



Designation: D 6577 – 00

Standard Guide for Testing Industrial Protective Coatings¹

This standard is issued under the fixed designation D 6577; 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.

1. Scope

1.1 This guide covers the selection and use of test methods and procedures for testing industrial protective coatings. Selection of the standards to be followed must be governed by experience and the requirements in each individual case, together with agreement between the supplier and the user.

1.2 This guide covers the testing of liquid coatings as applied on substrate by brushing, rolling, spraying, or other means appropriate to the coating and circumstance.

NOTE 1—The term “industrial protective coating” as used in this guide is described in the scope of Subcommittee D01.46¹ as “paints applied to substrates on-site of structures and buildings, especially where subject to corrosive environments, as industrial, urban, and marine environments.”

NOTE 2—Guides for testing other coating types, such as Guides D 4712, D 5146, D 5324 or for surface preparation, coating application, such as Guide D 3276, are available and should be used when it is applicable.

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.*

2. Referenced Documents

2.1 ASTM Standards:

- B 117 Practice for Operating Salt Spray (Fog) Apparatus²
- C 868 Test Method for Chemical Resistance of Protective Linings³
- D 16 Terminology for Paint and Related Coatings, Materials, and Applications⁴
- D 56 Test Method for Flash Point by Tag Closed Tester⁵
- D 93 Test Methods for Flash-Point by Pensky-Martens Closed Cup Tester⁵
- D 185 Test Methods for Coarse Particles in Pigments, Pastes, and Paints⁶
- D 344 Test Method for Relative Hiding Power of Paints by the Visual Evaluation of Brushouts⁴

¹ This guide is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of subcommittee D01.46 on Protective Coatings.

Current edition approved Aug. 10, 2000. Published October 2000.

² Annual Book of ASTM Standards, Vol 03.02.

³ Annual Book of ASTM Standards, Vol 04.05.

⁴ Annual Book of ASTM Standards, Vol 06.01.

⁵ Annual Book of ASTM Standards, Vol 05.01.

⁶ Annual Book of ASTM Standards, Vol 06.03.

- D 522 Test Methods for Mandrel Bend Test of Attached Organic Coatings⁴
- D 523 Test Method for Specular Gloss⁴
- D 562 Test Method for Consistency of Paints Using the Stormer Viscometer⁴
- D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products⁴
- D 610 Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces⁷
- D 658 Test Method for Abrasion Resistance of Organic Coatings by the Air Blast Abrasive⁸
- D 660 Test Method for Evaluating Degree of Checking of Exterior Paints⁴
- D 661 Test Method for Evaluating Degree of Cracking of Exterior Paints⁴
- D 662 Test Method for Evaluating Degree of Erosion of Exterior Paints⁴
- D 714 Test Method for Evaluating Degree of Blistering of Paints⁴
- D 772 Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints⁴
- D 822 Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus⁴
- D 823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels⁴
- D 869 Test Method for Evaluating Degree of Settling of Paint⁷
- D 870 Practice for Testing Water Resistance of Coatings Using Water Immersion⁴
- D 968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive⁴
- D 1005 Test Methods for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers⁴
- D 1014 Practice for Conducting Exterior Exposure Tests of Paints on Steel⁴
- D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base⁴
- D 1200 Test Method for Viscosity by Ford Viscosity Cup⁴
- D 1210 Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage⁴

⁷ Annual Book of ASTM Standards, Vol 06.02.

⁸ Discontinued; see 1995 Annual Book of ASTM Standards, Vol 06.01.

- D 1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings⁴
- D 1296 Test Method for Odor of Volatile Solvents and Diluents⁹
- D 1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes⁷
- D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base⁴
- D 1474 Test Methods for Indentation Hardness of Organic Coatings⁴
- D 1475 Test Method for Density of Liquid Coatings, Inks, and Related Products⁴
- D 1535 Practice for Specifying Color by the Munsell System⁴
- D 1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature⁴
- D 1653 Test Methods for Water Vapor Transmission of Organic Coating Films⁴
- D 1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments⁴
- D 1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials⁴
- D 1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting¹⁰
- D 1731 Practices for Preparation of Hot-Dip Aluminum Surfaces for Painting¹⁰
- D 1732 Practices for Preparation of Magnesium Alloy Surfaces for Painting¹⁰
- D 1735 Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus⁴
- D 1849 Test Method for Package Stability of Paint⁷
- D 2092 Guide for Treatment of Zinc-Coated (Galvanized) Steel Surfaces for Painting⁷
- D 2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer⁴
- D 2197 Test Methods for Adhesion of Organic Coatings by Scrape Adhesion⁴
- D 2201 Practice for Preparation of Zinc-Coated and Zinc-Alloy-Coated Steel Panels for Testing Paint and Related Coating Products⁴
- D 2243 Test Method for Freeze-Thaw Resistance of Waterborne Coatings⁷
- D 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates⁴
- D 2247 Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity⁴
- D 2354 Test Method for Minimum Film Formation Temperature (MFFT) of Emulsion Vehicles⁶
- D 2369 Test Method for Volatile Content of Coatings⁴
- D 2371 Test Method for Pigment Content of Solvent-Reducible Paints⁴
- D 2574 Test Method for Resistance of Emulsion Paints in the Container to Attack by Microorganisms⁴
- D 2616 Test Method for Evaluation of Visual Color Difference with a Gray Scale⁴
- D 2621 Test Method for Infrared Identification of Vehicle Solids from Solvent-Reducible Paints⁴
- D 2697 Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings⁴
- D 2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)⁴
- D 2803 Guide for Testing Filiform Corrosion Resistance of Organic Coatings on Metal⁴
- D 2805 Test Method for Hiding Power of Paints by Reflectometry⁴
- D 2832 Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings⁴
- D 3134 Practice for Establishing Color and Gloss Tolerances⁴
- D 3168 Practice for Qualitative Identification of Polymers in Emulsion Paints⁴
- D 3170 Test Method for Chipping Resistance of Coatings⁷
- D 3276 Guide for Painting Inspectors (Metal Substrates)⁷
- D 3278 Test Methods for Flash Point of Liquids by Small-Scale Closed-Cup Apparatus⁴
- D 3281 Test Method for Formability of Attached Organic Coatings with Impact-Wedge Bend Apparatus¹¹
- D 3359 Test Methods for Measuring Adhesion by Tape Test⁴
- D 3363 Test Method for Film Hardness by Pencil Test⁴
- D 3792 Test Method for Water Content of Water-Reducible Paints by Direct Injection into a Gas Chromatograph⁴
- D 3793 Test Method for Low-Temperature Coalescence of Latex Paint Films⁷
- D 3912 Test Method for Chemical Resistance of Coatings Used in Light-Water Nuclear Power Plants⁷
- D 3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquers, and Related Materials⁴
- D 3925 Practice for Sampling Liquid Paints and Related Pigmented Coatings⁴
- D 3928 Test Method for Evaluation of Gloss or Sheen Uniformity⁷
- D 3960 Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings⁴
- D 4017 Test Method for Water in Paints and Paint Materials by Karl Fischer Method⁴
- D 4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser⁴
- D 4062 Test Method for Leveling of Paints by Draw-Down Method⁷
- D 4138 Test Methods for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means⁷
- D 4141 Practice for Conducting Accelerated Outdoor Exposure Tests of Coatings⁴
- D 4212 Test Method for Viscosity by Dip-Type Viscosity Cups⁴
- D 4214 Test Methods for Evaluating Degree of Chalking of Exterior Paint Films⁴

⁹ Annual Book of ASTM Standards, Vol 06.04.

¹⁰ Annual Book of ASTM Standards, Vol 02.05.

¹¹ Discontinued; see 1994 Annual Book of ASTM Standards, Vol 06.01.

- D 4287 Test Method for High-Shear Viscosity Using the ICI Cone/Plate Viscometer⁴
- D 4366 Test Methods for Hardness of Organic Coatings by Pendulum Damping Tests⁴
- D 4400 Test Methods for Sag Resistance of Paints Using a Multinotch Applicator⁷
- D 4457 Test Method for Determination of Dichloromethane and 1,1,1-Trichloroethane in Paints and Coatings by Direct Injection into a Gas Chromatograph⁴
- D 4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers⁷
- D 4585 Practice for Testing the Water Resistance of Coatings Using Controlled Condensation⁴
- D 4587 Practice for Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus⁴
- D 4712 Guide for Testing Industrial Water-Reducible Coatings⁷
- D 4752 Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub⁷
- D 4958 Test Method for Comparison of the Brush Drag of Latex Paints⁷
- D 5009 Test Method for Evaluating and Comparing Transfer Efficiency Under Laboratory Conditions⁷
- D 5031 Practice for Conducting Tests on Paints and Related Coatings and Materials Using Enclosed Carbon-Arc Exposure Apparatus⁴
- D 5064 Practice for Conducting a Patch Test to Assess Coating Compatibility⁷
- D 5065 Guide for Assessing the Condition of Aged Coatings on Steel Surfaces⁷
- D 5146 Guide to Testing Solvent-Borne Architectural Coatings⁷
- D 5162 Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coatings on Metallic Substrates⁷
- D 5201 Practice for Calculating Formulation Physical Constants of Paints and Coatings⁴
- D 5235 Test Method for Microscopical Measurement of Dry Film Thickness of Coatings on Wood Products⁷
- D 5286 Test Methods for Determination of Transfer Efficiency Under General Production Conditions for Spray Application of Paints⁷
- D 5324 Guide for Testing Water-Borne Architectural Coatings⁷
- D 5327 Practice for Evaluating and Comparing Transfer Efficiency Under General Laboratory Conditions⁷
- D 5402 Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs⁷
- D 5894 Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)⁴
- D 6093 Test Method for Percent Volume Nonvolatile Matter in Clear or Pigmented Coatings Using a Helium Gas Pycnometer⁴
- D 6132 Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Over Concrete Using an Ultrasonic Gage⁴
- E 84 Test Method for Surface Burning Characteristics of Building Materials¹²
- F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor¹³
- G 7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials¹⁴
- G 8 Test Methods for Cathodic Disbonding of Pipeline Coatings⁷
- G 14 Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)⁷
- G 19 Test Method for Disbonding Characteristics of Pipeline Coatings by Direct Soil Burial⁷
- G 20 Test Method for Chemical Resistance of Pipeline Coatings⁷
- G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials¹⁴
- G 26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials¹⁴
- G 42 Test Method for Cathodic Disbonding of Pipeline Coatings Subjected to Elevated Temperatures⁷
- G 50 Practice for Conducting Atmospheric Corrosion Tests on Metals²
- G 53 Practice for Operating Light-and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials¹⁴
- G 80 Test Method for Specific Cathodic Disbonding of Pipeline Coatings⁷
- G 85 Practice for Modified Salt Spray (Fog) Testing²
- G 90 Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight¹⁴
- G 95 Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method)⁷
- G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials¹⁴
- G 141 Guide for Addressing Variability in Exposure Testing on Nonmetallic Materials¹⁴
- G 147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests¹⁴
- G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices That Use Laboratory Light Sources¹⁴
- G 152 Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials¹⁴
- G 153 Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials¹⁴
- G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials¹⁴
- G 155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials¹⁴

¹² Annual Book of ASTM Standards, Vol 04.07.

¹³ Annual Book of ASTM Standards, Vol 15.09.

¹⁴ Annual Book of ASTM Standards, Vol 14.04.

2.2 Federal Standards:

2.3 U.S. Federal Test Method Standard No. 141C:¹⁵

- 1022 Sampling for Inspection and Testing
- 2112 Application by Roller
- 2131 Application of Sprayed Films
- 2141 Application of Brushed Films
- 2161 Application of Film with Film Applicator (Magnetic Chuck)
- 2162 Application of Film with Film Applicator Using Suction Panel Holder
- 3011 Condition in Container
- 4061 Drying Time
- 4321 Brushing Properties
- 4331 Spraying Properties
- 4335 Roller Coating Properties
- 4401 Odor Test

2.4 U.S. Environmental Protection Agency Standard:¹⁶

- EPA Federal Reference Method 24 – Determination of Volatile Matter Content, Density, Volume Solids, and Weight Solids of Surface Coatings

2.5 NACE Standard:¹⁷

- TM-01-74 Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials in Immersion Service

2.6 ANSI Standard:¹⁸

- N512 Protective Coatings (Paints) for the Nuclear Industry

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this guide, refer to Terminology D 16.

3.1.2 The definitions given in Terminology G 113 relating to natural and artificial weathering tests are applicable to this guide.

4. Significance and Use

4.1 This guide is intended to provide assistance in selecting appropriate tests for evaluating the general performance level to be expected of a coating or coating system on a given substrate exposed to a given type of environment.

4.2 Surface preparation or cleanliness prior to application of the coating can be critical to the proper performance of the coating.

4.3 Results obtained in the tests cited in this guide may not be adequate for predicting coating service life of a specific coating system in a specific environmental exposure. A suitable control coating system of known performance in the service environment should be included in the testing for comparison.

¹⁵ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

¹⁶ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

¹⁷ Available from the National Association of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218.

¹⁸ Available from American National Standards Institute, 11 W. 42 St., 13th Floor, New York, NY 10036.

5. Conditions Affecting Performance

5.1 Practical requirements and performance of industrial coatings may vary with the following:

5.1.1 *Substrate Type*—Ferrous, nonferrous, previously coated surfaces, masonry, and other materials.

5.1.2 *Substrate Conditions and Surface Profile*—Cleanliness, porosity, smoothness, and weathering of the substrates.

5.1.3 *Substrate Aspects of Structure*—Construction defects or defects due to age such that excessive moisture makes its way through a porous substrate or is trapped in components; design defects that cause galvanic corrosion; environmental exposure to deteriorating materials such as deicing salts, improperly prepared welds, or other site-specific detrimental conditions.

5.1.4 Type, quality, and suitability of the surface treatment or primer used and time of drying before coating application.

5.1.5 Application methods and techniques.

5.1.6 *Application and Cure Conditions*—Environmental conditions, such as temperature and relative humidity, during application and drying.

5.1.7 *Service Conditions*—Environmental conditions such as temperature, humidity, and chemical and mechanical stress.

6. Sampling and Test Conditions

6.1 Prior to sampling, the condition of the container should be checked since damage to it may cause evaporation, skinning, or other undesirable effects on the coating.

6.2 Sample in accordance with Practice D 3925 or Method 1022 of Federal Test Method Standard No. 141C. Prepare coating films of uniform thickness on test panels in accordance with Practices D 823.

6.3 Tests and observations shall be at standard laboratory conditions in accordance with Specification D 3924 unless otherwise specified or agreed upon between the supplier and the user.

7. Liquid Coatings Properties

7.1 *Condition in Container*—Thickening, settling, and separation are undesirable and objectionable if a liquid coating cannot be reconditioned and made suitable for application with a reasonable amount of stirring. The referenced test method, Method 3011.1 covers procedures for determining changes in properties after storage. Determine the condition in the container in accordance with Method 3011.1 of U.S. Federal Test Method Standard No. 141C.

7.2 *Coarse Particles and Foreign Matter*—Liquid coatings must be free of coarse particles and foreign matter to be able to form uniform films of good appearance. A typical maximum value is 0.5 weight % of the total material. Determine the content of coarse particles and foreign matter in accordance with Test Methods D 185. This referenced method uses material retained in a 325-mesh (45- μ m) screen as a measure of coarse particle and foreign matter.

7.3 *Density or Weight per Gallon*—The density as measured by weight per gallon is used to help ensure product uniformity from batch to batch. Test Method D 1475. gives a procedure for measuring the density of the coating at specified temperature. A calibrated weight-per-gallon cup is used to determine the