Designation: D 3201 – 94 (Reapproved 2003)

Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products[1]

This standard is issued under the fixed designation D 3201; 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 prescribes the procedure for determining the moisture content of fire-retardant-treated wood and wood–based product samples after exposure to a standard high relative humidity condition of 90± 3 % at 27 ± 2°C (80 ± 4°F).

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 *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. Significance and Use

2.1 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 may cause staining, decay, poor paint adhesion, and migration and exuding of chemicals and moisture at the high humidities. Corrosion of metal fasteners may also occur.

2.2 The results obtained with this standard are important in determining the treatments with the lesser hygroscopic properties.

2.3 The results will be useful in determining exposure limitations in service for specific treated products.

2.4 Also, current leach-resistant, exterior-type, fire-retardant-treated wood and wood–based products have hygroscopic properties at this exposure nearly equal to untreated products. Therefore, the results from this standard may be useful in determining if exterior or interior type treatments have been used.

3. Apparatus

3.1 *Conditioning Room* or chamber with air circulation and controlling instruments capable of being maintained at 27 ± 2°C (80 ± 4°F) and a relative humidity of 90 ± 3 %.

NOTE 1—Other suitable means of maintaining these conditions are also acceptable; for example, the use of saturated disodium phosphate (Na_2HPO_4) or a barium chloride ($BaCl_2$) solution in a closed container with suitable solution agitation and air circulation at 27 ± 2°C (80 ± 4°F) has been found satisfactory. It is desirable to install an air pump in the air space of the container and bubble air from this space through the saturated solution.

3.2 *Oven*, air-circulated and vented, capable of maintaining a temperature of 103 ± 2°C (217± 4°F).

3.3 *Weighing Scale*—A scale or balance that will weigh a specimen within an accuracy of ±0.2 %.

NOTE 2—A torsion balance, Harvard trip balance, triple-beam balance, and automatic direct-reading balances are examples of suitable equipment.

4. Test Specimens

4.1 Specimens vary widely depending on the type of material being analyzed. 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 cm^3(2 $in.^3$).

4.2 The specimens shall be penetrated by the chemical to be representative for the treated product.

4.3 The specimens shall be in moisture equilibrium with a laboratory ambient condition of 30 to 65 % relative humidity or shall be exposed for at least 7 days at such a condition prior to high-humidity exposure.

NOTE 3—If it is likely that the specimen will support fungal or mold growth during the high humidity exposure, then the specimens should be sprayed with a suitable biocide just prior to the above exposure and allowed to air-dry for the seven days.

4.4 Untreated specimens, when available, of the same species or wood-based product and of the same size, shall be exposed to the preconditioning, high-humidity exposure, and drying along with the treated specimens.

[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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NOTE 4—The use of untreated control specimens is highly recommended not only to supply useful data on the relative influence of treatments, but also to provide relative information on the high-humidity conditions used.

5. Procedure

5.1 Weigh each specimen to an accuracy of ±0.2 %.

5.2 Expose all specimens under constant humidity conditions of 90 ± 3 % at 27 ± 2°C (80 ± 4°F) for seven days. Specimens shall be suitably suspended so that all surfaces are exposed.

NOTE 5—If it is likely that the specimen might exude moisture or chemicals or both under the exposure conditions, provisions should be made to collect any drippings and include the weight with the specimen weight.

5.3 Weigh each specimen immediately to an accuracy of ± 0.2 %, one at a time, as they are removed from the conditioning chamber. Observe and record the general appearance of the specimens.

5.4 Dry each specimen in an oven at 103 ± 2°C (217 ± 4°F) until approximately constant weight is attained, and reweigh. Constant weight can be assumed when two consecutive readings taken 2 h apart agree within 0.2 %. Avoid drying for periods longer than necessary to achieve constant weight, since thermal decomposition of chemical or wood might occur reflecting a higher than actual moisture content.

6. Calculations

6.1 Calculate the "apparent" moisture content of each sample prior to high-humidity exposure as follows:

$$\text{Moisture content, \%} = [(A - B)/B] \times 100 \quad (1)$$

where:

A = weight prior to high-humidity exposure, and
B = ovendry weight.

6.2 Calculate the "apparent" moisture content of each sample after high-humidity exposure as follows:

$$\text{Moisture content, \%} = [(C - B)/B] \times 100 \quad (2)$$

where:

C = weight after high-humidity exposure, and
B = ovendry weight.

6.3 When data are available for untreated specimens exposed under identical conditions, the change in the "apparent" moisture content of the specimens shall be calculated as the difference between the average moisture contents for the treated and untreated specimens as calculated in 6.2.

NOTE 6—These methods of determining the "apparent" moisture content do not correct for any volatilization of chemical during the ovendrying, which increases the calculated percent moisture content. Also, the calculation for percent moisture content is relative to the total specimen weight of wood and chemical. The percent moisture content relative to the wood weight alone is higher and this value may also be calculated by reducing the B value in the divisor of the above equation by the known or assumed percentage of chemical in the treated specimen.

7. Report

7.1 Report the following information:

7.1.1 Complete identification of the fire-retardant product as to species of wood, wood product, and treatment.

7.1.2 Description of sampling procedure and number and dimensions of test specimens.

7.1.3 General description of humidity chamber and controls used for the test.

7.1.4 When data are available for untreated specimens exposed simultaneously with the treated specimens to the high-humidity condition, the average moisture content of the untreated specimens shall be reported.

7.1.5 The average "apparent" moisture content for the treated specimens, both before and after high-humidity exposure, including the basis of the computation; treated specimen (wood and chemical) or wood only basis, shall be reported. The change in the average moisture content after high-humidity exposure compared to the moisture content of untreated specimens (7.1.4) shall also be reported.

7.1.6 Report any change in the appearance of the specimen during exposure, including surface wetness, chemical exudation, or crystals on surface.

8. Precision and Bias

8.1 There is insufficient data available to write a precision and bias statement. When such data becomes available, it will be included in a future edition of this test method.

9. Keywords

9.1 fire-retardant treated wood; hygroscopicity; moisture content