



Designation: E69 – 22

Standard Test Method for Combustible Properties of Treated Wood by the Fire-Tube Apparatus¹

This standard is issued under the fixed designation E69; 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 covers fire-tube test procedures for fire tests for combustible properties of wood treated to reduce flammability. This test method relates to properties of treated wood, as such, rather than to the performance of a fabrication used as an element of construction. Performance under this test method shall be as prescribed in requirements applicable to materials intended for specific uses.

1.2 This test method is a fire-test-response standard.

1.3 The SI values given in parentheses are provided for information purposes only.

1.4 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.07 on Fire Performance of Wood.

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2. Referenced Documents

2.1 *ASTM Standards:*²

D9 Terminology Relating to Wood and Wood-Based Products

E176 Terminology of Fire Standards

3. Terminology

3.1 *Definitions*—For definitions of terms found in this test method, refer to Terminologies D9 and E176.

4. Significance and Use

4.1 The purpose of this test method is to provide a relative measurement of the combustibility of fire-retardant-treated wood specimens based on their percentage loss in weight under controlled fire exposure conditions (**1**).³ In addition, other possible data include rate of weight loss, time of flaming and afterglowing, increase in temperature, and maximum vertical flame progress.

4.2 This test method is not sufficiently large scale to evaluate the suitability of a given treated product for building construction, but it is a convenient method to use for purposes of development or as a quality-control test during manufacture.

4.3 This test method gives a procedure for sampling and preparation of test specimens from a lot of treated material in which complete penetration is a requirement. A procedure is also given for the sampling of charges at a treating plant for purposes of quality control of the treatment process.

4.4 This test method has proven useful for evaluating comparative fire performance effectiveness of fire-retardant chemicals and treatment formulations for wood and wood products (**2-5**).

4.5 In this test method, the specimens are subjected to one or more specific sets of laboratory test conditions. If different test conditions are substituted or the anticipated end-use

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 boldface numbers in parentheses refer to the list of references at the end of this test method.

conditions are changed, it is possible that this test method will not predict changes in the fire-test-response characteristics measured. Therefore, the results are valid only for the fire test exposure conditions described in this procedure.

5. Apparatus

5.1 The apparatus for conducting the fire-tube test shall consist of the fire-tube assembly and accessory equipment as follows:

5.1.1 *Fire-Tube Assembly*—A specially constructed balance designed to indicate directly the percentage loss of weight suffered by the test specimen when exposed to a standardized flame for a given duration. Essential construction details of the apparatus assembly are shown in Fig. 1 and Fig. 2.

5.1.2 *Igniting Burner*—The igniting burner is to be of the low-form (curved-stem) bunsen type, having an inside tube diameter of 3/8 in. (9.5 mm) and attached to a ring-stand support. The igniting burner shall be provided with a device to maintain a constant gas flow, as described in 5.1.2.1 and the flame calibration, as required by 9.4.

5.1.2.1 *Gas Flow Device*—Typical devices utilized to control gas flow are manometers, pressure regulators or gas flowmeters with a rating of 0 to 5 SCFH (0 to 142 L/h). A gas

flowmeter is desirable since they are readily available, very accurate, and inexpensive.

5.1.3 *Temperature-Indicating Apparatus*—A thermometer or thermocouple equipment that will indicate temperatures up to 1000 °F (538 °C).

5.1.4 *Timer*—A timing device capable of being read to minutes and seconds.

5.1.5 *Balance*—A balance with readability of 0.1 g and suitable for weighing test specimens and moisture-content samples.

5.1.6 *Oven*—A suitable thermostatically controlled oven for moisture-content determinations.

6. Sampling and Test Specimens for Wood Impregnated Throughout Entire Section

6.1 For interior trim or other lumber requiring penetration of treating solution throughout the section (but not for wood given incomplete penetration), the test specimens shall be prepared as follows:

6.1.1 At least one sample shall be taken from the lot for each 5000 bd ft or fraction thereof. Different species, and pieces of the same species with widely different thicknesses, shall be considered as separate lots and sampled accordingly. The

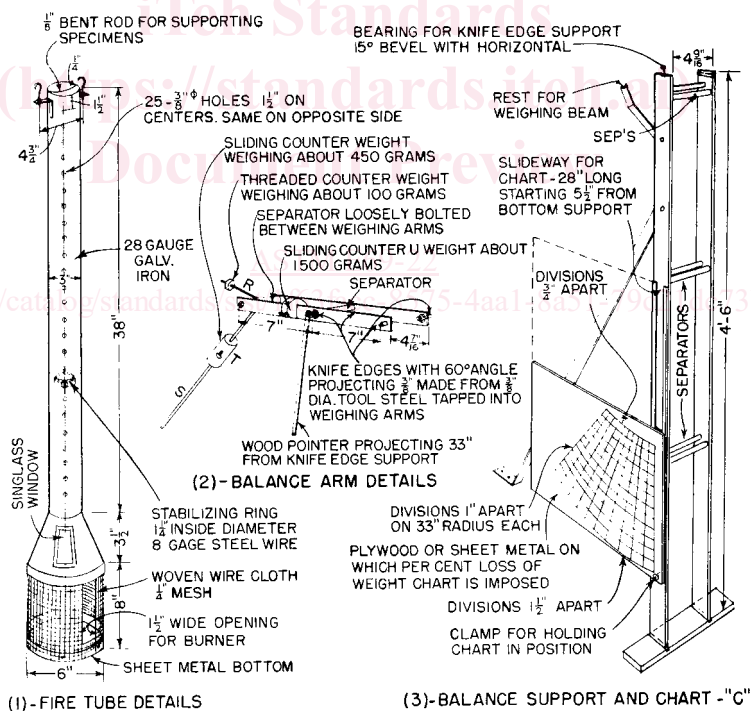


FIG. 1 Construction Details of Fire-Tube Apparatus

Inch-Pound Units
1/8 in.
1/4 in.
3/8 in.
1/2 in.
1 in.
1 1/4 in.
1 1/2 in.
3 in.
3 1/2 in.
4 1/4 in.

SI Units
3 mm
6 mm
9.5 mm
19 mm
25 mm
31.7 mm
38 mm
76 mm
89 mm
113 mm

Inch-Pound Units
4 1/16 in.
4 1/4 in.
5 1/2 in.
6 in.
8 in.
28 in.
33 in.
38 in.
4 ft 6 in.

SI Units
116 mm
121 mm
140 mm
152 mm
203 mm
711 mm
838 mm
965 mm
1.35 m

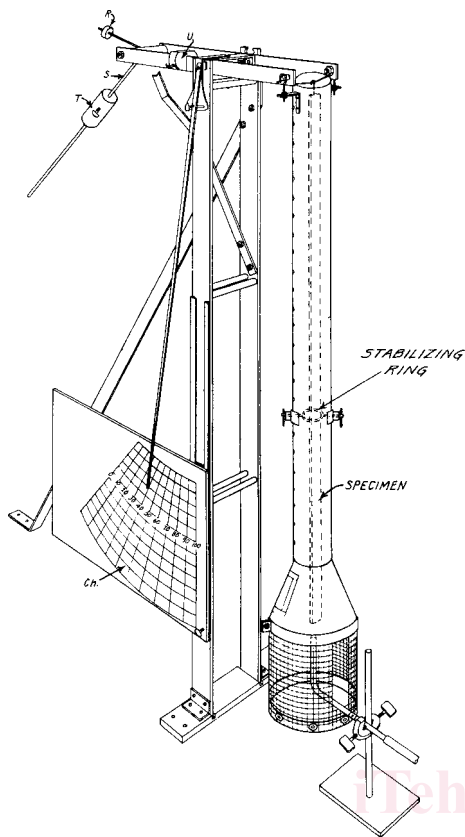


FIG. 2 Assembly of Fire-Tube Apparatus for Procedure A

samples shall be selected so as to include material from different sections of a finished unit or different lengths of finished trim, or to include variations such as heartwood or sapwood, rate of growth, density, and other visible nonuniformities. Samples shall be cut not closer than 2 ft (0.6 m) from the ends of treated boards.

6.1.2 Not less than five tests shall be made from each sample, except that where the quantity is less than 2000 bd ft the number of tests shall be left to the discretion of the testing authority but shall be not less than two.

6.1.3 The standard specimens cut from the selected samples shall be $\frac{3}{8}$ by $\frac{3}{4}$ in. (9.5 by 19 mm) in cross section by 40 in. (1016 mm) in length, with surfaces smooth-sawed to dimensions within $\pm\frac{1}{32}$ in. (0.8 mm). Each test specimen shall consist of one piece sawed the full 40-in. length or shall be made up of several shorter pieces joined at squared ends with six small wire staples at each joint to give a combined length of 40 in.

6.1.4 From samples taken from boards having thicknesses of $\frac{3}{4}$ in. (19 mm) or more, the specimen shall be prepared by cutting $\frac{3}{8}$ by $\frac{3}{4}$ -in. (9.5 by 19-mm) pieces longitudinally, not nearer than $\frac{3}{8}$ in. from the edge of the sample, and so that the face of the sample appears as one, or both, of the $\frac{3}{8}$ -in. edges of the specimen; provided, however, that if the thickness of the sample exceeds $1\frac{1}{2}$ in. (38 mm) an additional test specimen shall be cut from the center of the piece with the $\frac{3}{8}$ -in. edge parallel to the edge of the sample.

6.1.5 From samples taken from boards having thicknesses of $\frac{3}{8}$ in. (9.5 mm) or more but less than $\frac{3}{4}$ in. (19 mm), the

specimen shall be prepared by cutting $\frac{3}{8}$ by $\frac{3}{4}$ -in. pieces longitudinally not nearer than $\frac{3}{8}$ in. from the edge of the same and so that the face of the sample appears as one, or both, of the $\frac{3}{4}$ -in. faces of the specimen.

6.1.6 When the material to be tested is less than $\frac{3}{8}$ in. (9.5 mm) in thickness, a specimen built up in laminated form with plies of approximately equal thickness is acceptable. The plies shall be dressed smooth and assembled by nailing with $\frac{3}{8}$ -in. steel-wire brads (No. 20 Bwg, 0.035-in. nominal thickness). The weight of nails used shall be recorded for correction of the weight of the specimen.

6.1.7 A composite specimen prepared from more than one sample piece shall be taken so as to be representative of the average quality of the materials to be tested.

7. Sampling and Test Specimens

7.1 Where arrangements are made for sampling of each charge at the treating plant, the specimens shall be obtained as follows:

7.1.1 No charge shall contain less than six sample pieces. These sample pieces shall be of Douglas fir or of the same species and commodity (lumber, plywood, and so forth) of wood as the rest of the material in the charge. Each sample shall bear an identification mark.

7.1.2 Placement of sample pieces in the material to be treated on a tram shall be representative of the average exposure to the treating solution and yet be accessible for ready removal without seriously disturbing the loading.

7.1.3 Sample pieces shall be $\frac{3}{8}$ by $\frac{3}{4} \pm \frac{1}{32}$ in. (9.5 by 19 ± 0.8 mm) in cross section and be at least 42 in. (1.1 m) in length.

7.1.4 Fire-tube test specimens shall be cut from each selected sample and shall be 40 in. (1.016 m) in length, within $\pm\frac{1}{32}$ in. (0.8 mm). The remainder of the sample 2-in. (51-mm) or greater in length shall be cut off for moisture test specimens.

8. Conditioning

8.1 The moisture content of the specimen when tested shall be 7 ± 3 weight % of the dry material. Make the moisture determination for each specimen on a piece $\frac{3}{8}$ by $\frac{3}{4}$ in. (9.5 by 19 mm) in cross section and 2 to 8 in. (51 to 203 mm) in length, cut adjacent to one end of the specimens. Weigh the moisture test specimen and the fire tube test specimen to the nearest 0.1 g or less and record. Dry the moisture test specimen for 24 h at 212 ± 3 °F (100 ± 1.7 °C) or until a constant weight is achieved. Constant weight is achieved when readings are taken 2 h apart and agree within 0.2 %. Calculate the moisture content as follows:

$$X = [W_i - W_{od}] / W_{od} \times 100 \quad (1)$$

where:

X = moisture content of the moisture test specimen, %,
 W_i = initial weight of the moisture sample, and
 W_{OD} = oven dry weight of the moisture sample.

If the moisture content exceeds 10 %, condition the fire tube test sample or prepared specimen by drying at temperatures not exceeding 160 °F (71 °C) until the moisture content is within the prescribed limits of 4 to 10 %. If the moisture content of the specimen is less than 4 %, the moisture content can be