



Designation: D4587 – 23

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

This standard is issued under the fixed designation D4587; 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 practice describes artificial accelerated weathering methods for testing the durability of coatings and related products using fluorescent UV lamps and water apparatus operated in accordance with Practices [G151](#) and [G154](#).

1.2 This practice also makes recommendations for preparation of test specimens, exposure duration, and the evaluation of test results.

NOTE 1—ISO 16474-3 also describes fluorescent UV lamp and water apparatus for artificial accelerated weathering of paints and coatings.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- [D16 Terminology for Paint, Related Coatings, Materials, and Applications](#)
- [D523 Test Method for Specular Gloss](#)
- [D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and](#)

Related Coating Products

- [D610 Practice for Evaluating Degree of Rusting on Painted Steel Surfaces](#)
- [D659 Method for Evaluating Degree of Chalking of Exterior Paints \(Withdrawn 1990\)³](#)
- [D660 Test Method for Evaluating Degree of Checking of Exterior Paints](#)
- [D662 Test Method for Evaluating Degree of Erosion of Exterior Paints](#)
- [D714 Test Method for Evaluating Degree of Blistering of Paints](#)
- [D772 Test Method for Evaluating Degree of Flaking \(Scaling\) of Exterior Paints](#)
- [D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels](#)
- [D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers](#)
- [D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials](#)
- [D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting](#)
- [D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates](#)
- [D2616 Test Method for Evaluation of Visual Color Difference With a Gray Scale](#)
- [D3359 Test Methods for Rating Adhesion by Tape Test](#)
- [D4214 Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films](#)
- [D5870 Practice for Calculating Property Retention Index of Plastics](#)
- [D6631 Guide for Committee D01 for Conducting an Inter-laboratory Study for the Purpose of Determining the Precision of a Test Method](#)
- [D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals](#)
- [D7787 Practice for Selecting Wood Substrates for Weathering Evaluations of Architectural Coatings](#)

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 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 The last approved version of this historical standard is referenced on www.astm.org.

*A Summary of Changes section appears at the end of this standard

- E691** Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
- E1347** Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry
- E1348** Test Method for Transmittance and Color by Spectrophotometry Using Hemispherical Geometry
- E1349** Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry
- G113** Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials
- G141** Guide for Addressing Variability in Exposure Testing of Nonmetallic Materials
- G147** Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests
- 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 Materials
- G169** Guide for Application of Basic Statistical Methods to Weathering Tests

2.2 ISO Standard:⁴

ISO 16474-3 Paints and Varnishes—Methods of exposure to laboratory light sources – Part 3: Fluorescent UV Lamps

2.3 SAE Standard:⁵

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

3. Terminology

3.1 The definitions given in Terminology **D16** are applicable to this practice.

3.2 The definitions given in Terminology **G113** are applicable to this practice.

4. Significance and Use

4.1 The ability of a paint or coating to resist degradation of its physical and optical properties caused by exposure to light, heat, and water can be important for many applications. This practice describes artificial accelerated weathering methods designed to reproduce property changes associated with exposure to sunlight, moisture, and heat in end-use conditions. The weathering methods referenced in this practice do not 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 **G151** for

detailed information on the caveats applicable to use of results obtained according to this practice.

NOTE 2—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 **G141**.

4.2.1 The spectral irradiance 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 apparatus, 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 material.^{6,7} 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 that at least three replicates of each material be exposed to allow for statistical evaluation of results.

4.4 Repeatability and reproducibility of test results will depend upon the care that is taken to operate the equipment according to Practice **G154**. Significant factors include regulation of line voltage, temperature of the room in which the device operates, temperature control, and condition and age of the lamps.

4.5 All references to artificial accelerated weathering in accordance with this practice shall include a complete description of the test cycle and equipment used.

5. Apparatus

5.1 The fluorescent UV lamp and water apparatus shall conform to the requirements defined in Practices **G151** and **G154**.

5.2 Unless otherwise specified, the spectral irradiance of the fluorescent UV lamp shall conform to the requirements in Practice **G154** for a UVA 340 lamp.

NOTE 3—Fluorescent UV exposures described in SAE J2020 for automotive applications call for use of fluorescent UVA or UVB lamps.

5.3 Laboratory Conditions:

5.3.1 Locate the apparatus in an area maintained between 18 °C and 27 °C (65 °F and 80 °F). Measure ambient temperature at a maximum distance of 150 mm (6 in.) from the plane door of the apparatus. Control of ambient temperature is particularly critical when one apparatus is stacked above another, because the heat generated from the lower unit can affect the ambient conditions of the units above.

⁴ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

⁵ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

⁶ 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.

⁷ Ketola, W., and Fischer, R., "Characterization and Use of Reference Materials in Accelerated Durability Tests," *VAMAS Technical Report 16-97*, NIST, June 1997.