BS EN 252:2014

BSI Standards Publication

Field test method for determining the relative protective effectiveness of a wood preservative in ground contact

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 252:2014. It supersedes BS 7282:1990 which is withdrawn.

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

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 77751 6

ICS 71.100.50

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2014.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 252

November 2014

ICS 71.100.50

Supersedes EN 252:1989

English Version

Field test method for determining the relative protective effectiveness of a wood preservative in ground contact

Essai de champ pour déterminer l'efficacité protectrice relative d'un produit de préservation du bois en contact avec le sol

Freiland-Prüfverfahren zur Bestimmung der relativen Schutzwirkung eines Holzchutzmittels im Erdkontakt

This European Standard was approved by CEN on 30 August 2014.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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

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

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 252:2014) has been prepared by Technical Committee CEN/TC 38 “Durability of wood and wood-based products”, the secretariat of which is held by AFNOR.

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

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

This document supersedes EN 252:1989.

In relation to the previous version of the standard, the following main modifications have been made:

— change in the assessment criteria for fungal decay;

— minor changes in the description of termite attack;

— the addition of informative annexes concerning the determination of strength characteristics in wood stakes by measuring the modulus of elasticity; the characterization of field test sites and the setting-out of the test stakes in the field test sites.

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

Introduction

The method is primarily concerned with protection against microbial attack. However, it is also capable of being used in areas where a termite hazard exists. It should also be noted that microbial decay may alter the resistance of a stake to termite attack and that termite attack may obliterate evidence of microbial decay.

This field method provides one criterion by which the effectiveness of a wood preservative product can be assessed in a ground contact situation (Use Class 4 according to EN 335).

The main objective of the method described is to evaluate the effectiveness of a preservative relative to a reference material.

For this reason permeable timbers are used throughout so that the protective efficacy of various retentions of wood preservative can be determined.

NOTE Informative Annex A gives guidance for testing wood or wood based products in ground contact that have or have not been treated with a wood preservative.

1 Scope

This European Standard specifies a field test method for evaluating the effectiveness of wood preservatives in a ground contact situation. Wood treated with a reference preservative is included for comparison.

The protective effect of the test preservative is assessed in relation to the effect of a reference wood preservative applied by a specified treatment.

2 Principle

Wooden stakes are treated with preservative solutions to give a range of preservative retentions. After drying and, if necessary, an appropriate fixation period, the stakes are partially buried in soil in selected test fields in the open.

The stakes are regularly inspected and their condition compared with that of untreated controls and that of a group of stakes treated with a reference preservative both of which indicate the aggressiveness of the individual field.

The different agents of attack and their respective intensities are recorded.

3 Wood specimens

3.1 Wood species

Susceptible wood species that can be completely penetrated with preservative shall be chosen as follows:

— for every test the sapwood of Scots Pine (*Pinus sylvestris (L)),* shall be used;

— it is recommended that a hardwood species of local importance is included if the preservative is expected to be used in this type of wood;

— if desired other wood species may be incorporated in the test.

3.2 Wood quality

The wood shall be straight-grained and free from knots, cracks, stain, decay, insect holes, reaction wood or other defects. Test stakes with a resinous appearance shall be avoided. The wood shall not have been water-stored, floated, chemically treated or steamed or dried at a temperature above 60 °C.

The Scots Pine sapwood shall show an average rate of growth of 2,5 to 10 annual rings per 10 mm.

If additional wood species are to be used the range in the number of annual rings per 10 mm for each species shall be mentioned in the report.

The test report shall also include the mean density and moisture content for the wood used in the preparation of the stakes.

3.3 Characteristics and dimension of stakes

The boards shall be conditioned at (20 ± 2) °C, (65 ± 5) % relative humidity.

Stakes for test shall be cut from the test wood(s) as follows:

— Each stake shall be planed to within the thickness tolerance indicated. When viewed at the cross-cut end, the rings shall be oriented tangentially to one of the 50 mm edges within the limits (0 ± 25)°;

— The dimensions shall be: (500 ± 2) mm x (50 ± 1) mm x (25 ± 0,5) mm when measured at a moisture content of (12 ± 2) % (mass fraction).

Each test shall be carried out with stakes of comparable density and any stakes in a test batch which have densities outside the range of 15 % of the mean density shall be rejected.

Additional stakes of different dimensions may also be included in the tests.

3.4 Number of Stakes

At least 10 stakes per field for each wood preservative and retention shall be tested.

A greater number of stakes shall be treated so that stakes with deviating retentions can be rejected (5.3).

Additional stakes may also be included for chemical analysis, to aid determination of retentions and/or penetration/distribution (see 5.3).

To assess the virulence of the field conditions a series of at least 10 untreated control stakes shall be included in each field (see Clause 7).

Include in each field at least two series of 10 standard reference stakes of Scots Pine treated according to 5.2 with a reference preservative (see Clause 6).

3.5 Labelling of stakes

Each stake shall be labelled with an inert, long-lasting label or tag.

NOTE A map of the position of each stake within the site is desirable.

4 Sample of wood preservative

The sample shall be representative of the wood preservative to be tested. It shall be stored and handled in accordance with written recommendations from the manufacturer.

It is recommended to chemically quantify the active ingredients content.

5 Conditioning and treatment of the stakes

5.1 Conditioning

The stakes should be conditioned in conditions to reach constant mass at (20 ± 2) °C and (65 ± 5) %RH.

The stakes shall be air-dried indoors, to a moisture content at which a good penetration of the wood preservative can be obtained. For vacuum / pressure processes the moisture content of the specimens shall be (12 ± 2) % (mass fraction).

5.2 Treating process

For the reference stakes and unless otherwise specified for the test stakes a full-cell process is to be used. A typical full-cell process has an initial vacuum which shall be less than 10 kPa (0,10 bar) and maintained for at

least 30 min. Pressure of at least 1 MPa (10 bar) shall be applied for at least 90 min. Complete records of treatment shall be made for each charge.

5.3 Determination of retention of wood preservative product

Calculate the volume of each stake before treatment from its dimensions (see Clause 3). If shaped to a point before treatment this shall be taken into account in the calculation.

Determine the mass of each stake by weighing to the nearest 0,5 g.

After treatment, allow the stake to drain for several minutes. Reweigh each stake to the nearest 0,5 g to determine the mass of treatment solution absorbed.

Calculate the retention value of each stake from the mass of treatment solution absorbed, the concentration of the treating solution and the calculated stake volume. Express the retention of the wood preservative product as kilograms per cubic metre of wood. Calculate the mean retention for each series of test stakes.

Stakes with individual retentions deviating by more than 10 % from the mean value shall be rejected.

5.4 Range of preservative retention

Test each preservative with at least three and preferably five different retention levels. These different levels shall be achieved by using fresh preservative solutions at different dilutions and without varying the treatment conditions.

Use a fresh solution at each dilution; the dilution of a quantity of solution which has been used already may be unsatisfactory because preferential absorption may have occurred during the previous treatment schedule.

5.5 Post treatment conditioning of stakes

For those products requiring a fixation period the recommendations of the wood preservative manufacturer should be followed.

For the reference preservatives the stakes shall first be close-stacked, each retention group separately, and kept wrapped for an appropriate period (at least 3 weeks) at room temperature (above 15 °C) in polyethylene or similar non water permeable material to avoid rapid drying.

For drying after fixation, make open piles protected from rain and frost, with inert spacers to allow air flow between the stakes.

6 Reference stakes

6.1 Reference preservative

Stakes of Scots Pine sapwood shall be treated according to 5.2 using the reference preservative, with the following composition:

$CuSO_4 \cdot 5H_2O$	35,0 % mass fraction
$K_2Cr_2O_7$	45,0 % mass fraction
$As_2O_5 \cdot 2H_2O$	20,0 % mass fraction

Chemical purity of individual components should be at least 98 %.

Two dry salt retentions shall be used approximating to 2 kg/m^3, and 9 kg/m^3 respectively. The precise retentions obtained will be dependent on the concentration and uptake of the treating solution.

NOTE 1 Alternative raw materials could be used providing the same metal balance is achieved. In terms of elemental metal these retentions equate to the following:

— 2 kg/m^3 dry salt retention: 0,18 kg/m^3 copper, 0,32 kg/m^3 chromium, 0,23 kg/m^3 arsenic;

— 9 kg/m^3 dry salt retention: 0,80 kg/m^3 copper, 1,43 kg/m^3 chromium, 1,02 kg/m^3 arsenic.

NOTE 2 It is possible to use a third concentration at 6 kg/m^3 to provide additional information.

As a result of the implementation of the Biocidal Products Directive 98/8/EC there are restrictions in the use of chromium- containing wood preservatives.

6.2 Alternative reference preservative

If it is not possible to use a wood preservative containing arsenic the reference stakes shall be treated with an alternative preservative.

This preservative shall have the following composition:

$CuSO_4 \cdot 5H_2O$	50,0 % mass fraction
$K_2Cr_2O_7$	48,0 % mass fraction
CrO_3	2,0 % mass fraction

Chemical purity of individual components should be at least 98 %.

Two dry salt retentions shall be used approximating to 4 kg/m^3 and 17 kg/m^3 respectively. The precise retentions obtained will be dependent on the concentration and uptake of the wood preservative treatment solution.

NOTE Alternative raw materials could be used providing the same metal balance is achieved. In terms of elemental metal these retentions equate to the following:

— 4 kg/m^3 dry salt retention: 0,51 kg/m^3 copper, 0,72 kg/m^3 chromium;

— 17 kg/m^3 dry salt retention: 2,16 kg/m^3 copper, 3,06 kg/m^3 chromium.

7 Untreated control stakes

A series of at least 10 untreated control stakes shall be included in each test field.

These stakes shall be interspersed between the stakes treated with the wood preservative product(s).

8 Condition of the test field

In order to promote reproducibility and to reduce variation in the test results, avoid overabundant vegetation on the field.

The vegetation shall be cut by physical means and in such a way that the buried stakes remain untouched. Chemicals to control the growth of vegetation (herbicides) may affect the fungal attack and shall therefore not be used.

Information about test field quality and characterization is given in informative Annex B.

9 Installation of the stakes in the test field

The stakes of each test series shall be installed vertically with at least 300 mm between the stakes. Stakes shall be buried to half their length.

NOTE 1 A template aids installation.

Stakes of the same type (preservative and retention) shall be distributed across the test plot.

An example of a distribution pattern is given in informative Annex C.

The stakes shall not be hammered down into the soil, since this may damage the wood (fractures, splits) and influence the test results.

NOTE 2 A spike, spade or other convenient tool can be used to make a suitable hole in the ground.

Having inserted the stake in the hole it is important to press the surrounding soil tight to the stake so that a good contact is achieved between the soil and all the surfaces of the buried half of the stake.

10 Inspections

The stakes shall be examined annually. Inspections after a long dry period should be avoided. However, inspection during rain should be avoided as this also makes evaluation difficult.

Withdraw the stake from the ground by a straight upward pull and remove carefully the soil adhering to it while ensuring that the stake and its test position are not unduly damaged. Should the stake be difficult to withdraw, gentle waggling and tapping perpendicular to the narrow plane of the stake is permissible.

Examine all sides of the stake for the presence of symptoms of changes in the wood. It is not necessary to use magnification.

To determine any change in surface hardness of the wood a blunt pointed instrument can be used for probing.

However, the stake should be inspected without undue mutilation or removal of softened wood as this would destroy the surface of the wood and alter the test conditions.

The stakes shall be rated according to Clause 11. In case a rating 3 is recorded, a light blow on one of the 50 mm wide face shall be administered in order to assess if a rating 4 is appropriate.

If possible, the type of decay shall be recorded. These include white and brown rot, soft rot and bacterial attack.

After the inspection the stake is carefully re-installed into its original hole. The soil is carefully pressed against it so that a good contact is ensured between the soil and the surfaces of the buried part of the stake. The half of the stake that had been in the ground before shall be inserted again.

Other examinations, e.g. bending tests under carefully controlled conditions, may be carried out at these intermediate times (see informative Annex D).

11 Evaluation

11.1 General

The evaluation of the extent of attack is based on a number of observations which cannot be measured in absolute terms. In addition the apparent condition of an individual stake may vary slightly from time to time depending on the climatic conditions before and during the inspection.

It is therefore important not to make the rating procedure elaborate. If there is any uncertainty which rating a stake should be given, it is strongly recommended that the lower rating be used.

11.2 Attack by microorganisms

Usually fungi are the most destructive microorganisms on wood in ground contact. The rating system described in Table 1 shall be used to assess the extent of attack on the stake caused by microorganisms.

Table 1 — Rating system for the assessment of attack caused by microorganisms on test stakes

Rating	Classification	Definition
0	No attack	No change perceptible by the means at the disposal of the inspector in the field. If only a change of colour is observed, It shall be rated 0.
1	Slight attack	Perceptible changes, but very limited in their intensity and their position or distribution: changes which only reveal themselves externally by superficial degradation, softening of the wood being the most common symptom.
2	Moderate attack	Clear changes: softening of the wood to a depth of at least 2 mm over a surface area covering at least 10 cm^2, or softening to a depth of at least 5 mm over a surface area less than 1 cm^2.
3	Severe attack	Severe changes: marked decay in the wood to a depth of at least 3 mm over a wider surface (covering at least 25 cm^2), or softening to a depth of at least 10 mm over a more limited surface area.
4	Failure	Impact failure of the stake in the field.

By adding up the ratings for all stakes in each retention group and dividing by the number of stakes, a notional average rating is obtained for each retention of the wood preservative that has been tested.

If all stakes at a given retention have failed (average rating 4) the average life of stakes in the group is calculated together with the standard deviation.

In field test sites where wood destroying termites are present, the termite rating and fungal rating are noted and both are recorded in the test report. The final rating of each stake is given as the higher of the two (termites or fungi).

11.3 Attack by termites

The evaluation of the extent of termite attack shall be made separately according to the rating system described in Table 2.

Table 2 — Rating system for the assessment of attack by termites on test stakes

Rating	Classification	Definition of condition
0	No attack	No sign of attack
1	Slight attack	Perceptible, but slight attack, taking the form of a very superficial deterioration of approximately 1 mm to 2 mm deep, at some points or over small areas
2	Moderate attack	Moderate attack shown by deteriorated areas covering several cm^2 and 2 mm to 5 mm deep, or by scattered points down to a depth exceeding 5 mm, or by different combinations of the two types of attack
3	Severe attack	Severe attack, showing extended and deep destruction of approximately 5 mm to 10 mm or tunnels reaching to the centre of the stake, or by different combinations of the two types of severe attack
4	Failure	Extreme attack: overall generalized penetration involving a total or almost total destruction of the stake.

11.4 Simultaneous attack by microorganisms and termites

In the case of a simultaneous attack by microorganisms and termites the final rating for each stake is given by the higher degree of attack. Both ratings are recorded and reported.

12 Duration of the test

The test shall be run for a minimum period of five years (or until all stakes have failed if this occurs earlier). It is advisable to continue the test beyond five years, with inspections at suitable intervals, in order to determine longer performance of the treated stakes.

Ideally the test should be continued until all stakes of the product under test have failed.

13 Conditions for the validity of the test

The test is valid when:

— at least 75 % of untreated stakes are rated 4;

— the median rating for the reference stakes at the lower retention is not less than 2,0;

— signs of decay exist in at least one stake for the reference stakes at the highest retention.

14 Test report

A test report shall indicate:

a) the number of this European Standard and the year of issue;

b) the name of the applicant;

c) the name, the type of the product tested, the declaration or the chemical analysis of the active ingredients;

d) the solvent or diluent used;

e) the wood species used and the mean density of the wood selected;

f) any additional wood species used including the stake dimensions, the approximate number of annual rings per 10 mm and mean density of the wood selected;

g) the number of replicates;

h) the concentrations tested;

i) the date of treatment and the treatment conditions:

— initial vacuum: . . . kPa/ . . . min
— pressure: . . . kPa/ . . . min
— final vacuum: . . . kPa/ . . . min

j) the average amount of solution in litres per cubic meter absorbed in each series and the minimal and maximal values;

k) the average retention of preservative in kilograms per cubic metre for each series and the minimum and maximum values;

l) the reference preservative (composition, concentration, average retention and minimum and maximum values);

m) the method of post treatment conditioning and the dates;

n) the date of installation in the field;

o) a brief description of the test field including its location;

p) the date(s) of inspection of the stakes;

q) the duration of the exposure period;

r) the grading system used in the evaluation (Clause 11) and the degree of deterioration;

s) notional average ratings for controls, reference stakes and test stakes;

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

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

v) the following note:

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

The test report shall also list any variation from the described test method as well as any factors that may have influenced the results.

It is recommended to provide in an annex:

— the density of each stake;

— the wood preservative retention in each stake;

— the rating of each stake for each evaluation;

— the biological agents responsible for decay for each stake when it can be confidently established.

Annex A
(informative)

Guidance for the testing of wood or wood based products that have not been treated with a wood preservative

A.1 General

This European Standard describes the ground contact field test to assess the effectiveness of a wood preservative applied to solid wood. However, much of the test procedure described is applicable to wood products that fall outside the scope of this standard. This annex offers guidance as to how the standard may be adapted so that these products may be tested.

A.2 Naturally durable wood

When testing the natural durability of wood, this standard should be used with variations as described in EN 350-1.

A.3 Modified solid wood

Modified wood is wood that has been subjected to the action of a chemical, physical or biological agent resulting in property enhancement. Any enhancement in biological durability is by a non-biocidal mode of action.

Where a wood modification treatment can be applied at varying retentions similar to those for wood preservative (described in 5.4) then the wood treatment can be tested in the same way as preservative treated wood. However, for some types of modified wood the treatment process may not involve the application of chemical, or may involve a specific manufacturing process where the application of a range of retentions is either impractical or irrelevant. In such cases the method of sampling the wood product prior to testing will differ.

Modified wood from at least 3 separate batches should be tested. Test stakes should be cut from larger modified boards to the dimensions given in 3.3. Boards should be sampled at random from each batch. A minimum of 5 stakes from each batch and a minimum of 30 stakes in total should be exposed in each field test site. Where possible, the boards from which each test stake is cut should be analysed to determine the extent of modification. Reference stakes should be those as required in EN 350-1, but it is recommended that treated reference stakes described in Clause 7 are also used.

A.4 Wood panels or engineered wood products

Wood panels or engineered wood products can be tested in ground contact field sites as described in Clause 9, Clause 10, Clause 11, Clause 12, Clause 13 and Clause 14. Size constraints may mean that dimensions other than those in 3.3 are chosen.

Wood panels or engineered wood products from at least 3 separate batches should be tested. Test stakes should be cut from wood panels or engineered wood products to be as close as possible to the dimensions given in 3.3. The test material should be sampled at random from each batch. The first 40 cm around the edges of a wood panel or from the ends of the wood panel or engineered wood product should be discarded

prior to cutting test stakes. A minimum of 5 stakes from each batch and a minimum of 30 stakes in total should be exposed in each field test site.

The mode or pattern of degradation of a wood panel or engineered wood product may differ significantly from that for solid wood. It should be recognized that the grading system described in Clause 12 may not be relevant to such products and that alternative system may need to be described and used.

Annex B
(informative)

Characterization of the field test site

Every year, 10 new untreated stakes should be installed evenly in the field. The control stakes should be seasoned and stored in the same way as treated specimens before installation.

The object of using untreated controls is to give an indication about the type of biological agents present in the field and their aggressiveness.

Stakes treated with the reference preservative will give additional information of the type of decay and virulence.

Prior knowledge of the biological activity of the field over time (e.g. 5 years) is important. Information is provided from untreated stakes and reference preservative.

A specific area selected for the test field should be of uniform soil and surface, on level, moist but well drained land.

In some countries the fire-hazard in summer shall be considered very seriously and the site selected and protected accordingly.

Maintenance of Field Test Sites:

A previously unused test plot is recommended. However, field test sites are often limited in space. Therefore, it is likely that differently treated stakes are installed in the same plot in succession of a previous EN 252 test.

There is a need to verify that any remaining components of a previously tested wood preservative or their metabolites do not hinder wood damaging organisms.

At least 5 untreated wood specimens are placed into holes where the stakes with the highest retention of the preservative under test and 5 specimens where the highest concentration of each reference product had previously been situated.

For comparison at least 10 pine sapwood stakes should be installed at the same time in soil where no preservative testing has taken place.

If an area is to be reused the top soil should be turned, mixed and raked level.

Alternatively, a plot may be used as new ground after a period of 5 years following the removal of all stakes.

The used plot should be mixed by physical means taking care to fill any old holes and to keep the plot level. New holes shall not be closer than 15 cm from old holes.

A physical /chemical characterization of the test site should be made available and can be included in the test report. This should include parameters such as vegetation, organic content of the soil, clay content and water holding capacity. Experience in the variability of microbial activity within the test site should also be included in the test report.

Annex C
(informative)

Example of pattern for setting up field stakes into the ground

Care needs to be taken to start each row (see example rows 1 to 4 below) with a different type of stake (e.g. different product or retention), to ensure stakes of the same type are not planted adjacent to one another in any line. A typical test layout is shown in Table C.1 below.

Table C.1 — Example of a pattern for setting up field stakes into the ground at the field test site

ROW 1	*ROW 2*	*ROW 3*	*ROW 4*	*LINE*
P5	P1	RP 1.		23
P4	**UC**	P5		22
P3	RP 3.	P4	**UC**	21
P2	RP 2.	P3	RP 3.	20
P1	RP 1.	P2	RP 2.	19
UC	P5	P1	RP 1.	18
RP 3.	P4	**UC**	P5	17
RP 2.	P3	RP 3.	P4	16
RP 1.	P2	RP 2.	P3	15
P5	P1	RP 1.	P2	14
P4	**UC**	P5	P1	13
P3	RP 3.	P4	**UC**	12
P2	RP 2.	P3	RP 3.	11
P1	RP 1.	P2	RP 2.	10
UC	P5	P1	RP 1.	9
RP 3.	P4	**UC**	P5	8
RP 2.	P3	RP 3.	P4	7
RP 1.	P2	RP 2.	P3	6
P5	P1	RP 1.	P2	5
P4	**UC**	P5	P1	4
P3	RP 3.	P4	**UC**	3
P2	RP 2.	P3	RP 3.	2
P1	RP 1.	P2	RP 2.	1

P1, P2, P3, P4, P5: 1st, 2nd, 3rd, 4th, 5th retentions of the stakes treated with the wood preservative.

RP 1, RP 2, RP 3: 1st, 2nd, 3rd retentions of the stakes treated with the reference preservative.

UC: untreated control stakes.

Annex D
(informative)

Determination of strength characteristics in wood stakes through measuring Modulus of Elasticity

Next to the visual estimation as described in the standard, strength loss of treated wood can be an indicator for the performance of a wood preservative. Measuring the changes of Modulus of Elasticity (MOE) over time is one way to provide additional information in this respect. The method employed should ensure that no damage is done to the stakes while bending.

In a strictly physical sense it is very difficult to measure the correct MOE in more or less decaying wood stakes. The formula for, e.g. static MOE according to the standard EN 310:1993, *Wood-based panels - Determination of modulus of elasticity in bending and of bending strength,* works on a regular shape of the stake with a span of 20 × height and exact measurement of length, width and height. The problems have been addressed (IRG/WP 96-20093, 1996) and are mainly due to the uneven change of shape of a treated stake during the exposition in the field. These difficulties in mind it has been proposed to speak of a “modified MOE” (mod. MOE).

Nevertheless, recording mod. MOE-loss over time in a stake provides a data set that elucidates a different aspect of wood characteristics in microbiologically exposed wood than visual estimation (IRG/WP 05-20319, 2005).

The reproducibility of the results when determining the mod. MOE is enhanced when all the testing is carried out above fibre saturation, since bending strength of timber decreases with increasing fibre saturation. Therefore after fixation and prior to soil contact the initial mod. MOE of each wood stake is measured when wood moisture is still above fibre saturation (this is determined by weighing). Ten replicates are used for each concentration of the preservative under test, for the reference product and for virulence controls. This way for each stake there is a basis value that is equivalent to 100 %. Later loss of mod. MOE in percent is calculated for each stake.

In case the stake had been exposed in the field for some time the lower and the upper half are often quite different in moisture. It has shown to be beneficial to simulate extremely wet weather conditions by dipping the stakes under water for one week (no vacuum, but holding them down by inert weights). The dipping will lead to fibre saturation in most cases. If not, hydrophobicity can be assumed to be an intrinsic property of the treated stake and should not be tried to overcome.

Mod. MOE can be measured in intervals as agreed with the customer. When annual intervals seem to be appropriate then the stakes should be rated visually at the same time. It has shown to be beneficial to rate the stakes approximately 24 h after they have been taken from the water (see above). This enhances the comparability of signs of decay in dry or wet seasons in the field.

Example of measuring the mod. MOE

The following describes an example of the mod. MOE testing as performed in BAM, Berlin, Germany, for several years.

Test parameters include static MOE in bending over a span width of 30 cm of each stake. The programme calculates online whether the bending strength applied stays in the elastic range of each stake and determines the ending point of the test. The elastic range is calculated as follows: The ascent (load/deflection) of the load-deflection-curve is measured online during the bending. The elastic range has ended when the maximum of the ascent has been reached. This determines the end point of the loading for each stake individually.

This is a major benefit compared to other computerized bending machines where either the load or the deflection path shall be determined beforehand by the technician carrying out the test. The software developed by BAM calculates individual loads for each stake and its physical state (state of decay). This method ensures that also heavily decayed stakes are not loaded above their elastic range and that no damage is done to the stake while testing.

When during the test a stake has attained a mod. MOE of less than 25 % of its initial mod. MOE (before soil contact) the stake is considered to be “theoretically broken”. Table D.1 gives an example how to record the mod. MOE results as part of an EN 252 test report.

Table D.1 — Product “X”, results of bending tests after 1 year exposition of the stakes in the BAM field in Horstwalde, Germany

Type of stakes	Concentration tested (% mass fraction)	Initial MOE (kN/mm^2)	MOE after 1 year (kN/mm^2)	Median of residual MOE (%)
Test stakes	1,23	11,98[a] 10,23...13,23[b]	10,53 8,38...12,29	87,8
	1,82	11,21 10,24...12,53	9,78 8,20...12,03	87,1
	2,4	10,58 9,84...11,78	9,39 7,13...10,83	88,6
	3,0	10,55 9,46...11,45	10,04 9,01...10,97	95,2
	3,54	10,58 9,58…11,33	10,25 8,64...11,14	96,8
Reference stakes treated with CC according to DIN EN 252)	0,6	11,53 9,96...13,13	11,41 10,20...13,24	98,9
	1,5	11,64 10,25...12,84	10,79 10,28...12,93	101,3[c]
	2,2	11,33 9,03...12,05	11,37 9,16...12.06	100,4[c]
Reference stakes treated with CCA according to DIN EN 252)	0,3	11,83 10,45...12,83	10,99 9,42...12,40	92,9
	0,63	10,71 9,37...12,08	10,56 9,19...12,14	98,6
	1,2	10,46 9,10...11,77	10,58 9,41...12,19	101,2[c]
Untreated controls	0	9,20 6,36...10,93	4,45 0,00...6,53	48,7

[a] Median value.

[b] Lowest value…highest value.

[c] A higher MOE than the initial MOE can occur when fibre saturation is not achieved due to hydrophobic condition of the stake.

Annex E
(informative)

Example of a test report

Table E.1

Number of European Standard	EN 252:2014
Name of the applicant	Company P
Name and nature of the product	XYZ; product water based solution
Solvent or diluent used	Water
Wood species and density	Scots Pine (*Pinus sylvestris* sapwood; 530 kg/m^3 at 14 % moisture content
Additional wood species	European beech (*Fagus sylvatica)* - 6 annual rings per 10 mm; 690 kg/m^3 at 14 % moisture content. (The results of this test are contained in another Test Report.)
Number of replicates for each concentration of wood preservative	10
Concentrations tested % mass fraction	0,6 - 1,2 - 2,4 - 4,8 - 7,2
Date of treatment and treatment conditions	2011-03-15 Full-cell process as specified in the standard
Individual and average absorption	See annex and Table E.2
Individual and average retention	See annex and Table E.2
Reference preservative used	Reference preservative having the following composition: $CuSO_4 \cdot 5H_2O$ 35,0 % mass fraction $K_2Cr_2O_7$ 45,0 % mass fraction $As_2O_5 \cdot 2H_20$ 20,0 % mass fraction
Post treatment conditioning method	Stakes dried after impregnation in open piles for 45 d at 15 °C - 20 °C
Date of installation in the field	2011-05-02
Name and location of test field	Himstedt, Austria
Date of inspection	2016-06-10
Duration of exposure period	5 years
Grading system used in the evaluation and degree of deterioration	See Table E.3
Notional average ratings and average life of controls, reference stakes and test stakes	See Table E.2
This report has been prepared by the European Wood Preservative Test Institute in Austria.	
Vienna 2016-10-15.	
Signature of Author	

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

Table E.2 — Results from XYZ on Scots Pine *(Pinus sylvestris*) after 5 years exposure in ground contact

Type of stakes	Concentrations tested	Average absorption of treatment solution	Average retention of preservative	Notional average ratings based on the evaluation of attack of individual stakes	Average life
Test stakes	% mass fraction	l/m^3 sapwood	kg/m^3 sapwood		years
	0,6	630 (606–653)	3,78 (3,64–3,92)	4	3,2 ± 0,3[a]
	1,2	621 (600–645)	7,45 (7,20–7,74)	2,5 ± 0,3[a]	
	2,4	629 (601–663)	15,10 (14,42–15,91)	0,1	
	4,8	637 (615–648)	30,58 (29,52–31,10)	0	
	7,2	615 (595–640)	44,28 (42,84–46,08)	0	
Reference stakes	0,3	635 (601–658)	1,91 (1,80–1,97)	2,7 ± 0,2[a]	
	1,3	626 (609–649)	8,14 (7,92–8,40)	0,2	
Untreated controls	0,0	0	0	4	2,1
[a] Standard deviation.					

Table E.3 — Explanation of the grading system for the evaluation of microbial attack

Rating	Classification	Definition
0	No attack	No change perceptible by the means at the disposal of the inspector in the field. If only a change of colour is observed, it shall be rated 0.
1	Slight attack	Perceptible changes, but very limited in their intensity and their position or distribution: changes which only reveal themselves externally by superficial degradation, softening of the wood being the most common symptom.
2	Moderate attack	Clear changes: softening of the wood to a depth of at least 2 mm over a surface area covering at least 10 cm^2, or softening to a depth of at least 5 mm over a surface area less than 1 cm^2.
3	Severe attack	Severe changes: marked decay in the wood to a depth of at least 3 mm over a wider surface (covering at least 25 cm^2), or softening to a depth of at least 10 mm over a more limited surface area.
4	Failure	Impact failure of the stake in the field.

Table E.4 — Results of individual ratings and type of biological attack for the reference preservative at 2.0 kg/m^3

EN 252
Wood Preservative: CCA
Started: 2003
Test Field: HIMSTEDT

Attack (B = brown rot, W = white rot, SR = soft rot, Ba = bacteria)

Sample	Wood Preservative	Retention	Rating					2004				2005				2006				2007				2008			
			2004	2005	2006	2007	2008	B	W	Sr	Ba	B	W	Sr	Ba	B	W	Sr	Ba	B	W	Sr	Ba	B	W	Sr	Ba
			1	2	3	4	5																				
1	CCA	2,0	0	0	0	1	1															x					
2	CCA	2,1	0	0	1	1	1															x					
3	CCA	1,9	1	0	0	1	1			x																	
4	CCA	1,9	2	2	3	3	4	x				x				x				x				x			
5	CCA	1,8	1	1	2	3	4	x		x																	
6	CCA	1,9	1	1	1	2	3			x		x															
7	CCA	2,0	0	1	1	1	1																				
8	CCA	1,8	1	1	1	1	1			x																	
9	CCA	1,8	0	0	0	1	1																				
10	CCA	1,8	2	2	2	3	4	x		x		x				x				x				x		x	
Mean value		***1,9***	***0,8***	***0,8***	***1,1***	***1,7***	***2,1***																				
Standard deviation		***0,1***	***0,8***	***0,8***	***1,0***	***0,9***	***1,4***																				
Median value			***1,0***	***1,0***	***1,0***	***1,0***	***1,0***																				
Max			***2***	***2***	***3***	***3***	***4***																				
Min			***0***	***0***	***0***	***1***	***1***																				
Number of 0			***4***	***4***	***3***	***0***	***0***																				
Number of 1			***4***	***4***	***4***	***6***	***6***																				
Number of 2			***2***	***2***	***2***	***1***	***0***																				
Number of 3			***0***	***0***	***1***	***3***	***1***																				
Number of 4			***0***	***0***	***0***	***0***	***3***																				

Bibliography

[1] EN 350-1:1994 *Durability of wood and wood-based products - Natural durability of solid wood - Part 1: Guide to the principles of testing and classification of the natural durability of wood*

[2] EN 335:2013 *Durability of wood and wood-based products - Use classes: definitions, application to solid wood and wood-based products*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™