



Designation: D 4587 – 01

Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings¹

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1. Scope

1.1 This practice covers the selection of test conditions for accelerated exposure testing of coatings and related products in fluorescent UV and condensation devices conducted according to Practices G 151 and G 154. This practice also covers the preparation of test specimens, and the evaluation of test results. Table 1 describes commonly used test conditions.

NOTE 1—Previous versions of this practice referenced fluorescent UV devices described by Practice G 53, which described very specific equipment designs. Practice G 53 has been withdrawn and replaced by Practice G 151, which describes performance criteria for all exposure devices that use laboratory light sources, and by Practice G 154, which gives requirements for exposing nonmetallic materials in fluorescent UV devices.

NOTE 2—ISO 11507:1997 also describes fluorescent UV-condensation exposures of paints and coatings.

1.2 *This standard does not purport to address all of the safety problems 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 358 Specification for Wood to Be Used As Panels in Weathering Tests of Coatings²
- D 523 Test Method for Specular Gloss³
- D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products³
- D 610 Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces²
- D 659 Method of Evaluating Degree of Chalking of Exterior Paints⁴

- D 660 Test Method for Evaluating Degree of Checking of Exterior Paints³
- D 662 Test Method for Evaluating Degree of Erosion of Exterior Paints³
- D 714 Test Method for Evaluating Degree of Blistering of Paints³
- D 772 Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints³
- D 823 Test Methods for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels³
- D 1005 Test Methods for Measurement of Dry Film Thickness of Organic Coatings Using Micrometers³
- D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base³
- D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base³
- D 1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely Illuminated Opaque Materials³
- D 1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting⁵
- D 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates³
- D 2616 Test Method for Evaluation of Visual Color Difference With a Gray Scale³
- D 3359 Test Methods for Measuring Adhesion by Tape Test³
- D 3980 Practice for Interlaboratory Testing of Paint and Related Materials⁶
- D 4214 Test Methods for Evaluating Degree of Chalking of Exterior Paint Films³
- D 5870 Practice for Calculating Property Retention Index of Plastics⁷
- E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁸

¹ This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.27 on Accelerated Testing.

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² Annual Book of ASTM Standards, Vol 06.02.

³ Annual Book of ASTM Standards, Vol 06.01.

⁴ Discontinued 1989; see 1990 Annual Book of ASTM Standards, Vol 06.01.

⁵ Annual Book of ASTM Standards, Vol 02.05.

⁶ Discontinued 1998; see 1997 Annual Book of ASTM Standards, Vol 06.01.

⁷ Annual Book of ASTM Standards, Vol 08.03.

⁸ Annual Book of ASTM Standards, Vol 14.02.

TABLE 1 Test Cycles Commonly Used for Fluorescent UV–Condensation Exposure Testing of Paints and Related Coatings^A

Cycle Number	Cycle Description	340 nm Irradiance ^B	Black Panel Temperature ^C	Typical Uses ^D
1	8 h UV 4 h condensation Repeated continuously	0.72 W/(m ² ·nm) dark period	70 ± 2.5 °C (158 ± 5 °F) 50 ± 2.5 °C (122 ± 5 °F)	Automotive coatings ^E
2	4 h UV 4 h condensation Repeated continuously	0.77 W/(m ² ·nm) dark period	60 ± 2.5 (140 ± 5 °F) 50 ± 2.5 (122 ± 5 °F)	Industrial maintenance coatings ^F
3	4 h UV 20 h condensation Repeated continuously	0.77 W/(m ² ·nm) dark period	60 ± 2.5 (140 ± 5 °F) 50 ± 2.5 (122 ± 5 °F)	Exterior wood coatings
4	8 h UV 4 h condensation Repeated continuously	0.77 W/(m ² ·nm) dark period	60 ± 2.5 (140 ± 5 °F) 50 ± 2.5 (122 ± 5 °F)	General metal coatings

^A The cycles described are not listed in any order indicating importance, and are not necessarily recommended for the applications listed. Additional exposure cycles are described in Practice G 154.

^B The irradiance set point given is typical for devices operated without irradiance control. Other irradiance levels may be used, but must be described in the report.

^C Temperature is at equilibrium for either an uninsulated or insulated black panel, although the response of the insulated black panel might be slower than that for the uninsulated black panel. Refer to Practice G 151 for more information about the construction and differences between uninsulated and insulated black panels.

^D Typical uses do not imply that results from exposures of these materials according to the cycle described will correlate to those from actual use conditions.

^E SAE J2020 describes the test used in many automotive specifications and requires use of a FS40 fluorescent UVB lamp.

^F Historical convention has established this as a very commonly used test cycle. This cycle may not adequately simulate the effects of outdoor exposure.

E 1347 Test Method for Color and Color Difference Measured by Tristimulus (filter) Colorimetry³

G 53 Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials⁹

G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials¹⁰

G 141 Guide for Addressing Variability in Exposure Testing on Nonmetallic Materials¹⁰

G 147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests¹⁰

G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices That Use Laboratory Light Sources¹⁰

G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials¹⁰

G 169 Guide for Application of Basic Statistical Methods to Weathering Tests¹⁰

2.2 ISO Standard:¹¹

ISO 11507:1997

2.3 SAE Standard:¹²

SAE J2020 Accelerated Exposure of Automotive Exterior Materials Using a Fluorescent UV Condensation Apparatus

3. Terminology

3.1 The definitions given in Terminology G 113 are applicable to this practice.

4. Significance and Use

4.1 The ability of a paint or coating to resist deterioration of its physical and optical properties caused by exposure to light,

heat, and water can be very significant for many applications. This practice is intended to induce property changes associated with end-use conditions, including the effects of sunlight, moisture, and heat. The exposure used in this practice is not intended to simulate the deterioration caused by localized weather phenomena such as atmospheric pollution, biological attack, and saltwater exposure.

4.2 **Cautions**—Variation in results may be expected when different operating conditions are used. Therefore, no reference to the use of this practice shall be made unless accompanied by a report prepared according to Section 10 that describes the specific operating conditions used. Refer to Practice G 151 for detailed information on the caveats applicable to use of results obtained according to this practice.

NOTE 3—Additional information on sources of variability and on strategies for addressing variability in the design, execution and data analysis of laboratory accelerated exposure tests is found in Guide G 141.

4.2.1 The spectral power distribution of light from fluorescent UV lamps is significantly different from that produced in light and water exposure devices using other light sources. The type and rate of degradation and the performance rankings produced in exposures to fluorescent UV lamps can be much different from those produced by exposures to other types of laboratory light sources.

4.2.2 Interlaboratory comparisons are valid only when all laboratories use the same design of fluorescent UV device, lamp, and exposure conditions.

4.3 Reproducibility of test results between laboratories has been shown to be good when the stability of materials is evaluated in terms of performance ranking compared to other materials or to a control.^{13,14} Therefore, exposure of a similar material of known performance (a control) at the same time as the test materials is strongly recommended. It is recommended

⁹ Discontinued 2000; see 1999 Annual Book of ASTM Standards, Vol 14.04.

¹⁰ Annual Book of ASTM Standards, Vol 14.04.

¹¹ Available from International Organization for Standardization, 1 Rue de Varembe, Case Postale 56, CH-1211, Geneva 20, Switzerland.

¹² Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

¹³ Fischer, R., "Results of Round Robin Studies of Light- and Water-Exposure Standard Practices," *Accelerated and Outdoor Durability Testing of Organic Materials*, ASTM STP 1202, ASTM, 1993.

¹⁴ Ketola, W., and Fischer, R., "Characterization and Use of Reference Materials in Accelerated Durability Tests," *VAMAS Technical Report* 10, VAMAS, 1996.