



Designation: D4329 – 21

Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics¹

This standard is issued under the fixed designation D4329; 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 covers specific procedures and test conditions that are applicable for using a fluorescent UV lamp and water apparatus exposure of plastics conducted in accordance with Practices [G151](#) and [G154](#). This practice also covers the preparation of test specimens, the test conditions best suited for plastics, and the evaluation of test results.

1.2 The values stated in SI units are to be regarded as 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This standard and ISO 4892-3 address the same subject matter, but differ in technical contact.

1.4 *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

[D883 Terminology Relating to Plastics](#)

[D5870 Practice for Calculating Property Retention Index of Plastics](#)

[E456 Terminology Relating to Quality and Statistics](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

¹ This practice is under the jurisdiction of ASTM Committee [D20](#) on Plastics and is the direct responsibility of Subcommittee [D20.50](#) on Durability of Plastics.

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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.

[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 Nonmetallic Materials](#)

[G169 Guide for Application of Basic Statistical Methods to Weathering Tests](#)

[G177 Tables for Reference Solar Ultraviolet Spectral Distributions: Hemispherical on 37° Tilted Surface](#)

2.2 *ISO Standard:*³

[ISO 4892-3 Plastics—Methods of Exposure to Laboratory Light Sources—Part 3, Fluorescent UV Lamps](#)

2.3 *SAE Standard:*⁴

[SAE J2020 Accelerated Exposure of Automotive Exterior Materials Using a Fluorescent UV and Condensation Apparatus](#)

3. Terminology

3.1 For definitions of terms relating to plastics used in this practice, refer to Terminology [D883](#).

3.2 For definitions of terms relating to precision and bias and associated used in this practice, refer to Terminology [E456](#).

3.3 For definitions of terms relating to weathering used in this practice, refer to Terminology [G113](#).

4. Significance and Use

4.1 The ability of a plastic material to resist deterioration caused by exposure to light, heat, and water is a property of significance in many applications. This practice is intended to induce property changes associated with end-use conditions, including the effects of ultraviolet solar irradiance, moisture, and heat. The exposure used in this practice is not intended to

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

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

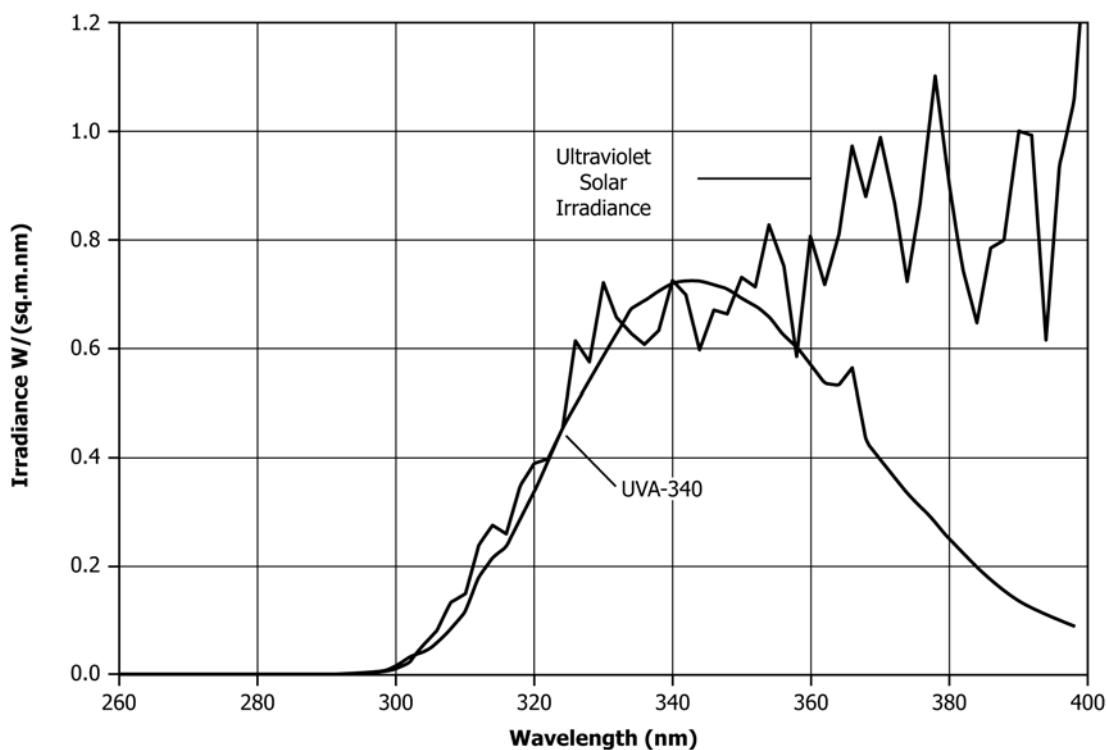


FIG. 1 Representative Spectral Power Distribution of UVA-340 Fluorescent Lamps

simulate the deterioration caused by localized weather phenomena, such as, atmospheric pollution, biological attack, and saltwater exposure. (**Warning**—Variation in operating conditions within the accepted limits of this practice will not necessarily provide the same results. Therefore, no reference to the use of this practice shall be made unless accompanied by a report prepared in accordance with Section 8 that describes the specific operating conditions used. Refer to Practice G151 for detailed information on the caveats applicable to use of results obtained in accordance with 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 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.^{5,6} 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.

4.3 Test results will depend upon the care that is taken to operate the equipment in accordance with Practice G154. Significant factors include regulation of line voltage, tempera-

ture of the room in which the device operates, temperature control, and condition and age of the lamp.

5. Apparatus

5.1 Use of fluorescent UV apparatus that conforms to the requirements defined in Practices G151 and G154 is required to conform to this practice.

5.2 Unless otherwise specified, the spectral power distribution of the fluorescent UV lamp shall conform to the requirements in Practice G154 for a UVA 340 lamp. Fig. 1 is a spectral irradiance plot for a typical UVA-340 lamp and benchmark solar radiation.

NOTE 3—The source of the ultraviolet solar irradiance data in Fig. 1 is the Standard G177 standard solar spectrum.

5.3 Test Apparatus Location:

5.3.1 Locate the apparatus in an area maintained between 18 and 27°C (65 and 80°F). 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.

5.3.2 Place the apparatus at least 300 mm from walls or other apparatus. Do not place the apparatus near a heat source such as an oven.

5.3.3 Ventilate the room in which the apparatus is located to remove heat and moisture.

6. Test Specimen

6.1 The size and shape of specimens to be exposed will be determined by the specifications of the particular test method used to evaluate the effects of the exposure on the specimens; the test method shall be determined by the parties concerned.

⁵ 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, Warren D. Ketola and Douglas Grossman, eds., American Society for Testing and Materials, Philadelphia, 1993.

⁶ Ketola, W., and Fischer, R., "Characterization and Use of Reference Materials in Accelerated Durability Tests," *VAMAS Technical Report No. 30*, available from NIST, Gaithersburg, MD.