AMERICAN SOCIETY FOR TESTING AND MATERIALS 100 Barr Harbor Dr., West Conshohocken, PA 19428 Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

# Standard Guide for Testing Printing Inks and Related Materials<sup>1</sup>

This standard is issued under the fixed designation D 5010; 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  $(\epsilon)$  indicates an editorial change since the last revision or reapproval.

#### 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.

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. Terminology

- 2.1 Definitions:
- 2.1.1 *printing ink*—a colored or pigmented liquid or paste composition that dries to a solid film after application as a thin layer by printing machinery.
- 2.1.1.1 *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.
- 2.1.2 printed ink film—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. Printed matter is the usual medium by which inks are tested for appearance properties, drying, and resistance to various agents.
  - 2.1.3 printing substrate—material onto which ink is depos-

ited in the production of printed matter. 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.

#### 3. Test Categories

3.1 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 classification are a follows:

3.1.1 *Group 1—Applicable in General*:

Class A—Bulk inks.

Class B—Printed ink films.

Class C—Substrates.

3.1.2 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.

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

Class A-Bulk inks.

Class B—Printed ink films.

Class C-Substrates.

#### 4. Precision and Bias

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

#### 5. Keywords

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

<sup>&</sup>lt;sup>1</sup> This guide is under the jurisdiction of the ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.56 on Printing Inks.

Current edition approved June 10, 1999. Published August 1999. Originally published as D 5010-91. Last previous edition D 5010-97.



TABLE 1 Numerical Listing of Ink-Related Standards

ASTM Designation	Volume	Title
D 16	06.01	Terminology Relating to Paint, Varnish, Lacquer, and Related Products
D 56	05.03	Test Method for Flash Point by Tag Closed Tester
	06.04	
D 93	04.09	Test Method for Flash Point by Pensky-Martin Closed Tester
	05.01	
D 405	06.04	
D 185	06.03	Test Methods for Coarse Particles in Pigments, Pastes, and Paints
D 344 D 523	06.01 06.01	Test Method for Relative Dry Hiding Power of Paints by the Visual Evaluation of Brushouts
D 528	15.09	Test Method for Specular Gloss Test Method for Machine Direction of Paper and Paperboard
D 562	06.01	Test Method for Consistency of Paints Using the Stormer 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 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 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	Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
D 4040	06.04	Total Marked for Finance of Original of District Inter-built. NDIDLO
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  Test Method for New glatile Method in Valentile Schungte for Lieu in Paint Variable Leagues and Balated Braduate
D 1353	06.04	Test Method for Nonvolatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer, and Related Products
D 1474 D 1475	06.01 06.01	Test Methods for Indentation Hardness of Organic Coatings 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 1647	06.03	Test Methods for Resistance of Dried Films of Varnishes to Water and Alkali
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 Printing Ink Dispersions
D 2067	06.02	Test Method for Coarse Particles in Printing Ink Dispersions
D 2091	06.02	Test Method for Print Resistance of Lacquers  Test Method for Phaserian Properties of Non Neutonian Metarials by Resettional (Propertied) Viscometer
D 2196 D 2243	06.01	Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer
D 2243 D 2244	06.02 06.01	Test Method for Freeze-Thaw Resistance of Water-Borne Coatings 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 2620	06.02	Test Method for Light Stability of Clear Coatings
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 Setaflash Closed-Cup Apparatus
D 3359	06.01	Test Methods for Measuring Adhesion by Tape Test
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 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  Test Method for Dynamic Surface Tension by the Fact Bubble Technique
D 3825	05.03 05.03	Test Method for Dynamic Surface Tension by the Fast Bubble Technique Test Method for Flach Point by Setaflash Closed Tester
D 3828 D 3924	06.01	Test Method for Flash Point by Setaflash Closed Tester  Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquers, and Related
D 0027	00.01	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



## TABLE 1 Continued

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	Gloss		
ABC	Gloss of High-Gloss Surfaces by Goniophotometry	E 430	06.01
ABC	Specular Gloss (20°, 60°, 85°)	D 523	06.01
ABC ABC	Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance Visual Evaluation of Gloss or Sheen Uniformity	D 4449 D 3928	06.01 06.02
	Opacity and Strength		
D.	History Devices of Deigste has Deflectory to	D 0005	00.04
В	Hiding Power of Paints by Reflectometry	D 2805	06.01
В	Relative Hiding Power of Paints by the Visual Evaluation of Brushouts	D 344	06.01
A	Relative Tinting Strength of Printing Ink Dispersions	D 2066	06.02
	Other Optical Properties		
A	Clarity and Cleaness of Paint and Ink Liquids	D 5010	06.02
В	Definitions of Terms Relating to Optical Character Recognition	F 149	15.09
3	Terminology of Image Quality in Impact Printing Systems	F 1125	15.09
	Chemical Resistance		
В	Detergent Resistance of Organic Finishes	D 2248	06.01
В	Extractability of Metals from Art Materials, Determining	D 5517	06.02
В	Household Chemicals on Clear and Pigmented Organic Finishes, Effect of	D 1308	06.01
3	Resistance of Dried Films of Varnishes to Water and Alkali	D 1647	06.03
	Density		
A	Density of Paint, Varnish, Lacquer, and Related Products	D 1475	06.01
A	Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25°C	D 1963	06.03
	Dispersion		
Ą	Coarse Particles in Pigments, Pastes, and Paints	D 185	06.03



## TABLE 2 Continued

Group	Торіс	ASTM Designation	ASTM Volume No.
1A	Coarse Particles in Printing Ink Dispersions	D 2067	06.02
1A	Fineness of Dispersion of Pigment-Vehicle Systems	D 1210	06.01
1A	Fineness of Grind of Printing Inks by the NPIRI Grindometer	D 1316	06.02
	Drying		
1B	Drying, Curing, or Film Formation of Organic Coatings at Room Temperature	D 1640	06.03
3B	Drying Time of Oxidative-Drying Printing Inks by Squalene Resistance	D 5909	06.02
3B	Relative Setting of Heatset Printing Inks by the Sinvatrol Tester	D 6073	06.02
	· ,		
1B	Reporting Cure Times of Ultraviolet-Cured Coatings	D 3732	06.02
	Heat Stability		
1A	Flash/No Flash Test—Equilibrium Method by a Closed-Cup Apparatus	D 3934	06.01
1A	Flash Point by Pensky-Martin Closed Tester	D 93	04.09
IA	Tasii Fulli by Felisky-Martin Glosed Testel	D 93	
			05.01
			06.04
1A	Flash Point of Liquids by Setaflash Closed-Cup Apparatus	D 3278	06.01
1A	Flash Point by Setaflash Closed Tester	D 3828	05.03
1A	Flash Point by Tag Closed Tester	D 56	05.01
			06.04
1C	Moisture Content of Paper and Paperboard by Oven Drying	D 644	15.09
1A	Flash Point and Fire Point by Tag Open-Cup Apparatus	D 1310	05.01
			06.04
2A	Nonvolatile Content of Latexes	D 4758	06.03
1A	Nonvolatile Content of Heatset and Liquid Printing Ink Systems	D 4713	06.02
1A	Nonvolatile Content of Resin Solutions	D 1259	06.01
1A	Nonvolatile Content of Varnishes	D 1644	06.01
1A	Nonvolatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer, and Related Products	D 1353	06.03
1A	Volatile Content of Coatings	D 2369	06.01
1A	Volatile Content of Radiation Curable Materials	D 5403	06.02
1A	Volatile Organic Compound (VOC) Content of Paints and Related Coatings	D 3960	06.01
3A	Volatile Organic Compound (VOC40) Content of Non-Heatset Paste Printing Ink Systems at 40°C	D 5328	06.02
	Light and Weather Fastness		
1B	Accelerated Outdoor Exposure Test of Coatings	D 4141	06.01
1B	Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and	D 4674	08.03
	Window-Filtered Daylight		
1B	Atmospheric Environmental Exposure Testing of Nonmetallic Materials	G 7	14.02
1B	Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources	G 151	14.02
1B	Gouache Paints	D 5724	06.02
1B	Light Stability of Clear Coatings	D 2620	06.02
1B	Lightfastness and Weatherability of Printed Matter	D 3424	06.02
1B	Lightfastness of Art Materials, Visual Determination by Art Technologists	D 5383	06.02
1B	Lightfastness of Art Materials, Visual Evaluation by the User	D 5398	06.02
1B	Lightfastness of Artists' Acrylic Emulsion Paints	D 5098	06.02
1B	Lightfastness of Artists' Oil, Resin-Oil, and Alkyd Paints	D 4302	06.02
1B	Lightfastness of Artists' Watercolor Paints		
	· ·	D 5067	06.02
1B	Natural Light Exposures Under Glass	G 24	14.02
1B	Operating an Accelerated Lightfastness Xenon-Arc-Type (Water Cooled) Light-Exposure Apparatus	D 4459	08.03
45	for the Exposure of Plastics for Indoor Applications	0.450	
1B	Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials	G 153	14.02
1B	Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of	G 23	14.02
1B	Nonmetallic Materials  Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of	G 26	14.02
	Nonmetallic Materials		
1B	Operating Xenon-Arc Light Apparatus for Exposure of Nonmetallic Materials	G 155	14.02
	Physical Strength and Resistance (Nonchemical)		
1B	Abrasion Resistance of Organic Coatings by Taber Abraser	D 4060	06.01
1B		D 5264	
	Abrasion Resistance of Printed Materials by the Sutherland Rub Tester		15.09
1B	Abrasion Resistance of Printed Matter by the GA CAT Comprehensive Abrasion Tester	D 5181	06.02
1B	Adhesion by Tape Test	D 3359	06.01
1B	Film Hardness (of Organic Coatings) by Pencil Test	D 3363	06.01
1B	Hardness of Organic Coatings by Pendulum Damping Test	D 4366	06.01
		D 1474	
	Indentation Hardness of Organic Coatings	U 14/4	06.01
	D: (4) 10 D 11	D 0004	00.00
1B 1B 1B	Print (Imprint) Resistance of Lacquers Pull-off Strength of Coatings Using Portable Adhesion Tester	D 2091 D 4541	06.02 06.02



TABLE 2 Continued

Gro	ир Торіс	ASTM Designation	ASTM Volume No.
1B	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)	D 2794	06.01
1B	Static Friction of Coating Surfaces	D 4518	06.01
	Porosity and Permeability		
1B	Porosity of Paint Films	D 3258	06.02
1B	Water Vapor Permeability of Organic Coating Films	D 1653	06.01
2C	Water Vapor Transmission Rate of Flexible Barrier Materials Using an Infrared Detection Technique	F 372	15.09
	Printing Properties		
3A	Definitions of Terms Relating to Lithographic Copy Products	F 425	15.09
1B	Definitions of Terms Relating to Printers	F 909	15.09
1C	Blocking Resistance of Paper and Paperboard	D 918	15.09
1C	Machine Direction of Paper and Paperboard	D 528	15.09
3AC	Preparation of an Offset Duplicator for Use in Functional Testing of Lithographic Copy Products	F 413	15.09
1C	Printing Ink Permeation of Paper (Castor Oil Test)	D 780	15.09
3A	Water Pickup of Lithographic Printing Inks and Vehicles in a Laboratory Mixer	D 4942	06.02
3C	Wax Pick Test for Surface Strength of Paper	D 2482	15.09
1C	Wire Side of Paper	D 5039	15.09
	Rheology		
3A	Apparent Tack of Printing Inks and Vehicles by the Inkometer	D 4361	06.02
1A	Consistency of Paints Using the Stormer Viscometer	D 562	06.01
1A	High-Shear Viscosity Using the ICI Cone/Plate Viscometer	D 4287	06.01
1A	Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer	D 2196	06.01
2A	Viscosity by Dip-Type Viscosity Cups	D 4212	06.01
1A	Viscosity by Eng-Type viscosity Cups Viscosity by Ford Viscosity Cup	D 1200	06.01
3A		D 4040	06.02
	Viscosity of Printing Inks and Vehicles by the Falling-Rod Viscometer		
1A 1A	Viscosity of Resin Solutions Viscosity of Transparent Liquids by Bubble Time Method	D 1725 D 1545	06.03 06.03
	Storage Stability		
4.0	Daniel of Oatling of Daiet	D 000	00.00
1A	Degree of Settling of Paint	D 869	06.02
2A	Freeze-Thaw Resistance of Water-Borne Paints	D 2243	06.02
1A	Freeze-Thaw Stability of Multicolor Lacquers	D 2337	06.02
1A	Package Stability of Coatings for Ultraviolet Curing	D 4144	06.02
1A	Package Stability of Paint	D 1849	06.02
2A	Resistance of Emulsion Paints in the Container to Attack by Microorganisms	D 2574	06.01
	Surface Chemistry		
1A	Dynamic Surface Tension by the Fast Bubble Technique	D 3825	05.03
1A	Interfacial Tension of Oil Against Water by the Ring Method	D 971	05.01
1A	Surface and Interfacial Tension of Solutions of Surface-Active Agents	D 1331	15.04
1A	Surface Tension of Water and Waste Water	D 1590	11.01
1C	Surface Wettability of Paper (Angle-of-Contact Method)	D 724	15.09
2C	Wetting Tension of Polyethylene and Polypropylene Films	D 2578	08.02
	Special Analytical Tests		
2C	Liquid Extraction of Flexible Barrier Materials	F 34	15.09
2C	Residual Solvents in Flexible Barrier Materials	F 151	15.09
1A	Water Content of Water-Reducible Paints by Direct Injection into a Gas Chromatograph	D 3792	06.01
-	Water in Paints and Paint Materials by Karl Fischer Method	D 4017	06.01

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