This is a free page sample. Access the full version online.

NSAI Standards

Irish Standard
I.S. EN 16351:2015

Timber structures - Cross laminated timber - Requirements

© CEN 2015 No copying without NSAI permission except as permitted by copyright law.

This is a free page sample. Access the full version online.

I.S. EN 16351:2015

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:	*Published:*
EN 16351:2015	2015-10-14

This document was published under the authority of the NSAI and comes into effect on:	ICS number:
2015-11-02	79.060.10
	NOTE: If blank see CEN/CENELEC cover page

NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

This is a free page sample. Access the full version online.

National Foreword

I.S. EN 16351:2015 is the adopted Irish version of the European Document EN 16351:2015, Timber structures - Cross laminated timber - Requirements

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

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This is a free page sample. Access the full version online.

This page is intentionally left blank

This is a free page sample. Access the full version online.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16351

October 2015

ICS 79.060.10

English Version

Timber structures - Cross laminated timber - Requirements

Structures en bois - Bois lamellé croisé - Exigences

Holzbauwerke - Brettsperrholz - Anforderungen

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

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2015 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 16351:2015 E

This is a free page sample. Access the full version online.

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

This is a free page sample. Access the full version online.

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

This is a free page sample. Access the full version online.

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

This is a free page sample. Access the full version online.

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**

This is a free page sample. Access the full version online.

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.

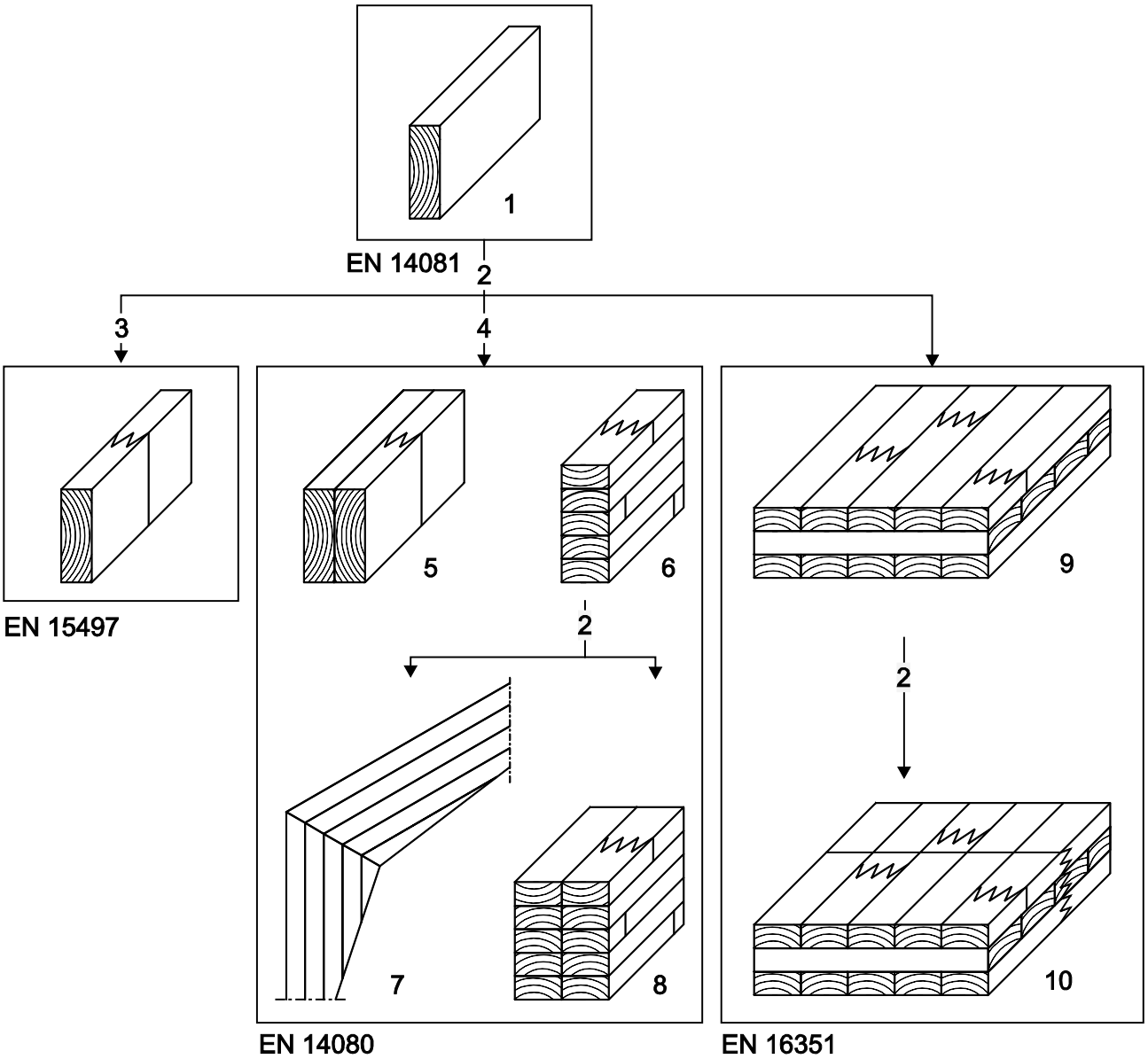
For relationship with the EU Regulations, see informative Annex ZA, which is an integral part of this document.

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.

This is a free page sample. Access the full version online.

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

This is a free page sample. Access the full version online.

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.

This is a free page sample. Access the full version online.

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*

SAI GLOBAL

This is a free preview. Purchase the entire publication at the link below:

Product Page

Looking for additional Standards? Visit Intertek Inform Infostore

Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation