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Designated according to Article 29 of Regulation (EU) No 305/2011

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European Technical Assessment

ETA-14/0349 of 07.01.2019

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	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	See Annex 1
This European Technical Assessment contains	30 pages including 6 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”.
This European Technical Assessment replaces	European Technical Assessment ETA-14/0349 of 19.10.2018.

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Remarks

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Specific parts

1 Technical description of the product

1.1 General

This European Technical Assessment (ETA) [1] applies to the cross laminated timber "CLT – Cross Laminated Timber". 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 2, Figure 1.

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

The solid wood slab elements consist of at least three and up to twenty 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 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. When the cover layer is substituted by two adjacent layers oriented in direction of the mechanical action with approximately the same overall thickness a symmetric assembly may be considered.

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.

CLT – Cross Laminated Timber and the boards for its manufacturing correspond to the specifications given in the Annexes 2 and 3. The material characteristics, dimensions and tolerances of CLT – Cross Laminated Timber, not indicated in these Annexes, are given in the technical file[2] 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 3, Table 2. Boards are visually or machine strength graded. Only technically dried wood shall be used.

Wood species is European spruce or equivalent softwood.

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[1] In 2014 ETA-14/0349 was firstly issued as European Technical Assessment ETA-14/0349 of 02.10.2014, amended to ETA-14/0349 of 19.10.2018 and amended to ETA-14/0349 of 07.01.2019.

[2] 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.

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1.2.2 Wood-based panels

The specification of the wood-based panels is given in Annex 3, Table 2. Wood-based panels are in accordance with EN 13986 or a European Technical Assessment.

1.2.3 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. The adhesive for the possible bonding of the edges shall conform to EN 301 or EN 15425.

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[3]. 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 not to be bonded.

<u>Design</u>

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 Annex 3 of the European Technical Assessment.

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

[3] Reference documents are listed in Annex 6.

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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.

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 CLT – Cross Laminated Timber 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 experience[4].

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.

[4] 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.

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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

№	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability [1)]		
1	Bending [2)]	Annex 3
2	Tension and compression [2)]	Annex 3
3	Shear [2)]	Annex 3
4	Embedment strength	Annex 3
5	Creep and duration of the load	Annex 3
6	Dimensional stability	Annex 3
7	In-service environment	Annex 3
8	Bond integrity	Annex 3
Basic requirement for construction works 2: Safety in case of fire		
9	Reaction to fire	Annex 3
10	Resistance to fire	Annex 3
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 3
Basic requirement for construction works 4: Safety and accessibility in use		
13	Impact resistance	Annex 3
Basic requirement for construction works 5: Protection against noise		
14	Airborne sound insulation	Annex 3
15	Impact sound insulation	Annex 3
16	Sound absorption	Annex 3
Basic requirement for construction works 6: Energy economy and heat retention		
17	Thermal conductivity	Annex 3
18	Air permeability	Annex 3
19	Thermal inertia	Annex 3

[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.

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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 CLT – Cross Laminated Timber 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 CLT – Cross Laminated Timber 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 CLT – Cross Laminated Timber 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 CLT – Cross Laminated Timber 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 plan[5];

(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;

[5] 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.

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(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 CLT – Cross Laminated Timber 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.

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 are met, including the certificate of conformity issued by the notified product certification body, the manufacturer shall draw up a declaration of performance.

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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 verify the ability of the manufacturer for a continuous and orderly manufacturing of CLT – Cross Laminated Timber according to the European Technical Assessment. In particular the following items shall be appropriately considered

- Personnel and equipment
- The suitability of the factory production control established by the manufacturer
- Full implementation of the control plan

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 routine inspection. In particular the following items shall be appropriately considered

- The manufacturing process including personnel and equipment
- The factory production control
- The implementation of the control plan

The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the control plan are no longer fulfilled, the certificate of constancy of performance is withdrawn by the notified product certification body.

Issued in Vienna on 07.01.2019
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits

Managing Director

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Manufacturing plants in Austria

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Manufacturing plants in Sweden

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Sweden

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Figure 1: Principle structure of the solid wood slab – Example

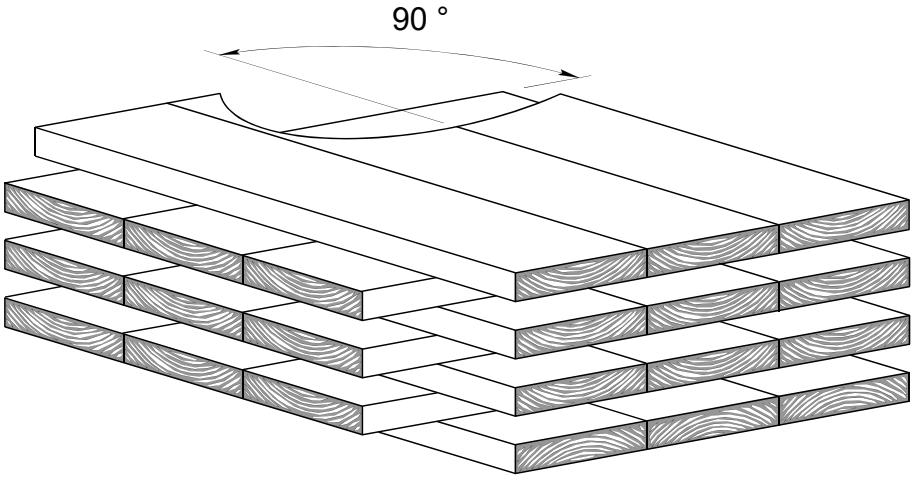


Figure 2: Principle structure of cross laminated timber with 3 layers – Example

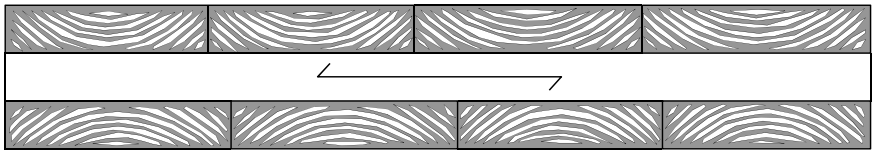
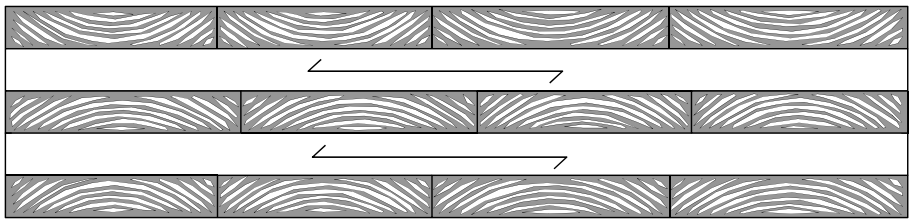


Figure 3: Principle structure of cross laminated timber with 5 layers – Example



CLT – Cross Laminated Timber	Annex 2
Structure of cross laminated timber	of European Technical Assessment ETA-14/0349 of 07.01.2019

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Table 2: Dimensions and specifications

Item		Dimension / Specification
Cross laminated timber		
Thickness	mm	42 to 350
Width	m	≤ 3.5
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
Boards		
Surface	—	planed
Thickness (planed dimension)	mm	14 to 45
Width	mm	40 to 300
Ratio width to thickness (if not edge glued)	—	≥ 4 : 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.	—	Within one member of cross laminated timber only one of the specified combinations of strength classes shall be applied. 100 % C16 or T11 [1)] ≥ 90 % C24 or T14 [1)] / ≤ 10 % C16 or T11 [1)] ≥ 90 % C30 or T21 [1)] / ≤ 10 % C24 or T14 [1)]

[1)] According to EN 338.

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Item	Dimension / Specification	
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
Wood-based panels	—	EN 13986

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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	See Table 2
	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/T11 8 000 MPa C24/T14 12 000 MPa C30/T21 12 000 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

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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	See Table 2
	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/T11 8 000 MPa C24/T14 12 000 MPa C30/T21 12 000 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} 3)	3.9 MPa 3)

NOTE 3) $A_{net} = max \begin{cases} A_{net,x} \\ A_{net,z} \end{cases}$

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BWR	Essential characteristic	Assessment method	Level / Class / Description	
	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		
	In-service environment			
	Durability of timber Service classes	EN 1995-1-1	1 and 2	
	Bond integrity	EAD 130005-00-0304	Pass	
2	**Safety in case of fire**			
	<u>Reaction to fire</u>			
	Glued laminated timber products	Commission Decision 2005/610/EC	Mean density of wood ≥ 380 kg/m³ Euroclass D-s2, d0	
	<u>Resistance to fire</u>			
	Structures with specified fire resistance	EN 13501-2	Annex 4	
	Charring rate - Charring of the cover layer - Charring of more layers than the cover layer	EAD 130005-00-0304	Floor/Roof 0.65 mm/min 1.3 mm/min [4)]	Wall 0.63 mm/min 0.86 mm/min
3	**Hygiene, health and environment**			
	Vapour permeability, μ, for wood	EN ISO 10456	50 (dry) to 20 (wet)	
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.		

NOTE [4)] until 25 mm of charring. Afterwards the charring rate 0.65 mm/min applies up to the next glue line

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BWR	Essential characteristic	Assessment method	Level / Class / Description
5	**Protection against noise**		
	Airborne sound insulation	EN ISO 10140-2, EN ISO 717-1	For R_w (C; C_{tr}), see Annex 5
	Impact sound insulation	EN ISO 10140-3, EN ISO 717-2	For $L_{n,w}$ (C_I) see Annex 5
	Sound absorption	EN ISO 354, EN ISO 11654	For α_s see Annex 5
6	**Energy economy and heat retention**		
	Thermal conductivity, λ, of wood	EN ISO 10456	0.12 W/(m·K)
	Air permeability	EN 12114	Class 4 according to EN 12207
	Thermal inertia, specific heat capacity, c_p, of wood	EN ISO 10456	1600 J/(kg·K)

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Examples with specified fire resistance

Wall structures

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classifi-cation
		Designation and structure [mm]	[kN/m]	[m]	i => o
–	–	CLT 100 C3s 30-40-30	35	3	REI 60
–	–	CLT 100 C5s 20-20-20-20-20	35	3	REI 60
12.5 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 80 C3s 30-20-30	35	3	REI 60
50 mm wood wool board Heraklith BM type L1/L2-W1-T1-S1/S2-P1-CS(10/Y)150-CI3 according to EN 13168, ρ = 18.5 kg/m³ 15 mm plaster	Heraklith screws 5 mm x 80 mm with a = 150 mm row distance 625 mm	CLT 80 C3s 30-20-30	35	3	REI 60
10 mm fermacell Firepanel A1 with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, ρ = 1 200 ± 50 kg/m³	Staples with a = 150 mm, row distance 390 mm	CLT 80 C3s 30-20-30	45	3	REI 60
12.5 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	Staples with a = 150 mm, row distance 400 mm	CLT 120 C3s 40-40-40	200	3	REI 60
Hat- spring bar Protektor 60-27 according to EN 14195 40 mm glass wool Ursa Trennwandfilz TWF 1 according to ÉN 13162 12.5 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	Wood screws with flat head 4.2 mm x 35 mm with a = 600 mm Drywall screws 3.9 mm x 30 mm with a = 250 mm	CLT 120 C3s 40-40-40	200	3	REI 60
2 x 18 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	First layer: staples with a = 200 mm, row distance 625 mm Second layer: staples with a = 80 mm, row distance 625 mm	CLT 80 C3s 20-40-20	120	3.28	REI-M 60

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Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classifi-cation
		Designation and structure [mm]	[kN/m]	[m]	i => o
2 x 15 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	First layer: ribbed nails l = 40 mm Second layer: ribbed nails l = 40 mm (left side) and staples l = 45 mm (right side) with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 80 C3s 30-20-30	–	3	EI 90
12.5 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 100 C3s 30-40-30	35	3	REI 90
12.5 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³ 40 mm mineral wool according to ÉN 13162, ρ = 11 kg/m³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 100 C3s 30-40-30	35	3	REI 90
50 mm wood wool board Heraklith BM type L1/L2-W1-T1-S1/S2-P1-CS(10/Y)150-CI3 according to EN 13168, ρ = 18.5 kg/m³ 15 mm plaster	Heraklith screws 5 mm x 80 mm with a = 150 mm row distance 625 mm	CLT 100 C3s 30-40-30 CLT 100 C5s 20-20-20-20-20	35	3	REI 90
Hat- spring bar Protektor 60-27 according to EN 14195 40 mm glass wool Ursa Trennwandfilz TWF 1 according to ÉN 13162 12.5 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	Wood screws with flat head 4.2 mm x 35 mm with a = 600 mm Drywall screws 3.9 mm x 30 mm with a = 250 mm	CLT 120 C3s 40-40-40	120	3	REI 90
12.5 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	Staples with a = 150 mm, row distance 400 mm	CLT 120 C3s 40-40-40	120	3	REI 90
2 x 15 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	First layer: staples with a = 200 mm, row distance 625 mm Second layer: staples with a = 150 mm, row distance 400 mm	CLT 120 C3s 40-40-40	200	3	REI 90

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Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classifi-cation
		Designation and structure [mm]	[kN/m]	[m]	i => o
2 x 18 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	First layer: staples with a = 200 mm, row distance 625 mm Second layer: staples with a = 80 mm, row distance 625 mm	CLT 80 C3s 20-40-20	100	3.28	REI-M 90
15 mm and 18 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	First layer: staples with a ≤ 200 mm, row distance 625 mm Second layer: staples with a ≤ 150 mm, row distance 400 mm	CLT 80 C3s 20-40-20	120	3	REI-M 90

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classifi-cation
		Designation and structure [mm]	[kN/m]	[m]	i => o
12.5 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³ 40 mm mineral wool according to ÉN 13162, ρ = 11 kg/m³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 100 C3s 30-40-30	35	3	REI 120
12.5 mm fermacell Firepanel A1 with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, ρ = 1 200 ± 50 kg/m³ 40 mm Rockwool panel 211, ρ = 40 kg/m³ 10 mm fermacell Firepanel A1 with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, ρ = 1 200 ± 50 kg/m³	Staples with a = 150 mm, row distance 390 mm	CLT 80 C3s 30-20-30	45	3	REI 120
18 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	Staples with a = 200 mm, row distance 400 mm	CLT 120 C3s 40-40-40	120	3	REI 120
2 x 15 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, ρ = 1 150 ± 50 kg/m³	First layer: staples with a = 200 mm, row distance 625 mm Second layer: staples with a = 150 mm, row distance 400 mm	CLT 120 C3s 40-40-40	150	3	REI 120

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Floor structures

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested span	Classifi-cation
		Designation and structure [mm]	[kN/m²]	[m]	b => a
–	–	CLT 140 C5s 40-20-20-20-40	5	5	REI 60
12.5 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 100 C3s 30-40-30	0.6	5	REI 60

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested span	Classifi-cation
		Designation and structure [mm]	[kN/m²]	[m]	b => a
–	–	CLT 160 C5s 40-20-40-20-40	6	5	REI 90
12.5 mm gypsum plasterboard type DF according to EN 520, ρ ≥ 800 kg/m³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 140 C5s 40-20-20-20-40	–	5	EI 90
35 mm wood wool board Heraklith EPV type L2-W1-T2-S2-P2-CS(10/Y)200-CI3 according to EN 13168	Heraklith screws 4.5 mm x 60 mm with a = 215 mm row distance 625 mm	CLT 140 C5s 40-20-20-20-40	–	5	EI 90

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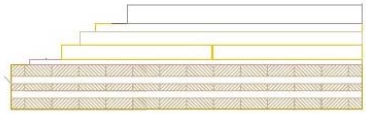
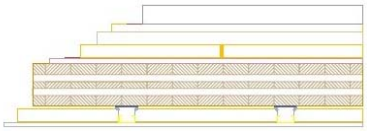
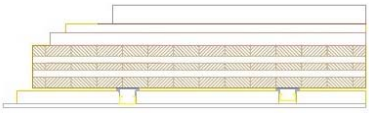
Examples for airborne and impact sound insulation

№	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 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 30 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 30 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 50 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**

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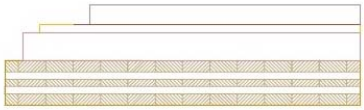
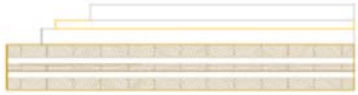
F 7	70 mm 0.2 mm 30 mm 100 mm 140 mm	Cement screed, 2210 kg/m³ Vapour barrier sheet Impact sound insulation board, 72 kg/m³, s' = 10 MN/m³ Latex bonded ballast weight, 1650 kg/m³ CLT 140 NVI L5S, 428 kg/m³	**$L_{n,w}(C_I)$ = 43 (-3) dB** 
F 8	60 mm 0.05 mm 30 mm 60 mm 0.1 mm 150 mm 70 mm 12.5 mm	Cement 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**

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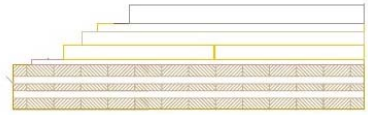
№	Roof elements		
R 1	2 mm 2 x 100 mm 0.1 mm 125 mm 70 mm 12.5 mm	Roofing membrane EPS F, 15 kg/m³ PE-foil (vapour barrier) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m³ Gypsum plasterboard, 720 kg/m³	**R_w(C; C_{tr}) = 48 (-3; -9) dB**
R 2	70 mm 0.7 mm 2 mm 2 x 100 mm 0.1 mm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

CLT – Cross Laminated Timber	Annex 5
Protection against noise	of European Technical Assessment ETA-14/0349 of 07.01.2019

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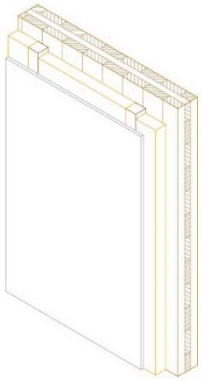
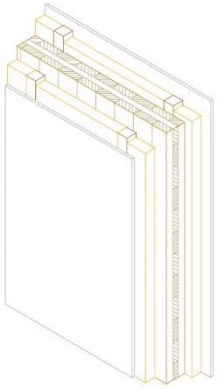
W 3	100 mm 3 mm 50 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m^3 Connection sealing tape Acoustical mounting, 388 kg/m^3 including 50 mm thermal insulation, 16 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**R_w(C; C_{tr}) = 51 (-2; -8) dB**
W 4	100 mm 50 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m^3 Wooden battens, 388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

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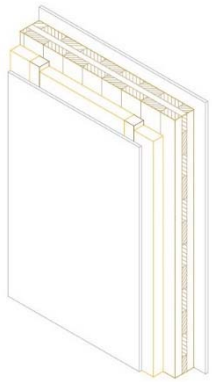
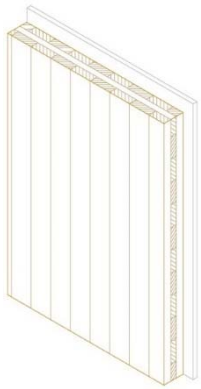
W 6	12.5 mm 100 mm 50 mm 12.5 mm	Gypsum plasterboard, 816 kg/m^3 CLT 100 NVI C3S, 371 kg/m^3 Wooden battens, 388 kg/m^3 including 50 mm thermal insulation, 16 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**R_w(C; C_{tr}) = 46 (-2; -6) dB** 
W 7	12.5 mm 100 mm 12.5 mm	Gypsum plasterboard, 816 kg/m^3 CLT 100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

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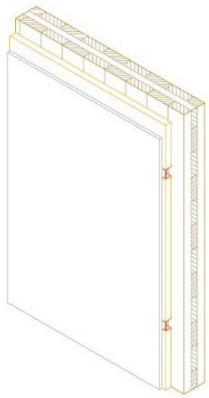
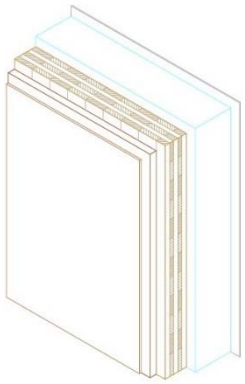
W 9	100 mm 27 mm 12.5 mm	CLT 100 NVI C3S, 371 kg/m^3 Acoustical mounting including 50 mm thermal insulation, 16 kg/m^3 Gypsum plasterboard, 816 kg/m^3	**R_w(C; C_{tr}) = 48 (-5; -12) dB** 
W 10	120 mm 35 mm 10 mm	CLT 120 NVI C5S, 445 kg/m^3 Clay building board, 1043 kg/m^3 Clay rendering including glass fibre 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 fibre reinforcement	**R_w(C; C_{tr}) = 48 (-3; -8) dB** 

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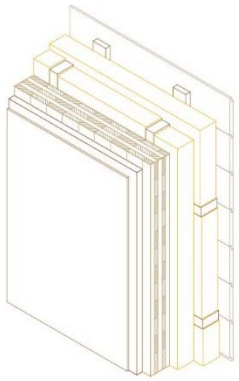
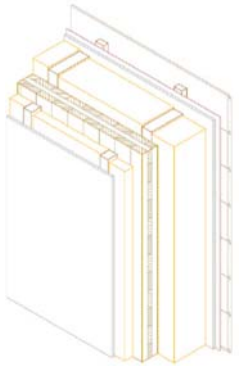
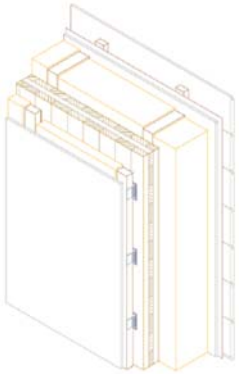
W 12	20 mm 27 mm 0.4 mm 100 mm 100 mm 120 mm 35 mm 10 mm	Rabbet edge shuttering of larch, 536 kg/m³ Spread shuttering, 640 kg/m³ Shuttering layer Wooden battens, 542 kg/m³ including 100 mm façade insulation board, 25 kg/m³, cross layer Wooden battens, 542 kg/m³ including 100 mm façade insulation board, 25 kg/m³ CLT 120 NVI C5S, 445 kg/m³ Clay building board, 1043 kg/m³ Clay rendering including glass fibre reinforcement	**R_w(C; C_{tr}) = 54 (-2; -7) dB** 
W 13	20 mm 30 mm 0.3 mm 15 mm 200 mm 100 mm 94 mm 60 mm 12.5 mm	Shuttering, laterally closed*/open all around** Timber beams 30/50 Foil (diffusion open) Gypsum fibre 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	20 mm 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 fibre board, 1190 kg/m³ Wooden battens 200/60, e = 62.5 cm including 200 mm thermal hemp-mats*, 30 kg/m³ or wood fibre 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 **** 

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W 15	100 mm 140 mm 8 mm	CLT 100 3s Mineral wool, 120 kg/m³ Plaster including reinforcement, 3 kg/m²	**R_w(C; C_{tr}) = 44 (-2; -8) dB**
W 16	100 mm 160 mm 11 mm	CLT 100 3s Hemp fibre insulation, 100 kg/m³ Plaster including reinforcement, 4 kg/m²	**R_w(C; C_{tr}) = 51 (-3; -10) 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

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

ETA-03/0050, European Technical Assessment ETA-03/0050 of 25 May 2018 for „fermacell Gypsum fibre boards – fermacell Gipsfaserplatte, fermacell Vapor, fermacell Gipsfaser-Platte greenline“ from Fermacell GmbH, Düsseldorfer Landstraße 395, 47259 Duisburg, Germany

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

EN 338 (04.2016), Structural timber – Strength classes

EN 520:2004+A1 (08.2009), Gypsum plasterboards – Definitions, requirements and test methods

EN 1995-1-1 (11.2004), +AC (06.2006), +A1 (06.2008), +A2 (05.2014), Eurocode 5 – Design of timber structures - Part 1-1: General – Common rules and rules for buildings

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EN 13168:2012+A1 (02.2015), Thermal insulation products for buildings – Factory made wood wool (WW) products – Specification

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EN ISO 717-2 (03.2013), Acoustics – Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation

EN ISO 10140-2 (09.2019), Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation

EN ISO 10140-3 (09.2010), +A1 (06.2015), Acoustics – Laboratory measurement of sound insulation of building Elements – Part 3: Measurement of impact sound insulation

EN ISO 10456 (12.2007), +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