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Standard Guide for Testing High-Performance Interior Architectural Wall Coatings¹

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1. Scope

1.1 This guide covers the selection and use of test methods for high-performance interior architectural wall coatings (HIPAC) that differ from more conventional coatings by being tougher, more stain-resistant, more abrasion-resistant and, ordinarily, designed to be applied to wall surfaces of steel, masonry (poured concrete, concrete block, or cinder block), and plaster or gypsum wallboard. The tests that are listed in **Tables 1 and 2** are designed to measure performance properties. These tests may not all be required for each HIPAC system. Selection of the test methods to be followed must be governed by experience and the requirements in each individual case, together with agreement between the purchaser and the seller.

1.2 High-performance architectural coatings are tough, extra-durable organic coating systems that are applied as a continuous (seamless) film and cure to a hard finish. The finish can be high gloss, semigloss, or low gloss as desired. These coatings are resistant to persistent heat, humidity, abrasion, staining, chemicals, and fungus growth. They are used in areas where humidity, wear, or unusual chemical resistance requirements, particularly to soiling, are required and where strong detergents are used to maintain sanitary conditions. Halls and stairways in public buildings, lavatories, stall showers, locker areas, animal pens, and biological laboratories are typical applications. In addition, food processing plants, dairies, restaurants, schools, and transport terminals frequently use HIPAC systems. These are effective in many areas of building interiors compared with tile and are of low materials and maintenance costs. They are used as a complete system only as recommended by the manufacturer since the individual coats in a system are formulated to be compatible with each other. HIPAC systems should be applied only to properly prepared surfaces such as steel or masonry, including cinder blocks and cement blocks. They can be applied over plaster and gypsum wallboard. Ordinarily, a prime or fill coat, if required, is part of the system.

1.3 While they are excellent for walls, HIPAC are not usually intended for ceilings and floors. They would not ordinarily be used in homes, although parents with small children might want to use HIPAC coatings on some walls.

1.4 The types of resin ordinarily used are the following: epoxy-polyamide, two-package; polyester-epoxy, two-package; polyurethane, one-package or two-package. However, other resin types are not excluded provided they can meet the requirements (performance specifications) laid down by the purchaser.

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

1.6 *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 a specific hazard statement, see the note in **7.6**.

2. Referenced Documents

2.1 ASTM Standards:²

- D16 Terminology for Paint, Related Coatings, Materials, and Applications**
- D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester**
- D154 Guide for Testing Varnishes**
- D185 Test Methods for Coarse Particles in Pigments**
- D344 Test Method for Relative Hiding Power of Paints by the Visual Evaluation of Brushouts**
- D523 Test Method for Specular Gloss**
- D562 Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer**
- D869 Test Method for Evaluating Degree of Settling of Paint**
- D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers**

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 List of Standards in Sectional Order

Property (or Related Test)	Section	ASTM Test Method	Federal Test Method Standard No. 141
Sampling:	5.2	D3925	...
Liquid Paint Properties:			
Skinning	7.1	D154	
Condition in container	7.2	...	3011
Coarse particles and foreign matter	7.3	D185	
Density or weight per gallon	7.4	D1475	
Fineness of dispersion	7.5	D1210	
Flash point	7.7	D93, D3278	
Dilution stability	7.8	...	4203
Volatile content	7.9	D2369	...
Free diisocyanate content	7.10	D3432	...
Package stability	7.11		
Heat stability	7.11.1	D1849	
Settling	7.11.2	D869	
Coating Application and Film Formation:			
Application properties	8.1	...	4541
Brush application	8.1.1	...	2141
Brush drag	8.1.1.1	D4958	...
Roller application	8.1.2	...	2112
Roller spatter	8.1.2.1	D4707	...
Spray application	8.1.3	...	2131
Rheological properties	8.2	...	...
Consistency (low-shear viscosity)	8.2.1	D562	...
Rheological properties of non-Newtonian liquids	8.2.2	D2196, D4287	...
Sag resistance	8.2.3	D4400	...
Leveling properties	8.2.4	D4062	...
Curing properties	8.3	...	...
Wet-film thickness	8.4	D1212	...
Touch-up uniformity	8.5	D3928	...
Appearance of Dry Coating:			
Color appearance	9.1.1	...	...
Color differences by visual comparison	9.1.2	D1729	...
Color differences using instrumental measurements	9.1.3	D2244	...
Directional reflectance	9.2	E1347	...
Gloss, 60°	9.3	D523	...
Hiding power	9.4	D344, D2805	...
Yellowness index	9.5	E313	...
Properties of Dry Film:			
Abrasion resistance	10.1	D4060	...
Adhesion	10.2	D4541	...
Impact resistance	10.3	D2794	...
Chemical resistance	10.4	D1308	...
Washability and cleansability	10.5	...	...
Washability	10.5.1	D2486, D4213	...
Cleansability	10.5.2	D3450, D4828	...
Mildew resistance	10.6	D3273	...
Perspiration resistance	10.7	...	...
Heat and cold resistance	10.8	D1211	...
Heat and humidity resistance	10.9	D2247	...
Fire hazards	10.10	E84	...
Dry-film thickness	10.11	D1005, D1186, D1400	...

D1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base³

D1210 Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage

D1211 Test Method for Temperature-Change Resistance of Clear Nitrocellulose Lacquer Films Applied to Wood³

D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings

D1296 Test Method for Odor of Volatile Solvents and Diluents

D1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

³ Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

TABLE 2 Alphabetical List of Test Methods

Test Method	Section	ASTM Test Method	Federal Test Method Standard No. 141
Abrasion resistance	10.1	D4060	...
Adhesion	10.2	D4541	...
Application properties	8.1	...	4541
Brush application	8.1.1	...	2141
Brush drag	8.1.1.1	D4958	...
Chemical resistance	10.4	D1308 ^A	...
Cleansability	10.5.2	D3450, D4828	...
Coarse particles and foreign matter	7.3	D185	...
Color appearance	9.1.1	...	...
Color differences by visual comparison	9.1.2	D1729	...
Color differences using instrumental measurements	9.1.3	D2244	...
Condition in container	7.2	...	3011
Consistency (low-shear viscosity)	8.2.1	D562	...
Curing properties	8.3	...	...
Density or weight per gallon	7.4	D1475	...
Dilution stability	7.8	...	4203
Directional reflectance	8.2	E1347	...
Dry-film thickness	10.11	D1005, D1186, D1400	...
Fineness of dispersion	7.5	D1210	...
Fire hazards	10.10	E84	...
Flash point	7.7	D93, D3278	...
Free diisocyanate content	7.10	D3432	...
Gloss (60-deg specular)	9.3	D523	...
Heat and cold resistance	10.8	D1211 ^A	...
Heat and humidity resistance	10.9	D2247 ^A	...
Heat stability	7.11.1	D1849	...
Hiding power	9.4	D344, D2805	...
Impact resistance	10.3	...	...
Leveling properties	8.2.4	D4062	...
Mildew resistance	10.6	D3273	...
Package stability	7.11	...	...
Perspiration resistance	10.7	...	...
Rheological properties of non-Newtonian liquids	8.2.2	D2196, D4287	...
Roller application	8.1.2	...	2112
Roller spatter	8.1.2.1	D4707	...
Sag resistance	8.2.3	D4400	...
Sampling	5.2	D3925	...
Settling	7.11.2	D869	...
Skinning	7.1	D154	...
Spray application	8.3	...	2131
Touch-up uniformity	8.5	D3928	...
Volatile content	7.9	D2369	...
Washability	10.5.1	D2486, D4213	...
Wet-film thickness	8.4	D1212	...
Yellowness index	9.5	E313	...

^A Modified.

[D1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base³](#)

[D1475 Test Method For Density of Liquid Coatings, Inks, and Related Products](#)

[D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials](#)

[D1849 Test Method for Package Stability of Paint](#)

[D2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational \(Brookfield type\) Viscometer](#)

[D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates](#)

[D2247 Practice for Testing Water Resistance of Coatings in](#)

[100 % Relative Humidity](#)

[D2369 Test Method for Volatile Content of Coatings](#)

[D2486 Test Methods for Scrub Resistance of Wall Paints](#)

[D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation \(Impact\)](#)

[D2805 Test Method for Hiding Power of Paints by Reflectometry](#)

[D3273 Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber](#)

[D3278 Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus](#)

[D3432 Test Method for Unreacted Toluene Diisocyanates in Urethane Prepolymers and Coating Solutions by Gas Chromatography³](#)

- D3450 Test Method for Washability Properties of Interior Architectural Coatings
- D3925 Practice for Sampling Liquid Paints and Related Pigmented Coatings
- D3928 Test Method for Evaluation of Gloss or Sheen Uniformity
- D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- D4062 Test Method for Leveling of Paints by Draw-Down Method
- D4213 Test Method for Scrub Resistance of Paints by Abrasion Weight Loss
- D4287 Test Method for High-Shear Viscosity Using a Cone/Plate Viscometer
- D4400 Test Method for Sag Resistance of Paints Using a Multinotch Applicator
- D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- D4585 Practice for Testing Water Resistance of Coatings Using Controlled Condensation
- D4707 Test Method for Measuring Paint Spatter Resistance During Roller Application
- D4828 Test Methods for Practical Washability of Organic Coatings
- D4958 Test Method for Comparison of the Brush Drag of Latex Paints
- E84 Test Method for Surface Burning Characteristics of Building Materials
- E105 Practice for Probability Sampling Of Materials
- E313 Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates
- E1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

2.2 U.S. Federal Standard:

- Federal Test Method Standard No. 141⁴
- 2112 Application by Roller
- 2131 Application of Sprayed Films
- 2141 Application of Brushed Films
- 3011 Condition in Container
- 4203 Reducibility and Dilution Stability
- 4541 Working Properties and Appearance of Dried Film
- 6141 Washability of Paints
- 6142 Scrub Resistance

2.3 U. S. Federal Specification:

- TT-F-1098 Filler, Block Solvent-Thinned for Porous Surfaces⁴

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in these practices, refer to Terminology D16.

4. Conditions Affecting Performance of HIPAC Coating Systems

4.1 Practical requirements for high performance coatings may vary with:

4.1.1 Substrate type such as concrete, poured or precast block, lime-gypsum plaster, etc.

4.1.2 Climatic conditions, both generally and specifically, at the time of coating application. ASTM standard conditions for laboratory testing are $73.5 \pm 3.5^{\circ}\text{F}$ ($23 \pm 2^{\circ}\text{C}$) and $50 \pm 5\%$ relative humidity.

5. Sampling

5.1 Prior to sampling, establish the condition of the container since damage to it may cause evaporation, skinning, or other undesirable effects. Excessive storage time and temperature fluctuations may cause settling or changes in viscosity.

5.2 Sample in accordance with Practice D3925. Determine the density in pounds per gallon (kilograms/litre) in accordance with Test Method D1475. Continue sampling and determining density until successive results agree within 0.1 lb (45 g) or as agreed upon between the purchaser and seller. Then take samples for testing.

5.3 Specify the amount required for a representative sample, the package sizes, and an identification code. A 1-U.S. gal (or 4-L) sample is usually sufficient for the recommended tests, but for guidance in selecting a sampling plan consult Practice E105.

6. Laboratory Tests

6.1 Preparation of Test Panels:

6.1.1 Unless otherwise specified, test panels shall be 40 by 190 by 395-mm ($1\frac{1}{2}$ by $7\frac{1}{2}$ by $15\frac{1}{2}$ -in.) masonry units made from standard lightweight concrete block, having an apparent specific gravity of 1.60 to 1.62.

6.1.2 One face only of the test panel shall be coated with the complete system, in a vertical position. The filler shall either comply with U.S. Federal Specification TT-F-1098 or be the material specified and supplied by the manufacturer. The filler coat shall be applied in conformance with the manufacturer's printed directions for surface preparation, mixing, application, coverage, and curing time under standard conditions of temperature and humidity.

7. Liquid Coating Properties

7.1 *Skimming*—Coatings that contain a binder that dries by oxidation may be subject to skin formation in a partially filled can. Since skins are insoluble in the material they must be removed before use. The referenced test in a partially filled container indicates the tendency of the material to skin. A typical minimum time for skinning in accordance with this method is 48 h. Examine the original sample for skins, both on and below the surface. Using a well-mixed skin-free portion of the sample, perform a skinning test in accordance with Guide D154, Section 10.

7.2 *Condition in Container*—Thickening, pigment settling, and separation are undesirable and objectionable if a coating, after storage, cannot be readily reconditioned and made suitable for application with a reasonable amount of stirring. The

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.