



Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus¹

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1. Scope

1.1 This practice covers the selection of test conditions from Practice G 53 to be employed for exposure testing of paint and related coatings and materials.

1.2 *This standard does not purport to address all of the safety problems 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:

- D 358 Specification for Wood to Be Used As Panels in Weathering Tests of Coatings²
- D 523 Test Method for Specular Gloss³
- D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products³
- D 610 Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces²
- D 659 Method of Evaluating Degree of Chalking of Exterior Paints³
- D 660 Test Method for Evaluating Degree of Checking of Exterior Paints³
- D 661 Test Method for Evaluating Degree of Cracking of Exterior Paints³
- D 662 Test Method for Evaluating Degree of Erosion of Exterior Paints³
- D 714 Test Method for Evaluating Degree of Blistering of Paints³
- D 772 Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints³
- D 823 Test Methods for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels³
- D 1005 Test Methods for Measurement of Dry Film Thick-

ness of Organic Coatings Using Micrometers³

- D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base³
- D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base³
- D 1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments³
- D 1729 Practice for Visual Evaluation of Color Differences of Opaque Materials³
- D 1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting⁴
- D 1731 Practices for Preparation of Hot-Dip Aluminum Surfaces for Painting⁴
- D 1732 Practices for Preparation of Magnesium Alloy Surfaces for Painting⁴
- D 2092 Practice for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting²
- D 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates³
- D 2616 Test Method for Evaluation of Visual Color Difference With a Gray Scale
- D 4214 Test Methods for Evaluating Degree of Chalking of Exterior Paint Films³
- E 97 Test Method for Directional Reflectance Factor, 45-deg 0-deg, of Opaque Specimens by Broad-Band Filter Reflectometry⁵
- G 53 Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials⁶

3. Significance and Use

3.1 Organic coatings on exterior exposure are subjected to attack by degrading elements of the weather, particularly ultraviolet light, oxygen, and water. This practice may be used for evaluating the behavior of films exposed in apparatus that produces ultraviolet radiation, high temperatures, and water condensation on the films. This apparatus is used to make an

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² *Annual Book of ASTM Standards*, Vol 06.02.

³ *Annual Book of ASTM Standards*, Vol 06.01.

⁴ *Annual Book of ASTM Standards*, Vol 02.05.

⁵ Discontinued; see 1992 *Annual Book of ASTM Standards*, Vol 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 14.02.

early materials comparison of the exterior exposure quality of paints. However, light sources, such as the fluorescent UV lamp, that emit a significant amount of radiation at wavelengths shorter than those in natural sunlight, may cause results that lead to unrealistic evaluations of weathering properties.

3.2 As no single 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, a specific correlation with outdoor exposure. It has, however, been useful in many instances.

3.3 Since climatic conditions vary with respect to time, geography, and topography, it may be expected that the effects of natural exposure will vary accordingly. All materials are not affected equally by the same environment. Results obtained by use of this practice should not be represented as equivalent to those of any outdoor weathering test unless the degree of quantitative correlation has been established for the material in question.

3.4 Variations in results may be expected when operating conditions among similar type instruments vary within accepted limits of this standard procedure.

4. Apparatus

4.1 *Fluorescent UV/Condensation Apparatus*, complying with Practice G 53.⁷

5. Test Specimens

5.1 Unless otherwise agreed upon, choose panels that meet the applicable base panel requirements specified in Standards D 358, D 609, D 1730, D 1731, D 1732, or D 2092. Select panel sizes suitable for exhibiting the failure mode to be observed.

5.2 Apply the coatings to flat panels with the base panel material, method of application, coating system, film thickness, and method of drying consistent with the anticipated end use, or as mutually agreed upon between the producer and the user. If it's not possible to test *flat* samples, you may need to take special precautions to ensure that (1) the sample holders seal behind the samples so that the water vapor does not escape from the test chamber, and (2) the closest part of the samples to the UV lamps is at the 50-mm distance specified in Practice G 53. If part of the sample is closer to the lamps, it will be subject to more intense UV exposure.

5.3 Unless otherwise agreed upon, coat test panels in accordance with Test Methods D 823 and measure the film thickness in accordance with an appropriate procedure selected from Test Methods D 1005, D 1186, or D 1400. Nondestructive methods are preferred because panels so measured do not need to be repaired.

5.4 Unless otherwise specified, before exposing coated panels in the apparatus, condition them at $73.5 \pm 3.5^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity for one of the following periods in accordance with the type of coating:

Baked coatings	24 h
Radiation-cured coatings	24 h
All other coatings	7 days minimum

6. Procedure

6.1 Place panels within the 8.25 by 35.35-in. (210 by 900-mm) area as described in Practice G 53. Reposition the panels on a regular schedule as described in Practice G 53 to minimize any effects from temperature or UV light variation. When the test specimens do not completely fill the racks, fill the empty spaces with blank non-rusting panels to maintain the test conditions within the chamber.

6.2 Use the test conditions specified by mutual consent or required by a product quality specification. Some test conditions in current use for testing paint and related coatings and materials are:

- A = 8 h UV/70°C followed by 4 h CON/50°C for automotive coatings,
- B = 4 h UV/60°C followed by 4 h CON/50°C for general metal coatings,
- C = 4 h UV/60°C followed by 20 h CON/60°C for exterior wood coatings,
- D = 8 h UV/60°C followed by 4 h CON/45°C for industrial maintenance coatings,
- E = other test temperatures and time cycles that conform to the Procedure section of Practice G 53.

where:

- UV = ultraviolet light (lamps) only, and
- CON = condensation conditions only.

NOTE 1—Temperatures are black panel temperatures measured in the panel rack.

6.3 Program the selected test conditions and operate the apparatus continuously within the limits specified in Practice G 53. Service the apparatus in accordance with Practice G 53.

NOTE 2—Variations in results can occur as the result of not changing lamps in accordance with the manufacturer's instructions.

7. Periods of Exposure

7.1 Use one of the following methods to determine the duration of the exposure under this practice:

7.1.1 A mutually agreed upon specified number of total hours.

7.1.2 The number of total hours of exposure required to produce a mutually agreed upon amount of change in either the test specimen or an agreed upon standard sample.

8. Evaluation of Results

8.1 Evaluate conditions of exposed test specimens by means of one or more of the following standards: D 523, D 610, D 659, D 660, D 661, D 662, D 714, D 772, D 1654, D 1729, D 2244, D 2616, D 4214 and E 97. Select methods in accordance with product use requirements.

8.2 Because of possible variations in results as described in 3.4, no reference should be made to results obtained from tests conducted in the apparatus using this practice unless accompanied by Section 9 or unless otherwise specified in a reference procedure.

⁷ Apparatus and lamps from Q-Panel Co., 26200 First St., Cleveland, OH 44145 and from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613, have been found suitable for this purpose.

9. Report

9.1 Report the following information:

9.1.1 Manufacturer and model of fluorescent UV/condensation apparatus.

9.1.2 Manufacturer's designation for the fluorescent UV lamp and the relative spectral energy distribution of the lamp. This may be accomplished by listing the manufacturer's designation, wavelength (nm) where peak emission occurs, and

the wavelength near low cut-off where 1 % of peak emission occurs.

9.1.3 Exposure cycle, for example, 4 h UV/60°C, 4 h CON/50°C.

9.1.4 Total exposure time.

9.1.5 Results of panel evaluation (see 8.1).

9.1.6 Identification of standard used for comparative evaluation, if any.

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