



Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials¹

This standard is issued under the fixed designation G 23; 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 Department of Defense.

1. Scope

1.1 This practice covers the basic principles and operating procedures for light-exposure apparatus with and without water spray employing a carbon-arc light source.

1.2 This practice does not specify the exposure conditions best suited for the material to be tested. It is limited to the method of obtaining, measuring, and controlling the conditions and procedures of the exposure. Sample preparation, test conditions, and evaluation of results are covered in ASTM test methods or specifications for specific materials.

NOTE 1—Attention is called to the following test methods and practices for more information on use of this practice for specific materials:

Practices D 822, D 904, D 1499, D 3361, D 3815, E 765 and Test Methods C 732, C 734, C 741, D 529, D 750, D 3424 and D 3583.

1.3 This practice includes four procedures:

1.3.1 *Method 1*—Continuous exposure to light and intermittent exposure to water spray.

1.3.2 *Method 2*—Alternate exposure to light and darkness and intermittent exposure to water spray.

1.3.3 *Method 3*—Continuous exposure to light without water spray. Specific exposure conditions for testing fabric are found in AATCC Test Method 16A.

1.3.4 *Method 4*—Alternate exposure to light and darkness without water spray.

1.4 The values stated in SI units are to be regarded as the standard. The inch-pound unit equivalents of the SI units may be approximate.

1.5 *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:*

C 732 Test Method for Aging Effects of Artificial Weathering on Latex Sealants²

C 734 Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering²

C 741 Test Method for Accelerated Aging of Wood Sash Face Glazing Compound²

D 529 Test Method for Accelerated Weathering Test Conditions and Procedures Bituminous Materials (Carbon-Arc Method)³

D 750 Test Method for Rubber Deterioration in Carbon-Arc Weathering Apparatus⁴

D 822 Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus⁵

D 859 Test Methods for Silica in Water⁶

D 904 Practice for Exposure of Adhesive Specimens to Artificial Light⁷

D 1293 Test Methods for pH of Water⁶

D 1499 Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics⁸

D 3361 Practice for Operating Light- and Water-Exposure Apparatus (Unfiltered Open-Flame Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products Using the Dew Cycle⁵

D 3424 Test Methods for Evaluating the Lightfastness and Weatherability of Printed Matter⁹

D 3583 Methods of Testing Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements, or Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type, for Portland Cement Concrete Pavements¹⁰

¹ This practice is under the jurisdiction of ASTM Committee G-3 on Durability of Nonmetallic Materials and is the direct responsibility of Subcommittee G03.03 on Simulated and Controlled Environmental Tests.

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Practice G 25, Standard Recommended Practice for Operating Enclosed Carbon Arc Type Apparatus for Light Exposure of Nonmetallic Materials, is to be discontinued since it now is covered in this edition of G23 and its Methods 3 and 4.

² *Annual Book of ASTM Standards*, Vol 04.07.

³ *Annual Book of ASTM Standards*, Vol 04.04.

⁴ *Annual Book of ASTM Standards*, Vol 09.01.

⁵ *Annual Book of ASTM Standards*, Vol 06.01.

⁶ *Annual Book of ASTM Standards*, Vol 11.01.

⁷ *Annual Book of ASTM Standards*, Vol 15.06.

⁸ *Annual Book of ASTM Standards*, Vol 08.01.

⁹ *Annual Book of ASTM Standards*, Vol 06.02.

¹⁰ *Annual Book of ASTM Standards*, Vol 04.03.

D 3815 Practice for Accelerated Aging of Pressure-Sensitive Tapes by Carbon-Arc Exposure Apparatus¹¹

D 4517 Test Methods for Low-Level Total Silica in High-Purity Water by Flameless Atomic Absorption Spectroscopy¹²

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

E 765 Practice for Evaluation of Cover Materials for Flat Plate Solar Collectors^{13,14}

2.2 AATCC Standards:¹⁵

Blue Wool Lightfastness

Test Method 16A Colorfastness to Light, Carbon-Arc Lamp, Continuous Light

2.3 ISO Standard:¹⁶

ISO Gray Scale

3. Significance and Use

3.1 Several types of apparatus with different exposure conditions are available for use. No single operating procedure for light exposure apparatus with or without water can be specified as a direct simulation of natural exposure. This practice does not imply expressly or otherwise an accelerated weathering test.

3.2 Since natural environments vary with respect to geography, topography, and different exposure periods, it may be expected that the effects of natural exposure will vary accordingly. Furthermore, all materials are not affected equally by the same environment. Therefore, results obtained by use of this practice should not be represented as equivalent to those of any natural weathering test until the degree of quantitative correlation has been empirically established for the material in question.

3.3 Variations in results may be expected among instruments of different types and when operating conditions among similar type instruments vary within the accepted limits of this practice. Therefore, no reference should be made to results from use of this practice unless accompanied by the report

form as specified in Fig. 1.

4. Apparatus¹⁷

4.1 The apparatus employed shall use one or two carbon-arc lamps as the source of radiation, and shall be one of the following types, or equivalent. The term “cycle” is defined as the total time for all exposure conditions (light, light plus water spray, dark periods) that are repeated.

NOTE 2—Several models of carbon-arc type exposure devices are no longer commercially available and should be considered obsolete. Exposures in these devices are not recommended and should only be made when mutually agreed upon by all interested parties.

4.1.1 *Type D*—Twin enclosed carbon-arc lamp apparatus, with a 762 mm (30 in.) diameter specimen drum rotating at 1 rpm, automatic control of temperature and cycle, and manually adjusted humidifier.

4.1.2 *Type DH*—Same as Type D, except with automatic control of the humidity.

4.1.3 *Type E*—Single open-flame sunshine carbon-arc lamp apparatus, with a 959 mm (37.75 in.) diameter specimen rack rotating at 1 rpm, automatic control of temperature and cycle, and manually adjusted humidifier.

4.1.4 *Type EH*—Same as Type E, except with automatic control of the humidity.

4.1.5 *Type H*—Single enclosed carbon-arc lamp apparatus, with a 508 mm (20 in.) diameter specimen rack, rotating at 1 rpm, automatic control of temperature and cycle, and manual regulation of the humidity.

4.1.6 *Type HH*—Same as Type H, except with automatic control of the humidity.

4.2 The apparatus should consist of a suitable frame within which is located a test chamber, and necessary compartments for housing control and regulating equipment.

4.3 Provision should be made for mounting or supporting the test specimens in a circular rack or drum that is rotated around the arc or arcs. This provides uniform distribution of the radiation on all specimens around the circumference of the rack. It does not, however, improve the distribution of the radiation along the vertical axis.

4.4 Adequate ventilation should be provided in the test chamber to prevent contamination of the specimens from combustion products of the arc.

4.5 The apparatus should include equipment necessary for measuring and controlling the following:

4.5.1 Arc current,

4.5.2 Arc voltage,

4.5.3 Black-panel temperature (Note 3),

4.5.4 Water-spray pressure,

4.5.5 Operating schedule or cycle,

4.5.6 Exposure time, and

4.5.7 Relative humidity (Types DH, EH, and HH only).

4.6 Types DH, EH, and HH apparatus are equipped with thermostatically actuated vaporizing units for adding moisture to the air as it passes through the conditioning chamber prior to

¹¹ Annual Book of ASTM Standards, Vol 15.09.

¹² Annual Book of ASTM Standards, Vol 11.02.

¹³ Annual Book of ASTM Standards, Vol 12.02.

¹⁴ Annual Book of ASTM Standards, Vol 14.02.

¹⁵ Available from the Secretary, American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

¹⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

¹⁷ Available from the Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL. 606132 and from Suga Test Instruments Co., Ltd. 4-14, Shinjuku 5-chome, Shinjuku-ku, Tokyo, 160, Japan.