Designation: D 3793 – 04

Standard Test Method for Low-Temperature Coalescence of Latex Paint Films[1]

This standard is issued under the fixed designation D 3793; 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 covers the determination of the comparative coalescence of a series of latex paints by determining the porosity of films dried at standard and at low temperature. Porosity is evaluated with a penetrating medium as in Test Method D 3258.

1.2 The texture of the film, which can affect cleanup, will influence the results of the test. Stain applied to a high-hiding paint will not lower the reflectance as much as the same stain applied to a low-hiding paint of equal porosity. These points must be considered in comparing the different paints.

1.3 This method should be used only for comparative testing within one laboratory, as the numerical results obtained by different laboratories do not usually agree.

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

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]

D 3258 Test Method for Porosity of White or Near White Paint Films by Staining

E 1347 Test Method for Color and Color Difference Measurement of Object-Color Specimens by Tristimulus (Filter) Colorimetry

3. Summary of Test Method

3.1 The test paints are applied to porous cardboard panels, dried at standard temperature and at 4.5°C (40°F) with 50 % relative humidity in both cases, and their reflectances measured. A special colored penetrating medium is applied to each, the excess removed in a specified manner, and reflectances measured again. The difference between the readings on the stained and unstained films indicates the porosity of that film; the difference between the readings for the two temperatures indicates the coalescence of that film compared to others in the series.

4. Significance and Use

4.1 This test method provides no absolute information, rather ranking only of the selected series of paints.

4.2 This test method can provide a pass-fail situation if known acceptable and unacceptable paints are included in the test.

5. Apparatus and Materials

5.1 *Plate Glass Panel* (base for cardboard panel).

5.2 *Strippable Adhesive.*[3]

5.3 *Test Panel*—Smooth porous cardboard pane, such as the back of a white drawdown chart.[4]

5.4 *Film Applicator*, 150 mm (6 in.) wide with a clearance of 150 µm (6 mils).

NOTE 1—It should be noted that some applicators are marked with the nominal wet film thickness, which is one half of the clearance.

5.5 *Film Applicator*, 140 mm (5½ in.) wide with a clearance of 255 µm (10 mils).[5]

5.6 *Reflectometer*, meeting the requirements of Test Method E 1347.

5.7 *Cold Cabinet*, maintaining 4.5 ± 1°C (40 ± 2°F) and 50 ± 5 % relative humidity.

5.8 *Camel's Hair Brush*, approximately 13 mm (½ in.) wide.

5.9 *Plastic Wash Bottle*, about 500 mL or 16 oz containing mineral spirits of the odorless type.

5.10 *Penetrating Medium*—A proprietary composition of pigments or dye, or both, dispersed in a liquid vehicle.

5.11 *Filter Paper*.

[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.

[3] Any strippable adhesive such as represented by the following formulas: vinyl acrylic emulsion (800 parts by weight) and polyethylene glycol, molecular weight 1450, (16 parts by weight).

[4] White cardboard drawdown chart, Form WA, from the Leneta Co., 15 Whitney Rd., Mahwah, NJ 07430, was used in the original test method to get the results.

[5] The Dow latex film caster from Byk-Gardner, Inc. Gardner Laboratory, 2435 Linden Lane, Silver Spring, MD 20910, was used originally in this test method.

6. Procedure

6.1 Adhere a porous cardboard test panel to each of as many plate glass panels as needed, using the strippable adhesive and ensuring that the cardboard panels are smooth with no wrinkles.

6.2 For each paint, coat one panel using the 150-µm (6-mil) clearance drawdown blade. Air dry 48 h under standard conditions of 23 ± 2°C (73.5 ± 3.5°F) and 50 ± 5 % relative humidity.

6.3 Determine the percent reflectance (*Y* tristimulus value) of the dry films. Use the green filter when using a reflectometer. When making these readings, back up each panel with a flat rigid opaque object and mark the area on which the reading was made.

6.4 Using the 255-µm (10-mil) blade, apply the penetrating medium to each test paint, covering the area marked as above and drawing the applicator blade in the same direction as before.

6.5 After 5 min ± 15 s, wash off excess penetrating medium. To do this hold the panel vertically and remove the medium using the camel's hair brush wet with odorless mineral spirits. Repeat the process until most of the excess is removed then apply the mineral spirits directly from the wash bottle to the area above the stain and allow to flow down across the stained area. Pause to observe the bead that forms at the bottom of the panel. If the bead is not clear, continue washing with odorless mineral spirits until the bead is essentially clear. Test with filter paper to be sure no dye remains in the bead.

6.6 Hang the panel in a vertical position and air dry for 3 h. As before, read the percent reflectance over the same area on the panels with the same flat rigid opaque object behind them.

6.7 Place one panel for each paint, the 150-µm (6-mil) clearance drawdown blade, and the can of each paint into the cold cabinet maintained at 4.5 ± 1°C (40 ± 2°F) and 50 ± 5 % relative humidity.

6.8 At the end of 24 h remove one can of paint and stir thoroughly. Then remove the drawdown blade along with one panel and make the drawdown immediately. Repeat the process for each paint under test. All items should be kept out of the cold cabinet only long enough to make drawdowns.

6.9 Place all the panels back into the cold cabinet and dry for 48 h.

6.10 Repeat the reflectance readings before and after application of the penetrating medium to these panels in accordance with 6.3, 6.4, 6.5, and 6.6.

7. Calculation

7.1 For each paint calculate the difference between the percent reflectance of the unstained and stained films at both standard and low temperatures. These two differences indicate the porosity of the film formed at the two temperatures. Calculate the low-temperature coalescence of each paint as the ratio of the porosity at low temperature to the porosity at standard temperature which is indicative of relative coalescence.

8. Report

8.1 Report the rank order of low-temperature coalescence of the test paints in the series.

9. Precision and Bias

9.1 In an interlaboratory study of this test method in which one operator in each of six laboratories tested paint films of three normally different levels of coalescence, all six laboratories ranked the three paints in the same order of coalescence. However, there were considerable differences between the values obtained by the laboratories for any one paint.

10. Keywords

10.1 coalescence; latex paint; porosity