

BS EN 15497:2014



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Structural finger jointed solid timber — Performance requirements and minimum production requirements

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National foreword

This British Standard is the UK implementation of EN 15497:2014. Together with BS EN 14080:2013 it supersedes BS EN 385:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/518, Structural timber.

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

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April 2014

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English Version

Structural finger jointed solid timber - Performance requirements and minimum production requirements

Bois massif de structure à entures multiples - Exigences de
performances et exigences minimales de fabrication

Keilgezinktes Vollholz für tragende Zwecke -
Leistungsanforderungen und Mindestanforderungen an die
Herstellung

This European Standard was approved by CEN on 6 February 2014.

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Foreword

This document (EN 15497:2014) has been prepared by Technical Committee CEN/TC 124 “Timber structures”, 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of an identical text or by endorsement, at the latest by October 2014, and conflicting national standards shall be withdrawn at the latest by January 2016.

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

This document, along with EN 14080:2013, supersedes EN 385:2001.

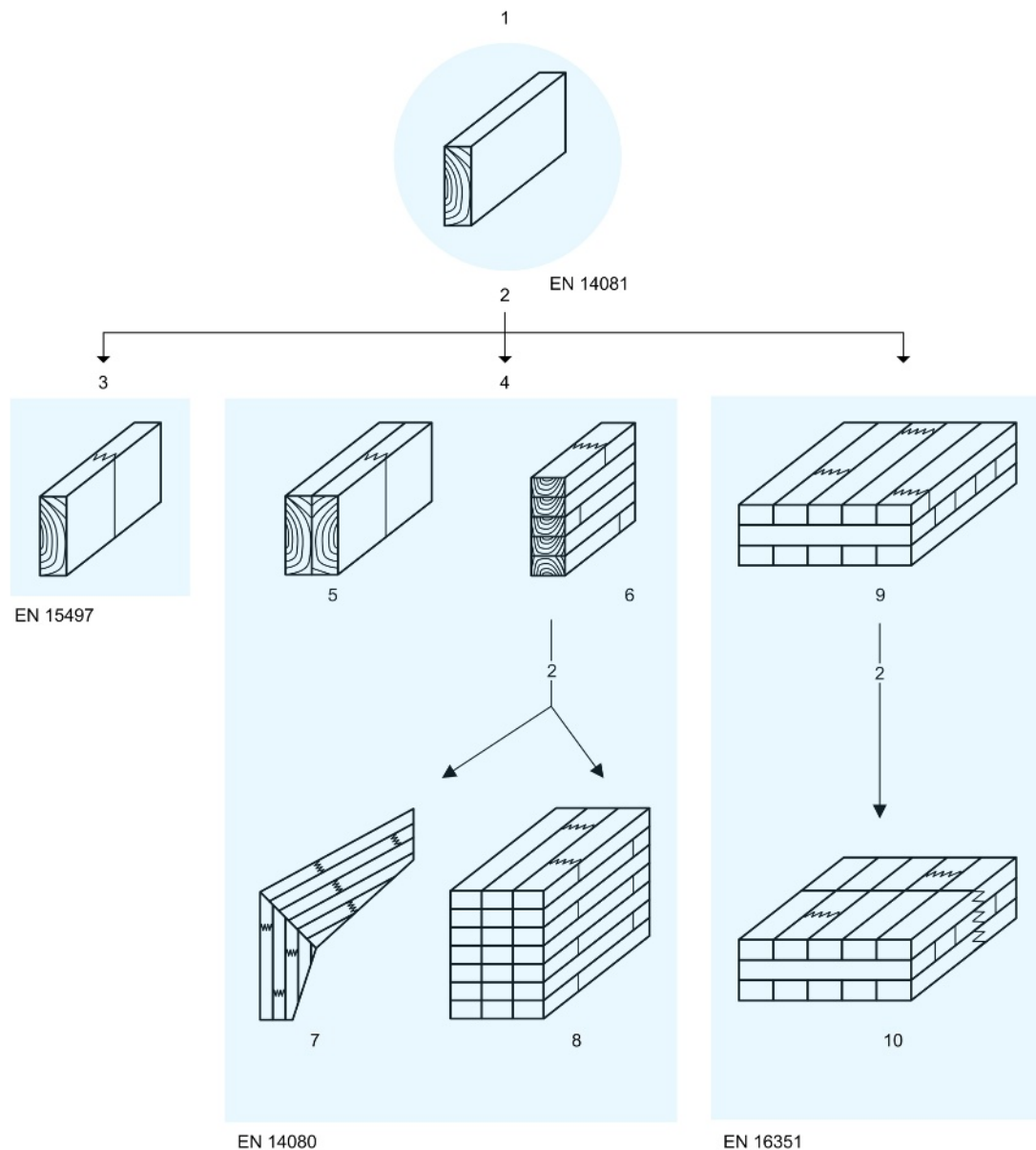
This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports basic work requirements of Regulation (EU) No 305/2011.

For relationship with the EU Regulations, see informative Annex ZA, which is an integral part of this document.

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

Introduction

Figure 1 shows the relation of European Standards for structural timber products prepared by CEN/TC 124.



Key

- | | | | |
|---|----------------------------------|----|---|
| 1 | boards | 6 | glued laminated timber (glulam) |
| 2 | is a component for | 7 | glulam with large finger joints |
| 3 | structural finger jointed timber | 8 | block glued glulam |
| 4 | glued laminated products | 9 | cross laminated timber (X-Lam) |
| 5 | glued solid timber | 10 | cross laminated timber (X-Lam) with large finger joints |

Figure 1 — Relation of European Standards for structural timber products prepared by CEN/TC 124

1 Scope

This European Standard sets out provisions regarding the performance characteristics for structural finger jointed timber with rectangular cross section for use in buildings and bridges.

The use of structural finger jointed timber may be limited to certain service classes in some member states.

It also lays down minimum production provisions and procedures for Assessment and Verification of Constancy of Performance for structural finger jointed timber.

This European Standard is applicable to structural finger jointed timber made of coniferous timber species listed in this standard or poplar.

Although it may be possible to produce structural finger jointed timber made from specific broadleaf species based on some provisions of this European Standard, this standard is not applicable to these products.

This European Standard is only applicable to finger joints between timber sections of the same species.

This European Standard does not cover impressed (die-formed) finger joints.

This European Standard covers structural finger jointed timber untreated or treated against biological attack. Structural finger jointed timber treated with fire retardants is not covered.

2 Normative references

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

EN 301:2013, *Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements*

EN 302-1, *Adhesives for load-bearing timber structures — Test methods — Part 1: Determination of longitudinal tensile shear strength*

EN 302-2:2013, *Adhesives for load-bearing timber structures — Test methods — Part 2: Determination of resistance to delamination*

EN 302-3:2013, *Adhesives for load-bearing timber structures — Test methods — Part 3: Determination of the effect of acid damage to wood fibres by temperature and humidity cycling on the transverse tensile strength*

EN 302-4, *Adhesives for load-bearing timber structures — Test methods — Part 4: Determination of the effects of wood shrinkage on the shear strength*

EN 302-5:2013, *Adhesives for load-bearing timber structures — Test methods — Part 5: Determination of maximum assembly time under referenced conditions*

EN 336, *Structural timber — Sizes, permitted deviations*

EN 338, *Structural timber — Strength classes*

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 408, *Timber structures — Structural timber and glued laminated timber — Determination of some physical and mechanical properties*

EN 717-1, *Wood-based panels — Determination of formaldehyde release — Part 1: Formaldehyde emission by the chamber method*

EN 1995-1-1, *Eurocode 5: Design of timber structures — Part 1-1: General — Common rules and rules for buildings*

EN 13183-1, *Moisture content of a piece of sawn timber — Part 1: Determination by oven dry method*

EN 13183-2, *Moisture content of a piece of sawn timber — Part 2: Estimation by electrical resistance method*

EN 13183-3, *Moisture content of a piece of sawn timber — Part 3: Estimation by capacitance method*

EN 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 14081-1:2005+A1:2011, *Timber structures — Strength graded structural timber with rectangular cross section — Part 1: General requirements*

EN 14358, *Timber structures — Calculation of characteristic 5-percentile values and acceptance criteria for a sample*

EN 15228:2009, *Structural timber — Structural timber preservative treated against biological attack*

EN 15416-3, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods — Part 3: Creep deformation test at cyclic climate conditions with specimens loaded in bending shear*

EN 15425:2008, *Adhesives — One component polyurethane for load bearing timber structures — Classification and performance requirements*

3 Terms and definitions

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

3.1

bonding strength

structural effectiveness of adhesives between timber components when subjected to stresses

3.2

finger angle

inclination α of each side of the fingers of a finger joint

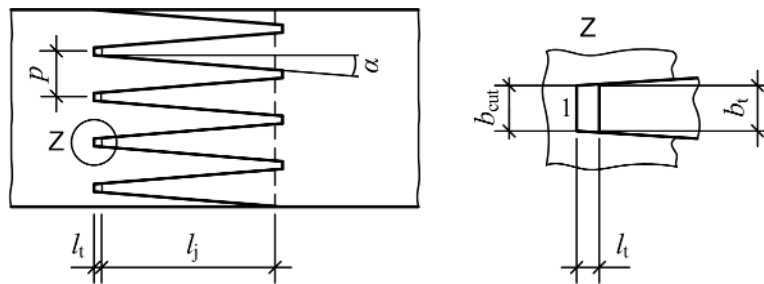
Note 1 to entry: See Figure 2.

3.3

finger joint

interlocking end joint formed by machining a number of similar, tapered, symmetrical fingers in the ends of timber members using a finger joint cutter and then bonded together

Note 1 to entry: See Figure 2:



Key

- 1 slot base
- l_j finger length
- p pitch
- α finger angle
- l_t tip gap
- b_{cut} tip width of the cutter
- b_t tip width

Figure 2 — Typical profile of a finger joint

3.4

finger length

distance between the finger base and the tip of the finger, measured along the centre line of the finger

Note 1 to entry: See Figure 2.

3.5

manufacturer specific strength class

set of characteristic strength, stiffness and density properties declared by a manufacturer

3.6

minimum mean density

required mean density at reference moisture content

Note 1 to entry: Minimum mean density is used for the classification of the reaction to fire.

3.7

pitch

distance between centres of adjacent finger tips

Note 1 to entry: See Figure 2.

3.8

ratio of resin to hardener

proportion of resin and hardener by mass with the resin set at 100 parts

3.9

reduction factor

ratio between tip width and pitch

Note 1 to entry: See Figure 2.

3.10

relative tip gap

ratio between tip gap and finger length

Note 1 to entry: See Figure 2.

3.11

tip gap

distance between finger tip and slot base in a bonded finger joint

Note 1 to entry: See Figure 2.

3.12

tip width

distance between finger faces, measured at the tip of the finger

Note 1 to entry: See Figure 2.

4 Symbols

4.1 Main symbols

A	area, in mm^2 ;
A_W	area of one wane, in mm^2 ;
a_W	diagonal length of wane, in mm;
b	width of cross section, in mm;
b_{cut}	tip width of the cutter, in mm (see Figure 2);
b_t	tip width, in mm (see Figure 2);
d	diameter, in mm;
e	relative tip gap;
f	strength, in N/mm^2 ;
h	depth of cross section, in mm;
k_{15}	statistical factor;
k_f	divisor for flatwise bending;
l_j	finger joint length, in mm;
l_t	tip gap, in mm (see Figure 2);
p	pitch, in mm (see Figure 2);
u	moisture content, in %;
v	reduction factor of a finger joint;
α	finger angle, in degree (see Figure 2).

4.2 Subscripts

dc	declared value;
j	properties of finger joints;
k	characteristic;
m	bending;

- 0 parallel to the grain;
05 5 %-fractile.

5 Performance characteristics for structural finger jointed timber

5.1 Mechanical resistance

5.1.1 General

This European Standard covers the following mechanical resistance characteristics: modulus of elasticity and bending strength, compressive strength, tensile strength and shear strength. These characteristics may be determined either by testing or by strength grading according to EN 14081-1 and declared either as individual values or as strength class. For the declaration of the bending strength of the structural finger jointed timber, 5.2.1 shall be taken into account.

In order to allow the calculation of the mechanical resistance of any structural product made with structural finger jointed timber it is necessary to determine and declare also the cross section of the finger jointed timber.

NOTE The above mentioned mechanical resistance characteristics of the structural finger jointed timber, together with the cross section, allow the determination of the mechanical performance of structural elements made with this structural material using the relevant calculation methods applicable in the country of final use.

5.1.2 Timber

The timber used in the manufacturing of structural finger jointed timber shall be strength graded according to EN 14081-1.

5.1.3 Bending strength of finger joints

The bending strength of the finger joints shall be determined and declared according to Annex C and shall be equal to or greater than the declared characteristic bending strength of the unjointed timber.

If it is intended to manufacture preservative treated structural finger jointed timber it shall be verified that the treatment does not affect the strength of the finger joints.

5.1.4 Related material properties

If the provisions of 5.1.3 are met the strength, stiffness and density properties of structural finger jointed timber shall be declared as the properties of the unjointed timber, e.g. as a strength class according to EN 338.

The designation of strength classes shall be accompanied by the letter M, if machine graded. If the designation of a manufacturer specific strength class is Cxx (where "xx" is the characteristic bending strength) it shall be accompanied by the company name, e.g. C24 AnyCompany.

5.2 Bonding strength and durability of bonding strength

5.2.1 General

Durable and reliable finger joints can only be achieved under accurately defined conditions of production. That general provision shall be considered satisfied if the respective minimum production provisions given in Annex G are fulfilled.

The bonding strength of the finger joints in the finger jointed timber is determined by the bending strength of the finger joints according to Annex C and is declared as the characteristic bending strength of the timber used in the manufacturing of the finger jointed timber.

Durability of bonding strength is declared indirectly by reference to species, adhesive type and adhesive family.

5.2.2 Species

Structural finger jointed timber shall consist of only one species throughout.

This European Standard covers structural finger jointed timber made from one of the following species:

Norway spruce (*Picea abies*, PCAB), Fir (*Abies alba*, ABAL), Scots pine redwood (*Pinus sylvestris*, PNSY), Douglas fir (*Pseudotsuga menziesii*, PSMN), Western Hemlock (*Tsuga heterophylla*, TSHT), Corsican pine (*Pinus nigra* Arnold subsp. *laricio*, PNNL), Austrian pine (*Pinus nigra* Arnold subsp. *nigra*, PNNN), European larch (*Larix decidua*, LADC), Siberian larch (*Larix sibirica*, LASI), Dahurian larch (*Larix gmelinii* (Rupr.) Kuzen.), Poplar (Applicable clones: *Populus x euramericana* cv "Robusta", "Dorskamp", "I214" and "I4551", POAL), Maritime pine (*Pinus pinaster*, PNP), Radiata-Pine (*Pinus radiata*, PNRD), Sitka-spruce (*Picea sitchensis*, PCST), Southern Yellow pine (*Pinus palustris*, PNPL), Western Red Cedar (*Thuja plicata*, THPL), Yellow Cedar (*Chamaecyparis nootkatensis*, CHNT).

Norway spruce and Fir may be considered as one species.

NOTE 1 Letter codes according to EN 13556, if available, are given after the botanical name.

NOTE 2 Not all of the species listed above have a national grade related to a European strength class in EN 1912.

5.2.3 Adhesives for the production of structural finger jointed timber

5.2.3.1 General

Adhesives shall enable the production of durable bonds in structural finger jointed timber throughout the lifetime of the structure for the required service class according to EN 1995-1-1.

For structural finger jointed timber used in service class 1 adhesives, which can be assigned to an adhesive type I or II (including subclasses, if relevant) according to EN 301:2013, Table 1, or EN 15425:2008, Table 1, shall be used. For structural finger jointed timber used in service class 2 or 3 adhesives, which can be assigned to an adhesive type I (including subclasses, if relevant) according to EN 301:2013, Table 1, or EN 15425:2008, Table 1, shall be used. Emulsion polymer isocyanate adhesives shall also be assigned to an adhesive type according to EN 15425:2008, Table 1.

Taking into account the restrictions given in the referred subclauses, the following adhesive families are applicable:

- phenolic and aminoplastic adhesives (e.g. MF, MUF, PRF, UF) in accordance with 5.2.3.2;
- moisture curing one-component polyurethane adhesives (PUR) in accordance with 5.2.3.3;
- emulsion polymer isocyanate adhesives (EPI) in accordance with 5.2.3.4.

NOTE The applicability of adhesives may be further limited by national provisions valid at the place of use.

If a preservative treatment is done before the bonding of the timber, it shall be documented that the provisions are fulfilled for the combination of the preservative and adhesive.

5.2.3.2 Phenolic and aminoplastic adhesives

Phenolic and aminoplastic adhesives shall fulfil the provisions of EN 301.

5.2.3.3 Moisture curing one-component polyurethane adhesives

Moisture curing one-component polyurethane adhesives shall fulfil the provisions of EN 15425 and B.2 taking into account the conditions given in B.1.

The provisions given in EN 302-5:2013, 5.1, 2nd paragraph apply. For moisture curing one-component polyurethane adhesives to be used in finger joints in larch wood the delamination test according to EN 302-2 may be replaced by tests according to EN 301:2013, Annex A, with larch wood.

5.2.3.4 Emulsion polymer isocyanate adhesives

5.2.3.4.1 General

Emulsion polymer isocyanate adhesives shall only be used for finger jointed structural timber to be used in service classes 1 and 2.

Emulsion polymer isocyanate adhesives shall be tested in accordance with EN 15425 and B.2 taking into account the conditions given in B.1 and the respective provisions shall be fulfilled.

5.2.3.4.2 Systems tested with a maximum glue line thickness of 0,3 mm

Testing according to EN 15425 and B.1 and B.2 may be done with a maximum glue line thickness of 0,3 mm instead of 0,5 mm if the glue line thicknesses in the finished structural finger jointed timber do not exceed 0,2 mm;

For tests with a maximum glue line thickness of 0,3 mm the provisions given in EN 15425 shall apply with the following exceptions:

- For bonding strength in longitudinal tensile strength tests according to EN 302-1 with a glue line thickness of 0,3 mm, the provisions given in Table 1 shall be met.
- For creep deformation tests with specimens loaded in bending shear according to EN 15416-3, the specimens shall have a glue line thickness of 0,2 mm.

Table 1 — Required mean shear strength in N/mm² for lap shear tests according to EN 15425 for samples glued with EPI having a glue line thickness of 0,3 mm

Treatment	Adhesive type	
	Type I	Type II
A1	9,5	9,5
A2	5,5	5,5
A3	7,6	7,6
A4	5,5	NR ^a
A5	7,6	NR ^a
A6	NR ^a	8,3
A7	7,2	NR ^a
^a Treatment cycle not required (NR).		

5.3 Durability against biological attack

5.3.1 Structural finger jointed timber without preservative treatment

The natural durability of structural finger jointed timber shall be taken as the natural durability of the timber from which it is made and shall be assessed according to EN 14081-1.

5.3.2 Structural finger jointed timber with preservative treatment

Only treatments according to EN 15228:2009, 4.5, which do not affect the strength and stiffness properties of the timber shall be used.

If either preservative treated timber is jointed or structural finger jointed timber is preservative treated, the information given in EN 15228:2009, Clause 6, shall be declared.

NOTE The use of timber preservatives may be restricted by provisions valid at the place of use.

Provisions according to EN 15228 apply to the structural finger jointed timber as supplied, e.g. planing needs to be taken into account regarding retention and penetration depth.

5.4 Resistance to fire

Resistance to fire of structural finger jointed timber shall be declared according to EN 13501-2 indirectly by geometrical data (member sizes) and material properties (charring rate). Charring rate is declared indirectly by declaring both the species and the characteristic density. These parameters allow selecting the appropriate charring rate from the respective fire design code.

NOTE The above mentioned fire resistance characteristics of the structural finger jointed timber, together with the cross section, allow the determination of the fire resistance performance of structural elements made with this structural material using the relevant calculation methods applicable in the country of final use.

5.5 Reaction to fire

The class of reaction to fire performance of the structural finger jointed timber (including the additional classification on smoke production and flaming droplets/particles, if any), either preservative treated against biological attack or not, shall be determined and declared by either method a) or b), as follows:

- a) without the need for further testing (CWFT), as given in Table 2, if the structural finger jointed timber is proved to meet the provisions of the class given therein¹⁾;
- b) or based on testing of the structural finger jointed timber according to the standards, referred to in EN 13501-1, when such a structural finger jointed timber does not meet the provisions of Table 2 or where a higher classification than the one in a) is sought. Tests may be done without conditioning according to EN 13238 with specimens having a moisture content of $u \leq 15\%$. The moisture content shall be reported.

The influence of a preservative treatment against biological attack on the performance of reaction to fire shall be taken into account as laid down in EN 15228:2009, 4.4.

1) A Commission's decision on the applicability of Table 2 for structural finger jointed timber has been filed.

Table 2²⁾ — Classes of reaction to fire performance for structural timber^a without the need of further testing

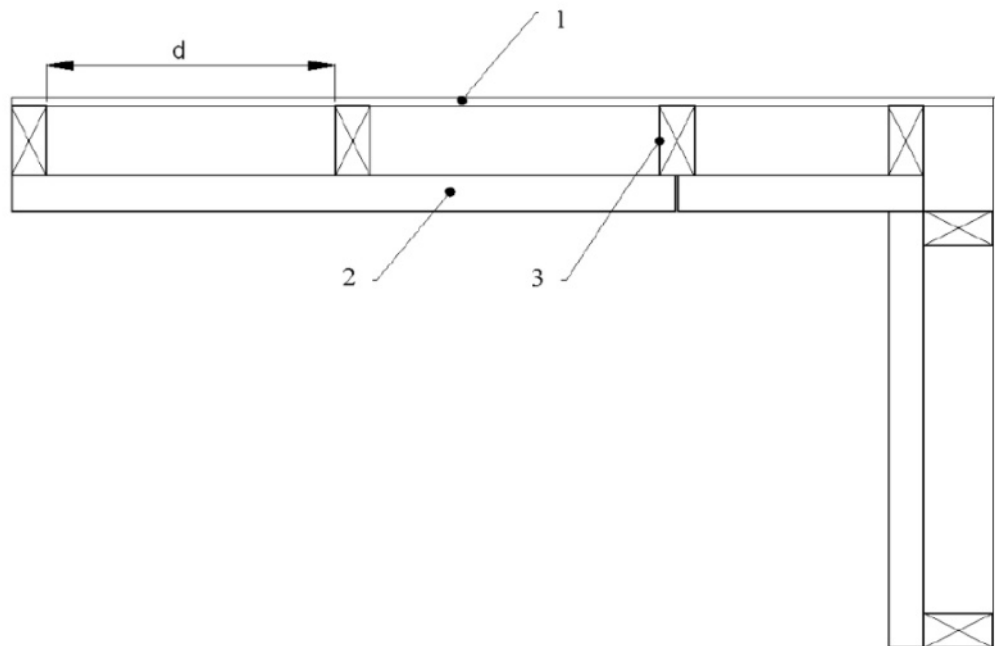
Product	Product details	Minimum mean density ^b kg/m ³	Minimum overall thickness mm	Class ^c (excluding floorings)
Structural timber	Visual and machine graded structural timber with rectangular cross sections shaped by sawing, planing or other methods or with round cross sections	350	22	D-s2, d0
^a Applies to all species covered by the product standards. ^b Conditioned according to EN 13238. ^c Class as provided for in Table 1 of the Annex to Decision 2000/147/EC.				

When reaction to Fire is determined by testing the product shall be tested according to EN 13823 (SBI test) and mounted and fixed in accordance with the following:

- the whole area of both wings in the SBI apparatus shall be covered with pieces of structural finger jointed timber mounted edge to edge (butt jointed), without jointing or bonding and orientated horizontally or vertically;
- supported by battens of the product concerned of a size minimum (40 × 80) mm, fixed to the test backing boards at 400 mm to 600 mm centres horizontally or vertically (perpendicular to the orientation of the product pieces), so that the resulting spacing between backing board and product is 80 mm; see also Figure 3.

NOTE Test results are valid for finger jointed structural timber having at least the density and the minimum overall thickness of the specimens tested.

2) This table is the same as given in the Decision of the Commission 2003/593/EC of 2003-08-07 (see OJEU L201 of 2003-08-08).



Key

$400 \text{ mm} \leq d \leq 600 \text{ mm}$

- 1 backing board
- 2 structural finger jointed timber
- 3 batten (cross section: 40 mm x 80 mm)

Figure 3 — Top view of fixing system for reaction to fire test according to EN 13823

5.6 Formaldehyde emission

The release of formaldehyde shall be declared as Class E1 or E2 according to Annex A.

NOTE Products of Class E2 are banned in some Member States.

5.7 Release/content of other dangerous substances

National regulations on dangerous substances may require verification and declaration on release and sometimes on content of other dangerous substances in addition to those dealt with in other clauses when construction products covered by this European Standard are placed on those markets.

In the absence of European harmonized tests methods verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction website on EUROPA accessed through: <http://ec.europa.eu/enterprise/construction/cpd-ds/>.

5.8 Deviation in sizes

The corrected sizes shall be calculated according to EN 336. They shall not deviate from the nominal width and thickness by more than the permissible deviations of the declared tolerance class given in EN 336.

6 Assessment and Verification of Constancy of Performance (AVCP)

6.1 General

The compliance of structural finger jointed timber with the provisions of this standard and with the performances declared by the manufacturer in the Declaration of Performance (DoP) shall be demonstrated by:

- determination of the product-type on the basis of type testing;
- factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

6.2 Type testing

6.2.1 General

All performances related to essential characteristics in Table 3 of this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests (e.g. use of previously existing data, CWFT and conventionally accepted performance).

Assessments previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE 1 Same AVCP system means testing by an independent third party, under the responsibility of a notified product certification body.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family

Products may be grouped in different families for different characteristics.

Reference to the assessment method standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product-type shall be carried out for all characteristics included in the standard for which the manufacturer declares the performance:

- at the beginning of the production of a new or modified structural finger jointed timber product (unless a member of the same product range), or
- at the beginning of a new or modified method of production (where this may affect the stated properties); or
- they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the structural finger jointed timber products design, in the raw material or in the supplier of the components, or in the method of production (e.g. production on a new production line), which would affect significantly one or more of the characteristics.

NOTE 2 In this context "design" means "product design".

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the DoP, although this does not replace the responsibility on the structural finger jointed timber product manufacturer to ensure that the structural finger jointed timber product as a whole is correctly manufactured and its component products have the declared performance values.

6.2.2 Test samples, testing and compliance criteria

The number of samples to be tested/assessed shall be in accordance with Table 3.

Table 3 — Numbers of samples to be tested and compliance criteria

Characteristics ^a	Clause	Assessment method	No. of samples	Compliance criteria
Mechanical resistance of structural finger jointed timber expressed as modulus of elasticity, bending strength, compressive strength, tensile strength and shear strength				
Strength, stiffness and density properties of timber	5.1.2	EN 14081-1	EN 14081-1:2005+A1:2011, 6.2	EN 14081-1:2005+A1:2011, 6.2
Finger joints	5.1.3	Annex C (test)	For each production line, each combination of species and adhesive, the highest declared characteristic bending strength of the timber and the largest cross section: - 30 specimens tested in edgewise bending	C.3 in combination with 5.1.3
		Annex C (test)	For the determination of k_f (if relevant) for each finger joint geometry, the highest declared characteristic bending strength of the timber and the cross section with the smallest number of fingers: - at least 30 specimens tested in edgewise bending and - at least 30 specimens tested in flatwise bending	C.3 in combination with 5.1.3
Geometrical data	5.8	5.8 (measurement)	—	5.8
Bonding strength				
Finger joints	5.1.3	As for mechanical resistance		