Designation: D 1641 – 04

Standard Practice for Conducting Outdoor Exposure Tests of Varnishes[1]

This standard is issued under the fixed designation D 1641; 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 practice covers the procedure for evaluating durability of varnishes applied to a wooden substrate.

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:* [2]

D 660 Test Method for Evaluating Degree of Checking of Exterior Paints

D 661 Test Method for Evaluating Degree of Cracking of Exterior Paints

D 962 Specification for Aluminum Powder and Paste Pigments for Paints

D 1475 Test Method for Density of Liquid Coatings, Inks and Related Materials

D 1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

D 3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquers, and Related Materials

G 7 Practice for Atmospheric Environment Exposure Testing of Nonmetallic Materials

2.2 *U. S. Federal Specification:*

TT-V-119 [3]

3. Significance and Use

3.1 The procedure described in this practice is designed to provide guidance for evaluating the effects of outdoor exposure on varnishes applied to wooden substrates. For many products, fixed angle exposures will produce higher degradation rates than the normal end use of the material.

3.2 The degradation rate produced by this procedure depends on the season of the exposure and geographical location. Because outdoor weather conditions vary from season to season and year to year, this practice is not reliable for establishing absolute performance ratings for varnishes. The practice should be used only for comparing the relative performance of varnishes exposed at the same time and same location.

4. Apparatus and Materials

4.1 *Maple Panels*, of close-grained clear maple, 75 by 305 by 13 mm (3 by 12 by ½ in.), with all edges rounded to a 6.4-mm (¼-in.) radius.

4.2 *Varnish Brushes*, 25-mm (1-in.) pure bristle.

4.3 *Sandpaper*, 180-grit.

4.4 *Balance*, capable of weighing to an accuracy of 0.1 g.

4.5 *Tung-Linseed Phenolic Aluminum Sealer*, composed of a varnish complying with the nonvolatile vehicle composition requirements of U. S. Federal Specification TT-V-119[4]; (July l973) that is, approximately 65 % oil content with a minimum of 45 % tung oil, and linseed and castor oils as required, and aluminum paste meeting the requirements of Specification D 962, Type II, Class B, using 1 gal of vehicle and 2 lb of paste (288 g paste to 1 L of varnish). If varnish to TT-V-119 is not available, another agreed upon material of known performance may be used.

5. Preparation of Test Panels

5.1 *Weight of Panel*—Weigh the test panel to the nearest 0.1 g, prior to varnishing.

5.2 *Application of First Coat*—For the first application of the varnish under test, coat both faces, ends, and edges of each panel, using a small brush and taking the precaution to brush

[1] This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.42 on Architectural Coatings.

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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] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

[4] The oil content was increased on the basis of studies reported in the *Journal of Paint Technology,* Vol 39, Issue 507, April 1967, p. 212.

the coat out well. Immediately weigh the coated panel. Allow the varnish to dry 24 h at room temperature (as defined in Specification D 3924) before applying the second coat.

5.3 *Application of Second Coat*—Before applying the second coat, lightly sand the panel with 180-grit sandpaper, taking care not to touch the faces of the panel after sanding, and remove sanding dust by air-blowing or vacuuming. Reweigh the panel. Then apply a second coat of the varnish as evenly as possible, covering both faces and all edges of the panel. Apply the second coat as evenly as possible. Immediately weigh the coated panel. Allow to dry for 24 h before applying the third coat.

5.4 *Application of Third Coat*—Sand, clean and reweigh the panel as in 5.3. Apply the third coat, covering both faces and edges, with a full brush, laying the varnish on as evenly as possible. Weigh the panel and record the weight of the third wet coat.

5.5 *Application of Aluminum Sealer*—Prepare the varnish based aluminum sealer as directed in 4.5. Coat one face and all edges of the panel with a smooth even coat. Take great care to ensure that the ends are completely covered. Record the weight of the wet sealer applied. Allow the coated panel to dry a minimum of 24 h before exposure.

5.6 *Determination of Spreading Rate*—To assure that the varnish has been applied in accordance with the manufacturers suggested spreading rate, calculate the coverage using the following equation. Determine density of the coating following procedures outlined in Test Method D 1475.

$$\text{Spreading Rate } (\text{ft}^2/\text{gal}) = \frac{454\ (\text{g/lb}) \times \text{Density of Coating } (\text{lb/gal}) \times \text{Area of Test Panel } (\text{in}^2)}{144\ (\text{in}^2/\text{ft}^2) \times \text{Weight of Coating Applied } (\text{g})} \quad (1)$$

6. Procedure

6.1 Unless otherwise agreed upon or specified, expose at least two replicates of each test panel and appropriate positive and negative controls (see Note 1) at an angle of 45° from the horizontal facing the equator at an appropriate outdoor exposure site in accordance with information provided in Practice G 7. Other agreed upon angles of exposure described in Practice G 7 can be used. The weather conditions at the site should, if possible, be similar to conditions where the varnish is regularly used. Because of variability in exposure conditions with location and time of year, the performance of the test panels is compared with the known performance of controls.

NOTE 1—The varnish described in 4.5 is considered to be a positive control while a clear alkyd or oil modified urethane is suitable for a negative control.

6.2 Inspect the panels at half-yearly intervals, adjusting this time according to the rapidity or slowness of degradation of the coatings. Record climatological data for the exposure site as specified in Practice G 7.. Examine each panel visually for dulling, discoloration, checking and cracking, rating each type on the 0 to 10 scale, in accordance with the ASTM Standardized Scoring Scheme[5] shown below, where 10 is perfect or no effect and 0 indicates complete failure.

Rating or Score	Effect/Change
10	None
8	Trace
6	Slight
4	Moderate
2	Severe
0	Complete Failure

6.2.1 The ratings of visual dulling and discoloration versus unexposed file specimens are subjective and can differ between laboratories and different observers. They should be used only for comparison of the test material to a control that is exposed at the same time or for intercomparison of different test materials exposed at the same time and evaluated by the same observer.

6.2.1.1 The equipment and procedures for visual evaluation of discoloration of opaque materials that are diffusely illuminated are specified in Practice D 1729.

6.2.2 Evaluate checking in accordance with Test Method D 660.

6.2.3 Evaluate cracking in accordance with Test Method D 661.

7. Report [6]

7.1 Report the results of the examination of the test panels in accordance with the ASTM Standardized Scoring Scheme and applicable items.

8. Keywords

8.1 durability outdoors; exterior varnish durability; varnishes

[5] Available on page 11 of Committee D01 Bylaws.

[6] The cooperative, experimental results on which this method is based were published in the *Official Digest*, Federation of Paint and Varnish Production Clubs, April 1952, pp. 219 to 220.