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European Technical Assessment ETA-14/0349 of 02.10.2014

GENERAL PART

Technical Assessment Body issuing the European Technical Assessment	**Österreichisches Institut für Bautechnik** Austrian Institute of Construction Engineering
Trade name of the construction product	**CLT – Cross Laminated Timber**
Product family to which the construction product belongs	**Solid wood slab elements to be used as structural elements in buildings**
Manufacturer	**Stora Enso Wood Products OY Ltd** **Kanavaranta 1** **00160 Helsinki** **Finland**
Manufacturing plants	**Stora Enso Wood Products Bad St. Leonhard GmbH** **Wisperndorf 4** **9462 Bad St. Leonhard** **Austria** **Stora Enso Wood Products GmbH** **Bahnhofstraße 31** **3370 Ybbs** **Austria**
This European Technical Assessment contains	**23 Pages including 5 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 13-0005-00-0304 "Solid wood slab element to be used as a structural element in buildings", Edition August 2014**

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

CLT – Cross Laminated Timber 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 structure of the cross laminated timber of e.g. three and five layers is shown in Annex 1, Figure 2 to Figure 3. Surfaces of the lamellas are planed.

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

The individual boards of the layers may be side-glued.

A maximum of three adjacent layers may be arranged in the same direction as long as a symmetric cross-section with cross-layering remains and 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 covered with additional layers without load bearing function on one side. This panels are not part of this European Technical Assessment.

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

1.2 Wood

Wood species is European spruce or equivalent softwood.

1.3 Wood-based panels

Wood-based panels are in accordance with EN 13986 or a European Technical Assessment.

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 1995-1-1[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 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 planning 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 not to be bonded.

Design

The European Technical Assessment only applies to the manufacture and use of CLT – Cross Laminated Timber. Verification of stability of the works including application of loads on the products is not subject to the European Technical Assessment.

The following conditions shall be observed:

- Design of the solid wood slab elements is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of the solid wood slab elements.
- The solid wood slab elements are installed correctly.

Design of the products can be according to EN 1995-1-1 and EN 1995-1-2, taking into account of Annex 2 of the European Technical Assessment.

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

Packaging, transport and storage

The manufacturer's instruction for packaging, transport and storage shall be observed.

The following aspects shall be considered:

- protection against unfavourable environmental effects
- protection against external damage, that may affect the proper assembling of the solid wood slab elements
- intermediate storage at the construction site.

Installation

The manufacturer shall prepare installation instructions in which the product-specific characteristics and the most important measures to be taken into consideration for installation are described. The installation instructions shall be available at every construction site and shall be deposited at Österreichisches Institut für Bautechnik.

Installation of solid wood slab elements 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 solid

[1] Reference documents are listed in Annex 6.

wood slab elements shall be installed and their designation. The assembly plan shall be available at the construction site.

Relevant items to be considered are e.g.

- definition and verification of the size, spacing and minimum length of support, and demands of serviceability
- fastening of components and eventual restrictions on the application of fixings to the product
- temporary bracing for temporary loads on the construction site during erection.

Damaged products shall not be installed.

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

Use, maintenance and repair

The assessment of the product is based on the assumption that maintenance is not required during the assumed intended working life.

Should repair prove necessary this is treated on an individual basis relative to the specific application and/or damage.

2.3 Assumed working life

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of CLT -- Cross Laminated Timber of 50 years, when installed in the works, provided that the solid wood slab 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 experience[2].

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.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, and the particular conditions of the design, execution, use and maintenance of that works may be outside this ETA. Therefore, it cannot be excluded that in these cases the real working life of the product may also be shorter than the assumed working life.

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

Table 1: Essential characteristics of the product and methods of verification and assessment

№	Essential characteristic	Method of verification and assessment	Expression of product performance
(1)	(2)	(3)	(4)
Basic Works Requirement 1: Mechanical resistance and stability [1)]			
1	Bending [2) 3)]	3.2	Annex 2
2	Tension and compression [2) 3)]	3.2	Annex 2
3	Shear [2) 3)]	3.2	Annex 2
4	Embedment strength [3)]	3.2	Annex 2
5	Creep and duration of the load [3)]	3.2	Annex 2
6	Dimensional stability [3)]	3.2	Annex 2
7	In-service environment [3)]	3.2	Annex 2
8	Bond integrity [3)]	3.2	Annex 2
Basic Works Requirement 2: Safety in case of fire			
9	Reaction to fire	3.2	Annex 2
10	Resistance to fire	3.2	Annex 2 and 3
Basic Works Requirement 3: Hygiene, health and the environment			
11	Content and/or release of dangerous substances	3.2	3.1.1.2
12	Water vapour permeability – Water vapour transmission	3.2	Annex 2
Basic Works Requirement 4: Safety and accessibility in use			
13	Impact resistance [3)]	3.2	Annex 2
Basic Works Requirement 5: Protection against noise			
14	Airborne sound insulation	3.2	Annex 2 and 4
15	Impact sound insulation	3.2	Annex 2 and 4
16	Sound absorption	3.2	Annex 2 and 4
Basic Works Requirement 6: Energy economy and heat retention			
17	Thermal conductivity	3.2	Annex 2
18	Air permeability	3.2	Annex 2
19	Thermal inertia	3.2	Annex 2
Basic Works Requirement 7: Sustainable use of natural resources			
--	No characteristic has been assessed		

1) These characteristics also relate to BWR 4.

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

3) Declaration of performance and CE mark shall not indicate “no performance determined” – NPD – for that characteristic.

3.1 Essential characteristics of the product

3.1.1 CLT – Cross Laminated Timber elements

3.1.1.1 General

CLT – Cross Laminated Timber and the boards for its manufacturing correspond to the specifications given in the Annexes 1 and 2. The material characteristics, dimensions and tolerances of CLT – Cross Laminated Timber, not indicated in these Annexes, are given in the technical file[3] of the European Technical Assessment.

3.1.1.2 Hygiene, health and the environment

On dangerous substances, the solid wood slab elements conform to the European Assessment Document EAD 130005-00-0304 "Solid wood slab element to be used as a structural element in buildings", Edition August 2014. A manufacturer's declaration to this effect has been submitted.

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.

3.1.2 Components

3.1.2.1 Boards, wood bases panels

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.

If wood based panels are used, these shall conform to EN 13986 or a European Technical Assessment.

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 covered with additional layers without load bearing function on one side. This panels are not part of this European Technical Assessment.

3.1.2.2 Adhesive

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

3.2 Methods of verification

3.2.1 General

The assessment of the solid wood slab elements for the intended use 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 the sense of the Basic Requirements 1 to 6 of Regulation (EU) № 305/2011 has been made in accordance with *European Assessment Document EAD 130005-00-03.04 "Solid wood slab element to be used as a structural element in buildings".*

3.2.2 Identification

The European Technical Assessment for the solid wood slab elements is issued on the basis of agreed data, deposited with Österreichisches Institut für Bautechnik, which identifies the product

[3] 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.

that has been assessed and judged. Changes to materials, to the composition or to characteristics of the product, or to the production process, which could result in this deposited data being incorrect, should be immediately notified to Österreichisches Institut für Bautechnik before the changes are introduced. Österreichisches Institut für Bautechnik will decide whether or not such changes affect the European Technical Assessment, and, if so, whether further assessment or alterations to the European Technical Assessment are considered 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

The manufacturer shall draw up the declaration of performance and determine the product-type on the basis of the assessments and verifications of constancy of performance carried out under the following system as laid down in the Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex V, 1.2, referred to as System 1. This system provides for:

(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 plan[4];

(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 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

At the manufacturing plant the manufacturer has implemented and continuously maintains a factory production control system. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. The factory production control system ensures that the performance of the solid wood slab elements is in conformity with the European Technical Assessment.

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

[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.

control of inspection documents (comparison with nominal values) presented by the manufacturer of the raw materials by verifying the dimensions and determining the material properties.

The frequencies of controls and tests 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 prescribed test plan.

The results of factory production control are recorded and evaluated. The records include at least the following data:

- Designation of the product, basic materials and components
- Type of control or test
- Date of manufacture of the product and date of testing of the product or basic materials or components
- Results of controls and tests and, if appropriate, comparison with requirements
- Name and signature of person responsible for factory production control

The records shall be kept at least for ten years time after the construction product has been placed on the market and shall be presented to the notified product certification body involved in continuous surveillance. On request they shall be presented to Österreichisches Institut für Bautechnik.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance including certification are met, the manufacturer shall issue a declaration of performance.

5.2 Tasks for the notified product certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified product certification body shall ascertain that, in accordance with the prescribed test plan, the factory, in particular personnel and equipment, and the factory production control, are

Timber with the specifications given in the specific parts as well as in the Annexes of the European Technical Assessment.

5.2.2 Continuous surveillance, assessment and evaluation of factory production control

The notified product certification body shall visit the factory at least once a year for surveillance. It shall be verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the prescribed test plan. On demand the results of continuous surveillance shall be made available by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the prescribed test plan are no longer fulfilled, the certificate of constancy of performance shall be withdrawn by the notified product certification body.

Issued in Vienna on 02.10.2014
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits

Managing Director

Figure 1: Structure of the solid wood slab - Example

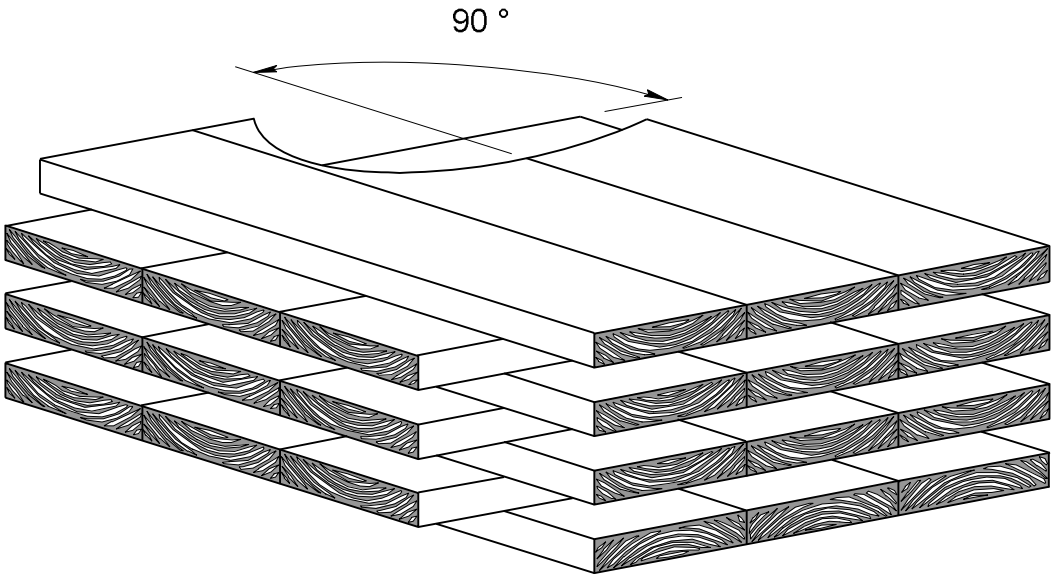

Figure 2: Structure of cross laminated timber with 3 layers - Example

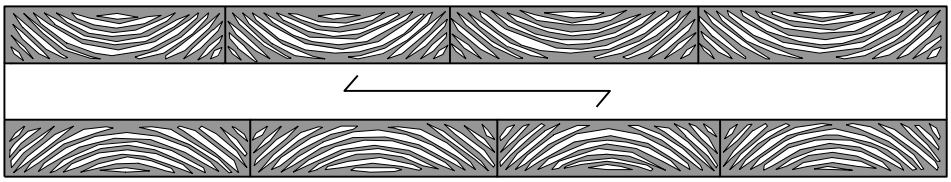

Figure 3: Structure of cross laminated timber with 5 layers - Example

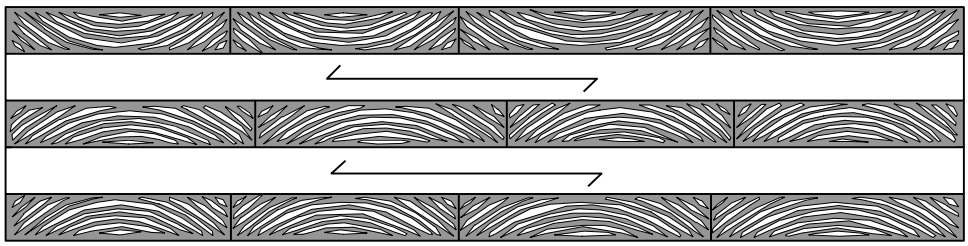

Table 2: Dimensions and specifications

Characteristic		Dimension / Specification
Cross laminated timber		
Thickness	mm	42 to 350
Width	m	≤ 3.0
Length	m	≤ 16.5
Number of layers	—	3 to 20 symmetric assembly
Maximum number of adjacent layers arranged in the same direction		2 for n = 4 or n = 5 3 for n > 5
Maximum width of joints between boards within one layer	mm	3
Board		
Surface	—	planed
Thickness (planed dimension)	mm	14 to 45
Width	mm	40 to 300
Ratio width to thickness	—	≥ 4 : 1
Boards shall be graded with suitable visual assign them to a strength class according to EN 338.	—	Within one member of cross laminated timber only one of the specified combinations of strength classes shall be applied. 100 % C16 ≥ 90 % C24 / ≤ 10 % C16 ≥ 90 % C30 / ≤ 10 % 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 [1)]	—	based on EN 14080

[1)] Finger joints with acceptable wane are acceptable

CLT – Cross Laminated Timber	Annex 2
Characteristic data of cross laminated timber	of European Technical Assessment ETA-14/0349 of 02.10.2014

Table 3: Product characteristics of the solid wood slab

BR	Essential characteristic	Method of verification	Level / Class / Description / NPD
1	**Mechanical resistance and stability**		
	1. Mechanical actions perpendicular to cross laminated timber		
	Strength class of boards	EN 338	C16 / C24 / C30
	Modulus of elasticity – parallel to the grain of the boards $E_{0,mean}$ – perpendicular to the grain of the boards $E_{90,mean}$	EAD 130005-00-0304, 2.2.1.1, I_{eff} EN 338	C16 8 000 MPa C24 12 500 MPa C30 12 500 MPa according to EN 338
	Shear modulus – parallel to the grain of the boards $G_{090,mean}$ – perpendicular to the grain of the boards (rolling shear) $G_{9090,mean}$	EN 338 EAD 130005-00-0304, 2.2.1.1	according to EN 338 50 MPa
	Bending strength – parallel to the grain of the boards $f_{m,k}$	EAD 130005-00-0304, 2.2.1.1, W_{eff}	C16 $1/k_{sys} \cdot 17.6$ MPa [1)] C24 $1/k_{sys} \cdot 26.4$ MPa [1)] C30 $1/k_{sys} \cdot 33.0$ MPa [1)]
	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	according to EN 338
	Shear strength – parallel to the grain of the boards $f_{v,090,k}$ – perpendicular to the grain of the boards (rolling shear strength) $f_{v,9090,k}$	EN 338 EAD 130005-00-0304, 2.2.1.3, A_{gross}	according to EN 338 Spruce: $\min\{1.25;1.45 - t_{cr}/100\}$ [2)] Pine: $\min\{1.70;1.90 - t_{cr}/100\}$ [2)]

NOTE [1)] $k_{sys} = \max\{1.0;1.1 - 0.025 \cdot n\}$ n ... number of boards within cover layer

[2)] t_{cr} is the thickness of the largest cross layer

CLT – Cross Laminated Timber	Annex 2
Characteristic data of cross laminated timber	of European Technical Assessment ETA-14/0349 of 02.10.2014

BR	Essential characteristic	Method of verification	Level / Class / Description / NPD
1	**Mechanical resistance and stability**		
	2. Mechanical actions in plane of cross laminated timber		
	Strength class of boards	EN 338	C16 / C24 / C30
	Modulus of elasticity – parallel to the grain of the boards $E_{0,mean}$	EAD 130005-00-0304, 2.2.1.1, A_{net}, I_{net}	C16 8 000 MPa 12 500 MPa C30 12 500 MPa
	Shear modulus – parallel to the grain of the boards $G_{090,mean}$	EAD 130005-00-0304, 2.2.1.3, A_{net}	460 MPa
	Bending strength – parallel to the grain of the boards $f_{m,k}$	EAD 130005-00-0304, 2.2.1.1, W_{net}	according to EN 338
	Tensile strength – parallel to the grain of the boards $f_{t,0,k}$	EN 338	according to EN 338
	Compressive strength – parallel to the grain of the boards $f_{c,0,k}$	EN 338	according to EN 338
	Shear strength – parallel to the grain of the boards $f_{v,090,k}$	EAD 130005-00-0304, 2.2.1.3, A_{net}	2.5 MPa
	3. Other mechanical actions		
	Creep and duration of load	EN 1995-1-1	
	Dimensional stability Moisture content during service shall not change to such an extend that adverse deformation will occur.		
	Fasteners	EN 1995-1-1, the direction of grain of the cover layer shall be taken as reference	

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BR	Essential characteristic	Method of verification	Level / Class / Description / NPD
	In-service environment		
	Durability of timber Service classes	EN 1995-1-1	1 and 2
	Bond integrity	EAD 130005-00-0304	Pass
2	**Reaction to fire**		
	Glued laminated timber products	EAD 130005-00-0304	Mean density of wood ≥ 380 kg/m³ Euroclass D-s2, d0
	Resistance to fire		
	Constructions with specified fire resistance		
	Wall structures	EN 13501-2	Annex 3
3	**Hygiene, health and environment**		
	Vapour permeability, μ, for wood	EN ISO 10456	20 to 50
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.	
5	**Protection against noise**		
	Airborne sound insulation	EN ISO 10140-2, EN ISO 717-1	For R_w (C; C_{tr}), see Annex 4
	Impact sound insulation	EN ISO 10140-3, EN ISO 717-2	For $L_{n,w}$ (C_I) see Annex 4
	Sound absorption	EN ISO 354, EN ISO 11654	For α_s see Annex 4
6	**Energy economy and heat retention**		
	Thermal conductivity, λ, of wood	EN ISO 10456	0.13 W/(m·K)
	Air permeability	EN 12114	Class 4
	Thermal inertia, specific heat capacity, c_p, of wood	EN ISO 10456	1600 J/(kg·K)

CLT – Cross Laminated Timber	Annex 2
Characteristic data of cross laminated timber	of European Technical Assessment ETA-14/0349 of 02.10.2014

Examples with specified fire resistance

Wall structures

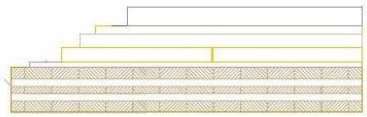
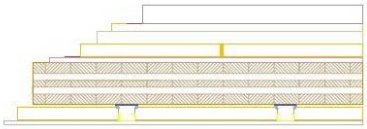
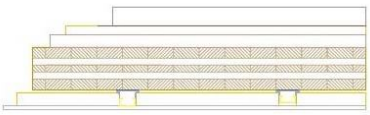
Cladding	CLT element	Mounting	Test load	Classification
	Designation and structure [mm]		[kN/m]	
10 mm Fermacell gypsum board with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, ρ = 1 200 kg/m³	CLT 80 C3s 30-20-30	Clamps with a = 150 mm, row distance 390 mm	45	REI 60

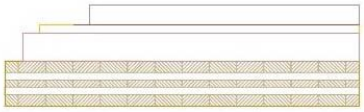
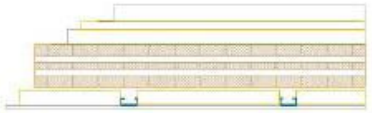
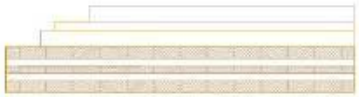
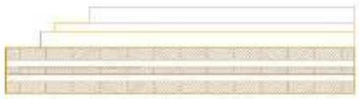
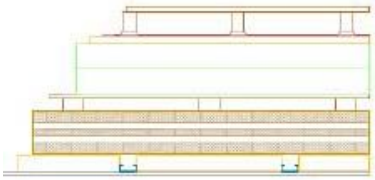
Cladding	CLT element	Mounting	Test load	Classification
	Designation and structure [mm]		[kN/m]	
2 x 18 mm KNAUF gypsum plasterboard type DF according to EN 520, ρ = 800 kg/m³	CLT 80 C3s 20-40-20	First board: clamps with a = 200 mm, row distance 625 mm Second board: clamps with a = 80 mm, row distance 625 mm	120	REI-M 60

Cladding	CLT element	Mounting	Test load	Classification
	Designation and structure [mm]		[kN/m]	
2 x 18 mm KNAUF gypsum plasterboard type DF according to EN 520, ρ = 800 kg/m³	CLT 80 C3s 20-40-20	First board: clamps with a = 200 mm, row distance 625 mm Second board: clamps with a = 80 mm, row distance 625 mm	100	REI-M 90

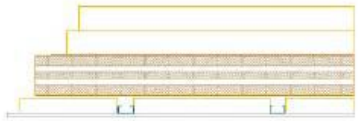
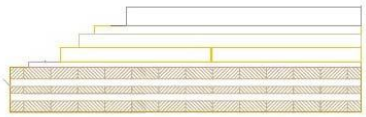
Cladding	CLT element	Mounting	Test load	Classification
	Designation and structure [mm]		[kN/m]	
10 mm Fermacell gypsum board with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, ρ = 1 200 kg/m³ 40 mm Rockwool panel 211, ρ = 40 kg/m³ 10 mm Fermacell gypsum board with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, ρ = 1 200 kg/m³	CLT 80 C3s 30-20-30	Clamps with a = 150 mm, row distance 390 mm	45	REI 120

Examples for airborne and impact sound insulation

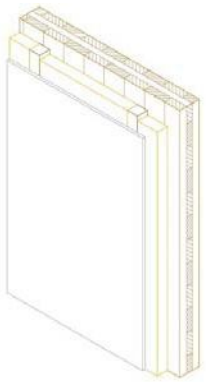
№	Floor elements		
F 1	140 mm	CLT 140 NVI L5S, 428 kg/m³	$L_{n,w}(C_I)$ = 88 (-5) dB 
F 2	70 mm 0.2 mm 30 mm 50 mm 0.2 mm 18 mm 140 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Ballast weight, 1650 kg/m³ Paving slab, 2320 kg/m³ Trickle course Soft fibre board, 250 kg/m³ CLT 140 NVI L5S, 428 kg/m³	$L_{n,w}(C_I)$ = 41 (1) dB 
F 3	70 mm 0.2 mm 50 mm 50 mm 0.2 mm 18 mm 140 mm 3 mm 70 mm 15 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Ballast weight, 1650 kg/m³ Paving slab, 2320 kg/m³ Trickle protection Soft fibre board, 250 kg/m³ CLT 140 NVI L5S, 428 kg/m³ Connection sealing tape Acoustical mounting including 50 mm thermal insulation, 16 kg/m³ Gypsum plasterboard, 800 kg/m³	$L_{n,w}(C_I)$ = 36 (3) dB 
F 4	70 mm 0.2 mm 50 mm 140 mm 3 mm 70 mm 15 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Ballast weight, 1650 kg/m³ CLT 140 NVI L5S, 428 kg/m³ Connection sealing tape Acoustical mounting including 50 mm thermal insulation, 16 kg/m³ Gypsum plasterboard, 800 kg/m³	$L_{n,w}(C_I)$ = 46 (1) dB 
F 5	70 mm 0.2 mm 30 mm 50 mm 140 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Ballast weight, 1650 kg/m³ CLT 140 NVI L5S, 428 kg/m³	$L_{n,w}(C_I)$ = 50 (-1) dB 
F 6	70 mm 0.2 mm 30 mm 20 mm 140 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Ballast weight, 1650 kg/m³ Impact sound insulation board, 69 kg/m³, s' = 14 MN/m³ CLT 140 NVI L5S, 428 kg/m³	$L_{n,w}(C_I)$ = 49 (1) dB 

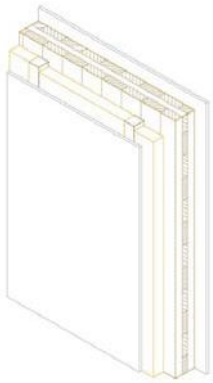
F 7	70 mm 0.2 mm 30 mm 140 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Latex bonded ballast weight, 1650 kg/m³ CLT 140 NVI L5S, 428 kg/m³	**$L_{n,w}(C_I)$ = 43 (-3) dB** 
F 8	60 mm 0.05 mm 30 mm 60 mm 0.1 mm 150 mm 70 mm 12.5 mm	Cement screed, 2200 kg/m³ PE-foil (separating layer) Impact sound insulation board, 120 kg/m³, s' ≤ 35 MN/m³ Ballast weight, 1700 kg/m³ PE-foil (trickle protection) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m³ Gypsum plasterboard, 720 kg/m³	**$L_{n,w}(C_I)$ = 53 (3) dB** 
F 9	60 mm 0.05 mm 30 mm 60 mm 0.1 mm 150 mm 70 mm 12.5 mm	Cement screed, 2200 kg/m³ PE-foil (separating layer) Impact sound insulation board, 80 kg/m³, s' = 10 MN/m³ Ballast weight, 1700 kg/m³ PE-foil (trickle protection) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m³ Gypsum plasterboard, 720 kg/m³	**$L_{n,w}(C_I)$ = 46 (2) dB** 
F 10	60 mm 0.05 mm 30 mm 60 mm 0.1 mm 150 mm	Cement screed, 2200 kg/m³ PE-foil (separating layer) Impact sound insulation board, 120 kg/m³, s' ≤ 35 MN/m³ Ballast weight, 1700 kg/m³ PE-foil (trickle protection) CLT 5s	**$L_{n,w}(C_I)$ = 57 (-1) dB** 
F 11	60 mm 0.05 mm 30 mm 60 mm 0.1 mm 150 mm	Cement screed, 2200 kg/m³ PE-foil (separating layer) Impact sound insulation board, 120 kg/m³, s' ≤ 35 MN/m³ Bonded ballast weight, 1840 kg/m³ PE-foil (trickle protection) CLT 5s	**$L_{n,w}(C_I)$ = 65 (-2) dB** 
F 12	20 + 80 mm 10 mm 2 mm 0.1 mm 30 mm 2 x 100 mm 0.1 mm 15 mm 50 mm 150 mm 70 mm 12.5 mm	Floor covering on timber beams 50/80 Protection mat Roofing membrane PE-foil Impact sound insulation board, 133 kg/m³, s' = 10 MN/m³ EPS F, 15 kg/m³ PE-foil (vapour barrier) OSB, 580 kg/m³ Timber beams 50/80 CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m³ Gypsum plasterboard, 720 kg/m³	**$L_{n,w}(C_I)$ = 52 (3) dB** 

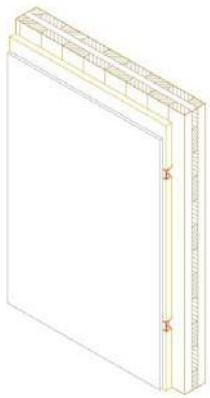
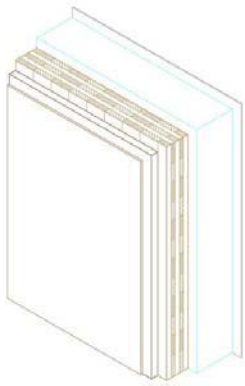
CLT – Cross Laminated Timber	Annex 4
Protection against noise	of European Technical Assessment ETA-14/0349 of 02.10.2014

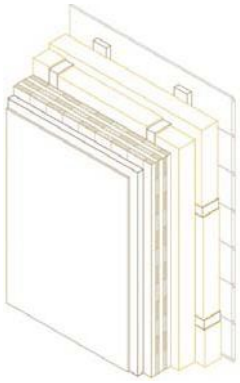
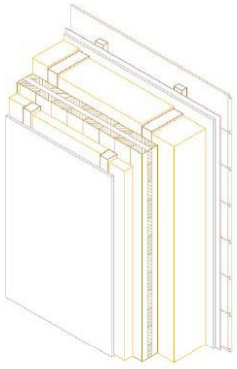
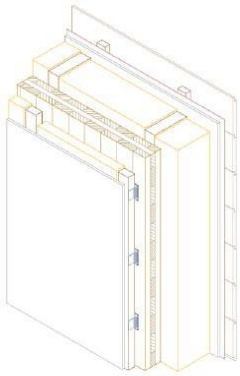
№	Roof elements		
R 1	2 mm 2 x 100 mm 0.1 mm 125 mm 70 mm 12.5 mm	Roofing membrane EPS F, 15 kg/m³ PE-foil (vapour barrier) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m³ Gypsum plasterboard, 720 kg/m³	$R_w(C; C_{tr})$ = 48 (-3; -9) dB 
R 2	70 mm 0.7 mm 2 mm 2 x 100 mm 0.1 mm 125 mm	Ballast weight, 1600 kg/m³ Separation geotextile Roofing membrane Mineral fibre board, 146 kg/m³ PE-foil (vapour barrier) CLT 5s	$R_w(C; C_{tr})$ = 44 (0; -3) dB 

№	Wall elements		
W 1	120 mm	CLT 120 NVI C5S, 445 kg/m³	$R_w(C; C_{tr})$ = 36 (-1; -4) dB 
W 2	100 mm	CLT 100 NVI C3S, 371 kg/m³	$R_w(C; C_{tr})$ = 34 (-1; -3) dB 

W 3	100 mm 3 mm 50 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m³ Connection sealing tape Acoustical mounting, 388 kg/m³ including 50 mm thermal insulation, 16 kg/m³ Gypsum plasterboard, 816 kg/m³	**$R_w(C; C_{tr})$ = 51 (-2; -8) dB** 
W 4	100 mm 50 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m³ Wooden battens, 388 kg/m³ including 50 mm thermal insulation, 16 kg/m³ Gypsum plasterboard, 816 kg/m³	**$R_w(C; C_{tr})$ = 45 (-1; -5) dB** 
W 5	12.5 mm 50 mm 100 mm 50 mm 12.5 mm	Gypsum plasterboard, 816 kg/m³ Wooden battens, 388 kg/m³ including 50 mm thermal insulation, 16 kg/m³ CLT 100 NVI C3S, 371 kg/m³ Wooden battens, 388 kg/m³ including 50 mm thermal insulation, 16 kg/m³ Gypsum plasterboard, 816 kg/m³	**$R_w(C; C_{tr})$ = 50 (-3; -10) dB** 

W 6	12.5 mm 100 mm 50 mm 12.5 mm	Gypsum plasterboard, 816 kg/m^3 CLT 100 NVI C3S, 371 kg/m^3 Wooden battens, 388 kg/m^3 including 50 mm thermal insulation, 16 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**$R_w(C; C_{tr})$ = 46 (-2; -6) dB** 
W 7	12.5 mm 100 mm 12.5 mm	Gypsum plasterboard, 816 kg/m^3 CLT 100 NVI C3S, 371 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**$R_w(C; C_{tr})$ = 37 (-1; -3) dB** 
W 8	100 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**$R_w(C; C_{tr})$ = 37 (-1; -3) dB** 

W 9	100 mm 27 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m^3 Acoustical mounting including 50 mm thermal insulation, 16 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**$R_w(C; C_{tr})$ = 48 (-5; -12) dB** 
W 10	120 mm 35 mm 10 mm	CLT 120 NVI C5S, 445 kg/m^3 Clay building board, 1043 kg/m^3 Clay rendering including glass fiber reinforcement	**$R_w(C; C_{tr})$ = 47 (-1; -5) dB** 
W 11	5 mm 200 mm 120 mm 35 mm 10 mm	Exterior basecoat including reinforcing mesh Stone wool rendering panel, 121 kg/m^3 CLT 120 NVI C5S, 445 kg/m^3 Clay building board, 1043 kg/m^3 Clay rendering including glass fiber reinforcement	**$R_w(C; C_{tr})$ = 48 (-3; -8) dB** 

W 12	27 mm 0.4 mm 100 mm 100 mm 120 mm 35 mm 10 mm	Rabbet edge shuttering of larch, 536 kg/m³ Spread shuttering, 640 kg/m³ Shuttering layer Wooden battens, 542 kg/m³ including 100 mm façade insulation board, 25 kg/m³, cross layer Wooden battens, 542 kg/m³ including 100 mm façade insulation board, 25 kg/m³ CLT 120 NVI C5S, 445 kg/m³ Clay building board, 1043 kg/m³ Clay rendering including glass fiber reinforcement	**$R_w(C; C_{tr})$ = 54 (-2; -7) dB** 
W 13	30 mm 0.3 mm 15 mm 200 mm 100 mm 60 mm 12.5 mm	Shuttering, laterally closed*/open all around** Timber beams 30/50 Foil (diffusion open) Gypsum fiber board, 1190 kg/m³ Wooden battens 200/60, e = 62.5 cm including 200 mm thermal hemp-mats, 30 kg/m³ CLT 3s or 5s Wooden battens 60/60, e = 62.5 cm including 50 mm mineral wool, 13 kg/m³ Gypsum plasterboard, 810 kg/m³	**$R_w(C; C_{tr})$ = 46 (-2; -5) dB *** **$R_w(C; C_{tr})$ = 45 (-1; -4) dB **** 
W 14	30 mm 0.3 mm 15 mm 200 mm 100 mm 94 mm 70 mm 12.5 mm	Shuttering Timber beams 30/50 Foil (diffusion open) Gypsum fiber board, 1190 kg/m³ Wooden battens 200/60, e = 62.5 cm including 200 mm thermal hemp-mats*, 30 kg/m³ or wood fiber insulation board**, 58kg/m³ CLT 3s or 5s Acoustical mounting including 50 mm mineral wool, 13 kg/m³ Gypsum plasterboard, 810 kg/m³	**$R_w(C; C_{tr})$ = 51 (-2; -7) dB *** **$R_w(C; C_{tr})$ = 53 (-2; -8) dB **** 

Sound absorption

f in Hz	63	125	250	500	1000	2000	4000
α_s	0.02	0.03	0.04	0.04	0.05	0.05	0.05

European Assessment Document EAD 130005-00-0304 “Solid wood slab element to be used as a structural element in buildings”, Edition August 2014

EN 301 (10.2013), Adhesives, phenolic and aminoplastic, for load-bearing timber structures - Classification and performance requirements

EN 338 (10.2009), Structural timber - Strength classes

EN 520 (08.2009), Gypsum plasterboards - Definitions, requirements and test methods

EN 1995-1-1 (11.2004), EN 1995-1-1/AC (06.2006), EN 1995-1-1/A1 (06.2008), Eurocode 5 - Design of timber structures - Part 1-1: General - Common rules and rules for buildings

EN 1995-1-2 (11.2004), EN 1995-1-2/AC (03.2009), Eurocode 5 - Design of timber structures - Part 1-2: General - Structural fire design

EN 12114 (03.2000), Thermal performance of buildings - Air permeability of building components and building elements - Laboratory test method

EN 13183-2 (04.2002) and AC (09.2003), Moisture content of a piece of sawn timber - Part 2: Estimation by electrical resistance method

EN 13501-2:2007+A1 (09.2009), Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services

EN 13986 (04.2010), Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking

EN 14080 (06.2013), Timber structures - Glued laminated timber and glued solid timber – Requirements

EN 15283-2 (08.2009), Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 2: Gypsum fibre boards

EN 15425 (02.2008), Adhesives - One component polyurethane for load bearing timber structures - Classification and performance requirements

EN ISO 354 (05.2003), Acoustics - Measurement of sound absorption in a reverberation room

EN ISO 717-1 (03.2013), Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

EN ISO 717-2 (03.1013), Acoustics - Rating of sound insulation in buildings and of building elements - Part 2: Impact sound insulation

CLT – Cross Laminated Timber	Annex 5
Reference documents	of European Technical Assessment ETA-14/0349 of 02.10.2014

EN ISO 10140-2 (09.2010), Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation

EN ISO 10140-3 (09-2010), Acoustics - Laboratory measurement of sound insulation of building Elements - Part 3: Measurement of impact sound insulation

EN ISO 10456 (12.2007), EN ISO 10456/AC (12.2009), Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values

EN ISO 11654 (04.1997), Acoustics - Sound absorbers for use in buildings - Rating of sound absorption