



# SLOVENSKI STANDARD

## oSIST prEN 16351:2019

01-januar-2019

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### Lesene konstrukcije - Križno lamelirani les - Zahteve

Timber structures - Cross laminated timber - Requirements

Holzbauwerke - Brettsperrholz - Anforderungen

Structures en bois - Bois lamellé croisé - Exigences

Ta slovenski standard je istoveten z: prEN 16351

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#### **ICS:**

79.060.10	Vežan les	Plywood
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NORME EUROPÉENNE  
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English Version

## Timber structures - Cross laminated timber - Requirements

Structures en bois - Bois lamellé croisé - Exigences

Holzbauwerke - Brettsper Holz - Anforderungen

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (prEN 16351:2018) 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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

For the relationship with Regulation No. 305/2011, see informative Annex ZA, which is an integral part of this document.

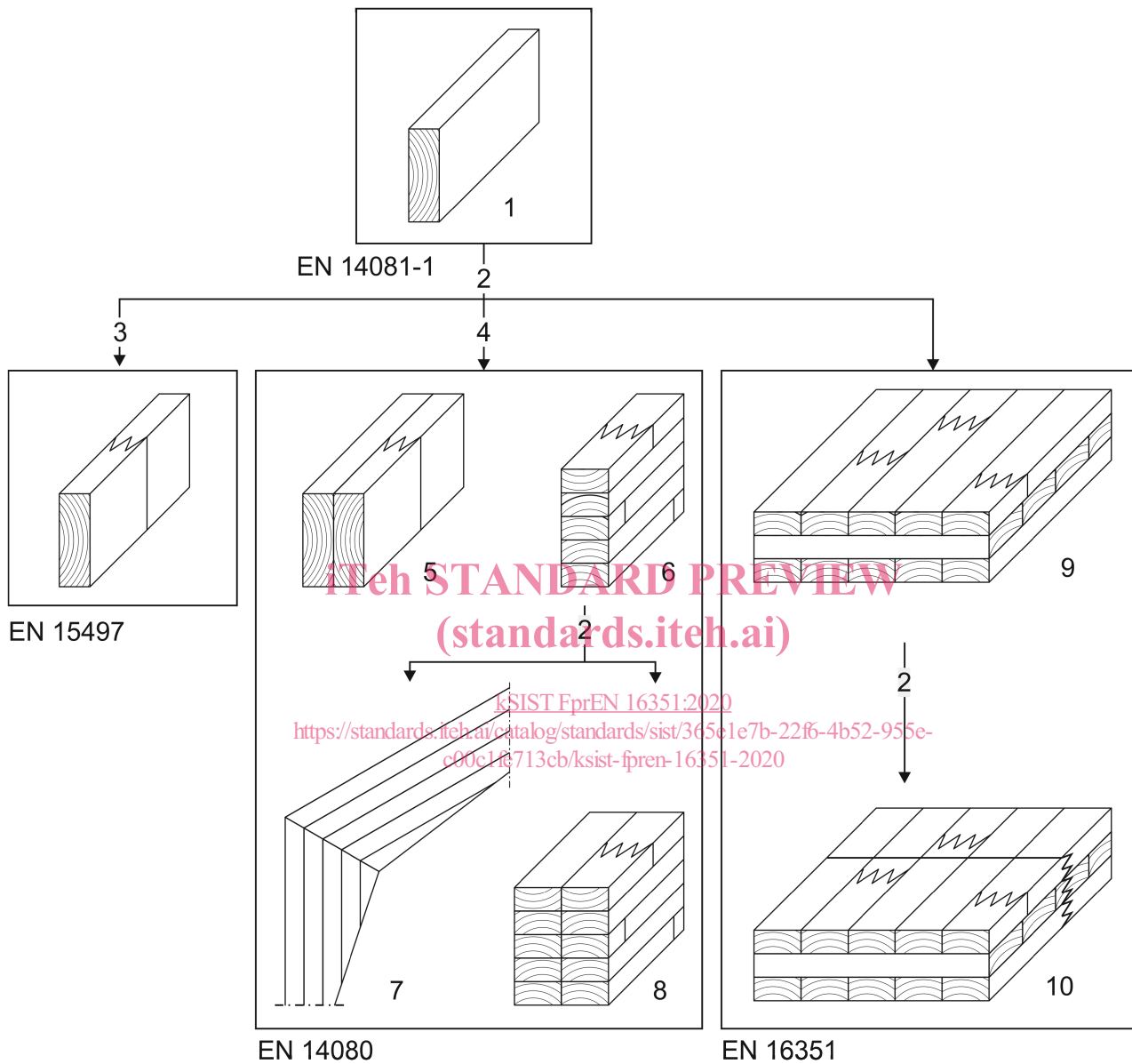
This document will supersede EN 16351:2015.

Compared to EN 16351:2015 the following changes have been made:

- the scope is limited to cross laminated timber with or without non-structural edge-bonds produced according to the provisions given in this standard;
- provisions for designation codes have been added;
- the standard has been adjusted to the latest versions of standards for adhesives;
- the provisions for reaction and resistance to fire have been modified;
- the provisions for gap widths and ratios of lamination width by thickness have been modified;
- missing provisions for factory production control have been added;
- the provisions for determination of strength, stiffness and density properties of cross laminated timber have been modified;
- the standard has been adjusted to the latest templates.

**Introduction**

Figure 1 shows the relation of some harmonized European Standards on structural timber products.



**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                          |
| 5 | glued solid timber               | 10 | cross laminated timber with large finger joints |

**Figure 1 — Relation of some harmonized European Standards on structural timber products**

Cross laminated timber in accordance to this European Standard and multilayer solid wood panels in accordance with EN 13353 may have the same layup, but for cross laminated timber the timber is strength graded according to EN 14081-1 and the adhesives are tested according to the provisions of this European Standard.



## 1 Scope

This document sets out requirements regarding the performance of characteristics of the following types of cross laminated timber to be used in buildings and bridges:

- type 1: Straight or curved cross laminated timber comprising only timber layers but no large finger joints;
- type 2: Straight cross laminated timber comprising only timber layers and large finger joints;
- type 3: Straight cross laminated timber comprising timber and wood-based panel layers but no large finger joints.

It also lays down procedures for assessment and verification of constancy of performance (AVPC) of characteristics and specifies marking and labelling of cross laminated timber.

This document covers cross laminated timber of all three types of cross laminated timber:

- manufactured according to this standard, which sets up provisions for:
  - boundary conditions during manufacture of cross laminated timber;
  - moisture content and temperature of timber to be bonded;
  - production of finger joints and bonds between layers;
- to be used in service class 1 or 2 according to EN 1995-1-1;
- made of coniferous species and poplar listed in this standard;
- which may be made of layers made of different species having similar properties;
- bonded with phenolic or aminoplastic or moisture curing one-component polyurethane or emulsion polymer isocyanate adhesives of adhesive type I according to the respective standard;
- built up of at least three orthogonally bonded layers (at least two of them timber layers);
- which may have, depending on the number of layers, adjacent layers bonded parallel to the grain;
- made of timber layers which are made of strength graded timber according to EN 14081-1;
- made of timber layers having nominal thicknesses between 6 mm (including) and 60 mm (including) depending on the layup;
- made of timber layers
  - which may comprise non-structural edge bonds; and
  - have a mean gap width of less than or equal to 0,6 mm and a 90<sup>th</sup> percentile of the gap width of 2 mm;
- having nominal overall thicknesses up to 500 mm.

Additional provisions of this document apply for straight cross laminated timber comprising only timber layers and comprising large finger joints (type 2):

- made from cross laminated timber pieces having the same cross-section and layup;

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- made from cross laminated timber pieces having nominal cross-sectional thicknesses from 51 mm (including) up to 345 mm (including) and nominal minimum thicknesses of the outer layers not less than 17 mm (including).
- made from cross laminated timber pieces solely comprising timber layers;
- made from plane cross laminated timber pieces;
- with parallel *x*-axes of the jointed components;
- with finger joints having a finger length of at least 45 mm and fingers which are visible at the two narrow sides of the components;
- bonded with phenolic or aminoplastic or moisture curing one-component polyurethane adhesives of adhesive type I according to the respective standard.

Additional provisions of this document apply for straight cross laminated timber comprising timber and wood-based panel layers but no large finger joints (type 3):

- made of structural wood-based panels specified in this European standard;
- made of one panel per layer and;
- having thicknesses between 6 mm (including) and 45 mm (including);

This document applies to cross laminated timber untreated or treated against biological attack.

This document does not cover:

- cross laminated timber treated with fire retardants;
- cross laminated timber which is produced from re-used timber or wood-based panels comprising re-used timber.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 301:2017, *Adhesives, phenolic and aminoplastic, for load-bearing timber structures - Classification and performance requirements*

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

EN 302-6, *Adhesives for load-bearing timber structures - Test methods - Part 6: Determination of the minimum pressing time under referenced conditions*

EN 335, *Durability of wood and wood-based products - Use classes: definitions, application to solid wood and wood-based products*

EN 350, *Durability of wood and wood-based products - Testing and classification of the durability to biological agents of wood and wood-based materials*

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

- EN 408:2010+A1:2012, *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 789, *Timber structures - Test methods - Determination of mechanical properties of wood based panels*
- EN 1995-1-1, *Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings*
- EN 12369-2, *Wood-based panels - Characteristic values for structural design - Part 2: Plywood*
- 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 13353, *Solid wood panels (SWP) - Requirements*
- 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 13986, *Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking*
- EN 14080:2013, *Timber structures - Glued laminated timber and glued solid timber - Requirements*
- EN 14081-1, *Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements*
- EN 14358, *Timber structures - Calculation and verification of characteristic values*
- EN 14374, *Timber structures - Structural laminated veneer lumber - Requirements*
- EN 15228:2009, *Structural timber - Structural timber preservative treated against biological attack*
- EN 15416-5, *Adhesives for load bearing timber structures other than phenolic and aminoplastic - Test methods - Part 5: Determination of minimum pressing time under referenced conditions*
- EN 15425:2017, *Adhesives - One component polyurethane (PUR) for load-bearing timber structures - Classification and performance requirements*
- EN 16254:2013+A1:2016, *Emulsion polymerized isocyanate (EPI) for load bearing timber structures - Classification and performance provisions*

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EN ISO 9239-1, *Reaction to fire tests for floorings - Part 1: Determination of the burning behaviour using a radiant heat source (ISO 9239-1)*

EN ISO 11925-2, *Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2)*

**3 Terms and definitions**

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

**3.1****actual size**

measured size of a cross laminated timber at a related measured/estimated moisture content

**3.2****bonding strength**

structural effectiveness of adhesives between timber pieces when subjected to stresses

**3.3****corrected size**

size of a cross laminated timber corrected by calculation from its actual size to its size at the reference moisture content

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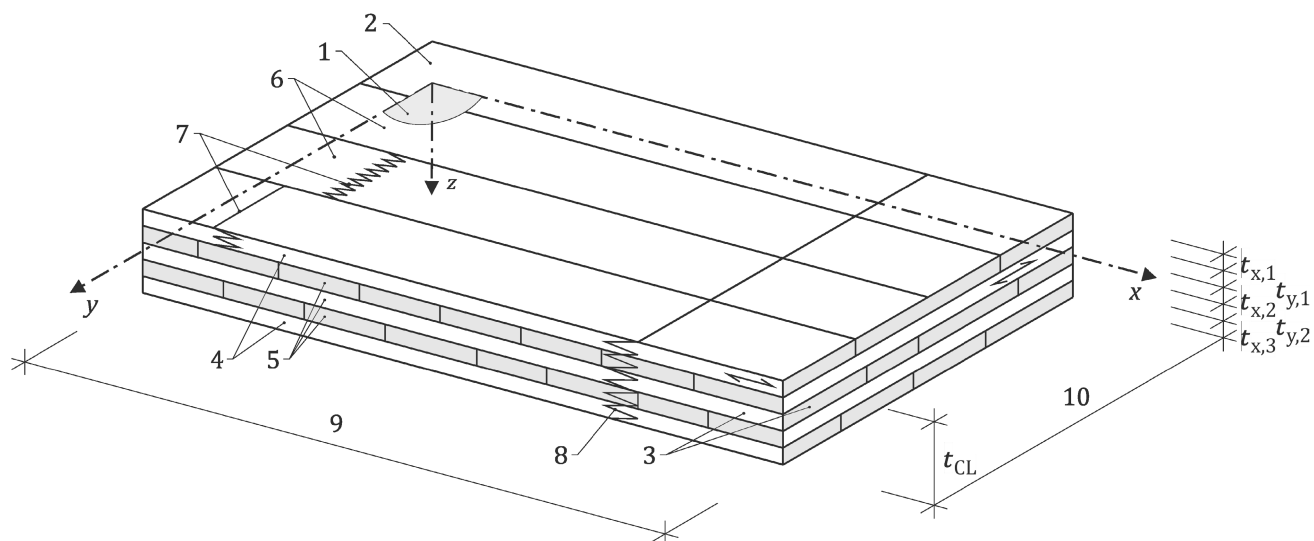
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**3.4****cross laminated timber**

structural timber consisting of at least three face-bonded layers which comprise solid timber laminations and may comprise wood-based panels, at least one layer orthogonally oriented to the two adjacent layers

Note 1 to entry: See also Figure 2.

**Key**

- 1 plane of the element    2 wide face    3 narrow face    4 outer layer

- 5 inner layer                      6 lamination                      7 finger joint in lamination                      8 large finger joint  
9 usually the length                      10 usually the width  $b_{CL}$  of a plate or height  $h_{CL}$  of a beam

**Figure 2 — Cross laminated timber**

### 3.5

#### curved cross laminated timber

cross laminated timber having a precamber greater than 1% of the respective span

### 3.6

#### edge bonds

non-structural bonds between adjacent laminations within a timber layer

### 3.7

#### finger angle

inclination  $\alpha$  of each side of the fingers of a finger joint

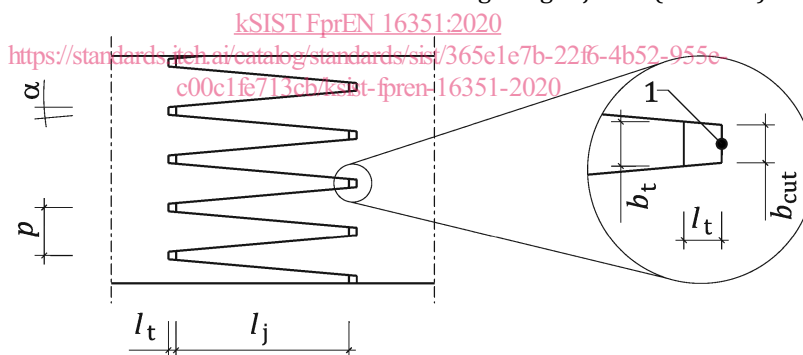
Note 1 to entry: See Figure 3.

### 3.8

#### finger joint

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

Note 1 to entry: In this European Standard, the term finger joint is used for finger joints in laminations whereas finger joints between cross laminated timber are defined as large finger joints (see 3.12).



#### Key

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

**Figure 3 — Typical profile of a finger joint**

### 3.9

#### finger length

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

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Note 1 to entry: See Figure 3.

**3.10****finished thickness**

thickness after planing

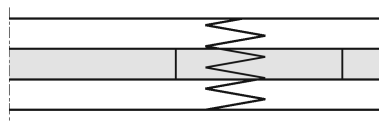
**3.11****laminations**

part of a structural glued timber product consisting of one board or two or more finger-jointed boards

**3.12****large finger joint**

finger joint through the full cross-sectional area of two cross laminated timber components

Note 1 to entry: See Figure 4.



**Figure 4 — Cross laminated timber with large finger joints**

**3.13****layup**

cross-sectional arrangement of timber layers or wood based panel layers in which layers may be made of different species and may be assigned to different strength classes or technical classes

**3.14****maximum delamination length**

largest delamination length in any single glue line measured around the circumference of the test piece

**3.15****mean moisture content**

mean value of the moisture content of cross laminated timber calculated from at least two measurements

Note 1 to entry: See D.3.

**3.16****minimum mean density**

required mean density at reference moisture content, estimated as the weighted mean of the mean densities of the layers, if necessary

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

**3.17****nominal size**

size specified at the reference moisture content to which deviations are related

**3.18****pitch**

distance between centres of adjacent finger tips

Note 1 to entry: See Figure 3.

**3.19****ratio of resin to hardener**

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

**3.20****reduction factor**

ratio  $v$  between tip width and pitch

Note 1 to entry: See Figure 3.

**3.21****reference moisture content**

moisture content of 12 % at which nominal sizes are established

**3.22****relative tip gap**

ratio  $e$  between tip gap and finger length

Note 1 to entry: See Figure 3.

**3.23****rolling shear**

shear stress for which both complementary stress components are perpendicular to the grain

**3.24****solid wood failure**

wood failure which is invariably more than two cell layers away from the adhesive layer

**3.25****timber layer**

layer made of timber laminations with or without edge bonds

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**3.26****tip gap**

distance  $t_p$  between finger-tip and slot base in a bonded finger joint

Note 1 to entry: See Figure 3.

**3.27****tip width**

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

Note 1 to entry: See Figure 3.

**3.28****total delamination length**

sum of delamination lengths of all glue lines measured around the circumference of the test piece

**3.29****wood-based panels**

structural plywood and structural solid wood panels according to EN 13986 and structural LVL according to EN 14374