



Designation: ~~G156-02~~ Designation: G 156 - 09

# ~~Standard Practice for Selecting and Characterizing Weathering Reference Materials Used to Monitor Consistency of Conditions in an Exposure Test~~ Selecting and Characterizing Weathering Reference Materials<sup>1</sup>

This standard is issued under the fixed designation G 156; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

~~1.1 This standard describes the criterion to be used for selection of a WRM and procedures to be used for determining within lab and between lab tolerances of changes in measured properties of a reference material intended for use in monitoring operating conditions to establish the consistency of exposure tests.~~

1.1 This standard describes the criteria to be used for selection of a weathering reference material (WRM) and procedures to be used for determining within lab and between lab tolerances of changes in measured properties of a reference materials. This standard also describes a procedure for comparing different lots of the same type of a reference material.

NOTE 1—Examples of laboratory accelerated tests in which a weathering reference material could be used to monitor consistency are ~~light and water~~ exposure tests such as those described in Practices G 152, G 153, ~~and G154~~ G155, G 154, and G 155 and other standards in which tests conducted according to these standards are referenced. Examples of outdoor exposures where a weathering reference material could be used to monitor consistency are those conducted according to Practices G 7, G 24, or G 90. A reference material can also be used to monitor consistency of exposure or conditioning test that do not involve exposure to light.

~~1.2 This practice does not cover (1) control materials used for comparison of stability with test materials, or (2) standard materials used to time exposures.~~

~~1.3 This practice provides an outline of experiments required to determine how the measured properties of the reference material change as a function of exposure to specified test conditions. It includes establishment of reproducible measurement procedures, determination of the critical region in the light source causing the changes, and effects of other critical exposure stresses such as temperature and moisture.~~

~~1.4 This practice describes procedures for conducting round-robin tests with the weathering reference material to determine reproducibility of the reference material property change in exposures conducted in different laboratories, and the repeatability when replicate reference material specimens are exposed in a single device and tested in one laboratory.~~

~~1.5 This practice describes procedures for using the results from analysis of variance on results from round-robin tests to determine the contribution of the exposure, the measurement device, reference material variability, and operator error to total variability.~~

1.2 Weathering reference materials are most often used to (1) monitor consistency of conditions in exposure tests, (2) to determine the time or radiant exposure at which test materials are evaluated, (3) as a reference material for comparing to test materials exposed at the same time. Weathering reference materials cannot be used to classify or characterize the relative severity of any exposure test because of the large variability in material responses to the effects of light, heat, and water.

1.3 This practice does not cover control materials which, by definition are selected to be of similar composition and construction to the test materials, and are exposed at the same time as test materials.

1.4 This practice provides an outline of experiments required to determine how the measured properties of the reference material change as a function of exposure to specified test conditions. It includes establishment of reproducible measurement procedures, determination of the critical spectral region in the light source causing the changes, and effects of other critical exposure stresses such as temperature and moisture.

## 2. Referenced Documents

### 2.1 *ASTM Standards:*

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee G03 on Weathering and Durability and is the direct responsibility of Subcommittee G03.01 on Joint Weathering Projects.

Current edition approved Feb. 10, 2002. Published May 2002. Originally published as G156-97. Last previous edition G156-97.

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~~D3980 Practice for conducting an Interlaboratory Study for Tests of Paints and Related Coatings~~ ASTM Standards:<sup>2</sup>

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E 1169 GuidePractice for Conducting Ruggedness Tests

G 7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials

G 24 Practice for Conducting Exposures to Daylight Filtered Through Glass

G 90 Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural ~~Sunlight~~<sup>4</sup>Sunlight

G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

G 152 Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

G 153 Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

G 155 ~~Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials~~<sup>4</sup>Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

G 178 Practice for Determining the Activation Spectrum of a Material (Wavelength Sensitivity to an Exposure Source) Using the Sharp Cut-On Filter or Spectrographic Technique

2.2 *SAE Standard:*

SAE J1960, Accelerated Exposure of Automotive Exterior Materials using a Controlled Irradiance Water-Cooled Xenon Arc Apparatus<sup>3</sup>

SAE J1885, Accelerated Exposure of Automotive Interior Materials Using a Controlled Irradiance Water-Cooled Xenon Arc Apparatus<sup>3</sup>

### 3. Terminology

3.1 *Definitions*— The definitions listed in Terminology G 113 are applicable to this standard.

### 4. Significance and Use

~~4.1 Weathering reference materials are used in laboratory accelerated exposure tests to establish consistency among tests run at different times and in different laboratories in the same type of device. Specifications defining consistency of exposure conditions based on the property change of a reference material are usually based on results for a single lot of the reference material. When a new lot of the reference material is introduced, round-robin studies are necessary to compare the new and old lots and to establish appropriate limits for expected performance of the new lot.~~

4.1 Weathering reference materials are used in laboratory accelerated exposure tests to verify consistency among tests run at different times and in different laboratories, using the same exposure conditions. Specifications defining consistency of exposure conditions are based on the property change of a reference material after a defined period of time. Some weathering reference materials are used to define periods of exposure. Specifications calling for use of these materials require the material to be exposed until a defined change in the weathering reference material is achieved. Specifications are usually based on results for a single lot of the weathering reference material. When a new lot of the reference material is introduced, round-robin studies are necessary to compare the new and old lots and to establish appropriate limits for expected performance of the new lot.

NOTE 2—An example of the use of a clear polystyrene reference standard for this purpose is given in SAE J1885 and SAE J1960.

NOTE 3—Some weathering reference materials (for example blue wools) are also used to define periods of exposure. Although not specifically covered by this standard, the procedures described for characterizing a reference material used to monitor consistency of exposures are also generally applicable to characterizing reference materials used to define periods of exposure.

4.2 It is important to test the consistency of exposure in the laboratory accelerated device with a weathering reference material that responds to the test conditions similar to the way the test materials respond. Therefore, the weathering reference material should be sensitive to the spectral region of the light source mainly responsible for producing degradation in the test materials to provide the most meaningful evaluation of exposure test consistency. The weathering reference material should also provide information on consistency of temperature and humidity conditions if the latter are important factors in degradation of the test materials.

NOTE 4—Material homogeneity can also be an important factor in selection of a weathering reference material, particularly if weathering is initiated by the radiation absorbed by impurities as is the case in aliphatic type polymers exposed to radiation longer than 300 nm.

4.3 The measurement of the characteristic property of a weathering reference material can be subject to error depending on the instrument and the procedure used to measure the property. It is important to develop measurement procedures that are clear and

<sup>2</sup>Discontinued—See

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* Vol 06.02-volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>4</sup> Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.