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Wood preservatives — Determination of the protective effectiveness of a preservative treatment against blue stain in wood in service — Laboratory method

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National foreword

This British Standard is the UK implementation of EN 152:2011. It supersedes BS7066-1:1990 (R93) and BS7066-2:1990 (R93) which are withdrawn

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

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

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Wood preservatives - Determination of the protective effectiveness of a preservative treatment against blue stain in wood in service - Laboratory method

Produits de préservation du bois - Détermination de l'efficacité préventive d'un traitement de protection du bois mis en œuvre contre le bleuissement fongique - Méthode de laboratoire

Holzschutzmittel - Bestimmung der vorbeugenden Wirksamkeit einer Schutzbehandlung von verarbeitetem Holz gegen Blaüepilze - Laboratoriumsverfahren

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Foreword

This document (EN 152:2011) has been prepared by Technical Committee CEN/TC 38 “Durability of wood and wood-based products”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2012, and conflicting national standards shall be withdrawn at the latest by May 2012

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

This document supersedes EN 152-1:1988, EN 152-2:1988.

Significant technical differences between this standard and EN 152-1 and EN 152-2:1988 are as follows:

a) introduction of a new harmonised specification for the test specimens used in the diverse biological tests;

b) merging of Part 1 relating to the brushing procedure and Part 2 concerning the application by methods other than brushing;

c) taking into account of the terms given in EN 1001-1 and the definitions of EN 1001-2;

d) introduction of an informative Annex to take account of consideration for minimisation of environmental and health hazards caused by the use of this biological test.

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

Introduction

The test method described in this European Standard is a laboratory method combined with pre-conditioning (natural or artificial weathering), which provides a basis for assessment of the effectiveness of a wood preservative or wood preservative systems in preventing the development of blue stain fungi in wood in service where disfigurement can be considered important, such as external decorative timber and joinery. The method permits the determination of the effectiveness of undiluted preservatives and may also be used to test preparations in which the proportions of the individual components (active ingredients) have been varied and so establish for the active ingredients the limit of their effectiveness.

It should be used to assess the value of the protection, taking into account the method of application and in particular the suppliers specifications. It is recommended that the results of these tests should be supplemented by further suitable tests and especially by practical experience.

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

1 Scope

This European Standard specifies a method which is only suitable for testing preparations and systems which are intended to prevent the occurrence of blue stain fungi in wood in service. It is not suitable for assessing the temporary preventive effectiveness of anti-stain preservatives on round wood or on freshly cut wood. The method is not intended for the determination of the fungicidal properties of the surface coating applied to the wood after the priming coat.

This European Standard lays down a method for determining the effectiveness of a preparation applied by e.g. brushing, spraying, spraying tunnel, dipping or vacuum and pressure treatments resulting in an equivalent retention of product in preventing the development of blue stain fungi in wood in service. It is also applicable where a primer paint is used in conjunction with the preservative system[1)].

This method is applicable to the following types of preparations or systems:

— type A: fungicidal preparations with or without pigment, used in conjunction with unspecified varnishes or paint coatings;

or

— type B: fungicidal preparations with or without pigment, used in conjunction with specified varnishes or paint coatings;

or

— type C: fungicidal preparations with or without pigment, used without any subsequent paint, varnish or other coating.

NOTE It is also possible to test the effectiveness in preventing blue stain in service of a combined protective system which involves the application of one preparation by a penetrating treatment technique followed by a subsequent application of a different preparation by a superficial treatment method.

2 Normative references

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

EN 927-6:2006, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 6: Exposure of wood coatings to artificial weathering using fluorescent UV lamps and water*

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

1) The method may also be used for first coat (primer) paints required to give protection during storage of components on-site (see Annex E). These are tested as for preparations of type C.

3 Terms and definitions

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

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

[EN 1001-2, **4.71**]

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

[Adapted from EN 1001-2, **4.83**]

4 Principle

The basic principles of the test method are to provide the conditions for infection by blue stain fungi into the treated face and into the cut surface behind the treated face (for surface treatments) and to observe the development of infection into the treated face.

A series of blocks of the given timber species are treated with the preparation under test on all faces except the end-grain faces. Subsequently the blocks are cut in the direction of the grain such that two specimens are produced. The treatment differs according to the type of preparation (Annex E, Table E.1) and specifications for its use:

— Type A Preparations designed to be used with unspecified varnish or paint coatings are tested using the application rate appropriate to the preparation (Annex E, Table E.2) or as otherwise specified by the supplier followed by the standard test varnish.

— Type B Preparations designed to be used with specified varnish or paint coatings are tested using the application rate appropriate to the preparation (Annex E, Table E.2) or as otherwise specified by the supplier followed by a surface coating strictly according to the supplier's specification.

— Type C Preparations designed to be used without subsequent varnish or paint coatings are tested using the application rate appropriate to the product (Annex E, Table E.2) or as otherwise specified by the supplier but with no subsequent application of coating.

— Treated test specimens are exposed to pre-conditioning (natural or artificial weathering).

— Weathered test specimens are then exposed in the laboratory to the action of a mixed culture of two fungi causing blue stain in service.

NOTE Preparations designed to be used solely in use class 2 (EN 335) may be preconditioned by using the evaporative aging method in EN 73 in place of the natural or artificial weathering procedures in this standard.

5 Test materials

5.1 Biological material

The test fungi to be used in all tests are[2)]

— *Aureobasidium pullulans* (de Bary) Arnaud, strain P 268[3)], source Hann. Münden;

— *Sydowia polyspora* (Bref. & Tavel) E. Müller (syn. *Sclerophoma pithyophila* (Corda) v. Höhnel) strain S 231[4)], source Hann. Münden.

Use the test fungi as a mixed culture in the form of a spore suspension. The technique for the preparation of this spore suspension is described in Annex B.

NOTE If desired, spore suspensions of other blue stain fungi of national importance can be used in additional series of tests. The type and extent of the growth of these fungi are to be described in the test report.

5.2 Products and reagents

5.2.1 Nutrient medium

A nutrient medium of malt buffered to pH 4,2 shall be used for the preparation of a spore suspension (see 8.3.4) of the test fungi. It shall contain 20 g/l dried malt or an equivalent amount of concentrated malt extract with a nitrogen content of mass fraction of (0,9 ± 0,3) %. The buffer shall be a citrate buffer solution composed of:

— Citric acid monohydrate, (analytical reagent grade) 12,5 g;

— 1 mol/l NaOH 120 ml;

— 0,1 mol/l HCl 390 ml;

— water to make up 1 000 ml.

5.2.2 Coating material

5.2.2.1 General

Tests can be performed for a specific coating material which has been specified by the supplier.

Otherwise a generic coating material can be used as detailed under 5.2.2.2 and 5.2.2.3 below.

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2) Maintain the strains on 2 % malt agar and subculture them at intervals not exceeding 6 months. Obtain new cultures if there is evidence of degeneration such as loss of pigmentation or the ability to produce conidia. Cultures can be obtained from Bundesanstalt für Materialforschung und -prüfung, Unter den Eichen 87, 12205 Berlin or from the CABI Bioscience, Bakeham Lane, Egham, Surrey TW20 9TY UK.

3) Identical to strain no. IMI 269 216 of culture deposited at CABI Bioscience, Egham.

4) Identical to strain no. IMI 269 217 of culture deposited at CABI Bioscience, Egham.

5.2.2.2 For organic solvent preservative products

An unpigmented varnish based on low viscosity, long oil alkyd resin, with driers and without any fungicidal or fungistatic components (see A.2). Two options are provided whether or not UV protection is present.

NOTE The varnish may be stored unopened for up to 2 years, but once the container has been opened, unused quantities should not be stored longer than 1 week for further use.

5.2.2.3 For waterborne preservative products

An unpigmented varnish based on low viscosity acrylic resin, with an in-can preservative for the resin (see A.3).

NOTE The varnish may be stored unopened for up to half a year, but once the container has been opened, unused quantities should not be stored longer than 1 week for further use.

5.2.3 Test product without active ingredients

If additional controls are requested, the product under test without the active ingredient(s) (see 7.5.2).

5.2.4 Solvents and diluents

5.2.4.1 White spirit

For the characteristics of the white spirit see Annex A (A.2.1.2).

5.2.4.2 Water

Complying with grade 3 of EN ISO 3696.

5.2.5 End sealer

The end sealer is necessary to prevent the product penetrating along the end grain. Any appropriate material which is resistant to the solvents employed during treatment. A material resistant to the penetration of the test product and the test fungi, or separate materials for each, and without any fungistatic or fungicidal activity within the test specimen.

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

5.2.6 Sterilant (see 8.3.2)

Access to radiation sterilisation facilities or autoclave available.

5.2.7 Hydrated, laminar, aluminium-iron-magnesium silicate (e.g. vermiculite)

Exfoliated to give particles of 1 mm to 3 mm with an apparent density of 80 kg/m^3 to 90 kg/m^3. Particles of less than 1 mm shall be eliminated by sieving prior to use.

NOTE The water holding capacity of the vermiculite should allow the wood moisture content to stay below 100 % at any time.

5.2.8 Reference product

The reference product used shall comply with the composition or equivalent specified in Table 1.

Table 1 — Composition of the reference product

Component [b])	**Quantity** (mass fraction in %)
Vialkyd VAF 4349/80 K-60	5,00
Dowanol PM	3,00
Preventol A 4 S (87,5 – 92,5 % DCFN [a])	0,55 (approx. 0,49 DCFN)
Methylethylketoxim	0,20
Octa Soligen Trockner 69	0,10
Shellsol D 60	91,15
[a] DCFN = dichlofluanide. [b] Example(s) of suitable product(s) available commercially. This information is given for the convenience of users of this EN 152 standard and does not constitute an endorsement by CEN of these products.	

The product containing dichlofluanide at this concentration shall be applied at 80 g/m² in combination with a varnish coating. If an alternative reference product is used, the concentration chosen should provide a performance equivalent to the specified concentration of DCFN. Evidence of equivalence shall be recorded in the test report.

5.2.9 Fumigant (if necessary)

Xylene technical grade.

5.3 Apparatus

5.3.1 **Incubation room**, with the following climatic conditions: (22 ± 2) °C and (70 ± 5) % relative humidity.

5.3.2 **Conditioning room** at (20 ± 2) °C and (65 ± 5) % relative humidity.

5.3.3 **Saw with blades giving a fine-sawn finish**

5.3.4 **Weathering site** for open air weathering of wood specimens in special racks :

— weathering racks: frames to take the wood specimens at 45° (see Figure D.5). The frames shall be constructed of inert material (e.g. plastics, aluminium). In the racks the wood test specimens shall be free on all sides and be secured against being dislodged;

— as a weathering site, any free area without extremes of environmental conditions with regard to humidity, dryness, UV radiation or industrial pollution is suitable. The site shall be free from tall vegetation (max. 0,5 m);

— erection of the weathering racks, the following are to be observed:

  — they shall at no time be in the shade of trees, houses or other structures;

  — the wood test specimens shall face the direction in which the exposure conditions are expected to be most severe;

NOTE In Central Europe and France this is to the South West and in the UK to the South.

  — the wood test specimens shall be placed 1 m to 2 m above the ground .

5.3.5 Device for artificial weathering (UV equipment with spray option, UVS)

A device providing spray of demineralised water of approximately 4 l/min and UV-light at a wave length of 340 nm (UVA), preferable produced by fluorescent tubes, programmable for different weathering cycles including alternating UV-radiation, spraying and condensation of different duration and controllable temperature during the radiation and the condensation periods.

5.3.6 Culture vessels with a capacity of 400 cm^3 to 600 cm^3 and an internal area of base of 90 cm^2 to 120 cm^2 (see Annex D for an example of a culture vessel).

5.3.7 Sterilisers

— access to ionising-radiation services (Annex C);

— autoclave, adjustable at (102 ± 2) °C and (121 ± 1) °C, and, if the autoclave is not adjustable at (102 ± 2) °C , a steaming chamber (Annex C).

5.3.8 Measuring magnifying glass with reading accuracy of 0,1 mm.

5.3.9 Usual laboratory equipment, especially:

— analytical balance with accuracy 0,01 g.

— various brushes.

— abrasive paper, grit size 120 and 180.

— drying oven, adjustable at (103 ± 2) °C.

5.4 Other material

Corrosion resistant nails of length of approx. 30 mm and diameter of approx. 1,5 mm to support wood specimens during weathering (see Figure D.3).

6 Sampling

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

A species of wood that is very susceptible to blue stain shall be used:

obligatory for every test is Scots pine sapwood *(Pinus sylvestris* Linnaeus).

NOTE Additional tests may be carried out using other species but, if so, this should be stated in the test report.

7.2 Wood quality

Sound, straight grain, knot-free and uniformly grown wood shall be used exclusively. The wood shall be stain-free. Wood with a resinous appearance shall be avoided.

Wood from the top of the trunk or the lowest 1 m of the trunk is unsuitable.

Exclusively sapwood shall be used showing a rate of growth of: 2,5 to 8 annual rings per 10 mm.

The proportion of latewood shall be less than 30 %.

The wood shall not have been floated, stored in water, heated above 60 °C or treated with chemicals.

Only winter felled trees shall be used which are converted to boards immediately after felling.

When requirements of wood quality on the history of the material cannot be verified, the wood batch shall be tested for fungal infection susceptibility using the procedure described in 8.3 on non- weathered specimens and validated according to Clause 9, 1st paragraph. Wood specimens shall be selected at random and they shall represent 1 % of the batch.

NOTE Air drying of the boards is possible but under inappropriate conditions rapid infection with blue stain fungi may occur. Therefore careful kiln drying at temperatures up to 60 °C is preferred.

Storage of derived test specimens shall not normally exceed 3 years from felling of the trees as this might influence the validity of the test.

7.3 Preparation of sticks and blocks

Unseasoned wood (sticks) shall be dried carefully to a moisture content of (12 ± 2) %. Prepare sticks of approximately 50 mm × 35 mm cross section with the annual rings forming an angle of (45 ± 15)° with the edges. Number the sticks and mark them at the cross sections to be able to identify the trunk from which they are cut.

Plane the sticks to a cross section of 40 mm × 25 mm and round the longitudinal edges with a moulding knife to a radius of curvature of 2 mm.

From these sticks cut blocks free from knots and defects (resin galls etc.) 110 mm long and mark them with the number of the stick in a way that the numbering is detectable after treatment.

Smooth the rounded edges and the face except the end grain faces with sandpaper grit size 120 and clean off sanding dust.

Store the blocks in the conditioning room (5.3.2) until use.

Take blocks from at least 3 different trees for the test of each preparation.

In Annex D, Figure D.2 detailed drawings are given in relation to the preparation of sticks and blocks.

NOTE 1 If it is recommended that the product under test should be applied by brushing only, it may be suitable to cut the blocks prior to treatment in order to give test specimens described under 7.4.1.

NOTE 2 If it is recommended that the product under test should be applied by spraying or dipping, it may be suitable to use only the upper part (representing the face closest to the outer part of the tree) of the treated block in order to give test specimens described under 7.4.1.

7.4 Preparation of test specimens

7.4.1 Treated test specimens

These treated test specimens are cut from treated blocks (8.1.3.2) after drying (8.1.5). Cut the blocks lengthwise with a saw blade which gives fine saw finishes, each to give two treated test specimens the dimensions of which at (12 ± 2) % moisture content shall be:

(110 ± 0,5) mm (grain direction) × (40 ± 0,5) mm × (10 ± 0,5) mm.

NOTE 1 In the case of treatment by brushing the treated test specimens may be cut prior to treatment (8.1.3.2).

NOTE 2 Longer treated test specimens (e.g. 30 cm) can be cut after weathering as long as this still relates to the same sampling.

7.4.2 Control test specimens

These control test specimens are cut from untreated blocks in the same way as the treated test specimens. The dimensions of these control test specimens at (12 ± 2) % moisture content shall be the same as those of the treated ones (7.4.1).

7.5 Number of test specimens

7.5.1 Treated test specimens

For each concentration of the preservative under test 3 blocks (1 from each of 3 trees) to be treated shall be used to give 6 treated test specimens per concentration.

NOTE If treatment procedures other than brushing are used, additional treated test specimens from further treated blocks should be prepared so that those which deviate through over- or under-absorption can be replaced.

7.5.2 Control test specimens

In each test the number of control test specimens required for exposure to fungi (independently from the number of concentrations of the preservative or under test), is as follows:

C_1 - untreated control test specimens:

$C_{1.1}$ without pre-conditioning 6 control test specimens (2 from each of 3 trees);

$C_{1.2}$ with pre-conditioning (using the same system as for the preparation under test) 3 control test specimens (1 from each of 3 trees).

A second set of controls can be included optionally. Where it is desired to test the effectiveness of an active ingredient or of a formulation diluted to different concentrations, the following additional control test specimens can be included.

C_2 - control test specimens treated with the product minus active ingredient:

$C_{2.1}$ without pre-conditioning 3 control test specimens (1 from each of 3 trees);

$C_{2.2}$ with pre-conditioning (using the same system as for the preparation under test) 3 control test specimens (1 from each of 3 trees).

In selecting the control test specimens note that if more than one preservative is tested, one control test specimen is taken from each tree used for the actual tests (7.3) (hence if only one preservative is being tested at a time, 3 control test specimens (1 from each of 3 trees), are required).

NOTE The partition of control specimens with different cutting direction (the outside of the trunk and the side towards the pith) should be the same as that of the treated test specimens.

7.5.3 Validation test specimens

Validation test specimens (positive control test specimens) to be treated with the reference product are derived from 3 blocks (1 from each of 3 trees) giving 6 treated test specimens all intended to be pre-conditioned .

NOTE Values are minimum numbers of test specimens for assessment. More specimens can be used.

8 Procedure[5)]

8.1 Treatment of the wood test specimens

8.1.1 Conditioning of the wood test specimens before preservative treatment

Place the test specimens in the conditioning room (5.3.2) until equilibrium is reached (mass changes less than 0,1g within 24 h).

8.1.2 Sealing of the end surfaces

Coat the conditioned wood test specimens on their end faces with an appropriate end sealer (5.2.5). Keep them in the conditioning room (5.3.2) until further use.

NOTE To ensure adequate end sealing it can be useful to apply the end sealer and overlap the edges 1 mm to 2 mm, e.g. by using a short dip in the sealer of the cross sections.

8.1.3 Application of test preparation to the wood test specimens

8.1.3.1 Determination of the amount to be applied

8.1.3.1.1 Application by superficial methods excluding dipping

The amounts to be applied and the number of applications shall be determined and shall be strictly observed for each parallel test specimen. For the gravimetric control the density of the test product shall be determined and the amount of application should, if necessary, be converted from ml/m² to g/m².

The amounts of the preparation under test and the number of coats shall be realistic in relationship to its normally intended method of use (see Annex E, Table E.2). In case no relevant experience is available, the amounts to be applied and the number of coats shall be determined in preliminary trials. Any direction given by the supplier shall be taken into account.

8.1.3.1.2 Application by dipping, vacuum or pressure methods

The method of application specified by the supplier shall be followed. In case the effectiveness of an active ingredient or a formulation shall be tested using different concentrations, these shall be specified by the supplier. In case the supplier simply indicates amounts to be applied, preliminary trials shall be made to determine with which concentrations or which times of treatment these amounts may be obtained.

The concentrations used and the duration of treatment shall be recorded in the test report. For each treatment block the exact amount of preservative applied shall be indicated.

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5) Annex E, Table E.1 gives a key to the sequence of operations with the various different types of product.

8.1.3.2 Treatment

8.1.3.2.1 Application by superficial methods excluding dipping

Treat the faces originally laying towards the surface and the centre of the trunk of the blocks except the end-grain faces including the rounded edges, in the laboratory at ambient conditions. The number of coatings and the amounts of preservative to be applied to each treatment block shall be recorded in the test report.

Test specimens shall be left to dry for 24 h before coatings are applied in accordance with 8.1.8.

NOTE The amount of preservative to be applied to each face of the blocks should be observed as precisely as possible by checking the increase in mass of the wood test specimen before and after the coatings. The preservative to be tested should be evenly applied to the surface to be treated, if possible, without treating the surface several times during one coating operation.

8.1.3.2.2 Application by dipping, vacuum or pressure methods

After a complete drying of the sealed end surfaces the treatment blocks are weighed, treated by the agreed method of application and the agreed time, are wiped off with a blotting paper to remove excess liquid and are again weighed. Then those blocks are chosen the retentions of which are closest to each other. The remaining treatment blocks are rejected. Subsequently to dipping the blocks are placed on an inert support allowing for free circulation of air in the conditioning room (5.3.2). Any direction given by the supplier regarding a minimum drying period shall be observed.

When a vacuum method is applied the blocks are stored as follows after treatment:

The blocks are arranged upon inert supports at a distance of at least 2 cm from each other within a test vessel that can be tightly sealed. During storage turn the test specimens twice a week by 180° so that they rest on their opposite faces.

The vessels shall be placed in a well ventilated room.

1) In the case of blocks treated with water-soluble products

   To prevent mould growth also place in the vessel small dishes containing xylene (5.2.9) and keep the vessels closed for 2 weeks. During the third week uncover the vessels progressively each day to allow the blocks to dry steadily. From the beginning of the fourth week, leave the vessels completely open.

2) In the case of blocks treated with water-insoluble products

   Keep the vessels covered for one week. Open them progressively each day during the second week and leave them open during the third and fourth weeks.

8.1.4 Treatment of the additional control test specimens C_2 and validation test specimens

Treat the control test specimens (C_2 - 7.5) at the same time as the treated wood test specimens in a similar manner as described in 8.1.3 with either:

— the product under test minus active ingredient; or

— the solvent carrier alone,

which ever is appropriate to the product under test.

Treat the validation test specimens with the reference product at 80 g/m² for the product detailed or equivalent (see 5.2.8).

8.1.5 Drying the blocks after treatment

In the case of brushed blocks after each preservative coat per face to be coated store all the blocks on a horizontal surface under ambient laboratory conditions. Avoid draughts.

In the case of blocks treated by dipping or vacuum methods dry the treated block according to the requirements of the supplier of the preparation.

8.1.6 Preparation of test specimens

After drying (8.1.5) the treated blocks according to 8.1.3.2 are cut longitudinally to produce two test specimens each according to 7.4.

Cut the untreated blocks the same way to give untreated test specimens of the same size.

8.1.7 Insertion of nails

To support wood test specimens during weathering the introduction of corrosion resistant nails (5.4) is required (see Figure D.3 and Figure D.5 for an example). The fixing procedure shall not have any chemical or biological effect on the wood.

Holes of approximately 1,3 mm diameter shall be bored approx. 6 mm into the end surfaces of the test specimens, one in the middle of one end and two in the opposite end at approximately 10 mm from each edge (see Figure D.3). Holes shall be bored parallel to the grain in such a way that cracking or splitting of the wood test specimens is avoided when nails are inserted.

Insert into the pre-drilled holes 3 corrosion resistant nails of length of approximately 30 mm and diameter of approx. 1,5 mm (5.4) to a depth of approximately 10 mm.

8.1.8 Coating the wood specimens

The application of coatings differs according to the type of preparation (Clause 1):

Type A

In the case of preparations intended for use with unspecified coatings, apply three coats of the standard test varnish appropriate to the preparation under test (5.2.2) at intervals of 24 h to the wood test specimens and their corresponding control test specimens (7.5.2) and validation test specimens (7.5.3) including the rounded edges.

The quantity applied amounts to approximately 70 ml/m² (waterborne) and 90 ml/m² (solventborne) of each top coat layer:

— for the first coat dilute the varnish with the appropriate solvent (5.2.4.1) at mass fraction 15 %;

— 24 h after the first coat, and immediately before the second coat, sand the coated surface lightly with abrasive paper of grit size 180;

— for the second coat dilute the varnish with the appropriate solvent (5.2.4.1) at mass fraction 7,5 %;

— use undiluted varnish for the third coat.

Type B

In the case of preparations intended for use with specified coatings apply these according to the appropriate specification and to the wood test specimens and their corresponding control test specimens (7.5.2) and validation test specimens (7.5.3).

During and after coating store the wood test specimens in ambient conditions.

Type C

If the preparation is designed for use without subsequent coating the test specimens are exposed without further application of varnish: similarly the control test specimens (7.5.2) do not receive an application of varnish contrary to the validation test specimens (7.5.3).

NOTE Validation test specimens always require a coating as indicated under 5.2.8.

8.2 Pre-conditioning of the test specimens prior to fungal test

8.2.1 Natural weathering

Expose the wood test specimens for 26 weeks in the period between 1st March and 31st October.

Commence weathering of the wood test specimens 5 to 7 days after application of the last coating.

Place the treated test specimens and control test specimens ($C_{1.2}$ and $C_{2.2}$ - 7.5) for weathering in the rack with the treated side facing upwards and weather them in the open air (5.3.4). Figure D.5.

8.2.2 Artificial weathering

Alternatively to the natural weathering procedure an artificial weathering in a device (5.3.5) providing UV-light and spray of demineralised water can be used. The duration of this procedure shall be four weeks. Detailed description of the artificial weathering cycle is given in Annex F.

8.2.3 Storing of control test specimens

Control test specimens which are not to be subjected to weathering in the above manner (8.2.1 - 8.2.2) are stored in the conditioning room (5.3.2).

8.3 Fungal test

8.3.1 Preparation of the test specimens

Test and control test specimens which are "blue stained" (8.5.2 rating 2) or "strongly blue stained" (8.5.2 rating 3) on the test surface after weathering need not be submitted to the fungal test; note these test specimens in the test report with the extent of blue stain. These test specimens shall be included in the final assessment.

24 h after the end of the weathering, prepare all other test specimens including the unweathered test specimens as follows:

— shorten them equally at both end faces to a final length of 90 mm (Figure D.4);

— groove them with a saw (5.3.3) to a width of approximately 3 mm and depth 4 mm in the middle of the untreated side parallel to the end surfaces (Figure D.4);

— wipe lightly on their treated sides with a damp cloth.

Condition the test specimens for a minimum of 2 weeks in the conditioning room (5.3.2).

NOTE Wet specimens should be air dried prior to conditioning.

8.3.2 Sterilisation of the test specimens

Sterilise the test specimens using the method as given in Annex C.

8.3.3 Preparation of the culture vessels

Introduce 200 ml aluminium-iron-magnesium silicate (5.2.7) into the culture vessels (5.3.6) narrow side down in the case of the jars. Level with a spatula. Moisten the surface uniformly with 75 ml water and fit closures loosely before sterilizing for 30 min in the autoclave at (121 ± 1) °C.

8.3.4 Introduction and inoculation of the test specimens

NOTE 1 See Annex B for detail on the preparation of the spore suspension.

Dip the sterilized test specimens (8.3.2) for 1 s to 2 s in the spore suspension (5.1) and transfer them aseptically to the prepared culture vessels (8.3.3) with their treated sides upwards.

Test specimens treated with different preparations shall be dipped into separate portions of the spore suspension.

Before introducing the test specimens pour 15 ml of spore suspension (5.1) in each culture vessel. Then introduce the test specimens and close the culture vessels.

NOTE 2 Care should be taken that the spores remain suspended during inoculation of the test specimens.

8.4 Test conditions and duration of test

Store the inoculated culture vessels in the incubation room (5.3.1) in the dark or protected from direct sunlight. Continue the test for 6 weeks from the time of inoculation of the test specimens.

8.5 Assessment of the test specimens

8.5.1 General

At the end of the test remove the test specimens from the culture vessels, wash them carefully and clean off all adhering residues of fungus.

8.5.2 Assessment of the test specimen surface

Examine the surface of the test specimens visually for the presence of blue stain. In case of preparations of type A or B (Clause 1) note if the blue stain is present only in the coating. Evaluate them as follows:

0 - not blue stained: no blue stain can be detected visually on the surface.

1 - insignificantly blue stained: the surface exhibits only individual small blue stained spots none larger than 1,5 mm in width and 4 mm in length, and not more than 5 in number.

2 - blue-stained: the surface is continuously blue stained up to a maximum of one third, or blue stained partially or in streaks up to half the total area.

3 - strongly blue stained: more than one third of the surface is continuously blue stained or more than half is partially blue stained.

In order to avoid impact of the rounded edges on the surface rating, the assessment shall only be based on the flat surface of the test specimens.

A separate evaluation of the rounded edges should be included in the report. Care should be taken on the correct application of the test product to the edges of the specimens.

Furthermore in order to avoid the effect of minor infection associated with the end grain a zone of 4 mm from each end will not be used for assessment.

Difficulties may arise in distinguishing development of blue-stain on certain types of darkly coloured finish. In these cases evaluation of the interior of the specimens is especially important.

NOTE Careful washing the surface with clear water using a soft cloth (without damaging the coating) is important to exclude unattached material on the top coat from the assessment.

8.5.3 Assessment of the interior of the test specimens

For evaluation of the interior of the test specimens, prepare the test specimens as follows:

— cut them parallel to the end faces at points 30 mm from each end;

— measure the depth of any zones free of blue stain to an accuracy of 0,5 mm with a measuring device (5.3.8) at each of 3 points on the transverse surface:

  — in the middle of the test specimen;

  — at a distance of 10 mm from each edge of the test specimen.

9 Validity of results

At least 80 % of the control test specimens tested as under section 8.3.4 (see 7.5.2: C1.1 and C.1.2) should be blue stained to at least rating 3 and show sufficient interior blue staining (all earlywood stained up to the surface), otherwise the test corresponding to these control test specimens must be repeated.

The test is valid if the median (50 percentile) rating is 1 or higher for the validation test specimens treated with the reference product (5.2.8).

10 Reporting the results

In evaluating the test take the following into consideration:

— with each preparation to be tested, evaluate at least 6 similarly tested test specimens (7.5) together;

— any untreated control test specimens (C_1 - 7.5) not blue stained on their surfaces shall be rejected together with all the treated test specimens originating from the same stick. The treated test specimens need not be rejected if they are distinctly blue stained at least on their under surfaces.

For each preparation tested state the following:

— the results of evaluation of the surface of all the test specimens examined: for varying degrees of blue staining, indicate the maximum and minimum rating value (from ...to ...) and both the median and mean value. In the case of dark coloured preparations, note if evaluation was difficult or impossible due to the dark appearance of the surface treatment itself;

— the smallest measured depth free of blue stain among all the points measured;

— the mean value of all the points measured for the depth free of blue stain in the series of test specimens.

The condition of treated control test specimens (C_2 - 7.5) is to be recorded in the same way in order to reveal whether there is an effect of the diluent or of the preparation in the absence of the active ingredient intended to control the blue stain.

11 Test report

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

a) reference to this European Standard and to the type of preparation tested (Clause 1);

b) the name of the supplier;

c) the name and description of the type of preparation tested and whether the formulation has been disclosed;

d) reference to the diluting medium used, if applicable;

e) if applicable, the dilution(s) in mass fraction of the preparation tested;

f) wood species used;

g) date of the preservative treatment;

h) type of preservative treatment and if applicable the number of applications;

i) number of replicate test specimens;

j) smallest and largest quantity of preservative applied on the six replicate test specimens: in the case of superficial application in ml/m^2 or g/m^2 (…to ...) and, if applicable, the method of application of the wood preservative or in the case of penetrating processes in kg/m^3;

k) if applicable, (types A and B in Clause 1) the types of subsequent coating materials and number of coatings applied;

When preparations have been tested according to the supplier's particular specification, especially where a combination of preservatives, methods of application and/or coating materials have been employed, full details shall be given in the report and the results stated as applying only to the particular system tested.

l) exact duration of weathering and place of weathering (natural or artificial). For natural weathering details this information shall include the height above sea level of the place of weathering and the orientation of the individual specimens. If applicable, an indication of any blue staining present and a note that consequently no further fungal tests were undertaken. For artificial weathering a detailed description of cycle used is included;

m) the test fungi used and their source including a description of anything unusual about the form and extent of growth of any test fungi used;

n) date of inoculation of the test specimens;

o) date of evaluation of the test specimens;

p) assessment of the test specimens at the end of the test:

- the rating of surface blue stain of each test specimen;
- the mean and median rating for surface blue stain;
- the smallest depth of stain-free zone;
- the mean depth of stain-free zones;
- evaluation of the blue staining of the edges;

q) the name of the institute responsible for the report and the date of issue;

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

s) the following note:

The interpretation of this test report and the practical conclusions that can be drawn from it require a basic knowledge of the problems of wood preservation. For this reason this test report alone does not indicate any official approval of the wood preservative tested.

The test report shall also mention all details of optional methods of work or those not provided for in the standard and also circumstances which might have had an effect on the result.

NOTE The report should include also a table with the individual results.

Annex A
(normative)

Detailed information on coating products

A.1 General

The standard provides an option to tests with a specific coating material which has been specified by the supplier.

When a more general use is envisaged generic coating materials can be used. This annex provides in both an alkyd coating material for organic solvent based preparations (A.2) and an acryl coating material for water based preparations (A.3). The acryl coating material has a minimal UV protection included while for the alkyd coating both a non-UV protected type and an alkyd coating including a reference UV-protection are available.

Trade names of products are examples of suitable products available commercially. This information is given for the convenience of users of this EN 152 standard and does not constitute an endorsement by CEN of these products.

A.2 Alkyd coating material for organic solvent based preparations (5.2.2.2)

A.2.1 Basic components of alkyd varnish

A.2.1.1 Alkyd resin

Solution of alkyd resin (based on soya oil or drying fatty acids with mass fraction 65 % to 68 % oil content) with 75 % solid content in white spirit with not less than 5 % aromatic content (see A.2.1.2); the solution shall correspond to the following characteristics:

— Gardner coloration max. 6;

— corresponding iodine colour number max. 10;

— acid number < 15;

— flow time at 20 °C (50 % of alkyd resin in white spirit) 30 s to 100 s;

— density 0,960 g/ml;

— soya oil or other vegetable oil, drying fatty acid mass fraction 65 % related to the solid content;

— phthalic anhydride mass fraction 23 % related to the solid content.

NOTE The commercial alkyd resin URALAC AD 97 (DSM Coating Resins) is suitable for this purpose.

A.2.1.2 White spirit (5.2.4.1)

Characteristics of white spirit suitable for the test:

— density at 15 °C 0,770 g/ml to 0,785 g/ml;

— distillation range 150 °C to 195 °C.

CAS registry number: 64742-82-1 (white spirit type 1).

A.2.1.3 Turpentine oil

The product shall correspond to the following characteristics:

— density at 15 °C 0,850 g/ml to 0,970 g/ml;

— distillation range 93 % up to 170 °C at normal pressure;

— acid number < 8.

A.2.1.4 Anti skinning agent

Methyl ethyl ketoxime.

A.2.1.5 Driers

A mixture of octoates or naphthenates comprising:

— calcium with mass fraction of 4 % metal 3 parts by mass;

— zirconium with mass fraction of 18 % metal 1,5 parts by mass;

— cobalt with mass fraction of 6 % metal 0,4 part by mass.

A.2.1.6 UV-absorbers and HALS

A UV absorber is a compounding material which, through its ability to absorb ultraviolet radiation and render it harmless, retards the deterioration caused by sunlight and other UV light sources. Incorporated into coating, this additive screens the most harmful UV portion of light and thereby protects films and sensitive substrates from the photo-destruction.

A hindered amine light stabilizer (HALS) is a radical scavenger which traps any radical formed during polymer degradation.

NOTE Trade names of products of suitable products available commercially are Tinuvin 99-2 and Tinuvin 123 as UV-absorber and Radical scavenger respectively. Both are available from Ciba Speciality Chemicals.

A.2.2 Composition of the coating material

The standard composition is as follows:

— alkyd resin	800 parts by mass;
— turpentine oil	25 parts by mass;
— anti-skinning agent	15 parts by mass;
— drier	49 parts by mass;
— white spirit	111 parts by mass
	1 000 parts by mass.

The coating material shall have a solid content in mass fraction of (60 ± 1) % and a flow time of (120 ± 10) s (measured at 20 °C in a flow cup with a 4 mm opening) (ISO 2431).

The coating material incorporating UV protection is composed as follows:

— alkyd resin	800 parts by mass;
— turpentine oil	25 parts by mass;
— anti-skinning agent	15 parts by mass;
— drier	49 parts by mass;
— white spirit	96 parts by mass;
— UV absorber	10 parts by mass;
— Radical scavenger (HALS)	5 parts by mass
	1 000 parts by mass.

A.3 Acrylic coating material for water based preparations (5.2.2.3)

A.3.1 Basic components of acrylic coating

A.3.1.1 Acrylic resin

Acrylic emulsion is used with approximately 46 % solids content. The emulsion may contain an in-can preservative that shows no activity against blue stain, e.g. a combination of approx. 150 mg/l of benz-isothiazolinone (BIT) and approximately 50 mg/l methyl-isothiazolinone (MIT). Minimum film formation temperature (MFFT) of the emulsion is approximately 12 °C and the glass transition temperature approximately 24 °C.

NOTE 1 To ensure good storage stability an addition of approximately 0,2 % of an in can preservative (i.e. BIT/MIT) to the composition would be necessary. To avoid possible in-can contamination after opening the can the water based stain varnish should be stored between 2 °C and 7 °C. This way it can be used up to 6 months.

NOTE 2 The commercial acryl resins Mowilith DM 772 or Mowilith LDM 7717URAL (Celanese Emulsions GmbH, 65926 Frankfurt/M, Germany) are suitable for this purpose.

A.3.1.2 Water

Complying with grade 3 of EN ISO 3696.

A.3.1.3 Plasticizer

1,2-Propyleneglycol is a good solvent for polar resins used as coupling agent.

A.3.1.4 pH adjustment component

Component used to adjust the pH, e.g. Aminomethylpropanol 90.

NOTE The commercial product AMP 90 (Angus Chemie GmbH, Zeppelinstrasse 30, 49479 Ibbenbüren, Germany) is suitable for this purpose.

A.3.1.5 Film forming agent

Solvent used as film forming agent: 2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (product 1).

Methoxybutanol is an organic solvent suitable as film forming agent (product 2).

NOTE The commercial product Texanol (Eastman Chemical GmbH, Charlottenstrasse 61, 51149 Köln, Germany) is suitable for this purpose as product 1 and Methoxybutanol (Celanese Emulsions GmbH, 65926 Frankfurt/M, Germany) is suitable for this purpose as product 2.

A.3.1.6 UV-absorbent

Compounding material which, through its ability to absorb ultraviolet radiation and render it harmless, retards the deterioration caused by sunlight and other UV light sources. Incorporated into coating, this additive screens the most harmful UV portion of light and thereby protects films and sensitive substrates from the photo-destruction.

NOTE The commercial product Tinuvin 1130 (Ciba Spezialitätenchemie GmbH, Chemiestraße, 68623 Lambertheim, Germany) is suitable for this purpose.

A.3.1.7 Anti foaming agent

Additive used to control, inhibit (foam inhibiting agent), or suppress (defoamer) foam formation in water-based coatings. Foam inhibiting agents are added to the system whereas defoamers are post-added.

NOTE The commercial products Texanol (Eastman Chemical GmbH, Charlottenstrasse 61, 51149 Köln, Germany) is suitable for this purpose.

A.3.1.8 Polyurethane thickener

Additive used to raise or control the viscosity without the necessity for major changes in the total solids content. Organic or inorganic, generally considered as being either pseudoplastic or thixotropic in nature.

NOTE The commercial product Tafigel PUR 40 (Münzing Chemie GmbH, Salzstrasse 174, 74076 Heilbronn, Germany) is suitable for this purpose.

A.3.1.9 Substrate wetting additive

Substance used to reduce the surface tension and thereby facilitate spreading or impregnation of a surface. Additive that belongs to the group of surfactants.

NOTE The commercial product Tego Wet KI 245 (Tego Chemie Service GmbH, Goldschmidtstraße 100, 45127 Essen, Germany) is suitable for this purpose.

A.3.1.10 Paraffin wax-emulsion

An emulsion of a wax, which is a solid or semi-solid material derived from petroleum distillates or residues by such treatments as chilling, precipitating with a solvent or de-oiling. It is a light-colored, more-or-less translucent crystalline mass, slightly greasy to the touch, consisting of a mixture of solid hydrocarbons in which paraffin series predominates.

NOTE The commercial product Südranol 230 (Süddeutsche Emulsions Chemie GmbH, Rhenaniastrasse 46, 68199 Mannheim-Neckarau, Germany) is suitable for this purpose.

A.3.2 Composition of the water based stain varnish (exterior)

The standard composition is as follows:

— acrylic emulsion resin	750 parts by mass;
— water	94 parts by mass;
— water + 1,2-propylenglycol + pH adjustment comp. (mixture)	12 + 10 + 2 parts by mass;
— film forming agent 1 + UV absorbent + antifoaming agent (mixture)	12 + 13 + 2 parts by mass;
— water + polyurethane thickener + film forming agent 2 (mixture)	18 + 2 + 25 parts by mass;
— water + substrate wetting additive + wax-emulsion (mixture)	9 + 1 + 50 parts by mass
	1 000 parts by mass.

Annex B
(normative)

Preparation of a spore suspension of the test fungi

For culturing the test fungi, place 150 ml of nutrient solution (5.2.1) into each of 300 ml conical flasks.

— close the conical flasks with cotton wool plugs and sterilise them for 20 min in the autoclave at (121 ± 1) °C. In the absence of an autoclave sterilize in a stream of steam for 20 min on each of 3 successive days. In this case keep the conical flasks at ambient temperature between the sterilisations;

— inoculate the sterilised conical flasks separately according to species of fungus with *Aureobasidium* and *Sydowia* cultures by means of 2 pieces (approximately 1 cm^2) of agar covered with fungus in each case. The inocula shall be taken from actively growing cultures on 3 % malt agar which have been incubated at (22 ± 1) °C for at least 14 days and which are not older than 28 days;

— sufficient conidial spores will normally be produced in 3 days to 5 days when at least 300 000 spores/ml have been formed. The contents of the conical flasks containing the two fungi shall then be mixed;

— filter the mixed solution through sterile muslin. Use the solution within a few hours for inoculation of the culture vessels (8.3.4). The solution cannot be stored. Example of a nutrient solution suitable for preparing a spore suspension: 2 % concentrated malt extract or 1,6 % dried malt dissolved in distilled or demineralised water complying with grade 3 of EN ISO 3696. The pH of the nutrient solution shall be 4,2 and shall be adjusted if necessary.

Annex C
(informative)

Information regarding sterilisation procedures

C.1 Ionising irradiation

This method is suitable for all preservatives.

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

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

Send the envelopes thus prepared to an irradiation centre. Advice with regard to the packing of the envelopes can be obtained from the irradiation centre. Subject the envelopes to radiation to a minimum level of 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 sterilisation 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.

The envelopes are not opened until the precise moment when the contents are to be used.

C.2 Steam

This method can 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 test specimens so that they do not touch, placing glass or stainless steel rods between each of them.

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

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

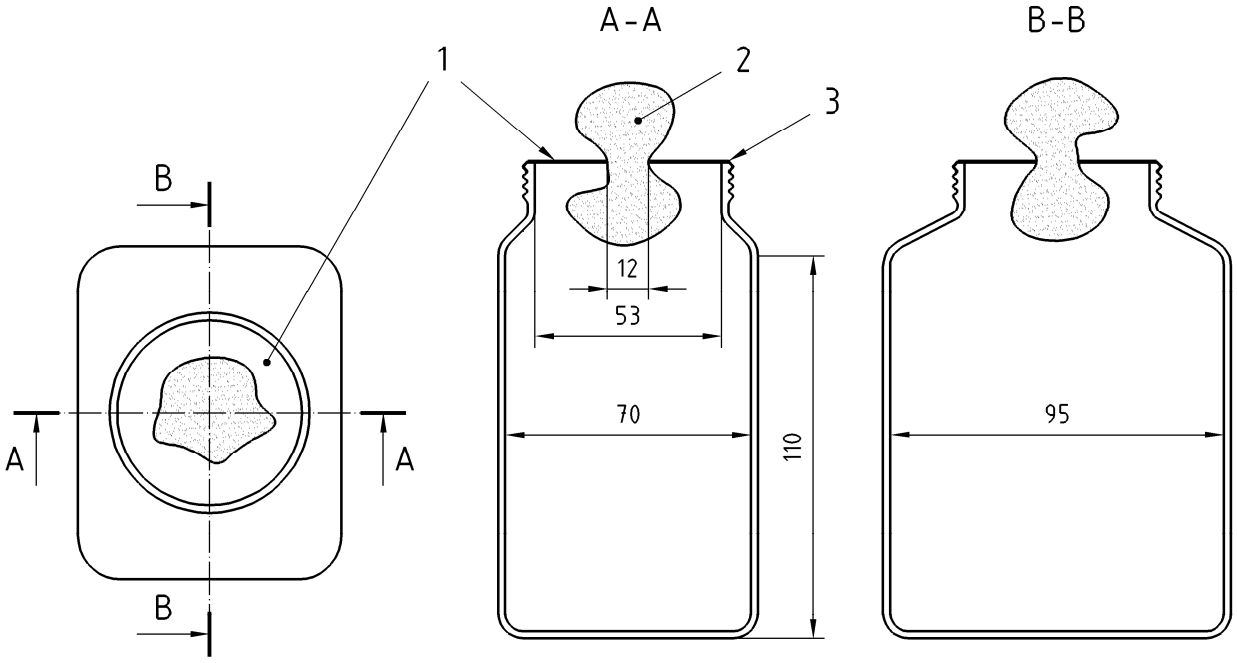
The dishes are not opened until the precise moment when the test specimens are to be placed in the culture vessels.

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

Annex D
(informative)

Figures on equipment and diagrams

Dimensions in millimeters



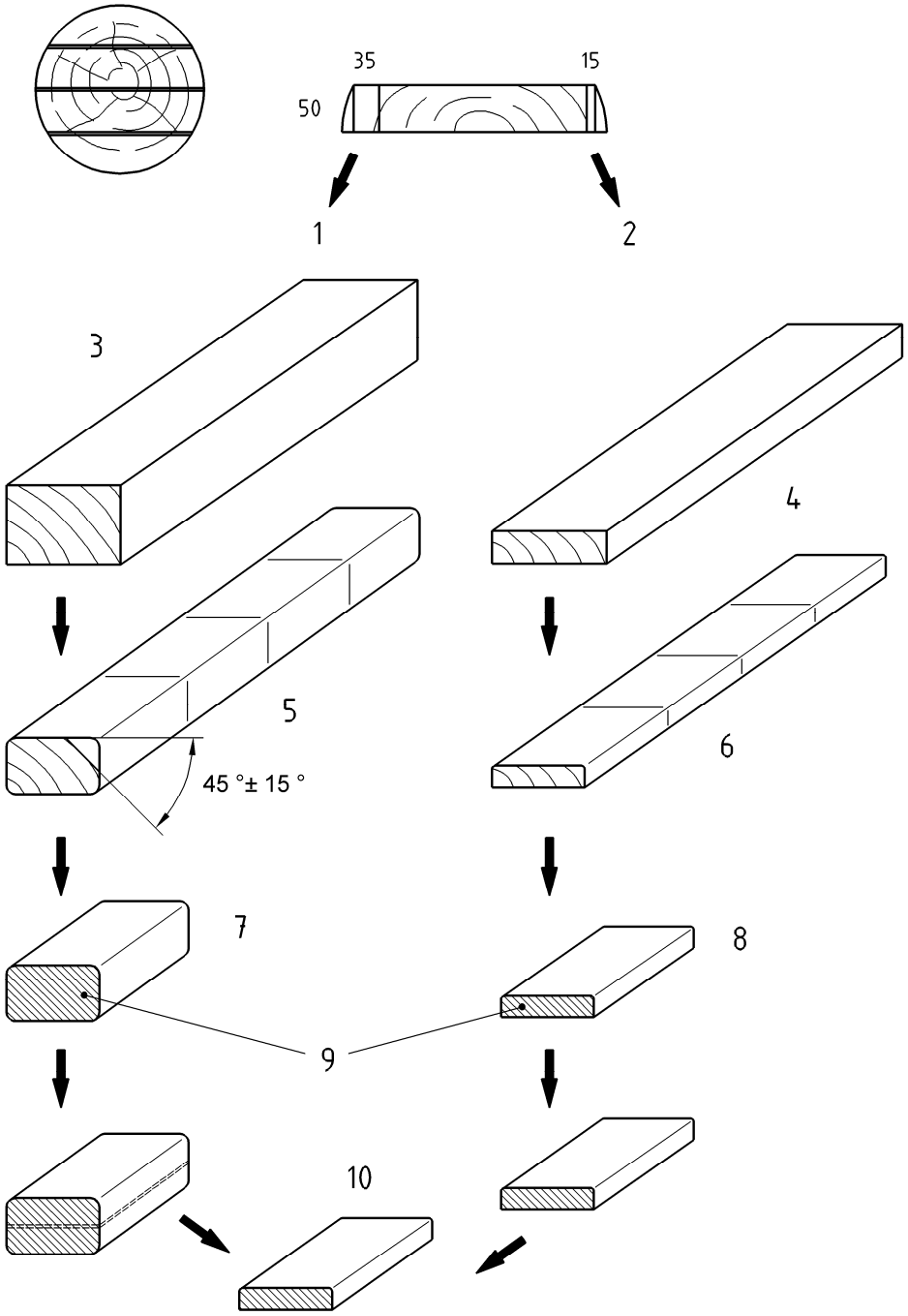
Key

1 metal lid
2 cotton wool plug in ∅ 12 mm hole
3 rubber washer

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

Figure D.1 — Culture vessel

Dimensions in millimeters



Key

1 general system
2 alternative solely for brush application
3 rough sawn stick: 500 mm × 50 mm × 35 mm
4 rough sawn plank: 500 mm × 50 mm × 15 mm
5 seasoned stick: 500 mm × 40 mm × 25 mm
6 seasoned plank: 500 mm × 40 mm × 10 mm
7 treatment block: 110 mm ×40 mm × 25 mm
8 treatment specimen: 110 mm × 40 mm × 10 mm
9 sealant
10 test specimen: 110 mm × 40 mm × 10 mm

Figure D.2 — Schematic diagram of the production of treatment blocks

Dimensions in millimetres

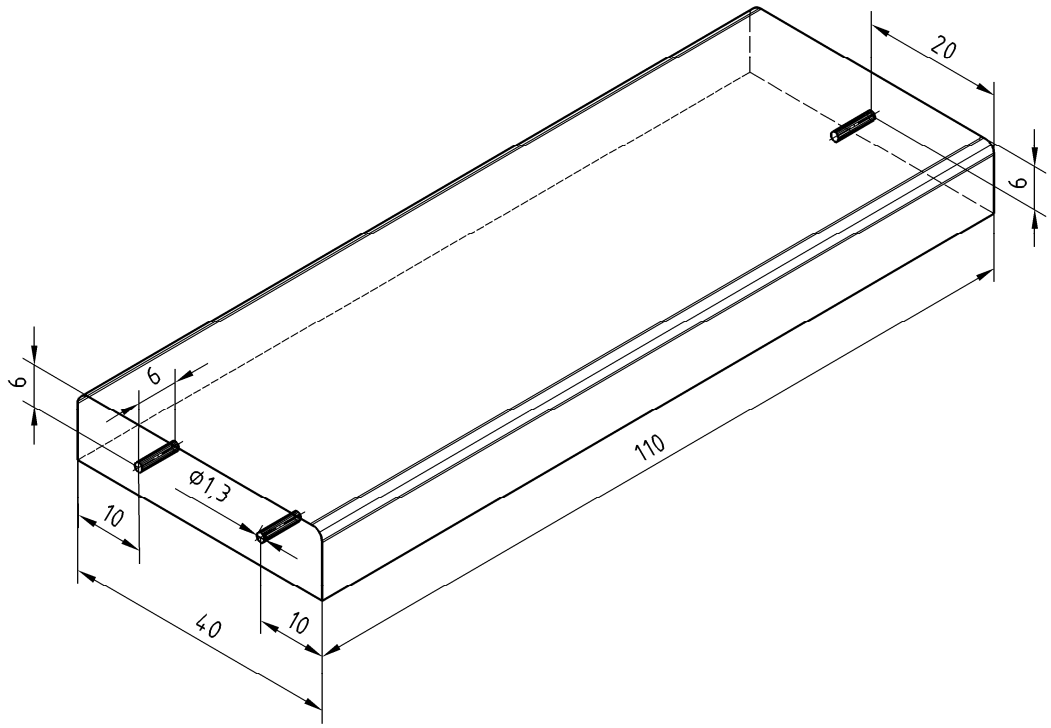
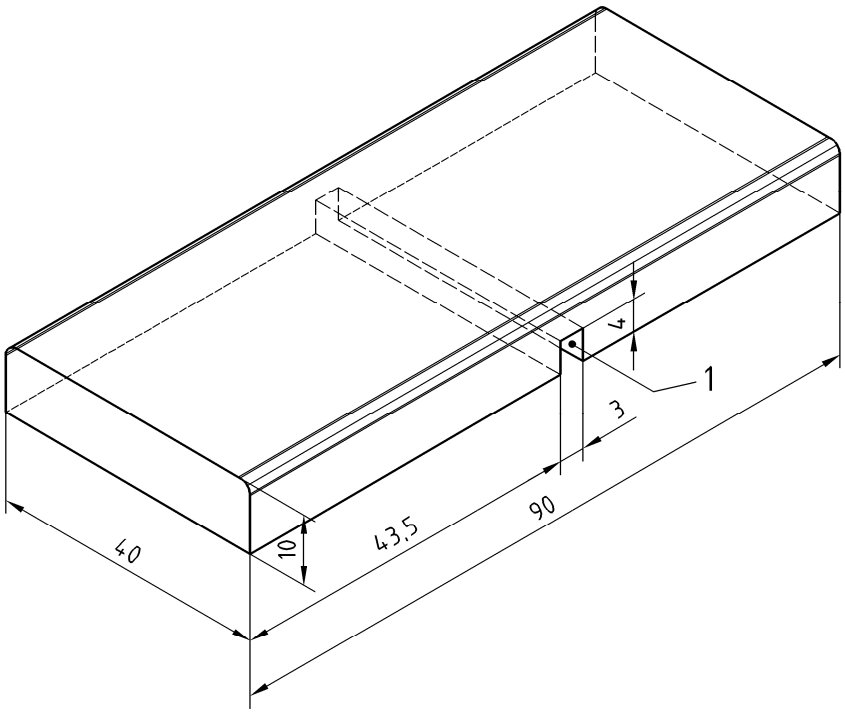


Figure D.3 — Preparation of wood specimens for insertion of nails

Dimensions in millimetres

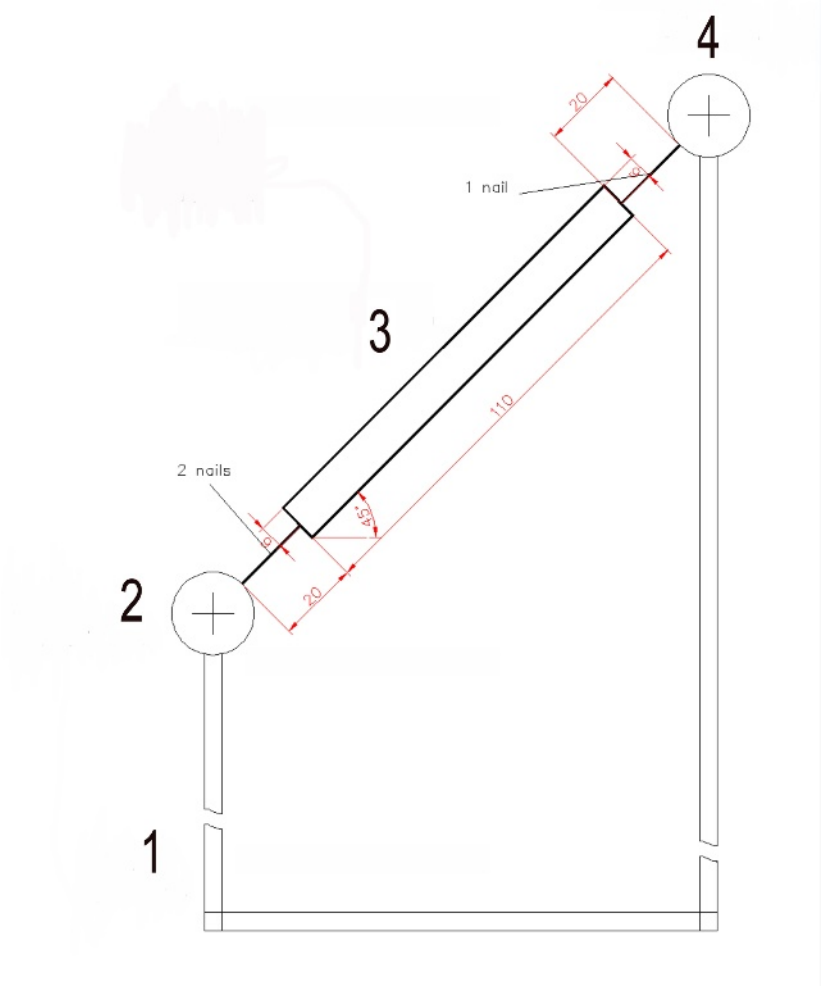


Key

1 groove 3 mm in width and 4 mm in depth

Figure D.4 — Wood test specimen for the fungal test

Dimensions in millimetres



Key

1 Support structure
2 Lower retaining bar
3 Wood specimen
4 Upper retaining bar

Figure D.5 — Diagram of the mounting of the wood test specimens in the weathering racks

Annex E
(informative)

Instructions on the test procedure

Table E.1 — Key of sequence of operations with each of the different types of products for preventing blue stain in service (the figures refer to the respective clause of the standard)

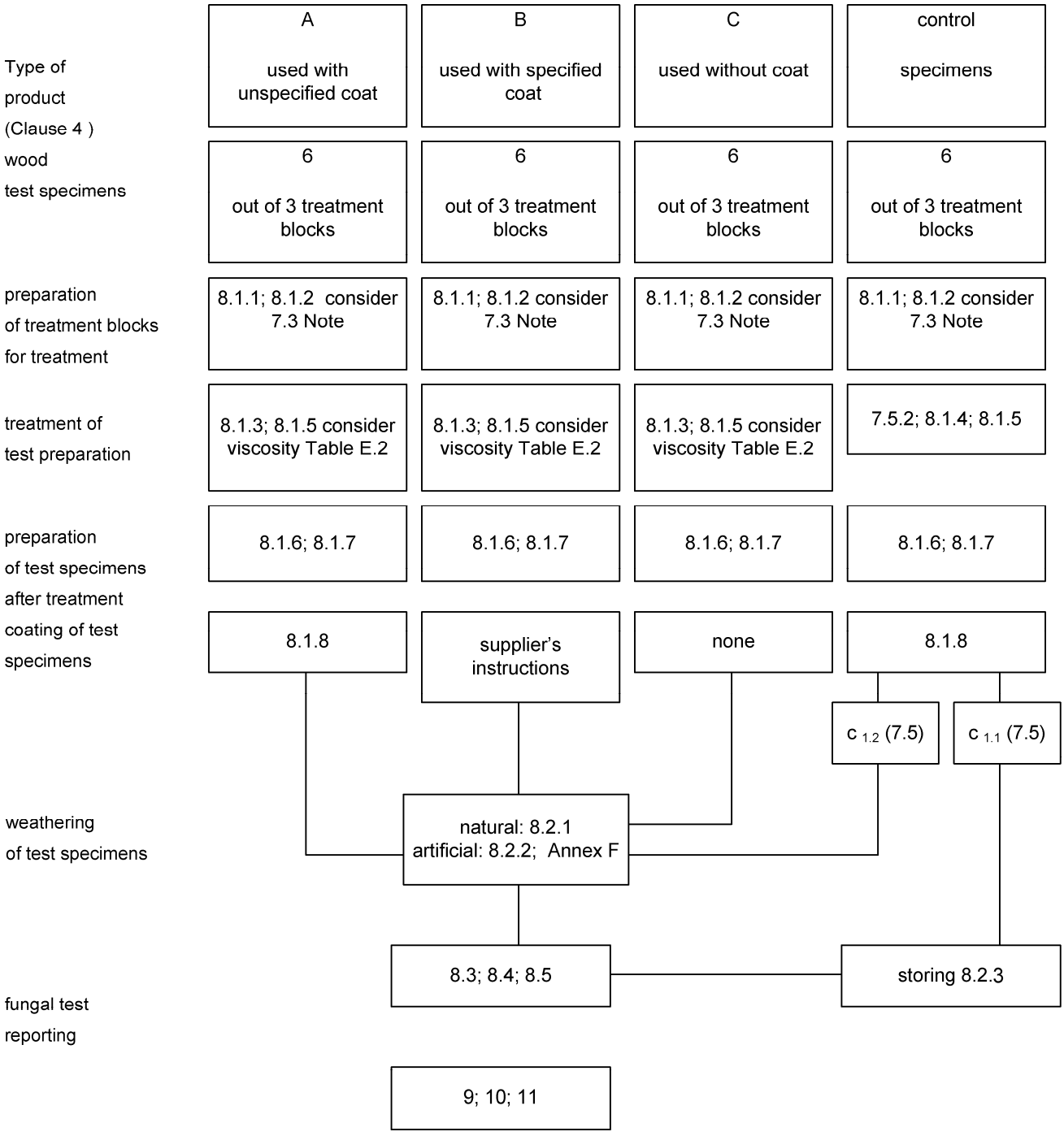


Table E.2 — Approximate values for the 4 main types of preparations when applied to the test species pine sapwood

Preparation[a]		Solids content [%]	Application rate for total amount[b]		Number of coats required[c]
			m^2/l	ml/m^2	
1. Preservative	Low build/ transparent	< 10	10	90 to 100	1
2. Exterior wood stain types	Low build/ semi-transparent	ca. 25	6 - 9	115 to 155	3
	Medium build/ semi-transparent	25 … 40	10	90 to 95	2
	High build/opaque	> 50	10	100 to 120	2
3. Paint types	Primer paint	10 .. 60	10 to 12	55 to 65	1

[a] Categories are for general guidance only refer to EN 927 part 1 and 2 represent product types A, B and C (Clause 2).

[b] Application rate in g/m² depending on individual density.

[c] The number of coats should be as shown unless otherwise specified. The interval between coats should be 18 h to 24 h.

NOTE Special care should be taken with the higher viscosity products to avoid unrealistically heavy rates of application. With such products it is particularly desirable to determine the rate of application on pieces of the same wood species with a larger surface area in order to calculate the amounts required for the smaller test specimens.

Annex F
(normative)

Artificial weathering cycle

F.1 Introduction

An artificial weathering process can be used instead of the natural weathering procedure described in 8.2.1.

NOTE Keeping in mind that in tests with natural weathering the results may vary due to local differences in climates, the artificial weathering process should lead to test results as far as possible comparable to the results of tests with the natural weathering procedure.

F.2 Apparatus – minimum requirements

A device providing spray of demineralised water and UV-light preferable produced by fluorescent tubes shall be used. The water shall not be used in a circulation system.

The main wave length of the UV-light shall be 340 nm. The UV exposure temperature shall not exceed 50 °C. The corresponding irradiance set point shall not exceed 0,83.

The temperature of the dark (conditioning) phase shall not exceed 40 °C.

The flow of demineralised water shall be approximately 4 l/min in a QUV or UVCON. These are optimal values derived from the water consumption of Weather-O-Meter machine. It is useful to limit the water consumption in QUV or UVCON machines[7)]. Therefore for a similar water consumption in the UVS equipment cabinets it can be recommended to install a switch providing an option of intermitted spray of 1/10 or 6 s every minute.

The water used for spraying shall not be recycled as biocides could accumulate.

The distance between the lamps and the surfaces to be weathered shall be approximately 50 mm.

During the exposition in the device the specimens shall be moved at regular intervals in a way as to bring all specimens for equal duration in all positions on the holder.

Additional information on UV artificial weathering equipment can be found in EN 927 part 6.

A suitable holder for the specimens is shown in Figure F.1.

7) Trade names of machines are examples of suitable machines available commercially. This information is given for the convenience of users of this EN 152 standard and does not constitute an endorsement by CEN of these machines.

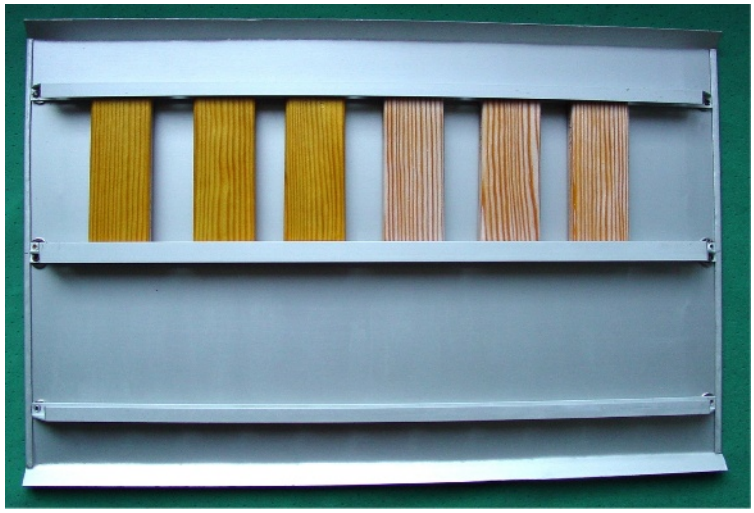


Figure F.1 — Example of a holder for test specimens

F.3 Weathering cycles

F.3.1 General

Three standard artificial weathering cycles are presented here. One can be used depending on suitability of the equipment.

When using other artificial weathering cycles equivalence with one of these 3 standard cycles should be demonstrated.

All cycles use:

Spray of demineralised water.

The demineralised water shall comply the following requirements:

— < 2 mg/kg $CaCO_3$;

— specific conductivity preferably < 0,2 µS/cm;

— < 0,02 mg/l silicates ;

— < 0,7 mg/l solid particles;

— pH 6 to 7.

The water used for spraying shall not be recycled as biocides could accumulate.

Dark: no light periods. In some devices this step can only be realised with the program step “Cond” (= conditioning)

UV-light.

F.3.2 Artificial weathering cycle 1

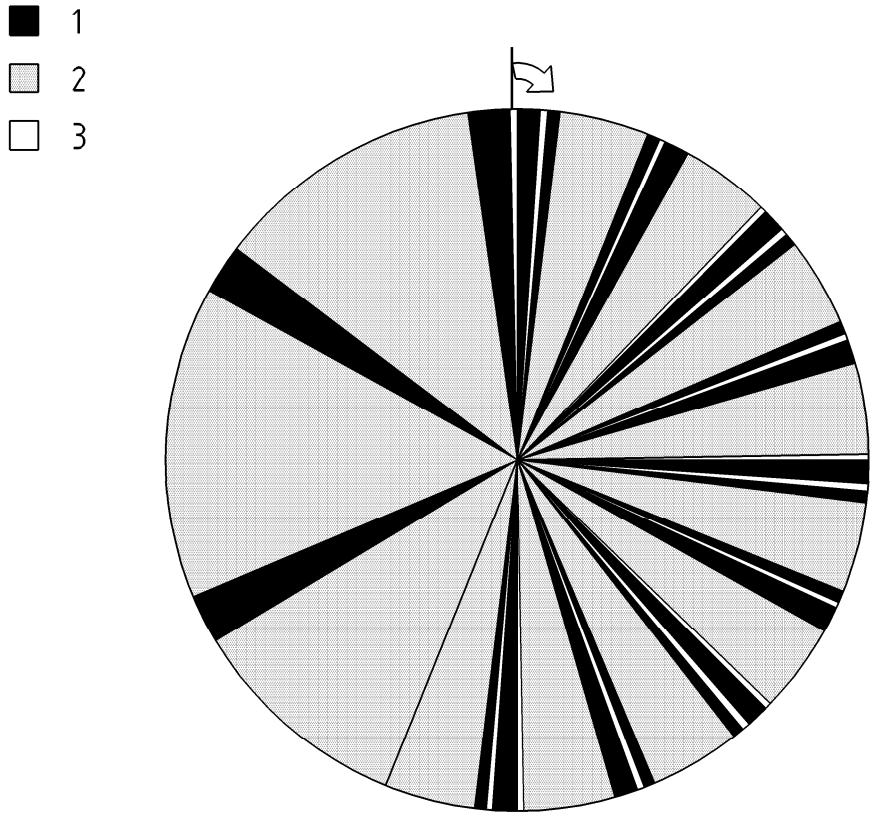
The artificial weathering cycle 1 is given in Table F.1 and Figure F.2.

Table F.1 — Artificial weathering cycle 1

Step	Program step Weathering cycle 1	Duration (h:min)	Summarized duration
1	Subcycle step 2 – 8, repeated 9 times	-	
2	Spray	0:01	
3	Dark	0:04	
4	Spray	0:01	
5	Dark	0:04	
6	Spray	0:01	
7	Dark	0:04	
8	UV	0:30	6:45
9	UV	1:15	
10	Dark	0:15	
11	UV	1:45	
12	Dark	0:15	
13	UV	1:30	
14	Dark	0:15	
15	Final step – go to step 1	-	5:15
			12:00

The overall duration of the artificial weathering cycle 1 shall be 672 h (56 repetitions).

Weathering cycle 1



Key

1 dark
2 UV-light
3 spray

Figure F.2 — Artificial weathering cycle 1 (one circle equals 12 h)

F.3.3 Artificial weathering cycle 2

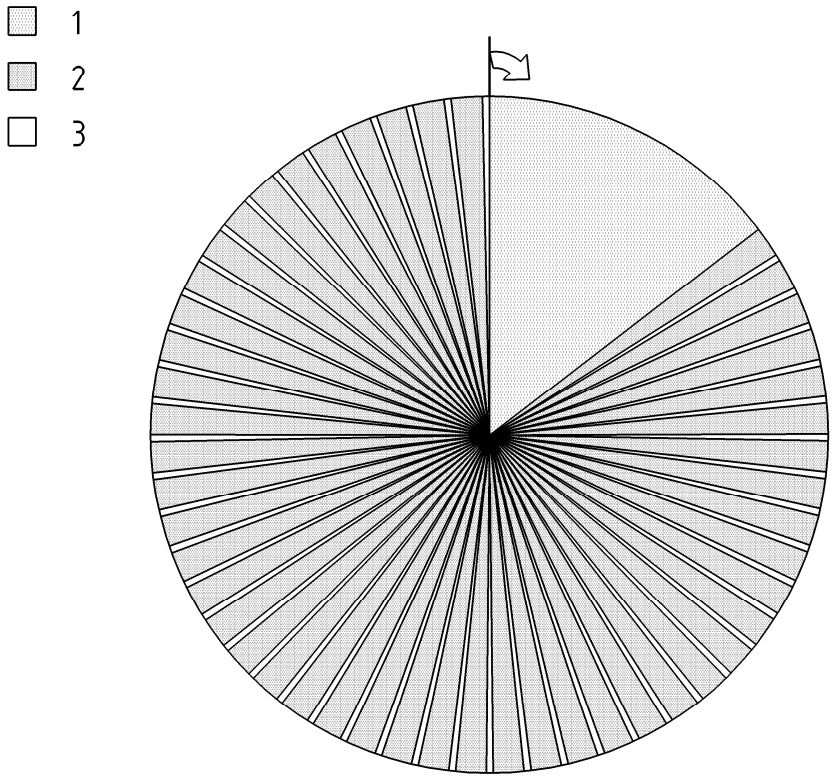
The artificial weathering cycle 2 is given in Table F.2 and Figure F.3.

Table F.2 — Artificial weathering cycle 2

Step	Program step Weathering cycle 2	Duration (h:min)	Summarized duration
1	Condensation	24:00	
2	Subcycle step 3-4, repeated 48 times		
3	UV-light	2:30	
4	Spray	0:30	
5	Final step – go to step 1	-	
			168:00

The overall duration of the artificial weathering cycle 2 shall be 672 h (4 repetitions).

Weathering cycle 2



Key

1 condensation
2 UV-light
3 spray

Figure F.3 — Artificial weathering cycle 2 (one circle equals 168 h)

F.3.4 Artificial weathering cycle 3

The artificial weathering cycle 3 is given in Table F.3 and Figure F.4.

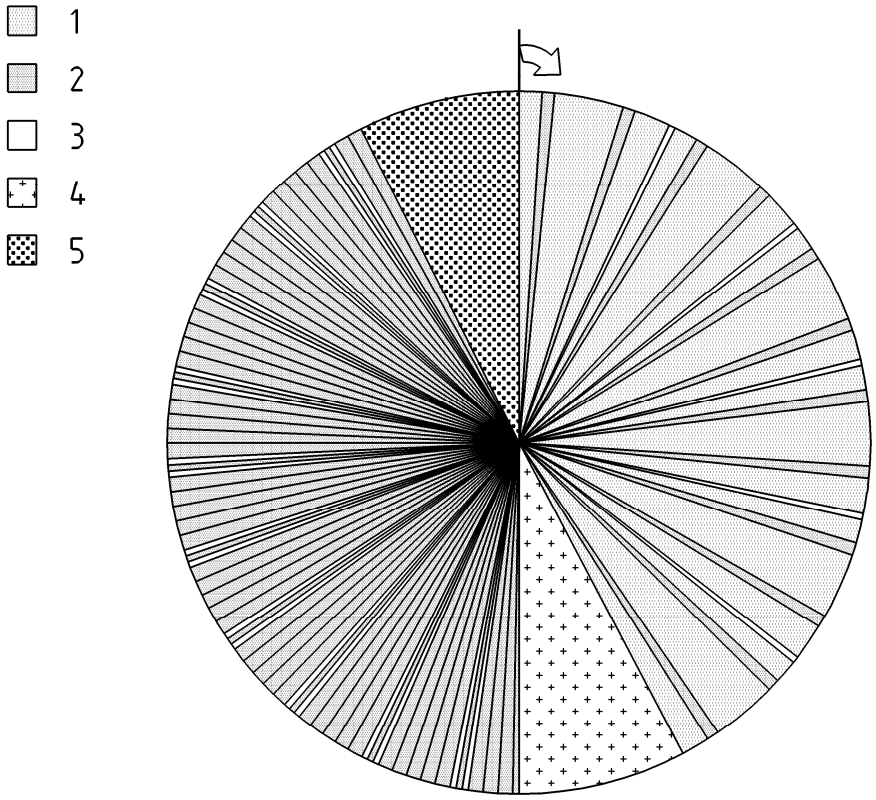
Table F.3 — Artificial weathering cycle 3

Step	Program step Weathering cycle 3	Duration (h:min)	Summarized duration
1	Subcycle step 2-6, repeated 6 times	-	
2	Spray + UV-light [a]	4:00	
3	UV-light	2:00	
4	Spray + UV-light	10:00	
5	UV-light	2:00	
6	Spray + UV-light	5:00	
7	Spray	1:00	
8	Refrigerator (+ 5 °C)	24:00	168:00 (1 week)
9	Subcycle step 10-11, repeated 72 times	-	
10	UV-light	1:42	
11	Spray + UV-light	0:18	
12	Deepfreeze (– 3 °C)	24:00	
15	Final step – go to step 1	-	168:00 (1 week)
			336:00 (2 weeks)

[a] The UVS equipment sometimes does not allow using Spray and UV-light simultaneously.

The overall duration of the artificial weathering cycle 3 shall be 672 h (2 repetitions).

Weathering cycle 3



Key

1 spray + UV-light
2 UV-light
3 spray
4 refrigerator
5 deepfreeze

Figure F.4 — Artificial weathering cycle 3 (one circle equals 336 h)

F.4 Criteria to select weathering cycles

The artificial weathering cycle has been used in collaborative research related to preconditioning of preservative treated wood.

The artificial weathering cycle 2 is derived from EN 927-6.

The artificial weathering cycle 3 has also been used in collaborative research related to preconditioning of preservative treated wood. This cycle was originally developed for an Atlas Weather-O-meter Ci 35 using a Xenon lamp of 3000 Watt and a quartz-borosilicate filter combination. It can be implemented on UVS equipment if appropriate programming is available.

F.5 Conditioning

After the exposure to the artificial weathering let the specimens dry for one week in the conditioning room (see 5.3.2).

Annex G
(informative)

Example of a test report

Number of European Standard and type tested	EN 152
Type of preparation	application of 1 coat with unspecified varnish
Name of the supplier	Company M
Name and description of the type of preparation	X, oily priming coating materials without pigment, formulation not disclosed
Solvent or diluent employed	None
Dilution of the preparation	None
Wood species	Scots pine sapwood *(Pinus sylvestris* Linnaeus)
Date of preservative treatment	2011-03-13
Type of preservative treatment and number of applications	By brushing -1 coat
Number of replicate test specimens	6
Smallest and largest quantity of preservative applied	91 ml/m^2 to 98 ml/m^2
Types of subsequent coating materials and	Alkyd resin varnish as prescribed in this standard,
Number of coatings	3 coats: first coat diluted with 16 % white spirit (flow time: 32 s), second coat with 7 % white spirit (flow time 49 s) and third undiluted. Before the second and third coat the varnished surface was sanded lightly with abrasive paper of grit size 180
Weathering	Start of weathering 2011-03-20 End of weathering 2011-09-25 Weathering took place in the open air on the roof of the Institute building in Y at 45° facing south west, at an altitude of 125 m. No natural blue-staining -all test specimens subjected to biological test.
Test fungi	*Aureobasidium pullulans* (de Barry) Arnaud, strain p 268 Source : Hann-Münden *Sydowia polyspora* (Bref. & Travel) E. Müller, strain S 231. Source : Hann-Münden.
Date of inoculation of specimens	2011-10-26
Date of evaluation of test specimens	2011-12-02
Evaluation of test specimens	None of the six test specimens were blue stained on the surface (median value 0, mean value 0). The zone free from blue stain amounted to at least 2,0 mm, on average 3,0 mm. The edges were free of blue stain.

This report has been prepared by the Institute P

Location y 2012-01-05

Mr. Z.

The report should include a detailed table with all individual ratings.

NOTE The interpretation of this test report and the practical conclusions that can be drawn from it require a basic knowledge of the problems of wood preservation. For this reason this test report alone does not indicate any official approval of the wood preservative tested.

Annex H
(informative)

Environmental, health and safety precautions within chemical/biological laboratory

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

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

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

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

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

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

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

— use a fume cupboard during preparation of organic solvent solutions; store, handle and dispose of chemicals in a safe and environmentally satisfactory manner: including chemicals for laboratory test, test specimens, unused solvents and reagents that have to be disposed of.

Bibliography

EN 73:1988, *Wood preservatives - Accelerated ageing tests of treated wood prior to biological testing - Evaporative ageing procedure*

EN 212, *Wood preservatives — General guidance on sampling and preparation for analysis of wood preservatives and treated timber*

EN 335, *Durability of wood and wood- based products - Use classes: definitions, application to solid wood and wood based panels*

EN 927-1:1996, *Paints and varnishes - Coating materials and coating systems for exterior wood - Part 1: Classification and selection*

EN 927-2:2006, *Paints and varnishes - Coating materials and coating systems for exterior wood - Part 2: Performance specification*

EN 927-3:2006, *Paints and varnishes - Coating materials and coating systems for exterior wood - Part 3: Natural weathering test*

EN 927-6:2006, *Paints and varnishes - Coating materials and coating systems for exterior wood - Part 6: Exposure of wood coatings to artificial weathering using fluorescent UV lamps and water*

EN 1001-1, *Durability of wood and wood-based products — Terminology — Part1: List of equivalent terms*

EN 1001-2, *Durability of wood and wood based products — Terminology — Part 2: Vocabulary*

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