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.

Designation: G154 – 23

Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials[1]

This standard is issued under the fixed designation G154; 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 is limited to the basic principles for operating a fluorescent UV lamp and water apparatus; on its own, it does not deliver a specific result.

1.2 It is intended to be used in conjunction with a practice or method that defines specific exposure conditions for an application along with a means to evaluate changes in material properties. This practice is intended to reproduce the weathering effects that occur when materials are exposed to sunlight (either direct or through window glass) and moisture as rain or dew in actual usage. This practice is limited to the procedures for obtaining, measuring, and controlling conditions of exposure.

NOTE 1—Practice G151 describes general procedures to be used when exposing nonmetallic materials in accelerated test devices that use laboratory light sources.

NOTE 2—A number of exposure procedures are listed in an appendix; however, this practice does not specify the exposure conditions best suited for the material to be tested.

1.3 Test specimens are exposed to fluorescent UV light under controlled environmental conditions. Different types of fluorescent UV lamp sources are described.

NOTE 3—In this standard, the terms *UV light* and *UV radiation* are used interchangeably.

1.4 Specimen preparation and evaluation of the results are covered in ASTM methods or specifications for specific materials. General guidance is given in Practice G151 and ISO 4892-1.

NOTE 4—General information about methods for determining the change in properties after exposure and reporting these results is described in ISO 4582 and Practice D5870.

1.5 This practice is not intended for corrosion testing of bare metals.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 This standard is technically similar to ISO 4892-3 and ISO 16474-3.

1.8 *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.*

1.9 *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]

D5870 Practice for Calculating Property Retention Index of Plastics

D6631 Guide for Committee D01 for Conducting an Interlaboratory Study for the Purpose of Determining the Precision of a Test Method

G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

G177 Tables for Reference Solar Ultraviolet Spectral Distributions: Hemispherical on 37° Tilted Surface

2.2 *ISO Standards:*[3]

ISO 4582 Plastics—Determination of the Changes of Colour and Variations in Properties After Exposure to Daylight Under Glass, Natural Weathering or Artificial Light

ISO 4892-1 Plastics—Methods of Exposure to Laboratory Light Sources—Part 1, Guidance

[1] This practice is under the jurisdiction of ASTM Committee G03 on Weathering and Durability and is the direct responsibility of Subcommittee G03.03 on Simulated and Controlled Exposure Tests.

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

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

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ISO 4892-3 Plastics—Methods of Exposure to Laboratory Light Sources—Part 3, Fluorescent UV lamps
ISO 16474-3 Paints and Varnishes—Methods of Exposure to Laboratory Light Sources—Part 3: Fluorescent UV Lamps

3. Terminology

3.1 *Definitions*—The definitions given in Terminology G113 are applicable to this practice.

3.2 *Definitions of Terms Specific to This Standard*—As used in this practice, the term *sunlight* is identical to the terms *daylight* and *solar irradiance, global* as they are defined in Terminology G113.

3.2.1 *Fluorescent Ultraviolet (UV) lamp Apparatus*—an apparatus specifically designed for performing artificial accelerated weathering and irradiation tests using fluorescent UV lamps as the light source and including a means to expose the test specimens to moisture and controlled temperature.

4. Summary of Practice

4.1 Specimens are exposed to repetitive cycles of light and moisture under controlled environmental conditions.

4.1.1 Moisture is usually produced by condensation of water vapor onto the test specimen or by spraying the specimens with demineralized/deionized water.

4.2 The exposure condition may be varied by selection of:

4.2.1 The fluorescent lamp,

4.2.2 The lamp's irradiance level,

4.2.3 The type of moisture exposure,

4.2.4 The timing of the light, dark, and moisture periods, and

4.2.5 The temperature during each exposure condition.

5. Significance and Use

5.1 The use of this apparatus is intended to induce property changes consistent with the end use conditions, including the effects of the UV portion of sunlight, moisture, and heat. Typically, these exposures would include moisture in the form of condensing humidity. Exposures are not intended to simulate the deterioration caused by localized weather phenomena, such as atmospheric pollution, biological attack, and saltwater exposure. Alternatively, the exposure may simulate the effects of sunlight through window glass. (**Warning—**Refer to Practice G151 for full cautionary guidance applicable to all laboratory weathering devices.)

5.2 This practice provides general procedures for operating fluorescent UV lamp weathering devices that allow for a wide range of exposure conditions. Therefore, no reference shall be made to results from the use of this practice unless accompanied by a report detailing the specific operating conditions in conformance with Section 10.

5.2.1 It is recommended that a similar material of known performance (a control) be exposed simultaneously with the test specimen to provide a standard for comparative purposes. Generally, two controls are recommended: one known to have poor durability and one known to have good durability. It is recommended that at least three replicates of each material evaluated be exposed in each test to allow for statistical evaluation of results.

5.2.2 Comparison of results obtained from specimens exposed in the same model of apparatus should not be made unless reproducibility has been established among devices for the material to be tested.

5.2.3 Comparison of results obtained from specimens exposed in different models of apparatus should not be made unless correlation has been established among devices for the material to be tested (see Guide D6631 for guidance).

6. Apparatus

6.1 *Laboratory Light Source*—The light source shall be one or more fluorescent UV lamps. A variety of fluorescent UV lamps can be used for this procedure. Differences in lamp intensity or spectrum may cause significant differences in test results.

6.1.1 Do not mix different types of lamps. Mixing different types of lamps (as described in 6.1.4) in a fluorescent UV apparatus causes major inconsistencies to the radiation received by the samples.

6.1.1.1 A detailed description of the type(s) of lamp(s) used shall be stated in the test report. The particular testing application determines which lamp is used. See Appendix X1 for lamp application guidelines.

6.1.2 The apparatus should include an irradiance control system to monitor and control the irradiance. In apparatuses without irradiance control, the actual irradiance levels at the test specimen surface may vary due to the type of lamps, manufacturer of the lamps, age of the lamps, accumulation of dirt or other residue on the lamps, distance to the lamp array, air temperature within the chamber and ambient laboratory temperature.

NOTE 5—In general, in apparatuses without irradiance control, lamp output will decrease with increasing chamber or laboratory temperature, or both.

6.1.3 Fluorescent lamps age with extended use. Follow the apparatus manufacturer's instructions on the procedure necessary to maintain desired irradiance (**1, 2**).[4]

6.1.4 *Standard Fluorescent UV Lamps*—Fluorescent UV lamps are available with a choice of spectral power distributions that vary significantly. The more common are identified as UVA-340, UVA-351, and UVB-313. These numbers represent the characteristic nominal wavelength (in nm) of peak emission for each of these lamp types. The actual peak emissions are at 343 nm, 350 nm, and 313 nm, respectively.

6.1.4.1 *Spectral Power Distribution (also known as Spectral Irradiance) of UVA-340 Lamps for Daylight UV*—The spectral power distribution of UVA-340 fluorescent lamps shall comply with the requirements specified in Table 1.

NOTE 6—The main application for UVA-340 lamps is for simulation of the short and middle UV wavelength region of daylight.

6.1.4.2 *Spectral Power Distribution of UVA-351 Lamps for Daylight UV Behind Window Glass*—The spectral power distribution of UVA-351 lamp for Daylight UV behind Window Glass shall comply with the requirements specified in Table 2.

[4] The boldface numbers in parentheses refer to a list of references at the end of this standard.