BS EN 839:2014

BSI Standards Publication

Wood preservatives — Determination of the protective effectiveness against wood destroying basidiomycetes — Application by surface treatment

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National foreword

This British Standard is the UK implementation of EN 839:2014. It supersedes DD CEN/TS 839:2008 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/515, Wood preservation.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Produits de préservation du bois - Détermination de l'efficacité protectrice vis-à-vis des champignons basidiomycètes lignivores - Application par traitement de surface

Holzschutzmittel - Bestimmung der vorbeugenden Wirksamkeit gegen Holz zerstörende Basidiomyceten - Anwendung mit Oberflächenverfahren

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Contents

Page

Foreword

This document (EN 839:2014) has been prepared by Technical Committee CEN/TC 38 “Durability of wood and wood-based products”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2015 and conflicting national standards shall be withdrawn at the latest by May 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 839:2008.

In comparison with the previous version of the document, EN 839:2014 has been revised editorially.

This document includes annexes; Annex A, Annex C, Annex D and Annex E are informative and Annex B is normative.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard specifies a laboratory method of test which gives a basis for assessing the effectiveness of a wood preservative, when applied as a surface treatment, against wood destroying basidiomycetes. It tests whether the applied treatment is able to prevent the penetration of the fungi into the untreated interior of the test specimens under the conditions of test.

This laboratory method provides one criterion by which the effectiveness of a product can be assessed. In making this assessment, the methods by which the preservative may be applied should be taken into account. It is also recommended that results from this test should be supplemented by those from other relevant tests and above all by practical experience.

The procedures described in this European Standard method are intended to be carried out by suitably trained and/or supervised specialists.

Suitable precautions should include the use of separate rooms, areas within rooms, extraction facilities, conditioning chambers and special training for personnel. Also see Annex E for environmental, health and safety precautions.

1 Scope

This European Standard specifies a method of test for the determination of the protective effectiveness of a wood preservative, applied to the surface of the wood, against wood destroying basidiomycetes cultured on an agar medium.

The method is applicable to all products which are to be applied by superficial application processes. This includes:

— organic solvent-based wood preservatives; or

— organic water-dispersible formulations, as supplied or as prepared in the laboratory by dilution of concentrates; or

— water-soluble products; or

— chemicals which are being studied as active ingredients for application by superficial processes.

This method may be used in conjunction with an ageing procedure, for example EN 73.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 3696, *Water for analytical laboratory use - Specification and test methods (ISO 3696)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
representative sample
sample having its physical and/or chemical characteristics identical to the volumetric average characteristics of the total volume being sampled

[SOURCE: EN 1001-2, 4.71]

3.2
supplier
sponsor of the test (person or company providing the sample of wood preservative to be tested)

[SOURCE: EN 1001-2, 4.83, modified]

3.3
superficial application process
process which does not include particular features or procedures intended to overcome the natural resistance of wood to penetration of a wood preservative in its ready to use form

[SOURCE: EN 1001-2, 4.82]

4 Principle

Several series of test specimens of a susceptible wood species are end-sealed with a material to prevent penetration of the wood preservative under test into the end grain of the test specimens. The end-sealed test specimens are treated with the wood preservative under test using the process and application rate specified by the supplier.

NOTE Suitable application methods are brushing, pipetting and dipping.

The treated test specimens are exposed to attack by basidiomycetes in pure culture. The performance of the test product is assessed in terms of its ability to prevent decay as determined by the maximum acceptable loss in mass and the absence of visible decay of the surface and the untreated interior.

5 Test materials and apparatus

5.1 Biological material

The test fungi to be used are as follows:

5.1.1 Obligatory fungus in all cases

— *Coniophora puteana* (Schumacher ex Fries) Karsten (BAM Ebw. 15) on softwood.

Loss in mass of Scots pine sapwood in 16 weeks: a mass fraction of minimum 20 %.

5.1.2 Obligatory fungus for particular hazards

— *Coriolus versicolor* (Linnaeus) Quélet (CTB 863A) on hardwood and/or on softwood as appropriate.

Loss in mass of beech in 16 weeks: a mass fraction of minimum 20 %.

Loss in mass of Scots pine sapwood in 16 weeks: a mass fraction of minimum 15 %.

5.1.3 Two species to be used compulsorily on the basis of the nature of the test product

For all products except creosote-type products:

— *Poria placenta* (Fries) Cooke *sensu* J. Eriksson (FPRL 280) on softwood.

Loss in mass of Scots pine sapwood in 16 weeks: a mass fraction of minimum 20 %;

— *Gloeophyllum trabeum* (Persoon ex Fries) Murrill (BAM Ebw. 109) on softwood.

Loss in mass of Scots pine sapwood in 16 weeks: a mass fraction of minimum 20 %.

For creosotes and similar products:

— *Lentinus lepideus* Fries ex Fries (BAM Ebw. 20) on softwood.

Loss in mass of Scots pine sapwood in 16 weeks: a mass fraction of minimum 20 %;

— *Lentinus cyathiformis* (Schaeffer ex Fries) Bresadola (CTB 67-02B) on hardwood.

Loss in mass of beech in 16 weeks: a mass fraction of minimum 20 %.

5.1.4 Optional fungi

For specific regional uses or conditions, it is also possible to select other fungi on an optional basis.

When optional fungi are used, information similar to that given in Annex A for the obligatory fungi should be included in the test report.

5.1.5 Maintenance of strains

The strains shall be maintained and treated (frequency of subculturing, alternation of culture media, etc.) in accordance with the instructions of their laboratory of origin (see A.2). The parent strain shall be maintained in the laboratory of its origin so as to conserve and to ensure its vigour.

If tests are not undertaken regularly or if a strain shows signs of degeneration a new standard culture of the strain should be obtained from the laboratory of its origin for each test (see A.2). When new strains are received, the virulence shall be tested to ensure the strain can achieve the minimum loss in mass (see 5.1.1, 5.1.2 and 5.1.3).

5.2 Products and reagents

5.2.1 Culture medium

The culture medium is a malt agar medium with the following composition:

— malt extract:

  — in concentrated form: (50 ± 0,5) g;

  — in powder form: (40 ± 0,5) g;

— agar causing no inhibition of growth of fungi:

  — (20 ± 0,5) g to (30 ± 0,5) g;

— water conforming to grade 3 of EN ISO 3696.

  — quantity to make up to 1 000 ml.

Prepare this medium by warming the mixture in a boiling water bath or steam bath, stirring until completely dissolved.

Place in each culture vessel (5.3.1) a sufficient quantity of the medium to provide a minimum depth of 3 mm to 4 mm when in its in-use position. Close the vessels as specified in 5.3.1 and sterilize in an autoclave at 121 °C for 20 min. Let the vessels cool in their in-use position.

5.2.2 Solvents and diluents

For water soluble or water dispersible preservatives:

— water conforming to grade 3 of EN ISO 3696.

For preservatives to be diluted or dissolved in an organic solvent:

— suitably volatile liquids that leave no residue in the wood that would have a toxic effect on the fungi at the end of the post-treatment conditioning period.

NOTE Toluene and xylene of recognized analytical grade have been found suitable.

5.2.3 Fumigant (if necessary)

Xylene technical grade.

5.2.4 End-seal compound

A material resistant to the penetration of the wood preservative under test and the test fungi, or separate materials for each, and without any fungistatic or fungicidal activity within the test specimen.

NOTE Three brush coats of a 2-component epoxy lacquer, with drying between each application, have been found to be suitable.

5.3 Apparatus

5.3.1 *Culture vessels*, Kolle flasks or equivalent vessels with a capacity of between 400 ml and 650 ml, providing a flat surface area of between 85 cm^2 and 120 cm^2 for the medium.

NOTE 1 Examples of suitable vessels are given in EN 113.

NOTE 2 Kolle flasks are usually plugged with a wad of cotton wool. Other culture vessels are usually fitted with leak proof lids, the centres of which are pierced with a round hole of up to 15 mm diameter and plugged with a wad of cotton wool.

5.3.2 *Drying oven*, capable of being controlled at (103 ± 2) °C.

5.3.3 *Desiccators*, with efficient desiccant (silica gel for example).

5.3.4 *Conditioning chamber*, well ventilated and controlled at (20 ± 2) °C and (65 ± 5) % relative humidity.

5.3.5 *Drying supports*, which will give a minimum contact with the treated test specimens. The supports shall be of a material that does not react with the test solvent or test wood preservative, for example glass for organic products.

5.3.6 *Culture chamber*, (incubator or room), dark and controlled at (22 ± 2) °C and (70 ± 5) % relative humidity.

5.3.7 *Test specimen supports*, made of glass, stainless steel or any other inert material, that is to say, with no risk of having any effect on the culture medium, the fungus, the wood or the test wood preservative, or of being itself modified. Supports can be capable of holding either one or two test specimens. The supports are used to prevent direct contact of the test specimens with the culture medium, but shall not separate them from it by more than 3 mm.

If abnormally high moisture contents in the test specimens are experienced consistently, use of test specimen supports of approximately 5 mm thick can help to control the problem. If thicker test specimen supports are used, this should be recorded in the test report.

5.3.8 *Ordinary laboratory equipment*, including a balance capable of weighing to the nearest of 0,01 g and an autoclave.

6 Sampling of the preservative

The sample of the wood preservative shall be representative of the product to be tested. Samples shall be stored and handled in accordance with any written instructions from the supplier.

For the sampling of wood preservatives from bulk supplies, the procedure given in EN 212 should be used.

7 Test specimens

7.1 Species of wood

The species of wood to be used shall be susceptible to attack by fungi and shall be readily penetrated by liquids.

The reference species are Scots pine (*Pinus sylvestris* Linnaeus) representing softwoods and beech (*Fagus sylvatica* Linnaeus) representing hardwoods.

Additional tests may be undertaken using other species corresponding to the above characteristics, and of particular importance for certain countries, but if so this shall be stated in the test report.

7.2 Wood quality

The wood shall be free from cracks, stain, decay, insect damage or other defects. The wood shall not have been water-stored, floated, chemically treated or steamed.

NOTE Wood that has been kiln dried at temperatures below 60 °C can be used.

The Scots pine shall be exclusively sapwood containing little resin and having between 2,5 and 8 annual growth rings per 10 mm. The proportion of latewood in the annual rings shall not exceed 30 % of the whole.

The beech shall be even-grained, free from tyloses and discoloration. It shall have between 2 and 6 annual growth rings per 10 mm.

7.3 Provision of the test specimens

Prepare planed strips having a cross section of (25 ± 0,5) mm × (15 ± 0,5) mm. The longitudinal faces shall be parallel to the direction of the grain. The annual rings shall have a contact angle of (45 ± 15)° to the broad faces. Make transverse cuts, neatly to give sharp edges and a fine-sawn finish to the end-grain surfaces, to give test specimens (50 ± 0,5) mm long.

For treatment, drying and ageing, the test specimens can be retained in planed strips of a length sufficient to provide one test specimen for exposure to each of the test fungi. Each strip should be end-sealed prior to treatment.

The specimens shall originate from a minimum of three trees or shall be taken at random from a stock originally of more than 500 test specimens and originating from at least five planks.

7.4 Dimensions and density of test specimens

The dimensions of each test specimen at a mass fraction of (12 ± 2) % moisture content shall be (50 ± 0,5) mm x (25 ± 0,5) mm x (15 ± 0,5) mm.

NOTE A moisture meter of the two-pronged electrical conductivity type is suitable for assessing moisture content.

The total surface area of the faces to be treated is theoretically 40 cm^2 but an allowance shall be made for any encroachment of the sealing compound on to these faces.

In a batch of test specimens to be treated, the density of an individual is permitted to differ from the mean value of the batch by ± 10 %. This tolerance is increased to ± 20 % for the untreated test specimens. The mean density for the treated test specimens used for the test shall be recorded in the test report.

7.5 Number and distribution of test specimens

The test specimens are divided into:

a) e_1 treated test specimens:

— These are the treated test specimens subjected to attack by the wood destroying fungi. Use at least six test specimens for each combination of preservative, quantity to be applied, preservative concentration, test fungus and for each timber species.

— In case of dipping select at least 6 test specimens within a range of 10 % from the target retention. Supplementary samples shall be treated, in order to have a sufficient number of correctly treated specimens to put in test.

The treated test specimens are assessed by visual examination for decay of their surfaces and/or interior by the test fungi. If optional tests for colonisation of the test fungi are required as an additional method of assessment, this should be carried out on a parallel series of treated test specimens (Annex C).

b) e_2 untreated test specimens:

— $e_{2.1}$ untreated control test specimens: these are untreated test specimens, equal in number to the treated test specimens e_1 and of the same wood species, which are placed one in each culture vessel together with a treated test specimen;

— $e_{2.2}$ virulence control test specimens: these are untreated test specimens which are subjected to attack by the test fungi to monitor vigour. Use six of these for each combination of test fungus and timber species used in the test.

c) e_3 treated check test specimens for calculation of the correction value:

These are test specimens treated in exactly the same way as the e_1 test specimens. Use at least six test specimens for each combination of preservative, quantity to be applied and preservative concentration and of the same wood species. They are placed, after drying, conditioning and any appropriate ageing in uninoculated culture vessels, two in each vessel. Variations in mass of these test specimens make it possible to determine the correction factor (C) of the variations in mass of the treated test specimens e_1 resulting from factors other than attack by the test fungi. At a given treating concentration, factor C is the mass fraction change of the e_3 test specimens.

Mark each specimen so that it can be identified throughout the test.

8 Procedure

8.1 Preparation of the untreated test specimens

Place the numbered untreated test specimens ($e_{2.1}$ and $e_{2.2}$) in the oven (5.3.2) and leave them there for 18 h to 24 h[1)]. Cool to room temperature in a desiccator (5.3.3) and weigh to the nearest 0,01 g to determine the initial dry mass (m_0). Place the test specimens in the conditioning chamber (5.3.4) until they need to be sterilized (8.3).

1) In the case of supplementary tests (7.1) using species of wood other than Scots pine sapwood or beech, this drying time may need to be longer than 18 h to 24 h; the drying time should be such that the test specimens achieve constant mass. This can be established by selecting at random from the batch being dried 10 test specimens; after drying and cooling as directed, determine the total mass, return the test specimens to the oven and repeat the operation at intervals of not less than 4 h. Constant mass is achieved when the total mass of the selected specimens does not lose more than 0,05 g between weighing.

NOTE Untreated test specimens are not end-sealed.

8.2 Preparation of the treated test specimens

8.2.1 Preparation

Place the numbered test specimens to be treated (e_1 and e_3) in the oven at (103 ± 2) °C (5.3.2) and leave them there for 18 h to 24 h[1)]. Cool to room temperature in a desiccator (5.3.3) and weigh to the nearest 0,01 g to determine the initial dry mass (m_0). Place the test specimens in the conditioning chamber (5.3.4) until they need to be end-sealed (8.2.2).

8.2.2 End-sealing

Apply the end-sealing compound resistant to the penetration of the test wood preservative (5.2.4) to both end-grain surfaces of each test specimen to be treated (e_1 and e_3). Allow to dry in the conditioning chamber (5.3.4) for at least 24 h after the last application.

Since variation in end seal amount can create errors on mass loss careful operation in applying the end seal as evenly as possible is required. As quality control guideline a variation within a 10 % limit should be envisaged and additional absolute mass correction to all specimens could be useful.

8.2.3 Treatment with the test wood preservative

Treat the test specimens e_1 and e_3 on the unsealed longitudinal faces. If application is by brushing or by pipette, calculate the amount of test product required to treat each face. Apply the amount evenly to each face individually and weigh the test specimen before (m_1) and after (m_2) each application to the nearest 0,01 g. Allow to dry between applications. Calculate the uptake of wood preservative solution for each face of each test specimen (m_2 - m_1). Calculate the total uptake for each test specimen and express it in grams of wood preservative per square metre of treated surface.

NOTE If the balance has a tare facility, it is easier to tare the balance with the test specimen on it, apply the test wood preservative, and then record the uptake directly.

If application is by dipping, weigh each test specimen to the nearest 0,01 g (m_1), dip for the required time then remove any excess liquid with absorbent paper. Reweigh each test specimen immediately and record the mass after treatment (m_2).

Calculate the uptake of wood preservative solution for each test specimen (m_2 - m_1) and express it in grams of wood preservative per square metre of treated surface.

8.2.4 Drying

Following treatment (8.2.3), place the treated test specimens on drying supports (5.3.5) in the conditioning chamber (5.3.4). Invert the test specimens twice each week. Dry the test specimens until weighing at 24 h intervals are within ± 0,01 g.

NOTE The length of the drying period will vary with the nature of the test wood preservative.

If test specimens are to be subjected to an ageing procedure, this shall be carried out after this drying procedure.

If the test specimens have been retained as planed strips, they should be cross-cut into (50 ± 0,5) mm lengths to provide individual test specimens at this point.

8.2.5 Final end-sealing

Following drying (8.2.4), apply the fungus resistant end-sealing compound (5.2.4) or, if necessary, additional dual-purpose end-sealing compound to both end-grain surfaces of each treated test specimen (e_1 and e_3).

NOTE Additional application of dual-purpose end-sealing compound is most likely to be necessary when the treatment has resulted in swelling of the test specimens and resultant cracking of the end-seal.

Since variation in end seal amount can create errors on mass loss careful operation in applying the end seal as evenly as possible is required. As quality control guideline a variation within a 10 % limit should be envisaged and additional absolute mass correction to all specimens could be useful.

8.2.6 Final conditioning

Place the treated test specimens in the conditioning chamber (5.3.4) for at least 3 d.

8.3 Exposure to fungi

Inoculate the culture medium (see 5.2.1) in the culture vessels (5.3.1) not more than seven days after sterilization of the medium. The inocula shall be obtained from cultures which are less than four weeks old and which are still actively growing across the growth medium, or have covered it for less than one week. After inoculation, place the culture vessels in the culture chamber (5.3.6).

The exposure to fungi shall take place as soon as the mycelium completely covers the surface of the culture medium. This corresponds to the active phase of development; in no case should this period exceed four weeks. The fungi shall be free from contamination by other organisms.

Into each culture vessel, introduce aseptically one or two previously sterilised test specimen supports (5.3.7).

NOTE 1 For methods of sterilization, see Annex B.

Place one treated test specimen (e_1) and one untreated test specimen ($e_{2.1}$), previously sterilized by one of the procedures given in Annex B, on the support(s) in each inoculated culture vessel.

Place the previously sterilized untreated test specimens ($e_{2.2}$) two in each inoculated culture vessel.

NOTE 2 If several tests are running in parallel, only one set of virulence test specimens is required.

Place two treated check test specimens (e_3) in each uninoculated culture vessel as indicated in 7.5 to establish the correction factor (C).

8.4 Culture conditions and duration of test

After introducing the test specimens, return the culture vessels to the culture chamber (5.3.6) and leave them there for 16 weeks.

8.5 Assessment of test

8.5.1 All test specimens

At the end of the test, withdraw the test specimens from the vessels, removing any adhering mycelium. Record evidence of waterlogging or inhibition of growth of the test fungus caused, by volatile components of the wood preservative or contaminating organisms.

Weigh each test specimen to the nearest 0,01 g at the end of the test, (m_3). After oven drying to constant mass, weigh each test specimen again to the nearest 0,01 g, (m_4). Calculate the moisture content of each test

specimen at the end of the test by expressing its water content (m_3 - m_4) as a percentage of its final dry mass (m_4).

Calculate the loss in mass of each untreated test specimen by expressing the loss in mass (m_0 - m_4) as a percentage of the initial dry mass (m_0).

Calculate the mean loss in mass of the virulence control test specimens ($e_{2.2}$).

Calculate the mass loss of each treated test specimen (e_1) by expressing the mass loss (m_o – m_4) as a percentage of the initial dry mass (m_o). Calculate the correction factor (C) which is the mean percentage mass loss of the treated check test specimens (e_3) of each treating solution concentration. Subtract the appropriate value of C from the percentage mass loss of each treated test specimen (e_1) to determine the corrected mass loss.

NOTE A method for determination of colonisation as an optional means of assessment is mentioned in Annex C and requires an additional series of test specimens.

8.5.2 Examination of the treated test specimens (e_1)

Examine the surface of each treated test specimen and record evidence of visible decay; this process can be aided by gently probing with a pointed implement, for example a knife with a pointed blade. Split each test specimen longitudinally and parallel to the 15 mm wide faces using a sharp knife.

Examine each half and record evidence of visible decay.

NOTE In the case of white rot fungi, white discoloration (bleaching) and/or dark inhibition streaks are regarded as decay.

8.5.3 Validity of results

Reject any treated test specimen (e_1) having no visible decay which:

a) appears abnormal in relation to moisture content, that is showing signs of an excessive moisture content (waterlogged) ; or

b) shows signs of contaminating microorganisms; or

c) when the corresponding untreated control test specimen ($e_{2.1}$) shows a mass loss of less than the minimum value given in 5.1.

Reject any treated test specimen showing visible decay which shows evidence of the colonization via a defective end-seal.

The test can be evaluated if the mean loss in mass of the virulence control test specimens ($e_{2.2}$) is equal to or higher than the minimum value given in 5.1.

The data from any combination of preservative, quantity to be applied, preservative concentration, test fungus and timber species are valid provided that the results from at least five treated test specimens have been accepted.

8.5.4 Interpretation of results

The protection provided for the wood by the test wood preservative at a given application rate is deemed to be adequate if:

a) not more than one test specimen showing signs of decay exclusively at its surface has suffered a mass loss greater than 3,0 % but less than 5,0 % independent of the number of valid replicates (8.5.3); or

b) not more than one treated test specimen e_1 shows internal decay.

9 Statement of results

Express the results in terms of the application rate as grams of product per square metre of treated area, giving information on how the product was diluted, if appropriate.

10 Test report

The test report shall include at least the following information (see also Annex D for an example):

a) the number of this European Standard and date of its publication;

b) the name of the supplier of the wood preservative product under test;

c) the unique name or code of the wood preservative tested (based on info from the manufacturer) and an indication of whether or not the composition has been declared;

d) the name and concentration of the active ingredient;

e) if relevant, the density of the wood preservative according to data provided by the supplier;

f) the date of supply of the wood preservative;

g) the solvent or diluent used;

h) the species of wood used;

i) the average density of the treated test specimens used for the test;

j) the species and strain numbers of the fungi used for the test;

k) details of any dilution(s) made;

l) method of treatment;

m) the quantity of solution, expressed in grams, applied to each test specimen, the quantity of the wood preservative, expressed in grams per square metre, and the mean values;

n) the length of the drying period;

o) the length of any storage period after drying and before any ageing or before exposure to fungi or both;

p) where applicable, the nature of any ageing test carried out, specifying the type, conditions and duration, reference being made to a standard where appropriate;

q) the means of sterilization used;

r) the date when the test specimens were exposed to the test fungi;

s) the date when the test specimens were removed from the test fungi and the duration of the test;

t) for each test specimen, the loss in mass expressed as percentage of the initial dry mass;

u) the mean loss in mass of the $e_{2.2}$ virulence control test specimens exposed to each of the test fungi and a statement on the validity of the test;

v) for each treated test specimen, the presence of visible decay;

w) a statement on the interpretation of the results;

x) any deviation from the standard method and any factors that may have affected the results;

y) the name of the organization responsible for the test report and the date of issue;

z) the name and signature of the officer(s) in charge of testing

and the following:

NOTE "The interpretation and practical conclusions that can be drawn from a test report demand a specialized knowledge of wood preservation and, for this reason, the test report cannot of itself constitute an approval certificate."

Annex A
(informative)

Test fungi

A.1 General information on maintenance and acquisition of test strains

Laboratories holding the parent strain should re-isolate the strain after growth on untreated wood if it shows any sign of weakness.

Laboratories which run tests regularly may maintain the strains themselves, but if the strain shows any signs of weakness, a fresh culture should be obtained from the laboratory of origin. All laboratories maintaining test fungi should test the virulence at least once a year, using virulence control test specimens, exposed using the method described in 8.4.

If tests are not undertaken regularly or if a strain shows signs of degeneration a new standard culture of the strain should be obtained from the laboratory of its origin for each test (see 5.1).

The laboratory sending test cultures should provide all growth features characteristic of the respective fungus.

When sending cultures special care has to be taken to avoid any harmful influence during transport, e.g. by freezing during air-transport. To avoid the effects of X-rays, the cultures should be packed in aluminium containers or wrapped in aluminium foil. International Regulations exist concerning the transport of cultures. Information on these can be obtained from any recognized culture collection, for example a member of the European Culture Collection Organization.

When new strains are received, the virulence should be tested to ensure it exceeds the minimum given in 5.1.

A.2 Maintenance and treatment of test fungi

At least every six months, test strains should be re-isolated from untreated wood which is being actively attacked.

NOTE When undertaking tests regularly, the process of re-isolation can be carried out in association with each test to provide cultures for future tests.

Two virulence control test specimens of beech for *Coriolus versicolor* and *Lentinus cyathiformis* and Scots pine sapwood for the other obligatory fungi should be sterilized. Alternatively, two small wood test specimens, measuring approximately 5 mm (grain direction) × 30 mm x 30 mm, of the appropriate species should be sterilised. The test specimens, without ageing, should be exposed to attack by the test fungus using the exposure system described in 8.4 for a period of six to eight weeks for virulence control test specimens or four weeks for the smaller test specimens. Without oven drying, under sterile conditions, the virulence control test specimens should be split open, small splinters of wood from the centre of the test specimens should be removed and partly embedded in a mass fraction of 5 % malt agar medium in test tubes or Petri dishes and the fungi should be allowed to grow. The smaller test specimens should be transferred whole to the mass fraction of 5 % malt agar medium. The fungi should be allowed to grow out of the wood. These cultures should be used for future tests and to provide stock cultures for future use.

The virulence of the test fungi should be checked at least once a year. If tests are done less than once a year, a separate virulence test should be undertaken prior to test.

A.3 Information regarding obligatory fungi

A.3.1 *Coniophora puteana* (Schumacher ex Fries) Karsten (Synonym: *Coniophora cerebella* (Persoon) Duby).

Strain: BAM Ebw. 15 (Bundesanstalt für Materialforschung und -prüfung - D 12200 BERLIN).

Activity: Fungus causing a brown rot of hardwood and softwood.

Simple laboratory culture, rapid growth on malt agar medium, or malt agar-peptone.

Maintenance: Store stock cultures at 5 °C to 8 °C.

Subculture every six months on malt agar medium.

A.3.2 *Coriolus versicolor* (Linnaeus) Quélet (Synonyms: *Polyporus versicolor* Linnaeus ex Fries - *Polystictus versicolor* (Linnaeus) Saccardo - *Trametes versicolor* (Linnaeus ex Fries) Pilát).

Strain: CTB 863A (Centre Technique du Bois et de l'Ameublement, Allée de Boutaut - BP 227, F 33 028 Bordeaux cedex).

Activity: Fungus causing a fibrous white rot of hardwood.

Simple laboratory culture, rapid growth on malt agar medium.

Maintenance: Store stock cultures at 5 °C to 20 °C.

Subculture every six weeks on malt agar medium.

A.3.3 *Gloeophyllum trabeum* (Persoon ex Fries) Murrill (Synonyms: *Lenzites trabea* (Persoon ex fries) Fries - *Trametes trabea* (Persoon ex Fries) Bresadola).

Strain: BAM Ebw. 109 (Bundesanstalt für Materialforschung und -prüfung - D 12200 BERLIN).

Activity: Fungus causing a brown rot of hardwood and softwood.

Cultivation in well-ventilated conditions, rapid growth on malt agar medium.

Maintenance: Store stock cultures at 5 °C to 8 °C.

Subculture every six months on malt agar medium.

A.3.4 *Lentinus cyathiformis* (Schaeffer ex Fries) Bresadola (Synonym: *Lentinus degener* Kalchbrenner apud Fries)

Strain: CTB 67-02B (Centre Technique du Bois et de l'Ameublement, Allée de Boutaut - BP 227, F 33 028 Bordeaux cedex).

Activity: Fungus causing a brown rot of hardwood.

Simple laboratory culture, medium rapid speed of growth.

Maintenance: Store stock cultures at 5 °C to 20 °C.

Subculture every six months on malt agar medium.

A.3.5 *Lentinus lepideus* Fries ex Fries (Synonym: *Lentinus lepideus* (Fries ex Fries) Fries).

Strain: BAM Ebw. 20 (Bundesanstalt für Materialforschung und -prüfung - D 12200 BERLIN).

Activity: Fungus causing a brown rot of softwood.

Simple laboratory culture, but fairly slow development on malt agar medium.

Maintenance: Store stock cultures at 5 °C to 8 °C.

Subculture every six months on malt agar medium.

A.3.6 *Poria placenta* (Fries) Cooke *sensu* J. Eriksson (Synonyms: *Poria monticola* Murrill - *Postia placenta* (Fries) M. Larsen ex Lombard)).

Strain: FPRL 280 (Building Research Establishment Ltd - Garston, Watford, Herts WD25 9XX - UK).

Activity: Fungus causing a brown rot of softwood.

Simple laboratory culture, rapid speed growth on malt agar medium.

Maintenance: Store stock cultures at 5 °C to 20 °C.

Keep stock cultures on a mass fraction of 5 % malt agar medium and subculture every three months.

Annex B
(normative)

Methods of sterilization

B.1 Ionizing radiation

This method is suitable for all wood preservatives and is especially preferred for organic wood preservatives and those wood preservatives for which the reactivity with epoxyethane is unknown.

Place the test specimens individually, or in groups of similarly treated replicates, in polyethylene envelopes (at least 90 µm thick) and seal the envelopes by hot iron welding.

Polyethylene sheeting may be used, folding the sheet over the test specimen bed and welding along three sides. It is more practical to use polyethylene tubing sold in rolls. The test specimens are introduced into this tubing which is then welded both sides of the test specimens.

Send the envelopes thus prepared to an irradiation centre. Advice with regard to the packing of the envelopes shall be obtained from the irradiation centre.

Subject the envelopes to a dose of between 25 kGy[2)] and 50 kGy when using radioisotopes (e.g. ^{60}Co sources) or between 50 kGy and 100 kGy when using electron-accelerators.

There does not appear to be any difference between sterilization obtained with a high intensity for a short time or a low intensity applied over a prolonged period. After irradiation, the envelopes may be safely stored for several weeks without detrimental effects.

Do not open the envelopes until the precise moment when the contents are to be used.

B.2 Epoxyethane-based sterilant

This method is not recommended for organic wood preservatives and is unsuitable for products containing boron compounds or chlorinated or phenolic substances.

The toxic and explosive nature of this product requires special safety measures. Reference should be made to any national regulations governing its use.

Place the test specimens individually in low density polyethylene envelopes (thickness of 30 µm to 90 µm) which are sealed by hot iron welding.

Place the test specimens for 60 min in an appropriate apparatus where the epoxyethane is at a concentration of 1,2 g/l at a pressure of 550 kPa, the temperature being 55 °C and the relative humidity being 70 % to 80 %.

Ventilate the test specimens for 5 d by exposing them to a current of sterile air.

Do not open the envelopes until the precise moment when the contents are to be used.

2) 1 kGy = 1 kJ/kg = 0,1 Mrad.

B.3 Epoxypropane-based sterilant

This method is not recommended for organic wood preservatives and is unsuitable for products containing boron compounds or chlorinated or phenolic substances.

The chemical nature of this product requires safety measures. Reference should be made to any national regulations governing its use.

Place the test specimens for 24 h in a vessel containing 2 ml of epoxypropane per litre volume of the vessel, and then ventilate them for at least 2 d by exposing them to a current of sterile air.

In the case of *Lentinus lepideus*, which is a fungus particularly sensitive to epoxypropane, experience has shown that the cultures shall not be more than 15 d old at the time when the test specimens are exposed. In order to obtain sufficient surface colonisation of the medium within 15 d, inoculate each culture vessel in at least three equidistant positions approximately 20 mm from the centre.

B.4 Steam

This method shall only be used for preparations known to be heat stable and not volatile in steam.

The day before the test specimens are to be planted in the culture vessels, place them in glass or other suitable dishes, placing only test specimens treated with the same application rate of the test product in the same dish. Arrange the test specimens so that they do not touch, placing glass or stainless steel rods between each of them.

Cover the dishes, and place them in a steamer. The steam shall circulate round the dishes for 20 min.

Leave the dishes to cool, store them for 24 h in a room at ambient temperature and then repeat the sterilization procedure for 10 min.

Do not open the dishes until the precise moment when the test specimens are to be placed in the culture vessels.

Annex C
(informative)

Examination of colonisation

C.1 General

Sometimes, especially if white rot fungi are used, it may be difficult to decide whether or not the test fungus has colonised the interior of the test specimens. In early stages of colonisation the fungus may have penetrated the wooden cells, using the cell content as nutrient source before degrading the wood substance. In this case tests for the isolation of the test fungus from the interior of the test specimens can provide additional information.

C.2 Procedure

If optional tests for colonisation of the test fungi are required as an additional method of assessment, this should be carried out on a parallel series of treated test specimens (see 7.5).

Use at least six treated test specimens c_1 and the equal number of untreated test specimens c_2 (equivalent to the test specimens e_1 and $e_{2.1}$ of 7.5) for each combination of wood preservative, quantity to be applied, wood preservative concentration, test fungus and for each timber species.

Prepare the test specimens according to 8.1 and 8.2, expose them to the test fungi according to 8.3 and leave them in the culture chamber according to 8.4.

C.3 Assessment of test

C.3.1 All test specimens

At the end of the test, withdraw the test specimens from the test vessels, removing any adhering mycelium. Record evidence of waterlogging or inhibition of growth of the test fungus caused, by volatile components of the wood preservative or contaminating organisms.

C.3.2 Untreated test specimens (c_2)

Weigh each test specimen to the nearest 0,01 g at the end of the test, (m_3). After oven drying to constant mass, weigh each test specimen again to the nearest 0,01 g, (m_4). Calculate the moisture content of each specimen at the end of the test by expressing its water content (m_3 - m_4) as a percentage of its final dry mass (m_4).

Calculate the loss in mass of each untreated test specimen by expressing the loss in mass (m_0 - m_4) as a percentage of the initial dry mass (m_0).

C.3.3 Examination of the treated test specimens (c_1)

Examine the surface of each treated test specimen and record evidence of visible decay; this process can be aided by gently probing with a pointed implement, for example a knife with a pointed blade. Clean the surface of each test specimen of adhering fungus and surface sterilize by lightly flaming or by a momentary dip in a disinfectant. Split each test specimen longitudinally and parallel to the 15 mm wide faces using an implement

which is sharply tapered to start the split (see Figure C.1). It is recognized that the splits will follow the grain of the wood and thus the slices will not be totally uniform.

NOTE 1 These procedures are designed to prevent transfer of fungal material from the original surface of the test specimens onto the surfaces created by splitting.

Examine each slice and record evidence of visible decay. If no decay is observed in a test specimen, select three slices for isolation of the test fungus. The slices shall be taken from the mid-line and approximately 6 mm either side of the mid-line. From each slice, cut three chips of wood from the central zone. Partly embed each chip in 5 % malt agar medium in test tubes or Petri dishes and incubate in the culture chamber (5.3.6). Observe for the growth of the test fungus over a period of 14 d and record.

NOTE 2 A medium selective for the growth of basidiomycetes can be used to prevent the growth of contaminating microorganisms.

C.4 Validity of results

Reject any treated test specimen (c_1) having no visible decay and no growth of the test fungus from the sample chips which:

a) appears abnormal in relation to moisture content, that is showing signs of an excessive moisture content (waterlogged); or

b) shows signs of contaminating microorganisms; or

c) if the corresponding untreated control test specimen (c_2) shows a mass loss of less than the minimum value given in 5.1.

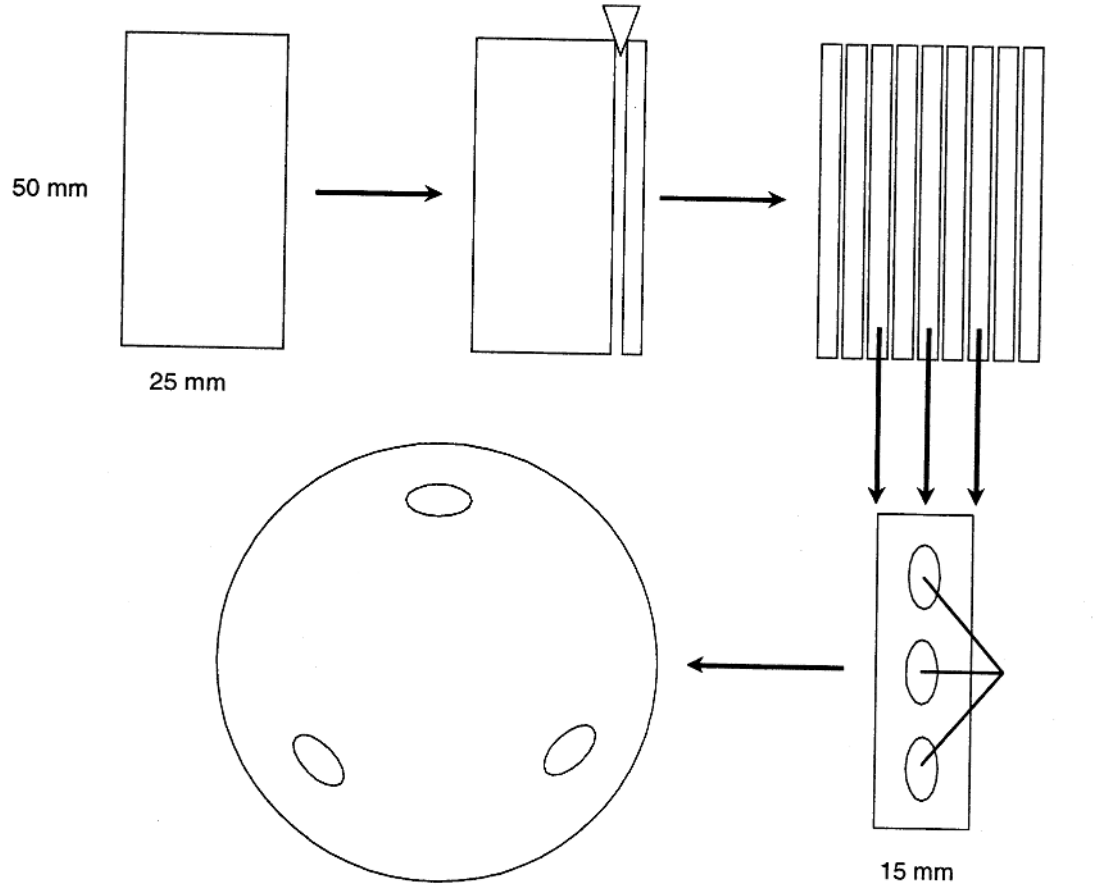
Reject any treated test specimen showing visible decay which shows evidence of the colonization via a defective end-seal.

The test can be evaluated if the mean loss in mass of the virulence control test specimens (c_2) is equal to or higher than the minimum value given in 5.1.

The data from any combination of preservative, quantity to be applied, wood preservative concentration, test fungus and timber species should be regarded as valid provided that the results from at least five treated test specimens have been accepted.

C.5 Statement of results

The results should be expressed in terms of the application rate as grams of wood preservative per square metre of treated area, giving information on how the wood preservative was diluted, if appropriate.



Key

1 sample chips

Figure C.1 — Splitting and sampling of treated test specimens

Annex D
(informative)

Example of a test report

Number and date of this European Standard:	EN 839:2014
Name of supplier:	Company S
Name and type of the product:	Z; organic solution; composition declared
Name and concentration of the active Ingredient:	W; a mass fraction of 0,25 %
Density of the product:	0,84 g/ml
Solvent or diluent used:	None, supplied ready-to-use
Species of wood used:	Scots pine sapwood (*Pinus sylvestris* L)
	Beech (*Fagus sylvatica* L)
Average density of treated test specimens:	485 kg/m^3 (pine); 710 kg/m^3 (beech)
Species of fungi used:	*Coniophora puteana* BAM Ebw. 15)
	Gloeophyllum trabeum BAM Ebw. 109) pine
	Poria placenta FPRL 280)
	Coriolus versicolor CTB 863A - on beech
Application of test product:	See Table D.2
Method of treatment	Brushing
Drying period:	7 d air drying
Storage period after drying:	None
Ageing procedures carried out:	None
Method of sterilization:	Ionizing irradiation
Date of exposure to fungi:	12/12/2014
Date removed from fungi:	03/04/2015; 16 weeks in test
Losses in mass virulence controls:	See Table D.1; the test was valid
Assessment of treated test specimens:	See Table D.2
Interpretation of results:	See Table D.2
Deviations from the standard:	None
Report prepared by:	Laboratory B, Anytown, UK
Name and signature of the officer(s) in charge:	Mr D, Mrs E
Date:	09/04/2015

The sample of product Z was received by Laboratory B on 19/11/2014.

NOTE The interpretation and practical conclusions that can be drawn from a test report demand a specialized knowledge of wood preservation and, for this reason; the test report cannot of itself constitute an approval certificate.

Table D.1 — Virulence control test specimens; loss in mass in percentage

Test fungus (timber)	Individual	Mean	Minimum required by this prestandard
Coniophora puteana (Scots pine)	45,6 55,3 54,6 57,2 56,1 57,7	54,4	20,0
Gloeophyllum trabeum (Scots pine)	34,2 27,7 31,0 31,1 28,2 28,8	30,2	20,0
Poria placenta (Scots pine)	41,0 38,8 27,0 30,8 33,6 28,0	33,2	20,0
Coriolus versicolor (beech)	30,1 33,3 29,3 29,0 43,4 34,3	33,2	20,0
The test was valid with the mean losses in mass for all fungi exceeding the minimum values required by this European Standard.			

Table D.2 — Summary of results with Product Z

Test fungus (timber)	Loss in mass untreated control test specimen	Application of test product by brushing		Condition of treated test specimen	
		g per specimen	g/m^2	Visible decay	Corrected mass loss %
Coniophora	62,3	0,74	185	-	0,0
puteana	39,8	0,76	190	-	0,1
BAM Ebw.15	38,9	0,75	188	-	0,1
(Scots pine)	58,5	0,76	190	-	0,3
	64,1	0,76	190	-	0,4
	62,5	0,74	185	-	0,0
		mean 0,75	**mean 188**		
Gloeophyllum	31,6	0,76	190	+	0,1
trabeum	38,9	0,75	188	-	0,0
BAM Ebw. 109	40,8	0,75	188	-	0,1
(Scots pine)	21,2	0,75	188	-	0,2
	31,4	0,76	190	+	2,5
	32,5	0,76	190	-	0,0
		mean 0,76	**mean 189**		
Poria placenta	47,0	0,76	190	-	0,0
FPRL 280	53,0	0,74	185	-	0,1
(Scots pine)	36,3	0,75	188	-	0,0
	44,0	0,76	190	-	0,0
	44,4	0,75	188	+	1,2
	38,5	0,76	190	-	0,0
		mean 0,75	**mean 189**		
Coriolus	27,9	0,76	190	+	0,4
versicolor	29,5	0,76	190	-	0,0
CTB 863A	27,2	0,75	188	-	0,0
(beech)	24,9	0,75	188	+	3,8
	28,8	0,75	188	-	0,3
	30,1	0,77	193	-	0,0
		mean 0,76	**mean 190**		

- \- Absent.
- \+ Present.

Annex E
(informative)

Environmental, health and safety precautions within chemical/biological laboratory

When preparing this standard, consideration was given to the minimization of environmental impacts caused by the use of the methods of analysis.

It is the users' responsibility to use safe and proper techniques in handling materials in the methods of analysis specified in this standard.

The following list is not exhaustive but users of this standard may use it as a guide to the use of safe and proper techniques. They should:

— investigate if European Directives, transposed European legislation and national laws, regulations and administrative provisions apply;

— consult manufacturers/ suppliers for specific details such as material safety data sheets and other recommendations;

— use safety equipment and wear protective clothing, usually goggles and coats, appropriate for the test product and the test chemicals, in all laboratory areas, to ensure the safety of the operator;

— be careful about flammable materials and substances that are toxic and/ or human carcinogens and generally take care during transportation, decanting, diluting and dealing with spillages;

— use a fume cupboard during preparation of organic solvent solutions;

— store, handle and dispose of chemicals in a safe and environmentally satisfactory manner: including chemicals for laboratory test, test specimens, unused solvents and reagents that have to be disposed of.

Bibliography

[1] EN 73, *Wood preservatives - Accelerated ageing tests of treated wood prior to biological testing - Evaporative ageing procedure*

[2] EN 113, *Wood preservatives - Test method for determining the protective effectiveness against wood destroying basidiomycetes - Determination of the toxic values*

[3] EN 212, *Wood preservatives - General guidance on sampling and preparation for analysis of wood preservatives and treated timber*

[4] EN 1001-1:2005, *Durability of wood and wood-based products - Terminology - Part 1: List of equivalent terms*

[5] EN 1001-2:2005, *Durability of wood and wood based products - Terminology - Part 2: Vocabulary*

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