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Standard Guide for Testing Varnishes[1]

This standard is issued under the fixed designation D154; 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 procedures for testing varnishes. Some test methods are included, but most sections refer to specific ASTM test methods.

1.2 Varnishes may be applied under such diverse conditions to so many different surfaces and their dried films may be subjected to so many kinds of wear and exposure, that it is not possible to assure desired performance from a single selection of test methods and numerical results. Those skilled in varnish technology may find partial assurance of obtaining desired qualities in various types of varnishes through careful selection of the methods covered and intelligent interpretation of results.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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:*[2]

D56 Test Method for Flash Point by Tag Closed Cup Tester

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D479 Method of Test for Reactivity of Paint Liquids (Withdrawn 1984)[3]

D523 Test Method for Specular Gloss

D658 Test Method for Abrasion Resistance of Organic Coatings by Air Blast Abrasive (Withdrawn 1996)[3]

D968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

D1200 Test Method for Viscosity by Ford Viscosity Cup

D1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)

D1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus

D1469 Test Method for Total Rosin Acids Content of Coating Vehicles (Withdrawn 2003)[3]

D1475 Test Method For Density of Liquid Coatings, Inks, and Related Products

D1542 Test Method for Qualitative Detection of Rosin in Varnishes (Withdrawn 1997)[3]

D1544 Test Method for Color of Transparent Liquids (Gardner Color Scale)

D1545 Test Method for Viscosity of Transparent Liquids by Bubble Time Method

D1546 Practice for Testing the Performance of Clear Floor Sealers (Withdrawn 2008)[3]

D1639 Test Method for Acid Value of Organic Coating Materials (Withdrawn 2005)[3]

D1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature

D1641 Practice for Conducting Outdoor Exposure Tests of Varnishes

D1644 Test Methods for Nonvolatile Content of Varnishes

D1647 Test Methods for Resistance of Dried Films of Varnishes to Water and Alkali (Withdrawn 2004)[3]

D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

D2090 Test Method for Clarity and Cleanness of Paint and Ink Liquids (Withdrawn 2007)[3]

D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D2369 Test Method for Volatile Content of Coatings

D2805 Test Method for Hiding Power of Paints by Reflectometry

D3278 Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus

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

D3964 Practice for Selection of Coating Specimens for Appearance Measurements
D4039 Test Method for Reflection Haze of High-Gloss Surfaces
D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
E308 Practice for Computing the Colors of Objects by Using the CIE System

LIQUID VARNISH PROPERTIES

3. Appearance

3.1 Appearance of the liquid varnish is important both for aesthetic reasons and because it indicates whether the dried film is likely to have a satisfactory appearance. Examine the liquid varnish for foreign matter, sediment or skins in accordance with Test Method D2090.

4. Color

4.1 Most varnishes are predominantly yellow, but the color of the liquid varnish is only a preliminary indication of the color of the dried varnish film. The initial color may bleach or may darken depending upon the conditions of exposure. Determine approximately and quickly the liquid color of small specimens in Gardner-Holdt tubes by comparison with the Gardner Color Standards in accordance with Test Method D1544.

4.2 Measure the color of extremely pale varnishes by using larger specimens in 100-mL cylinders, 300 mm deep, in accordance with Test Method D1209.

4.3 A more precise measure of color, in terms of tristimulus values, may be made on small specimens in 10-mm cells with parallel walls in accordance with Practice E308.

5. Viscosity

5.1 The viscosity of a varnish or clear vehicle is a property important in ease of application; varnishes for brush application are typically 1 to 2 St whereas varnishes with viscosities as high as 100 St may sometimes be added to lithography coatings or used as mixing vehicles for producing enamels. Viscosity is commonly measured at 77°F (25°C).

5.2 For the rapid, approximate measurement of the viscosity of transparent varnishes, determine the bubble time by Test Method D1545. Report the viscosity either in stokes or in Gardner-Holdt letter designations as described in Table 1 of Test Method D1545.

5.3 For a rapid, approximate measurement of the viscosity of translucent varnishes, determine the Ford cup efflux time in accordance with Test Method D1200.

5.4 For the precise measurement of viscosity, use capillary viscometers as described in Test Method D445.

6. Specific Gravity

6.1 Specific gravity of a varnish is the ratio of the weight of a given volume of the varnish at a given temperature to the weight of an equal volume of distilled water at the same temperature. Determine specific gravity or density at 77°F (25°C) or other agreed temperature in accordance with Test Method D1475 which allows use of either a pycnometer or a weight per gallon cup.

7. Volatile Content

7.1 Volatile matter determination is an indication of the amount of material in the coating that will be given off to the atmosphere in the area where the coating is applied. Depending upon the method of application, the time required to vaporize the volatile, and the conditions of the atmosphere surrounding the application, it is recommended that Test Method D2369 be used to determine the volatile content of a varnish.

8. Nonvolatile Matter

8.1 Nonvolatile content is an indication of the amount of permanent film-forming material contained in a varnish. The normal drying of a varnish film may involve varying amounts of absorption of oxygen from the air, loss of volatile solvents, and continuing decomposition of the dried film. The net result of this process may differ somewhat from a nonvolatile determination at a temperature higher than the normal drying conditions.

8.2 With due regard to the composition of the varnish, determine the nonvolatile matter in accordance with either Method A (3 h at 220°F (105°C)) or Method B (10 min at 300°F (149°C)) of Test Methods D1644.

8.3 As noted in Test Method D2369, nonvolatile matter can also be calculated by subtracting the volatile content from 100.

9. Flash Point

9.1 Determine the flash point of varnishes having a viscosity of less than 9.5 cSt at 77°F (25°C) (45 SUS at 100°F) by Test Method D56, and of varnishes having a viscosity of more than 9.5 cSt at 77°F by Test Methods D93. Alternatively, use Test Method D3278, which gives comparable results to Test Methods D56, D93, and Test Method D1310.

NOTE 1—Due to various U.S. Government and State regulations, it is now necessary to check with appropriate departments to determine which ASTM Test Method is applicable.

10. Skinning

10.1 Varnishes, which dry by oxidation, may form a skin in a partially filled can or in a filled can that is stored for a long time. Since skins are insoluble in the varnish, they must be removed before use if a satisfactory film is to be obtained. Use the following test to determine if a varnish has an objectionable tendency to early skin formation:

10.1.1 *Container*—A wide-mouth jar with a capacity of 8 fluid oz (235 mL) and dimensions of 4½ in. (115 mm) in height and 2 in. (50 mm) in diameter.

10.1.2 *Procedure*—Measure a 6-fluid oz (180-mL) specimen of the varnish into the glass container. Screw the cover on tightly, invert the jar, and leave in an inverted position, at rest, and in the dark (placing under a box or in a drawer is satisfactory). Examine the varnish for skinning at specified time intervals.