DRAFT FOR DEVELOPMENT

DD ENV
12038:2002

Durability of wood and wood-based products — Wood-based panels — Method of test for determining the resistance against wood-destroying basidiomycetes

ICS 79.060.01

National foreword

This Draft for Development is the English language version of ENV 12038:2002. It supersedes DD ENV 12038:1996 which is withdrawn.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because there is at present insufficient experience in the use of this test method. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European organization responsible for its conversion into a European Standard. A review of this publication will be initiated 2 years after its publication by the European organization so that a decision can be taken on its status at the end of its three-year life. The commencement of the review period will be notified by an announcement in *Update Standards*.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European Standard, to extend the life of the prestandard or to withdraw it. Comments should be sent in writing to the Secretary of BSI Subcommittee B/515/4, Assessment of preservation efficacy, at 389 Chiswick High Road, London W4 4AL, giving the document reference and clause number and proposing, where possible, an appropriate revision of the text.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

This Draft for Development, having been prepared under the direction of the Building and Civil Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 20 May 2002

Summary of pages

This document comprises a front cover, an inside front cover, the ENV title page, pages 2 to 25 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 38330 X

EUROPEAN PRESTANDARD

PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

ENV 12038

March 2002

ICS 79.060.01

Supersedes ENV 12038:1996

English version

Durability of wood and wood-based products - Wood-based panels - Method of test for determining the resistance against wood-destroying basidiomycetes

Durabilité du bois et des matériaux dérivés du bois - Panneaux à base de bois - Méthode d'essai pour déterminer la résistance aux champignons basidiomycètes lignivores

Dauerhaftigkeit von Holz und Holzwerkstoffen - Holzwerkstoffplatten - Bestimmung der Beständigkeit gegen holzzerstörende Basidiomyceten

This European Prestandard (ENV) was approved by CEN on 23 December 2001 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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

EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. ENV 12038:2002 E

Contents

Foreword

This document ENV 12038:2002 has been prepared by CEN /TC 38 "Durability of wood and wood-based products", the secretariat of which is held by AFNOR.

This document supersedes ENV 12038:1996.

Annexes A, B, C and F are informative.

Annexes D and E are normative.

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

Introduction

This European Prestandard describes a laboratory test method in which small samples of the wood-based panel product under test are exposed to attack by a range of wood-destroying basidiomycete fungi in pure culture. The thickness of the test specimens varies, since it is dictated by the thickness of the wood-based panel product under test. In order to make comparisons of the decay resistance of wood-based panel products of different thicknesses, solid wood specimens of the same dimensions as the wood-based panel product test specimens are included. The effect of constituents giving temporary protection is avoided by testing after pre-conditioning of the cut specimens in a freely ventilated environment. The test method also includes a minimum moisture uptake requirement.

The procedures described in this prestandard method are intended to be carried out by suitably trained and/or supervised specialists. Appropriate safety precautions should be observed throughout the use of this prestandard.

1 Scope

This European Prestandard specifies a method for assessing the resistance of wood-based panel products to attack by wood-destroying basidiomycete fungi growing in pure culture.

The method is applicable to uncoated, rigid wood-based panel products. It is applicable to the determination of the decay resistance of wood-based panel products:

— made from naturally durable materials;

— made from materials treated with preservatives prior to manufacture;

— treated with a preservative which is introduced during manufacture, for example as an additive to the adhesive;

— treated with preservative after manufacture.

NOTE 1 This method can be used in conjunction with an appropriate ageing procedure, for example EN 73 or EN 84.

NOTE 2 Wood-based panel products that have received a preservative treatment after manufacture can be susceptible to attack through the cut edges of the test specimens and the decay resistance indicated can be less than that of complete panels used in service.

2 Normative references

This European Prestandard 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 Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

EN 84, *Wood preservatives - Accelerated ageing tests of treated wood prior to biological testing - Leaching procedure*.

EN ISO 3696, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987)*.

3 Term and definition

For the purposes of this European Prestandard, the following term and definition apply.

3.1
supplier
the sponsor of the test

4 Principle

Specimens prepared from the wood-based panel product(s) under test, after pre-conditioning, and control specimens of defined function are exposed to attack by pure cultures of wood-destroying basidiomycete fungi.

After a prescribed period of incubation under defined conditions, the loss in dry mass of the specimens is used as the criterion for determining the extent of attack. This, in comparison with the loss in mass of the size control specimens, is used to estimate the resistance of the wood-based panel product(s) to attack by the test fungi.

5 Test materials

5.1 Biological material

5.1.1 Test fungi

5.1.1.1 Obligatory test fungi for all types of panel products (see also annex A):

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

Loss in mass of Scots pine sapwood virulence control specimens in16 weeks: a mass fraction of minimum 20 %

— *Pleurotus ostreatus* (Jacquin ex Fries) Quélet (FPRL 40C)

Loss in mass of beech virulence control specimens in 16 weeks: a mass fraction of minimum 20 %

5.1.1.2 Species to be used compulsorily on the nature of the test product (see also annex A):

For test products made only from softwood:

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

Loss in mass of Scots pine sapwood virulence control specimens in16 weeks: a mass fraction of minimum 20 %

For test products made only from hardwood:

— *Coriolus versicolor* (Linnaeus) Quélet (CTB 863A)

Loss in mass of beech virulence control specimens in 16 weeks: a mass fraction of minimum 20 %

For test products made from a mixture of softwood and hardwood, both *Gloeophyllum trabeum* and *Coriolus versicolor* shall be used.

5.1.1.3 Optional test fungi

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

5.1.1.4 Maintenance of strains

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

If tests are not undertaken regularly, or if a strain shows signs of degeneration, a new standard culture of the strain shall be obtained from the laboratory of origin for each test. When new strains are received, the virulence shall be tested to ensure that the mass loss achieved is above the minimum value given in annex A or annex B.

5.1.2 Solid wood stock

5.1.2.1 Wood species

The following species shall be used for the test:

— Scots pine sapwood (*Pinus sylvestris* Linnaeus)

— Beech (*Fagus sylvatica* Linnaeus)

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1) See annex B for a non-comprehensive list of recommended optional fungi.

5.1.2.2 Quality of the wood

The wood shall be free from visible 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 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.

5.1.2.3 Virulence control specimens

Prepare planed strips from the solid wood stock having a cross-section (25 ± 0,5) mm x (15 ± 0,5) mm. The longitudinal faces shall be parallel to the direction of the grain. The annual rings shall not be parallel to the faces (contact angle greater than 10°) but otherwise can run in any direction. Make transverse cuts, neatly to give sharp edges and a fine-sawn finish to the end-grain surfaces, to give virulence control specimens (50 ± 0,5) mm long.

The dimensions of each virulence control specimen at a mass fraction of (12 ± 2) % moisture content[2)] shall be (50 ± 0,5) mm × (25 ± 0,5) mm × (15 ± 0,5) mm.

The specimens shall originate from a minimum of three trees or shall be taken from a stock originally of more than 500 specimens.

5.1.2.4 Size control specimens

Prepare planed strips from the solid wood stock having a cross-section (50 ± 0,5) mm x thickness[3)] of the wood-based panel product under test. Make transverse cuts, neatly to give sharp edges and a fine-sawn finish to the end-grain surfaces, to give size control specimens (50 ± 0,5) mm long. The annual rings of the specimens shall be orientated as for the virulence control specimens (5.1.2.3).

The dimensions of each size control specimen at a mass fraction of (12 ± 2) % moisture content[2)] shall be (50 ± 0,5) mm x (50 ± 0,5) mm x thickness of the wood-based panel product.

The oven dry density shall be (0,48 ± 0,05) g/cm^3 for the Scots pine specimens and (0,67 ± 0,05) g/cm^3 for the beech specimens.

5.2 Other materials and reagents

5.2.1 Water

Water conforming to grade 3 of EN ISO 3696 shall be used throughout.

5.2.2 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.

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

3) Measured to an accuracy of 0,5 mm.

— water (5.2.1): quantity to make up to 1 000 ml.

Warm the mixture in a boiling water bath or a steam bath; stir until completely dissolved.

NOTE The quantity of culture medium required in each culture vessel varies with the thickness of the test product (see 8.4).

5.2.3 Additive for *Pleurotus ostreatus*

Anhydrated, laminar, aluminium-iron-magnesium silicate[4)] exfoliated to yield particles up to 3 mm diameter. Particles less than 2 mm diameter shall be removed by sieving. Before use, mix the sample of additive well. The additive shall be used only once.

5.3 Apparatus

5.3.1 *Conditioning supports*, made of glass, stainless steel or any other inert material, that is to say with no risk of having any effect on the test specimens. The supports shall provide free circulation of air around the test specimens whilst having a minimum of contact with the test specimens.

5.3.2 *Conditioning room*, well ventilated and controlled at (20 ± 1) °C and (65 ± 5) % relative humidity.

5.3.3 *Culture chamber* (incubator or room), dark and controlled at (22 ± 1) °C and (70 ± 5) % relative humidity.

5.3.4 *Culture vessels*, with a capacity of between 400 ml and 650 ml, made of a material which can be sterilized by autoclaving and which does not have a toxic effect on the fungi. The vessels shall be provided with leakproof lids, the centre of which shall be pierced with a round hole of up to 15 mm diameter and plugged so as to allow ventilation but to prevent access by contaminating fungi. The vessels shall be a minimum of 65 mm in depth and have a cross-sectional area of between 55 cm^2 and 90 cm^2.

NOTE A suitable culture vessel is shown in annex C.

5.3.5 *Ventilated drying oven*, capable of being controlled at (103 ± 2) °C.

5.3.6 *Desiccators*, with an efficient desiccant, for example silica gel.

5.3.7 *Equipment for chemical gas sterilization or access to a radiation service* (see annex D).

5.3.8 *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 or the test product or of being itself modified. The supports shall prevent direct contact between the test specimens and the culture medium but shall not separate them from it by more than 3 mm.

NOTE Two sizes of test specimen supports can be required to support specimens of 50 mm x 50 mm and 50 mm x 25 mm respectively.

5.3.9 *Safety equipment and protective clothing*, appropriate for the test procedures, to ensure the safety of the operator.

5.3.10 *Ordinary laboratory equipment*, including a balance readable to the nearest 0,01g and an autoclave.

6 Test product

6.1 General

A minimum of three replicate panels of the wood-based panel product under test shall be sampled. Ensure that the panels are clean and as free as possible of contaminants that might give misleading results.

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4) Vermiculite is suitable.

6.2 Test specimen preparation

Reject from each of the three panels of the test product a strip 300 mm wide from each of the edges. Cut test specimens (50 ± 0,5) mm x (50 ± 0,5) mm x thickness from the remaining central portion of each panel and mark to retain the identity of the panel. Reject any test specimens that show defects such as gaps, knot voids, veneer rupture or discontinuous adhesion.

NOTE 1 Other test specimens, for example for the determination of the wood preservative content, should also be cut from the central portion of each panel.

NOTE 2 Where small experimental panels of the test product are being used, it is necessary to reject a strip only 50 mm wide from each of the edges. This should be noted in the test report.

7 Numbers of test specimens

7.1 Test product specimens

7.1.1 Test specimens

Two test specimens from each of a minimum of three panels of the test product shall be exposed to each test fungus. For cement-bonded particleboards, additional specimens are required to test the alkalinity after curing with carbon dioxide (see 8.1).

7.1.2 Moisture content check specimens

Two test specimens from each panel of the test product used to provide test specimens shall be used as moisture content check specimens.

7.1.3 Wetting check specimens

If necessary, two test specimens from each panel of the test product used to provide test specimens shall be used as wetting check specimens (see 8.8.3).

NOTE Some types of dense panel products, for example cement-bonded particleboards, or products containing water repellent additives, can fail to attain the required moisture content. If this occurs, then the wetting check specimens should be used.

7.2 Virulence control specimens

Six Scots pine virulence control specimens (5.1.2.3) shall be exposed to each test fungus causing decay of the brown rot type[5)] and six beech virulence control specimens shall be exposed to each test fungus causing decay of the white rot type.

7.3 Size control specimens

Six Scots pine size control specimens (5.1.2.4) shall be exposed to each test fungus causing decay of the brown rot type[5)] and six beech size control specimens shall be exposed to each test fungus causing decay of the white rot type.

[5)] If *Lentinus cyathiformis* is selected as an optional test fungus (see annex B), beech virulence control specimens and size control specimens should be used.

8 Procedure

8.1 Pre-conditioning

If the test is being carried out in conjunction with an ageing procedure, such as EN 73 or EN 84, the ageing procedure replaces the pre-conditioning described in this subclause. Details of the procedure used shall be included in the test report.

For products being tested without ageing (except cement-bonded particleboards), place the test specimens (7.1.1), the moisture content check specimens (7.1.2) and the wetting check specimens (7.1.3) on one of their cut edges on conditioning supports (5.3.1) with a minimum of 10 mm between specimens and allow to ventilate for a minimum of 12 weeks at ambient temperature and under well ventilated conditions. Rotate the specimens onto another cut edge at regular intervals so that the specimens stand for approximately three weeks on each edge.

NOTE 1 The pre-conditioning procedure is carried out prior to establishing the initial mass of the test specimens to avoid having to make an allowance for changes in mass due to pre-conditioning.

NOTE 2 The ventilated storage is carried out to allow constituents of the test product that can give temporary protection against attack by fungi to be lost from the test specimens. An open bench in a laboratory is normally suitable for the procedure.

For cement-bonded particleboards, ensure that the test specimens are fully hardened before use. Pre-condition the test specimens and some additional specimens by curing using carbon dioxide for a period of four weeks. After this time, break open at least two of the additional specimens. Spray the broken surfaces with a solution of phenolphthalein (a mass fraction of 1 % in ethanol). If the colour of the specimens remains unchanged, curing is complete. If a red colour develops, continue the carbon dioxide curing for a further period of one week and retest. Repeat as necessary.

NOTE 3 A suitable method for curing with carbon dioxide is described in ENV 12404.

8.2 Initial dry mass

8.2.1 Test product specimens

Following pre-conditioning (8.1), transfer the test specimens (7.1.1), the moisture content check specimens (7.1.2) and the wetting check specimens (7.1.3) on their conditioning supports to the conditioning room (5.3.2). Rotate the specimens through 180 ° weekly onto another cut edge. After a period of at least 4 weeks or when the specimens have achieved constant mass, that is when weighings at 24 h intervals are within ± 0,05 g, weigh each test specimen, moisture content check specimen and wetting check specimen to the nearest 0,01g to determine the initial conditioned mass (m_0).

Place the moisture content check specimens in the oven (5.3.5) at (103 ± 2) °C for 16 h to 24 h. Cool the specimens to room temperature in desiccators (5.3.6) and weigh each specimen to the nearest 0,01 g to determine the oven dry mass (m_1).

Calculate the initial moisture factor (F_i) for each moisture content check specimen using the following formula:

$$F_i = 1 - \frac{m_0 - m_1}{m_0}$$

where

m_0 is the initial conditioned mass, and;

m_1 is the oven dry mass.

Calculate the mean value (F_{im}) for each set of check specimens and use this value to calculate the oven dry mass (m_1) of the equivalent set of test specimens and, if necessary wetting check specimens, using the following formula:

$$F_{im} \times m_0 = m_1$$

8.2.2 Virulence control specimens and size control specimens

Place the virulence control specimens (5.1.2.3) and the size control specimens (5.1.2.4) in the oven (5.3.5) at (103 ± 2) °C for 16 h to 24 h. Cool the specimens to room temperature in desiccators (5.3.6) and weigh each specimen to the nearest 0,01g to determine the initial dry mass (m_1).

8.3 Sterilization of test specimens

Sterilize the test specimens (7.1.1), the virulence control specimens (7.2) and the size control specimens (7.3) using one of the methods given in annex D.

8.4 Preparation of the culture vessels

Dispense 60 ml of the culture medium (5.2.2) into each culture vessel for use with test specimens up to 15 mm thick; use an additional 10 ml of culture medium for each additional 5 mm of thickness or part of 5 mm (for example for 18 mm thick specimens use 70 ml and for 30 mm thick specimens use 90 ml). Close the vessels as specified in 5.3.4 and sterilize in the autoclave at 121 °C for 20 min. Allow the vessels to cool in their in-use position.

8.5 Inoculation

Inoculate the culture medium not more than seven days after sterilization. Aseptically transfer two inocula, of minimum size 6 mm diameter, from the appropriate test fungus onto the test medium surface in each test vessel placing the inocula at opposite sides of the vessel and close to the vessel wall. Obtain the inocula from cultures which are still actively growing across the growth medium or which have covered it for less than one week.

NOTE This procedure ensures that the test specimens do not come into direct contact with the inocula when they are introduced into the test vessels.

Incubate the inoculated culture vessels in the culture chamber (5.3.3) until the test fungi have covered the surface of the culture medium; in no case shall this period exceed four weeks. The fungi shall be free from contamination by other organisms.

8.6 Exposure of test specimens

8.6.1 Preparation of additive for *Pleurotus ostreatus*

Estimate the amount of additive required to surround the test specimens and to give a depth of approximately 10 mm above the top surface of the specimens in all test assemblies with the test fungus *Pleurotus ostreatus*.

NOTE When carried out in the culture vessels illustrated in annex C, and using a test product 15 mm thick, approximately 220 ml per test assembly is required.

Soak the estimated volume of additive required in water for 1 h to 2 h then allow to drain freely for 2 h to 4 h. Place in containers and sterilize in the autoclave at 121 °C for 30 min Allow to cool.

8.6.2 Test specimens and size control specimens

Under aseptic conditions, introduce one previously sterilized test specimen support (5.3.8) into each culture vessel. Place a sterilized test specimen (7.1.1) or size control specimen (7.3) centrally on the support, ensuring that it does not come into direct contact with the original inocula. Cover all specimens exposed to the test fungus *Pleurotus ostreatus* with sterile additive (see 8.6.1) to a depth of 10 mm above the top surface of the specimens.

8.6.3 Virulence control specimens

Under aseptic condition, introduce one or two previously sterilized test specimen supports (see 5.3.8) into each culture vessel. Place two sterilized virulence control specimens on the support(s), ensuring that the specimens are

separated from one another by at least 5 mm. Cover all specimens exposed to the test fungus *Pleurotus ostreatus* with sterile additive (see 8.6.1) to a depth of 10 mm above the top surface of the specimens.

8.6.4 Wetting check specimens

Wrap any wetting check specimens in polyethylene and store in the conditioning room (5.3.2) until the test is assessed.

8.7 Culture conditions and duration of the test

Return the completed test assemblies to the culture chamber (5.3.3) for 16 weeks.

8.8 Assessment of the test

8.8.1 Examination of the test specimens

At the end of the incubation period, withdraw the test specimens (7.1.1), the virulence control specimens (5.1.2.3) and the size control specimens (5.1.2.4) from the culture vessels. Note the extent of overgrowth of each specimen by the test fungi and record evidence of waterlogging or of inhibition of growth of the test fungus caused by volatile components or contaminating organisms. Carefully remove any adhering mycelium, weigh each specimen to the nearest 0,01g to determine the wet mass (m_2).

Note any obvious stratification of the attack of the test product, for inclusion in the test report.

8.8.2 Final dry mass

Place the test specimens (7.1.1), the virulence control specimens (5.1.2.3) and the size control specimens (5.1.2.4) in the oven (5.3.5) at (103 ± 2) °C until the specimens have reached constant mass, that is when weighings carried out at minimum intervals of 4 h are within ± 0,05 g. Cool the specimens to room temperature in desiccators (5.3.6) and weigh each specimen to the nearest 0,01g to determine the final dry mass (m_3).

Calculate the final moisture content of each specimen by expressing its water content (m_2 - m_3) as a percentage of the final dry mass (m_3).

Calculate the loss in mass of each specimen by expressing the loss in mass (m_1 - m_3) as a percentage of the final dry mass (m_3). Calculate the mean loss in mass for the test product specimens exposed to each test fungus. Calculate the mean loss in mass of virulence control specimens and size control specimens exposed to each test fungus.

8.8.3 Validity of results

Reject any specimen on which there has been growth by contaminating moulds.

Reject the results from any test specimen having a moisture content of less than a mass fraction of 25 % except for those specimens of a particularly dense or water repellent nature (see 7.1.3). In these latter cases, the wetting check specimens shall be used to determine the validity of the test, by the following method.

Impregnate the wetting check specimens, using the method described in EN 84, soak overnight and blot lightly on absorbent paper. Weigh each specimen to the nearest 0,01g, to determine the saturated mass (s_1). Place the specimens in the oven (5.3.5) at (103 ± 2) °C until they have reached constant mass, that is when weighings carried out at minimum intervals of 4 h are within ± 0,05 g. Cool the specimens to room temperature in desiccators (5.3.6) and weigh each specimen to the nearest 0,01g to determine the dry mass (s_2). Calculate the saturation moisture content of each specimen by expressing the water content (s_1 - s_2) as a percentage of the dry mass (s_2). Calculate the mean value. If the mean saturation moisture content so determined is less than a mass fraction of 75%, reject only those test specimens having a moisture content less than one quarter of the determined value.

The data from any set of replicates are valid provided that the results from at least three test specimens have been accepted.

9 Validity of the test

The results shall be accepted as valid provided that the virulence control specimens (5.1.2.3) have lost more than the minimum value given in 5.1.1 or annex B for the fungus in question.

10 Assessment of results

10.1 The test product shall be designated as fully resistant to attack by wood-rotting basidiomycetes if:

a) The mean loss in mass of the test specimens is less than a mass fraction of 3 %, and

b) not more than one test specimen has suffered a loss in mass greater than a mass fraction of 3 % but less than a mass fraction of 5 %.

10.2 If the mean losses in mass are greater than a mass fraction of 3 %, calculate the decay susceptibility index (DSI) by the method given in annex E.

NOTE DSI values of 100 indicate the same decay resistance as that of the timber used for the size control specimens. Products with lower DSI values are more resistant to attack.

11 Test report

The test report shall include at least the following (an example of a test report is given in annex F):

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

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

c) the name of the wood-based panel product under test and a description including:

   1) type, for example, plywood, particleboard etc.;

   2) identifying marks, for example, batch number;

   3) country of origin and producer;

   4) main constituents, including for plywood the species of timber in each veneer;

   5) the nature and the quantity of any bonding agents used;

   6) product thickness and density;

   7) the presence of added biocides, their active ingredient(s), retention level and whether incorporated before, during or after manufacture;

d) reference to ageing or other pre-conditioning procedures applied to any of the test specimens prior to exposure to fungal attack, in addition to or instead of the pre-conditioning procedure described in 8.2, quoting, where appropriate, the standard describing the method;

e) the method of sterilization of the test specimens;

f) the names and strain numbers of the test fungi employed and the species of timber used with each fungus for the virulence control specimens;

g) the date of exposure to the test fungi;

h) the date of final inspection;

i) the duration of exposure to fungal attack;

j) the percentage loss in mass of each test specimen;

k) for each wood-based panel product, the mean percentage loss in mass of the replicates exposed to each test fungus;

l) a description of the extent of overgrowth by the test fungi of each type of test specimen and any evidence of the stratification of the attack;

m) the mean percentage loss in mass of the virulence control specimens;

n) the mean percentage loss in mass of the size control specimens;

o) an assessment of the results obtained using the guidelines laid down in clause 10 and, when calculated, the mean DSI values;

p) the organisation responsible for the report and the date of issue;

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

r) any variation from the standard, as well as any factors which may have influenced the results;

s) the following:

The interpretation and practical conclusions that can be drawn from a test report demand a specialized knowledge of the subjects of wood durability and 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 can maintain the strains themselves, but if the strain shows any sign 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 clause 8.

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 5.1.1).

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

NOTE When sending cultures, special care should 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 5.1.1.

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.

Sterilize two virulence control specimens of Scots pine sapwood for fungi causing decay of the brown rot type or beech for fungi causing decay of the white rot type. Alternatively, sterilize two small wood specimens, measuring approximately 5 mm (grain direction) x 30 mm x 30 mm, of the appropriate wood species. Expose the specimens, without ageing, to attack by the test fungus using the exposure system described in clause 8 for a period of 6 to 8 weeks for virulence control specimens or 4 weeks for the smaller specimens. Without oven drying, under sterile conditions, split open the virulence control specimens, remove small sticks of wood from the centre of the specimens and partly embed them in a mass fraction of 5 % malt agar medium in test tubes or Petri dishes and allow the fungi to grow. Transfer the smaller specimens whole to the mass fraction of 5 % malt agar medium. Allow the fungi to grow out from the wood. Use these cultures for future tests and to provide stock cultures for future use.

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 cuboidal brown 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.

Sub-culture every six months on malt agar medium.

A.3.2 *Pleurotus ostreatus* (Jacquin ex Fries) Kummer

Strain: FPRL 40C (Building Research Establishment, Garston, Watford, Hertfordshire, WD25 9XX, United Kingdom).

Activity: Fungus causing a fibrous white rot of hardwood and particleboard in service.

Simple laboratory culture, rapid growth on malt agar medium.

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

Sub-culture every six months 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 cuboidal 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.

Sub-culture every six months on malt agar medium.

A.3.4 *Coriolus versicolor* (Linnaeus) Quélet (Synonym *Polyporus versicolor* Linnaeus ex Fries - *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.

Sub-culture every six months on malt agar medium.

Annex B
(informative)

Recommended but non-comprehensive list of optional fungi

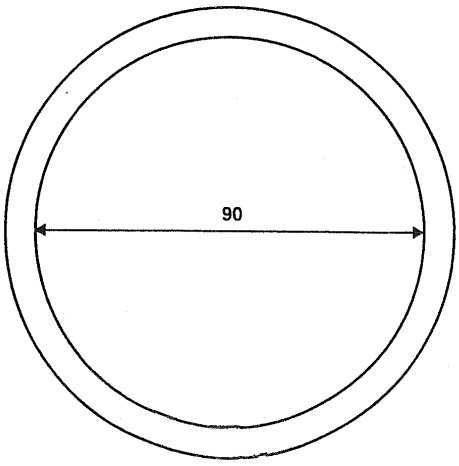
Test fungus	Strain	Virulence controls		Practical importance
		Minimum mass loss %	Timber	
Amyloporia xantha (Fries) Bondartsev and Singer	FPRL 62G	15	Scots pine sapwood	Brown rot. A cause of decay of roof decking and insulants; causes active attack of pine heartwood. Extremely sensitive to gaseous sterilants which should not be used.
Lentinus cyathiformis (Schaeffer ex Fries) Bresadola	CTB 67-02B	20	beech	Brown rot. Active decayer of hardwoods.
Lentinus lepideus Fries ex Fries	BAM Ebw. 20	20	Scots pine sapwood	Brown rot. Active decayer of poorly creosoted wood.
Lentinus squarrosulus Montagne	CTFT 55A	20	beech	White rot. Active on tropical woods.
Poria placenta (Fries) Cooke sensu J. Eriksson	FPRL 280	20	Scots pine sapwood	Brown rot. Active decayer of softwoods.
Serpula lacrymans (Schumacher ex Fries) S. F. Gray	BAM Ebw. 315	15	Scots pine sapwood	Brown rot. The cause of dry rot. Causes active decay in buildings in damp and confined conditions.

Annex C
(informative)

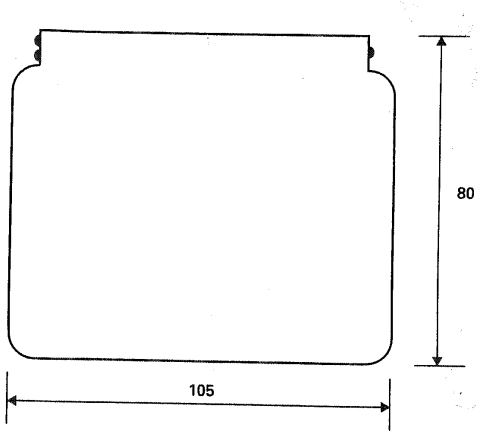
Culture vessels

An example of a culture vessel which has been found to be suitable is shown in Figure C.1.

Dimensions in millimetres



View in elevation



Top view

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 the agar surface is 87 cm^2.

Figure C.1 - Suitable culture vessel

Annex D
(normative)

Methods of sterilization

NOTE Sterilization using epoxyethane- or epoxypropane-based sterilants is not appropriate for wood-based panel products.

D.1 Ionizing radiation

This method is suitable for all wood-based panel products and is the preferred method for those treated with organic preservatives and those for which the reactivity with other sterilizing agents is unknown.

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

NOTE 1 Polyethylene sheeting can 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 of the 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[6)] and 50 kGy.

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 can be safely stored for several weeks without detrimental effects.

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

D.2 Steam

This method shall only be used for test specimens treated with preservatives 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 similar types of test specimen 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, store them for 24 h in a room at ambient temperature and then repeat the sterilizing procedure for 10 min.

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

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6) 1 kGy = 1 Kj/kg = 0,1 Mrad.

Annex E
(normative)

Calculation of the decay susceptibility index (DSI)

E.1 Principle

The loss in mass of each test specimen is expressed as a percentage of the mean loss in mass of the size control specimens exposed to the same fungus. In this way, an allowance is made for the different levels of decay that are achieved in test specimens of different thicknesses.

E.2 Calculation

Calculate the DSI of each test specimen as follows:

$$DSI = \frac{T}{S} \times 100$$

where

T is the percentage loss in mass of an individual test specimen, and;

S is the mean percentage loss in mass of the appropriate set of size control specimens.

Calculate the mean DSI values for the specimens of the test product exposed to each test fungus.

Annex F
(informative)

Example of a test report

Number and date of European Prestandard:	ENV 12038:2002
Name of supplier of test product:	Company X
Name of wood-based panel product:	Product Y, produced by Company Z in Finland
Product type:	MF/UF bonded chipboard, all softwood furnish
Identifying marks:	Red stripe
Product thickness:	12 mm
Product density:	695 kg/m^3
Added biocides:	None
Ageing procedures:	Pre-conditioning by ventilated storage for 12 weeks as required by the prestandard
Sterilization method:	Ionizing radiation
Test fungi:	*Coniophora puteana* BAM Ebw. 15 *Pleurotus ostreatus* FPRL 40C *Gloeophyllum trabeum* BAM Ebw. 109
Exposed to fungi:	2001.06.06
Assessed:	2001.09.26
Duration of test:	16 weeks
Losses in mass of test product:	See Table F.1
DSI values:	See Table F.1
Extent of overgrowth:	See Table F.2
Losses in mass virulence controls:	See Table F.3
Losses in mass size controls:	See Table F.3
Assessment of results:	Product Y is not resistant to decay by wood-destroying basidiomycetes. It is marginally more resistant to attack than the timbers used for the size controls, that is Scots pine sapwood for *C. puteana* and *G. trabeum* and beech for *P. ostreatus.*
Deviation from the standard	None
This report has been prepared by:	Laboratory A, Anytown, UK
Name and signature of the officer(s) in charge:	Mr C, Mrs D
	Date: 2001.10.05

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

Table F.1 - Results for test product Y

Test fungus	Loss in mass in %	DSI
Coniophora puteana	36,8	89,4
BAM 15	37,3	90,5
	38,2	92,7
	38,3	92,9
	41,3	100,3
	40,3	97,7
Mean	**38,7**	**93,9**
Pleurotus ostreatus	32,0	93,7
FPRL 40C	29,2	85,5
	29,8	87,1
	28,2	82,5
	30,5	89,0
	28,2	82,6
Mean	**29,7**	**86,7**
Gloeophyllum trabeum	36,0	88,0
BAM 109	35,3	86,3
	35,9	87,7
	36,0	87,9
	37,2	90,8
	38,0	92,9
Mean	**36,4**	**88,9**

Table F.2 - Condition of test specimens at end of test

Test fungus	Extent of overgrowth	Distribution of decay
Coniophora puteana BAM 15	Specimens fully overgrown	Decay general
Pleurotus ostreatus FPRL 40C	Specimens surrounded by fungal growth	Decay general
Gloeophyllum trabeum BAM 109	Thin growth on top of specimens	Decay more marked at base of specimens

Table F.3 - Losses in mass of virulence controls and size controls

Test fungus (timber)	Virulence controls	Size controls (12 mm)
Coniophora puteana	39,3	39,5
BAM 15	33,7	44,4
(Scots pine sapwood)	35,7	40,5
	36,1	36,8
	38,0	39,3
	34,2	46,8
Mean	**36,2**	**41,2**
Pleurotus ostreatus	35,3	35,3
FPRL 40C	29,9	34,1
(beech)	33,1	27,5
	31,8	37,2
	25,5	34,9
	33,2	36,1
Mean	**31,5**	**34,2**
Gloeophyllum trabeum	38,0	43,9
BAM 109	40,8	38,4
(Scots pine sapwood)	41,1	38,5
	45,8	40,0
	50,2	39,7
	45,4	44,8
Mean	**43,5**	**40,9**

Bibliography

ENV 12404, *Durability of wood and wood-based products - Assessment of the effectiveness of a masonry fungicide to prevent growth into wood of dry rot Serpula lacrymans (Schumacher ex Fries) S. F. Gray - Laboratory method.*

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