NORDTEST Method

NT FIRE 053
Approved 2003-12

UDC 620.1

ACCELERATED WEATHERING OF FIRE-RETARDANT TREATED WOOD FOR FIRE TESTING

Key words: Fire-retardant treated wood, weathering, fire testing, test method

1 SCOPE

1.1 The durability of a fire-retardant treatment of wood under exposure to accelerated weathering is covered by this standard. It is intended for fire-retardant treatment of wood by pressure impregnation, rather than simply by surface coating.

1.2 Two alternative methods are described, A and B, both suitable for application to a test specimen prior to subjecting that specimen to an appropriate fire test. These methods are applicable to treated wood products or assemblies thereof. The test specimens will be in the form of, or suitable for fabrication into, fire test specimens.

2 FIELD OF APPLICATION

2.1 This standard provides a choice between two methods, A and B, of exposing fire-retardant treated (FRT) wood products or assemblies to controlled accelerated weathering. The exposure simulates effects of leaching, drying, temperature and, in method B, also ultraviolet light.

2.2 A research study (Forest Products Laboratory, Research Paper FPL 194, 1973) showed that the two exposure methods, A and B, were equivalent in leaching effect as demonstrated by the flame-spread results obtained on specimens exposed by either method when fire tested by ASTM E 84, the 25-foot tunnel test, and ASTM E 286, the 8-foot tunnel test (now withdrawn).

3 REFERENCES

This Draft Nordtest Method is based on ASTM D 2898-94 (with the same title) and slightly extended. Pre-conditioning and weighing of specimen are added to increase the output information from the test. Rules for edge seal of small specimens are also added.

4 DEFINITIONS

–

5 SAMPLING, SAMPLE HANDLING AND PREPARATION

5.1 The test specimen shall include all those essential parts of the corresponding fire test specimen that may be subjected to weather exposure in normal use.

Products may be tested with a coating, e.g. a primer for exterior applications, but the results will then be valid only for products with this coating.

Products to be tested should have sufficient fire properties. If this is not documented, an initial fire test is recommended.

5.2 The specimen size shall be the same as for the subsequent fire testing or preferably larger. A minimum size along the grain shall be 500 mm.

5.3 The edges perpendicular to grain shall be sealed in order to avoid excessive leaching due to small sample size. A suitable seal consists of a thin coat of alkyd primer and a thick top coat of silicon sealer.

5.4 If the fire testing is performed in very small scale, e.g. in the cone calorimeter (ISO 5660), the specimen for fire testing shall be cut at a distance ≥100 mm from the sealed edge of the exposed board.

5.5 Specimens for preferably three or more, but at least two fire tests shall be exposed.

5.6 Untreated specimens, when available, of the same species or wood-based product and of the same size, shall be exposed to the pre-conditioning, accelerated weathering exposure and drying along with the treated specimens (but not to fire testing) in order to obtain mass loss data.

5.7 The retention level of FR chemicals in the wood specimen shall be noted when available.

6 TEST METHOD

6.1 Principle

FRT wood products are exposed to accelerated weathering by cycles of rain, drying and in one case (method B) also UV light before being fire tested.

Published by Nordtest
Tekniikantie 12
FIN–02150 Espoo
Finland

Phone: + 358 9 455 4600
Fax: + 358 9 455 4272
E-mail: nordtest@nordtest.org
Internet: www.nordtest.org

ISSN: 1459–2819
Project: 1527-01/2

6.2 Equipment (see Figures 1 and 2)

6.2.1 The test apparatus shall be capable of subjecting the specimen uniformly to the test conditions described in Section 6.5.

6.2.2 The specimen surface shall have a slope of 4:12 i.e. 18° to the horizontal plane.

6.2.3 Water spray nozzles shall be provided and arranged so as to distribute water evenly over the exposed specimen surface. Water shall not impinge directly on those surfaces which are not exposed either to the weather in the assembled form, or to fire in the subsequent fire test.

6.2.4 Heating during drying cycles shall be thermostatically controlled. Forced air movement shall be uniform across the specimen surface, with provisions made for adequate air changes to assure thorough drying.

6.2.5 In method B, ultraviolet light shall be distributed as evenly as possible over the specimen surface, using sunlamps (General Electric Type H275 RUV (275 W) or Osram Ultra-Vitalox (300 W) or equivalent) directed normal to, and mounted 66 mm above, the specimen measured from the bottom of the lamp. One lamp shall be used for each 0.75 m^2 of specimen, or fraction thereof.

6.3 Testing environment

See 6.5.

6.4 Pre-conditioning of test samples

The specimen shall be conditioned at 50 ± 3% RH and 23 ± 2°C (or other climate as specified for the subsequent fire test) before being exposed to accelerated weathering.

6.5 Test procedure

6.5.1 Weigh the test specimen before starting the exposure.

6.5.2 Method A

6.5.2.1 Subject the specimens to an exposure cycle consisting of twelve one-week cycles. Each cycle is to consist of 96 h of water exposure and 72 h of drying.

NOTE: A shorter period e.g. four weeks/cycle may be used for screening purposes.

6.5.2.2 Apply water in a moderately fine spray uniformly over the exposed specimen surfaces by spray nozzles that deliver an average of 1.8 cm of water per hour (0.30 l/min · m^2 of specimen surface) at a temperature between 2 and 16°C.

Do not re-circulate the water. Water quality may be important in some cases, especially pH and hardness, and should be noted.

6.5.2.3 Dry at a thermostatically controlled temperature of 57 to 60°C in a room or chamber. The controlling temperature shall be the air temperature measured 2.5 cm above the specimen surface. Accompany drying with air movement directed across the face of the specimens at a rate of at least 7.6 m/min.

6.5.2.4 At the start of the next cycle, change the position of each specimen within the exposure rig so that each specimen occupies approximately an equal number of cycles in each location used.

6.5.3 Method B:

6.5.3.1 Subject the specimen to a 24 h exposure cycle consisting of 4 h wetting, 4 h drying, 4 h wetting, 4 h drying, and 8 h rest. Repeat this cycle for a total of 1000 h.

6.5.3.2 Apply water in a moderately fine spray uniformly over the exposed specimen surface at a rate of 12 ± 0.8 l/min · m^2 of specimen surface. The temperature shall not exceed 32°C. During the first three cycles drain all water rather than re-circulate it. In each subsequent wetting period, circulate a volume of at least 18 l of fresh water through each spray head.

6.5.3.3 Dry at a temperature of 63 ± 3°C, with this temperature attained within 15 min from the start of drying. The controlling temperature shall be the air temperature 2.5 cm above the specimen surface. Obtain the temperature by bare thermocouples or other temperature sensors which are protected from the direct radiation of the lamps by a shield not larger than 13 cm^2. Accompany drying with air movement directed across the face of the specimen at a rate of at least 7.6 m/min. Exposure to the ultraviolet sunlamps shall be continuous throughout the drying period.

6.5.3.4 At the start of the next cycle, change the position of the specimens within the exposure rig so that each specimen occupies approximately an equal number of cycles in each location used.

6.5.4 Conditioning

6.5.4.1 Upon completion of the prescribed exposure, the specimens shall be conditioned at 50 ± 3% RH and 23 ± 2°C (or other climate as specified for the subsequent fire test).

6.5.4.2 Weigh the specimen.

6.5.4.3 Calculate the mass loss of each specimen exposed by

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

where:

A = conditioned weight prior to accelerated exposure
B = conditioned weight after accelerated exposure.

6.6 Applicability

6.6.1 The results from this standard and the subsequent fire testing are useful in determining exposure limitations in service of FRT wood products, mainly if exterior application is suitable.

6.6.2 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 3% measured as coefficient of variation and a mean reproducibility of 12% measured in the same way.

6.7 Uncertainty

6.7.1 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.

6.8 Test report

No formal test report is required. Mass loss, initial retention of FR chemicals and any deviations from the standard procedure and any special observations shall be reported to clients performing subsequent fire testing. Mass loss data for the untreated control specimens shall also be reported.

6.9 Acceptance or rejection of the results

Acceptance levels are based on subsequent fire testing, see e.g. [2].

7 LITERATURE

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

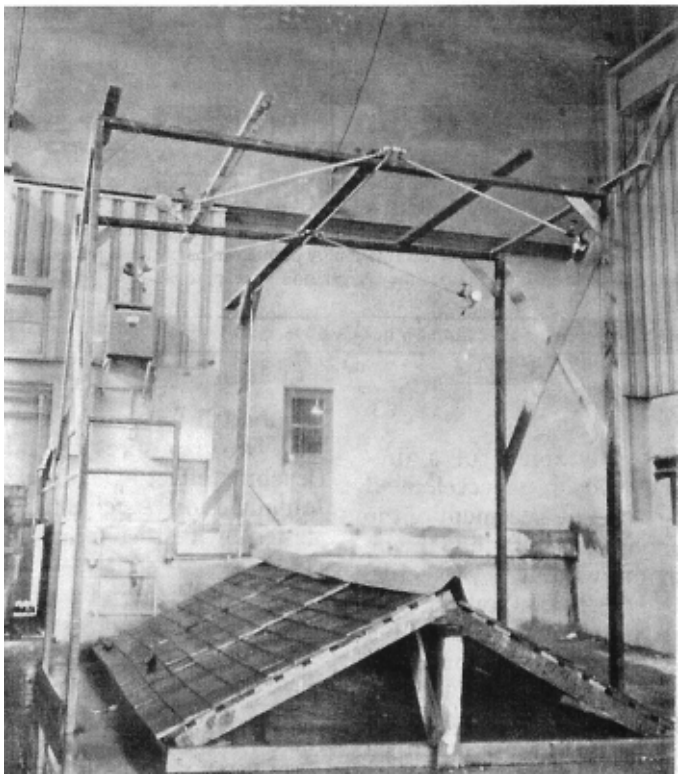

Figure 1. Rain test apparatus suitable for Method A (from ASTM D 2898-94).

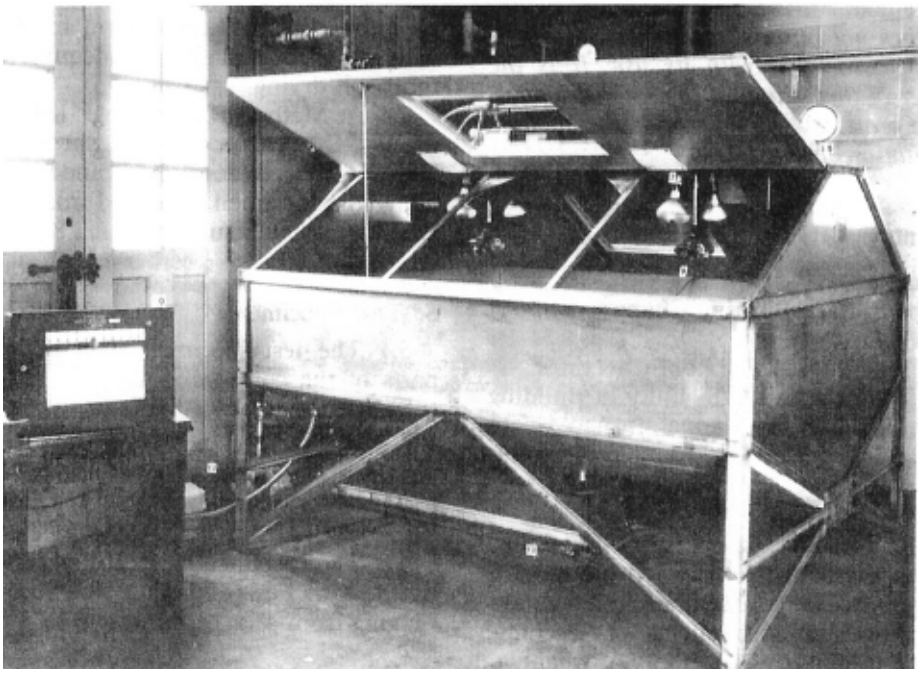

Figure 2. Exposure chamber suitable for Method B (from ASTM D 2898-94).

"This Nordtest method is derived, pursuant to a limited license, from ASTM D2898-94 (1999) Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing, copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA, 19428, USA. Reprinted with permission of ASTM."