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Timber structures — Cross laminated timber —

Part 1: Component performance, production requirements and certification scheme

Structures en bois — Plaques reconstituées à base de lamelles croisées —

Partie 1: Performances des composants et exigences de production et système de certification

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 165, *Timber structures*.

A list of all parts in the ISO 16696 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The general principle of this document is that a certain level of performance and production techniques are required in the production of cross laminated timber (CLT) to be acceptable for structural application of the product. This document specifies the minimum requirements for CLT production and performance assessment.

This document was based heavily on the draft European Standard EN 16351 prepared by Technical Committee CEN/TC 124 and the North American Standard ANSI/APA PRG 320. The technical contents from these standards were merged and modified to bring it into conformance with ISO procedures and requirements. The ISO 16696 series consists of two parts: this document (Part 1) gives performance and production requirements for CLT, which also includes conformance requirements, as provided in Annex D; ISO 16696-2 provides guidance on how CLT is to be installed and used.

The bibliography lists standards referenced during the development of this document.

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Timber structures — Cross laminated timber —

Part 1:
Component performance, production requirements and certification scheme

1 Scope

This document establishes the basic principles for component performance and minimum production requirements for cross laminated timber (CLT). This document also contains scheme requirements for conformance, as provided in Annex D.

The document is applicable to CLT products which are manufactured from solid-sawn timber or wood based panels built up of at least three layers in which the grain of adjoining layers are at right angles to each other.

This document provides CLT dimension tolerances; component requirements; performance criteria; production, testing and trade marking guidance; and minimum requirements for factory production control. This document is based on known species, species combination and/or wood based panel structural performance and bondability.

CLT qualified in accordance with the provisions of this document are intended to resist the effects of moisture on structural performance as can occur due to construction delays or other conditions of similar severity.

NOTE This document does not include how CLT is to be used and installed, as it will be detailed in ISO 16696-2.

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 16351, *Timber structures — Cross laminated timber — Requirements*

ISO/IEC 3130, *Wood — Determination of moisture content for physical and mechanical tests*

ISO 10983, *Timber — Finger joints — Minimum production requirements and testing methods*

ISO/IEC 12460 (all parts), *Wood-based panels — Determination of formaldehyde release*

ISO/IEC 13910, *Structural timber — Sampling, full-size testing, and evaluation of the characteristic values of strength graded timber*

ISO/IEC 16979, *Wood based panels — Determination of moisture content*

ISO 20152-1, *Timber structures — Bond performance of adhesives — Part 1: Basic requirements*

ISO 20152-2:2011, *Timber structures — Bond performance of adhesives — Part 2: Additional requirements*

3 Terms and definitions

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

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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 CLT product at a related moisture content

3.2
adhesive
substance capable of bonding materials together

3.3
adherend
material held to another material by an adhesive

3.4
bond
attachment at an interface between adhesive and adherends or the act of attaching adherends together by adhesive

3.5
bondline
layer of adhesive which attaches two adherends

3.6
characteristic value
structural property estimate, typically a population mean for stiffness properties or a tolerance limit (5^{th} percentile with 75 % confidence) for strength properties

Note 1 to entry: As estimated from the test data that is representative of the population being sampled as determined in accordance with ISO 12122-1.

3.7
corrected size
actual size of a CLT product corrected by calculation to the reference moisture content

3.8
corrective action
action to eliminate the cause of nonconformities

3.9
cross laminated timber
CLT
a prefabricated engineered wood product made of at least three orthogonal layers of graded sawn lumber or wood based panels that are laminated by gluing with structural adhesives

3.10
CLT thickness
dimension of the CLT panel measured perpendicular to the plane of the panel

3.11
delamination
separation of layers in a laminate due to failure of the adhesive either in the adhesive itself or at the interface between the adhesive and the adherend

3.12
edge
panel edge
narrow face of a panel that exposes the ends or narrow faces of the laminations

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3.13
edge gluing
edge joints
gluing the edges of adjacent lamination within a CLT layer

3.14
end joint
joint made by gluing of the finger joints of the same laminations within a CLT layer prior to laminating adjacent layers

3.15
face
one of the four longitudinal surfaces of a piece or panel

3.16
face bondline
bondline joining the wide faces of the laminations in adjacent layers

3.17
factory production control
FPC
procedures, regular inspections and tests which ensure that products placed on the market conform to the performance requirements stated by the manufacturer

3.18
finger angle
α
inclination of the fingers of a finger joint

Note 1 to entry: see Figure 1.

3.19
finger joint
self-locating end joint formed by machining a number of similar, tapered, symmetrical fingers in the ends of solid sawn timber components, which are formed by a finger joint cutter and then bonded together

Note 1 to entry: see Figure 1.

3.20
finger length
l_j
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 1.

3.21
finished thickness and width
thickness and width after planing

3.22
lamination
solid sawn timber or wood based panels, including stress rated boards and manufactured timber which has been prepared to be a layer

3.23
large finger joint
finger joint through the full cross sectional area at the end of plane cross laminated components solely made of solid sawn timber layer, having identical cross sectional layups and bonded together

Note 1 to entry: see Figure 2.

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3.24
layer
all laminations on one side of a face bondline and consist of one solid sawn timber grade or one grade of wood based panel

3.25
layup
cross-sectional arrangement of layers of solid sawn timber or wood based panels, which may have different species, strength classes, strength profiles, thicknesses or technical classes (3.41), into a CLT product

3.26
manufacturing standard
procedures established by manufacturer to produce and maintain a product with the stated performance requirements

3.27
major strength direction
general direction of the grain of the outermost layers of the CLT panel

3.28
maximum delamination length
largest delamination length in any single glue line measured around the circumference of the test piece

3.29
minor strength direction
direction perpendicular to the major strength direction of the CLT panel

3.30
moisture content
u
amount of water present in solid sawn timber or wood based panels, expresses as percentage of oven dry mass

Note 1 to entry: Determined in accordance with ISO 3130 or ISO 16979.

3.31
panel
single CLT billet formed by bonding lamination with a structural adhesive

3.32
pitch
distance between fingers, measured from centre to centre

Note 1 to entry: see Figure 1.

3.33
ply
all laminations between two adjacent bondline and consist of one solid sawn timber grade or one grade of wood-based panel

3.34
service class 1
service class characterized by a moisture content in the materials corresponding to a temperature of 20 °C and a relative humidity of the surrounding air exceeding 65 % for a few weeks per year

Note 1 to entry: In Service Class 1, the average equilibrium moisture content of most softwoods does not exceed 12 %.

[SOURCE: ISO 20152-1:2010, 3.1]

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3.35
service class 2
service class characterized by a moisture content in the materials corresponding to a temperature of 20 °C and a relative humidity of the surrounding air exceeding 85 % for a few weeks per year

Note 1 to entry: In Service Class 2, the average equilibrium moisture content of most softwoods does not exceed 20 %. Such conditions include resistance to the effects of moisture on structural performance due to construction delays or other conditions of similar severity.

[SOURCE: ISO 20152-1:2010, 3.2]

3.36
service class 3
service class characterized by climatic conditions leading to higher moisture content than Service Class 2 such as occurs when a member is fully exposed to the weather

[SOURCE: ISO 20152-1:2010, 3.3]

3.37
solid sawn timber grade
a solid sawn wood product population produced with standardized rules that maintain well-defined limits on strength-controlling characteristics or properties

3.38
specific gravity
ratio of the oven-dry mass of a specimen to the mass of a volume of water equal to the volume of the specimen at the specified moisture content

3.39
surveillance of FPC
continual monitoring of the factory production control test plan(s) and production processes

3.40
target size
size specified (at the reference moisture content) to which deviations are related

3.41
technical class
class of product performance included in a standard for the purpose of relating product performance to its intended use

3.42
tip gap
l_t
distance between fingertip and slot base in a bonded finger joint

Note 1 to entry: see Figure 1.

3.43
tip width
b_t
distance between finger faces, measured at the tip of the finger

Note 1 to entry: see Figure 1.

3.44
total delamination length
sum of delamination lengths of all glue lines around the circumference of a test piece

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3.45
wood based panel
engineered wood product that is intended for structural use and bonded with adhesives, such as oriented strand board (OSB), plywood, laminated veneer lumber (LVL), and plywood and single-layered solid wood panels

3.46
wood failure
rupture in or between wood fibres

3.47
wood failure percentage
area of wood fibre remaining at the bondline following the rupture of wood fibres from the specified shear test, expressed as a percentage of total area involved in such failure

4 Symbols and subscripts

4.1 Symbols

b_{cut} tip width of the cutter, in mm

b_l finished lamination width, in mm

E modulus of elasticity in bending, in MPa

f_b characteristic bending strength of CLT, in MPa

h depth of cross section, in mm

h_a actual depth, in mm

h_{cor} corrected depth, in mm

k moisture deformation factor perpendicular to the grain for a change in moisture content of 1 % for moisture contents between 6 % and 25 %

l length, in mm

n number

p pitch, in mm

S section modulus, in mm^3, of the composite CLT section for calculating the moment capacity of CLT

t thickness, in mm

t_l finished lamination thickness, in mm

u_a actual moisture content, in %

4.2 Subscripts

a actual

cor corrected

ref referenced

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