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European Technical Assessment

ETA 22/0557
of 12.09.2022

General part

Technical Assessment Body issuing the ETA: ITeC ITeC has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment)	
Trade name of the construction product	**Xilo-CLT and Xilo-CLT+**
Product family to which the construction product belongs	13- Structural timber products/elements and ancillaries
Manufacturer	**XILONOR SL** Polígono Industrial PedraPartida, N VI, km 565,5 ES 15316 Coirós (A Coruña) Spain
Manufacturing plant(s)	Polígono Industrial PedraPartida, N VI, km 565,5 ES 15316 Coirós (A Coruña) Spain
This European Technical Assessment contains	14 pages including 4 annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Regulation (EU) 305/2011, on the basis of	European Assessment Document (EAD) 130005-00-0304. *Solid wood slab element to be used as a structural element in buildings*. Edition March 2015.

General comments

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Specific parts of the European Technical Assessment

1 Technical description of the product

Xilo-CLT and Xilo-CLT+ are panels made of softwood boards which are bonded together to form cross laminated timber (solid wood slab elements).

Adjacent layers are generally arranged perpendicularly (angle of 90º) to each other. Cross-sections of the solid wood slabs are symmetric.

Xilo-CLT and Xilo-CLT+ consist of at least 3 and up to 9 layers. The lay-up of the cross laminated timber is shown in Annex 1. Dimensions and specifications are shown in Annex 2. Surfaces are planed.

The specification of the boards is given in Annex 2. Boards are machine strength graded. Only technically dried wood shall be used. Wood species used in the boards are *Pinus radiata* and *Pinus pinaster.*

Solid wood panel surfaces can be covered with additional layers without structural function on one or both sides.

The adhesive used for the surface bonding between layers, for the bonding of adjacent boards and for the finger joints is according to EN 15425.

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

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

Xilo-CLT and Xilo-CLT+ are intended to be used as structural or non-structural elements in buildings and timber structures.

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

The solid wood slab is intended to be used in service classes 1 and 2 according to EN 1995-1-1. Members which are directly exposed to the weather shall be provided with an effective protection for the solid wood slab element in service.

2.2 Working life

The provisions made in this ETA are based on a working life of Xilo-CLT and Xilo-CLT+ solid wood slab elements of 50 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee given by the manufacturer, but are regarded only as a means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and reference to the methods used for its assessment

The assessment of Xilo-CLT and Xilo-CLT+ for the intended use was performed following EAD 130005-00-0304 *Solid wood slab element to be used as a structural element in buildings*. Performance of Xilo-CLT and Xilo-CLT+ is shown in Table 3.1.

Table 3.1: Performance of Xilo-CLT and Xilo-CLT+.

Basic Works Requirement	Essential characteristic	Performance
BWR 1 Mechanical resistance and stability[1)]	Bending[2)]	See Clause A2.1 and A2.2 in Annex 2
	Tension and compression[2)]	
	Shear[2)]	
	Embedment strength	See Clause A2.3 in Annex 2
	Creep and duration of the load	
	Dimensional stability	
	In-service environment	
	Bond integrity	
BWR 2 Safety in case of fire	Reaction to fire	D-s2,d0
	Resistance to fire	See Annex 4
BWR 3 Hygiene, health and the environment	Content, emission and/or release of dangerous substances	No dangerous substances
	Water vapour permeability – water vapour transmission	50 (dry) to 20 (wet)
BWR 4 Safety and accessibility in use	Impact resistance	Soft body resistance is assumed to be fulfilled for walls with a minimum of 3 layers and minimum thickness of 60 mm
BWR 5 Protection against noise	Airborne sound insulation	Not assessed
	Impact sound insulation	Not assessed
	Sound absorption	Not assessed
BWR 6 Energy economy and heat retention	Thermal conductivity	0,13 W/(m·K)
	Air permeability	Not assessed
	Thermal inertia	1.600 J/(kg·K)

1) These characteristics also relate to basic work requirement 4.

2) Load bearing capacity and stiffness regarding mechanical actions perpendicular to and in plane of the solid wood slab element.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 1997/176/EC of the European Commission[1] as amended by 2001/596/EC[2], the system of AVCP (see EC delegated regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table applies.

Table 4.1: Applicable AVCP system.

Product	Intended use(s)	Level or class	System
Xilo-CLT and Xilo-CLT+	Solid wood slab element to be used as a structural element in buildings.	Any	1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the *Control Plan* deposited with the ITeC[3], with which the factory production control shall be in accordance.

Products not manufactured by the kit manufacturer shall also be controlled according to the Control Plan.

Where materials/components are not manufactured and tested by the supplier in accordance with agreed methods, then they shall be subject to suitable checks/tests by the kit manufacturer before acceptance.

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*.

Issued in Barcelona on 12 September 2022

by the Catalonia Institute of Construction Technology.

Ferran Bermejo Nualart

Technical Director, ITeC

[1] Official Journal of the European Union (OJEU) L73 of 14/03/1997.

[2] Official Journal of the European Union (OJEU) L209/33 of 02/08/2011.

[3] The *Control Plan* is a confidential part of the ETA and is only handed over to the notified certification body involved in the assessment and verification of constancy of performance.

ANNEX 1: Description of Xilo-CLT and Xilo-CLT+

A maximum of two adjacent layers can be arranged in the same direction if their combined thickness does not exceed 90 mm and the symmetric configuration of the cross-section is maintained.

When one of the external layers of the section is replaced by two adjacent layers oriented in the same direction of similar total thickness to that of the initial layer, the assembly of the cross-laminated timber element can be considered symmetrical.

Principal structure of solid wood slabs with 3, 5, 7 and 9 layers is shown in the following figures.

Principal structure of a solid wood slab with 3 layers

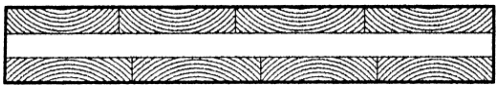

Figure A1.1: Principal structure of a solid wood slab with 3 layers.

Principal structure of a solid wood slab with 5 layers

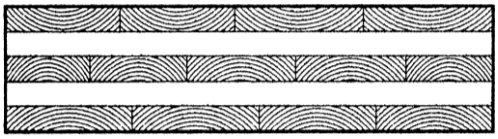

Figure A1.2: Principal structure of a solid wood slab with 5 layers.

Principal structure of a solid wood slab with 7 layers

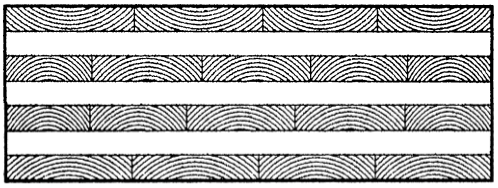

Figure A1.3: Principal structure of a solid wood slab with 7 layers.

Principal structure of a solid wood slab with 9 layers

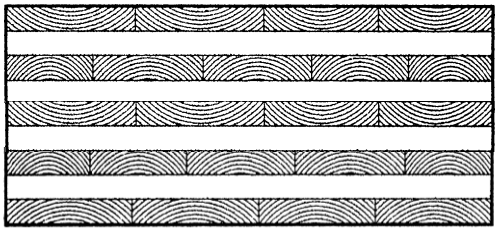

Figure A1.4: Principal structure of a solid wood slab with 9 layers.

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

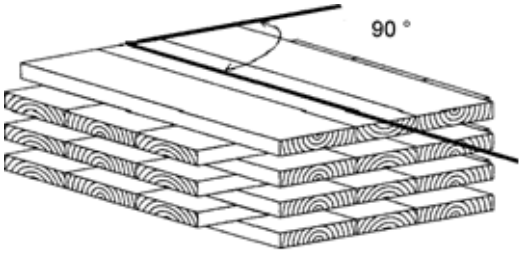

Figure A1.5: Generic structure of the solid wood slab (example with 7 layers).

ANNEX 2: Dimensions, specifications and characteristic data of Xilo-CLT and Xilo-CLT+

A2.1 Dimensions and specifications

Table A2.1: Dimensions and specifications of Xilo-CLT and Xilo-CLT+.

Characteristic	**Dimension / Specification**		
Boards			
Wood species		*Pinus radiata* *Pinus pinaster*	
Strength class according to EN 338. Boards are machine graded.	Xilo-CLT	External layers	100 % C16
		Internal layers	100 % C16
	Xilo-CLT+	External layers	100 % C24
		Internal layers	≥ 70 % C16 ≤ 30 % C24
Surface	Planed		
Minimum mean density	500 kg/m^3		
Length	3.000 mm		
Width	80 mm to 240 mm		
Thickness	20, 25, 30, 35 and 40 (± 2,0) mm		
Ratio width to thickness	b/t ≥ 4:1		
Moisture content of wood	9% to 16%		
Finger joints	EN 14080		
Elements			
Length	≤ 12.000 mm		
Width	≤ 3.000 mm		
Thickness	60 mm (3 layers x 20 mm) to 360 mm (9 layers x 40 mm)		
Numbers of layers	3, 5, 7 or 9		
Number of consecutive layers having the same direction	≤ 2		
Moisture content of wood	9% to 16%		

A2.2 Load bearing capacity and stiffness regarding mechanical actions perpendicular to the solid wood slab

Table A2.2: Load bearing capacity and stiffness regarding mechanical actions perpendicular to the solid wood slab.

Property	Verification method	Performance	
		Xilo-CLT	Xilo-CLT+
Modulus of elasticity			
- parallel to the grain of the boards $E_{0,mean}$	I_{ef} Annex 3 of ETA Clause 2.2.1.1 of EAD 130005-00-0304	9.000 MPa	11.600 MPa
- perpendicular to the grain of the boards $E_{90,mean}$	EN 338	270 MPa	370 MPa
Shear modulus			
- parallel to the grain of the cover boards $G_{090,mean}$	EN 338	500 MPa	690 MPa
- perpendicular to the grain of the cover boards (rolling shear modulus) $G_{9090,,mean}$	Clause 2.2.1.3 of EAD 130005-00-0304	50 MPa	
Bending strength			
- parallel to the grain of the boards $f_{m,k}$	W_{ef} Annex 3 of ETA Clause 2.2.1.1 of EAD 130005-00-0304	16 MPa	24 MPa
Tensile strength			
- perpendicular to the grain of the boards $f_{t,90,k}$	EN 338, reduced	0,12 MPa	
Compressive strength			
- perpendicular to the grain of the boards $f_{c,90,k}$	EN 338	2,2 MPa	2,5 MPa
Shear strength			
- parallel to the grain of the cover boards $f_{v,90,k}$	EN 338	3,2 MPa	4,0 MPa
- perpendicular to the grain of the cover boards (rolling shear strength) $f_{R,9090,k}$	A_{gross} Annex 3 of ETA Clause 2.2.1.1 of EAD 130005-00-0304	0,84 MPa	

A2.3 Load bearing capacity and stiffness regarding mechanical actions in plane of the solid wood slab

Table A2.3: Load bearing capacity and stiffness regarding mechanical actions in plane of the solid wood slab.

Property	Verification method	Performance	
		Xilo-CLT	Xilo-CLT+
Modulus of elasticity			
- parallel to the grain of the cover boards $E_{0,mean}$	A_{net}, I_{net} Annex 3 of ETA Clause 2.2.1.1 of EAD 130005-00-0304	9.000 MPa	11.600 MPa
Shear modulus			
- parallel to the grain of the cover boards $G_{090,mean}$	A_{net} Annex 3 of ETA Clause 2.2.1.3 of EAD 130005-00-0304	500 MPa	690 MPa
Bending strength			
- parallel to the grain of the boards $f_{m,k}$	A_{net} Annex 3 of ETA Clause 2.2.1.1 of EAD 130005-00-0304	16 MPa	24 MPa
Tensile strength			
- parallel to the grain of the boards $f_{t,0,k}$	EN 338	10 MPa	14 MPa
Compressive strength			
- parallel to the grain of the boards $f_{c,0,k}$	EN 338	17 MPa	21 MPa
Shear strength			
- parallel to the grain of the cover boards $f_{v,090,k}$	A_{net} Annex 3 of ETA Clause 2.2.1.3 of EAD 130005-00-0304	3,2 MPa	10 MPa

A2.4 Other mechanical actions

Table A2.4: Other mechanical actions on the solid wood slab Xilo-CLT and Xilo-CLT+.

Property	Verification method	Reference value					
Embedment strength	EN 1995-1-1	Joint design and embedding strength values given in EN 1995-1-1 for solid timber shall be used.					
Creep and duration of load	EN 1995-1-1		**k_{def} (creep)**				
			Actions perpendicular to the slab (1)		Actions in plane of the slab (2)		
		Service class 1	0,80		0,60		
		Service class 2	1,00		0,80		
			k_{mod} (duration of load)				
			Actions perpendicular and in plane of the slab (3)				
			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 to the slab, the creep of Xilo-CLT and Xilo-CLT+ corresponds to the creep of plywood.

(2) In case of actions in plane of the slab, the creep of Xilo-CLT and Xilo-CLT+ corresponds to the creep of solid wood.

(3) In case of actions perpendicular and in plane of the slab, the duration of load of Xilo-CLT and Xilo-CLT+ corresponds to the duration of load of solid wood.

Dimensional stability	• Tolerances of dimensions:			
	Manufacturer's declaration	Tolerances of dimensions in standard ambient conditions (20 ± 2 ºC, 65 ± 5 % relative humidity) are as follows:		
		• Thickness (h):	± 1 mm for solid wood slabs from 60 mm to 125 mm of thickness.	
			± 2 mm for solid wood slabs over 125 mm to 225 mm of thickness.	
			± 3 mm for solid wood slabs over 225 mm to 380 mm of thickness.	
		• Length (l):	± 2 mm.	
		• Width (b):	± 2 mm.	
	• Stability of dimensions:			
	Manufacturer's declaration	Moisture content of the solid wood slab varies between 9 % and 16 %. However, during manufacturing, the moisture content differences between the boards within one slab have to be less than 4 %. Due to changing temperature and relative humidity of the surrounding air the moisture content of the solid wood slab will continuously change. The stability of dimensions are: • Longitudinal to the grain direction: 1,2 %. • Radial to the grain direction: 0,3 %. • Perpendicular to the grain direction: 0,0005 %.		

Table A2.4: Other mechanical actions on the solid wood slab Xilo-CLT and Xilo-CLT+.

<table>
<tr><td rowspan="2"></td><td colspan="6">• Thermal expansion:</td></tr>
<tr><td>EN 1991-1-5</td><td colspan="5">Linear expansion coefficient parallel to the grain (α_T [x10^{-6}/ºC]): 5</td></tr>
<tr><td rowspan="6">In-service environment</td><td colspan="6">• Durability of timber</td></tr>
<tr><td rowspan="3">EN 350-1
EN 350-2
EN 335</td><td></td><td>Fungus attack</td><td>Hylotrupes attack</td><td>Anobium attack</td><td>Termites attack</td></tr>
<tr><td>Pinus radiata</td><td>4-5</td><td>S</td><td>SH</td><td>S</td></tr>
<tr><td>Pinus pinaster</td><td>3-4</td><td>D</td><td>D</td><td>S</td></tr>
<tr><td colspan="6">• Service classes</td></tr>
<tr><td>EN 1995-1-1 clause 2.3.1.3</td><td colspan="5">Service classes 1 and 2</td></tr>
<tr><td>Bond integrity</td><td>EAD 130005-00-0304</td><td colspan="5">Pass</td></tr>
</table>

ANNEX 3: Design considerations for Xilo-CLT and Xilo-CLT+ solid wood slab

A3.1. 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 clause A2.2 of Annex 2. Thus, with the symbols as defined in Figure A3.1, the following equations apply:

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

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

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

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

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

The symbol G in the equations above refers to $G_{9090,mean}$ of Clause A2.2 of Annex 2.

A_1, A_2, and A_3 are the cross-sectional areas of the layers whose grain direction is parallel to the span.

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 clause A2.2 of ETA may be multiplied by a system strength factor:

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

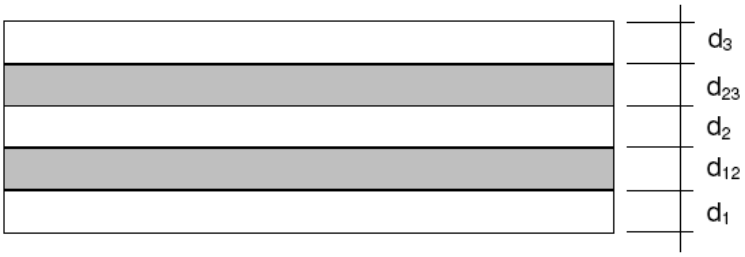

Figure A3.1: Symbols used in the calculations.

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

For 7 to 9 layers, the same methodology based on the same principles shall be used.

A3.2. 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 whose grain is oriented in the direction of the actions.

For the design of solid wood slabs the characteristic strength and stiffness values according to clause A2.3 of Annex 2 of ETA shall be used.

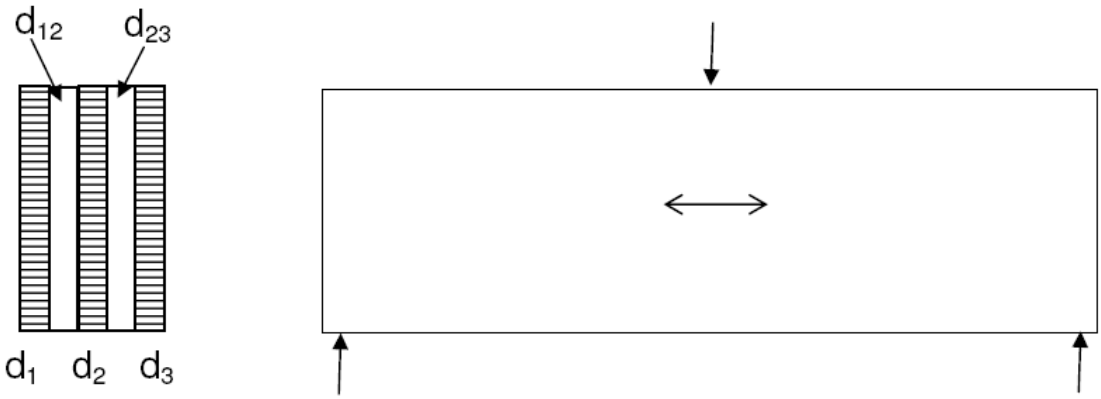

Figure A3.2: Symbols used in the calculations.

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. The slab in figure A3.2 is submitted to bending and the grain direction of the layers d_1, d_2 and d_3, shown by an arrow in the figure, is oriented in direction of the span, thus the layers d_1, d_2 and d_3 are effective.

ANNEX 4: Charring rates of Xilo-CLT and Xilo-CLT+ solid wood slab

Charring rate for the timber used as lamella in accordance with EN 1995-1-2 Table 3.1 is given below and will be used in the simplified bilinear model adopted by Clause 3.4.3 of EN 1995-1-2 to determine the charring depth according to time requirements, considering Clause 4.2.2 (Reduced cross-section method) of EN 1995-1-2.

For solid timber with a characteristic density ≥ 290 kg/m^3: β_0 (one-dimensional design charring rate under standard fire exposure) = 0,65 mm/min. This charring rate is used for design purposes of structural elements based on Xilo-CLT and Xilo-CLT+ solid wood panels.