



Designation: D 925 – 88 (Reapproved 2000)

Standard Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)¹

This standard is issued under the fixed designation D 925; 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 These test methods describe techniques to evaluate three types of staining or discoloration that rubber may cause when in contact with or in proximity to another surface that may be light colored.

1.2 The test methods also describe how to qualitatively evaluate the degree of staining or discoloration produced in such situations.

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

1.4 *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 1148 Test Method for Rubber Deterioration—Heat and Ultraviolet Light Discoloration of Light-Colored Surfaces²

D 1566 Terminology Relating to Rubber²

D 3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets²

D 3183 Practice for Rubber—Preparation of Pieces for Test Purposes from Products²

E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *stain, contact*—discoloration of a product by another material or product in the area of direct contact.

3.1.1.1 *Discussion*—A test for direct surface discoloration of rubber is covered by Test Method D 1148.

3.1.2 *stain, diffusion*—discoloration of a light colored veneer or coating, caused by the diffusion of staining materials from the rubber through the veneer or coating.

3.1.2.1 *Discussion*—The veneer or coating is in direct intimate contact with the underlying rubber.

3.1.3 *stain, migration*—discoloration, caused by constituents of a rubber, that occurs on any portion of the surface of any object in the proximity of or adjacent to but not in direct contact with the rubber causing the stain.

4. Summary of Test Methods

4.1 The test methods are as follows:

4.1.1 *Method A*—Contact Stain.

4.1.2 *Method B*—Migration Stain.

4.1.3 *Method C*—Diffusion Stain.

4.2 *Method A*—Specimens to be tested for contact staining are sandwiched between two metal panels. The metal panels are furnished with a desired light colored organic finish, which is in contact with the rubber. The assembly is exposed to elevated temperature for a specified length of time and the specimens are then removed from the metal. The degree of staining of the surface that was in contact with the rubber is rated against a known standard and a control panel, simultaneously tested without rubber.

4.3 *Method B*—Specimens to be tested for migration staining are placed on a metal plate with a desired light colored organic finish, and exposed to the ultraviolet radiation of a sunlamp bulb contained in a test chamber, for a specified length of time. The degree of staining beyond the area that was in contact with the specimens is then rated against a known standard and a control panel, simultaneously tested without rubber.

4.4 *Method C*—Diffusion staining is tested on specimens provided with a light colored rubber veneer or organic coating, deposited from organic solvent or water base. The specimens are placed under a sunlamp bulb contained in a test chamber and exposed to ultraviolet radiation for a specified length of time, with their veneer or coated side up. Any staining of the light colored veneer or coating is considered diffusion staining

¹ These test methods are under the jurisdiction of ASTM Committee D11 on Rubber and are the direct responsibility of Subcommittee D11.15 on Degradation Tests.

Current edition approved April 29, 1988. Published June 1988. Originally published as D 925 – 47T. Last previous edition D 925 – 83.

² *Annual Book of ASTM Standards*, Vol 09.01.

³ *Annual Book of ASTM Standards*, Vol 14.02.



and rated against a known standard and a control sample of the veneer or coating without the staining rubber.

4.5 Specimens used in all three staining tests shall include one or more reference samples of known staining characteristics. In addition, the contact and migration staining tests shall include a metal panel without rubber samples, to establish the effect of the test conditions on the finished metal surface itself. The diffusion staining test shall include as controls a vulcanized sample of the rubber veneer by itself or a sample of the coating applied to aluminum foil.

5. Significance and Use

5.1 Rubber in contact with light colored organic finishes may stain the surfaces in contact with the rubber (contact staining) and surfaces adjacent to or beyond the rubber (migration staining), especially under conditions of heat, pressure, or sunlight. When a light colored rubber veneer or organic coating covers a staining rubber compound, the staining ingredients can diffuse through the veneer or coating and stain the surface (diffusion staining). This staining of light colored surfaces is objectionable to the consumer.

5.2 These test methods provide a way of evaluating staining characteristics of rubber compounds but may not necessarily duplicate natural exposure and conditions. The sunlamp used in the migration and diffusion staining tests emits shortwave ultraviolet components that are not present in sunlight.

5.3 Results obtained should not be treated as being equivalent to any natural exposure, unless the degree of quantitative correlation has been established for the material in question.

5.4 These test methods may be used for producer-consumer acceptance, referee purposes, and research and development work.

METHOD A—CONTACT STAIN

6. Apparatus

6.1 *Circulating-Air Oven*—The oven shall meet the requirements of Test Method E 145, Type 11 B.

7. Materials and Manufacture

7.1 Metal panels 50 mm (2 in.) square shall be cut from sheet metal of approximately 0.9 mm (20 gage) thickness that has been coated with a desired organic finish (Note 1). When these test methods are used to determine compliance with specifications, the panels may be supplied by the purchaser and the type of finish used may be the subject of agreement between the purchaser and the seller. The panels shall be aged for at least 48 h after finishing before use in this test.

NOTE 1—When a control organic finish is desired, it is recommended that panels be coated with an acrylic enamel.⁴

8. Test Specimen

8.1 The test specimen shall be prepared from a vulcanized production part or from a test sheet in accordance with

Practices D 3182 and D 3183. The specimen shall be rectangular in shape, 25 by 12 mm (1 by 0.5 in.) and of uniform thickness. If a specimen of this size cannot be prepared from a production part, a modification of this size may be used, if agreed upon between the purchaser and the seller. The specimen shall be tested as received, but extraneous contamination may be removed by washing with mild soap solution or by mechanical means without surface abrasion.

9. Procedure

9.1 Place two rubber specimens from the same material between two metal plates, as shown in Fig. 1, with the finished surfaces of the panels in contact with the rubber.

9.1.1 Place the panel-rubber “sandwich” thus formed in the oven maintained at a temperature of $70 \pm 2^\circ\text{C}$ ($158 \pm 4^\circ\text{F}$). Place a 0.5 kg (1 lb) mass on top of the sandwich (or an adjusted mass, if nonstandard specimens are being tested).

9.1.2 Expose the assembly to the oven temperature for a specified time; time intervals frequently used are 6, 24, 48, and 96 h. Take care that no other volatile or vapor-producing materials that might produce staining are in the oven.

9.1.3 After the aging period remove the assembly from the oven and separate the specimens cleanly from the sandwich. Then wash the panels with mild soap solution.

9.2 Simultaneously test a control panel without rubber to check the effect of the test conditions on the finish itself. Expose no panel more than once.

9.3 One or more control assemblies using rubber materials of known staining characteristics shall be included in the test.

9.4 Consider any staining of the area that was in contact with the specimen that is greater than the discoloration of the control panel as contact staining. Judge the degree of this contact stain by comparison with a standard, or give a numerical rating based on an arbitrary scale that may be agreed upon between the purchaser and the seller. Observe and record any migration staining beyond the contact area that exceeds the degree of contact stain, since this is objectionable.

METHOD B—MIGRATION STAIN

10. Apparatus

10.1 *Light Source*—A sunlamp equipped with an oxidized aluminum reflector, approximately 350 mm (14 in.) in diameter at the lower rim and a RSM Type 275 W, 110 to 125 V sunlamp bulb⁵ with Mogul screw base shall be used. The bulb must be calibrated in accordance with Section 13.

10.2 *Alternative Light Sources*—The RS⁶, RS-HUV and S-1 sunlamp bulbs, formerly employed for this test, are no longer commercially available, but may be used if they can be obtained. These bulbs must also be calibrated in accordance with Section 13.

10.3 *Test Chamber*—A suitable metal or wood housing to enclose the sunlamp and test specimens shall be used for control of temperature during the test and shall be equipped

⁴ Delstar Acrylic Enamel—DAR 2185 white, in conjunction with Satin Primer DPE-1338 (light gray-nonsanding) has been found suitable. For the nearest distribution contact PPG Industries, Inc., Ditzler Automotive Finishes, Troy, MI 48084.

⁵ The General Electric Time-A-Tan bulb (RSM Type) has been found satisfactory.

⁶ The RS is the same as the RSM bulb, except that it has a standard instead of a Mogul screw base.