EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 113
September 1996
+ A1
January 2004

ICS 71.100.50 Supersedes EN 113:1980, EN 113:1980/A1:1981 and EN 113:1980/A2:1985

Descriptors: Wood, wood preservatives, pest control, fungi, basidiomycetes, laboratory tests, effectiveness, effectiveness limit

English version

Wood preservatives — Test method for determining the protective effectiveness against wood destroying basidiomycetes — Determination of the toxic values

(includes amendment A1:2004)

Produits de préservation du bois — Méthode d'essai pour déterminer l'efficacité protectrice vis-à-vis des champignons basidiomycètes lignivores — Détermination du seuil d'efficacité (inclut l'amendement A1:2004)

Holzschutzmittel — Prüfverfahren zur Bestimmung der vorbeugenden Wirksamkeit gegen holzzerstörende Basidiomyceten — Bestimmung der Grenze der Wirksamkeit (enthält Änderung A1:2004)

This European Standard was approved by CEN on 1996-09-02, and amendment A1 was approved by CEN on 2003-11-28. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 38, Durability of wood and derived materials, the Secretariat of which is held by AFNOR.

This European Standard supersedes EN 113:1980, EN 113:1980/A1:1981 and EN 113:1980/A2:1985.

The significant technical differences between this edition and EN 113:1980 are as follows:

— application to water-dispersible formulations;

— the use of only one fungus but *Coriolus versicolor* being only used for particular hazards;

— the taking into account of the correction value for the loss in mass;

— new criteria of validity of test and interpretation of results;

— complement to annex regarding test fungi.

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 March 1997, and conflicting national standards shall be withdrawn at the latest by March 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This document (EN 113:1996/A1:2004) has been prepared by Technical Committee CEN/TC 38, Durability of wood and derived materials, the Secretariat of which is held by AFNOR.

This Amendment to the European Standard EN 113:1996 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2004 and conflicting national standards shall be withdrawn at the latest by July 2004.

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

Contents

Introduction

This European Standard specifies a laboratory method of test which gives a basis for the assessment of the effectiveness of a wood preservative against wood destroying basidiomycetes. By using this method it is possible to determine the loading at which impregnated wood of a susceptible species may be regarded as adequately protected under the conditions of test.

This laboratory method provides one criterion by which the value of a product can be assessed, and this criterion should be used to judge the value of the preservative taking into account the methods of application likely to be used.

The procedures described in this standard method are intended to be carried out by suitably trained and/or supervised specialists. Appropriate safety precautions should be observed throughout the use of the standard. Any deviation, however small, from the procedures given in this standard can influence the results, so it is important that the procedures given in this method are followed precisely.

1 Scope

This European Standard specifies a method for determining the toxic values of wood preservatives previously introduced into the wood by full impregnation against wood destroying basidiomycetes cultured on an agar medium.

This method is applicable to products which are capable of achieving uniform and complete penetration of the test specimens including:

— water-insoluble chemicals which are being studied as active ingredients; or

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

— organic water-dispersible formulations as supplied or as prepared in the laboratory by dilution of concentrates which are capable of achieving uniform and complete penetration of test specimens (see Clause **7**) by the procedure described in **8.2.2**; or

— water-soluble products, for example salts.

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

2 Normative reference

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revisions. For undated references the latest edition of the publication referred to applies.

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods.*

3 Definitions

For the purposes of this standard, the following definitions apply:

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

3.2
supplier
the sponsor of the test

4 Principle

Impregnation of several series of test specimens of a susceptible wood species with solutions in which the concentrations of preservative are ranged in a given progression.

Exposure of these test specimens to attack by basidiomycetes in pure culture to establish the toxic values of the product under test.

5 Test materials and apparatus

5.1 Biological material

The test fungi to be used as follows:

5.1.1 ***Obligatory fungus in all cases*** (see also Annex D)

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

Loss in mass in percentage in 16 weeks of Scots pine sapwood specimens: minimum 20 % (*m*/*m*).

5.1.2 ***Obligatory fungus for particular hazards*** (see also Annex D)

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

Loss in mass in percentage in 16 weeks of beech specimens: minimum 20 % (*m*/*m*); of Scots pine sapwood specimens: minimum 15 % (*m*/*m*).

5.1.3 ***Two species to be used compulsorily on the basis of the nature of the product*** (see also Annex D)

For creosotes and similar products:

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

Loss in mass in percentage in 16 weeks of Scots pine sapwood specimens: minimum 20 % (*m*/*m*);

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

Loss in mass in percentage in 16 weeks of beech specimens: minimum 20 % (*m*/*m*).

For all other products:

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

Loss in mass in percentage in 16 weeks of Scots pine sapwood specimens: minimum 20 % (*m*/*m*);

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

Loss in mass in percentage in 16 weeks of Scots pine sapwood specimens: minimum 20 % (*m*/*m*).

5.1.4 For specific regional uses or conditions, it is also possible to select other fungi on an optional basis[1)].

5.1.5 Maintenance of strains. The strains shall be maintained and treated (that is frequency of subculturing, alternation of culture media, etc.) in accordance with the instructions from their laboratory of origin (see Annex **D.2**). The parent strain shall be maintained in the laboratory of its origin such that its vigour is conserved and assured.

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 ISO 3696; quantity to make up to 1 000 ml.

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

[1)] See Annex E for a recommended but non-comprehensive list of optional fungi.

Place in each culture vessel 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 **5.3.9** and sterilize in the 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 preservatives:

— water conforming to grade 3 of 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.

5.3 Apparatus

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

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

5.3.3 *Drying oven,* maintained at (103 ± 2) °C.

5.3.4 *Treatment vessels,* of a material that does not react with their contents, for example of glass for organic products and of plastics materials for salts containing fluorine.

5.3.5 *Ballast,* to prevent floating of test specimens. The ballast shall not react with any materials with which they come into contact during the test.

5.3.6 *Safety equipment and protective clothing,* appropriate for the test product and the test solvents, to ensure the safety of the operator.

5.3.7 *Vacuum vessels,* fitted with stopcocks.

5.3.8 *Vacuum pump,* fitted with a pressure gauge and capable of maintaining a pressure of (0,7 ± 0,1) kPa[2)]

5.3.9 *Kolle flasks or equivalent culture 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 (see Figure C.1, Figure C.2 and Figure C.3) and allowing air exchange.

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

5.3.10 *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 product impregnated, or of being itself modified. The supports are used to prevent direct contact of the specimens with the culture medium, but shall not separate them from it by more than 3 mm.

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

5.3.11 *Drying vessel(s),* provided with a close-fitting cover and containing supports that will give minimum contact with the treated test specimens to be placed on them. The vessels and supports shall be of materials that do not react with the test solvent or test preservative, for example glass for organic products or plastics material for salts containing fluorine.

5.3.12 *Equipment for chemical gas or steam sterilization or access to a rediation source* (see Annex B).

5.3.13 *Ordinary laboratory equipment,* including a balance capable of weighing to an accuracy of 0,01 g and a desiccator with an efficient desiccant (for example, silica gel).

[2)] 100 kPa = 1 bar.

6 Sampling of the preservative

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

NOTE For the sampling of 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 impregnated 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 may be used.

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

The beech shall be even-grained wood free from tyloses, discoloration and red heart. It shall have between two annual growth rings and six annual growth rings per 10 mm.

7.3 Provision of test specimens

Cut the specimens from planed strips having a cross-section of (25 × 15) mm, on which the growth rings may run in any direction with the exception of a completely tangential orientation on the broad faces which is unacceptable.

The longitudinal faces shall be parallel to the direction of the grain. Transverse cuts shall be made neatly to give sharp edges.

The specimens shall originate from a minimum of three trees or shall be taken at random from a stock originally of more that 5 000 specimens and originating from at least 20 planks.

7.4 Dimensions and density of specimens

The nominal dimensions of each specimen, measured at 12 % (*m*/*m*) moisture content, shall be: (50 ± 0,5) mm × (25 ± 0,5) mm × (15 ± 0,5) mm.

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

The volume of each specimen is theoretically 18,75 cm^3, but the dimensions of each test specimen shall be checked so that the actual volume is known. If the tolerance is no more than ±0,2 mm, the volume of all specimens can be taken as 18,75 cm^3.

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

7.5 Number and distribution of test specimens

The specimens are divided into:

e_1 Treated test specimens:

these are the impregnated specimens subjected to attack by the wood destroying fungi. Use at least four treated test specimens for each preservative concentration [including a solvent or diluent control (concentration = 0)], for each fungus and for each timber species.

e_2 Untreated test specimens:

$e_{2.1}$ control specimens: these are non-impregnated 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 with the treated specimens.

$e_{2.2}$ virulence control specimens: six of these non-impregnated specimens of the appropriate timber species are subjected to attack by each wood destroying fungus.

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, at least four per concentration which are placed, after drying, conditioning and any appropriate ageing in uninoculated culture vessels, two in each vessel. Variations in mass of these 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.

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

NOTE It is advisable to treat more specimens than the minimum number required to select those having the uptake nearest to the target.

8 Procedure

8.1 Preparation of test specimens

8.1.1 *Conditioning of test specimens before treatment*

Place the numbered test specimens in the oven (**5.3.3**) and leave them there for 18 h[3)]. Cool to room temperature in a desiccator and weigh to the nearest 0,01 g to determine the initial dry mass, (m_o). Replace the test specimens in the desiccator and store them there in order to keep them dry until impregnation.

Calculate the mean density of the specimens of each species using the mean mass and the specimen volume.

8.2 Treatment of test specimens

8.2.1 *Preparation of treatment solutions/dilutions*

Prepare a series of concentrations (by mass) of the preservative in the appropriate solvent or diluent (**5.2.2**).

For solid products prepare a sufficient quantity of the solution of a concentration equal to, or greater than, the highest concentration to be tested. Dilute, on a mass by mass basis, appropriate quantities of this solution to provide a series of at least five concentrations distributed about the expected toxic value.

For liquid products, dilute, on a mass by mass basis, appropriate quantities of the product to provide a series of at least five concentrations distributed about the expected toxic value.

A solvent or diluent control, i.e. treatment at concentration O shall also be included in each test series.

If the approximate toxic values are unknown, the concentrations shall form a widely spaced geometric progression for a first test, and a more closely spaced geometric or arithmetic progression for subsequent tests.

All treatment solutions shall be freshly prepared.

---

3) In the case of supplementary tests (**7.1**) using species of wood other than beech and pine sapwood, this drying time may need to be longer than 18 h; the drying time should be such that the test specimens reach constant mass.

8.2.2 *Impregnation*

Carry out impregnation in ascending order of concentration, starting with the solvent control (concentration = 0).

The following procedure ensures the required complete impregnation of test specimens by the test solutions.

— For each concentration place the test specimens, kept dry as described in **8.1.1** and of known dry mass (m_o) in one of the treatment vessels (see **5.3.4**) so that as much of their surface as possible is exposed (e.g. by piling them crosswise). Ballast the stack of specimens (see **5.3.5**) to prevent them from floating when the liquid is admitted.

— Place each treatment vessel in one of the vacuum vessels (see **5.3.7**) attach the vacuum pump (see **5.3.8**) and reduce the pressure to (0,7 ± 0,1) kPa. Maintain this vacuum for 15 min. Observe the proper safety measures for vacuum vessels. After this period, close the stopcock to the vacuum pump and open the other stopcock to allow the solution of preservative to be drawn into the treatment vessel within the vacuum vessel. Keep the specimens covered completely by the solution throughout the remainder of the impregnation process.

— Next, admit air to bring the vacuum vessel back to atmospheric pressure. Remove the treatment vessel with its submerged specimens from the vacuum vessel, cover it and leave it for 2 h, adding further solution if necessary to keep the specimens fully covered by the liquid.

After this impregnation treatment, remove the test specimens one by one, remove the excess liquid by light blotting with absorbent paper and immediately weigh each to the nearest 0,01 g to ascertain the mass after impregnation (m_1).

NOTE Usually the uptake of treatment solution per test specimen will be in the range of 12 ml to 16 ml in Scots pine sapwood and 10 ml to 14 ml in beech, depending on the type of preservative and solvent.

In the case of preservatives, which are being studied as active substances, calculate the mass of preservative retained for each test specimen, from the mass of solution absorbed ($m_1 - m_o$) and its concentration[4)].

In the case of organic formulations the retention is expressed for each test specimen in terms of the corresponding mass either as the ready to use product, or as the concentrated product, if the product under test is supplied in the form of a concentrate.

Calculate the mass of preservative retained per unit volume of wood in kilograms per cubic metre, for each specimen.

If, in a series of simultaneously impregnated test pieces, the quantity of product absorbed by some test specimens varies by more than 15 % from the mean absorption of the series, the results obtained from these test specimens shall not be included in the mean. These test specimens shall be replaced by supplementary specimens.

8.3 Drying and conditioning of test specimens after treatment

The procedures described below are usually applicable, but if the nature of the preservative is such that alternative procedures are required details of the procedure used shall be included in the test report.

Keep the specimens for four weeks in the conditioning chamber (see **5.3.1**). Arrange the test specimens in the drying vessels (see **5.3.11**), resting on their narrow faces on the supports, and placing only specimens treated with the same concentration of the test preservative in the same drying vessel; avoid contact between specimens. Invert the test specimens twice a week.

In the case of test specimens impregnated using water-soluble products keep the vessel covered for two weeks. To prevent mould growth, also place in the vessel a small dish containing xylene (see **5.2.3**). During the third week, uncover the vessel progressively each day to allow the specimens to dry steadily. From the beginning of the fourth week, leave the vessel completely open.

[4)] When dealing with preservative formulations whose constituents are absorbed selectively by wood, it is necessary to carry out chemical analysis of the solution before and after impregnation. Similarly, analysis is recommended when very dilute solutions are used.

In the case of specimens impregnated with water-insoluble products in an organic solvent, keep the vessel covered for one week. Open it gradually during the second week and finally leave it fully open for the third and fourth weeks.

NOTE The drying and conditioning of the specimens depends on the nature of the product under test and on the solvent or diluent used.

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

8.4 Exposure to fungi

Inoculate the culture medium (see **5.2.1**) in the culture vessels (see **5.3.9**) 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 fully covered it for less than one week.

The exposure to the 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 shall this period exceed four weeks. The fungi shall be free from contamination by other organisms.

Into each culture vessel introduce aseptically two previously sterilized test specimen supports (see **5.3.10**) and on each place one specimen previously sterilized by one of the procedures given in Annex B.

Place one treated specimen (e_1) and one non-impregnated control specimen ($e_{2.1}$) in each inoculated culture vessel.

Place the non-impregnated specimens for virulence control ($e_{2.2}$) two per inoculated culture vessel.

NOTE If several tests are running in parallel, only one set of virulence 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).

8.5 Culture conditions and duration of test

After introducing the test specimens, place the culture vessels in the culture chamber (see **5.3.2**) and leave them there for 16 weeks.

8.6 Assessment of test

8.6.1 *Examination of the test specimens*

At the end of the test, withdraw the test specimens from the culture vessels, removing any adhering mycelium. Record evidence of abnormally high moisture contents (waterlogging) in the test specimens or of inhibition of growth of the test fungus caused by volatile components of the preservative or the presence of contaminating organisms.

Weigh each specimen to the nearest 0,01 g at the end of the test, (m_2). After oven (see **5.3.3**) drying to constant mass, weigh each specimen again to the nearest 0,01 g, (m_3). Calculate the moisture content of each specimen at the end of the test by expressing its water content ($m_2 - m_3$) as a percentage of its final dry mass (m_3).

8.6.2 *Loss in mass caused by fungal attack*

Calculate the loss in mass of each treated test specimen (e_1) by expressing the loss in mass ($m_o - m_3$) as a percentage of the initial dry mass (m_o). Calculate the correction factor *(C)* which is the mean percentage loss in mass 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 loss in mass.

Calculate the mean corrected loss in mass of the treated test specimens (e_1), and the mean loss in mass of the virulence control specimens ($e_{2.2}$).

NOTE 1 Due to the uptake of the preservative, the correction values for specimens in higher concentrations of the preservative may be negative, indicating an increase of the mass. The correction values should be used strictly mathematically.

NOTE 2 With some preservatives, especially creosotes, the increases in mass of the treated check test specimens (e_3) may be very large for the higher concentrations of the preservative. Because of this fact, the use of the correction values of these concentrations may produce erroneous theoretical losses in mass of the treated test specimens (e_1).

To avoid incorrect assessments, the treated test specimens (e_1) of these concentrations of the preservative should be carefully investigated for any visible surface and/or internal attack by the fungus. If there is a calculated loss in mass of any of those test specimens, but no visible fungal attack, it should be mentioned in the test report.

If any test specimen (e_1) or (e_2) shows an increase in corrected mass, this increase should be recorded as such, but taken as zero in any subsequent calculations.

8.6.3 *Validity of results*

Reject any treated test specimen (e_1) having a mass loss of less than 3 % (m/m):

a) which appears abnormal in relation to moisture content, that is having a final moisture content of greater than 80 % (m/m) or less than 25 % (m/m); or

b) which shows signs of contaminating organisms; or

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

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

The data from any combination of concentration of the test preservative and fungus species are valid, provided that the results from at least three treated test specimens have been accepted.

8.6.4 *Interpretation of results*

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

a) the corrected mean loss in mass of the specimens is less than 3,0 % (m/m) of their initial dry mass; and

b) not more than one specimen has suffered a loss in mass greater than 3,0 % (m/m) but less than 5,0 % (m/m) independent of the number of valid replicates (**8.6.3**).

9 Statement of results

The toxic values of a preservative shall be expressed as the following two concentrations:

a) one corresponding to the lowest concentration deemed to be adequate;

b) the other corresponding to the next concentration below a) in the series used, at which the wood is not adequately protected.

Express the toxic values in kilograms of preservative per cubic metre of wood for each combination of fungal species and timber species and in each case also indicate the concentrations of the preservative in the solvent or diluent.

10 Test report

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

a) the number and date of this European Standard;

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

c) the type (Clause **1**) of the preservative tested together with its unique name or code and with 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 preservative according to data supplied by the supplier;

f) the date of supply of the preservative;

g) the solvent or diluent used;

h) the species of wood used;

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

j) the species and strain numbers of fungi used;

k) the concentrations of the preservative tested expressed as percentages by mass;

l) the quantity of solution, expressed in grams, absorbed by each specimen and the quantity of preservative, expressed in kilograms per cubic metre, retained by each specimen;

m) the length of any storage period after drying/conditioning and before any ageing or before exposure to fungi;

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

o) the means of sterilization used;

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

q) the date when the test specimens were removed from the test fungus;

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

s) the correction value *(C)* for each concentration studied;

t) for each combination of preservative concentration, fungal species and timber species, the corrected percentage loss in mass of each test specimen and the mean corrected loss in mass;

u) the mean loss of virulence control specimens exposed to each test fungus;

v) for each combination of fungal species and timber species, the toxic values expressed both as loading in kilograms per cubic metre of wood, and as the concentration of the corresponding solutions as percentage by mass;

w) any deviation from the standard method and any factors that may have influenced the results;

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

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

z) 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)
Example of a test report[5)]

Number and date of European Standard	EN 113:1996	
Name of supplier	Company S	
Name and type of the product	Z; Organic solution; composition declared	
Name and concentration of active ingredient	W; 0,25 % (*m*/*m*)	
Density of the product	0,84 g/ml	
Date of supply of the product	1995-03-01	
Solvent or diluent used	Xylene	
Species of wood used	Scots pine sapwood (*Pinus sylvestris* Linnaeus)	
	Beech (*Fagus sylvatica* Linnaeus)	
Average density of test specimens	485 kg/m^3 (pine); 710 kg/m^3 (beech)	
Species of fungi used	*Coniophora puteana* BAM Ebw. 15 *Lentinus lepideus* BAM Ebw. 20 *Poria placenta* FPRL 280	} on pine
	Lentinus cyathiformis CTB 67-02 B on beech	
Concentrations of the product tested	1 – 1,6 – 2,5 – 4,0 – 6,3 % (*m*/*m*)	
Absorption of solution and quantity of product retained	See Table A.2	
Duration of conditioning after impregnation	31 days	
Ageing tests carried out	None	
Method of sterilization used	Ionizing irradiation	
Date of exposure to fungi	1995-05-25	
Date removed from fungi	1995-09-14	
Uncorrected losses in mass	See Table A.2	
Correction values	See Table A.1 and Table A.2	
Corrected losses in mass	See Table A.2	
Mean mass loss of virulence specimens	*Coniophora puteana* 41,3 % (*m*/*m*) *Lentinus lepideus* 32,5 % (*m*/*m*) *Poria placenta* 33,1 % (*m*/*m*)	} on pine
	Lentinus cyathiformis 38,6 % (*m*/*m*) on beech	
Toxic values	See Table A.3	
This report has been prepared by	Laboratory B	
Location and date	C, 1995-09-25	
Name and signature of the officer(s) in charge	Mr D, Mrs E	

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.

[5)] Detailed results are presented for one test fungus only.

Table A.1 — Calculation of correction values *C* for wood preservative Z (organic) — Scots pine sapwood

Treating solution concentration % (m/m)	Specimen[a] Nr[a]	Uptake of solution g	Preservative retention kg/m^3	Mass loss %	Correction value *(C)* %
	7,3	15,68	0	1,0	
	7,4	15,97	0	0,8	
0	7,5	15,95	0	0,2	0,6
	7,6	16,72	0	0,3	
	mean	**16,08**	**0**	**0,6**	
	7,7	14,46	7,7	–0,8	
	7,8	15,70	8,4	–0,8	
1	7,9	16,27	8,7	–0,7	∠0,7
	8,0	16,53	8,8	–0,7	
	mean	**15,74**	**8,4**	**–0,7**	
	8,1	14,62	12,5	–0,9	
	8,2	16,04	13,7	–1,4	
1,6	8,3	16,27	13,9	–1,4	∠1,4
	8,4	16,82	14,4	–1,7	
	mean	**15,93**	**13,5**	**–1,4**	
	8,5	13,36	17,8	–1,9	
	8,6	14,02	18,7	–1,7	
2,5	8,7	15,72	21,0	–2,3	∠2,0
	8,8	16,11	21,5	–2,0	
	mean	**14,8**	**19,8**	**–2,0**	
	8,9	13,91	28,1	–4,1	
	9,0	14,37	30,7	–2,9	
4	9,1	15,98	34,1	–3,8	∠3,9
	9,2	17,18	36,7	–4,7	
	mean	**15,18**	**32,4**	**–3,9**	
	9,3	13,22	44,4	–5,1	
	9,4	14,85	49,9	–3,8	
6,3	9,5	15,09	50,7	–5,9	∠5,5
	9,6	16,33	54,7	–7,3	
	mean	**14,87**	**49,9**	**–5,5**	

[a] Optional.

Table A.2 — Summary of results (*Coniophora puteana* BAM Ebw. 15) for wood preservative Z (organic) — Scots pine sapwood

Treating solution concentration	Specimen	Uptake of solution	Preservative retention	Uncorrected mass loss	Correction value (see Table A.1)	Corrected mass loss[2]	Mass loss of control specimens	
% (m/m)	Nr[1]	g	kg/m^3	%	%	%	Nr[1]	%
	1	14,44	0	45,6		46,2	51	39.7
	2	15,70	0	30,5		31,1	52	38.6
0	3	15,61	0	38,0	0,6	38,6	53	39.6
	4	16,27	0	36,1		36,7	54	40.5
	mean	**15,51**	**0**	**37,5**		**38,2**		**39.6**
	5	15,60	8,3	4,6		5,3	55	41,6
	6	14,83	7,9	4,6		5,3	56	44,9
1	7	16,41	8,8	4,7	–0,7	5,4	57	43,7
	8	16,91	9,0	5,4		6,1	58	43,9
	mean	**15,93**	**8,5**	**4,8**		**5,5**		**43,5**
	9	13,76	11,7	4,7		6,1	61	36,2
	10	15,07	12,9	6,5		7,9	62	45,3
1,6	11	16,52	14,1	5,8	–1,4	7,2	76	41,3
	12	17,31	14,8	8,5		9,9	64	40,5
	mean	**15,66**	**13,4**	**6,3**		**7,6**	**40,9**	
	13	13,51	17,5	–1,4		0,6	65	31,3
	14	14,17	17,5	–1,8		0,2	66	36,7
2,5	15	16,40	20,1	–1,8	–2,0	0,2	67	37,4
	16	16,83	21,9	–2,1		0	68	33,7
	mean	**15,22**	**19,3**	–1,7		**0,3**		**34,8**
	17	13,51	28,8	–4,1		0	71	38,5
	18	14,17	30,2	–3,0		0,9[3]	72	44,5
4	19	16,40	35,0	–3,9	–3,9	0	73	43,2
	20	16,83	35,9	–4,7		0	74	39,8
	mean	**15,22**	**32,5**	**–3,9**		**0,2**	**41,1**	
	21	13,12	44,1	–5,6		0	75	30,3
	22	13,86	46,6	–3,7		1,8[3]	76	40,1
6,3	23	14,19	47,7	–5,5	–5,5	0	77	35,6
	24	16,27	54,7	–7,2		0	78	33,4
	mean	**14,36**	**48,3**	**–5,5**		**0,5**		**34,8**

[1] Optional.
[2] Gains in mass are taken as zero in subsequent calculations.
[3] Irrelevant theoretical value due to the caluculation of the correction value.

Table A.3 — Summary of toxic values for preservative Z (organic) in xylene

Test fungus	Strain	Timber	Toxic values		
			Treating solution concentration % (m/m)	Preservative retention kg/m³	Mean corrected mass loss for the highest failing concentration %
Coniophora puteana	BAM Ebw.15	Scots pine (sapwood)	1,6 to 2,5	13,4 to 19,3	7,6
Lentinus cyathiformis	CTB 67-02 B	Beech	0,63 to 1,0	4,7 to 7,1	12,4
Lentinus lepideus	BAM Ebw.109	Scots pine (sapwood)	4,0 to 6,3	34,3 to 51,8	3,1
Poria placenta	FPRL 280	Scots pine (sapwood)	1,6 to 2,5	13,6 to 21,3	10,3

Annex B (normative)
Methods of sterilization

B.1 Ionizing irradiation

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

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

NOTE 1 Polyethylene sheeting may be used, folding the sheet over the specimen bed and welding along three sides. It is more practical to use polyethylene tubing sold in rolls. The specimens are introduced into this tubing and welded on both sides.

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 radiation to a radiation dose between 25 kGy[6)] and 50 kGy when using radioisotopes (e.g. ^{60}Co sources) or between 50 kGy and 100 kGy when using electron-accelerators.

NOTE 2 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 preservatives and is unsuitable for products containing boron compounds or chlorinated or phenolic substances.

NOTE 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 specimens individually in low density polyethylene envelopes (between 30 µm to 90 µm thick), and seal by hot iron welding.

Place the 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 specimens for 5 days 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.

6) A1 1 kGy = 1 kJ/kg = 0,1 Mrad. A1

B.3 Epoxypropane-based sterilant

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

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

[A1] *Text deleted* [A1]

Place the 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 [A1] 2 days [A1] 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 days old at the time when the test specimens are exposed. In order to obtain sufficient surface colonization of the medium within 15 days, inoculate each culture vessel in at least three equidistant positions approximately 20 mm from the centre.

B.4 Steam

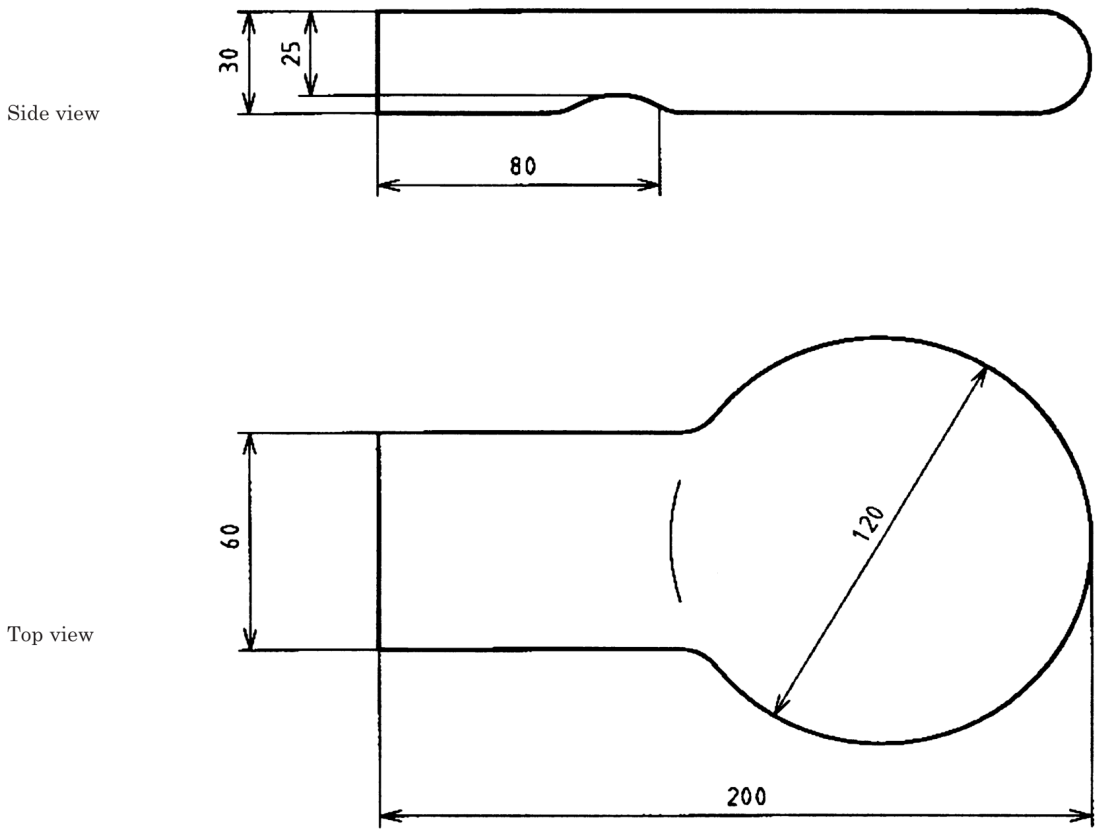
This method shall only be used for preparations known to be heat stable and not volatile in steam. The day before the test specimens are planted in the culture vessels, place them in glass or other suitable dishes, placing only test specimens treated with the same concentration of the test or reference preservative in the same dish. Arrange the 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 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 specimens are to be placed in the culture vessels.

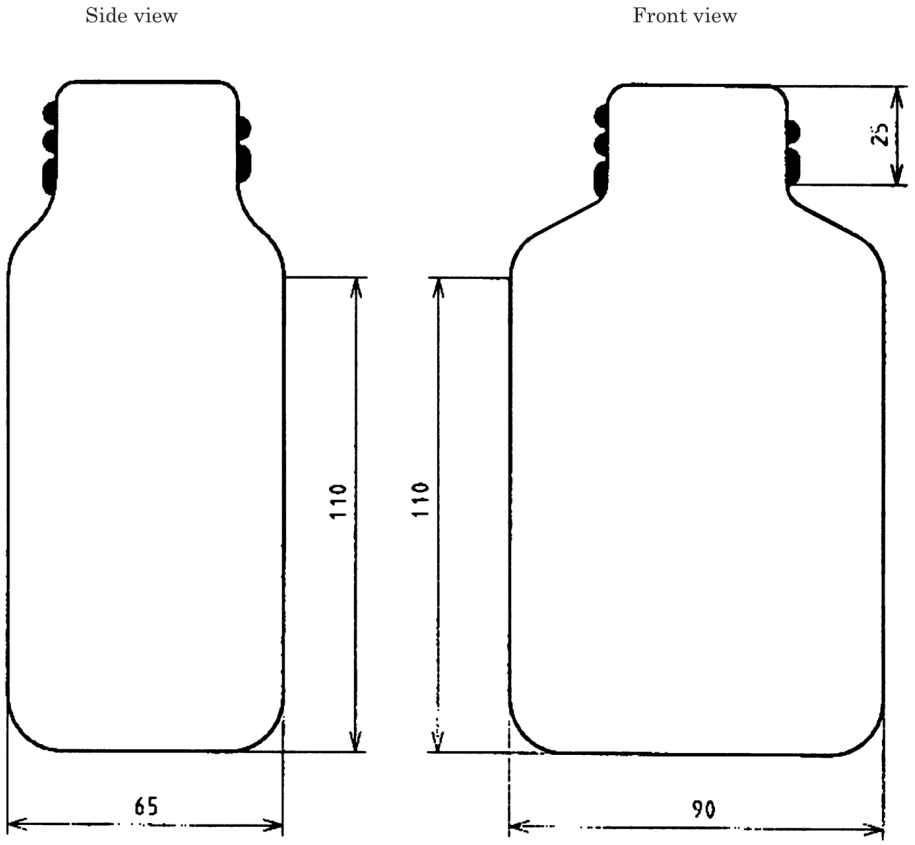
Annex C (informative)
Culture vessels

The following are examples of suitable culture vessels. It is also possible to use the test vessel given as an example in the laboratory methods “blue stain in service” (see EN 152-1).

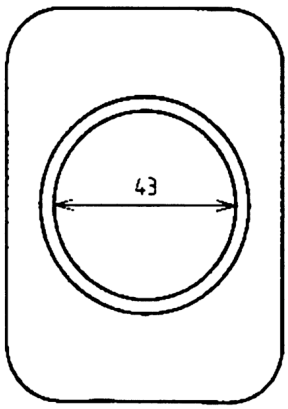


Dimensions in millimetres

Figure C.1 — Kolle flask



View in elevation



Top view

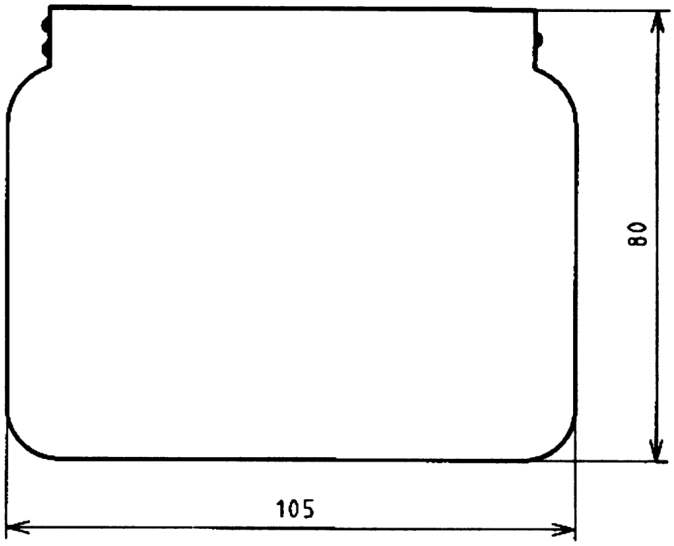
Dimensions in millimetres

Figure C.2 — Alternative type of test vessel

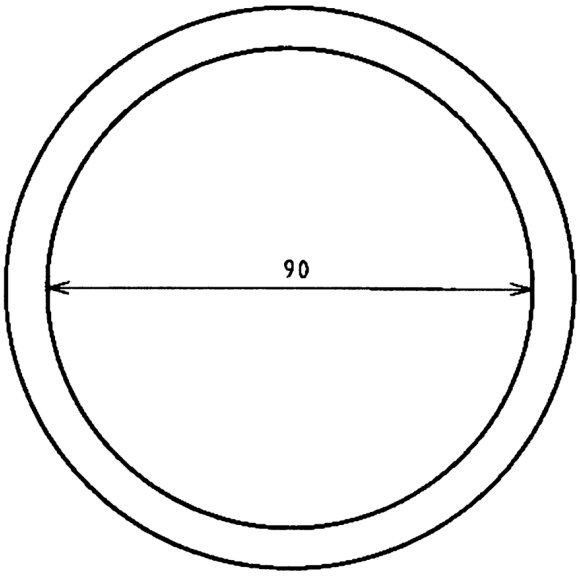
These diagrams are given as a guide only. The dimensions given are minimum dimensions and internal dimensions.

With the dimensions as indicated, the approximate volume is 605 ml and the area of the agar surface is 95 cm^2.

View in elevation



Top view



Dimensions in millimetres

Figure C.3 — Alternative type of test vessel

These diagrams are given as a guide only. The dimensions given are minimum dimensions and internal dimensions.

With the dimensions as indicated the approximate volume is 600 ml and the area of agar surface is 87 cm^2.

Annex D (informative)
Test fungi

D.1 General information on maintaining and acquisition of test strains

Laboratories holding the parent strain shall re-isolate the strain 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 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**).

NOTE 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 the Information Centre for European Culture Collections, Mascheroder Weg 1b, D-38124 Braunschweig, Germany.

The laboratory sending test cultures should provide all growth features characteristic of the respective fungus. When new strains are received, the virulence should be tested to ensure it is within the range given in **5.1**.

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

D.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 specimens of Scots pine sapwood for fungi causing decay of the brown rot type and beech for fungi causing decay of the white rot type should be sterilized. Alternatively, two small wood specimens, measuring approximately 5 mm (grain direction) × 30 mm × 30 mm, of the appropriate wood species should be sterilized. The 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 specimens or four weeks for the smaller specimens. Without oven drying, under sterile conditions, the virulence control specimens should be split open, small splinters of wood from the centre of the specimens should be removed and partly embedded in 5 % (*m*/*m*) malt agar medium in test tubes or petri dishes and the fungi should be allowed to grow. The smaller specimens should be transferred whole to the 5 % (*m*/*m*) malt agar medium. The fungi should be allowed to grow out from 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 the test.

D.3 Information regarding obligatory fungi

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

Strain: BAM Ebw. 15 (Bundesanstalt für Materialforschung und -prüfung — D 12205 BERLIN).

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

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

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

Subculturing should be carried out every six months. Every two years cultivate on wood chips with a few millilitres of a solution of malt extract.

D.3.2 *Coriolus versicolor* (Linnaeus) Quélet (Synonyms: *Polyporus versicolor* Linnaeus ex Fries — *Polystictus versicolor* (Linnaeus) Saccardo — *Trametes versicolor* (Linnaeus ex Fries) Pilat)

Strain: CTB 863 A (Centre Technique du Bois et de l'Ameublement, 10 Avenue de Saint-Mandé — F 75012 PARIS).

Activity: Fungus causing a white fibrous rot of hardwood.

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

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

Subculture every six months on malt agar medium.

D.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 12205 BERLIN).

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

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

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

Subculture every six months on malt agar medium.

D.3.4 *Lentinus cyathiformis* (Schaeffer ex Fries) Bresadola (Synonym: *Lentinus degener* Kalchbrenner Ap.)

Strain: CTB 67-02 B (Centre Technique du Bois et de l'Ameublement, 10, Avenue de Saint-Mandé — F 75012 PARIS).

Activity: Fungus causing a brown cuboidal 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.

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

Strain: BAM Ebw. 20 (Bundesanstalt für Materialforschung und -prüfung — D 12205 BERLIN)

Activity: Fungus causing a brown cuboidal rot of softwood.

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

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

Subculture every six months on malt agar medium.

D.3.6 *Poria placenta* (Fries) Cooke sensu J. Eriksson (Synonym: *Poria monticola* Murrill)

Strain: FPRL 280 (Building Research Establishment — Garston, Watford, Herts WD2 7JR — UK).

Activity: Fungus causing a brown cuboidal rot of softwood.

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

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

Keep stock cultures on 5 % (*m*/*m*) malt agar medium and subculture every three months. Every two years, or more frequently if necessary, inoculate the subcultures on wood or sawdust and subculture on malt agar after 6 to 12 weeks of development on the woody substrate.

Annex E (informative)
Recommended but non-comprehensive list of optional fungi

Fungus	Strain	Type of rot	Species of wood	Practical importance
Coniophora puteana (Schumacher ex Fries) Karsten (Synonym: *Coniophora cerebella* (Persoon) Duby)	FPRL 11 E	Brown cubic	Softwood and hardwood	Wood used in buildings and in the open air
Gloeophyllum abietinum (Bulliard ex Fries) Karsten (Synonym: *Lenzites abietina* (Bulliard ex Fries) Fries	BAM 68	Brown cubic	Various softwoods	Common in wood stored in poor conditions and in wood exposed to the weather
Gloeophyllum sepiarium (Wulfen ex Fries) Karsten (Synonym: *Lenzites sepiaria* (Wulfen ex Fries) Fries	CTB 885 B	Brown cubic	Various softwoods	Common in wood stored in poor conditions and in wood exposed to the weather
Paxillus panuoides (Fries ex Fries) Fries	CTB 57-03 B	Brown cubic	Various softwoods	Found chiefly in wood used in damp mines
Poria placenta (Fries) Cooke sensu J.Eriksson (Synonym: *Poria monticola* Murrill)	EMPA 45[1)]	Brown cubic	Softwood	Mainly posts
Serpula himantioides (Fries ex Fries) Karsten (Synonym: *Merulius himantioides* Fries ex Fries)	TI 55-77[2)]	Brown cubic	Softwood and hardwood	Wood for stringers, stakes, posts, relatively rare
Serpula lacrymans (Schumacher ex Fries) S.F. Gray (Synonym: *Merulius lacrymans* Schumacher ex Fries)	BAM 315	Brown cubic	Softwood and hardwood	Wood used inside in damp and confined conditions
Stereum hirsutum (Willdenow ex Fries) Fries	CTB 594 A	White fibrous	Various hardwoods	Common in wood stored in poor conditions and in wood in use in contact with the soil

[1)] Eidgenössische Materialprüfungs und Forschungsanstalt, Unterstrasse 11, CH 9001 ST GALLEN.
[2)] Teknologisk Institut, DK 2630 TASTRUP.
Minimum mass loss 20 % (*m*/*m*) in all cases except *Stereum hirsutum,* where it is 15 % (*m*/*m*)

Annex F (informative)
Bibliography

EN 73, *Wood preservatives — Accelerated ageing tests of treated wood prior to biological testing — Evaporative ageing procedure.*

EN 152-1, *Test methods for wood preservatives — Laboratory method for determining the preventive effectiveness of a preservative treatment against blue stain in service — Part 1: Brushing procedure.*

EN 212, *Wood preservatives — Guide to sampling and preparation of wood preservatives and treated timber for analysis.*