BRITISH STANDARD

BS EN
351-1:2007

Durability of wood and wood-based products — Preservative-treated solid wood —

Part 1: Classification of preservative penetration and retention

ICS 71.100.50; 79.040

Confirmed
April 2012

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 351-1:2007. It supersedes BS EN 351-1:1996 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee B/515, Wood preservation, to Subcommittee B/515/2, Durability, treatment, performance and environment issues.

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

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

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

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Durability of wood and wood-based products - Preservative-treated solid wood - Part 1: Classification of preservative penetration and retention

Durabilité du bois et des produits à base de bois - Bois massif traité avec produit de préservation - Partie 1 : Classification des pénétrations et rétentions des produits de préservation

Dauerhaftigkeit von Holz und Holzprodukten - Mit Holzschutzmitteln behandeltes Vollholz - Teil 1: Klassifizierung der Schutzmitteleindringung und -aufnahme

This European Standard was approved by CEN on 21 June 2007.

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Foreword

This document (EN 351-1:2007) has been prepared by Technical Committee CEN/TC 38 "Durability of wood and wood-based products", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by January 2008.

This document supersedes EN 351-1:1995.

Significant technical differences between this edition and EN 351-1:1995 are as follows:

a) introduction of new penetration classes, see Table 1;

b) modification of Figure A.1 to delete the suggested preservative treatments where no other guidance is available.

This document consists of two parts. Part 1 is concerned with defining the penetration requirements and gives guidance on the retention requirements for preservatives in preservative-treated solid wood and Part 2 gives guidance on the general procedures to be followed in the sampling for analysis of preservative-treated solid wood.

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

Introduction

This part of EN 351 allows a specifier or user to choose a preservative treatment for a solid wood product taking into a account its intended service or the needs of different regional or traditional practices throughout Europe and the use class conditions to which the solid wood products will be exposed (see EN 335-1). In addition, it provides the basis on which treatments for timber in European product standards are to be defined. No attempt has been made to quantify the working life that could be expected from a particular preservative treatment as this will depend on the geographical location and the associated climate of the service environment. The performance of treated wood cannot be assessed directly, for example by field tests or bioassay, as no agreed documents specifically for this purpose exist. As a consequence, the penetration and retention of a preservative in treated wood are used to define quality of treatment. The penetration and retention values are measured by analysing the active ingredient(s) in the treated wood.

Preservative treatment for certain wood species used in the different use classes might be unnecessary owing to their natural durability (see EN 350-2 and EN 460). If appropriate treatment is necessary, the specification for appropriate preservatives is defined in EN 599-1.

1 Scope

This part of EN 351 establishes classification for preservative-treated wood in terms of preservative penetration and gives guidance on a classification of retention. These should be used as a basis for specifying preservative treatments for particular products.

This part of EN 351 provides terminology to be used by the specifier when preparing a preservative treatment specification or product standard. It is not a treatment specification in itself.

This part of EN 351 is applicable to the production of preservative-treated solid wood, including glued laminated timber, suitable for use in those service conditions defined by the use classes in EN 335-1. It does not apply to any subsequent examination of treated wood in service.

This part of EN 351 is applicable to the protection of wood against attack by wood-destroying and wood-disfiguring fungi, insects and marine organisms.

This part of EN 351 does not consider other properties of treated wood, for example odour, corrosiveness and compatibility with other materials, nor does it consider any properties from the health, safety and environmental point of view.

This part of EN 351 does not apply to wood treated with formulations that are applied to timber in service to eliminate or control an existing fungal or insect infestation, or to prevent attack by sapstain fungi, or insects in green timber.

2 Normative references

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

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

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*

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

EN 1001-2:2005, *Durability of wood and wood-based products — Terminology — Part 2: Vocabulary*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1001-2:2005 and the following apply.

3.1
active ingredient(s)
individual chemical compound or compounds included in a wood preservative product to give it specific activity against biological agents of deterioration

NOTE Adapted from EN 1001-2:2005, **4.01.**

3.2
analytical zone
that part of the treated wood which is analysed for assessing compliance with the retention requirement (see 3.16)

NOTE The analytical zone is taken from the lateral surfaces of the treated wood. The depth to which sampling is required will depend upon the species of wood being analysed and the treatment level concerned.

[EN 1001-2:2005, **4.03**]

3.3
batch
clearly identifiable collection of units of preservative-treated wood manufactured to conform to the same defined penetration and retention requirements

[EN 1001-2:2005, **4.04**]

3.4
biological reference value
amount in grams per square metre or kilograms per cubic metre of a wood preservative (as product) found to be effective in the test in preventing attack by the particular biological agent being tested

[EN 1001-2:2005, **4.06**]

3.5
charge
all the wood treated together in a single operation

[EN 1001-2:2005, **4.13**]

3.6
composite sample
collection of all test samples derived from the sampling units taken from the batch in accordance with the chosen sampling plan for the determination of retention

[EN 1001-2:2005, **4.15**]

3.7
critical value
value equivalent to the highest biological reference value (in grams per square metre or kilograms per cubic metre) obtained from all the biological tests carried out in accordance with EN 599-1 for any given use class

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

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

3.8
exposed heartwood
heartwood of a timber component that is not enclosed by sapwood

[EN 1001-2:2005, **1.14**]

3.9
glued laminated timber (glulam)
structural member formed by the lateral surfaces of timber laminations with the grain running essentially parallel

3.10
incising
procedure of puncturing the lateral surfaces of wood as an aid in securing deeper and more uniform penetration of wood preservative

[EN 1001-2:2005, **4.38**]

3.11
lamination
layer of wood in glued laminated timber (see 3.9) formed from one or several boards, usually end jointed, but sometimes side jointed or both so as to extend to the full width and length of the member

3.12
penetration requirement
minimum depth to which the active ingredient(s) (3.1) of the wood preservative is (are) required to penetrate the wood

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

3.13
penetrating treatment process
process which includes features or procedures intended to overcome the natural resistance of wood to penetration by a wood preservative product in its ready for use form

NOTE Such processes include, for example, currently practised technologies of diffusion treatment, the double vacuum process and the vacuum/pressure process.

[EN 1001-2:2005, **4.58**]

3.14
permeable species
wood species having timber comprising of sapwood or both sapwood and heartwood of treatability class 1 as defined in EN 350-2

NOTE Adapted from EN 1001-2:2005, **4.61.**

3.15
resistant species
all wood species having timber not of treatability class 1 as defined in EN 350-2

NOTE Adapted from EN 1001-2:2005, **4.72.**

3.16
retention requirement
loading of the wood preservative product that is required in the analytical zone

NOTE The retention requirement is expressed in grams of product per square metre for superficial application processes (see 3.19) and kilograms of product per cubic metre for penetrating treatment processes (see 3.13). It is derived from the critical value in different ways depending upon the particular test involved [EN 1001-2:2005, **4.73**].

3.17
sampling unit
one unit (for example a pole, a board, a fence post) of preservative-treated wood taken from a batch (see 3.3) of preservative-treated wood

[EN 1001-2:2005, **4.75**]

3.18
solid wood
wood which has been sawn or otherwise machined

NOTE It may include finger jointed and/or laminated wood.

[EN 1001-2:2005, **1.39**]

3.19
superficial application process
process which does not include particular features or procedures intended to overcome the natural resistance of wood to penetration of a wood preservative product in its ready to use form

NOTE Such processes include for example brush and spray techniques and short-time immersion (dipping) processes in which the wood normally has only a few minutes contact with the wood preservative.

[EN 1001-2:2005, **4.82**]

3.20
transition wood
wood in a zone between the true sapwood and the true heartwood

NOTE This is only distinguishable in very few wood species. In general its durability is intermediate between that of sapwood and heartwood, whereas its treatability is similar to that of heartwood.

[EN 1001-2:2005, **1.45**]

4 Raw materials

4.1 Wood to be treated

The quality of the wood to be treated shall comply with relevant product specification or the standard to which this document is to be applied.

NOTE 1 The wood should be free from features which would prevent proper application of the preservative or impair the serviceability of the preservative-treated wood.

NOTE 2 The moisture content of the wood should be at a level appropriate to the wood preservative and method of treatment used. All machining of the wood should be carried out before treatment.

4.2 Wood preservatives

The wood preservatives used shall comply with the requirements of EN 599-1 concerning their efficacy against wood-destroying organisms.

5 Preservative-treated solid wood

5.1 General

Preservative-treated solid wood shall be defined in terms of a penetration and retention requirement.

5.2 Penetration

5.2.1 Penetration requirements

The penetration requirement relates to the lateral penetration of the sapwood but includes the heartwood where the sapwood and heartwood cannot be distinguished by eye and in certain specified instances where the heartwood has been exposed by sawing. Lateral penetration requirements can also be supplemented by a requirement for longitudinal penetration, which shall be at least ten times greater than the corresponding lateral penetration requirement.

For penetration classes requiring full sapwood penetration it is occasionally found that small zones of sapwood, for example transition wood, cannot be treated; these shall be ignored for the purpose of assessing sapwood penetration. In glued members untreated zones not exceeding 10 % of the total cross section of the sapwood expected to be treated in each lamination, shall also be ignored in the assessment of penetration.

Penetration shall be determined by detecting the presence of preservative at, or beyond, the limit of the required penetration.

NOTE 1 This should be carried out soon after appropriate post-treatment conditioning.

This document describes six penetration classes, NP1 to NP6. These penetration classes, together with their associated analytical zones for retention measurements, are presented in Table 1.

Table 1 — Penetration classes showing penetration requirements and corresponding analytical zones for retention measurements

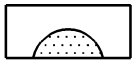
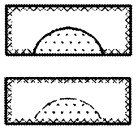
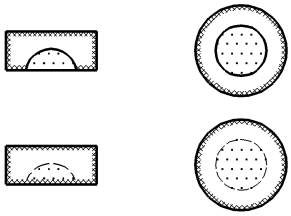
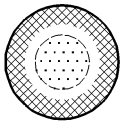
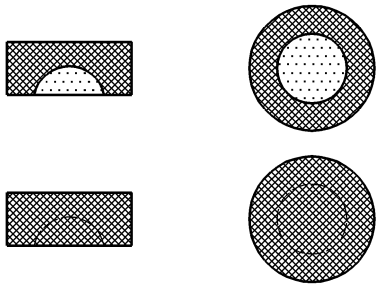
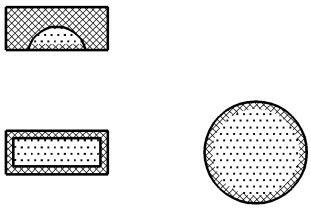
Penetration class	Penetration requirements [b]	Analytical zone	Stylized illustration of penetration requirements
NP1	None	3 mm lateral	
NP2	Minimum 3 mm lateral into the sapwood	3 mm lateral into sapwood[c]	 If it is impossible to distinguish between sapwood and heartwood
NP3	Minimum 6 mm lateral into the sapwood	6 mm lateral into sapwood[c]	 If it is impossible to distinguish between sapwood and heartwood
NP4[a]	Minimum 25 mm lateral	25 mm lateral into sapwood[c]	 Sapwood depth > 25 mm
			(continued)

Table 1 *(concluded)*

Penetration class	Penetration requirements[b]	Analytical zone	Stylized illustration of penetration requirements
NP5	Full sapwood	Full sapwood[c]	 If it is impossible to distinguish between sapwood and heartwood
NP6	Full sapwood and min 6 mm into exposed heartwood	Full sapwood and 6 mm into exposed heartwood	 Only if heartwood is present

Key (for figures)

——— boundary between sapwood and heartwood when it can be distinguished.

- - - - boundary between sapwood and heartwood when it cannot be distinguished.

[a] Applies to round wood of resistant species only.

[b] The ability to meet the requirements of a penetration class will depend on the treatability of the timber concerned. It should be recognised that it will not be possible to achieve certain penetration requirements with certain timbers and with some, special measures may be required to achieve the target penetrations (eg. incising, special drying schedules, dip-diffusion). Experience indicates this to be the case for NP5 and NP6 treatments of spruce *(Picea spp.)*.

[c] If it is impossible to distinguish between sapwood and heartwood the penetration requirement and the analytical zone have to be assumed to be the sapwood depth specified for the respective penetration class.

NOTE 2 Penetration requirements NP2 and NP3 may also be supplemented by a requirement for longitudinal penetration. Where required, the longitudinal penetration requirement will be denoted by appending with the letter L to the penetration depth description.

NOTE 3 Annex C contains details of the penetration classes described in the first edition of EN 351-1:1995. Although this system is being phased out, it may still be encountered in documents prepared before the publication of this revised EN 351-1.

5.2.2 Accepted quality level

Acceptable quality levels (tolerances) shall be calculated from the analysis of sampling unit results obtained from a batch, see Clause 7.

The maximum acceptable quality levels, expressed as a percentage of units in the batch not conforming to the penetration requirement are expected to be for:

- permeable species 10 %;
- resistant species, sawn timber 25 %;
- resistant species, round wood 10 %.

NOTE 1 If only sapwood is required to be penetrated to achieve the selected penetration class, the treatability of the sapwood is the deciding factor.

NOTE 2 Lower percentages of non-conforming units may be agreed between purchaser and producer.

5.3 Retention requirements

The retention requirement for a wood preservative is derived from its appropriate critical value for each use class as derived from EN 599-1. That retention requirement is calculated by multiplying the appropriate critical value by an adjustment factor. This adjustment factor will normally be stated in the relevant product standard or national interpretative document, or be applied by national standards bodies or those nominated by them. The adjustment factor is applied to take account of regional variations in building practices and climate as well as the variations in exposure conditions and service life requirements for different treated components within a use class.

NOTE For determining the retention of preservative in a batch, analysis may be carried out either on the individual analytical zones, followed by calculation of the average retention, or on a single composite sample comprising all analytical zones taken from that batch. This should be carried out soon after appropriate post-treatment conditioning.

Compliance with the retention requirements within a batch of treated wood shall be calculated from the results of analysis of sampling units obtained from the batch, see Clause 7.

The average retention shall be equal to or above the retention requirement.

6 Treatment specifications

Preservative-treated wood shall be specified in terms of a penetration class selected from Table 1 and a retention requirement (see 5.3) to provide the level of protection required in service.

If a penetration tolerance less than those given in 5.2.2 is specified it shall be included in the marking system, see Clause 8.

NOTE Reference should be made to European Product Standards or other standards at a national, regional or local level for guidance on the choice of appropriate treatment specification. If such specifications do not exist, general guidance on the selection of treatment is given in Annex A.

7 Factory production control

7.1 General

Factory production control systems is normally specified in the relevant product standard and compromises inspection of both raw materials and the preservative-treated wood carried out to ensure compliance with 4.1, 4.2, 5.2, and 5.3 under a quality system, for example based on the principles of EN ISO 9001.

For the control of the penetration and retention requirements, two test systems are available, direct testing or indirect testing.

NOTE In the event of a charge or batch of preservative-treated wood being rejected after factory production control, the charge or batch may be retreated and reassessed. Alternatively, each unit found to comply may be accepted.

7.2 Direct and indirect testing

7.2.1 Direct testing

Direct testing by the measurements of penetration and retention shall be made promptly after taking the sample from the sampling unit (see EN 351-2 for guidance on sampling). Unless otherwise agreed between purchaser and producer, the number of sampling units to be taken from the batch shall be determined by reference to ISO 2859-1.

The following shall be available, if necessary provided by the wood preservative manufacturer:

a) procedure for the determination of penetration;

b) procedures allowing conversion of the analytical sample to an appropriate homogeneous form for analysis;

c) analytical methods for determining retention.

7.2.2 Indirect testing

Direct testing can be impractical for frequent use. As an alternative it is acceptable to use “Indirect testing” in which a safe relationship has been established between the penetration and/or retention requirements laid down in 5.2 and 5.3 and measurable features of the treatment process used. When these features are used for routine quality assessment, the correctness of the relationship used shall be examined at certain intervals.

8 Marking

At least the following shall be marked either on the preservative-treated wood or on a label attached to it, or on its packaging, or on the accompanying documentation:

a) number and date of this document;

b) name of preservative;

c) penetration class NP1 to NP6;

d) penetration tolerance, if different from 5.2.2;

e) retention;

f) charge no/year;

g) name of treater.

NOTE 1 Specific efficacy properties as well as indications of suitable end uses (for example use class) of the treated wood may also be reported.

NOTE 2 An example of the marking system is given in Annex B.

Annex A
(informative)

Decision process for defining preservative treatment requirements

A specification for preservative treatment based upon this part of EN 351 should require that a retention and penetration requirement are selected, and achieved in the subsequent preservation process, to provide the necessary protection to the timber product when in service. The selection of the retention and penetration requirement thought to provide necessary protection is complex, and should only be made by those specialised in the field of wood preservation. Guidance on such a selection based on this part of EN 351 will normally be provided within the relevant product standard or national interpretative document, or by standards bodies or other independent authorities nominated by them. The selection process will include consideration of a range of features which affect overall performance, such as:

- some use classes include a range of exposure conditions (for example use class 4 includes fence posts and the timbers in fresh-water cooling towers) for which different retention and/or penetration requirements could be selected; regional variations exist for the same use class, for example rainfall could be different, leading to the selection of lower or higher retention and/or penetration requirement ;

- differing service life requirements:

  — product could be load-bearing and responsible for the continued integrity of the structure, thus requiring a higher retention and/or penetration requirement;

  — service life requirement or the economics of maintenance could be low;

  — accessibility for repair or replacement of the product could enable a lower retention and/or penetration requirement to be used.

Figure A.1 contains an example of the decision process for defining preservative treatment requirements.

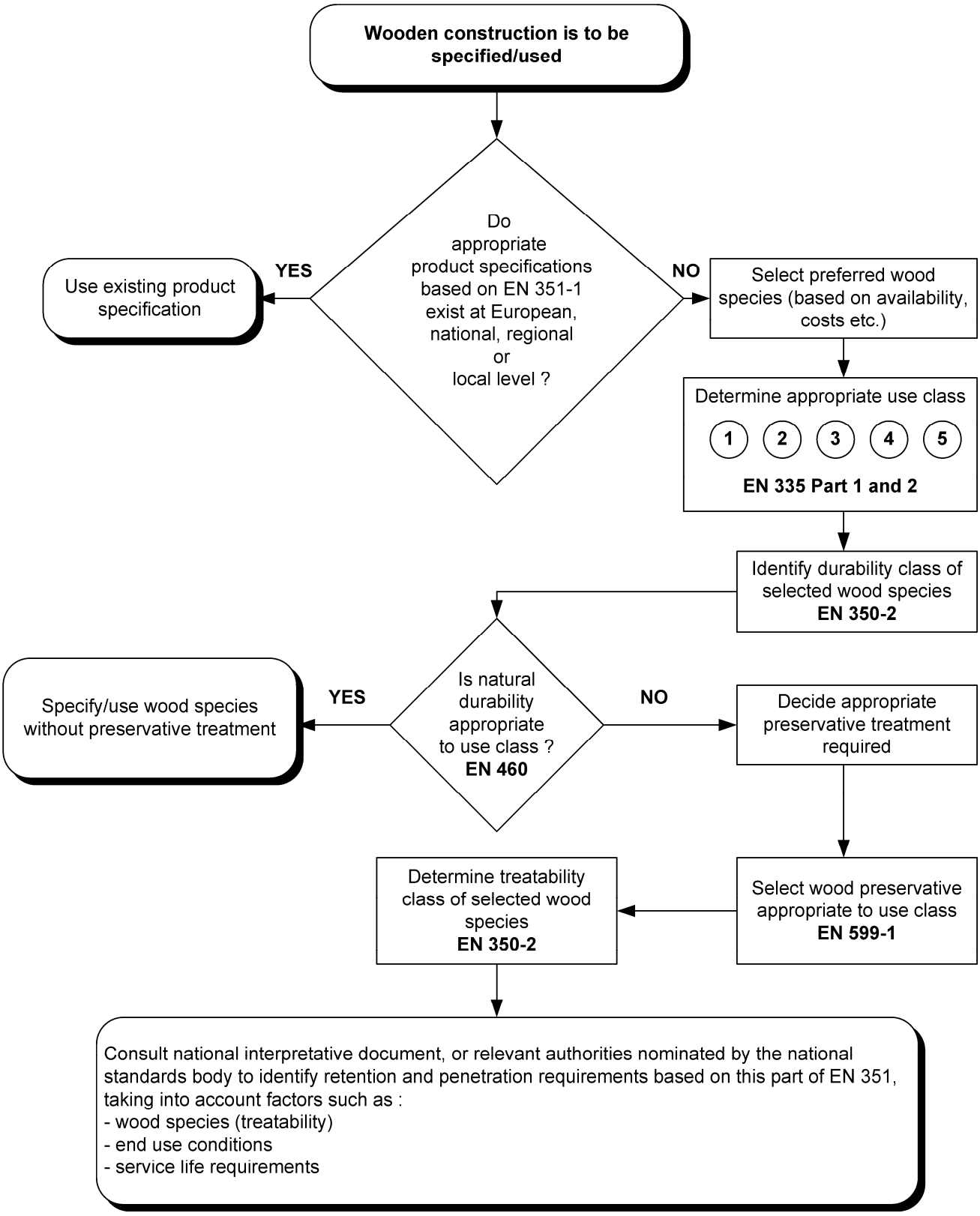


Figure A.1 — Flow diagram for preservative treatments

Annex B
(informative)

Marking system

Example of the marking system

Preservative-treated solid wood according to EN 351-1:2007

Preservative:	Z
Penetration class:	NP 5
Retention:	15 kg/m^3
Charge no./year:	457/06

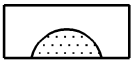
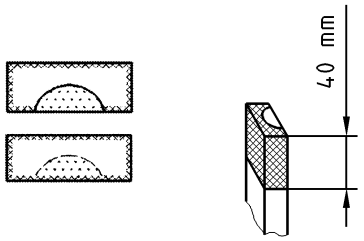
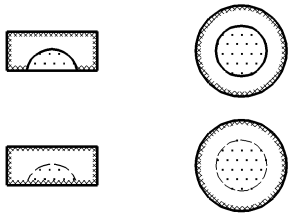
Company

Address

Annex C
(informative)

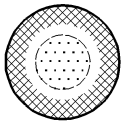
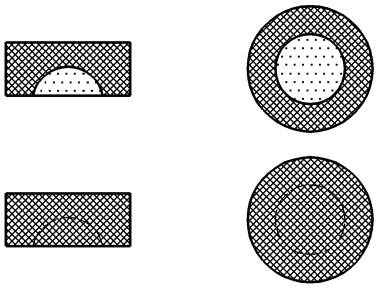
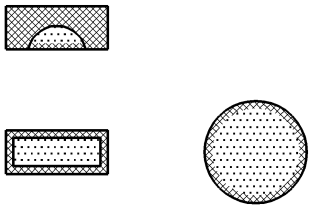
Penetration classes according to EN 351-1:1995

Table C.1 — Penetration classes according to EN 351-1:1995 showing penetration requirements and corresponding analytical zones for retention measurements

Penetration class	Penetration requirements	Analytical Zone	Stylized illustration of penetration requirements
P1	None	3 mm from lateral faces	
P2	Minimum 3 mm lateral and 40 mm axial into sapwood	3 mm lateral into sapwood	 If it is impossible to distinguish between sapwood and heartwood
P3	Minimum 4 mm lateral into sapwood	4 mm lateral into sapwood	 If it is impossible to distinguish between sapwood and heartwood

(continued)

Table C.1 *(concluded)*

Penetration class	Penetration requirements	Analytical Zone	Stylized illustration of penetration requirements
P4	Minimum 6 mm lateral into sapwood	6 mm lateral into sapwood	See P3
P5	Minimum 6 mm lateral and 50 mm axial into sapwood	6 mm lateral into sapwood	See P2
P6	Minimum 12 mm lateral into sapwood	12 mm lateral into sapwood	See P3
P7	For roundwood only. Minimum 20 mm into sapwood	20 mm into sapwood	 Sapwood depth >20 mm
P8	Full sapwood	Sapwood	 If it is impossible to distinguish between sapwood and heartwood
P9	Full sapwood and minimum 6 mm into exposed heartwood	Sapwood and 6 mm into exposed heartwood	 If only heartwood is present

Key (for figures):

_____ boundary between sapwood and heartwood when it can be distinguished.

- - - - - - boundary between sapwood and heartwood when it cannot be distinguished.

Table C.2 —Penetration class equivalences

EN 351-1:1995	EN 351-1:2007
P1	NP1
P2	
P3	
P4	NP3
P5	
P6	
P7	
P8	NP5
P9	NP6

Bibliography

[1] EN 460, *Durability of wood and wood-based products — Natural durability of solid wood — Guide to the durability requirements for wood to be used in hazard classes.*

[2] EN ISO 9001:2000, *Quality management systems — Requirements (ISO 9001:2000)*

[3] EN 335-1, *Durability of wood and wood- based products - Definition of use classes - Part 1: General*

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