



Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-23/6881 of 25/05/2023
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	CLT – Cross Laminated Timber
Product family to which the construction product belongs:	Structural timber products/elements and ancillaries
Manufacturer:	Stora Enso Oyj P.O. Box 309 00101 Helsinki Finland
Manufacturing plant(s):	See Annex 1
This UK Technical Assessment contains:	35 pages including 5 Annexes which form an integral part of this assessment
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD 130005-00-0304 <i>Solid wood slab element to be used as a structural element in buildings</i>

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1. Technical description of the product

1.1. General

This UK Technical Assessment (UKTA) 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 (at an angle of 90°) to each other - see Annex 2, Figure 1.

The principal structure of the cross laminated timber is shown in Annex 2, Figures 2 and 3. Surfaces of the cross laminated timber are planed or sanded. Surfaces of the boards 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 cases 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 must be suitable for structural use.

The transverse layers may be substituted with lamellae type “REX”. Lamellae type “REX” may be side-glued.

The surfaces of the solid wood slabs may be covered with additional layers. These panels are not part of this UK 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.

CLT – Cross Laminated Timber and the boards for its manufacture correspond to the specifications given in the Annexes 2 and 3.

The application of wood preservatives and flame retardants has not been assessed as part of this UK 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 can be used.

The wood species is European spruce or an equivalent softwood.

1.2.2. Lamellae type “REX”

The specification of the lamellae type “REX” is given in Annex 2, Table 2. Lamellae type “REX” are extracted from symmetrical cross laminated timbers of European spruce, fir or pine, of boards with a minimum strength class of ≥ 90 % T14 and ≤ 10 % T11 according to EN 338. Lamellae type “REX” shows a predefined percentage of end grain on the face of the lamellae, see Figure 4. Only technically dried wood can be used.

1.2.3. 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 UK or European Technical Assessment.

1.2.4. Adhesive

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

2. Specification of the intended use(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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 must 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. Members which are directly exposed to the weather must 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 UK Technical Assessment.

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

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

Adhesive must be applied on one face of each board. The edges of the boards need not to be bonded.

Design

The UK 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 assessed as part of the UK Technical Assessment.

The following conditions must be observed:

- Design of cross laminated timber members must be carried out under the responsibility of an engineer experienced in such products.
- Design of the works must 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 UK Technical Assessment.

Standards and regulations in force at the place of use must 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 their clients on the transport, storage, maintenance, replacement and repair of the product as considered 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 building professionals.

2.3. Assumed working life

The provisions made in the UK Technical Assessment (UKTA) 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 .

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 their representative, nor by the UK Approved 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 references to the methods used for its assessment

3.1. Mechanical resistance and stability (BWR 1)

No	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

⁽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.

3.2. Safety in case of fire (BWR 2)

No	Essential characteristic	Product performance
Basic Requirement for Construction Works 2: Safety in case of fire		
9	Reaction to fire	Annex 3
10	Resistance to fire	Annex 3

3.3. Health, hygiene and the environment (BWR 3)

No	Essential characteristic	Product performance
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

The release of dangerous substances is determined according to UKAD 130005-00-0304, “Solid wood slab element to be used as a structural element in buildings”. No dangerous

substances are released from CLT – Cross Laminated Timber in this respect.

NOTE In addition to the specific clauses relating to dangerous substances contained in the UK 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.

3.4. Safety and accessibility in use (BWR 4)

№	Essential characteristic	Product performance
Basic Requirement for Construction Works 4: Safety and accessibility in use		
13	Impact resistance	Annex 3

3.5. Protection against noise (BWR 5)

№	Essential characteristic	Product performance
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

3.6. Energy economy and heat retention (BWR 6)

№	Essential characteristic	Product performance
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

3.7. Sustainable use of natural resources (BWR 7)

No performance assessed.

3.8. Assessment methods

3.8.1. General

The assessment of the essential characteristics in Clause 3.1 to 3.7 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 UK Assessment Document UKAD 130005-00-0304, Solid wood slab element to be used as a structural element in buildings.

3.8.2. Identification

The UK 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. The BBA should be notified before the changes are implemented, as an amendment of the UK Technical Assessment may be necessary.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied

4.1. System of assessment and verification of constancy of performance

According to UKAD No. 130005-00-0304 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011) as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

5.1. UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance
- UKTA number.

On behalf of the British Board of Agrément



Date of Issue: 25 May 2023

Hardy Giesler
Chief Executive Officer



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ANNEXES

These annexes apply to the product described in the main body of the UK Technical Assessment.

ANNEX 1
CLT – Cross Laminated Timber
Manufacturing plants

Manufacturing plants in Austria:

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

Manufacturing plant in Sweden:

Stora Enso Timber AB
Timmervägen 2
664 33 Grums
Sweden

Manufacturing plant in Czech Republic:

Stora Enso WP HV s.r.o.
Nádražní 66
58263 Ždírec nad Doubravou
Czech Republic

ANNEX 2
CLT – Cross Laminated Timber
Structure of cross laminated timber

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

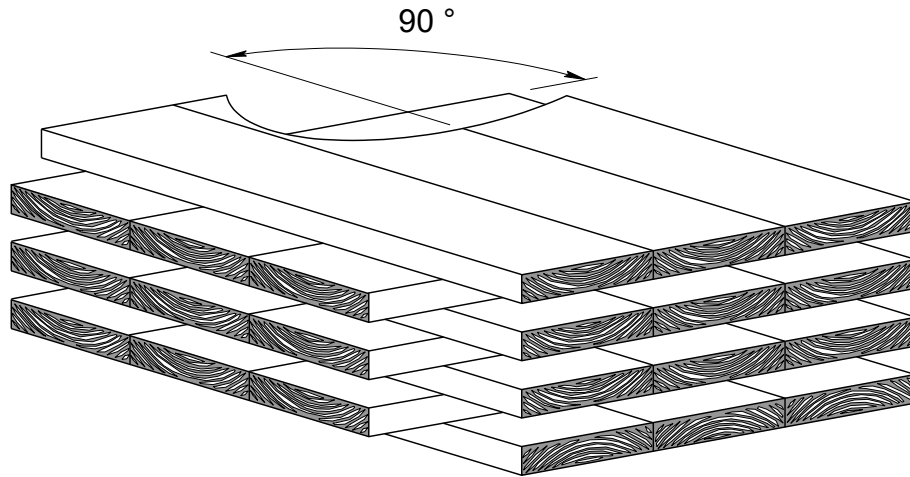


Figure 2: Principal structure of cross laminated timber with 3 layers – Example

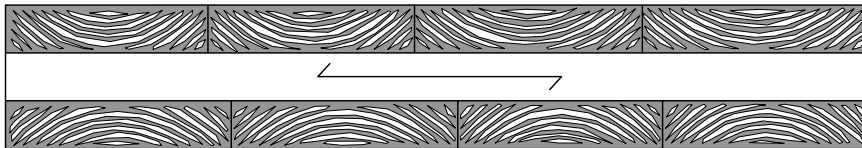
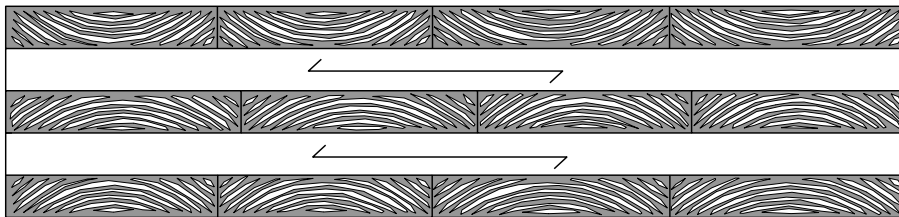


Figure 3: Principal structure of cross laminated timber with 5 layers – Example

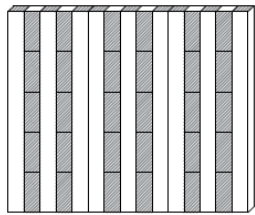
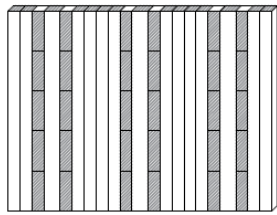


ANNEX 2
CLT – Cross Laminated Timber
Structure of cross laminated timber

Figure 4: Pattern of lamellae type “REX” to be used as transverse layers

Type	Illustration	Lamellae type “REX”	Type	Illustration	Lamellae type “REX”
REX 60L3s		20-20-20 33 % end grain in the face	REX 80 L3s		30-20-30 25 % end grain in the face
REX 90 L3s		30-30-30 33 % end grain in the face	REX 100 L3s		30-40-30 40 % end grain in the face
REX 100 L3s-B		40-20-40 20 % end grain in the face	REX 110 L3s		40-30-40 27 % end grain in the face
REX 120 L3s		40-40-40 33 % end grain in the face	REX 100 L5s		20-20-20-20-20 40 % end grain in the face
REX 120 L5s		30-20-20-20-30 33 % end grain in the face	REX 140 L5s		40-20-20-20-40 29 % end grain in the face
REX 160 L5s		40-20-40-20-40 25 % end grain in the face	REX 180 L5s		40-30-40-30-40 33 % end grain in the face

ANNEX 2
CLT – Cross Laminated Timber
Structure of cross laminated timber

Type	Illustration	Lamellae type "REX"	Type	Drawing	Lamellae type "REX"
REX 200 L5s		40-40-40-40-40 40 % end grain in the face	REX 220 L7s-2		60-30-40-30-60 27 % end grain in the face

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

Table 1: Dimensions and specifications

Item	Dimension / Specification	
Cross laminated timber		
Thickness	mm	42 to 360
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
Density ρ_k	kg/m ³	$1.1 \times \rho_{l,k} = 385$
Boards		
Surface	—	Planed
Thickness (planed dimension)	mm	14 to 45
Width	mm	40 to 300
Ratio width to thickness ⁽²⁾	—	$\geq 2.2 : 1$
Boards must be graded with suitable visual and/or machine procedures to be able to assign them to a strength class according to EN 338.	—	<p>Within one member of cross laminated timber only one of the specified combinations of strength classes must be applied.</p> <p>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⁾</p>

⁽¹⁾ According to EN 338.

⁽²⁾ Except lamellae type “REX”.

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

Item	Dimension / Specification	
Moisture of wood according to EN 13183-2	%	6 to 15 % Within one member of cross laminated timber the moisture content must not differ by more than 5 %.
Finger joints ⁽³⁾	—	EN 14080
Lamellae type “REX”	—	See Annex 2, Figure 4 Percentage of end grain in the face: 20 % to 40 %
Wood-based panels	—	EN 13986

⁽¹⁾ Finger joints with acceptable wane are permissible.

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

Table 2: 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 ⁽¹⁾		
	Strength class of boards	EN 338	See Table 2
	Modulus of elasticity		
	– Parallel to the grain of the boards $E_{0, mean}$	UKAD 130005-00-0304, 2.2.1.1, I_{eff}	C16/T11 8 000 MPa C24/T14 12 000 MPa ⁽²⁾ C30/T21 12 000 MPa
	– Perpendicular to the grain of the boards $E_{90, mean}$	EN 338	C16/T11 270 MPa C24/T14 370 MPa C30/T21 400 MPa
	Shear modulus		
	– Parallel to the grain of the boards $G_{090, mean}$	EN 338	C16/T11 500 MPa C24/T14 690 MPa C30/T21 750 MPa
– Perpendicular to the grain of the boards (rolling shear) $G_{9090, mean}$	UKAD 130005-00-0304, 2.2.1.1	50 MPa	
Bending strength			
– Parallel to the grain of the boards $f_{m, k}$	UKAD 130005-00-0304, 2.2.1.1, W_{eff}	C16/T11 $1/k_{sys} \cdot 17.6$ MPa ⁽³⁾ C24/T14 $1/k_{sys} \cdot 26.4$ MPa ⁽³⁾ C30/T21 $1/k_{sys} \cdot 33.0$ MPa ⁽³⁾	
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	C16/T11 2.2 MPa C24/T14 2.5 MPa C30/T21 2.7 MPa	

NOTE ⁽¹⁾ CLT – Cross Laminated Timber with transverse layers of lamellae type “REX” may be considered equivalent to C24/T14

⁽²⁾ $E_{0, mean} = 6\ 800$ MPa for lamellae type “REX”

⁽³⁾ $k_{sys} = \max\{1.0; 1.1 - 0.025 \cdot n\}$

n ... number of boards within cover layer

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

BWR	Essential characteristic	Assessment method	Level / Class / Description
	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 UKAD 130005-00-0304, 2.2.1.3, A_{gross}	C16/T11 3.2 MPa C24/T14 4.0 MPa C30/T21 4.0 MPa Spruce: $\min \left\{ 1.25; 1.45 - \frac{t_Q}{100} \right\} \text{ MPa}^{(4)}$ Pine: $\min \left\{ 1.70; 1.90 - \frac{t_Q}{100} \right\} \text{ MPa}^{(4)}$ Lamellae type "REX": $\min \left\{ 1.25; 1.45 - \frac{t_Q}{100} \right\} \text{ MPa}^{(4)}$

NOTE ⁽⁴⁾ t_Q is the thickness of the largest cross layer

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

BWR	Essential characteristic	Assessment method	Level / Class / Description
	2. Mechanical actions in plane of cross laminated timber ⁽¹⁾		
	Strength class of boards	EN 338	See Table 2
	Modulus of elasticity – Parallel to the grain of the boards $E_{0, mean}$	UKAD 130005-00-0304, 2.2.1.1, A_{net} , I_{net}	C16/T11 8 000 MPa C24/T14 12 000 MPa ⁽²⁾ C30/T21 12 000 MPa
	Shear modulus – Parallel to the grain of the boards $G_{090, mean}$	UKAD 130005-00-0304, 2.2.1.3, A_{net}	460 MPa
	Bending strength – Parallel to the grain of the boards $f_{m, k}$	UKAD 130005-00-0304, 2.2.1.1, W_{net}	C16/T11 16 MPa C24/T14 24 MPa C30/T21 30 MPa
	Tensile strength – Parallel to the grain of the boards $f_{t, 0, k}$	EN 338	C16/T11 8.5 MPa C24/T14 14.5 MPa C30/T21 19.0 MPa
	Compressive strength – Parallel to the grain of the boards $f_{c, 0, k}$	EN 338	C16/T11 17 MPa C24/T14 21 MPa C30/T21 24 MPa
	Shear strength – Parallel to the grain of the boards $f_{v, 090, k}$	UKAD 130005-00-0304, 2.2.1.3, A_{net} ⁽³⁾	3.9 MPa ⁽⁵⁾

NOTE ⁽⁵⁾ $A_{net} = \max \begin{cases} A_{net,x} \\ A_{net,z} \end{cases}$

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

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 must not change to such an extent that adverse deformation will occur.			
	Fasteners	EN 1995-1-1, the direction of grain of the cover layer must be taken as reference		
	In-service environment			
	Durability of timber	EN 1995-1-1		
	Service classes		1 and 2	
	Bond integrity	UKAD 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/m ³ Euroclass D-s2, d0	
	<u>Resistance to fire</u>			
	Structures with specified fire resistance	EN 13501-2	Annex 4	
	Charring rate	UKAD 130005-00-0304	Floor/Roof	Wall
	- Charring of the cover layer - Charring of more layers than the cover layer		0.65 mm/min 1.3 mm/min ⁽⁶⁾	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 ⁽⁶⁾ Until 25 mm of charring. Afterwards the charring rate 0.65 mm/min applies up to the next glue line.

ANNEX 3
CLT – Cross Laminated Timber
Characteristic data of cross laminated timber

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	1 600 J/(kg·K)

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

Examples with specified fire resistance

Wall structures

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classification
		Designation and structure [mm]	[kN/m]	[m]	i => o
–	–	CLT 90 C3s 30-30-30	70	3	REI 30

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classification
		Designation and structure [mm]	[kN/m]	[m]	i => o
–	–	CLT 100 C3s 30-40-30	35	3	REI 60
–	–	CLT 100 C3s 40-20-40	55	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, $\rho \geq 800 \text{ kg/m}^3$	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, $\rho = 18.5 \text{ kg/m}^3$ 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, $\rho = 1\,200 \pm 50 \text{ kg/m}^3$	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, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	Staples with a = 150 mm, row distance 400 mm	CLT 120 C3s 40-40-40	200	3	REI 60

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classification
		Designation and structure [mm]	[kN/m]	[m]	i => o
Hat- spring bar Protektor 60-27 according to EN 14195 40 mm glass wool Ursa Trennwandfilz TWF 1 according to EN 13162 12.5 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	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, $\rho \geq 800 \text{ kg/m}^3$	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
12.5 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800 \text{ kg/m}^3$	Drywall screws 3.5 mm x 35 mm with a = 250 mm row distance 400 mm	CLT 100 C5s 20-20-20-20-20	160	3	REI 60

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classification
		Designation and structure [mm]	[kN/m]	[m]	i => o
2 x 15 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800 \text{ kg/m}^3$	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, $\rho \geq 800 \text{ kg/m}^3$	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, $\rho \geq 800 \text{ kg/m}^3$ 40 mm mineral wool according to EN 13162, $\rho = 11 \text{ kg/m}^3$	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, $\rho = 18.5 \text{ kg/m}^3$ 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 EN 13162 12.5 mm fermacell Gypsum Fibreboard with fibrous reinforcement type GF-I-W2-C1 according to ETA-03/0050, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	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, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	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, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	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

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classification
		Designation and structure [mm]	[kN/m]	[m]	i => o
2 x 18 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800 \text{ kg/m}^3$	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, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	First layer: staples with a \leq 200 mm, row distance 625 mm Second layer: staples with a \leq 150 mm, row distance 400 mm	CLT 80 C3s 20-40-20	120	3	REI-M 90
12.5 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800 \text{ kg/m}^3$	Drywall screws 3.5 mm x 35 mm with a = 250 mm row distance 400 mm	CLT 100 C3s 30-40-30	50	3	REI 90

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

Cladding on the fire exposed side	Mounting	CLT element	Test load	Tested wall height	Classification
		Designation and structure [mm]	[kN/m]	[m]	i => o
12.5 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800 \text{ kg/m}^3$ 40 mm mineral wool according to EN 13162, $\rho = 11 \text{ kg/m}^3$	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, $\rho = 1\,200 \pm 50 \text{ kg/m}^3$ 40 mm Rockwool panel 211, $\rho = 40 \text{ kg/m}^3$ 10 mm fermacell Firepanel A1 with fibrous reinforcement type GF-I-W2-C1 according to EN 15283-2, $\rho = 1\,200 \pm 50 \text{ kg/m}^3$	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, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	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, $\rho = 1\,150 \pm 50 \text{ kg/m}^3$	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

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

Floor structures

Cladding on the fire exposed side	Mounting	CLT element	Test load	Classification
		Designation and structure [mm]		b => a
–	–	CLT 120 L5s 30-20-20-20-30	$M_{d,fi} = 16.1$ kNm/m $V_{d,fi} = 10.3$ kN/m	REI 60
–	–	CLT 140 L5s 40-20-20-20-40	$M_{d,fi} = 25$ kNm/m $V_{d,fi} = 18$ kN/m	REI 60
12.5 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800$ kg/m ³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 100 L3s 30-40-30	$M_{d,fi} = 1.9$ kNm/m $V_{d,fi} = 2.8$ kN/m	REI 60

Cladding on the fire exposed side	Mounting	CLT element	Test load	Classification
		Designation and structure [mm]		b => a
–	–	CLT 160 L5s 40-20-40-20-40	$M_{d,fi} = 42.1$ kNm/m $V_{d,fi} = 27$ kN/m	REI 90
–	–	CLT 200 L5s 40-40-40-40-40	$M_{d,fi} = 68.8$ kNm/m $V_{d,fi} = 50$ kN/m	REI 90
12.5 mm gypsum plasterboard type DF according to EN 520, $\rho \geq 800$ kg/m ³	Drywall screws 3.9 mm x 35 mm with a = 75/150 mm (edge/centre) row distance 625 mm	CLT 140 L5s 40-20-20-20-40	–	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 L5s 40-20-20-20-40	–	EI 90

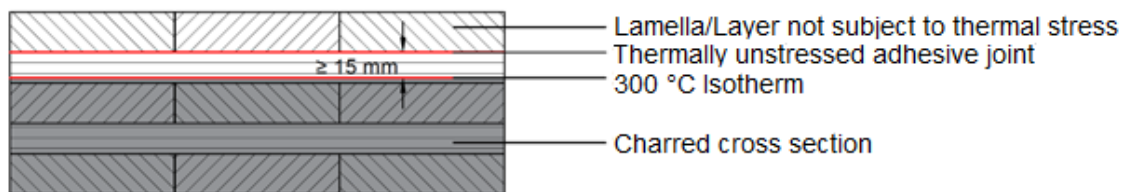
Cladding on the fire exposed side	Mounting	CLT element	Test load	Classification
		Designation and structure [mm]		b => a
–	–	CLT 220 L7s 40-20-40-20-40-20-40	$M_{d,fi} = 62$ kNm/m $V_{d,fi} = 45.2$ kN/m	REI 120

ANNEX 4
CLT – Cross Laminated Timber
Resistance to fire

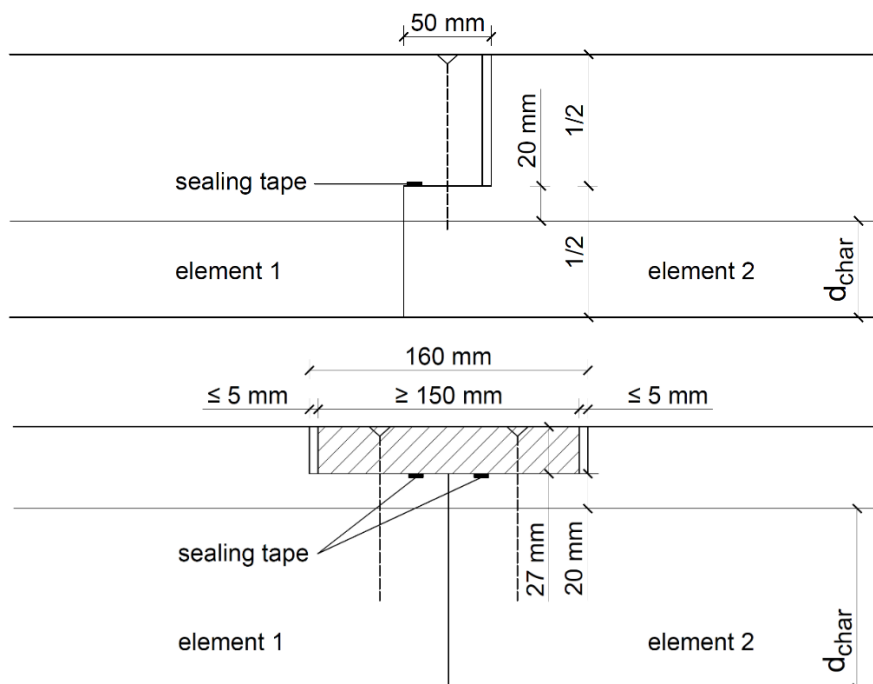
Performances E and I – integrity and insulation

The criteria E (integrity) and I (insulation) as well as the smoke tightness at an undisturbed element in terms of fire protection and the surface temperature at the unexposed fire side are considered to be fulfilled if

- the distance between the non-charred bond line and the 300°C isotherm is ≥ 15 mm and
- the residual timber cross-section consists of at least one non-charred bond line and a layer above it.



The design of element joints, e.g. with stepped rebate or top-side cover board, fulfil the criteria E (integrity) and I (insulation) if a residual timber cross-section of 2 cm exists up to the element joint, e.g. stepped rebate or cover board.


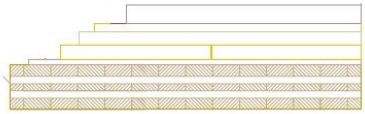
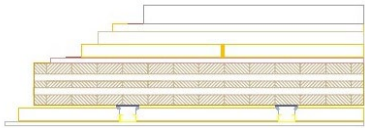
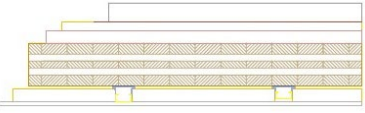




Sealing tapes are not required for the above-mentioned joints if


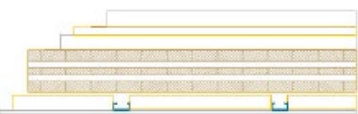



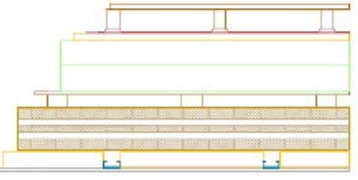
- the surface temperature is $< 120^{\circ}\text{C}$ and
- the maximum distance of the screw connection of 250 mm is observed.
- For stepped rebate joints, the temperature in the rebate area must be $< 150^{\circ}\text{C}$ and the maximum distance of the screw connection must be < 250 mm.

ANNEX 5
CLT – Cross Laminated Timber
Protection against noise

Examples for airborne and impact sound insulation

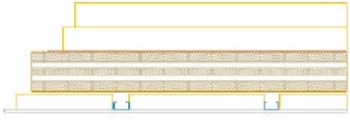
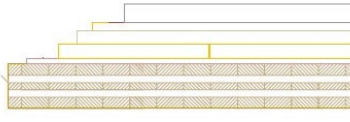
No	Floor elements		
F 1	140 mm	CLT 140 NVI L5S, 428 kg/m ³	L_{n,w}(C_i) = 88 (-5) dB 
F 2	70 mm 0.2 mm 30 mm 50 mm 50 mm 0.2 mm 18 mm 140 mm	Cement screed, 2210 kg/m ³ Vapour barrier sheet Impact sound insulation board, 72 kg/m ³ , s' = 10 MN/m ³ Ballast weight, 1650 kg/m ³ Paving slab, 2320 kg/m ³ Trickle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

ANNEX 5
CLT – Cross Laminated Timber
Protection against noise



F 7	70 mm 0.2 mm 30 mm 100 mm 140 mm	Cement screed, 2210 kg/m ³ Vapour barrier sheet Impact sound insulation board, 72 kg/m ³ , s' = 10 MN/m ³ Latex bonded ballast weight, 1650 kg/m ³ CLT 140 NVI L5S, 428 kg/m ³	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/m ³ PE-foil (separating layer) Impact sound insulation board, 120 kg/m ³ , s' ≤ 35 MN/m ³ Ballast weight, 1700 kg/m ³ PE-foil (trickle protection) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m ³ Gypsum plasterboard, 720 kg/m ³	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/m ³ PE-foil (separating layer) Impact sound insulation board, 80 kg/m ³ , s' = 10 MN/m ³ Ballast weight, 1700 kg/m ³ PE-foil (trickle protection) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m ³ Gypsum plasterboard, 720 kg/m ³	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/m ³ PE-foil (separating layer) Impact sound insulation board, 120 kg/m ³ , s' ≤ 35 MN/m ³ Ballast weight, 1700 kg/m ³ 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/m ³ PE-foil (separating layer) Impact sound insulation board, 120 kg/m ³ , s' ≤ 35 MN/m ³ Bonded ballast weight, 1840 kg/m ³ 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/m ³ , s' = 10 MN/m ³ EPS F, 15 kg/m ³ PE-foil (vapour barrier) OSB, 580 kg/m ³ Timber beams 50/80 CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m ³ Gypsum plasterboard, 720 kg/m ³	L_{n,w}(C_i) = 52 (3) dB 

ANNEX 5
CLT – Cross Laminated Timber
Protection against noise


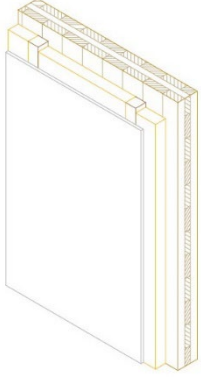
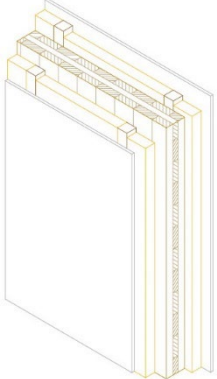
№ Roof elements

R 1	2 mm 2 x 100 mm 0.1 mm 125 mm 70 mm 12.5 mm	Roofing membrane EPS F, 15 kg/m ³ PE-foil (vapour barrier) CLT 5s Acoustical mounting including 60 mm thermal insulation, 22 kg/m ³ Gypsum plasterboard, 720 kg/m ³	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/m ³ Separation geotextile Roofing membrane Mineral fibre board, 146 kg/m ³ PE-foil (vapour barrier) CLT 5s	R_w(C; C_{tr}) = 44 (0; -3) dB 

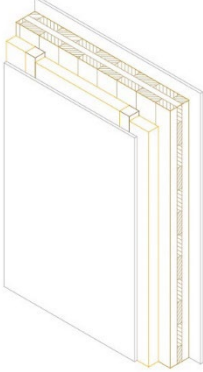


№ Wall elements

W 1	120 mm	CLT 120 NVI C5S, 445 kg/m ³	R_w(C; C_{tr}) = 36 (-1; -4) dB 
W 2	100 mm	CLT 100 NVI C3S, 371 kg/m ³	R_w(C; C_{tr}) = 34 (-1; -3) dB 



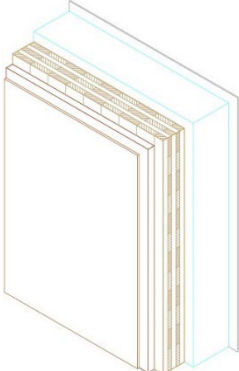
ANNEX 5
CLT – Cross Laminated Timber
Protection against noise

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 

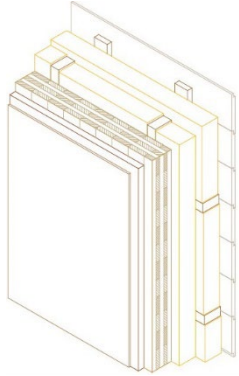
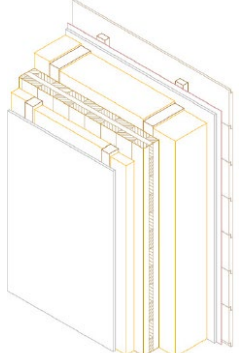
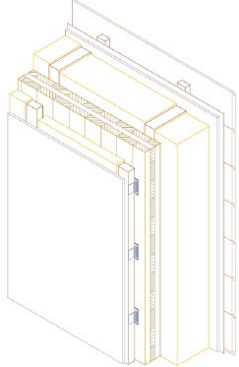
ANNEX 5
CLT – Cross Laminated Timber
Protection against noise

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 



ANNEX 5
CLT – Cross Laminated Timber
Protection against noise

<p>W 9</p>	<p>100 mm 27 mm 12.5 mm</p>	<p>CLT 100 NVI C3S, 371 kg/m³ Acoustical mounting including 50 mm thermal insulation, 16 kg/m³ Gypsum plasterboard, 816 kg/m³</p>	<p>R_w(C; C_{tr}) = 48 (-5; -12) dB</p> 
<p>W 10</p>	<p>120 mm 35 mm 10 mm</p>	<p>CLT 120 NVI C5S, 445 kg/m³ Clay building board, 1043 kg/m³ Clay rendering including glass fibre reinforcement</p>	<p>R_w(C; C_{tr}) = 47 (-1; -5) dB</p> 
<p>W 11</p>	<p>5 mm 200 mm 120 mm 35 mm 10 mm</p>	<p>Exterior basecoat including reinforcing mesh Stone wool rendering panel, 121 kg/m³ CLT 120 NVI C5S, 445 kg/m³ Clay building board, 1043 kg/m³ Clay rendering including glass fibre reinforcement</p>	<p>R_w(C; C_{tr}) = 48 (-3; -8) dB</p> 

ANNEX 5
CLT – Cross Laminated Timber
Protection against noise

<p>W 12</p>	<p>20 mm 27 mm 0.4 mm 100 mm 100 mm 120 mm 35 mm 10 mm</p>	<p>Rabbit 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</p>	<p>R_w(C; C_{tr}) = 54 (-2; -7) dB</p> 
<p>W 13</p>	<p>20 mm 30 mm 0.3 mm 15 mm 200 mm 100 mm 94 mm 60 mm 12.5 mm</p>	<p>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</p>	<p>R_w(C; C_{tr}) = 46 (-2; -5) dB * R_w(C; C_{tr}) = 45 (-1; -4) dB **</p> 
<p>W 14</p>	<p>20 mm 30 mm 0.3 mm 15 mm 200 mm 100 mm 94 mm 70 mm 12.5 mm</p>	<p>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</p>	<p>R_w(C; C_{tr}) = 51 (-2; -7) dB * R_w(C; C_{tr}) = 53 (-2; -8) dB **</p> 

ANNEX 5
CLT – Cross Laminated Timber
Protection against noise

W 15	100 mm 140 mm 8 mm	CLT 100 3s Mineral wool, 120 kg/m ³ Plaster including reinforcement, 3 kg/m ²	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/m ³ Plaster including reinforcement, 4 kg/m ²	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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