Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-16/0115 of 26 January 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	X Panel
Product family to which the construction product belongs	Multilayered timber elements for walls, ceilings, roofs and special construction components
Manufacturer	Gaujas Koks Ltd 24/35 Gaujas street VANGAZILV-LV-2136 LETTLAND
Manufacturing plant	Zilanu street 93a Jekapils LV-5202 Latvia
This European Technical Assessment contains	18 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	EAD 130005-00-0304

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Specific Part

1 Technical description of the product

"X Panel" are plane timber building components which are made of at least three layers of softwood boards. Adjacent layers are glued together with an angle of 90°. The cross section of the elements is symmetric.

The components and the system setup of the elements are given in Annex 2. The building elements are plane.

Two adjacent layers may be oriented with parallel grain direction if a symmetric and crosswise blocked structure is guaranteed.

Not load-bearing outer layers are possible.

The elements can be produced with a width up to 3.0 m and a length up to 12 m.

The layers are bonded together to the required thickness of the cross laminated timber.

Specifications of the used boards are given in Annex 2. Boards are visually or machine strength graded. Only technically dried wood is used.

Only boards which are planed on both sides of the outer layer are used. The boards may be connected by finger joints in longitudinal direction according to EN 14080. There are no butt joints.

The single boards of the layers in longitudinal direction are not glued at narrow side. The permissible width of the gap is given in Annex 2.

The solid wood slab elements correspond to the specifications given in Annexes 2 to 3 of this European Technical Assessment. The material characteristics, dimensions and tolerances of the solid wood slab elements not indicated in these Annexes are given in the technical documentation of the European Technical Assessment.

The cross laminated timber elements are manufactured in accordance with the provisions of this European Technical Assessment using the automated manufacturing process in accordance with the technical documentation and inspection.

The adhesive for gluing the board layers and the finger joint connections of the individual boards fulfils the requirements for adhesives type I acc. to EN 15425.

Details on the adhesives and the bonding process are deposited with Deutsches Institut für Bautechnik.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The elements are intended to be used as load-bearing and/or stiffening or not load-bearing wall, ceiling/floor, roof and special construction components for timber structures. For the taking up and transmitting of loads they may be stressed both perpendicular to the element plane and in the element plane.

The performances given in Section 3 are only valid if the solid wood slab elements are used in compliance with the specifications and conditions given in Annex 2 to 5.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the solid wood slab element of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right 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 [1] (BWR 1)

Essential characteristic	Performance
Bending [2]	Annex 3
Tension and compression [2]	Annex 3
Shear [2]	Annex 3
Embedment strength	Annex 3
Creep and duration of the load	Annex 3
Dimensional stability	Annex 3
In-service environment	Annex 3
Bond integrity	Annex 3

[1] This characteristic also relates to BWR 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)

Essential characteristic	Performance
Reaction to fire	Annex 3
Resistance to fire	no performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	
Substance/s classified as EU-cat. Carc. 1A and/or 1B in accordance with Regulation (EC) No 1272/2008.	The product does not contain these dangerous substances.[a]
Substance/s classified as EU-cat. Muta. 1A and/or 1B in accordance with Regulation (EC) No 1272/2008.	
Substance/s classified as EU-cat. Acute Tox. 1, 2 and/or 3; Repr. 1A and/or 1B; STOT SE 1 and/or STOT RE 1 in accordance with Regulation (EC) No 1272/2008.	
Water vapour permeability - Water vapour transmission	Annex 3
Use scenarios regarding BWR 3 in accordance with EOTA TR 034: IA 1, IA 2	

[a] Assessment based on a detailed manufacturer's product declaration.

3.4 Safety and accessibility in use (BWR 4)

Essential characteristic	Performance
Impact resistance	Annex 3

3.5 Protection against noise (BWR 5)

Essential characteristic	Performance
Airborne sound insulation	no performance assessed
Impact sound insulation	no performance assessed
Sound absorption	no performance assessed

3.6 Energy economy and heat retention (BWR 6)

Essential characteristic	Performance
Thermal conductivity	Annex 3
Air permeability	no performance assessed
Thermal inertia	Annex 3

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

In accordance with EAD No. 130005-00-0304 the applicable European legal act is: 1997/176/EC amended by 2001/596/EC

The system to be applied is: 1

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 26 January 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Deniz

Deutsches Institut für Bautechnik DIBt

Annex 1 Specifications of intended use

A.1.1 Intended Use and Loading

The elements are intended to be used as load-bearing and/or stiffening or not load-bearing wall, ceiling/floor, roof and special construction components for timber structures. For the taking up and transmitting of loads they may be stressed both perpendicular to the element plane and in the element plane.

The solid wood slab element shall be subjected to static and quasi-static actions only.

The solid wood slab element is intended to be used in service classes 1 and 2 according to EN 1995-1-1.

A.1.2 Design

The suitability of the solid wood slab elements for the specified purpose is given under the following conditions:

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

The design of the solid wood slab element can be performed according to EN 1995-1-1, taking into account Annexes 2 to 5 of the European Technical Assessment.

A.1.3 Packaging, transport, storage

The solid wood slab elements shall be protected during transport and storage against any damage and detrimental moisture effects. The manufacturer's instructions for packaging, transport and storage shall be observed.

A.1.4 Installation provisions

EN 1995-1-1 in conjunction with the respective national annex applies for the installation.

The manufacturer shall prepare assembling instructions in which the product-specific characteristics and important measures to be taken into consideration for assembling are described. The assembling instructions shall be available at every construction site.

The assembling of the solid wood slab elements according to this European Technical Assessment shall be carried out by appropriately qualified personnel.

Installation of the elements shall be done as ordinary glued laminated timber. The product shall only be installed in structures where they are protected from wetting, weathering and moisture.

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

X Panel	Annex 1
Specifications of intended use	

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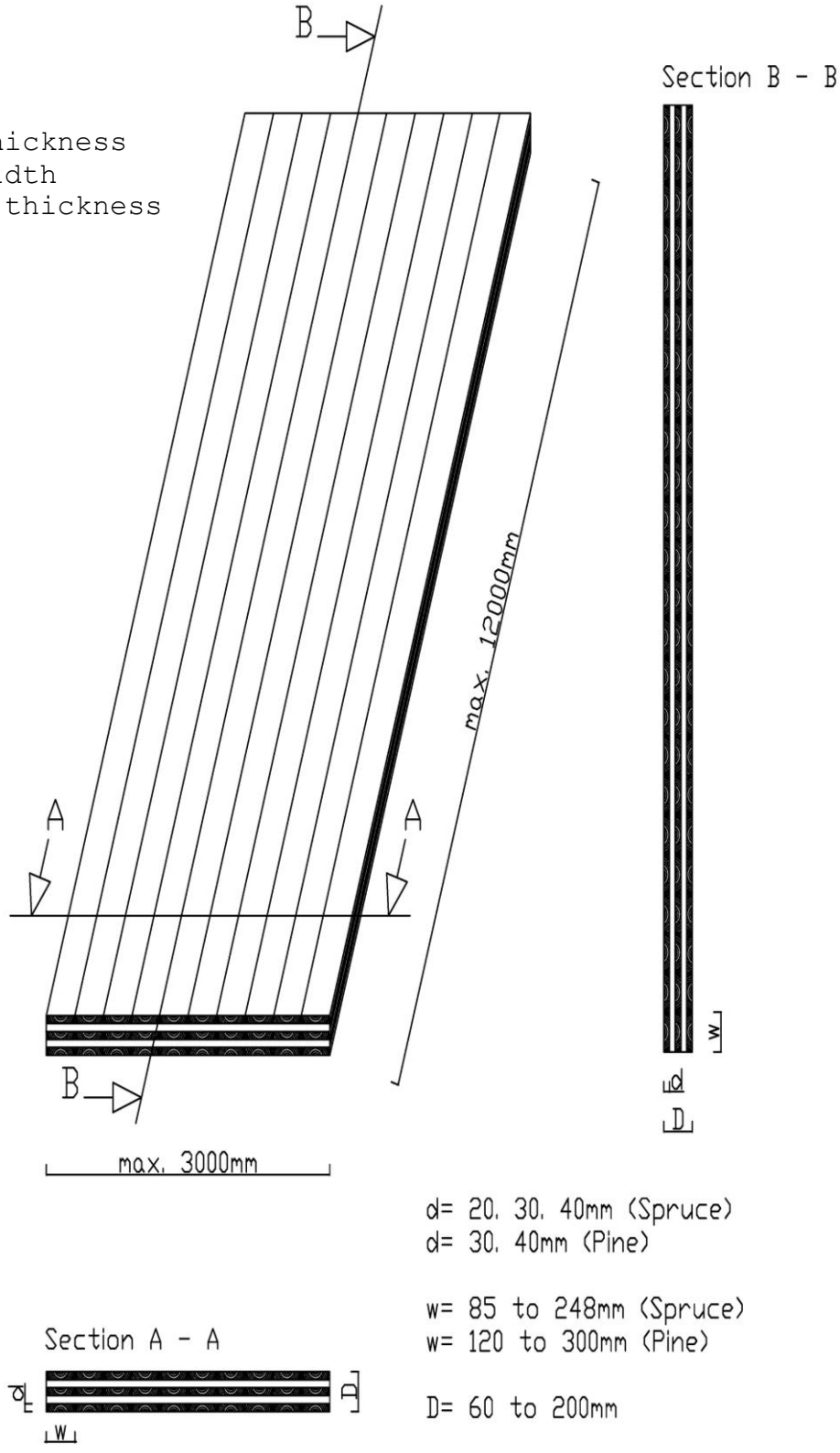
Annex 2 Dimensions and specifications of the elements

Legend:
d = board thickness
w = board width
D = element thickness



d= 20, 30, 40mm (Spruce)
d= 30, 40mm (Pine)

w= 85 to 248mm (Spruce)
w= 120 to 300mm (Pine)

D= 60 to 200mm

X Panel	Annex 2
Structure of the cross laminated timber element	

Table A.2.1: Dimensions and specifications of the elements

CLT-elements	
Characteristic	**Specification**
Cross laminated timber element	
Thickness	60 to 200 mm
Tolerance in thickness	± 2 mm
Width	≤ 3.0 m
Tolerance in width	± 2 mm
Length	≤ 12 m
Tolerance in length	± 2 mm
Number of layers	3 or 5
maximum number of consecutive layers having the same grain direction	2
maximum width of gap between the boards of a layer	4 mm
Layup	Symmetric layup
Boards	
Material	Softwood (spruce, pine)
Strength class [1)]	spruce[2)]: LS 15 acc. to EN 14081-4 (≙ C24) pine: C24 acc. to EN 338
Thickness	Spruce: 20, 30 or 40 mm Pine: 30 or 40 mm
Width [*)] please note the ratio width to thickness	spruce: 85 to 248 mm [*)] pine: 120 to 300 mm
Ratio width to thickness of the cross-layers	≥ 4:1
Moisture of wood according to EN 13183-2	12 ± 2.5 %
Finger joints	according to EN 14080

[1)] The boards within a width of at least 90% of the total width of the layer shall comply with the declared grade. The boards within a width of up to 10 % of the total width of the layer may deviate from the declared tension strengths parallel to the grain by not more than 35%.

[2)] Spruce lamellas are graded by machine strength grading to LS15 according to EN 14081-4. The strengths and stiffnesses can be derived from C24 acc. to EN 338.

X Panel	Annex 2
Dimensions and specifications of the cross laminated timber	

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Annex 3 Essential requirements of the solid wood slab

Table A.3.1: Essential requirements of the solid wood slab

BWR	Requirement	Verification method	Class / Use category / Value
1	**Mechanical resistance and stability**		
	For the calculation of the individual layers the characteristic strength and stiffness values of softwood of the corresponding strength classes acc. to EN 338 and EN 14081-1 (for LS 15) shall be used taking into consideration the definitions in Annex 2. In addition the following values apply:		
	Mechanical actions in plane of cross laminated timber	Shear strength (5%-fractile) $f_{v,k}$	see Annex 4, clause A.4.1.4.1
	Mechanical actions perpendicular to the plane of cross laminated timber		
		Rolling shear strength (5%-fractile) $f_{v,9090,k}$	1.1 N/mm²
		Rolling shear modulus (mean value) $G_{9090,mean}$	50 N/mm²
	For references regarding the calculation see Annex 4.		
	Creep and duration of load	according to EN 1995-1-1	
	Dimensional stability	Moisture content during use shall not change to such extent that adverse deformations can occur.	
	Durability of timber In-service environment	EN 1995-1-1	1 and 2
	Bond integrity	EAD 130005-00-0304	Passed
2	**Safety in case of fire**		
	Reaction to fire		
	Timber elements except for floorings	Commission Decision 2005/610/EC	Euroclass D-s2, d0
	Resistance to fire		
	Charring rate	EN 1995-1-2 EN 13501-2	No performance assessed
3	**Hygiene, health and the environment**		
	Water vapour permeability μ	EN ISO 10456	No performance assessed 50 (dry) to 20 (wet)
	Content of dangerous substances	EAD 130005-00-0304	See clause 3.3
4	**Safety in use**		
	Impact resistance	Soft body resistance is assumed to be fulfilled for walls with a minimum of 3 layers and minimum thickness of 60 mm.	
5	**Protection against noise**		
	Airbourne sound insulation	no performance assessed	
	Impact sound insulation	no performance assessed	
	Sound absorption	no performance assessed	
6	**Energy economy and heat retention**		
	Thermal conductivity λ	EN ISO 10456	0.12 W/(m² · K)
	Air permeability	no performance assessed	
	Thermal inertia c_p	EN ISO 10456	1.600 J/(kg · K)

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Annex 4 Design considerations

A.4.1 Recommendations for the design of the elements

A.4.1.1 General

Design, calculation and realization may be performed according to EN 1995-1-1 taking into account the following provisions. For the calculation according to EN 1995-1-1 national regulations may have to be followed.

The determination of the distribution of stresses and internal forces must consider the influence of shear deformations of the cross layers. In Annex 4 advice is given on how to perform the calculation of the elements.

If using panels as cover, the deformation of the covers might have to be taken into account. These cover layers may not be used for calculation of the bearing capacity of the cross laminated timber elements.

A.4.1.2 Characteristic values

The characteristic strength and stiffness values can be taken from Annex 2 and 3. In addition the following applies:

The deformations caused by shear forces may be calculated by using the element thickness D irrespective of the given layup and a global shear modulus of G = 60 N/mm².

A.4.1.3 Mechanical actions perpendicular to the element`s plane

A.4.1.3.1 Bending and shear

For the calculation of the characteristic values of the element according to Annex 4, only the boards, which are oriented parallel to the span direction, may be considered.

For the verification of the bending strength of a layer the design value of the bending strength may be multiplied with a system factor k_λ:

$$k_\lambda = \min \begin{cases} 1 + 0.025\,n \\ 1.1 \end{cases}$$

where n = number of adjacent boards

A.4.1.3.2 Tension and compression

The behaviour in bearing and deformation against compression perpendicular to the element's plane can be calculated according to EN 1995-1-1 using the strength and stiffness values given in chapter A.4.1.2.

Tension loads perpendicular to plane of the element should be avoided.

A.4.1.4 Mechanical actions in plane of the element

For loads in plane of the element only layers can be taken into account, where the direction of the grain is parallel to the stresses occurring from external loads.

A.4.1.4.1 Shear

Shear stresses may be calculated with the gross cross section. These shear stresses are to be compared with an effective characteristic shear strength $f_{v,k}$ according to the following equation:

$$f_{v,k} = \min \begin{cases} 3.5 \\ 8.0 \dfrac{D_{net}}{D} \\ 2.5 \dfrac{(n-1)\left(a^2 + b^2\right)}{6\, D\, b} \end{cases} \quad \text{in } [N/mm^2]$$

where

D element thickness (see Annex 2)

D_{net} total thickness of longitudinal or cross layers within the element; the smaller value applies

n number of layers within the element, adjacent layers with parallel lamellae shall be considered as one layer and

a, b width of the boards in the longitudinal or cross layers, where b > a
(If a and b is unknown, the minimum value must be applied for a and b.)

A.4.1.4.2 Tension and compression

The load-bearing and deformation behaviour in the element plane can be calculated according to EN 1995-1-1 using the strength and stiffness values given in chapter A.4.1.2.

A.4.2 Design according to the theory of flexible bonded beams

The calculation of elements with up to five layers can be performed using the theory of flexible bonded beams as described in EN 1995-1-1.

To consider deformations due to shear the factor s_i/K_i according to the standard is substituted by the factor $\overline{h}_i/(G_R \cdot b)$.

The effective moment of inertia is calculated by:

$$I_{ef} = \sum_{i=1}^{3} (I_i \cdot + \gamma_i \cdot A_i \cdot a_i^2) \qquad \text{where} \quad A_i = b_i \cdot h_i ; \qquad I_i = \frac{b_i \cdot h_i^3}{12}$$

$$\gamma_1 = \frac{1}{1 + \frac{\pi^2 \cdot E_0 \cdot A_1 \cdot \overline{h_1}}{G_R \cdot b \cdot l^2}} ; \qquad \gamma_2 = 1 ; \qquad \gamma_3 = \frac{1}{1 + \frac{\pi^2 \cdot E_0 \cdot A_3 \cdot \overline{h_2}}{G_R \cdot b \cdot l^2}}$$

$$a_1 = \left(\frac{h_1}{2} + \overline{h_1} + \frac{h_2}{2} \right) - a_2 ; \qquad a_3 = \left(\frac{h_2}{2} + \overline{h_2} + \frac{h_3}{2} \right) + a_2$$

$$a_2 = \frac{\gamma_1 \cdot A_1 \cdot \left(\frac{h_1}{2} + \overline{h_1} + \frac{h_2}{2} \right) - \gamma_3 \cdot A_3 \cdot \left(\frac{h_2}{2} + \overline{h_2} + \frac{h_3}{2} \right)}{\sum_{i=1}^{3} (\gamma_i \cdot A_i)}$$

The bending stress in the centre of the boards may be disregarded.

The governing bending stress in the outermost fibre of the boards:

$$\sigma_{m,r,i,d} = \pm \frac{M_d}{I_{ef}} \cdot \left(\gamma_i \cdot a_i + \frac{h_i}{2} \right) \le f_{m,d}$$

Shear design is in the governing plane:

$$\tau_{v,d} = \frac{V_d \cdot \gamma_i \cdot S_i}{I_{ef} \cdot b} \le f_{R,d}$$

Notation:

h_{tot} = thickness of the whole element [mm]

h_i = thickness of the layer i parallel to the direction of load transfer [mm]

$\overline{h_i}$ = thickness of the layer i perpendicular to the direction of load transfer [mm]

b = width of the element [mm]

n = number of layers

l = span width [mm]

I_{ef} = effective moment of inertia [Nmm²]

G_R = rolling shear modulus [N/mm²]

E_0 = modulus of elasticity parallel to the grain of the boards [N/mm²]

X Panel	Annex 4
Design according to the theory of flexible bonded beams	

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Annex 5 Fasteners

A.5 Recommendations for the design of the fasteners

A.5.1 General

The determination of characteristic values of the load-bearing capacity of fasteners in the element shall be carried out according to EN 1995-1-1 or acc. to an European Technical Approval or Assessment which has been granted for the relevant fastener as for softwood or for glued laminated timber. For the calculation according to European regulations national provisions may apply.

Wide faces are the surfaces of the element parallel to the plane of the element consisting of the surface of the outer layers.

Narrow faces are the lateral and the cross grain board surfaces perpendicular to the plane of the element.

Only fasteners according to EN 1995-1-1 or a European Technical Approval or Assessment or according to national regulations may be used.

If the position of the fasteners in the narrow faces is not clearly defined (end grain, gaps between the single boards, etc.), then the most unfavorable case is to be assumed.

The grain direction of the cover layers governs the minimum spacings of the fasteners as well as the embedding strength is.

For the minimum spacings, minimum thicknesses, minimum layer thicknesses and minimum penetration length of fasteners, see Annex 5 and EN 1995-1-1.

Additional please note the following:

A.5.2 Nails

The nails must be at least 2.8 mm in diameter.

Wide faces

The characteristic load-carrying capacity of laterally loaded nails in the wide faces is to be determined according to EN 1995-1-1. Decisive for the minimum spacings is the grain direction of the cover layers. The characteristic density of the cover layers is decisive for the density.

The effective number of nails n_{ef} may be set equal to the actual number n.

Narrow faces

Nails in the narrow faces of the elements shall not be considered as load-bearing.

A.5.3 Screws

The outer thread diameter shall be used as the relevant diameter d of the screw. Penetration lengths $l_{ef} < 4$ d should not be considered as load-carrying.

The minimum diameter for screws in the wide faces is 4 mm and in the narrow faces 6 mm.

Wide faces

The load direction must be perpendicular to the screw axis and parallel to the wide face of the cross laminated timber.

The embedding strength may be determined as for nails in solid timber according to DIN EN 1995-1-1 where the characteristic density of the cover layers is to be used.

Decisive for the minimum spacings is the grain direction of the cover layers.

The effective number of screws n_{ef} may be set equal to the actual number n.

X Panel	Annex 5
Fasteners	

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Narrow faces

The load direction must be perpendicular to the screw axis and parallel to the narrow face of the cross laminated timber.

Regardless of the arrangement of the screw in the narrow face (e.g. for angles between screw axis and grain direction of 0° ≤ α < 90°), the characteristic value of the embedding strength, when using screws without predrilling, shall be calculated as follows:

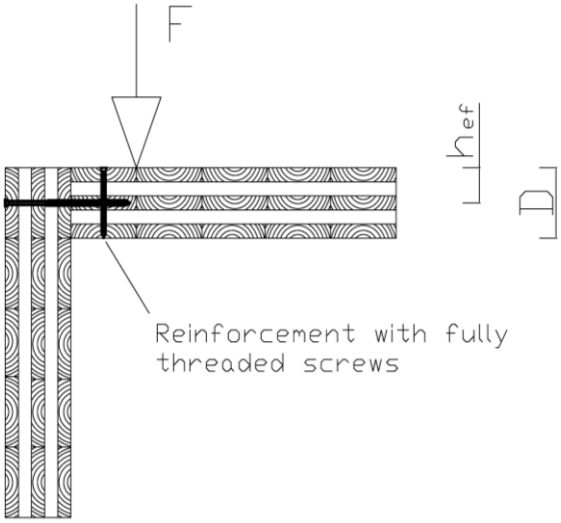
$$f_{h,k} = 20 \cdot d^{-0,5} \qquad \text{in N/mm}^2$$

where

d nominal diameter of the screw in mm

The effective number of screws n_{ef} may be set as for bolts in solid timber according to DIN EN 1995-1-1.

Note: For actions perpendicular to the plane of the cross laminated timber the possibility of splitting caused by the tension force component perpendicular to the grain, shall be taken into account. Connections with ratios $h_{ef}/D \leq 0.7$ should be reinforced with fully threaded screws (see Figure).



Axially loaded screws (pull-out)

The characteristic withdrawal capacity of a fastener in the wide face shall be carried out according to EN 1995-1-1 or acc. to a European Technical Approval or Assessment of the fastener.

Screws with an angles α <15 ° between the screw axis and the grain direction may be loaded only in the load duration classes "short" and "very short". This only applies to screws for which this direction of load is regulated in the European Technical Approval or Assessment of the screw.

Screws oriented parallel to the wide face of the cross laminated timber should be completely arranged within one board layer. The outer diameter of the threaded part should not exceed the thickness of the board layer the screw is arranged in.

The characteristic pull-through strength of the screw head is to be determined as for solid timber, depending on the characteristic density of the corresponding layer in the head area of the screw.

X Panel	Annex 5
Fasteners	

Deutsches Institut für Bautechnik DIBt

A.5.4 Split ring, shear plate and toothed-plate connectors

Wide faces

The characteristic load-carrying capacity of split ring, shear plate and toothed-plate connectors in the wide faces of cross laminated timber may be calculated according to EN 1995-1-1 for an angle between force and grain direction of $\alpha = 0°$ regardless of the actual angle between the force and grain direction of the cover layers.

When inserting in the wide faces a minimum layer thickness of 18 mm must be maintained .

Narrow faces

For split ring and shear plate connectors in the narrow faces of the cross laminated timber the regulations for connections with split ring connectors in the end grain of timber members may be applied.

A.5.5 Connections with dowels and bolts

Wide faces

The characteristic load-carrying capacity of dowelled or bolted connections in the wide faces is to be determined with the embedding strength according to the following equation:

$$f_{h,\alpha,k} = \frac{32 \cdot (1 - 0.015 \cdot d)}{1.1 \cdot \sin^2 \alpha + \cos^2 \alpha} \qquad \text{in N/mm}^2$$

where

d fastener diameter in mm

α angle between force and grain direction of the cover layer

Decisive for the calculation of the embedding strength is the grain direction of the cover layers.

For dowels and bolts connections with a diameter ≥ 10 mm, $n_{ef} = n$ may be assumed.

Narrow faces

The characteristic load-carrying capacity of dowelled or bolted connections in the narrow faces is to be determined with the embedding strength according to the following equation:

$$f_{h,k} = 9 \cdot (1 - 0.017 \cdot d) \qquad \text{in N/mm}^2$$

where

d fastener diameter in mm

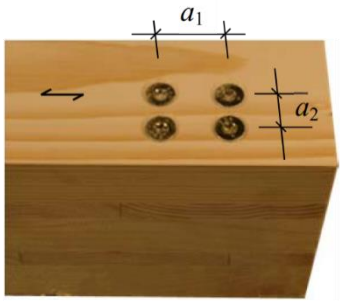
Note: For actions perpendicular to the plane of the cross laminated timber the possibility of splitting caused by the tension force component perpendicular to the grain, shall be taken into account. Connections with ratios $h_{ef}/D \leq 0.7$ should be reinforced with fully threaded screws.

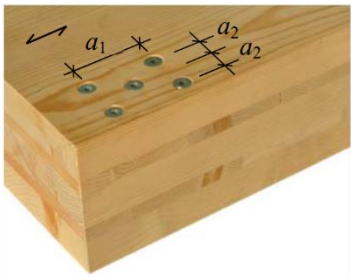
X Panel	Annex 5
Fasteners	

A.5.6 Minimum spacings of fasteners

A.5.6.1 Minimum spacings of fasteners in the wide faces

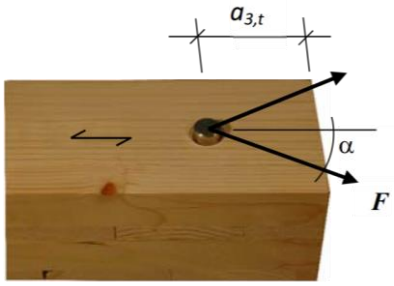
Minimum spacings – parallel and perpenticular to grain



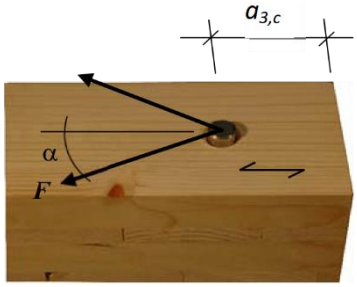


Edge and end distances

loaded end $a_{3,t}$



unloaded end $a_{3,c}$



unloaded edge $a_{4,c}$
loaded edge $a_{4,t}$

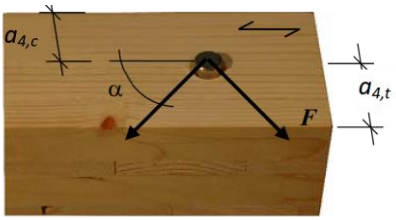


Table A.5.1: Minimum spacings of fasteners in the wide faces

fastener	a_1	a_2	$a_{3,t}$	$a_{3,c}$	$a_{4,t}$	$a_{4,c}$
screws [1)]	4·d	2.5·d	6·d	6·d	6·d	2.5·d
nails	(3+3·cosα)·d	3·d	(7+3·cosα)·d	6·d	(3+4·sinα)·d	3·d
dowels	(3+2·cosα)·d	3·d	5·d	4·d·sinα min. 3·d	3·d	3·d
bolts	(3+2·cosα)·d min. 4·d	4·d	5·d	4·d·sinα min. 4·d	3·d	3·d
α	angle between force and grain direction of the cover layer					
1)	self-tapping screws					

A.5.6.2 Minimum spacings, minimum thicknesses, minimum layer thicknesses und minimum penetration lengths of fasteners in the narrow faces

The minimum spacings in the narrow faces are independent of the angle between fastener axis and grain direction.

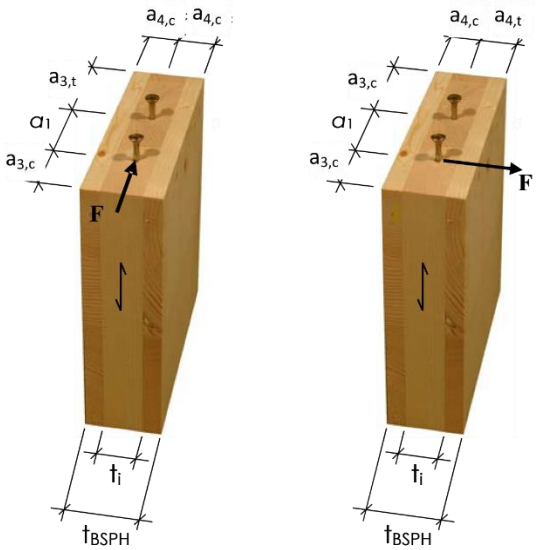


Table A.5.2: Minimum spacings of fasteners in the narrow faces

	a_1	a_2	$a_{3,t}$	$a_{3,c}$	$a_{4,t}$	$a_{4,c}$
screws [1)]	10·d	3·d	12·d	7·d	6·d	5·d
dowels	4·d	3·d	5·d	3·d	5·d	3·d
bolts	4·d	4·d	5·d	4·d	5·d	3·d
[1)] self-tapping screws						

Table A.5.3: Requirements for fasteners in the narrow faces of cross laminated timber

fastener	Minimum thickness of the cross laminated timber	Minimum thickness of the relevant layer	Minimum penetration length of the fastener t_1 oder t_2 *)
	t_{BSPH} in mm	t_i in mm	in mm
screws	10·d	d > 8 mm: 3·d d ≤ 8 mm: 2·d	10·d
dowels bolts	6·d	d	5·d
*) t_1 Minimum penetration length of the fastener in side members (member to be connected) t_2 Minimum penetration length of the fastener in middle members (cross laminated timber element)			

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Annex A.6 Reference documents

EAD 130005-00-0304, European Assessment Document for “Solid wood slab element to be used as a structural element in buildings”, Edition March 2015

EN 14080:2013, Timber structures - Glued laminated timber and glued solid timber - Requirements

EN 1995-1-1:2004 + A1:2008 + A2:2014, Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings

EN 1995-1-2:2004 + AC:2009, Eurocode 5 - Design of timber structures - Part 1-2: General - Structural fire design

EN 301:2013, Adhesives, phenolic and aminoplastic, for load-bearing timber structures

EN 15425:2008, Adhesives - One component polyurethane for load bearing timber structures - Classification and performance requirements

EN 338:2016, Structural timber – Strength classes

EN 13986:2014 + A1:2015, Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking

EN 13183-2:2002, Moisture content of a piece of sawn timber – Part 2: Estimation by electrical resistance method

EN ISO 10456:2007 + AC:2009, Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values