

SVENSK STANDARD

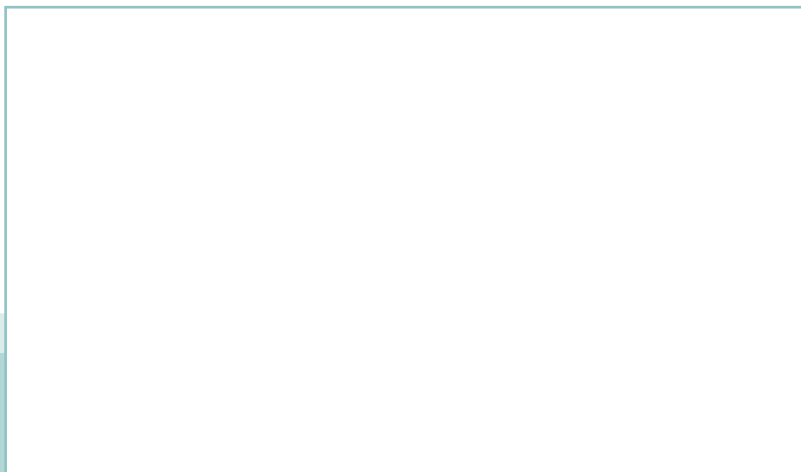
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Timber structures – Cross laminated timber – Requirements



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EUROPEAN STANDARD

EN 16351

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2015

ICS 79.060.10

English Version

Timber structures - Cross laminated timber - Requirements

Structures en bois - Bois lamellé croisé - Exigences

Holzbauwerke - Brettsper Holz - Anforderungen

This European Standard was approved by CEN on 29 August 2015.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents	Page
European foreword.....	6
Introduction	7
1 Scope	8
2 Normative references	9
3 Terms and definitions	10
4 Symbols.....	14
4.1 Main symbols.....	14
4.2 Subscripts.....	15
5 Components and product characteristics, testing and assessment methods.....	16
5.1 Components characteristics.....	16
5.1.1 Timber to be used in laminations	16
5.1.2 Laminations.....	16
5.1.3 Timber layers	17
5.1.4 Wood-based panel layers	17
5.1.5 Species.....	17
5.1.6 Adhesives for the production of cross laminated timber	18
5.2 Characteristics of cross laminated timber	20
5.2.1 General.....	20
5.2.2 Geometrical data	20
5.2.3 Strength and stiffness properties of cross laminated timber	24
5.2.4 Strength and stiffness properties of cross laminated timber with large finger joints.....	25
5.2.5 Bonding strength.....	26
5.2.6 Resistance to fire	27
5.2.7 Reaction to fire.....	27
5.2.8 Dimensional stability.....	29
5.2.9 Release of dangerous substances.....	29
5.2.10 Durability	30
6 Assessment and Verification of Constancy of Performance (AVCP).....	31
6.1 General.....	31
6.2 Type testing.....	31
6.2.1 General.....	31
6.2.2 Test samples, testing and compliance criteria	32
6.2.3 Test reports.....	36
6.2.4 Shared other party results.....	36
6.2.5 Cascading determination of the product type results	37
6.3 Factory production control (FPC)	38
6.3.1 General.....	38
6.3.2 Requirements	39
6.3.3 Product specific requirements.....	45
6.3.4 Initial inspection of factory and of FPC	45
6.3.5 Continuous surveillance of FPC.....	46
6.3.6 Procedure for modifications	46
7 Marking and labelling.....	46

7.1	General	46
7.2	Cross laminated timber	47
Annex A (normative) Release of Formaldehyde.....		48
A.1	General	48
A.2	Classification	48
A.2.1	Cross laminated timber	48
A.2.2	Cross laminated timber with large finger joints	49
Annex B (normative) Additional test methods and requirements for adhesives		50
B.1	General	50
B.2	Long-term sustained load test at cyclic climate conditions with specimens loaded perpendicular to the glue line for moisture curing one-component polyurethane and emulsion polymer isocyanate adhesives (glass house test)	50
B.2.1	General description	50
B.2.2	Production of the specimens	50
B.2.3	Test procedure and climate conditions.....	51
B.2.4	Requirements.....	52
B.2.5	Test report	52
Annex C (normative) Delamination test of glue lines between layers		53
C.1	Principle.....	53
C.2	Apparatus	53
C.2.1	Pressure vessel.....	53
C.2.2	Drying duct.....	53
C.2.3	Balance	53
C.2.4	Metal wedge and hammer	53
C.3	Sampling and preparation of test pieces.....	53
C.4	Procedures	54
C.4.1	General	54
C.4.2	Measurement and evaluation of delamination.....	54
C.4.3	Test cycle	55
C.5	Results	55
C.5.1	General	55
C.5.2	Total delamination.....	55
C.5.3	Maximum delamination	56
C.5.4	Wood failure percentage.....	56
C.6	Test report	56
Annex D (normative) Shear tests		57
D.1	Principle.....	57
D.2	Apparatus	57
D.2.1	Testing machine.....	57
D.2.2	Shearing tool	57
D.3	Test pieces.....	58
D.3.1	General	58
D.3.2	Test pieces for edge bonds in timber layers	58
D.3.3	Test pieces for glue lines between layers	58
D.3.4	Test pieces for testing single glue lines within cross laminated timber	60
D.3.5	Sampling of test pieces	60
D.3.6	Marking of test pieces	61
D.4	Procedure	61
D.5	Results	61
D.6	Test report	62

Annex E (normative) Tests with laminations with or without finger joints (including compliance criteria)	63
E.1 Sampling	63
E.1.1 General	63
E.1.2 For type testing	63
E.1.3 For factory production control	63
E.2 Testing	63
E.2.1 General	63
E.2.2 Additional requirements for type testing	63
E.2.3 Additional requirements for factory production control	63
E.3 Compliance criteria of finger joints in laminations	64
E.3.1 For type testing	64
E.3.2 For factory production control	64
E.4 Report of tests with finger joints in laminations	64
E.5 Tests with laminations without finger joints	65
Annex F (normative) Determination of strength, stiffness and density properties of cross laminated timber	66
F.1 Indices	66
F.2 General	69
F.2.1 Sampling	69
F.2.2 Specimens	69
F.2.3 Testing	69
F.2.4 Analysis of test results	70
F.2.5 Test reports	70
F.3 Characteristics determined by tests with loads perpendicular to the plane	70
F.3.1 Bending test	70
F.3.2 (Rolling) shear strength and stiffness derived from bending tests	71
F.3.3 (Rolling) shear strength and stiffness derived from shear test (alternative test method)	72
F.3.4 Compression perpendicular to the plane	74
F.3.5 Large finger joint - Bending test	74
F.4 Characteristics determined by tests with in-plane loads	75
F.4.1 Bending	75
F.4.2 Shear values within a layer - net cross section	76
F.4.3 Shear values for glue lines between layers - torsional shear	77
F.4.4 Shear stiffness for cross laminated timber in plane by bending test	78
F.4.5 Large finger joint - Bending test	79
Annex G (normative) Measurement of moisture content	80
G.1 General	80
G.2 Measurement of moisture content of boards during production	80
G.3 Mean moisture content of cross laminated timber made from timber laminations	80
Annex H (normative) Separation tests with finger joints in laminations produced with contact-free application of adhesive	81
Annex I (normative) Minimum production requirements	82
I.1 Personnel	82
I.2 Production and storage facilities	82
I.2.1 General	82
I.2.2 Facilities for drying and storage of timber	82
I.2.3 Facilities for processing and storage of adhesives	82
I.2.4 Facilities for production and curing	82
I.3 Equipment	83
I.4 Finger joints in laminations	83

I.4.1	Wane and edge damages	83
I.4.2	Finger joint geometry	84
I.4.3	Knots and local grain deviation	84
I.4.4	Moisture content at bonding	85
I.4.5	Bonding surface and application of the adhesive	85
I.4.6	Time between cutting and adhesive application	86
I.4.7	Pressure	86
I.4.8	Curing.....	86
I.5	Bonding of laminations and layers.....	87
I.5.1	General	87
I.5.2	Moisture content at bonding	87
I.5.3	Bonding surfaces and adhesive application.....	87
I.5.4	Cramping.....	87
I.5.5	Glue line thickness	87
I.5.6	Curing.....	88
I.6	Cross laminated timber with large finger joints	88
I.6.1	Cross laminated timber to be jointed.....	88
I.6.2	Moisture content at bonding	88
I.6.3	Finger joint geometry.....	88
I.6.4	Machining of the fingers.....	88
I.6.5	Adhesive, bonding surface and adhesive application	88
I.6.6	Cramping.....	89
I.6.7	Glue line thickness	89
I.6.8	Curing.....	89
Annex ZA (informative) Clauses of this European Standard addressing the requirements of the EU Construction Products Regulation		90
Bibliography		102

European foreword

This document (EN 16351:2015) 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 April 2016, and conflicting national standards shall be withdrawn at the latest by July 2017.

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.

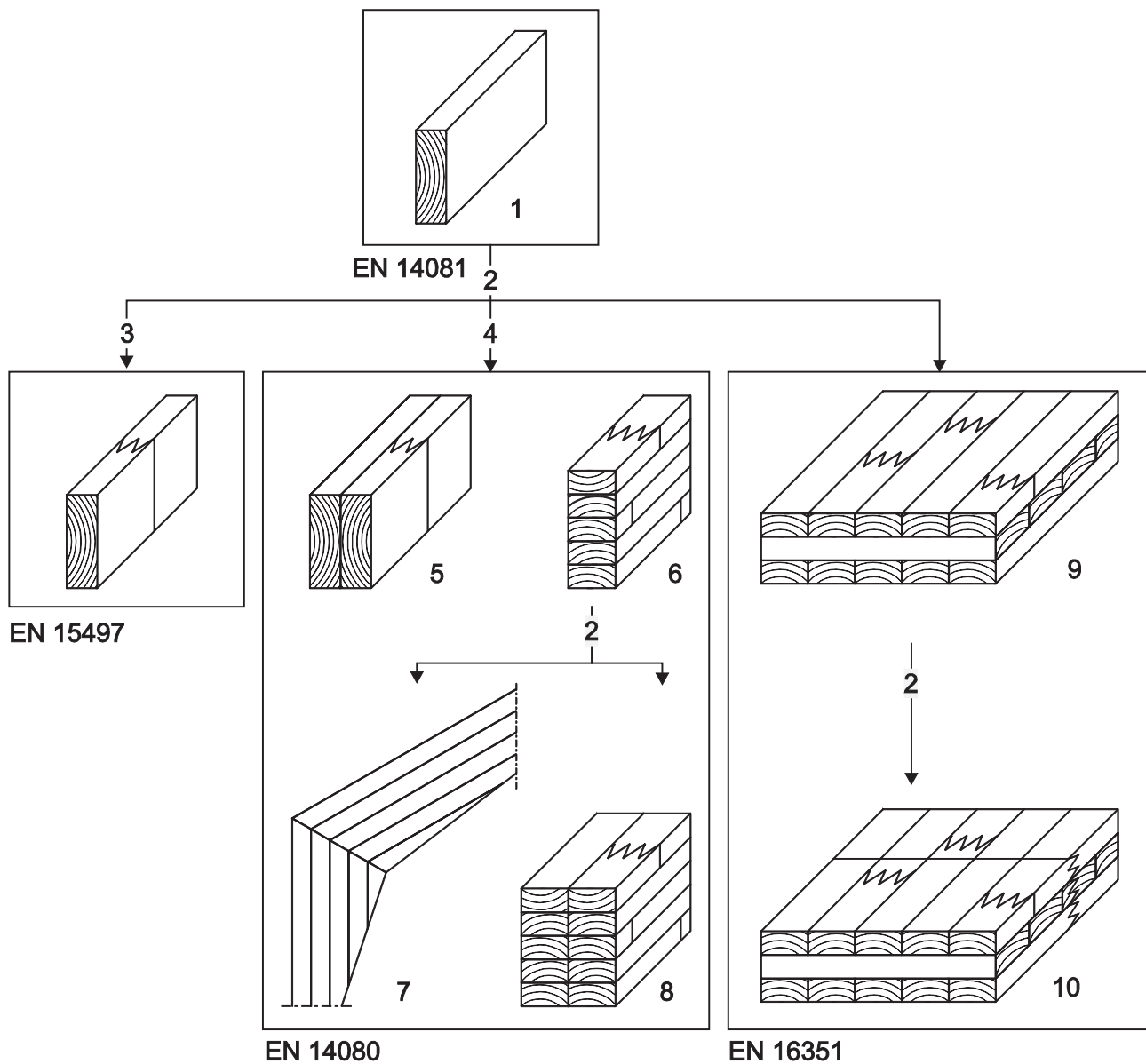
This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports basic work requirements of Regulation (EU) No 305/2011.

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 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 prepared by CEN/TC 124

1 Scope

This European Standard sets out provisions regarding the performance characteristics for straight and curved structural cross laminated timber (X-Lam) both without and with large finger joints as a material for the manufacture of structural elements to be used in buildings and bridges.

This European Standard applies to cross laminated timber:

- to be used in service class 1 or 2 according to EN 1995-1-1;
- made of coniferous species and poplar listed in 5.1.5 of this standard;
- built up of at least three orthogonally bonded layers (at least two of them timber layers);
- having, depending on the number of layers, adjacent layers which may be 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 thicknesses between 6 mm and 60 mm (including) taking into account the layup requirements given in this European standard;
- made of timber layers which may be edge bonded or which are not bonded and have spacing less than 6 mm between adjacent laminations;
- which may comprise wood based panel layers made of structural wood based panels specified in this European standard, fulfilling the requirements for use in service class 2 or 3 according to EN 1995-1-1, having no structural joints between the single panels and having thicknesses between 6 mm and 45 mm (including);
- bonded with adhesives, fulfilling the requirements given in this European standard;
- having overall thicknesses up to 500 mm;
- which is not made from reused timber or wood based panels comprising reused timber.

This European Standard also applies to cross laminated timber with large finger joints:

- made from cross laminated timber pieces having the same cross section and layup;
- made from cross laminated timber pieces having cross sectional thicknesses from 51 mm up to 345 mm (inclusive) and minimum thicknesses of the outermost layers not less than 17 mm.
- made from cross laminated timber pieces solely comprising timber layers;
- made from plane cross laminated timber pieces jointed so that no regular change between the grain directions of the layers occurs;
- 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.

This European Standard applies to cross laminated timber treated against biological attack. Cross laminated timber treated with fire retardants is not covered.

It also sets out minimum production requirements and procedures for Assessment and Verification of Constancy of Performance.

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

EN 338, *Structural timber - Strength classes*

EN 350-1, *Durability of wood and wood-based products — Natural durability of solid wood — Part 1: Guide to the principles of testing and classification of the natural durability of wood*

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 789:2004, *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 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*

SS-EN 16351:2015 (E)

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

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 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 14374, *Timber structures — Structural laminated veneer lumber — Requirements*

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 15416-5, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — 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 purpose of this document, the following terms and definitions apply.

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

3.4

cross laminated timber

X-Lam

structural timber consisting of at least three layers of which a minimum of three are orthogonally bonded, which always comprise timber layers and may also comprise wood-based panel layers

Note 1 to entry: See also 5.2.2.7.

Note 2 to entry: Cross laminated timber in accordance with EN 16351 and multilayer solid wood panels in accordance with EN 13353 may have the same layup but the timber to be used in laminations is strength graded according to EN 14081-1 and the adhesives are tested according to 5.1.6 of this European Standard.

3.5

curved cross laminated timber

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

3.6

edge bonds

bonds between adjacent laminations within a timber layer

3.7

edge bonded layer

timber layer comprising structural edge bonds

3.8

finger angle

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

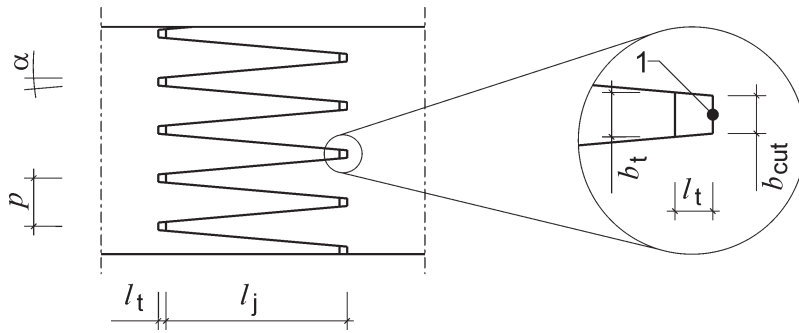
Note 1 to entry: See Figure 2.

3.9

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 3.13).



Key

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

Figure 2 — Typical profile of a finger joint

3.10

finger length

distance l_j 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.

3.11

finished thickness

thickness after planing

3.12

laminations

structural timber boards, finger jointed unless the length of a single board matches the lamination length, being part of timber layers in cross laminated timber

3.13

large finger joint

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

Note 1 to entry: See Figure 3.

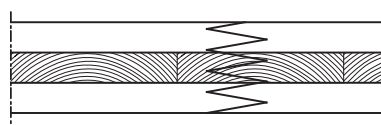


Figure 3 — Cross laminated timber with large finger joints

3.14**layup**

cross sectional arrangement of timber layers or wood-based panel layers in which each layer may be made of different species and may have different strength classes, manufacturer specific strength classes or technical classes

3.15**manufacturer specific strength class**

set of characteristic strength, stiffness and density properties not tabulated in a standard

3.16**maximum delamination length**

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

3.17**mean moisture content**

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

Note 1 to entry: See G.3.

3.18**minimum mean density**

required 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.

3.19**pitch**

distance between centres of adjacent finger tips

Note 1 to entry: See Figure 2.

3.20**ratio of resin to hardener**

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

3.21**reduction factor**

ratio between tip width and pitch

Note 1 to entry: See Figure 2.

3.22**reference moisture content**

moisture content at which target sizes are established

3.23**relative tip gap**

ratio between tip gap and finger length

Note 1 to entry: See Figure 2.

SS-EN 16351:2015 (E)**3.24****rolling shear**

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

3.25**target size**

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

3.26**timber layer**

layer made of edge bonded or non-edge bonded timber laminations

3.27**tip gap**

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

Note 1 to entry: See Figure 2.

3.28**tip width**

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

Note 1 to entry: See Figure 2.

3.29**total delamination length**

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

3.30**wood-based panels**

structural plywood, structural laminated veneer lumber (LVL) and structural solid wood panels according to EN 13986 and structural LVL according to EN 14374

3.31**wood-based panel layer**

layer made of one type and technical class of wood-based panels

3.32**wood failure**

rupture in or between wood fibres

3.33**wood failure percentage**

percentage of the wood failure area in relation to the total sheared or split area

4 Symbols**4.1 Main symbols**

A	area, in mm ² ;
A_w	area of wane, in mm ² (see Figure I.1);
a_w	length of the diagonal of wane, in mm (see Figure I.1);

b	width, in mm;
b_{cut}	tip width of the cutter (see Figure 2);
b_t	tip width, in mm (see Figure 2);
C	compression force in N (for indices see also Figures F.1 and F.2 and Tables F.1 to F.3);
d	diameter, in mm;
$Delam_{\text{max}}$	maximum delamination, in %;
$Delam_{\text{tot}}$	total delamination, in %;
e	relative tip gap;
f	strength, in N/mm ² ;
G	shear modulus, in N/mm ² ;
k	moisture deformation factor;
k_{15}	statistical factor;
l	length, in mm;
l_j	finger length, in mm (see Figure 2);
l_t	tip gap, in mm (see Figure 2);
p	pitch, in mm (see Figure 2);
M	Moment, in Nmm (for indices see also Figures F.1 and F.2 and Tables F.1 to F.3);
r	radius of curvature, in mm;
R	Resistance to forces in N or to moments in Nm (for indices see also Figures F.1 and F.2 and Tables F.1 to F.3);
t	thickness, in mm;
T	Tension force in N (for indices see also Figures F.1 and F.2 and Tables F.1 to F.3);
u	moisture content, in %;
V	Shear force in N (for indices see also Figures F.1 and F.2 and Tables F.1 to F.3);
w	deflection, in mm;
α	finger angle, in degree (see Figure 2);
ρ	density, in kg/m ³ ;
v	reduction factor of a finger joint.

4.2 Subscripts

a	actual;
c	compression;
cor	corrected;
dc	declared value;
j	properties of finger joints in laminations;
k	characteristic;
l	properties of laminations;