

1(3)

UDC 620.1

HYGROSCOPIC PROPERTIES OF FIRE-RETARDANT TREATED WOOD AND WOOD-BASED PRODUCTS

Key words: Wood, fire-retardant treated wood, moisture, hygroscopic properties, test method

1 SCOPE

This test method prescribes the procedure for determining the equilibrium moisture content of fire-retardant treated (FRT) wood and wood-based product samples after exposure to a standard high relative humidity condition of $90 \pm 3\%$ at $27 \pm 2^\circ\text{C}$.

2 FIELD OF APPLICATION

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, 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 if FRT wood has hygroscopic properties, i.e. obtains higher moisture contents than equivalent untreated wood at the same climatic conditions.

3 REFERENCES

This Nordtest method is a slightly modified and extended version of ASTM D 3201-94 (with the same title). The extension aims at more repeatable and reproducible results by requiring conditioning to equilibrium moisture content (instead of a specified time, one week, in the ASTM version without specifying the sample size or air velocities in the climate chamber).

4 DEFINITIONS

Constant mass is defined as being reached when the difference between two successive weighing operations carried out at an interval of 24 h is not greater than or equal to 0,1% or 0,1 g, whichever is the greater in terms of mass (in accordance with EN 13238).

5 SAMPLING, SAMPLE HANDLING AND PREPARATION

5.1 Specimens that represent the lot shall be selected. Unless otherwise specified, the specimen size shall be 100 x 100 mm and with actual thickness, preferably 10–20 mm. The specimens shall be free from knots, if possible, and may be either planed or unplaned. At least three specimens per product shall be sampled.

5.2 The retention level of the FR chemicals shall be noted when available. The retention shall be at least the same as required for fire classification.

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

6 TEST METHOD

6.1 Principle

The test is based on gravimetric measurements.

6.2 Equipment

6.2.1 Conditioning Rooms or chambers with air circulation and controlling instruments capable of maintaining the climates $90 \pm 3\%$ RH at $27 \pm 2^\circ\text{C}$ and $50 \pm 3\%$ RH at $23 \pm 2^\circ\text{C}$.

6.2.2 Oven, air-circulated and vented, capable of maintaining a temperature of $103 \pm 2^\circ\text{C}$.

6.2.3 Balance – A balance that will weigh a specimen within an accuracy of $\pm 0.2\%$.

6.2.4 Trays or bowls for collecting exuded liquid from each specimen at high moisture exposure, see 6.5.1.3.

6.3 Testing environment

See 6.2, 6.4 and 6.5.1.

6.4 Pre-conditioning of test samples

The specimens shall be conditioned at $50 \pm 3\%$ RH at $23 \pm 2^\circ\text{C}$ until constant mass prior to the high-humidity exposure.

6.5 Test procedure and data processing

6.5.1 Test procedure

6.5.1.1 Weigh each specimen to an accuracy of $\pm 0.2\%$.

6.5.1.2 Expose all specimens under constant humidity conditions of $90 \pm 3\%$ at $27 \pm 2^\circ\text{C}$ until constant mass is obtained. Specimens shall be suitably suspended so that all surfaces are exposed.

6.5.1.3 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. One tray or bowl per specimen shall be used. Report if exudation occurs.

6.5.1.4 Weigh each specimen immediately to an accuracy of $\pm 0.2\%$, one at a time, as they are removed from the conditioning chamber. Repeat the weighing after 24 h until constant mass is achieved. Constant weight can be assumed when two consecutive readings agree within 0.2 %. Observe and record the general appearance of the specimens, e.g. salt stains on the surface.

6.5.1.5 Dry each specimen in an oven at $103 \pm 2^\circ\text{C}$ 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.

6.5.2 Data processing

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

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

where:

A = weight prior to high-humidity exposure

B = oven-dry weight.

6.5.2.2 Calculate the equilibrium moisture content of each sample after high-humidity exposure as follows:

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

where:

C = weight after high-humidity exposure (incl. any liquid exuded from the FRT wood)

B = oven-dry weight.

6.6 Applicability

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

6.6.2 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.

6.6.3 The repeatability and reproducibility of the method have to be determined. The validity has been demonstrated mainly in the US. An initial limited study [1] has shown a mean repeatability in four laboratories of 6% measured as coefficient of variation and a mean reproducibility of 9% measured in the same way.

6.7 Uncertainty

6.7.1 There is insufficient data available to write a precision and bias statement. When further data become available, they will be included in a future edition of this test method.

6.7.2 Untreated control specimen should always be used to provide relative information on the high-humidity conditions used.

6.8 Test report

Report the following information:

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

6.8.2 Description of sampling procedure, number and dimensions of test specimens.

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

6.8.4 The moisture content for untreated specimens exposed simultaneously with the treated specimens.

6.8.5 The moisture content for the treated specimens, both before and after high-humidity exposure, shall be reported. The change in the average moisture content after high-humidity exposure compared to the moisture content of untreated specimens (6.8.4) shall also be reported.

6.8.6 Any changes in the appearance of the specimen during exposure, including surface wetness, chemical exudation, or crystals on surface.

6.8.7 Name and address of the testing laboratory incl identification number of the test report.

6.8.8 Name and address of the organisation or person ordering the test.

6.8.9 Name and address of the manufacturer or supplier of the tested object.

6.8.10 Date of supply of tested objects and duration of test period.

6.9 Acceptance or rejection of the result

Rules for acceptance based on maximum moisture content and appearance of specimen are given separately, see e.g. [2].

7 LITERATURE

1. Durability of fire retardant wood – New test methods and round robin. Nordtest-project 1527-01. Tråtek report P 0211040, 2002.
2. Requirements for approval of FRT wood products used at humid conditions. In Norwegian (Kravdokument for frivillig godkjenningssordning for brannimpregnerte treprodukter brukt i fuktige miljøer). Nordic Wood project P99096. Final version, December 2001.