



# Standard Test Method for Rubber Deterioration—Discoloration from Ultraviolet (UV) or UV/Visible Radiation and Heat Exposure of Light-Colored Surfaces<sup>1</sup>

This standard is issued under the fixed designation D1148; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.  
(This test method was prepared jointly by the Society of Automotive Engineers and ASTM International.)

## 1. Scope

1.1 This test method covers techniques to evaluate the surface discoloration of white or light-colored vulcanized rubber that may occur when subjected to UV or UV/visible exposure from specified sources under controlled conditions of relative humidity, or moisture, and temperature.

1.2 This test method also describes how to qualitatively evaluate the degree of discoloration produced under such conditions.

1.3 The term “discoloration” applies to a color change of the rubber sample, as distinguished from staining (see [Note 1](#)), that refers to a color change of a metal finish in contact with or adjacent to the rubber specimen.

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.*

NOTE 1—Tests for staining are covered by Test Methods [D925](#).

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D925](#) Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)

[D2244](#) Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [D11](#) on Rubber and is the direct responsibility of Subcommittee [D11.15](#) on Degradation Tests.

Current edition approved Jan. 1, 2013. Published February 2013. Originally approved in 1951. Last previous edition approved in 2007 as [D1148 – 07a](#). DOI: 10.1520/D1148-13.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

[D3182](#) Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

[D3183](#) Practice for Rubber—Preparation of Pieces for Test Purposes from Products

[G151](#) Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

[G154](#) Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

[G155](#) Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

## 3. Summary of Test Method

3.1 Specimens to be tested for discoloration are exposed to UV or UV/visible radiation. The specimens shall include one or more control specimens of known discoloration characteristics.

3.2 After exposing the specimens to actinic radiation for specified periods of time, under controlled conditions of relative humidity, or moisture, and temperature, the degree of discoloration is rated against discoloration of the control specimens, which have been exposed simultaneously with the test specimens.

## 4. Significance and Use

4.1 The surface of white or light-colored vulcanized rubber articles, or vulcanized rubber covered with an organic finish, may discolor when exposed to conditions of humidity, or moisture, heat, and sunlight. This change in color of light-colored rubber surfaces is objectionable to the consumer.

4.2 Results obtained should be treated only as indicating the effect of irradiance from the specified source (either UVA-340 lamps or a xenon arc with a Daylight Filter) and not as equivalent to the result of any natural exposure, unless the degree of quantitative correlation has been empirically established for the material in question.

4.3 This test method may be used for producer-consumer acceptance, referee purposes, and research and development work.

## 5. Apparatus

5.1 *Fluorescent UV/Condensation Apparatus (Practice G154)*—Use Fluorescent UV test apparatus that conforms to the requirements defined in Practices G151 and G154.

5.1.1 Unless otherwise specified, the spectral power distribution (SPD) of the fluorescent lamp shall conform to the requirements of Table 1 in Practice G154 (UVA-340 Lamp). Refer to Fig. 1.

5.2 *Xenon Arc Light Apparatus (Practice G155)*—Use xenon arc test apparatus that conforms to the requirements defined in Practices G151 and G155.

5.2.1 Unless otherwise specified, the spectral power distribution (SPD) of the filtered xenon lamp shall conform to the requirements of Table 1 in Practice G155 (Xenon Arc with Daylight Filter). Refer to Fig. 2.

5.3 Color meter capable of measuring tristimulus colors for amber, blue, and green with or without automatic calculation for  $L a b$  or  $L^* a^* b^*$  values. If without automatic calculations, a computer program should be available for this calculation.

## 6. Test Specimen

6.1 The test specimen shall be prepared from a vulcanized production part or from a test slab prepared in accordance with Practices D3182 and D3183. The specimen shall be rectangular in shape, 62 by 12 mm (2.4 by 0.5 in.). If a specimen of this size cannot be prepared from a production part, a modification of the size may be agreed upon between the purchaser and the seller.

6.2 An unexposed file specimen of the same compound as that stated in 6.1 shall be prepared and reserved for color comparisons without being subjected to exposure.

## 7. Procedure

7.1 The two procedures (Fluorescent UV/Condensation and Xenon Arc) contain different types of exposure sources and test

conditions and may produce different test results. They cannot be used interchangeably without supporting data that demonstrates equivalency of the procedures for the materials tested.

7.2 Refer to Table A3.1 in Practice G151 for the allowed operational fluctuations of the specified set points for irradiance, temperature, and relative humidity. If the actual operating conditions do not comply with the maximum allowable fluctuations in Table A3.1 after the equipment has stabilized, discontinue the test and correct the cause of the problem before continuing.

7.3 Specimens should be confined to an exposure area in which the irradiance is at least 90 % of the irradiance at the center of the exposure area. Unless it is known that irradiance uniformity meets this requirement, use one of the procedures described in Practice G151, Section 5.1.4, to ensure equal radiant exposure on all specimens, or to compensate for differences within the exposure chamber. If the specimens do not completely fill the racks, fill the empty spaces with blank metal panels to maintain the test conditions within the chamber. The apparatus shall be operated continuously. However, if the test needs to be interrupted to perform routine maintenance or inspection, it should be during a dry period.

7.4 *Procedure for Exposure in Fluorescent UV/Condensation Apparatus (Practice G154)*—Unless otherwise specified, operate the fluorescent UV test apparatus with UVA-340 lamps in accordance with Practice G154.

7.4.1 Use the following exposure cycle: Set the irradiance level to 0.77 W / (m<sup>2</sup> · nm) at 340 nm. Expose specimens to a continuous cycle of 8 h light at 60°C uninsulated black panel temperature followed by 4 h of condensation at 50°C uninsulated black panel temperature.

7.5 *Procedure for Exposure in Xenon Arc Apparatus (Practice G155)*—Unless otherwise specified, use the following operating conditions:

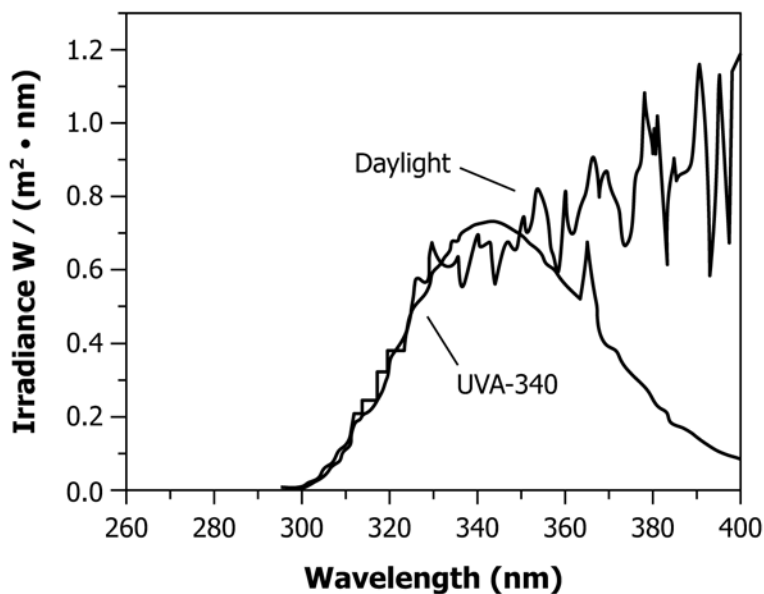


FIG. 1 Spectral Power Distributions of UVA-340 Lamp Versus Daylight