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ITeC

**Institut de
Tecnologia de la Construcció
de Catalunya**

Member of EOTA

European Technical Approval

ETA 11/0464

Nombre comercial
Trade name

EGO_CLT™

Titular del DITE
Holder of approval

Egoin SA
Astei
E-48287 Natxitua-Ea
Bizkaia, Spain

Tipo genérico y uso del
producto de construcción

Madera contralaminada – Panel de tablas de madera maciza para su uso como elemento estructural en edificación.

*Generic type and use
of construction product*

Cross Laminated Timber (CLT) – Solid wood slab element to be used as a structural element in buildings.

Validez: de
Validity: from
hasta
to

30-11-2011

29-11-2016

Planta de fabricación
Manufacturing plant

Astei
E-48287 Natxitua-Ea
Bizkaia, Spain

El presente Documento de
Idoneidad Técnica Europeo
contiene:

16 páginas, incluyendo anexos 1, 2 y 3 que forman parte del documento.

*This European Technical
Approval contains:*

16 pages including annexes 1, 2 and 3 which form an integral part of the document.



Organización Europea para la Idoneidad Técnica

European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European Technical Approval is issued by the Catalonia Institute of Construction Technology (ITeC) in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - Real Decreto 1630/1992, de 29 de diciembre, por el que se dictan disposiciones para la libre circulación de productos de construcción en aplicación de la Directiva 89/106/CEE⁴;
 - Real Decreto 1328/1995, de 28 de julio, por el que se modifican, en aplicación de la Directiva 93/68/CEE, las disposiciones para la libre circulación aprobadas por el Real Decreto 1630/1992, de 29 de diciembre. (BOE 19-8-95) y la Orden CTE/2276/2002 de 4 de septiembre;
 - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the annex to Commission Decision 94/23/EC⁵.
- 2 The Catalonia Institute of Construction Technology (ITeC) is authorized to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.
- 3 This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 laid down in the context of this European Technical Approval.
- 4 This European Technical Approval may be withdrawn by the Catalonia Institute of Construction Technology (ITeC), in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
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- 6 The European Technical Approval is issued in Spanish by the Catalonia Institute of Construction Technology (ITeC). This version corresponds fully to the version circulated in EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities N° L 40, 11.2.1989, p.12.

² Official Journal of the European Communities N° L 220, 30.8.1993, p.1.

³ Official Journal of the European Communities N° L 284, 31.10.2003, p.1.

⁴ Boletín Oficial del Estado núm. 34 de 9 de febrero de 1993.

⁵ Official Journal of the European Communities N° L 17, 20.1.1994, p.34.

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of products and intended use

1.1 Definition of the construction product

1.1.1 General

EGO_CLT™ panel is made of softwood boards which are bonded together in order to form cross laminated timber (solid wood slab element). Adjacent layers are arranged perpendicularly (angle of 90°) to each other, see annex 1. Cross-sections of the solid wood slabs are symmetric.

The lay up of cross laminated timber is shown in annex 1. Dimensions and specifications are shown in annex 2. Surfaces are planed.

The application of chemical substances (wood preservatives and flame retardant agents) is not subject to this European Technical Approval.

1.1.2 Wood

Wood species used in the softwood species and its strength classes used in the boards of EGO_CLT™ and its strength classes are *Picea Abies* for C24, or *Pinus Radiata* for C18.

1.2 Intended use

The solid wood slab is intended to be used as structural element in buildings and timber structures in service classes 1 and 2 according to EN 1995-1-1.

The solid wood slab is subject to static and quasi static actions only.

In a roof construction, the solid wood slab will not contribute to the watertightness, but will receive a suitable waterproofing or roof covering. Waterproofing and roof covering are not covered by this European Technical Approval.

1.3 Assumed working life

The provisions made in this European Technical Approval are based on an assumed intended working life of solid wood slab elements of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer or the Approval Body, but are regarded only as a means for selecting the appropriate product in relation to the expected, economically reasonable working life of the construction works.

2 Characteristics of products and methods of verification

The assessment of the fitness of EGO_CLT™ for the intended use considering the relevant characteristics was performed following the document *Solid wood slab element to be used as a structural element in buildings*; version June 2005.

EGO_CLT™ and their boards are defined in annexes 1 and 2.

2.1 Mechanical resistance and stability (ER 1)

The resistance and stiffness design values of each EGO_CLT™ configuration for each project shall be calculated according to EN 1995-1-1, and the design principles given in annex 3. Tension perpendicular to the solid wood slab shall be avoided.

The specification of the boards is given in annex 1. Boards of *Picea Abies* (C24) are strength graded by the supplier. Boards of *Pinus Radiata* (C18) are visually strength graded by the manufacturer.

2.1.1 Load bearing capacity and stiffness regarding mechanical actions perpendicular to the solid wood slab

Property	Verification method	Reference value	Class	Numeric value (MPa)
Strength class of boards	-----	EN 338	C18 C24	-----
Modulus of elasticity				
- parallel to the grain of the boards $E_{0,mean}$	- I_{ef} - Annex 3 of ETA - Clause 4.1.1.1 ⁽¹⁾	EN 338 EN 1194	C18 C24	9.000 11.600
- perpendicular to the grain of the boards $E_{90,mean}$	-----	EN 338 EN 1194	C18 C24	300 390
Shear modulus				
- parallel to the grain of the cover boards G_{mean}	-----	EN 338 EN 1194	C18 C24	560 720
- perpendicular to the grain of the cover boards (rolling shear modulus) $G_{R,mean}$	- Clause 4.1.1.1 ⁽¹⁾	-----	C18 C24	50 50
Bending strength				
- parallel to the grain of the boards $f_{m,k}$	- W_{ef} - Annex 3 of ETA - Clause 4.1.1.1 ⁽¹⁾	EN 338 EN 1194	C18 C24	18,0 24,0
Tensile strength				
- perpendicular to the grain of the boards $f_{t,90,k}$	-----	EN 338	C18 C24	0,4 0,4
Compressive strength				
- perpendicular to the grain of the boards $f_{c,90,k}$	-----	EN 338 EN 1194	C18 C24	2,2 2,7
Shear strength				
- parallel to the grain of the cover boards $f_{v,k}$	-----	EN 338	C18 C24	3,4 4,0
- perpendicular to the grain of the cover boards (rolling shear strength) $f_{R,v,k}$	- A_{gross} - Annex 3 of ETA - Clause 4.1.1.3 ⁽¹⁾	-----	C18 C24	0,65 0,65

⁽¹⁾ Document: *Solid wood slab element to be used as a structural element in buildings*.

Table 1: Mechanical capacities with actions perpendicular to the solid wood slab EGO_CLT™.

2.1.2 Load bearing capacity and stiffness regarding mechanical actions in plane of the solid wood slab

Property	Verification method	Reference value	Class	Numeric value (MPa)
Strength class of boards	-----	EN 338	C18 C24	-----
Modulus of elasticity				
- parallel to the grain of the cover boards $E_{0,mean}$	- A_{net} - Annex 3 of ETA - Clause 4.1.2.1 ⁽¹⁾	EN 338 EN 1194	C18 C24	9.000 11.600
Bending strength				
- parallel to the grain of the boards $f_{m,k}$	- A_{net} - Annex 3 of ETA - Clause 4.1.2.1 ⁽¹⁾	EN 338 EN 1194	C18 C24	18,0 24,0
Tensile strength				
- parallel to the grain of the boards $f_{t,0,k}$	-----	EN 338 EN 1194	C18 C24	11,0 16,5
Compressive strength				
- parallel to the grain of the boards $f_{c,0,k}$	-----	EN 338 EN 1194	C18 C24	18,0 24,0
Shear strength				
- parallel to the grain of the boards $f_{v,0,k}$	- A_{net} - Annex 3 of ETA - Clause 4.1.2.3 ⁽¹⁾	-----	C18 C24	5,0 5,0

⁽¹⁾ Document: *Solid wood slab element to be used as a structural element in buildings.*

Table 2: Mechanical capacities with actions in plane of the solid wood slab EGO_CLT™.

2.1.3 Embedding strength

Joint design and embedding strength values given in EN 1995-1-1 for solid timber shall be used.

2.1.4 Creep and duration of load

The modification factors k_{def} (creep) and k_{mod} (duration of load) shown in the tables 3 and 4, respectively, shall be used.

	k_{def} (Creep)	
	Actions in plane of the slab ⁽¹⁾	Actions perpendicular to the slab ⁽²⁾
Service class 1	0,60	0,80
Service class 2	0,80	1,00

⁽¹⁾ In case of actions in plane of the slab, the creep of EGO_CLT™ corresponds to the creep of solid wood.

⁽²⁾ In case of actions perpendicular to the slab, the creep of EGO_CLT™ corresponds to the creep of plywood.

Table 3: Values of k_{def} (creep) to be used in EGO_CLT™.

k_{mod} (duration of load)					
Actions perpendicular and in plane of the slab ⁽¹⁾					
	Permanent	Long term	Medium term	Short term	Instantaneous
Service class 1	0,60	0,70	0,80	0,90	1,10
Service class 2	0,60	0,70	0,80	0,90	1,10

⁽¹⁾ In case of actions perpendicular and in plane of the slab, the duration of load of EGO_CLT™ corresponds to the duration of load of solid wood.

Table 4: Values of k_{mod} (duration of load) to be used in EGO_CLT™.

2.1.5 Dimensional stability

2.1.5.1 Tolerances of dimensions

According to a manufacturer's declaration, tolerances of dimensions are as follows, given in standard ambient conditions (20 ± 2°C temperature, 65 ± 5% relative humidity):

- Thickness (h): ± 1 mm for solid wood slabs of 60, 73, 86, 99 and 135 mm of thickness.
± 2 mm for solid wood slabs of 165 and 225 mm of thickness.
± 3 mm for solid wood slabs of 231 mm of thickness.
- Length (l): ± 2 mm.
- Width (b): ± 2 mm.

2.1.5.2 Stability of dimensions

Moisture content of the solid wood slab varies between 10 and 16%. However, during manufacturing, the moisture content between the boards within one slab has to be between 10 and 14%.

Due to changing temperature and relative humidity of the surrounding air the moisture content of the solid wood slab will continuously change.

According to a manufacturer's declaration, the stability of dimensions is:

- Longitudinal to the grain direction: 1,2%.
- Radial to the grain direction: 0,3%.
- Perpendicular to the grain direction: 0,0005 %.

2.1.5.3 Thermal expansion

Not relevant.

2.2 Safety in case of fire (ER 2)

2.2.1 Reaction to fire

According to Commission Decision 2003/43/EC, and to Commission Decision 2007/348/EC, EGO_CLT™ is classified as:

- Reaction to fire class D-s2, d0 for walls and roofs.
- Reaction to fire class D_{FL}-s1 for floors.

2.2.2 Resistance to fire

No performance determined for resistance to fire.

2.3 Hygiene, health and environment (ER 3)

2.3.1 Release of dangerous substances

According to the manufacturer's declaration, EGO_CLT™ does not contain harmful or dangerous substances as defined in the *Indicative list of regulated dangerous substances possibly associated with construction products under the CPD, DS 041/051*.

According to the manufacturer's declaration, possible harmful or dangerous substances contained in EGO_CLT™ as defined in Annex VI of the regulation (CE) N° 1272/2008 are defined as NPD.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

2.3.2 Vapour permeability

No performance determined for water vapour permeability.

2.3.3 Application of biocides

According to the manufacturer's declaration, EGO_CLT™ does not contain biocides.

2.4 Safety in use (ER 4)

2.4.1 Slipperiness

Not relevant.

2.5 Protection against noise (ER 5)

2.5.1 Airborne sound insulation

No performance determined for airborne sound insulation.

2.5.2 Impact sound insulation

No performance determined for impact sound insulation.

2.5.3 Sound absorption

No performance determined for sound absorption.

2.6 Energy economy and heat retention (ER 6)

2.6.1 Thermal resistance

No performance determined for thermal resistance.

2.6.2 Air tightness

No performance determined for air tightness.

2.6.3 Thermal inertia

No performance determined for thermal inertia.

2.7 Aspects of durability, serviceability and identification of the product

2.7.1 Durability of timber

Natural durability for the timber species used in EGO_CLT™ slabs is indicated in the following table:

Natural durability according to EN 350-1 and EN 350-2				
	Fungus attack	Hylotrupes attack	Anobium attack	Termites attack
<i>Pinus Radiata</i> (C18)	4-5	S	SH	S
<i>Picea Abies</i> (C24)	4	SH	SH	S

Table 5: Natural durability according to EN 350-1 and EN 350-2.

Structural wood components are in hazard class 1, except wood components in suspended ground floors, which are in hazard class 2, according EN 335-1 and EN 335-2.

When necessary and required by the local authorities at the building site, solid wood slab elements shall be treated against biological attack according to the rules valid at the place. Any adverse effects of the treatment on other properties of the slab shall be taken into account. These kinds of treatments are not subject to the ETA.

2.7.2 Bond integrity

The adhesives used in bonding layers, as well as in the finger joints, correspond to type I according to EN 301.

2.7.3 Serviceability

Deflections of floor, roof and wall made of solid wood slabs elements are to be determined according to each building project.

2.7.4 Identification of the product

The ETA is issued for the product on the basis of agreed data/information, deposited with the Catalonia Institute of Construction Technology which identifies the solid wood slab elements that have been assessed and judged. Identification tests have been carried out on the wood slab and its components, which confirm that the product under assessment conforms to its declared characteristics.

The description of the EGO_CLT™ solid wood slab elements and its components are given in chapter 1 and annex 2 of this ETA.

3 Evaluation and attestation of conformity and CE marking

3.1 Attestation of conformity

The system of attestation of conformity specified by the European Commission in mandate M112 on "Structural Timber Products and Ancillaries", product family (2/3) "Structural glued laminated products and other glued timber products", published in EC's decision 97/176/EC⁶ and the characteristics of the manufacturing process of EGO_CLT™, is system 1 as described in Council Directive 89/106/EEC Annex III, and it is detailed as follows:

System 1 for any intended uses:

⁶ Official Journal of the European Communities N° L 73, 14 March.

Tasks of the manufacturer:

- Factory production control.
- Further testing of samples taken at the factory in accordance with a prescribed test plan.

Tasks of the certification body:

- Initial type testing of the product.
- Initial inspection of the factory and of factory production control.
- Continuous surveillance, assessment and approval of factory production control.

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed in accordance with the *Control Plan*. This production control system shall ensure that the product is in conformity with this European Technical Approval (ETA).

Only the raw materials and materials stated in the technical documentation of this ETA may be used in the production of the products.

The factory production control shall be in accordance with the *Control Plan (26-09-2011)* relating to this ETA, which is part of the technical documentation of this European technical approval. The *Control Plan* is laid down in the context of the factory production control system operated by the manufacturer and deposited with the ITeC.⁷

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the *Control Plan*. On request they shall be presented to the ITeC.

The personnel involved in the production process shall be identified, sufficiently qualified and trained to operate and maintain the production equipment. Machinery and equipment shall be regularly maintained and this shall be documented. All processes and production procedures shall be recorded at regular intervals.

All testing equipment is maintained, calibrated and/or verified against measurement standards traceable to relevant international or national measurement standards.

The manufacturer shall ensure that handling, preservation and storage of test equipment is such that its accuracy and fitness for purpose is maintained. The calibration of all test equipment shall be repeated if any repair or failure occurs which could upset the calibration of the test equipment.

The manufacturer shall maintain a traceable documentation of the production process from purchasing or delivery of raw or basic raw materials up to the storage and delivery of finished products.

Products that do not comply with requirements as specified in the ETA shall be separated from the conforming products and marked as such. The manufacturer shall register non-compliant production and action(s) taken to prevent further non-conformities. External complaints shall also be documented, as well as actions taken.

3.2.1.2 Testing of samples taken at the factory

The testing of samples taken at the factory shall be carried out in accordance with the *Control Plan*.

⁷ The *Control Plan* is a confidential part of the European technical approval and only handed over to the approved body or bodies involved in the procedure of attestation of conformity.

3.2.1.3 Other tasks for manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of wood structural elements in order to undertake the actions laid down in section 3.2.2. For this purpose, the *Control Plan* referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the ETA 11/0464 issued on 30.11.2011.

3.2.2 Tasks for approved bodies

The approved body shall perform the activities referred to above according to the specific conditions, in accordance with the provisions laid down in the *Control Plan* relating to this ETA.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

3.2.2.1 Initial type testing

The verifications on which this ETA is based have been carried out on representative samples from the current production. The results of the tests performed as part of the assessment shall be used for initial type-testing (ITT) unless changes in the manufacturing procedure affect the product properties.

Any change in the manufacturing procedure which may affect the properties of the product shall be notified and the necessary type-testing revised according to the *Control Plan*.

3.2.2.2 Initial inspection of factory and the factory production control

The approved body shall assess the factory production control system to check that the factory production control is in conformity with this European Technical Approval and any subsidiary information. The approved body shall ensure that the manufacturer has acceptable premises, technical equipment and competent staff to produce the EGO_CLT™ as described in this European Technical Approval.

3.2.2.3 Continuous surveillance, assessment and approval of factory production control

Continuous surveillance of the factory production control is necessary to ensure continuing conformity with the ETA. It is recommended that surveillance inspections be conducted at least once per year.

3.2.2.4 Certification

Once the ITT, the initial inspection and surveillance of the FPC have been performed and whether a favourable conclusion can be drawn on the basis of available information, the notified certification body shall issue an EC Certificate of product Conformity, permitting the manufacturer to issue an EC Declaration of Conformity, enabling CE Marking of the EGO_CLT™.

3.3 CE marking


3.3.1 General

The CE marking shall be affixed on product on a label attached to the packaging of product or on the accompanying documents. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- The name and address of the ETA-holder.
- The last two digits of year in which the CE marking was affixed.
- The number of the EC Certificate of Conformity for the product.
- The number of the European Technical Approval.
- Designation code for relevant performance characteristics, as far as they are not specified in the ETA, for instance use categories, type, intended use, characteristics, declared values, etc.

3.3.2 Example of CE marking

Example of CE marking and accompanying information for EGO_CLT™:

 nnnn	Letters "CE"
Egoín SA Astei E-48287 Natxitua-Ea Bizkaia, Spain YY	Identification number of notified certification body
ETA-11/0464	Name and address of the ETA-holder
XXXXX	Two last digits of year of affixing the CE marking
	Number of European technical approval
	Designation code for relevant performance characteristics

4 Assumptions under which the fitness of the product for the intended use is favourably assessed

The European Technical Approval is issued for the products on the basis of agreed data/information deposited with the ITeC, which identifies the products that have been assessed and judged. Changes to the products or production processes, which could result in this deposited data/information being incorrect should be notified to ITeC before changes are introduced. ITeC will decide whether such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and, if so, whether further assessment or alterations to the ETA shall be necessary.

The detailed description and conditions of the manufacturing process of EGO_CLT™ and all the relevant design and installation criteria of EGO_CLT™ are specified in the technical documentation of the manufacturer deposited with the ITeC. The main aspects of this information are specified in the following chapters.

4.1 Manufacturing

EGO_CLT™ is manufactured in accordance with the provisions of this European Technical Approval as identified during the inspection of the plant by The Catalonia Institute of Construction Technology (ITeC).

Layers of planed boards are bonded together according to the specified lay up to the required thickness of the solid wood slab. The individual boards may be joined in longitudinal direction by means of finger joints, according to EN 385. The edges of the boards are not bonded. Gluing of the layers of the solid wood slab and of the finger joints is performed according to specific provisions based on relevant standards for structural gluing of wood material.

4.2 Design

The European Technical Approval only applies to the manufacture and use of solid wood slab. Verification of stability of the works including application of loads on solid wood slab is not subject of the European Technical Approval.

The design of the solid wood slab elements may be undertaken according to EN 1995-1-1 taking into account the annexes 1 to 3 of this European Technical Approval. Standards and regulations valid in the place of use shall be considered.

The design of solid wood slab element is to be carried out under the responsibility of an engineer experienced in solid wood construction and under the assistance given by the manufacturer.

4.3 Installation

The fitness for use of the EGO_CLT™ can be assumed only if the installation is carried out according to the instructions stated in the technical documentation of the manufacturer, in particular taking the following main points into account:

- Design of the works shall account for the protection of the solid wood slab elements.
- The solid wood slab elements are installed correctly.

EGO_CLT™ installation shall be carried out by appropriately qualified personnel under the supervision of the person responsible for technical matters on site. An assembly plan shall be prepared for each structure, which contains the sequence in which the individual members of solid wood slab elements shall be installed and the designation of the members of solid wood slab. The assembly plan shall be available at the construction site.

The safety-at-work and health protection regulations have to be observed.

4.4 Manufacturer's responsibilities

It is the manufacturer responsibility to make sure that all those who use the product are appropriately informed of the specific conditions according to sections 1, 2, 4 and 5, including the annexes to this ETA.

5 Recommendations

5.1 Recommendations on packaging, transport and storage

The instructions of the manufacturer related to packaging, transport and storage shall be followed.

Special attention must be paid on protection against weather conditions which could produce damage and on the instructions of storage. EGO_CLT™ shall be protected during transportation and storage against any damage or detrimental moisture effects.

Solid wood slab elements shall be protected against harmful moisture during transport and storage. Storage on the buildings site shall be only temporarily. Any measures to keep the moisture content low and to avoid condensation shall be done carefully. Weather exposure of rain, water flowing as well as water convection from other structures shall be avoided.

5.2 Recommendations on use, maintenance and repair

The assessment of the fitness for use is based on the assumption that maintenance is not required during the assumed intended working life. In case of a severe damage of a member of the solid wood slab immediate actions regarding mechanical resistance and stability of the works shall be initiated.

On behalf of the Catalonia Institute of Construction Technology.
Barcelona, 30 November 2011

Anton Maria Checa Torres
General Manager, ITeC

Annex 1 – Description of EGO_CLT™

Principal structure of a solid wood slab with 3 layers



Figure A1.1 Principal structure of a solid wood slab with 3 layers.

Principal structure of a solid wood slab with 5 layers

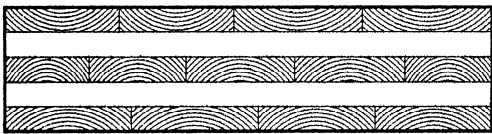


Figure A1.2 Principal structure of a solid wood slab with 5 layers.

Principal structure of a solid wood slab with 7 layers

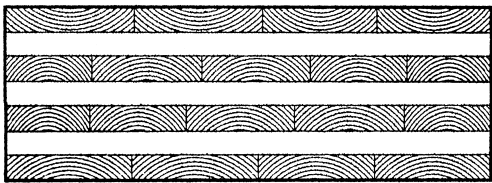


Figure A1.3 Principal structure of a solid wood slab with 7 layers.

Generic structure of the solid wood slab (example with 7 layers)

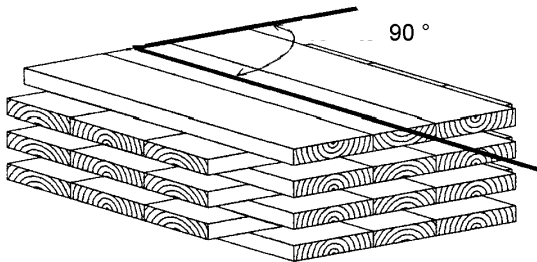


Figure A1.4 Generic structure of the solid wood slab (example with 7 layers).

Annex 2 – Dimensions and specifications of EGO_CLT™

Characteristic	Dimension / Specification								
Boards									
Surface	Planed with 0,5 mm of tolerance								
Material and strength class according to EN 338	<i>Pinus Radiata</i> (C18)			<i>Picea Abies</i> (C24)			--		
	Graded with suitable visual procedure			Graded and certificated by supplier					
Length	≤ 6.000 without finger joints ≤ 16.000 with finger joints								mm
Width	100	140	170	200	mm				
Thickness	20	20, 33	20, 33	20, 33, 45	mm				
Ratio width to thickness	≥ 4:1								--
Moisture of wood according to EN 13183-2	Between 10 and 14								%
Finger joints	EN 385								--
Elements									
Length	≤ 14.000								mm
Width	≤ 3.800								mm
Thickness	60	73	86	99	135	165	225	231	mm
Numbers of layers	3	3	3	3	3	5	5	7	--
Number of consecutive layers having the same direction	1								--
Moisture	Between 10 and 16								%

Table A2.1: Dimensions and specifications of EGO_CLT™.

Annex 3 – Design considerations for EGO_CLT™ - solid wood slab

Actions perpendicular to the solid wood slab

Stress distribution within the solid wood slab shall be calculated taking into account the rolling shear deformation of the cross layers.

For simply supported solid wood slabs with up to 5 layers the stress distribution may be calculated applying EN 1995-1-1 Annex B, Mechanically jointed beams, where the deformation between the parts due to yield of the fasteners is replaced by the shear deformation of the cross layers.

Characteristic strength and stiffness values to be used are given in points 2.1.1 and 2.1.2. Thus, with the symbols as defined in Figure 3.1, the following equations apply:

$$I_{ef} = I_1 + I_2 + I_3 + \gamma_1 a_1^2 A_1 + \gamma_2 a_2^2 A_2 + \gamma_3 a_3^2 A_3$$

$$\gamma_1 = \left(1 + \frac{\pi^2 E A_1 \cdot d_{12}}{\ell^2 G \cdot b} \right)^{-1} \quad \gamma_2 = 1 \quad \gamma_3 = \left(1 + \frac{\pi^2 E A_3 \cdot d_{23}}{\ell^2 G \cdot b} \right)^{-1}$$

$$a_1 = \left(\frac{d_1}{2} + d_{12} + \frac{d_2}{2} \right) - a_2 \quad a_3 = \left(\frac{d_2}{2} + d_{23} + \frac{d_3}{2} \right) + a_2$$

$$a_2 = \frac{\gamma_1 A_1 \cdot \left(\frac{d_1}{2} + d_{12} + \frac{d_2}{2} \right) - \gamma_3 A_3 \cdot \left(\frac{d_2}{2} + d_{23} + \frac{d_3}{2} \right)}{\gamma_1 A_1 + \gamma_2 A_2 + \gamma_3 A_3}$$

$$\sigma_{r,i} = \pm \frac{M}{I_{ef}} \cdot \left(\gamma_i a_i + \frac{d_i}{2} \right) \quad \tau_{max} = \frac{V \gamma_i S_i}{I_{ef} \cdot b}$$

For symmetrical lay up, $a_2=0$ and $\gamma_1=\gamma_3$. For 3 layers, $d_2=0$, $d_{12}=d_{23}=d/2$ (half the thickness of the cross layer in the middle of the slab).

For the bending design only the stresses at the edges of the boards are decisive; axial stresses in the center of the boards need not to be considered in the design.

The characteristic bending strength properties from section 2.1 of ETA may be multiplied by a system strength factor:

$$k_1 = \min \begin{cases} 1+0,025 \cdot n; & n = \text{number of boards along the width of the element.} \\ 1,2 \end{cases}$$

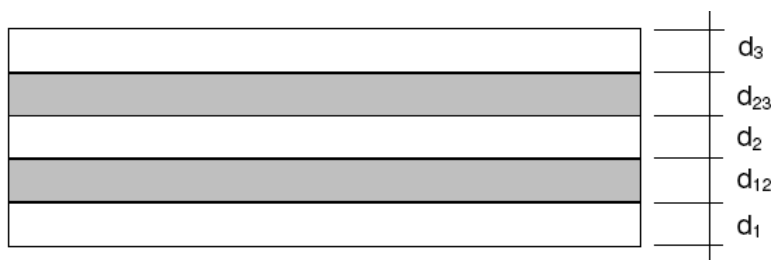


Figure A3.1 Symbols used in the calculations.

Effective layers in bending are d_1 , d_2 and d_3 . Rolling shear layers are d_{12} and d_{23} .

For 7 layers, the same methodology based on the same principles shall be used.

Actions in the plane of the solid wood slab

Stress distribution within the solid wood slab has to be calculated by taking into account only the boards which are oriented in the direction of the actions.

For the design of solid wood slabs the characteristic strength and stiffness values according to points 2.1.1 and 2.1.2 of ETA shall be used.

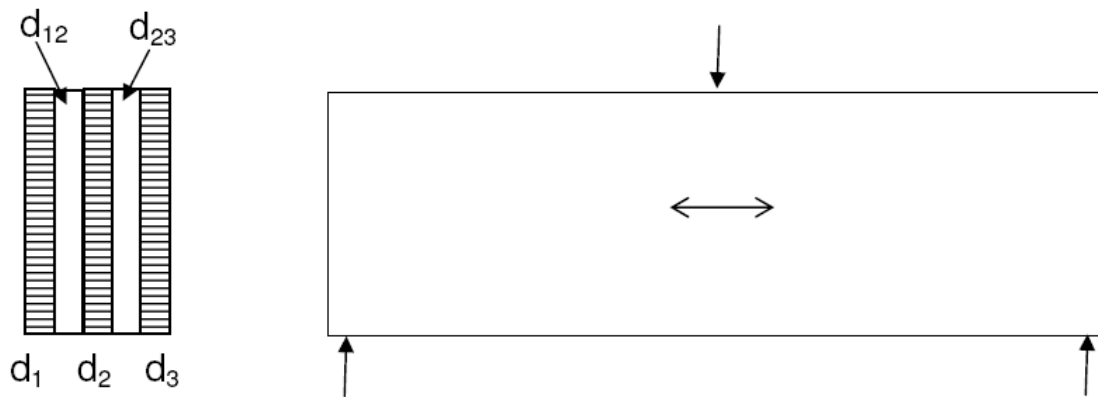


Figure A3.2 Symbols used in the calculations.

Effective layers are either d_1 , d_2 and d_3 or d_{12} and d_{23} , depending on the grain direction of the layers. Layers d_1 , d_2 and d_3 in the figure A3.2 are effective and their grain direction is shown by an arrow.