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Standard Practice for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method)¹

This standard is issued under the fixed designation D4798/D4798M; 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 test conditions and procedures for xenon-arc exposures according to Practices G151 and G155 for bituminous roofing and waterproofing materials that have a minimum softening point of approximately 95°C [200°F] as determined by Test Method D36. (Also 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.*

2. Referenced Documents

2.1 ASTM Standards:²

D36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)

D1669 Practice for Preparation of Test Panels for Accelerated and Outdoor Weathering of Bituminous Coatings

D1670 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

G155 ~~Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials~~ Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

G169 Guide for Application of Basic Statistical Methods to Weathering Tests

3. Summary of Test Method

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

4. Significance and Use

~~4.1 It is not possible to establish a precise correlation between accelerated and natural weathering because (~~

~~4.1 Tests conducted according to this practice are used to compare the weathering characteristics of bituminous materials versus a control material of known outdoor durability. It is not possible to establish a single relationship that is applicable to all materials between time in accelerated tests conducted according to this practice and time in 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 with differences in acceleration factors between materials as well as for different formulations of the same material. This weathering apparatus and procedure are used for comparing the weathering~~

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 Prepared Roofings, Shingles and Siding Materials.

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Current edition approved July 1, 2010. Published January 2011. Originally approved in 1988. Last previous edition approved in 2009 as D4798/D4798M – 09. DOI: 10.1520/D4798_D4798M-10.

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.

~~characteristics of bituminous materials against a control material for which the outdoor weathering characteristics are known. Guide—) the relation between accelerated and natural weathering is material dependent with differences in acceleration factors between materials as well as for different formulations of the same material. Guide G141 provides guidance regarding this issue. provides guidance regarding variability in outdoor and accelerated weathering tests and about the use of control materials.~~

~~NOTE1—This practice can be used for other than bituminous materials, but the significance and use have not been evaluated. 1—It is recommended that outdoor weathering be used to validate the laboratory accelerated test in terms of performance ranking.~~

~~NOTE 2—This practice can be used for other than bituminous materials, but the significance and use have not been evaluated.~~

5. Apparatus

5.1 The xenon-arc apparatus used shall conform to the requirements defined in Practices G151 and G155.

5.2 *Filters*—Daylight filter as described in Practice G155.

5.3 *Radiometer*—The use of a radiometer to monitor and control the amount of radiant energy received at the specimen is required. The use of the radiometer shall comply with the requirements in Practice G151.

6. Test Specimens

6.1 Unless otherwise agreed upon, test specimens shall be approximately 70 by 150 mm [$2\frac{3}{4}$ by $5\frac{7}{8}$ in.]. Bituminous materials with adequate flow resistance shall be applied as uniform coatings on aluminum panels in accordance with Practice D1669: ~~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.~~ Fabricated materials such as bituminous roofing, shingles, and similar products shall be cut to size and their weather surfaces exposed. Bituminous materials that are too flexible to sustain their own weight when exposed in a vertical position are permitted to be mounted on aluminum panels using stainless steel or other non-rusting clips.

6.1.1 Unless otherwise specified, expose at least three replicate specimens of each test and control material.

6.1.2 Other test specimen sizes are permitted to be used to provide sufficient material for postexposure testing when desired.

6.1.3 Follow the procedures described in Practice G147 for identification, conditioning, and handling of specimens of test and control materials before, during, and after exposure.

6.1.4 Do not mask the face of a specimen for the purpose of showing on one panel the effects of various exposure times. Misleading results may be obtained by this method, since the masked portion of the specimen is still exposed to temperature and humidity cycles that in many cases will affect results.

7. Procedure

7.1 Proceed in accordance with Section 9 of Practice G155.

7.2 *Water Purity:*

7.2.1 The purity of water used for specimen spray is very important. Without proper treatment to remove cations, anions, organics, and particularly silica, exposed panels will develop spots or stains that may not occur in exterior exposures.

7.2.2 Follow the requirements for water purity described in Practice G151.

7.2.3 When specimens are found to have deposits or stains after exposure in the apparatus, the water purity must be checked to determine if it meets the requirements of 7.2.2. On some occasions, exposed specimens can be contaminated by deposits from bacteria that can grow in the purified water used for specimen spray. When bacterial contamination is detected, the entire system used for specimen water spray must be flushed with chlorine and thoroughly rinsed before resuming exposures.

7.2.4 The temperature of water used for specimen spray shall be $7.2 \pm 3^\circ\text{C}$ [$45 \pm 5^\circ\text{F}$].

7.2.5 When the water purity requirements above are met and there is disagreement between parties on the extent of problems caused by stain or deposit, run referee tests in at least one other laboratory that can meet the water quality requirements described in 7.2.

~~7.3 Unless otherwise specified, operate the apparatus continuously according to one of the following schedules for 24 h at a light intensity of 0.35 ± 0.02 W/(m~~

7.3 Unless otherwise specified, operate the apparatus continuously with the device programmed to control irradiance at 340 nm at 0.35 W/(m²·nm) at 340 nm. Specimens should 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 G155, 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 the racks, fill the empty spaces with blank metal panels to maintain the test conditions within the chamber. The chamber air temperature shall be set at $44 \pm 2^\circ\text{C}$ in equipment that allows for its adjustment. nm) and operating according to the conditions described in Cycle A or Cycle B. Unless otherwise specified, place specimens in an exposure area where irradiance is at least 90 % of the maximum irradiance measured within the exposure area. In devices with rotating specimen racks, fill any empty spaces with blank metal panels in order to properly maintain the conditions within the exposure area.

~~NOTE2—For exposures in which relative humidity is controlled, the recommended setting is $50 \pm 10\%$ during the dry period of exposure to light.~~

~~7.3.1 Cycle A—51-min light only exposure, 9-min light and water spray; uninsulated black panel temperature during the light only period shall be $60 \pm 2.5^\circ\text{C}$.~~