SLOT

CONNECTOR FOR STRUCTURAL PANELS

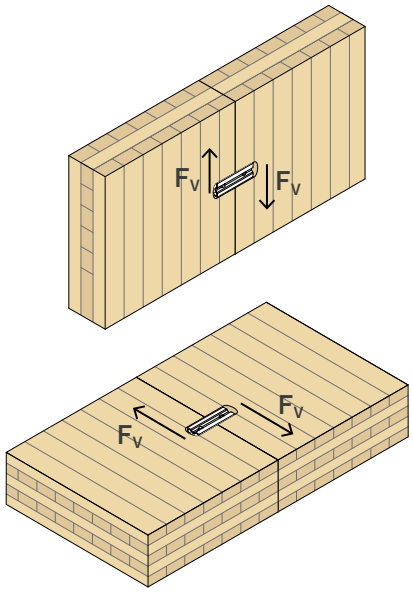
VIDEO | MY PROJECT SOFTWARE | PATENTED | DESIGN REGISTERED | CE ETA-19/0167

SERVICE CLASS SC1 SC2

MATERIAL

alu 6005A EN AW-6005A aluminium alloy

EXTERNAL LOADS



MONOLITHIC PANEL

It allows very high stiff joints and can transfer exceptional shear stresses between the panels. Ideal for walls and floors.

TOLERANCE

The wedge shape makes the insertion easy into the groove. It is possible to increase the thickness of the routing cut to handle all kinds of tolerances using SHIM shims.

FAST INSTALLATION

Possibility of assembly with inclined auxiliary screws that make tightening between panels easy. The honeycomb geometry and lightweight aluminium ensure excellent performance: one connector can replace up to 60 Ø6 screws.

USA, Canada and more design values available online.

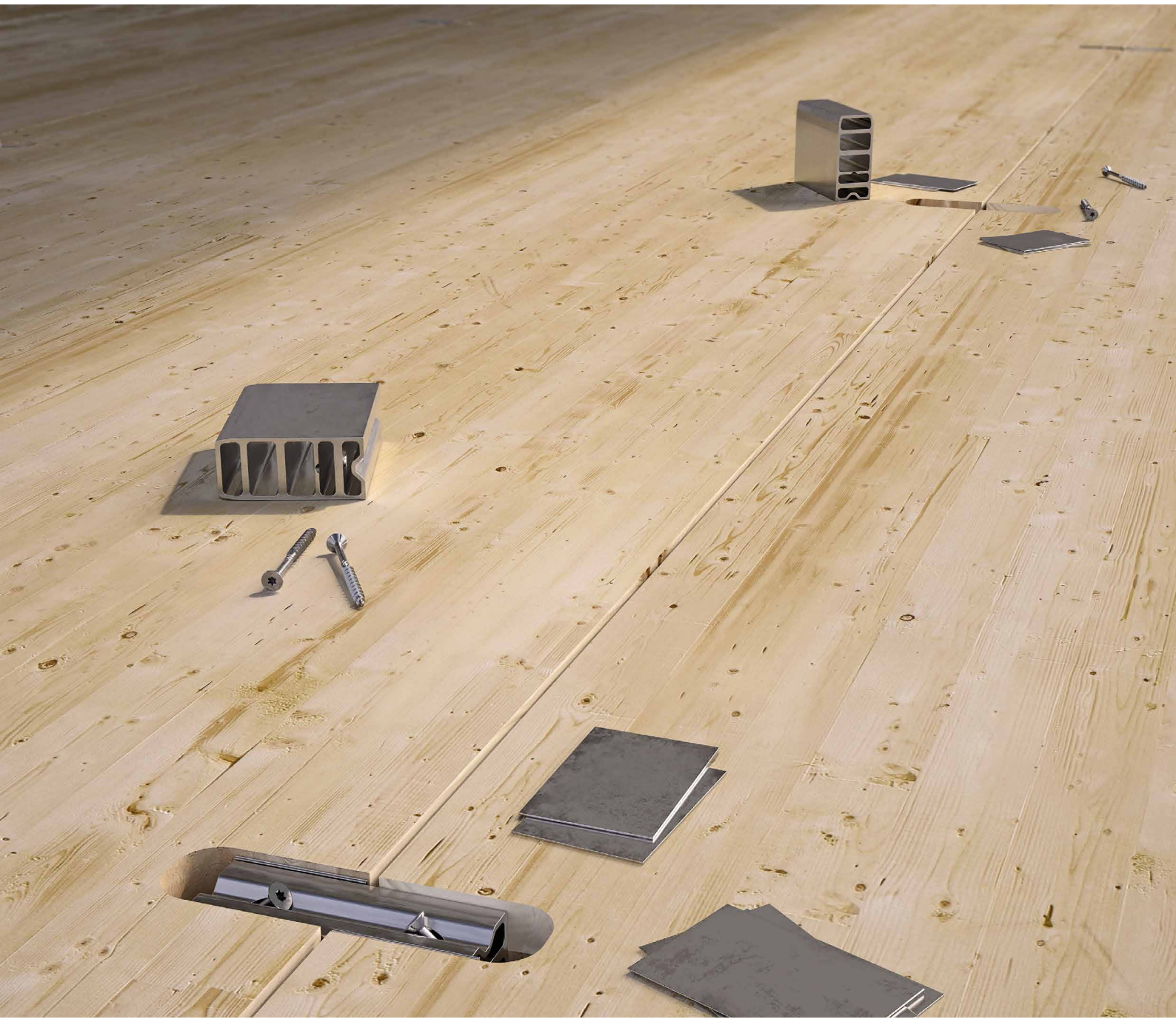
VIDEO
Scan the QR Code and watch the video on our YouTube channel

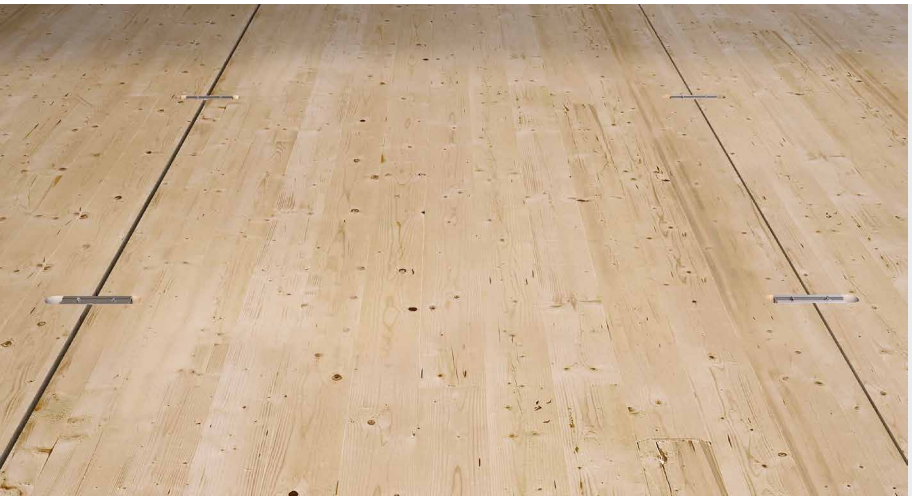
FIELDS OF USE

Panel-to-panel shear connections.
High-stiffness connections in rigid diaphragm floors or in multi-panel walls with monolithic behaviour.
The connector also serves as an installation tool to close the gap between panels.

Can be applied to:

- CLT, LVL or glulam panel floors and walls





MONOLITHIC BEHAVIOUR

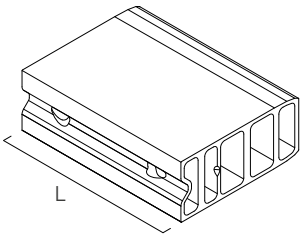
Ideal for panel wall and floor joints. It enables monolithic behaviour to be created between panels cut in the factory with small dimensions for transportation needs.

GLULAM, CLT, LVL

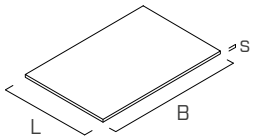
CE mark according to ETA. Values tested, certified and calculated also on glulam, CLT, LVL Softwood and LVL Hardwood.

CODES AND DIMENSIONS

CODE	L [mm]	*L* *[in]*	pcs
SLOT90	120	*4 3/4*	10

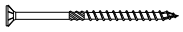


CODE	B [mm]	L [mm]	s [mm]	*B* *[in]*	*L* *[in]*	*s* *[in]*	pcs
SHIMS609005	89	60	0,5	*3 1/2*	*2 3/8*	*0.02*	100
SHIMS609010	89	60	1	*3 1/2*	*2 3/8*	*0.04*	50



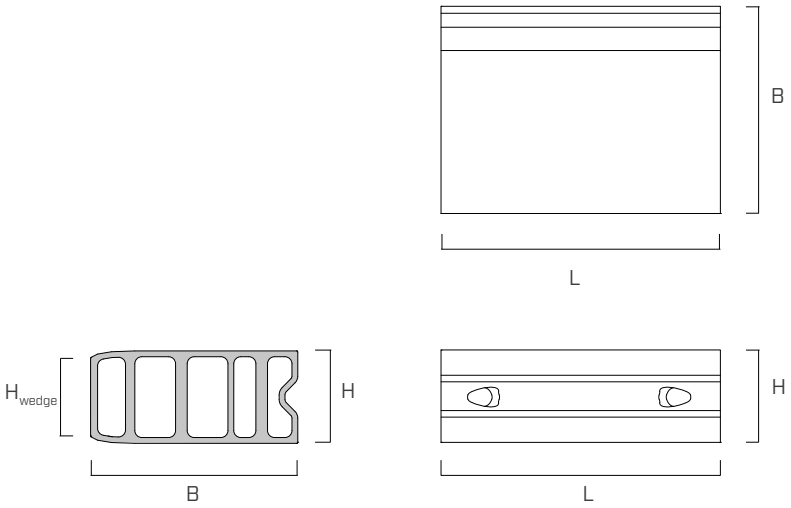
Material: bright zinc plated carbon steel

FASTENERS

type	description	d [mm]	L [mm]	support
HBS	countersunk screw 	6	120	
HBS	countersunk screw 	8	140	

For further details please see the "TIMBER SCREWS AND DECK FASTENING" catalogue.

GEOMETRY



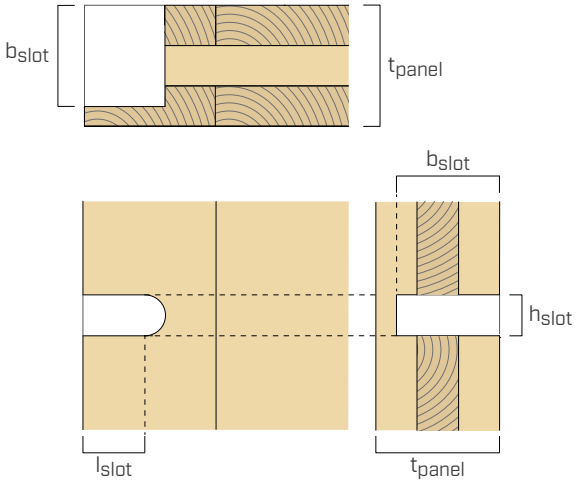
B [mm]	H [mm]	H_{wedge} [mm]	L [mm]	n_{screws} [pcs]
89	40	34	120	2

The screws are optional and not included in the package.

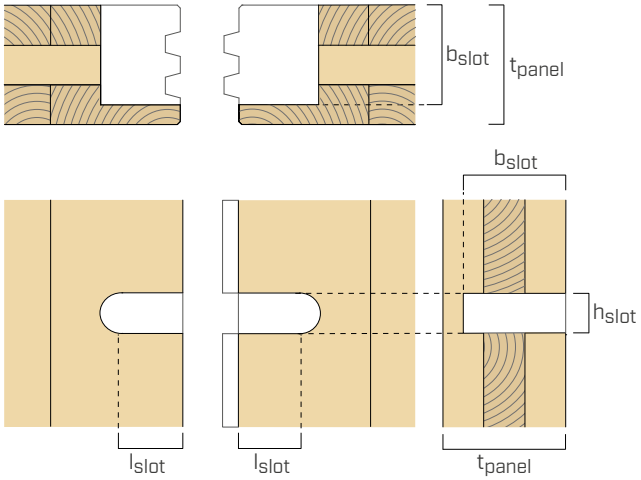
GEOMETRY

ROUTING IN THE PANEL

PANEL WITH FLAT EDGE



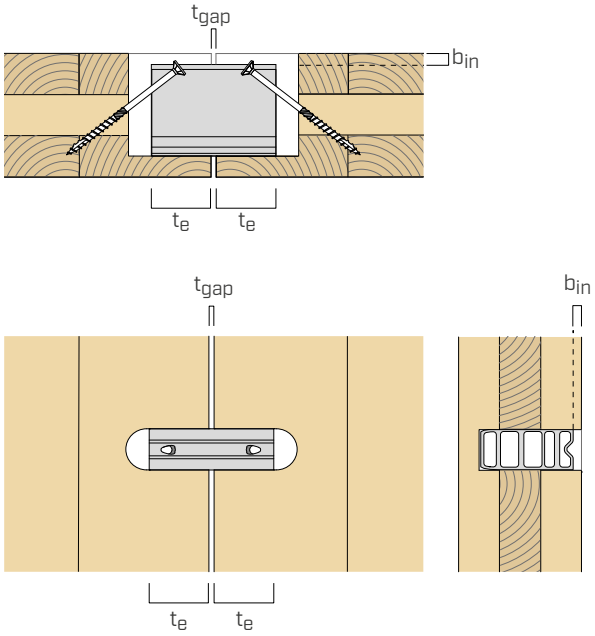
PANEL WITH TAPPED EDGE



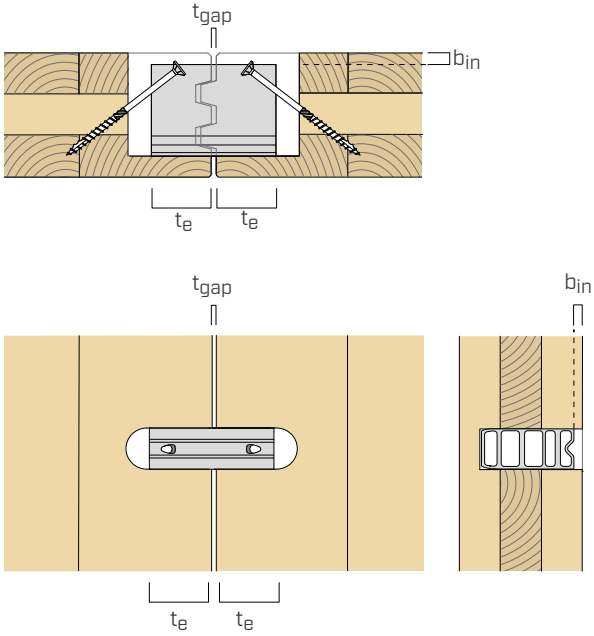
$b_{slot,min}$ [mm]	$l_{slot,min}$ [mm]	$t_{panel,min}$ [mm]	h_{slot} (1) [mm]
90	60	90	40,5

INSTALLATION

PANEL WITH FLAT EDGE



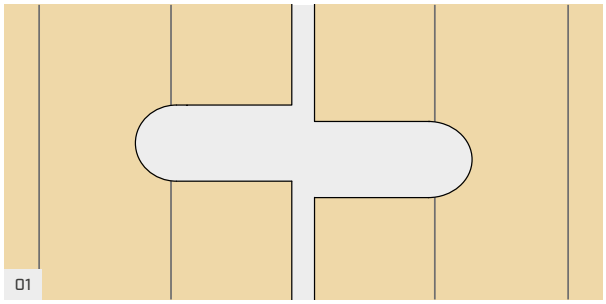
PANEL WITH TAPPED EDGE

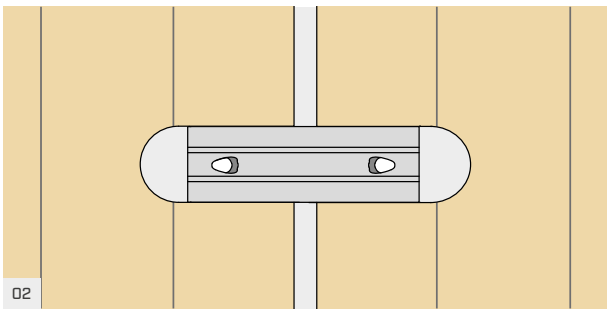


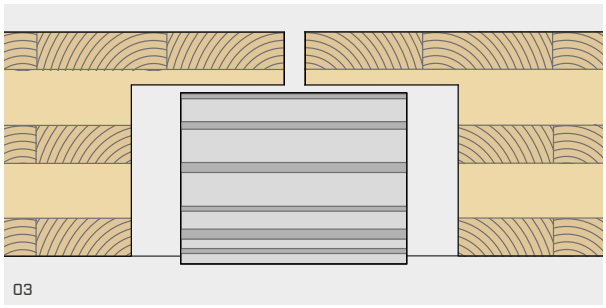
$t_{gap,max}$ (2) [mm]	$b_{in,max}$ [mm]	$t_{e,min}$ [mm]
5	t_{panel}-90 (3)	57,5

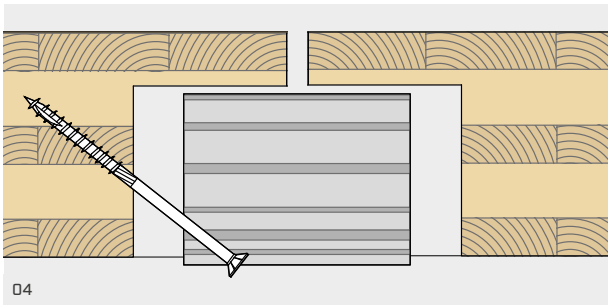
USE OF THE CONNECTOR AS ASSEMBLY EQUIPMENT

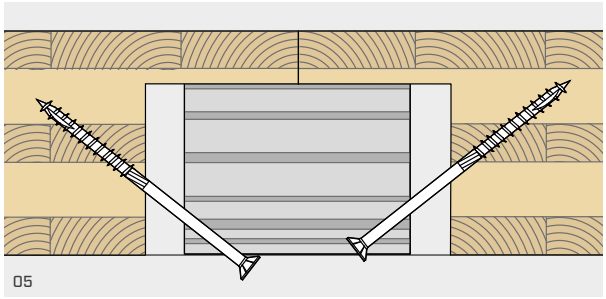
The connector can also be used as assembly equipment, thanks to its wedge shape and the presence of screws.

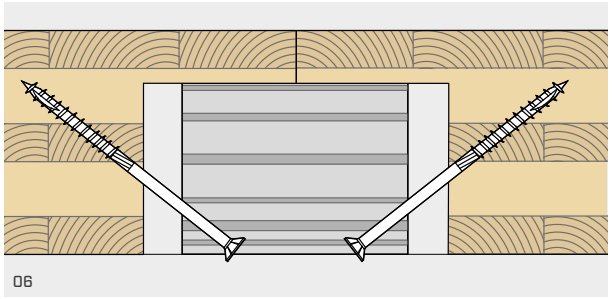










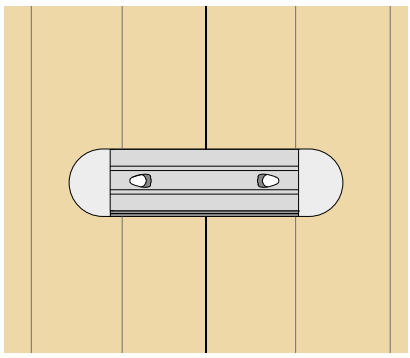


USE OF SHIM ACCESSORIES

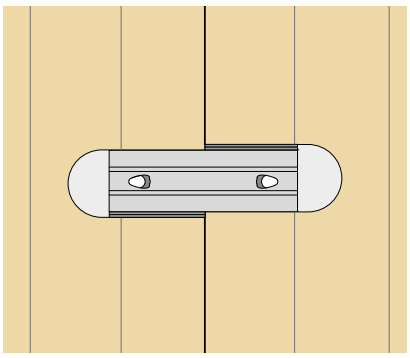
The connector is designed for a h_{slot} thickness of 40.5 mm but a different nominal h_{slot} size can be set. For example, by using an oversized routing, all tolerances in the connection can be compensated for:

- tolerance on total routing thickness h_{slot}.
- tolerance on the reciprocal positioning of the two grooves on the opposing panels.

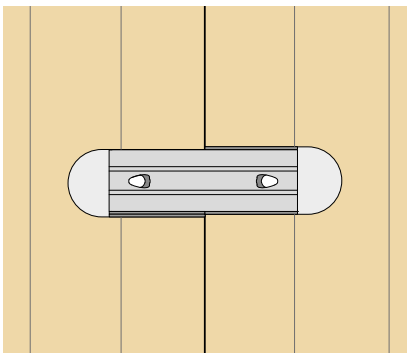
Depending on the actual situation on site, the different spacer models can be combined.



Spacers positioned on one side only, to compensate for the thickness of the routing.



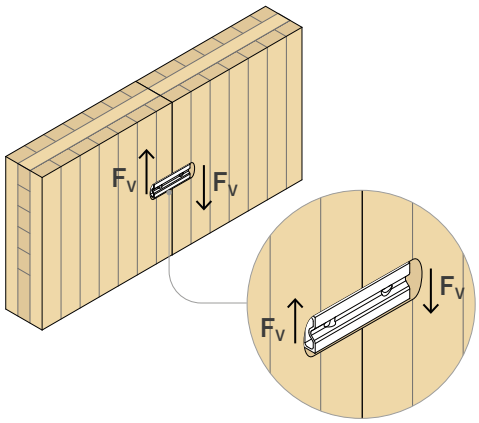
Spacers positioned on opposite sides, to compensate for a misalignment of the two grooves.

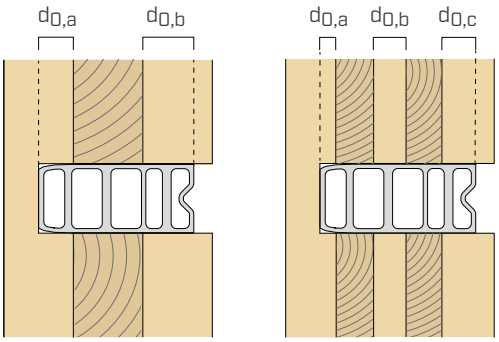


Combination of spacers for use in intermediate situations.

STRUCTURAL VALUES

				$R_{v,k}$ [kN]	k_{ser} [kN/mm]
CLT [5]	$\sum d_0$ [6] =	40	[mm]	**34,4**	17,50
		45	[mm]	**37,8**	
		49	[mm]	**40,6**	
		50	[mm]	**41,3**	
		55	[mm]	**44,7**	
		59	[mm]	**47,5**	
		60	[mm]	**48,2**	
		65	[mm]	**51,6**	
		69	[mm]	**54,4**	
LVL softwood	cross grain veneer [7]			**52,7**	24,00
	parallel grain veneer [8]			**71,0**	
LVL hardwood	cross grain veneer [9]			**125,7**	48.67
	parallel grain veneer [10]			**116,6**	
glulam [11]	-			**68,1**	25.67





$$\sum d_0 = d_{0,a} + d_{0,b} + d_{0,c}$$

As an example, in the case of an CLT panel with a thickness of 160 mm and 40/20/40/20/40 layer structure, the sum d_0 parameter is equal to 69 mm, with a characteristic strength of 54.4 kN.

NOTES

(1) The h_{slot} thickness of 40.5 mm is to be regarded as indicative and depends on the precision of the specific machine used to cut the panels. When using the connector for the first time, it is recommended that 41.0 mm be grooved and to shim the joints, if any, using SHIM. For subsequent uses, it may be considered whether to reduce to 40.5 mm.

(2) The gap between the panels must be taken into account when calculating the connector strength; refer to ETA-19/0167 for the calculation. The gap between panels may contain a filling material.

(3) The connector can be installed in any position within the panel thickness.

(4) For CLT e LVL with cross grain veneer, in case of installation with $a_1 < 480$ mm or $a_{3,t} < 480$ mm, the strength is reduced with a k_{a1} coefficient, as provided by ETA-19/0167.

$$k_{a1} = 1 - 0{,}001 \cdot \left(480 - min\left\{ a_1 ; a_{3,t} \right\}\right)$$

(5) Values calculated according to ETA-19/0167 and valid in Service Class 1 according to EN 1995-1-1. The following parameters were considered in the calculation: $f_{c,0k}$ = 24 MPa, ρ_k =350 kg/m^3, t_{gap}= 0 mm, $a_1 \geq 480$ mm, $a_{3,t} \geq 480$ mm.

(6) The parameter $\sum d_0$ corresponds to the cumulative thickness of the layers parallel to F_v, inside the thickness B of the connector (see image).

(7) Values calculated according to ETA-19/0167. The following parameters were considered in the calculation: $f_{c,0k}$ = 26 MPa, ρ_k = 480 kg/m^3, t_{gap} = 0 mm, $a_1 \geq 480$ mm, $a_{3,t} \geq 480$ mm.

(8) Values calculated according to ETA-19/0167. The following parameters were considered in the calculation: $f_{c,0k}$ =35 MPa, ρ_k = 480kg/m^3, t_{gap} = 0 mm.

(9) Values calculated according to ETA-19/0167. The following parameters were considered in the calculation: $f_{c,0k}$ = 62 MPa, ρ_k = 730 kg/m^3, t_{gap} = 0 mm, $a_1 \geq 480$ mm, $a_{3,t} \geq 480$ mm.

(10) Values calculated according to ETA-19/0167. The following parameters were considered in the calculation: $f_{c,0k}$ = 57,5 MPa, ρ_k = 730 kg/m^3, t_{gap} = 0 mm.

(11) Values calculated according to ETA-19/0167 and valid in Service Class 1 according to EN 1995-1-1. The following parameters were considered in the calculation: $f_{c,0k}$ = 24 MPa, ρ_k = 385 kg/m^3, t_{gap} = 0 mm.

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-19/0167.
- The design values are obtained from the characteristic values as follows:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

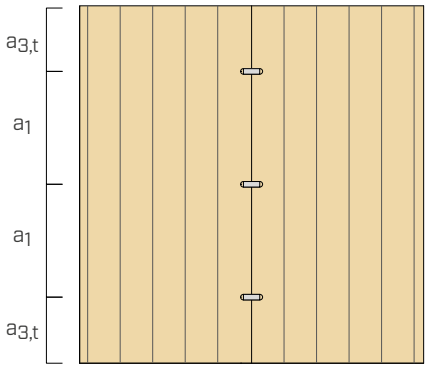
  The coefficients k_{mod} and γ_M should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of the timber elements must be carried out separately.
- Resistance values for the fastening system are valid for the calculation examples shown in the table. For different calculation methods, the MyProject software is available free of charge (www.rothoblaas.com).
- The connector can be used for connections between glulam, CLT and LVL elements or similar glued elements.
- The contact surface between the panels can be flat or "male-female" shaped, see the image in the INSTALLATION section.
- A minimum of two connectors must be used within one connection.
- The connectors must be inserted with the same pull-through depth (t_e) into both elements to be fastened.
- The two inclined screws are optional and have no influence on the strength and stiffness calculation.

INTELLECTUAL PROPERTY

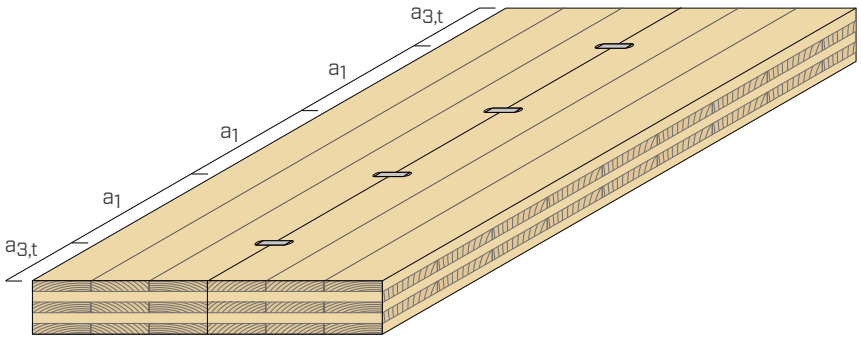
- The SLOT connector is protected by the following patents: EN102018000005662 | US11.274.436.
- It is also protected by the following Registered Community Designs: RCD 005844958-0001 | RCD 005844958-0002.

MINIMUM DISTANCES

WALL

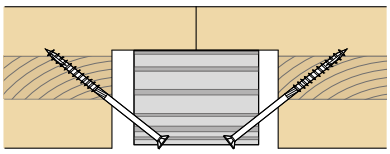


FLOOR SLAB

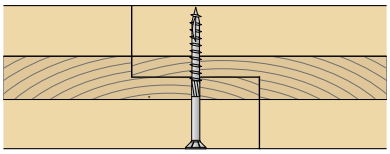


		CLT	LVL		glulam
			cross grain veneer	parallel grain veneer	
a_1	[mm]	320(4)	320(4)	480	480
$a_{3,t}$	[mm]	320(4)	320(4)	480	480

ANALYTICAL COMPARISON BETWEEN CONNECTION SYSTEMS

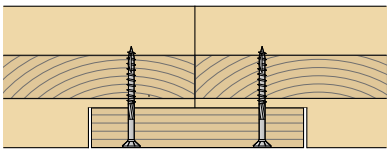


SLOT



HALF-LAP JOINT

HBS Ø8 x 100



SPLINE JOINT

2 x HBS Ø6 x 70

INCREASED SPACING

connection system	number of connectors	spacing [mm]	$R_{v,k}$ [kN]
SLOT	2	967	**81.1**
HALF-LAP	14	200	**42,6**
SPLINE JOINT	56	100	**60,9**

REDUCED SPACING

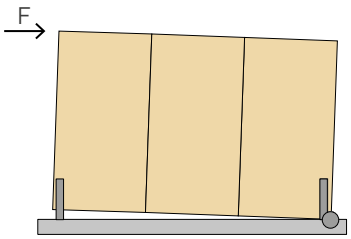
connection system	number of connectors	spacing [mm]	$R_{v,k}$ [kN]
SLOT	4	580	**162.3**
HALF-LAP	28	100	**73,1**
SPLINE JOINT	114	50	**70.1**

The strength values are calculated according to ETA-19/0167, ETA-11/0030 and EN 1995:2014.

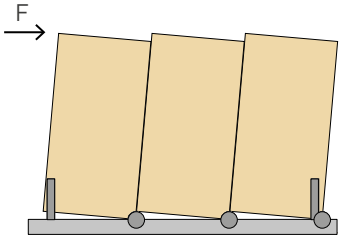
The tables show a comparison in terms of strength between SLOT and two types of traditional connection. A 2.9 m high wall panel was used for the calculation. In the INCREASED SPACING table, 200 mm and 100 mm spacings have been used for half-lap joint and spline joint respectively. For the SLOT connector a spacing of about 1 m has been used; in this case the screw connections offer much lower strengths than the SLOT connector. As shown in the REDUCED SPACING table, halving the distance between the screws (and therefore doubling the number of screws) it is not possible to reach the strength offered by only the two SLOT connectors alone of the previous case, due to the reduction of strength given by the effective number. Using 4 SLOT connectors, it is also possible to achieve very difficult strength values with screws. This means that high connection strength values cannot be achieved with traditional connections.

CLT MULTI-PANEL WALLS WITH HOLD-DOWN AT THE ENDS

SINGLE-WALL BEHAVIOUR



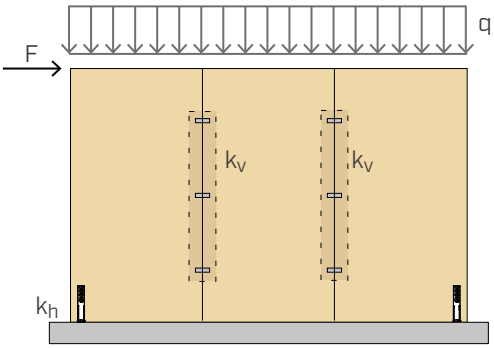
COUPLED PANEL BEHAVIOUR



There are two possible rotational behaviours of the multi-panel CLT wall, determined by multiple parameters. At equal conditions, it can be stated that the k_v/k_h stiffness ratio determines the rotational behaviour of the wall, where:

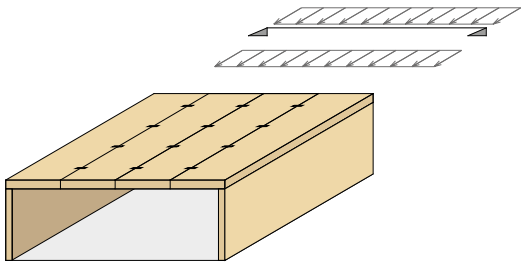
- k_v total shear stiffness of the connection between panels;
- k_h tensile strength of the hold-down.

At equal conditions, it can be stated that for high k_v/k_h values (i.e. for high k_v values) the kinematic behaviour of the wall tends to be similar to the single wall behaviour. This type of wall is much easier to design than a wall with coupled panel behaviour, due to the simplicity of modelling.



MULTIPANEL CLT FLOORS

The distribution of horizontal loads (earthquake or wind) from the floor to the lower walls depends on the stiffness of the floor in its own plane. A stiff floor allows the transmission of horizontal external loads to the underlying walls with diaphragm behaviour. The stiff diaphragm behaviour is much easier to design than a deformable floor in its own plane, due to the simplicity in the structural outline of the floor. In addition, many international seismic regulations, require the presence of a stiff diaphragm as a requirement to obtain the building plan regularity and therefore a better seismic response of the building.



THE ADVANTAGE OF HIGH STIFFNESS CERTIFIED BY TEST

The use of the SLOT connector, characterized by high stiffness and strength values, leads to undoubted advantages, both in the case of multi-panel CLT wall and in the case of the diaphragm floor. These strength and stiffness values are experimentally validated and are certified according to ETA-19/0167; this means that the designer is provided with certified, precise and reliable data.