



Designation: ~~D3201-08~~^{ε1} D3201/D3201M-13

Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products¹

This standard is issued under the fixed designation ~~D3201~~; D3201/D3201M; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

^{ε1} NOTE—Note 2 was editorially added in October 2009.

1. Scope

1.1 This test method prescribes the procedure for determining the hygroscopicity of fire retardant treated wood products by determining the moisture content of fire-retardant-treated wood and wood-based product samplespecimens after exposure to a standard high relative humidity test condition of $92 \pm 2\%$ at $27 \pm 2^\circ\text{C}$ ($81 \pm 4^\circ\text{F}$)-relative humidity at $81 \pm 4^\circ\text{F}$ [$27 \pm 2^\circ\text{C}$].

1.2 The text of this test method references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this test method.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. The inch-pound values given in parentheses are for information only and are not considered stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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 *ASTM Standards:*²

[D9 Terminology Relating to Wood and Wood-Based Products](#)

[E84 Test Method for Surface Burning Characteristics of Building Materials](#)

[E176 Terminology of Fire Standards](#)

[E2768 Test Method for Extended Duration Surface Burning Characteristics of Building Materials \(30 min Tunnel Test\)](#)

3. Terminology

3.1 *Definitions*—Definitions used in this practice are in accordance with Terminologies [D9](#) and [E176](#).

4. Significance and Use

4.1 The hygroscopic properties of wood and wood-based products treated with fire-retardant chemicals are often greater than for untreated products. This is particularly true at the higher relative humidity conditions. This higher hygroscopicity sometimes is the cause for staining, decay, poor paint adhesion, and migration and exuding of chemicals and moisture at the high humidities. Corrosion of metal fasteners sometimes also occurs.

4.2 The results obtained with this standard are important in identifying treatments with low hygroscopic properties.

4.3 Results can be useful in determining exposure limitations in service for specific treated products.

4.4 Building codes and other specifications for fire-retardant-treated wood for interior use include requirements based on this test method.

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. Current edition approved Nov. 1, 2008; June 15, 2013. Published December 2008; July 2013. Originally approved in 1973. Last previous edition approved in 2008 as ~~D3201-08~~; D3201-08^{ε1}. DOI: 10.1520/D3201-08AE01; 10.1520/D3201-13.

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.



5. Apparatus

5.1 *Conditioning* chamber with air circulation and capable of being maintained at $2781 \pm 2^\circ\text{C}$ (814°F [$27 \pm 4^\circ\text{F}$] 2°C) and a relative humidity of $92 \pm 2\%$.

5.2 *Oven*, air-circulated and vented, capable of maintaining a temperature of $103217 \pm 2^\circ\text{C}$ (2174°F [$103 \pm 4^\circ\text{F}$] 2°C).

5.3 *Weighing Scale*—A scale or balance that will weigh a specimen within an accuracy of $\pm 0.2\%$.

6. Test Specimens

6.1 A minimum of five specimens shall be selected that represent the lot. Unless otherwise specified, specimens shall be full cross sections, no less than 25.4 mm (1 in.) along the grain, but longer as needed to provide a minimum volume of 33 000 mm³ from the untreated product/species combination that is to be tested. Solid wood specimens with identifiable sapwood shall be selected with as much sapwood as can be readily obtained from the lot of material from³ (2 in. which³); it is selected.

6.2 Specimen Size:

6.2.1 Solid wood specimens shall be cross sections cut from solid sawn, surfaced lumber of nominal 2×6 size. The test specimens shall be 1.0 ± 0.1 in. [25 ± 3 mm] along the grain by 5.5 ± 0.1 in. [139 ± 3 mm] wide by 1.5 ± 0.1 in. [38 ± 3 mm] deep.

6.2.2 Panel product specimens shall be cut from panels with a nominal thickness between 15/32 in. [12 mm] and 5/8 in. [16 mm]. The test specimens shall be the thickness of the panel by 5.5 ± 0.1 in. [139 ± 3 mm] by 5.5 ± 0.1 in. [139 ± 3 mm].

6.2.3 Products for which the specimen sizes in 6.2.1 and 6.2.2 are not applicable may be tested using specimens with surface area to volume ratios greater than 3.7 in.²:1 in.³ [0.15 mm²:1 mm³] and minimum mass of 0.11 lb. [50 g].

6.3 The specimens shall be penetrated by the fire-retardant chemical to be representative for the treated product. Treatment with fire-retardant chemicals shall be done in a manner representative of that for the product/species being tested.

NOTE 1—The use of untreated specimens as control specimens is recommended to provide verification of the high-humidity conditions used.

6.3.1 The fire retardant chemical retention of the treated product shall not be less than that specified by the agency certifying the flame spread index of the treated product. The retention shall provide a flame-spread index of 25 or less when tested in accordance with either Test Method E2768 or with Test Method E84 for 10 min with no evidence of significant progression combustion when the test is continued for an additional 20-min period and without progression of the flame front beyond a distance of 10.5 ft. [3.2 m] beyond the centerline of the burners anytime during the 30-min extended test.

6.3.2 The provisions of 6.3.1 are not intended to prevent use of this test method when the fire-retardant treatments being tested are for applications other than those requiring conformance to building code requirements for “fire-retardant-treated wood” that require Test Method E84 test extended to 30 min or Test Method E2768. When alternative performance criteria for the treated products are applicable, the test report shall include the alternative performance criteria and the treatment retention required for specimens conforming to any alternative performance criteria.

NOTE 1—The use of solid wood, untreated control specimens is recommended to provide verification of the high-humidity testing conditions.

NOTE 2—Southern pine sapwood is suggested as the test species because it requires higher fire-retardant chemical retentions to obtain the same flame spread rating compared to other commonly used species. Because the hygroscopicity of fire retardant treated wood correlates to the chemical retention levels, southern pine is believed to represent a worst case scenario for the same chemical formulation and treating procedures. Thus, testing of other species, rather than by application of southern pine test results, are considered to be indicative of that species only.

7. Procedure

7.1 All measurements of the specimen weight shall be to an accuracy of $\pm 0.2\%$.

7.2 The specimens shall be in moisture equilibrium with air dried in a laboratory ambient condition of at normal indoor ambient temperature and 30 to 65 % relative humidity or shall be exposed for at least 7 days at such a condition 14 days prior to high-humidity exposure. Specimens shall be separated while drying to permit unrestricted air flow to all surfaces.

7.3 If the specimens will support fungal or mold growth during the high humidity exposure, then the specimens they shall be sprayed with a suitable biocide just prior to the above exposure air drying (see 7.2 and allowed to air-dry for the seven days).

7.4 Weigh each specimen to obtain weight prior to high humidity exposure.

7.5 Expose all specimens under constant humidity conditions of $92 \pm 2\%$ at $2781 \pm 2^\circ\text{C}$ (814°F [$27 \pm 4^\circ\text{F}$] 2°C) for 7 days. 168 hours for not less than 168 or more than 180 hours. Specimens shall be suitably suspended so that all surfaces are exposed.

NOTE 3—In this test method, the samples specimens are not exposed for sufficient duration to obtain equilibrium moisture content. This test method was developed for fire-retardant-treated wood. For the purpose of identifying treatments with low hygroscopic properties, the duration of seven days 168 hours (seven days) has been shown to be adequate for fire-retardant-treated wood. adequate. If the method is applied to other materials, the necessity for a longer duration of exposure needs to be investigated.

7.6 If the specimens exude moisture or chemicals or both under the exposure conditions, collect any drippings and include the weight with the specimen weight.