Designation: D1360 – 98 (Reapproved 2011)

Standard Test Method for Fire Retardancy of Paints (Cabinet Method)[1]

This standard is issued under the fixed designation D1360; 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 test method determines quantitatively the fire retardant properties of a coating or coating system on a wood surface and the leaching effect of water on the fire retardancy of the coating or coating system. Specifically, this test method determines the weight loss and char index of coated panels subjected to a flame and the effect of leaching of the coating on these parameters.

1.2 This test method should be used solely to measure and describe the properties of materials, products, or systems in response to heat and flame under controlled laboratory conditions and should not be considered or used for the description, appraisal, or regulation of the fire hazard of materials, products, or systems under actual fire conditions.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 *Federal Standard:*[2]
Fed. Spec. TT-V-119 — Varnish Spar, Phenolic Resin

2.2 *Military Standard:*[2]
Mil. Spec. MIL-A-22397 — Adhesive Phenol, and Resorcinal Resin Base for Marine Use

2.3 *ASTM Adjuncts:*
Cabinet Assembly[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *fire retardancy, n— in paint,* the ability of a paint to retard the spread of a flame over coated substrate usually at the sacrifice of the paint film.

4. Summary of Test Method

4.1 *Fire Retardancy*—Panels are conditioned before and after coating with the material under test. They are subjected to a flame from a small amount of burning alcohol or other solvent, and the weight loss and char index are determined.

4.2 *Leaching*—Similarly prepared panels are immersed in water for a specified time and then subjected to the fire-retardancy test. The weight loss, char index, and difference in weight loss and char index between leached and unleached panels are determined.

5. Significance and Use

5.1 This test method determines the relative fire-retardant properties of coatings and the water leaching of the fire-retardant material from the applied coating. Leaching simulates the effect of high humidity, weathering, and washing on the fire retardancy of a coating, and is specified in various regulations and specifications for fire-retardant paints.

6. Apparatus

6.1 *Cabinet,*[3,4] a glass and metal box as shown in Fig. 1.

6.2 *Assembly,*[3,4] consisting of supports for the test panels and solvent cup. The assembly is shown within the cabinet in Fig. 1.

6.3 *Cylindrical Cup,* to hold solvent, made of brass to the following dimensions:

Outside diameter, mm (in.)	24 (15/16)
Outside height, mm (in.)	17 (11/16)
Wall thickness, mm (in.)	1 (1/32)
Volume, mL	6.0
Operating capacity, mL	5.0

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.21 on Chemical Analysis of Paints and Paint Materials.

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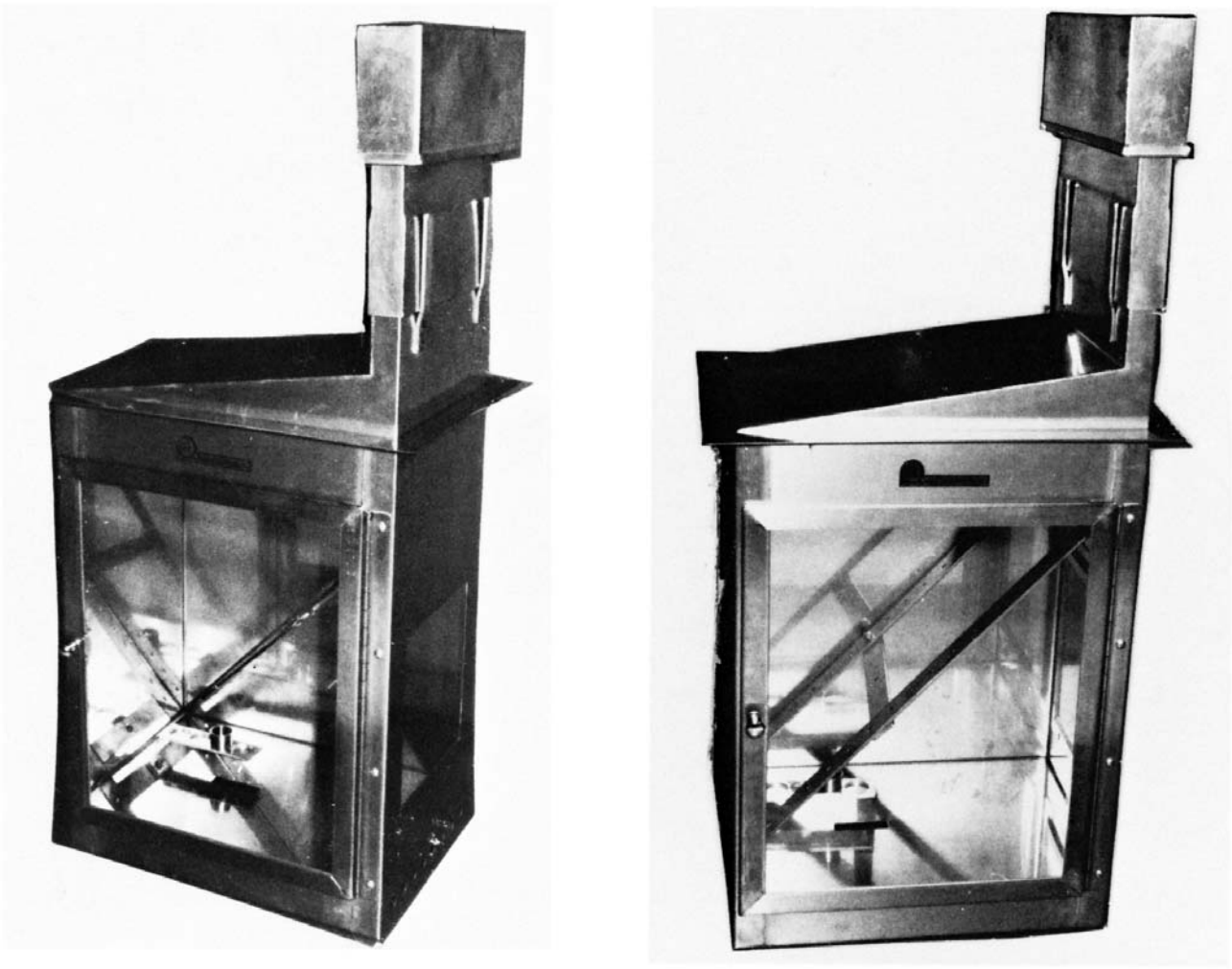
[2] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

[3] Drawings of cabinet, assembly, etc., are available from ASTM International Headquarters. Order Adjunct No. ADJD1360. Original adjunct produced in 1985.

[4] The sole source of supply of a suitable cabinet and assembly known to the committee at this time is Dek-Tron Scientific, 244 East 3rd St., Plainfield, NJ 07060. If you are aware of alternative suppliers, pleasse provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.



View A View B

FIG. 1 Apparatus

6.4 *Balance,* weighing to 0.1 g.

6.5 *Buret or Pipet,* calibrated in millilitres.

6.6 *Container or Water Bath,* 320 by 165 by 165 mm (12.5 by 6.5 by 6.5 in.), galvanized steel with cover to accommodate 15 panels, or other sizes to accommodate 5 to 10 panels.

6.7 *Oven* capable of maintaining a temperature of 50 ± 2°C (120 ± 3°F).

6.8 *Constant Temperature and Humidity Cabinet or Room,* maintained at 50 ± 5 % relative humidity and 23 ± 2°C (73.5 ± 3.5°F).

7. Test Materials

7.1 *Ignition Fuel,* absolute ethyl alcohol (ethanol) or comparable solvent blend.

NOTE 1—A mixture of 71.4 % reagent grade isopropanol and 28.6 % reagent grade methanol having the same heat of combustion as pure absolute ethanol may be used as the source of ignition.

7.2 *Test Panels:*

7.2.1 Unless otherwise specified or agreed, yellow poplar heartwood panels 6 by 150 by 305 mm (¼ by 6 by 12 in.), close-grain, and as nearly edge grain as possible, free from knots and other imperfections, with surfaces planed and sanded. Panels shall be of solid wood or edge glued sections to obtain the width, provided that no strip is less than 38 mm (1 ½ in.) wide and that no more than two glue lines occur in any one panel. The adhesive used in gluing these panels shall conform to Mil. Spec. MIL-A-22397. Test panels shall be kiln dried so as to contain no more than 10.0 weight % moisture and after conditioning as specified in 8.1 shall weigh from 125 to 140 g/panel (27 to 30 lb/ft^3).

7.2.2 Douglas fir or other woods shown in Table 1 may be used where required. Table 1 shows the densities and weight per panel for each wood after conditioning.

NOTE 2—Asbestos board (or inorganic reinforced cement board), steel,

TABLE 1 Densities and Panel Weights of Various Woods

NOTE 1—Conditioned at relative humidity 50 ± 5 % and 23 ± 2°C (73.5 ± 3.5°F) for 14 days.

Type of Wood	Density (9 to 10 weight % Moisture), kg/m^3 (lb/ft^3)	Weight of 152 by 305 by 6 mm (6 by 12 by ¼ in.) Panel, g
Red cedar	345–360 (21.4–22.4)	101–106
Douglas fir	465–560 (29–35)	137–165
White pine–ponderosa pine	360–420 (22.4–26.4)	106–125
Southern yellow pine	495–590 (31–37)	147–175
Redwood	435–450 (27.2–28.2)	129–133

or concrete may be used upon agreement between the purchaser and the seller.

8. Preparation of Test Panels

8.1 Condition panels for 14 days in a controlled atmosphere of 50 ± 5 % relative humidity and 23 ± 2°C (73.5 ± 3.5°F) prior to coating. Seal the ends of the panels with two coats of varnish conforming to Fed. Spec. TT-V-119 after the conditioning. Allow each coat of varnish to air dry 18 to 24 h.

8.2 Brush apply the material under test in one coat at 6 m^2/L (250 ft^2/gal) (wet film thickness of 6.4 mils) or in two coats at 12 m^2/L (500 ft^2/gal) (3.2 mils per coat) to each face of each panel, obtaining as uniform coverage as possible. Application can be by other conventional means and in as many coats to obtain the necessary weight of coating or desired wet or dry film thickness. Also coat the edges and sides of the panels with the same material. When applied in more than one coat, dry 24 h between coats under standard conditions (see 6.8) and, after the final coat, dry 14 days under the controlled conditions. Prior to subjecting the specimens to the burning test, place them in the oven at 50 ± 2°C (120 ± 3°F) for a period of 40 h.

8.3 Calculate the weight of the coating to be applied using the following equation:

$$W = \frac{(6 \times 12)}{144S} D \times 454 \quad (1)$$

where:

W = weight of applied wet coating, g,
D = coating density, lb/gal, and
S = spreading rate in ft^2/gal.

8.3.1 Use the following equation when metric units are employed:

$$W = (46.4D)/S \quad (2)$$

where:

W = weight of applied wet coating, g,
D = coating density, g/mL, and
S = spreading rate, m^2/L.

9. Procedure—Fire Retardancy

9.1 Assemble the apparatus as shown in Fig. 1, including the stack extension and downdraft hood, in an area where facilities are available for the removal or escape of combustion products (standard laboratory hood without forced ventilation). Weigh the panel to be tested to the nearest 0.1 g and record the weight. Center the panel, face down, on the angular supports with the lower edge 50 mm (2 in.) from the angle formed by the floor and the side wall of the cabinet. Place the fuel cup, at room temperature, on the pedestal so that the vertical distance from the cup lip nearest to the face of the specimen is exactly 25 mm (1.0 in.). Using a buret or pipet, add 5.0 mL of pure absolute ethanol or any mixture with the same heat of combustion (Note 1) to the cup and ignite without delay by means of a flame approximately 13 mm (½ in.) in length. Close the door and adjust the draft to assure complete burning of the alcohol. Allow the test to continue until all flames self-extinguish. Repeat this procedure with at least five replicate panels.

9.2 *Weight Loss*—Cool each panel to room temperature and weigh to the nearest 0.1 g. Determine the weight loss in grams of each of the five specimens by subtracting from its original weight (see 9.1). Calculate the mean and standard deviation for the weight loss. If the standard deviation of the five replicates is greater than 10 % of the mean, test five additional panels and calculate the mean weight loss of the ten panels.

9.3 *Char Index*—Cut the panels by means of a fine-toothed saw along the lines of maximum length and width of attack. Measure in centimetres the maximum width of charring of the wood panel below the paint film on the lateral cut. Likewise, measure the maximum length of charring found on the longitudinal cut. Measure the maximum depth to which charring has penetrated the wood as evidenced on the longitudinal or lateral cuts. Determine the char index by multiplying the maximum char length, width, and depth figures. Calculate the mean and standard deviation for the char index. If the standard deviation of the five replicates is greater than 10 % of the mean, test five additional panels and calculate the mean char index on the basis of the ten panels.

10. Procedure—Leaching Test

10.1 Prepare, coat, and condition 15 panels of each material under test as described in Section 8.

10.2 At the end of 14 days at 50 % humidity and 23°C (73.5°F), immerse the 15 panels in 2250 ± 30 mL of water (150 mL/panel) (Note 3) for 40 h at 50 ± 2°C (120 ± 3°F).

NOTE 3—The water bath is made to contain 15 panels and 2250 mL of water to cover the specimens. If less than 15 coated panels are immersed, add blank panels to make up the 15. Place panels so that their faces do not touch. Cover the bath to prevent excessive evaporation.

10.3 Subject each of the 15 panels to the fire retardant test in accordance with 9.1 and calculate the differences in mean weight loss and mean char index between the leached and the unleached set of specimens as follows:

△wt. loss = mean wt. loss of leached specimens – mean wt. loss of unleached specimens.
△char index = mean char index of leached specimens – mean char index of unleached specimens.

11. Report

11.1 Report the following information:

11.1.1 The number of coats and the coverage in m^2/L (ft^2/gal) of the total numbers of coats for each set of each material under test,

11.1.2 The mean weight loss and the mean char index of the set exposed only to the fire retardancy test, the number of specimens used in calculating the means, and the final standard deviation, and

11.1.3 The difference in mean weight loss and mean char index between the sets of unleached and leached specimens as determined in 10.3.

12. Precision and Bias

12.1 The precision of this test is to be determined.

12.2 *Bias*—The bias of this test method cannot be determined as the value of fire retardancy can be defined only in terms of a test method.

13. Keywords

13.1 cabinet method; char index; fire retardancy; government specification; paint