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Preservation of wood – Code of practice

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Contents

Summary of pages
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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from the British Standards Institution, and came into effect on 31 March 2011. It was prepared by Technical Committee B/515, *Wood Preservation*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 8417:2011 superseded BS 1282:1999, which has been withdrawn.

BS 8417:2011+A1:2014 supersedes BS 8417:2011, which is withdrawn.

Relationship with other publications

This British Standard is one of a group of documents dealing with the preservative treatment of wood. It is based on the principles given in BS EN 599-1, BS EN 351-1 and BS EN 335 developed to support product standards mandated by the Construction Products Directive [1]. This standard is the national interpretative document for BS EN 599-1 and BS EN 351-1, and is intended to provide complementary information that is relevant to the wood treater and to the specifier or purchaser of treated wood for use in the United Kingdom.

Information about this document

BS 8417:2011 was a full revision of the standard and introduced the following principal changes:

a) recommendations for the application of preservatives conforming to BS 4072 and BS 5707 are omitted as these materials are now largely unavailable;

b) "R" (the lowest appropriate level of preservative retention), qualified by a number identifying the relevant use class, replaces "cv" (the critical value derived from tests in BS EN 599-1) as the designator of preservative retention in Table 4;

c) the recommendation for the acceptable quality level for resistant wood to be used in use class 4 and use class 5 has been updated.

Text introduced or altered by Amendment No. 1 is indicated in the text by tags [A1] ⟨A1⟩. Minor editorial changes are not tagged.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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

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

1 Scope

This British Standard gives recommendations and guidance for the preservative treatment of wood to provide protection against biodeterioration in end-use situations. It gives recommendations for determining the need for treatment and specifying the type of treatment.

It also recommends levels for the penetration and retention requirements of preservatives tested to BS EN 599-1 and for boron and creosote preservatives, using the terminology used in BS EN 351-1, for different timber components and takes into account the natural durability and treatability of the wood employed, the use class as defined in BS EN 335 and the desired service life. It also provides guidance on establishing whether a specified level of treatment has been achieved.

This British Standard does not include precise treatment parameters to achieve the recommended penetrations and retentions. It is the responsibility of the treater to use wood in an appropriate condition and to use an appropriate treatment schedule to achieve the recommended values.

This British Standard applies only to solid wood, including glued laminated wood. It does not apply to panel products, as no European standards have been published on the preservation of these products. This British Standard does not apply to wood, which has been modified by physical, biological or non-biocidal chemical techniques in order to enhance its performance.

This British Standard does not apply to curative treatments.

NOTE Only preservatives approved under the Control of Pesticides Regulations 1986 (as amended) [2] or authorized under the Biocidal Products Regulations 2012 [3] are permitted for the treatment of wood in the United Kingdom.

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.

〉A1〈 BS EN 330, *Wood preservatives – Field test method for determining the relative protective effectiveness of wood preservative for use under a coating and exposed out-of-ground contact – L-joint method* 〉A1〈

〉A1〈 BS EN 335, *Durability of wood and wood-based products – Use classes: definitions, application to solid wood and wood-based products* 〉A1〈

BS EN 350-2, *Durability of wood and wood-based products – Natural durability of solid wood – Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe*

BS EN 351-1, *Durability of wood and wood-based products – Preservative treated solid wood – Part 1: Classification of preservative penetration and retention*

BS EN 351-2, *Durability of wood and wood-based products – Preservative treated solid wood – Part 2: Guidance on sampling for the analysis of preservative-treated wood*

BS EN 599-1, *Durability of wood and wood-based products – Performance of preservatives as determined by biological tests – Part 1: Specification according to hazard class*

BS EN 13183 (all parts), *Moisture content of a piece of sawn timber*

BS EN 13991, *Derivatives from coal pyrolysis – Coal tar based oils: Creosotes – Specifications and test methods*

[N1] WOOD PROTECTION ASSOCIATION. *WPA Manual – Industrial wood preservation – Specification and Practice*. Castleford: WPA, 2007.

3 Terms and definitions

For the purposes of this British Standard the terms and definitions given in BS EN 351-1 and the following apply.

3.1 acceptable quality level (AQL)
maximum percentage of units in a batch of treated wood which is allowed to fall below the specified penetration without causing the batch to be rejected

3.2 critical value (cv)
value equivalent to the highest biological reference value (in grams per square metre or kilograms per cubic metre) obtained from all the biological tests carried out in accordance with BS EN 599-1 for any given use class

NOTE The critical value will vary according to use class, method of application and organisms against which the preservative is to provide protection and whether it is to be applied to softwood or hardwood.

[BS EN 1001-2:2005, **4.18**]

3.3 penetration requirement
minimum depth to which the active ingredient(s) of the wood preservative is (are) required to penetrate the wood

[BS EN 1001-2:2005, **4.59**]

*NOTE The term "penetration requirement" relates to the treatment specification (see Clause **5** and Clause **6**) rather than a provision of this standard.*

3.4 retention requirement
loading of the wood preservative product that is required in the analytical zone

NOTE 1 The retention requirement is expressed in grams of product per square metre for superficial application processes and kilograms of product per cubic metre for penetrating treatment processes. It is derived from the critical value in different ways depending upon the particular test involved.

[BS EN 1001-2:2005, **4.73**]

*NOTE 2 The term "retention requirement" relates to the treatment specification (see Clause **5** and Clause **6**) rather than a provision of this standard.*

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4 Determining the need for treatment

4.1 General

To determine whether a timber component needs preservative treatment, the following should be assessed:

- the biological hazard indicated by the use class;
- the likelihood and consequence of failure;
- the inherent natural durability of the wood to be used.

4.2 Use classes

Use classes should be identified in accordance with Table 1: this table summarizes the use class system and gives examples of typical service situations.

NOTE 1 The different service situations in which wood can be used have been categorized into five use classes defined in BS EN 335.

As different biological agents of wood deterioration occur in different use classes, wood should either have natural durability, or be treated with a preservative, appropriate to the given use class (see **4.4** and Clause **5**).

NOTE 2 The allocation of a component to a particular use class assumes good design and maintenance of the construction. If conditions arise during the service life of the component that result in unexpected wetting of the wood, for example as a result of design faults, condensation, failure of other materials, poor workmanship or lack of maintenance, the use class assigned to the component would change and the protection afforded by the preservative treatment might be inadequate.

Table 1 **Use class and typical service situations**

Use class	General service situation (from BS EN 335)	Principal biological agents [A)]	Description of exposure to wetting in service (from BS EN 335)	Examples of service situations
1 [B)]	Interior, covered	Insects	Dry	All timber in normal pitched roofs except tiling battens and valley gutter members; floor boards, architraves, internal joinery, skirtings; all timbers in upper floors not built into solid external walls [B)]
2	Interior or covered	Fungi/insects	Occasionally wet	Tiling battens, frame timbers in timber frame houses [C)], wood in pitched roofs with high condensation risk, woods in flat roofs, ground floor joists [C)], sole plates (above dpc), wood joists in upper floors built into external walls [C)]

Table 1 **Use class and typical service situations** *(continued)*

Use class	General service situation (from BS EN 335)	Principal biological agents [A)]	Description of exposure to wetting in service (from BS EN 335)	Examples of service situations
3	Coated:[D)] exterior, above ground	Fungi[E)]	Occasionally wet	External joinery including roof soffits and fascias, bargeboards, etc., cladding, valley gutter timbers[C)], external structural load bearing timbers
	Uncoated: exterior, above ground, unprotected	Fungi[E)]	Frequently wet, (e.g. above damp proof course (dpc) uncoated[D)])	Fence rails, gates, fence boards, sleepers (on maintained free-draining ballast), agricultural timbers not in soil / manure contact and garden decking timbers that are not in contact with the ground
4[F)]	Exterior, in contact with ground or fresh water	Fungi[E)]	Permanently exposed to wetting (e.g. below dpc)	Fence posts, gravel boards, agricultural woods in soil/manure content, poles, sleepers (laid in direct contact with the ground), playground equipment, motorway and highway fencing and garden decking timbers that are in contact with the ground, lock gates and revetments, cooling tower packing
5	In salt water	Marine borers, fungi	Permanently wet	Marine piling, piers and jetties, dock gates, sea defences and ships hulls

A) BS EN 335 lists a range of biological agents, the principal agents in the UK have been identified in this table.

B) Timbers for use in use class 1 situations are not normally treated unless the risk of insect attack is considered to be important. Attention is drawn to Building Regulations for England and Wales Approved Document A [4], which require treatment of roof timbers in the *Hylotrupes* area.

C) These woods are assigned to a "higher" use class than suggested by their location in the structure, owing to the potential consequences of failure based on experience within the UK.

D) Some preservatives, e.g. microemulsion or boron preservatives, are only recommended for use in use class 3 when protected by a coating.

E) BS EN 335 includes insects, in particular termites, as a risk factor in use class 3 and use class 4 but this is not, under present conditions, recognized as a significant risk for wood in these situations in the UK.

F) Use class 4 in BS EN 335 has two sub-classes. In the UK, the difference between biological agents in these sub-classes is not recognised as sufficiently different to affect the type or level of preservation needed, i.e. the climate is such that wood in the ground is always wet due to weather or water table, and recommended preservative treatments in this standard are, therefore, based on a single use class for wood in ground or fresh water contact.

4.3 Likelihood and consequence of failure related to use classes

Although different components can fall into the same use class as given in Table 1, the likelihood of failure or the consequence of failure can be quite different and these should be assessed in accordance with a recognized process. Each component should be classified by service factor in accordance with Table 2 based on the likelihood and consequence of failure.

Table 2 **Service factors**

Description of the likelihood and consequences of failure	Need for preservation [A)]	Service factor code
Negligible risk of failure	Unnecessary	A
Where risk of failure is low and preservation can be regarded as an insurance against cost of repairs, and/or where replacement or remedial action is not difficult or expensive	Optional	B
Where risk of failure is high and/or where replacement or remedial action is difficult and expensive	Desirable	C
Where risk of failure is very high and/or where failure of timber components would result in serious danger to structure or persons	Essential	D

[A)] An alternative to preservation is the selection of wood of suitable natural durability (see **4.4**).

4.4 Natural durability of wood

NOTE 1 Different wood species vary in their resistance to attack by wood-destroying organisms such as fungi, insects and marine borers. In order to classify the natural durability of different species a comparison can be made of the resistance of their heartwood to attack by wood-destroying fungi when placed in contact with the ground. This is the classification method used in this standard; the durability classifications of woods of commercial importance within Europe based on this method are listed in BS EN 350-2.

If the heartwood has sufficient natural durability it can be used without preservative treatment even where a recognized hazard exists. However, where sapwood is present preservative treatment should be applied whatever the associated natural durability of the heartwood.

Where naturally durable components are to be used, their natural durability should not be less than that given in Table 3.

NOTE 2 The durability classes in Table 3 are based on the information given in BS EN 350-2 regarding the natural durability against wood destroying fungi. These classes are deemed to be the minimum necessary to achieve the desired service life without the need for treatment.

Table 3 **Natural durability recommendations for timber components (based on natural durability against fungi given in BS EN 350-2)**

Component	Use class	Durability class of wood for which heartwood can be used without treatment [A)]		
		Desired service life = 15 years	Desired service life = 30 years	Desired service life = 60 years
Internal joinery	1	5	5	5
Roof timbers dry	1	5	5	5
Roof timbers dry (*Hylotrupes* area [B)])	1	3 [C)]	3 [C)]	3 [C)]
Roof timbers (risk of wetting)	2	4	3	2
External walls/ground floor joists	2	4	3	2
Sole plates above dpc	2	3	2	2

Table 3 **Natural durability recommendations for timber components (based on natural durability against fungi given in BS EN 350-2)** *(continued)*

Component	Use class	Durability class of wood for which heartwood can be used without treatment [A]		
		Desired service life = 15 years	Desired service life = 30 years	Desired service life = 60 years
A1 External joinery (non load-bearing, coated) and cladding (coated) A1	3 coated	4	3	2
A1 Fence rails, deck boards and joists, external joinery (non load-bearing, uncoated) and cladding (coated) A1	3 uncoated	3	2	1
Fence and deck posts	4	2	1	1 [D]
Poles	4	2	1	1 [D]
Sleepers	4	2	1	1 [D]
Wood in fresh water	4	2	1	1
Wood in salt water	5	1 [E]	No recommendation [F]	No recommendation [F]
A1 Cooling tower timbers (fresh water) A1	4	2	1	No recommendation
A1 Cooling tower timbers (salt water) [G] A1	4	1	No recommendation	No recommendation

[A] Natural durability categories for wood species listed in BS EN 350-2.

[B] As defined in Building Regulations for England and Wales Approved Document A [4].

[C] Any hardwood can be used. Recommendations based on evidence that the house longhorn beetle (*H.bajulus* L) can attack the heartwood of some softwoods of lower natural durability.

[D] Selected woods of natural durability class 1 can be expected to achieve 60 years' service life.

[E] Species of hardwoods, the heartwood of which is preferred for use untreated in sea water: afrormosia, andaman padauk, basralocus, ekki, greenheart, iroko, jarrah, kapur, okan, opepe.

[F] In general, species of natural durability class 1 cannot be relied upon to give more than 15 years' service.

[G] Although timber is exposed to salt water, the exposure is considered to be use class 4, not use class 5.

Where natural durability against insect and marine borer attack is required, a suitable wood species should be chosen in accordance with BS EN 350-2, using the additional classifications for durability against these organisms.

NOTE 3 The natural durability classes in Table 3 refer to those derived from the performance of the wood in ground contact. It needs to be understood that the durability classifications in Table 3 are typically based on the performance of virgin forest material in ground contact tests and are the highest durability ratings that can be expected from individual species. Faster grown plantation material might not achieve these grades.

*NOTE 4 Laboratory test methods have been developed in Europe allowing durability to be measured against different decay fungi. Although such methods can provide a provisional natural durability classification, the desired service lives given in Table 3 are not applicable to natural durability classes derived from these methods (see also **5.2**).*

5 Specifying treatment of wood

5.1 General

The treatment of wood should be specified in a way that communicates all necessary information to the treater. The following information should be included in the specification:

a) component description and use class (see **4.2**);

b) desired service life (see **5.2**).

In cases where a specific preservative type or wood species is necessary, the following information should also be specified:

1) preservative type (see **5.3**);

2) wood species (see **6.5.1**).

NOTE A sample specification is as follows:

"Wood [insert species if desired] to be treated with preservative [insert preservative type if desired] according to the recommendations in BS 8417 for [insert component name] for use in use class [insert number] from which a desired service live of [insert number] years is required."

5.2 Desired service life

The level of preservative treatment depends not only on the risk of attack but also on the desired service life of the timber component in service. Table 3 should be referred to for natural durability classes for the desired service life, i.e. 15 years, 30 years and 60 years. Tables 4 to 6 should be referred to for preservative recommendations for the desired service life.

NOTE Where a treatment is not recommended in these tables for a particular use class/desired service life/service factor combination, it is because a generic recommendation is not currently possible.

It should be realized that the prediction of service life is not precise and these desired service lives are indicative rather than a guarantee of performance, and are based on an assumption of good design and maintenance. These desired service lives relate solely to the resistance of the wood to biodeterioration. Other factors could limit the life of the complete commodity, such as mechanical damage or failure of other elements of the construction, and should be taken into account. In addition it should be noted that the minimum durability and/or treatment recommendations in Tables 3 to 6 might be revised as more experience is gained.

5.3 Preservative type

As not all preservative types are suitable for the treatment of wood to be used in all use classes, if a particular type of wood preservative is to be specified, the Wood Protection Association (WPA) Manual [N1] should be consulted to confirm the chosen type is suitable for the required end use.

NOTE An updated list of the types of wood preservatives available and their advantages and disadvantages for use in different end use situations is given in the WPA Manual [N1].

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6 Preservative treatment of wood

*COMMENTARY ON CLAUSE **6***
Tables 4 to 6 recommend levels for the preservative penetration and retention requirements, taking into account the use class, the likelihood and consequence of failure, the desired service life and the treatability of the wood being used.

The penetration is expressed in terms of penetration classes ("NP" classes), which are described in Table 7 and BS EN 351-1.

The retention requirements relate to the analytical zone, which is governed by the penetration class and is defined in Table 7 and BS EN 351-1.

6.1 General

For wood used in use class 4 or use class 5, only preservative that has undergone both laboratory testing and field trials to determine retention should be used for treatment. Further information on the performance of a preservative should be obtained from the manufacturer as necessary.

6.2 Preservatives where the performance has been tested in accordance with BS EN 599-1

NOTE See Annex A regarding the determination of a preservative's retention (R) for different use classes, using laboratory and field test data.

When preservative treatments tested in accordance with BS EN 599-1 are selected, the levels of preservative penetration and retention should be in accordance with Table 4.

Some component/service life combinations in Table 4 do not have allocated retention and penetration requirements. This occurs when performance over extended service lives, or in particularly severe conditions, cannot easily be predicted using standard test methods. For such components and service lives, the preservative manufacturer should be consulted.

6.3 Preservatives involving aqueous solutions of boron compounds

When boron treatment is selected, the boron preservative should conform to the WPA Manual [N1], Appendix 1, and the level of preservative retention (in kg/m^3) should be in accordance with Table 5.

6.4 Preservatives involving creosote

When creosote treatment is selected, the creosote preservative should conform to BS EN 13991 and the level for the preservative's retention requirement (in kg/m^3) should be in accordance with Table 6.

6.5 Achieving the penetration and retention requirements

*COMMENTARY ON **6.5***
A number of factors contribute to the achievement of the penetration and retention requirements, including the wood species, the condition of the wood, the treatment process and the preservative type.

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6.5.1 Selecting sapwood or heartwood

NOTE 1 BS EN 350-2 gives four classes to indicate the treatability of the sapwood and heartwood for a range of wood species. For preservative treatment purposes, however, this standard only uses two classes: permeable (Treatability Class 1) and resistant (Treatability Classes 2, 3 and 4), in both cases based on the treatability of the sapwood. Although the treatment process can, to a certain extent, be matched to the treatability of the species, natural variability, as seen for example in Sitka spruce, could result in significant variation in the outcome of treatment unless measures such as incising are used.

The penetration classes in BS EN 351-1 and Table 7 are largely described on the basis of the penetration of sapwood. With species where sapwood is easier to treat than heartwood, and where the natural durability of the heartwood is insufficient for adequate service life in the chosen end use, wood with as high as possible a proportion of sapwood should be used to maximize protection.

NOTE 2 For use class 4 and use class 5, optimum performance can be achieved with round wood as a band of more easily treatable sapwood is present on the outside of the wood. The maximum amount of treatable sapwood is found on debarked but otherwise unmachined posts or poles. Regularizing round wood removes sapwood and reduces potential for preservative penetration.

To achieve the penetration recommendations given in Tables 4 to 6, special measures, such as incising or careful control of moisture content, should be performed for some wood species with resistant sapwood.

NOTE 3 This applies to wood species that can display very irregular penetration such as spruce, and where achieving the specified penetration is particularly important such as in use class 4 and use class 5.

〈A1〉 *NOTE 4 Sawn wood often has areas of exposed heartwood whose natural durability contributes to the overall performance of treated wood but which might not always be of sufficient durability to fully protect the wood in the destined use class. Heartwood is difficult to treat (regardless of sapwood permeability) and even where a use class/desired service life combination does not include a requirement for penetration in heartwood, consideration is to be given to the advantages of special measures, such as incising, to improve penetration. This applies especially to use class 4, where the resistance to decay conferred by the natural durability of heartwood is subject to challenge by fungi in the soil, more or less continuously, over the (minimum) 15 year desired service life of the treated wood, and where better preservative penetration would increase confidence in performance.* 〈A1〉

6.5.2 Condition and moisture content of wood prior to treatment

The surface of the wood should be free from anything that interferes with preservative penetration, e.g. mud, dirt, dust and bark, decorative coatings, paint, stain, polish and any other surface finishes.

The wood should be free from all signs of attack by wood destroying fungi and insects. However, wood showing signs of attack by mould, sapstain (blue stain) fungi or pinhole borers might be acceptable subject to an agreement between the wood supplier and the customer.

The moisture content of the wood should be determined in accordance with BS EN 13183 (all parts) and should be appropriate for the preservative (as specified by the preservative manufacturer), treatment method and end use. Wood that is either excessively wet or excessively dry can be more difficult to impregnate. With the exception

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of diffusion treatments, wood should be treated at, or close to, its expected in-service moisture content. In most cases wood should be treated at a moisture content of less than 30% (m/m calculated on the dry mass of wood). For wood undergoing diffusion treatment, moisture content should be not less than 30% for the entire diffusion period.

NOTE 1 Some resistant species such as spruce can benefit from being treated at a moisture content of up to 40%.

Wood should not be treated if it is frozen.

All cutting, drilling, profiling and sanding of the wood should be carried out as far as possible before treatment. In cases where reworking after treatment is unavoidable, this should then be limited to cross cutting, boring, drilling or notching, and exposed surfaces should be re-treated with preservative in accordance with the recommendations of the preservative manufacturer.

NOTE 2 Machining wood after preservative treatment might impair the protection conferred by treatment.

6.5.3 Treatment process

Penetrating treatment processes should be used to treat wood as these processes include features designed to overcome the natural resistance of wood to penetration by preservatives.

NOTE Typical penetrating processes are vacuum/high pressure (for example full cell and empty cell) for copper-organic preservatives and creosote, and double vacuum/low pressure for microemulsion and organic solvent-based preservatives.

Where timber components of different or variable treatability, and/or dimensions, are treated in the same charge, a process that enables all timbers to achieve the retention and penetration requirements should be selected.

Where NP6 is selected, or where the sapwood and heartwood are indistinguishable, the penetration class might require penetration into heartwood that is less permeable than the sapwood. In these cases, the treatment process should be selected to achieve penetration into the less permeable portion of the wood.

7 Sampling and testing

NOTE 1 BS EN 351-1 contains provisions for two forms of factory production control, namely direct and indirect testing. Direct testing involves the measurements of penetration and retention in samples taken from a batch of treated wood. Indirect testing involves first demonstrating a consistent relationship (known as a safe relationship) between the penetration and retention requirements and the more easily measurable parameters of the treatment process, such as preservative concentration and pressure cycle, and then controlling these parameters in subsequent treatment activities. See BS EN 351-1 and BS EN 351-2.

When undertaking direct testing in accordance with BS EN 351-2, inspection level S-3 should be used. The AQL should be 10%, except for sawn resistant wood for which the AQL should be 25%.

If verification of the level of preservation applied is required by direct testing, prior consultation between customer and treater should be undertaken, and excess material on which post-treatment analysis can be carried out should be included in the charge.

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NOTE 2 Alternative inspection levels and or AQLs can be chosen by prior agreement between the customer and the treater.

〈A1〉 Where penetration class NP6 is specified for permeable timbers in use class 4 end uses, full sapwood penetration is required. When tested in accordance with BS EN 351-2, heartwood penetration should be visible at 6 mm and in 75% of the cross-section of the heartwood analytical zone along any face in which heartwood is present.

Where a penetration depth of 12 mm in the sapwood and 6 mm in the heartwood is specified for resistant timbers in use class 4 end uses, full penetration of the sapwood analytical zone is required. When tested in accordance with BS EN 351-2, heartwood penetration should be visible at 6 mm and in 75% of the cross-section of the heartwood analytical zone along any face in which heartwood is present.

In both cases, there should be a minimum penetration depth of 6 mm into the wood in addition to the penetration class requirement, regardless of whether the wood includes sapwood or heartwood. This includes areas where machining has resulted in a very narrow band of sapwood (less than 6 mm) at the surface (see also footnote [N)] of Table 4). 〈A1〉

Table 4 **Treatment using preservatives tested in accordance with BS EN 599-1**

Component	Use class	Service factor	Preservative requirements											
			Desired service life = 15 years				Desired service life = 30 years				Desired service life = 60 years			
			Permeable wood		Resistant wood		Permeable wood		Resistant wood		Permeable wood		Resistant wood	
			Penetration [A]	Retention [B]	Penetration [A]	Retention [B]	Penetration [A]	Retention [B]	Penetration [A]	Retention [B]	Penetration [A]	Retention [B]	Penetration [A]	Retention [B]
Internal joinery	1	A	No treatment required [C]				No treatment required [C]				No treatment required [C]			
Roof timber dry	1	B	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1
Roof timbers dry (*Hylotrupes* area)	1	D	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1	NP1	R_1 x 1
Roof timbers (risk of wetting)	2	C	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1
External walls/ground floor joists	2	C/D	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1	NP1 [D]	R_2 x 1
Sole plates (above dpc)	2 [E]	D	NP2	R_3 [E] x 1	NP2	R_3 [E] x 1	NP2	R_3 [E] x 1	NP2	R_3 [E] x 1	NP2	R_3 [E] x 1	NP2	R_3 [E] x 1
External joinery (non load-bearing, coated) [M] and cladding (coated)	3 [F] coated	C/D	NP2	R_{3c} [G] x 1	NP2	R_{3c} [G] x 1	NP2	R_{3c} [G] x 1.25	NP2	R_{3c} [G] x 1.25	NP3	R_{3c} [G] x 1.5	NP3 [G]	R_{3c} [G] x 1.5
Fence rails, deck boards and joists, external joinery (non load-bearing, uncoated) and cladding (uncoated)	3 [F] uncoated	C/D	NP5	R_3 x 1	NP2	R_3 x 1	NP5	R_3 x 1.25	NP3 [H]	R_3 x 1.25	[I]			
Fence and deck posts	4 [F]	C/D	NP5	R_4 x 1	NP3 [H]	R_4 x 1	NP6 [H], [N]	R_4 x 1.5	12/6 mm [H], [J], [N]	R_4 x 1.5	[I]			
Poles (round with no exposed heartwood)	4 [F]	D	NP5	R_4 x 1	NP4 [H]	R_4 x 1	NP5	R_4 x 1.5	NP5 [H]	R_4 x 1.5	[I]			
Sleepers	4 [F,K]	D	NP5	R_4 x 1	NP5 [H]	R_4 x 1	NP6 [H]	R_4 x 1.5	NP6 [H]	R_4 x 1.5	[I]			
Wood in fresh water	4 [F]	D	NP6	R_4 x 1	NP6 [H]	R_4 x 1	NP6 [H]	R_4 x 1.5	NP6 [H]	R_4 x 1.5	[I]			
Wood in salt water	5	D	NP6	R_5 x 1	NP6 [H]	R_5 x 1	NP6 [H]	R_5 x 1.75	NP6 [H]	R_5 x 1.75	[I]			
Cooling tower timbers (fresh water)	4 [F]	D	[I]				[I]				[I]			
Cooling tower timbers (salt water) [L]	4 [F]	D	[I]				[I]				[I]			

Table 4 **Treatment using preservatives tested in accordance with BS EN 599-1** *(continued)*

A) Penetration classes are summarized in Table 7 and described fully in BS EN 351-1.

B) Retention is expressed as a multiple of R; see Annex A. With the exception of unfixed water-soluble preservatives, retention values refer only to the analytical zone. For unfixed water-soluble preservatives, retention requirements should be calculated on the basis of the whole cross-section and should be R × 2 to allow for possible losses prior to installation.

C) Exceptionally a specifier or purchaser of treated wood may consider that a use class 1 or use class 2 treatment is required.

D) Recommended treatment only by a penetrating treatment process.

E) Soleplates are at greater risk of wetting so the decay hazard is higher than for other components in use class 2. For this end use the preservative retention should be derived from R_3.

F) Multiplication factors are applied to R for use class 3 and use class 4 to indicate that higher retentions of preservative are used for longer service lives. The multiplication factors in this table are the default factors that apply to all preservatives. Long term information from field tests or from practical experience can provide a sound and acceptable basis for using multiplication factors for a wood preservative different from those in this table.

G) For use class 3 applications where wood is coated, retention requirements can vary from uncoated use class 3 retentions. For these end uses the retention is referred to as R_{3c}.

H) Achievement of NP3 and deeper penetration in resistant timbers and in heartwood is often very difficult. Processes to aid penetration such as incising might be required.

I) Standard treatment recommendations are not available for these component and service life combinations (see **6.2**). Where such combinations are desired, preservative suppliers should be consulted. NP6 penetration class is normally necessary.

J) No appropriate NP class exists for these specifications. Penetration and analytical zone should be 12 mm lateral into the sapwood and 6 mm into exposed heartwood faces.

K) Sleepers, which are laid on well-drained ballast and maintained in service, are considered to be use class 3 but durability appropriate to use class 4 is indicated to reflect service life requirements and the safety-critical use. Sleepers in direct ground contact are use class 4.

L) Although timber is exposed to salt water, the exposure is considered to be use class 4, not use class 5.

M) Preservative recommendations as given in Table 4 are based on penetrating processes (see **6.5.3**) for which laboratory and, where appropriate, field tests and service experience provide a high degree of confidence in performance. Developments in treatment techniques using superficial processes (such as flow coating) combined with other aspects of production (such as end-sealing of joint surfaces and high-performance coatings) might justify the use of such processes as alternatives to penetrating treatments for wood in use class 3. In the case of factory-finished windows and doors, superficial processes are accepted as equivalent to penetrating where testing of superficially applied preservatives meets the following criteria. For the purposes of factory finished windows and doors specified in BS 644, for preservatives for use in superficial processes, to achieve the efficacy criteria for use class 3, coated, in accordance with BS EN 599-1:2009, Table 3a, Option 3, the wood should be preservative treated so as to achieve a penetration class NP1 and a retention requirement of 1.5 times the critical value. For field testing to BS EN 330, the preservative should be applied using the manufacturer's proposed method of application, and the reference preservative should be applied by double vacuum.

N) In these end use/service life combinations a minimum penetration depth of 6 mm into the wood is recommended in addition to the penetration class requirement, and regardless of whether the wood includes sapwood or heartwood. This includes areas where machining has resulted in a very narrow band of sapwood (less than 6 mm) at the surface. The analytical zone should be as described in footnote J and Table 7 but also should be no less than 6 mm from any surface.

Table 5 **Treatment using aqueous solutions of boron compounds conforming to Appendix 1 of the WPA Manual [N1]**

Component	Use class	Service factor	Preservative requirements											
			Desired service life = 15 years				Desired service life = 30 years				Desired service life = 60 years			
			Permeable wood		Resistant wood		Permeable wood		Resistant wood		Permeable wood		Resistant wood	
			Penetration[A]	Retention[B] kg/m^3	Penetration[A]	Retention[B] kg/m^3	Penetration[A]	Retention[B] kg/m^3	Penetration[A]	Retention[B] kg/m^3	Penetration[A]	Retention[B] kg/m^3	Penetration[A]	Retention[B] kg/m^3
Internal joinery	1	A	No treatment necessary[C]											
Roof timber dry	1	B	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0
Roof timbers dry (*Hylotrupes* area)	1	D	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0
Roof timbers (risk of wetting)	2	C	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0
External walls/ground floor joists	2	C/D	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0
Sole plates (above dpc)	2	D	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0	NP2L[D]	2.0
External joinery (non load-bearing, coated) and cladding (coated)	3 coated	C/D	NP2L[D], [E]	2.0	NP2L[D], [E]	2.0	NP2L[D], [E]	2.0	NP2L[D], [E]	2.0	[F]			
Fence rails, deck boards and joists, external joinery (non load-bearing, uncoated) and cladding (uncoated)	3 uncoated	C/D	Boron is not recommended											
Fence and deck posts	4	C/D												
Poles	4	D												
Sleepers	4	D												
Wood in fresh water	4	D												
Wood in salt water	5	D												
Cooling tower timbers (fresh water)	4	D												
Cooling tower timbers (salt water)	4	D												

[A] Penetration classes are summarized in Table 7. The penetrations recommended in this table do not allow for machining after treatment.

[B] These values are 'boric acid equivalent' (BAE). The values are intended to give a minimum assay of 0.4% m/m BAE. The analytical zone is the full cross section of the piece(s) being analysed.

[C] Exceptionally a specifier may consider a use class 1 or use class 2 treatment is required.

[D] Longitudinal penetration requirement is 10 mm (this is different from that indicated in BS EN 351 (40 mm) but reflects a technical re-appraisal of the requirement for the UK).

[E] These recommendations assume that the exposed surfaces of the wood will be painted or given some other protective finish which will be maintained in service.

[F] Standard treatment recommendations are not available for these component and service life combinations. Where such combinations are desired, consult preservative suppliers for recommendations.

Table 6 **Treatment using creosote [A] conforming to BS EN 13991**

Component	Use Class	Service factor	Preservative requirements											
			Desired service life = 15 years				Desired service life = 30 years				Desired service life = 60 years			
			Permeable wood		Resistant wood		Permeable wood		Resistant wood		Permeable wood		Resistant wood	
			Penetration [B]	Retention [C] kg/m^3	Penetration [B]	Retention [C] kg/m^3	Penetration [B]	Retention [C] kg/m^3	Penetration [B]	Retention [C] kg/m^3	Penetration [B]	Retention [C] kg/m^3	Penetration [B]	Retention [C] kg/m^3
All internal components			Creosote treatment not permitted in the European Union [A]											
External joinery (non load-bearing, coated) and cladding (coated)	3 coated	C/D	Creosote treatment not recommended where coatings are to be applied											
Fence rails, deck boards and joists, external joinery (non load-bearing, uncoated) and cladding (uncoated)	3 uncoated	C/D	12 mm [D]	145	NP3 [E]	160	NP5	160	12 mm [D], [E]	180	NP5	180	NP5 [E]	180
Fence and deck posts – round	4	C/D	NP4	160	NP3 [E]	185	NP5	185	NP4 [E]	195	NP5	195	NP5 [E]	210
Fence and deck posts – sawn	4	C/D	NP5	180	NP3 [E]	195	NP5	185	12 mm [D], [E]	195	NP5	210	NP6 [E]	210
Poles	4	D	NP4	160	NP4 [E]	160	NP5	185	NP5 [E]	185	NP5	195	NP5 [E]	195
Sleepers	4 [G]	D	NP5	180	NP5 [E]	180	NP5	185	NP5 [E]	185	NP5	210	NP5 [E]	210
Wood in fresh water	4	D	NP5	195	NP5 [E]	195	NP5	210	NP5 [E]	210	NP5	240	NP5 [E]	250
Wood in salt water	5	D	NP5	240	NP5 [E]	240	NP5	290	NP5 [E]	290	[F]			
Cooling tower timbers (fresh water)	4	D	NP5	240	NP5 [E]	240	NP5	290	NP5 [E]	290				
Cooling tower timbers (salt water) [H]	4 [H]	D	NP5	290	NP5 [E]	290	NP5	290	NP5 [E]	290				

[A] Use of creosote-treated wood is restricted in the UK under European Community Regulation 1907/2006 (REACH) [5].

[B] Penetration classes are summarized in Table 7.

[C] These values take account of industrial experience in the UK. Retention values refer only to the analytical zone.

[D] No appropriate NP class exists for these situations. In these cases the penetration and analytical zone are both 12 mm lateral into the sapwood.

[E] Achievement of NP3 and deeper penetration in resistant timbers is often very difficult. Processes to aid penetration such as incising might be necessary.

[F] Standard treatment recommendations are not available for these component and service life combinations. Where such combinations are desired, preservative suppliers should be consulted.

[G] Sleepers, which are laid on well-drained ballast and maintained in service, are considered to be use class 3 but durability appropriate to use class 4 is indicated to reflect service life requirements and the safety-critical use. Sleepers in direct ground contact are use class 4.

[H] Although timber is exposed to salt water, the exposure is considered to be use class 4, not use class *5*.

Table 7 **Summary of penetration classes and analytical zones for determination of retention in accordance with BS EN 351-1**

Penetration class	Penetration requirement [A)]	Analytical zone [B)]
NP1	None	3 mm from the lateral faces
NP2 [C)]	Min. 3 mm lateral into the sapwood	3 mm lateral into sapwood
NP3 [C)]	Min. 6 mm lateral into the sapwood	6 mm lateral into sapwood
NP4	Min. 25 mm lateral	25 mm lateral into sapwood
NP5	Full sapwood	Full sapwood
NP6	Full sapwood and min. 6 mm into exposed heartwood	Full sapwood and 6 mm into exposed heartwood

A) If it is not possible to distinguish between heartwood and sapwood the whole sample should be regarded as sapwood.

B) Where water soluble, unfixed preservatives are used to treat timber components in use classes 1, 2 and 3, the analytical zone for the determination of preservative retention should be the full cross-section so that preservative retention continues at the recommended depth, even if the preservative redistributes in the wood in service. Such preservatives include boron solutions (see Table 5) and any water-soluble unfixed preservatives used in accordance with Table 4.

C) Penetration for NP2 and NP3 may be supplemented by a requirement for longitudinal penetration, denoted by the suffix L. Longitudinal penetration should be ten times the required lateral penetration, unless otherwise stated.

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Annex A (informative)

The determination of preservative retention (R)

In Table 4, "R" represents the retention of the preservative, measured in kg/m^3. R is determined by the preservative manufacturer for a given use class. R always has a subscript to indicate the use class it is intended for (e.g. R_2).

For preservatives designed for use in use class 1 and use class 2, laboratory tests provide an adequate basis for the assignment of R_1 and R_2. For use class 3, field trials might provide additional information and confidence in service life when deriving R_3. For use class 4 and use class 5, data from field tests is essential for the determination of R_4 and R_5.

R cannot be less than the critical value (cv) (derived from the results of the minimum efficacy tests required in BS EN 599-1) for the given use class and the claims made for the preservative. However, preservative manufacturers need to take into account factors that might have an effect on the lifetime of the treated timber, which are not taken into account in the laboratory tests used in the derivation of cv in BS EN 599-1. Unlike comparatively short term laboratory procedures, field trials take into account depletion and biodegradation mechanisms and allow for losses in the level of protection over a prolonged period of service life.

R can be determined at a retention that is higher than the cv.

R might vary for a given end use, depending on the organisms against which the preservative is to provide protection (e.g. protection against blue stain, wood boring insects etc.), and whether the preservative is to be applied to softwood or hardwood.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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