Designation: D2565 – 16

# Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications[1]

This standard is issued under the fixed designation D2565; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope*

1.1 This practice covers specific procedures and test conditions that are applicable for xenon-arc exposure of plastics conducted in accordance with Practices G151 and G155. 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 mathematical conversions to inch-pound units that are provided for information only and are not considered 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.*

NOTE 1—This practice and ISO 4892-2 address the same subject matter, but differ in technical content.

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D3980 Practice for Interlaboratory Testing of Paint and Related Materials (Withdrawn 1998)[3]

D5870 Practice for Calculating Property Retention Index of Plastics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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

G169 Guide for Application of Basic Statistical Methods to Weathering Tests

2.2 *ISO Standard:*[4]

ISO 4892-2 Plastics—Methods of Exposure to Laboratory Light Sources—Part 2, Xenon Arc Lamp

2.3 *Society of Automotive Engineers' Standards:*[5]

SAE J2412 Accelerated Exposure of Autmotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus

SAE J2527 Accelerated Exposure of Autmotive Exterior Materials Using a Controlled Irradiance Xenon-Arc Apparatus

## 3. Terminology

3.1 The definitions in Terminology G113 are applicable to this practice.

## 4. Significance and Use

4.1 The ability of a plastic material to resist deterioration of its electrical, mechanical, and optical properties caused by exposure to light, heat, and water can be very significant for many applications. This practice is intended to induce property changes associated with end-use conditions, including the effects of daylight, moisture, and heat. The exposure used in this practice is not intended to simulate the deterioration caused by localized weather phenomena, such as, atmospheric pollution, biological attack, and saltwater exposure.

[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.

Current edition approved Sept. 15, 2016. Published October 2016. Originally approved in 1966. Last previous edition approved in 2008 as D2565 - 99(08). DOI: 10.1520/D2565-16.

[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] The last approved version of this historical standard is referenced on www.astm.org.

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

[5] 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**

4.2 **Caution**—Variations in results are possible when operating conditions are varied within the accepted limits of this practice. Therefore, all references to the use of this practice must be accompanied by a report prepared in accordance with Section 9 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.

4.3 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.[6,7] Therefore, exposure of a similar material of known performance (a control) at the same time as the test materials is strongly recommended. It is preferable that the number of specimens of the control material be the same as that used for test materials. It is recommended that at least three replicates of each material be exposed to allow for statistical evaluation of results.

4.4 Test results will depend upon the care that is taken to operate the equipment in accordance with Practice G155. Significant factors include regulation of line voltage, freedom from salts or other deposits from water, temperature and humidity control, and condition and age of the lamp and filters.

## 5. Apparatus

5.1 Use xenon-arc apparatus that conform to the requirements defined in Practices G151 and G155.

5.2 Unless otherwise specified, the spectral power distribution (SPD) of the xenon lamp shall conform to the requirements of Table 1 in Practice G155 for a xenon lamp with daylight filters.

## 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. Where practical, it is recommended that specimens be sized to fit specimen holders and racks supplied with the exposure apparatus. Unless supplied with a specific backing as an integral part of the test, specimens shall be mounted so that only the minimum specimen area required for support by the holder shall be covered. This unexposed surface must not be used as part of the test area. In cases where it is necessary to support flexible specimens during exposure, attach the flexible specimens to a thin supporting panel.

NOTE 3—For supporting flexible specimens, aluminum panels that are 0.025 in. (0.64 mm) thick have been found to be acceptable for many applications.

6.2 Unless otherwise specified, expose at least three replicate specimens of each test material and of the control material, if used.

6.3 Retain a supply of unexposed file specimens of all materials evaluated.

6.3.1 For destructive tests, it is preferred to retain unexposed file specimens. When this practice is followed, ensure that sufficient file specimens are retained so that the property of interest can be measured on the file specimens for all planned evaluations of the exposed materials.

NOTE 4—Since it is possible that the stability of the file specimen is also time-dependent, users are cautioned that over prolonged exposure periods, or where small differences in the order of acceptable limits are anticipated, it is possible that comparison of exposed specimens with the file specimen is invalid. The stored initial measurements of the file specimens are recommended wherever possible.

6.4 Follow the procedures described in Practice G147 for identification and conditioning and handling of test specimens, control, and reference materials prior to, during, and after exposure.

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

6.6 Since it is possible that the thickness of a specimen will markedly affect the results, thickness of test and control specimens shall be within ±10 % of the nominal dimensions.

NOTE 5—The thickness of a specimen is especially important when mechanical properties are being investigated.

## 7. Procedure

7.1 If performance comparisons are not being made between the test materials themselves, it is recommended that a control material be exposed simultaneously with experimental materials for determination of relative performance. All concerned parties must agree on the control material used.

7.2 Practice G155 lists a number of exposure cycles that are used for xenon-arc exposures of nonmetallic materials. Table 1 lists some of these cycles. It is possible to use any exposure conditions as long as the exact conditions are detailed in the report. The exposure cycles listed in the table are not necessarily preferred and no recommendation is implied. These cycles are provided for reference only. Obtain mutual agreement among all concerned parties for the specific exposure cycle used. Each setpoint and its tolerances found in Table 1 represent an operational control point for equilibrium conditions at a single location in the cabinet that has the potential not to represent the uniformity of those conditions throughout the cabinet.

NOTE 6—Spray, condensation, and immersion are different kinds of moisture exposures and frequently produce different results.

[6] 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.

[7] 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.

**TABLE 1 Test Cycles Commonly Used for Xenon-Arc Exposure Testing of Plastics[A]**

| Cycle Number | Cycle Description[B] | Parameter | Set Point[C,D,E,F] | Maximum Allowed Operational Fluctuation[C,D,E] | Typical Uses[G] |
|---|---|---|---|---|---|
| 1[H] | 102 minutes of light followed by 18 minutes of light and front spray | Irradiance | 0.35 W/(m$^2$ nm) at 340 nm or | ±0.02 W/(m$^2$ nm) | Historical convention[J] |
| | | | 41.5 W/m$^2$ from 300 to 400 nm | ±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 63°C | ±2°C | |
| | [repeat] | | | | |
| 1A[H] | 102 minutes of light followed by 18 minutes of light and front spray | Irradiance | 0.35 W/(m$^2$ nm) at 340 nm or | ±0.02 W/(m$^2$ nm) | Modified historical convention with air temperature and humidity control option[J] |
| | | | 41.5 W/m$^2$ from 300 to 400 nm | ±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 63°C | ±2°C | |
| | | Air Temperature | 47°C[I] | ±2°C | |
| | | Relative Humidity | 50 % | ±10 % | |
| | [repeat] | | | | |
| 2[H] | 18 h, consisting of alternating 102 minutes of light followed by 18 minutes of light and front spray | Irradiance | 0.35 W/(m$^2$ nm) at 340 nm or | ±0.02 W/(m$^2$ nm) | General plastics[J] |
| | | | 41.5 W/m$^2$ from 300 to 400 nm | ±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 63°C | ±2°C | |
| | 6 h dark, with no water spray | Uninsulated Black Panel Temperature | 38°C | ±2°C | |
| | | Relative Humidity | 95 % | +5 /–10 % | |
| | [repeat] | | | | |
| 2A[H] | 18 h, consisting of alternating 102 minutes of light followed by 18 minutes of light and front spray | Irradiance | 0.35 W/(m$^2$ nm) at 340 nm or | ±0.02 W/(m$^2$ nm) | Modified general plastics with air temperature control option[J] |
| | | | 41.5 W/m$^2$ from 300 to 400 nm | ±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 63°C | ±2°C | |
| | | Air Temperature | 47°C[I] | ±2°C | |
| | | Relative Humidity | 50 %[K] | ±10 % | |
| | 6 h dark, with no water spray | Uninsulated Black Panel Temperature | 38°C | ±2°C | |
| | | Air Temperature | 38°C | ±2°C | |
| | | Relative Humidity | 95 % | +5 / –10 % | |
| | [repeat] | | | | |
| 3[H] | 1.5 h light followed by 0.5 h light and front water spray | Irradiance | 0.35 W/(m$^2$ nm) at 340 nm or | ±0.02 W/(m$^2$ nm) | Fabrics |
| | | | 41.5 W/m$^2$ from 300 to 400 nm | ±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 77°C | ±2°C | |
| | | Relative Humidity | 70 % | ±10 % | |
| | [repeat] | | | | |

**TABLE 1** *Continued*

| Cycle Number | Cycle Description[B] | Parameter | Set Point[C,D,E,F] | Maximum Allowed Operational Fluctuation[C,D,E] | Typical Uses[G] |
|---|---|---|---|---|---|
| 4[K,L] | 40 minutes light | Irradiance | 0.55 W/(m$^2$ nm) at 340 nm or<br>65.5 W/m$^2$ from 300 to 400 nm | ±0.02 W/(m$^2$ nm)<br>±2.5 W/m$^2$ | Automotive exterior |
| | | Uninsulated Black Panel Temperature | 70°C | ±2°C | |
| | | Air Temperature | 47°C | ±2°C | |
| | | Relative Humidity | 50 % | ±10 % | |
| | 20 minutes light with front water spray | Irradiance | 0.55 W/(m$^2$ nm) at 340 nm or<br>65.5 W/m$^2$ from 300 to 400 nm | ±0.02 W/(m$^2$ nm)<br>±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 70°C (158°F) | See Footnote *E* | |
| | | Air Temperature | 47°C | ±2°C | |
| | 60 minutes light | Irradiance | 0.55 W/(m$^2$ nm) at 340 nm or<br>65.5 W/m$^2$ from 300 to 400 nm | ±0.02 W/(m$^2$ nm)<br>±2.5 W/m$^2$ | |
| | | Uninsulated Black Panel Temperature | 70°C | ±2°C | |
| | | Air Temperature | 47°C | ±2°C | |
| | | Relative Humidity | 50 % | ±10 % | |
| | 60 minutes dark with front and back spray | Uninsulated Black Panel Temperature | 38°C | See Footnote *E* | |
| | | Air Temperature | 38°C | ±2°C | |
| | | Relative Humidity | 95 % | +5 / 10 % | |
| | [repeat] | | | | |
| 5[K,M] | 3.8 h light | Irradiance | 0.55 W/(m$^2$ nm) at 340 nm or<br>65.5 W/m$^2$ from 300 to 400 nm | ±0.02 W/(m$^2$ nm)<br>±2.5 W/m$^2$ | Automotive interior |
| | | Uninsulated Black Panel Temperature | 89°C | ±2°C | |
| | | Air Temperature | 62°C | ±2°C | |
| | | Relative Humidity | 50 % | ±10 % | |
| | 1.0 dark | Uninsulated Black Panel Temperature | 38°C | ±2°C | |
| | | Air Temperature | 38°C | ±2°C | |
| | | Relative Humidity | 95 % | +5 / 10 % | |
| | [repeat] | | | | |

[A]The cycles described are not listed in any order indicating importance, and are not necessarily recommended for the applications shown.

[B]Unless otherwise specified, water spray refers to water sprayed on the exposed surface of the test specimens.

[C]Unless otherwise specified, operate the device so that the allowable deviations about the set points given in Table 1, Set Point column, is within the specified limits specified in Table 1, Operational Fluctuation column. If the actual operating conditions do not agree with the machine settings after the equipment has stabilized, discontinue the test and correct the cause of the disagreement before continuing.

[D]Set points and operational fluctuations are listed in separate columns in Table 1. They are sometimes listed as set point ± operational fluctuation. The set point is the target condition for the sensor used at the operational control point as programmed by the user. Operational fluctuations are deviations from the indicated set point at the control point indicated by the readout of the calibrated control sensor during equilibrium operation and do not include measurement uncertainty. At the operational control point, the operational fluctuation can exceed no more than the listed value at equilibrium. Therefore, when a standard calls for a particular set point, the user programs that exact number. The operational fluctuations specified with the set point do not imply that the user is allowed to program a set point higher or lower than the exact set point specified.

[E]Unless otherwise indicated, black panel and air temperatures apply during the light-only portion of the cycle. The equilibrium black panel temperature and air temperature are obtained during a period without water spray. For light intervals less than 30 min, it is possible that the maximum black panel temperature and air temperature will not reach equilibrium.

[F]The irradiance values given are those that have historically been used. In devices capable of producing higher irradiance, it is possible that the actual irradiance used will be higher than the stated values. For example, Japanese auto industry specifications allow use of exposures according to cycle 1 with 300 to 400 nm irradiance of up to 190 W/m$^2$ from 300 to 400 nm.

[G]Typical uses do not imply that results from exposures of these materials according to the cycle described will correlate to those from actual use conditions.

[H]As stated in 5. Apparatus, unless otherwise specified, the SPD of the xenon lamp shall conform to the requirements of Practice G155 Table 1 for a xenon lamp with daylight filters.

[I]Preferably, air temperature can be controlled to minimize variability in test results. Air temperature was not specified in previous versions of this practice. Instruments without this capability can run this cycle without air temperature control, and listed as a deviation in the test report.

[J]This cycle has been used for plastics by historical convention and it is possible that it does not adequately simulate the effects of outdoor exposure.

[K]The SPD of the xenon lamp with the filters required in current SAE standards SAE J2527 and SAE J2412 requiring extended UV filters meet the requirements of Practice G155 Table 3 for a xenon lamp with extended UV filters. The extended UV filters do not meet the requirements of G155 Table 1 for daylight filters. Alternately, SAE J2527 allows the use of the daylight filters that conform to the requirements of Practice G155 Table 1 for a xenon lamp with daylight filters.

[L]Refer to SAE J2527 for specific test cycle information and requirements.

[M]Refer to SAE J2412 for specific test cycle information and requirements.

7.3 If no other cycle is specified, use Cycle No. 1.

NOTE 7—The temperature of water used for specimen spray is typically 21 ± 5°C (70 ± 9°F). If ambient temperature is low or high, the temperature of water used for specimen spray could be outside the typical range given.

7.3.1 Unless otherwise specified, control the irradiance to produce 0.35 ± 0.02 W/(m$^2$ · nm) at 340 nm or 41.5 ± 2.5 W/m$^2$ between 300 and 400 nm. If the exposure device is not equipped with irradiance control, follow the device manufacturer's recommendations to produce this irradiance, or other specified irradiance level.

7.3.2 Unless otherwise specified, in devices which allow for control of relative humidity, maintain relative humidity at 50 ± 10 % equilibrium during the light-only interval.

7.3.3 Unless otherwise specified, the equilibrium temperature of an uninsulated black panel thermometer shall be 63 ± 2°C.

7.3.4 Preferably, air temperature can be controlled to minimize variability in test results. Air temperature was not specified in previous versions of this practice. Instruments without this capability can run this cycle without air temperature control, and listed as "Not Controlled" in the test report.

7.3.4.1 Unless otherwise specified, if chamber air temperature control is desired in devices which allow for control of chamber air temperature, maintain the air temperature at 47 ± 2°C equilibrium during the light-only interval.

7.4 Mount test specimens in the device following the placement and specimen repositioning procedures described in Practice G155. It is recommended that all unused spaces in the specimen exposure area be filled with blank metal panels that are not highly reflective.

7.5 If the irradiance uniformity does not meet the requirements of Practice G155 (9.5), reposition specimens in devices preferably using the procedure described in Practice G151 (Appendix X2, X2.2) or, at a minimum, one of the procedures described in Practice G155 (9.5.1 through 9.5.1.3).

7.5.1 If specimen repositioning is used, and no other repositioning schedule is specified, follow the 'Suggested Frequency for Specimen Repositioning' specified in Practice G151 (Appendix X2, Table X2.1).

7.6 *Water Purity:*

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

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

7.6.3 If 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 for water purity in Practice G151. On some occasions, exposed specimens can be contaminated by deposits from bacteria that can grow in the purified water used for specimen spray. If bacterial contamination is detected, the entire system used for specimen water spray must be flushed with chlorine and thoroughly rinsed prior to resuming exposures.

7.6.4 When the preceding water purity requirements 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 Practice G151.

7.7 Some tests for lightfastness are run without any specimen wetting. When this type of test is required, omit the period where water is sprayed on specimens.

## 8. Periods of Exposure and Evaluation of Test Results

8.1 In most cases, periodic evaluation of test and control materials is necessary to determine the variation in magnitude and direction of property change as a function of exposure time or radiant exposure.

8.2 The time or radiant exposure necessary to produce a defined change in a material property can be used to evaluate or rank the stability of materials. This method is preferred over evaluating materials after an arbitrary exposure time or radiant exposure.

8.2.1 It is possible to use an exposure to an arbitrary time or radiant exposure for the purpose of a specific test if agreed upon between the parties concerned or if required for conformance to a particular specification. When a single exposure period is used, select a time or radiant exposure that will produce the largest performance differences between the test materials or between the test material and the control material.

8.2.2 The minimum exposure time used shall be that necessary to produce a substantial change in the property of interest for the least stable material being evaluated. An exposure time that produces a significant change in one type of material cannot be assumed to be applicable to other types of materials.

8.2.3 The relation between time to failure in an exposure conducted in accordance with this practice and service life in an outdoor environment requires determination of a valid acceleration factor. Do not use arbitrary acceleration factors relating time in an exposure conducted in accordance with this practice and time in an outdoor environment because they can give erroneous information. The acceleration factor is material-dependent and is only valid if it is based on data from a sufficient number of separate exterior and laboratory-accelerated exposures so that results used to relate times to failure in each exposure can be analyzed using statistical methods.

NOTE 8—An example of a statistical analysis using multiple-laboratory and exterior exposures to calculate an acceleration factor is described by Simms.[8] See Practice G151 for more information and additional cautions about the use of acceleration factors.

8.3 After each exposure increment, evaluate or rate changes in exposed test specimens in accordance with applicable ASTM test methods.

NOTE 9—For some materials, it is possible that changes will continue after the specimen has been removed from the exposure apparatus. It is preferable to make measurements (visual or instrumental) within a standardized time period or as agreed upon between the interested parties.

[8] Simms, J.A., *Journal of Coatings Technology*, Vol 50, 1987, pp. 45-53.

The standardized time period needs to consider conditioning prior to testing.

8.4 Use of results from exposures conducted in accordance with this practice in specifications:

8.4.1 If a standard or specification for general use requires a definite property level after a specific time or radiant exposure in an exposure test conducted in accordance with this practice, base the specified property level on results from round-robin experiments run to determine the test reproducibility from the exposure and property measurement procedures. Conduct these round robins in accordance with Practice E691 or Practice D3980 and include a statistically representative sample of all laboratories or organizations who would normally conduct the exposure and property measurement.

8.4.2 If a standard or specification for use between two or three parties requires a definite property level after a specific time or radiant exposure in an exposure test conducted in accordance with this practice, base the specified property level on two independent experiments run in each laboratory to determine the reproducibility for the exposure and property measurement process. The reproducibility of the exposure/property measurement process is then used to determine the minimum level of property after the exposure that is mutually agreeable to all parties.

8.4.3 When reproducibility in results from an exposure test conducted in accordance with this practice has not been established through round-robin testing, specify performance requirements for materials in terms of comparison (ranked) to a control material. All specimens shall be exposed simultaneously in the same device. All concerned parties must agree on the specific control material used.

8.4.3.1 Use appropriate statistical analysis techniques to determine whether any differences between test materials and control materials are statistically significant. Expose replicates of the test specimen and the control specimen so that statistically significant performance differences can be determined.

NOTE 10—Fischer illustrates the use of rank comparison between test and control materials in specifications.[9]

NOTE 11—ASTM Standard G169, Guide for Application of Basic Statistical Methods to Weathering Tests, includes examples showing use of analysis of variance to compare materials.

## 9. Report

9.1 Report the following information. Report any deviations from this practice:

9.1.1 Complete identification and description (for example, dimensions) of test materials used.

9.1.2 Type and model of exposure device.

9.1.3 If the exposed face of a specimen does not lie within the exposure device's specimen plane, report the distance from specimen to light source. For three-dimensional specimens extending beyond the specimen plane (in front of and/or behind the specimen plane), report the minimum and maximum distance from the exposed face of the specimen to the light source.

9.1.4 If required, irradiance in $W/(m^2 \cdot nm)$, or radiant exposure in $J/(m^2 \cdot nm)$ at the sample plane, and the wavelength region in which the measurements were made. For broad band measurements, irradiance in $W/m^2$, or radiant exposure in $J/m^2$ and the wavelength region in which the measurements were made.

9.1.4.1 Do not report irradiance or radiant exposure unless direct measurement of irradiance was made during the exposure.

9.1.5 Elapsed exposure time.

9.1.5.1 Report intervals longer than 24 h when the specimens are removed from the exposure and returned for additional exposure.

9.1.6 Light- and dark-water spray cycle employed.

9.1.7 Type of black panel (insulated or uninsulated) used and operating set point for the black panel temperature. If light and dark periods are employed, report the set point for each period.

9.1.8 If controlled, operating relative humidity set point. If light and dark periods are employed, report the relative humidity set point for each period.

9.1.9 If chamber temperature is controlled, report chamber temperature set point. If light and dark periods are employed, report the chamber temperature set point for each period.

NOTE 12—Chamber temperature is the air temperature inside of the test chamber. Chamber temperature is also referred to as air temperature.

9.1.10 Type of spray water, if used.

9.1.10.1 Total solids and silica level of water used for specimen spray (if above limits specified in Practice G151).

9.1.11 If used, specimen repositioning procedure.

9.1.12 Date, results of physical property tests, identification of laboratory conducting the exposure and property tests, (if different labs conduct the exposures and property tests, identify both).

9.1.12.1 Calculate retention of characteristic property in accordance with Practice D5870 when it is reported.

## 10. Precision and Bias

10.1 *Precision*—The repeatability and reproducibility of results obtained in exposures conducted in accordance with 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 in accordance with 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 degradation; exposure; light exposure; ultraviolet; xenon-arc

[9] Fischer, R., Ketola, W., "Impact of Research on Development of ASTM Durability Testing Standards," *Durability Testing of Non-Metallic Materials, ASTM STP 1294*, Robert Herling, ed., American Society for Testing and Materials, Philadelphia, 1995.

## SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D2565 - 99(08)) that may impact the use of this standard. (September 15, 2016)

*(1)* Revised to make the standard easier to understand and to harmonize this standard with other industry standards.
*(2)* Reformatted Table 1 making parameters easier to understand, and clarifying cycle descriptions.
*(3)* Introduced additional cycles in Table 1, which allow for the control, if desired, of chamber temperature and relative humidity in cycles that previously did not have recommended setpoints.
*(4)* Introduced text in Section 7 indicating preference for control of air temperature and relative humidity if available, while still allowing the option not to control these parameters for comparison to legacy tests or for testing in devices without these control features.
*(5)* Revised text to remove permissive language.