



Designation: D 1006 – 01

Standard Practice for Conducting Exterior Exposure Tests of Paints on Wood¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice covers procedures to be followed for direct exposure of house and trim paints on new, previously unpainted wood materials to the environment. When originators of a weathering test have the actual exposure conducted by a separate agency, the specific conditions for the exposure of test and control specimens should be clearly defined and mutually agreed upon between all parties.

1.2 The values stated in SI units are to be regarded as the standard.

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 358 Specification for Wood to Be Used as Panels in Weathering Tests of Coatings²

E 41 Terminology Relating to Conditioning³

G 7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials³

G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials³

G 147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests³

2.2 U.S. Federal Standard:

TT-W-571b Federal Specification for Wood-Preservative, Recommended Treating Practice⁴

3. Terminology

3.1 *Definitions*—The definitions given in Terminologies E 41 and G 113 are applicable to this practice.

¹ This practice is under the jurisdiction of ASTM Committee D01 on Paints and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.27 on Accelerated Tests for Paints.

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² *Annual Book of ASTM Standards*, Vol 06.02.

³ *Annual Book of ASTM Standards*, Vol 14.04.

⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

4. Significance and Use

4.1 The procedure described in this practice is intended to aid in evaluating the performance of house and trim paints to new, previously unpainted wood.

4.2 The relative durability of paints in outdoor exposures can be very different depending on the location of the exposure because of differences in solar radiation, time of wetness, temperature, pollutants, and other factors. Therefore, it cannot be assumed that results from one exposure in a single location will be useful for determining relative durability in a different location. Exposures in several locations with different climates which represent a broad range of anticipated service conditions are recommended.

4.2.1 Because of year-to-year climatological variations, results from a single exposure test cannot be used to predict the absolute rate at which a material degrades. Several years of repeat exposures are needed to get an “average” test result for a given location.

4.2.2 Solar radiation varies considerably as function of time of year. This can cause large differences in the apparent rate of degradation in many polymers. Comparing results for materials exposed for short periods (less than one year) is not recommended unless materials are exposed at the same time in the same location.

4.3 The Significance and Use section in Practice G 7 addresses many variables to be considered in exterior exposure tests.

5. Location of Test Sites and Exposure Orientation

5.1 *Test Sites*—The climatic conditions of the test sites should be representative of those of the area in which the paints are to be used. The type and rate of failure of a paint film will vary when exposed to different combinations of climatic and atmospheric conditions. For reliable results, exposure sites should be selected that are representative geographically, climatically, and in atmospheric contaminations with those of the locality in which the paint will be used. To obtain conclusions that are valid for paints with national distribution requires exposure at several sites, selected to cover a wide range in climatic conditions. Suggested sites include south Florida, the Great Lakes region, the hot desert southwest, the northeast, and extreme southern Louisiana.

5.2 *Exposure Orientation*—Unless otherwise specified, specimens for testing house paint should be exposed on vertical test fixtures facing both north or south, or both. In comparisons where dirt collection and mildew resistance are not pertinent, north vertical exposures may be omitted. Test fixtures shall be placed in a location so that there is no shadow on any specimen when the sun’s angle of elevation is greater than 20°. Specimens can be exposed at north or south orientations or other “exposure angles” in order to focus on the degradation mode desired. Typical exposure angles are as follows:

5.2.1 *Vertical North (Northern Hemisphere)*—Exposure rack is positioned so that the exposed surfaces of specimens are vertical (90°) facing north, away from the equator. This orientation allows for the accelerated growth of biological organisms since the amount of direct sunlight reaching the specimens is reduced or completely eliminated depending on latitude.

5.2.2 *Vertical South (Northern Hemisphere)*—Exposure rack is positioned so that the exposed surfaces of the specimens are vertical (90°) facing south, toward the equator. This orientation allows direct sunlight to reach the specimens and results in degradation commonly associated with ultraviolet exposure.

NOTE 1—*Other Exposure Orientations*—If desired, exposures may also be conducted to provide faster results. See Practice G7 for more information on other exposure options.

5.3 In the case where it is desirable to expose coated panels in a sheltered area, such as under eaves, a suitable test fence with a sheltered or eave arrangement can be used (see Annex A1).

6. Construction of Test Fixtures (Exposed Racks)

6.1 Test fixtures should be durable and rigid enough to withstand the effects of weather. All materials used for test fixtures shall be either treated wood or noncorrodible metal without surface treatment. Aluminum Alloys 6061T6 or 6063T6 have been found suitable for use in most locations. Properly primed and coated steel is suitable for use in desert areas.

6.2 *Test Fixture Design*—Test racks of several different designs are currently used for the exposure testing of paints on wood. Test racks for the exposure of paints and trims that more closely simulate end-use applications, including under eave exposures, are presented fully in Annex A1. Test racks that are commonly used for the exposure of wood siding boards, primarily for the evaluation of mildew growth, dirt accumulation, and color change are shown in Fig. 1. These racks can be configured to hold specimens or specimen holders of any convenient width and length. Adjustable racks can be used to accommodate specimens of different lengths. An offset design (notched cutouts) in the mounting hardware shall be used in order to avoid contamination from specimens mounted above other specimens. Offsets shall be of the proper size to accommodate the width of the siding board. Typically, 152-mm (6-in.) or 230-mm (9-in.) sized offsets are used. Other sizes are available. An example of an offset mounting hardware is shown in Fig. 2.



FIG. 1 Typical Exposure Rack

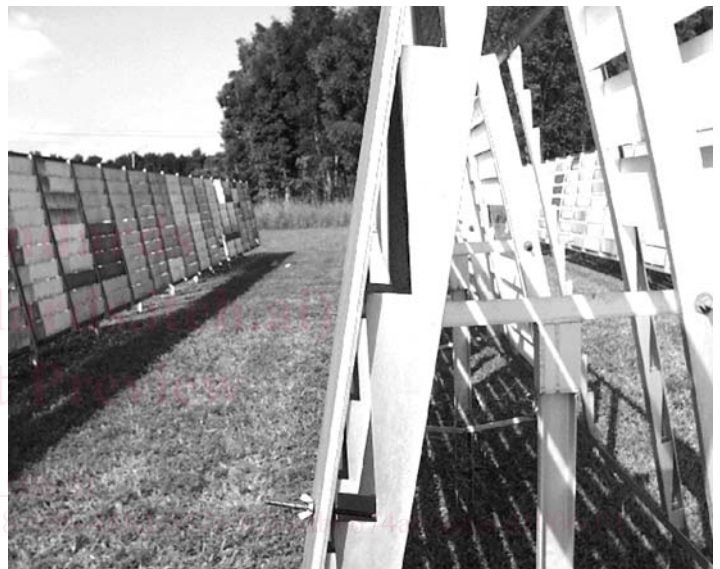


FIG. 2 Offset Mounting Hardware

7. Construction of Test Specimens

7.1 Choose a wood substrate in accordance with Specification D 358. Prior to use, test lumber and panels shall be stored under such conditions that the moisture content of the wood will be maintained within the normal range for exterior woodwork in the region in which the tests are conducted. Exposures on wood substrates should be performed on three panels to allow for variations in wood.

7.2 For house paints, unless the pattern of siding requires some other choice, test panels should be made of one or the other of two patterns of siding, namely 127-mm (0.5-in.) or 190-mm (0.75-in.) bevel siding or 25-mm (1-in.) by 152-mm (6-in.) drop siding. A test panel may be subdivided into two or more test areas. A subdivided panel is one complete panel in which multiple paint specimens are applied to sections of the panel. If the panels in the house paint test are not subdivided, one 914-mm (3-ft) length of 152-mm siding will be acceptable. If the panels are subdivided, each test area shall be a minimum of 152-mm in length.

7.3 For trim paints, the test panel may have 25-mm (1-in.) by 102-mm (4-in.) pieces of lumber at each end (see Annex A1).

7.4 For exposures of paints on test fixtures described in 6.2 and Fig. 1, a test panel should be a 914-mm (36-in.) length of 152-mm (6-in.) siding substrate unless otherwise agreed upon. Each area shall be a minimum of 152 mm in length. Each test area can be painted with a different paint thus providing a side-by-side comparison for performance.

NOTE 2—It is important to remember that up to 75 mm (3 in.) of each end of the test will be masked by the exposure rack.

8. Use of Control or Reference Materials

8.1 When several paints are being compared, one paint should be selected as a “control.” The control paint should be applied to one area of each test panel. Variations caused by wood differences are revealed in the performance of the control paint, and can be used to adjust the ratings of other paints to a common basis. For best results there should be two controls, one known to perform well and one known to perform poorly.

9. Application of Paints

9.1 All materials being compared in a single study shall be prepared and exposed within a thirty-day period. For very large studies where all specimens cannot be prepared and exposed within the thirty-day period, prepare duplicate coatings of at least 30 % of the materials or prepare and expose specimens of a control paint at the beginning and at the end of the period needed for completion.

9.2 It is best in theory and practice to do the painting outdoors in proper weather for painting; however, indoor painting is permissible provided no more than one week (72 h is the preferred maximum time) elapses between the successive coats and between applying the last coat and exposing on the test fence. Furthermore, all painting must be performed under essentially the same drying conditions. It is necessary to allow each coat to cure sufficiently before top coating.

9.3 The preferred procedure is to apply paints with the test panel in a vertical position and kept vertical until the paint has set. If paint is spread on horizontal panels, the panels should be placed vertically immediately thereafter.

9.4 Records should be kept of the spreading rates at which paints are applied. When the purpose of the tests is to compare commercial paints, it may be appropriate to let the painter apply them at their natural spreading rates. When the purpose is to study variation in the paint composition, application should usually be at suitable predetermined spreading rates that can be controlled by applying a given weight or volume of coating to a measured area.

10. Procedure

10.1 After the panels have been prepared, identify each specimen with a unique mark that will not be destroyed or become illegible during the exposure. Practice G 147 provides guidance for this procedure.

10.2 Measure the desired properties on all test and reference control specimens prior to exposure.

10.3 Mount the specimens on the correctly oriented exposure rack that accommodates the dimensions of the specimens being exposed.

10.4 Perform the exposure test in accordance with the guidelines in Practices G 7 and G 147.

10.5 Select one of the methods for defining the duration of the exposure in accordance with Practice G 7.

11. Inspection and Records

11.1 After the panels have been exposed to the weather, inspections should be made after not more than one month, at three months, and at intervals of three months during the first two years, and every six months thereafter. Midwinter inspections, however, may be omitted in northern latitudes. Inspections may be made more frequently if desired. Usually the exposures should be continued for a considerable length of time after deterioration has reached the point at which best practice calls for repainting.

11.2 Records should be kept on report forms agreed upon between the purchaser and the seller.

12. Report

12.1 The report section shall contain the following information when applicable and available. In most cases, commercial testing agencies used to perform exposures may not have specific information about the materials used or preparation of the test specimens and, therefore, cannot be reported.

12.1.1 Complete description of the test specimens and any control and weathering materials used, including:

12.1.1.1 Composition, including description of substrate to which the paint is applied and

12.1.1.2 Method of preparation (reference applicable standards here).

12.1.2 Location of exposure (including whether specimens were exposed at ground level, on a rooftop, and so forth).

12.1.3 Ground cover in area of test racks.

12.1.4 Angle at which exposure was conducted.

12.1.5 Type of exposure (unbacked or backed). If backed exposure is used, include thickness and type of backing and, if painted, the color of paint used.

12.1.6 Date exposure started and date exposure completed.

12.1.7 If required, solar radiant energy for all exposures oriented towards the equator including the wavelength band-pass in which radiant energy is measured. All solar radiant energy reported should be measured in accordance with Practice G 7. If required, include a certificate of calibration for the radiometer used, with this information.

12.1.8 If used, details of any specimen treatment such as washing conducted during the exposure. Include description of the treatment used and the frequency of treatment.

12.1.9 If required, the following climate information:

12.1.9.1 Ambient temperature (daily maximum and minimum),

12.1.9.2 Relative humidity (daily maximum and minimum),

12.1.9.3 Total hours of wetness and method used to measure,

12.1.9.4 Rainfall in centimetres, and

12.1.9.5 Concentration of pollutants such as NO₂, SO₂, O₃, and method used to measure the concentration.