paints, with optional control paint, are drawn down using a 7-mil clearance Dow applicator (~11 m^2/L) across a cured alkyd gloss enamel previously drawn down on a black or white plastic panel.

4.2 The drawdown films are allowed to dry under standardized conditions. Then, eighteen cuts are made to form a 6 by 10 cut block, creating sixty 6.4 mm (0.25 in) squares, in the center of each film with a razor blade.

4.3 The panels are then soaked for 30 min in ambient tap water. The panel is mounted in a washability tester and 20 mL of water are applied. The panel is then scrubbed for up to 500 cycles or until all of the squares within each block are completely removed.

5. Significance and Use

5.1 After application to either interior or exterior surfaces, latex paints may be subjected to conditions of high humidity, condensation, or precipitation. This may sometimes lead to a loss of adhesion to the substrate over which they have been applied. This method is a quantitative measure of the adhesion of latex paints to glossy substrates under such conditions.

6. Apparatus

6.1 Constant temperature/humidity room in accordance with Specification D3924 [23 ± 2°C (73.5 ± 3.5°F) and 50 ± 5 % relative humidity].

6.2 *Drawdown Plate.*

6.3 *Straight Line Washability Tester and Accessories,* per Test Methods D2486.

6.4 *Nylon Bristle Brush and Accessories* (nominal weight 455 g), having nylon brush bristles in 5/4 pattern extending 19 mm (¾ in.) from block (as per Test Methods D2486).

6.5 *Dow Film Applicator,* having 7-mil (0.18-mm) clearance by 5.2-in. (132-mm) width. applicator blade.

6.6 *Single-edge Razor Blade,* in safety holder.

6.7 *Metal Straight Edge,* (or appropriate guide).

[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 D01.42 on Architectural Coatings.

Current edition approved June 1, 2015. Published June 2015. Originally approved in 2003. Last previous edition approved in 2010 as D6900 – 10. DOI:10.1520/D6900-10R15.

[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.

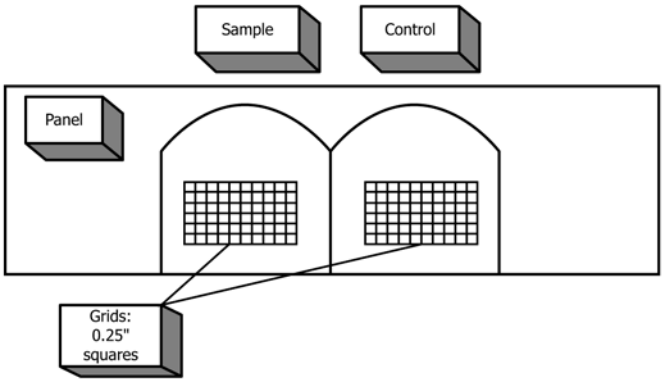

FIG. 1 Illustration

7. Reagents and Materials

7.1 A ready-mix deep-tint alkyd gloss enamel with a 60° gloss of at least 65 as measured in accordance with Test Method D523 (or alkyd as agreed upon by the purchaser and supplier).

7.2 Plastic test panels as used in Test Methods D2486.[3]

8. Procedure

8.1 *Preparation of the Alkyd Substrate Panels*—Attach the plastic panel to the drawdown plate and drawdown the alkyd gloss enamel lengthwise using a 7-mil clearance Dow applicator. The time for application should be fairly slow—3 to 4 s from end to end. The drawdown must be free of ridges, holidays, specks, or other imperfections, which may affect adhesion.

8.1.1 Allow the alkyd gloss enamel to air-dry in a horizontal position. Allow to cure typically for a minimum of three weeks. Panels are to be used between three to six weeks from the date of preparation. Wet adhesion with some latex paints may be dramatically reduced if the alkyd is allowed to cure for more than six weeks.

8.2 *Application and Evaluation of Test Paints:*

8.2.1 Attach the cured alkyd enamel-coated plastic panel to the drawdown plate and simultaneously drawdown test paint and an optional control paint side-by-side using the 7-mil clearance Dow applicator. The time for application should be fairly slow—1 to 2 s from edge to edge. Each drawdown is made perpendicular to the length of the panel and positioned so that the drawdowns are contiguous (See Fig. 1).

NOTE 1—Typically a control paint of known wet adhesion is recommended for use in the method to limit the variability of results from test to test.

8.2.2 Condition the panels for one week in the constant temperature/humidity room as specified in Specification D3924 or under other conditions agreed upon by buyer and seller. Shorter conditioning times may be used if more stringent measures of wet adhesion are needed, as in the case of determining a coating's "early" wet adhesion.

NOTE 2—Since humidity and temperature both markedly influence the rate at which paint dries, a constant temperature/humidity room is strongly recommended in order to achieve reproducible results using this method.

8.2.3 Condition, break in and rinse the scrub brush as specified in Test Methods D2486.

8.2.4 Using a metal straightedge or suitable guide, make eighteen razor blade cuts, spaced 6.4 mm (0.25 in.) apart forming a 6 by 10 array with a razor blade in the center of each paint (See Fig. 1). Each cut should be made in one steady motion with sufficient pressure to cut, but not tear the latex paint film. (**Warning—**Avoid cutting completely through the alkyd enamel into the plastic substrate.)

8.2.5 Submerge each panel face-up for 30 min in a flat container of ambient tap water, being careful not to bend the substrate.

8.2.6 Remove the panel from the water and quickly examine the panel for blistering, per Test Method D714 (optional). Immediately secure the panel in the washability tester using the gasketed frame accessory, ensuring that the array is in the path of the brush. Place 20 mL of water in the path of the brush and start the machine.

8.2.7 Observe each test paint to determine its point of adhesive failure. Record the number of cycles when 100 % adhesive failure occurs or the percent adhesive failure at 500 cycles. If the test paint is not removed within 500 cycles, the test is terminated. Since the array is larger than the brush for ease of placement, only rate the path of the brush.

9. Report

9.1 Record any blistering, per Test Method D714 (optional).

9.2 The number of cycles for 100 % adhesive failure or percent adhesive failure after 500 cycles.

9.3 The wet film thickness of the gloss alkyd enamel and latex test paints if different than those specified in this test method.

9.4 The drying time and conditions used, if different than those specified in this test method.

9.5 Report alkyd used in 7.1.

9.6 Report any variation from the test method.

10. Precision and Bias[4]

10.1 The precision of this test method is based on an interlaboratory study of Test Method D6900, Standard Test Method for Wet Adhesion of Latex Paints to a Gloss Alkyd Enamel Substrate, conducted in 2007. Results in this study were obtained from five laboratories, testing six different paints. Every "test result" reported represents an individual determination. Each participating laboratory reported four replicate test results for every material. Except for the inclusion of only five laboratories, Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report RR:D01-1148.

[3] This test method was qualified by a round robin using Leneta P-121-10N dull black plastic panels 6½ by 17 in. by 10 mils (165 by 432 by 0.25 mm) in size, obtainable from the Leneta Co., 15 Whitney Rd, Mahwah, NJ 07430.

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D01-1148. Contact ASTM Customer Service at service@astm.org.

TABLE 1 24 Hour (% failure)

Panel	Paint	Average[A] $\bar{x}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Green Alkyd	A	0	0.3	0.3	0.7	0.7
	B	0	0.4	0.4	1.0	1.1
	C	100	0.0	0.0	0.0	0.0
	D	0	0.3	0.4	0.7	1.2
	E	7	0.4	12.3	1.0	34.4
	F	100	0.0	0.0	0.0	0.0
Red Alkyd	A	0	0.0	0.0	0.0	0.0
	B	0	0.4	0.4	1.0	1.1
	C	100	0.0	0.0	0.0	0.0
	D	0	0.0	0.0	0.0	0.0
	E	19	24.6	36.6	68.9	102.5
	F	100	0.0	0.0	0.0	0.0

[A] The average of the laboratories' calculated averages.

TABLE 2 7 Day (% failure)

Panel	Paint	Average[A] $\bar{x}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Green Alkyd	A	0	0.0	0.5	0.0	1.4
	B	1	0.0	1.0	0.0	2.8
	C	100	0.0	0.0	0.0	0.0
	D	0	0.3	0.7	0.7	1.9
	E	0	0.4	0.8	1.0	2.3
	F	100	0.0	0.0	0.0	0.0
Red Alkyd	A	0	0.0	0.0	0.0	0.0
	B	0	0.0	0.0	0.0	0.0
	C	98	5.0	5.6	14.0	15.7
	D	0	0.0	0.0	0.0	0.0
	E	0	0.4	0.4	1.0	1.1
	F	100	0.0	0.0	0.0	0.0

[A] The average of the laboratories' calculated averages.

10.1.1 *Repeatability Limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the "*r*" value for that material; "*r*" is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

10.1.1.1 Repeatability limits are listed in Table 1 and Table 2.

10.1.2 *Reproducibility Limit (R)*—Two test results shall be judged not equivalent if they differ by more than the "*R*" value for that material; "*R*" is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

10.1.2.1 Reproducibility limits are listed in Table 1 and Table 2.

10.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

10.1.4 Any judgment in accordance with statements 10.1.1 and 10.1.2 would normally have an approximate 95 % probability of being correct, however the precision statistics obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The limited number of materials tested and laboratories reporting results guarantees that there will be times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95 % probability limit would imply. The repeatability limit and the reproducibility limit should be considered as general guides, and the associated probability of 95 % as only a rough indicator of what can be expected.

10.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore, no statement on bias is being made.

10.3 The precision statement was determined through statistical examination of 208 results, from four laboratories, on six materials, and two substrates. Data from one outlier lab was excluded from the calculations.

11. Keywords

11.1 wet adhesion