SLOVENSKI STANDARD
oSIST prEN 15497:2011

01-november-2011

Konstrukcijski zobati spoj masivnega lesa - Zahteve za uporabo in minimalne zahteve za proizvodnjo

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

Keilzinkenverbindungen im Bauholz - Leistungsanforderungen und Mindestanforderungen an die Herstellung

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

Ta slovenski standard je istoveten z: **prEN 15497**

ICS:

79.040	Les, hlodovina in žagan les	Wood, sawlogs and sawn timber

oSIST prEN 15497:2011 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 15497 rev

August 2011

ICS 79.040

Will supersede EN 385:2001

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

Keilzinkenverbindungen im Bauholz - Leistungsanforderungen und Mindestanforderungen an die Herstellung

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

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Foreword

This document (prEN 15497:2011) has been prepared by Technical Committee CEN/TC 124 “Timber structures”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede 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 essential requirements of EU Directive.

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

1 Scope

This European standard specifies performance and production requirements for structural finger jointed solid timber with rectangular cross-section. This standard covers also test and/or calculation methods to carry out the evaluation of conformity and requirements for marking of structural finger jointed solid timber.

This standard is only applicable to finger joints between timber members of the same species or species combination.

The standard covers not only coniferous species but also broad-leaved species where it has been verified that the type of adhesive used and the assembly conditions for finger-jointing timber are suitable for that type of species.

This standard covers structural finger jointed solid timber untreated or treated against biological attack after finger-jointing.

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

Individual finger jointed laminations and large finger joints for glued laminated timber are not covered by the present standard.

NOTE Individual finger jointed laminations and large finger joints for glued laminated timber are respectively covered by EN 385 and EN 387.

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 301:2006, 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 bond strength in longitudinal tensile shear strength

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

EN 302-3:2004, 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 effect of wood shrinkage on the shear strength

EN 302-6, Adhesives for load-bearing timber structures — Test methods — Part 6: Determination of the conventional pressing time

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 1912, *Structural timber – Strength classes – Assignment of visual strength and classes*

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

EN 1995-1-2, Eurocode 5 - Design of timber structures - Part 1-2: General - Structural fire design

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 test 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 13556, *Round and sawn timber – Nomenclature of timbers used in Europe*

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, *Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements*

EN 14358, *Structural timber – Calculation of characteristic 5-percentile values*

EN 15228, *Structural timber – Structural timber preservative treated against biological attack*

EN 15416-5, Adhesives for load bearing timber structures with the exception of phenolic and amino plastic adhesives — Test methods — Part 5: Determination of conventional pressing time

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

3 Terms and definitions

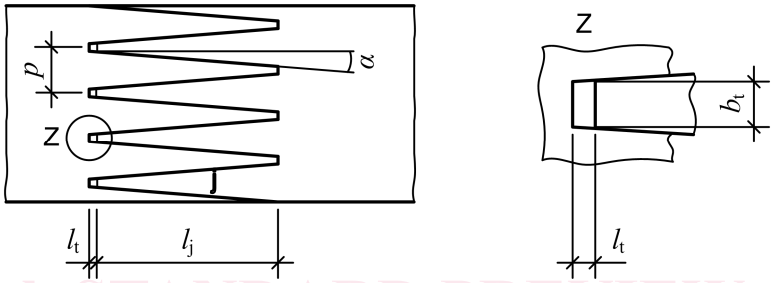
For the purposes of this standard, the following terms and definitions apply:

3.1
characteristic strength
population 5-percentile value obtained from the results of tests with a duration of 300 s using test pieces at an equilibrium moisture content resulting from a temperature of 20 °C and a relative humidity of 65 %

3.2
declared strength profile
a set of characteristic strength, stiffness and density properties declared by the manufacturer

3.3
finger angle
inclination α of the fingers of a finger joint (see Figure 1)

3.4
finger joint
self-locating end joint formed by machining a number of similar, tapered, symmetrical fingers in the ends of timber members, which are then bonded together (see Figure 1)



Key

l_j finger length

p pitch

α finger angle

l_t tip gap

b_t tip width

Figure 1 — Typical profile of a finger joint

3.5
finger length
distance between the finger base and the tip of the finger, measured along the centre line of the finger

3.6
grade
strength grade or strength class

3.7
moisture content
amount of water present in timber, expressed as percentage of oven dry mass

3.8
pitch
distance between fingers, centre to centre

3.9
production batch
joints, all of which have the same profile, manufactured from the same species of timber, the same strength class, having the same nominal cross section, bonded with the same adhesive and made during a continuous run on one production line in a shift (e.g. 8 hours)

3.10
ratio of resin and hardener
proportion of resin and hardener by mass based on a scale with the resin set at 100 parts

3.11
reduction factor
ratio between tip width and pitch (see Figure 1)

3.12
relative tip gap
ratio between the distance between finger tip and the opposite slot base in a bonded finger joint and the finger length (see Figure 1)

3.13
strength class
classification of timber based on particular values of mechanical properties

3.14
tip gap
distance between finger tip and slot base in a bonded finger joint

3.15
tip width
distance between finger faces, measured at the tip of the finger

3.16
total delamination length
sum of the length of all delaminations measured in all glue lines of a test piece

3.17
wood failure
rupture in or between wood fibres

3.18
wood failure percentage
percentage of the wood failure area in relation to the total sheared area

4 Symbols and subscripts

4.1 Symbols

A area, in square millimetres;

A_W area of one wane, in square millimetres;

a_W diagonal length of wane, in millimetres;

b_t tip width, in millimetres;

d diameter, in millimetres;

$Delam_{max}$ maximum delamination;

$Delam_{tot}$ total delamination;

e relative tip gap;

E modulus of elasticity, in N/mm^2;

f strength, in N/mm^2;

f_m bending strength, in Newtons per square millimetre;

$f_{m,k}$ characteristic bending strength, in Newtons per square millimetre;

$f_{m,\,k,dc}$ characteristic bending strength, declared by the manufacturer, in Newtons per square millimetre;

F_u ultimate load, in N;

G shear modulus, in N/mm^2;

h largest dimension of cross section, in millimetres;

k_f factor for flatwise bending

l length, in mm;

l_j finger joint length, in mm;

l_t tip gap, in millimetres;

$l_{tot,delam}$ total delamination length, in mm;

$l_{tot,glue\ line}$ entire length of glue lines on the two end-grain surfaces of each test piece, in mm;

p pitch, in millimetres;

μ moisture content, in %;

v reduction factor of a finger joint;

α finger angle, in degree (see Figure 2);

ρ density, in kg/m^3;

4.2 Subscripts

c compression;

dc declared value;

j properties of finger joints;

k characteristic;

m bending;

mean mean value;

min minimal;

t tension;

05 5 %-percentile;

5 Requirements for components and bonding

5.1 Timber

5.1.1 General

Structural timber shall fulfil the requirements of EN 14081-1.

5.1.2 Species

Only species or species combinations proven to be suitable for structural finger jointed solid timber shall be used.

NOTE The following wood species are suitable for finger-jointing:

European whitewood (Picea abies, Abies alba); European redwood (Pinus sylvestris); Douglas fir (Pseudotsuga menziesii); Corsican Pine, Laricio Pine and Austrian black pine (Pinus nigra); Larch (Larix decidua); Siberian Larch (Larix sibirica LASI); Maritime Pine (Pinus pinaster); Poplar (Populus robusta, Populus alba); Radiata pine (Pinus radiata); Sitka spruce (Picea sitchensis); Western Hemlock (Tsuga heterophylla); Western red cedar (Thuja plicata).

5.2 Adhesives

The adhesive shall enable finger joints of such a performance that the integrity of the bond is maintained throughout the intended lifetime of the structure.

If the timber is treated against biological attack by a preservative, it shall be checked that the strength properties of the finger jointed timber are maintained.

The adhesive shall meet the requirements of Annex B.

NOTE National regulations and/or Eurocode 5 may limit the use of adhesive type II

5.3 Finger joints

5.3.1 Finger joint geometry

The geometry of the fingers shall permit the joint to be self-interlocking after pressing.

The finger length l_j, the pitch p, the finger tip b_t the reduction factor $v = b_t/p$ and the finger angle α shall fulfil Equations (1) and (2), respectively:

$$l_j \geq 4\ p\ (1 - 2\ v) \quad (1)$$

$$\alpha \leq 7{,}1° \quad (2)$$

The reduction factor v shall be $v \leq 0{,}18$ and the finger length l_j shall be $l_j > 10$ mm.

NOTE Recommended geometries are given in Table 1.

Table 1 — Recommended geometries

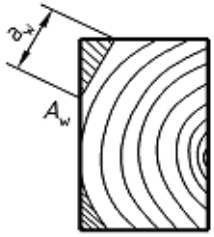
Finger length l_j (mm)	Pitch p (mm)	Finger tip b_t (mm)	Reduction factor v
15	3,8	0,42	0,11

20	5,0	0,5	0,10
20	6,2	1,0	0,16
30	6,2	0,6	0,10

5.3.2 Wane or edge damage

There shall be no wane or edge damage affecting more than two corners at the joint within the finger length and within 75 mm of the root of the fingers. The area, A_w, of the wane at any corner shall not exceed 1 % of the cross-sectional area (see Figure 2).

NOTE Conformity with this requirement can be verified by measuring the diagonal aw of the wane and demonstrating that it is less than the maximum diagonal given in Figure 3 as a function of the cross-sectional area A.

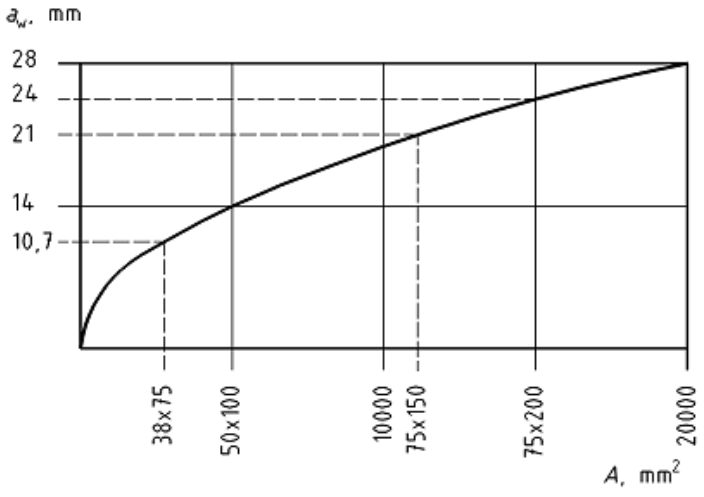


Key

a_w maximum diagonal of wane

A_w area of the wane

Figure 2 — Cross section of timber with wane



Key

a_w maximum diagonal of wane

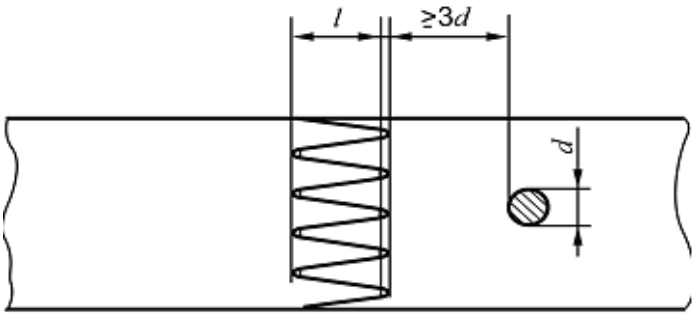
A cross-sectional area of timber

Figure 3 — Maximum diagonal of wane $a_{W,max} = \sqrt{A}/5$

5.3.3 Knots and fissures

There shall be no knots or pronounced grain disturbance within the joint itself. Fissures are allowed as long as they are not more than 50 % of the thickness. Outside the joint the distance between a knot and the end of the cross-cut timber shall be not less than (l + 3d) where d is the diameter of the knot measured perpendicular to the grain direction (longitudinal direction), (see Figure 4), except where an appropriate system guarantees that in the range of the finger joints the grain orientation is parallel to the longitudinal direction.

Knots with a diameter not greater than 6 mm may be disregarded.



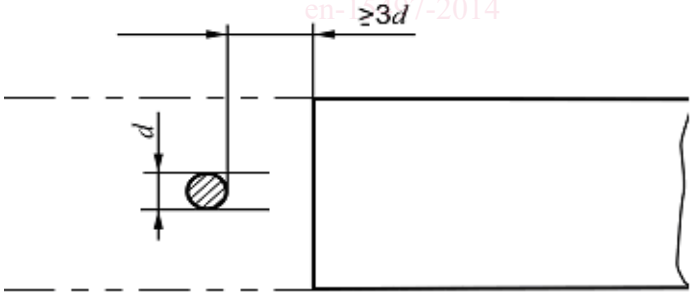
Key:

d knot diameter

l_j finger length

Figure 4 — Minimum distance from the end of the timber to a knot

Where a member is cross-cut to remove a knot, the cut shall be made at a distance from the knot at least equal to a length of 3d , where d is diameter of a knot (see Figure 5).



Key :

d knot diameter

Figure 5 — Minimum distance for a cross-cut to remove a knot

When timber pieces are cross cut to remove a knot, the grain at the cross-cut shall be approximately parallel to the axis of the board. The distance between the edge of a knot and the cross cut shall be at least 1,5 d. The grain deviation needs not to be checked if the distance is 3 d.

6 Requirements for products

6.1 General

The cutting and the bonding operations of finger joints shall result in reliable and durable bonds of required strength.

These general requirements shall be considered satisfied if both the requirements in this clause and the minimum production requirements in Clause 7 are fulfilled.

6.2 Mechanical resistance

The strength and stiffness properties of the structural finger jointed solid timber, tested according to Annex E, shall be equal to or greater than the properties of the non-jointed timber used for the product. The strength and stiffness properties of the non-jointed timber shall be stated as the declared values of the product.

NOTE In this European Standard the "strength, stiffness and density" characteristics cover the following essential characteristics of the structural finger jointed solid timber with rectangular cross section: modulus of elasticity, bending strength, compressive strength, tensile strength, shear strength, shear modulus, and density.

Influence of preservative treatment on performance of the strength and stiffness of the structural finger jointed solid timber shall be assessed according to EN 15228.

6.3 Durability against biological attack

6.3.1 Timber without preservative treatment

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

NOTE In addition to the natural durability, the use class in which the finger jointed timber can be used may also depend on the integrity of the glues of the finger joints.

6.3.2 Timber treated against biological attack

Structural finger jointed solid timber treated against biological attack shall meet the requirements of EN 15228. If preservative treated timber is used, the durability class, type of preservative, critical retention value and penetration class shall be declared after the influence of such treatment on performance of the durability of the structural finger jointed solid timber has been assessed according to EN 15228.

6.4 Reaction to fire

The class of reaction to fire performance of the structural finger jointed solid timber (including the additional classification on smoke production and flaming droplets/particles, if any) shall be determined and declared according to EN 13501-1:

a) either without the need for further testing (CWFT), as given in Table 2 [1)], if the timber is proved to meet the requirements of the class also given therein;

b) or based on testing of the timber according to the standards, referred to in EN 13501-1, when the timber does not meet the requirements of Table 2 or where a higher classification than the one in a) is sought.

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[1] This table is the same as given in the Decision of the Commission 2003/43/EC of 2003-01-17 (*see OJEU L13 of 2003-01-18*), as amended firstly by 2003/593/EC of 2003-08-07 (*see OJEU L201 of 2003-08-08*), secondly by 2006/673/EC of 2006-10-05 (*see OJEU L276 of 2006-10-07*) and thirdly by 2007/348/EC of 2007-05-15 (*see OJEU L131 of 2007-05-23*), and corrected by the Corrigendum (*see OJEU L331 of 2003-02-08*).