Designation: D7786 – 13

Standard Test Method for Determining Enamel Holdout [1]

This standard is issued under the fixed designation D7786; 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 standard provides a method for determining the holdout characteristics of a primer and topcoat coating application. A standard topcoat is used to determine the absorption characteristics of a primer. Enamel holdout can be measured as a difference in observed gloss of the topcoat over a primer, relative to the gloss of the same topcoat over a non-porous smooth surface.

1.2 The standard is written in the context that the user will be evaluating the enamel holdout characteristics of a primer. Alternatively, the standard may be used as a method to evaluate the enamel holdout characteristics of primer/topcoat system where the primer is constant and different topcoats are used as test paints.

1.3 This standard may also be used for evaluation of paints other than primers as the first coat. In this alteration the user can test the enamel holdout characteristics of a self primed topcoat, or use of any other type of paint as the primer followed by the use of a standard topcoat.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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

D823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels

D1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature

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

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

3. Terminology

3.1 *Definitions:*

3.1.1 *enamel holdout, n*—the ability of a primer/topcoat system to retain gloss of the topcoat relative to gloss of the topcoat over a non-porous smooth surface.

3.1.2 *primer, n*—an undercoat of paint applied to prepare a surface for final painting.

3.1.3 *topcoat, n*—a coating, intended as the final coat of a finished system, which has the desired appearance and resistance properties as specified by the end user.

4. Summary of Test Method

4.1 A substrate, preferably a non-porous smooth drawdown card, is coated using a test primer and allowed to dry. The primer-coated substrate is then coated with the standard topcoat and allowed to dry (primed topcoat).

4.2 A non-porous smooth substrate is coated using only the standard topcoat and allowed to dry (unprimed topcoat).

4.3 Gloss measurements are taken over the primed topcoat and also over the unprimed topcoat. The difference in the gloss reading between the primed topcoat system and unprimed topcoat system is an indication of enamel holdout. Smaller differences indicate better enamel holdout.

5. Significance and Use

5.1 This standard may be used by paint companies and raw material suppliers to assess the interactions of primers and topcoats with respect to their ability to provide good enamel holdout. Primer/topcoat systems with the best enamel holdout will result in desirable gloss in the first coat of topcoat application.

6. Apparatus

6.1 *Film Applicator,* preferably a drawdown bar, capable of applying wet-film thickness of approximately 0.075 mm (3.0 mils).

[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.

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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.

6.2 If preferred, brush, roller or spray applicators can be substituted for the drawdown applicators.

6.3 *Gloss Meter* capable of measuring 20 and 60°gloss.

7. Reagents and Materials

7.1 *Substrate Desired for Testing*—The preferred substrate should have a uniform flat surface to enable paint films to be applied with the preferred drawdown bar applicator. Unless otherwise agreed upon, a non-porous smooth drawdown card is used. Other commonly used substrates include: gypsum panel, wood or drawdown cards with non-porous and porous sections. The choice to use an alternative substrate often necessitates the choice of an alternate applicator such as brush, roller or spray.

7.2 *Standard Paints*—The topcoat will be a mutually agreed upon standard topcoat. Unless otherwise agreed, use a commercially available latex topcoat which yields a gloss between 40 and 55 when applied in accordance with 9.2.

8. Hazards

8.1 The user of this test method should refer to appropriate MSDS for hazards associated with handling and disposal of paint samples or other laboratory items used as specified in this standard.

9. Procedure

9.1 Application of primer (or other primary coating) and topcoat.

9.1.1 Apply the primer onto the selected substrate using the film applicator across the full length of the drawdown card or alternative substrate. Refer to Practices D823, for the procedure and information related to the application of films with uniform thickness.

9.1.2 Allow the primer to dry in a controlled environment for an appropriate period of time for the primer that has been applied. Refer to Test Methods D1640 for the procedure and information related to drying, curing, or film formation of organic coatings at room temperature. Report the environmental condition (°C, %RH) and dry time interval.

9.1.3 Using a film applicator capable of applying a wet film thickness of approximately 0.075 mm (3 mils), apply the standard topcoat on top of the dried primer coat from step 9.1.1. Casting the topcoat in a direction perpendicular to the primer coat will allow the use of a single drawdown bar for both primer and topcoat application while ensuring that the drawdown bar can travel a uniform path across the primer coat (Fig. 1).

9.1.4 Allow the topcoat to dry in a controlled environment for an appropriate period of time for the topcoat that has been applied. Report the environmental condition (°C, %RH) and dry time interval.

9.2 Application of standard topcoat to non-porous smooth surface:

9.2.1 Apply the standard topcoat to the non-porous smooth substrate using the same film applicator as in section 9.1.3 across the full length of the drawdown card. This application should be made at a similar time as the topcoat in step 9.1.3.

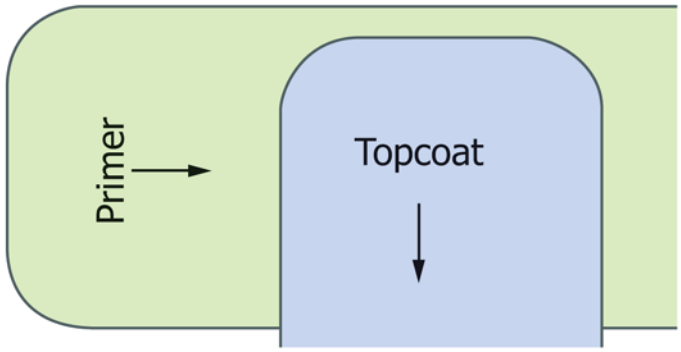

FIG. 1 Diagram of Perpendicular Drawdown Technique

9.2.2 Allow the topcoat from step 9.2.1 to dry in a controlled environment for an appropriate period of time for the topcoat that has been applied. This environment and dry time should be the same as in step 9.1.4. Report the environmental condition (°C, %RH) and dry time interval.

9.3 Gloss measurement:

9.3.1 Measure the gloss of the topcoat on both the primer/topcoat card and the unprimed card. Refer to Test Method D523 for the procedure and information related to measuring gloss.

9.3.2 Record the average of three readings from each chart. If the 60° gloss of the unprimed topcoat is greater than 80 gloss units, use the 20° gloss reading; otherwise use the 60° gloss reading.

10. Calculation or Interpretation of Results

10.1 *Variable Definitions:*

Enamel Holdout (%retained) = $100*G_P/G_U$

Enamel Holdout (%difference) = $100*(G_U–G_P)/G_U$

Enamel Holdout (difference) = $G_U–G_P$

where:

G_P = Gloss of primed topcoat

G_U = Gloss of unprimed topcoat

10.2 Users may choose which calculation to use for reporting enamel holdout, though percent retained is the preferred method.

11. Report

11.1 Substrate system, applicator choice and application method for primers and topcoats.

11.2 Number of coats of topcoat.

11.3 Whether test paints are used as primer or topcoat.

11.4 Identification of standard topcoat or standard primer.

11.5 Environmental conditions and dry time intervals.

11.6 Angle of gloss measurements (20°, 60°).

11.7 Gloss value of unprimed topcoat.

TABLE 1 Enamel Holdout

Material	Average[A] X	Reproducibility Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Primer 1	66.07	2.64	5.03	7.40	14.07
Primer 2	101.77	0.65	0.88	1.82	2.46
Primer 3	98.81	1.92	2.87	5.39	8.04

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

11.8 Calculation method and enamel holdout result.

12. Precision and Bias[3]

12.1 The precision of this test method is based on an inter laboratory study of ASTM D7786, Test Method for Determining Enamel Holdout, conducted in 2012. Each of ten laboratories tested one topcoat and three different primers for enamel holdout. Every "test result" represents an individual determination and all participants were asked to report five replicate test results for each analysis. Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. RR:D01-1174.

12.1.1 *Repeatability Limit (r)*—The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

12.1.1.1 Repeatability can be interpreted as maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

12.1.1.2 Repeatability limits are listed in Table 1.

12.1.2 *Reproducibility Limit (R)*—The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

12.1.2.1 Reproducibility can be interpreted as maximum difference between two results, obtained under reproducibility conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

12.1.2.2 Reproducibility limits are listed in Table 1.

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

12.1.4 Any judgment in accordance with statements 12.1.1 and 12.1.2 would have an approximate 95 % probability of being correct.

12.2 *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.

12.3 The precision statement was determined through statistical examination of 145 results, from ten laboratories, on three different primers.

12.4 To judge the equivalency of two test results, it is recommended to choose the material closest in characteristics to the test material.

13. Keywords

13.1 absorption; enamel holdout; primer; sealer; undercoater

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D01-1174. Contact ASTM Customer Service at service@astm.org.