



Standard Guide for Testing Coil Coatings¹

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1. Scope

1.1 This guide covers procedures for testing coil coatings. The test methods included are listed in **Table 1**. Where more than one test method is listed for the same characteristic, no attempt is made to indicate superiority of one method over another. Selection of test methods to be followed must be governed by the requirements in each individual case, together with agreement between the producer and user.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 of Salt Spray (Fog) Apparatus²
- B 368** Test Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (Cass Test)³
- D 522** Test Methods for Mandrel Bend Test of Attached Organic Coatings⁴
- D 523** Test Methods for Specular Gloss⁴
- D 610** Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces⁵
- D 660** Test Method for Evaluating Degree of Checking Exterior Paints⁴
- D 661** Test Method for Evaluating Degree of Cracking of Exterior Paints⁴
- D 714** Test Method for Evaluating Degree of Blistering of Paints⁴
- D 822** Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Apparatus⁴

- D 823** Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels⁴
- 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 Method 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 1193** Specification for Reagent Water⁶
- 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
- D 1212** Test Methods for Measurement of Wet Film Thickness of Organic Coatings⁴
- D 1308** Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes⁵
- 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 Paint, Varnish, Lacquer, and Related Products⁴
- 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 1735** Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus⁴
- D 1823** Test Method for Apparent Viscosity of Plastics and Organosols at High Shear Rates by Extrusion Viscometer⁷
- D 1824** Test Method for Apparent Viscosity of Plastics and Organosols at Low Shear Rates by Brookfield Viscometer⁷
- D 2092** Guide for Treatment of Zinc-Coated (Galvanized)

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 D01.53 on Coil Coated Metal.

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² Annual Book of ASTM Standards, Vol 03.02.

³ Annual Book of ASTM Standards, Vol 02.05.

⁴ Annual Book of ASTM Standards, Vol 06.01.

⁵ Annual Book of ASTM Standards, Vol 06.02.

⁶ Annual Book of ASTM Standards, Vol 11.01.

⁷ Annual Book of ASTM Standards, Vol 08.01.

- Steel Surfaces for Painting⁵
- D 2196** Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer⁴
- D 2197** Test Method for Adhesion of Organic Coatings by Scrape Adhesion⁴
- 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 2248** Practice for Detergent Resistance of Organic Finishes⁴
- D 2369** Test Method for Volatile Content of Coatings⁴
- D 2454** Practice for Determining the Effect of Overbaking on Organic Coatings⁴
- 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 3003** Test Method for Pressure Mottling and Blocking Resistance of Organic Coatings on Metal Substrates⁵
- D 3134** Practice for Establishing Color and Gloss Tolerances⁴
- D 3170** Test Method for Chipping Resistance of Coatings⁵
- D 3278** Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus⁴
- D 3359** Test Methods for Measuring Adhesion by Tape Test⁴
- 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 Cycle⁴
- D 3363** Test Method for Film Hardness by Pencil Test⁴
- D 3960** Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings⁴
- D 4060** Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser⁴
- D 4138** Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means⁵
- D 4141** Practice for Conducting Accelerated Outdoor Exposure Tests of Coatings⁴
- D 4145** Test Method for Coating Flexibility of Prepainted Sheet⁵
- D 4146** Test Method for Formability of Zinc-Rich Primer/Chromate Complex Coatings on Steel⁵
- D 4147** Practice for Applying Coil Coatings Using the Wire-Wound Drawdown Bar⁵
- D 4212** Test Method for Viscosity by Dip-Type Viscosity Cups⁴
- D 4214** Test Methods for Evaluating Degree of Chalking of Exterior Paint Films⁴
- D 4287** Test Method for High-Shear Viscosity Using the ICI Cone/Plate Viscometer⁴
- D 4518** Test Methods for Measuring Static Friction of Coating Surfaces⁸
- D 4585** Practice for Testing 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 5031** Practice for Conducting Tests on Paints and Related Coatings and Materials Using Enclosed Carbon-Arc Light and Water Exposure Apparatus⁴
- D 5178** Test Method for Mar Resistance of Organic Coatings⁴
- D 5402** Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs⁵
- D 5531** Guide for Preparation, Maintenance and Distribution of Physical Product Standards for Color and Geometric Appearance of Coatings⁴
- D 5723** Practice for Determination of Chromium Treatment Weight on Metal Substrates by X-Ray Fluorescence⁵
- D 5796** Test Method for Measurement of Dry Film Thickness of Thin Film Coil-Coated Systems by Destructive Means Using a Boring Device⁵
- D 5894** Practice for Cyclic Salt Fog-UV Exposure of Painted Metal (Alternating Exposure in a Fog/Dry Cabinet and UV/Condensation Cabinet)⁴
- D 6093** Test Method for Percent Volume Nonvolatile Matter in Clear or Pigmented Coatings Using a Helium Gas Pycnometer⁴
- D 6491** Practice for Evaluation of Aging Resistance of Prestressed Prepainted Metal in a Dry Heat Test⁵
- D 6492** Practice for Detection of Hexavalent Chromium On Zinc and Zinc/Aluminum Alloy Coated Steel⁵
- E 70** Test Method for pH of Aqueous Solutions with the Glass Electrode⁹
- E 84** Test Method for Surface Burning Characteristics of Building Materials¹⁰
- E 284** Terminology of Appearance⁴
- E 308** Practice for Computing the Colors of Objects by Using the CIE System⁴
- E 408** Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques¹¹
- E 643** Test Method for Ball Punch Deformation of Metallic Sheet Material¹²
- E 903** Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres¹³
- E 1164** Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation⁴
- E 1356** Test Method for Glass Transition Temperatures by Differential Scanning Calorimetry or Differential Thermal Analysis¹⁴
- E 1541** Practice for Specifying and Matching Color Using

⁸ Discontinued; see 1999 *Annual Book of ASTM Standards*, Vol 06.01.

⁹ *Annual Book of ASTM Standards*, Vol 15.05.

¹⁰ *Annual Book of ASTM Standards*, Vol 04.07.

¹¹ *Annual Book of ASTM Standards*, Vol 15.03.

¹² *Annual Book of ASTM Standards*, Vol 03.01.

¹³ *Annual Book of ASTM Standards*, Vol 12.02.

¹⁴ *Annual Book of ASTM Standards*, Vol 14.02.

- the Colorcurve System⁴
- E 1545** Test Method for Assignment of the Glass Transition Temperature by Thermomechanical Analysis¹⁴
- E 1640** Test Method for Assignment of the Glass Transition Temperature by Dynamic Mechanical Analysis¹⁴
- E 1808** Guide for Designing and Conducting Visual Experiments⁴
- E 1918** Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field¹⁰
- G 7** Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials¹⁵
- G 60** Test Method for Conducting Cyclic Humidity Tests²
- G 85** Practice for Modified Salt Spray (Fog) Testing²
- G 87** Practice for Conducting Moist SO₂ Tests²
- G 90** Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight¹⁵
- G 113** Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials¹⁵
- G 151** Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources¹⁵
- G 152** Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials¹⁵
- G 153** Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials¹⁵
- G 154** Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials¹⁵
- G 155** Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials¹⁵
- G 159** Tables for References Solar Spectral Irradiance at Air Mass 1.5: Direct Normal and Hemispherical for a 37° Tilted Surface¹⁵

¹⁵ Annual Book of ASTM Standards, Vol 14.04.

3. Terminology

3.1 Definitions:

3.1.1 *coil coating*—application of coatings or films to continuous metal coil stock.

3.1.2 *direct roller coat*—coating with the applicator or coating roll revolving in the same direction as the strip.

3.1.3 *metal pretreatment*—chemical treatment normally applied to the metal substrate prior to prime or finish coating.

3.1.3.1 *Discussion*—The treatment is designed to react with and modify the metal substrate to produce a surface suitable for coating or adhesive bonding.

3.1.4 *reverse roller coat*—coating with the applicator or coating roll revolving in a direction opposite to that of the strip.

3.2 The definitions given in Terminology **G 113** are applicable to this guide.

4. Significance and Use

4.1 This guide represents a collection of pertinent ASTM test methods used within the coil coatings industry. In the past, coil coaters world wide depended on industry standards written by the National Coil Coaters Association. That association, working cooperatively with ASTM, will no longer issue new, nor update old, standards.

5. General Requirements

5.1 All standard tests shall be made at 25 ± 3°C (77 ± 25°F) and 50 ± 5 % relative humidity, immediately after baking unless otherwise specified.

6. Sampling

6.1 The number of samples per unit of production shall be agreed upon between the producer and user.

TABLE 1 List of Test Methods and Recommended Practices

	Section	ASTM Standard
Liquid Coatings Properties:		
Viscosity:	7.1	
Ford cup viscosity	7.1.2	D 1200
Zahn cup viscosity	7.1.2	D 4212
High-Shear extrusion viscometer	7.1.3	D 1823
Plastisol and organosol low-shear viscosity	7.1.4	D 1824
Brookfield-type viscometer	7.1.5	D 2196
Cone and Plate viscometer	7.1.6	D 4287
Weight Solids	7.2	D 2369
Volatile Content	7.2	D 2369
Volume Solids	7.3	D 2697, D 6093
Fineness of dispersion	7.4	D 1210
Density (weight per gallon)	7.5	D 1475
VOC Determination	7.6	D 3960
pH	7.7	E 70
Flash Point	7.8	D 3278
Metal Pretreatment:		
Preparation of galvanized steel for painting	8.2	D 2092
Detecting Cr+6	8.3.1	D 6492
X-ray fluorescence, chrome determination	8.3.2	D 5723
Panel Preparation:		
Wire-wound drawdown bars	9.4.1.1	D 4147
Blade film applicator	9.4.1.2	D 823

