



Designation: D4799/D4799M – 17

Standard Practice for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Fluorescent UV, Water Spray, and Condensation Method)¹

This standard is issued under the fixed designation D4799/D4799M; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This practice describes test conditions and procedures for fluorescent UV and condensation exposures conducted according to Practices [G151](#) and [G154](#) for bituminous roofing and waterproofing materials. (See Terminology [G113](#).)

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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

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

[D36/D36M Test Method for Softening Point of Bitumen \(Ring-and-Ball Apparatus\)](#)

[D1669/D1669M Practice for Preparation of Test Panels for Accelerated and Outdoor Weathering of Bituminous Coatings](#)

¹ This practice is under the jurisdiction of ASTM Committee [D08](#) on Roofing and Waterproofing and is the direct responsibility of Subcommittee [D08.02](#) on Steep Roofing Products and Assemblies.

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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.

[D1670/D1670M Test Method for Failure End Point in Accelerated and Outdoor Weathering of Bituminous Materials](#)

[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](#)

3. Summary of Test Method

3.1 Thin films of bitumen are uniformly applied to aluminum panels. Shingles and similar materials are cut to size and exposed to specified cycles of temperature, light, and water. A choice of six test cycles is given along with options for determining the period of exposure and evaluating results.

4. Significance and Use

4.1 This weathering apparatus is used for comparing the weathering characteristics of bituminous materials against a control material for which the outdoor weathering characteristics are known. It is not possible to establish a precise correlation between accelerated and natural weathering because (1) there are geographical climatic variations, local weather variations, and variations in local pollutants, and (2) the relation between accelerated and natural weathering is material dependent. Acceleration factors differ between materials as well as between formulations of the same material. Guide [G141](#) provides guidance regarding this issue.

NOTE 1—This practice can be used for other than bituminous materials, but the significance and use have not been evaluated.

5. Apparatus

5.1 The fluorescent UV and condensation apparatus used shall conform to the requirements defined in Practices [G151](#) and [G154](#).

5.2 Lamps—The lamps shall be fluorescent UVA-340 lamps as described in 6.1.3.1 of Practice **G154**.

5.3 Moisture—It is permitted to expose the test specimens to moisture in the form of water spray, condensation, or high humidity.

5.3.1 Water Spray—It is permitted to equip the test chamber with a means to introduce intermittent water spray onto the test specimens under specified conditions. The spray shall be uniformly distributed over the samples. The spray system shall be made from corrosion resistant materials that do not contaminate the water used.

5.3.1.1 Spray Water Quality—Spray water shall have a conductivity below 5 $\mu\text{S}/\text{cm}$, contain less than 1-ppm solids, and leave no observable stains or deposits on the specimens. Very low levels of silica in spray water can cause significant deposits on the surface of test specimens. Care should be taken to keep silica levels below 0.1 ppm. In addition to distillation, a combination of deionization and reverse osmosis can effectively produce water of the required quality. The pH of the water used shall be reported. See Practice **G151** for detailed water quality instructions.

6. Test Specimens

6.1 Unless otherwise agreed upon, test specimens shall be approximately 3 by 6 in. [75 by 150 mm]. Bituminous materials with adequate flow resistance shall be applied as uniform coatings on aluminum panels in accordance with Practice **D1669/D1669M**. Fabricated materials such as bituminous roofing, shingles, and similar products shall be cut to size and their weather surfaces exposed. If these are too flexible to sustain their own weight in a vertical position, they may be mounted on aluminum panels.

6.1.1 Unless otherwise specified, expose at least three replicate specimens of each test and control material using nondestructive tests of change in material properties and six replicate specimens using destructive tests. Do not mask the face of each specimen for the purpose of showing on one panel a record of degradation at different time intervals. Misleading results may be obtained by this method because the masked portion of the specimen is still exposed to temperature and moisture that in many cases will affect results. Instead, provide a replicate set of specimens for each time interval.

6.1.2 Retention of an unexposed specimen is recommended for comparison with exposed specimens when destructive tests are used to measure change in material properties.

7. Procedure

7.1 Proceed in accordance with Section 9 of Practice **G154**.

7.2 Apparatus shall be operated continuously, except for intervals for repositioning of samples or inspection of samples, according to one of the following cycles. The temperature specifications are for an uninsulated black panel thermometer. For equipment that requires an irradiance setting for its operation, it shall be $0.89 \pm 0.02 \text{ W}/(\text{m}^2 \cdot \text{nm})$ at 340 nm. Specimens shall 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 **G154**, Section 9.5, to ensure equal radiant exposure on all specimens or to compensate for differences within the exposure chamber. If the specimens do not completely fill all of the spaces, fill the empty spaces with blank panels of corrosion resistant material to maintain the test conditions within the chamber.

Cycle A— 4 h UV at $60 \pm 2.5^\circ\text{C}$, alternating with 4 h condensation at $50 \pm 2.5^\circ\text{C}$.

Cycle B— 20 h UV at $60 \pm 2.5^\circ\text{C}$, alternating with 4 h condensation at $50 \pm 2.5^\circ\text{C}$.

Cycle C— 20 h UV at $80 \pm 2.5^\circ\text{C}$, alternating with 4 h condensation at $50 \pm 2.5^\circ\text{C}$.

Cycle D— 4 h UV at $60 \pm 2.5^\circ\text{C}$, 15 min water spray, alternating with 3.75 h condensation at $50 \pm 2.5^\circ\text{C}$.

Cycle E— 20 h UV at $60 \pm 2.5^\circ\text{C}$, 15 min water spray, alternating with 3.75 h condensation at $50 \pm 2.5^\circ\text{C}$.

Cycle F— 20 h UV at $80 \pm 2.5^\circ\text{C}$, 15 min water spray, alternating with 3.75 h condensation at $50 \pm 2.5^\circ\text{C}$.

7.3 If inspection of the panels is to be performed at any stage in the cycle, the interruption of the test procedure shall take only sufficient time to allow for such inspection. The time taken for inspection of the samples shall not be counted as part of the exposure.

NOTE 2—The cycle to be employed shall be specified in the product standard.

NOTE 3—The operational fluctuations, that is, the positive and negative deviations from the specified set points for the irradiance and temperature, are allowable deviations from the set points during equilibrium operation of the equipment. They do not imply that the user is allowed to program a set point higher or lower than that specified. Operate the apparatus to maintain the allowable operational fluctuations. If the latter are greater than the maximum allowable after the equipment has stabilized, discontinue the test and correct the cause of the problem before continuing.

8. Period of Exposure and Evaluation of Results

8.1 The duration of the exposure under this practice shall be one of the following:

8.1.1 A mutually agreed upon number of hours of exposure,

8.1.2 The number of hours of exposure required to produce a mutually agreed upon minimum amount of change in the test specimen, or

8.1.3 The number of hours required to produce mutually agreed upon minimum acceptable change in either the test specimen or a mutually agreed upon standard sample.

8.2 It is permitted to evaluate changes in the exposed samples visually each day by comparing them with unexposed samples, or in terms of the number of hours exposure required to produce physical or chemical changes as determined by Test Method **D1670/D1670M**.

9. Report

9.1 In addition to the items specified in Practice **G151**, the report shall include the following:

9.1.1 Test cycle employed (in accordance with 7.2),

9.1.2 Manufacturer and designation of the fluorescent lamp employed, and

9.1.3 Coating thickness employed.

9.1.4 Method of sample repositioning, if used, or other means of assuring equal radiant exposure on all specimens or compensation for differences in irradiance within the exposure chamber.



9.1.5 Type of fluorescent/condensation device used, that is, irradiance controlled or non-controlled.

10. Precision and Bias

10.1 *Precision*—The repeatability of results obtained in exposures conducted according to this practice will vary with the materials being tested, the material property being measured, and the specific test conditions and cycles that are used. It is essential to determine reproducibility of the exposure/property measurement process when using the results from exposures conducted according to this practice in product specifications.

10.2 *Bias*—Bias cannot be determined because no acceptable standard weathering reference materials are available.

11. Keywords

11.1 accelerated weathering; bituminous materials; degradation; exposure; fluorescent UV and condensation; light exposure; roofing; ultraviolet; waterproofing

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