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Standard Guide for Testing Printing Inks and Related Materials¹

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1. Scope*

1.1 This guide covers a list of test methods, practices, and specifications that can be used for the testing and evaluation of printing inks, printed ink films, and substrates used in their production (see [Table 1](#)).

1.2 This guide includes methods that were developed to test paints, paint films, and substrates, but may be adapted for use in testing printing inks and printed matter. Tests on raw materials and analytical methods in general have not been included. Tests for printing ink vehicles are covered in Guide [D 6687](#).

NOTE 1—For the purpose of this guide, clear coatings such as overprint varnishes are classed as printing inks.

1.3 Other ASTM standards not specified here may also be applicable.

2. Referenced Documents

2.1 *ASTM Standards:*²

[D 16](#) Terminology for Paint, Related Coatings, Materials, and Applications

[D 6687](#) Guide for Testing Printing Ink Vehicles and Components Thereof

3. Terminology

3.1 *Definitions:*

3.1.1 The following definition is given in Terminology [D 16](#).

3.1.2 *printing ink, n*—a colored or pigmented liquid or paste composition that dries to a solid film after application as a thin layer by printing machinery.

¹ This guide is under the jurisdiction of the ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.56 on Printing Inks.

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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.

3.1.2.1 *Discussion*—Printing inks may contain vehicles, colorants, waxes, solvents, and other additives. Bulk inks are tested for dispersion, tinting strength, density, heat and storage stability, rheology, and printing properties.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *printed ink film, n*—thin layer of a printing ink deposited onto a substrate by means of a laboratory or production printing press, occasionally by a drawdown or roll-out technique.

3.2.1.1 *Discussion*—Printed matter is the usual medium by which inks are tested for appearance properties, drying, and resistance to various agents.

3.2.2 *printing substrate, n*—material onto which ink is deposited in the production of printed matter.

3.2.2.1 *Discussion*—Printing substrates include paper, paperboard, plastic film, glass, and metallic surfaces. In this guide, standards relating to substrates are largely restricted to properties associated with appearance and printability.

4. Test Categories

4.1 For convenience in selection, the test methods, practices, and specifications, listed in this guide are classified into three groups by type of printing process and in subgroups indicating whether the test is conducted on a bulk ink, a printed ink film, or a substrate (see [Table 2](#)). The group is given in the left column preceding the test method reference. The classifications are as follows:

4.1.1 *Group 1—Applicable in General:*

Class A—Bulk inks.

Class B—Printed ink films.

Class C—Substrates.

4.1.2 *Group 2—Applicable to Low Viscosity or Liquid Inks Associated With Flexography or Gravure:*

Class A—Bulk inks.

Class B—Printed ink films.

Class C—Substrates.

4.1.3 *Group 3—Applicable to High Viscosity or Paste Inks Associated With Letterpress, Lithography, or Silk Screen:*

*A Summary of Changes section appears at the end of this standard.

Class A—Bulk inks.
 Class B—Printed ink films.
 Class C—Substrates.

6. Keywords

6.1 printed matter; printing inks; printing substrates; test methods and practices (tabulation of)

5. Precision and Bias

5.1 If available, precision for each test method listed can be found in the latest revision of that test method.

TABLE 1 Numerical Listing of Ink-Related Standards

| ASTM Designation | Volume | Title |
|------------------|-------------------------|--|
| D 16 | 06.01 | Terminology for Paint, Related Coatings, Materials, and Applications |
| D 56 | 05.03 06.04 | Test Method for Flash Point by Tag Closed Cup Tester |
| D 93 | 04.09 05.01 06.04 | Test Method for Flash Point by Pensky-Martin Closed Tester |
| D 185 | 06.03 | Test Methods for Coarse Particles in Pigments, Pastes, and Paints |
| D 344 | 06.01 | Test Method for Relative Dry Hiding Power of Paints by the Visual Evaluation of Brushouts |
| D 523 | 06.01 | Test Method for Specular Gloss |
| D 528 | 15.09 | Test Method for Machine Direction of Paper and Paperboard |
| D 562 | 06.01 | Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer |
| D 644 | 15.09 | Test Method for Moisture Content of Paper and Paperboard by Oven Drying |
| D 685 | 15.09 | Method for Conditioning Paper and Paperboard Products for Testing |
| D 724 | 15.09 | Test Method for Surface Wettability of Paper (Angle-of-Contact Method) |
| D 780 | 15.09 | Test Method for Printing Ink Permeation of Paper (Castor Oil Test) |
| D 822 | 06.01 | Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings |
| D 869 | 06.02 | Test Method for Evaluating the Degree of Settling of Paint |
| D 918 | 15.09 | Test Method for Blocking Resistance of Paper and Paperboard |
| D 971 | 05.01 | Test Method for Interfacial Tension of Oil Against Water by the Ring Method |
| D 1006 | 06.01 | Practice for Conducting Exterior Exposure Tests of Paints on Wood |
| D 1014 | 06.01 | Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates |
| D 1200 | 06.01 | Test Method for Viscosity by Ford Viscosity Cup |
| D 1210 | 06.01 | Test Method for Fineness of Dispersion of Pigment-Vehicle Systems |
| D 1259 | 06.01 | Test Methods for Nonvolatile Content of Resin Solutions |
| D 1308 | 06.01 | Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes. |
| D 1310 | 05.01 06.04 | Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus |
| D 1316 | 06.02 | Test Method for Fineness of Grind of Printing Inks by the NPIRI Grindometer |
| D 1331 | 15.04 | Test Methods for Surface and Interfacial Tension of Solutions of Surface-Active Agents |
| D 1353 | 06.04 | Test Method for Nonvolatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer, and Related Products |
| D 1474 | 06.01 | Test Methods for Indentation Hardness of Organic Coatings |
| D 1475 | 06.01 | Test Method for Density of Paint, Varnish, Lacquer, and Related Products |
| D 1535 | 06.01 | Test Method for Specifying Color by the Munsell System |
| D 1544 | 06.01 | Test Method for Color of Transparent Liquids (Gardner Color Scale) |
| D 1545 | 06.03 | Test Method for Viscosity of Transparent Liquids by Bubble Time Method |
| D 1590 | 11.01 | Test Methods for Surface Tension of Water and Waste Water |
| D 1640 | 06.03 | Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature |
| D 1644 | 06.01 | Test Methods for Nonvolatile Content of Varnishes |
| D 1653 | 06.01 | Test Methods for Water Vapor Permeability of Organic Coating Films |
| D 1725 | 06.03 | Test Method for Viscosity of Resin Solutions |
| D 1729 | 06.01 | Practice for Visual Evaluation of Color Differences of Opaque Materials |
| D 1849 | 06.02 | Test Method for Package Stability of Paint |
| D 1963 | 06.03 | Test Method for Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25°C |
| D 2066 | 06.02 | Test Methods for Relative Tinting Strength of Paste-Type Printing Ink Dispersions |
| D 2067 | 06.02 | Test Method for Coarse Particles in Printing Ink Dispersions |
| D 2090 | 06.03 | Test Method for Clarity and Cleanness of Paint and Ink Liquids |
| D 2091 | 06.02 | Test Method for Print Resistance of Lacquers |
| D 2196 | 06.01 | Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer |
| D 2243 | 06.02 | Test Method for Freeze-Thaw Resistance of Water-Borne Coatings |
| D 2244 | 06.01 | Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates |
| D 2248 | 06.01 | Practice for Detergent Resistance of Organic Finishes |
| D 2337 | 06.02 | Test Method for Freeze-Thaw Stability of Multicolor Lacquers |
| D 2369 | 06.01 | Test Method for Volatile Content of Coatings |
| D 2482 | 15.09 | Method for Wax Pick Test for Surface Strength of Paper |
| D 2574 | 06.01 | Test Method for Resistance of Emulsion Paints in the Container to Attack by Microorganisms |
| D 2578 | 08.02 | Test Method for Wetting Tension of Polyethylene and Polypropylene Films |
| D 2616 | 06.01 | Test Method for Evaluation of Visual Color Difference with a Gray Scale |
| D 2794 | 06.01 | Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) |
| D 2805 | 06.01 | Test Method for Hiding Power of Paints by Reflectometry |
| D 3134 | 06.01 | Practice for Establishing Color and Gloss Tolerances |
| D 3258 | 06.02 | Test Method for Porosity of Paint Films |
| D 3278 | 06.01 | Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus |
| D 3359 | 06.01 | Test Methods for Measuring Adhesion by Tape Test |

TABLE 1 *Continued*

| ASTM Designation | Volume | Title |
|------------------|--------|---|
| D 3361 | 06.01 | Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings |
| D 3363 | 06.01 | Test Method for Film Hardness by Pencil Test |
| D 3424 | 06.02 | Test Methods for Evaluating the Relative Lightfastness and Weatherability of Printed Matter |
| D 3456 | 06.01 | Practice for Determining by Exterior Exposure Tests the Susceptibility of Paint Films to Microbiological Attack |
| D 3732 | 06.02 | Practice for Reporting Cure Times of Ultraviolet-Cured Coatings |
| D 3792 | 06.01 | Test Method for Water Content of Water-Reducible Paints by Direct Injection into a Gas Chromatograph |
| D 3825 | 05.03 | Test Method for Dynamic Surface Tension by the Fast Bubble Technique |
| D 3828 | 05.03 | Test Method for Flash Point by Small Scale Closed Cup Tester |
| D 3924 | 06.01 | Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquers, and Related Materials |
| D 3925 | 06.01 | Practice for Sampling Liquid Paints and Related Pigmented Coatings |
| D 3928 | 06.02 | Test Method for Evaluation of Gloss or Sheen Uniformity |
| D 3934 | 06.01 | Test Method for Flash/No Flash Test—Equilibrium Method by a Closed-Cup Apparatus |
| D 3960 | 06.01 | Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings |
| D 4017 | 06.01 | Test Method for Water in Paints and Paint Materials by Karl Fischer Method |
| D 4040 | 06.02 | Test Method for Rheological Properties of Paste Printing Inks and Vehicles by the Falling-Rod Viscometer |
| D 4060 | 06.01 | Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser |
| D 4086 | 06.01 | Practice for Visual Evaluation of Metamerism |
| D 4141 | 06.01 | Practice for Conducting Accelerated Outdoor Exposure Tests of Coatings |
| D 4144 | 06.02 | Method for Estimating Package Stability of Coatings for Ultraviolet Curing |
| D 4147 | 06.02 | Practice for Applying Coil Coatings Using the Wire-Wound Drawdown Bar |
| D 4212 | 06.01 | Test Method for Viscosity by Dip-Type Viscosity Cups |
| D 4287 | 06.01 | Test Method for High-Shear Viscosity Using the ICI Cone/Plate Viscometer |
| D 4302 | 06.02 | Specification for Artists' Oil, Resin-Oil, and Alkyd Paints |
| D 4303 | 06.02 | Test Methods for Lightfastness of Colorants Used in Artists' Paints |
| D 4359 | 06.01 | Test Method for Determining Whether a Material is a Liquid or a Solid |
| D 4361 | 06.01 | Test Method for Apparent Tack of Printing Inks and Vehicles by a Three-Roller Tackmeter |
| D 4366 | 06.01 | Test Methods for Hardness of Organic Coatings by Pendulum Damping Tests |
| D 4449 | 06.01 | Test Method for Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance |
| D 4459 | 08.03 | Practice for Operating an Accelerated Lightfastness Xenon-Arc-Type (Water Cooled) Light-Exposure Apparatus for the Exposure of Plastics for Indoor Applications |
| D 4518 | 06.01 | Test Methods for Measuring Static Friction of Coating Surfaces |
| D 4541 | 06.02 | Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers |
| D 4674 | 08.03 | Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments |
| D 4713 | 06.02 | Test Methods for Nonvolatile Content of Printing Inks, Resin Solutions, and Vehicles |
| D 4758 | 06.03 | Test Method for Nonvolatile Content of Latexes |
| D 4942 | 06.02 | Test Methods for Water Pickup of Lithographic Printing Inks and Vehicles in a Laboratory Mixer |
| D 5031 | 06.01 | Practice for Enclosed Carbon-Arc Exposure Tests of Paint and Related Coatings |
| D 5039 | 15.09 | Methods for Identification of Wire Side of Paper |
| D 5067 | 06.02 | Specification for Artists' Watercolor Paints |
| D 5098 | 06.02 | Specification for Artists' Acrylic Emulsion Paints |
| D 5181 | 06.02 | Test Method for Abrasion Resistance of Printed Matter by the GA-CAT Comprehensive Abrasion Tester |
| D 5264 | 15.09 | Practice for Abrasion Resistance of Printed Materials by the Sutherland Rub Tester |
| D 5383 | 06.02 | Practice for Visual Determination of the Lightfastness of Art Materials by Art Technologists |
| D 5398 | 06.02 | Practice for Visual Evaluation of the Lightfastness of Art Materials by the User |
| D 5403 | 06.02 | Test Method for Volatile Content of Radiation Curable Materials |
| D 5717 | 06.02 | Test Method for Determining Extractability of Metals from Art Materials |
| D 5724 | 06.02 | Specification for Gouache Paints |
| D 5909 | 06.02 | Test Method for Drying Time of Oxidative-Drying Printing Inks by Squalene Resistance |
| D 6073 | 06.02 | Test Method for the Relative Setting of Heatset Printing Inks by the Sinvatrol Tester |
| D 6419 | 06.02 | Test Method for Volatile Content of Sheet-Fed and Coldset Web Offset Printing Inks |
| D 6487 | 06.02 | Practice for Preparing Prints of Paste Printing Inks by Rollouts on a Laboratory Flat-Bed Press |
| D 6488 | 06.02 | Terminology Relating to Print Problems |
| D 6531 | 06.02 | Test Method for Relative Tinting Strength of Aqueous Ink Systems by Instrumental Measurement |
| D 6606 | 06.03 | Test Method for Viscosity and Yield of Vehicles and Varnishes by the Duke Viscometer |
| D 6687 | 06.03 | Guide for Testing Printing Ink Vehicles and Components Thereof |
| D 6688 | 06.02 | Test Method for Relative Resistance of Printed Matter to Liquid Chemicals by a Sandwich Method |
| D 6695 | 06.01 | Practice for Xenon-Arc Exposure to Paints and Related Coatings |
| D 6846 | 06.02 | Practice for Preparing Prints of Paste Printing Inks With a Printing Gage |
| D 7163 | 06.02 | Test Method for Specular Gloss of Printed Matter |
| D 7188 | 06.02 | Terminology for Printing Inks, Materials, and Processes |
| D 7189 | 06.02 | Test Method for Relative Mileage of News Inks on Newsprint |
| D 7244 | 06.02 | Test Method for Relative Cure of Energy-Cured Inks and Coatings |
| D 7305 | 06.02 | Test Method for Reflection Density of Printed Matter |
| E 284 | 06.01 | Terminology of Appearance |
| E 308 | 06.01 | Test Method for Computing the Colors of Objects by Using the CIE System |
| E 313 | 06.01 | Test Method for Indexes of Whiteness and Yellowness of Near-White, Opaque Materials |
| E 429 | 06.01 | Method for Measurement and Calculation of Reflecting Characteristics of Metallic Surfaces Using Integrating Sphere Instruments |
| E 430 | 06.01 | Method for Measurement of Gloss of High-Gloss Surfaces by Goniophotometry |
| E 691 | 06.04 | Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method |
| E 805 | 06.01 | Practice for Identification of Instrumental Methods of Color and Color-Difference Measurement of Materials |
| E 991 | 06.01 | Practice for Color Measurement of Fluorescent Specimens |
| E 1331 | 06.01 | Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry |