Designation: D 2336 – 99

Standard Guide for Specifying Factory Applied Wood Coatings[1]

This standard is issued under the fixed designation D 2336; 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 summarizes the test methods that may be used to assist in quality control during application and in specifying pigmented coatings that shall be used in factory finishing of wood products.

1.2 This practice is not intended for use by the consumer of coated wood products in specifying such coated wood products.

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:*

D 154 Guide for Testing Varnishes[2]
D 523 Test Method for Specular Gloss[3]
D 562 Test Method for Consistency of Paints Using the Stormer Viscometer[3]
D 869 Test Method for Evaluating Degree of Settling of Paint[4]
D 968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive[3]
D 1005 Test Methods for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers[3]
D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base[3]
D 1200 Test Method for Viscosity by Ford Viscosity Cup[3]
D 1210 Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage[3]
D 1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings[3]
D 1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes[4]
D 1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus[3]
D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base[3]
D 1474 Test Methods for Indentation Hardness of Organic Coatings[3]
D 1475 Test Method for Density of Paint, Varnish, Lacquer, and Related Products[3]
D 1644 Test Methods for Nonvolatile Content of Varnishes[3]
D 1729 Practice for Visual Evaluation of Color Differences of Opaque Materials[3]
D 2065 Test Method for Determination of Edge Performance of Composite Wood Products Under Surfactant Accelerated Moisture Stress[4]
D 2134 Test Method for Determining the Hardness of Organic Coatings with a Sward-Type Hardness Rocker[3]
D 2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer[3]
D 2197 Test Methods for Adhesion of Organic Coatings by Scrape Adhesion[3]
D 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates[3]
D 2793 Test Method for Block Resistance of Organic Coatings on Wood Panel Substrates[4]
D 2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)[3]
D 2801 Test Method for Leveling Characteristics of Paints by Draw-Down Method[5]
D 2805 Test Method for Hiding Power of Paints by Reflectometry[3]
D 2830 Test Method for Exterior Durability of Factory-Primed Field Finished Wood Products[4]
D 3023 Practice for Determination of Resistance of Factory-Applied Coatings on Wood Products to Stains and Reagents[4]
D 3259 Practice for Infrared Determination of the Temperature of Applied Coatings on Wood Products During the Curing Cycle[4]
D 3278 Test Methods for Flash Point of Liquids by Seta-Flash Closed-Cup Apparatus[3]
D 3359 Test Methods for Measuring Adhesion by Tape Test[3]
D 3363 Test Methods for Film Hardness by Pencil Test[3]

[1] This practice is under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings and is the direct responsibility of Subcomittee D01.52 on Factory-Coated Wood Products.

Current edition approved Dec. 10, 1999. Published February 2000. Originally published as D 2336 – 65 T. Last previous edition D 2336 – 96.

[2] *Annual Book of ASTM Standards*, Vol 06.03.
[3] *Annual Book of ASTM Standards*, Vol 06.01.
[4] *Annual Book of ASTM Standards*, Vol 06.02.
[5] Discontinued; see *1989 Annual Book of ASTM Standards*, Vol 06.01.

D 3934 Test Method for Flash/No Flash Test – Equilibrium Method by a Closed-Cup Apparatus[3]
D 3941 Test Method for Flash Point by the Equilibrium Method with a Closed-Cup Apparatus[3]
D 3960 Practice for Determining Volatile Organic Content (VOC) of Paints and Related Coatings[3]
D 4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser[3]
D 4206 Test Methods for Sustained Burning of Liquid Mixtures Using the Small Scale Open-Cup Apparatus[3]
D 4212 Test Method for Viscosity by Dip-Type Viscosity Cups[3]
D 4287 Test Method for High-Shear Viscosity Using the ICI Cone/Plate Viscometer[3]
D 4366 Test Methods for Hardness of Organic Coatings by Pendulum Damping Tests[3]
D 4518 Test Methods for Measuring Static Friction of Coating Surfaces[3]
D 5125 Test Method for Viscosity of Paints and Related Materials by ISO Flow Cups[3]
D 5178 Test Method for Mar Resistance of Organic Coatings[3]
D 5235 Test Methods for Microscopical Measurement of Dry Film Thickness of Coatings on Wood Products[4]
D 5722 Practice for Performing Accelerated Outdoor Weathering of Factory Coated Embossed Hardboard Using Concentrated Natural Sunlight and a Soak-Freeze-Thaw Procedure[4]
D 5795 Test Method for Determination of Liquid Water Absorption of Coated Hardboard and Other Composite Wood Products Via "Cobb Ring" Apparatus[4]
D 6037 Test Methods for Dry Abrasion Mar Resistance of High Gloss Coatings[3]

2.2 *U.S. Federal Test Method:*
141b/3011 Condition in Container[6]

3. Significance and Use

3.1 Control of the parameters that are measured by the test methods outlined in this practice has been found to be the primary determinant of coating quality and reproducibility in the package, during coating application and on the coated product. Accurate measurement is essential if such control is to be achieved.

4. Characteristics in the Package

4.1 *Skinning, Settling, and Condition in the Container*:

4.2 Settling is determined in accordance with Test Method D 869, and by Federal Test Method No. 141b, Method 3011 which also covers condition in the container. Both of these methods are designed for trade sales type paints rather than industrial coatings, but could be adapted satisfactorily.

4.3 Skinning can occur in a partially filled container. Remove insoluble skins and perform a skinning test on a well-mixed portion in accordance with Guide D 154.

4.4 *Consistency*—Measurements of paint consistency or viscosity vary considerably depending upon the type of instrument used to measure it. For most coatings, there is not a straight-line relationship between Stormer viscosity (Test Method D 562) a rotational method, and Ford cup viscosity (Test Method D 1200) an efflux method. Other efflux cups (Test Methods D 4212 and D 5125) and rotationals (Test Methods D 2196 and D 4287) are also used.

4.4.1 Most factory wood finishing is done with airless spray, curtain coating, or roller coating techniques. It is doubtful that any single method of viscosity measurement is truly indicative of the ability of coatings to be applied by production methods or, more especially, to be applied satisfactorily by curtain coating.

4.4.2 These methods are useful in that once a certain formula has been established, control of the viscosity by either method helps to ensure subsequent reproduction of that formula. In this way, they would be useful in specifying previously qualified coatings for factory finishing of wood products.

4.5 *Fineness of Dispersion*—The fineness of dispersion determined in accordance with Test Method D 1210, is based on visual observation of a few of the largest size particles remaining in a coating after dispersion. In itself, the test does not indicate the degree of dispersion of the bulk of the pigment in the coating except that when batches are dispersed in similar equipment the ratio of large particles remaining in the coating to the dispersion of the bulk of the pigment tends to remain constant. Therefore, if in an enamel with satisfactory gloss no particles remain that are above a size of 0.5 mil (7 Hegman dispersion), then successive batches of that coating having a similar Hegman rating can be said to have a good enamel grind. Hiding power and color control along with fineness of dispersion control should be adequate to ensure proper dispersion.

4.6 *Weight per Gallon*—Weight per gallon is determined in accordance with Test Method D 1475 to ensure batch-to-batch and composition product uniformity. This method is not related to the quality of the coatings per se.

4.7 *Nonvolatile Content*—Non-volatile content is determined in accordance with Test Methods D 1644 as another measure of coating uniformity and of the amount of film-forming material provided.

4.8 *Volatile Organic Content (VOC)*—VOC is determined in accordance with Practice D 3960 both to ensure coating uniformity and to comply with governmental regulation where required.

4.9 *Flash Point*—Flash point is determined in accordance with one of several accepted methods (Test Methods D 1310, D 3278, D 3934, and D 3941) as a measure of the degree of flammability or fire hazard of a coating material.

5. Coating Characteristics During and Immediately After Application

5.1 *Flow*—Flow is a property related to consistency, but it is influenced by other factors such as rate and order of solvent release. Visual observation of the leveling of a coating film during and after drying and the tendency of the film to sag during application and drying are usually adequate to determine flow. However, Test Method D 2801 may be used if desired.

[6] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

5.2 *Gloss*—Specular gloss may be determined in accordance with Test Method D 523.

5.3 *Hiding Power*—Hiding power determined in accordance with Test Method D 2805 is a measure of the ability of a paint to hide the substrate. It is dependent upon uniform film thickness which is influenced by flow and leveling.

5.4 *Wet Film Thickness*—The thickness of a wet paint film is determined in accordance with Test Methods D 1212 as a rapid indication that the required amount of coating has been applied.

6. Coating Characteristics During and Immediately After Curing

6.1 *Curing Temperature*—The temperature of a coating film during the curing cycle is an important quality control parameter and should be monitored. Practice D 3259, discusses several infrared measuring instruments that can be used for such monitoring. Infrared measuring instruments can be based on the measurement of carefully filtered narrow bands of infrared energy emitted from test surfaces and can be unaffected by surface color or gloss. Thermocouples have been used but are subject to the defects that metals are good heat conductors and do not necessarily absorb heat from infrared radiation at the same rate as the paint film. Better results are obtained with portable pyrometers if they are preheated slightly above the operating temperature. Papers impregnated with wax powders of varying melting points have been suggested also. These tend to absorb infrared energy faster than most wet paint films and, therefore, give higher temperatures than actual.

6.2 *Film Thickness*—Measurement of film thickness in accordance with Test Methods D 1005, is designed for use on plane rigid surfaces such as metal or glass. It can be adapted to forest products by the simple use of an auxiliary panel of metal or glass placed alongside the wood substrate and coated in the identical way that the wood substrate is coated. Test Methods D 1400 or D 1186 also could be adapted to the forest products industry in a similar manner. This is a simpler but perhaps less accurate method. This adaptation leads to a measurement of application rate rather than to a true measurement of film thickness of the coating on a wood product because of the possibility of penetration by the coating into the wood product. Test Methods D 5235 gives a method for measuring the actual film thickness present on a wood products substrate.

6.3 *Hardness*—The measurement of hardness of coating films by means of an indenter, as described in Test Methods D 1474, calls for the measurement of film hardness on smooth, rigid substrates such as glass or metal. There may be some question as to its applicability on films applied to some of the rougher and softer forest products substrates. However, it can provide at least an "apparent hardness" value, which may be useful in comparison of coatings. A similar caution applies to other hardness methods (Test Methods D 2134, D 4366 and D 3363).

6.4 *Color Difference*—Color difference between a product and the standard can be measured instrumentally. Generally, the tolerance is agreed upon by the purchaser and the seller and may also be required if a product specification is involved. Although color instruments are not more sensitive than the eye, and Practice D 1729 may be used for visual evaluation of color differences, color instruments do provide numerical values that can be subsequently compared to later measurements. Test Method D 2244 covers the instrumental determination of small color differences observable in daylight illumination between nonfluorescent, nonmetameric, or opaque surfaces such as coated specimens. If metamerism is suspected, visual evaluation should be used to verify the results.

6.5 *Adhesion*—There are no available ASTM test methods directly applicable to measuring adhesion on forest products substrates. It has been found that the available test methods have poor precision even on hard, smooth substrates. They would probably be even less satisfactory on wood substrates. Two methods that might give some indication of adhesion are Test Methods D 2197 and D 3359.

6.6 *Blocking*—Many coated wood products are immediately stacked after curing. Often they are subject to "blocking" or sticking together if improperly coated or cured. Test Method D 2793 may be used to detect and quantify the degree of blocking. It may be used as a control test to detect this condition during the coating operation.

6.7 *Weathering*—Many coated wood products require durability in outdoor exposure. Test Method D 2830 may be used to evaluate some primed wood products and Practice D 5722 has been found to be a useful accelerated weathering test for embossed prefinished hard board.

6.8 *Water Absorption*—Some coated wood products are exposed to liquid water in service. Test Method D 5795 may be used to quantify water absorption of coated hardboard and other composite wood products.

6.9 *Edge Performance*—Coated wood products with edges that are exposed to water may be evaluated using Test Method D 2065.

6.10 *Abrasion Resistance*—The resistance of a coating to surface damage or mar due to abrasion can be measured by Test Methods D 5178, D 968, D 4060 or D 6037.

6.11 *Impact Resistance*—The resistance of a coating or coated wood product may be determined using Test Method D 2794 with some care to use appropriate pass/fail controls since this test is designed for use on metal panels rather than wood.

6.12 *Chemical Resistance*—Some coated wood products are intended for service in contact with aggressive chemicals (laboratory furniture, for example). These may require testing with special solutions or chemicals. For most purposes, the test solutions specified in Test Method D 1308 or Practice D 3023 provide a useful measure.

6.13 *Slip Resistance*—A measure of friction or slip can be an important consideration for some coated products, Test Methods D 4518 provides a useful measurement.

7. Keywords

7.1 cured properties; factory application; wood coatings; wood products