Designation: D 2198 – 02

Standard Test Method for Stain Removal From Multicolor Lacquers[1]

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1. Scope

1.1 This test method covers a procedure for the removal of pencil, crayon, and grease stains from multicolor lacquer films that have been applied to primed steel panels.

NOTE 1—Due to the nature of the test, comparable results can be obtained only when exactly the same materials and apparatus are used. In this test method it has not been found possible to describe the materials and apparatus adequately in more than general terms.

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:*

A 109 Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled[2]

A 366/A 366M Specification for Commercial Steel (CS), Sheet, Carbon (0.15 Maximum Percent), Cold-Rolled, Commercial Quality[3]

D 209 Specification for Lampblack Pigment[4]

D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products[5]

2.2 *U. S. Federal Specifications:*[6]

Fed. Spec. EE-0-451C Specification for Oleo (Margarine)

Fed. Spec. TTV-121C Specification for Varnish, Spar, Water Resisting

Fed. Spec. VV-0-551 Specification for Oil, Lubricating, Marine and Engine, Mineral

Fed. Spec. VV-P-236 Specification for Petrolatum

2.3 *U. S. Military Specification:*[6]

MIL-P-11414A Specification for Primer Coating, Lacquer, Rust Inhibiting

3. Summary of Test Method

3.1 Three 165 by 430 mm (6½ by 17 in.) primed steel panels are sprayed with multicolor lacquer and allowed to dry for 24 h. Varnish is then applied to the ends of the panels and allowed to dry 72 h. The three stains are applied by a mechanical apparatus and removed by washing.

4. Significance and Use

4.1 The procedure described in this test method is intended as an aid in evaluating the ease of removal for surface stains encountered by surfaces coated with multicolor lacquers.

5. Apparatus and Materials

5.1 *Steel Panels*, 165 by 430 mm (6½ by 17 in.), 20-gage cold-rolled steel conforming to Specification A 109 or Specification A 366/A 366M.

5.2 *Washability Machine*,[7] The washability machine should be capable of moving the abrasion boat linearly across the sample with a reciprocating motion. The speed should be 37 ± 1 cycles (double strokes) per minute over a 10 in. travel.

5.3 *Lacquer Primer*, conforming to MIL-P-11414A.

5.4 *Drafting Pencil.*

5.5 *China Marking Crayon.*

5.6 *Wetting Agent.*[8]

5.7 *Silica.*[9]

5.8 *Diaper Cloth.*

5.9 *Varnish*, clear and waterproof, conforming to Fed. Spec. TT-V-121C or equal cut in mineral spirits.

5.10 *Carriage*, for mounting pencil and crayon.

5.11 *Arm*, extendible, for mounting mohair roller.

5.12 *Mohair Roller*, 40 mm (1½ in.), for application of grease stain.

5.13 *Glass Plate*, 100 by 175 mm (4 by 7 in.), for holding grease stain.

[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 D01.55 on Factory Applied Coatings on Preformed Products.

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[2] *Annual Book of ASTM Standards*, Vol 01.03.

[3] Discontinued; see *Annual Book of ASTM Standards*, Vol 01.03.

[4] *Annual Book of ASTM Standards*, Vol 06.03.

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

[6] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

[7] A list of machines suitable for this purpose is found in supporting data available from ASTM International Headquarters. Request RR: D01–1124.

[8] Triton X-100, available from Dow Chemical, 2040 Dow Center, Midland, MI 48674, has been found suitable for this purpose.

[9] A list of silicas suitable for this purpose is found in supporting data available from ASTM International Headquarters. Request RR: D01–1125.

5.14 *Grease*—The grease shall consist of the following ingredients:

5.14.1 *Lanolin*, anhydrous, 50 g,

5.14.2 *Petrolatum*, 50 g, conforming to Fed. Spec. VV-P-236,

5.14.3 *Margarine*, 30 g, conforming to Fed. Spec. EE-0-451C,

5.14.4 *Mineral Oil*, 10 g, conforming to Fed. Spec. VV-0-551, and

5.14.5 *Lampblack*, 5 g, conforming to Specification D 209.

6. Preparation of Panels

6.1 Prepare three 165 by 430-mm (6½ by 17-in.) steel panels in accordance with Practice D 609. Spray a 0.5-mil (13-µm) film of the lacquer primer then air dry for 24 h at normal room temperature. With the primer reduced 100 % with the recommended thinner, one wet coat will give approximately 0.5 mil.

6.2 Spray two coats of multicolor lacquer over the primer with the atomization pressure adjusted to get complete covering and allow 1 h between coats for flash off.

6.3 To protect the end of the panels in handling and scrubbing, brush one coat of varnish on the 125 mm (5 in.) of the end of each panel after 24 h of drying of the multicolor. Leave 175 mm (7 in.) of exposed test lacquer in the center of the panels and allow the varnish to dry 72 h before staining the panels. Test within 1 to 2 h after staining.

7. Procedure

7.1 *Application of Stains*:

7.1.1 *Pencil and China Marking Crayon*— Make both the pencil lead and the crayon flat by rubbing over fine sandpaper before application of pencil and crayon stains. Mount the pencil vertically in the carriage so that it rests with its own weight on the surface to be stained. Add an additional weight so that the total is 40 g. Move the pencil over the panel 5 strokes perpendicular to the abrasion boat path. Repeat this procedure with the crayon. Stain three panels.

7.1.2 *Grease Stain*—Apply 1 g of grease to a 100 by 175-mm (4 by 7-in.) glass plate and smooth with a rubber roller. Pass a 40-mm (1½-in.) mohair roller mounted on the extendible arm over the greased plate making three stripes and removing the grease down to the glass on each stripe so that the entire surface of the roller is uniformly coated. Then pass the roller over the panels coated with the lacquer under test. Make one stripe on the glass panel between the staining of each subsequent panel under test to maintain a uniform amount of grease on the roller.

7.2 *Removal of Stains*:

7.2.1 Cut the diaper cloth into a strip 150 by 170 mm (5⅞ by 6¾ in.) and fold to three thicknesses to give 50 by 170 mm. (2 by 6¾ in), keeping the embossed side out and the raw edges in. Soak the folded cloth in water, squeeze out the excess water, and place on the 2-lb (900-g) abrasion boat[10] (load boat with weight if necessary). Place 2 g of No. 22 silica wet with 2 mL of a 5 % wetting agent solution and smear this paste uniformly on the scrubbing area of the cloth with a spatula.

7.2.2 Start the scrubbing test using the washability machine[7] and record the number of cycles required to remove completely each of the three stains. If any of the stain is not removed after 100 cycles, add 1 mL of 5 % wetting agent solution to rewet the cloth and continue the test. Repeat at 100-cycle intervals stopping after 500 cycles. Rinse the panel in running water and allow to dry.

8. Report

8.1 Record the results as the number of cycles (double strokes) needed to remove each stain completely. Describe any stain that is not removed after 500 cycles as the percent of stain remaining on each of three panels and record the mean of the three panels.

9. Precision and Bias

9.1 *Precision*

9.1.1 Because of the variations that can arise from the application of the stains, meaningful estimates of precision cannot be given.

9.2 *Bias*

9.2.1 No information can be presented on bias of the procedure in Test Method D 2138 for measuring the number of cycles needed to remove each stain completely since no material having an acceptable reference value is available.

10. Keywords

10.1 lacquer; multicolor lacquers; stain removal

[10] A device to which the soaked cloth is affixed with a clamping device and is used to hold the cloth flatly against the sample during the reciprocating action. The total weight of the abrasion boat and wetted cloth should be 2 lb (900 g).