Wood Protection Association

Code of Practice:

Industrial Wood Preservation

4th edition: January 2024

This publication and subsequent editions replaces the formerly titled:
WPA Manual: Industrial Wood Preservation - Specification and Practice

endorsed by:

TIMBER DEVELOPMENT UK

tdca
TIMBER DECKING AND CLADDING ASSOCIATION

The Wood Protection Association (WPA)

The WPA is a not for profit, technical and advisory body. The organisation is focussed on the development and promotion of wood protection technology – to support the use of wood as a cost effective, sustainable and low environmental impact construction material.

The WPA acts as a technical advisor to British and European Standards setters on wood preservation, modified wood and the fire protection of wood. On the Regulations governing wood protection, the WPA enjoys lead body status with agencies such as the Health & Safety Executive, the Environment Agency, Scottish Environmental Protection Agency, the Department for Environment, Food & Rural Affairs and the Highways Agency.

The WPA operates Benchmark quality approval schemes for preservatives, flame retardants and modified wood – providing valid independent assessment and verification. They are designed to further assure products and processes are fit for purpose.

As designers look increasingly to wood as a low carbon construction material, the WPA is committed to providing guidance on the best ways to ensure wood is fit for the purpose intended.

Benchmark QUALITY APPROVAL SCHEMES WPA

TIMBER DEVELOPMENT UK

Timber Developement UK (TDUK) is the largest, most comprehensive supply chain body for timber in the UK. Its membership spans sawmills to specifiers and all points in between. The WPA works closely with the TDUK on all matters concerning wood protection under a strategic partnership agreement aimed at strengthening the UK market for treated wood.

tdca TIMBER DECKING AND CLADDING ASSOCIATION

The **Timber Decking & Cladding Association** (TDCA) is an independent technical and advisory body for the timber decking and cladding industry. Its members make up a database of approved UK suppliers and installers. TDCA operates the DeckMark and CladMark quality assurance schemes. The WPA share vital resources with the TDCA, occupying the same registered office.

Front cover image: courtesy of PiveteauBois

WPA
Wood Protection Association

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Wood Protection Association

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How to use this document

This WPA Code of Practice provides detailed guidance on industrial wood preservation for **specifiers, wood treaters** and those involved with **using treated wood**.

Throughout this document underlined links provide speedy navigation and signpost access to relevant key information – including a range of WPA *Guidance Notes* which provide concise answers to the most frequently asked questions and can be found at the RESOURCE CENTRE of the WPA website.

Specifiers

Gain an understanding of the correct way to specify wood preservative treatment in the UK to ensure that treated wood is fit for purpose in the service conditions in which each commodity has to perform.

This document provides guidance on the allocation of wood components to use classes and service factors applying to end-use situations which also help to make the decision on whether treatment is required or not.

Information is provided on quality assurance procedures that underpin confidence in the performance of treated material. The advantages of using wood treated under the **WPA Benchmark Quality Assurance Scheme** are explained.

Treatment plant managers and operators

Find detailed information on preparing wood for treatment and how to achieve the level of treatment to conform to specifications received.

In many cases preservative suppliers will assist treatment companies with guidance on processes to achieve combinations of penetration and retention of their preservative products. However, plant operators can also use the tables and techniques described here to assess the conformity of their procedures with the requirements of preservative treatment specifications. Included are sections on Factory Production Control, quality assurance and handling and storing treated wood.

Users of treated wood

Learn about the characteristics of treated wood and its safety and disposal at the end of service life.

The relevant sections should be consulted by users to ensure that the full benefits of additional durability conferred by treatment can be obtained while conforming to safety, health and environmental protection rules.

Other useful publications available from the WPA

WPA Code of Practice: Timber Treatment Installations

This document provides up-to-date practical guidance on environmental, safety and health issues relevant to all companies engaged in the activity of industrial timber treatment.

The Buyer's Guide to Preservative Treated Wood

It's a mistake to assume that all pressure treated wood is the same. This illustrative and concise guide to preservative treatment summarises the differences.

WPA Commodity (C) Specification

WPA Commodity Codes are legacy specifications that were provided to assist specifiers by covering all aspects of treatment requirements. These are being phased out, but for reference information see 'Specification Guidance' at www.thewpa.org.uk/preservative-treatments.

Preservative treatment specifications should now be drawn up in accordance with Table 5 and Table 6 of this Code of Practice.

All of the WPA publications referenced in this Code of Practice can be found, free of charge at our website: **www.thewpa.org.uk** - just head to the RESOURCE CENTRE page.

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1. Objectives and Practice of Industrial Wood Preservation

Industrial wood preservation covers only those processes that include factory production control.

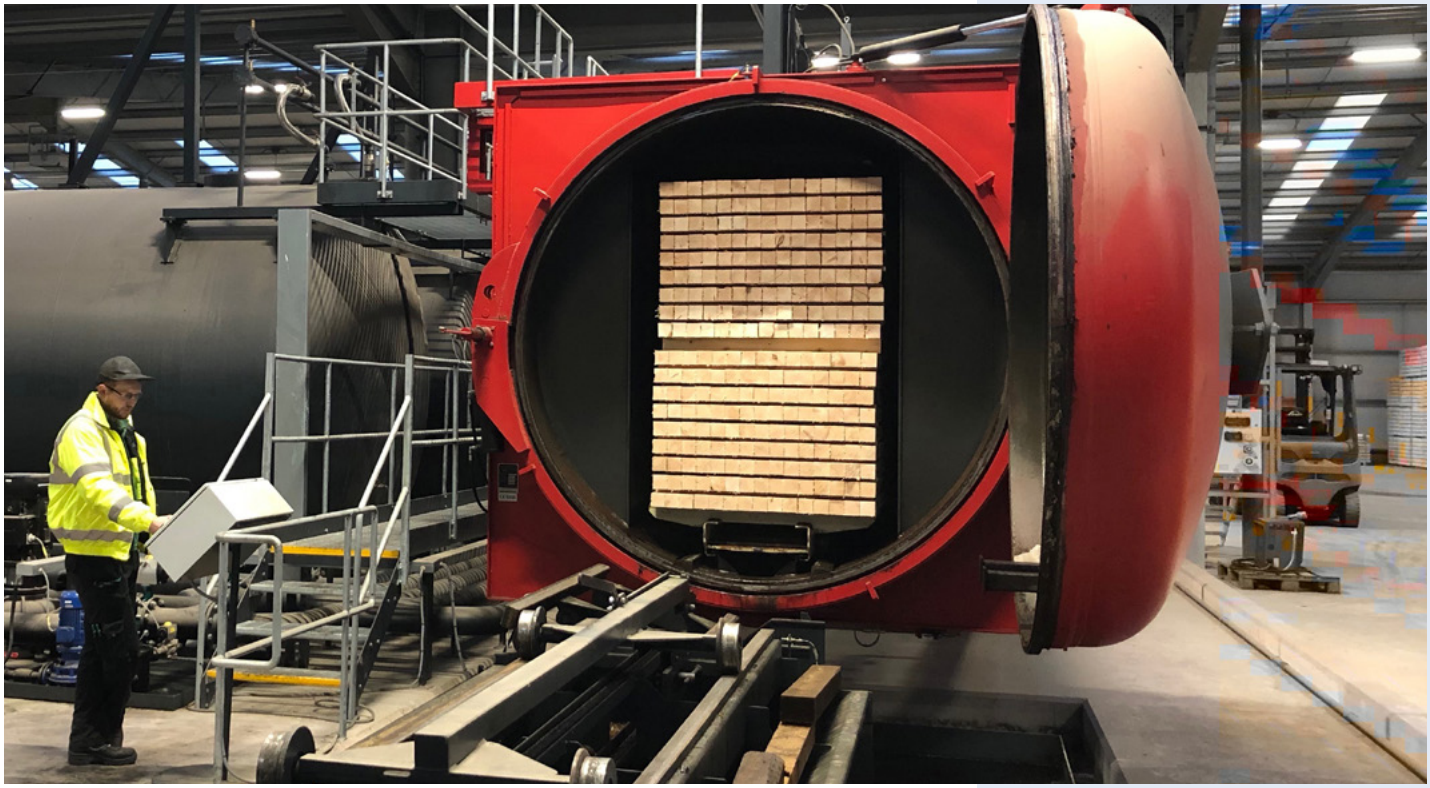
The fundamental objective of industrial treatment of wood with preservatives is to ensure that, even when wood is inherently vulnerable to biological deterioration, once treated it remains sound throughout the design life of the structure of which it forms a part.

Achieving this objective enables designers and specifiers to make maximum use of wood - the most sustainable construction material available. It is important to understand, however, that preservation is not a substitute for good design and appropriate maintenance programmes over the life of a structure; rather it is one component of a holistic approach to design, construction and maintenance.

It is also an objective of industrial treatment to achieve the desired improvement in wood durability with the minimum of environmental impact. It is a major advantage of such treatment that it is carried out in controlled impregnation or application equipment which:

a) **minimises the potential for exposure of either workers or the environment, to wood preservative chemicals, and**

b) **can impart greater durability than is possible with uncontrolled superficial processes, such as brushing and spraying.**



A typical wood preservative pressure treatment plant. Photo courtesy of James Jones & Sons Ltd.

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2. Wood preservatives

2.1 Regulation of preservatives

The sale and use of wood preservatives are governed by legislation.

Legislation imposes a regime of controls based on approval of active substances such as fungicides and insecticides with authorisation at national level of wood preservative formulations that incorporate one or more approved active substances. Wood preservatives used in the UK must be authorised by HSE for England, Wales and Scotland (GB) under the Biocidal Products (Health and Safety) (Amendment) Regulations 2022 (UKBPR) that implement an amended version of the EU Biocidal Products Regulation (BPR). The latter applies in N. Ireland. Some products used in the UK are approved under legacy regulations (The Control of Pesticides Regulations (CoPR) 1986 (as amended). The BPR (for the EU or as amended for GB) also imposes rules on labelling of treated articles (for example treated wood) aimed at ensuring that essential information on handling and use is provided with the product.

Although the legislation incorporates a requirement to demonstrate efficacy, it is at a basic level and approval under the regulations cannot be taken as an indication that performance of treated wood will meet any particular standard.

While certain characteristics of individual products may lead a purchaser or specifier to prefer one preservative over another, all preservatives should be considered safe for both people and the environment when used in accordance with conditions of approval or authorisation and other regulations that apply to their use.

Go to the **RESOURCE CENTRE** for *Guidance Note* **WPA TW 3:** Brexit and the BPR

2.2 Types of wood preservatives

Wood preservatives are classified into types, descriptions of each are listed below.

Determining which one is suitable will depend on the end use of the timber (Use Class), service life requirements, application methods and the desired physical properties or appearance of the treated timber.

Copper-organic

Copper-organic preservatives are water-based mixtures of copper compound(s) with organic compounds that act either as active substances that extend the efficacy of a formulation to protect against a wider range of fungi and/or insects or act as co-formulants to improve the product in other ways.

Generally suitable for **Use Classes 1 - 4.** Applied by **high-pressure processes.** Suitable where wood is exposed to a high risk of biological attack, *e.g.* **fencing, path edge boards and wood embedded in masonry**.

These preservatives are cost effective for the degree of protection afforded. Treatment imparts a greenish colour to the wood making it easy to identify. A dye may be added to impart a brown or other colour. Treatment will cause wood to swell, raise the grain and may cause some distortion.

Microemulsion (water-based)

Water-based preservatives that contain organic active substances, usually both fungicides and insecticides. They are applied to provide an envelope of preservative protection and do not fully penetrate the wood, thereby minimising the uptake of water and reducing the issues of swelling or grain raising. Therefore, machined and coated joinery components, traditionally treated with solvent based preservatives, can usually be successfully treated. These preservatives are usually colourless but marker dyes are often added to distinguish treated and untreated timber.

Generally restricted to **Use Classes 1, 2 and 3** *(coated).* Ideally suited for **internal construction** wood and **painted joinery**. Applied by **low-pressure (double vacuum) processes.**

Learn more about **Use Classes**

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Organic solvent

These are also commonly known as light organic solvent-based preservatives (LOSP).

Generally restricted to Use Classes 1, 2 and 3 *(coated).* Ideal for **Joinery components.**
Applied by low-pressure processes.

Their main advantage is they do not change the dimensions of treated wood or raise its grain; they do not change the colour of the wood *(unless tinted for the purposes of identification),* making them particularly suitable for joinery components. These formulations minimise swelling of treated wood and may be suitable for machined components. These formulations have very high VOC content - check with the preservative manufacturer if this is a concern.

Creosote

Creosote is a highly effective hydrocarbon based preservative derived from coal tar. Creosote preservatives for vacuum pressure treatment must comply with the requirements of BS EN 13991.

Creosote is suitable for wood to be used **externally, above and below ground** – Use Classes 3 uncoated and 4.
Applied by high-pressure processes.

Treatment with creosote reduces moisture movement in wood but is difficult to paint. It can stain absorbent materials with which it comes into contact.

NOTE: The REACH etc. (Amendment) **Regulations 2021** amend Regulation (EC) No 1907/2006 of The European Parliament and of the Council (REACH) which restricts the marketing and use of creosote and creosote treated wood. Individual authorisations under the BPR impose additional restrictions in the EU including N. Ireland.
Before specifying creosote treatment consult the regulations and the Wood Protection Association Guidance Note TW 6 for details of where creosote treated wood may be used.

Go to the RESOURCE CENTRE for *Guidance Note*
WPA TW 6: Use of Creosote and Creostoe treated wood.

Copper-organic oil-based preservatives

Copper-organic oil-based preservatives are mixtures of active substances, including copper and organic compounds, dissolved in an oil that remains in the wood after treatment and drying. These have been developed primarily for heavy duty end uses as alternatives to creosote.

Suitable for use externally above and below ground: **Use Classes 3 and 4.** Applied by **high-pressure processes.** Suitable where wood is exposed to a high risk of biological attack and consequence of failure of treated timber is more critical, *e.g.* **utility poles, railway sleepers, roadside fencing.**

Treatment with these preservatives reduce moisture movement in wood, can often exhibit a shiny surface in certain climatic conditions and can be difficult to paint.

2.2.1 Preservative Effectiveness

Also refer to °NOTE to 3.3.3

A European performance standard for wood preservatives, **BS EN 599-1 Efficacy of preventive wood preservatives as determined by biological tests – Specification according to Use Class,** defines the biological tests and the results needed to demonstrate preservative effectiveness. Effectiveness is expressed as the **Critical Value (CV)** – the amount of preservative required to protect wood in biological tests carried out in accordance with BS EN 599-1 for any given Use Class.

The retention of preservative required in practice for Use Class and service life combinations may be either the CV or, typically for a longer service life, a higher figure calculated by applying a factor to the CV. Where a factor is applied, it is shown in Table 5. Preservative suppliers will declare, subject to any conditions of authorisation or approval, the retention they recommend for each Use Class for which a preservative is suitable. Some Use Class 4 (ground contact) preservative formulations are approved under the **WPA Benchmark approval scheme** and these can be found here: www.thewpa.org.uk/preservative-treatments.

For creosote, whose efficacy has been established over many years in service, retentions based on custom and practice and shown to be effective in service over many years are used in this Code of Practice instead of data from BS EN 599 efficacy tests.

Benchmark APPROVED FORMULATION WPA

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3. Specifying Preservative treatment

3.1 A concise guide to specification

Preservative treatment provides wood with added durability. However, it's a mistake to assume that all pressure treated wood is the same. Whilst one piece of treated wood may look very much like any other, the level of preservative protection could be very different. That's because the retention and penetration of preservative, impregnated into the wood, is tailored to the desired end use.

Table 1: BS EN 335 groups the applications for treated wood into 'Use Classes', the main three being:

INTERIOR	EXTERIOR	
Use Class 2	**Use Class 3(u)**	**Use Class 4**
Above the ground or DPC, covered	**Above the ground** (uncoated)	**Ground or fresh water contact** (and exterior structural support)
Internal construction timbers within the building envelope: **Tiling battens, framing and roof timbers** *(including CLT*)*, **internal joists, sole plates.**	External construction timbers: **Deck boards, fence rails and boards, cladding** *(including battens)* **and fascias.**	External construction timbers: **Fence posts, agricultural timbers, retaining walls, playground equipment, decking posts, joists and sub-structures.**

Check List - Buying and Using Preservative Treated Wood

✓ DO establish the Use Class of the timber you need, before ordering.

✓ DO tell your supplier in writing, that the wood must be treated to that particular Use Class.

✓ DO Ask your supplier to verify that the wood supplied meets your Use Class specification – on the delivery note and invoice or a treatment certificate.
When buying from stock always check which Use Class the wood has been treated to.

! DO NOT substitute wood that has been treated for an indoor application for use in an external application – failure is inevitable.

For wood in permanent ground or fresh water contact, or providing exterior structural support, **Use Class 4** levels of protection must be be specified, otherwise service life, structural safety and customer satisfaction will be compromised.

! When cross cutting, notching or boring treated timber products during installation, ALWAYS apply an end grain preservative treatment to freshly exposed areas to maintain the integrity of the protection. NEVER put cut ends in the ground, even if end grain coated.

Go to the RESOURCE CENTRE for
The Buyer's Guide to Preservative Treated Wood

* **Cross-laminated timber (CLT)** is used for example, for exterior walls, floors, partition walls and roofs, typically in Use Class 2, and there is a risk of wetting in service that may last longer than in smaller dimension wood components. Moisture dynamics are becoming better understood and while wetting times might be slower, drying times are likely to be significantly longer after any moisture uptake, resulting in an increased risk of fungal decay developing. This is especially the case in instances of water penetration through flat roofs and with internal leaks of water in, for example, wetrooms. Precautions should be taken to allow for protection against wetting during construction and in use. Further precautions may be taken in the design, to allow for water drainage and drying.

While the design detailing and workmanship of the wood material in a component has a significant impact on the performance of the component, the different construction methods and detailing in CLT also influence the moisture behaviour and drying time during service life. The massive nature of CLT creates difficulties for post manufacture preservative treatment and treatment specifications are not yet developed enough to include in this Code of Practice. Some CLT material is manufactured from pressure-treated components which overcomes the difficulty of post-manufacture treatment. Check with preservative manufacturers for their latest advice.

Learn more about the WPA's campaign.

Make sure 4 it's Use Class 4 GROUND CONTACT

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3.2 The need for treatment

To determine whether a wood component needs preservative treatment, three main factors must be considered; the **biological hazard**, the **risk and consequence of failure**, and the inherent **natural durability** of the wood.

3.2.1 Use classes

The different service situations in which wood can be used have been categorised into a series of Use Classes. Five such classes, which describe the different service situations based on the **biological hazard** likely at expected in-service moisture conditions, are defined in BS EN 335.

The allocation of a component to a Use Class assumes good design, installation and maintenance of the construction. If conditions arise during the service life of the component which 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 will no longer apply and performance may be affected.

If specifiers wish to take these long-term risks into account, they can allocate a component to a higher Use Class and a different preservative treatment may then be necessary.

Table 2 summarises the Use Class system. Examples of typical service situations are given.

Column 5 of Table 2 allocates a representative range of components to the Use Class which they usually occupy in the UK. If a component being considered is not listed, the specifier should either allocate it to the appropriate Use Class based on the examples given, or contact the Wood Protection Association for advice.

Notes to Table 2

1. UK Building Regulations require preservative treatment of softwood species used for roof construction in the *Hylotrupes* area. UK government climate change criteria indicate an increased risk of insect attack in Use Class 1 in all parts of the UK.
2. These 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.
3. Some preservatives are only recommended for use in Use Class 3 when protected by a coating, guidance is provided at appropriate points in this Code of Practice. If in doubt consult the preservative manufacturer.
4. BS EN 335 includes insects as a risk factor in Use Classes 3 and 4 but this is not, under present conditions, recognised as a significant risk for wood in these situations in the UK.
5. Sleepers laid on well-drained ballast maintained in service are considered for regulatory purposes to be Use Class 3 but durability appropriate to Use Class 4 is indicated to meet service life requirements in this safety-critical use. Sleepers in direct ground contact are Use Class 4.

Table 2. Use Class and typical service situations

USE CLASS	SERVICE SITUATION	PRINCIPAL BIOLOGICAL AGENTS	TYPICAL SERVICE SITUATION	EXAMPLES
1 *(note 1)*	Above ground, covered. Permanently dry.	Insects	Internal, with no risk of wetting.	All woods in normal pitched roofs *(note 1)* except tiling battens and valley gutter members. Floorboards, architraves, internal joinery, skirtings. All wood in upper floors not built into solid external walls.
2	Above ground, covered *(i.e. by a roof or other building component).* Occasional risk of wetting.	Fungi / Insects	Internal, with risk of wetting.	Tiling battens, frames in timber-frame houses *(note 2)*, wood in pitched roofs with high condensation risk, wood in flat roofs, ground floor joists *(note 2)*, wood joists in upper floors built into external walls *(note 2)*, sole plates (*above dpc*) *(note 2).*
3	Above ground, protected, *e.g. by a coating.* Exposed to frequent wetting. If wood becomes wet, drying out may be delayed by a coating. Above ground, not protected, *e.g. by a coating.* Exposed to frequent wetting.	Fungi *(note 4)* Fungi *(note 4)*	External, above damp-proof course (DPC) coated *(note 3).* External, above DPC uncoated *(note 3)*	External joinery including roof soffits and fascias, bargeboards, etc., cladding (*inc. battens*), valley gutter wood *(note 2)*, external structural load bearing wood. Fence rails, gates, fence boards, agricultural wood not in soil / manure contact and garden deck boards *(other than deck substructures)* not in contact with the ground.
4	In contact with ground or fresh water. Permanently exposed to wetting.	Fungi *(note 4)*	Permanently exposed to wetting *(e.g. in contact with the ground/ below dpc)* and/ or providing exterior structural support.	Fence posts, gravel boards, agricultural wood in soil / manure, earth-retaining walls, poles, sleepers *(note 5)* , playground equipment, motorway and highway fencing and deck components that are in contact with the ground. Deck substructures whether or not *(note 2)* directly in contact with the ground, lock gates and revetments, raised beds, bridge timbers.
5	Permanently exposed to wetting by salt water.	Marine borers, Fungi	All components in permanent contact with sea water.	Marine piling, piers and jetties, dock gates, sea defences, ships hulls.

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3.2.2 Risk and consequence of failure

Although different components may fall into the same Use Class as given in Table 2, the risk of failure or consequence of failure may be quite different. These considerations may be very important when deciding whether a component should be treated.

Table 3 contains four service factors that have been used in this Code of Practice to describe variations in risk and consequence of failure.

Table 3. Service factors

SERVICE FACTOR CODE	DESCRIPTION OF RISK AND CONSEQUENCES OF FAILURE	NEED FOR PRESERVATION (note *1*)
A	Where risk of failure is negligible *(note 2)*.	**Optional**
B	Where risk of failure is low and preservation can be regarded as an insurance against cost of repairs, and/or where replacement of wood or remedial action is not difficult or expensive.	**Advisable**
C	Where risk of failure is high and/or where replacement of wood or remedial action is difficult and expensive.	**Desirable**
D	Where risk of failure is very high and/or where failure of wood components would result in serious danger to structure or persons.	**Essential**

Notes to Table 3

1. An alternative to preservation is the selection of a wood species of suitable natural durability.
2. Determining the likelihood of failure in service, especially over the 60 year life expected of structural wood in buildings, should take into account potential changes in activity of insects and increased risk of rain penetration as a consequence of climate change.

3.2.3 Natural durability of wood

The natural durability of **heartwood** varies between wood species. For some end uses, the natural durability of the heartwood of a particular species may provide sufficient durability to be used without preservation. **BS EN 350** defines the durability class of commonly available wood species.

NOTE: *EN 350 may give a range of durabilities for a species and in such cases the lowest durability should be assumed unless the provenance of a particular source has been demonstrated to provide a reliable and predictable durability rating.*

Where naturally durable components are to be used, their natural durability should not be less than that given in Table 4. The natural durability ratings in **Table 4** are relevant to durability to decay fungi. Where natural durability against insect and/or marine borer attack is required, a suitable wood species should be chosen in accordance with BS EN 350, using the additional classifications in that standard for durability against these organisms.

The durability of **sapwood** is minimal whatever the species. Where sapwood is present, the loss of which would render the component unfit for its intended use, preservative treatment should be applied whatever the associated natural durability of the heartwood.

Softwoods contain a high percentage of sapwood, which may be difficult to distinguish from the heartwood and it is usually impractical and uneconomical to exclude it. The practical result is that softwoods for general purposes must be regarded as non-durable when considering the need for preservative treatment if conditions favour fungal and/or insect attack.

Wood of high natural durability is often available only from sources prone to be environmentally vulnerable or fragile. The full implications of specifying particular species of wood should be considered when choosing between the use of naturally durable wood and a less durable wood from sustainable sources with preservative treatment.

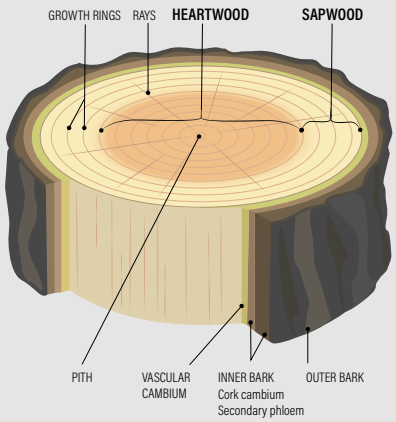

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Table 4. Natural durability recommendations for wood components

COMPONENT	USE CLASS	DURABILITY CLASS OF WOOD WHOSE HEARTWOOD CAN BE USED WITHOUT TREATMENT (note 1)		
		DESIRED SERVICE LIFE (*Years*)		
		15	**30**	**60**
Internal joinery (note 1A)	1	60 year desired service life is always required		5, D *(insects)*
Wood in roofs dry (note 1A)	1	60 year desired service life is always required		5, D *(insects)*
Wood in roofs dry (*Hylotrupes* area)	1	60 year desired service life is always required		3 (note 2), D *(insects)*
Wood in roofs *(risk of wetting)*	2	60 year desired service life is always required		2, D *(insects)*
External walls/ground floor joists		60 year desired service life is always required		2
Sole plates above damp-proof course (DPC)		60 year desired service life is always required		2
External joinery *(coated)* and cladding *(coated)*	3 C	4	3	2
Fence rails, deck boards, external joinery *(uncoated)*, cladding *(uncoated)* and battens for cladding	3 U	3	2	1
Fence and deck posts, deck substructures, earth retaining walls, raised beds and wood in bridge construction	4	2	1	(note 3)
Poles	4	2	1	(note 3)
Sleepers	4 (note 6)	2	1	(note 3)
Wood in fresh water (note 7)	4	2	1	(note 3)
Wood in salt water (note 7)	5	(note 4)	(note 5)	(note 5)

Note on wood-based sheet materials

Due to the specific structure of particleboard, OSB and fibreboards (i.e. high density, lack of splits or checks, randomised glue lines and small size of particles/fibres or strands) they are resistant to infestation by wood boring beetles.

Products with veneers e.g. plywood, equal to or thicker than 2mm will not be intrinsically resistant to wood-boring beetles. The frequency and importance of this risk depends upon the geographical region.

All wood-based composite materials are susceptible to attack by termites.

Notes to Table 4

1. Natural durability categories for wood species listed in BS EN 350:
   - numbers = Fungal decay rating,
   - letters = additional rating [named organisms].

1A. UK government climate change criteria are expected to indicate an increased risk of insect attack in Use Class 1 in all parts of the UK.

2. Any hardwood can be used. Recommendations based on evidence that the House longhorn beetle (*Hylotrupes* bajulus L) can attack the heartwood of some softwoods of lower natural durability.

3. No standard recommendation of durability class exists for these specifications. The heartwood of some hardwood species might be expected to achieve a 60 year service life on the basis of long term experience of use in ground contact.

4. Resistance against marine borers is essential in this end use. In addition to this, a durability class 1 against fungi is required in this use. Species of hardwoods, the heartwood of which is preferred for use untreated in sea water include andaman padauk, basralocus, ekki, greenheart, iroko, jarrah, kapur, okan, opepe. For such material, CITES should always be consulted as entries in the CITES list do change from time to time (www.cites.org).

5. In general, species of natural durability class 1 cannot be relied upon to give more than 15 years' service. However, certain species can give longer service, particularly if adequately sized cross-sections are used.

6. Sleepers laid on well-drained ballast maintained in service are considered for regulatory purposes to be Use Class 3 but durability appropriate to Use Class 4 is indicated to meet service life requirements in this safety-critical use. Sleepers in direct ground contact are Use Class 4.

7. Wood used as packing in cooling towers is not common now. It is exposed to fresh or salt water and advice should be sought from preservative manufacturers if such wood is to be treated.

Go to the RESOURCE CENTRE for *Guidance Note* **WPA TW 15:** Preservative Treatment of wood-based sheet materials.

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3.3 Specifying treatment

3.3.1 UK regulations, product standards and warranty schemes

Historically, the decision whether or not to specify preservative treatment of particular wood or wood-based components was largely a matter for the individual specifier, unless a structure came under statutory or voluntary regulation.

Examples are:

a) Building Regulations which lay down statutory treatment requirements for a limited range of wood roof components in the small area around north west Surrey subject to a high risk of infestation by *Hylotrupes bajulus (House longhorn beetle) see* Approved Document A - Structure;

b) Insurance backed warranty schemes for new homes such as those operated by NHBC where considerations of building durability and performance are laid down in specification manuals for both insurance purposes and owner confidence;

c) Grant schemes where the granting of some types of financial support to, for example, farmers has been conditional on a certain minimum life expectancy being designed into agricultural buildings and fencing.

However, the EU Construction Products Regulation (CPR), now amended for the UK as The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 and The Construction Products (Amendment) Regulations 2022, create a different framework of standards and regulations. The seven basic requirements for construction works include a requirement that building products covered in the scope of the legislation exhibit adequate mechanical resistance and stability throughout their design life.

Harmonised (EU) or Designated (UK) European product standards exist for certain wood and wood-based products and these may include durability and preservation requirements. Where such standards exist, they must be adhered to for products governed by the legislation. Producers must provide Declarations of Performance and apply marking (CE and/or UKCA marking) to products covered by such standards. Guidance is available from www.thewpa.org.uk.

Thus, there is a clear legal onus on the designer of any structure encompassed by The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 and The Construction Products (Amendment) Regulations 2022 to take such measures as are necessary to ensure the materials specified are of sufficient strength and durability to fulfil these requirements. It is from this that the need to apply appropriate preservative treatment to wood arises. Thus, whilst the designer / specifier continues to have considerable freedom in the choice and use of preservatives, a duty to safeguard the mechanical resistance and stability of the structure is now more explicit than formerly.

3.3.2 Basis of specifications

BS EN 351-1 Durability of wood and wood-based products – Preservative-treated sold wood sets out a framework for specifying preservative treatment based on a combination of penetration and retention of preservative. Quality assurance involves demonstrating by analysis that the required combination of penetration and retention has been achieved in each batch unless for thinner components in UC3, a derogation from penetration requirements is shown in Table 5.

If this had to be carried out on each batch (***direct testing***) the cost would normally be considered to be prohibitive *(though not invariably, for example in the case of small batches of high value and performance-critical commodities such as poles)*. This is avoided in most cases by taking advantage of the allowance in the standard for the treatment of batches of similar size, species, end-use and desired service life to be evaluated to show that the application of a preservative by a particular process can be safely relied upon to achieve the desired result (***indirect testing***). This is explained in more detail in Factory Production Control.

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3.3.3 Desired Service Life (DSL)

The level of preservative treatment recommended depends not only on the risk of attack but also on the expected life of the component in service. In Table 5 and Table 6 preservative recommendations are given where appropriate for desired service lives of **15, 30** and **60 years**. Where a treatment is not recommended for a particular end use/service life combination, it is because a generic recommendation is not currently possible. Similar desired service lives using naturally durable wood species are in Table 4.

Service life within a Use Class relies on many factors. For preservative treated wood these include the preservative and the quality of treatment. Other important factors include the **quality of wood** *(e.g. sapwood and / or heartwood ° content, liability to split/check),* the **design of the wooden component,** the **design of the structure** in which the wood is incorporated, the **quality of construction**, the quality and regularity of any **maintenance** undertaken and the local **climatic/exposure conditions** in which the wood is in use. Consequently, the prediction of service life is not precise; these desired service lives are not guarantees of performance but indications of the expectation against which the recommendations for treatment are drawn up, assuming good design and normal conditions of use.

As they relate solely to the resistance of the wood to biodeterioration, it is essential to bear in mind that other factors, such as **mechanical damage** or **failure of other elements** of the construction, could limit the life of the complete commodity. The service lives in Table 5 and Table 6 have in some cases not been established by direct service evidence and therefore could be subject to revision as more experience is gained.

Warranties or guarantees relating to service life may be provided by preservative manufacturers and/or treatment companies and purchasers/users should carefully check warranty conditions to satisfy themselves that a warranty meets their requirements.

°NOTE: While preservative treatment of sapwood, especially permeable sapwood, is expected to provide protection for the desired service life, heartwood is often difficult to treat. Penetration classes in Table 4A (up to NP5), except where sapwood and heartwood cannot be distinguished, relate solely to penetration of sapwood. For longer desired service life, NP6 or NP7 may apply when heartwood penetration is required (as it is where sapwood and heartwood cannot be distinguished) and measures such as incising are essential to ensure penetration in accordance with treatment specifications. Especially for wood in Use Class 4, it is essential to understand that if material with high heartwood content is used where heartwood penetration is not required and the natural durability of the heartwood is insufficient on its own to protect the wood, then wood with as high as possible a proportion of sapwood should be used to maximize protection (BS 8417, clause 6.5.1). Even where some heartwood penetration is achieved or where round wood with a complete ring of sapwood is used, splitting of wood in service may expose heartwood to decay organisms that may result in shorter than desired service life.

3.3.4 Treatment specification

Table 5 and Table 6 allocate component groups to Use Classes and specify penetration and retention values for treatment of permeable and resistant species for 15, 30 or 60 year service lives. Compliance is achieved by meeting these penetration *(to an acceptable quality level)* and retention requirements which involves a combination of process control parameters specific to each treatment installation with confirmatory chemical analysis on a mutually agreed basis. For further details see Factory Production Control.

When specifying treatment, the following information should be given:

Component type *(plus Use Class if known)*
Species or wood type *(permeable or resistant)* (note 1) if required
Desired service life *(15 or 30 years or 60 years where available)*
Preservative type *(if a specific type is required)* (note 2)

NOTES:

1. It should be noted that the treatability of wood varies between species. If a specific wood species is to be specified, care should be taken to ensure that a species is chosen appropriate to the treatment requirements.
2. It should be noted that not all preservatives are appropriate for all Use Classes.

Example model specification phrases

'**Fencing** † *[add species or type if desired]* (Use Class *[insert Use Class(es)]*) treated with a preservative *[add preservative type if desired*]* in accordance with the current WPA Code of Practice for which a desired service life of 15 years *[or alternative from Tables 6 to 11]* is required'.

'**Structural wood** † *[add species or type if desired]* (Use Class *[insert Use Class(es)]*) treated with a preservative *[add preservative type if desired*]* in accordance with the current WPA Code of Practice for which a desired service life of 60 years *[or alternative from Tables 6 to 11]* is required'.

NOTES:

* A generic preservative type may be chosen e.g. copper-organic, organic solvent or microemulsion.

† As much detail as possible of the end use should be given; for example, 'Structural wood *(sole plates)*'.

REMEMBER: If specifying particular preservative types or wood species, it is important to note that not all preservatives are appropriate for all Use Classes and that some species are not sufficiently permeable to achieve the penetration levels required, at least without additional processing such as mechanical incising.

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4. Treating wood

The importance of ensuring that treatment procedures do not compromise the health and safety of humans and the environment cannot be over-emphasised.

The design and operation of wood treatment installations should be in accordance with a permit issued under the Industrial Emissions Directive (IED) (2010/75/EU) or, where a plant does not exceed the IED daily capacity threshold, in accordance with the **WPA Code of Practice for Timber Treatment Installations.**

4.1 Condition of wood for treatment

BS EN 350 gives four classes to indicate the treatability of the sapwood and heartwood for a range of wood species. For preservative treatment purposes, however, this Code of Practice 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 for higher hazard applications such as fencing.

For optimum protection, wood should be in an appropriate condition to receive treatment, as follows:

4.1.1 Surface characteristics

The surface of the wood shall 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.

4.1.2 Freedom from decay and insect attack

The wood shall be free from all signs of attack by wood destroying fungi and insects. Wood showing signs of attack by mould, sapstain *(bluestain)*, fungi or pinhole borers may be acceptable subject to agreement between the wood supplier and the customer.

4.1.3 Moisture content

The moisture content of the wood shall be appropriate for the preservative, treatment method and end use. For all methods of treatment, the moisture content should be **below the fibre saturation point** (*circa 300g/kg [30% mass/mass]).* Care should be taken that wood is presented for treatment at a moisture content which is at or below the likely in-service moisture content**.** *See* Determination of moisture content

4.1.4 Temperature

Wood shall not be treated if it is frozen.

4.1.5 Glued wood and board materials

Although most cured adhesives are not affected by preservative treatment, there are some exceptions to this (*notably PVA is not suitable where wood is subsequently to be treated with a water-containing preservative).*

For wood-based boards for which a glue bond is an integral feature, bond performance is critical and guidance is provided in **BS EN 13986**.

4.1.6 Metal fittings and fixings

It is important that metal fittings and fixings should not be attached to wood prior to treatment with copper-based preservatives unless the preservative manufacturer confirms this is acceptable.

4.1.7 Mixed species

As far as is practicable, wood for which different treatment schedules are appropriate *(for example more than one species or end-use)* should not be treated in the same charge, unless the most intense schedule required can be applied without detriment to those components only requiring lesser schedules.

4.1.8 Stacking for treatment

The wood should be stacked to ensure that preservative solution shall have access to all faces of the wood and to facilitate natural drainage. Bindings should be sufficiently loose to permit this.

Mechanical incising of the surface is now used widely to help achieve the desired penetration of preservative.

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4.1.9 Wrapped packs

Packs should not be treated with any wrapping still in place. If packs are treated wrapped, the wrapping may interfere with penetration of the preservative and wrapping material becomes coated in preservative solution posing a handling and disposal hazard at the point of unwrapping.

4.2 The treatment process

Table 5 and Table 6 **allocate specific component groups to Use Classes and recommend appropriate penetration and retention values for permeable and resistant species for 15, 30 and 60 year service lives.**

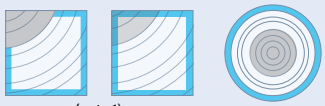
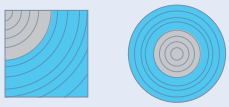
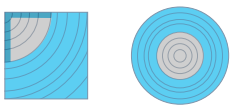
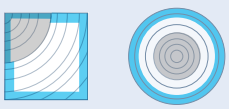
A penetrating process, one which includes features or procedures intended to overcome the natural resistance of wood to penetration by a wood preservative in its ready for use form, is required. Process parameters must be selected to achieve the required penetration and retention requirements. Processes (*typically involving requirements for wood moisture content, preservative solution concentration and vacuum and pressure phases*) are not defined in specifications based on penetration and retention of a preservative (as in Table 5). However, penetrating processes for resistant species where Table 5 allows derogations from normal penetration requirements (see Table 5 ***Note 13***) should include a pressure phase (*typically* ≥ 6 *bar for at least 60 minutes*) to ensure that penetration is the best that can be achieved in a resistant species like spruce and the required retention is achieved in the treated zone.

The treatment cycles and concentration of preservative used for treatment will vary depending upon the species being treated, the desired service life and the Use Class. Generally speaking, there is an increased biological risk of wood deterioration the higher the Use Class number and the longer the service life. In such cases, more severe treatment cycles which result in increased penetration are frequently necessary to meet these more demanding requirements, often in conjunction with higher preservative retention.

4.2.1 Penetration

Penetration is defined as a **Penetration Class** taken from **BS EN 351-1** (Table 4A gives details). The **analytical zone** given in Table 4A is that part of the treated wood which is analysed for assessing the retention requirement.

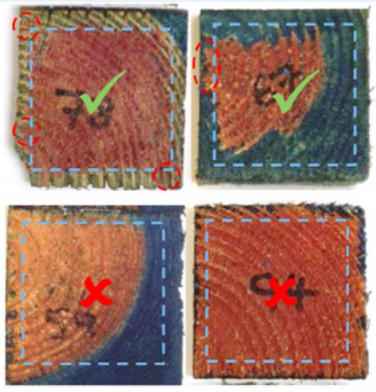
Table 4A. Penetration requirements and analytical zone of each Penetration Class

PENETRATION CLASS	PENETRATION REQUIREMENTS (note 1)	ANALYTICAL ZONE	TYPICAL COMPONENT PENETRATION (note 4)
NP1	None	3mm from lateral faces	
NP2	Minimum 3mm lateral into sapwood	3mm lateral into sapwood	 (note 1)
NP3	Minimum 6mm lateral into sapwood	6mm lateral into sapwood	 (note 1)
NP4 (note 2)	Minimum 25mm	25mm lateral into sapwood	
NP5	Full sapwood	Full sapwood	
NP6 (note 3)	Full sapwood and minimum 6mm into exposed heartwood	Full sapwood and minimum 6mm into exposed heartwood	
NP7 (note 3)	Minimum 12mm into the sapwood and minimum 6mm into exposed heartwood	12mm into sapwood and 6mm into exposed heartwood	

Preservative penetration requirements of exposed heartwood (ref. Table 4A)

Top two images show 6mm preservative penetration into a minimum 75% of the exposed heartwood of 75 x 75mm posts (red circles indicate portions of heartwood showing less than 6mm penetration).

Bottom two images show examples which do not achieve 6mm penetration across 75% of the exposed heartwood surfaces.



NOTES to Table 4A

1. If it is not possible to distinguish between heartwood and sapwood, the whole sample should be regarded as sapwood.
2. NP4 only applies to round wood of resistant species.
3. Where penetration class NP6 is specified for some timbers in Use Class 4 end uses, full sapwood penetration is required. 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 NP7 is specified for resistant timbers in Use Class 4 and 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.
4. Diagrams in last column, showing preservative penetration are for illustrative purposes only – actual penetration will vary by species and heartwood/ sapwood ratios within each component treated.

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4.2.2 Permeability and Treatability

Treatment requirements in this manual may vary depending on whether the chosen species is classified as **permeable** or **resistant**.

BS EN 350 defines four treatability classes for wood species depending on the ease with which they can be impregnated with preservative. For the purposes of BS EN 351-1, BS 8417 and this document, this system is simplified into two groups of species:

Permeable species:	Those wood species with sapwood or both sapwood and heartwood of treatability class 1 as defined in EN 350.
Resistant species:	All wood species not defined as permeable.

4.3 Specifications

A specification for treatment needs to describe the component to be treated and the desired service life of that component. This information, along with the treatability of the wood species to be treated will enable the treater to establish the required retention and penetration to achieve that specification (Table 5, Table 6). The required retention is the amount of preservative to be found in the analytical zone as defined by the penetration class - *see* Table 4A.

4.3.1 Products for which the manufacturer declares compliance with BS EN 599-1

Products that have been tested in accordance with BS EN 599-1 should be applied to give the penetration and retention combinations recommended by their supplier. Table 5 provides recommendations for penetration and retention combinations for each Use Class.

The recommended retentions in Table 5 are expressed in terms of 'R'.

- R represents a figure declared by the preservative manufacturer for a given Use Class.
- R is always qualified by a suffix to indicate the Use Class it is intended for (e.g. R2).
- R should not 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 ensure that the recommended retention takes into account factors which have an effect on the lifetime of preservative treated wood but which are not taken into account in the laboratory tests used in the derivation of the CV in BS EN 599-1. Therefore R may often be higher than the CV. Conditions of authorisation of wood preservative formulations under the BPR may include minimum and maximum retentions reflecting assessments of efficacy and risks to health and safety and the environment. Manufacturers have to comply with such conditions. If a retention indicated in Table 5 is outside an authorised range, the preservative may not be used for that purpose and the preservative manufacturer should be consulted.
- 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. For preservatives designed for Use Classes 1 and 2 laboratory tests provide an adequate basis for the assignment of R. For Use Class 3 field trials may provide additional information and confidence in service life when deriving R3. For Use Class 4 data from field tests should be considered in the determination of R4.
- R may be declared at a retention that is higher than the CV.
- R may vary for a given end use depending on the organisms against which the preservative is to provide protection (*e.g. if protection against blue stain, wood boring insects etc. is required*), and whether the preservative is to be applied to softwood or hardwood.
- Multiplication factors are applied to R for Use Classes 3 and 4 to indicate that higher retentions of preservative should be used where longer service lives are required.
- Multiplication factors in Table 5 are the default factors that apply to all preservatives unless 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 the Table.
- For treatments in Use Class 5, R is based on laboratory and field tests.
- Some component / service life combinations in Table 5 do not have allocated retention and penetration requirements. This occurs where performance over extended service lives or the use of treated wood in particularly severe conditions cannot easily be predicted using standard test methods. For these uses and service lives the preservative manufacturer should be consulted.

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4.3.2 Preservatives complying with product specifications

Products meeting the requirements of **BS EN 13991 (creosote)** should be applied in accordance with Table 6.
These penetration and retention requirements are based on experience of use in the UK.

Table 5: Treatment recommendations for solid wood to be treated with preservatives tested in accordance with BS EN 599-1

COMPONENT	USE CLASS	SERVICE FACTOR	DESIRED SERVICE LIFE *Years*							
			15				30			
			PERMEABLE WOOD		RESISTANT WOOD		PERMEABLE WOOD		RESISTANT WOOD	
			PENETRATION *note 1* / RETENTION *note 2*		PENETRATION *note 1* / RETENTION *note 2*		PENETRATION *note 1* / RETENTION *note 2*		PENETRATION *note 1* / RETENTION *note 2*	
Internal joinery	1	A	No treatment required *(note 13, note 3)*							
Roof timber dry	1	B	60 year desired service life is always required							
Roof timbers dry *(Hylotrupes* area) *(note 11)*	1	D	60 year desired service life is always required							
Roof timbers *(risk of wetting)* - if in the *Hylotrupes* area *(note 11)*; Service Factor becomes 'D'	2	C	60 year desired service life is always required							
External walls *(sawn wood)* / ground floor joists	2	C/D	60 year desired service life is always required							
Sole plates above DPC	2 *note 5*	D	60 year desired service life is always required							
External joinery *(coated)* and external wood features e.g. cladding, facias and bargeboards *(coated) (note 6)*	3c	C/D	**NP2**	R3c×1	**NP2** *note 8* (NP1 *notes 4 & 12*)	R3c×1	**NP2**	R3c×1.25	**NP2** *note 8*	R3c×1.25
Fence rails, deck boards, external joinery *(uncoated)*, external wood features e.g. cladding, facias and bargeboards *(uncoated)*	3u	C/D	**NP5**	R3×1		R3×1	**NP5**	R3×1.25	**NP3** *note 8*	R3×1.25
Fence and deck posts, deck substructures *(whether in direct soil contact or not)*, soil-retaining walls, raised beds, bridge timbers *(above water) (note 10)*	4	C/D	**NP5**	R4×1	**NP3** *note 8*	R4×1	**NP6** *note 8*	R4×1.5	**NP7** *note 8*	R4×1.5
Poles *(round with no exposed heartwood)*	4	D	**NP5**	R4×1	**NP4** *note 8*	R4×1	**NP5**	R4×1.5	**NP5** *note 8*	R4×1.5
Sleepers	4 *note 9*	D	**NP5**	R4×1	**NP5** *note 8*	R4×1	**NP6**	R4×1.5	**NP6** *note 8*	R4×1.5
Wood in fresh water	4	D	**NP6**	R4×1	**NP6** *note 8*	R4×1	**NP6**	R4×1.5	**NP6** *note 8*	R4×1.5
Wood in salt water	5	D	**NP6**	R5×1	**NP6** *note 8*	R5×1	*note 7*			

60			
PERMEABLE WOOD		RESISTANT WOOD	
PENETRATION *note 1* / RETENTION *note 2*		PENETRATION *note 1* / RETENTION *note 2*	
NP1	R1 × 1	NP1	R1 × 1
NP1	R1 × 1	NP1	R1 × 1
NP1	R2 × 1	NP1 *note 4*	R2 × 1
NP1	R2 × 1	NP1 *note 4*	R2 × 1
NP2	R3 × 1 *note 5*	NP2 *note 8*	R3 × 1 *note 5*
note 7			
note 7			
note 7			
note 7			
note 7			
note 7			
note 7			

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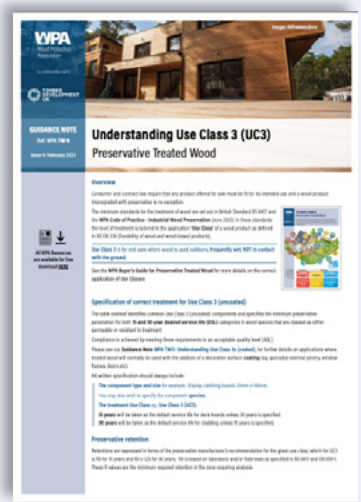
Notes to Table 5

1. Penetration classes are in Table 4A. Treatment processes must be compliant with 4.2.
2. Retention expressed as a multiple of the 'R'. Except for unfixed water-soluble preservatives, retention values refer only to the analytical zone.
3. UK government climate change criteria are expected to indicate an increased risk of insect attack in Use Class 1 in all parts of the UK. Consequently a specifier may consider a Use Class 1 or 2 treatment is required.
4. Treatment only by a penetrating treatment process compliant with 4.2.
5. 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 R3.
6. These recommendations assume that the exposed surfaces of the woodwork will be painted or given some other protective finish which will be maintained in service.
7. Generic treatment recommendations are not given for these component and service life combinations. See Section 4.3.1 for further explanation. Where such combinations are desired, consult preservative suppliers for recommendations. NP6 Penetration Class will normally be required.
8. Achievement of NP2 and deeper penetration in resistant species is often very difficult. Processes to aid penetration such as incising may be required.
9. Sleepers laid on well-drained ballast maintained in service are considered to be Use Class 3 but durability appropriate to Use Class 4 is indicated to meet service life requirements and the safety-critical use. Sleepers in direct ground contact are Use Class 4.
10. Wood components in bridges above water are Use Class 3 but UC4 treatment is recommended.
11. If wood is to be used to construct roofs in the Hylotrupes area then a preservative suitable for Use Class 1 (*dry roofs*) or 2 (*roofs with risk of wetting in service*) which has been tested against *Hylotrupes bajulus* must be selected.
12. Experience with thinner, (<44mm), components fabricated from resistant species and used in well-ventilated, water shedding service environments indicates that provided the required retention is achieved in the 3mm treated zone, performance is adequate, even when a minimum 3mm penetration cannot be achieved. As an alternative to NP2, a penetrating treatment process in accordance with Section 4.2 with an appropriate preservative concentration may be used to achieve the maximum penetration possible and minimum required retention. Examples of end uses that would be covered by this category include, cladding, barge boards and soffits and above ground fencing components such as rails, boards, featheredge, arris and cant rails.

    For components of 44mm thickness and above, or those used where the consequence of failure is high, (Table 3. Service Factor Code D), the minimum penetration requirement (NP2) must be achieved. Examples of end uses that would be covered by this category include non-structural decking and balcony components and play equipment.
13. Exceptionally a specifier or purchaser of treated wood may consider that a Use Class 1 or Use Class 2 treatment is required.

Go to the **RESOURCE CENTRE** for *Guidance Note* **WPA TW 8:** Understanding Use Class 4



Go to the **RESOURCE CENTRE** for *Guidance Note* **WPA TW 9:** Understanding Use Class 3

Go to the **RESOURCE CENTRE** for *Guidance Note* **WPA TW 10:** Understanding Use Class 2

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Table 6: Treatment recommendations for creosote *(note 1)* conforming to BS EN 13991

COMPONENT	USE CLASS	SERVICE FACTOR	DESIRED SERVICE LIFE *Years*											
			15				30				60			
			PERMEABLE WOOD		RESISTANT WOOD		PERMEABLE WOOD		RESISTANT WOOD		PERMEABLE WOOD		RESISTANT WOOD	
			PENETRATION *note 2* / RETENTION kg/m³ *note 3*		PENETRATION *note 2* / RETENTION kg/m³ *note 3*		PENETRATION *note 2* / RETENTION kg/m³ *note 3*		PENETRATION *note 2* / RETENTION kg/m³ *note 3*		PENETRATION *note 2* / RETENTION kg/m³ *note 3*		PENETRATION *note 2* / RETENTION kg/m³ *note 3*	
All Internal components			Creosote treatment not permitted in the UK or the European Union *(note 1)*											
Fence rails *(coated)* external joinery (non load-bearing, coated) and cladding *(coated)*	3c	C	Creosote treatment not recommended where coatings are to be applied.											
Fence rails, deck boards, external joinery *(uncoated)*, external wood features e.g. cladding, facias and bargeboards *(uncoated)*	3u	C/D	12mm *note 7*	145	NP3 *note 4*	160	NP5	160	NP7 *note 4*	180	NP5	180	NP5 *note 4*	180
Fence (*note 5),* and deck posts - round.	4	C/D	NP4	160	NP3 *note 4*	185	NP5	185	NP4 *note 4*	195	NP5	195	NP5 *note 4*	210 *note 7*
Fence (*note 5),* and deck posts – sawn, earth-retaining walls, raised beds.	4	C/D	NP5	180	NP3 *note 4*	195	NP5	185	NP7 *note 4*	195	NP5	210 *note 7*	NP6 *note 4*	210 *note 7*
Poles	4	D	NP4	160	NP4 *note 4*	160	NP5	185	NP5 *note 4*	185	NP5	195	NP5 *note 4*	195
Sleepers	4 *note 6*	D	NP5	180	NP5 *note 4*	180	NP5	185	NP5 *note 4*	185	NP5	210 *note 7*	NP5 *note 4*	210 *note 7*
Creosote treatment of wood in fresh and salt water is not permitted in the UK or the European Union *(note 1)*														

Notes to Table 6

1. **EU Regulation 1907/2006 (REACH)** now amended for the UK by The REACH etc. (Amendment) Regulations 2021 restrict the marketing and use of creosote and creosote treated wood. Individual authorisations under the **UK BPR** or **EU BPR** may impose additional restrictions. Before specifying creosote treatment consult the regulations and the WPA *Guidance Note* **TW 6** available at www.thewpa.org.uk for details of where creosote treated wood may be used.
2. Penetration Classes are summarised in Table 4A.
3. These values take account of industrial experience in the UK. Retention values refer only to the analytical zone.
4. Achievement of NP3 and deeper penetration in resistant woods is often very difficult. Processes to aid penetration such as incising may be required.
5. BS 8417 introduced in 2003 a uniform range of service lives for treatment specifications – 15, 30 and 60 years. However, in the pre-existing standard BS 5589 service lives of 20 and 40 years were indicated. For specifications for fencing components linked to 20 and 40 years, the 15 and 30 year life penetration and retention recommendations respectively in this table are considered to be appropriate.
6. Sleepers laid on well-drained ballast maintained in service are considered to be Use Class 3 for regulatory purposes but durability appropriate to Use Class 4 is indicated to meet service life requirements and the safety-critical use. Sleepers in direct ground contact are Use Class 4.
7. Although 210 kg/m³ has long been the recommended retention for this use class/service life combination, authorisations for use of creosote may include a maximum retention less than this and specifiers and users should check with the creosote supplier or treater for advice on retentions.

Go to the RESOURCE CENTRE for *Guidance Note* **WPA TW 6:** Use of Creosote and Creosote treated wood

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4.5 Factory production control and labelling

By reference to Tables 5 and 6 a treater can determine the penetration and retention required to satisfy a given specification. It is the responsibility of the treater to ensure that those treatment criteria are fulfilled. Compliance is achieved by meeting these retention and penetration requirements (*in the case of penetration to an acceptable quality level*) which involves a combination of process control parameters specific to each wood treatment installation with confirmatory chemical analysis on a mutually agreed basis. For thinner components in UC3, a derogation from penetration requirements is shown in Table 5.

Assessment and verification of constancy of performance (AVCP) is the phrase used in European Standards to describe procedures for declaring that a material conforms to a relevant specification. There are different levels of AVCP ranging from a supplier's declaration to a full third-party assessment and validation. Note some older European standards use the term 'Attestation of Conformity'.

Where a treater operates a quality management system which complies with **BS EN ISO 9001 Quality Management Systems** and can demonstrate that his process reliably achieves the requirements of the specification, analysis of each batch of wood is not necessary. Once a pattern of consistent specification compliance has been established, (*known as the* **safe relationship**), chemical analysis to demonstrate continuing compliance should be undertaken at 6 monthly intervals unless for thinner components in UC3, a derogation from penetration requirements is shown in Table 5.

This process is used under the WPA Benchmark Approved Treater scheme**.** Individual treated wood products certificated under the scheme are verified as being compliant with this code of practice - for either 15 or 30 years desired service life. Details of this and other quality schemes operated by the WPA are at www.thewpa.org.uk/quality-schemes.

Where a treater does not operate such a Quality Management System, specifiers may require analysis of each batch treated.

Unless otherwise required by the customer or specifier a batch should be considered to comply with specification if the requirements of BS EN 351-2 are met unless for thinner components in UC3, a derogation from penetration requirements is shown in Table 5.

When determining whether the penetration requirements appearing in Tables 5 and 6 have been met, some evidence of penetration at the limit of the penetration zone must be found. Unless acceptable quality levels (AQL) have been agreed between the supplier and customer, those levels given in BS EN 351-1 will apply (***10% AQL for permeable species and round resistant species; 25% AQL for sawn resistant species***). The number of samples selected should be in accordance with Inspection level S3 (BS EN 351-2). Sampling units shall be selected from a charge immediately after appropriate post-treatment conditioning. As several sampling procedures are destructive, arrangements should be made to include additional material in a batch to be included for sampling purposes.

4.6 Post-treatment handling

An authorisation/approval includes conditions of use and may include instructions on handling treated wood. Requirements/advice on product labels or data sheets or passed on by the preservative manufacturer and/or the treater should be followed. The EU BPR and EU BPR-based GB regulations additionally have general requirements for example on labelling and importing treated wood.

4.6.1 Drying treated wood

a) Water based preservatives

High pressure impregnation with water-containing preservatives increases the moisture content of wood. After treatment this needs to be reduced to a level suitable for the end use of the wood. Drying may be accelerated by open stickering with through ventilation, by an increase in temperature, or by use of other means such as kiln drying.

Low pressure impregnation with water-containing preservatives will raise moisture levels only in a superficial outer zone and this is normally fully reversible by air drying within a short time.

Go to the **RESOURCE CENTRE** for *Guidance Note* **WPA TW 7:** WPA Benchmark Scheme for Preservative Treated Wood - Executive Summary.

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b) Organic solvent based preservatives

The moisture content is not increased with treatments using organic solvent preservatives. The solvents evaporate quite quickly providing there is adequate ventilation and good airflow. Most treated wood can be used within 2 to 7 days of treatment depending on the uptake of preservative and the prevailing conditions.

Occasionally a pack of treated wood will contain some pieces which have pockets of abnormally permeable sapwood. Although undetectable before treatment, after treatment these can be seen as dark-coloured streaks. Such pieces, when identified, should be removed from the pack for prolonged drying before gluing, painting or installation.

c) Creosote

Creosote is used undiluted and as such has no carrier solvent to evaporate and so does not 'dry' in the conventional sense. Users should be aware, therefore, that because it continues to contain liquid preservative for many years it is in the nature of creosoted wood that creosote may re-migrate to the surface, especially when the wood is exposed to sunlight.

d) Copper-organic oil-based preservatives

The manufacturer should be consulted about post-treatment handling.

4.6.2 Machining

Machining after treatment is not recommended. *See* 5.3 Cutting after treatment.

4.6.3 Storage of treated wood

All treated wood should be stored at the treatment site in accordance with the requirements of any permits that relate to the treatment operation, or if none are applicable, in accordance with the **WPA Code of Practice for Timber Treatment Installations - Safe Design and Operation**. It is good practice to protect from the weather all treated wood destined for use in Use Classes 1 and 2, also 3 when treated with a preservative that is used with a coating in that Use Class.

5. Using treated wood

5.1 Compatibility with other materials

5.1.1. Adhesives

In consultation with the adhesive manufacturer, select an adhesive appropriate to the in-service exposure condition and appropriate for load bearing or non-load bearing requirements. Although much treated wood can be bonded perfectly satisfactorily, there are potential incompatibility problems and care is required.

Wood treated with creosote cannot normally be satisfactorily bonded using adhesives. Gluing after treatment is not recommended for wood treated with copper-organic oil-based preservatives.

Wood treated with water-based preservatives can normally be bonded satisfactorily provided the wood is first re-dried, (i) to a moisture content suitable for the glue being used *(usually less than 22%)* and (ii) to the in-service moisture content of the wood.

Wood treated with organic solvent preservatives can normally be bonded satisfactorily provided adequate solvent evaporation has occurred. Adhesives differ widely in their tolerance to residual solvent and thus the advice of the specific adhesive supplier should be sought. Compatibility problems may also arise where water-based adhesives are used on wood treated with water-repellent grades of preservative, but here again compatibilities differ widely and the advice of the preservative manufacturer and adhesive manufacturer should be sought.

Although most cured adhesives are not affected by preservative treatment, there are some exceptions to this *(notably PVA is often not suitable where wood is subsequently to be treated with water-containing preservative).* Additionally, certain wood-based composites do not retain their integrity during treatment.

Go to the **RESOURCE CENTRE** for *Guidance Note* **WPA TW 5:** Preventing mould growth on treated wood products.

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5.1.2 Putties, mastics, sealants, floor coverings

Provided that waterborne preservative treated wood is dried to a moisture content below 22% there should be no difficulties with the application of glazing putties, mastics, sealants or floor coverings.

Organic solvent based preservative treated wood is also compatible provided adequate solvent has evaporated.

5.1.3 Surface finishes

Wood which has been treated with a waterborne preservative, or with an organic solvent-based preservative formulated for use under a surface coating, can be painted, stained, varnished or lacquered satisfactorily. It is important however that adequate provision has been made to ensure that the treated wood is in the correct condition for coating. In principle wood should be dry and solvent free. This can vary for the different preservative types and the manufacturer's advice should be sought and followed.

5.1.4 Metal fasteners and fittings

To prevent premature corrosion and failure of metal fixings and fastenings it is important to follow the recommendations of the manufacturer of the metal products for specific advice regarding suitability, desired service life expectations and particular exposure conditions.

Preservative treated wood has a long life expectancy and it is appropriate to use metal fixings and fastenings that will have a comparable length of life.

It is important that the specifier is aware that there are many thicknesses of galvanised coating available and the thicker the galvanised coating the longer the expected service life. The level of galvanising should be commensurate with the end use.

- Electroplated metals only provide a thin coating and are unsuitable for exterior applications.
- It is important not to apply any metal fixings until the wood has been dried to less than 22%.
- It is important that with water-based preservatives metal fixings should not be attached to wood prior to treatment.
- If wood treated with a copper containing preservative is to be used with aluminium sheeting an impermeable barrier such as bituminous paper should be included between the materials to prevent direct contact.

Refer to **BS 5534 Slating and tiling for pitched roofs and vertical cladding. Code of practice**.

Eurocode 5 (BS EN 1995-1-1) gives minimum specifications for material protection against corrosion for fasteners and fixings used in internal building, low hazard situations *(Use Classes 1 and 2)* where the moisture content of the treated wood will not exceed 200 g/kg *(20% mass/mass)* throughout its service life.

5.2 Flammability of treated wood

Wood treated with waterborne preservatives show the same flammability as untreated wood unless specific flame retardant properties are claimed.

Once solvent has evaporated, the flammability of wood treated with organic solvent preservatives is no greater than the untreated wood.

The burning characteristics of wood treated with **creosote** are different from that of untreated wood. Consult the manufacture for information on the flammability characteristics of wood treated with copper-organic oil-based preservatives.

5.3 Cutting after treatment

It is best practice to treat wood in its final dimensions. reworking should be limited to cross cutting, boring, drilling or notching and exposed surfaces should be given two liberal brush coats of a suitable preservative as recommended by the manufacturer of the industrial wood preservative.

For treated wood to be used in Use Class 4, always put an uncut end in the ground.

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5.4 Strength of treated wood

For wood treated with preservatives it may be assumed that any loss of strength or stiffness due to the preservative treatment will be small and may be disregarded. **BS EN 15228 Structural timber preservative treated against biological attack** lists preservative types that are considered not to affect strength or stiffness of treated wood. Contact the preservative supplier for specific advice.

The impact of incising (*which may be used in certain Use Class 4 situations to ensure the required penetration class is achieved)* on wood strength is generally less than 10% but if wood is to be used where a strength class is specified, consult the wood treater for advice.

6. Safety, health, and the environment

6.1 Wood preservatives

Treatment of wood with preservatives contributes positively to the environment by prolonging the useful life of wood in construction, reducing the requirement to fell more trees and reducing the energy inputs into a construction during its desired service life. However, wood preservatives can adversely affect human health and the environment if misused.

Wood preservatives used in the UK must be authorised by HSE for England, Wales and Scotland (GB) under the Biocidal Products (Health and Safety) (Amendment) Regulations 2022 that implement an amended version of the EU Biocidal Products Regulation (BPR). The latter applies in N. Ireland. Some products used in the UK are approved under legacy regulations (The Control of Pesticides Regulations (CoPR) 1986 (as amended)) but whichever regulations apply, the statutory instructions and precautions resulting from authorisation/approval should be given on the product label and on product safety data sheets for wood preservatives.

6.2 Treatment plant and treatment processes

Industrial timber treatment installations in the UK are subject to specific environmental legislation and will usually require a permit to operate. See the **WPA Code of Practice: Timber Treatment Installations** for further information.

6.3 Treated wood

CoPR approval and BPR authorisation include conditions of use and may include instructions on handling treated wood. The following are general guidelines but any specific statutory requirements passed on by the preservative manufacturer and/or the treater must be followed.

6.3.1 Handling

An authorisation/approval includes conditions of use and may include instructions on handling treated wood. Requirements/advice on product labels or data sheets or passed on by the preservative manufacturer and/or the treater should be followed. The EU BPR and EU BPR-based GB regulations additionally have general requirements for example on labelling and importing treated wood.

6.4 Waste and its disposal

It is recommended that wherever possible, steps are taken to avoid or minimise the production of waste.

6.4.1 Preservative and used containers

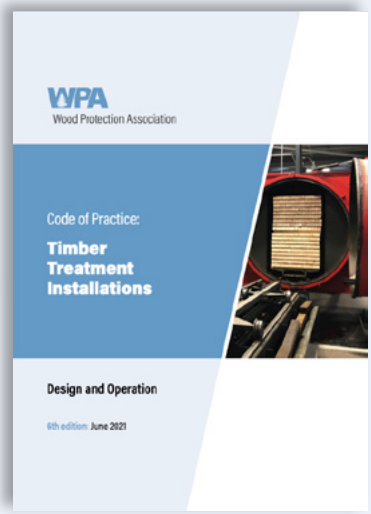
Waste wood preservative product and used containers must be disposed of safely in accordance with any conditions laid down in CoPR approval/BPR authorisation and by reference to the **Product Safety Data Sheet** and in accordance with regulations.

6.4.2 Waste treated wood

Wherever possible redundant treated wood should be reused. Appropriate disposal strategies may be to landfill or incinerate. Enquiries should be made to the local waste management authority or the preservative supplier. Treated wood waste must not be supplied for use as animal bedding or litter; or be used in barbeques or domestic fires.

6.4.3 Disposal options for treated wood

For guidance on options for disposal of waste, see the WPA **Guidance Note TW14: UK Guidance on the Classification of Treated Wood Waste**.



Go to the RESOURCE CENTRE for *Code of Practice* **Timber Treatment Installations**

Go to the RESOURCE CENTRE for *Guidance Note* **WPA TW 4:** Preservative Treated Wood and Indoor Air Quality.

Go to the RESOURCE CENTRE for *Guidance Note* **WPA TW14:** Treated Wood Waste.

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7. Supporting information

7.1 Evaluation and test procedures

7.1.1 Sampling preservatives

Follow guidance in BS EN 212.

7.1.2 Sampling treated wood.

Follow guidance in BS EN 351-2.

Guidance on 'Safe Relationship' (SR) testing

Safe relationship testing must be done in accordance with BS EN 351-2: 2023. This standard is referenced in **WPA Quality Guidance Note 2 (QGN2)**, relating to the controlled preservation of wood and wood-based materials to improve their durability (August 2021 or later).

The number of samples for assessment of penetration and retention must be in accordance with **BS EN 351-2 AQL table A-2**.

The treater/laboratory conducting the analysis should know what the AQL is, along with the batch size dictating, according to EN 351-2 Annex A, Table A-2 (the default), how many samples to take and how many can 'fail' the penetration requirement without failing the whole batch. WPA Benchmark stipulates **AQL is 10% for pine** and **25%** for everything else.

Guidance of how and where to take samples for penetration and retention determination is in **section 7** of the standard. Typically, retention is calculated as the retention of a composite sample or as an average of the sampled pieces but the detail in **section 8.5** and **Annex B** of the standard should be followed. Penetration must be in accordance with Table 5 (or, for creosote treatment, Table 6) in this Code of Practice (May 2023 or later).

A report often includes photographs showing the penetration in the sample pieces, which is helpful, but it isn't a requirement. So, an SR report should state how the analysis complies with the standard and list: the **species; the Use Class; the desired service life; the AQL; the number of pieces in the batch; the number of samples taken; and the preservative penetration outcome in the context of the Annex A table used and the preservative retention**. The report should state the **penetration and retention required** for the **species/use class/desired service life intended.**

Typically, the laboratory will be that of the preservative supplier so they should know what retention is required for any particular species/use class/desired service life combination, otherwise the treater should state what the preservative supplier advises to use.

Example of a Safe Relationship report:

Date of treatment:	23 November 2023	Date of analysis:	6 December 2023		
Charge no. / designation:	XXXXXXX	Treater name:	A.N. Treater	Treater address:	Forest A, Woodside XX1 XX1

Description of treated wood (including species):

Pine (Pinus sylvestris) sawn posts	Use class 4, 15-year desired service life, 10% AQL
Batch size: 100	Number of samples: 5

Sampling was carried out from preservative-treated sawn timber of Pinus sylvestris, treated according to a penetration requirement of NP5.

The preservative product had the following nominal formulation in g/kg (% mass fraction):

CuO	119 g/kg (11,9 % mass fraction)	Cu 9,5 % (mass fraction)
Benzalkonium chloride (BAC)	48 g/kg (4,8 % mass fraction)	BAC 4,8 % (mass fraction)
Water	to 1000 g/kg (100 % mass fraction)	

Sampling was carried out according to inspection level S-3 in EN 351-2, resulting in 5 cross-sections selected from five different packages.

All had full sapwood penetration and thus complied with the penetration requirement.

A composite sample from the sapwood parts of the 5 samples was prepared for chemical analysis of the active ingredients which resulted in g/kg (% m/m):

Cu	4,2 g/kg (0,42 % mass fraction)
BAC	1,9 g/kg (0,19 % mass fraction)

A nominal sapwood density of 480 kg/m^3 (oven dry wood) was used for calculating the retention of product in the sapwood (If comparison with the retention requirement for a moisture content other than oven dry wood is required, the retention has to be recalculated for the particular moisture content).

Retention of product based on result for Cu:	$4.2 \times 480/1000 \times 100/9,5 = 21,2$ kg/m^3
Retention of product based on result for BAC:	$1.9 \times 480/1000 \times 100/4,8 = 19,0$ kg/m^3

The average retention of product in sapwood, expressed with three significant digits, is 20,1 kg/m^3.

The preservative manufacturer recommends 20 kg/m^3 for the combination of species (sapwood), use class and desired service life so **the samples comply with the retention requirement.**

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7.2 Determination of moisture content

7.2.1 Oven dry method

Apparatus: A ventilated oven which can be thermostatically controlled at 103 ± 2°C.

Sample selection: The sample to be cut should be a full cross-section taken not less than 230mm from one end and 13 - 19mm thick.
If it is not possible to cut the wood, borings totalling not less than 8g may be taken not less than 230mm from one end. The bore should be taken from the sapwood face to the centre of the section using a test borer consisting of a hollow auger and extractor. If the samples cannot be weighed immediately after extraction they should be individually sealed in a weighed airtight container.

Procedure: The samples should be weighed as soon as possible after extraction or cutting and placed in an oven which has been adjusted to a temperature of 103 ± 2°C. The samples should be removed periodically, allowed to cool in a desiccator and then reweighed. The samples should be dried to a constant weight, such that the loss of weight for a drying interval of six hours does not exceed 0.1%.

Calculation: The moisture content of the sample, as a percentage of the dry weight, is calculated using the following equation:

$$\text{Moisture content (g/kg [\% mass/mass])} = \frac{m1\text{-}m2 \times 100}{m1}$$

where: m1 is the mass of the sample, in grams, when wet.
m2 is the mass of the sample, in grams, after drying to a constant mass.

7.2.3 Moisture meter method

Apparatus: An electrical resistance type moisture meter provided with insulated electrodes and calibrated for the species of wood to be measured. It should be capable of taking an individual measurement with an error of not greater than 20g/kg (2% mass/mass) for moisture contents of between 70g/kg (7% mass/mass) and 280g/kg (28% mass/mass). It should be noted that such moisture meters are less accurate outside this range. Additionally, where treated wood is concerned the preservative can influence the accuracy of such meters and the advice of the preservative manufacturer should be sought.

Sample selection: The wood whose moisture content is to be measured should be selected from random positions in the treatment charge. The number of heartwood and sapwood faces should be in the same ratio as the proportions of these types of wood in the charge as a whole.
If the number of components in the charge is n, moisture meter readings should be taken on no fewer than the square root of half n. The moisture content should be measured on each face not less than 230mm from either end at a point midway across the width.

Procedure: The electrodes should be driven into the wood to half its depth, or to a depth appropriate to the type of wood specified below. The line between the tips of the electrodes should be in direction of, or perpendicular to, the grain according to the instructions for the type of meter used.

TYPES OF WOOD	ELECTROLODE DEPTH
i) SAPWOOD OF ALL SPECIES	25mm or sapwood thickness if less than 25mm
ii) HEARTWOOD of: *sweet chestnut, dahoma, danta, ekki, cuarea, iroko, kapur, kempas, makore, mansonia, oak, akan, opepe, utile.*	5mm
iii) HEARTWOOD of species other than those listed in ii)	
- Posts	25 mm
- Other components	12 mm

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7.3 Analysis of biocides used in wood preservatives

Where British Standard methods are available, these should be used. Reference should be made to the BSI for information on available appropriate analytical methods. Where no British Standard method exists, the supplier of the preservative should be approached for advice.

The following British Standard documents give guidance on the analysis of wood preservatives and preservative treated wood:

BS EN 212	Wood preservatives – General guidance on sampling and preparation for analysis of wood preservatives and treated timber
BS EN 351-2	Durability of wood and wood-based products – Preservative-treated solid wood. Guidance on sampling for the analysis of preservative-treated wood
BS EN 1014-1	Wood preservatives – Creosote and creosoted timber – Methods of sampling and analysis – Part 1. Procedure for sampling creosote
BS EN 1014-2	Wood preservatives – Creosote and creosoted timber – Methods of sampling and analysis – Part 2. Procedure for obtaining a sample of creosote from creosoted timber for subsequent analysis
BS EN 1014-3	Wood preservatives – Creosote and creosoted timber – Methods of sampling and analysis – Part 3. Determination of the benzo(a)pyrene content of creosote
BS EN 1014-4	Wood preservatives – Creosote and creosoted timber – Methods of sampling and analysis – Part 4. Determination of the water-extractable phenols content of creosote
BS EN 12490	Durability of wood and wood-based products - Preservative-treated solid wood - Determination of the penetration and retention of creosote in treated wood
BS 5666-2	Methods of analysis of wood preservatives and treated timber. Qualitative analysis

7.4 Standards

The principal British and European Standards concerning wood treatments are:

BS 144	Specification for coal tar creosote for wood preservation. *Note this standard has some content also covered in BS EN 13991 which takes precedent but it contains certain information not available elsewhere so is referenced solely for that purpose.*
BS EN 314-2	Plywood. Bonding quality. Requirements.
BS EN 335	Durability of wood and wood-based products. Use classes: definitions, application to solid wood and wood-based products.
BS EN 350	Durability of wood and wood-based products. Testing and classification of the durability to biological agents of wood and wood-based materials.
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 460	Durability of wood and wood-based products. Guidance on performance.
BS EN 599-1	Durability of wood and wood-based products. Efficacy of preventive wood preservatives as determined by biological tests - Specification according to use class.
BS EN 599-2	Durability of wood and wood-based products. Efficacy of preventive wood preservatives as determined by biological tests - Labelling.
BS EN 636	Plywood. Specifications.
BS EN 942	Timber in joinery. General requirements.
BS 1722	Fences – Parts 2, 4, 5, 7 and 11.
BS 8417	Preservation of wood – Code of practice.
BS EN 13991	Derivatives from coal pyrolysis. Coal tar based oils. Creosotes. Specifications and test methods.
BS EN 13986	Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking.
BS EN 15228	Structural timber preservative treated against biological attack.
DD CEN/TS 1099	Plywood. Biological durability. Guidance for the assessment of plywood for use in different Use Classes
DD ENV 12038	Durability of wood and wood-based products. Wood-based panels – Method of test for determining the resistance against wood-destroying Basidiomycetes.

bsi.knowledge

Readers are advised to check that they refer to the current version of a standard, including any amendments. The status of British Standards can be checked online at BSI from where copies of standards can also be ordered.

7.5 Other sources of information

Timber Development UK (TDUK) www.timberdevelopment.uk

The Timber Decking & Cladding Association (TDCA) www.tdca.org.uk

WPIF PanelGuide: The Wood Panel Industry Federation www.wpif.org.uk/PanelGuide

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Wood Protection Association

WOOD: designed by nature, protected by innovation.

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