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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus[1]

This standard is issued under the fixed designation D 822; 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 selection of test conditions for accelerated exposure testing of coatings and related products in filtered open-flame carbon-arc devices operated according to Practice G 23. Two basic apparatus types are available for coating evaluation since open-flame carbon-arc devices can be manufactured with or without automatic humidity control. These are Types E and EH as described in Practice G 23.[2] Each type of device can be operated with different types of glass filters that filter various amounts of ultraviolet (UV) radiation. *All references to use of this practice must include a description of the filter used.* Table 1 describes commonly used test conditions. Interlaboratory comparisons *must* be made only with devices using the same filter type and test conditions.

1.2 Previous versions of this practice described exposures using either open-flame carbon arcs or enclosed carbon arcs.

NOTE 1—Practice D 5031 describes use of enclosed carbon-arc exposure apparatus. Another procedure for exposing these products is covered by Practice D 3361 in which the specimens are subjected to radiation from an unfiltered open-flame carbon arc that produces much higher levels of short wavelength radiation than filtered open flame or enclosed carbon arcs. Only automatic humidity controlled open-flame carbon-arc apparatus (Type EH) is applicable to Practice D 3361.

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.* For specific hazard statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

D 358 Specification for Wood to Be Used as Panels in Weathering Tests of Coatings[3]

D 523 Test Method for Specular Gloss[4]

D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products[4]

D 610 Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces[3]

D 659 Method of Evaluating Degree of Chalking of Exterior Paints[5]

D 660 Test Method for Evaluating Degree of Checking of Exterior Paints[4]

TABLE 1 Test Cycles Commonly Used for Filtered Open-Flame Carbon-Arc Exposure Testing of Paints and Related Coatings[A]

Cycle Description	Black Panel Temp,[B] °F (°C)	Typical Uses[C]
102 min light 18 min light and water spray[D,E]	145 ± 5 (63 ± 2.5)	general coatings
18 h using: 102 min light 18 min light and water spray 6 h at 95 ± 4 % relative humidity with no water spray	 145 ± 5 (63 ± 2.5) 75 ± 3 (24± 1.5)	general coatings
48 min light 12 min light and water spray	145 ± 5 (63 ± 2.5)	coatings used in original equipment manufacturing
4 h light 4 h water spray	145 ± 5 (63 ± 2.5)	exterior pigmented paints
12 h light 12 h water spray	145 ± 5 (63 ± 2.5)	exterior wood stains and clears
8 h light 10 h light and water spray 6 h water spray	145 ± 5 (63 ± 2.5)	marine enamels

[A]The cycles described are not listed in any order indicating importance, and are not necessary recommended.
[B]Unless otherwise indicated, black panel temperature during light only portion of the cycle.
[C]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.
[D]Unless otherwise specified, water spray refers to water sprayed on the exposed surface of the test specimens.
[E]Historical convention has established this as a very commonly used test cycle.

[1] This practice is under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.27 on Accelerated Tests for Protective Coatings.

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[2] Apparatus and carbon arcs manufactured by Atlas Electric Devices Company, 4114 N. Ravenswood Ave., Chicago, IL 60613, and by Suga Test Instruments Co., Ltd, 4–14 Shinjuku 5-chrome, Shinjuku-ku, Tokyo, 160, Japan, have been found satisfactory for this purpose.

[3] *Annual Book of ASTM Standards*, Vol 06.02.

[4] *Annual Book of ASTM Standards*, Vol 06.01.

[5] Discontinued; see *1990 Annual Book of ASTM Standards*, Vol 06.01.

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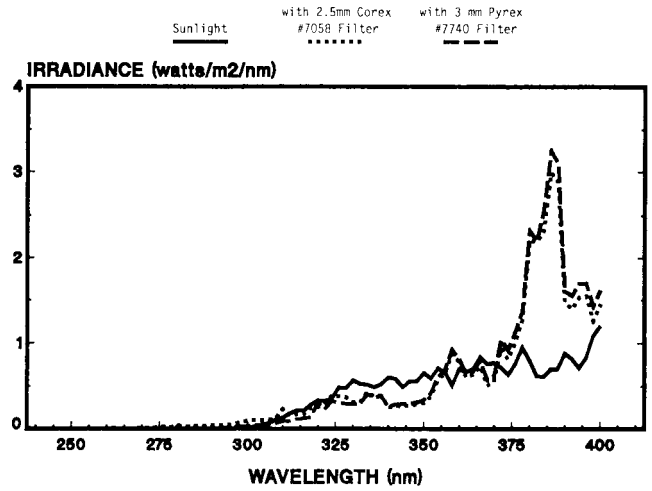
D 662 Test Method for Evaluating Degree of Erosion of Exterior Paints[4]
D 714 Test Method for Evaluating Degree of Blistering of Paints[4]
D 772 Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints[4]
D 823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels[4]
D 1005 Test Methods for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers[4]
D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base[4]
D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base[4]
D 1729 Practice for Visual Evaluation of Color Differences of Opaque Materials[4]
D 1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting[6]
D 2244 Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates[4]
D 2616 Test Method for Evaluation of Visual Color Difference with a Gray Scale[4]
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 Cycle[4]
D 3980 Practice for Interlaboratory Testing of Paint and Related Materials[4]
D 4214 Test Methods for Evaluating Degree of Chalking of Exterior Paint Films[4]
D 5031 Practice for Conducting Tests on Paint and Related Coatings and Materials Using Enclosed Carbon-Arc Light and Water Exposure Apparatus[4]
E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of Test Methods[7]
E 1347 Test Method for Color and Color Difference Measured by Tristimulus (filter) Colormetry[4]
G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials[7]
G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials[7]

3. Terminology

3.1 The definitions given in Terminology standard G 113 are applicable to this practice.

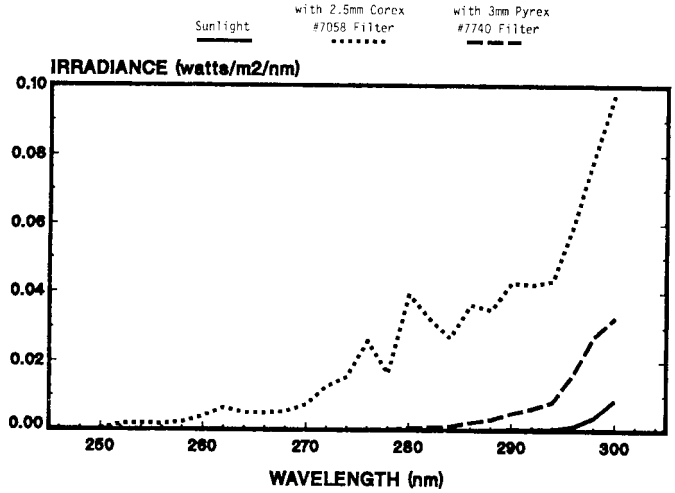
4. Significance and Use

4.1 Organic coatings on exterior exposure are subjected to attack by degrading elements of the weather, particularly ultraviolet light, oxygen, and water. This practice is intended to evaluate coating films for their stability in an apparatuas that exposes specimens to ultraviolet (UV) light, heat, and moisture. If the spectral power distribution of the light source used for exposure tests does not adequately simulate that of terrestrial solar radiation, it may produce a different type of degradation and distort the ranking of materials obtained in outdoor exposure. Fig. 1 and Fig. 2 compare representative spectral power distributions of the open-flame carbon-arc (with



NOTE 1—Sunlight was measured in Phoenix, AZ, at the summer solstice with clear sky at solar noon using a double grating monochromator (1-nm bandpass) with a quartz cosine receptor on an equatorial follow-the-sun mount. The carbon arc irradiance was measured at the sample plane centered within the allowed sample area. Because of momentary fluctuations in intensity due to flickering of the carbon arc flame, the spectral power distributions shown in this figure are representative and are not meant to be used to calculate or estimate total radiant exposure for tests in carbon-arc devices.

FIG. 1 Representative Spectral Power Distributions (250 to 400 nm) for Terrestrial Sunlight and Open Flame Carbon Arc Using Two Types of Glass Filters



NOTE 1—Measurements made as described in Fig. 1. Because of momentary fluctuations in intensity due to flickering of the carbon arc flame, the spectral power distributions shown in this figure are representative and are not meant to be used to calculate or estimate total radiant exposure for tests in carbon-arc devices.

FIG. 2 Representative Spectral Power Distributions (250 to 300 nm) for Terrestrial Sunlight and Open Flame Carbon Arc Using Two Types of Glass Filters

[6] *Annual Book of ASTM Standards*, Vol 02.05.
[7] *Annual Book of ASTM Standards*, Vol 14.02.

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