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European Technical Assessment

ETA-20/0843
of 16.11.2020

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB)
Austrian Institute of Construction Engineering

Trade name of the construction product

Theurl CLTPLUS

Product family to which the construction product belongs

Solid wood slab elements to be used as structural elements in buildings

Manufacturer

Theurl Timber Structures
Industriezone 1
9754 Steinfeld
Austria

Manufacturing plant

Theurl Timber Structures
Industriezone 1
9754 Steinfeld
Austria

This European Technical Assessment contains

15 pages including 4 Annexes which form an integral part of this assessment.

This European Technical Assessment is issued in accordance with Regulation (EU) No 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".

Remarks

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

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Specific parts

1 Technical description of the product

1.1 General

This European Technical Assessment (ETA) applies to the cross laminated timber "Theurl CLTPLUS". Theurl CLTPLUS is made of softwood boards which are bonded together in order to form cross laminated timber (solid wood slab elements). Generally, adjacent layers of the softwood boards are arranged perpendicular (angle of 90°) to each other, see Annex 1, Figure 1.

The principle structure of the cross laminated timber is shown in Annex 1, Figure 2 and Figure 3. Surfaces are planed.

The solid wood slab elements consist of at least three and up to nine adjacent layers which are arranged perpendicular to each other. With regard to the thickness of the solid wood slab element, thickness and orientation of individual layers are symmetrically assembled. In case of serious deviations from symmetry potential effects should be investigated.

The individual boards of the layers are side-glued.

In multilayer elements with at least five layers, a maximum of two consecutive board layers may be arranged in the same direction if their all over thickness does not exceed 90 mm.

Single board layers (maximum 50 % of the cross section) may be replaced by one- and multilayer solid wood panels. The solid wood panels shall be suitable for structural use.

The surfaces of the solid wood slabs may be provided with additional layers without load-bearing function. These panels are not part of this European Technical Assessment. Strength and stiffness characteristics for mechanical actions perpendicular to and in plane of the cross laminated timber are only assigned to the cross laminated timber without covering.

Theurl CLTPLUS and the boards for its manufacturing correspond to the specifications given in the Annexes 1 and 2. The material characteristics, dimensions and tolerances of Theurl CLTPLUS, not indicated in these Annexes, are given in the technical file¹ of the European Technical Assessment.

The application of wood preservatives and flame retardants is not subject of the European Technical Assessment.

1.2 Components

1.2.1 Boards

The specification of the boards is given in Annex 2, Table 2. Boards are visually or machine strength graded. Only technically dried wood shall be used.

Wood species is European spruce or equivalent softwood.

¹ The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik and, in so far as is relevant to the tasks of the notified product certification body involved in the assessment and verification of constancy of performance procedure, is handed over to the notified product certification body.

1.2.2 Adhesive

The adhesive for bonding of the cross laminated timber and the finger joints of the individual boards shall conform to EN 301 or EN 15425.

Normally a PU adhesive is used.

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

2.1 Intended use

The solid wood slab is intended to be used as a structural or non-structural element in buildings and timber structures.

The solid wood slab shall be subjected 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 1995-1-1². 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 General assumptions

The solid wood slab elements are manufactured in accordance with the provisions of the European Technical Assessment using the manufacturing process as identified in the inspection of the manufacturing plant by Österreichisches Institut für Bautechnik and laid down in the technical file.

The manufacturer shall ensure that the requirements in accordance with the Clauses 1, 2 and 3 as well as with the Annexes of the European Technical Assessment are made known to those who are concerned with design and execution of the works.

Layers of planed boards shall be bonded together to the required thickness of the cross laminated timber. The individual boards shall be jointed in longitudinal direction by means of finger joints according to EN 14080, there shall be no butt joints.

Adhesive shall be applied on one face of each board. The edges of the boards need to be bonded.

Design

The European Technical Assessment only applies to the manufacture and use of cross laminated timber. Verification of stability of the works including application of loads on the cross laminated timber is not subject to the European Technical Assessment.

The following conditions shall be observed:

- Design of cross laminated timber members is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of the cross laminated timber.
- The cross laminated timber members are installed correctly.

Design of cross laminated timber members elements may be according to EN 1995-1-1 and EN 1995-1-2, taking into account of Annexes 2 and 3 of the European Technical Assessment.

Standards and regulations in force at the place of use shall be considered.

Packaging, transport, storage, maintenance, replacement and repair

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

² Reference documents are listed in Annex 4.

Installation

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

2.3 Assumed working life

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of Theurl CLTPLUS of 50 years, when installed in the works, provided that the cross laminated timber elements are subject to appropriate installation, use and maintenance (see Clause 2.2). These provisions are based upon the current state of the art and the available knowledge and experience³.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, 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

3.1 Essential characteristics of the product

Table 1: Essential characteristics of the product and assessment methods

| No | Essential characteristic | Product performance |
|---|--|--------------------------|
| Basic requirement for construction works 1: Mechanical resistance and stability ¹⁾ | | |
| 1 | Bending ²⁾ | Annex 2 |
| 2 | Tension and compression ²⁾ | Annex 2 |
| 3 | Shear ²⁾ | Annex 2 |
| 4 | Embedment strength | Annex 2 |
| 5 | Creep and duration of the load | Annex 2 |
| 6 | Dimensional stability | Annex 2 |
| 7 | In-service environment | Annex 2 |
| 8 | Bond integrity | Annex 2 |
| Basic requirement for construction works 2: Safety in case of fire | | |
| 9 | Reaction to fire | Annex 2 |
| 10 | Resistance to fire | No performance assessed. |
| Basic requirement for construction works 3: Hygiene, health and the environment | | |
| 11 | Content, emission and/or release of dangerous substances | 3.1.1 |
| 12 | Water vapour permeability – Water vapour transmission | Annex 2 |
| Basic requirement for construction works 4: Safety and accessibility in use | | |
| 13 | Impact resistance | Annex 2 |

³ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product can also be shorter than the assumed working life.

| Basic requirement for construction works 5: Protection against noise | | |
|--|---------------------------|--------------------------|
| 14 | Airborne sound insulation | No performance assessed. |
| 15 | Impact sound insulation | No performance assessed. |
| 16 | Sound absorption | No performance assessed. |
| Basic requirement for construction works 6: Energy economy and heat retention | | |
| 17 | Thermal conductivity | Annex 2 |
| 18 | Air permeability | Annex 2 |
| 19 | Thermal inertia | Annex 2 |
| ¹⁾ These characteristics also relate to basic requirement for construction works 4. | | |
| ²⁾ Load bearing capacity and stiffness regarding mechanical actions perpendicular to and in plane of the solid wood slab element. | | |

3.1.1 Hygiene, health and the environment

The release of dangerous substances is determined according to EAD 130005-00-0304, "Solid wood slab element to be used as a structural element in buildings". No dangerous substances is the performance of Theurl CLTPLUS in this respect.

NOTE In addition to the specific clauses relating to dangerous substances contained in the European Technical Assessment, 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 Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 of Theurl CLTPLUS for the intended use, and in relation to the requirements for mechanical resistance and stability, for safety in case of fire, for hygiene, health and the environment, for safety and accessibility in use, for protection against noise and for energy economy and heat retention in use in the sense of the basic requirements for construction works № 1 to 6 of Regulation (EU) № 305/2011 has been made in accordance with the European Assessment Document EAD 130005-00-0304, Solid wood slab element to be used as a structural element in buildings.

3.2.2 Identification

The European Technical Assessment for Theurl CLTPLUS is issued on the basis of agreed data that identify the assessed product. Changes to materials, to composition, to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are implemented, as an amendment of the European Technical Assessment is possibly necessary.

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

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 97/176/EC the system of assessment and verification of constancy of performance to be applied to Theurl CLTPLUS is System 1. System 1 is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, 1.2., and provides for the following items

- (a) The manufacturer shall carry out
 - (i) factory production control;
 - (ii) further testing of samples taken at the manufacturing plant by the manufacturer in accordance with a prescribed test plan⁴;
- (b) The notified product certification body shall decide on the issuing, restriction, suspension or withdrawal of the certificate of constancy of performance of the construction product on the basis of the outcome of the following assessments and verifications carried out by that body:
 - (i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product;
 - (ii) initial inspection of the manufacturing plant and of factory production control;
 - (iii) continuous surveillance, assessment and evaluation of factory production control.

4.2 AVCP for construction products for which a European Technical Assessment has been issued

Notified bodies undertaking tasks under System 1 shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in point 4.1 (b)(i).

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant the manufacturer shall establish and continuously maintain a factory production control. All procedures and specification adopted by the manufacturer shall be documented in a systematic manner. The factory production control shall ensure the constancy of performances of Theurl CLTPLUS with regard to the essential characteristics.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials shall be subject to controls by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents presented by the manufacturer of the raw materials.

The frequencies of controls conducted during manufacturing and on the assembled product are defined by taking account of the manufacturing process of the product and are laid down in the control plan.

⁴ The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified product certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

Table 2: Dimensions and specifications

| Item | Dimension / Specification | |
|--|---------------------------|--|
| Cross laminated timber | | |
| Thickness | mm | 60 to 320 |
| Width | m | ≤ 3.50 |
| Length | m | ≤ 16.0 |
| Number of layers | — | 3 to 9 symmetric assembly |
| Mean value of joint width between boards within one layer | mm | 3 |
| Boards | | |
| Surface | — | planed |
| Thickness (planed dimension) | mm | 18 to 45 |
| Width | mm | 78 to 250 |
| Ratio width b_l to thickness t_l | — | ≥ 2.6 : 1 |
| Boards shall be graded with suitable visual and/or machine procedures to be able to assign them to a strength class according to EN 338. | — | |
| Cover layer | | C24 |
| Inner layer | | ≤ 10 % C16 ≥ 90 % C24 |
| Moisture of wood according to EN 13183-2 | % | 6 to 15 % Within one member of cross laminated timber the moisture content shall not differ by more than 5 %. |
| Finger joints | — | EN 14080 |

Theurl CLTPLUS

Annex 2

Characteristic data of cross laminated timber

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Table 3: Product characteristics of the solid wood slab

| BWR | Essential characteristic | Assessment method | Level / Class / Description |
|---|--|---|---|
| 1 | Mechanical resistance and stability | | |
| | 1. Mechanical actions perpendicular to cross laminated timber | | |
| | Strength class of boards | EN 338 | C24 |
| | Modulus of elasticity | <i>I_{eff}</i> , Annex 3 EAD 130005-00-0304, 2.2.1.1 | 11 600 MPa ¹⁾ |
| | – parallel to the grain of the boards <i>E_{0, mean}</i> | | |
| | – perpendicular to the grain of the boards <i>E_{90, mean}</i> | EN 338 | 370 MPa |
| | Shear modulus | EN 338 EAD 130005-00-0304, 2.2.1.1 | 690 MPa 50 MPa |
| | – parallel to the grain of the boards <i>G_{090, mean}</i> | | |
| | – perpendicular to the grain of the boards (rolling shear modulus) <i>G_{9090, mean}</i> | | |
| | Bending strength | <i>W_{eff}</i> , Annex 3 EAD 130005-00-0304, 2.2.1.1 | $1/k_{sys} \cdot 26.4 \text{ MPa}^{2)}$ |
| – parallel to the grain of the boards <i>f_{m, k}</i> | | | |
| Tensile strength | EN 338, reduced | 0.12 MPa | |
| – perpendicular to the grain of the boards <i>f_{t, 90, k}</i> | | | |
| Compressive strength | EN 338 | 2.5 MPa | |
| – perpendicular to the grain of the boards <i>f_{c, 90, k}</i> | | | |
| Shear strength | EN 338 <i>A_{gross}</i> , Annex 3 EAD 130005-00-0304, 2.2.1.3 | 4.0 MPa 1.3 MPa | |
| – parallel to the grain of the boards <i>f_{v, 090, k}</i> | | | |
| – perpendicular to the grain of the boards (rolling shear strength) <i>f_{v, 9090, k}</i> | | | |

NOTE 1) 1 MPa = 1 N/mm²

2)

$$k_{sys} = \max \left\{ \begin{array}{l} 1.1 - 0.025 \cdot n \\ 1 \end{array} \right.$$

.....n.....number of boards within cover layer

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Characteristic data of cross laminated timber

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| BWR | Essential characteristic | Assessment method | Level / Class / Description |
|---|--|--|-----------------------------|
| 1 | Mechanical resistance and stability | | |
| | 2. Mechanical actions in plane of cross laminated timber | | |
| | Strength class of boards | EN 338 | C24 |
| | Modulus of elasticity – parallel to the grain of the boards $E_{0, mean}$ | $A_{net}, I_{net}, Annex 3$ EAD 130005-00-0304, 2.2.1.1 | 11 600 MPa |
| | Shear modulus – parallel to the grain of the boards $G_{090, mean}$ | $A_{net}, Annex 3$ EAD 130005-00-0304, 2.2.1.3 | 450 MPa |
| | Bending strength – parallel to the grain of the boards $f_{m, k}$ | $W_{net}, Annex 3$ EAD 130005-00-0304, 2.2.1.1 | 24 MPa |
| | Tensile strength – parallel to the grain of the boards $f_{t, 0, k}$ | EN 338 | 14.5 MPa |
| | Compressive strength – parallel to the grain of the boards $f_{c, 0, k}$ | EN 338 | 21 MPa |
| | Shear strength – parallel to the grain of the boards $f_{v, 090, k}$ | $A_{net}, Annex 3$ EAD 130005-00-0304, 2.2.1.3 | 5.0 MPa |
| | 3. Other mechanical actions | | |
| | Creep and duration of load | k_{mod} and k_{def} according to EN 1995-1-1 for glued laminated timber | |
| | Dimensional stability Moisture content during service shall not change to such an extent that adverse deformation will occur. | | |
| | Fasteners | EN 1995-1-1, the direction of grain of the cover layer shall be taken as reference | |
| | In-service environment | | |
| | Durability of timber | EN 1995-1-1 | 1 and 2 |
| | Service classes | | |
| | Bond integrity | EAD 130005-00-0304 | Pass |
| Theurl CLTPLUS | | Annex 2 | |
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Mechanical actions perpendicular to plane and in plane of cross laminated timber

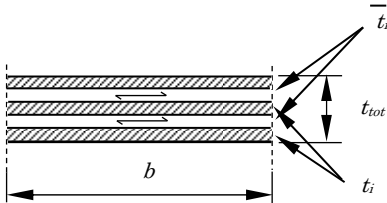
General

Due to the perpendicular orientation of the boards, cross laminated timber is able to transfer loads in all directions according to its condition of support. For cross laminated timber multi-axle stressed in both principal directions, different stiffness for the two principal directions shall be considered.

For calculation of characteristic values of cross-section, only boards which are oriented in direction of the mechanical action may be employed.

For design of cross laminated timber according to EN 1995-1-1, characteristic strength and stiffness of solid wood according to Annex 2 shall be taken.

Mechanical actions perpendicular to cross laminated timber



Where

- t_i Thickness of board layers in direction of mechanical actions
- \bar{t}_i Thickness of board layers perpendicular to direction of mechanical actions

The bending stiffness is specified in relation to the effective moment of inertia I_{eff} . The calculation of the effective moment of inertia and therewith of the effective bending stiffness is according to EN 1995-1-1.

For I_{eff} see clause 9.1.3 and Annex B of EN 1995-1-1.

The term $\frac{S_i}{K_i}$ of EN 1995-1-1 should be substituted by $\frac{\bar{t}_i}{G_{9090} \cdot b}$.

$$I_i = \frac{b \cdot t_i^3}{12}$$

$$W_{eff} = \frac{2 \cdot I_{eff}}{t_{tot}}$$

$$A_i = b \cdot t_i$$

$$t_{tot} = \sum_i (t_i + \bar{t}_i)$$

$$\tau_{v,d} = \frac{1.5 \cdot V_d}{A_{gross}}$$

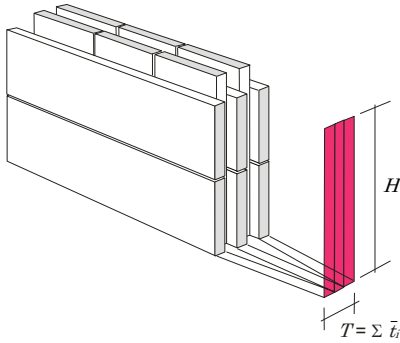
$$A_{gross} = b \cdot t_{tot}$$

Where

- I moment of inertia
- I_{eff} effective moment of inertia
- s spacing of fasteners according to EN 1995-1-1 (*not relevant for solid wood slab*)
- K slip modulus according to EN 1995-1-1 (*not relevant for solid wood slab*)
- G_{9090} shear modulus of the board perpendicular to grain (*rolling shear modulus*); $G_{9090} = 50$ MPa
- b width of the member of cross laminated timber

| | |
|--|---|
| Theurl CLTPLUS | Annex 3 |
| Design considerations for cross laminated timber | of European Technical Assessment ETA-20/0843 of 16.11.2020 |

Mechanical actions in plane of the solid wood slab



Where

t_i Thickness of board layers in direction of mechanical actions

\bar{t}_i Thickness of board layers perpendicular to direction of mechanical actions

V Shear force

Under the terms of the technical beam theory the following equations may be used.

Moment of inertia

$$I_{net} = \frac{T \cdot H^3}{12}$$

Shear stress

$$\tau_{v,d} = \text{Minimum} \begin{cases} \frac{3}{2} \cdot \frac{V_d}{A_{x,net}} \\ \frac{3}{2} \cdot \frac{V_d}{A_{z,net}} \end{cases}$$

Section modulus

$$W_{net} = \frac{T \cdot H^2}{6}$$

$$A_{x,net} = H \cdot \sum_i \bar{t}_i$$

$$A_{z,net} = H \cdot \sum_i t_i$$

TheurI CLTPLUS

Annex 3

Design considerations for cross laminated timber

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