PLATES AND CONNECTORS FOR TIMBER

BUILDINGS, STRUCTURES AND OUTDOOR

rothoblaas

Solutions for Building Technology

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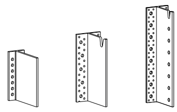

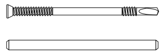

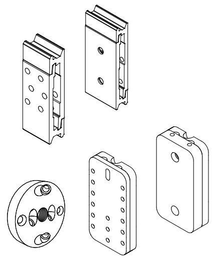

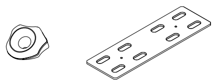

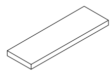

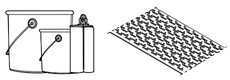

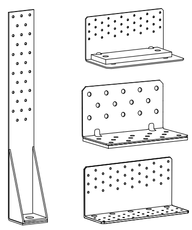

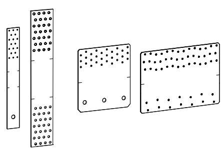

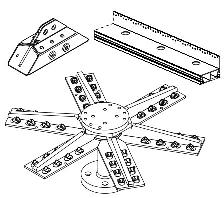

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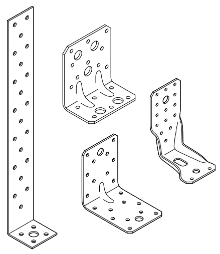

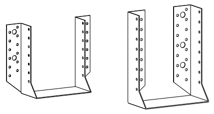

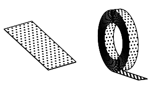

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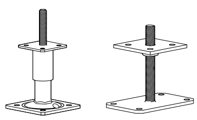

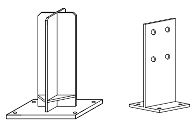

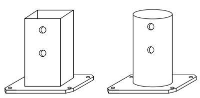

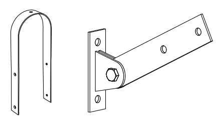

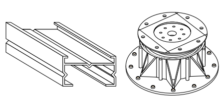

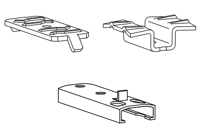

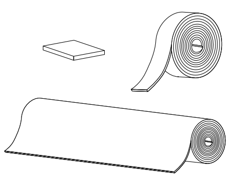

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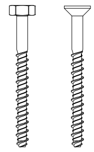

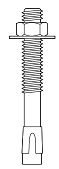

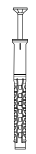

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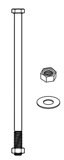

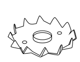

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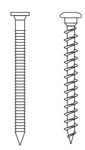
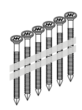




FROM IDEA TO MARKET

CREATION OF A NEW PRODUCT

"Here, everything that involves the product is done internally. We take care of the entire process from the idea to its development, through to its entry on the market. We design, we test, we carry out checks on our products and we follow the entire certification process. We prepare the data sheets and the construction details, we develop the calculation and verification software, and we offer complete consulting. We are responsible for advertising, we create our catalogues, and we are directly involved in every aspect of packaging and labelling. And we do all this with the skills we have within our company."

Robert Blaas, founder and CEO

UNIVERSITY, RESEARCH CENTRES | DESIGNERS | SALES NETWORK | CUSTOMERS

NETWORK ROTHOBLAAS

IDEAS - REQUIREMENTS - SUGGESTIONS

ROTHOBLAAS

Through an idea management flow the collected inputs are evaluated

RESEARCH AND DEVELOPMENT

Initiation of procedures for the development of the new feature

ANALYSIS

In-depth study of the current status of the technique, cost and timing analysis

COLLABORATIONS

Search for collaborations with academic partners or third parties

PRODUCT DEVELOPMENT

Prototype development and continuous improvement until the optimal result is achieved

CERTIFICATION / QUALITY CONTROL

Product certification process by independent international bodies

PRODUCTION

Start of production

LOGISTICS

Labelling, planning for shipments and storage in our logistics centres

MARKET LAUNCH

Marketing activities aimed at promoting the new product placed on international markets

NETWORK ROTHOBLAAS

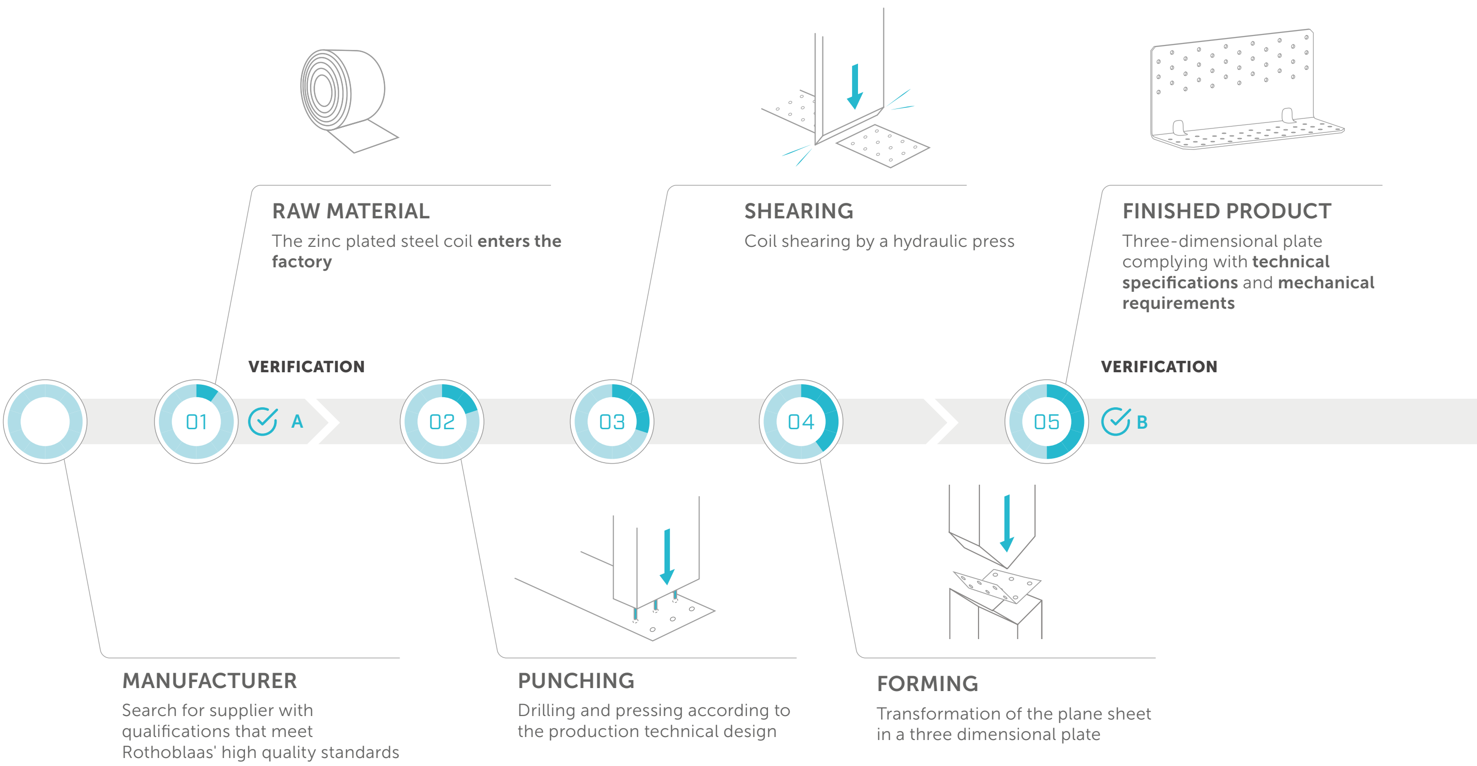
UNIVERSITY, RESEARCH CENTRES | DESIGNERS | SALES NETWORK | CUSTOMERS

QUALITY CONTROL

PRODUCTION PHASES CONTROLS

Rothoblaas designs, tests, manufactures, certifies and markets its products under its own name and brand. The manufacturing process is systematically checked during each phase (FPC), the whole procedure strictly monitored and controlled to ensure compliance and quality at each stage.

EXAMPLE OF ANGLE BRACKETS PRODUCTION STEPS



ALL-IN-ONE

The automatic pressing line is designed to perform the various manufacturing phases sequentially: punching, shearing and forming are realized within a single cycle without need of further treatments (e.g. welding).

TRACEABILITY

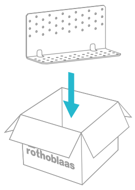
During the production process each plate is assigned an **identifying code** (batch number) **which guarantees the traceability** of raw materials before the product is placed on the market.

CE - ETA - DoP

As manufacturer, Rothoblaas is responsible for its products covered by ETA. These products must be provided with CE marking, normally on the label, which ensures legal validity and contains all the information necessary to identify the product including:

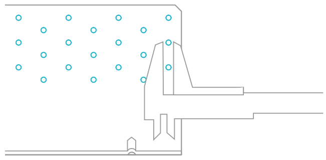
1. **Identification of the producer**
2. **ETA number**
3. **Declaration of performance**

CE
1 -------------------- Rotho Blaas
2 -------------------- ETA 11/0496
3 -------------------- DoP: TITAN_DoP_110496
(www.rothoblaas.com)



PACKAGING AND LABELLING

Packaging and labelling



QUALITY CONTROL

The Factory Production Control (FPC) continues with a second phase of **checks performed at the central warehouse**

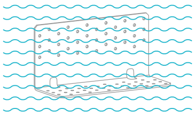
06 — VERIFICATION C

07 — VERIFICATION D

08

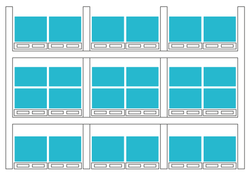
09 — VERIFICATION E

10



PROTECTIVE TREATMENTS

Coating process (e.g. zinc plating)



STORAGE

Acceptance of the incoming goods and sampling by the Quality Check Laboratory

SELLING AND TRACEABILITY

With the batch number and the selling order **it is possible to track all the manufacturing phases**: the customer can be sure to obtain a certified quality product

CONTROLS

A. Verification, check and registration of the incoming raw materials

B. Geometric inspection according to regulated tolerances and calibration

C. Check on coating thickness

D. Inspection of package and label

E. **QUALITY CONTROL**
Geometric inspection according to regulated tolerances and calibration

REACH REGULATION

Registration, Evaluation, Authorisation of Chemicals (CE n. 1907/2006)

It's the European regulation for the management of chemical substances as such or as components of **preparations** (mixtures) and **items** *(ref. Art. 3 points 2 and 3*). This regulation attributes precise responsibilities to each link of the supply chain regarding the communication and safe use of hazardous substances.

WHAT'S IT FOR?

REACH aims to ensure a high level of human health and environmental protection. The introduction of REACH requires the collection and communication of complete information on the dangers of certain substances and their safe use within the supply chain (regulation CLP 1272/2008).

The regulation provides for continual updating of the information and control by ECHA (the European Chemicals Agency).

In particular, for users, these concepts translate into:

- **SVHC - Substances Of Very High Concern**
  List of any hazardous substances contained in items

- **SDS - Safety Data Sheet**
  Document that contains the information for correct management of every hazardous mixture

We have added **REACH compliance** among the **selection parameters for our products and production processes.**
In this way, we can guarantee high quality standards in terms of health and environmental protection.

REACH COMPLIANCE

PROJECT

Product design and choice of the most suitable materials.

PRODUCTION

Start of the production phase with evaluation of the substances used during the entire process.

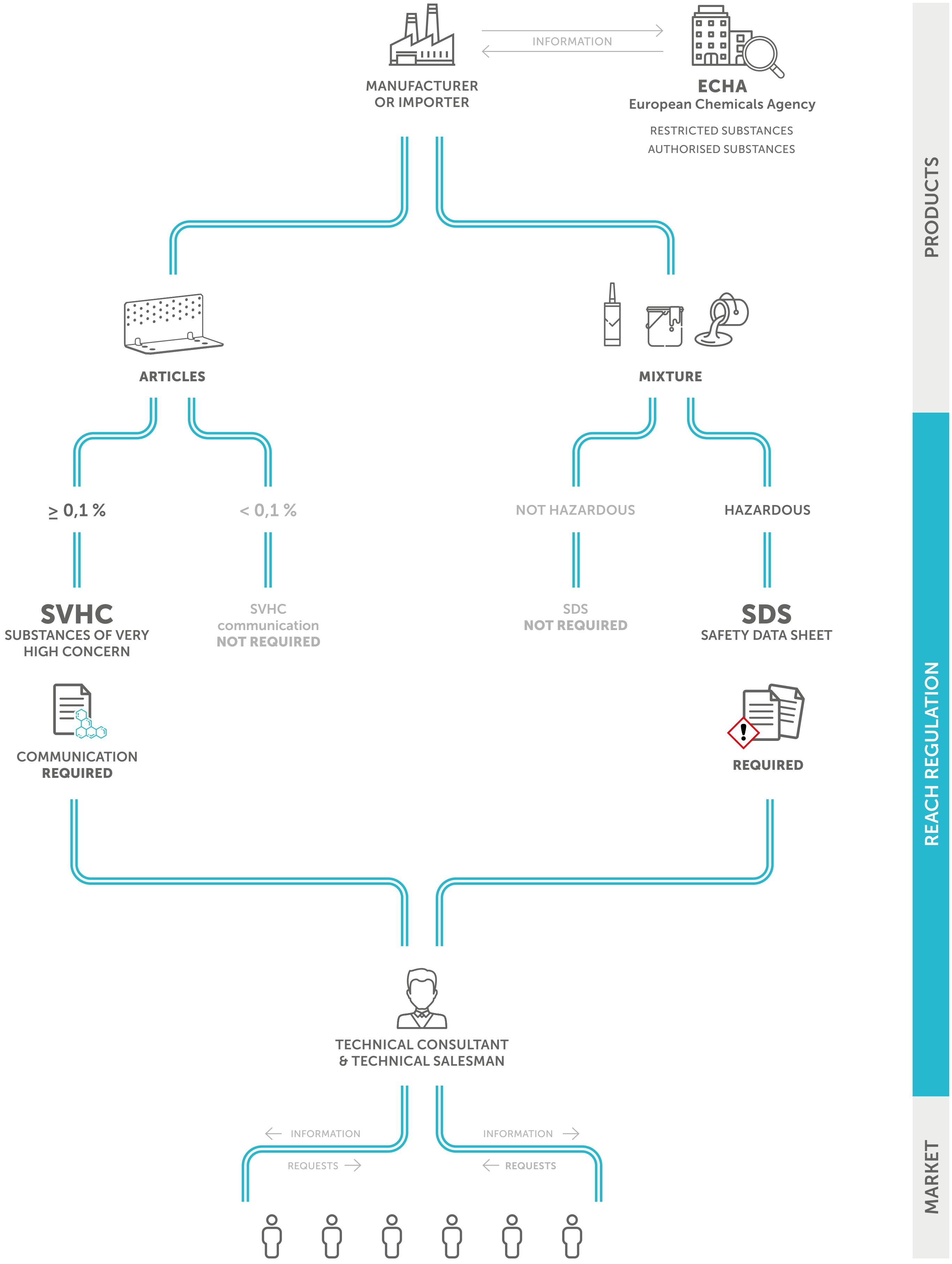
REACH COMPLIANCE

Analysis/screening on samples to verify REACH compliance.

MARKET

Product meeting the requirements of REACH regulation and Rothoblaas quality standards.

REACH PROCESS



CONCEALED BEAM JOINTS

CONCEALED BEAM JOINTS

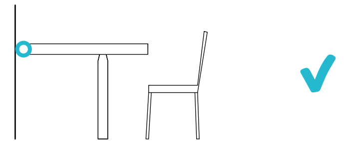
CONCEALED BEAM JOINTS

MAIN–SECONDARY JOINT

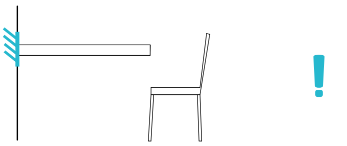
The wide choice of connection systems are applicable to many different design demands: joints between timber elements must ensure static resistance and reliability under fire conditions, while providing an optimal aesthetic result.

STATIC SAFETY

DEFINITION



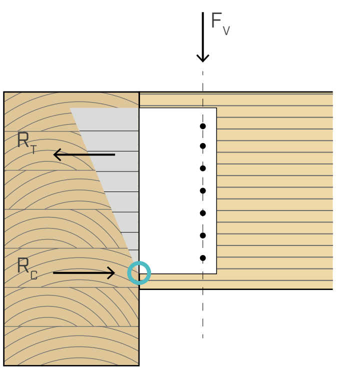
HINGE



ENCASTRE (FIXED END)

The main-to-secondary beam connection in timber structures can be schematised as a hinge. This type of joint restrains the element translation but not its rotation, differently from the encastre (fixed end) that is usually found in concrete structures.
Hinge nodes can transfer shear force and axial force from secondary to main joist but cannot bear bending moment or torsion.

ANALYSIS

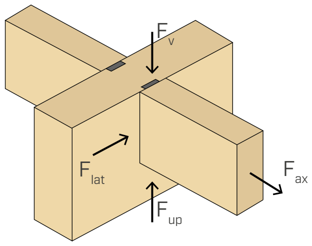


The connection system is not a punctual joint, as it is realized through the interaction of more elements.
The geometry of the connection creates, along with the shear transfer, an extra "parasitic" bending moment. Consequently, **additional stress** generates on the elements (tension on the fasteners and compression on the main beam).

SOLUTION

ETA

The **load bearing** capacity values are certified (CE marking), computable (according to ETA) and refined by **Rothoblaas** based on the designer needs (technical documentation).



Depending on connector typology, different values of load bearing capacity are obtained according to the loading direction:

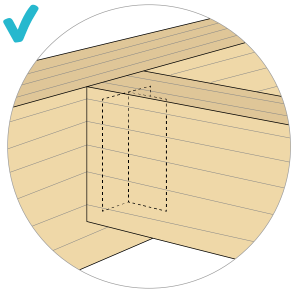
- F_v = shear load directed towards the bottom
- F_{up} = shear load directed towards the top
- F_{lat} = lateral shear load
- F_{ax} = axial load (tension)

AESTHETIC REQUIREMENTS

"Everyone sees what you appear to be, few experience what you really are." [N. Machiavelli]

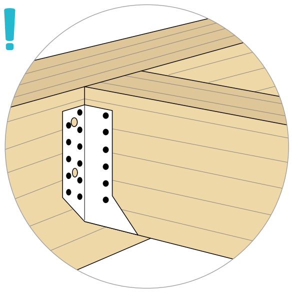
CONCEALED JOINT

The connectors are placed entirely inside the timber elements to provide an optimal aesthetic result.



VISIBLE JOINT

The metal fasteners are placed on the surface of the timber element, thus being visible and with a high aesthetic impact.



FIRE PROTECTION

Timber structures properly designed ensure high performance also under fire circumstances.

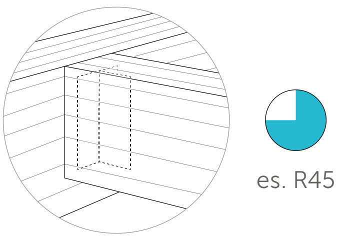
TIMBER

Timber is a slow-burning combustible material. Under fire conditions there is a reduction of the cross section, with the portion not affected by carbonisation that remains efficient.

METAL

At high temperatures, metallic materials experience drastic deterioration of their mechanical properties.

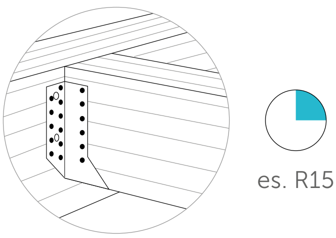
METAL-TIMBER JOINTS



es. R45

PROTECTED JOINTS

The metallic connection is adequately protected and isolated by the surrounding timber. Hence there is no strength reduction and it maintains its mechanical properties unaltered for the required amount of time.
(e.g. R45 = 45 minutes)



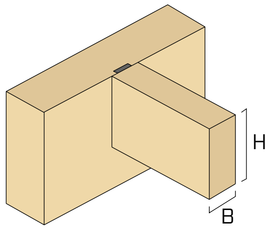
es. R15

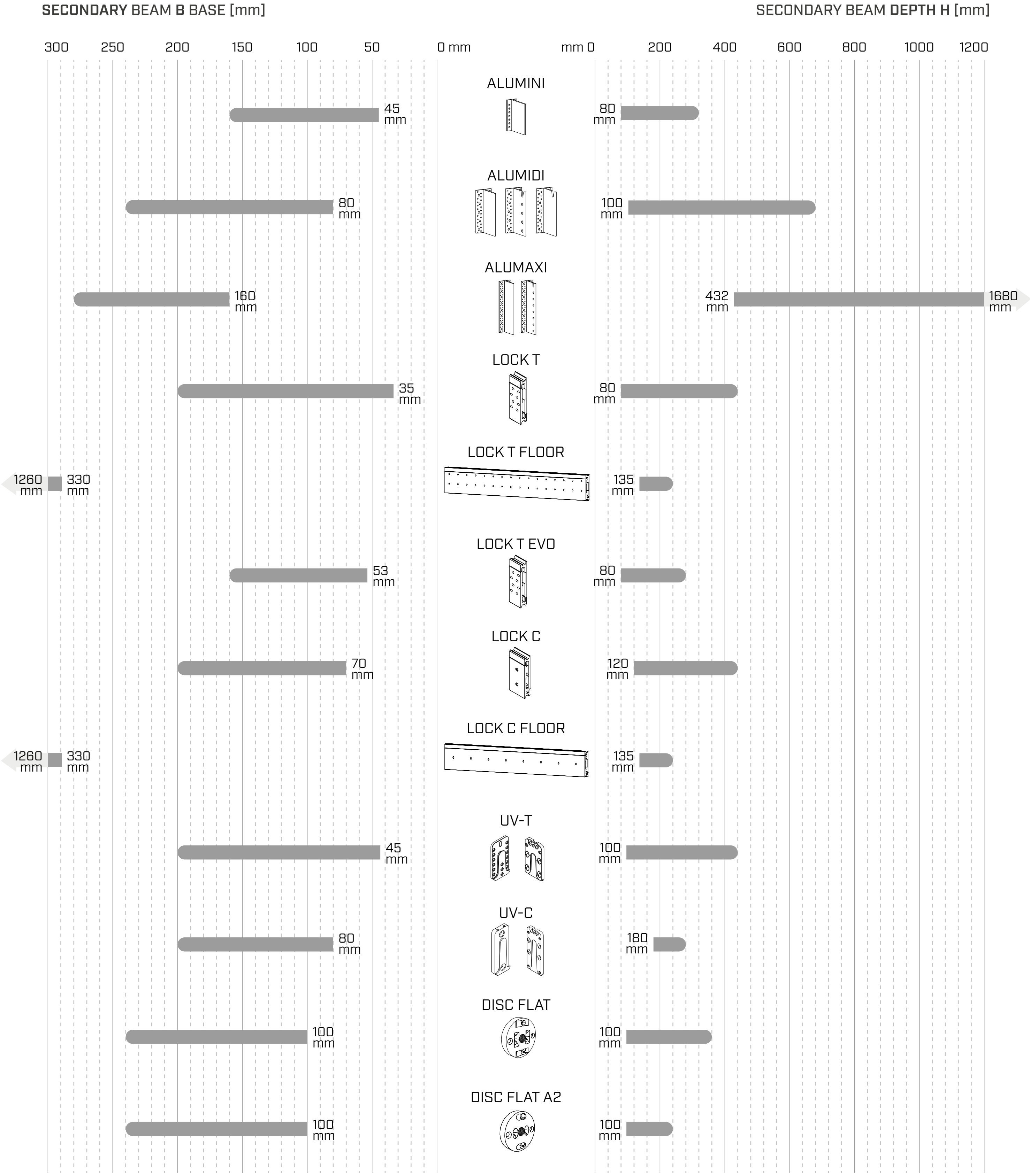
UNPROTECTED JOINTS

The metallic connection is directly exposed to fire and has very limited load bearing capacity.
(usually R15 = 15 minutes)
Furthermore the reduction of the timber section due to carbonization, results in a reduction of the fastener pull-through depth.

GEOMETRY

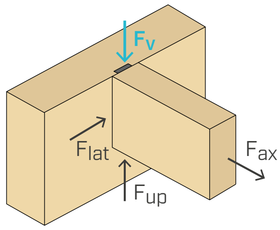
Choice of connection system according to the secondary beam cross section





STRENGTH

Choice of the connection system according to the vertical component of the shear load



	FIELDS OF USE		OUTDOOR	EXTERNAL LOADS				WOOD SIDE STRENGTH R_{vk} [kN]
				F_v	F_{ax}	F_{lat}	F_{up}	0 50 100 150 200 250 300
ALUMINI	✓	✓		●	●	●	●	40 kN
ALUMIDI	✓	✓		●	●	●	●	155 kN
ALUMAXI	✓	✓		●	●	●	●	370 kN
LOCK T	✓			●				65 kN
LOCK T FLOOR	✓			●				80 kN
LOCK T EVO	✓		✓	●				35 kN
LOCK C		✓		●				65 kN
LOCK C FLOOR		✓		●				80 kN
UV-T	✓			●	●	●	●	65 kN
UV-C		✓		●	●	●	●	40 kN
DISC FLAT	✓			●	●	●	●	65 kN
DISC FLAT A2	✓		✓	●	●	●	●	45 kN

ALUMINI

MY PROJECT SOFTWARE | VIDEO | CE ETA 09/0361

CONCEALED BRACKET WITHOUT HOLES

STEEL-ALUMINUM
EN AW-6060 aluminium alloy bracket obtained by extrusion and therefore weld-free.

SLENDER STRUCTURES
The small dimensions of the side allows to connect secondary beams with limited width (starting from 45 mm).

INCLINED JOINTS
Certified strengths calculated in all directions: vertical, horizontal and axial. They can be used in inclined joints.

CHARACTERISTICS

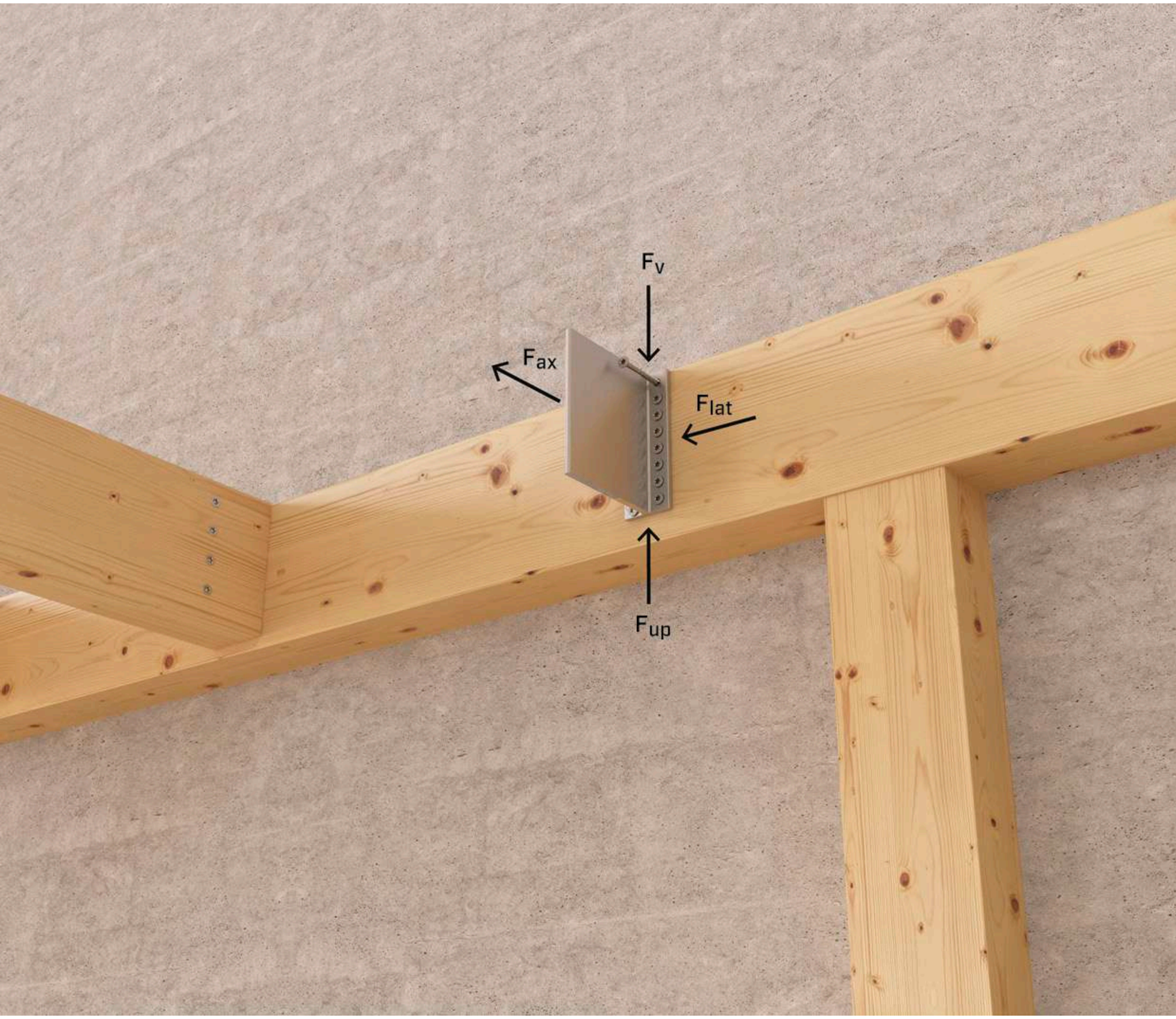
FOCUS	concealed joints
TIMBER SECTIONS	from 45 x 70 mm to 140 x 280 mm
STRENGTH	$R_{v,k}$ up to 36 kN
FASTENERS	HBS PLATE EVO, SBD, STA, SKS

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Timber-to-timber and timber-to-concrete shear joints, both perpendicular and inclined

- solid timber and glulam
- CLT, LVL
- timber based panels



QUICK ASSEMBLING

The fastening, simple and fast, is realized through screws HBS PLATE EVO on the main beam and self-drilling or smooth dowels on the secondary beam.

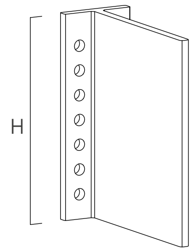
INVISIBLE

The concealed connection provides a satisfying appearance to the joint and fulfils the fire safety requirements. When adequately protected by timber, it is suitable for outdoor use.

CODES AND DIMENSIONS

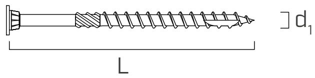
ALUMINI

CODE	type	H [mm]	pcs
ALUMINI65	without holes	65	25
ALUMINI95	without holes	95	25
ALUMINI125	without holes	125	25
ALUMINI155	without holes	155	15
ALUMINI185	without holes	185	15
ALUMINI215	without holes	215	15
ALUMINI2165	without holes	2165	1



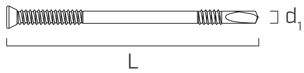
HBS PLATE EVO

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSPEVO550	5	50	30	TX25	200
HBSPEVO560	5	60	35	TX25	200



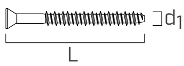
SBD

CODE	d_1 [mm]	L [mm]	TX	pcs
SBD7555	7,5	55	TX40	50
SBD7575	7,5	75	TX40	50
SBD7595	7,5	95	TX40	50



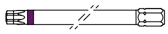
SKS ALUMINI

CODE	d_1 [mm]	L [mm]	TX	pcs
SKSALUMINI660	6	60	TX30	100



LONG BIT

CODE	L [mm]	colour	TX	pcs
TX30200	200	purple	TX30	100



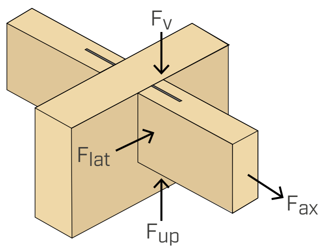
MATERIAL AND DURABILITY

ALUMINI: EN AW-6060 aluminium alloy.
To be used in service classes 1 and 2 (EN 1995-1-1).

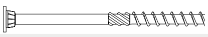
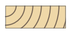
FIELDS OF USE

- Timber-to-timber, timber-to-concrete and timber-to-steel joints
- Perpendicular and inclined joints

EXTERNAL LOADS

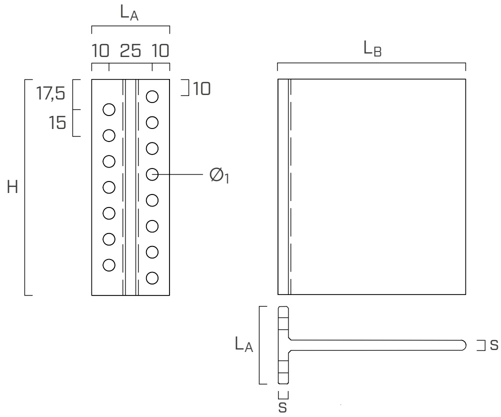


ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support	page
HBS PLATE EVO	screw for timber		5		568
SBD	self-drilling dowel		7,5		48
STA	smooth dowel		8		54

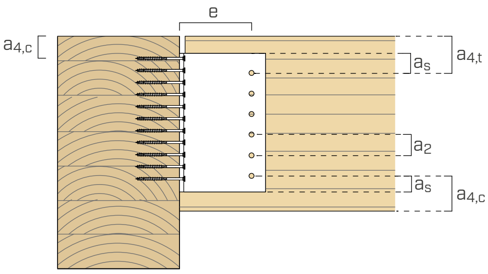
GEOMETRY

ALUMINI			
thickness	**s**	[mm]	6
wing width	L_A	[mm]	45
web length	L_B	[mm]	109,9
small flange-holes	$Ø_1$	[mm]	7,0



INSTALLATION

MINIMUM DISTANCES



secondary beam-timber				self-drilling dowel SBD Ø7,5	smooth dowel STA Ø8
dowel-dowel	a_2	[mm]	≥ 3 d	≥ 23	≥ 24
dowel-top of beam	$a_{4,t}$	[mm]	≥ 4 d	≥ 30	≥ 32
dowel-bottom of beam	$a_{4,c}$	[mm]	≥ 3 d	≥ 23	≥ 24
dowel-bracket edge	a_s	[mm]	≥ 1,2 d_0 [(1)]	≥ 10	≥ 12
dowel-main beam	**e**	[mm]		86	86

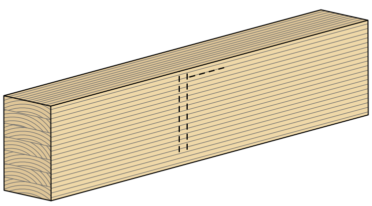
[(1)] Hole diameter.

main beam-timber				HBS PLATE EVO Ø5 screw
first connector-top of beam	$a_{4,c}$	[mm]	≥ 5 d	≥ 25

ASSEMBLY

VIDEO

01



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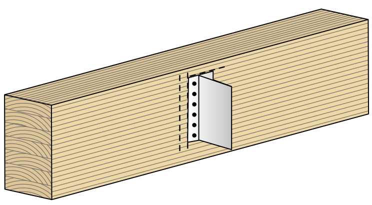

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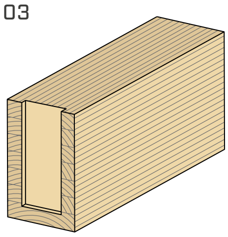

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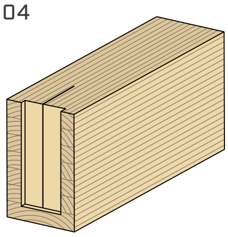

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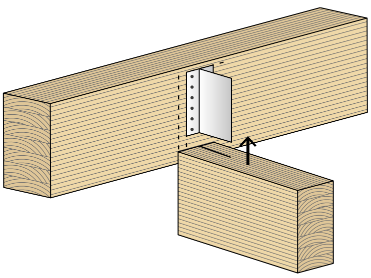

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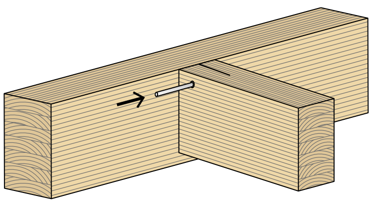

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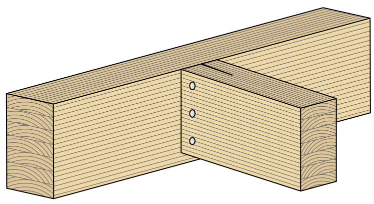
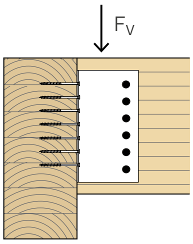
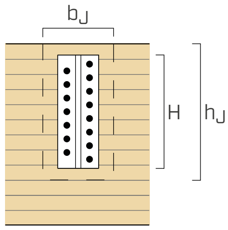


STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_V





ALUMINI with SBD self-drilling dowels

	SECONDARY BEAM			MAIN BEAM	
ALUMINI $H^{(1)}$ [mm]	b_J [mm]	h_J [mm]	SBD dowels Ø7,5[(2)] [pcs Ø x L]	HBS PLATE EVO screw Ø5 x 60 [pcs]	$R_{v,k}$ [kN]
65	60	90	2 - SBD Ø7,5 x 55	7	**2,9**
95	60	120	3 - SBD Ø7,5 x 55	11	**7,1**
125	60	150	4 - SBD Ø7,5 x 55	15	**12,9**
155	60	180	5 - SBD Ø7,5 x 55	19	**19,9**
185	60	210	6 - SBD Ø7,5 x 55	23	**27,9**
215	60	240	7 - SBD Ø7,5 x 55	27	**36,5**

ALUMINI with STA dowels

	SECONDARY BEAM			MAIN BEAM	
ALUMINI $H^{(1)}$ [mm]	b_J [mm]	h_J [mm]	STA dowels Ø8[(3)] [pcs Ø x L]	HBS PLATE EVO screw Ø5 x 60 [pcs]	$R_{v,k}$ [kN]
65	60	90	2 - STA Ø8 x 60	7	**2,9**
95	60	120	3 - STA Ø8 x 60	11	**7,1**
125	60	150	4 - STA Ø8 x 60	15	**12,9**
155	60	180	5 - STA Ø8 x 60	19	**19,9**
185	60	210	6 - STA Ø8 x 60	23	**27,9**
215	60	240	7 - STA Ø8 x 60	27	**35,0**

NOTES:

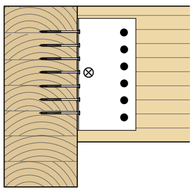
(1) The bracket with height H is available pre-cut (codes on page 20) or can be obtained from the rod ALUMINI2165.

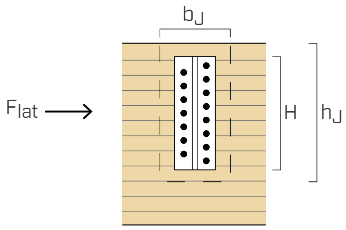
(2) SBD self-drilling dowels Ø7,5: $M_{y,k}$ = 42000 Nmm.

(3) STA smooth dowels Ø8: $M_{y,k}$ = 24100 Nmm.

General calculation principles see page 25.

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_{lat}

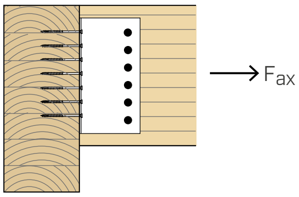


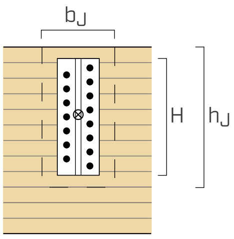


ALUMINI with SBD self drilling dowels and STA dowels

	SECONDARY BEAM[1]		MAIN BEAM		
ALUMINI H [mm]	**b_J** [mm]	**h_J** [mm]	**HBS PLATE EVO screw Ø5 x 60** [pcs]	**$R_{lat,k,alu}$** [kN]	**$R_{lat,k,beam}$**[2] [kN]
65	60	90	7	**1,6**	**3,1**
95	60	120	11	**2,3**	**4,1**
125	60	150	15	**3,0**	**5,1**
155	60	180	19	**3,8**	**6,2**
185	60	210	23	**4,5**	**7,2**
215	60	240	27	**5,2**	**8,2**

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_{ax}





ALUMINI with SBD self-drilling dowels

	SECONDARY BEAM			MAIN BEAM	
ALUMINI H [mm]	**b_J** [mm]	**h_J** [mm]	**SBD dowels Ø7,5** [pcs Ø x L]	**HBS PLATE EVO screw Ø5 x 60** [pcs]	**$R_{ax,k}$** [kN]
65	60	90	2 - SBD Ø7,5 x 55	7	**15,5**
95	60	120	3 - SBD Ø7,5 x 55	11	**24,3**
125	60	150	4 - SBD Ø7,5 x 55	15	**33,2**
155	60	180	5 - SBD Ø7,5 x 55	19	**42,0**
185	60	210	6 - SBD Ø7,5 x 55	23	**50,8**
215	60	240	7 - SBD Ø7,5 x 55	27	**59,7**

NOTES:

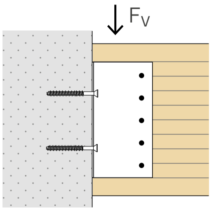
(1) The strength values are valid for both SBD Ø7,5 self-drilling dowels and STA Ø8 dowels.

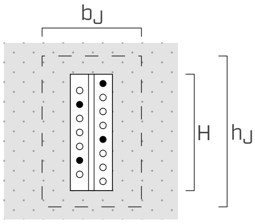
(2) Glulam GL24h.

General calculation principles see page 25.

RECOMMENDED STATIC VALUES | TIMBER-TO-CONCRETE JOINT | F_V

SCREW ANCHOR





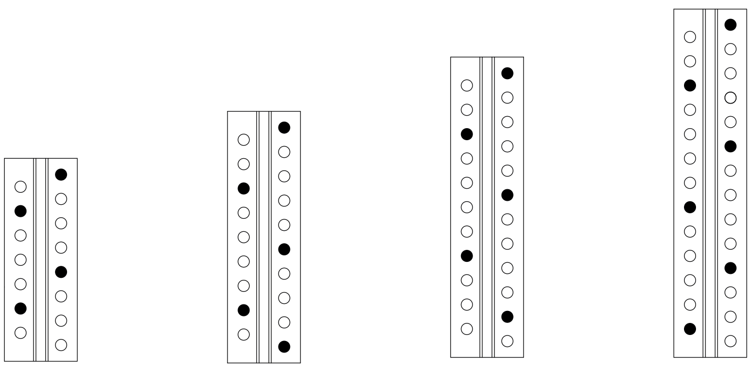
ALUMINI with SBD self-drilling dowels

	SECONDARY BEAM TIMBER				MAIN BEAM UNCRACKED CONCRETE	
ALUMINI			SBD dowels		SKSALUMINI660 anchor(3)	
H(1)	b_J	h_J	Ø7,5	$R_{v,k\ timber}$	Ø6 x 60	$R_{v,d\ concrete}$
[mm]	[mm]	[mm]	[pcs Ø x L]	[kN]	[pcs]	[kN]
125	60	150	3 - SBD Ø7,5 x 55	**15,6**	4	**6,0**
155	60	180	3 - SBD Ø7,5 x 55	**15,6**	5	**7,3**
185	60	210	4 - SBD Ø7,5 x 55	**20,8**	5	**9,1**
215	60	240	5 - SBD Ø7,5 x 55	**26,1**	6	**11,5**

ALUMINI with STA dowels

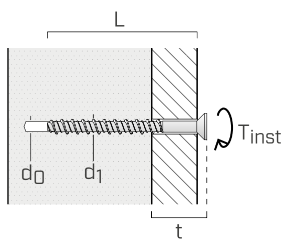
	SECONDARY BEAM TIMBER				MAIN BEAM UNCRACKED CONCRETE	
ALUMINI			STA dowels		SKSALUMINI660 anchor(3)	
H(1)	b_J	h_J	Ø8	$R_{v,k\ timber}$	Ø6 x 60	$R_{v,d\ concrete}$
[mm]	[mm]	[mm]	[pcs Ø x L]	[kN]	[pcs]	[kN]
125	60	150	3 - STA Ø8 x 60	**15,0**	4	**6,0**
155	60	180	3 - STA Ø8 x 60	**15,0**	5	**7,3**
185	60	210	4 - STA Ø8 x 60	**20,0**	5	**9,1**
215	60	240	5 - STA Ø8 x 60	**25,0**	6	**11,5**

ANCHORS INSTALLATION



ALUMINI125 ALUMINI155 ALUMINI185 ALUMINI215

anchor	d_1 [mm]	L [mm]	d_0 [mm]	t [mm]	TX	T_{inst} [Nm]
SKSALUMINI660	6,0	60	5	≈ 10	TX30	15



GENERAL PRINCIPLES:

- Resistance values for the fastening system are valid for the calculation examples shown in the table.
- The calculation process used a timber characteristic density of $\rho_k = 385\ kg/m^3$ and C20/25 concrete with a thin reinforcing layer, where edge-distance is not a limiting factor.
- The coefficients k_{mod} and γ_M should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

STATIC VALUES | F_v

TIMBER-TO-TIMBER

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361.

  The design values are obtained from the characteristic values as follows:

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

- In some cases the connection shear strength $R_{V,k}$ is notably large and may be higher than the secondary beam strength. Particular attention should be paid to the shear check of the reduced timber cross-section in correspondence with the bracket location.

STATIC VALUES | F_{lat} | F_{ax}

TIMBER-TO-TIMBER

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361. The design values are obtained from the characteristic values as follows:

$$R_{lat,d} = min \begin{cases} \dfrac{R_{lat,k,alu}}{\gamma_{M,alu}} \\ \dfrac{R_{lat,k,beam} \cdot k_{mod}}{\gamma_{M,T}} \end{cases}$$

$$R_{ax,d} = \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M}$$

with $\gamma_{M,T}$ partial coefficient of the timber.

STATIC VALUES | F_v

TIMBER-TO-CONCRETE

- Characteristic values on wood side are consistent with EN 1995-1-1 and in accordance with ETA-09/0361. The strength values of anchors for concrete are recommended design values derived from laboratory data. Fastening on concrete is not CE marked, it is advisable to use the joint system for non-structural applications.

  Design resistance values can be obtained from the tabled values as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ R_{d,\ concrete} \end{cases}$$

- Because of the arrangement of the fasteners on concrete, special care should be taken during installation.

ALUMIDI

CONCEALED BRACKET WITH AND WITHOUT HOLES

INCLINED JOINTS
Certified strengths calculated in all directions: vertical, horizontal and axial. They can be used in seismic areas and in mixed-mode bending.

STEEL-ALUMINUM
EN AW-6005A high strength aluminium alloy bracket, obtained by extrusion and therefore weld-free.

TIMBER AND CONCRETE
Optimal hole spacing both for timber (nails or screws) and reinforced concrete (chemical or screwed anchor) joints.

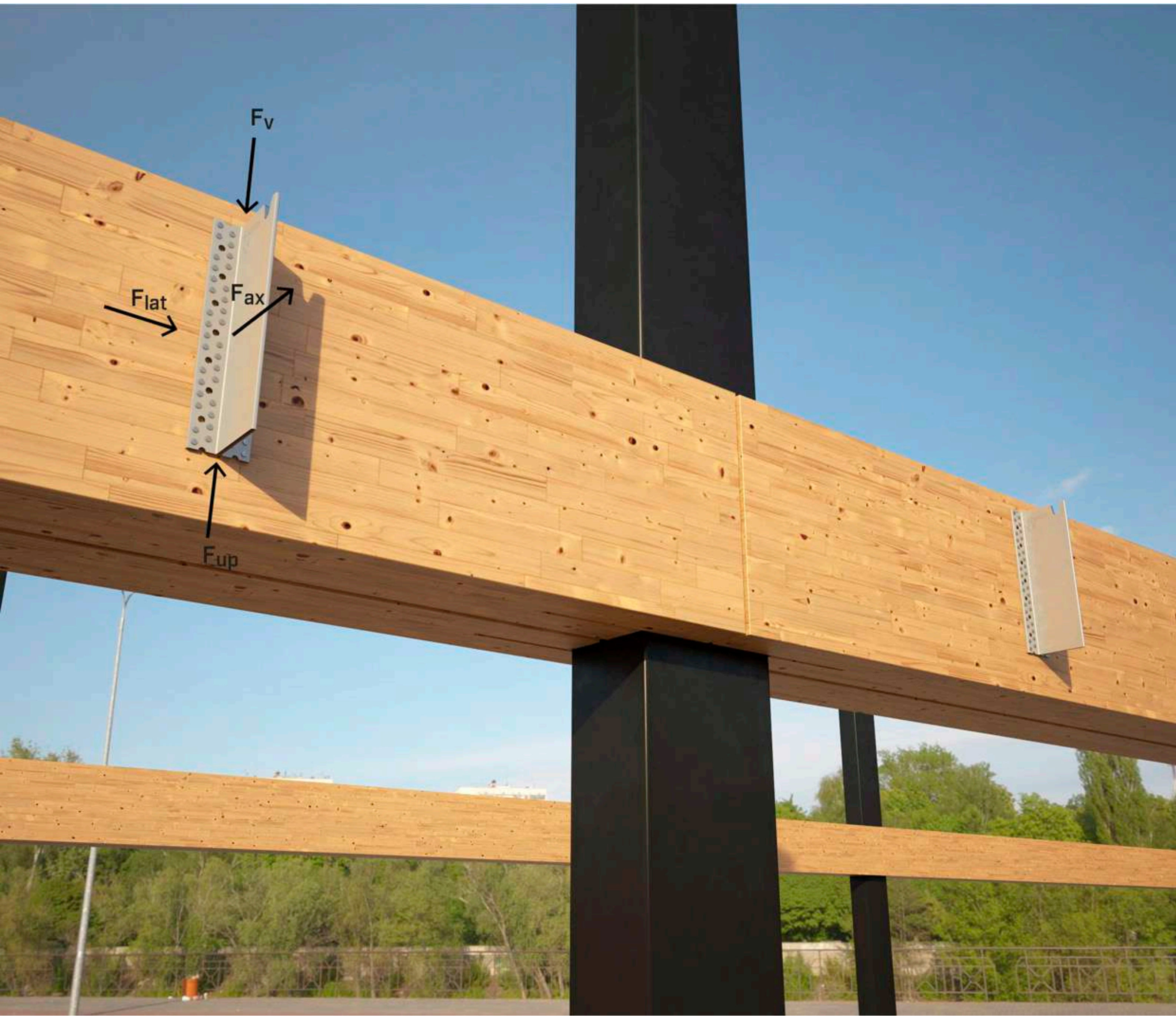
CHARACTERISTICS

FOCUS	concealed joints
TIMBER SECTIONS	from 80 x 100 mm to 200 x 520 mm
STRENGTH	$R_{v,k}$ up to 150 kN
FASTENERS	LBA, LBS, SBD, STA, SKR

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Timber-to-timber and timber-to-concrete shear joints, both perpendicular and inclined
- solid timber and glulam
- CLT, LVL
- timber based panels



INVISIBLE

The concealed connection provides a satisfying appearance to the joint and fulfils the fire safety requirements. A countersink where the first hole is located, facilitates the introduction of the secondary beam from the top.

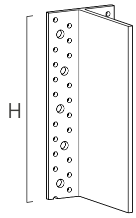
TIMBER AND CONCRETE

For applications on concrete or other uneven surfaces the self-drilling dowels allow a greater installation tolerance when fastening the timber element. Values are certified, tested and consolidated.

CODES AND DIMENSIONS

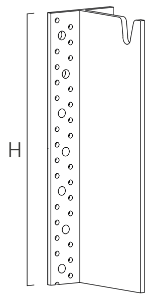
ALUMIDI WITHOUT HOLES

CODE	type	H [mm]	pcs
ALUMIDI80	without holes	80	25
ALUMIDI120	without holes	120	25
ALUMIDI160	without holes	160	25
ALUMIDI200	without holes	200	15
ALUMIDI240	without holes	240	15
ALUMIDI2200	without holes	2200	1



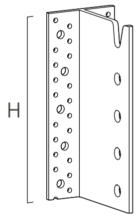
ALUMIDI WITHOUT HOLES WITH UPPER COUNTERSINK

CODE	type	H [mm]	pcs
ALUMIDI280N	without holes	280	15
ALUMIDI320N	without holes	320	8
ALUMIDI360N	without holes	360	8
ALUMIDI400N	without holes	400	8
ALUMIDI440N	without holes	440	8



ALUMIDI WITH HOLES

CODE	type	H [mm]	pcs
ALUMIDI120L	with holes	120	25
ALUMIDI160L	with holes	160	25
ALUMIDI200L	with holes	200	15
ALUMIDI240L	with holes	240	15
ALUMIDI280L	with holes	280	15
ALUMIDI320L	with holes	320	8
ALUMIDI360L	with holes	360	8



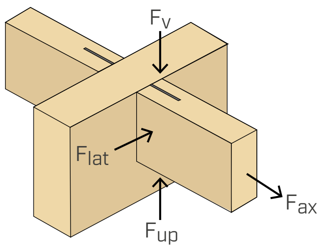
MATERIAL AND DURABILITY

ALUMIDI: EN AW-6005A aluminium alloy.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELDS OF USE

- Timber-to-timber, timber-to-concrete and timber-to-steel joints
- Secondary beam on main beam or on column
- Perpendicular and inclined joints

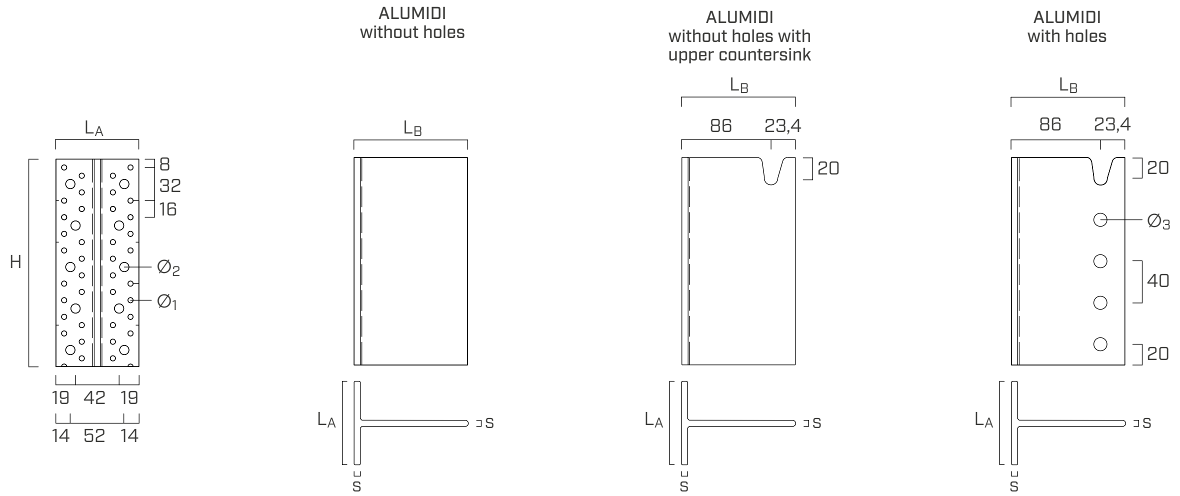
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
LBA	Anker nail	4		548
LBS	screw for plates	5		552
SBD	self-drilling dowel	7,5		48
STA	smooth dowel	12		54
SKR	screw anchor	10		488
VIN-FIX PRO	chemical anchor	M8		514
EPO-FIX PLUS	chemical anchor	M8		517

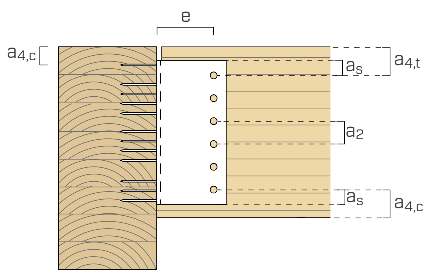
GEOMETRY

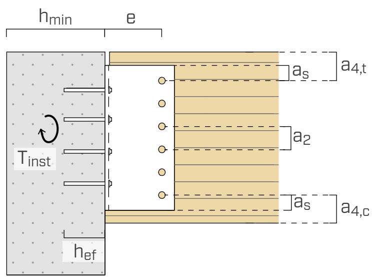


ALUMIDI			
thickness	s	[mm]	6
wing width	L_A	[mm]	80
web length	L_B	[mm]	109,4
small flange-holes	$Ø_1$	[mm]	5,0
large flange-holes	$Ø_2$	[mm]	9,0
web holes (dowels)	$Ø_3$	[mm]	13,0

INSTALLATION

MINIMUM DISTANCES





secondary beam-timber				**self-drilling dowel** SBD Ø7,5	**smooth dowel** STA Ø12
dowel-dowel	a_2	[mm]	≥ 3 d	≥ 23	≥ 36
dowel-top of beam	$a_{4,t}$	[mm]	≥ 4 d	≥ 30	≥ 48
dowel-bottom of beam	$a_{4,c}$	[mm]	≥ 3 d	≥ 23	≥ 36
dowel-bracket edge	a_s	[mm]	$\geq 1{,}2\ d_0$ (1)	≥ 10	≥ 16
dowel-main beam	e	[mm]		86	86

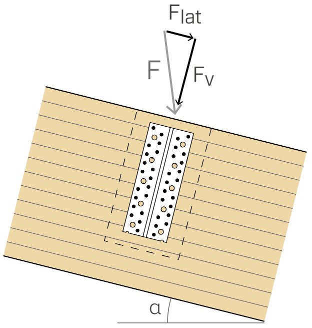
(1) Hole diameter.

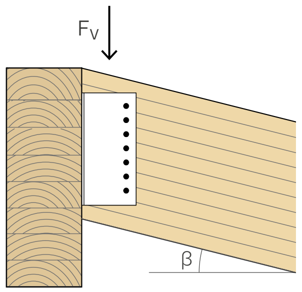
main beam-timber				**Anker nail** LBA Ø4	**screw** LBS Ø5
first connector-top of beam	$a_{4,c}$	[mm]	≥ 5 d	≥ 20	≥ 25

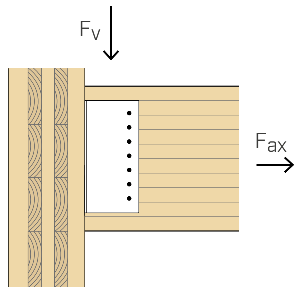
main beam-concrete			**chemical anchor** VIN FIX-PRO Ø8	**screw anchor** SKR-E Ø10
minimum support thickness	h_{min}	[mm]	$h_{ef} + 30 \geq 100$	110
concrete hole diameter	d_0	[mm]	10	8
tightening torque	T_{inst}	[Nm]	10	50

h_{ef} = effective anchoring depth in concrete.

APPLICATION EXAMPLES



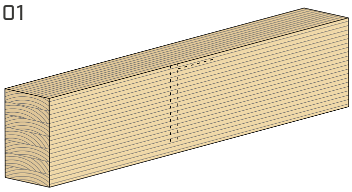




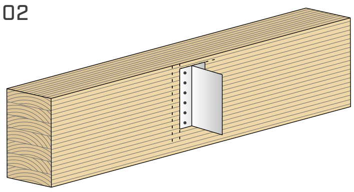
ASSEMBLY

VIDEO

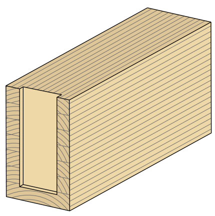
01



02

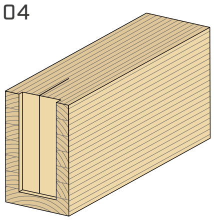


03

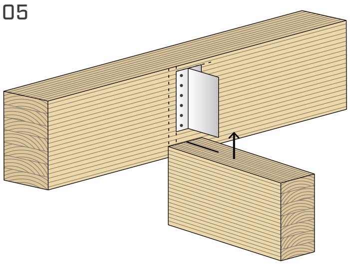


ALUMIDI WITHOUT HOLES

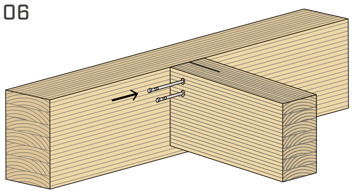
04



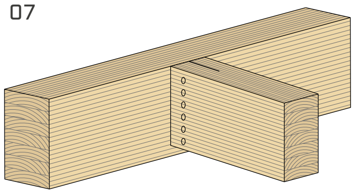
05



06

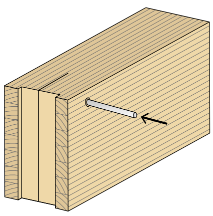


07



ALUMIDI WITHOUT HOLES WITH UPPER COUNTERSINK

04



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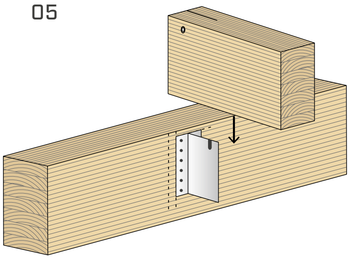

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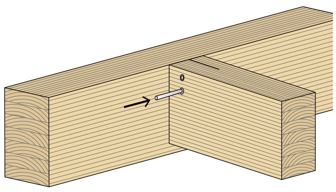
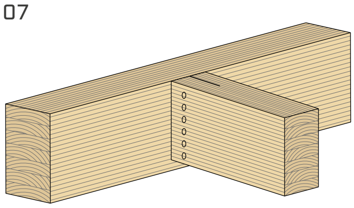
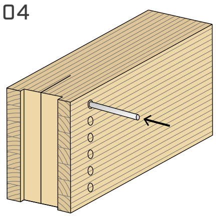


07



ALUMIDI WITH HOLES

04



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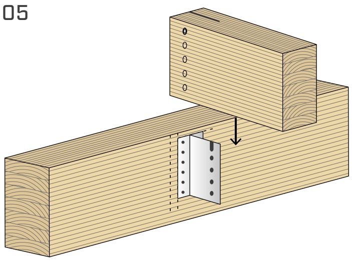

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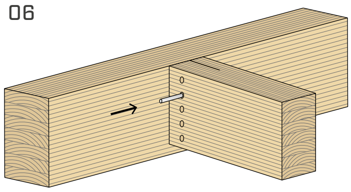

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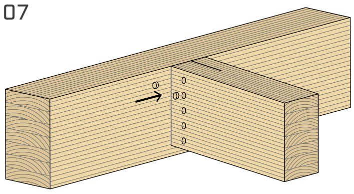
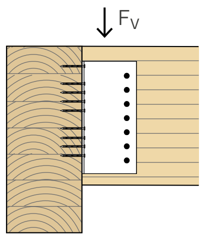
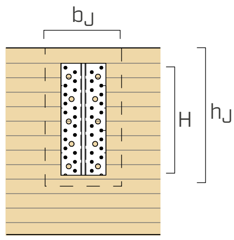


STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_V

FULL NAILING





ALUMIDI with SBD self-drilling dowels

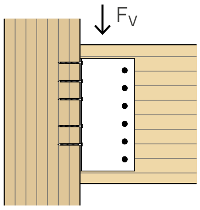
ALUMIDI	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
H(1) [mm]	b_J [mm]	h_J [mm]	SBD dowels Ø7,5(2) [pcs Ø x L]	LBA nails Ø4 x 60 [pcs]	$R_{v,k}$ [kN]	LBS screws Ø5 x 60 [pcs]	$R_{v,k}$ [kN]
80	120	120	3 - Ø7,5 x 115	14	**10,9**	14	**13,4**
120	120	160	4 - Ø7,5 x 115	22	**19,7**	22	**24,6**
160	120	200	5 - Ø7,5 x 115	30	**29,6**	30	**35,3**
200	120	240	7 - Ø7,5 x 115	38	**42,5**	38	**51,6**
240	120	280	9 - Ø7,5 x 115	46	**54,6**	46	**66,5**
280	140	320	10 - Ø7,5 x 135	54	**71,8**	54	**85,0**
320	140	360	11 - Ø7,5 x 135	62	**84,9**	62	**99,9**
360	160	400	12 - Ø7,5 x 155	70	**103,6**	70	**119,9**
400	160	440	13 - Ø7,5 x 155	78	**116,3**	78	**130,7**
440	160	480	14 - Ø7,5 x 155	86	**134,5**	86	**145,6**

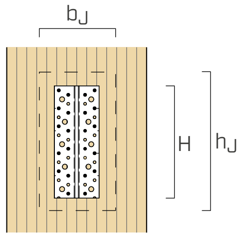
ALUMIDI with STA dowels

ALUMIDI	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
H(1) [mm]	b_J [mm]	h_J [mm]	STA dowels Ø12(3) [pcs Ø x L]	LBA nails Ø4 x 60 [pcs]	$R_{v,k}$ [kN]	LBS screws Ø5 x 60 [pcs]	$R_{v,k}$ [kN]
120	120	160	3 - Ø12 x 120	22	**23,0**	22	**25,8**
160	120	200	4 - Ø12 x 120	30	**34,5**	30	**40,6**
200	120	240	5 - Ø12 x 120	38	**46,5**	38	**54,8**
240	120	280	6 - Ø12 x 120	46	**60,9**	46	**68,4**
280	140	320	7 - Ø12 x 140	54	**77,2**	54	**87,0**
320	140	360	8 - Ø12 x 140	62	**93,2**	62	**102,4**
360	160	400	9 - Ø12 x 160	70	**114,3**	70	**124,7**
400	160	440	10 - Ø12 x 160	78	**127,3**	78	**141,0**
440	160	480	11 - Ø12 x 160	86	**144,6**	86	**154,9**

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_V

PARTIAL NAILING[4]





ALUMIDI with SBD self-drilling dowels

ALUMIDI	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
$H^{(1)}$ [mm]	b_J [mm]	h_J [mm]	SBD dowels Ø7,5[2] [pcs Ø x L]	LBA nails Ø4 x 60 [pcs]	$R_{v,k}$ [kN]	LBS screws Ø5 x 60 [pcs]	$R_{v,k}$ [kN]
80	120	120	3 - Ø7,5 x 115	10	**9,0**	10	**11,2**
120	120	160	4 - Ø7,5 x 115	14	**15,0**	14	**18,6**
160	120	200	5 - Ø7,5 x 115	18	**24,7**	18	**25,2**
200	120	240	6 - Ø7,5 x 115	22	**31,0**	22	**35,2**
240	120	280	7 - Ø7,5 x 115	26	**38,0**	26	**45,5**
280	140	320	8 - Ø7,5 x 135	30	**47,6**	30	**54,8**
320	140	360	9 - Ø7,5 x 135	34	**55,0**	34	**64,8**
360	160	400	10 - Ø7,5 x 155	38	**66,2**	38	**75,2**
400	160	440	11 - Ø7,5 x 155	42	**74,9**	42	**84,4**
440	160	480	12 - Ø7,5 x 155	46	**83,2**	46	**95,3**

ALUMIDI with STA dowels

ALUMIDI	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
$H^{(1)}$ [mm]	b_J [mm]	h_J [mm]	STA dowels Ø12[3] [pcs Ø x L]	LBA nails Ø4 x 60 [pcs]	$R_{v,k}$ [kN]	LBS screws Ø5 x 60 [pcs]	$R_{v,k}$ [kN]
120	120	160	3 - Ø12 x 120	14	**18,2**	14	**21,4**
160	120	200	4 - Ø12 x 120	18	**26,4**	18	**30,9**
200	120	240	5 - Ø12 x 120	22	**34,8**	22	**39,7**
240	120	280	6 - Ø12 x 120	26	**44,0**	26	**48,5**
280	140	320	7 - Ø12 x 140	30	**54,0**	30	**63,5**
320	140	360	8 - Ø12 x 140	34	**64,2**	34	**73,2**
360	160	400	9 - Ø12 x 160	38	**80,2**	38	**83,0**
400	160	440	10 - Ø12 x 160	42	**89,4**	42	**92,7**
440	160	480	11 - Ø12 x 160	46	**98,7**	46	**102,5**

NOTES:

TIMBER-TO-TIMBER | F_v

(1) The bracket with height H is available pre-drilled in the ALUMIDI versions without holes, ALUMIDI with holes and ALUMIDI with countersink (codes on page 28) or can be obtained from the ALUMIDI2200 rod.

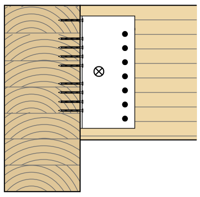
(2) SBD self-drilling dowels Ø7,5: $M_{y,k}$ = 42000 Nmm.

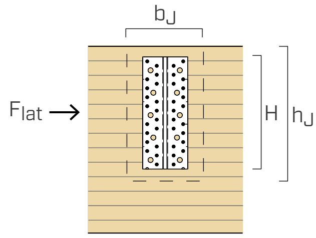
(3) STA smooth dowels Ø12: $M_{y,k}$ = 69100 Nmm.

(4) Partial nailing is necessary for beam-column joints in order to observe minimum fastener spacings; it can be applied also for beam-beam joints. Partial nailing is performed by nailing each column alternately as shown in the picture.

General calculation principles see page 36.

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_{lat}

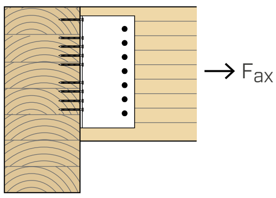


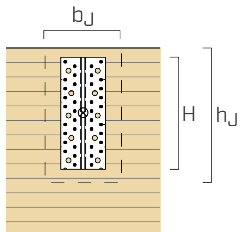


ALUMIDI with SBD self drilling dowels or STA dowels

	SECONDARY BEAM[1]		MAIN BEAM[2]		
ALUMIDI H [mm]	b_J [mm]	h_J [mm]	LBA nails / LBS screws Ø4 x 60 / Ø5 x 60 [pcs]	$R_{lat,k,alu}$ [kN]	$R_{lat,k,beam}$[3] [kN]
80	120	120	≥ 10	**3,6**	**9,0**
120	120	160	≥ 14	**5,4**	**12,0**
160	120	200	≥ 18	**7,2**	**15,0**
200	120	240	≥ 22	**9,1**	**18,0**
240	120	280	≥ 26	**10,9**	**21,0**
280	140	320	≥ 30	**12,7**	**28,1**
320	140	360	≥ 34	**14,5**	**31,6**
360	160	400	≥ 38	**16,3**	**40,1**
400	160	440	≥ 42	**18,1**	**44,1**
440	160	480	≥ 46	**19,9**	**48,1**

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_{ax}





ALUMIDI with SBD self-drilling dowels

	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
ALUMIDI H [mm]	b_J [mm]	h_J [mm]	SBD dowels Ø7,5 [pcs Ø x L]	LBA nails Ø4 x 60 [pcs]	$R_{ax,k}$ [kN]	LBS screws Ø5 x 60 [pcs]	$R_{ax,k}$ [kN]
80	120	120	3 - Ø7,5 x 115	14	**11,3**	14	**23,9**
120	120	160	4 - Ø7,5 x 115	22	**17,8**	22	**37,5**
160	120	200	5 - Ø7,5 x 115	30	**24,3**	30	**51,2**
200	120	240	7 - Ø7,5 x 115	38	**30,8**	38	**64,8**
240	120	280	9 - Ø7,5 x 115	46	**37,3**	46	**78,4**
280	140	320	10 - Ø7,5 x 135	54	**43,7**	54	**92,1**
320	140	360	11 - Ø7,5 x 135	62	**50,2**	62	**105,7**
360	160	400	12 - Ø7,5 x 155	70	**56,7**	70	**119,4**
400	160	440	13 - Ø7,5 x 155	78	**63,2**	78	**133,0**
440	160	480	14 - Ø7,5 x 155	86	**69,7**	86	**146,6**

NOTES:

TIMBER-TO-TIMBER | F_{lat} | F_{ax}

[1] The strength values are valid for both SBD Ø7,5 self-drilling dowels and STA Ø12 dowels.

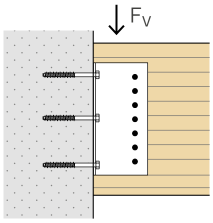
[2] The strength values are valid for both LBA Ø4 nails and for LBS Ø5 screws.

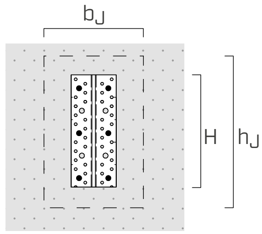
[3] Glulam GL24h.

General calculation principles see page 36.

STATIC VALUES | TIMBER-TO-CONCRETE JOINT | F_V

SCREW ANCHOR





ALUMIDI with SBD self-drilling dowels

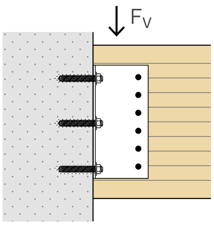
	SECONDARY BEAM TIMBER				MAIN BEAM UNCRACKED CONCRETE	
ALUMIDI			SBD dowels		SKR-E anchor	
H(1) [mm]	b_J [mm]	h_J [mm]	Ø7,5(2) [pcs Ø x L]	$R_{v,k\ timber}$ [kN]	Ø10 x 80(4) [pcs]	$R_{v,d\ concrete}$ [kN]
80	120	120	2 - Ø7,5 x 115	**16,6**	2	**6,1**
120	120	160	3 - Ø7,5 x 115	**24,9**	4	**10,2**
160	120	200	4 - Ø7,5 x 115	**33,2**	4	**12,9**
200	120	240	5 - Ø7,5 x 115	**41,6**	6	**17,4**
240	120	280	6 - Ø7,5 x 115	**49,9**	6	**19,8**
280	140	320	6 - Ø7,5 x 135	**55,1**	8	**24,3**
320	140	360	7 - Ø7,5 x 135	**64,3**	8	**26,5**
360	160	400	7 - Ø7,5 x 155	**71,1**	10	**31,1**
400	160	440	8 - Ø7,5 x 155	**81,2**	10	**33,1**
440	160	480	9 - Ø7,5 x 155	**91,4**	12	**38,8**

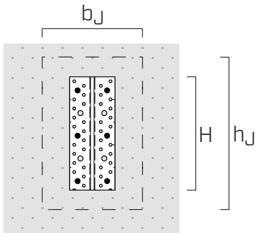
ALUMIDI with STA dowels

	SECONDARY BEAM TIMBER				MAIN BEAM UNCRACKED CONCRETE	
ALUMIDI			STA dowels		SKR-E anchor	
H(1) [mm]	b_J [mm]	h_J [mm]	Ø12(3) [pcs Ø x L]	$R_{v,k\ timber}$ [kN]	Ø10 x 80(4) [pcs]	$R_{v,d\ concrete}$ [kN]
120	120	160	3 - Ø12 x 120	**35,5**	4	**10,2**
160	120	200	4 - Ø12 x 120	**47,3**	4	**12,9**
200	120	240	5 - Ø12 x 120	**59,1**	6	**17,4**
240	120	280	6 - Ø12 x 120	**70,9**	6	**19,8**
280	140	320	7 - Ø12 x 140	**91,0**	8	**24,3**
320	140	360	8 - Ø12 x 140	**104,0**	8	**26,5**
360	160	400	9 - Ø12 x 160	**128,4**	10	**31,1**
400	160	440	10 - Ø12 x 160	**142,7**	10	**33,1**
440	160	480	11 - Ø12 x 160	**157,0**	12	**38,8**

STATIC VALUES | TIMBER-TO-CONCRETE JOINT | F_V

CHEMICAL ANCHOR





ALUMIDI with SBD self-drilling dowels

			SECONDARY BEAM TIMBER		MAIN BEAM UNCRACKED CONCRETE	
ALUMIDI			SBD dowels		VIN-FIX PRO anchor	
H[1]	b_J	h_J	Ø7,5[2]	$R_{v,k\ timber}$	Ø8 x 110[5]	$R_{v,d\ concrete}$
[mm]	[mm]	[mm]	[pcs Ø x L]	[kN]	[pcs]	[kN]
80	120	120	3 - Ø7,5 x 115	**24,9**	2	**8,8**
120	120	160	4 - Ø7,5 x 115	**33,2**	4	**15,4**
160	120	200	5 - Ø7,5 x 115	**41,6**	4	**22,1**
200	120	240	7 - Ø7,5 x 115	**58,2**	6	**30,7**
240	120	280	8 - Ø7,5 x 115	**66,5**	6	**37,0**
280	140	320	10 - Ø7,5 x 135	**91,9**	8	**48,7**
320	140	360	11 - Ø7,5 x 135	**101,1**	8	**55,6**
360	160	400	12 - Ø7,5 x 155	**121,9**	10	**64,4**
400	160	440	13 - Ø7,5 x 155	**132,0**	10	**66,4**
440	160	480	14 - Ø7,5 x 155	**142,2**	12	**80,0**

ALUMIDI with STA dowels

			SECONDARY BEAM TIMBER		MAIN BEAM UNCRACKED CONCRETE	
ALUMIDI			STA dowels		VIN-FIX PRO anchor	
H[1]	b_J	h_J	Ø12[3]	$R_{v,k\ timber}$	Ø8 x 110[5]	$R_{v,d\ concrete}$
[mm]	[mm]	[mm]	[pcs Ø x L]	[kN]	[pcs]	[kN]
120	120	160	3 - Ø12 x 120	**35,5**	4	**15,4**
160	120	200	4 - Ø12 x 120	**47,3**	4	**22,1**
200	120	240	5 - Ø12 x 120	**59,1**	6	**30,7**
240	120	280	6 - Ø12 x 120	**70,9**	6	**37,0**
280	140	320	7 - Ø12 x 140	**91,0**	8	**48,7**
320	140	360	8 - Ø12 x 140	**104,0**	8	**55,6**
360	160	400	9 - Ø12 x 160	**128,4**	10	**64,4**
400	160	440	10 - Ø12 x 160	**142,7**	10	**66,4**
440	160	480	11 - Ø12 x 160	**157,0**	12	**80,0**

NOTES:

TIMBER-TO-CONCRETE

(1) The bracket with height H is available pre-drilled in the ALUMIDI versions without holes, ALUMIDI with holes and ALUMIDI with countersink (codes on page 28) or can be obtained from the ALUMIDI2200 rod.

(2) SBD self-drilling dowels Ø7,5: $M_{y,k}$ = 42000 Nmm.

(3) STA smooth dowels Ø12: $M_{y,k}$ = 69100 Nmm.

(4) Screw anchor SKR-E according to ETA 19/0100. Install the anchors two at a time, starting from the top, dowelling alternate rows.

(5) Chemical anchor VIN-FIX PRO with threaded rods (type INA) of minimum strength grade equal to 5.8. with h_{ef} = 93 mm. Install the anchors two at a time, starting from the top, dowelling alternate rows.

General calculation principles see page 36.

GENERAL PRINCIPLES:

- Resistance values for the fastening system are valid for the calculation examples shown in the table.
- The calculation process used a timber characteristic density of ρ_k = 385 kg/m^3 and C25/30 concrete with a thin reinforcing layer, where edge-distance is not a limiting factor.
- The coefficients k_{mod} and γ_M should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- In case of combined loading the following verification shall be satisfied:

$$\left(\frac{F_{v,d}}{R_{v,d}}\right)^2 + \left(\frac{F_{lat,d}}{R_{lat,d}}\right)^2 + \left(\frac{F_{ax,d}}{R_{ax,d}}\right)^2 \leq 1$$

STATIC VALUES | F_v

TIMBER-TO-TIMBER

- Characteristic values are consistent with EN 1995-1-1, in accordance with ETA-09/0361 and evaluated with Rothoblaas experimental method.
- The design values are obtained from the characteristic values as follows:

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

- In some cases the connection shear strength $R_{v,k}$ is notably large and may be higher than the secondary beam strength. Particular attention should be paid to the shear check of the reduced timber cross-section in correspondence with the bracket location.

STATIC VALUES | F_{lat} | F_{ax}

TIMBER-TO-TIMBER

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361.
- The design values are obtained from the characteristic values as follows:

$$R_{lat,d} = min \begin{cases} \dfrac{R_{lat,k,alu}}{\gamma_{M,alu}} \\ \dfrac{R_{lat,k,beam} \cdot k_{mod}}{\gamma_{M,T}} \end{cases}$$

$$R_{ax,d} = \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M}$$

with $\gamma_{M,T}$ partial coefficient of the timber.

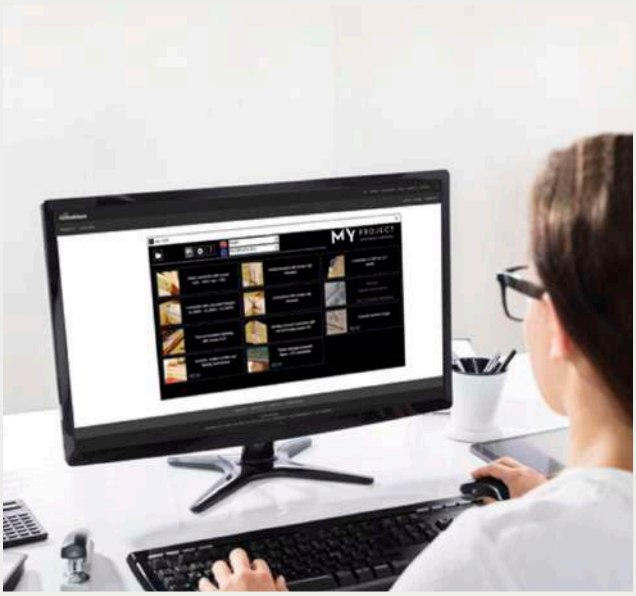
STATIC VALUES | F_v

TIMBER-TO-CONCRETE

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.

Design resistance values can be obtained from the tabled values as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ R_{d,\ concrete} \end{cases}$$



MY PROJECT calculation software

MY PROJECT SOFTWARE

For different calculation methods, the MyProject software is available free of charge (www.rothoblaas.com).

- The analysis of various configurations is possible by varying number and type of fasteners, inclination, dimensions and material of the structural elements to maximize the mechanical strength.
- Possibility of using two different methods of calculation (according to ETA 09/0361 and experimental model).
- Wide and diversified variety of ALUMINI, ALUMIDI and ALUMAXI brackets able to satisfy different static requirements.

LABORATORY TESTING

EXPERIMENTAL INVESTIGATION

A comprehensive experimental campaign aimed at defining the real behaviour of the ALU brackets was carried out in collaboration the University of Trento. A numerical model has then been proposed and validated on the experimental results (Rothoblaas experimental method).

RESEARCH AND DEVELOPMENT

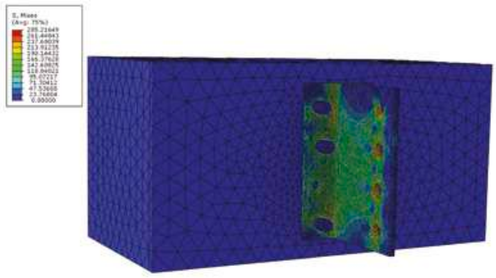
Experimental investigation – Materials and Structures Tests Laboratory (Faculty of Engineering, Trento).

Tests on specimens with reduced dimensions (timber-to-timber and timber-to-concrete).

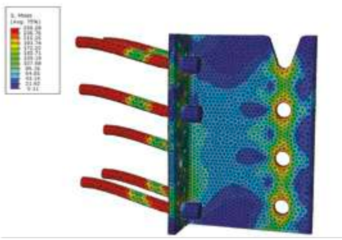
Tests on full-scale specimens (main-secondary beam connection).

NUMERICAL MODELING

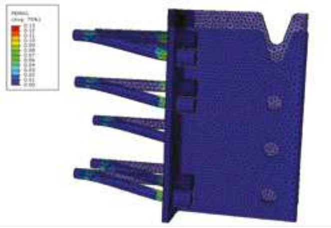
Investigation on the plastic deformation history of anchors and ALU brackets through finite element analysis.



Solid model of ALU bracket on concrete



Mises stress history on anchors and ALU bracket



Comparison between undeformed and deformed shape at the end of the test

ALUMAXI

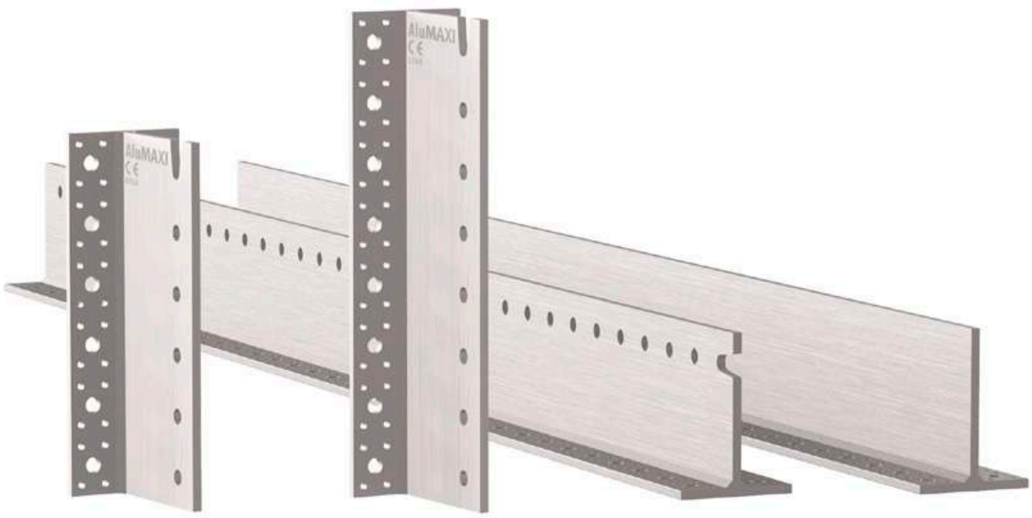
MY PROJECT SOFTWARE | VIDEO | ETA 09/0361

CONCEALED BRACKET WITH AND WITHOUT HOLES

SUPERIOR STRENGTH
Standard connection system developed to guarantee higher values of design strength. All values are calculated and certified.

STEEL-ALUMINUM
EN AW-6005A high strength aluminium alloy bracket, obtained by extrusion and therefore weld-free.

FAST FASTENING
Certified strengths calculated in all directions: vertical, horizontal and axial. Certified fastening with LBS screws and SBD self-drilling dowels.



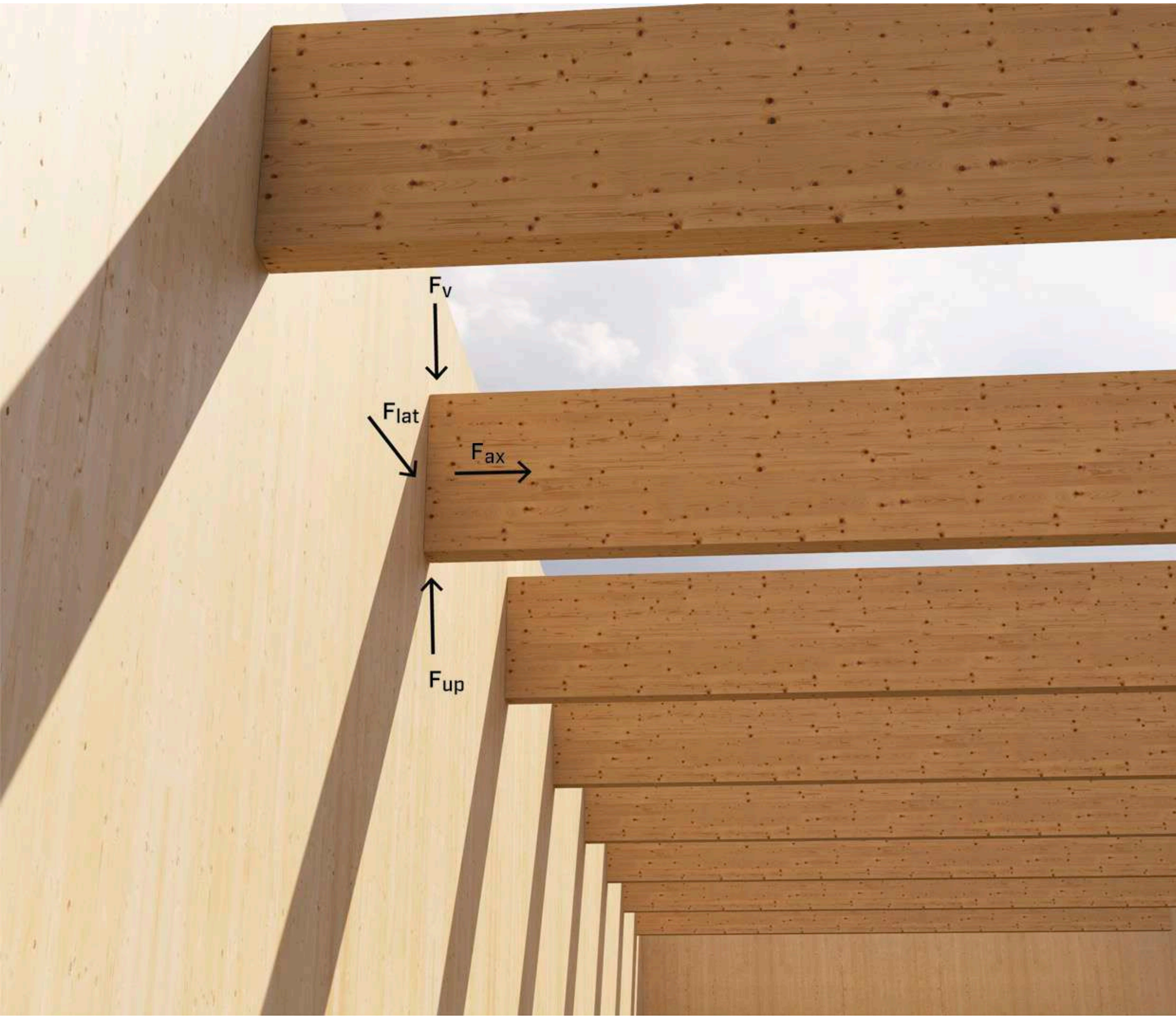
CHARACTERISTICS

FOCUS	concealed joints
TIMBER SECTIONS	from 160 x 432 mm to 280 x 1200 mm
STRENGTH	$R_{v,k}$ up to 345 kN
FASTENERS	LBA, LBS, SBD, STA, VIN-FIX PRO

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Timber-to-timber and timber-to-concrete shear joints, both perpendicular and inclined
- solid timber and glulam
- CLT, LVL
- timber based panels



FIRE RESISTANCE

The low weight of the steel - aluminium alloy facilitates easy transportation and on-site movements, while guaranteeing a very high strength.
Being a concealed joint, it satisfies the fire safety requirements.

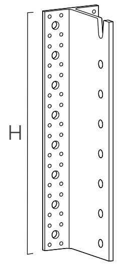
LARGE SCALE STRUCTURES

Ideal for joints between oversize beams or when high strength is required. The version without holes provides free choice when positioning the dowels.

CODES AND DIMENSIONS

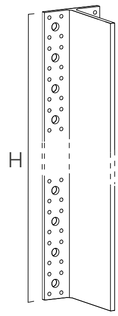
ALUMAXI WITH HOLES

CODE	type	H [mm]	pcs
ALUMAXI384L	with holes	384	1
ALUMAXI512L	with holes	512	1
ALUMAXI640L	with holes	640	1
ALUMAXI768L	with holes	768	1
ALUMAXI2176L	with holes	2176	1



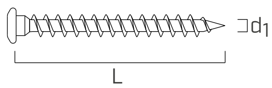
ALUMAXI WITHOUT HOLES

CODE	type	H [mm]	pcs
ALUMAXI2176	without holes	2176	1



LBS

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
LBS760	7	60	55	TX30	100
LBS780	7	80	75	TX30	100
LBS7100	7	100	95	TX30	100



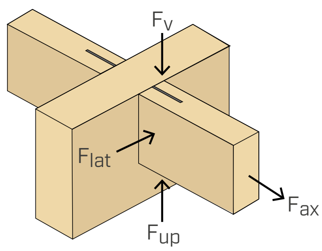
MATERIAL AND DURABILITY

ALUMAXI: EN AW-6005A aluminium alloy.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELDS OF USE

- Timber-to-timber, timber-to-concrete and timber-to-steel joints
- Secondary beam on main beam or on column
- Perpendicular and inclined joints

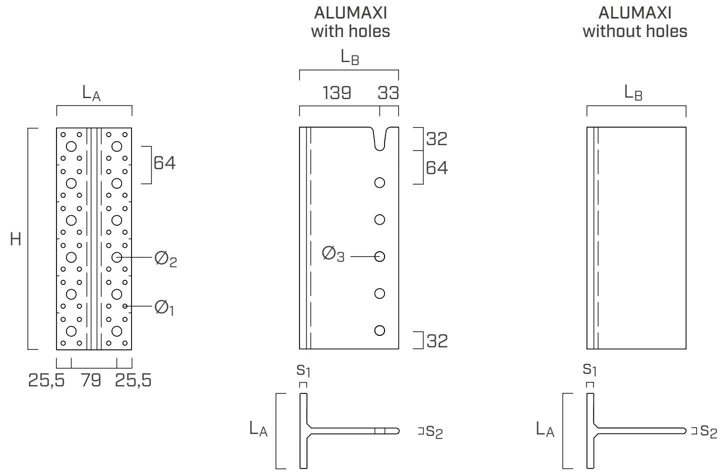
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
LBA	Anker nail	6		548
LBS	screw for plates	7		552
SBD	self-drilling dowel	7,5		48
STA	smooth dowel	16		54
KOS	bolt	M16		526
VIN-FIX PRO	chemical anchor	M16		514
EPO-FIX PLUS	chemical anchor	M16		517

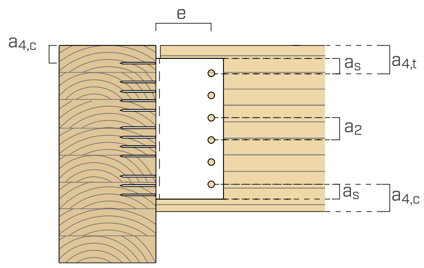
GEOMETRY

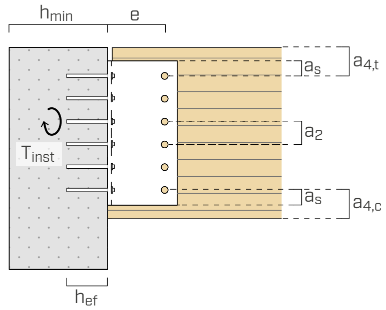


ALUMAXI			
flange thickness	s_1	[mm]	12
web thickness	s_2	[mm]	10
wing width	L_A	[mm]	130
web length	L_B	[mm]	172
small flange-holes	$Ø_1$	[mm]	7,5
large flange-holes	$Ø_2$	[mm]	17,0
web holes (dowels)	$Ø_3$	[mm]	17,0

INSTALLATION

MINIMUM DISTANCES





secondary beam-timber				self-drilling dowel SBD Ø7,5	smooth dowel STA Ø16
dowel-dowel	a_2	[mm]	$\geq 3\ d$	≥ 23	≥ 48
dowel-top of beam	$a_{4,t}$	[mm]	$\geq 4\ d$	≥ 30	≥ 64
dowel-bottom of beam	$a_{4,c}$	[mm]	$\geq 3\ d$	≥ 23	≥ 48
dowel-bracket edge	a_s	[mm]	$\geq 1{,}2\ d_0$ (1)	≥ 10	≥ 21
dowel-dowel	a_1 (2)	[mm]	$\geq 3\ d$	≥ 23	-
dowel-main beam	e	[mm]		92 ÷ 139	139

(1) Hole diameter.

(2) Spacing between dowels parallel to the grain for force-fibre angle α = 90° for application with SBD.

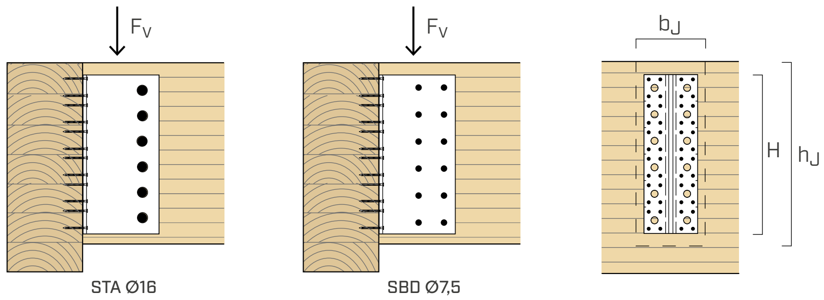
main beam-timber				Anker nail LBA Ø6	screw LBS Ø7
first connector-top of beam	$a_{4,c}$	[mm]	$\geq 5\ d$	≥ 30	≥ 35

main beam-concrete			chemical anchor VIN-FIX PRO Ø16
minimum support thickness	h_{min}	[mm]	$h_{ef} + 30 \geq 100$
concrete hole diameter	d_0	[mm]	18
tightening torque	T_{inst}	[Nm]	80

h_{ef} = effective anchoring depth in concrete

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_V

FULL NAILING



ALUMAXI with STA dowels

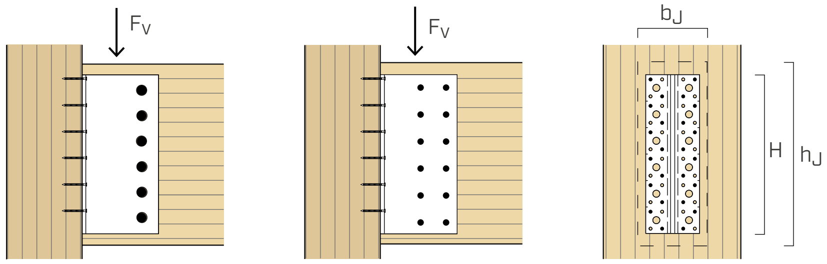
	SECONDARY BEAM			MAIN BEAM			
ALUMAXI				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
H(1) [mm]	**b_J** [mm]	**h_J** [mm]	**STA dowels Ø16**(2) [pcs Ø x L]	**LBA nails Ø6 x 80** [pcs]	**$R_{v,k}$** [kN]	**LBS screws Ø7 x 80** [pcs]	**$R_{v,k}$** [kN]
384	160	432	6 - Ø16 x 160	48	**122,8**	48	**130,3**
448	160	496	7 - Ø16 x 160	56	**152,0**	56	**152,0**
512	160	560	8 - Ø16 x 160	64	**173,8**	64	**173,8**
576	160	624	9 - Ø16 x 160	72	**195,5**	72	**195,5**
640	200	688	10 - Ø16 x 200	80	**246,0**	80	**246,0**
704	200	752	11 - Ø16 x 200	88	**270,6**	88	**270,6**
768	200	816	12 - Ø16 x 200	96	**295,2**	96	**295,2**
832	200	880	13 - Ø16 x 200	104	**319,8**	104	**319,8**
896	200	944	14 - Ø16 x 200	112	**344,4**	112	**344,4**
960	200	1008	15 - Ø16 x 200	120	**369,0**	120	**369,0**

ALUMAXI with SBD self-drilling dowels

	SECONDARY BEAM			MAIN BEAM			
ALUMAXI				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
H(1) [mm]	**b_J** [mm]	**h_J** [mm]	**SBD dowels Ø7,5**(3) [pcs Ø x L]	**LBA nails Ø6 x 80** [pcs]	**$R_{v,k}$** [kN]	**LBS screws Ø7 x 80** [pcs]	**$R_{v,k}$** [kN]
384	160	432	12 - Ø7,5 x 155	48	**121,0**	48	**121,0**
448	160	496	14 - Ø7,5 x 155	56	**141,2**	56	**141,2**
512	160	560	16 - Ø7,5 x 155	64	**161,3**	64	**161,3**
576	160	624	18 - Ø7,5 x 155	72	**181,5**	72	**181,5**
640	200	688	20 - Ø7,5 x 195	80	**230,7**	80	**230,7**
704	200	752	22 - Ø7,5 x 195	88	**253,8**	88	**253,8**
768	200	816	24 - Ø7,5 x 195	96	**276,9**	96	**276,9**
832	200	880	26 - Ø7,5 x 195	104	**299,9**	104	**299,9**
896	200	944	28 - Ø7,5 x 195	112	**323,0**	112	**323,0**
960	200	1008	30 - Ø7,5 x 195	120	**346,1**	120	**346,1**

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_V

PARTIAL NAILING[4]



STA Ø16 SBD Ø7,5

ALUMAXI with STA dowels

ALUMAXI	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
H[1] [mm]	**b_J** [mm]	**h_J** [mm]	**STA dowels Ø16[2]** [pcs Ø x L]	**LBA nails Ø6 x 80** [pcs]	**$R_{v,k}$** [kN]	**LBS screws Ø7 x 80** [pcs]	**$R_{v,k}$** [kN]
384	160	432	6 - Ø16 x 160	24	61,4	24	83,6
448	160	496	7 - Ø16 x 160	28	80,0	28	103,5
512	160	560	8 - Ø16 x 160	32	99,7	32	123,3
576	160	624	9 - Ø16 x 160	36	120,2	36	143,1
640	200	688	10 - Ø16 x 200	40	141,3	40	162,7
704	200	752	11 - Ø16 x 200	44	162,7	44	182,2
768	200	816	12 - Ø16 x 200	48	184,3	48	201,5
832	200	880	13 - Ø16 x 200	52	206,1	52	220,8
896	200	944	14 - Ø16 x 200	56	227,8	56	239,9
960	200	1008	15 - Ø16 x 200	60	249,6	60	258,9

ALUMAXI with SBD self-drilling dowels

ALUMAXI	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
H[1] [mm]	**b_J** [mm]	**h_J** [mm]	**SBD dowels Ø7,5[3]** [pcs Ø x L]	**LBA nails Ø6 x 80** [pcs]	**$R_{v,k}$** [kN]	**LBS screws Ø7 x 80** [pcs]	**$R_{v,k}$** [kN]
384	160	432	8 - Ø7,5 x 155	24	61,4	24	80,7
448	160	496	10 - Ø7,5 x 155	28	80,0	28	100,8
512	160	560	12 - Ø7,5 x 155	32	99,7	32	121,0
576	160	624	14 - Ø7,5 x 155	36	120,2	36	141,2
640	200	688	16 - Ø7,5 x 195	40	141,3	40	162,7
704	200	752	18 - Ø7,5 x 195	44	162,7	44	182,2
768	200	816	20 - Ø7,5 x 195	48	184,3	48	201,5
832	200	880	22 - Ø7,5 x 195	52	206,1	52	220,8
896	200	944	24 - Ø7,5 x 195	56	227,8	56	239,9
960	200	1008	26 - Ø7,5 x 195	60	249,6	60	258,9

NOTES:

TIMBER-TO-TIMBER | F_v

(1) The bracket with height H is available pre-cut in the ALUMAXI versions with holes (codes on page 40) or can be obtained from the rod ALUMAXI2176 or ALUMAXI2176L rod.

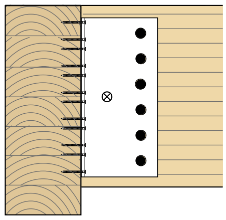
(2) STA smooth dowels Ø16: $M_{y,k}$ = 191000 Nmm

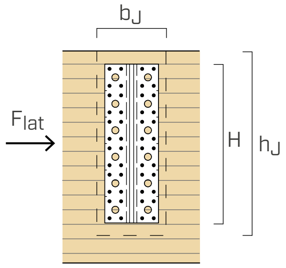
(3) SBD self-drilling dowels Ø7,5: $M_{y,k}$ = 42000 Nmm.

(4) Partial nailing is necessary for beam-column joints in order to observe minimum fastener spacings; it can be applied also for beam-beam joints. Partial nailing is performed by nailing each column alternately as shown in the picture.

General calculation principles see page 46.

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_{lat}

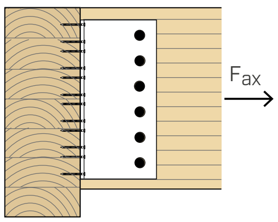


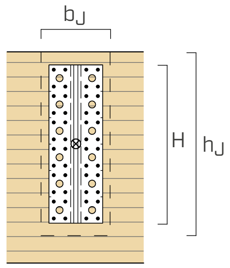


ALUMAXI with SBD self drilling dowels and STA dowels

	SECONDARY BEAM[1]		MAIN BEAM[2]		
ALUMAXI H [mm]	b_J [mm]	h_J [mm]	LBA nails / LBS screws Ø6 x 80 / Ø7 x 80 [pcs]	$R_{lat,k,alu}$ [kN]	$R_{lat,k,beam}$[3] [kN]
384	160	432	≥ 24	31,2	34,3
448	160	496	≥ 28	36,4	39,4
512	160	560	≥ 32	41,6	44,4
576	160	624	≥ 36	46,8	49,5
640	200	688	≥ 40	52,0	69,1
704	200	752	≥ 44	57,2	75,6
768	200	816	≥ 48	62,4	82,0
832	200	880	≥ 52	67,6	88,4
896	200	944	≥ 56	72,8	94,9
960	200	1008	≥ 60	78,0	101,3

STATIC VALUES | TIMBER-TO-TIMBER JOINT | F_{ax}





ALUMAXI with STA dowels

	SECONDARY BEAM			MAIN BEAM			
				FASTENING THROUGH NAILS		FASTENING THROUGH SCREWS	
ALUMAXI H[1] [mm]	b_J [mm]	h_J [mm]	STA dowels Ø16 [pcs Ø x L]	LBA nails Ø6 x 80 [pcs]	$R_{ax,k}$ [kN]	LBS screws Ø7 x 80 [pcs]	$R_{ax,k}$ [kN]
384	160	432	6 - Ø16 x 160	48	79,2	48	144,3
448	160	496	7 - Ø16 x 160	56	92,4	56	168,3
512	160	560	8 - Ø16 x 160	64	105,6	64	192,3
576	160	624	9 - Ø16 x 160	72	118,8	72	216,4
640	200	688	10 - Ø16 x 200	80	132,0	80	240,4
704	200	752	11 - Ø16 x 200	88	145,2	88	264,5
768	200	816	12 - Ø16 x 200	96	158,4	96	288,5
832	200	880	13 - Ø16 x 200	104	171,6	104	312,5
896	200	944	14 - Ø16 x 200	112	184,8	112	336,6
960	200	1008	15 - Ø16 x 200	120	198,0	120	360,6

NOTES:

TIMBER-TO-TIMBER | F_{lat} | F_{ax}

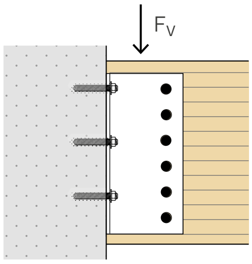
(1) The strength values are valid for both STA Ø16 dowels and for SBD Ø7,5 self-drilling dowels.

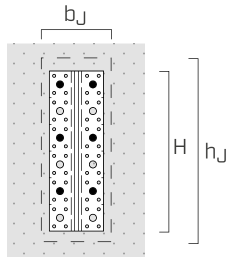
(2) The strength values are valid for both LBA Ø6 nails and for LBS Ø7 screws.

(3) Glulam GL24h.

General calculation principles see page 46.

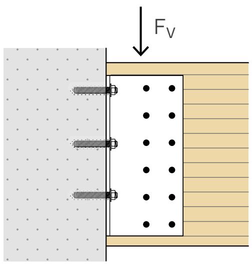
CHEMICAL ANCHOR

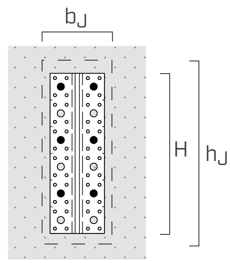




ALUMAXI with STA dowels

ALUMAXI			SECONDARY BEAM TIMBER		MAIN BEAM UNCRACKED CONCRETE	
			STA dowels		VIN-FIX PRO anchor	
H[(1)] [mm]	b_J [mm]	h_J [mm]	Ø16[(2)] [pcs Ø x L]	$R_{v,k\ timber}$ [kN]	Ø16 x 160[(4)] [pcs]	$R_{v,d\ concrete}$ [kN]
384	160	432	6 - Ø16 x 160	130,3	6	89,3
448	160	496	7 - Ø16 x 160	152,0	8	112,4
512	160	560	8 - Ø16 x 160	173,8	8	126,4
576	160	624	9 - Ø16 x 160	195,5	10	149,5
640	200	688	10 - Ø16 x 200	246,0	10	163,8
704	200	752	11 - Ø16 x 200	270,6	12	191,4
768	200	816	12 - Ø16 x 200	295,2	12	197,2
832	200	880	13 - Ø16 x 200	319,8	14	226,2
896	200	944	14 - Ø16 x 200	344,4	14	239,7
960	200	1008	15 - Ø16 x 200	369,0	16	258,9





ALUMAXI with SBD self-drilling dowels

ALUMAXI			SECONDARY BEAM TIMBER		MAIN BEAM UNCRACKED CONCRETE	
			SBD dowels		VIN-FIX PRO anchor	
H[(1)] [mm]	b_J [mm]	h_J [mm]	Ø7,5[(3)] [pcs Ø x L]	$R_{v,k\ timber}$ [kN]	Ø16 x 160[(4)] [pcs]	$R_{v,d\ concrete}$ [kN]
384	160	432	12 - Ø7,5 x 155	121,0	6	89,3
448	160	496	14 - Ø7,5 x 155	141,2	8	112,4
512	160	560	16 - Ø7,5 x 155	161,3	8	126,4
576	160	624	18 - Ø7,5 x 155	181,5	10	149,5
640	200	688	20 - Ø7,5 x 195	230,7	10	163,8
704	200	752	22 - Ø7,5 x 195	253,8	12	191,4
768	200	816	24 - Ø7,5 x 195	276,9	12	197,2
832	200	880	26 - Ø7,5 x 195	299,9	14	226,2
896	200	944	28 - Ø7,5 x 195	323,0	14	239,7
960	200	1008	30 - Ø7,5 x 195	346,1	16	258,9

NOTES:

TIMBER-TO-CONCRETE

(1) The bracket with height H is available pre-cut in the ALUMAXI versions with holes (codes on page 40) or can be obtained from the rod ALUMAXI2176 or ALUMAXI2176L rod.

(2) STA smooth dowels Ø16: $M_{y,k}$ = 191000 Nmm.

(3) SBD self-drilling dowels Ø7,5: $M_{y,k}$ = 42000 Nmm.

(4) Chemical anchor VIN-FIX PRO with threaded rods (type INA) of minimum strength grade equal to 5.8. with h_{ef} = 128 mm. Install the anchors two at a time, starting from the top, dowelling alternate rows.

General calculation principles see page 46.

GENERAL PRINCIPLES:

- 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 calculation process used a timber characteristic density of ρ_k = 385 kg/m^3 and C25/30 concrete with a thin reinforcing layer, where edge-distance is not a limiting factor.
- The coefficients k_{mod} and γ_M should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- In case of combined loading the following verification shall be satisfied:

$$\left(\frac{F_{v,d}}{R_{v,d}}\right)^2 + \left(\frac{F_{lat,d}}{R_{lat,d}}\right)^2 + \left(\frac{F_{ax,d}}{R_{ax,d}}\right)^2 \leq 1$$

STATIC VALUES | F_v

TIMBER-TO-TIMBER

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361.
- The design values are obtained from the characteristic values as follows:

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

- In some cases the connection shear strength $R_{v,k}$ is notably large and may be higher than the secondary beam strength. Particular attention should be paid to the shear check of the reduced timber cross-section in correspondence with the bracket location.

STATIC VALUES | F_{lat} | F_{ax}

TIMBER-TO-TIMBER

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361.
- The design values are obtained from the characteristic values as follows:

$$R_{lat,d} = min \begin{cases} \dfrac{R_{lat,k,alu}}{\gamma_{M,alu}} \\ \dfrac{R_{lat,k,beam} \cdot k_{mod}}{\gamma_{M,T}} \end{cases}$$

$$R_{ax,d} = \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M}$$

with $\gamma_{M,T}$ partial coefficient of the timber.

STATIC VALUES | F_v

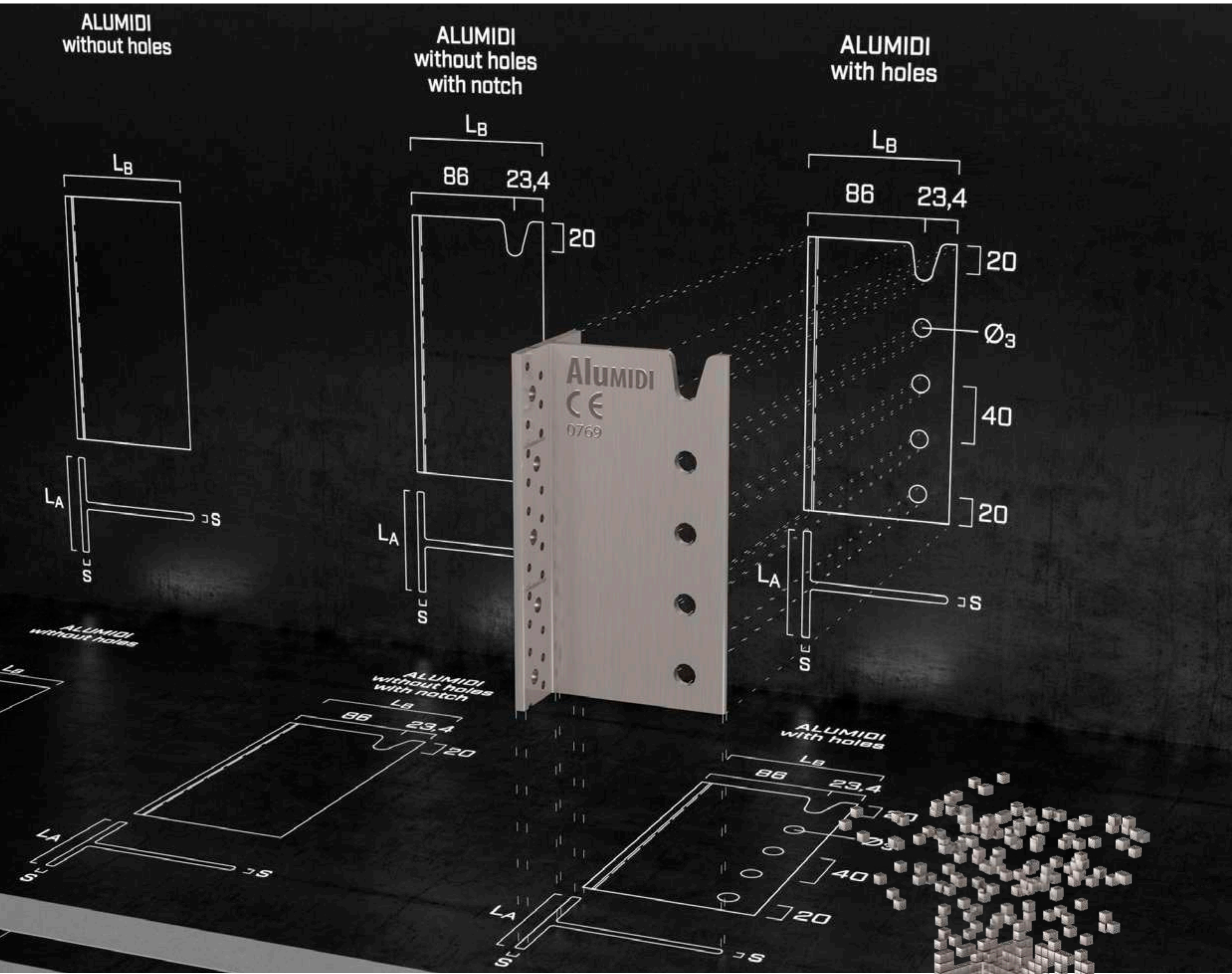
TIMBER-TO-CONCRETE

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-09/0361. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.

  Design resistance values can be obtained from the tabled values as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ R_{d,\ concrete} \end{cases}$$

BIM LIBRARY
BUILDING INFORMATION MODELING



Structural connection elements in digital format

Complete with three-dimensional geometric features and additional parametric information, they are available in IFC, REVIT, ALLPLAN, ARCHICAD, SKETCHUP and TEKLA format, and are ready to integrate into your next successful project. Download them now!

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Solutions for Building Technology

SBD

BIT INCLUDED | MY PROJECT SOFTWARE | VIDEO | CE EN 14592

SELF-DRILLING DOWEL

STEEL AND ALUMINUM
Special self-perforating timber-metal tip geometry that reduces the possibility of breakage. The concealed cylindrical head ensures an optimal visual appearance and meets fire-resistance requisites.

INCREASED DIAMETER
The diameter of 7,5 mm ensures a shear strength of over 15 % and enables the optimisation of the number of fasteners.

DOUBLE THREAD
The thread close to the tip (b_1) facilitates screwing. The longer under-head thread (b_2) allows quick and precise closing of the joint.

CHARACTERISTICS

FOCUS	self-drilling, timber-metal-timber
HEAD	cylindrical, countersunk
DIAMETER	7,5 mm
LENGTH	from 55 to 235 mm

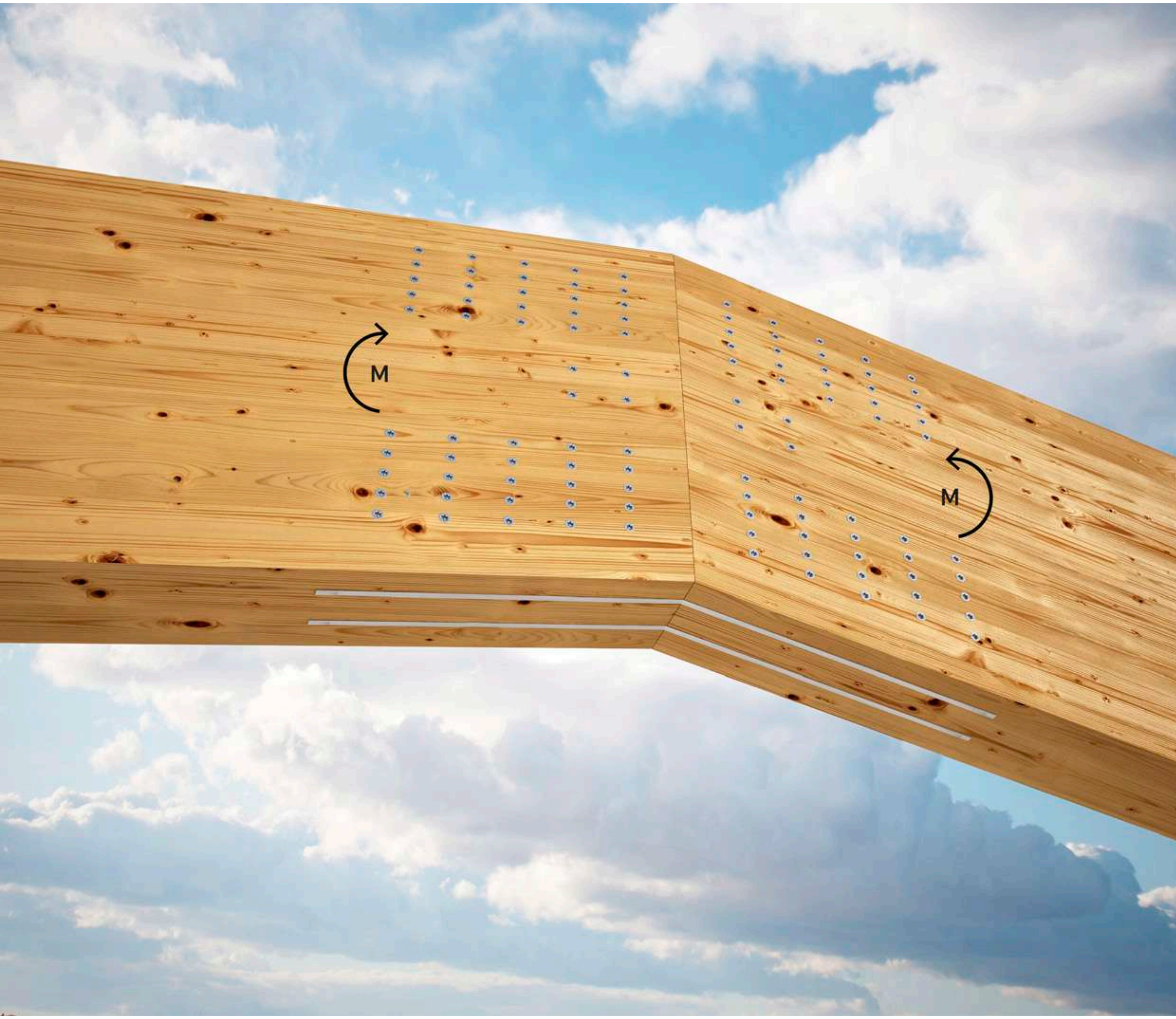
VIDEO
Scan the QR Code and watch the video on our YouTube channel

MATERIAL
Bright zinc plated carbon steel.

FIELDS OF USE
Self-drilling system for concealed timber-to-steel and timber-to-aluminium joints. It can be used with screw guns running at 600-1500 rpm with:

- steel S235 ≤ 10,0 mm
- steel S275 ≤ 8,0 mm
- steel S355 ≤ 6,0 mm
- ALUMINI, ALUMIDI and ALUMAXI brackets

Service classes 1 and 2.



KNEE BEAM

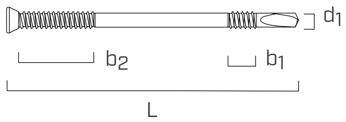
Ideal for joining head beams and making continuous beams, restoring shear and moment forces. The small dowel diameter guarantees joints that offer high stiffness.

MOMENT RESISTING JOINT

Also certified, tested and calculated for fastening standard Rothoblaas plates such as the TYP X post base.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b_2 [mm]	b_1 [mm]	pcs
7,5 TX40	**SBD7555**	55	10	-	50
	SBD7575	75	10	15	50
	SBD7595	95	20	15	50
	SBD75115	115	20	15	50
	SBD75135	135	20	15	50
	SBD75155	155	20	15	50
	SBD75175	175	40	15	50
	SBD75195	195	40	15	50
	SBD75215	215	40	15	50
	SBD75235	235	40	15	50



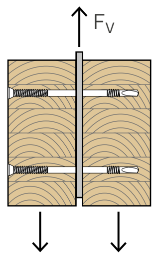
MATERIAL AND DURABILITY

SBD: bright zinc plated carbon steel
To be used in service classes 1 and 2 (EN 1995-1-1).

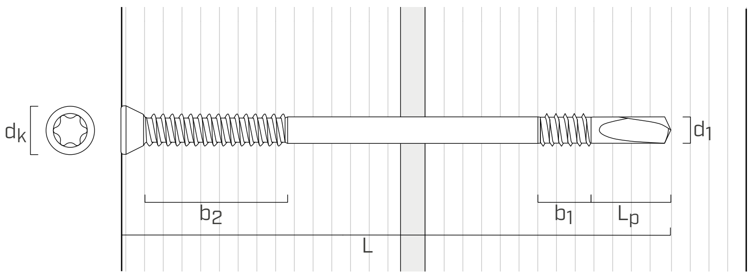
FIELD OF USE

- Timber-steel-timber joints

EXTERNAL LOADS



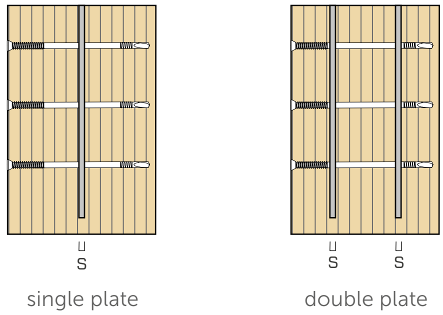
GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	**d_1**	**[mm]**	**7,5**
Head diameter	d_K	[mm]	11,0
Tip length	L_p	[mm]	19,0
Effective length	L_{eff}	[mm]	L - 8,0
Characteristic yield moment	$M_{y,k}$	[Nmm]	42000

INSTALLATION

plate	s single plate [mm]	s double plate [mm]
S235 steel	10,0	8,0
S275 steel	8,0	6,0
S355 steel	6,0	5,0
ALUMINI	6,0	-
ALUMIDI	6,0	-
ALUMAXI	10,0	-



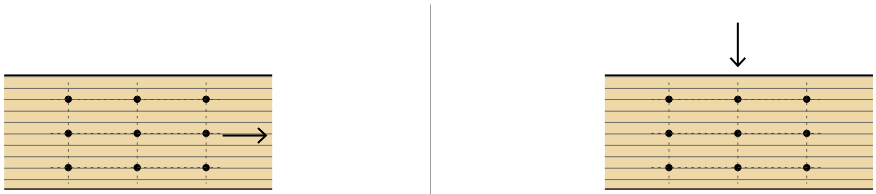
Timber-metal plate-timber shear joint

Recommended pressure: ≈ 40 kg

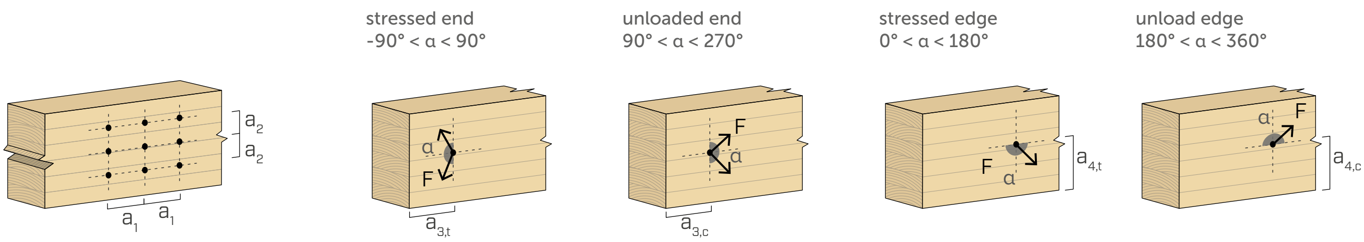
Recommended screwing: ≈ 1000 - 1500 rpm (steel plate)

≈ 600 - 1000 rpm (aluminium plate)

MINIMUM DISTANCES FOR CONNECTORS SUBJECTED TO SHEAR STRESS[1]



		Load-to-grain angle α = 0°	Load-to-grain angle α = 90°
d_1	**[mm]**	**7,5**	**7,5**
a_1	[mm]	38	23
a_2	[mm]	23	23
$a_{3,t}$	[mm]	80	80
$a_{3,c}$	[mm]	40	40
$a_{4,t}$	[mm]	23	30
$a_{4,c}$	[mm]	23	23



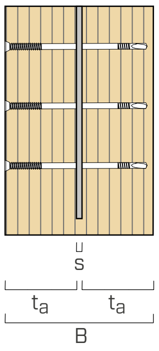
NOTES:

[1] The minimum distances are compliant with EN 1995-1-1.

TIMBER-TO-STEEL AND ALUMINIUM STATIC VALUES

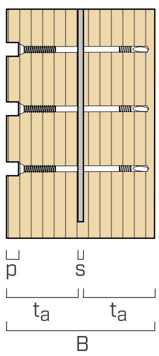
SHEAR $R_{v,k}$ - 1 INTERNAL PLATE

DOWEL HEAD INSERTION DEPTH 0 mm



FASTENING	SBD	[mm]	7,5x55	7,5x75	7,5x95	7,5x115	7,5x135	7,5x155	7,5x175	7,5x195	7,5x215	7,5x235
Beam width	B	[mm]	60	80	100	120	140	160	180	200	220	240
Head insertion depth	p	[mm]	0	0	0	0	0	0	0	0	0	0
Exterior wood	t_a	[mm]	27	37	47	57	67	77	87	97	107	117
$R_{v,k}$ [kN]	load-to-grain angle	0°	7,48	9,20	10,18	11,46	12,91	13,69	13,95	13,95	13,95	13,95
		30°	6,89	8,59	9,40	10,51	11,77	12,71	13,21	13,21	13,21	13,21
		45°	6,41	8,09	8,77	9,72	10,84	11,90	12,53	12,57	12,57	12,57
		60°	6,00	7,67	8,24	9,08	10,07	11,15	11,78	12,02	12,02	12,02
		90°	5,66	7,31	7,79	8,53	9,42	10,40	11,14	11,54	11,54	11,54

DOWEL HEAD INSERTION DEPTH 15 mm



FASTENING	SBD	[mm]	7,5x55	7,5x75	7,5x95	7,5x115	7,5x135	7,5x155	7,5x175	7,5x195	7,5x215	7,5x235
Beam width	B	[mm]	80	100	120	140	160	180	200	220	240	-
Head insertion depth	p	[mm]	15	15	15	15	15	15	15	15	15	-
Exterior wood	t_a	[mm]	37	47	57	67	77	87	97	107	117	-
$R_{v,k}$ [kN]	load-to-grain angle	0°	8,47	9,10	10,13	11,43	12,89	13,95	13,95	13,95	13,95	-
		30°	7,79	8,49	9,35	10,48	11,75	13,06	13,21	13,21	13,21	-
		45°	7,25	8,00	8,72	9,70	10,82	12,04	12,57	12,57	12,57	-
		60°	6,67	7,58	8,19	9,05	10,05	11,14	12,02	12,02	12,02	-
		90°	6,14	7,23	7,74	8,50	9,40	10,39	11,40	11,54	11,54	-

CORRECTIVE COEFFICIENT k_F FOR DIFFERENT DENSITIES ρ_k

Strength class	C24	GL22h	C30	GL24h	C40 / GL32c	GL28h	D24	D30
ρ_k [kg/m^3]	350	370	380	385	400	425	485	530
k_F	0,91	0,96	0,99	1,00	1,02	1,05	1,12	1,17

For different densities ρ_k the wood-side design strength is calculated as: $R'_{V,d} = R_{V,d} \cdot k_F$.

EFFECTIVE NUMBER OF DOWELS n_{ef} FOR $\alpha = 0°$

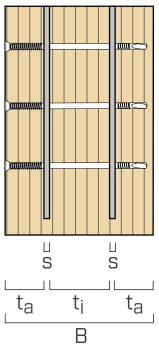
		a_1 [mm]								
	n. SBD	40	50	60	70	80	90	100	120	140
n_{ef}	2	1,49	1,58	1,65	1,72	1,78	1,83	1,88	1,97	2,00
	3	2,15	2,27	2,38	2,47	2,56	2,63	2,70	2,83	2,94
	4	2,79	2,95	3,08	3,21	3,31	3,41	3,50	3,67	3,81
	5	3,41	3,60	3,77	3,92	4,05	4,17	4,28	4,48	4,66
	6	4,01	4,24	4,44	4,62	4,77	4,92	5,05	5,28	5,49
	7	4,61	4,88	5,10	5,30	5,48	5,65	5,80	6,07	6,31

In the case of multiple dowels placed parallel to the fibres, the effective number must be taken into account: $R'_{V,d} = R_{V,d} \cdot n_{ef}$.

TIMBER-TO-STEEL AND ALUMINIUM STATIC VALUES

SHEAR $R_{v,k}$ - 2 INTERNAL PLATES

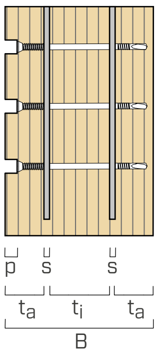
DOWEL HEAD INSERTION DEPTH 0 mm



FASTENING	SBD	[mm]	7,5x55	7,5x75	7,5x95	7,5x115	7,5x135	7,5x155	7,5x175	7,5x195	7,5x215	7,5x235
Beam width	**B**	[mm]	-	-	-	-	140	160	180	200	220	240
Head insertion depth	**p**	[mm]	-	-	-	-	0	0	0	0	0	0
Exterior wood	t_a	[mm]	-	-	-	-	37	42	48	56	66	74
Interior wood	t_i	[mm]	-	-	-	-	54	64	72	76	76	80

			7,5x55	7,5x75	7,5x95	7,5x115	7,5x135	7,5x155	7,5x175	7,5x195	7,5x215	7,5x235
$R_{v,k}$ [kN]	load-to-grain angle	**0°**	-	-	-	-	21,03	23,07	24,25	25,28	26,71	27,41
		30°	-	-	-	-	19,19	21,17	22,71	23,60	24,85	25,72
		45°	-	-	-	-	17,69	19,62	21,08	22,19	23,30	24,25
		60°	-	-	-	-	16,45	18,32	19,62	20,75	21,73	22,84
		90°	-	-	-	-	15,40	17,09	18,40	19,40	20,28	21,48

DOWEL HEAD INSERTION DEPTH 10 mm



FASTENING	SBD	[mm]	7,5x55	7,5x75	7,5x95	7,5x115	7,5x135	7,5x155	7,5x175	7,5x195	7,5x215	7,5x235
Beam width	**B**	[mm]	-	-	-	140	160	180	200	220	240	-
Head insertion depth	**p**	[mm]	-	-	-	10	10	10	10	10	10	-
Exterior wood	t_a	[mm]	-	-	-	37	42	48	56	66	74	-
Interior wood	t_i	[mm]	-	-	-	54	64	72	76	76	80	-

			7,5x55	7,5x75	7,5x95	7,5x115	7,5x135	7,5x155	7,5x175	7,5x195	7,5x215	7,5x235
$R_{v,k}$ [kN]	load-to-grain angle	**0°**	-	-	-	19,31	22,20	23,23	24,02	25,28	26,42	-
		30°	-	-	-	17,49	20,25	21,86	22,52	23,60	24,59	-
		45°	-	-	-	16,01	18,65	20,36	21,26	22,19	23,07	-
		60°	-	-	-	14,78	17,32	19,02	19,94	20,75	21,78	-
		90°	-	-	-	13,75	16,07	17,88	18,68	19,40	20,52	-

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1.
- The design values are obtained from the characteristic values as follows:

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

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- The values provided are calculated using 5 mm thick plates, a 6 mm thick milled cut in the timber and a single SBD dowel.
- For the calculation process a timber density ρ_k = 385 kg/m^3 has been considered.
- Sizing and verification of the wooden elements and metal plates must be done separately.

STA

EN 14592

SMOOTH DOWEL

STEEL
S355 steel grade to provide higher shear strength to the standard sizes used in structural design (Ø16 and Ø20).

GEOMETRY
Tapered end for an easy insertion of the fastener into the pre drilled timber element. Available in 1,0 m long version.

SPECIAL VERSION
Available upon request in high bond steel and geometry designed to avoid pull-out when used in seismic areas.

CHARACTERISTICS

FOCUS	concealed joints
DIAMETER	from 8,0 to 20,0 mm
LENGTH	from 60 to 500 mm
STEEL	S235 (Ø8-Ø12) - S355 (Ø16-Ø20)

MATERIAL
Bright zinc plated carbon steel.

FIELDS OF USE
Timber-to-timber and steel to timber shear connections
- solid timber and glulam
- CLT, LVL
- timber based panels

LARGE SCALE STRUCTURES

Calculation accuracy: CE marking guarantees the usage suitability. Improved bond version ideal in seismic areas.

TIMBER-TO-METAL

Ideal for being used with ALU brackets in realizing concealed joints. When used with wood taps it meets the fire safety requirements and provides a rewarding aesthetic appearance.

CODES AND DIMENSIONS

d1 [mm]	CODE	L [mm]	steel	pcs
8	STA860B	60	S235	200
	STA880B	80	S235	200
	STA8100B	100	S235	200
	STA8120B	120	S235	200
	STA8140B	140	S235	200
12	STA1260B	60	S235	100
	STA1270B	70	S235	100
	STA1280B	80	S235	100
	STA1290B	90	S235	100
	STA12100B	100	S235	100
	STA12110B	110	S235	100
	STA12120B	120	S235	100
	STA12130B	130	S235	100
	STA12140B	140	S235	100
	STA12150B	150	S235	100
	STA12160B	160	S235	100
	STA12170B	170	S235	100
	STA12180B	180	S235	100
	STA12200B	200	S235	100
	STA12220B	220	S235	100
	STA12240B	240	S235	100
	STA12260B	260	S235	100
	STA12280B	280	S235	100
	STA12320B	320	S235	100
	STA12340B	340	S235	100
12	STA121000B	1000	S235	1
16	STA1680B	80	S355	50
	STA16100B	100	S355	50
	STA16110B	110	S355	50
	STA16120B	120	S355	50
	STA16130B	130	S355	50
	STA16140B	140	S355	50
	STA16150B	150	S355	50
	STA16160B	160	S355	50
	STA16170B	170	S355	50
	STA16180B	180	S355	50
	STA16190B	190	S355	50

d1 [mm]	CODE	L [mm]	steel	pcs
16	STA16200B	200	S355	50
	STA16220B	220	S355	50
	STA16240B	240	S355	50
	STA16260B	260	S355	50
	STA16280B	280	S355	50
	STA16300B	300	S355	50
	STA16320B	320	S355	50
	STA16340B	340	S355	50
	STA16360B	360	S355	50
	STA16380B	380	S355	50
	STA16400B	400	S355	50
	STA16420B	420	S355	50
	STA16500B	500	S355	50
16	STA161000B	1000	S355	1
20	STA20120B	120	S355	25
	STA20140B	140	S355	25
	STA20160B	160	S355	25
	STA20180B	180	S355	25
	STA20190B	190	S355	25
	STA20200B	200	S355	25
	STA20220B	220	S355	25
	STA20240B	240	S355	25
	STA20260B	260	S355	25
	STA20300B	300	S355	25
	STA20320B	320	S355	25
	STA20360B	360	S355	25
	STA20400B	400	S355	25
20	STA201000B	1000	S355	25

Available upon request:high bond steel and shaped to avoid pull-out when used in seismic areas (e.g. STAS16200). Minimum quantity 1000 pieces.

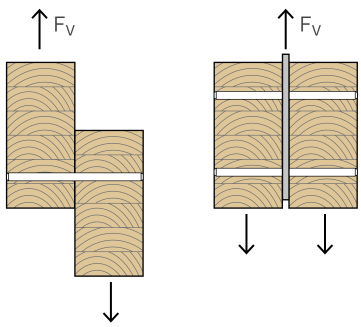
MATERIAL AND DURABILITY

STA Ø8-Ø12: S235 bright zinc plated carbon steel.
STA Ø16-Ø20: S355 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints
- Timber-steel-timber joints

EXTERNAL LOADS

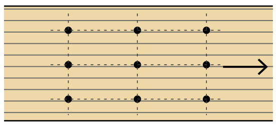


GEOMETRY AND MECHANICAL CHARACTERISTICS

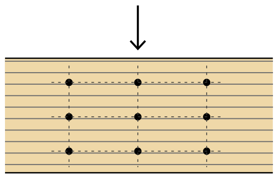
Nominal diameter	d_1	[mm]	8	12	16	20
Length	L	[mm]	60 ÷ 140	60 ÷ 340	80 ÷ 500	120 ÷ 400
Material	steel		S235	S235	S355	S355
	$f_{u,k,min}$	[N/mm^2]	360	360	460	460
	$f_{y,k,min}$	[N/mm^2]	235	235	355	355
Characteristic yield moment	$M_{y,k}$	[Nmm]	24100	69100	191000	340000

Mechanical parameters according to CE marking, in accordance with EN 14592.

MINIMUM DISTANCES FOR CONNECTORS SUBJECTED TO SHEAR STRESS[1]

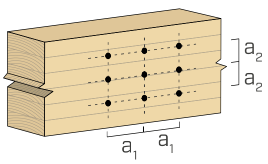


Load-to-grain angle α = 0°

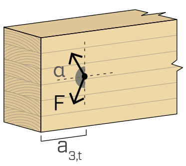


Load-to-grain angle α = 90°

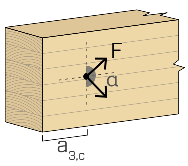
		Load-to-grain angle α = 0°				Load-to-grain angle α = 90°			
d_1	[mm]	8	12	16	20	8	12	16	20
a_1	[mm]	40	60	80	100	24	36	48	60
a_2	[mm]	24	36	48	60	24	36	48	60
$a_{3,t}$	[mm]	80	84	112	140	80	84	112	140
$a_{3,c}$	[mm]	40	42	56	70	80	84	112	140
$a_{4,t}$	[mm]	24	36	48	60	32	48	64	80
$a_{4,c}$	[mm]	24	36	48	60	24	36	48	60



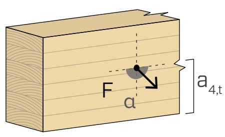
stressed end
-90° < α < 90°



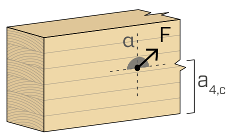
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°

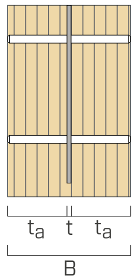


NOTES:

[1] The minimum distances are compliant with EN 1995-1-1.

TIMBER-TO-STEEL AND ALUMINIUM STATIC VALUES

1 INTERNAL PLATE - SHEAR $R_{v,k}$



d_1 [mm]	L [mm]	B [mm]	t_a [mm]	$R_{vk,0°}$ [kN]	$R_{vk,30°}$ [kN]	$R_{vk,45°}$ [kN]	$R_{vk,60°}$ [kN]	$R_{vk,90°}$ [kN]
12	60	60	27	13,9	12,9	12,2	11,5	11,0
	80	80	37	15,2	13,9	12,9	12,1	11,5
	100	100	47	17,0	15,4	14,2	13,2	12,4
	120	120	57	19,1	17,2	15,7	14,6	13.6
	140	140	67	21,4	19,2	17,5	16,1	14,9
	160	160	77	22,1	20,7	19,3	17,7	16,4
	> 180	-	-	22,1	20,7	19,6	18,7	17,8
16	80	80	37	25,5	23,6	22,2	21,0	19,7
	100	100	47	26,8	24,6	22,8	21,4	20,2
	120	120	57	28,7	26,1	24,0	22,4	21,0
	140	140	67	31,1	28,0	25,6	23,7	22,2
	160	160	77	33,7	30,2	27,4	25,3	23,5
	180	180	87	36,5	32,5	29,5	27,0	25,0
	200	200	97	39,4	35,0	31,6	28,9	26,7
	220	220	107	40,9	37,6	33,9	30,9	28,4
	240	240	117	40,9	38,2	36,0	32,9	30,3
20	120	120	57	39,0	35,5	32,8	30,6	28,9
	140	140	67	41,2	37,1	34,1	31,6	29,7
	160	160	77	43,8	39,2	35,8	33,0	30,8
	180	180	87	46,8	41,6	37,7	34,7	32,2
	190	180	87	46,8	41,6	37,7	34,7	32,2
	200	200	97	50,0	44,3	39,9	36,5	33,8
	220	220	107	53,3	47,0	42,3	38,6	35,6
	240	240	117	56,8	50,0	44,8	40,7	37,4

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1.
- The design values are obtained from the characteristic values as follows:

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

- The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- The values provided are calculated using 5 mm thick plate, a 6 mm thick grooved cut in the timber and a single STA dowel.
- For the calculation process a timber density ρ_k = 385 kg/m^3 has been considered.
- Sizing and verification of the timber elements and metal plate must be done separately.

CORRECTIVE COEFFICIENT k_F FOR DIFFERENT DENSITIES ρ_k

Strength class	C24	GL22h	C30	GL24h	C40 / GL32c	GL28h	D24	D30
ρ_k [kg/m^3]	350	370	380	385	400	425	485	530
k_F	0,91	0,96	0,99	1,00	1,02	1,05	1,12	1,17

For different densities ρ_k the wood-side design strength is calculated as: $R'_{V,d} = R_{V,d} \cdot k_F$.

EFFECTIVE NUMBER OF DOWELS n_{ef} FOR $\alpha = 0°$

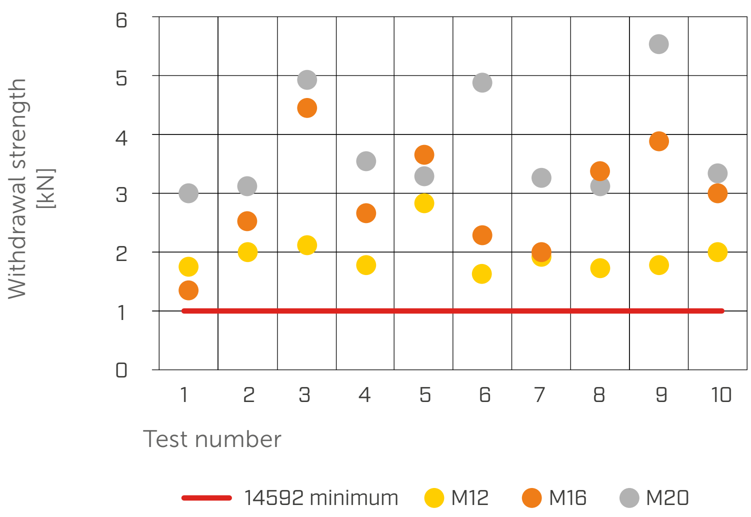
		a_1 [mm]						
	n. STA	5·d	7·d	10·d	12·d	16·d	18·d	20·d
n_{ef}	2	1,47	1,60	1,75	1,83	1,97	2,00	2,00
	3	2,12	2,30	2,52	2,63	2,83	2,92	2,99
	4	2,74	2,98	3,26	3,41	3,67	3,78	3,88
	5	3,35	3,65	3,99	4,17	4,48	4,62	4,74
	6	3,95	4,30	4,70	4,92	5,28	5,44	5,59
	7	4,54	4,94	5,40	5,65	6,07	6,25	6,42

In the case of multiple dowels placed parallel to the fibres, the effective number must be taken into account $R'_{v,d} = R_{v,d} \cdot n_{ef}$.
d = nominal dowel diameter

STAS - IMPROVED BOND DOWEL FOR SEISMIC LOADS

The knurled dowel is available on request, it anticipates the standard requirement of the new EN 14592 ("FINAL DRAFT FprEN 14592:2019", 04/03/2019), guaranteeing a minimum withdrawal strength of **1 kN**, necessary in seismic areas. The knurling also responds to the provision of EC8 aimed at preventing the cylindrical shank elements from coming out from the joints in the seismic zone.

STAS - WITHDRAWAL VALUES



"Knurled pins" are the submitted to a utility model.

LOCK T TIMBER

MY PROJECT SOFTWARE | VIDEO | ETA 19/0831

CONCEALED HOOK TIMBER-TO-TIMBER CONNECTOR

PRACTICAL
Easy and quick to install, it can be fastened with a single type of screw. Joint that can be easily disassembled, ideal for the construction of temporary structures.

SLENDER STRUCTURES
It can also be used concealed with wooden elements having small cross-section. Ideal for structures, gazebos and furnishings.

VERSATILE
It provides excellent assembly tolerance. It can be integrated with side locking plates and vertical anti-slip screw.

LOCK T FLOOR

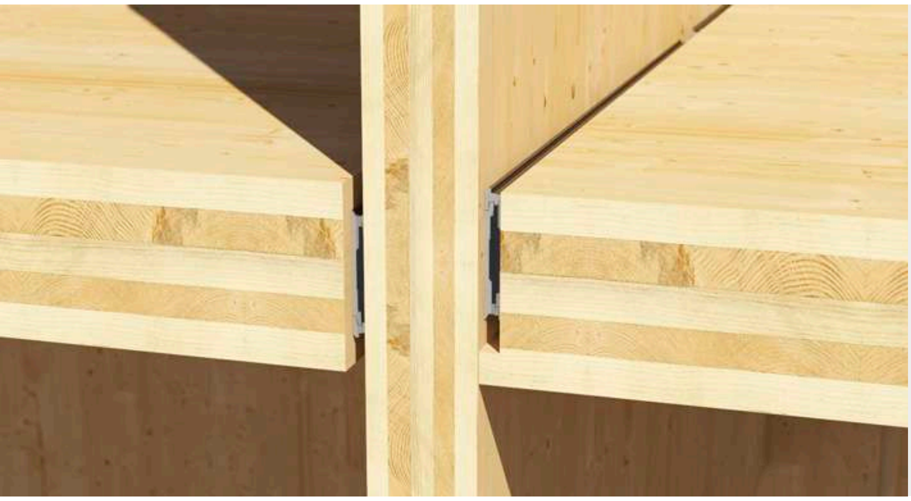
CHARACTERISTICS

FOCUS	joints that can be disassembled
TIMBER SECTIONS	from 35 x 80 mm to 200 x 440 mm
STRENGTH	$R_{v,k}$ up to 65 kN
FASTENERS	LBS

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Timber-to-timber shear joint
- solid timber and glulam
- CLT, LVL



AESTHETICS

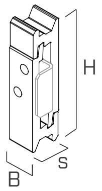
Completely concealed joint; satisfies fire safety requirements. Thanks to the assembly with only one type of screw, installation is quick and easy.

CLT FLOORS

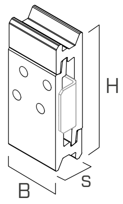
The rod version is specially designed for fastening CLT panel floors. Innovative joint with exceptional strength values.

CODES AND DIMENSIONS

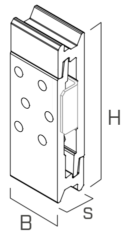
LOCK T Ø5



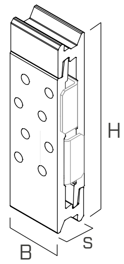
LOCKT1880



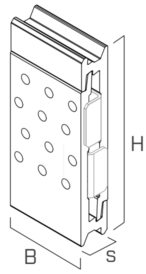
LOCKT3580



LOCKT35100



LOCKT35120



LOCKT53120

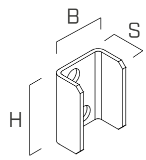
CODE	B	H	s	n_{screws} - Ø	$n_{LOCKSTOP}$ - type	pcs *
	[mm]	[mm]	[mm]			
LOCKT1880	17,5	80	20	4-Ø5	1 LOCKSTOP5U	50
LOCKT3580	35	80	20	8-Ø5	2 LOCKSTOP5	50
LOCKT35100	35	100	20	12-Ø5	2 LOCKSTOP5	50
LOCKT35120	35	120	20	16-Ø5	4 LOCKSTOP5	25
LOCKT53120	52,5	120	20	24-Ø5	4 LOCKSTOP5	25

Screws and LOCK STOP not included in the package.
* number of connector pairs

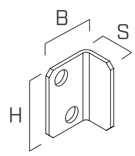
LOCK STOP Ø5

CODE	B	H	s	pcs
	[mm]	[mm]	[mm]	
LOCKSTOP5U	21,5	27,5	13	50
LOCKSTOP5	19	27,5	13	100

LOCKSTOP5U for use with LOCKT1880.
LOCKSTOP5 for use with other models.
The use of LOCK STOP is optional and does not affect structural performance.



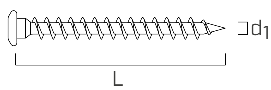
LOCKSTOP5U



LOCKSTOP5

LBS

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
LBS550	5	50	46	TX20	200
LBS570	5	70	66	TX20	200



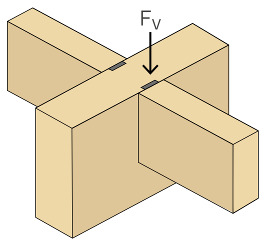
MATERIAL AND DURABILITY

LOCK T: EN AW-6005A aluminium alloy
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

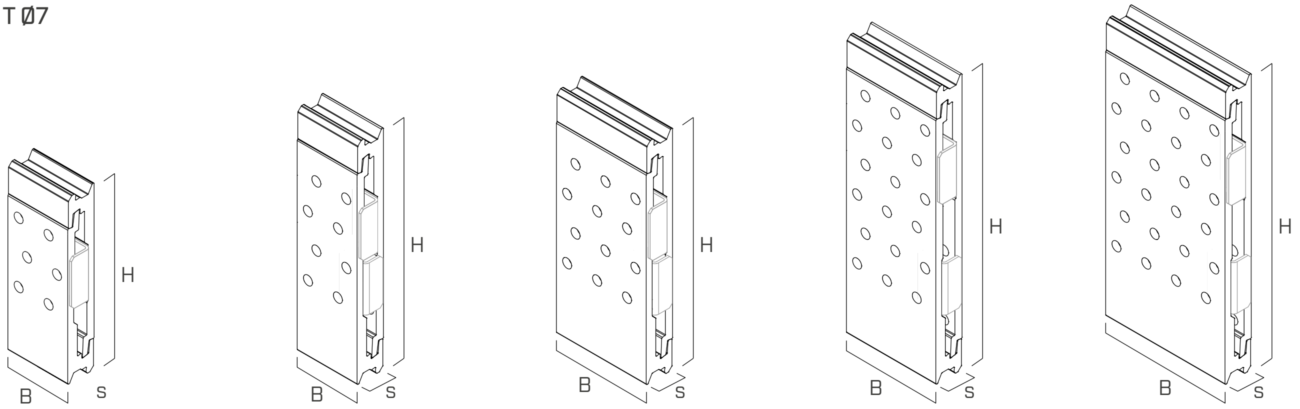
- Timber-to-timber joints between solid timber, glulam, LVL and CLT structural elements

EXTERNAL LOADS



CODES AND DIMENSIONS

LOCK T Ø7

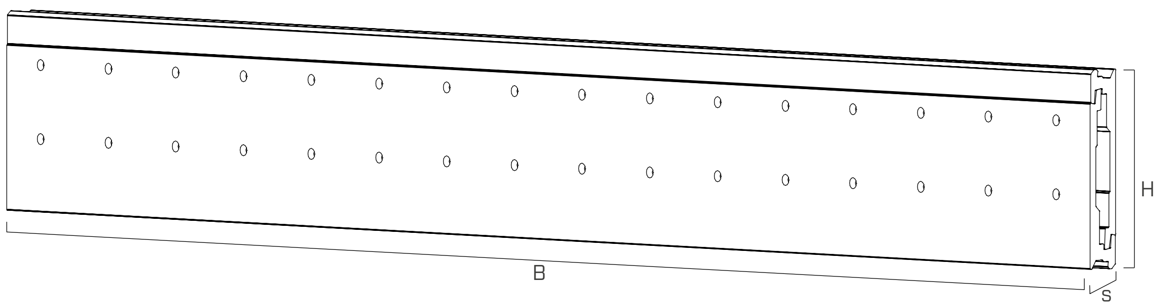


LOCKT50135 LOCKT50175 LOCKT75175 LOCKT75215 LOCKT100215

CODE	B	H	s	n_{screws} - Ø	$n_{LOCKSTOP}$ - type	pcs*
	[mm]	[mm]	[mm]			
LOCKT50135	50	135	22	12-Ø7	2 LOCKSTOP7	25
LOCKT50175	50	175	22	16-Ø7	4 LOCKSTOP7	18
LOCKT75175	75	175	22	24-Ø7	4 LOCKSTOP7	12
LOCKT75215	75	215	22	36-Ø7	4 LOCKSTOP7	12
LOCKT100215	100	215	22	48-Ø7	4 LOCKSTOP7	8

Screws and LOCK STOP not included in the package.
* number of connector pairs

LOCK T FLOOR Ø7

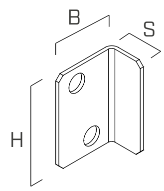


CODE	B	H	s	n_{screws} - Ø	pcs*
	[mm]	[mm]	[mm]		
LOCKTFLOOR135	1200	135	22	64-Ø7	1

Screws not included in the box.
* number of connector pairs

LOCK STOP Ø7

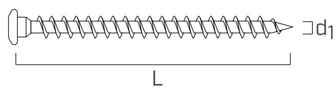
CODE	B	H	s	pcs
	[mm]	[mm]	[mm]	
LOCKSTOP7	26,5	38	15	50



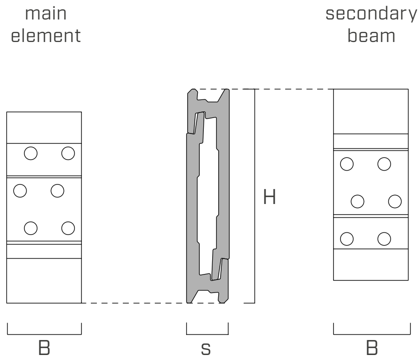
The use of LOCK STOP is optional and does not affect structural performance.

LBS

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
LBS780	7	80	75	TX30	100



GEOMETRY | LOCK T Ø5



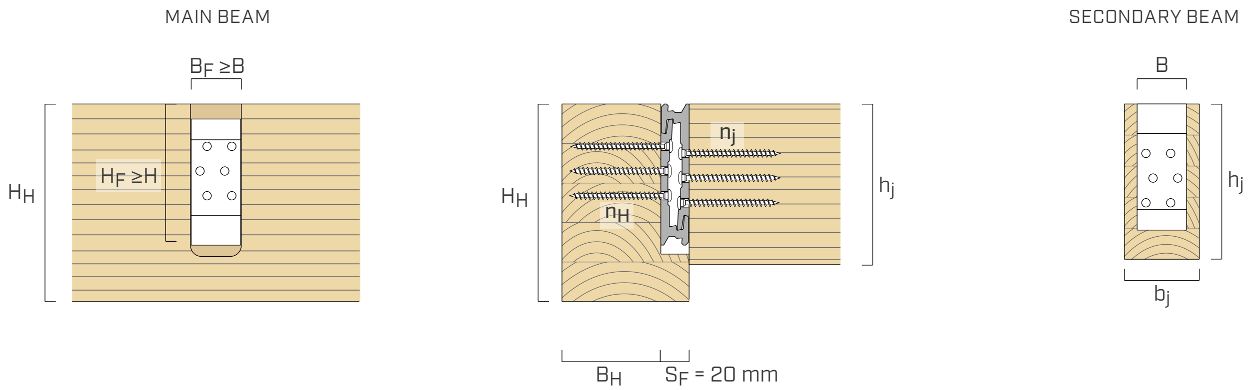
SINGLE CONNECTOR

LOCK T CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
type	B x H x s [mm]	**LBS** n_H+n_j - ØxL [mm]	**column** $B_{S,min}$ x $H_{S,min}$ [mm] with pre-drilling hole	**beam** $B_{H,min}$ x $H_{H,min}$ [mm] without pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] with pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] without pre-drilling hole
LOCKT1880	17,5 x 80 x 20	2+2 - Ø5x50	35 x 50	50 x 95	35 x 80	43 x 80
		2+2 - Ø5x70	35 x 70	70 x 95		
LOCKT3580	35 x 80 x 20	4+4 - Ø5x50	53 x 50	50 x 95	53 x 80	61 x 80
		4+4 - Ø5x70	53 x 70	70 x 95		
LOCKT35100	35 x 100 x 20	6+6 - Ø5x50	53 x 50	50 x 115	53 x 100	61 x 100
		6+6 - Ø5x70	53 x 70	70 x 115		
LOCKT35120	35 x 120 x 20	8+8 - Ø5x50	53 x 50	50 x 135	53 x 120	61 x 120
		8+8 - Ø5x70	53 x 70	70 x 135		
LOCKT53120	52,5 x 120 x 20	12+12 - Ø5x50	70 x 50	50 x 135	70 x 120	78 x 120
		12+12 - Ø5x70	70 x 70	70 x 135		

COUPLED CONNECTORS

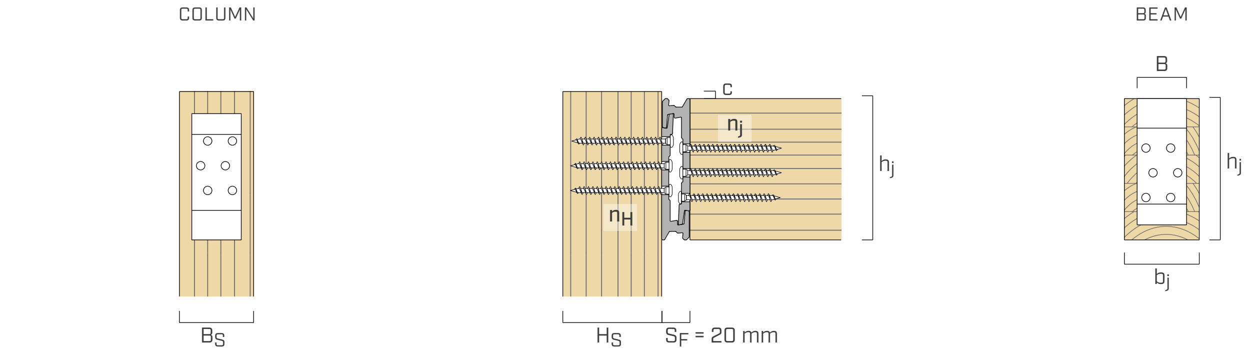
LOCK T CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
type	B x H x s [mm]	**LBS** n_H+n_j - ØxL [mm]	**column** $B_{S,min}$ x $H_{S,min}$ [mm] with pre-drilling hole	**beam** $B_{H,min}$ x $H_{H,min}$ [mm] without pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] with pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] without pre-drilling hole
LOCKT 35100 + 35100	70 x 100 x 20	12+12 - Ø5 x 50	88 x 50	50 x 115	88 x 100	96 x 100
		12+12 - Ø5 x 70	88 x 70	70 x 115		
LOCKT 35120 +35120	70 x 120 x 20	16+16 - Ø5 x 50	88 x 50	50 x 135	88 x 120	96 x 120
		16+16 - Ø5 x 70	88 x 70	70 x 135		
LOCKT 35120 + 53120	87,5 x 120 x 20	20+20 - Ø5 x 50	105 x 50	50 x 135	105 x 120	113 x 120
		20+20 - Ø5 x 70	105 x 70	70 x 135		

INSTALLATION ON BEAM | LOCK T Ø5



The H_F dimension refers to the minimum height of the grooving at constant width. The rounded part must be taken into account when grooving.

INSTALLATION ON COLUMN | LOCK T Ø5

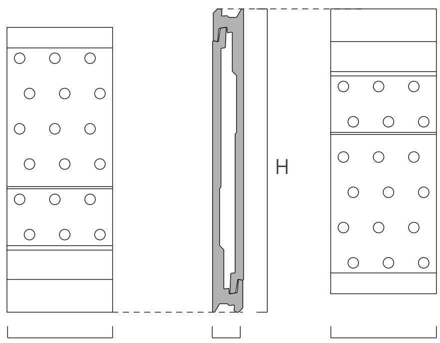


CONNECTOR POSITIONING | LOCK T Ø5

connector	c_{min} [mm]
LOCKT1880	7,5
LOCKT3580	7,5
LOCKT35100	5,0
LOCKT35120	2,5
LOCKT53120	2,5

For installation on column, respecting the minimum distance of the screw from the unloaded end of the column, requires to lower the connector by a quantity c, compared to the end of the column. This can be achieved either by raising the column with respect to the to the top of the beam (as in the image) or by lowering the connector with respect to the top of the beam by a c amount.

GEOMETRY | LOCK T Ø7



SINGLE CONNECTOR

LOCK T CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
		LBS	**column**	**beam**		
type	**B x H x s** [mm]	**n_H+n_j - ØxL** [mm]	**$B_{S,min}$ x $H_{S,min}$** [mm] with pre-drilling hole	**$B_{H,min}$ x $H_{H,min}$** [mm] without pre-drilling hole	**$b_{J,min}$ x $h_{j,min}$** [mm] with pre-drilling hole	**$b_{J,min}$ x $h_{j,min}$** [mm] without pre-drilling hole
LOCKT50135	50 x 135 x 22	6+6 - Ø7x80	74 x 80	80 x 155	74 x 135	80 x 140(1)
LOCKT50175	50 x 175 x 22	8+8 - Ø7x80	74 x 80	80 x 190	74 x 175	80 x 175
LOCKT75175	75 x 175 x 22	12+12 - Ø7x80	99 x 80	80 x 190	99 x 175	105 x 175
LOCKT75215	75 x 215 x 22	18+18 - Ø7x80	99 x 80	80 x 230	99 x 175	105 x 215
LOCKT100215	100 x 215 x 22	24+24 - Ø7x80	124 x 80	80 x 230	124 x 215	130 x 215

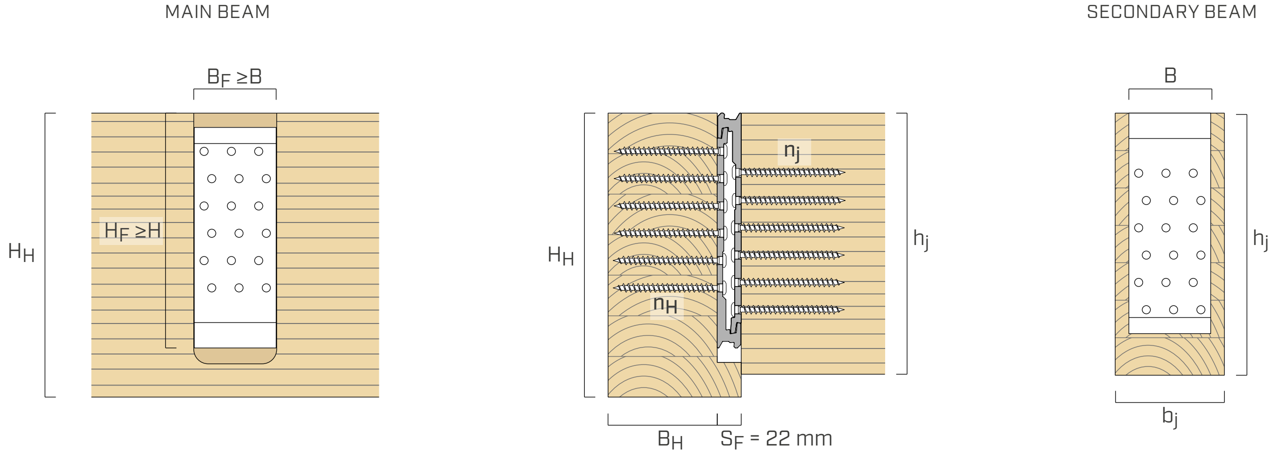
COUPLED CONNECTORS

LOCK T CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
		LBS	**column**	**beam**		
type	**B x H x s** [mm]	**n_H+n_j - ØxL** [mm]	**$B_{S,min}$ x $H_{S,min}$** [mm] with pre-drilling hole	**$B_{H,min}$ x $H_{H,min}$** [mm] without pre-drilling hole	**$b_{J,min}$ x $h_{j,min}$** [mm] with pre-drilling hole	**$b_{J,min}$ x $h_{j,min}$** [mm] without pre-drilling hole
LOCKT 50135 + 50135	100 x 135 x 22	12+12 - Ø7x80	124 x 80	80 x 155	124 x 135	130 x 140(1)
LOCKT 50175 + 50175	100 x 175 x 22	16+16 - Ø7x80	124 x 80	80 x 190	124 x 175	130 x 175
LOCKT 50175 + 75175	125 x 175 x 22	20+20 - Ø7x80	149 x 80	80 x 190	149 x 175	155 x 175
LOCKT 75215 + 75215	150 x 215 x 22	36+36 - Ø7x80	174 x 80	80 x 230	174 x 215	180 x 215
LOCKT 75215 + 100215	175 x 215 x 22	42+42 - Ø7x80	199 x 80	80 x 230	199 x 215	205 x 215

NOTES:

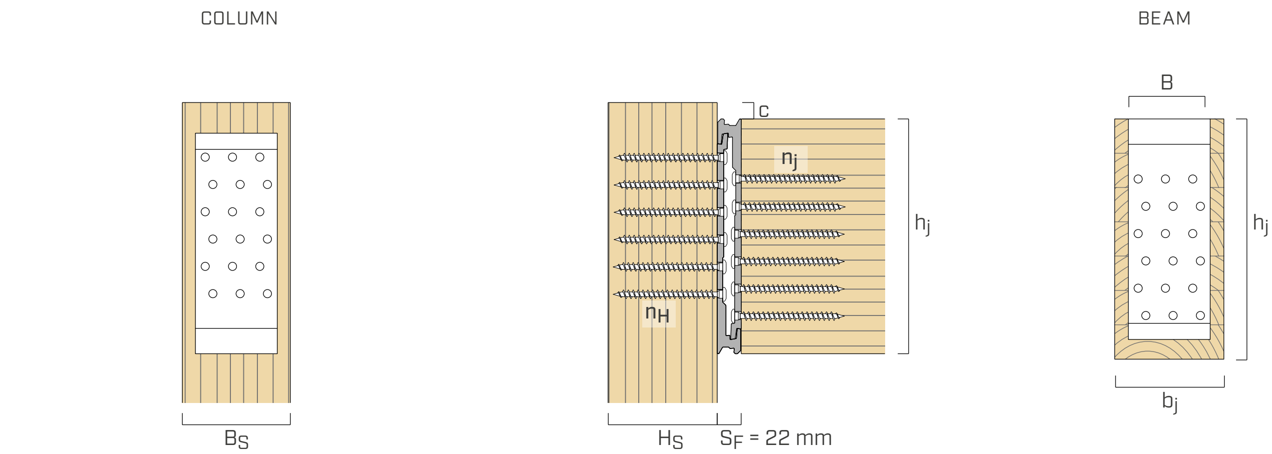
(1) In case of installation without pre-drilling hole, the LOCKT50135 connector must be installed 5 mm lower than the upper wire of the secondary beam, in order to respect the minimum distances of the screws.

INSTALLATION ON BEAM | LOCK T Ø7



The H_F dimension refers to the minimum height of the grooving at constant width. The rounded part must be taken into account when grooving.

INSTALLATION ON COLUMN | LOCK T Ø7

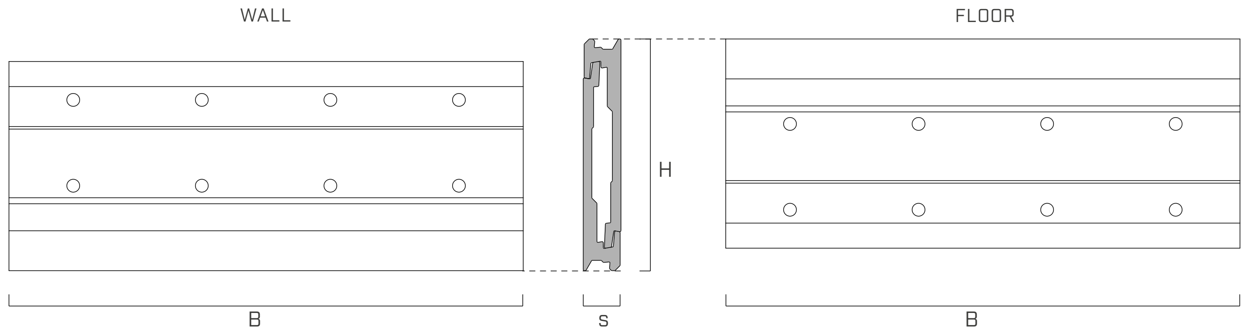


CONNECTOR POSITIONING | LOCK T Ø7

connector	c_{min} [mm]
LOCKT50135	15
LOCKT50175	5
LOCKT75175	5
LOCKT75215	15
LOCKT100215	15

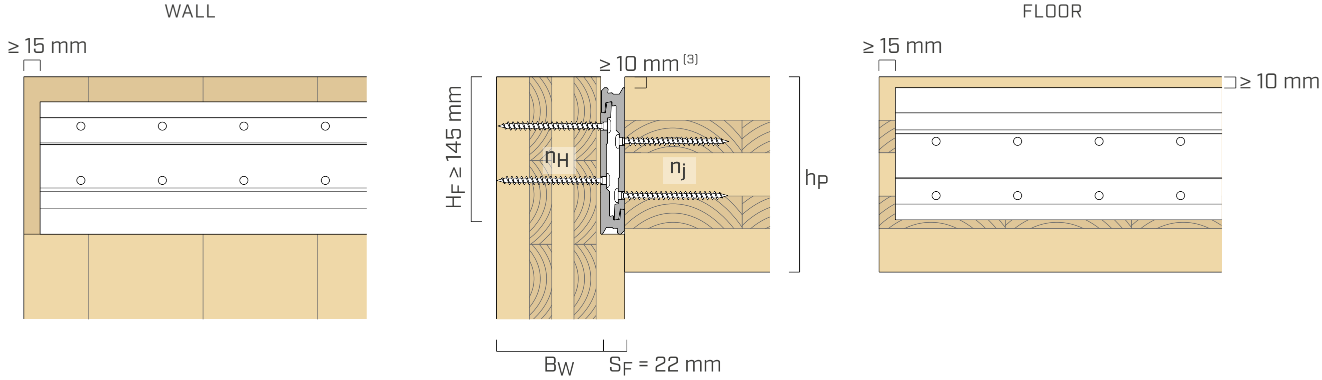
For installation on column, respecting the minimum distance of the screw from the unloaded end of the column, requires to lower the connector by a quantity c, compared to the end of the column. This can be achieved either by raising the column with respect to the to the top of the beam (as in the image) or by lowering the connector with respect to the top of the beam by a c amount.

GEOMETRY | LOCK T FLOOR

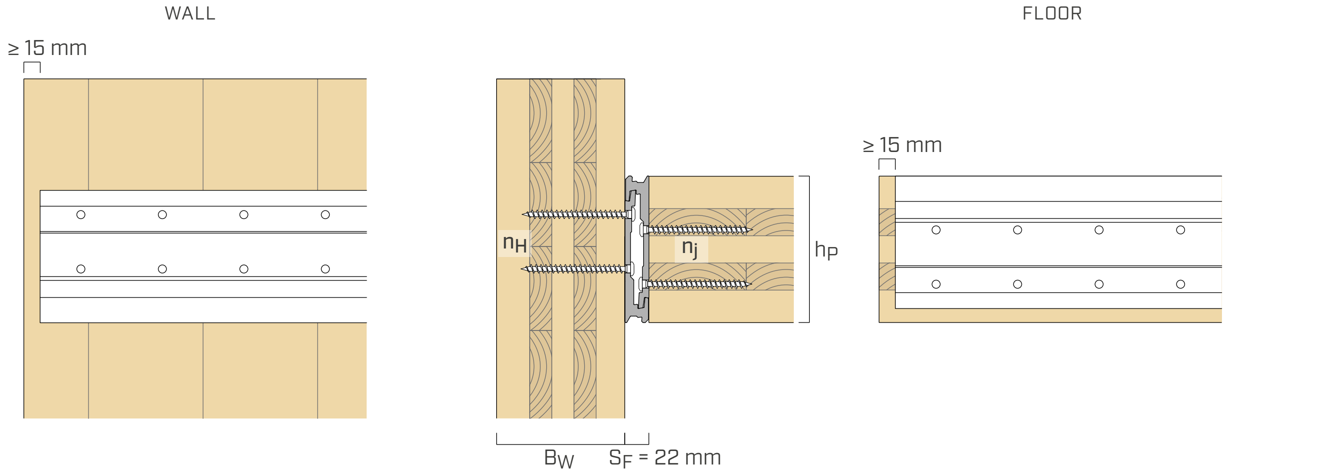


CONNECTOR LOCK T FLOOR			SCREWS	WALL	FLOOR
			LBS		
type	no. of modules(2)	B x H x s	n_H+n_j - ØxL	$B_{W,min}$	$h_{p,min}$
		[mm]	[mm]	[mm]	[mm]
LOCKTFLOOR135	1	300x135x22	8+8 - Ø7x80	80	135(3)
LOCKTFLOOR135	2	600x135x22	16+16 - Ø7x80		
LOCKTFLOOR135	3	900x135x22	24+24 - Ø7x80		
LOCKTFLOOR135	4	1200x135x22	32+32 - Ø7x80		

CONCEALED INSTALLATION | LOCK T FLOOR



EXPOSED INSTALLATION | LOCK T INSTALLATION



NOTES:

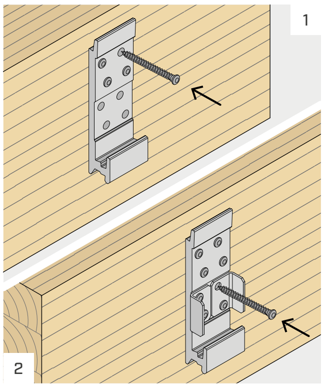
(2) The connector with 1200 mm length can be cut into modules with 300 mm width.

(3) In case of installation with the floor aligned with the top wire of the wall, the connector should be installed 10 mm from the top edge of the CLT floor. This allows the minimum distance between the screws in the wall with respect to the top of the panel. In this case, the minimum thickness of the h_P floor is 145 mm.

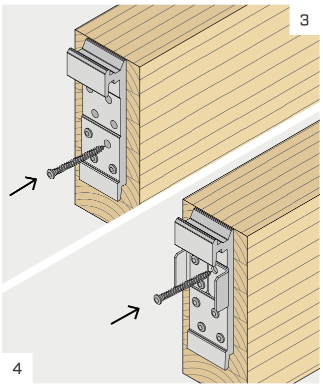
INSTALLATION

VIDEO

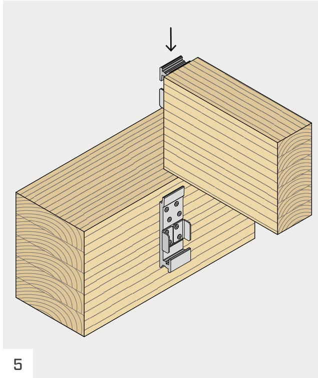
EXPOSED INSTALLATION WITH LOCK STOP



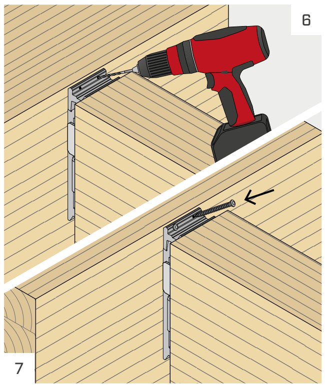
Place the connector on the main element and fasten the first screws. When using LOCK STOP (optional) position LOCK STOP and fasten the remaining screws.



Place the connector on the secondary beam and fasten the first screws. When using LOCK STOP (optional) position LOCK STOP and fasten the remaining screws.

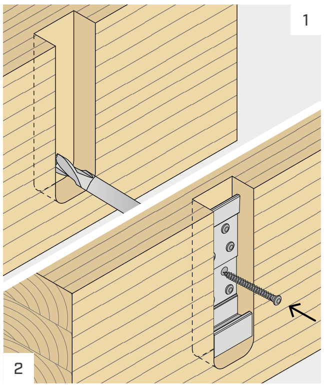


Hook the secondary beam fitting it from the top to the bottom.

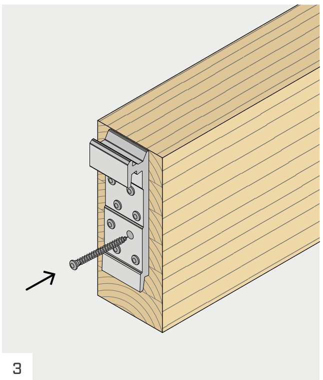


It is possible to insert anti-slip screws without structural function, by drilling one hole Ø5 inclined at 45° in the upper part of the connector. A Ø5 screw must be inserted in the hole.

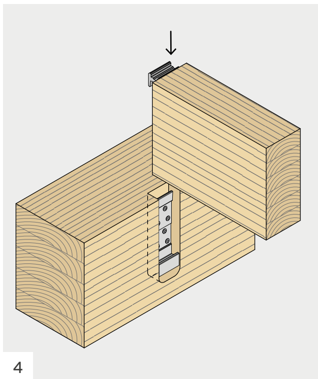
CONCEALED INSTALLATION



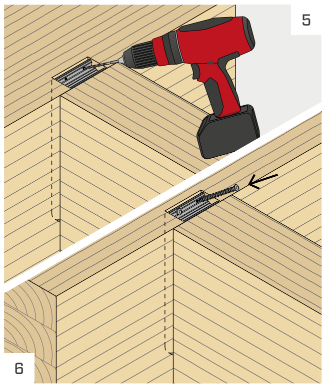
Carry out the grooving on the main element. Place the connector on the main element and fasten all screws.



Place the connector on the secondary beam and fasten all screws.

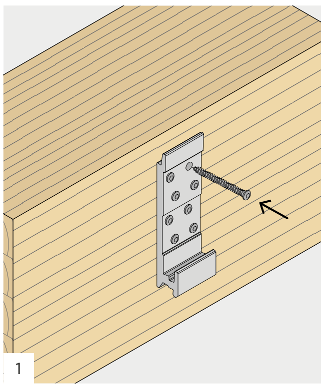


Hook the secondary beam fitting it from the top to the bottom.

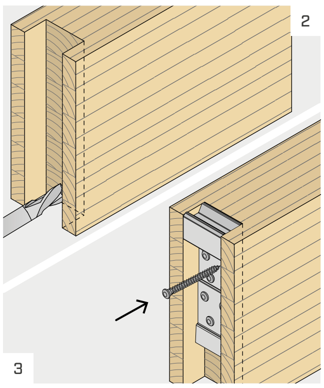


It is possible to insert anti-slip screws without structural function, by drilling one or more holes Ø5 inclined at 45° in the upper part of the connector. A Ø5 screw must be inserted in the holes.

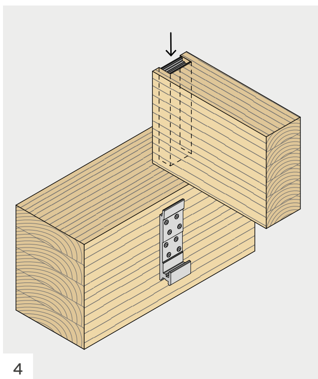
SEMI-CONCEALED INSTALLATION



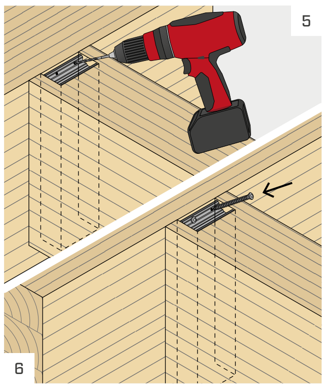
Place the connector on the main element and fasten all screws.



Perform full grooving on the secondary beam. Position the connector and fasten all screws.



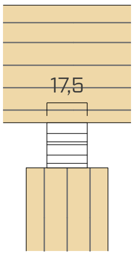
Hook the secondary beam fitting it from the top to the bottom.



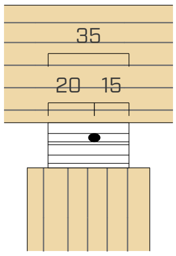
It is possible to insert anti-slip screws without structural function, by drilling one or more holes Ø5 inclined at 45° in the upper part of the connector. A Ø5 screw must be inserted in the holes.

OPTIONAL INCLINED SCREWS

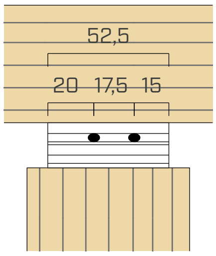
The holes inclined at 45° must be drilled on site using a drill and iron drill bit with a diameter of 5 mm. The image shows the positions for the optional inclined holes.



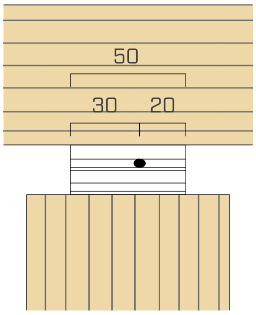
LOCKT1880



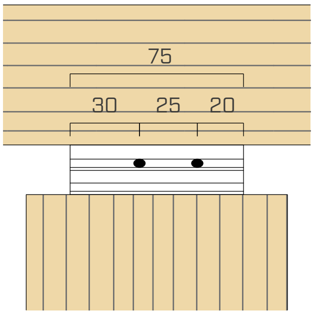
LOCKT3580
LOCKT35100
LOCKT35120



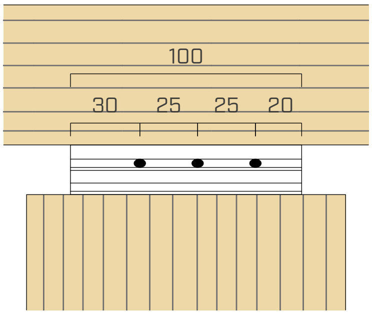
LOCKT53120



LOCKT50135
LOCKT50175

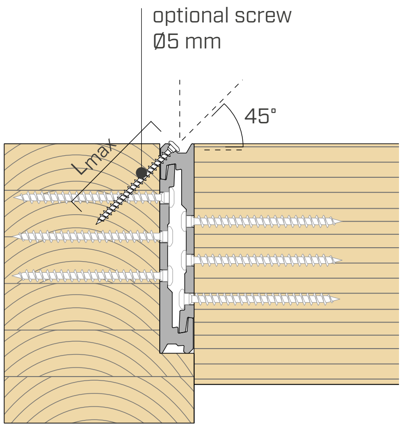


LOCKT75175
LOCKT75215

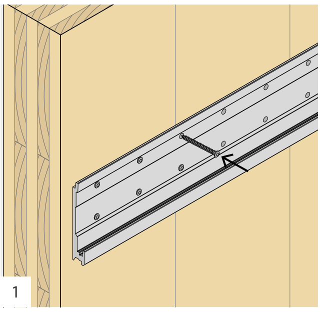


LOCKT100215

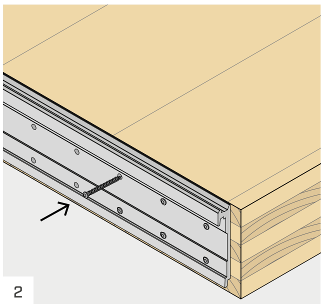
type	optional screws Ø5 L_{max} [mm]
LOCKT1880	
LOCKT3580	
LOCKT35100	50
LOCKT35120	
LOCKT53120	
LOCKT50135	
LOCKT50175	
LOCKT75175	80
LOCKT75215	
LOCKT100215	



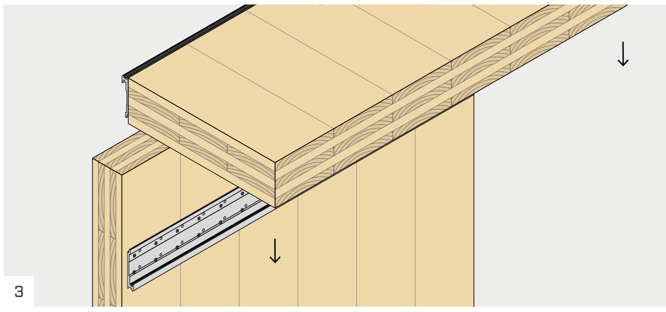
LOCK T FLOOR INSTALLATION ON CLT



Place the connector on the wall and fasten all screws.



Place the connector on the floor and fasten all screws.



Hook the floor fitting it from the top to the bottom.

STATIC VALUES

LOCK T Ø5

LOCK T CONNECTOR			TIMBER			ALUMINIUM
type	B x H x s [mm]	LBS screws n_H+n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] C24[4]	$R_{v,timber,k}$ [kN] GL24h[5]	$R_{v,timber,k}$ [kN] LVL[6]	$R_{v,alu,k}$ [kN]
LOCKT1880	17,5 x 80 x 20	2+2 - Ø5x50	2,33	2,54	2,58	10,0
		2+2 - Ø5x70	2,86	3,00	2,99	
LOCKT3580	35 x 80 x 20	4+4 - Ø5x50	4,65	5,07	5,17	20,0
		4+4 - Ø5x70	5,72	6,00	5,97	
LOCKT35100	35 x 100 x 20	6+6 - Ø5x50	6,98	7,61	7,75	20,0
		6+6 - Ø5x70	8,57	8,99	8,96	
LOCKT35120	35 x 120 x 20	8+8 - Ø5x50	9,31	10,15	10,33	20,0
		8+8 - Ø5x70	11,43	11,99	11,94	
LOCKT53120	52,5 x 120 x 20	12+12 - Ø5x50	13,96	15,22	15,50	30,0
		12+12 - Ø5x70	17,15	17,99	17,92	
LOCKT 35100 + 35100	70 x 100 x 20	12+12 - Ø5x50	13,96	15,22	15,50	40,0
		12+12 - Ø5x70	17,15	17,99	17,92	
LOCKT 35120 +35120	70 x 120 x 20	16+16 - Ø5x50	18,61	20,30	20,66	40,0
		16+16 - Ø5x70	22,87	23,98	23,89	
LOCKT 35120 + 53120	87,5 x 120 x 20	20+20 - Ø5x50	23,27	25,37	25,83	50,0
		20+20 - Ø5x70	28,58	29,98	29,86	

LOCK T Ø7

LOCK T CONNECTOR			TIMBER			ALUMINIUM
type	B x H x s [mm]	LBS screws n_H+n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] C24[4]	$R_{v,timber,k}$ [kN] GL24h[5]	$R_{v,timber,k}$ [kN] LVL[6]	$R_{v,alu,k}$ [kN]
LOCKT50135	50 x 135 x 22	6+6 - Ø7x80	15,38	16,36	15,90	30,0
LOCKT50175	50 x 175 x 22	8+8 - Ø7x80	20,50	21,81	21,20	40,0
LOCKT75175	75 x 175 x 22	12+12 - Ø7x80	30,75	32,72	31,80	60,0
LOCKT75215	75 x 215 x 22	18+18 - Ø7x80	46,13	49,08	47,70	60,0
LOCKT100215	100 x 215 x 22	24+24 - Ø7x80	61,51	65,43	63,60	80,0
LOCKT 50135 + 50135	100 x 135 x 22	12+12 - Ø7x80	30,75	32,72	31,80	60,0
LOCKT 50175 + 50175	100 x 175 x 22	16+16 - Ø7x80	41,01	43,62	42,40	80,0
LOCKT 50175 + 75175	125 x 175 x 22	20+20 - Ø7x80	51,26	54,53	53,00	100,0
LOCKT 75215 + 75215	150 x 215 x 22	36+36 - Ø7x80	92,26	98,15	95,40	120,0
LOCKT 75215 + 100215	175 x 215 x 22	42+42 - Ø7x80	107,64	114,51	111,30	140,0

STATIC VALUES

LOCK T FLOOR FOR CLT

CONNECTOR LOCK T FLOOR		TIMBER		ALUMINIUM
type	B x H x s [mm]	LBS screws n_H+n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] CLT(7)	$R_{v,alu,k}$ [kN]
LOCKTFLOOR135	300 x 135 x 22	8+8 - Ø7x80	20,40	240,0
LOCKTFLOOR135	600 x 135 x 22	16+16 - Ø7x80	40,79	480,0
LOCKTFLOOR135	900 x 135 x 22	24+24 - Ø7x80	61,19	720,0
LOCKTFLOOR135	1200 x 135 x 22	32+32 - Ø7x80	81,59	960,0

CONNECTION STIFFNESS

The sliding module can be calculated according to ETA-19/0831, with the following expression:

$$K_{v,ser} = \frac{n \cdot \rho_m^{1,5} \cdot d^{0,8}}{30} \quad \frac{kN}{mm}$$

where:
- d is the diameter of the screw thread in the secondary beam, in mm;
- ρ_m is the average density of the secondary beam, in kg/m^3;
- n is the number of screws in the secondary beam.

NOTES:

(4) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=350 kg/m^3 has been taken in consideration in the calculation.

(5) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=385 kg/m^3 has been taken in consideration in the calculation.

(6) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws with pre-drilling hole. ρ_k=480 kg/m^3 has been taken in consideration in the calculation.

(7) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=350 kg/m^3 has been taken in consideration in the calculation.

GENERAL PRINCIPLES:

- The design values are obtained from the characteristic values as follows:
- The coefficient γ_{M2} is the partial coefficient for aluminium sections subject to tension, to be taken according to the current regulations used for the calculation. If there are no other provisions, it is suggested to use the value provided by EN 1999-1-1, equal to γ_{M2}=1.25.
- The coefficient γ_M the relevant safety coefficient, on the timber connection side, to be taken according to the current regulations used for the calculation.
- The design strength is obtained from the characteristic values as follows:

$$R_{v,d} = min \begin{cases} R_{v,timber,d} = \dfrac{R_{v,timber,k} \cdot k_{mod}}{\gamma_M} \\ R_{v,alu,d} = \dfrac{R_{v,alu,k}}{\gamma_{M2}} \end{cases}$$

- Dimensioning and verification of the timber elements must be carried out separately. In particular, for loads perpendicular to the beam axis, it is recommended to perform a splitting check in both wooden elements.
- If coupled connectors are used, special care must be taken in alignment during installation to avoid different stresses in the two connectors.
- Screws with the same length must be used in all holes, separately for each side of the connector. It is possible to use screws of different length in the two connectors, main element side and secondary beam side.
- The connector must always be fully fastened using all the holes.
- The pre-drill is not required for screws on main or secondary beam, with characteristic density $\rho_k \leq$420 kg/m^3. The pre-drill is mandatory on main or secondary beam with characteristic density ρ_k> 420 kg/m^3.
- For screws on column, pre-drilling is always mandatory.
- For the LOCKTFLOOR135 connector installed on CLT panels no pre-drilling hole is required.

LOCK T EVO TIMBER

MY PROJECT SOFTWARE | VIDEO | CE ETA 19/0831

OUTDOOR CONCEALED HOOK TIMBER-TO-TIMBER CONNECTOR

ALLUMINIO EVO
Thanks to the special painting it can be used outdoors in service class 3. Easy and quick to install, it can be fastened with a single type of screw.

OUTDOOR
The joint can be easily disassembled, ideal for the construction of temporary structures exposed to weather.

AGGRESSIVE WOODS
Ideal for applications with woods containing tannin or treated with impregnating agents and other chemical processes.

CHARACTERISTICS

FOCUS	outdoor joints that can be disassembled
TIMBER SECTIONS	from 53 x 80 mm to 160 x 280 mm
STRENGTH	$R_{v,k}$ up to 35 kN
FASTENERS	HBS PLATE EVO, KKF AISI410

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

MATERIAL
Aluminium alloy with special paint in graphite black colour.

FIELDS OF USE
Outdoor timber-to-timber shear joints
- solid timber and glulam
- CLT, LVL
- aggressive woods (containing tannin)
- chemically treated woods

SERVICE CLASS 3

The specially painted aluminium alloy together with the C4 EVO coated screws or martensitic stainless steel screws allow the joint to be used in service class 3.

OAK FRAME

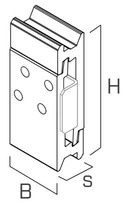
Ideal for fastening aggressive woods containing tannin, such as chestnut and oak. Assembly with KKF AISI410 outdoor screws.

CODES AND DIMENSIONS

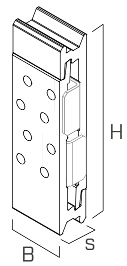
LOCK T EVO Ø5

CODE	B [mm]	H [mm]	s [mm]	n_{screws} - Ø	$n_{LOCKSTOP}$ - type	pcs *
LOCKTEVO3580	35	80	20	8 - Ø5	2 LOCKSTOP5	50
LOCKTEVO35120	35	120	20	16 - Ø5	4 LOCKSTOP5	25

Screws and LOCK STOP not included in the package.
* number of connector pairs



LOCKTEVO3580

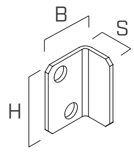


LOCKTEVO35120

LOCK STOP Ø5

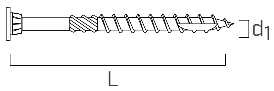
CODE	B [mm]	H [mm]	s [mm]	pcs
LOCKSTOP5	19	27,5	13	100

The use of LOCK STOP is optional and does not affect structural performance.



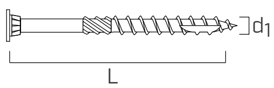
HBS PLATE EVO

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSPEVO550	5	50	30	TX25	200
HBSPEVO570	5	70	40	TX25	100



KKF AISI410

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
KKF550	5	50	30	TX25	200
KKF570	5	70	40	TX25	100



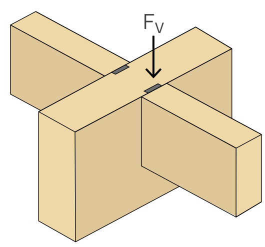
MATERIAL AND DURABILITY

LOCK T EVO: EN AW-6005A aluminium alloy.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints between solid timber, glulam, LVL and CLT structural elements

EXTERNAL LOADS

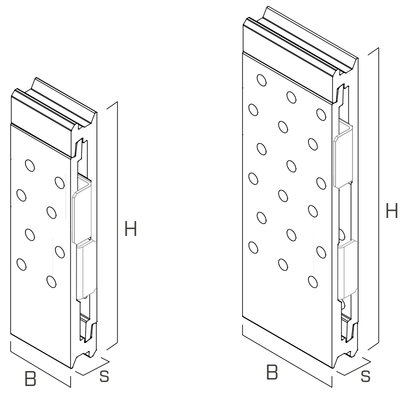


CODES AND DIMENSIONS

LOCK T EVO Ø6

CODE	B [mm]	H [mm]	s [mm]	n_{screws} - Ø	$n_{LOCKSTOP}$ - type	pcs*
LOCKTEVO50175	50	175	22	16 - Ø6	4 LOCKSTOP 7	18
LOCKTEVO75215	75	215	22	36 - Ø6	4 LOCKSTOP 7	12

Screws and LOCK STOP not included in the package.
* number of connector pairs

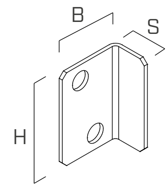


LOCKTEVO50175 LOCKTEVO75215

LOCK STOP Ø6

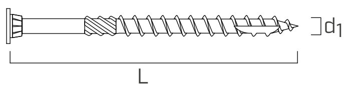
CODE	B [mm]	H [mm]	s [mm]	pcs
LOCKSTOP7	26,5	38	15	50

The use of LOCK STOP is optional and does not affect structural performance.



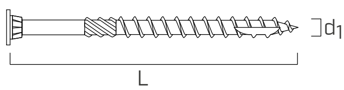
HBS PLATE EVO

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSPEVO680	6	80	50	TX30	100



KKF AISI410

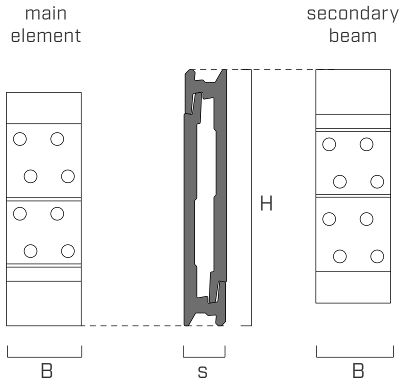
CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
KKF680	6	80	50	TX30	100



PERGOLAS AND GAZEBOS

Ideal for the construction of wooden structures placed outdoors and in service class 3. Possibility to uninstall the joint for seasonal needs.

GEOMETRY | LOCK T EVO Ø5



SINGLE CONNECTOR

LOCK T EVO CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
		HBS PLATE EVO KKF AISI410	column	beam		
type	B x H x s	n_H+n_j - ØxL	$B_{S,min}$ x $H_{S,min}$	$B_{H,min}$ x $H_{H,min}$	$b_{J,min}$ x $h_{j,min}$	
	[mm]	[mm]	[mm]	[mm]	[mm]	
			with pre-drilling hole	without pre-drilling hole	with pre-drilling hole	without pre-drilling hole
LOCKTEVO3580	35 x 80 x 20	4+4 - Ø5x50	53 x 50	50 x 95	53 x 80	61 x 80
		4+4 - Ø5x70	53 x 70	70 x 95		
LOCKTEVO35120	35 x 120 x 20	8+8 - Ø5x50	53 x 50	50 x 135	53 x 120	61 x 120
		8+8 - Ø5x70	53 x 70	70 x 135		

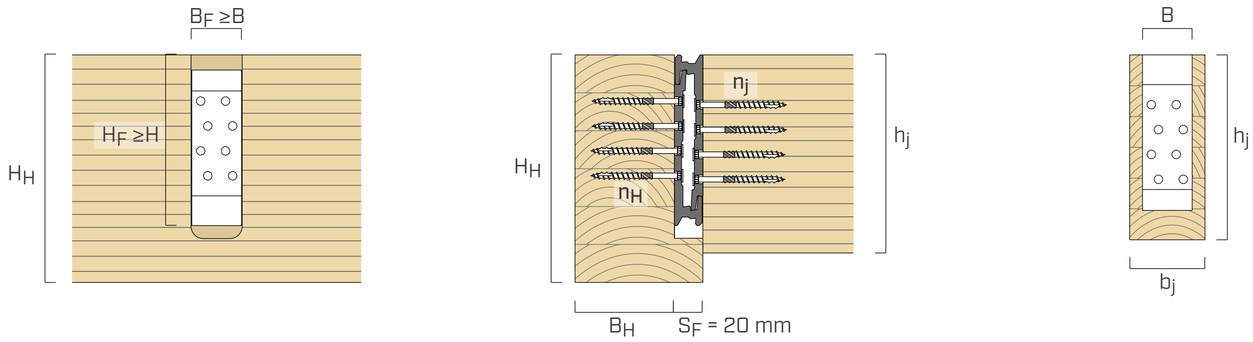
COUPLED CONNECTORS

LOCK T EVO CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
		HBS PLATE EVO KKF AISI410	column	beam		
type	B x H x s	n_H+n_j - ØxL	$B_{S,min}$ x $H_{S,min}$	$B_{H,min}$ x $H_{H,min}$	$b_{J,min}$ x $h_{j,min}$	
	[mm]	[mm]	[mm]	[mm]	[mm]	
			with pre-drilling hole	without pre-drilling hole	with pre-drilling hole	without pre-drilling hole
LOCKTEVO 35120 + 35120	70 x 120 x 20	16+16 - Ø5x50	88 x 50	50 x 135	88 x 120	96 x 120
		16+16 - Ø5x70	88 x 70	70 x 135		

INSTALLATION ON BEAM | LOCK T EVO Ø5

MAIN BEAM

SECONDARY BEAM

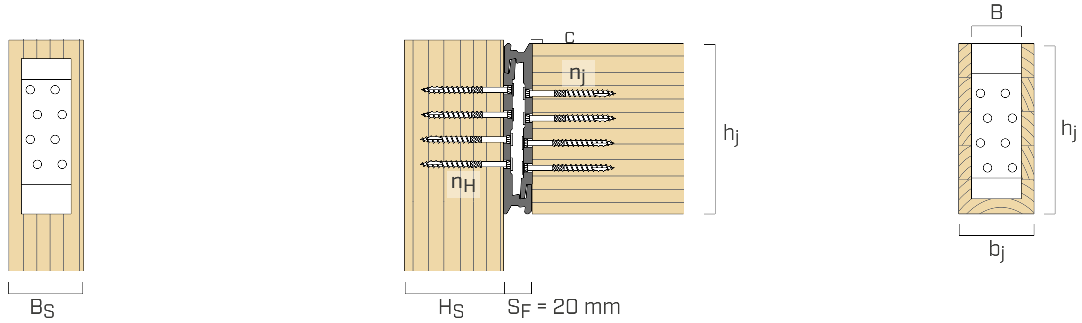


The H_F dimension refers to the minimum height of the grooving at constant width. The rounded part must be taken into account when grooving.

INSTALLATION ON COLUMN | LOCK T EVO Ø5

COLUMN

BEAM

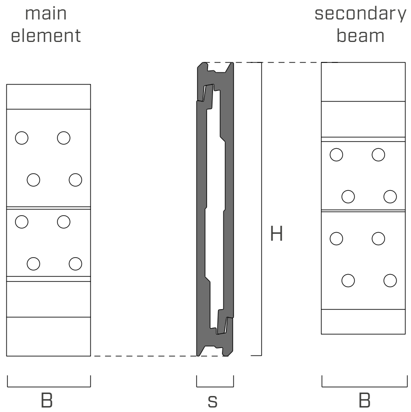


CONNECTOR POSITIONING | LOCK T EVO Ø5

connector	c_{min} [mm]
LOCKTEVO3580	7,5
LOCKTEVO35120	2,5

For installation on column, respecting the minimum distance of the screw from the unloaded end of the column, requires to lower the connector by a quantity c, compared to the end of the column. This can be achieved either by raising the column with respect to the to the top of the beam (as in the image) or by lowering the connector with respect to the top of the beam by a c amount.

GEOMETRY | LOCK T EVO Ø6



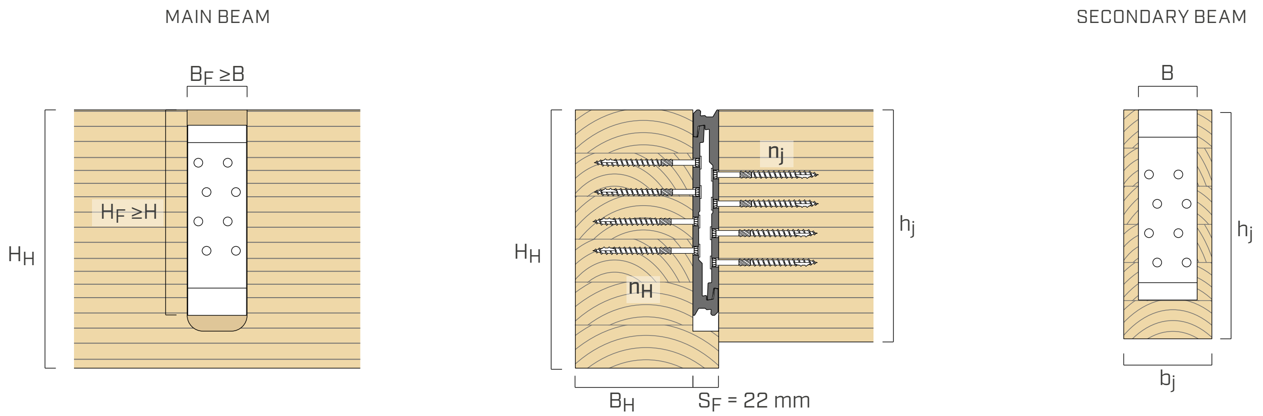
SINGLE CONNECTOR

LOCK T EVO CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
		HBS PLATE EVO KKF AISI410	column	beam		
type	B x H x s [mm]	n_H+n_j - ØxL [mm]	$B_{S,min}$ x $H_{S,min}$ [mm] with pre-drilling hole	$B_{H,min}$ x $H_{H,min}$ [mm] without pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] with pre-drilling hole	without pre-drilling hole
LOCKTEVO50175	50 x 175 x 22	8+8 - Ø6x80	68 x 80	80 x 180	68 x 175	80 x 175
LOCKTEVO75215	75 x 215 x 22	18+18 - Ø6x80	93 x 80	80 x 220	93 x 215	105 x 215

COUPLED CONNECTORS

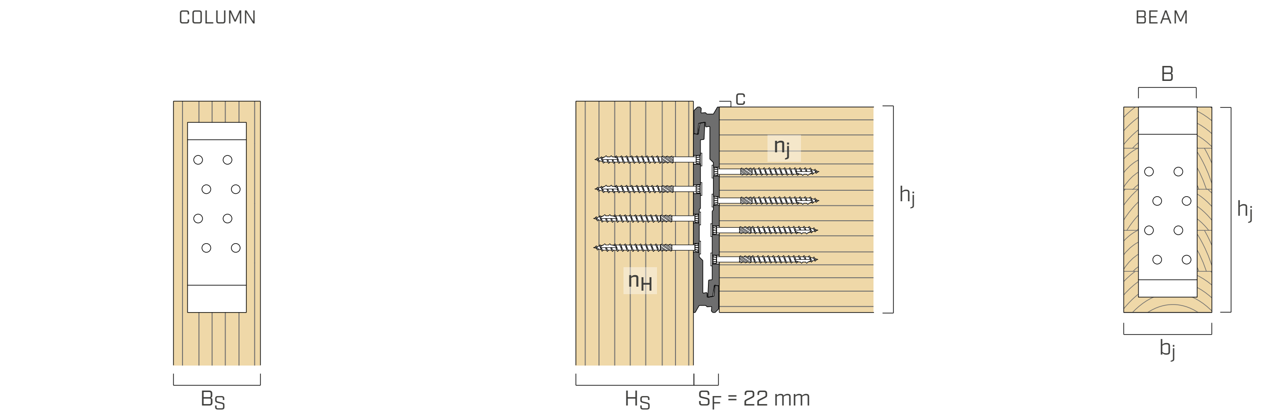
LOCK T EVO CONNECTOR		SCREWS	MAIN ELEMENT		SECONDARY BEAM	
		HBS PLATE EVO KKF AISI410	column	beam		
type	B x H x s [mm]	n_H+n_j - ØxL [mm]	$B_{S,min}$ x $H_{S,min}$ [mm] with pre-drilling hole	$B_{H,min}$ x $H_{H,min}$ [mm] without pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] with pre-drilling hole	without pre-drilling hole
LOCKTEVO 50175 + 50175	100 x 175 x 22	16+16 - Ø6x80	118 x 80	80 x 180	118 x 175	130 x 175
LOCKTEVO 75215 + 75215	150 x 215 x 22	36+36 - Ø6x80	168 x 80	80 x 220	168 x 215	180 x 215

INSTALLATION ON BEAM | LOCK T EVO Ø6



The H_F dimension refers to the minimum height of the grooving at constant width. The rounded part must be taken into account when grooving.

INSTALLATION ON COLUMN | LOCK T EVO Ø6



CONNECTOR POSITIONING | LOCK T EVO Ø6

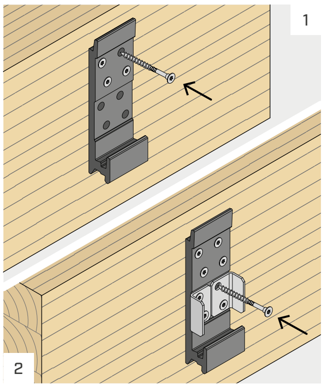
connector	c_{min} [mm]
LOCKTEVO50175	5
LOCKTEVO75215	15

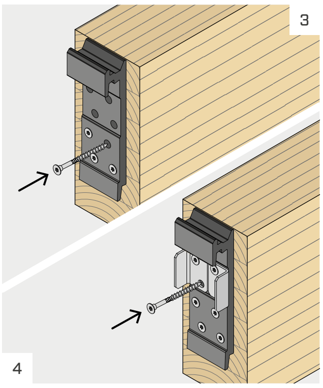
For installation on column, respecting the minimum distance of the screw from the unloaded end of the column, requires to lower the connector by a quantity c, compared to the end of the column. This can be achieved either by raising the column with respect to the to the top of the beam (as in the image) or by lowering the connector with respect to the top of the beam by a c amount.

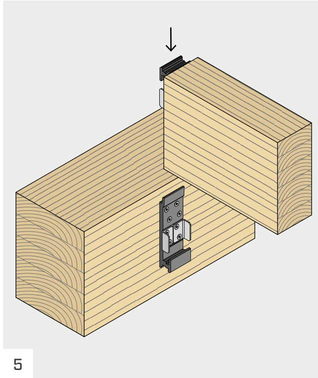
INSTALLATION

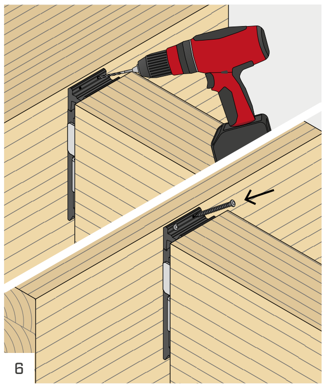
VIDEO

EXPOSED INSTALLATION WITH LOCK STOP









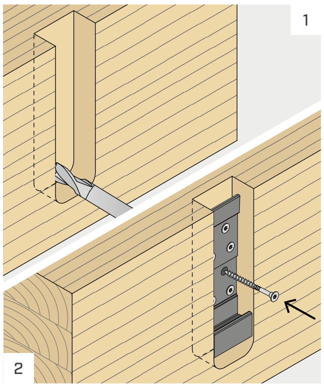
Place the connector on the main element and fasten the first screws. When using LOCK STOP (optional) position LOCK STOP and fasten the remaining screws.

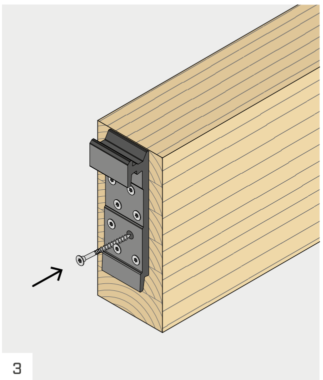
Place the connector on the secondary beam and fasten the first screws. When using LOCK STOP (optional) position LOCK STOP and fasten the remaining screws.

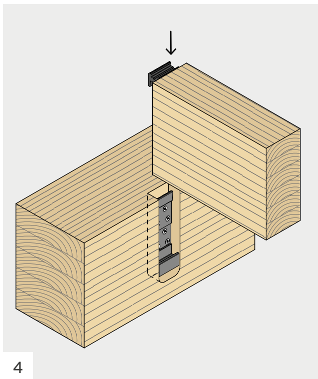
Hook the secondary beam fitting it from the top to the bottom.

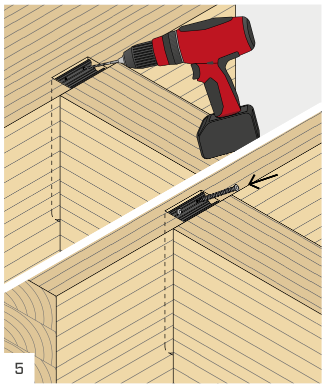
It is possible to insert anti-slip screws without structural function, by drilling one hole Ø5 inclined at 45° in the upper part of the connector. A Ø5 screw must be inserted in the hole.

CONCEALED INSTALLATION









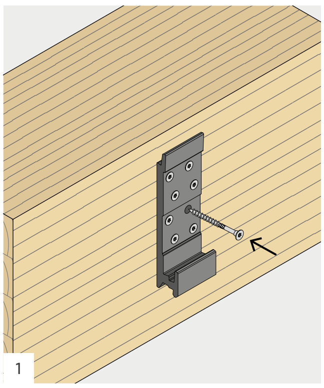
Carry out the grooving on the main element. Place the connector on the main element and fasten all screws.

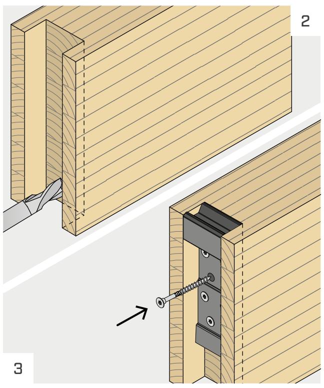
Place the connector on the secondary beam and fasten all screws.

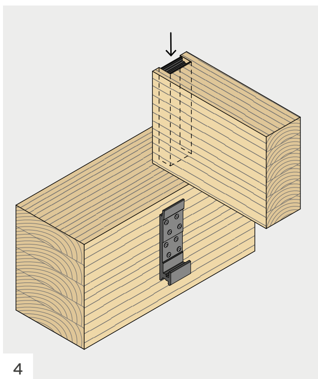
Hook the secondary beam fitting it from the top to the bottom.

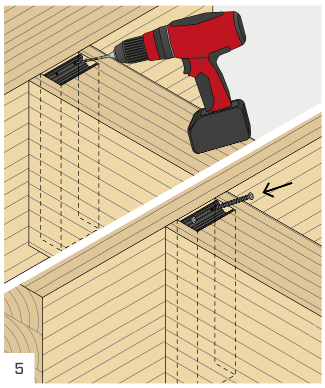
It is possible to insert anti-slip screws without structural function, by drilling one or more holes Ø5 inclined at 45° in the upper part of the connector. A Ø5 screw must be inserted in the holes.

SEMI-CONCEALED INSTALLATION









Place the connector on the main element and fasten all screws.

Perform full grooving on the secondary beam. Position the connector and fasten all screws.

Hook the secondary beam fitting it from the top to the bottom.

It is possible to insert anti-slip screws without structural function, by drilling one or more holes Ø5 inclined at 45° in the upper part of the connector. A Ø5 screw must be inserted in the holes.

NOTE: for the geometry of the holes for the optional inclined screws see the "OPTIONAL INCLINED SCREWS" page 70.

STATIC VALUES

LOCK T EVO Ø5

LOCK T EVO CONNECTOR		TIMBER			ALUMINIUM
type	B x H x s [mm]	**HBS PLATE EVO screws KKF AISI410** n_H+n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] C24(1)	$R_{v,timber,k}$ [kN] C50(2)	$R_{v,alu,k}$ [kN]
LOCKTEVO3580	35 x 80 x 20	4+4 - Ø5x50	3,97	5,66	20,0
		4+4 - Ø5x70	4,81	6,23	
LOCKTEVO35120	35 x 120 x 20	8+8 - Ø5x50	7,94	11,31	20,0
		8+8 - Ø5x70	9,62	12,46	
LOCKTEVO 35120 + 35120	70 x 120 x 20	16+16 - Ø5x50	15,88	22,62	40,0
		16+16 - Ø5x70	19,23	24,92	

LOCK T EVO Ø6

LOCK T EVO CONNECTOR		TIMBER			ALUMINIUM
type	B x H x s [mm]	**HBS PLATE EVO screws KKF AISI410** n_H+n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] C24(1)	$R_{v,timber,k}$ [kN] C50(2)	$R_{v,alu,k}$ [kN]
LOCKTEVO50175	50 x 175 x 22	8+8 - Ø6x80	13,92	18,24	40,0
LOCKTEVO75215	75 x 215 x 22	18+18 - Ø6x80	31,31	41,04	60,0
LOCKTEVO 50175 + 50175	100 x 175 x 22	16+16 - Ø6x80	27,83	36,48	80,0
LOCKTEVO 75215 + 75215	150 x 215 x 22	36+36 - Ø6x80	62,62	82,07	120,0

CONNECTION STIFFNESS:

- The sliding module can be calculated according to ETA-19/0831, with the following expression:

$$K_{v,ser} = \frac{n \cdot \rho_m^{1,5} \cdot d^{0,8}}{30} \quad \frac{kN}{mm}$$

where:

d is the diameter of the screw thread in the secondary beam, in mm;

ρ_m is the average density of the secondary beam, in kg/m^3;

n is the number of screws in the secondary beam.

NOTES:

(1) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=350 kg/m^3 has been taken in consideration in the calculation.

(2) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws with pre-drilling hole. ρ_k=430 kg/m^3 has been taken in consideration in the calculation.

GENERAL PRINCIPLES:

- The design values are obtained from the characteristic values as follows:
- The coefficient γ_{M2} is the partial coefficient for aluminium sections subject to tension, to be taken according to the current regulations used for the calculation. If there are no other provisions, it is suggested to use the value provided by EN 1999-1-1, equal to γ_{M2}=1.25.
- The coefficient γ_M the relevant safety coefficient, on the timber connection side, to be taken according to the current regulations used for the calculation.
- The design strength is obtained from the characteristic values as follows:

$$R_{v,d} = min \begin{cases} R_{v,timber,d} = \dfrac{R_{v,timber,k} \cdot k_{mod}}{\gamma_M} \\ R_{v,alu,d} = \dfrac{R_{v,alu,k}}{\gamma_{M2}} \end{cases}$$

- Dimensioning and verification of the timber elements must be carried out separately. In particular, for loads perpendicular to the beam axis, it is recommended to perform a splitting check in both wooden elements.
- If coupled connectors are used, special care must be taken in alignment during installation to avoid different stresses in the two connectors.
- Screws with the same length must be used in all holes, separately for each side of the connector. It is possible to use screws of different length in the two connectors, main element side and secondary beam side.
- The connector must always be fully fastened using all the holes.
- The pre-drill is not required for screws on main or secondary beam, with characteristic density $\rho_k \leq 420$ kg/m^3. The pre-drill is mandatory on main or secondary beam with characteristic density $\rho_k >$ 420 kg/m^3.
- For screws on column, pre-drilling is always mandatory.

LOCK C CONCRETE

CONCEALED HOOK TIMBER-TO-CONCRETE CONNECTOR

VIDEO

ETA 19/0831

SIMPLE
Quick installation on concrete. Easy to hook system with screw anchors on the concrete side and self-drilling screws on the wood side.

REMOVABLE
Thanks to the hooking system, the wooden beams can be easily removed for seasonal requirements.

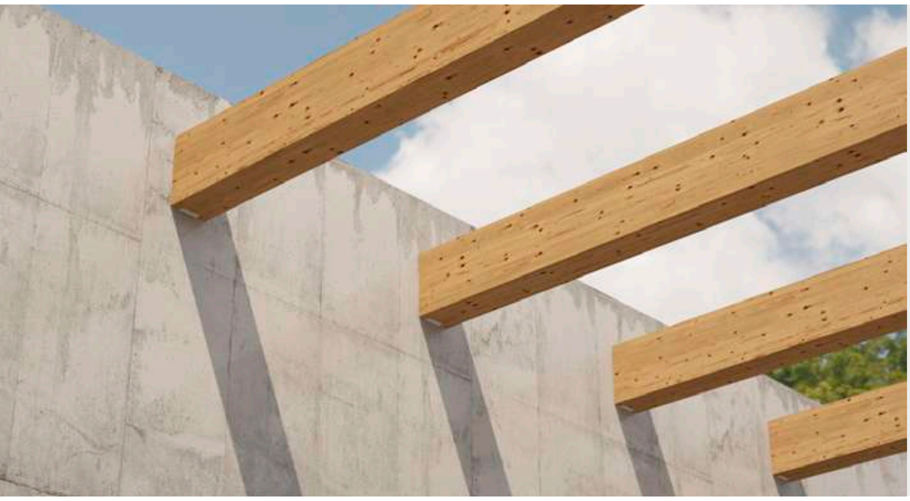
CONCEALED
Fastening on concrete is concealed. When installed without grooving, it generates an aesthetically pleasing joint shadow.

LOCK C FLOOR

CHARACTERISTICS

FOCUS	joints for concrete that can be disassembled
TIMBER SECTIONS	from 70 x 120 mm to 200 x 440 mm
STRENGTH	$R_{v,k}$ up to 65 kN
FASTENERS	LBS, SKS-E

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



MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete shear joint
- solid timber and glulam
- CLT, LVL

BUILDING RECOVERY

The rod version is specially designed for fastening CLT floors to reinforced concrete beams or kerbs or masonry elements. Ideal for the restoration or renovation of existing buildings.

TIMBER-TO-CONCRETE

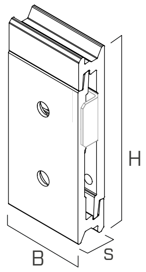
Ideal for the construction of roofs or pergolas near concrete supports. Concealed fastening and easy to install.

CODES AND DIMENSIONS

LOCK C Ø5

CODE	B	H	s	n_{screws} - Ø	$n_{anchors}$ - Ø	$n_{LOCKSTOP}$ - type	pcs *
	[mm]	[mm]	[mm]				
LOCKC53120	52,5	120	20	12 - Ø5	2 - Ø8	2 LOCKSTOP5	25

Screws, anchors and LOCK STOP not included in the package.
* number of connector pairs (wood side connector + concrete side connector)

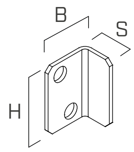


LOCKC53120

LOCK STOP Ø5

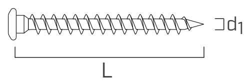
CODE	B	H	s	pcs
	[mm]	[mm]	[mm]	
LOCKSTOP5	19	27.5	13	100

The use of LOCK STOP is optional and does not affect structural performance.



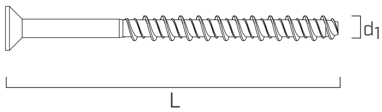
LBS

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
LBS550	5	50	46	TX20	200
LBS570	5	70	66	TX20	200



SKS-E

CODE	d_1	L	d_0	T_{inst}	TX	pcs
	[mm]	[mm]	[mm]	[Nm]		
SKS75100CE	8	100	6	20	TX30	50



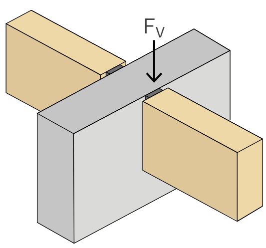
MATERIAL AND DURABILITY

LOCK C: EN AW-6005A aluminium alloy.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-concrete or timber to-steel joints

EXTERNAL LOADS

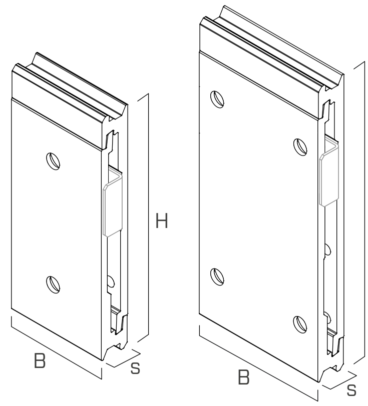


CODES AND DIMENSIONS

LOCK C Ø7

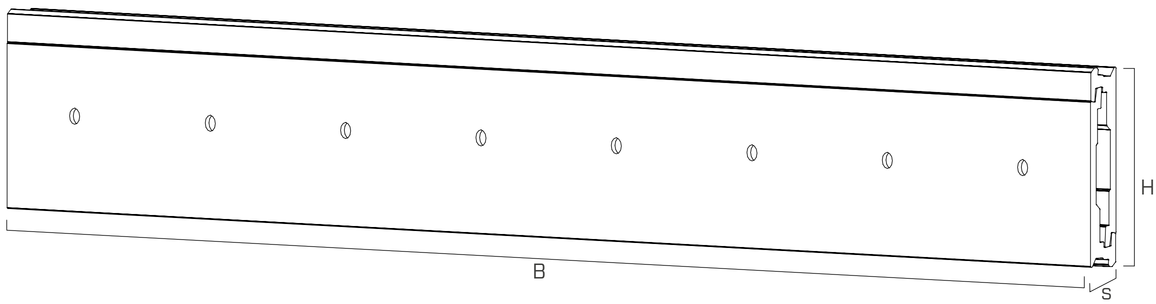
CODE	B [mm]	H [mm]	s [mm]	n_{screws} - Ø	$n_{anchors}$ - Ø	$n_{LOCKSTOP}$ - type	pcs*
LOCKC75175	75	175	22	12 - Ø7	2 - Ø10	2 LOCKSTOP7	12
LOCKC100215	100	215	22	24 - Ø7	4 - Ø10	2 LOCKSTOP7	8

Screws, anchors and LOCK STOP not included in the package.
* number of connector pairs (wood side connector + concrete side connector)



LOCKC75175 LOCKC100215

LOCK C FLOOR Ø7



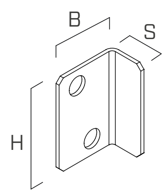
CODE	B [mm]	H [mm]	s [mm]	n_{screws} - Ø	$n_{anchors}$ - Ø	pcs*
LOCKCFLOOR135	1200	135	22	32 - Ø7	8 - Ø10	1

Screws and anchors not included in the package.
* number of connector pairs (wood side connector + concrete side connector)

LOCK STOP Ø7

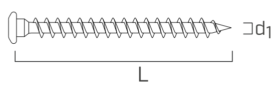
CODE	B [mm]	H [mm]	s [mm]	pcs
LOCKSTOP7	26.5	38	15	50

The use of LOCK STOP is optional and does not affect structural performance.



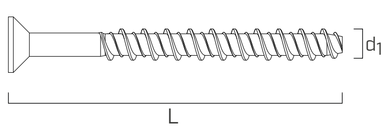
LBS

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
LBS780	7	80	75	TX30	100

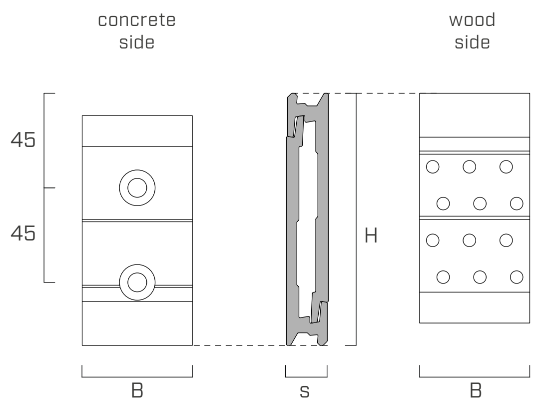


SKS-E

CODE	d_1 [mm]	L [mm]	d_0 [mm]	T_{inst} [Nm]	TX	pcs
SKS10100CE	10	100	8	50	TX40	50



GEOMETRY | LOCK C Ø5

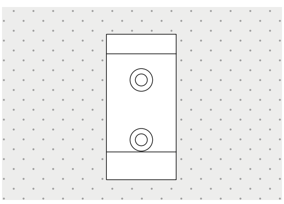


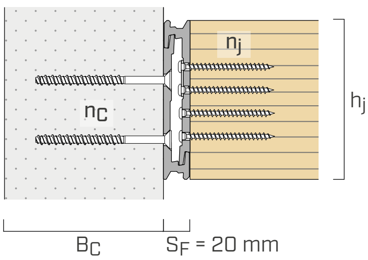
LOCK C CONNECTOR		CONCRETE		TIMBER		
		SKS-E anchors		LBS screws		
type	**B x H x s** [mm]	**n_C - ØxL** [mm]	**$B_{C,min}$** [mm]	**n_j - ØxL** [mm]	**$b_{J,min}$ x $h_{j,min}$** [mm] with pre-drilling hole	without pre-drilling hole
LOCKC53120	52,5 x 120 x 20	2 - Ø8x100	120	12 - Ø5x50 12 - Ø5x70	70 x 120	78 x 120

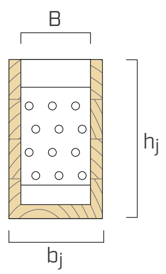
INSTALLATION | LOCK C Ø5

CONCRETE

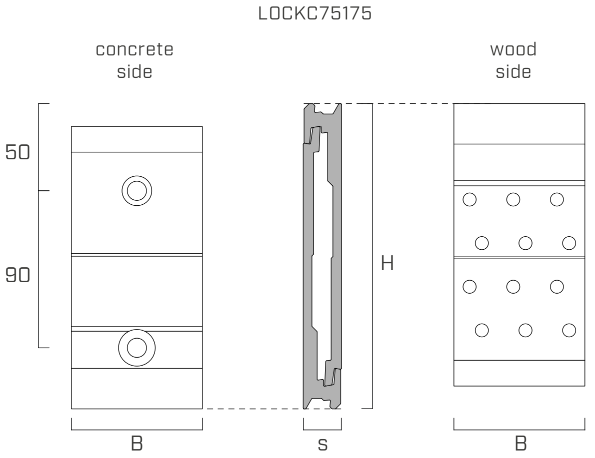
TIMBER

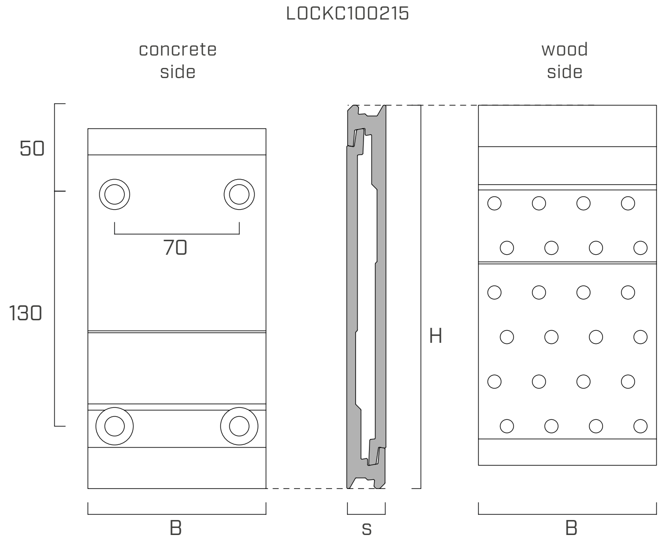






GEOMETRY | LOCK C Ø7

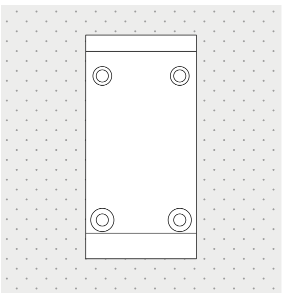


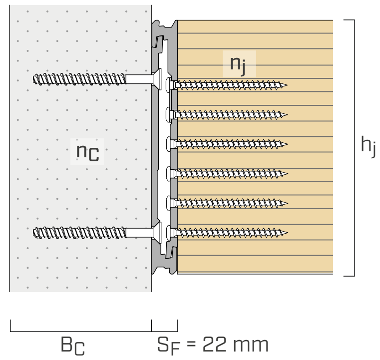


LOCK C CONNECTOR		CONCRETE		TIMBER		
		SKS-E anchors		LBS screws		
type	B x H x s [mm]	n_C - ØxL [mm]	$B_{C,min}$ [mm]	n_j - ØxL [mm]	$b_{J,min}$ x $h_{j,min}$ [mm] with pre-drilling hole	$b_{J,min}$ x $h_{j,min}$ [mm] without pre-drilling hole
LOCKC75175	75 x 175 x 22	2 - Ø10x100	120	12 - Ø7x80	99 x 175	105 x 175
LOCKC100215	100 x 215 x 22	4 - Ø10x100	120	24 - Ø7x80	124 x 215	130 x 215

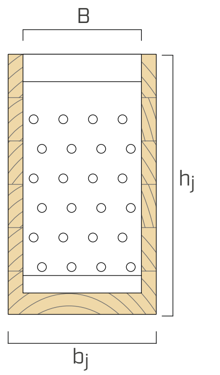
INSTALLATION | LOCK C Ø7

CONCRETE

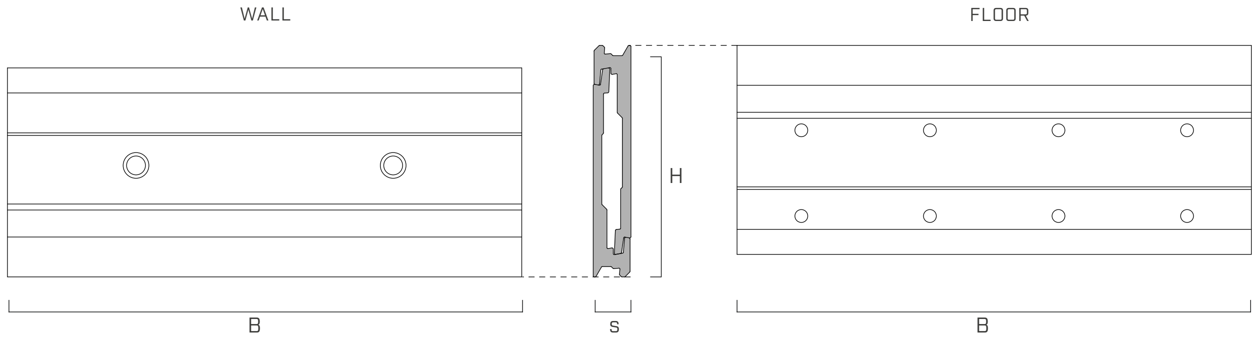




TIMBER

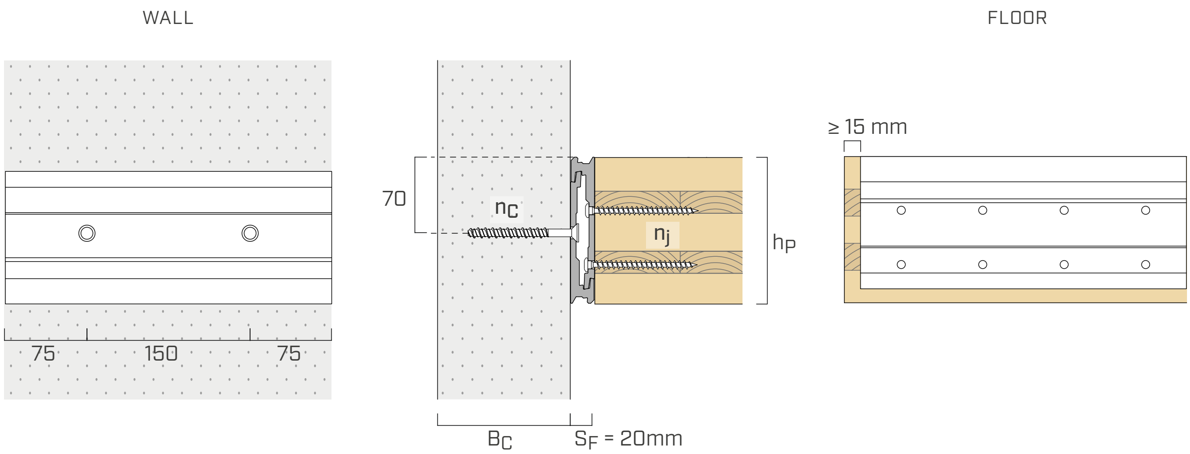


GEOMETRY| LOCK C FLOOR ON CLT



CONNECTOR LOCK T FLOOR			WALL		CLT FLOOR	
type	**no. of modules**[1]	**B x H x s** [mm]	**SKS-E anchors** n_C **- ØxL** [mm]	$B_{C,min}$ [mm]	**LBS screws** n_j **- ØxL** [mm]	$h_{p,min}$ [mm]
LOCKFLOOR135	1	300 x 135 x 22	2 - Ø10x100	120	8 - Ø7x80	135
LOCKFLOOR135	2	600 x 135 x 22	4 - Ø10x100	120	16 - Ø7x80	135
LOCKFLOOR135	3	900 x 135 x 22	6 - Ø10x100	120	24 - Ø7x80	135
LOCKFLOOR135	4	1200 x 135 x 22	8 - Ø10x100	120	32 - Ø7x80	135

INSTALLATION| LOCK C 120 ON CLT



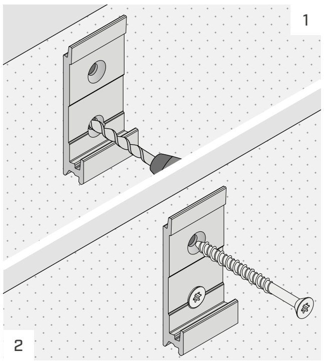
NOTES:

[1] The connector with 1200 mm length can be cut into modules with 300 mm width.

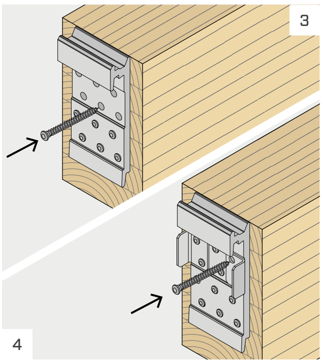
INSTALLATION

VIDEO

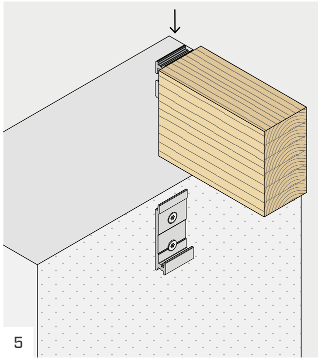
EXPOSED INSTALLATION WITH LOCK STOP

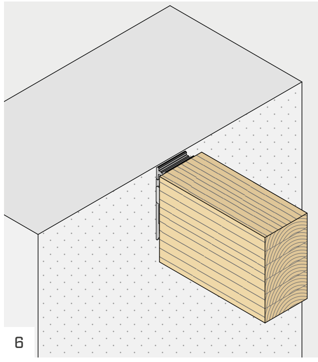


Place the connector on concrete and fasten the anchors according to the installation instructions.



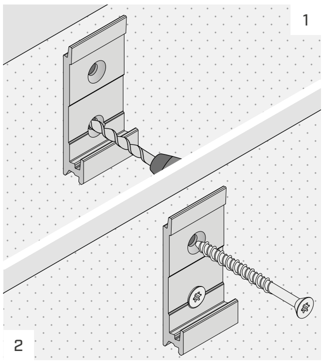
Place the connector on the wooden beam and fasten the first screws. When using LOCK STOP (optional) position LOCK STOP and fasten the remaining screws.



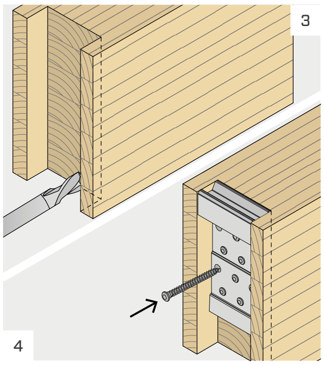


Hook the beam fitting it from the top to the bottom.

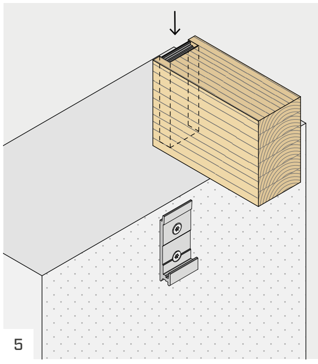
SEMI-CONCEALED INSTALLATION

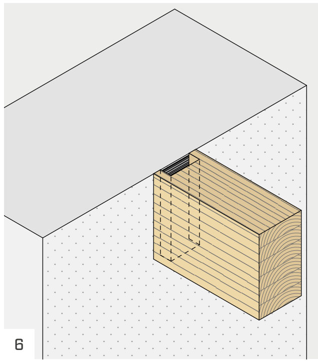


Place the connector on concrete and fasten the anchors according to the installation instructions.



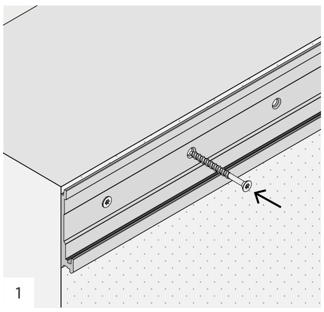
Perform full grooving on the secondary beam. Position the connector and fasten all screws.



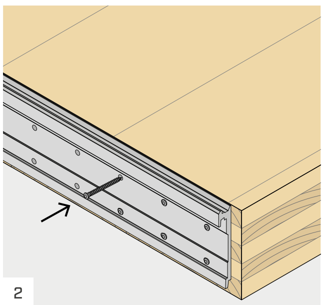


Hook the beam fitting it from the top to the bottom.

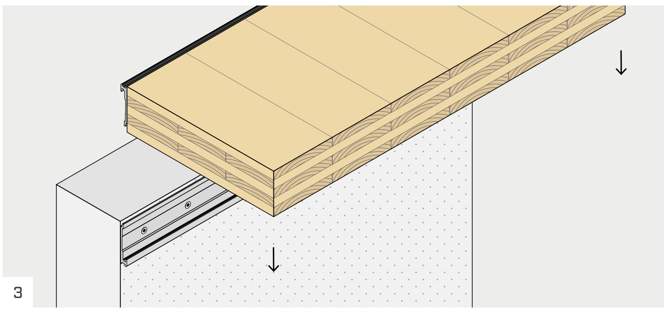
LOCK T FLOOR INSTALLATION



Place the connector on concrete and fasten the anchors according to the installation instructions.



Place the connector on the floor and fasten all screws.



Hook the beam fitting it from the top to the bottom.

STATIC VALUES

LOCK C Ø5

LOCK C CONNECTOR		TIMBER				ALUMINIUM	CONCRETE UNCRACKED	
type	B x H x s [mm]	LBS screws n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] C24(2)	GL24h(3)	LVL(4)	$R_{v,alu,k}$ [kN]	SKS-E anchors n_C - ØxL [mm]	$R_{v,concrete,d}$ [kN]
LOCKC53120	52,5 x 120 x 20	12 - Ø5x50	13,96	15,22	15,50	30,0	2 - Ø8x100	12,10
		12 - Ø5x70	17,15	17,99	17,92			

LOCK C Ø7

LOCK C CONNECTOR		TIMBER				ALUMINIUM	CONCRETE UNCRACKED	
type	B x H x s [mm]	LBS screws n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] C24(2)	GL24h(3)	LVL(4)	$R_{v,alu,k}$ [kN]	SKS-E anchors n_C - ØxL [mm]	$R_{v,concrete,d}$ [kN]
LOCKC75175	75 x 175 x 22	12 - Ø7x80	30,75	32,72	31,80	60,0	2 - Ø10x100	20,80
LOCKC100215	100 x 215 x 22	24 - Ø7x80	61,51	65,43	63,60	80,0	4 - Ø10x100	35,50

LOCK C FLOOR FOR CLT

LOCK C FLOOR CONNECTOR		TIMBER		ALUMINIUM	CONCRETE UNCRACKED	
type	B x H x s [mm]	LBS screws n_j - ØxL [mm]	$R_{v,timber,k}$ [kN] CLT(5)	$R_{v,alu,k}$ [kN]	SKS-E anchors n_C - ØxL [mm]	$R_{v,concrete,d}$ [kN]
LOCKCFLOOR135	300 x 135 x 22	8 - Ø7x80	20,40	240,0	2 - Ø10x100	24,60
LOCKCFLOOR135	600 x 135 x 22	16 - Ø7x80	40,79	480,0	4 - Ø10x100	47,90
LOCKCFLOOR135	900 x 135 x 22	24 - Ø7x80	61,19	720,0	6 - Ø10x100	71,10
LOCKCFLOOR135	1200 x 135 x 22	32 - Ø7x80	81,59	960,0	8 - Ø10x100	94,30

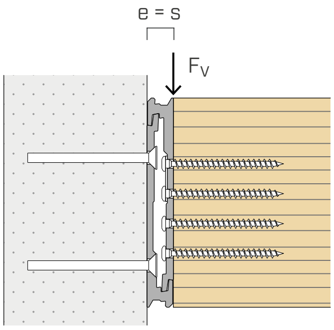
STATIC VALUES

DIMENSIONING OF ALTERNATIVE ANCHORS

For fastening by means of anchors other than those listed in the table, the calculation of the fasteners on concrete can be carried out with reference to the anchor ETA, following the diagram shown aside.

In the same way, for fastening on steel using countersunk head bolts, the calculation of the fasteners on steel can be carried out with reference to the regulations in force for the calculation of bolts in steel structures, following the diagram shown aside.

The group of anchors shall be tested for shear force and bending moment respectively equal to:



$$V_d = F_{v,d}$$

$$M_d = e \cdot F_{v,d}$$

CONNECTION STIFFNESS

The sliding module can be calculated according to ETA-19/0831, with the following expression:

$$K_{v,ser} = \frac{n \cdot \rho_m^{1,5} \cdot d^{0,8}}{30} \quad \frac{kN}{mm}$$

where:

- d is the diameter of the screw thread in the secondary beam, in mm;
- ρ_m is the average density of the secondary beam, in kg/m^3;
- n is the number of screws in the secondary beam.

NOTES:

(2) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=350 kg/m^3 has been taken in consideration in the calculation.

(3) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=385 kg/m^3 has been taken in consideration in the calculation.

(4) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws with pre-drilling hole. ρ_k=480 kg/m^3 has been taken in consideration in the calculation.

(5) Values calculated according to ETA-19/0831, ETA-11/0030 and EN 1995-1-1 for screws without pre-drilling hole. The strength value can be accepted as valid, for higher safety standards, even in the presence of pre-drill. ρ_k=350 kg/m^3 has been taken in consideration in the calculation.

GENERAL PRINCIPLES:

- The design values are obtained from the characteristic values as follows:
- The coefficient γ_{M2} is the partial coefficient for aluminium sections subject to tension, to be taken according to the current regulations used for the calculation. If there are no other provisions, it is suggested to use the value provided by EN 1999-1-1, equal to γ_{M2}=1.25.
- The coefficient γ_M the relevant safety coefficient, on the timber connection side, to be taken according to the current regulations used for the calculation.
- The design strength is obtained from the characteristic values as follows:

$$R_{v,d} = min \begin{cases} R_{v,timber,d} = \dfrac{R_{v,timber,k} \cdot k_{mod}}{\gamma_M} \\ R_{v,alu,d} = \dfrac{R_{v,alu,k}}{\gamma_{M2}} \\ R_{v,concrete,d} \end{cases}$$

- Dimensioning and verification of the timber beam must be carried out separately. In particular, for loads perpendicular to the beam axis, it is recommended to perform a splitting check.
- Screws with same length must be used in all the holes, with a total connector fastening , using all the holes.
- The pre-drill is not required for screws on beam, with characteristic density $\rho_k \leq$420 kg/m^3. The pre-drill is mandatory on beams with characteristic density ρ_k> 420 kg/m^3.
- For the LOCKTFLOOR135 connector installed on CLT panels no pre-drilling hole is required.
- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used. The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from those in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side strength must be calculated separately (see the DIMENSIONING OF ALTERNATIVE ANCHORS section).

UV-T TIMBER

VIDEO

ETA

CONCEALED HOOK TIMBER-TO-TIMBER CONNECTOR

COMPLETE RANGE
Available in five versions, to adapt to the secondary beam and the applied load. Strength over 60 kN.

DISASSEMBLED
The hanging system is quick to install and can be easily removed; ideal for the construction of temporary structures.

WIND AND EARTHQUAKE
Certified strengths in all load directions, for safe fastening even under lateral, axial and lifting forces.

CHARACTERISTICS

FOCUS	joints that can be disassembled
TIMBER SECTIONS	from 45 x 100 mm to 240 x 520 mm
STRENGTH	$R_{v,k}$ up to 63 kN
FASTENERS	LBS, HBS, VGS

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Timber to timber shear joints and applications requiring strength in all directions
- solid timber and glulam
- CLT, LVL

ALL DIRECTIONS

The inclined screws fixed in the secondary beam guarantee strength in all directions: vertical, horizontal and axial. The joint is safe even in the presence of wind and earthquake forces.

FAST ASSEMBLY

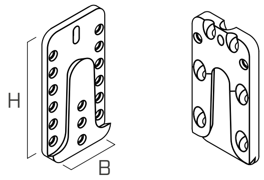
The installation is intuitive, simple and fast. The locking screw prevents pull-out, guaranteeing also strength in the direction opposite to insertion.

CODES AND DIMENSIONS

UV-T

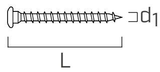
CODE	B	H	s	Ø90°	Ø45°	pcs
	[mm]	[mm]	[mm]	[mm]	[mm]	
UVT3070	30	70	16	5	4	25
UVT4085	40	85	16	5	6	25
UVT60115	60	115	16	5	6	25
UVT60160	60	160	16	5	6	10
UVT60215	60	215	16	5	6	10

Screws not included in the box.



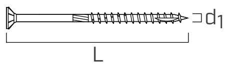
LBS: 90° screw

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
LBS550	5	50	46	TX20	200
LBS560	5	60	56	TX20	200
LBS570	5	70	66	TX20	200



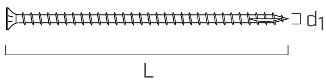
HBS: 45° screw for UVT3070

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
HBS450	4	50	30	TX20	400
HBS470	4	70	40	TX20	200



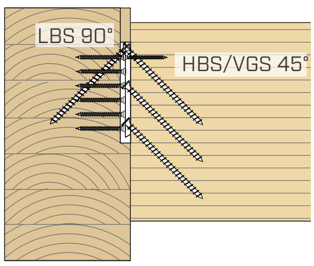
VGS: 45° screw for UVT4085 / UVT60115 / UVT60160 / UVT60215

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
VGS6100	6	100	88	TX30	100
VGS6160	6	160	148	TX30	100



FASTENERS

	MAXIMUM NUMBER OF FASTENERS FOR EACH CONNECTOR (full nailing)	
CODE	$n_{90°}$	$n_{45°}$
	[pcs - Ø]	[pcs - Ø]
UVT3070	8 - LBS Ø5	6 (+1) - HBS Ø4
UVT4085	11 - LBS Ø5	4 (+1) - VGS Ø6
UVT60115	17 - LBS Ø5	6 (+1) - VGS Ø6
UVT60160	25 - LBS Ø5	6 (+1) - VGS Ø6
UVT60215	34 - LBS Ø5	8 (+1) - VGS Ø6



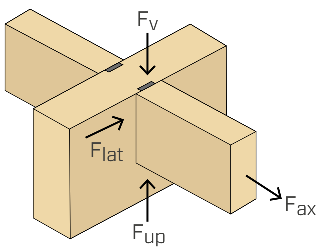
MATERIAL AND DURABILITY

UV: aluminium alloy
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELDS OF USE

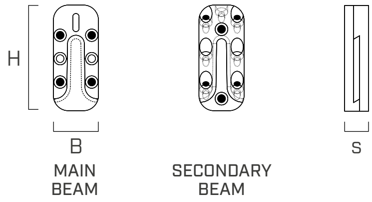
- Timber-to-timber joints
- Secondary beam on main beam or on column

EXTERNAL LOADS



UVT3070

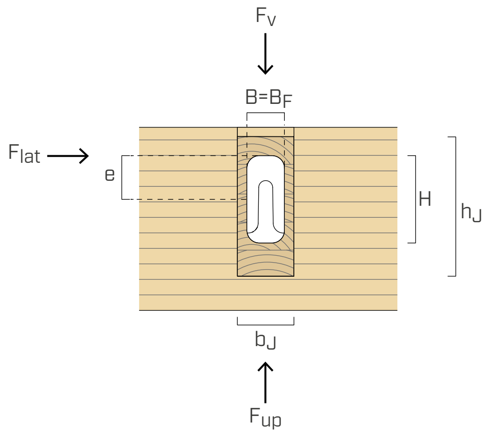
TIMBER ELEMENTS MINIMUM DIMENSIONS

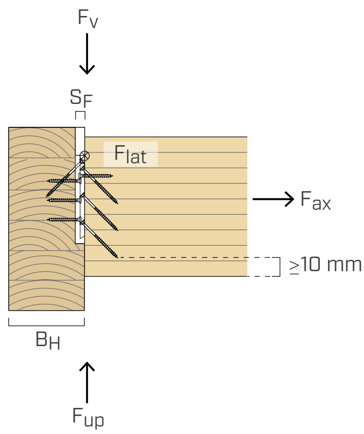


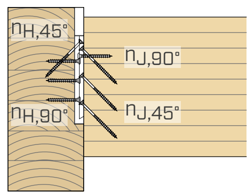
UV CONNECTOR		45° SCREWS TYPE	MAIN BEAM			SECONDARY BEAM[1]	
				grooving			
type	**B x H x s** [mm]	**Ø x L** [mm]	$B_{H,min}$ [mm]	B_F [mm]	S_F [mm]	$b_{J,min}$ [mm]	$h_{J,min}$ [mm]
UVT3070	30 x 70 x 16	HBS Ø4 x 50	45	30	16	45	100
		HBS Ø4 x 70	60			45	115

FASTENERS

			MAIN BEAM		SECONDARY BEAM	
type	**nailing**		$n_{H,90°}$ [pcs - Ø]	$n_{H,45°}$[3] [pcs - Ø]	$n_{J,90°}$ [pcs - Ø]	$n_{J,45°}$ [pcs - Ø]
UVT3070	total	● + ○	6 - LBS Ø5	1 - HBS Ø4	2 - LBS Ø5	6 - HBS Ø4
	partial[2]	●	4 - LBS Ø5	1 - HBS Ø4	2 - LBS Ø5	4 - HBS Ø4





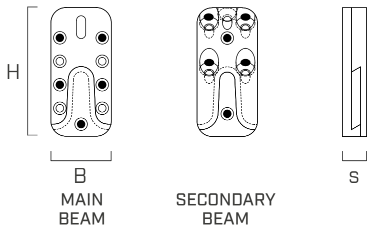


STATIC CHARACTERISTIC VALUES | TIMBER-TO-TIMBER JOINT

			FULL NAILING ● + ○		PARTIAL NAILING ●	
			45° screws type		**45° screws type**	
			HBS Ø4 x 50 [kN]	**HBS Ø4 x 70** [kN]	**HBS Ø4 x 50** [kN]	**HBS Ø4 x 70** [kN]
90° screws type	**LBS Ø5 x 50**	$R_{ax,k}$	**1,45**	**1,45**	1,45	1,45
		$R_{v,k}$	**6,77**	**9,03**	4,51	6,02
		$R_{up,k}$	**1,13**	**1,50**	1,13	1,50
		$R_{lat,k}$	**1,72**	**1,81**	1,49	1,57
	LBS Ø5 x 60	$R_{ax,k}$	**1,76**	**1,76**	1,76	1,76
		$R_{v,k}$	**6,77**	**9,03**	4,51	6,02
		$R_{up,k}$	**1,13**	**1,50**	1,13	1,50
		$R_{lat,k}$	**1,72**	**1,81**	1,49	1,57
	LBS Ø5 x 70	$R_{ax,k}$	**2,08**	**2,08**	2,08	2,08
		$R_{v,k}$	**6,77**	**9,03**	4,51	6,02
		$R_{up,k}$	**1,13**	**1,50**	1,13	1,50
		$R_{lat,k}$	**1,72**	**1,81**	1,49	1,57

UVT4085

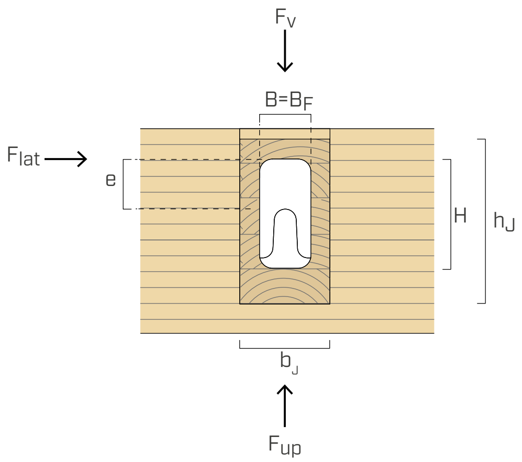
TIMBER ELEMENTS MINIMUM DIMENSIONS

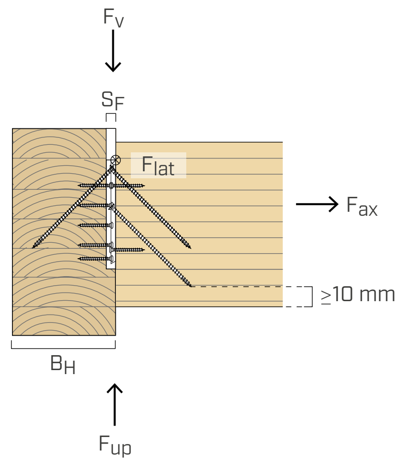


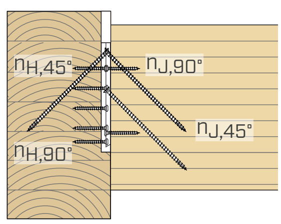
UV CONNECTOR		45° SCREWS TYPE	MAIN BEAM			SECONDARY BEAM[1]	
				grooving			
type	B x H x s	Ø x L	$B_{H,min}$	B_F	S_F	$b_{J,min}$	$h_{J,min}$
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
UVT4085	40 x 85 x 16	VGS Ø6 x 100	80	40	16	70	120
		VGS Ø6 x 160	120			70	160

FASTENERS

			MAIN BEAM		SECONDARY BEAM	
type	nailing		$n_{H,90°}$	$n_{H,45°}$[(3)]	$n_{J,90°}$	$n_{J,45°}$
			[pcs - Ø]	[pcs - Ø]	[pcs - Ø]	[pcs - Ø]
UVT4085	total	● + ○	9 - LBS Ø5	1 - VGS Ø6	2 - LBS Ø5	4 - VGS Ø6
	partial[(2)]	●	5 - LBS Ø5	1 - VGS Ø6	2 - LBS Ø5	4 - VGS Ø6





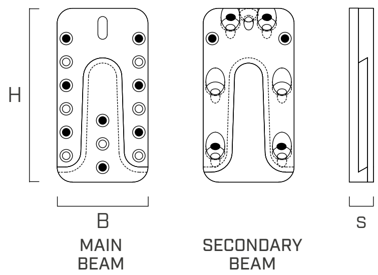


STATIC CHARACTERISTIC VALUES | TIMBER-TO-TIMBER JOINT

			FULL NAILING ● + ○		PARTIAL NAILING ●	
			45° screws type		45° screws type	
			VGS Ø6 x 100	VGS Ø6 x 160	VGS Ø6 x 100	VGS Ø6 x 160
			[kN]	[kN]	[kN]	[kN]
90° screws type	LBS Ø5 x 50	$R_{ax,k}$	**1,45**	**1,45**	1,45	1,45
		$R_{v,k}$	**18,67**	**19,22**	10,68	10,68
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**1,50**	**1,50**	1,50	1,50
	LBS Ø5 x 60	$R_{ax,k}$	**1,76**	**1,76**	1,76	1,76
		$R_{v,k}$	**18,67**	**20,40**	11,33	11,33
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**1,57**	**1,57**	1,57	1,57
	LBS Ø5 x 70	$R_{ax,k}$	**2,08**	**2,08**	2,08	2,08
		$R_{v,k}$	**18,67**	**21,58**	11,99	11,99
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**1,64**	**1,64**	1,64	1,57

UVT60115

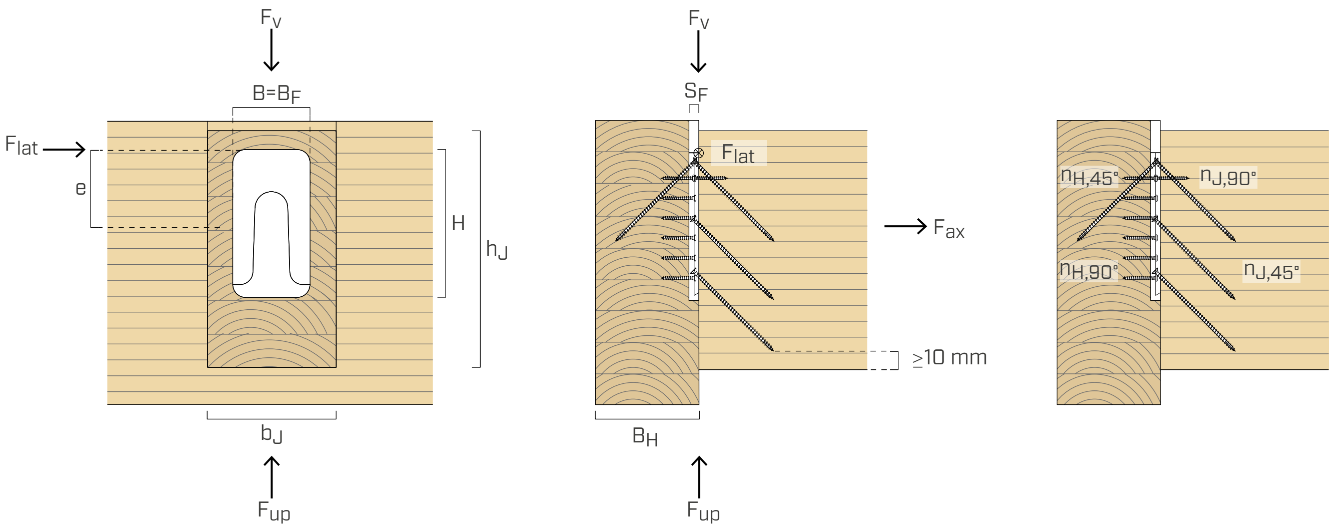
TIMBER ELEMENTS MINIMUM DIMENSIONS



UV CONNECTOR		45° SCREWS TYPE	MAIN BEAM			SECONDARY BEAM[1]	
				grooving			
type	B x H x s [mm]	Ø x L [mm]	$B_{H,min}$ [mm]	B_F [mm]	S_F [mm]	$b_{J,min}$ [mm]	$h_{J,min}$ [mm]
UVT60115	60 x 115 x 16	VGS Ø6 x 100	80	60	16	80	180
		VGS Ø6 x 160	120			80	220

FASTENERS

			MAIN BEAM		SECONDARY BEAM	
type	nailing		$n_{H,90°}$ [pcs - Ø]	$n_{H,45°}$[3] [pcs - Ø]	$n_{J,90°}$ [pcs - Ø]	$n_{J,45°}$ [pcs - Ø]
UVT60115	total	● + ○	15 - LBS Ø5	1 - VGS Ø6	2 - LBS Ø5	6 - VGS Ø6
	partial[2]	●	8 - LBS Ø5	1 - VGS Ø6	2 - LBS Ø5	4 - VGS Ø6

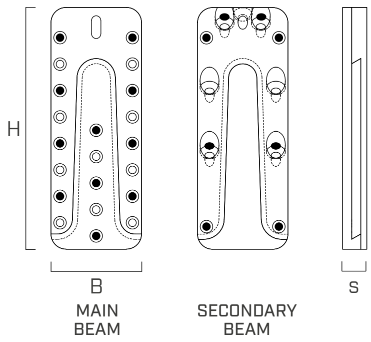


STATIC CHARACTERISTIC VALUES | TIMBER-TO-TIMBER JOINT

			FULL NAILING ● + ○		PARTIAL NAILING ●	
			45° screws type		45° screws type	
			VGS Ø6 x 100 [kN]	VGS Ø6 x 160 [kN]	VGS Ø6 x 100 [kN]	VGS Ø6 x 160 [kN]
90° screws type	LBS Ø5 x 50	$R_{ax,k}$	**1,45**	**1,45**	1,45	1,45
		$R_{v,k}$	**28,00**	**32,03**	17,08	17,08
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**2,59**	**2,59**	2,18	2,18
	LBS Ø5 x 60	$R_{ax,k}$	**1,76**	**1,76**	1,76	1,76
		$R_{v,k}$	**28,00**	**34,00**	18,13	18,13
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**2,70**	**2,70**	2,28	2,28
	LBS Ø5 x 70	$R_{ax,k}$	**2,08**	**2,08**	2,08	2,08
		$R_{v,k}$	**28,00**	**35,97**	18,67	19,18
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**2,82**	**2,82**	2,38	2,38

UVT60160

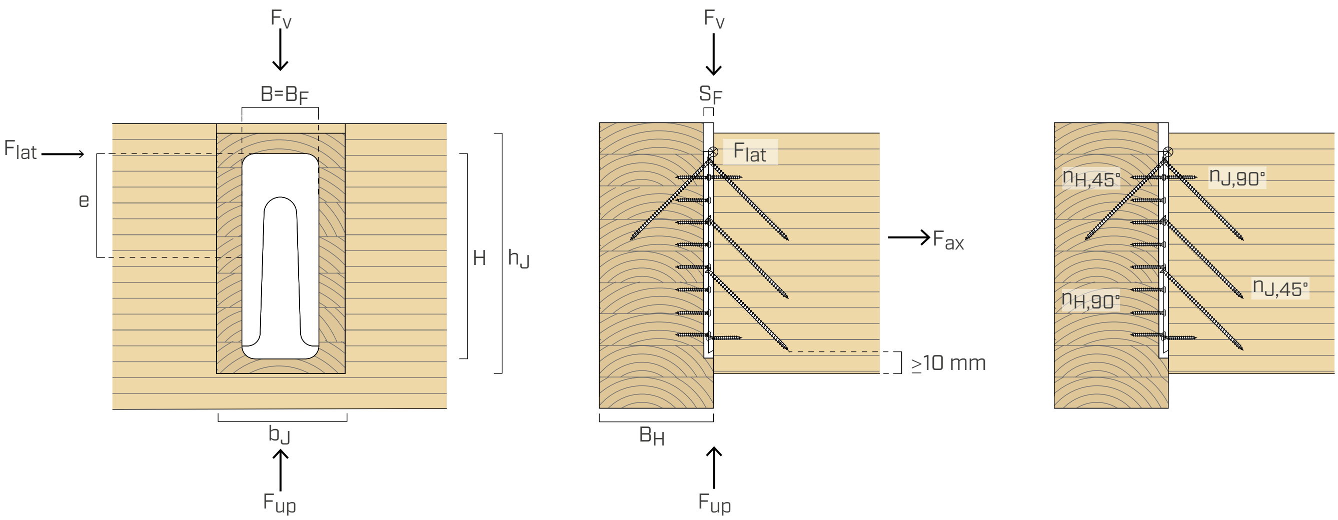
TIMBER ELEMENTS MINIMUM DIMENSIONS



UV CONNECTOR		45° SCREWS TYPE	MAIN BEAM			SECONDARY BEAM[1]	
				grooving			
type	B x H x s [mm]	Ø x L [mm]	$B_{H,min}$ [mm]	B_F [mm]	S_F [mm]	$b_{J,min}$ [mm]	$h_{J,min}$ [mm]
UVT60160	60 x 160 x 16	VGS Ø6 x 100	80	60	16	100	180
		VGS Ø6 x 160	120			100	220

FASTENERS

type	nailing		MAIN BEAM		SECONDARY BEAM	
			$n_{H,90°}$ [pcs - Ø]	$n_{H,45°}$ (3) [pcs - Ø]	$n_{J,90°}$ [pcs - Ø]	$n_{J,45°}$ [pcs - Ø]
UVT60160	total	● + ○	21 - LBS Ø5	1 - VGS Ø6	4 - LBS Ø5	6 - VGS Ø6
	partial(2)	●	11 - LBS Ø5	1 - VGS Ø6	4 - LBS Ø5	4 - VGS Ø6

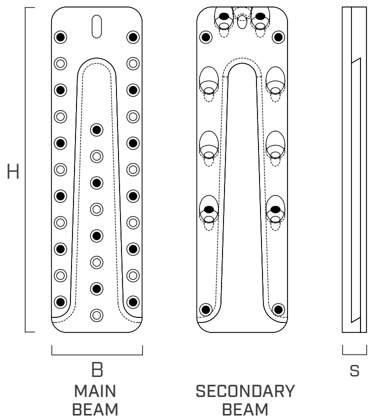


STATIC CHARACTERISTIC VALUES | TIMBER-TO-TIMBER JOINT

			FULL NAILING ● + ○		PARTIAL NAILING ●	
			45° screws type		45° screws type	
			VGS Ø6 x 100 [kN]	VGS Ø6 x 160 [kN]	VGS Ø6 x 100 [kN]	VGS Ø6 x 160 [kN]
90° screws type	LBS Ø5 x 50	$R_{ax,k}$	**2,90**	**2,90**	2,90	2,90
		$R_{v,k}$	**28,00**	**44,85**	18,67	23,49
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**3,01**	**3,01**	2,71	2,71
	LBS Ø5 x 60	$R_{ax,k}$	**3,53**	**3,53**	3,53	3,53
		$R_{v,k}$	**28,00**	**47,09**	18,67	24,93
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**3,15**	**3,15**	2,83	2,83
	LBS Ø5 x 70	$R_{ax,k}$	**4,16**	**4,16**	4,16	4,16
		$R_{v,k}$	**28,00**	**47,09**	18,67	26,38
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**3,28**	**3,28**	2,95	2,95

UVT60215

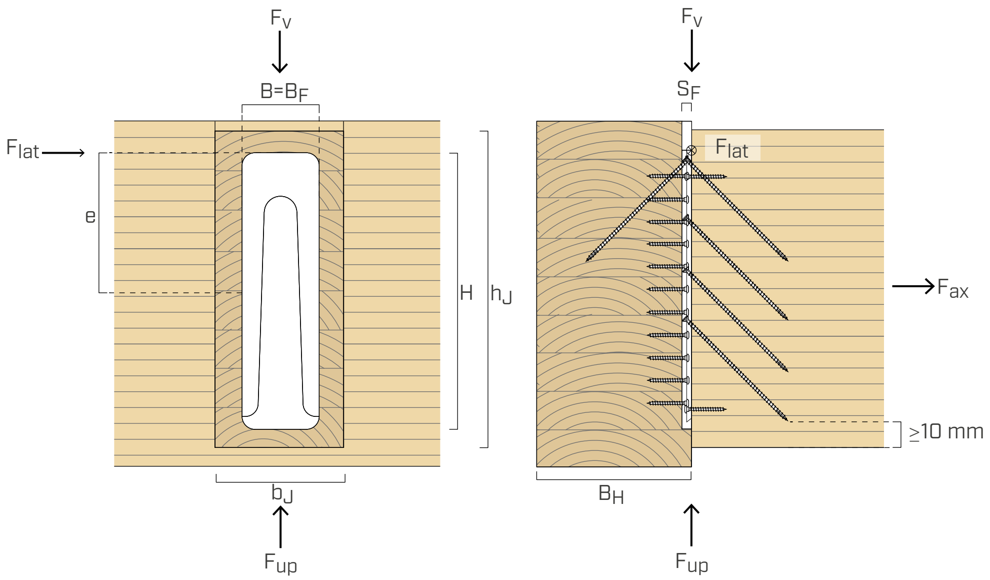
TIMBER ELEMENTS MINIMUM DIMENSIONS



UV CONNECTOR		45° SCREWS TYPE	MAIN BEAM			SECONDARY BEAM[1]	
				grooving			
type	B x H x s [mm]	Ø x L [mm]	$B_{H,min}$ [mm]	B_F [mm]	S_F [mm]	$b_{J,min}$ [mm]	$h_{J,min}$ [mm]
UVT60215	60 x 215 x 16	VGS Ø6 x 100	80	60	16	100	220
		VGS Ø6 x 160	120			100	260

FASTENERS

			MAIN BEAM		SECONDARY BEAM	
type	nailing		$n_{H,90°}$ [pcs - Ø]	$n_{H,45°}$[3] [pcs - Ø]	$n_{J,90°}$ [pcs - Ø]	$n_{J,45°}$ [pcs - Ø]
UVT60215	total	● + ○	30 - LBS Ø5	1 - VGS Ø6	4 - LBS Ø5	8 - VGS Ø6
	partial[2]	●	16 - LBS Ø5	1 - VGS Ø6	4 - LBS Ø5	4 - VGS Ø6



STATIC CHARACTERISTIC VALUES | TIMBER-TO-TIMBER JOINT

			FULL NAILING ● + ○		PARTIAL NAILING ●	
			45° screws type		45° screws type	
			VGS Ø6 x 100 [kN]	VGS Ø6 x 160 [kN]	VGS Ø6 x 100 [kN]	VGS Ø6 x 160 [kN]
90° screws type	**LBS Ø5 x 50**	$R_{ax,k}$	**2,90**	**2,90**	2,90	2,90
		$R_{v,k}$	**37,34**	**62,79**	18,67	31,40
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**3,37**	**3,37**	2,78	2,78
	LBS Ø5 x 60	$R_{ax,k}$	**3,53**	**3,53**	3,53	3,53
		$R_{v,k}$	**37,34**	**62,79**	18,67	31,40
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**3,53**	**3,53**	2,90	2,90
	LBS Ø5 x 70	$R_{ax,k}$	**4,16**	**4,16**	4,16	4,16
		$R_{v,k}$	**37,34**	**62,79**	18,67	31,40
		$R_{up,k}$	**4,67**	**7,85**	4,67	7,85
		$R_{lat,k}$	**3,68**	**3,68**	3,03	3,03

NOTES:

(1) The minimum dimensions of the wooden elements vary when the stress direction varies and must be checked from time to time. The table shows the minimum dimensions in order to guide the designer in the choice of the connector. Dimensioning and verification of the timber elements must be carried out separately.

(2) Partial nailing must be carried out according to the installation diagrams shown in the figure and in accordance with ETA.

(3) In case of F_v or F_{up} stress, an additional inclined screw is required in the main beam to be inserted after installing the connector.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with the product ETA.

  The design values are obtained from the characteristic values as follows:

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

  Coefficients γ_M and k_{mod} must be taken according to the current regulations.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.
- In case of combined loading the following verification shall be satisfied:

  $$\left(\frac{F_{ax,d}}{R_{ax,d}} + \frac{F_{v/up,d}}{R_{v/up,d}}\right)^2 + \left(\frac{F_{lat,d}}{R_{lat,d}}\right)^2 \leq 1$$

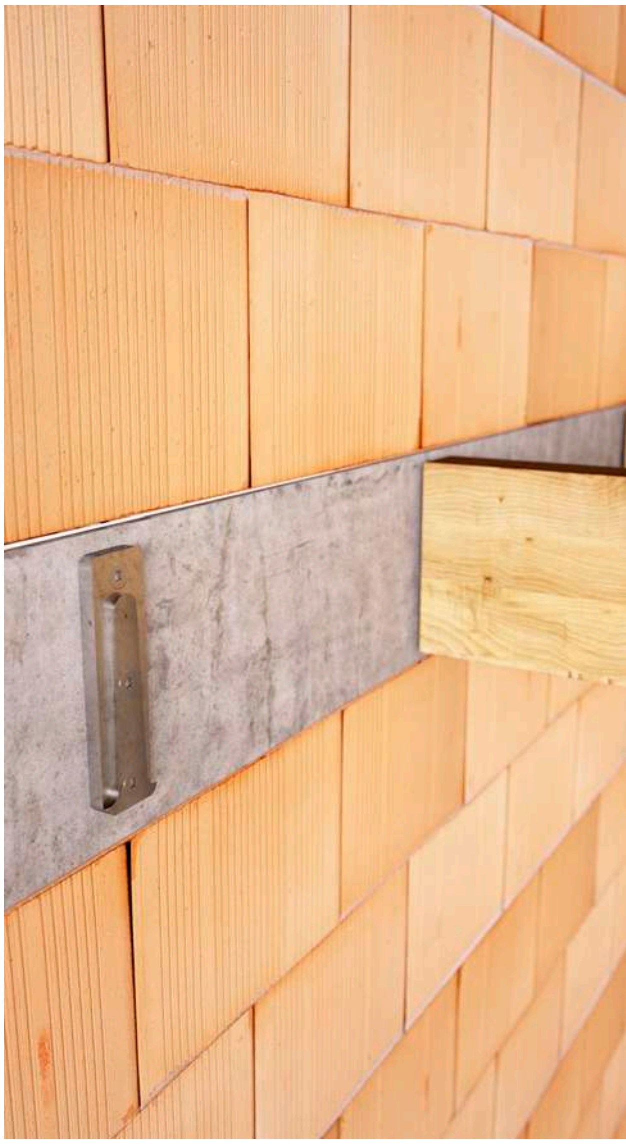
- Fastening nailing for beam applications or partial nailing for column applications is possible. On the secondary beam side, inclined screws must always be inserted in the upper two holes and the two lower holes.
- Lateral stress F_{lat} is assumed to act at a distance e = H/2 from the center of the connector. For different values of "e" it is possible to calculate the strength values according to ETA.
- It is assumed that the main beam is prevented from rotating. If the UV connector is installed on only one side of the beam, it must be considered a moment caused by eccentricity $M_v = F_d$. (B_H /2 . 14 mm). This applies in the case of connection on both sides of the main beam when the difference between the acting stresses is > 20%.

UV-C CONCRETE

CONCEALED HOOK TIMBER-TO-CONCRETE CONNECTOR

VIDEO

ETA



TIMBER AND CONCRETE
Calculated and certified joint for fastening secondary beams to concrete supports (beams or columns); also certified for steel supports.

DISASSEMBLED
The hanging system is quick to install and can be easily removed; ideal for the construction of temporary structures.

LOCKING SYSTEM
The additional locking screws included in the package guarantee strength for bottom-to-up forces.

CHARACTERISTICS

FOCUS	joints that can be disassembled
TIMBER SECTIONS	from 80 x 180 mm to 240 x 440 mm
STRENGTH	$R_{v,k}$ up to 63 kN
FASTENERS	LBS, VGS, SKS-E

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

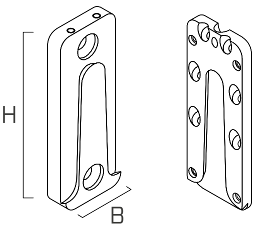
FIELDS OF USE
Timber-to-concrete shear joints and applications requiring strength in all directions
- solid timber and glulam
- CLT, LVL

CODES AND DIMENSIONS

UV-C

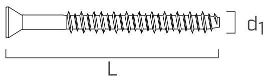
CODE	B [mm]	H [mm]	s [mm]	$Ø_{concrete}$ [mm]	$Ø_{90°}$ [mm]	$Ø_{45°}$ [mm]	pcs
UVC60115	60	115	24	12	5	6	10
UVC60160	60	160	24	12	5	6	10
UVC60215	60	215	24	12	5	6	10

Fasteners not included in the package.



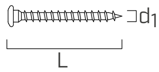
SKS-E: screw anchor with countersunk head

CODE	d_1 [mm]	L [mm]	d_0 [mm]	T_{inst} [Nm]	TX	pcs
SKS10100CE	10	100	8	50	TX40	50



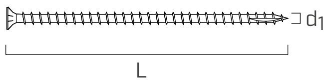
LBS: 90° screw

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
LBS550	5	50	46	TX20	200
LBS560	5	60	56	TX20	200
LBS570	5	70	66	TX20	200



VGS: 45° screw

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
VGS6100	6	100	88	TX30	100
VGS6160	6	160	148	TX30	100



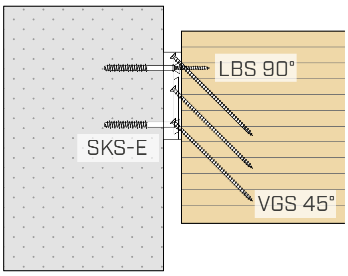
MATERIAL AND DURABILITY

UV: aluminium alloy
To be used in service classes 1 and 2 (EN 1995-1-1).

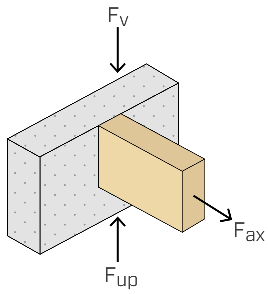
FIELD OF USE

- Timber to concrete joints

FASTENERS



EXTERNAL LOADS

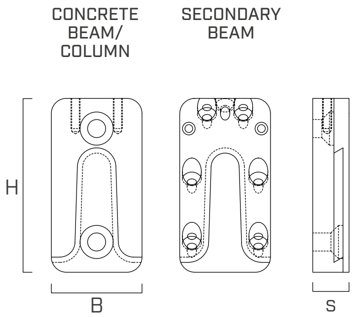


FAST FASTENING

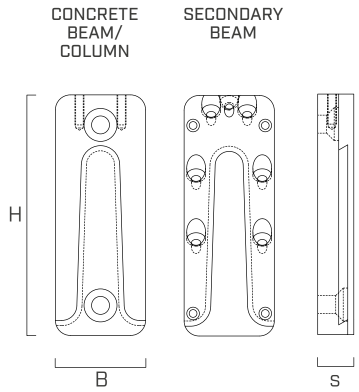
Installation on concrete is facilitated by the use of SKS-E screw anchors to be installed dry quickly and easily. Values for application on concrete are calculated and available.

STATIC VALUES | TIMBER-TO-CONCRETE JOINT

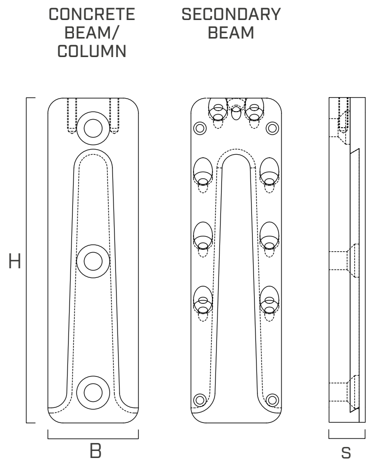
UVC60115



UVC60160



UVC60215

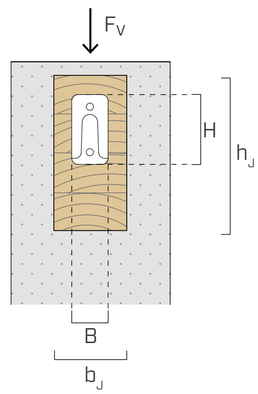


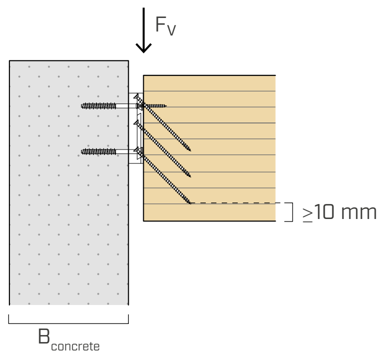
FASTENERS

UV-C CONNECTOR			CONCRETE BEAM/COLUMN	SECONDARY BEAM TIMBER	
	B x H x s	nailing / dowelling	$n_{H,90°}$	$n_{J,90°}$	$n_{J,45°}$
	[mm]		[pcs - Ø]	[pcs - Ø]	[pcs - Ø]
UVC60115	60 x 115 x 24	nailing	2 - SKS-E Ø10	2 - LBS Ø5	6 - VGS Ø6
UVC60160	60 x 160 x 24	nailing	2 - SKS-E Ø10	4 - LBS Ø5	6 - VGS Ø6
UVC60215	60 x 215 x 24	nailing	3 - SKS-E Ø10	4 - LBS Ø5	8 - VGS Ø6

If it is necessary to prevent the connector from being pulled upwards (e.g. F_{up} stress), two additional M6 x 20 screws are provided. The screws and washers are included in the package.

TIMBER-TO-CONCRETE JOINT



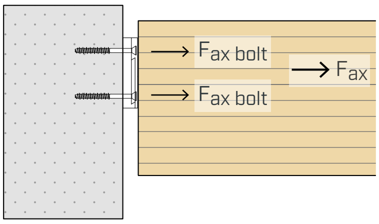


	SECONDARY BEAM TIMBER[2]		$R_{V,k}$ TIMBER			$R_{V,d}$ UNCRACKED CONCRETE	
type	$b_{J,min}$	$h_{J,min}$	holes fastening Ø5[1]	holes fastening Ø6[1]	$R_{v,k\ timber}$	holes fastening Ø12	$R_{v,d\ concrete}$
	[mm]	[mm]	Ø x L [mm]	Ø x L [mm]	[kN]	Ø x L [mm]	[kN]
UVC60115	80	180	LBS Ø5 x 50	VGS Ø6 x 100	**28,00**	SKS-E Ø10 x 100	**12,70**
UVC60160	100	180	LBS Ø5 x 50	VGS Ø6 x 100	**28,00**	SKS-E Ø10 x 100	**17,20**
UVC60215	100	220	LBS Ø5 x 50	VGS Ø6 x 100	**37,34**	SKS-E Ø10 x 100	**21,30**

DIMENSIONING OF ALTERNATIVE ANCHORS

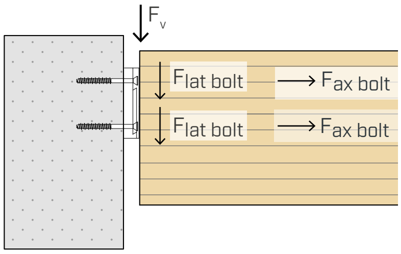
Fastening to the concrete through anchors not listed in the table, shall be verified according to the F_{bolt} forces stressing the anchors, which can be determined by means of the k_t coefficients.

TENSILE STRESS F_{ax}



$$F_{ax\ bolt,d} = \frac{F_{ax,d}}{n_{bolt}}$$

VERTICAL SHEAR STRESS F_V



$$F_{lat\ bolt,d} = k_{t\perp} \cdot F_{v,d}$$
$$F_{ax\ bolt,d} = k_{t//} \cdot F_{v,d}$$

	n_{bolt}	$k_{t\perp}$	$k_{t//}$
UVC60115	2	0,50	0,299
UVC60160	2	0,50	0,192
UVC60215	3	0,33	0,106

The anchor check is satisfied if the design strength, calculated considering the group effects and the UV-C connector geometry, is greater than the design stress:

$$R_{bolt,d} \geq F_{bolt,d}$$

NOTES:

(1) The use of LBS and VGS screws of longer lengths than listed in the table is permitted without affecting the overall strength of the connection (failure on concrete side). In this case the installation parameters must be reassessed (secondary wooden beam).

(2) The minimum dimensions of the wooden elements vary when the stress direction varies and must be checked from time to time. The table shows the minimum dimensions in order to guide the designer in the choice of the connector. Dimensioning and verification of the timber elements must be carried out separately.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with the product ETA. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{v,k\ timber} \cdot k_{mod}}{\gamma_M} \\ R_{v,d\ concrete} \end{cases}$$

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 350 kg/m^3 and a strength class of C25/30 concrete with thin reinforcement, minimum $B_{concrete}$ thickness of 120 mm without distance from the edge.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- The strength values are valid under the calculation hypotheses listed in the table; for different boundary conditions (e.g. minimum edge distances) must be verified by the designer in charge.

DISC FLAT

REMOVABLE CONCEALED CONNECTOR

VIDEO

ETA 19/0706

COMBINED LOADS
Combined shear-tensile load bearing capacity due to tightening provided by the pass-through rod. CE mark according to ETA.

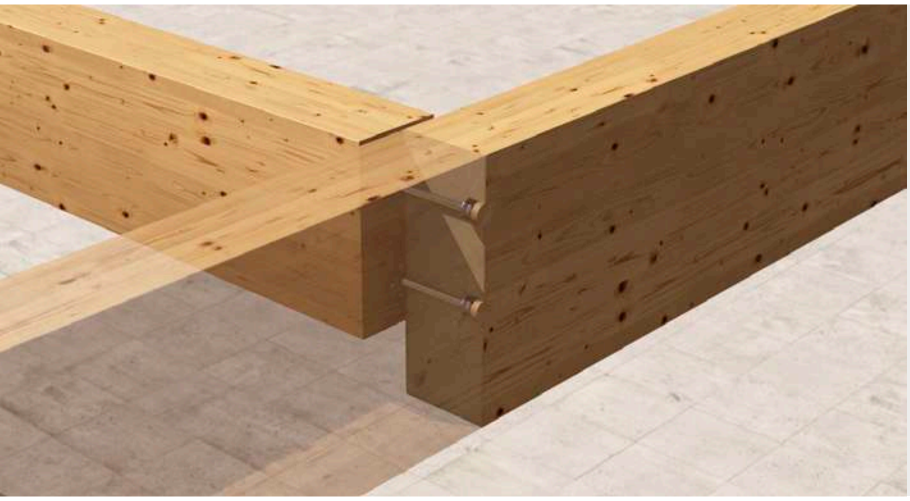
PRACTICAL
Simple to install thanks to the possibility of being tightened after the assembly. Fast and precise fastening thanks to LBS screws.

DISASSEMBLED
Usable for temporary structures, it can be easily removed thanks to the pass-through rod.

CHARACTERISTICS

FOCUS	universal joints
TIMBER SECTIONS	from 100 x 100 mm to 280 x 280 mm
STRENGTH	R_V over 60 kN, R_{ax} over 100 kN
FASTENERS	LBS, KOS

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



MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Timber-to-timber shear joints along all directions of the secondary beam
- solid timber and glulam
- CLT, LVL
- timber based panels

AESTHETICS

Completely concealed joint to ensure a pleasant aesthetic appearance.

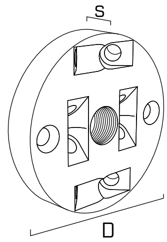
VERSATILITY

Usable in various applications, allowing to realize shear and tensile joints among the timber elements.

CODES AND DIMENSIONS

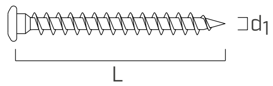
CODE	D [mm]	s [mm]	M [mm]	$n_{0°} + n_{45°}$	pcs
DISCF55	55	10	12	10	16
DISCF80	80	15	16	10	8
DISCF120	120	15	20	18	4

Screws not included in the box.



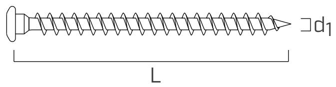
LBS for DISCF55

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
LBS550	5	50	46	TX20	200
LBS560	5	60	56	TX20	200
LBS570	5	70	66	TX20	200



LBS for DISCF80 and DISCF120

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
LBS760	7	60	55	TX30	100
LBS780	7	80	75	TX30	100
LBS7100	7	100	95	TX30	100



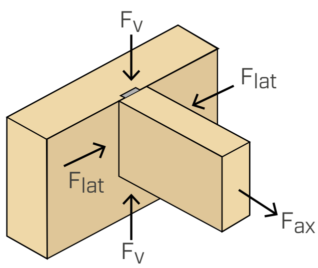
MATERIAL AND DURABILITY

DISC FLAT: bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

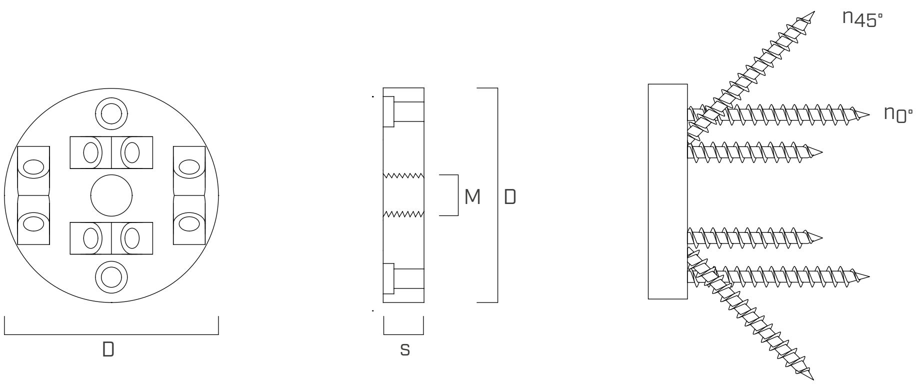
FIELDS OF USE

- Timber-to-timber joints between solid timber, glulam, LVL and CLT structural elements
- Timber-to-steel joints
- Timber to concrete joints

EXTERNAL LOADS



GEOMETRY



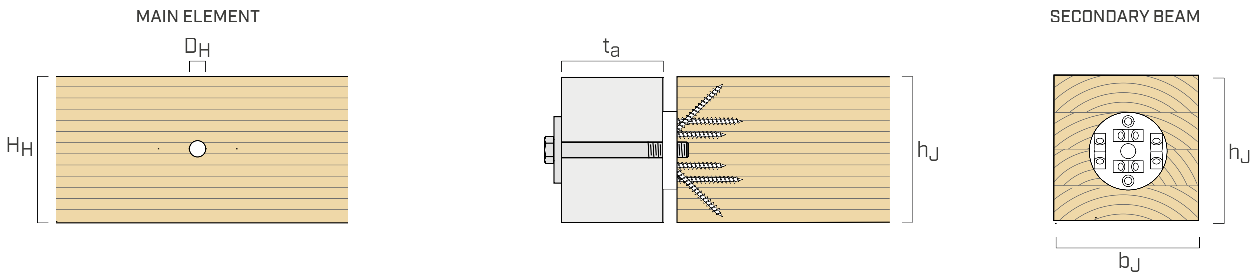
MINIMUM DIMENSIONS

DISC FLAT CONNECTOR	SCREWS	SECONDARY BEAM		MAIN ELEMENT			
	Ø x L	$b_{J,min}$	$h_{J,min}$	$H_{H,min}$*	D_H	S_F	D_F
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
DISCF55	LBS Ø5 x 50	100	100	110	13	11	56
	LBS Ø5 x 60	110	110	115			
	LBS Ø5 x 70	130	130	130			
DISCF80	LBS Ø7 x 60	120	120	150	17	16	81
	LBS Ø7 x 80	150	150	165			
	LBS Ø7 x 100	180	180	180			
DISCF120	LBS Ø7 x 80	160	160	200	21	16	121
	LBS Ø7 x 100	190	190	215			

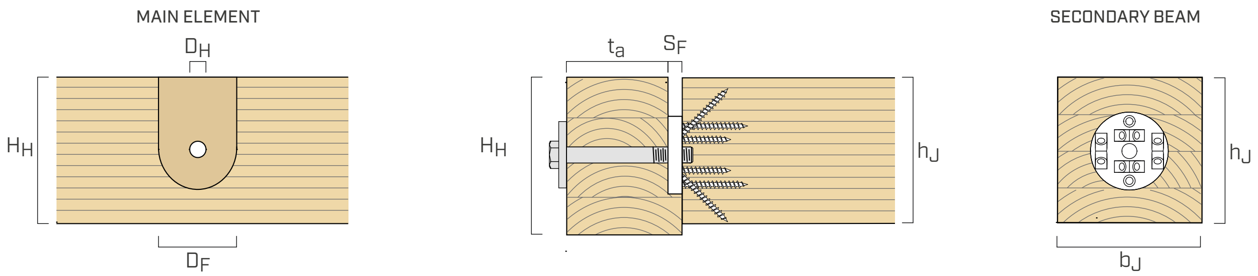
* $H_{H,min}$ is only valid in case of installation with grooving. For installation without grooving, the minimum bolt distances according to EN 1995-1-1 apply.

INSTALLATION

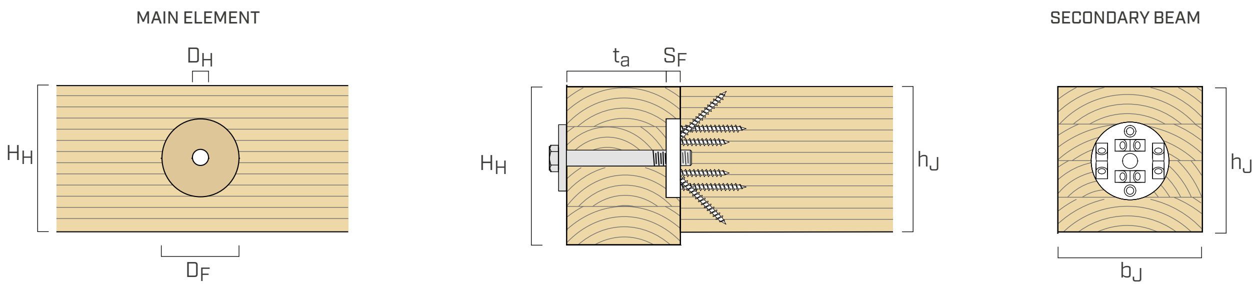
WITHOUT SLOT



WITH OPEN SLOT



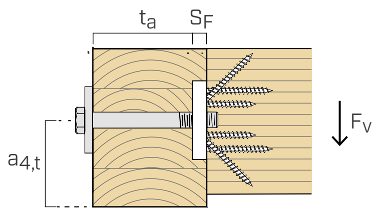
WITH ROUND SLOT



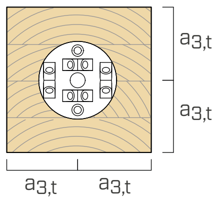
SPACING

connector	screws Ø x L [mm]	a_1 [mm]	$a_{3,t}$ [mm]	$a_{4,t}$ [mm]
DISCF55	LBS Ø5 x 50 LBS Ø5 x 60 LBS Ø5 x 70	90 105 120	50 55 65	60
DISCF80	LBS Ø7 x 60 LBS Ø7 x 80 LBS Ø7 x 100	110 140 170	60 75 90	90
DISCF120	LBS Ø7 x 80 LBS Ø7 x 100	150 180	80 95	120

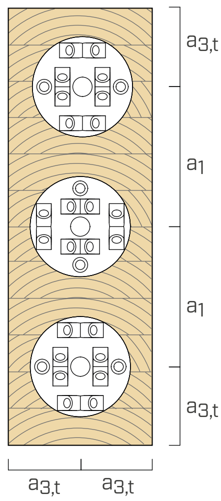
MAIN ELEMENT
INSTALLATION WITH GROOVING



SECONDARY BEAM
SINGLE INSTALLATION



SECONDARY BEAM
MULTIPLE INSTALLATION

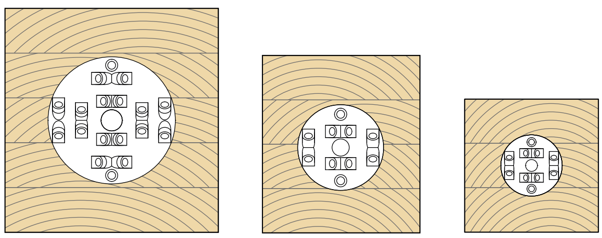


INSTALLATION OPTIONS

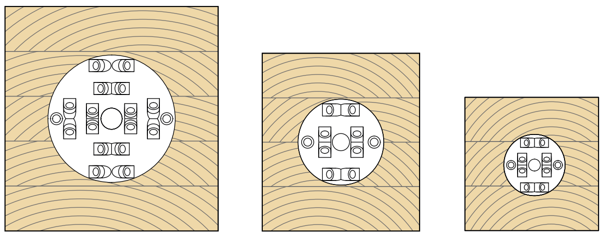
The direction of the connector makes no difference. It can be installed according to OPTION 1 or OPTION 2.

DISCF120 DISCF80 DISCF55

OPTION 1



OPTION 2



FASTENERS

DISC FLAT CONNECTOR	SCREWS			
	$n_{45°}$ [pcs - Ø]	$n_{0°}$ [pcs - Ø]	**bolts for fastening on timber** [pcs - Ø]	**washers for timber** [pcs - Ø]
DISCF55	8 - LBS Ø5	2 - LBS Ø5	1 - KOS M12	1 - ULS1052 M12
DISCF80	8 - LBS Ø7	2 - LBS Ø7	1 - KOS M16	1 - ULS1052 M16
DISCF120	16 - LBS Ø7	2 - LBS Ø7	1 - KOS M20	1 - ULS1052 M20

STATIC VALUES

SECONDARY BEAM SIDE STRENGTHS

connector	screws Ø x L [mm]	$b_{J,min}$ x $h_{J,min}$ [mm]	$R_{v,screws,k} = R_{lat,screws,k}$ [kN]		$R_{ax,screws,k}$ [kN]	
			GL24h (1)	LVL (2)	GL24h (1)	LVL (2)
DISCF55	LBS Ø5 x 50	100 x 100	9,60	8,03	17,01	11,64
	LBS Ø5 x 60	110 x 110	11,83	9,89	20,96	14,34
	LBS Ø5 x 70	130 x 130	14,06	11,76	24,91	17,04
DISCF80	LBS Ø7 x 60	120 x 120	14,69	12,28	26,10	17,91
	LBS Ø7 x 80	150 x 150	20,94	17,51	37,16	25,47
	LBS Ø7 x 100	180 x 180	27,19	22,73	48,22	33,03
DISCF120	LBS Ø7 x 80	160 x 160	41,88	48,15	70,66	81,24
	LBS Ø7 x 100	190 x 190	54,38	62,52	91,72	105,46

SHEAR STRENGTH ON MAIN ELEMENT SIDE

connector	$R_{v,main,k}$ (8) [kN]								
	WITHOUT SLOT					WITH GROOVING			
	beam		column		wall	beam		column	
	GL24h (1)	LVL (2)	GL24h (1)	LVL (2)	CLT (3)	GL24h (1)	LVL (2)	GL24h (1)	LVL (2)
DISCF55	13,9	14,3	19,9	23,0	19,0	25,1	28,3	35,6	42,5
DISCF80	21,2	21,7	31,0	37,5	25,7	40,8	46,2	58,6	71,9
DISCF120	34,1	35,0	48,1	54,4	32,8	71,1	80,0	98,7	117,5

connector	$R_{lat,main,k}$ (8) [kN]								
	WITHOUT SLOT					WITH GROOVING(7)			
	beam		column		wall	beam		column	
	GL24h (1)	LVL (2)	GL24h (1)	LVL (2)	CLT (3)	GL24h (1)	LVL (2)	GL24h (1)	LVL (2)
DISCF55	19,9	23,0	13,9	14,3	17,5	35,6	42,5	25,1	28,3
DISCF80	31,0	37,5	21,2	21,7	23,8	58,6	71,9	40,8	46,2
DISCF120	48,1	54,4	34,1	35,0	30,7	98,7	117,5	71,1	80,0

TENSILE STRENGTH ON MAIN ELEMENT SIDE

connector	$R_{ax,main,k}$ [kN]		
	GL24h (4)	LVL (5)	CLT(6)
DISCF55	18,7	22,4	17,9
DISCF80	25,3	30,4	24,3
DISCF120	34,8	41,8	33,5

CONNECTION STIFFNESS

The sliding module can be calculated according to ETA-19/0706, with the following expressions:

$$K_{ax,ser} = 150\ kN/mm$$

$$K_{v,ser} = K_{lat,ser} = \frac{\rho_m^{1,5} \cdot d}{23}\ kN/mm$$ For shear stressed connectors in timber-to-timber joints

$$K_{v,ser} = K_{lat,ser} = 70 \cdot d^2\ kN/mm$$ For shear stressed connectors in steel-to-timber joints

where:
- d is the bolt diameter in mm;
- ρ_m is the average density of the main element, in kg/m^3.

NOTES:

(1) Values calculated according to ETA-19/0706. ρ_k=385 kg/m^3 has been taken in consideration in the calculation.

(2) Values calculated according to ETA-19/0706. ρ_k=480kg/m^3 has been taken in consideration in the calculation.

(3) Values calculated according to ETA-19/0706. ρ_k=350kg/m^3 has been taken in consideration in the calculation.

(4) Values calculated according to ETA-19/0706 with DIN1052 washers, they must be recalculated if other washers are used. $f_{c,90,k}$=2.5 MPa has been considered in the calculation.

(5) Values calculated according to ETA-19/0706 with DIN1052 washers, they must be recalculated if other washers are used. $f_{c,90,k}$=3,0 MPa has been considered in the calculation.

(6) Values calculated according to ETA-19/0706 with DIN1052 washers, they must be recalculated if other washers are used. $f_{c,90,k}$=2,4 MPa has been considered in the calculation.

(7) When using the connector with grooving in the main beam, if a F_{lat} stress is applied, it is necessary to perform a closed circular grooving.

(8) The strength values have been calculated for a usable bolt length of:
- t_a = 100 mm for DISCF55 on beam or column;
- t_a = 120 mm for DISCF80 on beam or column;
- t_a = 180 mm for DISCF120 on beam or column;
- t_a = 100 mm for DISCF55, DISCF80 and DISCF120 on wall.

In the case of longer or shorter lengths, the strengths can be calculated according to ETA-19/0706.

GENERAL PRINCIPLES:

- The characteristic strength values of the connection are obtained as follows:

$$R_{v,k} = min \begin{cases} R_{v,screws,k} \\ R_{v,main,k} \end{cases}$$

$$R_{ax,k} = min \begin{cases} R_{ax,screws,k} \\ R_{ax,main,k} \end{cases}$$

$$R_{lat,k} = min \begin{cases} R_{lat,screws,k} \\ R_{lat,main,k} \end{cases}$$

- The design values are obtained from the characteristic values as follows: The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

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

- In case of combined F_v, F_{ax} and F_{lat} stress the following expression must be fulfilled:

$$\left(\frac{F_{ax,d}}{R_{ax,d}}\right)^2 + \frac{F_{v,d}}{R_{v,d}} + \frac{F_{lat,d}}{R_{lat,d}} \leq 1$$

- Dimensioning and verification of the timber elements must be carried out separately.
- In case of steel or concrete main element, the calculation of $R_{v,main,k}$, $R_{ax,main,k}$ and $R_{lat,main,k}$ must be performed by the designer. The calculation of the relative design values must be carried out using the γ_M coefficients to be assumed according to the regulations in force used for the calculation.
- There are two options or installation on secondary beam (option 1/option 2). The strengths do not vary in both cases. In case of multiple installation, it is recommended to install the connectors alternating them with option 1 and option 2.
- If several connector are used, the strengths on screw side ($F_{v,screws}$,$F_{ax,screws}$,$F_{lat,screws}$) can be multiplied by the number of connectors.
- If several connectors are used, the calculation of the connection on the main element side must be carried out by the designer in accordance with chapters 8.5 and 8.9 EN 1995-1-1.
- Screws with the same length must be used in all holes.

DISC FLAT A2

REMOVABLE CONCEALED CONNECTOR

VIDEO

ETA 19/0706

COMBINED LOADS
Combined shear-tensile load bearing capacity due to tightening provided by the pass-through rod. CE mark according to ETA.

PRACTICAL
Simple to install thanks to the possibility of being tightened after the assembly. Fast and precise fastening thanks to KKF AISI410 screws.

DISASSEMBLED
Usable for temporary structures, it can be easily removed thanks to the pass-through rod.

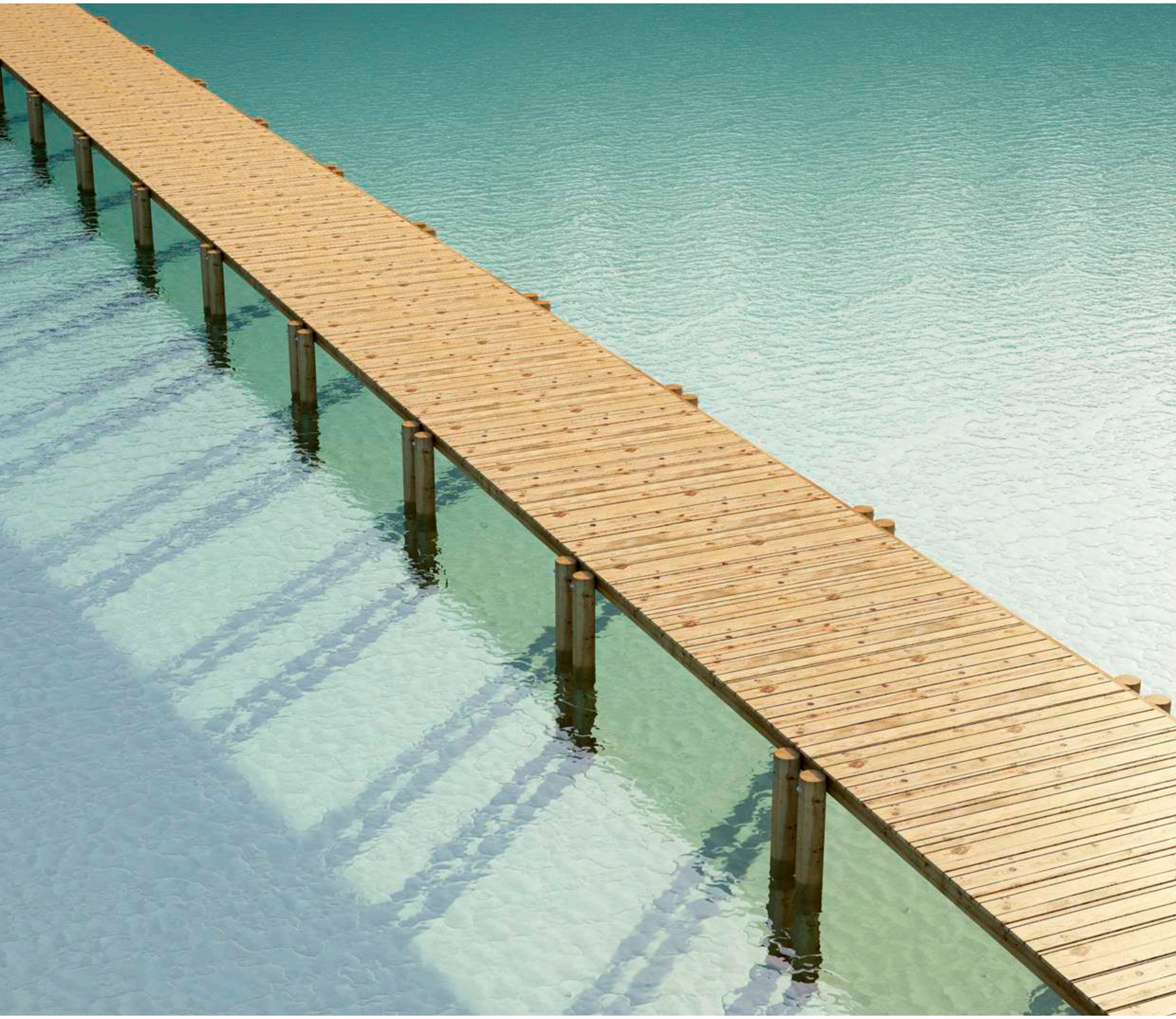
CHARACTERISTICS

FOCUS	universal joints
TIMBER SECTIONS	from 100 x 100 mm to 280 x 280 mm
STRENGTH	R_v over 40 kN, R_{ax} over 70 kN
FASTENERS	KKF AISI410, KOS A2

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

MATERIAL
Stainless steel A2 | AISI 304.

FIELDS OF USE
Timber-to-timber shear joints along all directions of the secondary beam
- solid timber and glulam
- CLT, LVL
- timber based panels



SERVICE CLASS 3

Stainless steel A2 | AISI304 together with martensitic stainless steel KKF screws allow the joint to be used in service class 3.

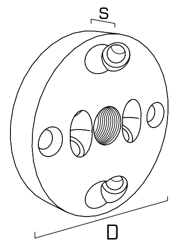
OAK FRAME

Ideal for fastening aggressive woods containing tannin, such as chestnut and oak. Assembly with KKF AISI410 outdoor screws.

CODES AND DIMENSIONS

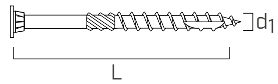
CODE	D [mm]	s [mm]	M [mm]	$n_{0°} + n_{45°}$	pcs
DISCFA255	55	10	12	10	16
DISCFA280	80	15	16	10	8
DISCFA2120	120	15	20	18	4

Screws not included in the box.



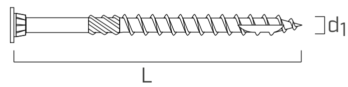
KKF AISI410 for DISCFA255

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
KKF550	5	50	30	TX25	200
KKF560	5	60	35	TX25	200
KKF570	5	70	40	TX25	100



KKF AISI410 for DISCFA280 and DISCFA2120

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
KKF680	6	80	50	TX30	100
KKF6100	6	100	60	TX30	100
KKF6120	6	120	75	TX30	100



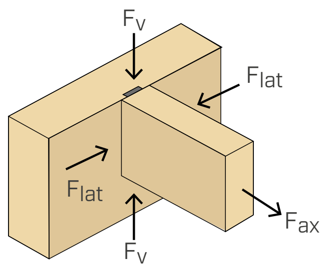
MATERIAL AND DURABILITY

DISC FLAT A2: AISI304 stainless steel.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

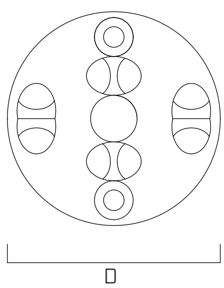
FIELD OF USE

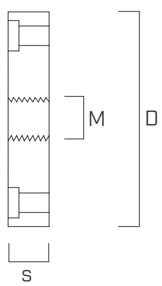
- Timber-to-timber joints between solid timber, glulam, LVL and CLT structural elements
- Timber-to-steel joints
- Timber-to-concrete joints

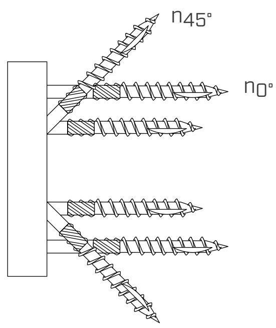
EXTERNAL LOADS



GEOMETRY







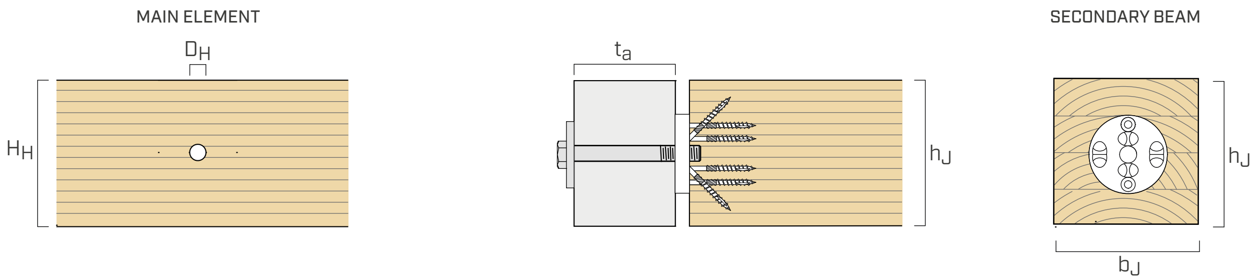
MINIMUM DIMENSIONS

DISC FLAT CONNECTOR	SCREWS	SECONDARY BEAM		MAIN ELEMENT			
	Ø x L [mm]	$b_{J,min}$ [mm]	$h_{J,min}$ [mm]	$H_{H,min}$* [mm]	D_H [mm]	S_F [mm]	D_F [mm]
	KKF AISI410 Ø5 x 50	100	100	110			
DISCFA255	KKF AISI410 Ø5 x 60	110	110	115	13	11	56
	KKF AISI410 Ø5 x 70	130	130	130			
	KKF AISI410 Ø6 x 80	150	150	165			
DISCFA280	KKF AISI410 Ø6 x 100	180	180	180	17	16	81
	KKF AISI410 Ø6 x 120	210	210	210			
	KKF AISI410 Ø6 x 80	160	160	200			
DISCFA2120	KKF AISI410 Ø6 x 100	190	190	215	21	16	121
	KKF AISI410 Ø6 x 120	220	220	230			

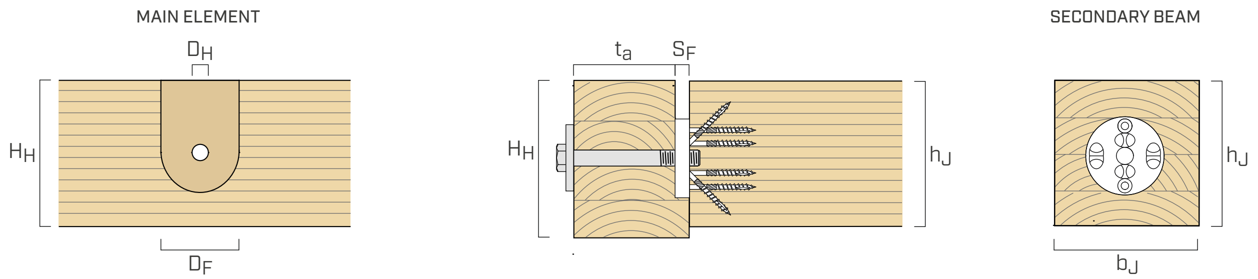
* $H_{H,min}$ is only valid in case of installation with grooving. For installation without grooving, the minimum bolt distances according to EN 1995-1-1 apply.

INSTALLATION

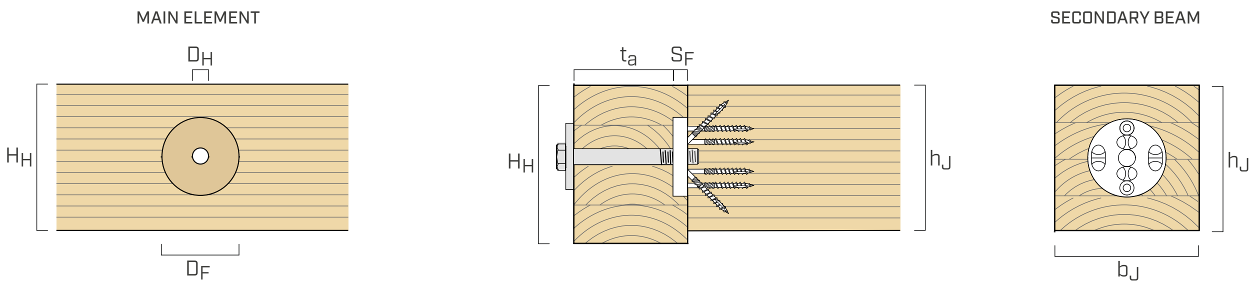
WITHOUT SLOT



WITH OPEN SLOT



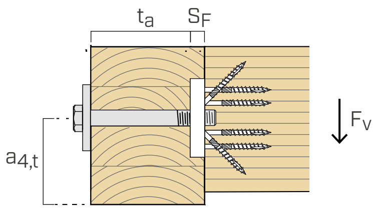
WITH ROUND SLOT



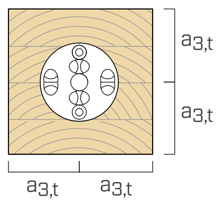
SPACING

connector	screws Ø x L [mm]	a_1 [mm]	$a_{3,t}$ [mm]	$a_{4,t}$ [mm]
DISCFA255	KKF AISI410 Ø5 x 50 KKF AISI410 Ø5 x 60 KKF AISI410 Ø5 x 70	90 105 120	50 55 65	60
DISCFA280	KKF AISI410 Ø6 x 80 KKF AISI410 Ø6 x 100 KKF AISI410 Ø6 x120	140 170 200	75 90 105	90
DISCFA2120	KKF AISI410 Ø6 x 80 KKF AISI410 Ø6 x 100 KKF AISI410 Ø6 x 120	150 180 210	80 95 110	120

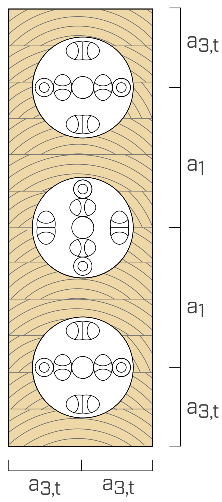
MAIN ELEMENT
INSTALLATION WITH GROOVING



SECONDARY BEAM
SINGLE INSTALLATION



SECONDARY BEAM
MULTIPLE INSTALLATION

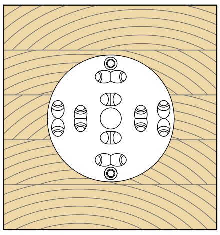
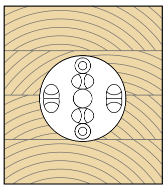
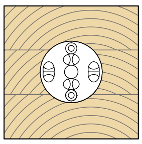


INSTALLATION OPTIONS

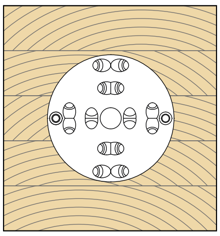
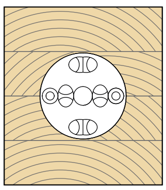
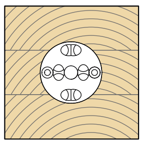
The direction of the connector makes no difference. It can be installed according to OPTION 1 or OPTION 2.

DISCFA255 DISCFA280 DISCFA2120

OPTION 1

OPTION 2

FASTENERS

DISC FLAT CONNECTOR	SCREWS			
	$n_{45°}$ [pcs - Ø]	$n_{0°}$ [pcs - Ø]	bolts for fastening on timber [pcs - Ø]	washers for timber [pcs - Ø]
DISCFA255	8 - KKF AISI410 Ø5	2 - KKF AISI410 Ø5	1 - AI601 M12	1 - AI9021 M12
DISCFA280	8 - KKF AISI410 Ø7	2 - KKF AISI410 Ø7	1 - AI601 M16	1 - AI9021 M16
DISCFA2120	16 - KKF AISI410 Ø7	2 - KKF AISI410 Ø7	1 - AI601 M20	1 - AI9021 M20

STATIC VALUES

SECONDARY BEAM SIDE STRENGTHS

connector	screws Ø x L [mm]	$b_{J,min}$ x $h_{J,min}$ [mm]	$R_{v,screws,k} = R_{lat,screws,k}$ [kN]		$R_{ax,screws,k}$ [kN]	
			C24(1)	C50(2)	C24(1)	C50(2)
DISCFA255	KKF AISI410 Ø5 x 50	100 x 100	6,20	7,32	10,98	12,95
	KKF AISI410 Ø5 x 60	110 x 110	7,24	8,53	12,81	15,10
	KKF AISI410 Ø5 x 70	130 x 130	8,27	9,75	14,64	17,26
DISCFA280	KKF AISI410 Ø6 x 80	150 x 150	12,41	14,63	21,96	25,89
	KKF AISI410 Ø6 x 100	180 x 180	14,89	17,56	26,35	31,07
	KKF AISI410 Ø6 x120	210 x 210	18,61	21,95	32,94	38,84
DISCFA2120	KKF AISI410 Ø6 x 80	160 x 160	24,82	29,26	41,82	49,30
	KKF AISI410 Ø6 x 100	190 x 190	29,78	35,12	50,18	59,16
	KKF AISI410 Ø6 x 120	220 x 220	37,23	43,89	62,73	73,95

SHEAR STRENGTH ON MAIN ELEMENT SIDE

connector	$R_{v,main,k}$ (6) [kN]							
	WITHOUT SLOT				WITH GROOVING			
	beam		column		beam		column	
	C24(1)	C50(2)	C24(1)	C50(2)	C24(1)	C50(2)	C24(1)	C50(2)
DISCFA255	11,1	11,5	13,5	14,7	21,3	24,0	27,7	32,3
DISCFA280	15,0	15,2	20,2	22,2	32,9	37,2	45,2	53,0
DISCFA2120	25,7	26,6	32,5	35,6	58,5	67,0	78,5	92,1

connector	$R_{lat,main,k}$ (6) [kN]							
	WITHOUT SLOT				WITH GROOVING(5)			
	beam		column		beam		column	
	C24(1)	C50(2)	C24(1)	C50(2)	C24(1)	C50(2)	C24(1)	C50(2)
DISCFA255	13,5	14,7	11,1	11,5	27,7	32,3	21,3	24,0
DISCFA280	20,2	22,2	15,0	15,2	45,2	53,0	32,9	37,2
DISCFA2120	32,5	35,6	25,7	26,6	78,5	92,1	58,5	67,0

TENSILE STRENGTH ON MAIN ELEMENT SIDE

connector	$R_{ax,main,k}$ [kN]	
	C24(3)	C50(4)
DISCFA255	6,8	8,5
DISCFA280	12,5	15,6
DISCFA2120	17,6	22,0

CONNECTION STIFFNESS

The sliding module can be calculated according to ETA-19/0706, with the following expressions:

$$K_{ax,ser} = 150\ kN/mm$$

$$K_{v,ser} = K_{lat,ser} = \frac{\rho_m^{1,5} \cdot d}{23}\ kN/mm$$

For shear stressed connectors in timber-to-timber joints

$$K_{v,ser} = K_{lat,ser} = 70 \cdot d^2\ kN/mm$$

For shear stressed connectors in steel-to-timber joints

where:

- d is the bolt diameter in mm;
- ρ_m is the average density of the main element, in kg/m^3.

NOTES:

(1) Values calculated according to ETA-19/0706. Softwood with ρ_k=350 kg/m^3 has been taken in consideration in the calculation

(2) Values calculated according to ETA-19/0706. Softwood with ρ_k=430 kg/m^3 has been taken in consideration in the calculation

(3) Values calculated according to ETA-19/0706 with DIN9021 washers, they must be recalculated if other washers are used. $f_{c,90,k}$=2,4 MPa has been considered in the calculation.

(4) Values calculated according to ETA-19/0706 with DIN9021 washers, they must be recalculated if other washers are used. $f_{c,90,k}$=3,0 MPa has been considered in the calculation.

(5) When using the connector with grooving in the main beam, if a F_{lat} stress is applied, it is necessary to perform a closed circular grooving.

(6) The strength values have been calculated for a usable bolt length of:
- t_a = 100 mm for DISCFA255;
- t_a = 120 mm for DISCFA280;
- t_a = 160 mm for DISCFA2120.

In the case of longer or shorter lengths, the strengths can be calculated according to ETA-19/0706.

GENERAL PRINCIPLES:

- The characteristic strength values of the connection are obtained as follows:

$$R_{v,k} = min \begin{cases} R_{v,screws,k} \\ R_{v,main,k} \end{cases}$$

$$R_{ax,k} = min \begin{cases} R_{ax,screws,k} \\ R_{ax,main,k} \end{cases}$$

$$R_{lat,k} = min \begin{cases} R_{lat,screws,k} \\ R_{lat,main,k} \end{cases}$$

- The design values are obtained from the characteristic values as follows: The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

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

- In case of combined F_v, F_{ax} and F_{lat} stress the following expression must be fulfilled:

$$\left(\frac{F_{ax,d}}{R_{ax,d}}\right)^2 + \frac{F_{v,d}}{R_{v,d}} + \frac{F_{lat,d}}{R_{lat,d}} \leq 1$$

- Dimensioning and verification of the timber elements must be carried out separately.
- In case of steel or concrete main element, the calculation of $R_{v,main,k}$, $R_{ax,main,k}$ and $R_{lat,main,k}$ must be performed by the designer. The calculation of the relative design values must be carried out using the γ_M coefficients to be assumed according to the regulations in force used for the calculation.
- There are two options or installation on secondary beam (option 1/option 2). The strengths do not vary in both cases. In case of multiple installation, it is recommended to install the connectors alternating them with option 1 and option 2.
- If several connector are used, the strengths on screw side ($F_{v,screw}$s,$F_{ax,screws}$,$F_{lat,screws}$) can be multiplied by the number of connectors.
- If several connectors are used, the calculation of the connection on the main element side must be carried out by the designer in accordance with chapters 8.5 and 8.9 EN 1995-1-1.
- Screws with the same length must be used in all holes.

VGU

45° WASHER FOR VGS

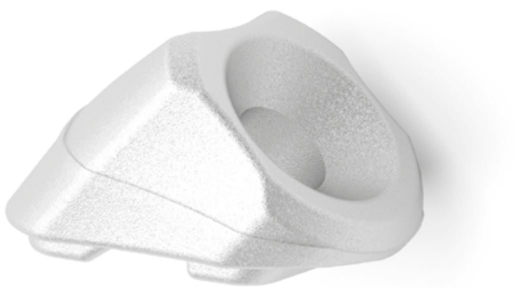
VIDEO

ETA 11/0030

SAFETY
The VGU washer makes possible to install VGS screws at a 45° angle on steel plates. Washer marked CE as per ETA-11/0030.

STRENGTH
Using the VGU washer with VGS screws inclined at a 45° angle on steel plates restores the sliding strength.

PRACTICALITY
The ergonomic shape ensures a firm, precise grip during installation. Three versions of washer, compatible with VGS Ø9, Ø11 and Ø13 mm, for plates of variable thickness.



CHARACTERISTICS

FOCUS	45°steel-to-timber joints
PLATE THICKNESS	from 3,0 to 20,0 mm
PLATE HOLES	slotted
WASHER HOLE	9,0 | 11,0 | 13,0 mm

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

MATERIAL
Bright zinc plated carbon steel.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL
- timber based panels
- high density woods

Service classes 1 and 2.

TENSILE STRENGTH

Ideal for joints requiring high tensile or sliding strength. It can be used on VGU PLATE T plates.

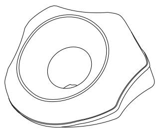
VGU PLATE T

Ideal in combination with VGU PLATE T plates for rigid joints with partial restoration of moment forces.

CODES AND DIMENSIONS

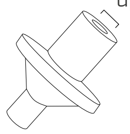
VGU WASHER

CODE	screw [mm]	d_V [mm]	pcs
VGU945	VGS Ø9	5	25
VGU1145	VGS Ø11	6	25
VGU1345	VGS Ø13	8	25



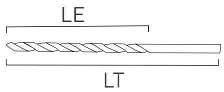
JIG VGU TEMPLATE

CODE	washer [mm]	d_h [mm]	d_V [mm]	pcs
JIGVGU945	**VGU945**	5,5	5	1
JIGVGU1145	**VGU1145**	6,5	6	1
JIGVGU1345	**VGU1345**	8,5	8	1



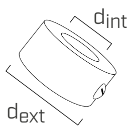
HSS WOOD DRILL BIT

CODE	d_V [mm]	LT [mm]	LE [mm]	pcs
F1599105	5	150	100	1
F1599106	6	150	100	1
F1599108	8	150	100	1



LOCKING RING FOR HSS BITS

CODE	d_V [mm]	d_{int} [mm]	d_{ext} [mm]	pcs
F2108005	5	5	10	10
F2108006	6	6	12	10
F2108008	8	8	16	10



d_V = pre-drilling hole diameter

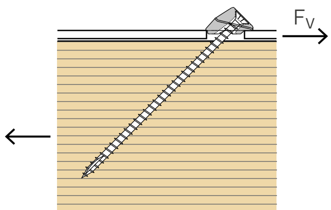
MATERIAL AND DURABILITY

VGU: S235 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

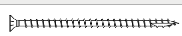
FIELD OF USE

- Steel-to-timber joints

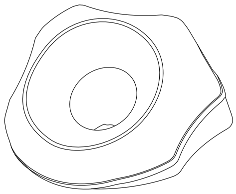
EXTERNAL LOADS

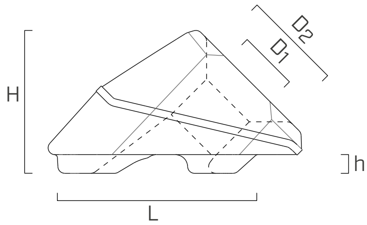


ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support	page
VGS	full thread connector		9-11-13		564

GEOMETRY

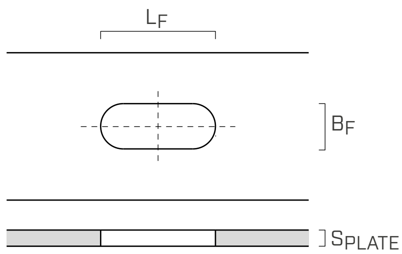




Washer			VGU945	VGU1145	VGU1345
VGS screw diameter	d_1	[mm]	9,0	11,0	13,0
Pre-drilling hole diameter	d_V	[mm]	5,0	6,0	8,0
Internal diameter	D_1	[mm]	9,7	11,8	14,0
External diameter	D_2	[mm]	19,0	23,0	27,4
Base length	L	[mm]	31,8	38,8	45,8
Base heigth	h	[mm]	3,0	3,6	4,3
Global heigth	H	[mm]	23,0	28,0	33,0

For VGS screw-lengths L > 300 mm a Ø5 pre-drill is recommended.
The assembly must be performed so as to guarantee that the stress is evenly distributed among all the installed VGU washers.

INSTALLATION



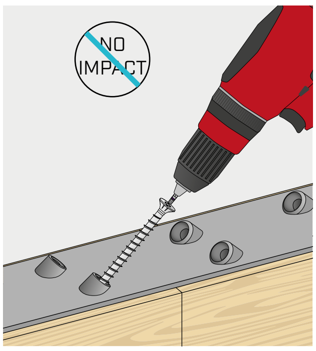
Washer			VGU945	VGU1145	VGU1345
Slotted-hole length	L_F	[mm]	min, 33,0 max, 34,0	min, 41,0 max, 42,0	min, 49,0 max, 50,0
Slotted-hole width	B_F	[mm]	min, 14,0 max, 15,0	min, 17,0 max, 18,0	min, 20,0 max, 21,0
Steel plate thickness	S_{PLATE}	[mm]	min, 3,0 max. 12,0*	min, 4,0 max. 15,0*	min, 5,0 max. 15,0*

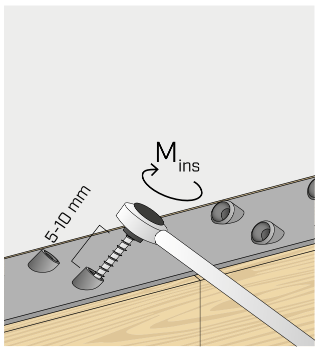
(*) For thicker plates it is necessary to realize a countersink in the lower part of the steel plate.

TIMBER-TO-STEEL APPLICATION

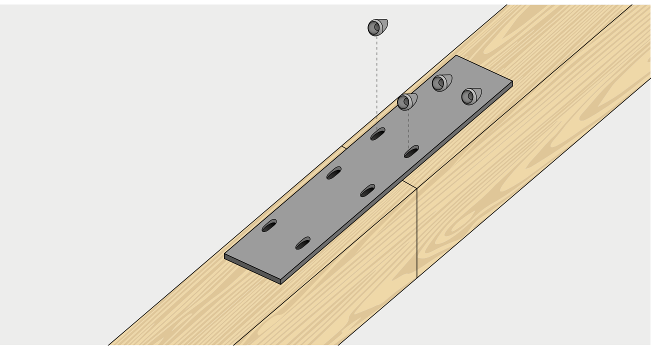
RECOMMENDED INSERTION MOMENT: M_{ins}

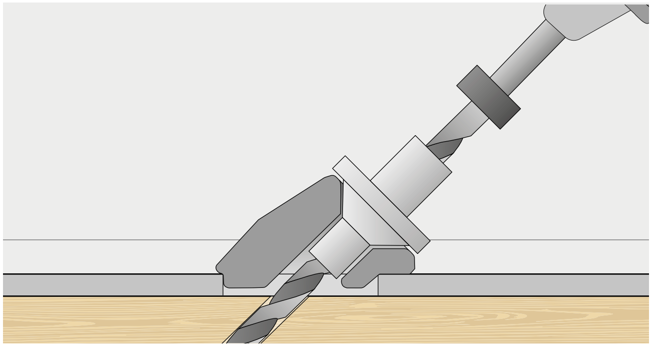
VGS Ø9	M_{ins} = 20 Nm
VGS Ø11 L < 400 mm	M_{ins} = 30 Nm
VGS Ø11 L ≥ 400 mm	M_{ins} = 40 Nm
VGS Ø13	M_{ins} = 50 Nm



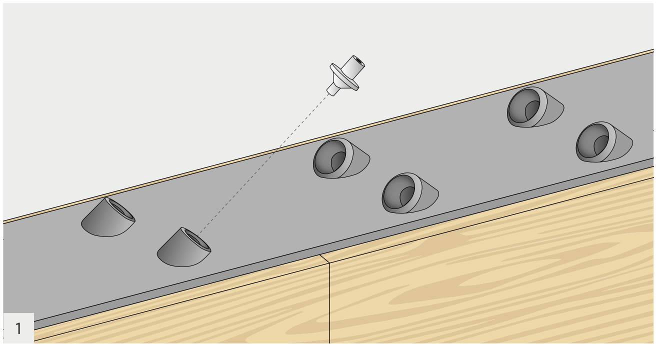


INSTALLATION WITH THE AID OF A PRE-DRILL TEMPLATE

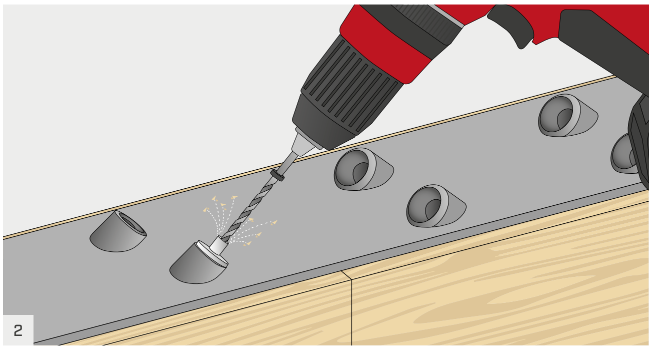




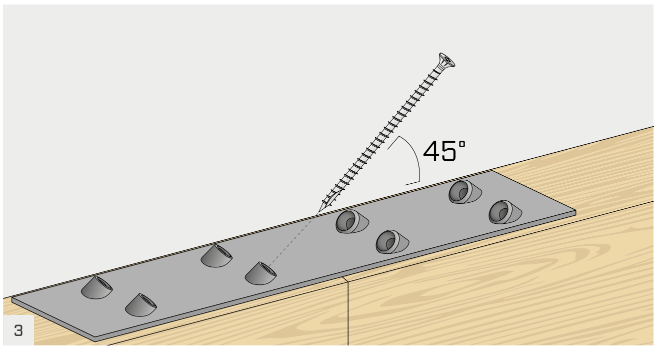
The pre-drill template makes it possible to prepare a 45° angle pre-drill to facilitate screwing.



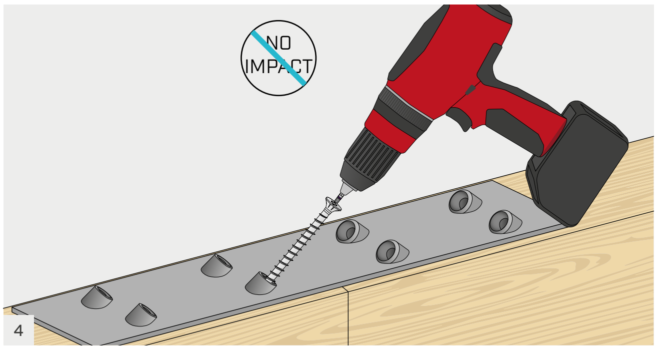
Place the VGU washer in the slot provided and use the JIG-VGU template of the correct diameter.



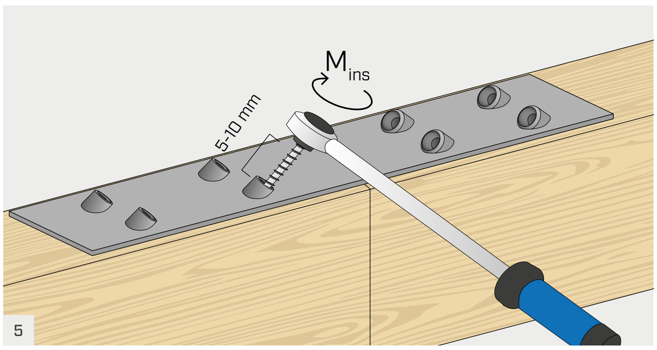
Using the template, prepare a pre-drill using a special bit (at least 20 mm).



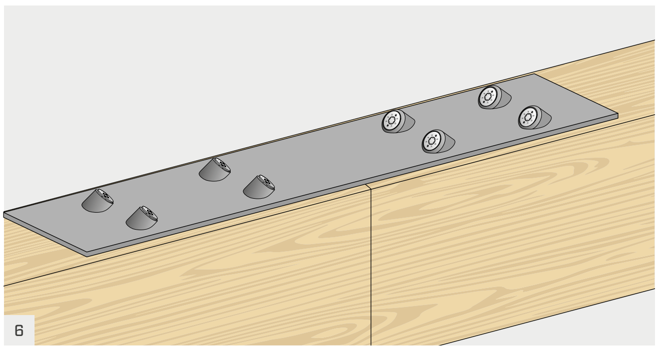
Position the screw and respect the 45° angle of insertion.



Screw down with a NON-PULSED screw gun, stopping at about 1 cm from the washer.

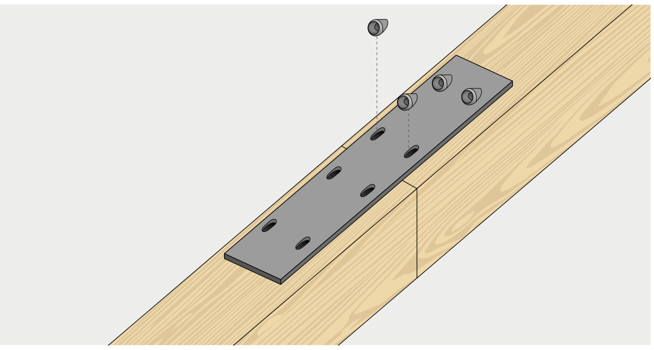


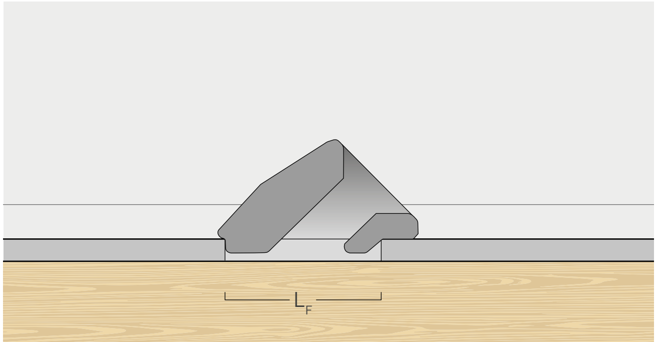
Complete screwing using a torque wrench, applying the correct maximum insertion moment.



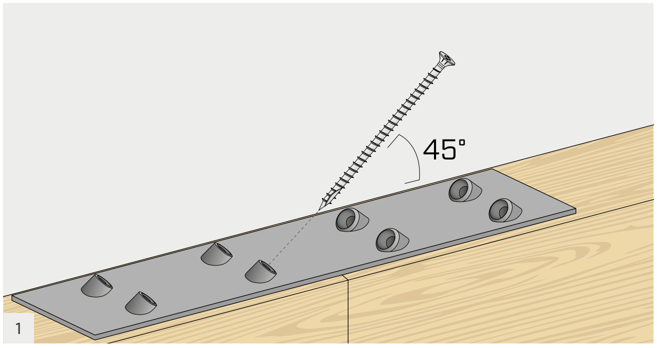
Perform the operation for all washers.

INSTALLATION WITHOUT PRE-DRILL

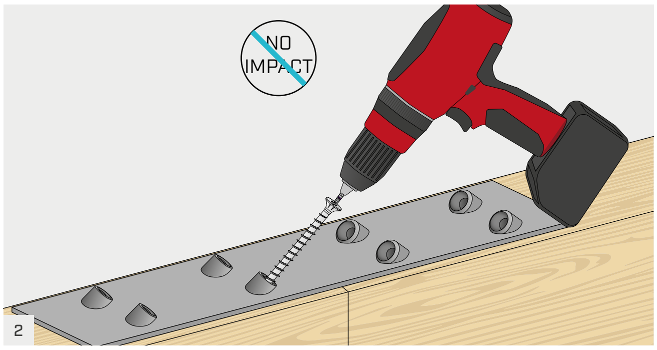




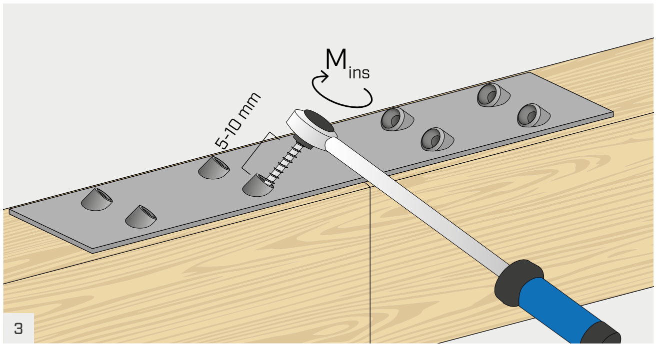
Place the steel plate on the timber and set the VGU washers in the slots provided.



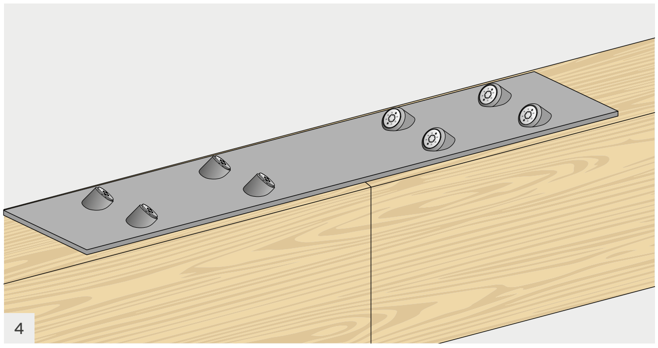
Position the screw and respect the 45° angle of insertion.



Screw down with a NON-PULSED screw gun, stopping at about 1 cm from the washer.



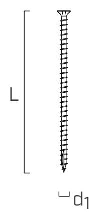
Complete screwing using a torque wrench, applying the correct maximum insertion moment.

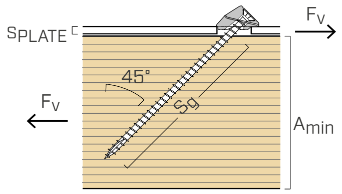


Perform the operation for all washers.

STATIC VALUES | STEEL-TO-TIMBER JOINT

SLIDING RESISTANCE R_V

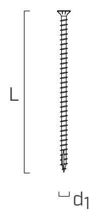


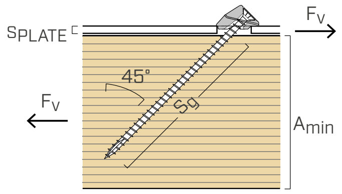


VGU	VGS				timber			timber			timber	steel
	d_1	L	S_g	A_{min}	$R_{V,k}$ (1)	S_g	A_{min}	$R_{V,k}$ (1)	S_g	A_{min}	$R_{V,k}$ (1)	$R_{tens,k\ 45°}$ (2)
	[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[kN]
S_{PLATE}			3 mm			7 mm			12 mm			
		100	80	75	**6,43**	75	75	**6,03**	65	65	**5,22**	
		120	100	90	**8,04**	95	85	**7,63**	85	80	**6,83**	
		140	120	105	**9,64**	115	100	**9,24**	105	95	**8,44**	
		160	140	120	**11,25**	135	115	**10,85**	125	110	**10,04**	
		180	160	135	**12,86**	155	130	**12,46**	145	125	**11,65**	
		200	180	145	**14,46**	175	145	**14,06**	165	135	**13,26**	
		220	200	160	**16,07**	195	160	**15,67**	185	150	**14,87**	
		240	220	175	**17,68**	215	170	**17,28**	205	165	**16,47**	
		260	240	190	**19,29**	235	185	**18,88**	225	180	**18,08**	
VGU945	**9**	280	260	205	**20,89**	255	200	**20,49**	245	195	**19,69**	**17,96**
		300	280	220	**22,50**	275	215	**22,10**	265	205	**21,29**	
		320	300	230	**24,11**	295	230	**23,71**	285	220	**22,90**	
		340	320	245	**25,71**	315	245	**25,31**	305	235	**24,51**	
		360	340	260	**27,32**	335	255	**26,92**	325	250	**26,12**	
		380	360	275	**28,93**	355	270	**28,53**	345	265	**27,72**	
		400	380	290	**30,54**	375	285	**30,13**	365	280	**29,33**	
		440	420	315	**33,75**	415	315	**33,35**	405	305	**32,54**	
		480	460	345	**36,96**	455	340	**36,56**	445	335	**35,76**	
		520	500	375	**40,18**	495	370	**39,78**	485	365	**38,97**	
S_{PLATE}			4 mm			10 mm			15 mm			
		100	75	75	**7,37**	70	70	**6,88**	60	60	**5,89**	
		125	100	90	**9,82**	95	85	**9,33**	85	80	**8,35**	
		150	125	110	**12,28**	120	105	**11,79**	110	100	**10,80**	
		175	150	125	**14,73**	145	125	**14,24**	135	115	**13,26**	
		200	175	145	**17,19**	170	140	**16,70**	160	135	**15,71**	
		225	200	160	**19,64**	195	160	**19,15**	185	150	**18,17**	
		250	225	180	**22,10**	220	175	**21,61**	210	170	**20,63**	
		275	250	195	**24,55**	245	195	**24,06**	235	185	**23,08**	
		300	275	215	**27,01**	270	210	**26,52**	260	205	**25,54**	
VGU1145	**11**	325	300	230	**29,46**	295	230	**28,97**	285	220	**27,99**	**26,87**
		350	325	250	**31,92**	320	245	**31,43**	310	240	**30,45**	
		375	350	265	**34,38**	345	265	**33,88**	335	255	**32,90**	
		400	375	285	**36,83**	370	280	**36,34**	360	275	**35,36**	
		450	425	320	**41,74**	420	315	**41,25**	410	310	**40,27**	
		500	475	355	**46,65**	470	350	**46,16**	460	345	**45,18**	
		550	525	390	**51,56**	520	390	**51,07**	510	380	**50,09**	
		600	575	425	**56,47**	570	425	**55,98**	560	415	**55,00**	
		700	675	495	**66,30**	670	495	**65,80**	660	485	**64,82**	
		800	775	570	**76,12**	770	565	**75,63**	760	555	**74,64**	

STATIC VALUES | STEEL-TO-TIMBER JOINT

SLIDING RESISTANCE R_V





VGU	VGS				timber			timber			timber	steel
	d_1	L	S_g	A_{min}	$R_{V,k}$ (1)	S_g	A_{min}	$R_{V,k}$ (1)	S_g	A_{min}	$R_{V,k}$ (1)	$R_{tens,k\ 45°}$ (2)
	[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[kN]
S_{PLATE}			5 mm			10 mm			15 mm			
VGU1345	13	100	65	65	**7,54**	60	60	**6,96**	50	55	**5,80**	37,48
		150	115	100	**13,35**	110	100	**12,77**	100	90	**11,61**	
		200	165	135	**19,15**	160	135	**18,57**	150	125	**17,41**	
		300	265	205	**30,76**	260	205	**30,18**	250	195	**29,02**	
		400	365	280	**42,37**	360	275	**41,79**	350	265	**40,63**	
		500	465	350	**53,97**	460	345	**53,39**	450	340	**52,23**	
		600	565	420	**65,58**	560	415	**65,00**	550	410	**63,84**	

NOTES:

(1) The connector pull-out strength has been evaluated by considering a 45° angle to the grain and an effective length of the threaded part equal to S_g.

(2) The connector tensile strength was calculated considering a 45° angle between the fibres and the connector.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0030.
- The design sliding strength of the joint is either the timber-side design strength ($R_{V,d}$) or the steel design strength ($R_{tens,d}$ 45°), whichever is lower:

$$R_{V,d} = min \begin{cases} \dfrac{R_{V,k} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{tens,k\ 45°}}{\gamma_{M2}} \end{cases}$$

The coefficients k_{mod} and γ_M should be taken according to the current regulations used for the calculation.

- For the correct realization of the joint, the fastener head should be fully embedded into the VGU washer.
- For intermediate values of S_{PLATE} linear interpolation is allowed.
- For the calculation process a timber density ρ_k = 385 kg/m$_3$ has been considered.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- For a row of n connectors parallel to the F_v stress, it is recommended that the effective load-bearing capacity is evaluated as :

$R_{v,d,tot} = n_{ef} \cdot R_{v,d}$ with $n_{ef} = \max\{0,9\ n\ ;\ n^{0,9}\}$

VGU PLATE T TIMBER

PLATE FOR TENSILE LOADS

MOMENT RESISTING JOINT
In combination with the VGU washer and VGS screws, it enables the transfer of moment stresses into the beam-column joints.

TENSION JOINT
Thanks to the use of VGS screws arranged at 45°, the high tensile forces can be transferred.

EASY INSTALLATION
The plate is equipped with slots for housing the VGU washers that allow the VGS screws to be inserted at 45°.

CHARACTERISTICS

FOCUS	beam-column moment joints
TIMBER SECTIONS	from 120 x 120 mm to 280 x 400 mm
MOMENT STRENGTH	M_k up to 20 kNm
FASTENERS	VGU, VGS

MATERIAL
Bright zinc plated carbon steel, two dimensional perforated plate.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL

Service classes 1 and 2.

CARPORTS AND PERGOLAS

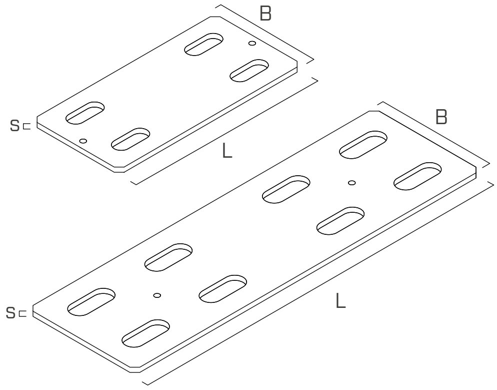
Thanks to the interlocking beam-column joint that can be created with VGU PLATE T, VGU and VGS, small portals can be easily built.

TENSION AND COMPRESSION

The moment joint is broken down into a tension action absorbed by the VGU PLATE T plate and a compression action absorbed by the timber or, as in this case, by the DISC FLAT concealed connector.

CODES AND DIMENSIONS

CODE	B [mm]	L [mm]	s [mm]		pcs
VGUPLATET185	88	185	3	●	1
VGUPLATET350	108	350	4	●	1



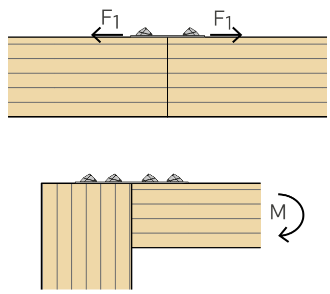
MATERIAL AND DURABILITY

VGU PLATE T: bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1)

FIELD OF USE

- Timber-to-timber joints

EXTERNAL LOADS

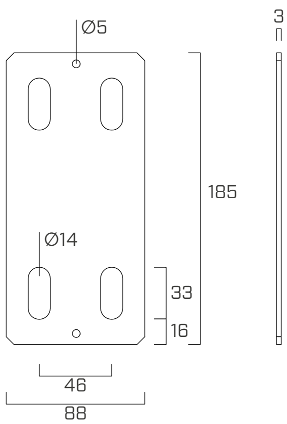


ADDITIONAL PRODUCTS

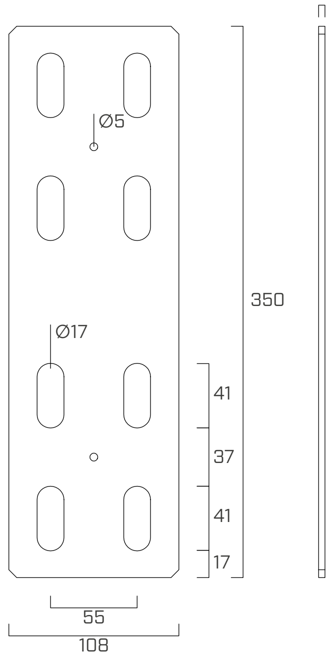
type	description		d [mm]	support	page
VGS	full thread screw		9-11		564
VGU	45° washer		9-11		124

GEOMETRY

VGUPLATET185



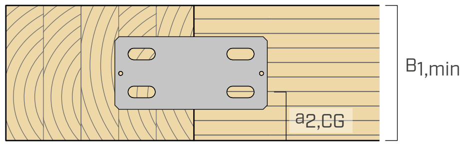
VGUPLATET350



INSTALLATION AND MINIMUM DISTANCES

DISTANCE FROM EDGE $a_{4,C}$

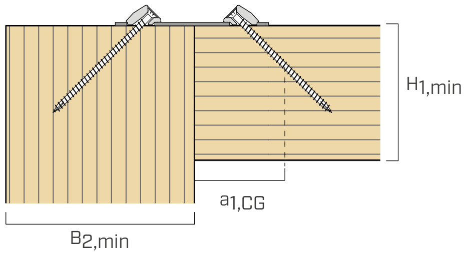
	d screw	$a_{4,c}$		$B_{1,min}$
	[mm]	[mm]		[mm]
VGUPLATET185	9	≥ 4d	36	120
VGUPLATET350	11	≥ 4d	44	150



DISTANCE BETWEEN SCREW BARICENT AND LOADED END $a_{1,CG}$

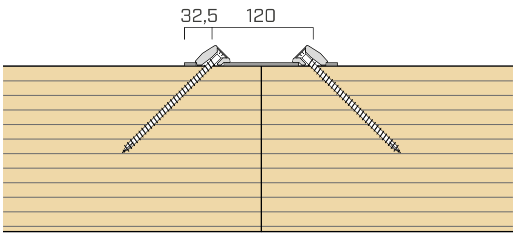
	d screw	$a_{1,CG}$		$L_{screw,min}$ (1)	$H_{1,min}$ (1)	$B_{2,min}$ (1)
	[mm]	[mm]		[mm]	[mm]	[mm]
VGUPLATET185	9	≥ 10d	90	120	90	150
VGUPLATET350	11	≥ 10d	110	175	125	260

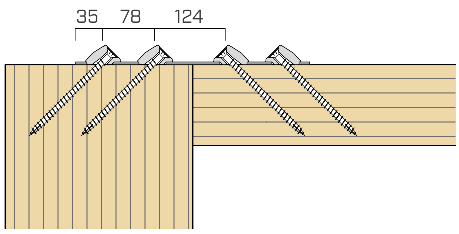
(1) Valid limit value considering the centerline of the plate centered at the interface of the timber elements, using all connectors.



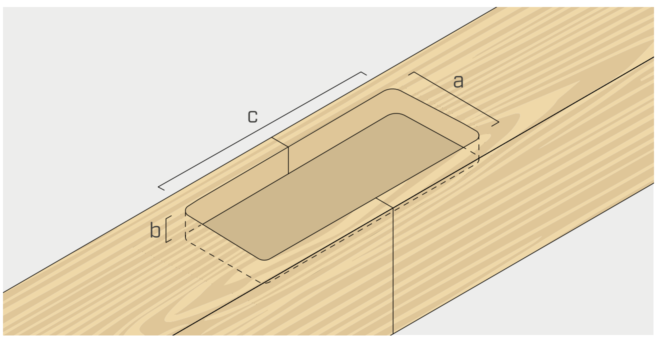
POSITIONING

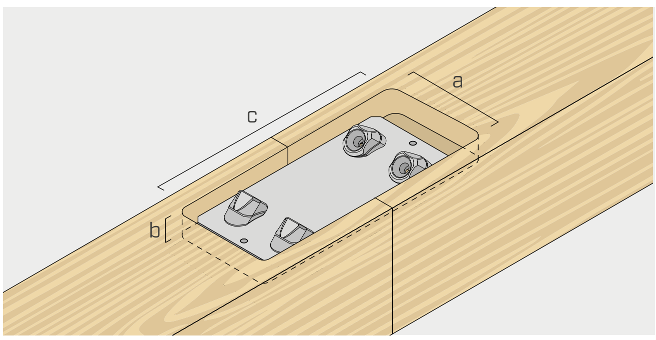
The VGU PLATE T plates can be used in tensile or moment connections; positioning must be carried out in compliance with the minimum distances for inclined screws.
The Ø5 holes are designed to position the plate with LBA Ø4/LBS Ø5 before fastening the inclined screws with washer; for VGU assembly details see page 128-129
The fixed spacing between the connectors for both plates is indicated.





Depending on the design requirements, it is possible to create a concealed connection by grooving the timber elements according to the indications on the table.



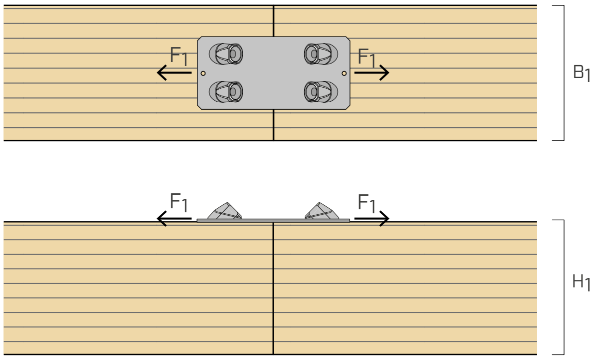


Grooving dimensions

	a	b	c
	[mm]	[mm]	[mm]
VGUPLATET185	90	25	215
VGUPLATET350	110	30	380

STATIC VALUES

TENSION JOINTS



CODE	element dimensions		R1,k screw					R1,k steel plate
	B1 [mm]	H1 [mm]	VGU	fasteners VGS - d1 x L [mm]	nV pcs	R1,k ax [kN]	R1,k tens [kN]	R1,k plate [kN]
VGUPLATET185	120	160	VGU945	9 x 220	2+2	**32,1**	**35,9**	**39,3**
		200		9 x 260	2+2	**38,6**		
	140	200		9 x 260	2+2	**38,6**		
		240		9 x 320	2+2	**48,2**		
	160	240		9 x 320	2+2	**48,2**		
		280		9 x 380	2+2	**57,9**		
VGUPLATET350	160	200	VGU1145	11 x 275	4+4	**91,6**	**100,3**	**95,9**
		240		11 x 325	4+4	**110,0**		
	180	240		11 x 325	4+4	**110,0**		
		280		11 x 375	4+4	**128,3**		
	200	280		11 x 375	4+4	**128,3**		
		320		11 x 450	4+4	**155,8**		

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and ETA-11/0030.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{1,k\ ax} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{1,k\ tens}}{\gamma_{Msteel}} \\ \dfrac{R_{1,k\ steel}}{\gamma_{Msteel}} \end{cases} \qquad M_d = min \begin{cases} \dfrac{M_{k\ timber} \cdot k_{mod}}{\gamma_{Mtimber}} \\ \dfrac{M_{k\ steel}}{\gamma_{Msteel}} \end{cases}$$

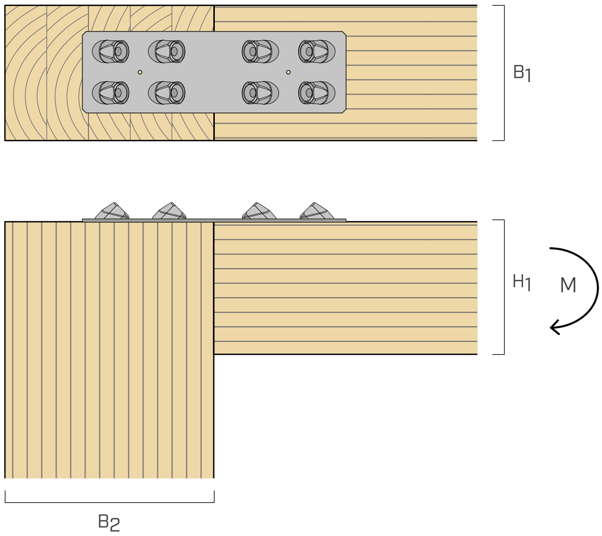
γ_{Msteel} should be taken as γ_{M2}

The coefficients k_{mod}, γ_M and γ_{M2} should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 385 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately. When used for moment joints, a suitable connection system must be used to absorb shear loads.
- The strength values of the connection system are valid under the calculation hypotheses listed in the table; for different boundary conditions shall be verified.

STATIC VALUES

BEAM-COLUMN MOMENT JOINT



CODE	elements dimensions			fasteners			$M_{k\ timber}$ (2)	$M_{k\ steel}$ (2)
	B_2 (1)	B_1	H_1	VGU	VGS - d_1 x L	n_v		
	[mm]	[mm]	[mm]		[mm]	pcs	[kNm]	[kNm]
VGUPLATET185	220	120	160	VGU945	9 x 220	2+2	**2,9**	**4,0**
	240		200		9 x 260	2+2	**4,5**	**5,0**
	240	140	200		9 x 260	2+2	**5,1**	**5,0**
	290		240		9 x 320	2+2	**7,3**	**6,0**
	290	160	240		9 x 320	2+2	**8,1**	**6,1**
	330		280		9 x 380	2+2	**11,2**	**7,1**
VGUPLATET350	330	160	200	VGU1145	11 x 275	4+4	**6,7**	**11,6**
	370		240		11 x 325	4+4	**9,6**	**13,9**
	370	180	240		11 x 325	4+4	**10,6**	**14,0**
	400		280		11 x 375	4+4	**14,4**	**16,4**
	400	200	280		11 x 375	4+4	**15,8**	**16,5**
	460		320		11 x 450	4+4	**20,8**	**18,8**

NOTES:

(1) Minimum column dimensions using the screw lengths in the table, considering the plate centred at the interface of the timber elements.

(2) Strength moments calculated with elastic-linear bonds, considering the deformability of the screws in the stress distribution.

NEO

NEOPRENE SUPPORTING PLATES

DIMENSIONS

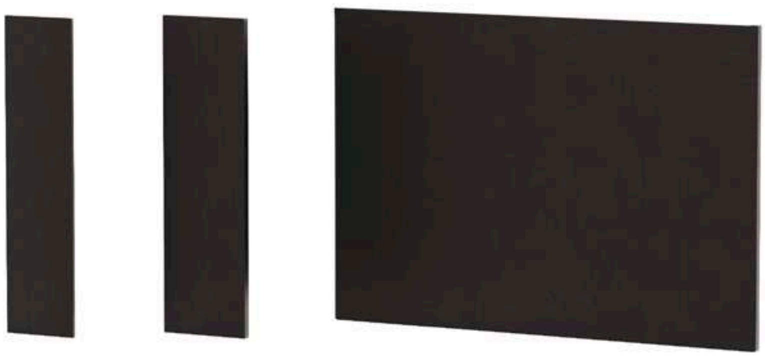
The stripe width has been optimised for the most common joist cross sections. Available also in sheets to be conveniently cut depending on the work site needs.

SUPPORTS

Ideal to realise structural supports and static constraints with two degrees of freedom. Model with CE mark to guarantee the suitability for use.

CE MARKING

Model according to EN 1337-3 ideal for structural use.



MATERIAL

Natural and styrenated gum sheets.

FIELDS OF USE

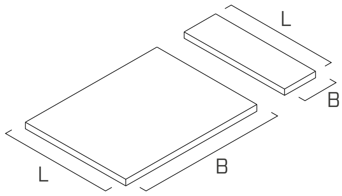
Structural supports on concrete

- solid timber and glulam
- CLT, LVL
- timber based panels

CODES AND DIMENSIONS

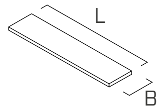
NEO 10 AND NEO 20

CODE	description	s [mm]	B [mm]	L [mm]	weight [kg]	pcs
NEO101280	stripe	10	120	800	1,46	1
NEO101680	stripe	10	160	800	1,95	1
NEO202080	stripe	20	200	800	4,86	1
NEO202480	stripe	20	240	800	5,84	1
NEO10PAL	sheet	10	1200	800	14,6	1
NEO20PAL	sheet	20	1200	800	29,2	1



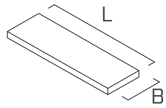
NEO 10 CE

CODE	description	s [mm]	B [mm]	L [mm]	weight [kg]	pcs
NEO101680CE	stripe	10	160	800	1,60	1
NEO102080CE	stripe	10	200	800	2,00	1



NEO 20 CE

CODE	description	s [mm]	B [mm]	L [mm]	weight [kg]	pcs
NEO202080CE	stripe	20	200	800	4,00	1
NEO202480CE	stripe	20	240	800	4,80	1



TECHNICAL SPECIFICATIONS

NEO

Characteristics		values
Density	g/cm³	1,25

NEO CE

Characteristics		regulations			values
Density				g/cm³	1,25
Shear modulus G	-	EN 1337-3 p. 4.3.1.1		MPa	0,9
Tensile strength	-	ISO 37 type 2	printed specimen specimen from a support	MPa	≥ 16 ≤ 14
Minimum elongation at failure	-	ISO 37 type 2	printed specimen specimen from a support	%	425 375
Minimum strength to laceration	24 h; 70 °C	ISO 34-1 method A		kN/m	≥ 8
Residual deformation after compression	spacer 9,38 - 25 %	ISO 815 / 24 h 70 °C		%	≤ 30
Resistance to ozone	elongation: 30 % - 96 h; 40 °C ± 2 °C; 25 pphm	ISO 1431-1		visual	no visible cracks
Accelerated ageing	(minimum variation of the non-aged value)	ISO 188		-	- 5 + 10
Hardness	7 d, 70 °C	ISO 48		IRHD	60 ± 5
Tensile strength	7 d, 70 °C	ISO 37 type 2		%	± 15
Elongation at failure	7 d, 70 °C	ISO 37 type 2		%	± 25

COMPRESSION STRENGTH:

- The characteristic compressive strength R_k for simple bearing supports is calculated according to EN 1337-3.

$$R_k = min\left(1,4 \cdot G \cdot \frac{A^2}{l_p \cdot 1,8t}; 7 \cdot A \cdot G\right)$$

with plate A=area, l_p= perimeter and t=thickness.

- The design values are obtained from the characteristic values as follows: $R_d = R_k / \gamma_M$
The coefficient γ_M should be taken according to the current regulations used for the calculation.

EPOXY ADHESIVES AND HOOKED PLATES

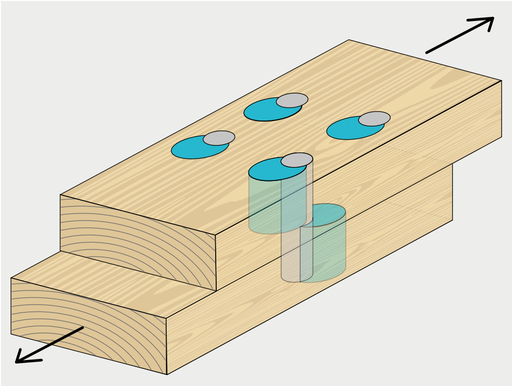
EPOXY ADHESIVES AND HOOKED PLATES

EPOXY ADHESIVES AND HOOKED PLATES

DIFFUSE AND CONCENTRATED JOINTS

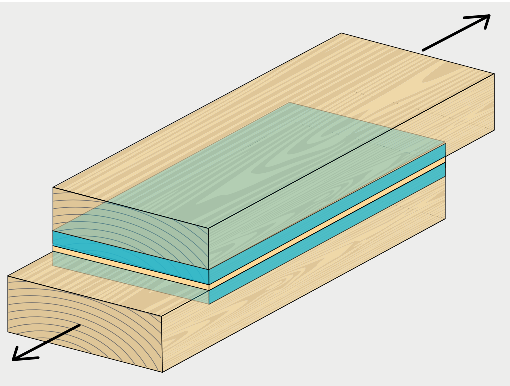
FORCE TRANSFER MODE

Joints with cylindrical shank connectors transmit the load through high and very localised shear forces: these are transmitted in the structural elements in an uneven manner, stressing a limited volume of timber (demonstrated by the blue areas in the adjacent diagram).

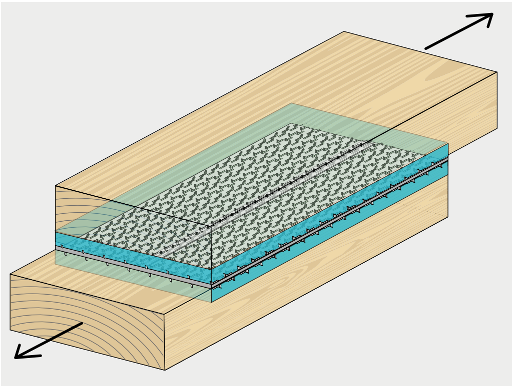


Joint with cylindrical shank connectors.

XEPOX epoxy adhesive and SHARP METAL technology allow to spread the load over a very wide area compared to that involved by a cylindrical shank connector. This results in a more homogeneous and less severe stress on the wood component.



Joint glued with XEPOX.

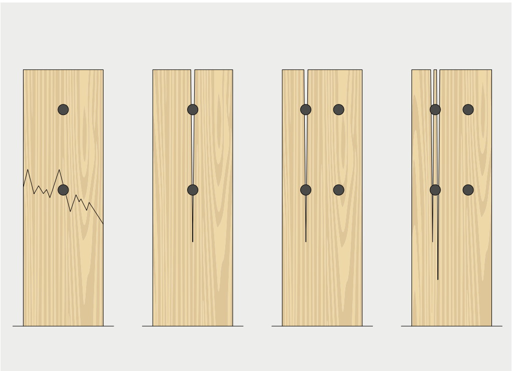


Joint with SHARP METAL.

SCALE FACTORS

Cylindrical shank connections typically have diameters between 4 and 20 mm and are loaded with forces proportional to this dimension. Since the force is concentrated, when using these connectors it is necessary to respect the minimum distances and spacing, in order to avoid fragile failures along the stressed wood fibre. In addition, when using connectors with a large diameter, there is a considerable weakening of the net cross-section of the timber elements at the drill holes.

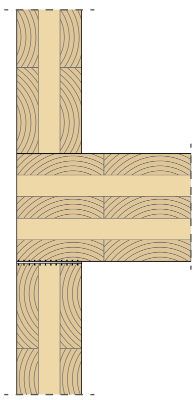
The mechanical engagement of the SHARP METAL hooked surface and the pull-through into the timber structure of the XEPOX adhesive allow a load distribution over the whole connected timber area, avoiding splitting and weakening of the cross-section.



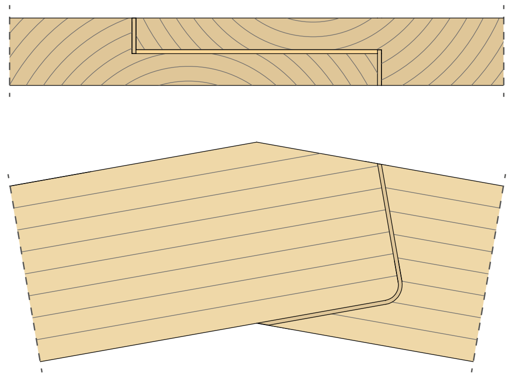
VERSATILITY OF CONNECTIONS FOR DIFFUSE FORCES

Diffuse force operating technologies are able to adapt to different design solutions by exploiting the different bearing mechanism. XEPOX epoxy adhesive and SHARP METAL technologies are able to provide connections between two wooden elements, transferring loads with shear stresses on the surfaces involved.

SHARP METAL

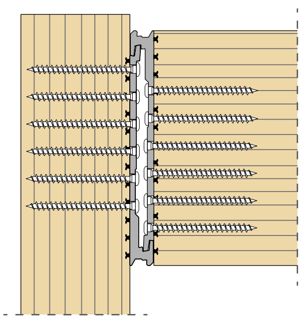


XEPOX



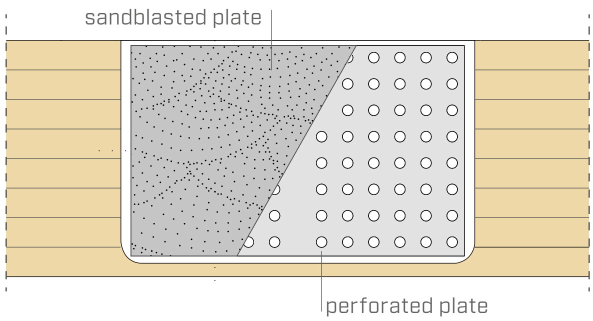
In addition, the diffused force mechanism is also applicable to joints usually made with cylindrical shank connectors providing an increase in stiffness and strength.

LOCK SHARP



SHARP METAL technology is applied directly to the connector, increasing the screws strength.

MOMENT JOINTS



The plate concealed in a grooving transfers the loads thanks to the resin, which adheres perfectly to the sandblasted plate, or engages in its cavities if it is grooved.

XEPOX

TWO COMPONENTS EPOXY ADHESIVE

RELIABLE
Proven durability evidenced by 30 years of use in timber construction.

HIGH PERFORMANCE
High-performance two-components epoxy adhesive. The strength of the connection is dependent on the timber due to the adhesives over-performance.

VERSATILE
In cartridges for practical and fast use, in 3 litre and 5 litre sizes for larger volume joints.

CHARACTERISTICS

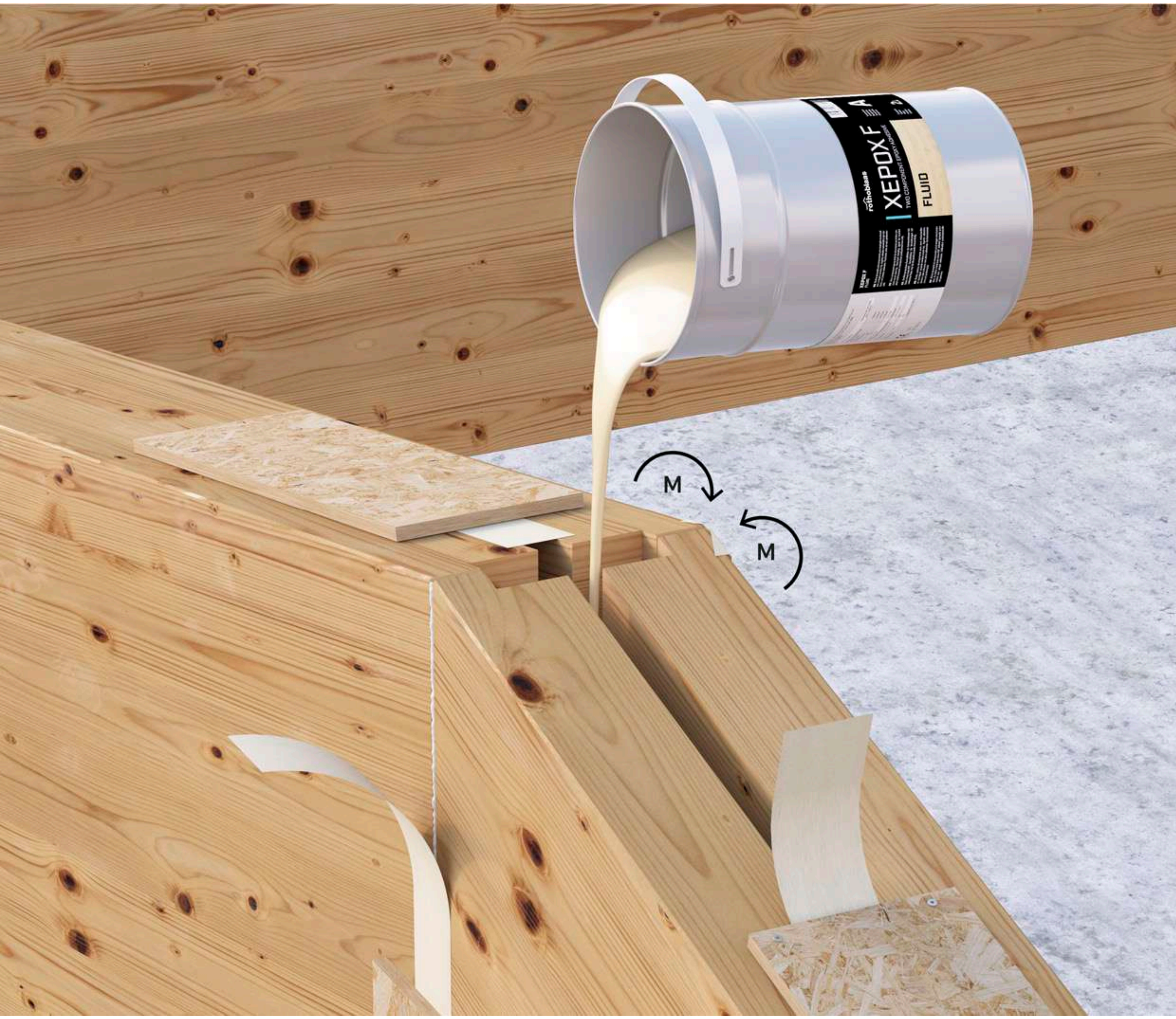
FOCUS	structural gluing
TYPES	joints with rods, joints with perforated or sand-blasted plates
RANGE	5 products to adapt to all installation requirements
APPLICATION	applicable by spray, brush, percolation or spatula depending on viscosity

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

MATERIAL
Two components epoxy adhesive.

FIELDS OF USE
Shear joints, axial action and moment achievable on

- solid timber and glulam
- CLT
- concrete



STRUCTURAL

Ideal for creating rigid multi-directional joints.

STATIC CONSOLIDATION

Can be used to rebuild “timber material” in combination with metal rods and other materials.

CODES AND DIMENSIONS

DRUMS

CODE	description	content [ml]	pcs
XEPOXP3000	P - primer	A + B = 3000	1
XEPOXL3000	L - liquid	A + B = 3000	1
XEPOXL5000		A + B = 5000	1
XEPOXF3000	F - fluid	A + B = 3000	1
XEPOXF5000		A + B = 5000	1
XEPOXG3000	G - gel	A + B = 3000	1

CARTRIDGES

CODE	description	content [ml]	pcs
XEPOXF400	F - fluid	400	1
XEPOXD400	D - dense	400	1

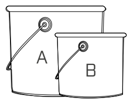
ADDITIONAL PRODUCTS - ACCESSORIES

CODE	description	pcs
MAMDB	double cartridge gun	1
STINGXP	mixing nozzle	1

APPLICATIONS

XEPOX P - primer

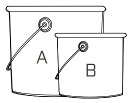
Two-components epoxy adhesive with extremely low viscosity and high wetting properties for structural reinforcments through carbon or glass fibre textures. Useful to protect sanded metal sheets SA2,5/SA3 (ISO 8501) and to realize FRP (Fiber Reinforced Polymers) bits. Applicable by roller, spray and brush. Shelf life 36 months in the original unopened packaging, at temperatures between +5°C and +30°C.



Component A classification: Eye Irrit. 2; Skin Irrit. 2; Skin Sens. 1; Aquatic Chronic 2. Component B classification: Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1;Skin Sens. 1; Aquatic Chronic 3.

XEPOX L - liquid

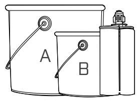
Two-components epoxy adhesive for structural usage, very fluid, applicable via pouring into very deep vertical holes and suitable for large joints with hidden bits placed in quite extended grooves, also good in case of reduced spacing (1mm or more), provided that the slots are accurately sealed.
Pourable and injectable. Shelf life 36 months in the original unopened packaging, at temperatures between +5°C and +30°C.



Component A classification: Eye Irrit. 2; Skin Irrit. 2; Skin Sens. 1; Aquatic Chronic 2. Component B classification: Acute Tox. 4; STOT RE 2; Skin Corr. 1B; Eye Dam. 1; Skin Sens. 1; Aquatic Chronic 3.

XEPOX F - fluid

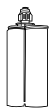
Two-components epoxy adhesive for structural usage, applicable via injection into holes and grooves, provided that the slots are accurately sealed. Preferable for binding timber connectors bent (Turrini-Piazza method) into timber-concrete composite floors, both with new and existing beams; gaps between timber and metal of approximately 2 mm or more. Percolation into the vertical holes in the groves after inserting the metal plate or rod bits. Pourable and injectable with cartridge. Shelf life 36 months in the original unopened packaging, at temperatures between +5°C and 30°C.



Component A classification: Eye Irrit. 2; Skin Irrit. 2; Skin Sens. 1; Aquatic Chronic 2. Component B classification: STOT RE 2; Skin Corr. 1A; Eye Dam. 1; Skin Sens. 1; Aquatic Chronic 3.

XEPOX D - dense

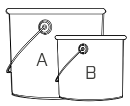
Two-components epoxy thixotropic (dense) adhesive for structural usage, applicable via injections especially into horizontal or vertical holes in Glulam and solid timber beams, masonry or reinforced concrete walls.
Injectable with cartridge.
Shelf life 36 months in the original unopened packaging, at temperatures between +5°C and +30°C.



Component A classification: Eye Irrit. 2; Skin Irrit. 2; Skin Sens. 1; Aquatic Chronic 2. Component B classification: Repr. 1A; Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1; Skin Sens. 1; Aquatic Chronic 3.

XEPOX G - gel

Two-components epoxy gel adhesive for structural usage, applicable via trowel also on vertical surfaces, permits the realization of thick or uneven layers. Suitable for large timber overlaps, for gluing structural reinforcing elements by using glass or carbon fiber textures and for metal or timber coatings.
Spreadable. Shelf life 36 months in the original unopened packaging, at temperatures between +5°C and +30°C.



Component A classification: Eye Irrit. 2; Skin Irrit. 2; Skin Sens. 1; Aquatic Chronic 2. Component B classification: Acute Tox. 4; Skin Corr. 1A; Eye Dam. 1; STOT SE 3; Skin Sens. 1; Aquatic Chronic 3.

TECHNICAL FEATURES

Properties	Standard		XEPOX P	XEPOX L	XEPOX F	XEPOX D	XEPOX G
Density	**ASTM D 792-66**		≈ 1,10	≈ 1,40	≈ 1,45	≈ 2,00	≈ 1,90
Stoichiometric volume ratio (A/B)[1]	-		100 : 50 [2]	100 : 50	100 : 50	100 : 50	100 : 50
Pot life 23 ± 2° 150 cc	**ERL 13-70**	[min]	-	50 ÷ 60	50 ÷ 60	50 ÷ 60	60 ÷ 70
Working life of the mixture	**ERL 13-70**	[min]	25 ÷ 30	25 ÷ 30	25 ÷ 30	25 ÷ 30	-
Application temperature (maximum relative moisture 90%)	-	[°C]	10 ÷ 35	10 ÷ 35	10 ÷ 35	5 ÷ 40	5 ÷ 40
Suggested thickness	-	[mm]	0.1 ÷ 2	1 ÷ 2	2 ÷ 4	2 ÷ 6	1 ÷ 10
Normal adhesion tension σ	**EN 12188**	[N/mm^2]	21	27	25	19	23
Slant shear strength σ_0 50°	**EN 12188**	[N/mm^2]	94	70	93	55	102
Slant shear strength σ_0 60°	**EN 12188**	[N/mm^2]	106	88	101	80	109
Slant shear strength σ_0 70°	**EN 12188**	[N/mm^2]	121	103	115	95	116
Shear-adhesion strength τ	**EN 12188**	[N/mm^2]	39	27	36	27	37
Unitary breaking load in compression[3]	**EN 13412**	[N/mm^2]	83	88	85	84	94
Elastic modulus in compression	**EN 13412**	[N/mm^2]	3438	3098	3937	3824	5764
Thermal expansion coefficient (ranging between -20°C / +40°C)	**EN 177**	[m/m·°C]	$7{,}0 \times 10^{-5}$	$7{,}0 \times 10^{-5}$	$6{,}0 \times 10^{-5}$	$6{,}0 \times 10^{-5}$	$7{,}0 \times 10^{-5}$
Tensile strength[4]	**ASTM D638**	[N/mm^2]	40	36	30	28	30
Elastic modulus in tension[4]	**ASTM D638**	[N/mm^2]	3300	4600	4600	6600	7900
Flexural strength[4]	**ASTM D790**	[N/mm^2]	86	64	38	46	46
Elastic modulus in flexure[4]	**ASTM D790**	[N/mm^2]	2400	3700	2600	5400	5400
Unitary shear strength by punch tool[4]	**ASTM D732**	[N/mm^2]	28	28	28	19	25
Viscosity	-	[mPa·s]	A = 1100 B = 250	A = 2300 B = 800	A = 14000 B = 11500	A = 300000 B = 300000	A = 450000 B = 13000

NOTES:

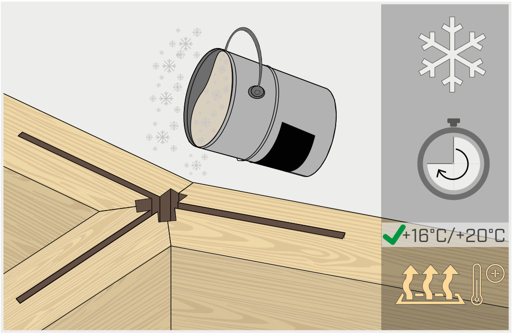
[1] The components are packaged in pre-measured quantities, ready to use. The ratio is by volume (not weight).

[2] It is best not to use more than one litre of mixed product at a time. The weight ratio between components A:B is around 100:44,4.

[3] Average value at the end of the loading / unloading cycles.

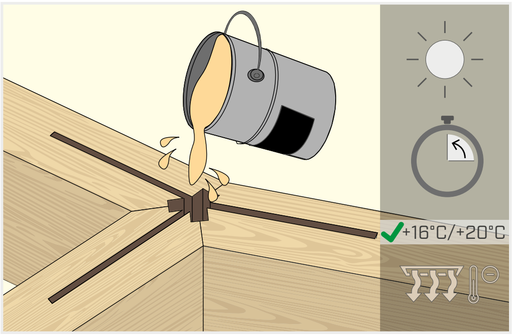
[4] Test values from the research campaign "Innovative links for timber structural elements" - Politecnico di Milano.

APPLICATION AND CONSERVATION TEMPERATURE



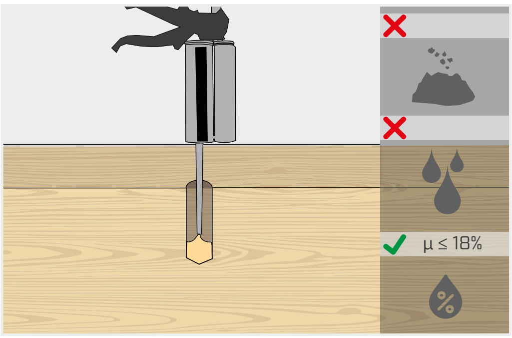
ADHESIVE CONSERVATION

Epoxy adhesives must be maintained at moderate temperature levels (approximately +16°C/+20°C) both in winter and summer until the moment they are used. Do not store the package in cold temperature environments, as it may increase the viscosity and hinder the pouring and the cartridge extrusion. Do not leave the package exposed to direct sunlight, as heat reduces the polymerisation times.



ADHESIVE APPLICATION

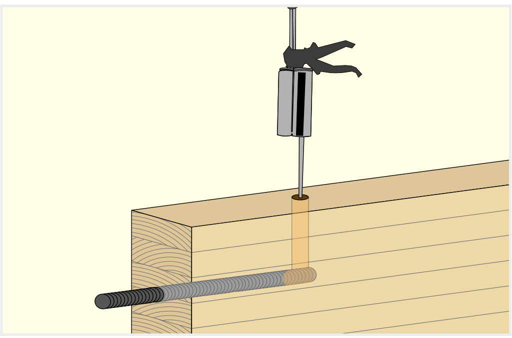
The advised ambient application temperature is > + 10 °C. If the temperature is too cold, it will be necessary to warm up the packages at least one hour prior to using them or warm up the application sites and the metallic bits before percolating the product. If the temperatures should be too high, it will be necessary cool the product down, avoiding the hottest time of day.



GROOVING AND HOLE TREATMENTS

Before pouring and injecting the adhesive, holes and grooves must be protected from meteoric water and humidity, and cleaned with compressed air. If the parts expecting the potting are wet, it is mandatory to dry them. XEPOX adhesive is recommended for use with timber that has been adequately dried, with a moisture content lower than 18%.

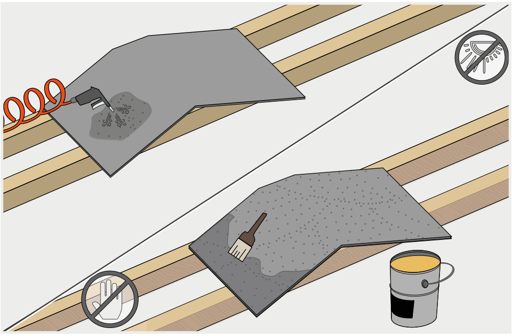
JOINTS WITH GLUED RODS



RESIN

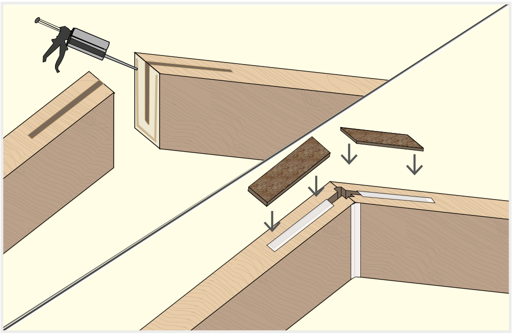
Joints with rods are suitable for extrusion with biaxial cartridges, given the small quantities of resin. To change the amount of adhesive to be injected, cut the end of the nozzle. For gluing long rods, it is recommended to prepare filling holes at right angles to the rod.

MOMENT JOINTS WITH PLATES



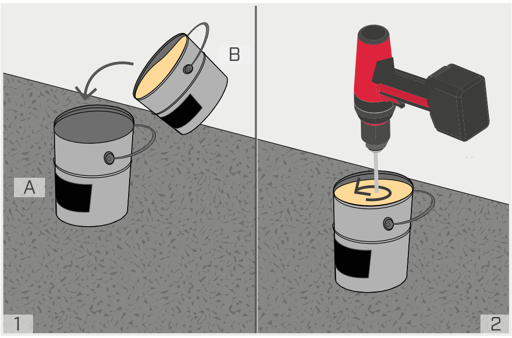
PREPARATION OF METALLIC SUPPORTS

The metallic bits reinforcing the joints must be cleaned and ungreased. Smooth sheets must be treated with grade SA2,5/SA3 sanding and then protected through a layer of XEPOX P to avoid their oxidation. Especially during hot seasons, it is necessary to protect the metallic surfaces from direct sunlight.



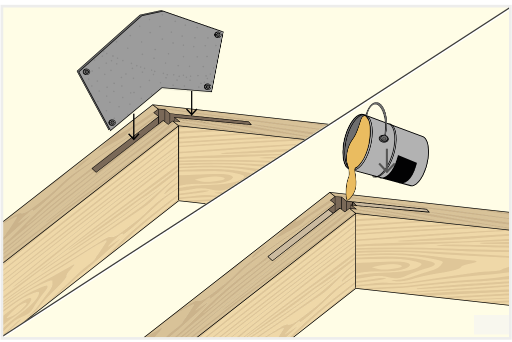
PREPARATION OF TIMBER SUPPORTS

Close to the vertical edges, apply continuous strips of adhesive paper tape at about 2÷3 mm from the edge.
Next, apply a continuous bead of acetic silicone and apply pressure so that it also adheres to the surface protected by the tape. The outer grooves of the sloping elements must be sealed with strips or wooden planks, leaving only the end of the grooves uncovered at the highest point from where the adhesive is exposed.



PRODUCT PREPARATION

To use the product in drums, poor the hardener (component B) into the drum containing the epoxy resin (component A). Vigorously mix the two different coloured components. We recommend a suitable mixer with a double helix mounted on an power tool; alternatively a metal whisk can be used. Mix until the colour is consistent. Pour the resulting mixture.
To distribute the mixture into crevices of significant length and for castings, pour directly from the drum or spread the product with a spatula.



RESIN

It is best to provide “useful” bearing of adhesive to be made with a special machine at the top of the structural timber elements as an additional guarantee of the functionality of the contact system. Spaces between the metallic and timber bits should be 2÷3 mm wide on each side. To guarantee the correct positioning of the bits in the grooves, place spacing washers in the inserts during the protection polymerisation phase with XEPOX P.

XEPOX EPOXY ADHESIVE

A HISTORICAL FAMILY OF PRODUCTS FOR JOINTS BETWEEN TIMBER ELEMENTS, ABLE TO GUARANTEE AN EXCELLENT RESTORATION OF STRENGTH AND STIFFNESS

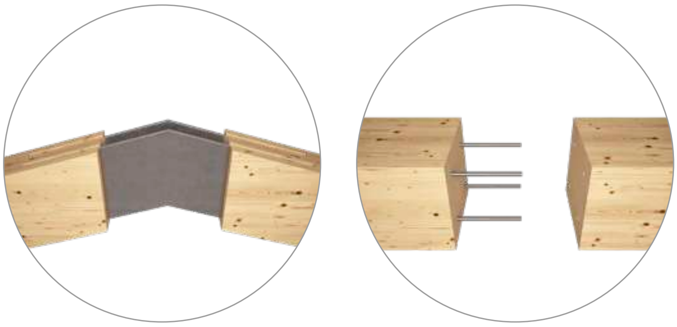
XEPOX epoxy adhesives are two-component resins specifically formulated to penetrate the microstructure of wood and adhere to it with great effectiveness, and to reduce the typical resin crystallization.

The mixture of components A and B causes an exothermic reaction (heat development) and, once hardened, forms a three-dimensional structure with exceptional properties, such as: durability over time, interaction with no humidity, excellent thermal stability, great stiffness and strength.
Each chemical or mineral element of the formulation has a specific role and all together they contribute to the achievement of the performance characteristics of the adhesive.

FIELD OF USE

The different viscosities of XEPOX products guarantee versatile uses for different types of joints, both for new constructions and for structural recoveries. The use in combination with steel, in particular plates, sandblasted or drilled, and rods, allows to provide high strength in limited thickness.

1. MOMENT CONTINUITY JOINT



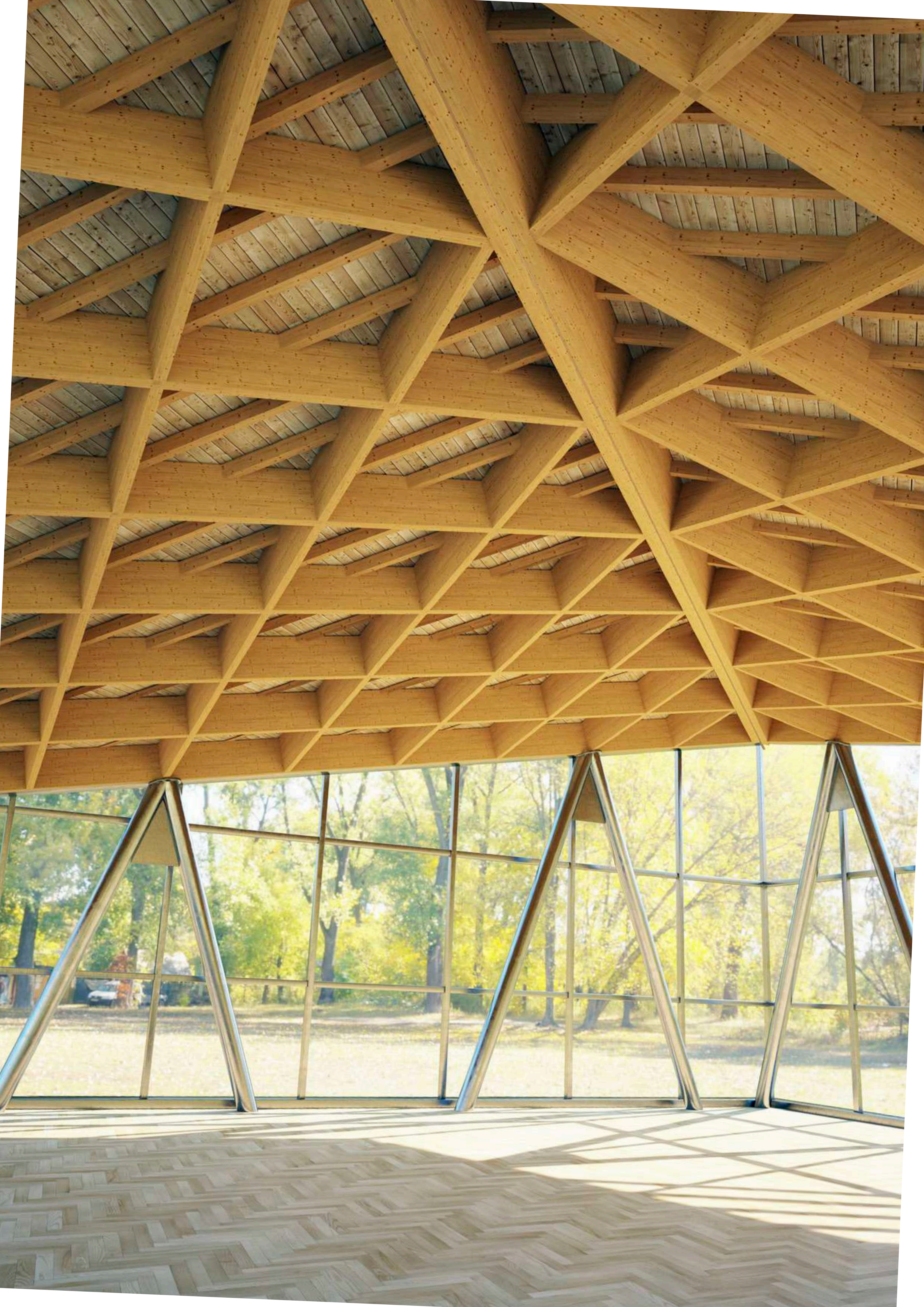
2. TWO OR THREE-WAY CONNECTIONS

3. TIMBER JOINT

4. REHABILITATION OF DAMAGED PARTS

AESTHETIC IMPROVEMENTS

The cartridge format also allows it to be used for aesthetic adjustments and gluing in small quantities.



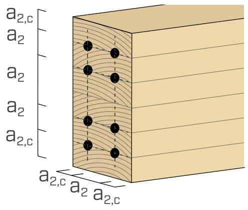
JOINTS WITH GLUED RODS

The indications contained in DIN 1052:2008 and in the Italian standards CNR DT 207:2018 are reported.

MINIMUM DISTANCES FOR RODS

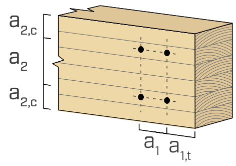
TENSION
Rods glued // to the fibre

a_2	**5d**
$a_{2,c}$	**2,5d**



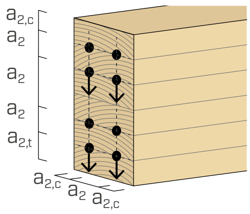
TENSION
Rods glued ⊥ to the fibre

a_1	**4d**
a_2	**4d**
$a_{1,t}$	**2,5d**
$a_{2,c}$	**2,5d**



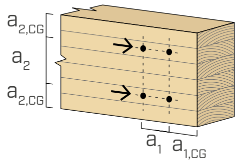
SHEAR
Rods glued // to the fibre

a_2	**5d**
$a_{2,c}$	**2,5d**
$a_{2,t}$	**4d**



SHEAR
Rods glued ⊥ to the fibre

a_1	**7d**
a_2	**5d**
$a_{1,CG}$	**10d**
$a_{2,CG}$	**4d**



The minimum insertion length is:

$$l_{min} = max \begin{Bmatrix} 0,5\ d^2 \\ 10\ d \end{Bmatrix}$$

CALCULATION METHOD

TENSILE STRENGTH

The tensile strength of a rod of diameter d is equal to:

$$R_{ax,d} = min \begin{cases} f_{yd} \cdot A_{res} & \text{steel failure} \\ \pi \cdot d \cdot l \cdot f_{v,d} & \text{timber shear failure} \\ f_{t,0,d} \cdot A_{eff} & \text{timber tensile strength} \end{cases}$$

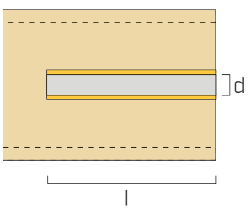
The effective area considers a square of timber with a maximum side of 6d; the area is reduced for smaller distances between the elements or from the edge.

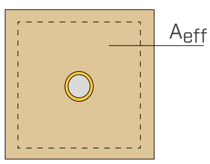
f_{yd} = design steel strength

$f_{t,0,d}$ = timber design tensile strength

The shear strength of the bonding $f_{v,k}$ depends on the insertion length

l [mm]	**$f_{v,k}$** [MPa]
≤ 250	**4**
250 < l ≤ 500	**5,25 - 0,005 x l**
500 < l ≤ 1000	**3,5 - 0,0015 x l**





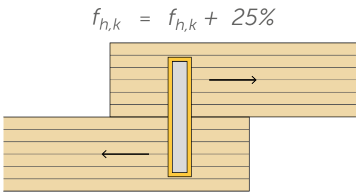
for angle α of inclination with respect to the fibre the following occurs:

$$f_{v,\alpha,k} = f_{v,k} \cdot (1,5 \cdot sin^2\alpha + cos^2\alpha)$$

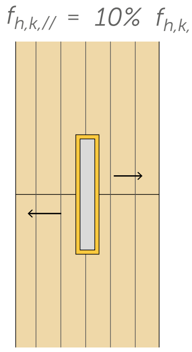
SHEAR STRENGTH

The shear strength of a rod can be calculated using the well-known Johansen's formulas for bolts with the following measures.

For rods glued perpendicularly to the fibre, the bearing stress strength can be increased by up to 25%.



The bearing stress strength for rods glued parallel to the fibre is 10% of the value perpendicular to the fibre.



The hollow effect is evaluated as the strength given by the extraction bonding (failure b).
To obtain the strength of a rod bonded at an α angle, it is permitted to interpolate linearly between the strength values for α at 0° and 90°.

EXPERIMENTATION

The extraction calculation of a rod glued with XEPOX is reported, comparing the result with the tests carried out at the University of Biel, measuring the overstrength factor between the test and the calculation. This demonstrates the existing safety margin: however, it should be remembered that the value resulting from the test is not a characteristic value and is not intended to be used in the design.

GEOMETRIC DATA

Specimen side	80	mm
A_{eff}	6400	mm
d	16	mm
l	160	mm
f_{yk}	900	MPa
$f_{t,0,k}$	27	MPa
γ_{M0}	1	
k_{mod}	1,1	
γ_M	1,3	

Steel failure	162,9	kN
Timber shear failure	29,0	kN
Timber tensile strength	146,2	kN
$R_{ax,d}$ = design resistant axial action	29,0	kN
$R_{ax,m}$ = experimental average strength axial action	96,3	kN
f = overstrength factor	3,3	

NOTES:

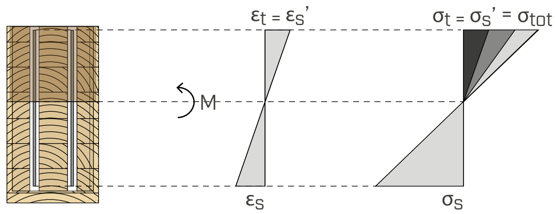
The tensile strength was derived from the average density of the specimens used for the tests.

The calculations were made taking into account the values of k_{mod} and γ_M according to EN 1995 1-1, and γ_{M0} according to EN 1993 1-1.

MOMENT JOINTS WITH PLATES

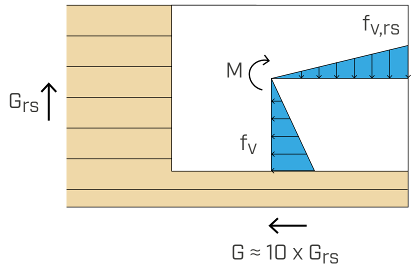
CALCULATION MODE | HEAD SECTION

The stresses due to the moment and the axial action are determined by homogenizing the materials of the section, in the hypothesis of conservation of the flat sections. The shear stress is absorbed only by the plates. It is also necessary to check the stresses acting on the timber section net of the grooved sections.



CALCULATION METHOD | MOMENT DISTRIBUTION ON THE STEEL-WOOD-ADHESIVE INTERFACE

The moment is distributed over the number of interface surfaces and then broken down into stresses, considering both the polar inertia around the centre of gravity and the different rigidity of the wood. In this way, the maximum tangential tensions are obtained in the orthogonal and parallel direction to the fibre, to be verified also in their interaction.



Polar moment of inertia of half the bit with respect to the centre of gravity, weighed on the timber cutting modules:

$$J_P^* = \frac{l_i \cdot h^3}{12} \cdot G + \frac{l_i^3 \cdot h}{12} \cdot G_{rs}$$

Calculation of tangential forces and combined verification:

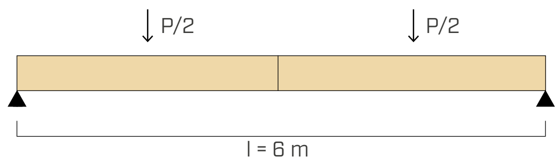
$$\tau_{max,hor} = \frac{(M_d + M_{T,Ed})}{2 \cdot n_i \cdot J_P^*} \cdot \frac{h}{2} \cdot G + \frac{N_d}{2\ n_i\ A_i}$$

$$\tau_{max,vert} = \frac{(M_d + M_{T,Ed}) \cdot e}{2 \cdot n_i \cdot J_P^*} \cdot G_{rs} + \frac{V_d}{2\ n_i\ A_i}$$

$$\sqrt{\left(\frac{\tau_{max,hor}}{f_{v,d}}\right)^2 + \left(\frac{\tau_{max,vert}}{f_{v,rs,d}}\right)^2} \leq 1$$

EXPERIMENTATION

The calculation of two joints made with XEPOX is shown, comparing the result with the 4 point bending tests carried out at the Politecnico di Milano. The **overstrength factor** between the test and the calculation is determined, which demonstrates the good safety margin that exists in the calculation of the joints. The value resulting from the test **is not a characteristic value and is not intended to be a use value in the design**.



LEGEND:

B	beam base
H	beam height
α_1	beams angle of inclination
n_i	number of bits
S_i	metal bits thickness
h_i	metal bits height
l_i	metal bits insertion length
A_i	half bit surface
e	eccentricity between the centre of gravity of the plate and the head joint
B_n	beam width less the grooving
σ_t	maximum compressive stress in timber
σ_s'	maximum compressive stress in steel
σ_s	maximum tensile stress in steel
σ_{tm}	maximum flexural force in timber
$\tau_{max,hor}$	maximum horizontal tangential force
$\tau_{max,vert}$	maximum vertical tangential force
$f_{v,d}$	shear strength parallel to the fibre
$f_{v,rs,d}$	shear strength perpendicular to the fibre
$k_{c,90}$	parameter from EC 1995 1-1

EXAMPLE 1 | CONTINUITY JOINT

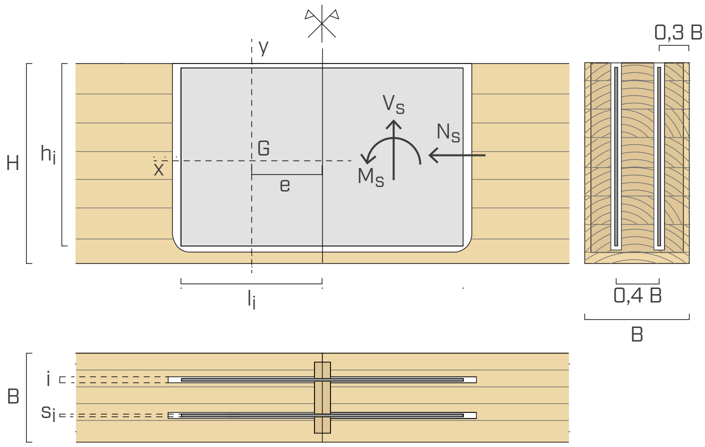
GEOMETRY OF THE NODE: BEAM AND PLATES

n_i	2	mm	B	200	mm
S_i	5	mm	H	360	mm
h_i	320	mm	B_n	182	mm
l_i	400	mm			
e	200	mm			

PROJECT MATERIAL AND DATA

Steel class	**S275**
γ_{M0}	1
Wood class	**GL24h**
k_{mod}	1,1
$\gamma_{M\ timber}$	1,3

Metal bits sandblasted to grade SA2.5/SA3 (ISO8501).



USE OF XEPOX

Protect the bits from oxidation with **XEPOX P**. Use **XEPOX F** or **XEPOX L** adhesive.

CONTROLS

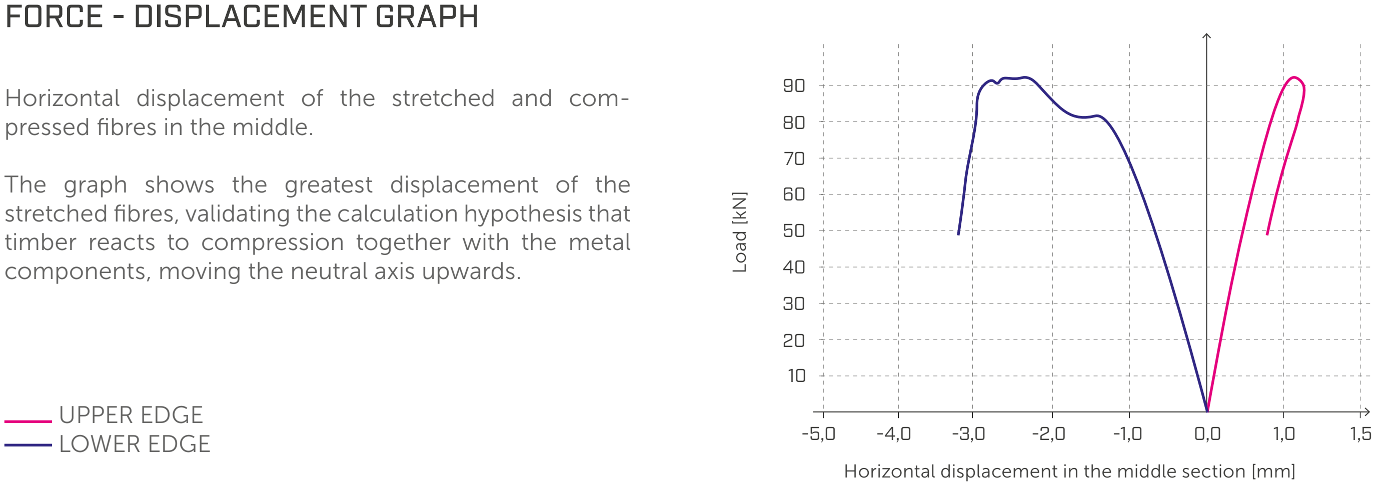
M_d	design moment applied		**54,3 kNm**
HEAD JOINT VERIFICATION [1], [2]			
			% verification
σ_t		10,6 MPa	53 %
$\sigma_{s'}$		185,8 MPa	68 %
σ_s		274,9 MPa	100 %
VERIFICATION OF THE TIMBER CROSS-SECTION WITHOUT THE GROOVING			
			% verification
σ_{tm}		14,1 MPa	70 %
INTERFACE SURFACES MAXIMUM TANGENTIAL TENSION CHECK [3], [4]			
			% verification
J_p*		$8{,}56 \cdot 10^{11}$ Nmm^2	
$\tau_{max,hor}$ (3)		1,7 MPa	57 %
$\tau_{max,vert}$ (3)		0,2 MPa	20 %
combined verification			60 %

$M_d = M_{Rd}$	applied moment = design strength moment	**54,3 kNm**
M_{TEST}	test resistant moment	**94,1 kNm**
f	overstrength factor	**1,7**

FORCE - DISPLACEMENT GRAPH

Horizontal displacement of the stretched and compressed fibres in the middle.

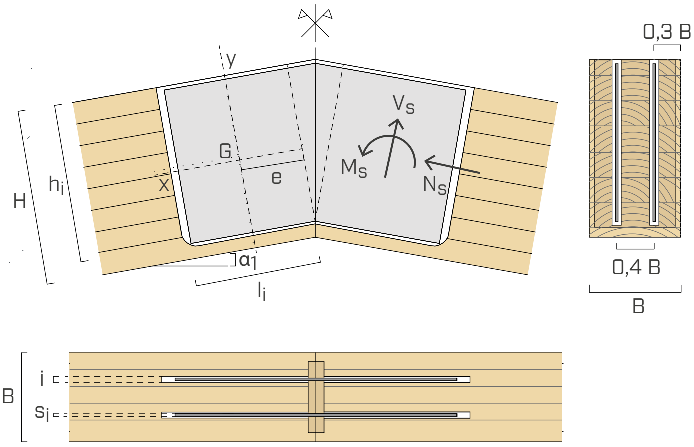
The graph shows the greatest displacement of the stretched fibres, validating the calculation hypothesis that timber reacts to compression together with the metal components, moving the neutral axis upwards.



EXAMPLE 2: KNEE JOINT

GEOMETRY OF THE NODE: BEAM AND PLATES

n_i	2	mm	B	200	mm
S_i	6	mm	H	360	mm
h_i	300	mm	B_n	176	mm
l_i	568	mm	α_1	21,8	°
e	332	mm			



PROJECT MATERIAL AND DATA

Steel class	**S275**
γ_{M0}	1
Wood class	**GL32c**
k_{mod}	1,1
$\gamma_{M\ timber}$	1,3

Metal bits sandblasted to grade SA2.5/SA3 (ISO8501).

USE OF XEPOX

Protect the bits from oxidation with **XEPOX P**. Use **XEPOX F** or **XEPOX L** adhesive.

CONTROLS

M_d	design moment applied	**63,5**	**kNm**

HEAD JOINT VERIFICATION [1], [2]

		% verification
$k_{c,90}$ (A)	1,75	
σ_c	12,7 MPa	100 %
$\sigma_{s'}$	180,7 MPa	66 %
σ_s	262,0 MPa	95 %

VERIFICATION OF THE TIMBER CROSS-SECTION WITHOUT THE GROOVING

		% verification
σ_t	16,7 MPa	62 %

INTERFACE SURFACES MAXIMUM TANGENTIAL TENSION CHECK [3], [4]

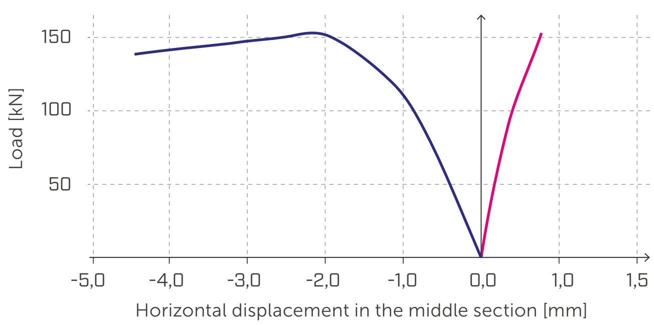
		% verification
J_p*	$1,52 \cdot 10^{12}$ Nmm^2	
$\tau_{max,hor}$ (3)	1,1 MPa	38 %
$\tau_{max,vert}$ (3)	0,2 MPa	21 %
combined verification		43 %

$M_d = M_{Rd}$	applied moment = design strength moment	**63,5**	**kNm**
M_{TEST}	test resistant moment	**131,8**	**kNm**
f	overstrength factor	**2,1**	

FORCE - DISPLACEMENT GRAPH

Horizontal displacement of the stretched and compressed fibres in the middle.

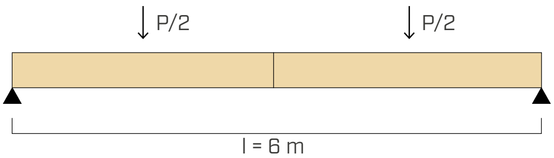
The graph shows the greatest displacement of the stretched fibres, validating the calculation hypothesis that timber reacts to compression together with the metal components, moving the neutral axis upwards.



UPPER EDGE
LOWER EDGE

JOINTS STIFFNESS

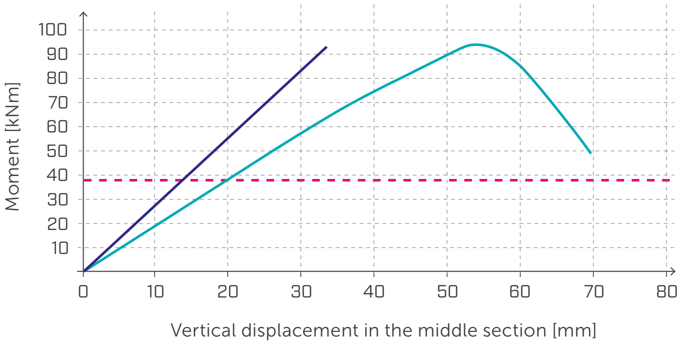
The moment joints made with XEPOX adhesives guarantee excellent stiffness to the connected elements. In support of this, we compare the deflection values obtained from analytical calculations for an unjointed beam of equal span, cross-section and load with the experimental data in calculation example 1.



To obtain a deflection reference value from the available experimental data, an operating load must be determined. To achieve this, it is possible to consider the strength moment of 54.5 kNm calculated for the beam in calculation example 1, which ideally corresponds to the maximum acceptable stress at the Ultimate Limit State. Starting from this data, and assigning a realistic load distribution on the beam, it is possible to determine a maximum stressing moment in operation using the load amplification coefficients according to the reference standard.
Assuming therefore to dimension a flat roof made of timber that cannot be walked on, the following loads are defined.
$p = 1{,}5\ kN/m^2$; $q = 1{,}5\ kN/m^2$
In this hypothesis, the total load, in the strictest operational combination, is about 70% of the load at the Ultimate Limit State. As a result, the maximum working moment is 54.3 x 0.7 = 38 kNm, which causes an instantaneous deflection, for the unjointed beam, of about 13 mm, while the deflection measured experimentally is 19 mm. The increase in vertical displacement during operation is therefore: l/1050.

MOMENT - DISPLACEMENT GRAPH

BEAM WITH XEPOX JOINT
CONTINUOUS BEAM
MAXIMUM MOMENT IN OPERATION



NOTES:

(A) $k_{c,90}$ is a factor that modulates the compressive strength of timber in relation to the force-fibre angle in the Hankinson formula (EC 1995-1-1, section 6.1.5). However, the formula does not take into account the stabilization of the wood fibres offered by resin, which fills the wood voids; the designer can decide to increase this factor.

(1) The calculation of the cross-section has been made considering elastic-line bonds for all materials. It should be noted that in case of axial and shear loads, it is necessary to check the combination of these forces.

(2) In this calculation, it is considered that the resin bearing allows full contact of the interface section, and therefore the timber can react to compression. If the bearing is not made, it is advisable to check the metal bit alone as a reagent, applying the formula with the geometrical parameters of the bit:

$$f_{yd} \leq \frac{M_d}{\frac{B \cdot h^2}{6}}$$

(3) XEPOX adhesives are characterized by tensile and shear strength values much larger than those of timber and with constant value over time. Due to this reason the interface torsional capacity check can be performed only on the timber element, considering the same check satisfied by the adhesive.

(4) The shear stress "τ" of the timber-adhesive-steel interface, transferred to the timber, is calculated at its maximum value in the case of an inclination parallel or perpendicular to the wood grain. These stresses are compared for the wood shear strength and the rolling shear strength, respectively. The calculation made here should also take into account the value of the transport moment $M_{T,Ed}$ resulting from the shear stress, if any.

It should be noted that the calculations have been made taking into account the values of k_{mod} and γ_M according to EN 1995 1-1, and γ_{M0} according to EN 1993 1-1.

SHARP METAL

STEEL HOOKED PLATES

NEW TECHNOLOGY

The plates have a multitude of small hooks, spread all over the steel surface. The joint is made by the mechanical engagement of the metal hooks in the timber.

HOOKED PLATES

The large number of hooks distributed over the entire surface generates a biting grip of the plates in the timber with exceptional strength and stiffness values. The connection performance is comparable to the adhesion of a bonding agent. Non-invasive and uninstallable system.

DIFFUSED LOAD

The forces are absorbed by the hooks and distributed over the entire surface. Concentrated forces are eliminated and the problem of minimum distances is reduced. The thickness of the steel (0.75 mm) is optimised so it can be screwed without pre-drilling with HBS and TBS screws for tightening the joint.

CHARACTERISTICS

FOCUS	timber-to-timber shear joint
LENGTH	1,2 and 5 m
THICKNESS	0,75 mm
FASTENERS	HBS, TBS, TBS MAX

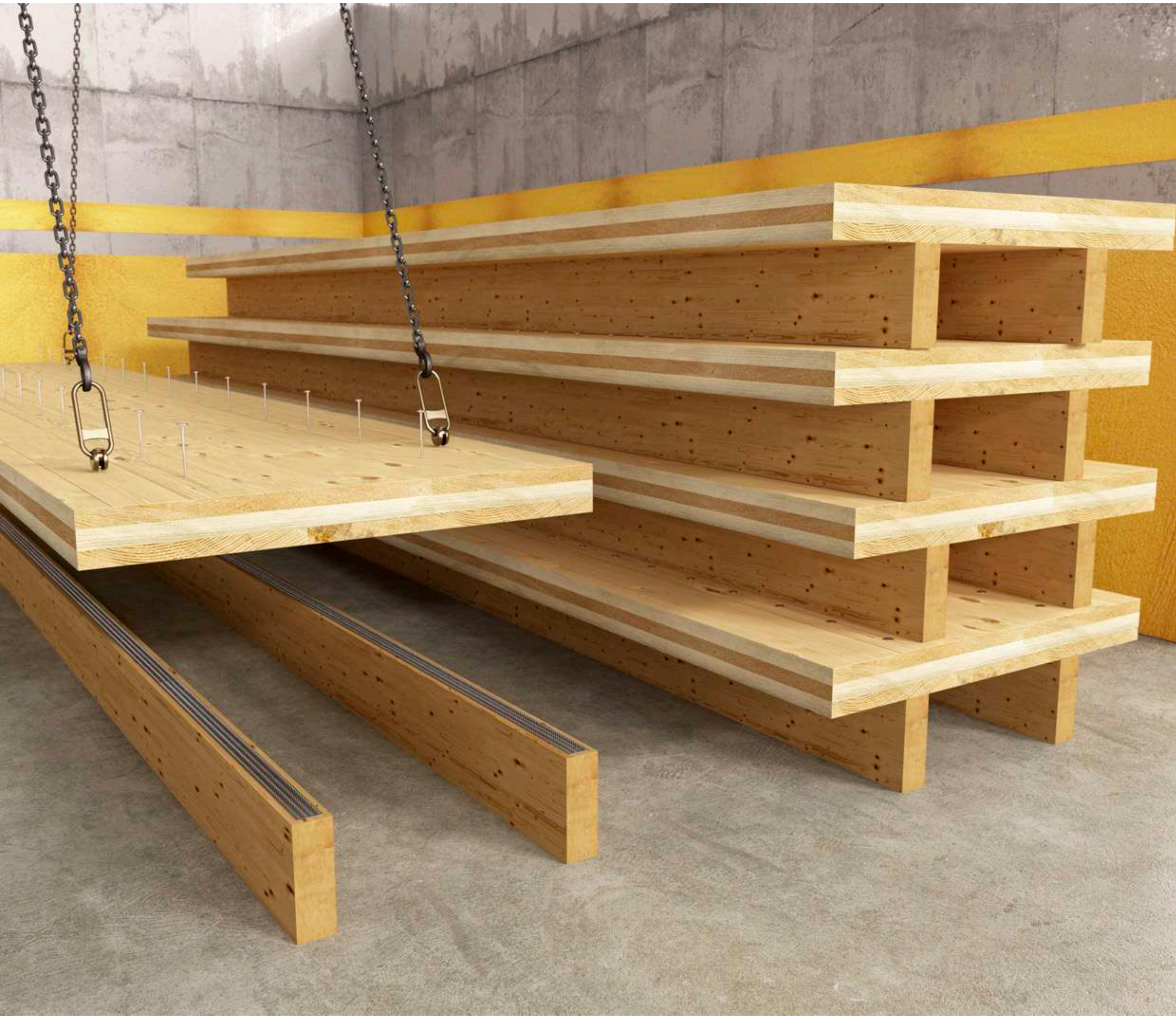
MATERIAL

Carbon steel with electrolytic coating.

FIELDS OF USE

Shear joints between timber surfaces

- solid timber and glulam
- CLT, LVL
- timber based panels



RIBBED FLOOR WITHOUT GLUE

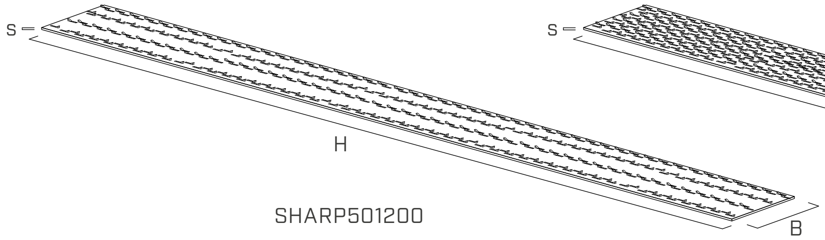
Thanks to the hook technology, it is ideal for the production of ribbed floors (Rippendecke, ribbed floor) without the use of glues, adhesives and presses. Elimination of waiting times for glue setting and curing.

SHEAR JOINTS

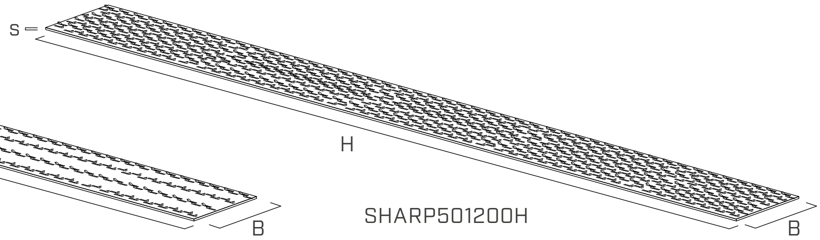
Hooked plates allow the transfer of shear forces between two timber surfaces. Performance comparable to gluing.

CODES AND DIMENSIONS

SHARP METAL - plates



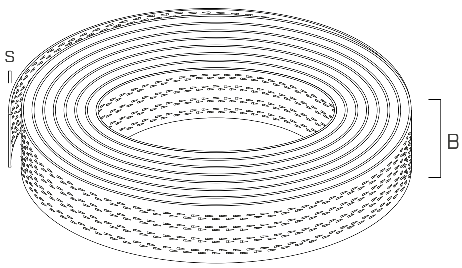
SHARP501200



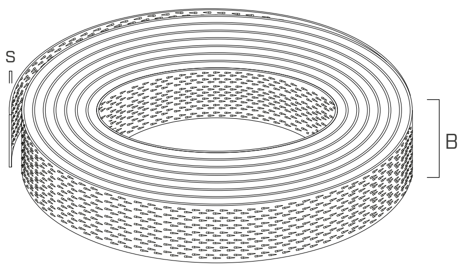
SHARP501200H

CODE	B [mm]	H [mm]	s [mm]	version		pcs
SHARP501200	50	1200	0,75	Low Density	●	10
SHARP501200H	50	1200	0,75	High Density	●	10

SHARP METAL - tapes



SHARP50



SHARP50H

CODE	B [mm]	L [m]	s [mm]	version		pcs
SHARP50	50	5	0,75	Low Density	●	1
SHARP50H	50	5	0,75	High Density	●	1

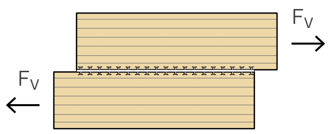
MATERIAL AND DURABILITY

SHARP METAL: carbon steel with electrolytic coating.
To be used in service classes 1 and 2 (EN 1995-1-1).

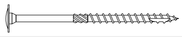
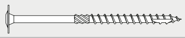
FIELD OF USE

- Timber-to-timber joints

EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support
TBS	washer head timber screw		8	
TBS MAX	washer head timber screw		8	

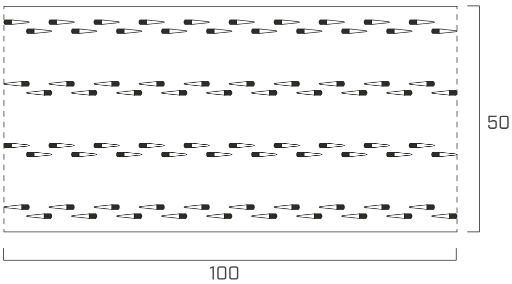
For further details refer to the "Screws and connectors for timber" catalogue.

PRODUCT VERSIONS

SHARP METAL plates and tapes are made with a special finish on both surfaces; this allows the steel to anchor to the timber elements and develop a sliding strength.

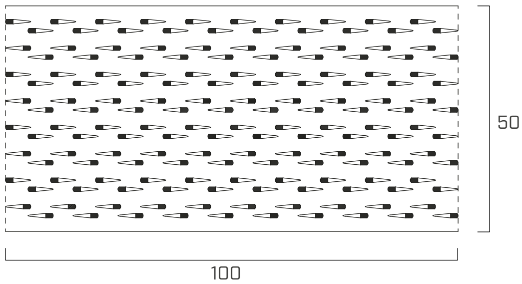
LOW DENSITY (LD)

SHARP501200
SHARP50

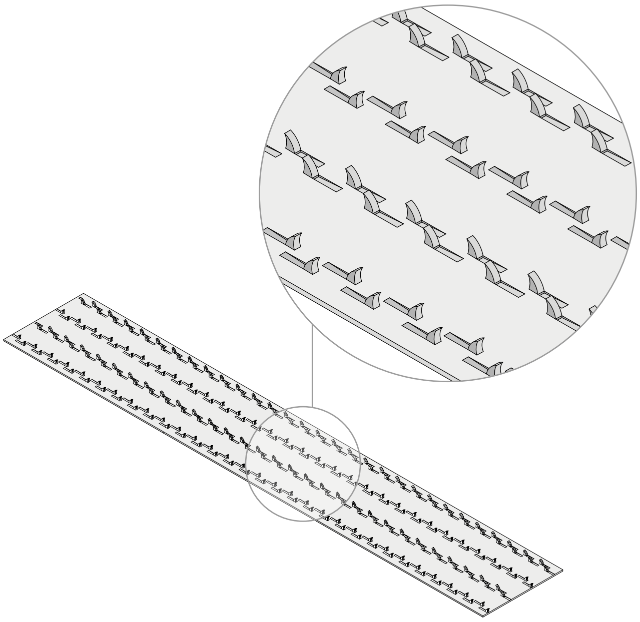


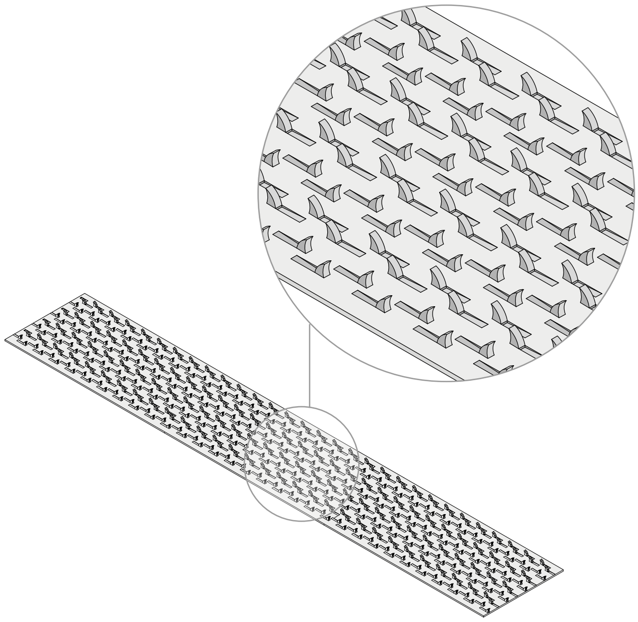
HIGH DENSITY (HD)

SHARP501200H
SHARP50H



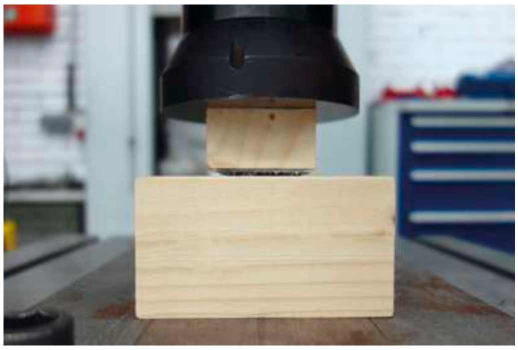
- need for reduced pressure to ensure the engagement
- high strength and rigidity concentrated in small dimensions





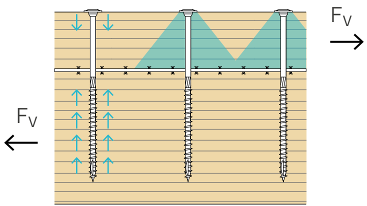
INSTALLATION

The connection with SHARP METAL HD requires a minimum application pressure of 1,5-2,5 MPa, depending on the type of wood, in order to ensure the engagement; the LD version requires about half the force.



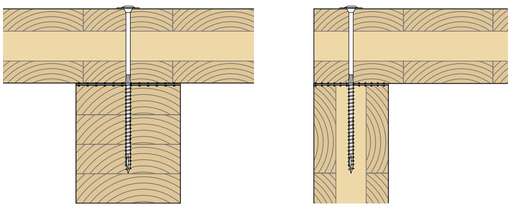
With TBS screws

For a practical use of the plates it is possible to use Ø8 TBS through screws without pre-drilling hole, 12d pitch.
The larger head of the TBS screws applies sufficient compression to the anchor of the SHARP METAL system; it is necessary that the thread of the screw falls entirely into the second connected ashlar.



With TBS MAX screws

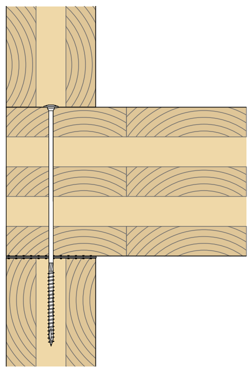
It is possible to use TBS MAX screws, increasing the pitch to 20d, for example in application in ribbed timber floors or in corner connections between CLT walls.



Functionality in the use of screws

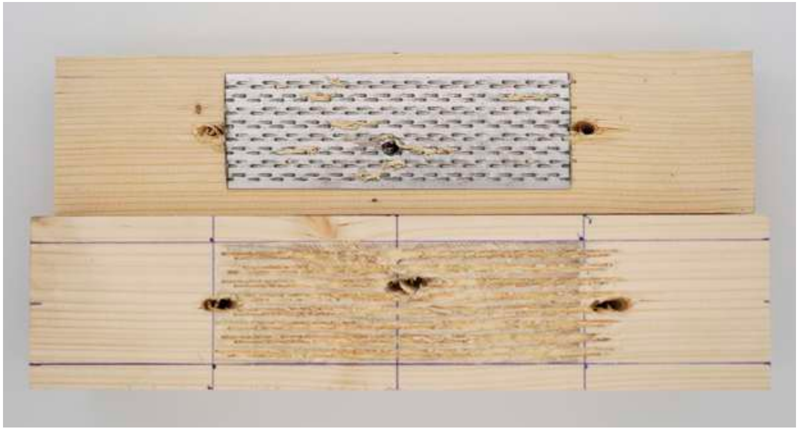
The use of SHARP METAL in combination with screws allows a practical and safe installation. The hooked plate provides considerable confinement to the timber, increasing its strength against splitting failure due to loads parallel to the fiber acting on the screws.

The use of screws is also recommended for supporting tensile loads between connected surfaces, e.g. in a floor-wall shear connection. Although the vertical loads of the deck ensure adequate pressure between the surfaces, it is possible that tension is transmitted. The screws, in this case, absorb the stress without affecting the shear connection engagement.



EXPERIMENTATION

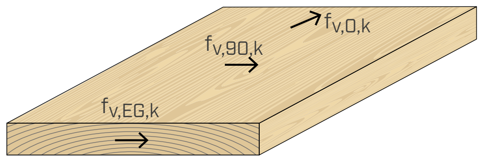
An extensive experimental campaign on SHARP METAL products was carried out in collaboration with the University of Innsbruck; the results of tests on solid timber in different directions with respect to wood grain are proposed. In order to check possible scale effects, different plate lengths were tested and pressure was guaranteed with screws.



Characteristic strength values WITHOUT SCREWS

type	$f_{v,0,k}$ (1) [MPa]	$f_{v,90,k}$ (1) [MPa]	$f_{v,EG,k}$ (1) [MPa]
LD	0,93	0,20	1,03
HD	1,15	0,51	1,03

The values in the table are derived from the experimental data from which the strengths of the test screws have been deducted.



Characteristic strength values of the SHARP METAL connection WITH SCREWS

type	$f_{v,0,k}$ [MPa]	$k_{ser,0,k}$ [N/mm]*[1/mm²]	$f_{v,90,k}$ [MPa]	$k_{ser,90,k}$ [N/mm]*[1/mm²]	$f_{v,EG,k}$ [MPa]	$k_{ser,EG,k}$ [N/mm]*[1/mm²]
LD	2,02	3,13	2,11	0,65	1,92	4,19
HD	2,24	6,47	2,42	0,90	1,92	5,00

The values in the table correspond to the experimental data with TBS 8x160 screws at 10d (80 mm) pitch with under head timber thickness of 60 mm.

The overall stiffness of the K_{ser} connection [N/mm] is determined by multiplying the k_{ser} coefficient by the plate surface.

NOTES:

(1) For characteristic densities ρ_k less than 450 kg/m³, the shear strength can be calculated as a function of ρ_k, by multiplying the strength values in the table by the k_{dens} factor

$$k_{dens} = \left(\frac{\rho_k}{450}\right)^{1,1}$$

GENERAL PRINCIPLES:

- The strengths and stiffness values are obtained experimentally on wooden specimens with a density of 450 kg/m³.
- SHARP METAL must be used on medium density wood-based materials $\rho_m \leq 525$ kg/m³.

PANELS AND BUILDING JOINTS

PANELS AND BUILDING JOINTS

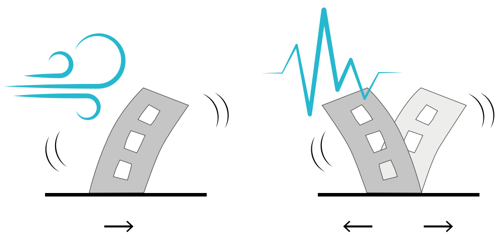
PANELS AND BUILDING JOINTS

TIMBER BUILDINGS

HORIZONTAL LOADS

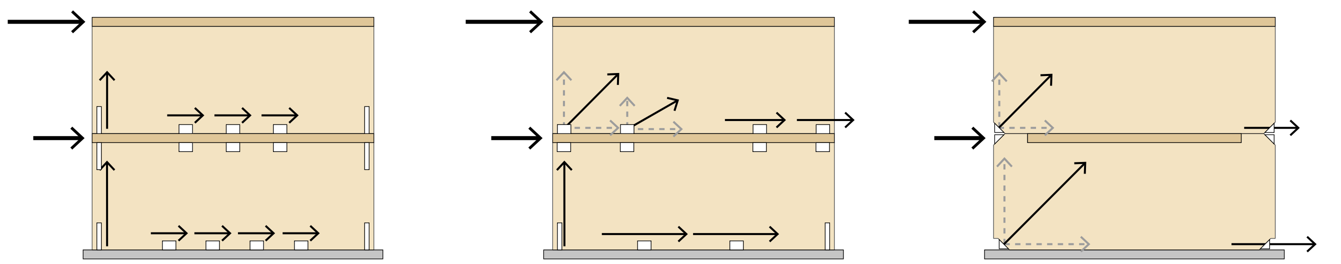
During the design phase of a building its reaction to horizontal and vertical actions such as, **wind** and/or **earthquakes** must be considered.

Horizontal actions can be schematised as loads acting on the floor levels. To guarantee the adequate seismic performance of timber buildings and avoid all the possible failure modes, it is fundamental to design all the connection systems correctly.



LOAD PATTERN

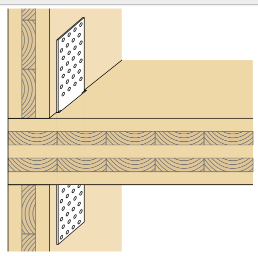
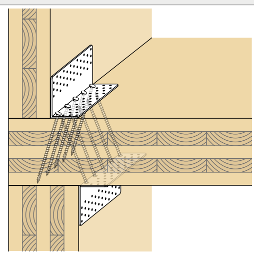
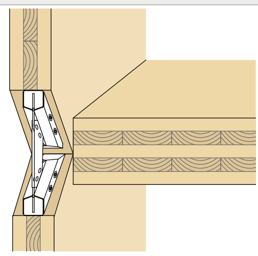
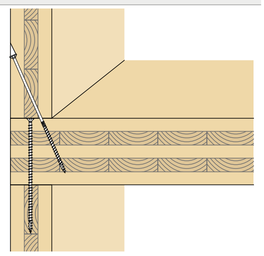
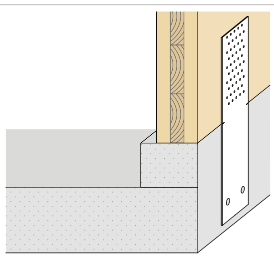
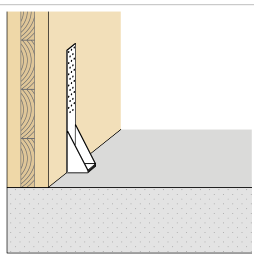
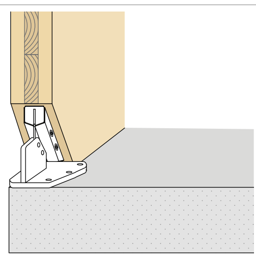
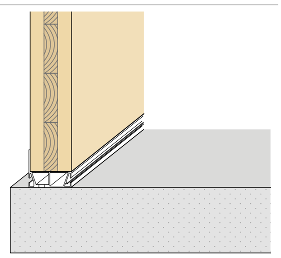
STANDARD APPROACH | INNOVATIVE APPROACHES



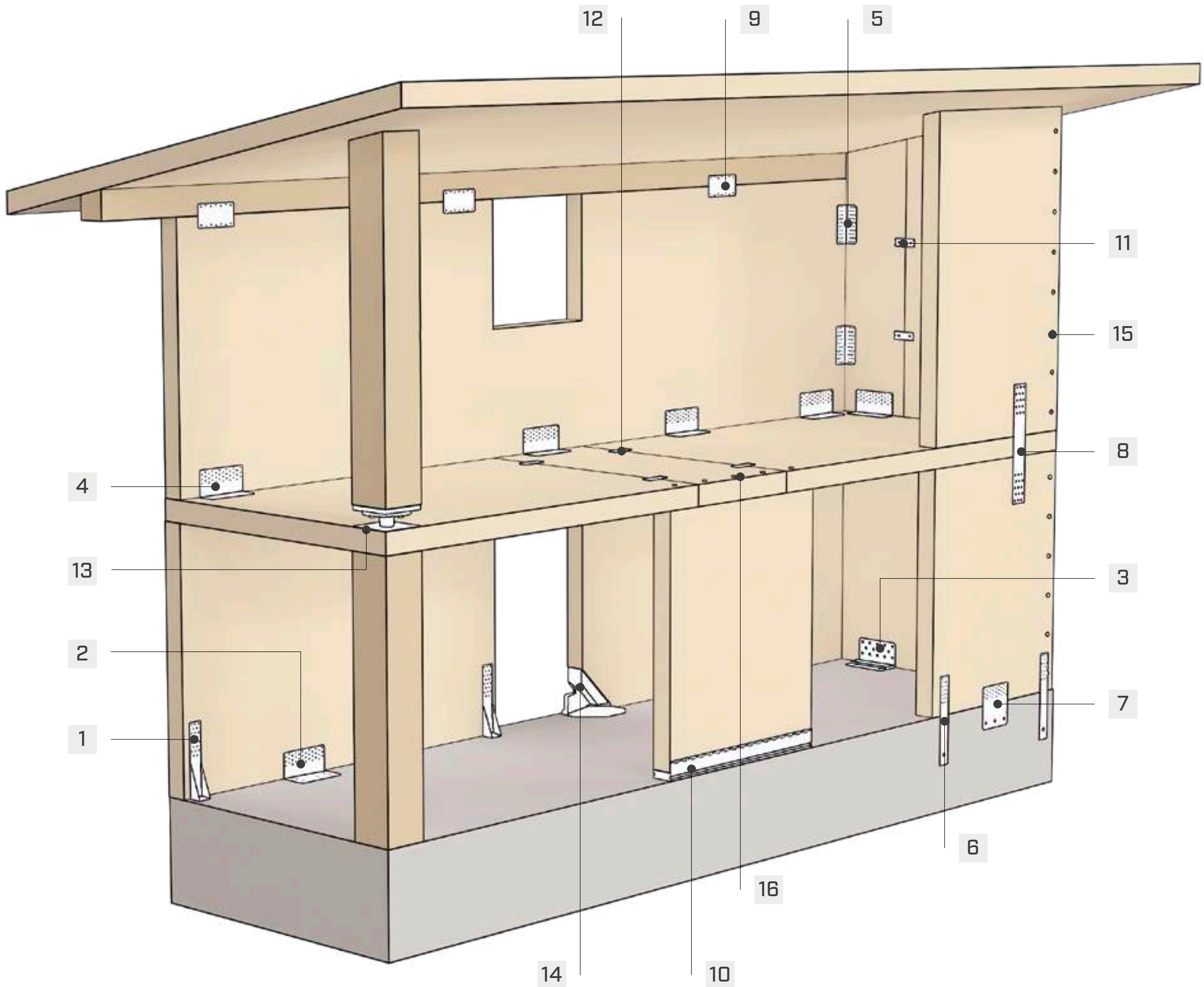
Horizontal loads acting at the floor level introduce shear and tension forces on the structural elements of the building; these forces must be absorbed by an effective connection system. A complete range of joints for walls and buildings also allows for innovative design approaches.

THE RIGHT SOLUTION FOR EVERY JOINT

The same structural problem can be solved using different alternative connection systems.

	TWO-DIMENSIONAL PLATES	THREE-DIMENSIONAL ANGLE BRACKETS	CONCEALED JOINTS	DISTRIBUTED JOINTS
INTERMEDIATE FLOOR JOINT				
	WHT/TITAN PLATE T TIMBER	TITAN	X-RAD	VGZ/HBS
BASE JOINT				
	WHT/TITAN PLATE C CONCRETE	WHT/TITAN	X-RAD	ALU START

CONNECTIONS



ANGLE BRACKETS		
They are used for both timber-to-timber and timber-to-concrete connections. Depending on the specific model, they can be used to transfer tensile and shear forces, or a combination of both forces. The addition of special washers improves their performance and versatility.	1	WHT
	2	TITAN N
	3	TITAN S + WASHER
	4	TITAN V
	5	TITAN F

TWO-DIMENSIONAL PLATES		
They allow the transfer of both tensile and shear forces; depending on the type used, they are suitable for both timber-to-timber and timber-to-concrete connections. Using fasteners with different diame-ters means that a wide range of strengths can be covered.	6	WHT PLATE C
	7	TITAN PLATE C
	8	WHT PLATE T
	9	TITAN PLATE T

SPECIAL CONNECTORS		
A new range of simple solutions are available to solve complex problems from small residential buildings to multi-storey buildings. These solutions offer the opportunity for designers and builders to break the mould and find innovative solutions.	10	ALU START
	11	SLOT
	12	SLOT
	13	SPIDER/PILLAR
	14	X-RAD

SELF-DRILLING SCREWS		
The self-tapping product range of screws that provide an optimal solution to satisfy the design re-quirements regardless of the type of external action.	15	HBS/TBS screws
	16	VGZ screws

SEISMIC-REV

Reduction of Earthquake Vulnerability

The **Seismic-REV project (Reduction of Earthquake Vulnerability)** had the clear aim of reducing the seismic vulnerability of the timber constructions, by studying and then characterizing the behavior of the traditional metallic connections used to assemble timber buildings. An innovative connection system, named X-RAD, that is meant to be used for residential CLT buildings (Cross Laminated Timber, i.e. timber panels made of layers of boards arranged perpendicularly one to each other), has also been proposed. This research project involved different institutions. Together with Rothoblaas, collaborated the CNR-IVALSA Institute of San Michele all'Adige and the University of Trento, where the experimental and research work has been carried out.

The scientific report on experimental testing is available at Rothoblaas.

CONNECTORS (screws, nails, ...)

Cylindrical connectors (such as screws and nails) under both tensile and shear loads, for timber-to-panel, steel-to-timber and timber-to-timber joints.

1

Sheathing-to-framing specimen with ring nails tested in shear load

2

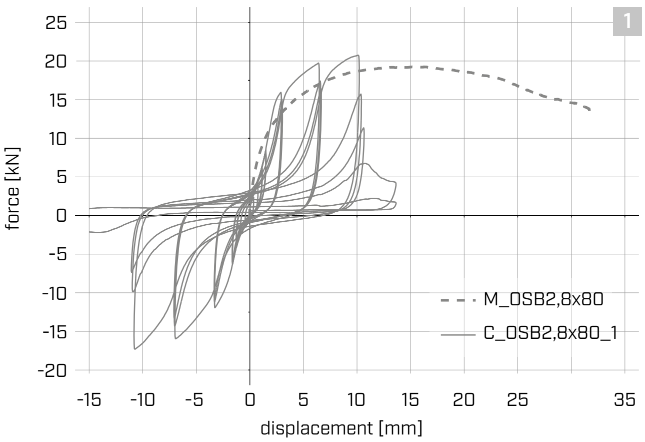
Steel-to-timber specimen with LBS screws tested in shear

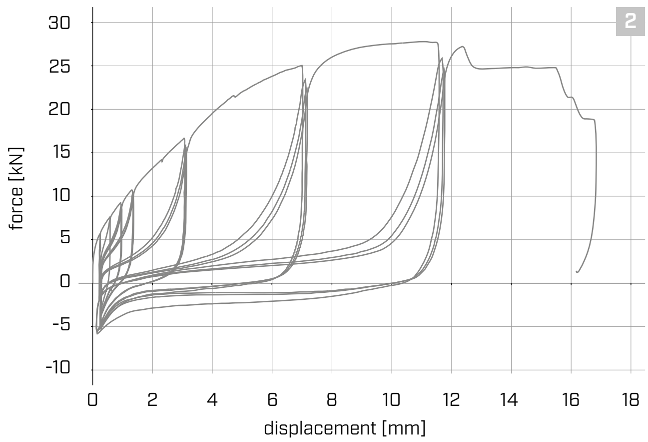
3

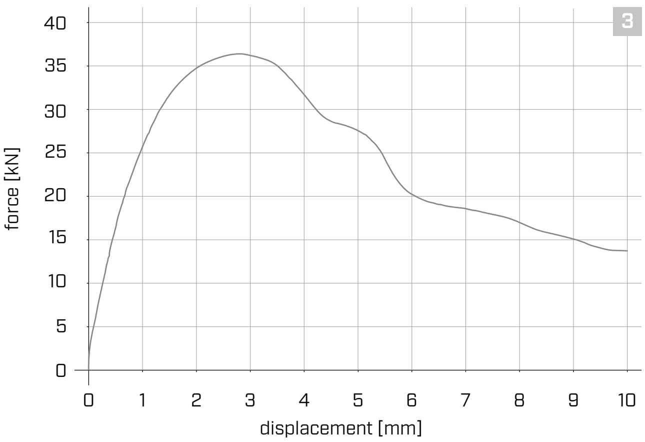
Timber-to-timber specimen with VGZ inclined screws tested in combined tension and compression

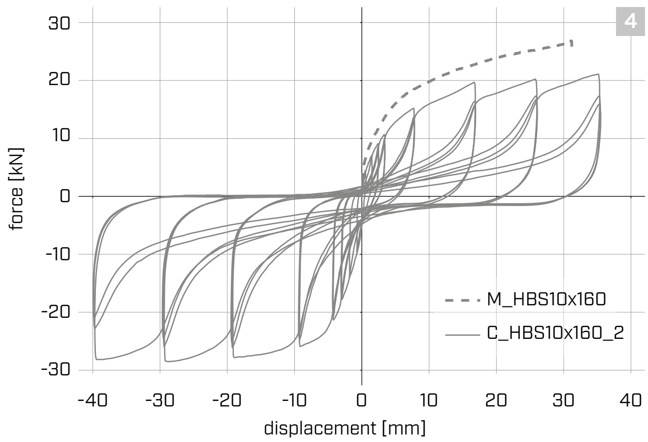
4

Timber-to-timber specimen with HBS screws tested in shear









CONNECTIONS (angle brackets and metal plates + fastening)

Complete steel connections (loaded in shear and tension) for timber-to-timber and timber-to-concrete joints.

1

TITAN timber-to-timber

2

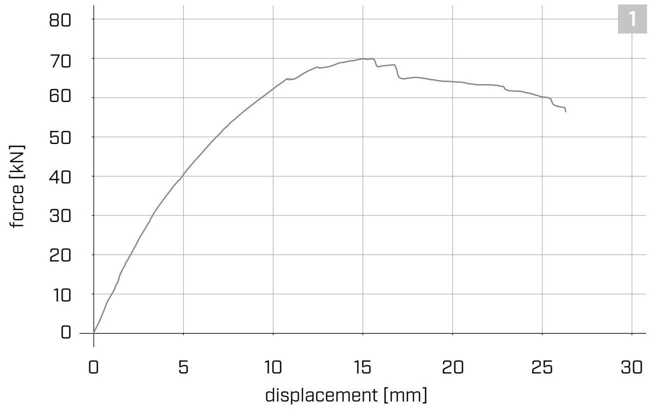
TITAN timber-to-timber with acoustic profiles

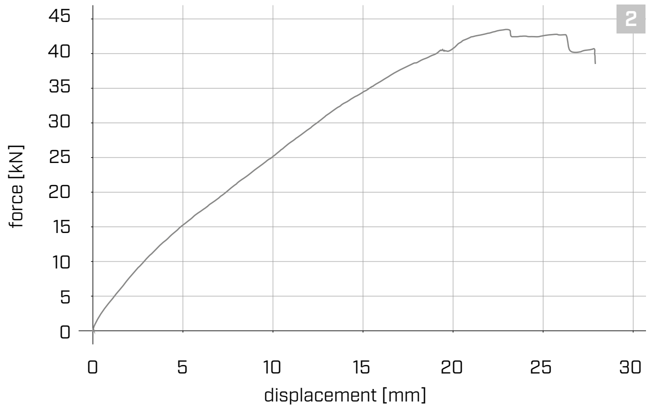
3

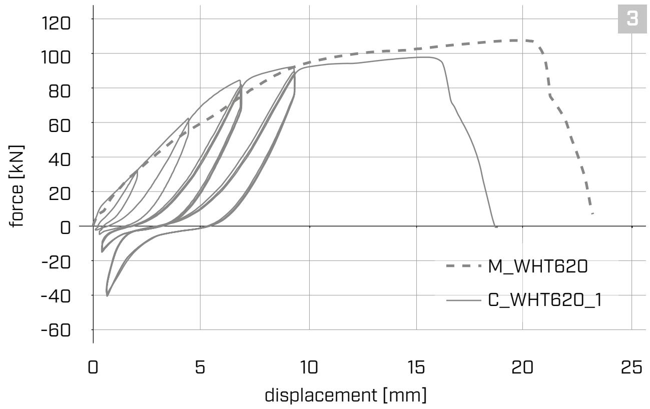
WHT timber-to-concrete

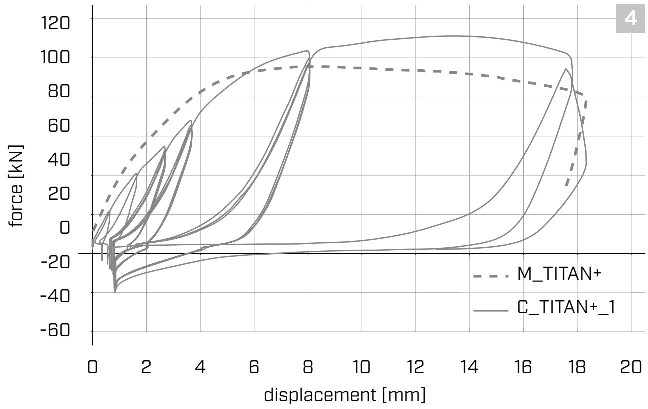
4

TITAN WASHER timber-to-concrete (tension)









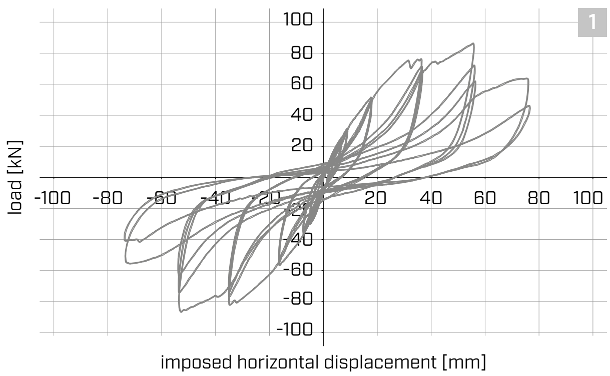
WALL SYSTEM

Frame walls and CLT (Cross Laminated Timber) walls assembled by using the connection types previously tested.

Frame wall during testing

1

CLT (Cross Laminated Timber) wall during testing



WHT

ETA 11/0086

ANGLE BRACKET FOR TENSILE LOADS

COMPLETE RANGE
Available in 5 sizes to be combined with 5 washers to meet all static performance requirements.

SPECIAL STEEL
S355 steel ensures high tensile strength.

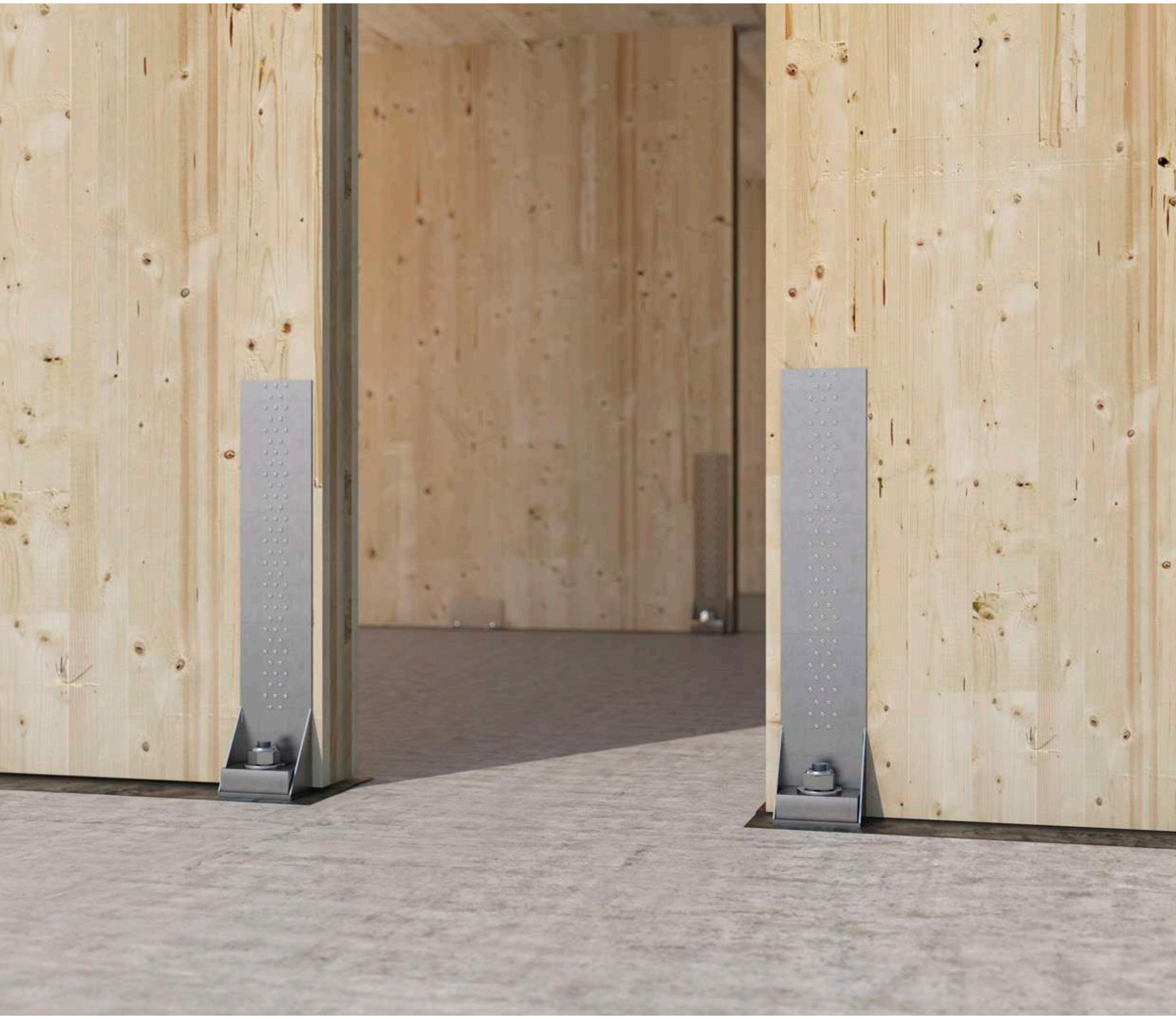
HOLE DIAMETER
The hole for "big size" rods is proportioned to the system dimensions.

CHARACTERISTICS

FOCUS	tensile joints
HEIGHT	from 340 to 740 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, VIN-FIX PRO, EPO-FIX PLUS

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete and timber-to-timber tensile joints for panels and timber beams
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels



CLT, TIMBER FRAME

High strength thanks to S355 steel, side reinforcement flanges and larger diameter hole at the base.

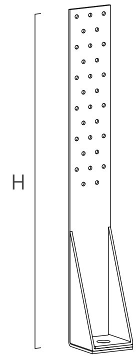
SEISMIC AND STIFFNESS

Within the SEISMIC-REV research project framework, the product and the related fastening elements were tested under static and cyclic loading, providing stiffness parameters (K_{ser}) and ductility levels.

CODES AND DIMENSIONS

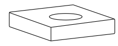
WHT ANGLE BRACKET

CODE	H	hole	n_v Ø5	s	pcs
	[mm]	[mm]	[pcs]	[mm]	
WHT340	340	Ø18	20	3	10
WHT440	440	Ø18	30	3	10
WHT540	540	Ø22	45	3	10
WHT620	620	Ø26	55	3	10
WHT740	740	Ø29	75	3	1



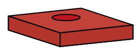
WHTW WASHER

CODE	hole	s	WHT340	WHT440	WHT540	WHT620	WHT740	pcs
	[mm]	[mm]						
WHTW50	Ø18	10	●	●	●	-	-	1
WHTW50L	Ø22	10	-	-	●	-	-	1
WHTW70	Ø22	20	-	-	-	●	-	1
WHTW70L	Ø26	20	-	-	-	●	-	1
WHTW130	Ø29	40	-	-	-	-	●	1



XYLOFON WASHER RESILIENT PROFILE

CODE		hole	P	B	s	pcs
		[mm]	[mm]	[mm]	[mm]	
XYLW806060	WHT340 WHT440 WHT540	Ø23	60	60	6,0	10
XYLW808080	WHT620	Ø27	80	80	6,0	10
XYLW8080140	WHT740	Ø30	80	140	6,0	1



MATERIAL AND DURABILITY

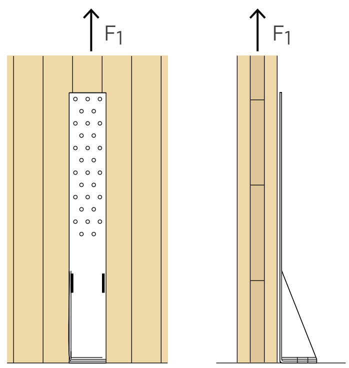
WHT: S355 bright zinc plated carbon steel.
WHTW WASHER: S235 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON WASHER: Monolithic polyurethane compound.

FIELD OF USE

- Timber-to-concrete joints
- OSB-to-concrete joints
- Timber-to-timber joints
- Timber-to-OSB joints
- Timber-to-steel joints

EXTERNAL LOADS

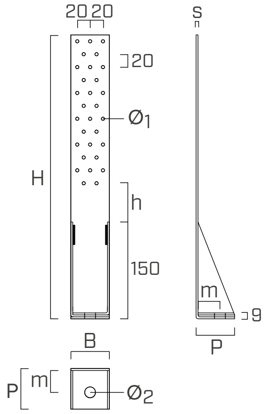


ADDITIONAL PRODUCTS - FASTENING

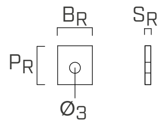
type	description	d	support	page
		[mm]		
LBA	Anker nail	4		548
LBS	screw for plates	5		552
VIN-FIX PRO	chemical anchor	M16 - M20 - M24 - M27		511
EPO-FIX PLUS	chemical anchor	M16 - M20 - M24 - M27		517
KOS	bolt	M16 - M20		526

GEOMETRY

WHT			WHT340	WHT440	WHT540	WHT620	WHT740
Height	H	[mm]	340	440	540	620	740
Base	B	[mm]	60	60	60	80	140
Depth	P	[mm]	63	63	63	83	83
Thickness	s	[mm]	3	3	3	3	3
Hole position in timber	h	[mm]	40	60	40	40	-
Hole position in concrete	m	[mm]	35	35	35	38	38
Flange holes	$Ø_1$	[mm]	5,0	5,0	5,0	5,0	5,0
Base hole	$Ø_2$	[mm]	18,0	18,0	22,0	26,0	29,0



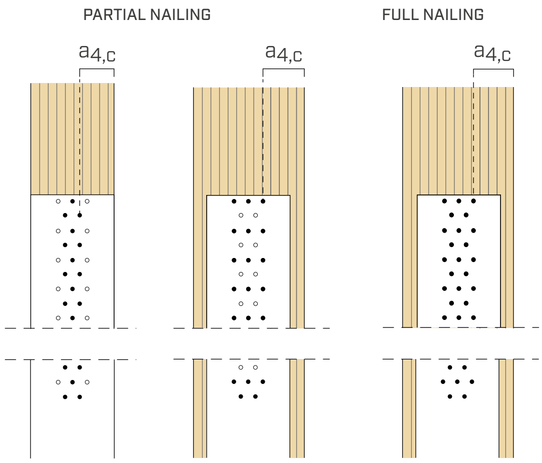
WHTW WASHER			WHTW50	WHTW50L	WHTW70	WHTW70L	WHTW130
Base	B_R	[mm]	50	50	70	70	130
Depth	P_R	[mm]	56	56	77	77	77
Thickness	s_R	[mm]	10	10	20	20	40
Washer hole	$Ø_3$	[mm]	18,0	22,0	22,0	26,0	29,0



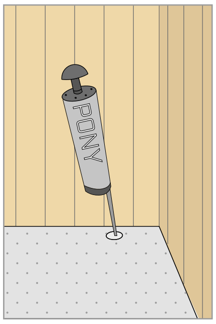
INSTALLATION

TIMBER minimum distances			nails LBA Ø4	screws LBS Ø5
C/GL	$a_{4,c}$	[mm]	≥ 20	≥ 25
CLT	$a_{4,c}$	[mm]	≥ 12	≥ 12,5

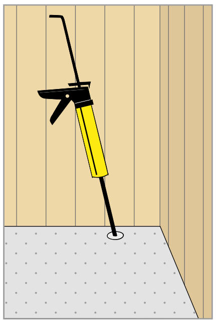
- C/GL: minimum distances for solid timber or glulam consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420$ kg/m^3
- CLT: minimum distances for Cross Laminated Timber according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA-11/0030 for screws



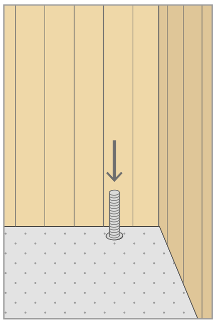
ASSEMBLY



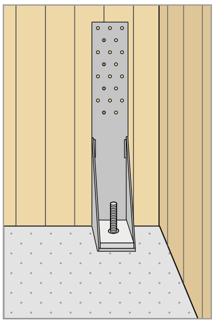
Drilling of the concrete support and hole cleaning



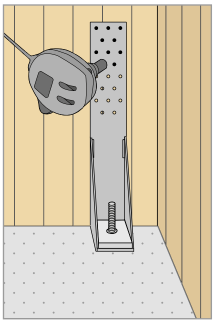
Injection of the chemical anchor into the hole



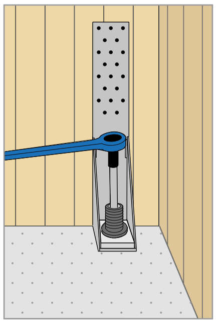
Positioning of the threaded rod



Installation of WHT angle bracket (with washer if prescribed)



Nailing of the angle bracket

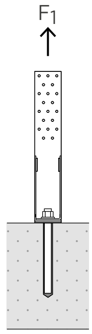


Positioning of the nut by adequate tightening

STATIC VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

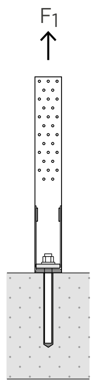
WHT340 - with or without WHTW50 washer

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• total fastening • washer WHTW50 • M16 anchor	LBA nails	Ø4,0 x 40	20	**31,4**	**63,4**	γ_{M2}	M16 x 190	**39,0**	M16 x 190	**33,8**	M16 x 230 M16 x 190	**21,0** **16,6**
		Ø4,0 x 60	20	**38,6**								
	LBS screws	Ø5,0 x 40	20	**31,4**								
		Ø5,0 x 50	20	**38,6**								
• partial fastening • washer WHTW50 • M16 anchor	LBA nails	Ø4,0 x 40	14	**22,0**	**63,4**	γ_{M2}	M16 x 190	**39,0**	M16 x 190	**33,8**	M16 x 230 M16 x 190	**21,0** **16,6**
		Ø4,0x 60	14	**27,0**								
	LBS screws	Ø5,0 x 40	14	**22,0**								
		Ø5,0 x 50	14	**27,0**								
• total fastening • without washer • M16 anchor	LBA nails	Ø4,0 x 40	20	**31,4**	**42,0**	γ_{M0}	M16 x 160	**33,8**	M16 x 160	**29,3**	M16 x 190 M16 x 160	**17,7** **14,4**
		Ø4,0 x 60	20	**38,6**								
	LBS screws	Ø5,0 x 40	20	**31,4**								
		Ø5,0 x 50	20	**38,6**								
• partial fastening • without washer • M16 anchor	LBA nails	Ø4,0 x 40	14	**22,0**	**42,0**	γ_{M0}	M16 x 160	**33,8**	M16 x 160	**29,3**	M16 x 190 M16 x 160	**17,7** **14,4**
		Ø4,0x 60	14	**27,0**								
	LBS screws	Ø5,0 x 40	14	**22,0**								
		Ø5,0 x 50	14	**27,0**								



WHT440 - with or without WHTW50 washer

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• total fastening • washer WHTW50 • M16 anchor	LBA nails	Ø4,0 x 40	30	**47,1**	**63,4**	γ_{M2}	M16 x 230	**49,2**	M16 x 230	**42,7**	M16 x 230	**21,0**
		Ø4,0 x 60	30	**57,9**								
	LBS screws	Ø5,0 x 40	30	**47,1**								
		Ø5,0 x 50	30	**57,9**								
• partial fastening • washer WHTW50 • M16 anchor	LBA nails	Ø4,0 x 40	20	**31,4**	**63,4**	γ_{M2}	M16 x 230 M16 x 190	**49,2** **39,0**	M16 x 230 M16 x 190	**42,7** **33,8**	M16 x 230 M16 x 190	**21,0** **16,6**
		Ø4,0 x 60	20	**38,6**								
	LBS screws	Ø5,0 x 40	20	**31,4**								
		Ø5,0 x 50	20	**38,6**								
• partial fastening • without washer • M16 anchor	LBA nails	Ø4,0 x 40	20	**31,4**	**42,0**	γ_{M0}	M16 x 160	**33,8**	M16 x 160	**29,3**	M16 x 160	**14,4**
		Ø4,0x 60	20	**38,6**								
	LBS screws	Ø5,0 x 40	20	**31,4**								
		Ø5,0 x 50	20	**38,6**								



NOTES FOR SEISMIC DESIGN

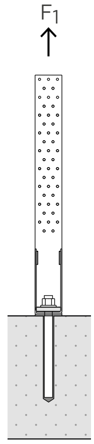
Particular attention has to be paid to the "capacity design" applied at different scale levels: the global structure and the connection system. Experimentally the ultimate strength of the LBA nail (and of the LBS screw) is notably larger than the characteristic strength evaluated according to EN 1995.
E.g. LBA nail Ø4 x 60 mm: $R_{v,k}$ =2,8 - 3,6 kN by experimental tests (variable according to the type of timber and plate thickness).

Experimental data derive from tests carried out within the Seismic-Rev research project and are reported in the scientific report: "Connection systems for timber buildings: experimental campaign to characterize stiffness, strength and ductility" (DICAM - Department of Civil, Environmental and Mechanical Engineering - UniTN).

STATIC VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

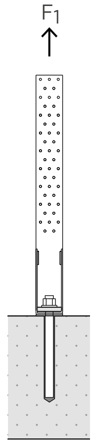
WHT540 - with WHTW50 washer (M16)

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• total fastening • washer WHTW50 • M16 anchor	LBA nails	Ø4,0 x 40	45	**70.7**	63,4	γ_{M2}	M16 x 190	**39,0**	M16 x 190	**33,8**	M16 x 190	**16,6**
		Ø4,0 x 60	45	**86,9**								
	LBS screws	Ø5,0 x 40	45	**70,7**								
		Ø5,0 x 50	45	**86,9**								
• partial fastening • washer WHTW50 • M16 anchor	LBA nails	Ø4,0 x 40	29	**45,5**	63,4	γ_{M2}	M16 x 190	**39,0**	M16 x 190	**33,8**	M16 x 190	**16,6**
		Ø4,0 x 60	29	**56,0**								
	LBS screws	Ø5,0 x 40	29	**45,5**								
		Ø5,0 x 50	29	**56,0**								



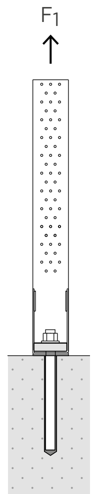
WHT540 - with washer WHTW50L (M20)

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• total fastening • washer WHTW50L • M20 anchor	LBA nails	Ø4,0 x 40	45	**70,7**	63,4	γ_{M2}	M20 x 240	**59,3**	M20 x 240 M20 x 284	**50,2** **62,3**	M20 x 240 M20 x 284	**25,1** **31,1**
		Ø4,0 x 60	45	**86,9**								
	LBS screws	Ø5,0 x 40	45	**70,7**								
		Ø5,0 x 50	45	**86,9**								
• partial fastening • washer WHTW50L • M20 anchor	LBA nails	Ø4,0 x 40	29	**45,5**	63,4	γ_{M2}	M20 x 240	**59,3**	M20 x 240 M20 x 284	**50,2** **62,3**	M20 x 240 M20 x 284	**25,1** **31,1**
		Ø4,0 x 60	29	**56,0**								
	LBS screws	Ø5,0 x 40	29	**45,5**								
		Ø5,0 x 50	29	**56,0**								



WHT620 - with WHTW70 washer (M20)

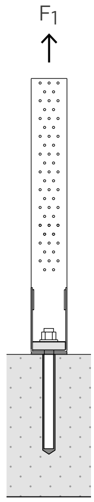
	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• total fastening • washer WHTW70 • M20 anchor	LBA nails	Ø4,0 x 40	55	**86.4**	85.2	γ_{M2}	M20 x 240	**57,15**	M20 x 240	**48,5**	M20 x 240	**24,2**
		Ø4,0 x 60	55	**106,2**								
	LBS screws	Ø5,0 x 40	55	**86,4**								
		Ø5,0 x 50	55	**106,2**								
• partial fastening • washer WHTW70 • M20 anchor	LBA nails	Ø4,0 x 40	35	**55,0**	85,2	γ_{M2}	M20 x 240	**57,15**	M20 x 240	**48,5**	M20 x 240	**24,2**
		Ø4,0 x 60	35	**67,6**								
	LBS screws	Ø5,0 x 40	35	**55,0**								
		Ø5,0 x 50	35	**67,6**								



STATIC VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

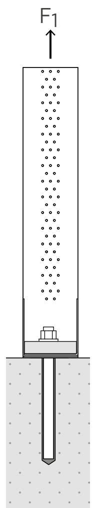
WHT620 - with WHTW70L washer (M24)

configuration	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE			
	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]
• total fastening • washer WHTW70L • M24 anchor	LBA nails	Ø4,0 x 40	55	86.4	85,2	γ_{M2}	M24 x 270	73,50	M24 x 270 M24 x 323	60,6 75,6
		Ø4,0 x 60	55	106,2						
	LBS screws	Ø5,0 x 40	55	86,4						
		Ø5,0 x 50	55	106,2						
• partial fastening • washer WHTW70L • M24 anchor	LBA nails	Ø4,0 x 40	35	55,0	85,2	γ_{M2}	M24 x 270	73,50	M24 x 270 M24 x 323	60,6 75,6
		Ø4,0 x 60	35	67,6						
	LBS screws	Ø5,0 x 40	35	55,0						
		Ø5,0 x 50	35	67,6						



WHT740 - with WHTW130 washer

configuration	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE			
	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$	
	type	Ø x L	n_v				EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]
• total fastening • M27 anchor • washer WHTW130	LBA nails	Ø4,0 x 40	75	117,8	158,6	γ_{M2}	M27 x 400	153,3	M27 x 400	109,0
		Ø4,0 x 60	75	144,8						
	LBS screws	Ø5,0 x 40	75	117,8						
		Ø5,0 x 50	75	144,8						
• partial fastening • M27 anchor • washer WHTW130	LBA nails	Ø4,0 x 40	45	70,7	158,6	γ_{M2}	M27 x 300	122,6	M27 x 300	70,5
		Ø4,0 x 60	45	86,9						
	LBS screws	Ø5,0 x 40	45	70,7						
		Ø5,0 x 50	45	86,9						



GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0086. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.

  The connection design strength value is obtained from the values on the table as follows:

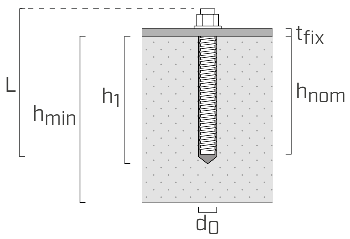
$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\ steel}}{\gamma_{steel}} \\ R_{d,\ concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.
- The calculation process used a timber characteristic density of ρ_k = 350 kg/m^3 and a C25/30 concrete strength class with a thin reinforcing layer, where there is no edge-distance and minimum thickness indicated in the installation parameters tables.
- Concrete design strength values are supplied for uncracked ($R_{1,d\ uncracked}$), cracked ($R_{1,d\ cracked}$) concrete and in case of seismic verification ($R_{1,d\ seismic}$) for use of chemical anchor with threaded rod in steel class 5.8.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- For applications on CLT (Cross Laminated Timber) it is recommended to use nails/screws of adequate length to ensure that the fixing depth involves a sufficient timber thickness to prevent fragile failure for group effects.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchors-to-concrete can be verified using MyProject calculation software according to the design requirements.

CHEMICAL ANCHORS INSTALLATION PARAMETERS[1]

type of rod		WHT type	type of washer	t_{fix}	$h_{nom} = h_{ef}$	h_1	d_0	h_{min}
Ø x L [mm]					[mm]	[mm]	[mm]	[mm]
M16	**160**	WHT340	-	9	132	140	18	**200**
	190	WHT340 / WHT440	-	9	162	170		**200**
		WHT340 / WHT440 / WHT540	WHTW50	19	152	160		**200**
	230	WHT340 / WHT440	WHTW50	19	192	200		**240**
M20	**240**	WHT540	-	9	206	215	22	**240**
		WHT540	WHTW50L	19	196	205		**240**
		WHT620	WHTW70	29	189	195		**240**
	min 284	WHT540	WHTW50L	19	243	250		**300**
M24	**270**	WHT620	WHTW70L	29	215	220	26	**300**
	min 323	WHT620	WHTW70L	29	268	275		**320**
M27	**min 300**	WHT740	WHTW130	49	223	230	30	**300**
	400	WHT740	WHTW130	49	310	315		**380**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534



t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

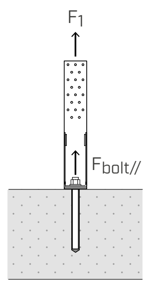
DIMENSIONING OF ALTERNATIVE ANCHORS

Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the $k_{t//}$ coefficients. The axial load acting on the anchor can be obtained as follows:

$$F_{bolt//,d} = k_{t//} \cdot F_{1,d}$$

$k_{t//}$	coefficient of eccentricity
F_1	axial load on the WHT angle bracket

	$k_{t//}$
WHT340	1,00
WHT440	1,00
WHT540	1,00
WHT620	1,00
WHT740	1,00



The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_{bolt\,//,d} \geq F_{bolt\,//,d}$.

NOTES:

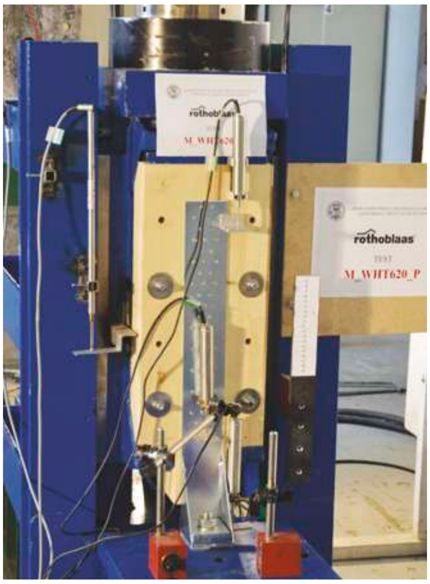
[1] Valid for the strength values shown in the table.

CONNECTION STIFFNESS

EVALUTATION OF SLIP MODULUS K_{ser}

- $K_{1,ser}$ experimental average value for WHT joints on GL24h Glulam and on CLT

WHT type	configuration	fastening type	n_v	$K_{1,ser}$ [N/mm]	
		Ø x L [mm]	[pcs]	GL24h	CLT
WHT340	• total fastening • without washer	LBA nails Ø4,0 x 60	20	-	**3440**
	• total fastening • with washer	LBA nails Ø4,0 x 60	20	**5705**	**7160**
	• partial fastening • with washer	LBA nails Ø4,0 x 60	12	-	**5260**
WHT440	• total fastening • with washer	LBA nails Ø4,0 x 60	30	**6609**	**10190**
	• partial fastening • with washer	LBA nails Ø4,0 x 60	20	-	**8060**
WHT540	• total fastening • with washer	LBA nails Ø4,0 x 60	45	-	**11470**
	• partial fastening • with washer	LBA nails Ø4,0 x 60	29	-	**9700**
WHT620	• total fastening • with washer	LBA nails Ø4,0 x 60	52/55	**13247**	**13540**
	• partial fastening • with washer	LBA nails Ø4,0 x 60	30/35	**9967**	**10310**



Seismic-REV experimental campaign on GL24h glulam (DICAM-University of Trento and CNR-IVALSA San Michele All'Adige, 2015).

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint nails* GL24h/C24

Nails (without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

WHT type	fastening type	n_v	K_{ser}
	Ø x L [mm]	[pcs]	[N/mm]
WHT340	LBA nails Ø4,0 x 60	14	**12177**
		20	**17395**
WHT440	LBA nails Ø4,0 x 60	20	**17395**
		30	**26093**
WHT540	LBA nails Ø4,0 x 60	29	**25223**
		45	**39139**
WHT620	LBA nails Ø4,0 x 60	35	**30442**
		55	**47837**

* For steel-to-timber connections the reference standard indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

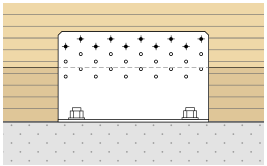
Experimental campaign on CLT panels (C24) (CNR-IBE San Michele All'Adige,2020).

TITAN ANGLE BRACKETS: ALL SOLUTIONS IN ONE RANGE

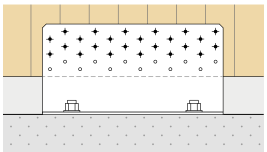
SELECTION GUIDE

TIMBER-TO-CONCRETE JOINT

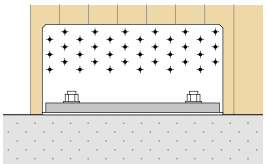
TITAN N



		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TCN200	FULL PATTERN (30)	-	22.4	17,7	2,7	14,9
	PARTIAL 4 (25)	-	17,3	-	-	-
	PARTIAL 3 (20)	-	13,5	-	-	-
	PARTIAL 2 (15)	-	9,5	17,5	1,6	19,0
	PARTIAL 1 (10)	-	6,3	-	-	-

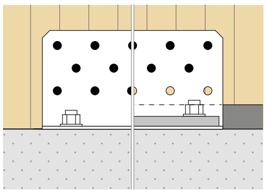


		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TCN240	FULL PATTERN (36)	-	30,7	20,4	3,3	23,5
	PARTIAL 4 (30)	-	23,9	-	-	-
	PARTIAL 3 (24)	-	18,7	-	-	-
	PARTIAL 2 (18)	-	13,2	20,2	1,9	21,3
	PARTIAL 1 (12)	-	8,8	-	-	-



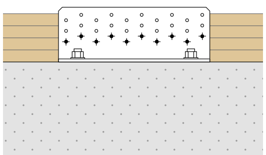
		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TCN200 + TCW200	FULL PATTERN (30)	37,6	41,3	-	-	-
TCN240 + TCW240	FULL PATTERN (36)	41,4	61,6	-	-	-

TITAN S



		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TCS240	FULL PATTERN (14)	-	59,5	17,9	4,3	18,8
TCS240 + TCW240	FULL PATTERN (14)	41,4	64,7	-	-	-
	PARTIAL (9)	28,7	-	-	-	-

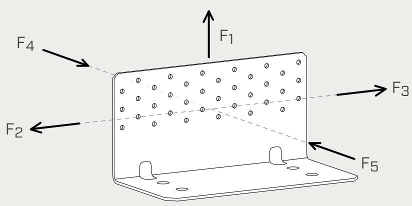
TITAN F



		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TCF200	FULL PATTERN (30)	-	36,0	9,5	4,8	12,3
	PARTIAL 3 (25)	-	31,5	-	-	-
	PARTIAL 2 (15)	-	21,2	-	-	-
	PARTIAL 1 (10)	-	15,3	-	-	-

EXTERNAL LOADS

Certified tensile (R_1), shear ($R_{2/3}$) and tilting ($R_{4.5}$) strengths. Different full pattern and partial pattern fastening configurations. Certified values also with interposed acoustic profiles (XYLOFON and ALADIN).



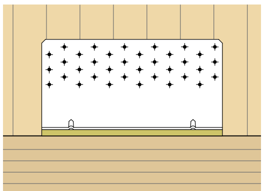
The strength values shown in the table are to be considered as indicative values provided to guide the designer in the choice of the TITAN angle bracket. The final verification must be carried out in accordance with the technical specifications given on the individual product pages, depending on the design requirements and the actual boundary conditions.

As an example, the design strength values (R_d), calculated according to EN 1995-1-1 and EN 1993-1-1, considering an instant load duration class (k_{mod} = 1,1), in case of uncracked concrete, fastening on timber using LBS screws Ø5 x 50 mm (HBS PLATE for TITAN S), and type of anchor on concrete variable according to the type of angle bracket.

TIMBER-TO-TIMBER JOINT

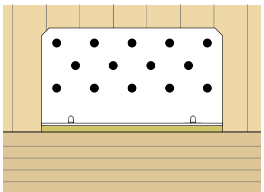
TITAN N

		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TTN240	FULL PATTERN (36)	13,7	39,5	20,1	3,4	22,6
	FULL PATTERN (36) + Xylofon	-	21,0	-	-	-
	FULL PATTERN (36) + Aladin S.	-	24,5	-	-	-
	FULL PATTERN (36) + Aladin Es.	-	23,3	-	-	-



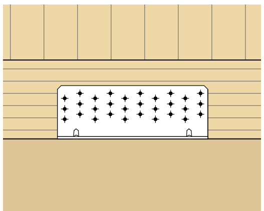
TITAN S

		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TTS240	FULL PATTERN (14)	-	50,8	17,5	4,2	21,3
	FULL PATTERN (14) + Xylofon	-	10,6	-	-	-
	FULL PATTERN (14) + Aladin S.	-	12,4	-	-	-
	FULL PATTERN (14) + Aladin Es.	-	11,8	-	-	-



TITAN F

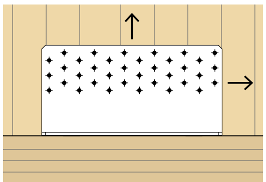
		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TTF200	FULL PATTERN (30)	-	36,0	10,4	4,7	14,2
	PARTIAL 3 (25)	-	31,5	-	-	-
	PARTIAL 2 (15)	-	21,2	-	-	-
	PARTIAL 1 (10)	-	15,3	-	-	-
	FULL PATTERN (30) + Xylofon	-	14,6	-	-	-
	FULL PATTERN (30) + Aladin S.	-	16,9	-	-	-
	FULL PATTERN (30) + Aladin Es.	-	16,1	-	-	-



TITAN V

		$R_{1,d}$ [kN]	$R_{2/3,d}$ [kN]	$R_{4,d}$ [kN]	$R_{5,d}$ [kN]	$R_{4/5,d}$ [kN]
TTV240	FULL PATTERN (36)	85,5	50,5	-	-	-
	PARTIAL (24)	54,6	43,6	-	-	-
	FULL PATTERN (36) + Xylofon(*)	-	43,0	-	-	-

(*) Experimental value not included in ETA.



TITAN N

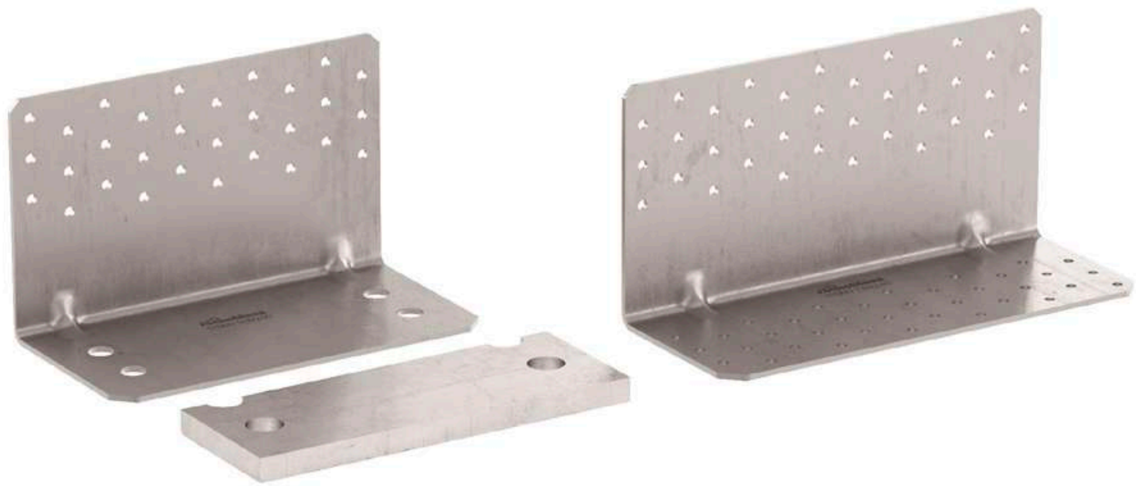
ETA 11/0496

ANGLE BRACKET FOR SHEAR AND TENSILE FORCES

HIGH HOLES
Ideal for CLT, it is easy to install thanks to the raised holes. Values also certified with partial fastening for presence of bedding mortar or root beam.

80 kN SHEAR
Exceptional shear strengths. Up to 82,6 kN on concrete (with TCW washer). Up to 46,7 kN on timber.

70 kN TENSILE
On concrete, TCN angle brackets with TCW washers provide excellent tensile strength. $R_{1,k}$ up to 69,8 kN characteristic values.



CHARACTERISTICS

FOCUS	shear and tensile joints
HEIGHT	120 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, VIN-FIX PRO, EPO-FIX PLUS, SKR, AB1

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Shear and tensile joints for timber-to-concrete and timber-to-timber applications
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels

CONCEALED HOLD DOWN

Ideal on timber-to-concrete both as a hold down at the ends of the walls and as shear angle bracket along the walls. It can be integrated into the floor panels.

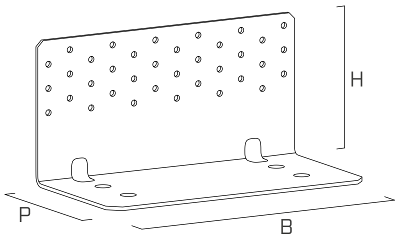
ALL DIRECTIONS

Certified shear ($F_{2,3}$), tensile (F_1) and tilting ($F_{4,5}$) strengths. Values certified also for partial fastenings and with interposed acoustic profiles.

CODES AND DIMENSIONS

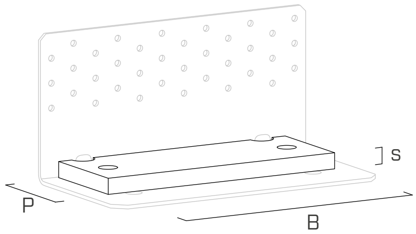
TITAN N - TCN | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm]	P [mm]	H [mm]	holes [mm]	n_V Ø5 [pcs]	s [mm]		pcs
TCN200	200	103	120	Ø13	30	3	●	10
TCN240	240	123	120	Ø17	36	3	●	10



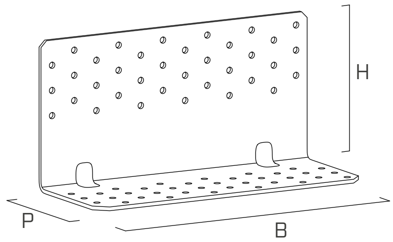
TITAN WASHER - TCW | CONCRETE-TO-TIMBER JOINTS

CODE	TCN200	TCN240	B [mm]	P [mm]	s [mm]	holes [mm]		pcs
TCW200	●	-	190	72	12	Ø14	●	1
TCW240	-	●	230	73	12	Ø18	●	1



TITAN N - TTN | TIMBER-TO-TIMBER JOINTS

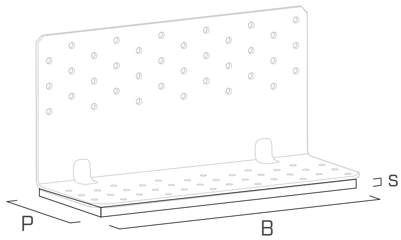
CODE	B [mm]	P [mm]	H [mm]	n_H Ø5 [mm]	n_V Ø5 [mm]	s [mm]		pcs
TTN240	240	93	120	36	36	3	●	10



ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

CODE	type	B	P [mm]	s [mm]		pcs
XYL35120240	xylofon plate	240 mm	120	6	●	10
ALADIN95	soft	50 m(*)	95	5	●	10
ALADIN115	extra soft	50 m(*)	115	7	●	10

(*) To be cut on site.



MATERIAL AND DURABILITY

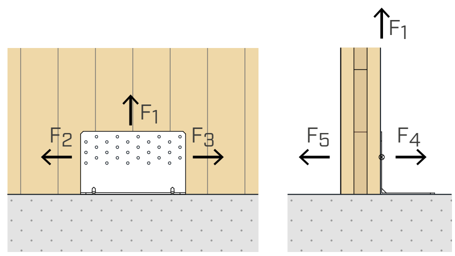
TITAN N: carbon steel DX51D+Z275.
TITAN WASHER: S235 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON PLATE: 35-shore polyurethane compound.
ALADIN STRIPE: Compact EPDM.

FIELD OF USE

- Timber-to-concrete joints
- Timber-to-timber joints
- Timber-to-steel joints

EXTERNAL LOADS

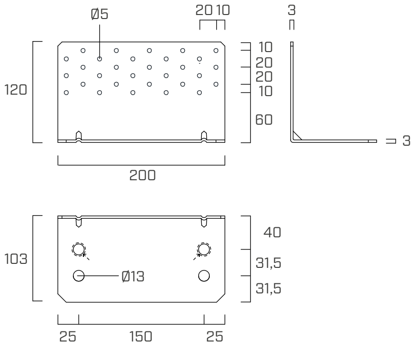


ADDITIONAL PRODUCTS - FASTENING

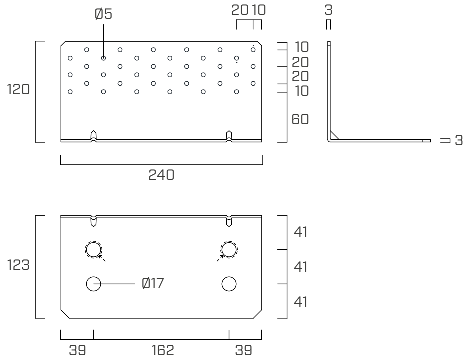
type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
AB1	mechanical anchor		12 - 16		494
SKR	screw anchor		12 - 16		488
VIN-FIX PRO	chemical anchor		M12 - M16		511
EPO-FIX PLUS	chemical anchor		M12 - M16		517

GEOMETRY

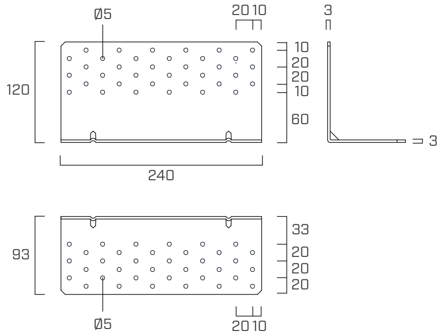
TCN200



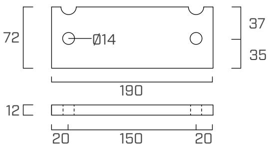
TCN240



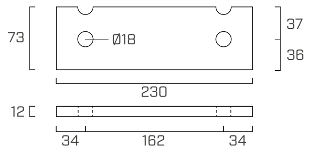
TTN240



TCW200



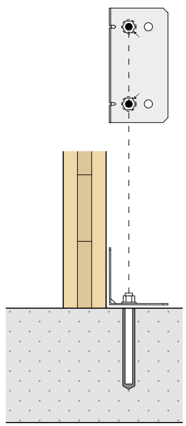
TCW240



INSTALLATION ON CONCRETE

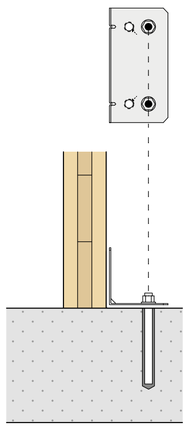
To fix **TITAN TCN** angle bracket to the concrete foundation, **2 anchors** must be used, according to one of the following installation configurations, according to the acting stress.

IDEAL INSTALLATION



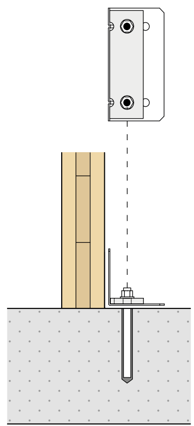
2 anchors positioned in the INTERNAL HOLES (**IN**) (identified by a mark on the product)

ALTERNATIVE INSTALLATION



2 anchors placed in the EXTERNAL HOLES (**OUT**) (e.g. interaction between the anchor and the concrete support reinforcement)

INSTALLATION WITH WASHER



The WASHER TCW must be fastened by means of 2 anchors positioned in the INTERNAL HOLES (**IN**)

Reduced stress on the anchor (minimum e_y and k_t eccentricity)

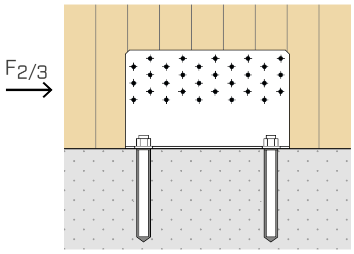
Maximum stress on the anchor (maximum e_y and k_t eccentricity)

Optimized connection strength

Reduced connection strength

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCN200



TIMBER STRENGTH

configuration on timber[1]	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø13		IN[2]	OUT[3]
	type	Ø x L	n_v		Ø	n_H	$e_{y,IN}$	$e_{y,OUT}$
		[mm]	[pcs]	[kN]	[mm]	[pcs]	[mm]	[mm]
• full pattern	LBA nails	Ø4,0 x 60	30	**22,1**	M12	2	38,5	70,0
	LBS screws	Ø5,0 x 50		**26,5**				
• pattern 4	LBA nails	Ø4,0 x 60	25	**17,4**				
	LBS screws	Ø5,0 x 50		**20,4**				
• pattern 3	LBA nails	Ø4,0 x 60	20	**13,7**				
	LBS screws	Ø5,0 x 50		**16,0**				
• pattern 2	LBA nails	Ø4,0 x 60	15	**9,6**				
	LBS screws	Ø5,0 x 50		**11,2**				
• pattern 1	LBA nails	Ø4,0 x 60	10	**6,4**				
	LBS screws	Ø5,0 x 50		**7,5**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$	
	type	Ø x L	IN[2]	OUT[3]
		[mm]	[kN]	[kN]
• uncracked	VIN-FIX PRO 5.8	M12 x 130	**29,7**	**24,4**
	VIN-FIX PRO 8.8	M12 x 130	**48,1**	**39,1**
	SKR-E	12 x 90	**38,3**	**31,3**
	AB1	M12 x 100	**35,4**	**28,9**
• cracked	VIN-FIX PRO 5.8	M12 x 130	**29,7**	**24,4**
	VIN-FIX PRO 8.8	M12 x 130	**35,1**	**28,9**
	SKR-E	12 x 90	**34,6**	**28,4**
	AB1	M12 x 100	**35,4**	**28,9**
• seismic	EPO-FIX PLUS 5.8/8.8	M12 x 130	**19,2**	**15,7**
	SKR-E	12 x 90	**8,8**	**7,2**
	AB1	M12 x 100	**10,6**	**8,7**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN200	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M12 X 130	3	112	112	120	14	**200**
	SKR-E	12 x 90	3	64	87	110	10	
	AB1	M12 x 100	3	70	80	85	12	

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

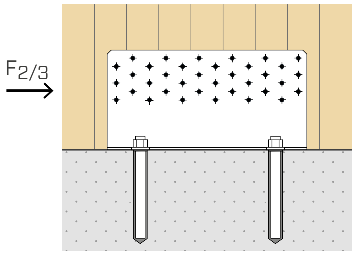
t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

NOTES:

(1) Partial fastening pattern on page 192.
(2) Installation of the anchors in the two internal holes (IN).
(3) Installation of the anchors in external holes (OUT).

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCN240



TIMBER STRENGTH

configuration on timber[1]	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø17		IN[2]	OUT[3]
	type	Ø x L	n_V		Ø	n_H	$e_{y,IN}$	$e_{y,OUT}$
		[mm]	[pcs]	[kN]	[mm]	[pcs]	[mm]	[mm]
• full pattern	LBA nails	Ø4,0 x 60	36	**30,3**	M16	2	39,5	80,5
	LBS screws	Ø5,0 x 50		**36,3**				
• pattern 4	LBA nails	Ø4,0 x 60	30	**24,0**				
	LBS screws	Ø5,0 x 50		**28,2**				
• pattern 3	LBA nails	Ø4,0 x 60	24	**18,8**				
	LBS screws	Ø5,0 x 50		**22,1**				
• pattern 2	LBA nails	Ø4,0 x 60	18	**13,3**				
	LBS screws	Ø5,0 x 50		**15,6**				
• pattern 1	LBA nails	Ø4,0 x 60	12	**8,9**				
	LBS screws	Ø5,0 x 50		**10,4**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø17		$R_{2/3,d\ concrete}$	
	type	Ø x L	IN[2]	OUT[3]
		[mm]	[kN]	[kN]
• uncracked	VIN-FIX PRO 5.8	M16 x 160	**55,8**	**43,9**
	VIN-FIX PRO 8.8	M16 x 160	**90,1**	**70,9**
	SKR-E	16 x 130	**67,4**	**53,1**
	AB1	M16 x 145	**67,4**	**53,1**
• cracked	VIN-FIX PRO 5.8/8.8	M16 x 160	**55,0**	**43,2**
	SKR-E	16 x 130	**55,0**	**43,2**
	AB1	M16 x 145	**55,0**	**43,2**
• seismic	EPO-FIX PLUS 5.8	M16 x 160	**26,6**	**21,1**
	EPO-FIX PLUS 8.8	M16 x 160	**28,1**	**21,9**
	SKR-E	16 x 130	**19,9**	**15,8**
	AB1	M16 x 145	**19,9**	**15,8**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN240	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M16 x 160	3	137	137	145	18	**200**
	SKR-E	16 x 130	3	85	127	150	14	
	AB1	M16 x 145	3	85	97	105	16	

Precut INA threaded rod, with nut and washer: see page 520

MGS threaded rod class 8.8 to be cut to size: see page 534

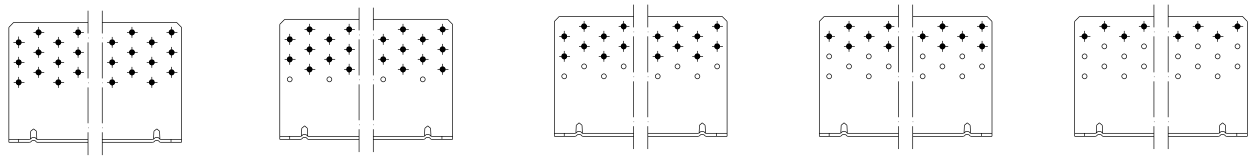
t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

GENERAL PRINCIPLES:

For the general principles of calculation, see page 202.

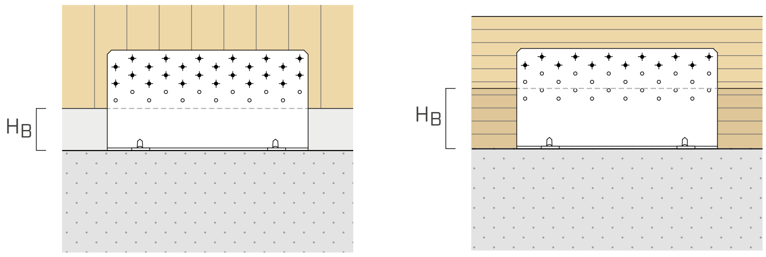
TCN200 - TCN240 | PARTIAL FASTENING PATTERNS FOR STRESS $F_{2/3}$

In the presence of design requirements such as $F_{2/3}$ stresses of different value or the presence of an intermediate H_B layer (levelling mortar, sill or ground) between the wall and the supporting surface, partial fastening patterns can be adopted:



Pattern 2 also applies in case of F_4, F_5 and $F_{4/5}$ stresses.

MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER



configuration on timber	n_v holes Ø5 [pcs]		CLT $H_{B\ max}$ [mm]		C/GL $H_{B\ max}$ [mm]	
	TCN200	TCN240	nails LBA Ø4	screws LBS Ø5	nails LBA Ø4	screws LBS Ø5
• full pattern	*30*	*36*	20	30	32	10
• pattern 4	*25*	*30*	30	40	42	20
• pattern 3	*20*	*24*	40	50	52	30
• pattern 2	*15*	*18*	50	60	62	40
• pattern 1	*10*	*12*	60	70	72	50

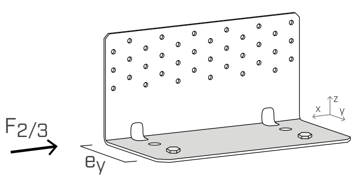
The height of the H_B intermediate layer (levelling mortar, sill or timber platform beam) is determined by taking into account the following regulatory requirements for fastenings on timber:
- CLT: minimum distances according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA-11/0030 for screws.
- C/GL: minimum distances for solid timber or glulam with horizontal fibres consistent with EN 1995-1-1 according to ETA considering a timber density of $\rho_k \leq 420$ kg/m^3.

TCN200 - TCN240 | VERIFICATION OF ANCHORS FOR CONCRETE FOR $F_{2/3}$ STRESS

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).
E_y calculation eccentricities vary depending on the type of installation selected: 2 internal anchors (IN) or 2 external anchors (OUT).

The anchor group must be verified for:

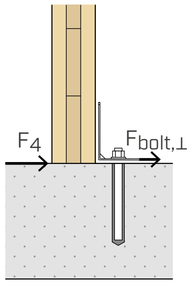
$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN/OUT}$



STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-CONCRETE

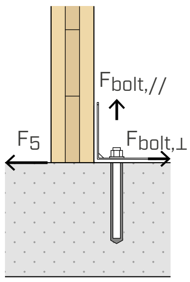
TCN200 - TCN240

		TIMBER				STEEL		CONCRETE			
F_4		holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$		holes fastening		IN[1]	
		type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
			[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCN200	• full nailing	LBA nails	Ø4,0 x 60	30	**20,9**	**22,4**	γ_{M0}	M12	2	0,5	-
		LBS screws	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	15	**20,7**	**24,3**	γ_{M0}				
		LBS screws	Ø5,0 x 50								
TCN240	• full nailing	LBA nails	Ø4,0 x 60	36	**24,1**	**26,9**	γ_{M0}	M16	2	0,5	-
		LBS screws	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	18	**23,9**	**29,1**	γ_{M0}				
		LBS screws	Ø5,0 x 50								



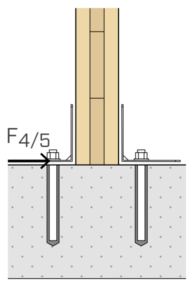
The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{4,d}$

		TIMBER				STEEL		CONCRETE			
F_5		holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$		holes fastening		IN[1]	
		type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
			[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCN200	• full pattern	LBA nails	Ø4,0 x 60	30	**6,6**	**2,7**	γ_{M0}	M12	2	0,5	0,47
		LBS screws	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	15	**3,6**	**1,6**	γ_{M0}			0,5	0,83
		LBS screws	Ø5,0 x 50								
TCN240	• full pattern	LBA nails	Ø4,0 x 60	36	**8,0**	**3,3**	γ_{M0}	M16	2	0,5	0,48
		LBS screws	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	18	**4,3**	**1,9**	γ_{M0}			0,5	0,83
		LBS screws	Ø5,0 x 50								



The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{5,d}$; $N_{Sd,z} = 2 \times k_{t//} \times F_{5,d}$

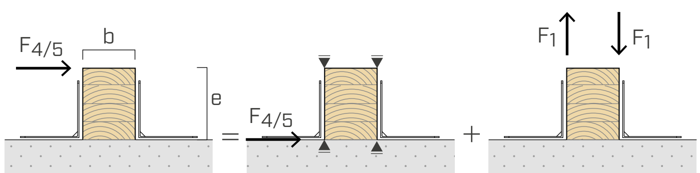
		TIMBER				STEEL		CONCRETE			
$F_{4/5}$ TWO ANGLE BRACKETS		holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$		holes fastening		IN[1]	
		type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
			[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCN200	• full pattern	LBA nails	Ø4,0 x 60	30 + 30	**25,6**	**14,9**	γ_{M0}	M12	2 + 2	0,41	0,08
		LBS screws	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	15 + 15	**22,4**	**20,9**	γ_{M0}			0,46	0,06
		LBS screws	Ø5,0 x 50								
TCN240	• full pattern	LBA nails	Ø4,0 x 60	36 + 36	**27,8**	**24,7**	γ_{M0}	M16	2 + 2	0,43	0,06
		LBS screws	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	18 + 18	**25,2**	**30.,6**	γ_{M0}			0,48	0,04
		LBS screws	Ø5,0 x 50								



The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{4/5,d}$; $N_{Sd,z} = 2 \times k_{t//} \times F_{4/5,d}$

The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating). For joints with 2 angle brackets, in case the stress $F_{4/5,d}$ is applied with eccentricity e≠0, the verification for combined loads is required considering the contribution of the additional tensile component:

$$\Delta F_{1,d} = F_{4/5,d} \cdot \frac{e}{b}$$



NOTES:

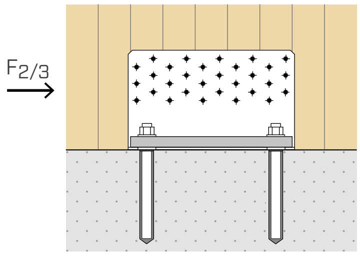
(1) Installation of the anchors in the two internal holes (IN).

GENERAL PRINCIPLES:

For the general principles of calculation, see page 202.

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCN200 + TCW200



TIMBER STRENGTH

configuration on timber	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø13		IN(1)	
	type	Ø x L [mm]	n_V [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{z,IN}$ [mm]
TCN200 + TCW200	LBA nails	Ø4,0 x 60	30	**56,7**	M12	2	38,5	83,5
	LBS screws	Ø5,0 x 50		**66,4**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$ IN(1)
	type	Ø x L [mm]	[kN]
• uncracked	VIN-FIX PRO 5.8	M12 x 130	**25,8**
	VIN-FIX PRO 8.8	M12 x 180	**41,3**
	SKR-E	12 x 110	**17,4**
	AB1	M12 x 120	**26,1**
• cracked	VIN-FIX PRO 5.8	M12 x 130	**14,7**
	VIN-FIX PRO 5.8/8.8	M12 x 180	**20,8**
	EPO-FIX PLUS 5.8	M12 x 130	**25,8**
	AB1	M12 x 120	**17,3**
• seismic	EPO-FIX PLUS 5.8	M12 x 180	**10,8**
	EPO-FIX PLUS 8.8	M12 x 180	**12,4**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN200 + TCW200	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M12 x 130	15	99	99	105	14	200
		M12 x 180	15	149	149	149	14	
	SKR-E	12 x 110	15	64	95	115	10	
	AB1	M12 x 120	15	70	80	85	12	

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

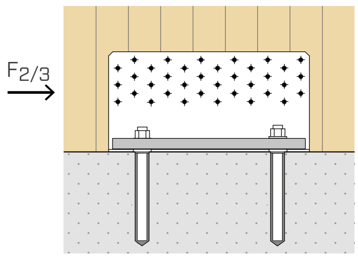
t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

NOTES:

(1) Installation of the anchors in the two internal holes (IN).

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCN240 + TCW240



TIMBER STRENGTH

	TIMBER				CONCRETE			
configuration on timber	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø17		IN(1)	
	type	Ø x L [mm]	n_v [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{z,IN}$ [mm]
TCN240 + TCW240	LBA nails	Ø4,0 x 60	36	**70,5**	M16	2	39,5	83,5
	LBS screws	Ø5,0 x 50		**82,6**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø17		$R_{2/3,d\ concrete}$
	type	Ø x L [mm]	IN(1) [kN]
• uncracked	VIN-FIX PRO 5.8	M16 X 190	**49,5**
	VIN-FIX PRO 8.8	M16 X 190	**61,6**
	SKR-E	16 X 130	**32,1**
	AB1	M16 X 145	**39,5**
• cracked	VIN-FIX PRO 5.8/8.8	M16 X 190	**30,9**
	EPO-FIX PLUS 5.8/8.8	M16 X 160	**40,1**
		M16 X 190	**49.1**
	AB1	M16 X 145	**28,4**
• seismic	EPO-FIX PLUS 5.8	M16 X 190	**15,2**
		M16 X 230	**16,6**
	EPO-FIX PLUS 8.8	M16 X 190	**16,6**
		M16 X 230	**21,0**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN240 + TCW240	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M16 x 160	15	126	126	135	18	**200**
		M16 x 190	15	155	155	155	18	**200**
		M16 x 230	15	195	195	195	18	**240**
	SKR-E	16 x 130	15	85	115	145	14	**200**
	AB1	M16 x 145	15	85	97	105	16	**200**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

GENERAL PRINCIPLES:

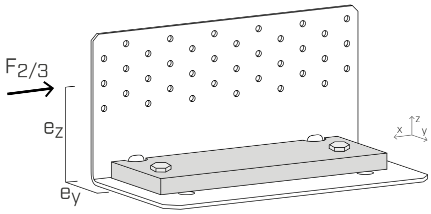
For the general principles of calculation, see page 202.

TCW200 - TCW240 | VERIFICATION OF ANCHORS FOR CONCRETE FOR $F_{2/3}$ STRESS

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).
The calculation eccentricities e_y and e_z refer to installation with WASHER TCW of 2 internal anchors (IN).

The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN}$
$M_{Sd,y} = F_{2/3,d} \times e_{z,IN}$



TCW200 - TCW240 | CONNECTION STIFFNESS FOR STRESS $F_{2/3}$

EVALUTATION OF SLIP MODULUS $K_{2/3,ser}$

- $K_{2/3,ser}$ experimental average value for TITAN joint on CLT (Cross Laminated Timber) according to ETA-11/0496

type	fastening type Ø x L [mm]	n_v [pcs]	$K_{2/3,ser}$ [mm]
TCN200 + TCW200	LBS nails Ø5,0 x 50	30	**9600**
TCN240 + TCW240	LBS nails Ø5,0 x 50	36	**10000**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint screws* GL24h/C24

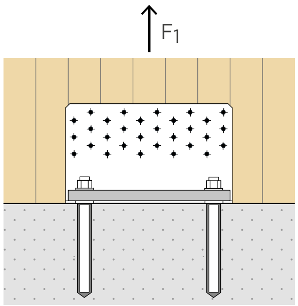
Screws (nails without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 §7.1)

type	fastening type Ø x L [mm]	n_v [pcs]	K_{ser} [mm]
TCN200 + TCW200	LBS nails Ø5,0 x 50	30	**31192**
TCN240 + TCW240	LBS nails Ø5,0 x 50	36	**37431**

* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

STATIC VALUES | TENSILE JOINT F_1 | TIMBER-TO-CONCRETE

TCN200 + TCW200



TIMBER STRENGTH

	TIMBER				STEEL		CONCRETE		
configuration on timber	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		holes fastening Ø13		IN[(1)]
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_H [pcs]	$k_{t//}$ [mm]
TCN200 + TCW200	LBA nails	Ø4,0 x 60	30	**57,9**	**45,7**	γ_{M0}	M12	2	**1,09**
	LBS screws	Ø5,0 x 50		**68,1**					

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø13		$R_{1,d\ concrete}$
	type	Ø x L [mm]	IN[(1)] [kN]
• uncracked	VIN-FIX PRO 5.8/8.8	M12 x 180	**22,1**
	EPO-FIX PLUS 5.8/8.8	M12 x 130	**23,1**
	EPO-FIX PLUS 5.8	M12 x 180	**25,4**
	EPO-FIX PLUS 8.8	M12 x 180	**37,6**
• cracked	VIN-FIX PRO 5.8/8.8	M12 x 180	**10,6**
	EPO-FIX PLUS 5.8/8.8	M12 x 130	**12,9**
		M12 x 180	**19,7**
• seismic	EPO-FIX PLUS 5.8/8.8	M12 x 180	**8,1**
		M12 x 230	**10,9**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN200 + TCW200	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M12 x 130	15	95	95	100	14	**200**
		M12 x 180	15	145	145	150	14	**200**
		M12 x 230	15	195	195	195	14	**240**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

NOTES:

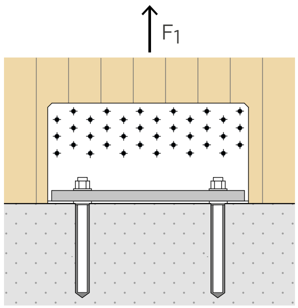
(1) Installation of the anchors in the two internal holes (IN).

GENERAL PRINCIPLES:

For the general principles of calculation, see page 202.

STATIC VALUES | TENSILE JOINT F_1 | TIMBER-TO-CONCRETE

TCN240 + TCW240



TIMBER STRENGTH

	TIMBER				STEEL		CONCRETE		
configuration on timber	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		holes fastening Ø17		IN(1)
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_H [pcs]	$k_{t//}$ [mm]
TCN240 + TCW240	LBA nails	Ø4,0 x 60	36	**69,5**	**68,9**	γ_{M0}	M16	2	**1,08**
	LBS screws	Ø5,0 x 50		**81,7**					

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø17		$R_{1,d\ concrete}$ IN(1)
	type	Ø x L [mm]	[kN]
• uncracked	VIN-FIX PRO 5.8/8.8	M16 x 190	**28,2**
		M16 x 230	**35,8**
	EPO-FIX PLUS 5.8/8.8	M16 x 160	**34,1**
		M16 x 190	**41,4**
• cracked	VIN-FIX PRO 5.8/8.8	M16 x 190	**14,5**
		M16 x 230	**18,3**
	EPO-FIX PLUS 5.8/8.8	M16 x 190	**23,7**
		M16 x 230	**30,0**
• seismic	EPO-FIX PLUS 5.8/8.8	M16 x 190	**10,4**
		M16 x 230	**13,2**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN240 + TCW200	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M16 x 160	15	126	126	126	18	**200**
		M16 x 190	15	155	155	155	18	**200**
		M16 x 230	15	195	195	195	18	**240**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

NOTES:

(1) Installation of the anchors in the two internal holes (IN).

GENERAL PRINCIPLES:

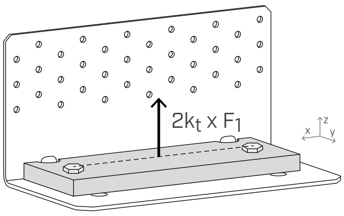
For the general principles of calculation, see page 202.

TCW200 - TCW240 | VERIFICATION OF ANCHORS FOR CONCRETE FOR F_1 STRESS

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (k_t).
2 internal anchors (IN) must be provided for installation on concrete with WASHER TCW.

The anchor group must be verified for:

$N_{Sd,z} = 2 \times k_{t//} \times F_{1,d}$



TCW200 - TCW240 | CONNECTION STIFFNESS FOR STRESS F_1

EVALUTATION OF SLIP MODULUS $K_{1,ser}$

- $K_{1,ser}$ experimental average value for TITAN joint on C24 CLT (Cross Laminated Timber) panels

type	fastening type Ø x L [mm]	n_v [pcs]	$K_{1,ser}$ [N/mm]
TCN200 + TCW200	-	-	-
TCN240 + TCW240	LBA nails Ø4,0 x 60	36	**28455**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint nails* GL24h/C24

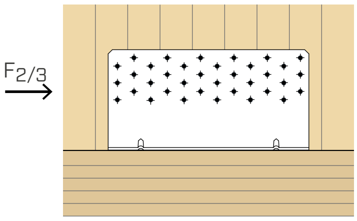
Nails (without pre-drilling hole) $\dfrac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

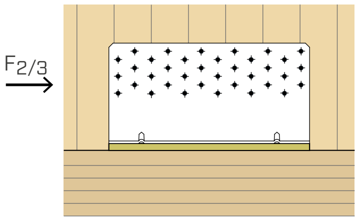
type	fastening type Ø x L [mm]	n_v [pcs]	K_{ser} [N/mm]
TCN200 + (TCW200)	LBA nails Ø4,0 x 60	30	**26093**
TCN240 (+ TCW240)	LBA nails Ø4,0 x 60	36	**31311**

* For steel-to-timber connections the reference standard indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3))

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-TIMBER

TTN240

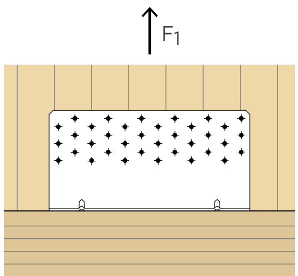




	TIMBER					
configuration on timber(1)	**holes fastening Ø5**				**profile**(2)	$R_{2/3,k\ timber}$
	type	**Ø x L** [mm]	n_v [pcs]	n_H [pcs]	**s** [mm]	[kN]
TTN240	LBA nails	Ø4,0 x 60	36	36	-	**37,9**
	LBS screws	Ø5,0 x 50				**46,7**
TTN240 + XYLOFON	LBA nails	Ø4,0 x 60	36	36	6	**24,8**
	LBS screws	Ø5,0 x 50				**22,8**
TTN240 + ALADIN STRIPE SOFT	LBA nails	Ø4,0 x 60	36	36	5	**28,9**
	LBS screws	Ø5,0 x 50				**27,5**
TTN240 + ALADIN STRIPE EXTRA SOFT	LBA nails	Ø4,0 x 60	36	36	7	**27,5**
	LBS screws	Ø5,0 x 50				**25,8**

STATIC VALUES | TENSILE JOINT F_1 |TIMBER-TO-TIMBER

TTN240



	TIMBER				
	holes fastening Ø5				$R_{1,k\ timber}$
	type	**Ø x L** [mm]	n_v [pcs]	n_H [pcs]	[kN]
TTN240	LBA nails	Ø4,0 x 60	36	36	**7,4**
	LBS screws	Ø5,0 x 50			**16,2**

NOTES:

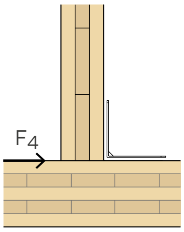
(1) The TTN240 angle bracket can be installed in combination with different resilient acoustic profiles inserted below the horizontal flange in full pattern configuration. The strength values in the table are given in ETA-11/0496 and calculated according to *"Blaß, H.J. und Laskewitz, B. (2000); Load-Carrying Capacity of Joints with Dowel-Type fasteners and Interlayers."*, conservatively disregarding the stiffness of the profile.

(2) Profile thickness: in the case of ALADIN profile, the calculation took into account the reduced thickness, due to the corrugated section and the consequent crushing induced by the nail head during insertion.

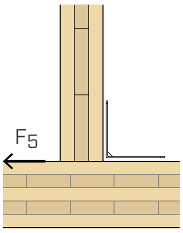
STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-TIMBER

TTN240

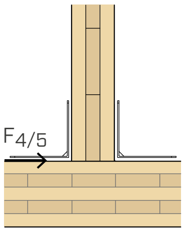
		TIMBER				STEEL	
F_4		holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$	
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
TTN240	• full pattern	LBA nails	Ø4,0 x 60	36 + 36	**23,8**	**31,1**	γ_{M0}
		LBS screws	Ø5,0 x 50				



		TIMBER				STEEL	
F_5		holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$	
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
TTN240	• full pattern	LBA nails	Ø4,0 x 60	36 + 36	**7,3**	**3,4**	γ_{M0}
		LBS screws	Ø5,0 x 50				

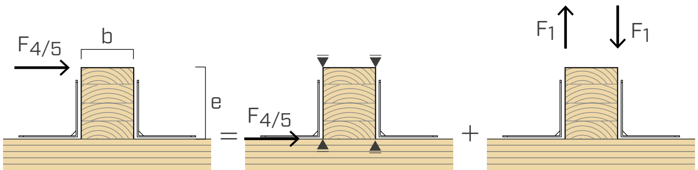


		TIMBER				STEEL	
$F_{4/5}$ TWO ANGLE BRACKETS		holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$	
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
TTN240	• full pattern	LBA nails	Ø4,0 x 60	72 + 72	**26,7**	**31,6**	γ_{M0}
		LBS screws	Ø5,0 x 50				



The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating). For joints with 2 angle brackets, in case the stress $F_{4/5,d}$ is applied with eccentricity e≠0, the verification for combined loads is required considering the contribution of the additional tensile component:

$$\Delta F_{1,d} = F_{4/5,d} \cdot \frac{e}{b}$$



GENERAL PRINCIPLES:

For the general principles of calculation, see page 202.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0496. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments (see Chapter 6 ANCORS FOR CONCRETE). The connection design strength values are obtained from the values on the table as follows:

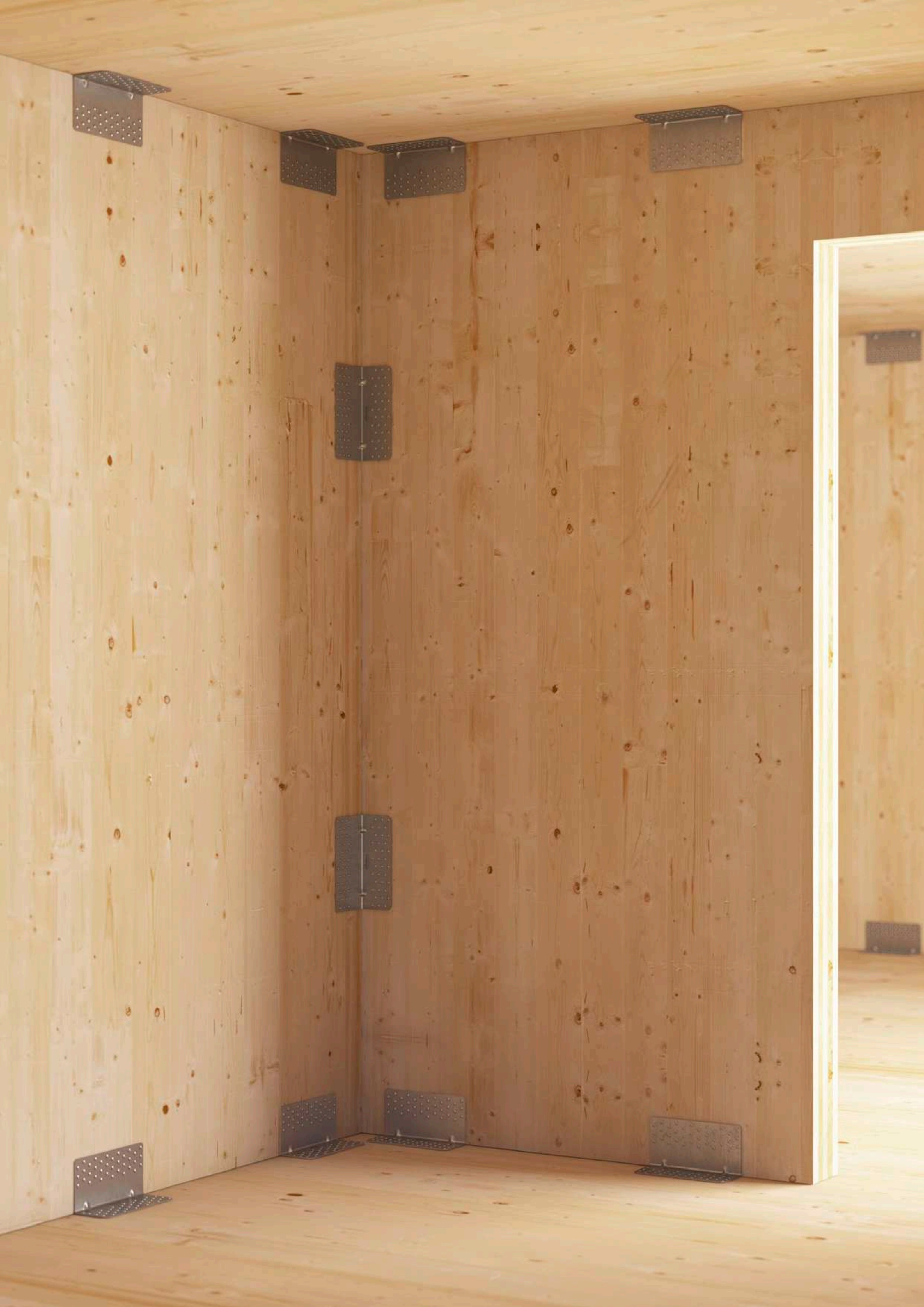
$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\ steel}}{\gamma_{steel}} \\ R_{d,\ concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ 350\ kg/m^3 \leq \rho_k \leq 420\ kg/m^3$$

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ LVL\ with\ \rho_k \leq 500\ kg/m^3$$

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used. The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045. For chemical anchors subjected to shear stress it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).



TITAN S

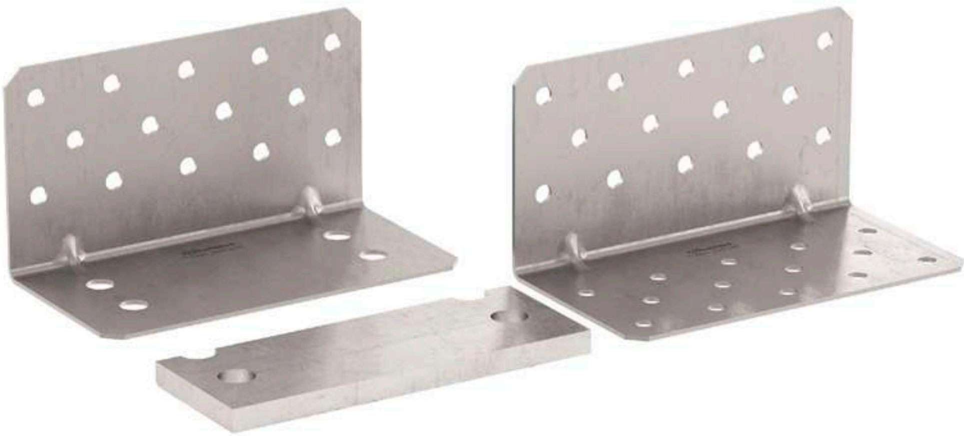
ETA 11/0496

ANGLE BRACKET FOR SHEAR AND TENSILE FORCES

HOLES FOR HBS PLATE
Fastening with HBS PLATE Ø8 screws using a screwdriver makes installation easy and fast and allows you to work safely and comfortably.

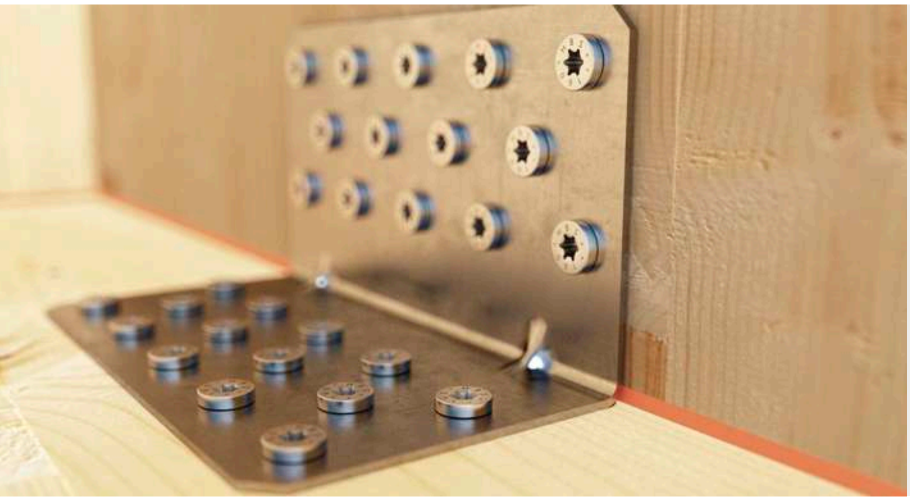
85 kN SHEAR
Exceptional shear strengths. Up to 85,9 kN on concrete (with TCW washer). Up to 60,0 kN on timber.

75 kN TENSILE
On concrete, the TCS angle bracket with TCW washer provides excellent tensile strength. $R_{1,k}$ up to 75,9 kN characteristic values.



CHARACTERISTICS

FOCUS	shear and tensile joints
HEIGHT	130 mm
THICKNESS	3,0 mm
FASTENERS	HBS PLATE, VIN-FIX PRO, EPO-FIX PLUS, SKR, AB1



MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete and timber-to-timber shear tensile joints for timber panels and timber stringers

- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels

COMFORT

The angle brackets fastening using a reduced number of HBS PLATE Ø8 screws makes installation faster and increases operator comfort.

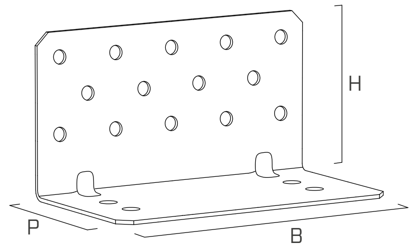
ALL DIRECTIONS

Certified shear ($F_{2,3}$), tensile (F_1) and tilting ($F_{4,5}$) strengths. Certified values also with interposed acoustic profiles.

CODES AND DIMENSIONS

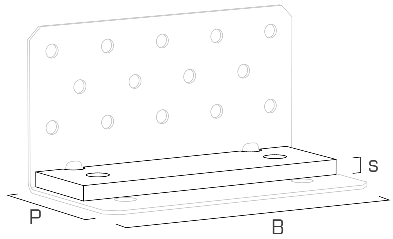
TITAN S - TCS | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm]	P [mm]	H [mm]	holes [mm]	n_V Ø11 [pcs]	s [mm]		pcs
TCS240	240	123	130	4 x Ø17	14	3	●	10



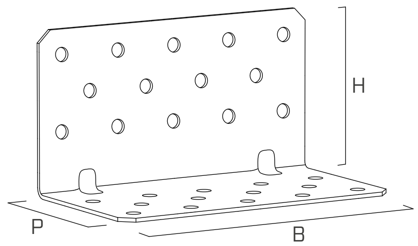
TITAN WASHER - TCW240 | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm]	P [mm]	s [mm]	holes [mm]		pcs
TCW240	230	73	12	Ø18	●	1



TITAN S - TTS | TIMBER-TO-TIMBER JOINTS

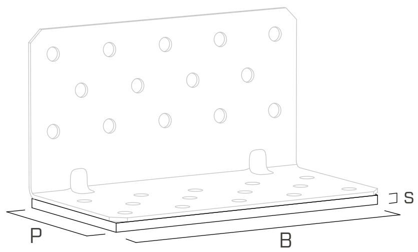
CODE	B [mm]	P [mm]	H [mm]	n_H Ø11 [pcs]	n_V Ø11 [pcs]	s [mm]		pcs
TTS240	240	130	130	14	14	3	●	10



ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

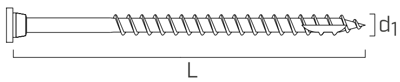
CODE	type	B	P [mm]	s [mm]		pcs
XYL35120240	xylofon plate	240 mm	120	6	●	10
ALADIN95	soft	50 m(*)	95	5	●	10
ALADIN115	extra soft	50 m(*)	115	7	●	10

(*) To be cut on site



HBS PLATE

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSP880	8	80	55	TX40	100



MATERIAL AND DURABILITY

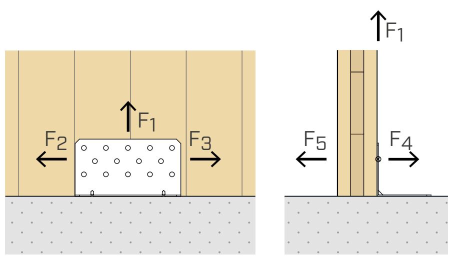
TITAN S: carbon steel DX51D+Z275.
TITAN WASHER: S235 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON PLATE: 35-shore polyurethane compound.
ALADIN STRIPE: Compact EPDM.

FIELD OF USE

- Timber-to-concrete joints
- Timber-to-timber joints
- Timber-to-steel joints

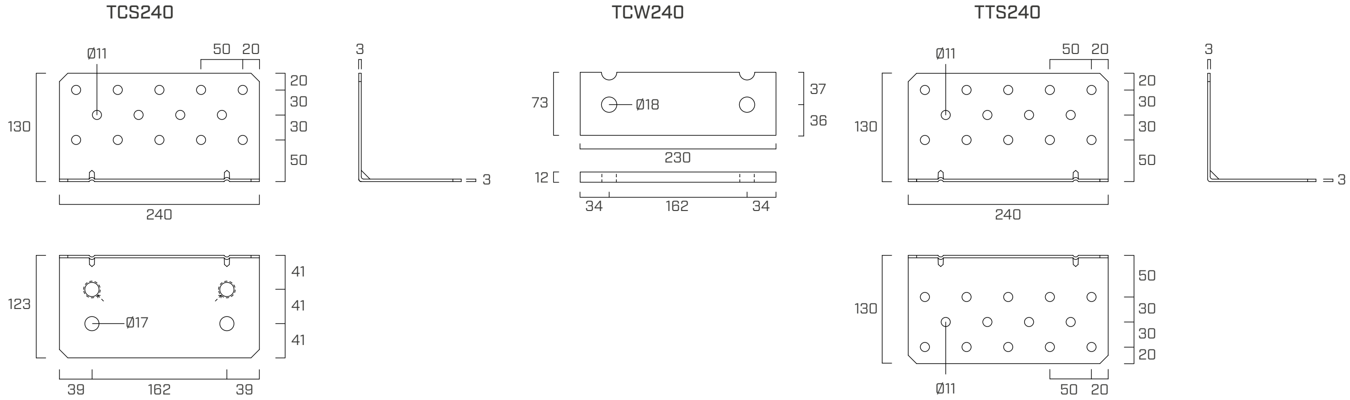
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support	page
HBS PLATE	pan head screw		8		560
AB1	mechanical anchor		16		494
SKR	screw anchor		16		488
VIN-FIX PRO	chemical anchor		M16		511
EPO-FIX PLUS	chemical anchor		M16		517

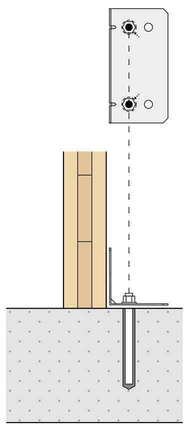
GEOMETRY



INSTALLATION ON CONCRETE

To fix **TITAN TCS** angle bracket to the concrete foundation, **2 anchors** must be used, according to one of the following installation configurations, according to the acting stress.

IDEAL INSTALLATION

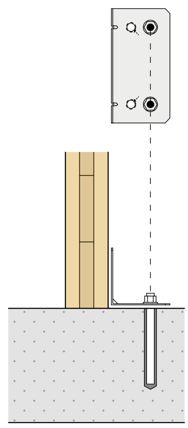


2 anchors positioned in the INTERNAL HOLES (**IN**) (identified by a mark on the product)

Reduced stress on the anchor (minimum e_y and k_t eccentricity)

Optimized connection strength

ALTERNATIVE INSTALLATION

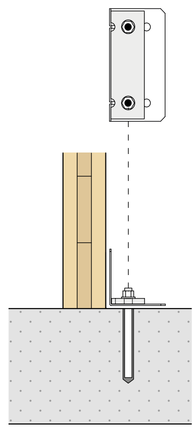


2 anchors placed in the EXTERNAL HOLES (**OUT**) (e.g. interaction between the anchor and the concrete support reinforcement)

Maximum stress on the anchor (maximum e_y and k_t eccentricity)

Reduced connection strength

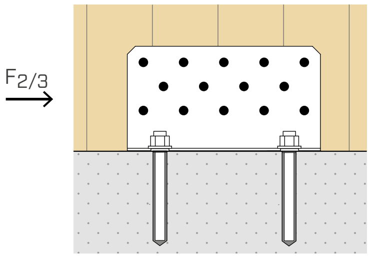
INSTALLATION WITH WASHER



The WASHER TCW must be fastened by means of 2 anchors positioned in the INTERNAL HOLES (**IN**)

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCS240



TIMBER STRENGTH

configuration on timber	TIMBER				CONCRETE			
	holes fastening Ø11			$R_{2/3,k\ timber}$	holes fastening Ø17		IN[1]	OUT[2]
	type	Ø x L [mm]	n_v [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{y,OUT}$ [mm]
TCS240	HBS PLATE	Ø8,0 x 80	14	**70,3**	M16	2	39,5	80,5

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø17		$R_{2/3,d\ concrete}$	
	type	Ø x L [mm]	IN[1] [kN]	OUT[2] [kN]
• uncracked	VIN-FIX PRO 5.8	M16 x 160	**55,8**	**43,9**
	VIN-FIX PRO 8.8	M16 x 160	**90,1**	**70,9**
	SKR-E	16 x 130	**67,4**	**53,1**
	AB1	M16 x 145	**67,4**	**53,1**
• cracked	VIN-FIX PRO 5.8/8.8	M16 x 160	**55,0**	**43,2**
	SKR-E	16 x 130	**55,0**	**43,2**
	AB1	M16 x 145	**55,0**	**43,2**
• seismic	EPO-FIX PLUS 5.8	M16 x 160	**26,6**	**21,1**
	EPO-FIX PLUS 8.8	M16 x 160	**28,1**	**21,9**
		M16 x 190	**33,8**	**26,7**
		M16 x 230	**42,1**	**33,2**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCS240	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M16 x 160	3	137	137	145	18	**200**
	EPO-FIX PLUS 8.8	M16 x 190	3	164	164	170	18	**200**
		M16 x 230	3	204	204	210	18	**240**
	SKR-E	16 x 130	3	85	127	150	14	**200**
	AB1	M16 x 145	3	85	97	105	16	**200**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

NOTES:

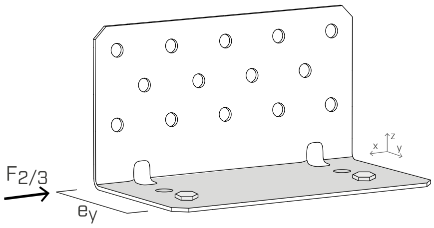
(1) Installation of the anchors in the two internal holes (IN).
(2) Installation of the anchors in external holes (OUT).

TCS240 | VERIFICATION OF CONCRETE ANCHORS FOR STRESS | $F_{2/3}$

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).
E_y calculation eccentricities vary depending on the type of installation selected: 2 internal anchors (IN) or 2 external anchors (OUT).

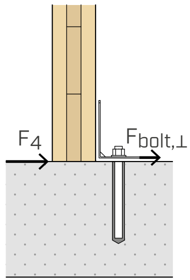
The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN/OUT}$



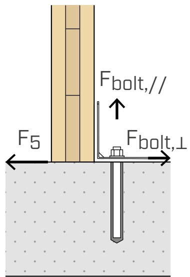
STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-CONCRETE

TCS240



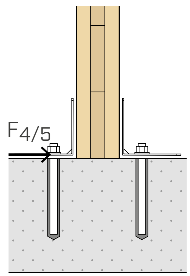
	TIMBER				STEEL		CONCRETE			
F_4	holes fastening Ø11			$R_{4,k\ timber}$	$R_{4,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCS240	HBS PLATE	Ø8,0 x 80	14	**21,1**	**18,1**	γ_{M0}	M16	2	0,5	-

The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{4,d}$



	TIMBER				STEEL		CONCRETE			
F_5	holes fastening Ø11			$R_{5,k\ timber}$	$R_{5,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCS240	HBS PLATE	Ø8,0 x 80	14	**17,1**	**4,3**	γ_{M0}	M16	2	0,5	0,36

The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{5,d}$; $N_{Sd,z} = 2 \times k_{t//} \times F_{5,d}$

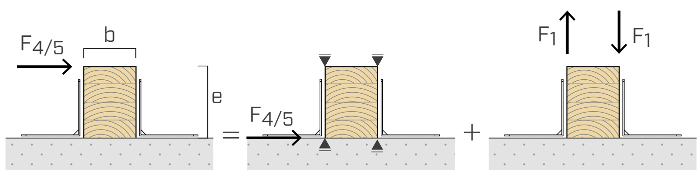


	TIMBER				STEEL		CONCRETE			
$F_{4/5}$ TWO ANGLE BRACKETS	holes fastening Ø11			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCS240	HBS PLATE	Ø8,0 x 80	14 + 14	**27,4**	**18,8**	γ_{M0}	M16	2 + 2	0,39	0,08

The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{4/5,d}$; $N_{Sd,z} = 2 \times k_{t//} \times F_{4/5,d}$

The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating). For joints with 2 angle brackets, in case the stress $F_{4/5,d}$ is applied with eccentricity e≠0, the verification for combined loads is required considering the contribution of the additional tensile component:

$$\Delta F_{1,d} = F_{4/5,d} \cdot \frac{e}{b}$$

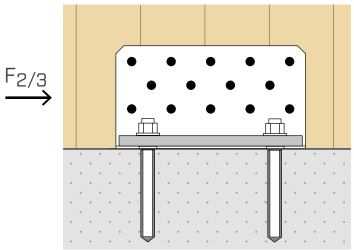


GENERAL PRINCIPLES:

For the general principles of calculation, see page 216.

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCS240 + TCW240



TIMBER STRENGTH

	TIMBER				CONCRETE			
configuration on timber	holes fastening Ø11			$R_{2/3,k\ timber}$	holes fastening Ø17		IN[(1)]	
	type	Ø x L [mm]	n_V [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{z,IN}$ [mm]
TCS240 + TCW240	HBS PLATE	Ø8,0 x 80	14	**85,9**	M16	2	39,5	78,5

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø17		$R_{2/3,d\ concrete}$ IN[(1)]
	type	Ø x L [mm]	[kN]
• uncracked	VIN-FIX PRO 5.8	M16 x 190	**50,4**
	VIN-FIX PRO 8.8	M16 x 190	**64,7**
	SKR-E	16 x 130	**33,9**
	AB1	M16 x 145	**41,6**
• cracked	VIN-FIX PRO 5.8/8.8	M16 x 190	**32,3**
	EPO-FIX PLUS 5.8/8.8	M16 x 160	**41,7**
		M16 x 190	**50,4**
	AB1	M16 x 145	**29,6**
• seismic	EPO-FIX PLUS 5.8	M16 x 190	**15,7**
		M16 x 230	**17,1**
	EPO-FIX PLUS 8.8	M16 x 190	**17,3**
		M16 x 230	**21,7**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCS240 + TCW240	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M16 x 160	15	126	126	135	18	**200**
		M16 x 190	15	155	155	155	18	**200**
		M16 x 230	15	195	195	195	18	**240**
	SKR-E	16 x 130	15	85	115	145	14	**200**
	AB1	M16 x 145	15	85	97	105	16	**200**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

NOTES:

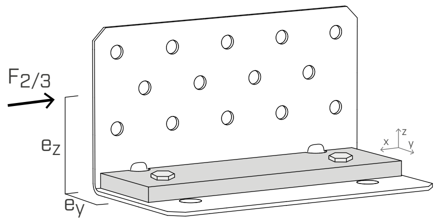
(1) Installation of the anchors in the two internal holes (IN).
(2) Installation of the anchors in external holes (OUT).

TCW240 | VERIFICATION OF CONCRETE ANCHORS FOR STRESS $F_{2/3}$

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).
The calculation eccentricities e_y and e_z refer to installation with WASHER TCW of 2 internal anchors (IN).

The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN}$
$M_{Sd,y} = F_{2/3,d} \times e_{z,IN}$



TCS240 - TCW240 | CONNECTION STIFFNESS FOR STRESS | $F_{2/3}$

EVALUTATION OF SLIP MODULUS $K_{2/3,ser}$

- $K_{2/3,ser}$ experimental average value for TITAN joint on CLT (Cross Laminated Timber) according to ETA-11/0496

type	fastening type Ø x L [mm]	n_v [pcs]	$K_{2/3,ser}$ [N/mm]
TCS240	HBS PLATE Ø8,0 x 80	14	**8200**
TCS240 + TCW240	HBS PLATE Ø8,0 x 80	14	**8600**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint screws* C24/GL24h

Screws (nails without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

type	fastening type Ø x L [mm]	n_v [pcs]	K_{ser} [N/mm]
TCS240 + (TCW240)	HBS PLATE Ø8,0 x 80	14	**21201**

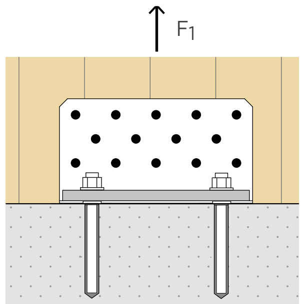
* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

GENERAL PRINCIPLES:

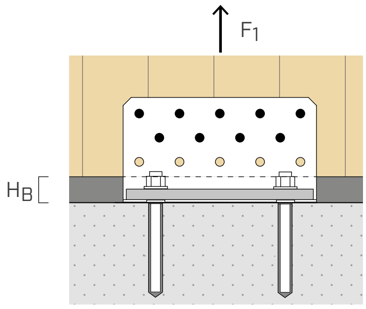
For the general principles of calculation, see page 216.

STATIC VALUES | TENSILE JOINT F_1 | TIMBER-TO-CONCRETE

TCS240 + TCW240



FULL PATTERN



PARTIAL PATTERN[1]

TIMBER STRENGTH

configuration on timber		TIMBER holes fastening Ø11 type	Ø x L [mm]	n_v [pcs]	$R_{1,k\ timber}$ [kN]	STEEL $R_{1,k\ steel}$ [kN]	γ_{steel}	CONCRETE holes fastening Ø17 Ø [mm]	n_H [pcs]	IN[2] $k_{t//}$ [mm]
TCS240 + TCW240	full pattern	HBS PLATE	Ø8,0 x 80	14	-	**75,9**	γ_{M0}	M16	2	**1,08**
	partial pattern	HBS PLATE	Ø8,0 x 80	9	**33,9**	**75,9**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø17 type	Ø x L [mm]	$R_{1,d\ concrete}$ IN[2] [kN]
• uncracked	VIN-FIX PRO 5.8/8.8	M16 x 190	**28,2**
		M16 x 230	**35,8**
	EPO-FIX PLUS 5.8/8.8	M16 x 160	**34,1**
		M16 x 190	**41,4**
• cracked	VIN-FIX PRO 5.8/8.8	M16 x 190	**14,5**
		M16 x 230	**18,3**
	EPO-FIX PLUS 5.8/8.8	M16 x 190	**23,7**
		M16 x 230	**30,0**
• seismic	EPO-FIX PLUS 5.8/8.8	M16 x 190	**10,4**
		M16 x 230	**13,2**

installation	anchor type: type	Ø x L [mm]	t_{fix} [mm]	h_{ef} [mm]	h_{nom} [mm]	h_1 [mm]	d_0 [mm]	h_{min} [mm]
TCS240 + TCW240	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M16 x 160	15	126	126	126	18	**200**
		M16 x 190	15	155	155	155	18	**200**
		M16 x 230	15	195	195	195	18	**240**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

- t_{fix} fastened plate thickness
- h_{nom} nominal anchoring depth
- h_{ef} effective anchor depth
- h_1 minimum hole depth
- d_0 hole diameter in the concrete support
- h_{min} concrete minimum thickness

NOTES:

(1) In case of design requirements such as F_1 stress of different value or presence of an H_B intermediate layer between the wall and the supporting surface, partial fastening with $H_B \leq 32$ mm can be adopted for application on CLT panel.

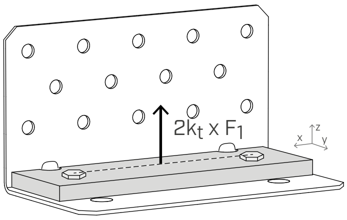
(2) Installation of the anchors in the two internal holes (IN).

TCW200 - TCW240 | ANCHORS FOR CONCRETE STRESS VERIFICATION | F_1

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (k_t).
2 internal anchors (IN) must be provided for installation on concrete with WASHER TCW.

The anchor group must be verified for:

$N_{Sd,z} = 2 \times k_{t//} \times F_{1,d}$

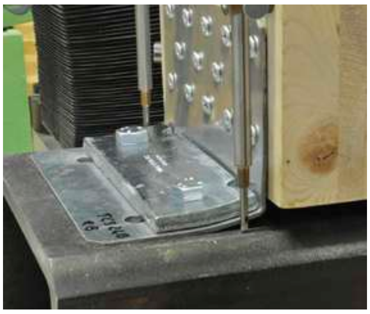


TCW240 | CONNECTION STIFFNESS FOR STRESS F_1

EVALUTATION OF SLIP MODULUS $K_{1,ser}$

- $K_{1,ser}$ experimental average for TITAN connection on CLT (Cross Laminated Timber) according to ETA-11/0496

type	fastening type **Ø x L** [mm]	n_v [pcs]	$K_{1,ser}$ [N/mm]
TCS240 + TCW240	HBS PLATE Ø8,0 x 80	14	**11500**



- K_{ser} according to EN 1995-1-1 for timber-to-timber joint screws* C24/GL24h

Screws (nails without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

type	fastening type **Ø x L** [mm]	n_v [pcs]	K_{ser} [N/mm]
TCS240 + TCW240	HBS PLATE Ø8,0 x 80	14	**21201**

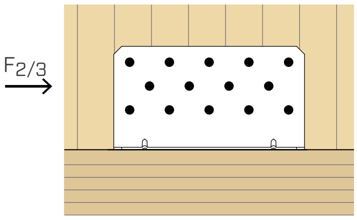
* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

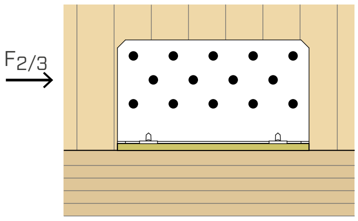
GENERAL PRINCIPLES:

For the general principles of calculation, see page 216.

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-TIMBER

TTS240





	TIMBER					
configuration on timber(1)	holes fastening Ø11				profile(2)	$R_{2/3,k\ timber}$
	type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	s [mm]	[kN]
TTS240	HBS PLATE	Ø8,0 x 80	14	14	-	**60,0**
TTS240 + XYLOFON	HBS PLATE	Ø8,0 x 80	14	14	6	**12.5**
TTS240 + ALADIN STRIPE SOFT					5	**14,7**
TTS240 + ALADIN STRIPE EXTRA SOFT					7	**13,9**

TTS240 | CONNECTION STIFFNESS FOR STRESS | $F_{2/3}$

EVALUTATION OF SLIP MODULUS $K_{2/3,ser}$

- $K_{2/3,ser}$ experimental average value for TITAN joint on CLT (Cross Laminated Timber) according to ETA 11/0496

type	fastening type Ø x L [mm]	n_V [pcs]	n_H [pcs]	$K_{2/3,ser}$ [N/mm]
TTS240	HBS PLATE Ø8,0 x 80	14	14	**5600**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint screws* C24/GL24h

Screws (nails without pre-drilling hole) $\dfrac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

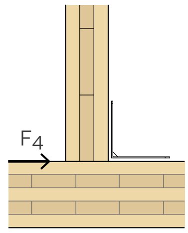
type	fastening type Ø x L [mm]	n_V [pcs]	K_{ser} [N/mm]
TTS240	HBS PLATE screws Ø8,0 x 80	14	**21201**

* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

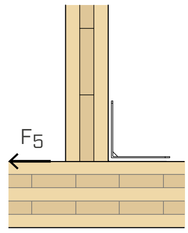
STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-TIMBER

TTS240

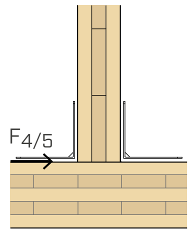
F_4	TIMBER				STEEL	
	type	holes fastening Ø11 Ø x L [mm]	n [pcs]	$R_{4,k\ timber}$ [kN]	$R_{4,k\ steel}$ [kN]	γ_{steel}
TTS240	HBS PLATE	Ø8,0 x 80	14 + 14	**20,7**	**20,9**	γ_{M0}



F_5	TIMBER				STEEL	
	type	holes fastening Ø11 Ø x L [mm]	n [pcs]	$R_{5,k\ timber}$ [kN]	$R_{5,k\ steel}$ [kN]	γ_{steel}
TTS240	HBS PLATE	Ø8,0 x 80	14 + 14	**16,8**	**4,2**	γ_{M0}



$F_{4/5}$ TWO ANGLE BRACKETS	TIMBER				STEEL	
	type	holes fastening Ø11 Ø x L [mm]	n_v [pcs]	$R_{4/5,k\ timber}$ [kN]	$R_{4/5,k\ steel}$ [kN]	γ_{steel}
TTS240	HBS PLATE	Ø8,0 x 80	28 + 28	**25,2**	**23,4**	γ_{M0}



The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

NOTES:

(1) The TTS240 angle bracket can be installed in combination with different resilient acoustic profiles inserted below the horizontal flange. The strength values in the table are given in ETA 11/0496 and calculated according to *"Blaß, H.J. und Laskewitz, B. (2000); Load-Carrying Capacity of Joints with Dowel-Type fasteners and Interlayers."*, conservatively disregarding the stiffness of the profile.

(2) Profile thickness: in the case of ALADIN profile, the calculation took into account the reduced thickness of the profile itself, due to the corrugated section and the consequent crushing induced by the nail head during insertion.

GENERAL PRINCIPLES:

For the general principles of calculation, see page 216.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0496. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments (see Chapter 6 ANCORS FOR CONCRETE). The connection design strength values are obtained from the values on the table as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,\,timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\,steel}}{\gamma_{steel}} \\ R_{d,\,concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.

- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad \text{for } 350 \text{ kg/m}^3 \leq \rho_k \leq 420 \text{ kg/m}^3$$

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad \text{for LVL with } \rho_k \leq 500 \text{ kg/m}^3$$

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used. The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045. For chemical anchors subjected to shear stress it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).

TITAN F

ETA 11/0496

ANGLE BRACKET FOR SHEAR FORCES

LOW HOLES
Ideal for TIMBER FRAME, designed for fastening on platform beams or on the stringers of the frame structures. It also has certified values for use with partial nailing.

FRAME
Thanks to the lowered position of the holes on the vertical flange, it offers excellent shear strength values even on low height platform beams. $R_{2,k}$ up to 42.5 kN on both timber and concrete.

CONCRETE HOLES
The TITAN angle bracket are designed to offer two fastening possibilities, in order to avoid interference with the rods in the concrete support.

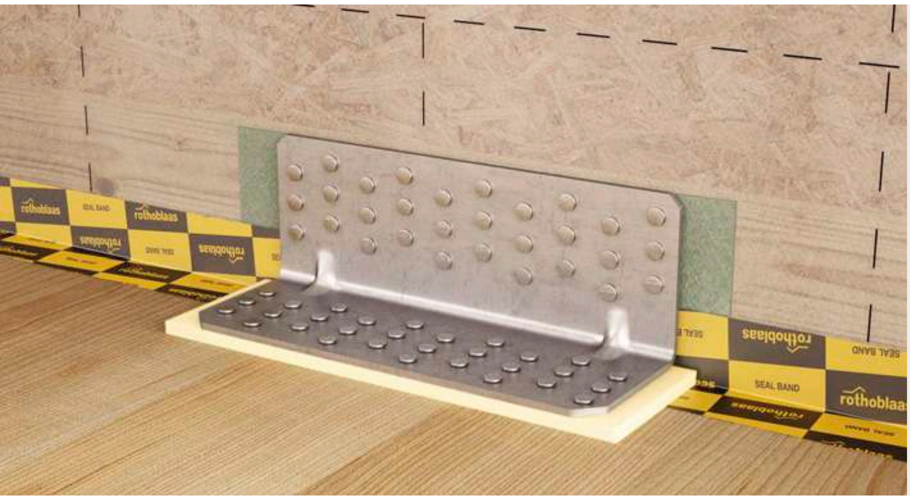
CHARACTERISTICS

FOCUS	shear joints
HEIGHT	71 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, VIN-FIX PRO, EPO-FIX PLUS, SKR, AB1

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete and timber-to-timber shear joints for panels and timber stringers.

- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels



TIMBER-TO-TIMBER

Ideal for shear joints between floor and wall and between wall and wall. The high shear strength allows to optimize the number of fastenings.

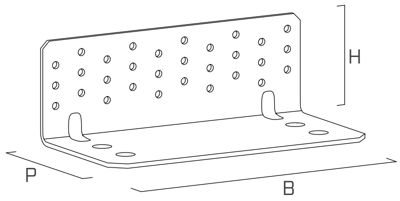
TITAN SILENT

Ideal in combination with XYLOFON PLATE to limit acoustic bridges and reduce walking vibrations of timber floors.

CODES AND DIMENSIONS

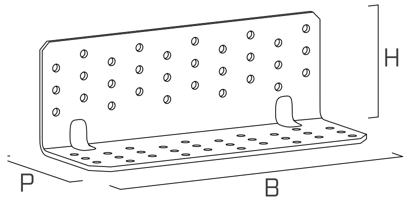
TITAN F - TCF | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm]	P [mm]	H [mm]	holes [mm]	n_V Ø5 [pcs]	s [mm]		pcs
TCF200	200	103	71	Ø13	30	3	●	10



TITAN F - TTF | TIMBER-TO-TIMBER JOINTS

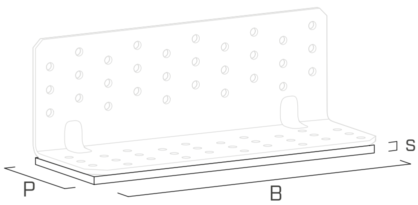
CODE	B [mm]	P [mm]	H [mm]	n_H Ø5 [pcs]	n_V Ø5 [pcs]	s [mm]		pcs
TTF200	200	71	71	30	30	3	●	10



ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

CODE	type	B	P [mm]	s [mm]		pcs
XYL3570200	xylofon plate	200 mm	70	6	●	10
ALADIN95	soft	50 m(*)	95	5	●	10
ALADIN115	extra soft	50 m(*)	115	7	●	10

(*) To be cut on site



MATERIAL AND DURABILITY

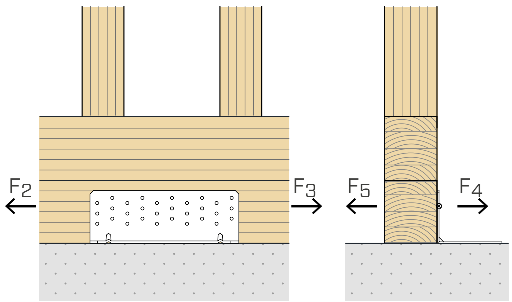
TITAN F: carbon steel DX51D+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON PLATE: 35-shore polyurethane compound.
ALADIN STRIPE: Compact EPDM.

FIELD OF USE

- Timber-to-concrete joints
- Timber-to-timber joints
- Timber-to-steel joints

EXTERNAL LOADS

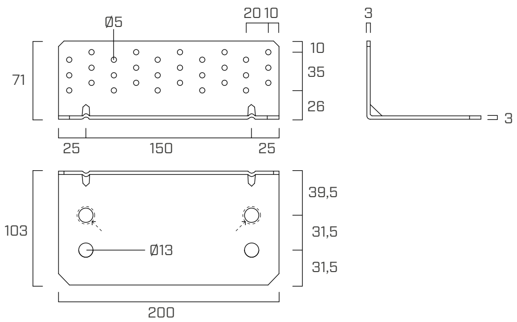


ADDITIONAL PRODUCTS - FASTENING

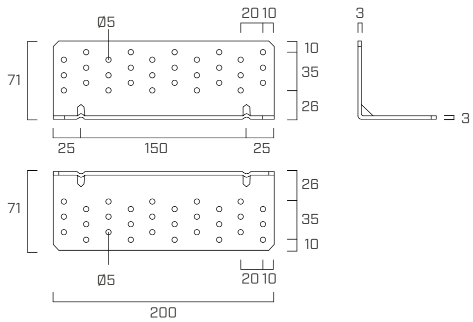
type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
AB1	mechanical anchor		12		494
SKR	screw anchor		12		488
VIN-FIX PRO	chemical anchor		M12		511
EPO-FIX PLUS	chemical anchor		M12		517

GEOMETRY

TCF200

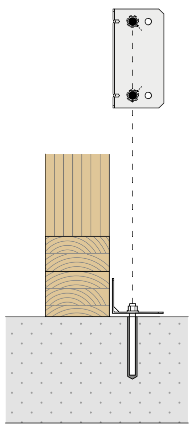
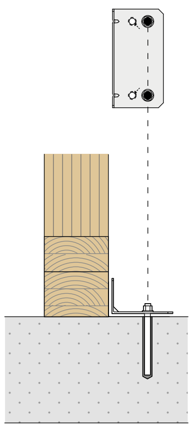


TTF200



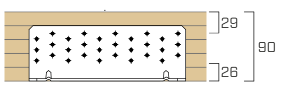
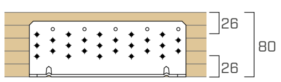
INSTALLATION ON CONCRETE

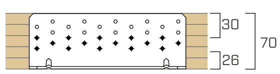
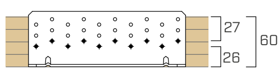
To fix the **TITAN TCF200** angle bracket to the concrete, **2 anchors** must be used, according to one of the following installation modes:

IDEAL INSTALLATION	ALTERNATIVE INSTALLATION
	
2 anchors positioned in the INTERNAL HOLES (**IN**) (identified by a mark on the product)	2 anchors placed in the EXTERNAL HOLES (**OUT**) (e.g. interaction between the anchor and the concrete support reinforcement)
Reduced stress on the anchor (minimum e_y and k_t eccentricity)	Maximum stress on the anchor (maximum e_y and k_t eccentricity)
Optimized connection strength	Reduced connection strength

TCF200 - TTF200 | PARTIAL FASTENING PATTERNS FOR STRESS $F_{2/3}$

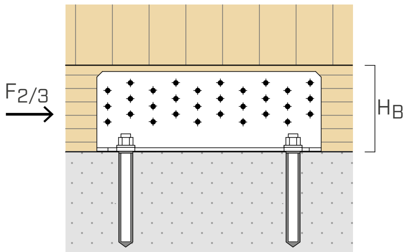
In the presence of design requirements such as $F_{2/3}$ stresses of different value or presence of sill or platform beam, it is possible to use partial fastening patterns, depending on the height H_B of the timber element:

configuration on timber	H_B	n_v pcs	fastening diagrams
full pattern	$H_B \geq 90$ mm	30	
pattern 3	$H_B \geq 80$ mm	25	

configuration on timber	H_B	n_v [pcs]	fastening diagrams
pattern 2	$H_B \geq 70$ mm	15	
pattern 1	$H_B \geq 60$ mm	10	

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCF200



TIMBER STRENGTH

configuration on timber	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø13		IN[(1)]	OUT[(2)]
	type	Ø x L [mm]	n_v [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{y,OUT}$ [mm]
• full pattern $H_B \geq 90$ mm	LBA nails	Ø4,0 x 60	30	**35,5**	M12	2	38,5	70,0
	LBS screws	Ø5,0 x 50		**42,5**				
• pattern 3 $H_B \geq 80$ mm	LBA nails	Ø4,0 x 60	25	**31,0**				
	LBS screws	Ø5,0 x 50		**37,2**				
• pattern 2 $H_B \geq 70$ mm	LBA nails	Ø4,0 x 60	15	**20,9**				
	LBS screws	Ø5,0 x 50		**25,1**				
• pattern 1 $H_B \geq 60$ mm	LBA nails	Ø4,0 x 60	10	**15,1**				
	LBS screws	Ø5,0 x 50		**18,1**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$	
	type	Ø x L [mm]	IN[(1)] [kN]	OUT[(2)] [kN]
• uncracked	VIN-FIX PRO 5.8	M12 x 130	**29,7**	**24,4**
	VIN-FIX PRO 8.8	M12 x 130	**48,1**	**39,1**
	SKR-E	12 x 90	**38,3**	**31,3**
	AB1	M12 x 100	**35,4**	**28,9**
• cracked	VIN-FIX PRO 5.8	M12 x 130	**29,7**	**24,4**
	VIN-FIX PRO 8.8	M12 x 130	**35,1**	**28,9**
	SKR-E	12 x 90	**34,6**	**28,4**
	AB1	M12 x 100	**35,4**	**28,9**
• seismic	EPO-FIX PLUS 5.8/8.8	M12 x 130	**19,2**	**15,7**
	SKR-E	12 x 90	**8,8**	**7,2**
	AB1	M12 x 100	**10,6**	**8,7**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCF200	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M12 x 130	3	112	112	120	14	**200**
	SKR-E	12 x 90	3	64	87	110	10	
	AB1	M12 x 100	3	70	80	85	12	

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

NOTES:

(1) Installation of the anchors in the two internal holes (IN).
(2) Installation of the anchors in the two external holes (OUT).

TCF200 | VERIFICATION OF CONCRETE ANCHORS FOR STRESS $F_{2/3}$

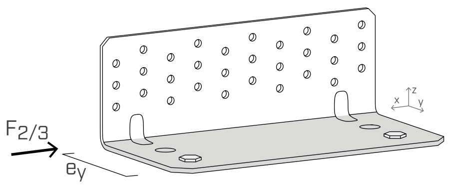
Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).

E_y calculation eccentricities vary depending on the type of installation selected: 2 internal anchors (IN) or 2 external anchors (OUT).

The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$

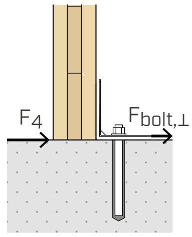
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN/OUT}$



STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-CONCRETE

TCF200

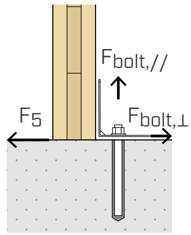
	TIMBER				STEEL		CONCRETE			
F_4	holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
• full pattern	LBA nails	Ø4,0 x 60	30	**14,6**	**9,5**	γ_{M0}	M12	2	0,5	-
	LBS screws	Ø5,0 x 50								



The group of 2 anchors must be verified for:

$V_{Sd,y} = 2 \times k_{t\perp} \times F_{4,d}$

	TIMBER				STEEL		CONCRETE			
F_5	holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
• full pattern	LBA nails	Ø4,0 x 60	30	**10,7**	**4,8**	γ_{M0}	M12	2	0,5	0,27
	LBS screws	Ø5,0 x 50								

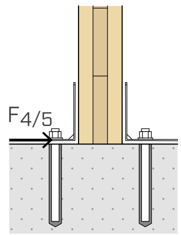


The group of 2 anchors must be verified for:

$V_{Sd,y} = 2 \times k_{t\perp} \times F_{5,d}$

$N_{Sd,z} = 2 \times k_{t//} \times F_{5,d}$

	TIMBER				STEEL		CONCRETE			
$F_{4/5}$ TWO ANGLE BRACKETS	holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L	n_v				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
• full pattern	LBA nails	Ø4,0x60	30 + 30	**23,8**	**12,3**	γ_{M0}	M12	2 + 2	0,31	0,10
	LBS screws	Ø5,0x50								



The group of 2 anchors must be verified for:

$V_{Sd,y} = 2 \times k_{t\perp} \times F_{4/5,d}$

$N_{Sd,z} = 2 \times k_{t//} \times F_{4/5,d}$

The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

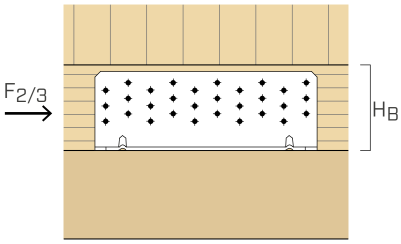
GENERAL PRINCIPLES:

For the general principles of calculation, see page 226.

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-TIMBER

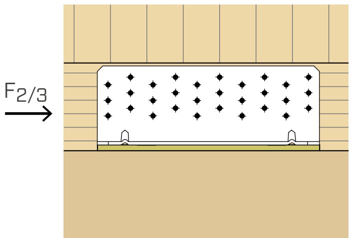
TTF200

SHEAR STRENGTH $R_{2/3}$



configuration on timber	TIMBER				
	holes fastening Ø5				$R_{2/3,k}$ timber
	type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	[kN]
• full pattern $H_B \geq 90$ mm	LBA nails	Ø4,0 x 60	30	30	**35,5**
	LBS screws	Ø5,0 x 50			**42,5**
• pattern 3 $H_B \geq 80$ mm	LBA nails	Ø4,0 x 60	25	25	**31,0**
	LBS screws	Ø5,0 x 50			**37,2**
• pattern 2 $H_B \geq 70$ mm	LBA nails	Ø4,0 x 60	15	15	**20,9**
	LBS screws	Ø5,0 x 50			**25,1**
• pattern 1 $H_B \geq 60$ mm	LBA nails	Ø4,0 x 60	10	10	**15,1**
	LBS screws	Ø5,0 x 50			**18,1**

SHEAR STRENGTH $R_{2/3}$ WITH ACOUSTIC PROFILE



configuration on timber(1)	TIMBER					
	holes fastening Ø5				profile(2)	$R_{2/3,k}$ timber
	type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	s [mm]	[kN]
TTF200 + XYLOFON	LBA nails	Ø4,0 x 60	30	30	6	**17,2**
	LBS screws	Ø5,0 x 50				**15,8**
TTF200 + ALADIN STRIPE SOFT	LBA nails	Ø4,0 x 60	30	30	5	**20,0**
	LBS screws	Ø5,0 x 50				**19,0**
TTF200 + ALADIN STRIPE EXTRA SOFT	LBA nails	Ø4,0 x 60	30	30	7	**19,0**
	LBS screws	Ø5,0 x 50				**17,9**

NOTES:

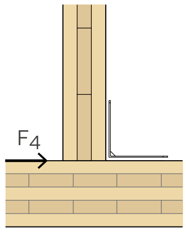
(1) The TTF200 angle bracket can be installed in combination with different resilient acoustic profiles inserted below the horizontal flange in full pattern configuration. The strength values in the table are given in ETA 11/0496 and calculated according to *"Blaß, H.J. und Laskewitz, B. (2000); Load-Carrying Capacity of Joints with Dowel-Type fasteners and Interlayers."*, conservatively disregarding the stiffness of the profile.

(2) Profile thickness: in the case of ALADIN profile, the calculation took into account the reduced thickness of the profile itself, due to the corrugated section and the consequent crushing induced by the nail head during insertion.

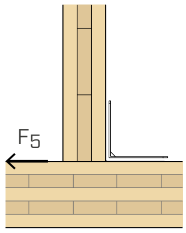
STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-TIMBER

TTF200

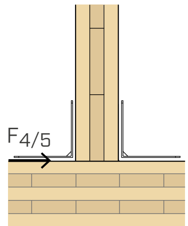
	TIMBER				STEEL	
	holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$	
F_4	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
• full pattern	LBA nails	Ø4,0 x 60	30 + 30	**14,1**	**10,4**	γ_{M0}
	LBS screws	Ø5,0 x 50				



	TIMBER				STEEL	
	holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$	
F_5	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
• full pattern	LBA nails	Ø4,0 x 60	30 + 30	**10,8**	**4,7**	γ_{M0}
	LBS screws	Ø5,0 x 50				



	TIMBER				STEEL	
	holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$	
$F_{4/5}$ TWO ANGLE BRACKETS	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
• full pattern	LBA nails	Ø4,0 x 60	60+60	**21,0**	**14,2**	γ_{M0}
	LBS screws	Ø5,0 x 50				



The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

GENERAL PRINCIPLES:

For the general principles of calculation, see page 226.

TCF200 - TTF200 | CONNECTION STIFFNESS FOR STRESS $F_{2/3}$

EVALUTATION OF SLIP MODULUS $K_{2/3,ser}$

- $K_{2/3,ser}$ experimental average value for TITAN joint on C24 CLT (Cross Laminated Timber) panels

type	fastening type **Ø x L** [mm]	n_V [pcs]	n_H [pcs]	$K_{2/3,ser}$ [N/mm]
TCF200	LBA nails Ø4,0 x 60	30	-	**8479**
TTF200	LBA nails Ø4,0 x 60	30	30	**8212**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint nails* GL24h/C24

Nails (without pre-drilling hole) $\dfrac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

type	fastening type **Ø x L** [mm]	n_V [pcs]	K_{ser} [N/mm]
TCF200	LBA nails Ø4,0 x 60	30	**26093**
TTF200	LBA nails Ø4,0 x 60	30	**26093**

* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0496. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments (see Chapter 6 ANCORS FOR CONCRETE). The connection design strength values are obtained from the values on the table as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\ steel}}{\gamma_{steel}} \\ R_{d,\ concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ 350\ kg/m^3 \le \rho_k \le 420\ kg/m^3$$

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ LVL\ with\ \rho_k \le 500\ kg/m^3$$

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used. The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045. For chemical anchors subjected to shear stress it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).

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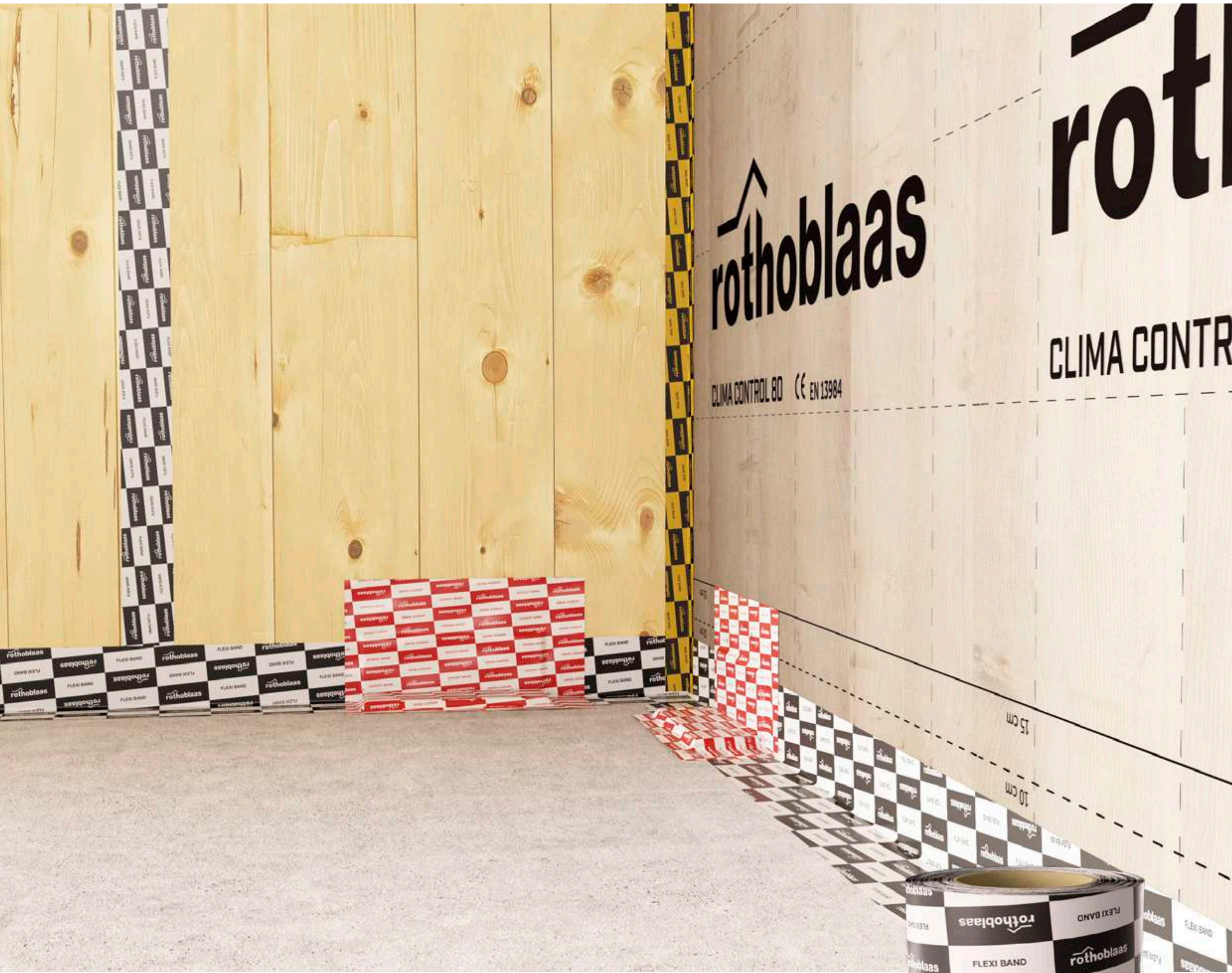

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TITAN V

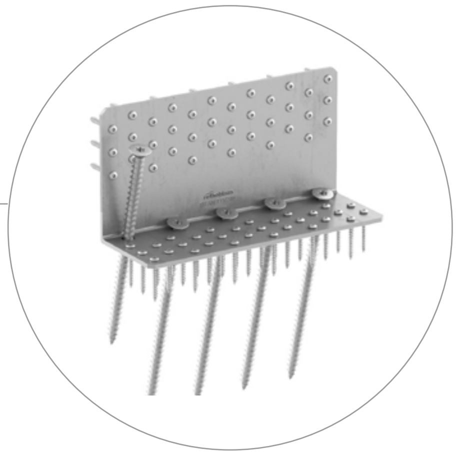
VIDEO
ETA 11/0496

ANGLE BRACKET FOR SHEAR AND TENSILE FORCES

HOLES FOR VGS
Ideal for CLT. The full thread VGS Ø11 inclined screws offer exceptional strength and allow to fasten inter-storey walls even of different thickness.

CONCEALED
The reduced height of the vertical flange allows hidden installation of the bracket within the floor panels. Steel thickness: 4 mm.

100 kN TENSILE
On timber, the TTV angle bracket guarantees exceptional tensile strength ($R_{1.k}$ up to 101,0 kN) and shear strength ($R_{2.k}$ up to 59,7 kN). Partial fastening possibilities.



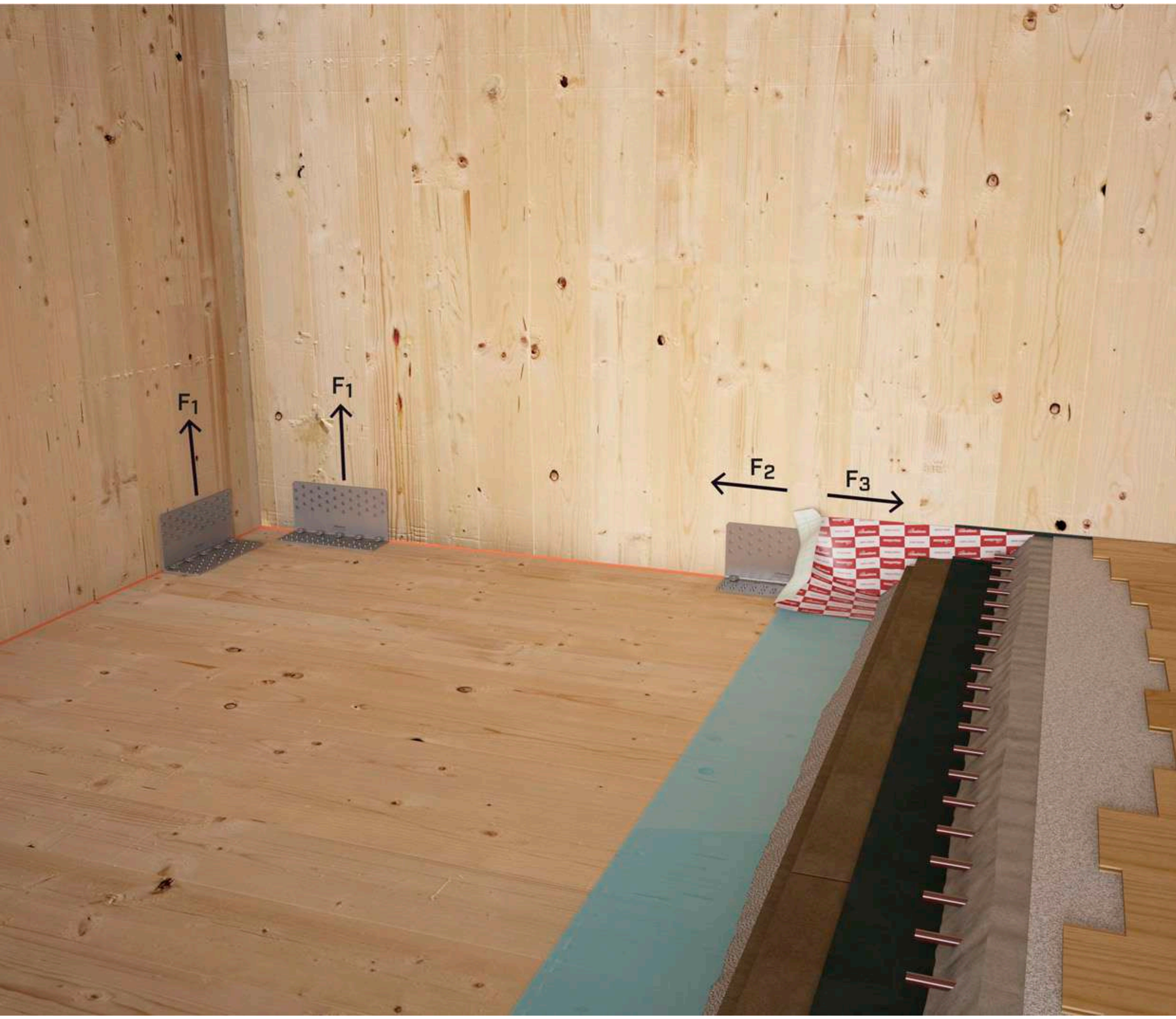
CHARACTERISTICS

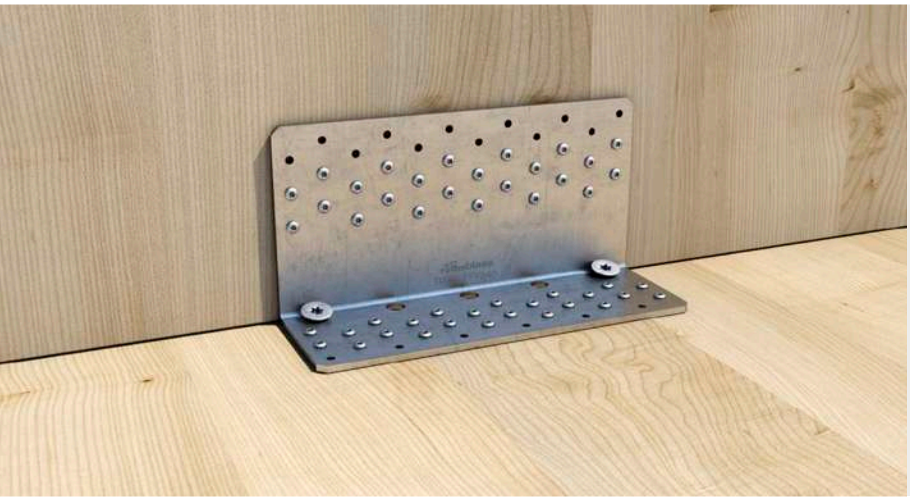
FOCUS	shear and tensile joints
HEIGHT	120 mm
THICKNESS	4,0 mm
FASTENERS	LBA, LBS, VGS

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

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Timber-to-timber tensile or shear joints
- CLT, LVL
- solid timber and glulam





CONCEALED HOLD DOWN

Ideal on timber-to-timber both as a hold down at the ends of the walls and as shear angle bracket along the walls. It can be integrated into the floor panels.

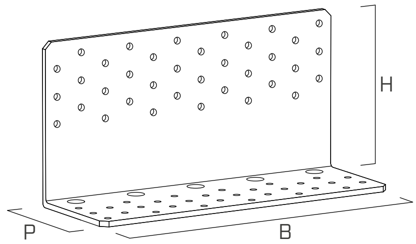
A SINGLE ANGLE BRACKET

Use of a single type of angle bracket for both shear and tensile wall fastening. Optimisation and consistency of fastenings. Possibility of partial fastening with interposed acoustic profiles.

CODES AND DIMENSIONS

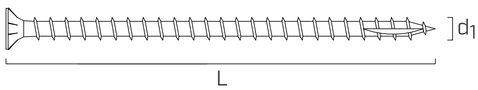
TITAN V - TTV | TIMBER-TO-TIMBER JOINTS

CODE	B	P	H	n_V Ø5	n_H Ø5	n_H Ø12	s	pcs
	[mm]	[mm]	[mm]	[pcs]	[pcs]	[pcs]	[mm]	
TTV240	240	83	120	36	30	5	4	10



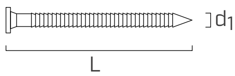
VGS

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
VGS11150	11	150	140	TX50	25
VGS11200	11	200	190	TX50	25



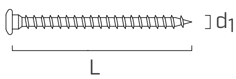
LBA

CODE	d_1	L	pcs
	[mm]	[mm]	
LBA460	4	60	250



LBS

CODE	d_1	L	TX	pcs
	[mm]	[mm]		
LBS550	5	50	TX20	200



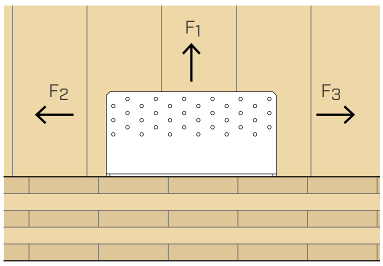
MATERIAL AND DURABILITY

TITAN V: S275 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

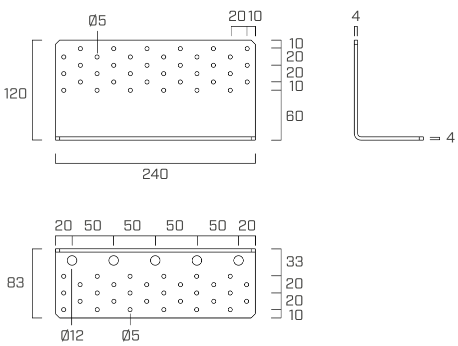
- Timber-to-timber joints

EXTERNAL LOADS

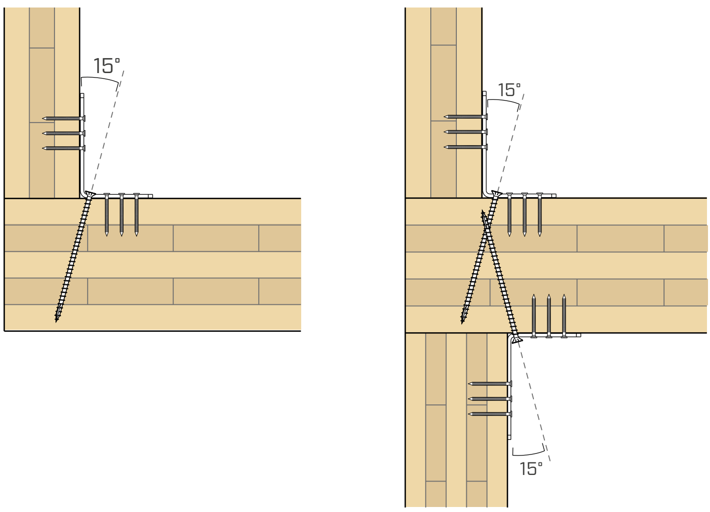


GEOMETRY

TTV240

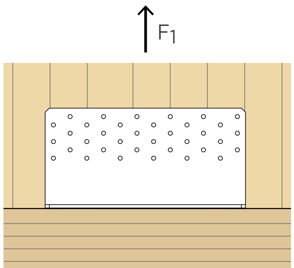


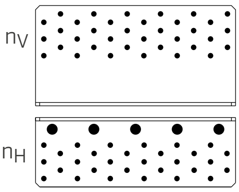
INSTALLATION



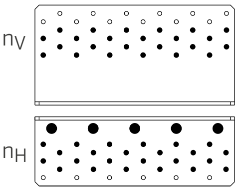
STATIC VALUES | TENSILE JOINT F_1 | TIMBER-TO-TIMBER

TTV240





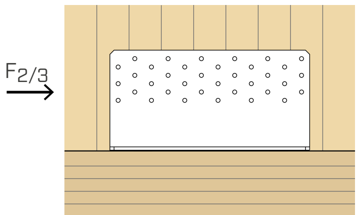
configuration	holes fastening Ø5 type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	holes fastening Ø12 type	Ø x L [mm]	n_H [pcs]	$R_{1,k\ timber}$ [kN]	$K_{1,ser}$ [kN/mm]
• full pattern F_1	LBA nails	Ø4,0 x 60	36	30	VGS screws	Ø11 x 200	5	**101,0**	12,5
	LBS screws	Ø5,0 x 50	36	30					

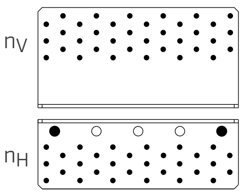


configuration	holes fastening Ø5 type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	holes fastening Ø12 type	Ø x L [mm]	n_H [pcs]	$R_{1,k\ timber}$ [kN]	$K_{1,ser}$ [kN/mm]
• partial pattern F_1	LBA nails	Ø4,0 x 60	24	24	VGS screws	Ø11 x 150	5	**64,5**	10,5
	LBS screws	Ø5,0 x 50	24	24					

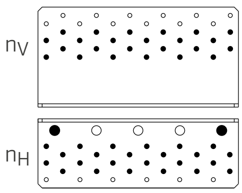
STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-TIMBER

TTV240





configuration	holes fastening Ø5 type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	holes fastening Ø12 type	Ø x L [mm]	n_H [pcs]	$R_{2/3,k\ timber}$ [kN]	$K_{2/3,ser}$ [kN/mm]
• full pattern $F_{2/3}$	LBA nails	Ø4,0 x 60	36	30	VGS screws	Ø11 x 200	2	**59,7**	6,6
	LBS screws	Ø5,0 x 50	36	30					
• full pattern $F_{2/3}$ + xylofon(1)	LBA nails	Ø4,0 x 60	36	30	VGS screws	Ø11 x 200	2	**49,4**	6,2
	LBS screws	Ø5,0 x 50	36	30					



configuration	holes fastening Ø5 type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	holes fastening Ø12 type	Ø x L [mm]	n_H [pcs]	$R_{2/3,k\ timber}$ [kN]	$K_{2/3,ser}$ [kN/mm]
• partial pattern $F_{2/3}$	LBA nails	Ø4,0 x 60	24	24	VGS screws	Ø11 x 150	2	**51,5**	4,8
	LBS screws	Ø5,0 x 50	24	24					

NOTES:

(1) The characteristic strength values $R_{2/3,k}$ and the slip modulus $K_{2/3,ser}$ were obtained from the results of laboratory tests carried out on CLT samples (5 layers) with 6 mm thick XYLOFON 35 acoustic profile (tests carried out at CNR-IBE - San Michele all'Adige). Configuration not included in ETA-11/0496.

GENERAL PRINCIPLES:

For the general principles of calculation, see page 233.

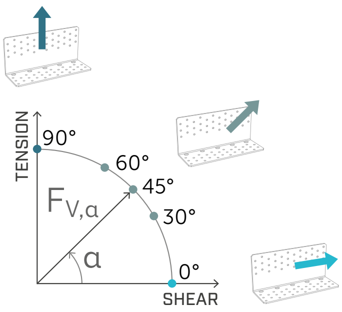
EXPERIMENTAL INVESTIGATIONS | TTV240

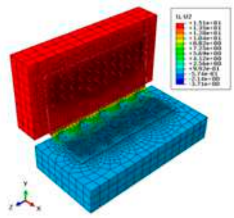
BIAXIAL BEHAVIOR FOR SHEAR AND TENSILE FORCES

The TTV240 angle bracket is an innovative connection system that can withstand both tensile and shear loads with high performance. Thanks to the increased thickness and the use of all thread screws for the fastening of the floor panel, it has an excellent behaviour in case of **biaxial stress** with different directions.

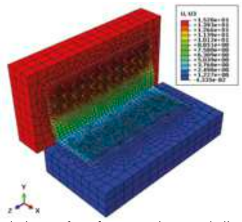
Following a first phase of numerical modelling and analytical tests, an extensive experimental campaign was carried out, with the aid of both monotonic and cyclic tests, on 5-layer CLT panels, in total and partial fastening configuration[1], with different inclinations of the acting load:

$$\alpha = 0°; 30°; 45°; 60°; 90°.$$





Deformed shape for **tension** action and displacement contour of the ABAQUS model



Deformed shape for **shear** action and displacement contour of the ABAQUS model

Figure 1. 30° setup for 60° stress.

The experimental campaigns were carried out within an international collaboration with the University of Kassel (Germany), the "Kore" University of Enna (Italy) and CNR-IBE Institute for BioEconomy (Italy).

EXPERIMENTAL STRENGTH DOMAIN

In all shear (α=0°), tensile (α=90°) and load inclination (30° ≤ α ≤ 60°) tests, similar collapse modes were achieved, which, due to the lower flange overstrength, are attributable to nail failure in the vertical flange. Also the mechanical parameters for cyclic load behaviour showed a good match ensuring ductile failures in the upper nails.

Using small diameter fasteners, it was possible to achieve comparable strengths independent of the stress load direction. The comparison of the experimental results confirmed the analytical considerations that a **circular strength domain** can be provided.

Figure 2. Samples at the end of cyclic tests: tension (a), shear (b) and 45° (c) (partial fastening).

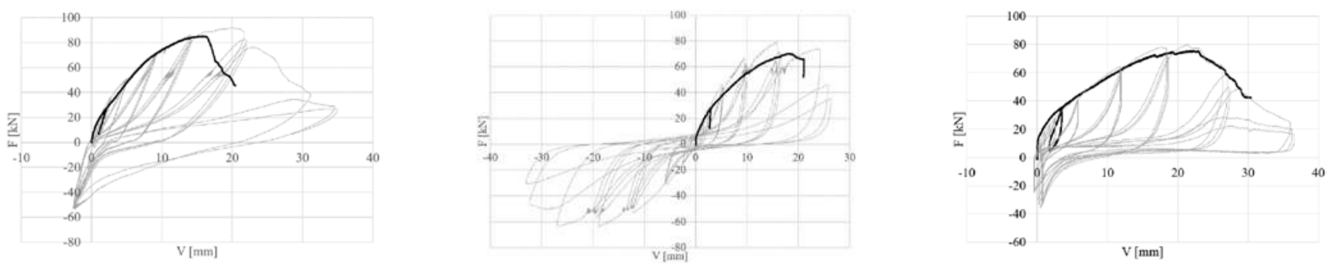


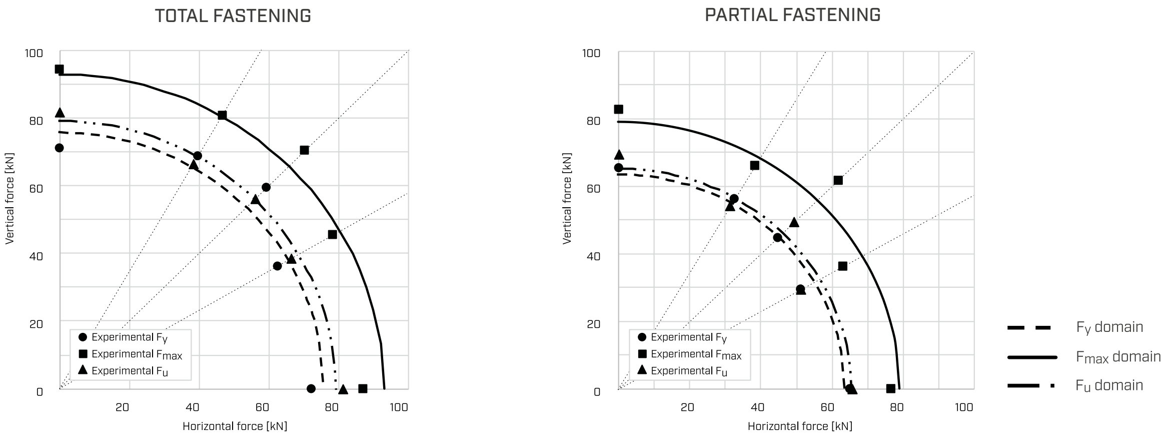
Figure 3. Monotonic and cyclic load-displacement curves for traction (a), shear (b) and 45° (c) (partial fastening).

NOTES:

[1] Full fastening - Full nailing:
- 5 VGS Ø11x150 mm e 36+30 LBA Ø4x60 mm for 90°/60°/45°/30°
- 2 VGS e 36+30 LBA Ø4x60 mm for 0°

Partial fastening - Partial nailing:
- 5 VGS Ø11x150 mm e 24+24 LBA Ø4x60 mm for 90°/60°/45°/30°
- 2 VGS e 24+24 LBA Ø4x60 mm for 0°

EXPERIMENTAL STRENGTH DOMAIN



FULL SCALE TEST

At the end of the single connection investigation, full-scale tests were performed on CLT walls, considering different h/b ratios of the wall panel. The data analysis is in progress.

h/b ≈ 2:1

h/b ≈ 1:1

h/b ≈ 2:3

INSIGHTS AND PUBLICATIONS:

- *European Technical Assessment ETA-11/0496: Rotho Blaas TITAN Angle Brackets, 2018.*
- D'Arenzo G., Rinaldin G., Fossetti M., Fragiacomo M., Nebiolo F., Chiodega M. *Tensile and shear behaviour of an innovative angle bracket for CLT structures. World Conference on Timber Engineering, WCTE; South Korea, 2018.*
- D'Arenzo G., Rinaldin G., Fossetti M., Fragiacomo M. *An innovative shear-tension angle bracket for Cross-Laminated Timber structures: Experimental tests and numerical modelling. Engineering Structures 197, 2019.*
- D'Arenzo G., Cottonaro D.R., Macaluso G., Fossetti M., Fragiacomo M., Seim W., Chiodega M., Sestigiani L. *Mechanical characterization of an innovative wall-to-floor connection for Cross-Laminated Timber structures. XVIII ANIDIS Conference; Ascoli Piceno, 2019.*
- D'Arenzo G., Blaas H. *Structural Fasteners Design and Challenges in Mass Timber Buildings. CTBUH; Chicago, 2019.*
- *Tensile and shear behaviour of an innovative angle bracket for CLT structures. PTEC; Brisbane, Australia, 2019.*
- D'Arenzo G. *Innovative biaxial behaviour connector for Cross-laminated Timber structures. PhD thesis, University of Enna "Kore", 2020.*

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0496.
- The connection design strength values are obtained from the values on the table as follows:

$$R_{i,d} = R_{i,k\ timber} \cdot \frac{k_{mod}}{\gamma_M}$$

  The coefficients k_{mod} and γ_M should be taken according to the current regulations used for the calculation.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad \text{for } 350\ kg/m^3 \leq \rho_k \leq 420\ kg/m^3$$

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad \text{for LVL with } \rho_k \leq 500\ kg/m^3$$

- Dimensioning and verification of the timber elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.

TITAN SILENT

FLANKSOUND

EN ISO 10848

CE
ETA 11/0496

ANGLE BRACKET FOR SHEAR LOADS WITH RESILIENT PROFILE

SOUNDPROOFING

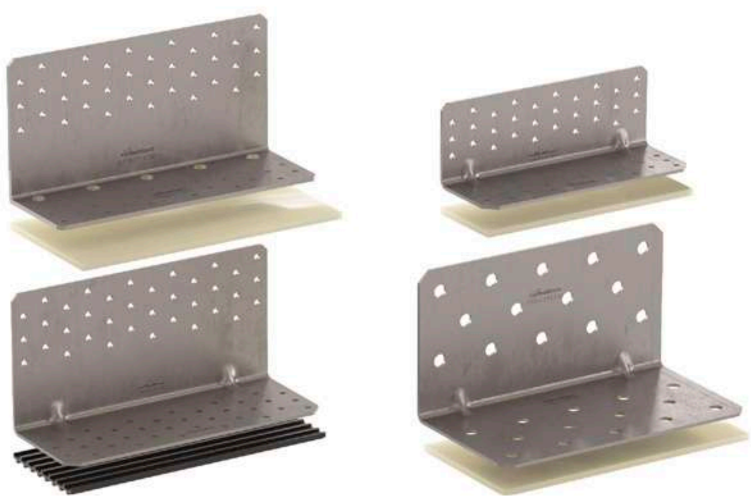
Significant attenuation of walking excitation and noise transfer, for an excellent acoustic comfort.

CERTIFIED VALUES

Vibration reduction qualities are validated by tests, within the academia and the industrial world. Shear strength values tested and certified according to ETA.

NO ACOUSTIC BRIDGES

The excellent shear strength of the angle bracket and the soundproofing properties of the profile allow to eliminate acoustic bridges caused by the connections.



CHARACTERISTICS

FOCUS	shear joints
HEIGHT	from 71 to 130 mm
THICKNESS	3,0 and 4,0 mm
FASTENERS	LBA, LBS, HBS PLATE, VGS

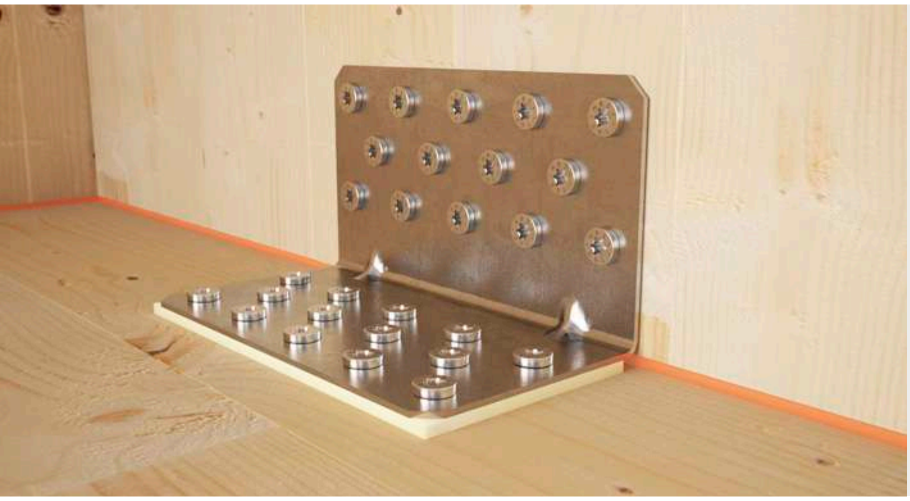
MATERIAL

Three-dimensional perforated steel plate with resilient profile in polyurethane compound.

FIELDS OF USE

Timber-to-timber joints with reduction of acoustic bridges

- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels



HOUSING COMFORT

The strength of TITAN angle brackets, in combination with the acoustic performance of XYLOFON PLATE, ensure the reduction of noise due to walking vibrations.

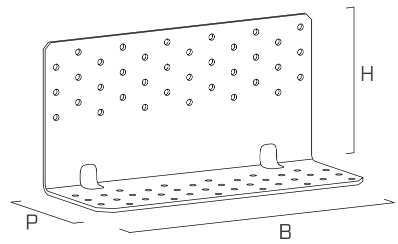
ACOUSTICS AND STATICS

Shear strength values are certified according to ETA. Values further tested in both academic and industrial fields and available for consultation.

CODES AND DIMENSIONS

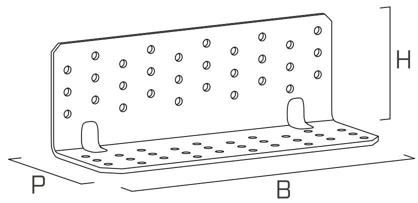
TITAN N - TTN

CODE	B	P	H	n_H Ø5	n_V Ø5	s	pcs
	[mm]	[mm]	[mm]	[pcs]	[pcs]	[mm]	
TTN240	240	93	120	36	36	3	10



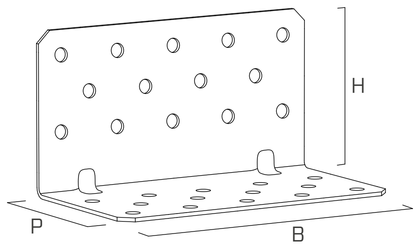
TITAN F - TTF

CODE	B	P	H	n_H Ø5	n_V Ø5	s	pcs
	[mm]	[mm]	[mm]	[pcs]	[pcs]	[mm]	
TTF200	200	71	71	30	30	3	10



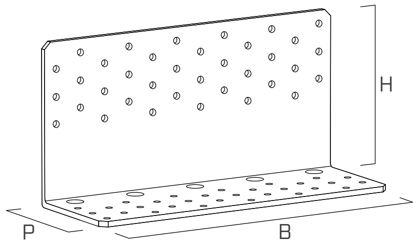
TITAN S - TTS

CODE	B	P	H	n_H Ø11	n_V Ø11	s	pcs
	[mm]	[mm]	[mm]	[pcs]	[pcs]	[mm]	
TTS240	240	130	130	14	14	3	10



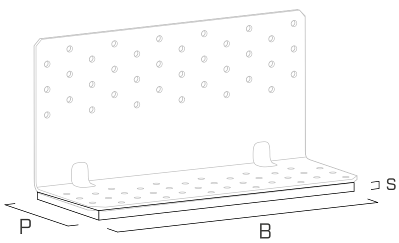
TITAN V - TTV

CODE	B	P	H	n_V Ø5	n_H Ø5	n_H Ø12	s	pcs
	[mm]	[mm]	[mm]	[pcs]	[pcs]	[pcs]	[mm]	
TTV240	240	83	120	36	30	5	4	10



XYLOFON PLATE

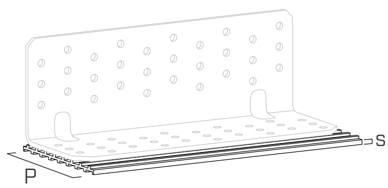
CODE	B	P	s	pcs
	[mm]	[mm]	[mm]	
XYL3570200	200	70	6,0	10
XYL35100200	200	100	6,0	10
XYL35120240	240	120	6,0	10



ALADIN STRIPE

CODE	type	L	P	s	pcs
	[mm]	[m]	[mm]	[mm]	
ALADIN95	soft	50(*)	95	5	1
ALADIN115	extra soft	50(*)	115	7	1

(*) To be cut on site.



MATERIAL AND DURABILITY

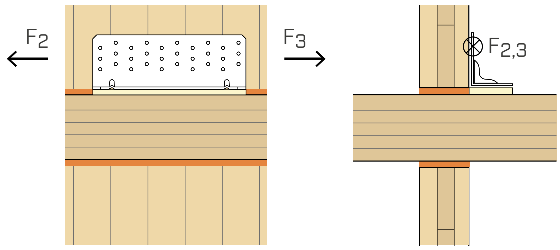
TITAN: see the product pages.

XYLOFON PLATE: 35 shore monolithic polyurethane compound, free of VOCs or harmful substances.
ALADIN STRIPE: Extruded compact EPDM (soft version) and expanded compact EPDM (extra soft version). High chemical stability, it does not contain VOC.

FIELD OF USE

- Timber-to-timber joints with reduction of acoustic bridges

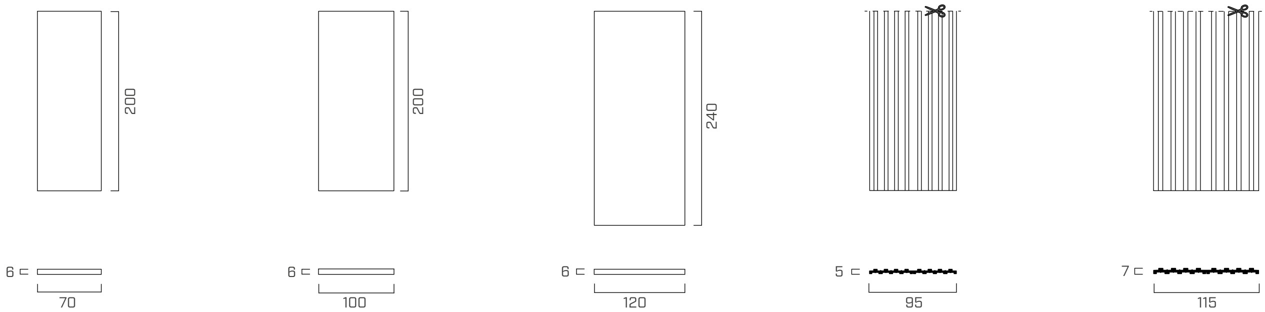
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

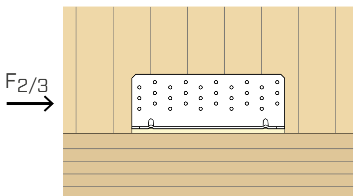
type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
HBS PLATE	screws for TTS240		8		560
VGS	full thread screw for TTV240		11		564

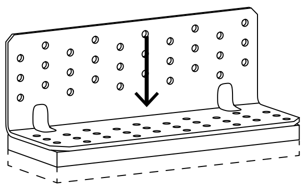
GEOMETRY



STATIC VALUES AND INSTALLATION

SHEAR JOINT | TIMBER-TO-TIMBER



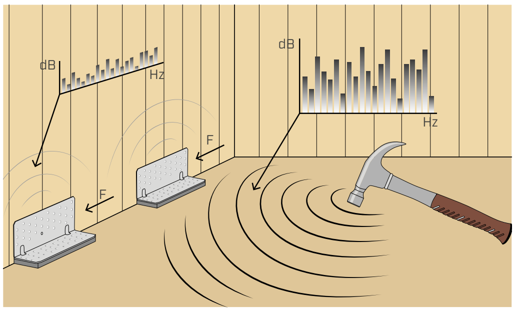


TITAN: The mechanical strength values and installation methods are indicated on the respective product pages.

XYLOFON PLATE/ALADIN STRIPE: Technical data and installation instructions can be found in the "SOUNDPROOFING SOLUTIONS" catalogue or in the product data sheets (www.rothoblaas.com)

ACOUSTIC - MECHANICAL BEHAVIOR OF TITAN SILENT

The TITAN SILENT system has been tested in order to determine its mechanical and acoustic behaviour. The experimental campaigns carried out within the Seismic-Rev project and in collaboration with multiple research institutes, have shown how the characteristics of the resilient profile influence the mechanical performance of the connection. From an acoustic point of view, with the Flanksound project, it has been demonstrated that the ability to dampen vibrations through the joint is strongly influenced by the type and number of connections.



EXPERIMENTAL INVESTIGATION: MECHANICAL BEHAVIOUR

Within the Seismic-Rev project, in collaboration with the University of Trento and the Institute for BioEconomy (IBE - San Michele all'Adige), an investigation project was launched to evaluate the mechanical behaviour of TITAN angle brackets used in combination with different soundproofing profiles.

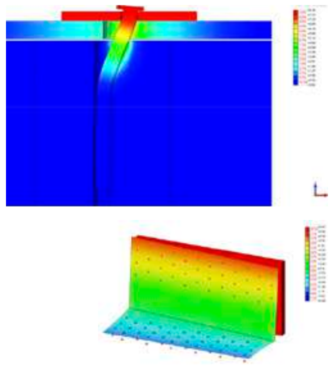
FIRST LABORATORY PHASE

Monotonic shear tests were carried out, in the first experimental phase, using linear loading procedures in displacement control, aimed at evaluating the variation in ultimate strength and stiffness offered by the TTF200 connection with LBA Ø4 x 60 mm nails.

Test samples:
CLT panels
TITAN TTF200 angle bracket

NUMERICAL MODELING

The results of the preliminary investigation campaign highlighted the importance of carrying out more accurate analyses of the influence of acoustic profiles on the mechanical behaviour of TTF200 and TTN240 metal angle brackets in terms of overall strength and stiffness. For this reason it was decided to carry out further evaluations by means of finite element numerical modelling, starting from the behaviour of the individual nail. The influence of three different resilient profiles was analysed in this case: XYLOFON 35 (6 mm), ALADIN STRIPE SOFT (5 mm) and ALADIN STRIPE EXTRA SOFT (7 mm).



Tx deformation [mm]
for induced displacement 8 mm

SECOND LABORATORY PHASE

Laboratory tests were carried out at this phase in accordance with certain requirements of EN 26891. The TITAN SILENT specimens, assembled with different TITAN devices in combination with the resistive profile XYLOFON 35 (6 mm), have been brought to failure to investigate the maximum load, the load at 15 mm and the relative displacements, without load influence and therefore crushing effects on the acoustic profile (maximum gap between the plate and the timber panel).

Test samples:
5-layer CLT panels
TITAN angle brackets with full fastening
TTF200 - TTN240 - TTS240 - TTV240
XYLOFON 35 resilient profile

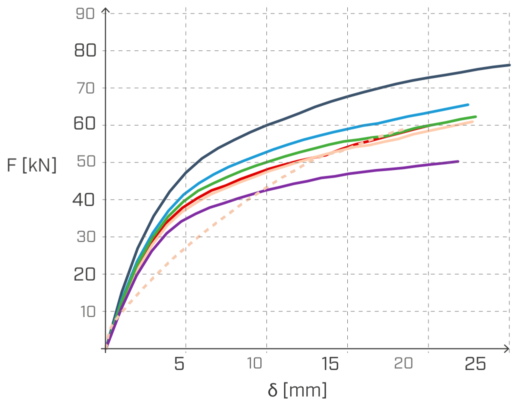
VARIATION OF MECHANICAL SHEAR STRENGTH ACCORDING TO THE SOUNDPROOFING PROFILE

The comparison of the results between the different configurations analysed is reported in terms of load variation at 15 mm displacement ($F_{15\ mm}$) and elastic stiffness at 5 mm ($K_{s,5\ mm}$).

TITAN TTF200

configurations	sp [mm]	$F_{15\ mm}$ [kN]	$\Delta F_{15\ mm}$	$K_{5\ mm}$ [kN/mm]	$\Delta K_{5\ mm}$
TTF200	-	68,4	-	9,55	-
TTF200 + ALADIN STRIPE SOFT red.*	3	59,0	-14 %	8,58	-10 %
TTF200 + ALADIN STRIPE EXTRA SOFT red.*	4	56,4	-18 %	8,25	-14 %
TTF200 + ALADIN STRIPE SOFT	5	55,0	-20 %	7,98	-16 %
TTF200 + XYLOFON PLATE	6	54,3	-21 %	7,79	-18 %
TTF200 + ALADIN STRIPE EXTRA SOFT	7	47,0	-31 %	7,30	-24 %
TTF200 + XYLOFON PLATE - test 003	6	54,2	-21 %	5,49	-43 %

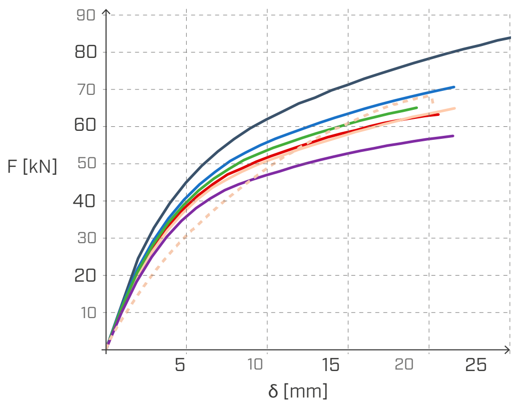
* Reduced thickness: reduced profile height due to the trapezoidal section and consequent crushing induced by the head of the nail during operation.



TITAN TTN240

configurations	sp [mm]	$F_{15\ mm}$ [kN]	$\Delta F_{15\ mm}$	$K_{5\ mm}$ [kN/mm]	$\Delta K_{5\ mm}$
TTN240	-	71,9	-	9,16	-
TTN2400 + ALADIN STRIPE SOFT red.*	3	64,0	-11 %	8,40	-8 %
TTN240 + ALADIN STRIPE EXTRA SOFT red.*	4	61,0	-15 %	8,17	-11 %
TTN240 + ALADIN STRIPE SOFT	5	59,0	-18 %	8,00	-13 %
TTN240 + XYLOFON PLATE	6	58,0	-19 %	7,81	-15 %
TTN240 + ALADIN STRIPE EXTRA SOFT	7	53,5	-26 %	7,47	-18 %
TTN240 + XYLOFON PLATE - test 001	6	61,5	-15%	6,19	-32%

* Reduced thickness: reduced profile height due to the trapezoidal section and consequent crushing induced by the head of the nail during operation.



EXPERIMENTAL RESULTS

The results obtained show a reduction in the strength and stiffness of the devices following the interposition of the soundproofing profiles. This variation is highly dependent on the thickness of the profile. In order to limit the reduction of strength of about 20% it is therefore necessary to adopt profiles with real thickness of approximately 6 mm or less.

EXPERIMENTAL INVESTIGATION: FLANKSOUND PROJECT

Rothoblaas has financed a research aimed at measuring the K_{ij} vibration reduction index for a variety of joints between CLT panels.

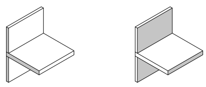
For each joint, the vibration reduction index for the transmission paths involved are given in one-third-octave bands in the range 100-3150 Hz. An average value (200-1250 Hz) that can be used for the simplified calculation is also reported, aware of the limited use of this method.

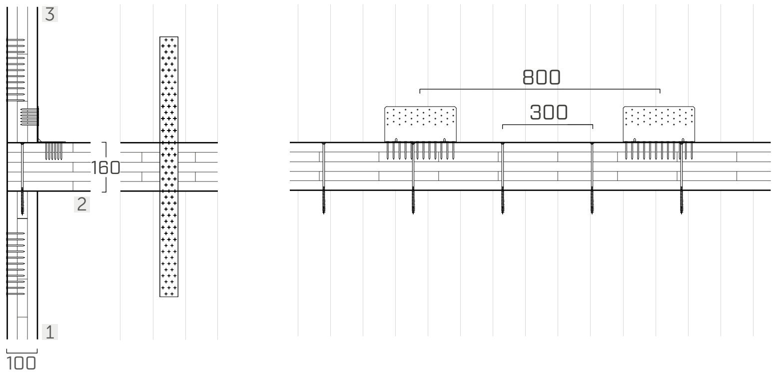
Below, by way of example, there is a comparison of the damping capacity of the TITAN SILENT system.

T-SHAPED JOINT

FASTENING SYSTEM
HBS screws Ø8 x 240 mm
TTN240 angle brackets
LBV perforated plate 100 x 500 mm

RESILIENT PROFILE
NO



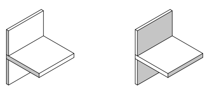


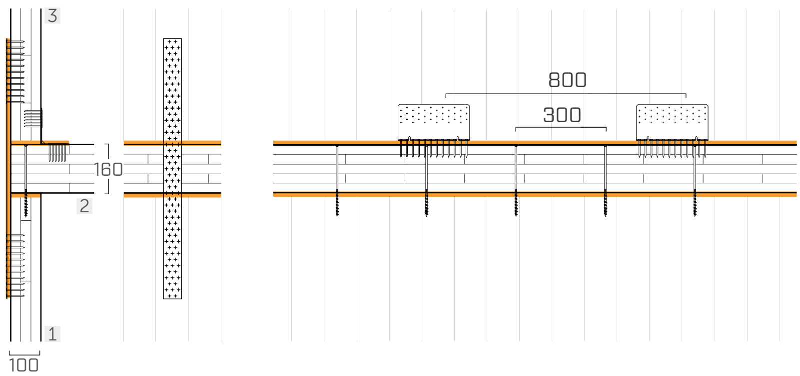
f (Hz)	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	AVG $_{200-1250}$
K_{12} (dB)	13,6	14,9	4,4	9,4	11,4	7,0	8,9	9,0	14,5	18,2	17,4	20,2	21,9	28,9	28,3	36,7	12,9
K_{13} (dB)	22,5	25,3	15,7	16,5	15,0	12,6	13,4	15,8	21,1	18,6	19,3	18,8	23,5	29,0	27,5	32,3	16,8
K_{23} (dB)	4,8	- 1,3	- 4,1	4,7	5,7	1,2	- 3,7	2,2	6,5	8,5	9,0	17,5	16,0	16,6	17,3	22,7	5,7

T-SHAPED JOINT

FASTENING SYSTEM
HBS screws Ø8 x 240 mm
TTN240 angle brackets
LBV perforated plate 100 x 500 mm

RESILIENT PROFILE
XYLOFON + TITAN SILENT





f (Hz)	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	AVG $_{200-1250}$
K_{12} (dB)	17,4	13,1	7,0	11,1	10,8	11,5	10,5	15,6	20,4	22,4	21,9	24,7	24,5	38,4	38,6	41,0	16,6
K_{13} (dB)	23,9	24,5	18,3	20,6	16,3	18,2	19,4	19,6	25,7	27,2	25,6	21,9	24,5	41,7	44,9	49,0	21,6
K_{23} (dB)	7,1	- 3,1	- 2,5	6,2	6,0	6,4	0,7	9,7	9,5	12,5	12,7	19,3	16,8	21,8	25,2	27,2	9,2

EXPERIMENTAL RESULTS

The results obtained show a reduction in the strength and stiffness of the devices following the interposition of the sound-proofing profiles. This variation is highly dependent on the thickness of the profile. In order to limit the reduction of strength of about 20 % it is therefore necessary to adopt profiles with real thickness of approximately 6 mm or less.

WHT PLATE C CONCRETE

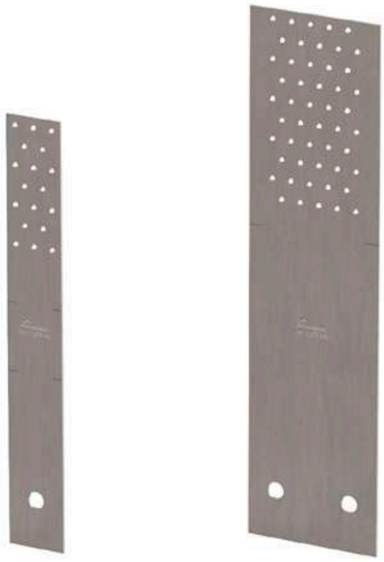
CE
EN 14545

PLATES FOR TENSILE LOADS

TWO VERSIONS
WHT PLATE 440, ideal for framed structures (platform frame); WHT PLATE 540, ideal for CLT panel structures (Cross Laminated Timber).

PLANAR JOINTS
Ideal for realizing distributed connections under tensile stress between the CLT (Cross Laminated Timber) panels and framed structures (platform frame) to and the concrete understructure.

QUALITY
The high tensile strength allows to optimize the number of plates installed, ensuring remarkable time saving.
Values calculated and certified according to CE marking.



CHARACTERISTICS

FOCUS	tensile joints on concrete
HEIGHT	440 | 540 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, SKR, VIN-FIX PRO, EPO-FIX PLUS

MATERIAL
Bright zinc plated carbon steel, two dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete shear joints for panels and timber struts
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels

TIMBER-TO-CONCRETE

Beside its natural function, it is ideal for solving situations where the transfer of tensile loads from timber to concrete is required.

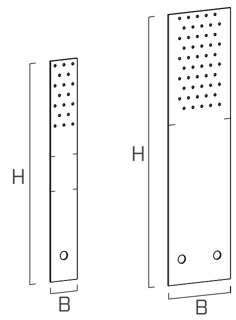
MULTIPURPOSE

Pre-calculated partial nailing can be used if there is a varying amount of stress or a levelling layer.

CODES AND DIMENSIONS

WHT PLATE C

CODE	B	H	holes	n_v Ø5	s		pcs
	[mm]	[mm]	[mm]	pcs	[mm]		
WHTPLATE440	60	440	Ø17	18	3	●	10
WHTPLATE540	140	540	Ø17	50	3	●	10



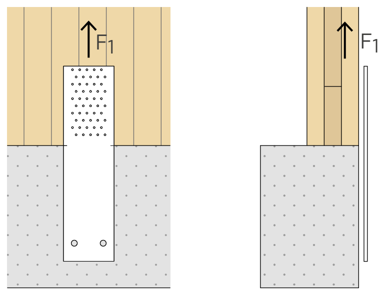
MATERIAL AND DURABILITY

WHT PLATE C: carbon steel DX51D+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-concrete joints
- OSB-to-concrete joints
- Timber-to-steel joints

EXTERNAL LOADS

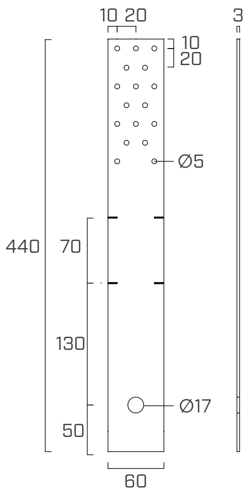


ADDITIONAL PRODUCTS - FASTENING

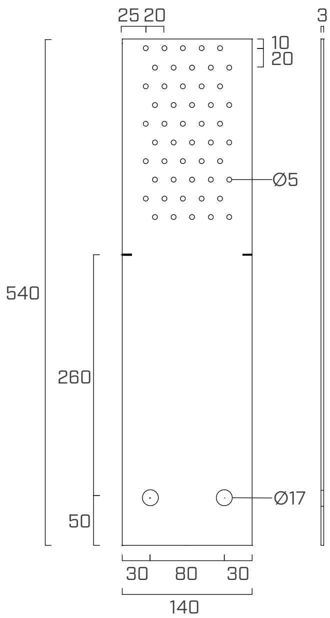
type	description		d	support	page
			[mm]		
LBA	Anker nail		4		548
LBS	screw for plates		5		552
AB1	mechanical anchor		16		494
VIN-FIX PRO	chemical anchor		M16		511
EPO-FIX PLUS	chemical anchor		M16		517
KOS	bolt		M16		526

GEOMETRY

WHTPLATE440



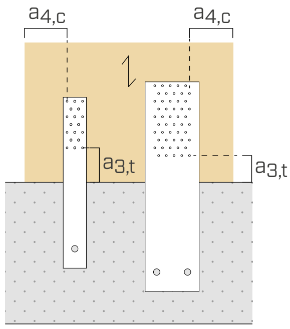
WHTPLATE540



INSTALLATION

TIMBER minimum distances			nails LBA Ø4	screws LBS Ø5
C/GL	$a_{4,c}$	[mm]	≥ 20	≥ 25
	$a_{3,t}$	[mm]	≥ 60	≥ 75
CLT	$a_{4,c}$	[mm]	≥ 12	≥ 12.5
	$a_{3,t}$	[mm]	≥ 40	≥ 30

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420\ kg/m^3$
- CLT: Minimum distances for Cross Laminated Timber according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA-11/0030 for screws



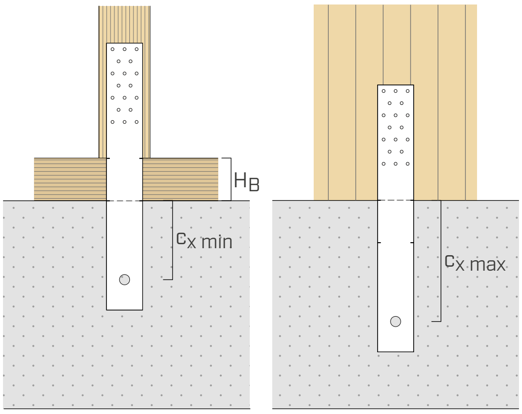
WHTPLATE440 INSTALLATION

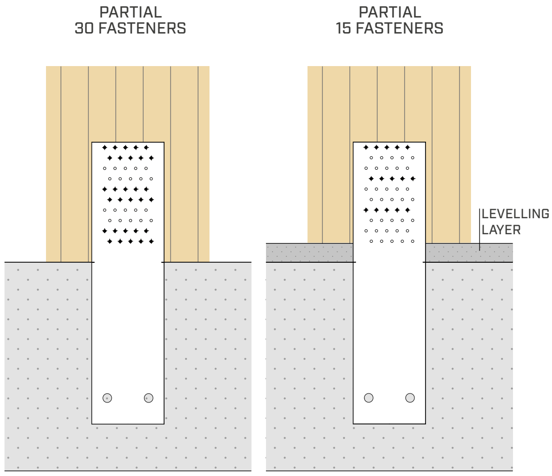
The WHT PLATE 440 can be used for different construction systems (CLT/frame) and ground connection systems (with/without **platform beam**, with/without levelling layer). Depending on the presence and dimension of H_B of the intermediate layer, in accordance with the minimum distances of the timber and concrete fasteners, the WHT PLATE 440 must be positioned in way that the anchor is at a distance from the concrete edge:

130 mm ≤ c_x ≤ 200 mm.

WHTPLATE540 INSTALLATION

In the presence of design requirements such as varying stress values or the presence of a **levelling layer** between the wall and the support surface, it is possible to use pre-calculated and optimised **partial nailing** in order to influence the effective n_{ef} number of fastenings on timber. Alternative nailings are possible in accordance with the minimum distances for the connectors.

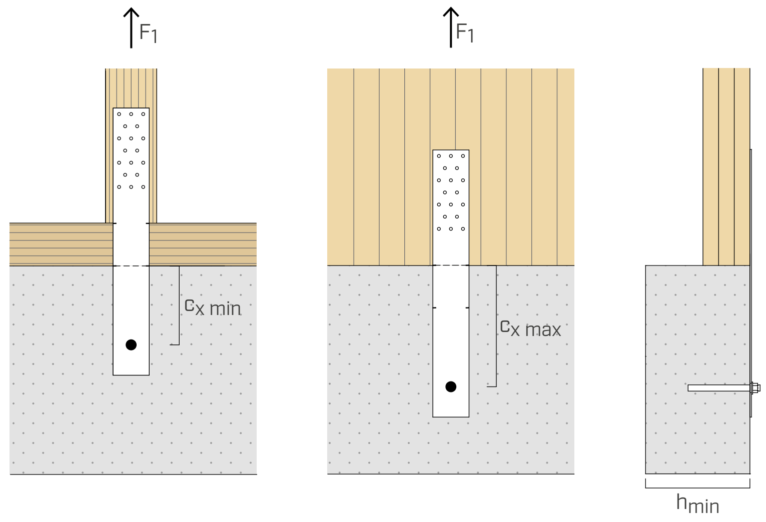




c_x [mm]	H_B [mm]
$c_{x\,min}$ = 130	70
$c_{x\,max}$ = 200	0

STATIC VALUES | TENSILE JOINT | TIMBER-TO-CONCRETE

WHTPLATE440



MINIMUM CONCRETE THICKNESS $h_{min} \geq$ 200 mm

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	**holes fastening Ø5**			**$R_{1,k\ timber}$**	**$R_{1,k\ steel}$**		**$R_{1,d\ uncracked}$**		**$R_{1,d\ cracked}$**		**$R_{1,d\ seismic}$**	
	type	**Ø x L**	**n_v**				VIN-FIX PRO **Ø x L**		VIN-FIX PRO **Ø x L**		EPO-FIX PLUS **Ø x L**	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• $c_{2\ min}$ = **130 mm** • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 190	**24,8**	M16 x 190	**17,6**	M16 x 190	**17,6**
	LBS screws	Ø5,0 x 60	18	**31,8**								
• $c_{2\ max}$ = **200 mm** • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 190	**31,2**	M16 x 190	**25,1**	M16 x 190	**17,6**
	LBS screws	Ø5,0 x 60	15(1)	**27,5**								

MINIMUM CONCRETE THICKNESS $h_{min} \geq$ 150 mm

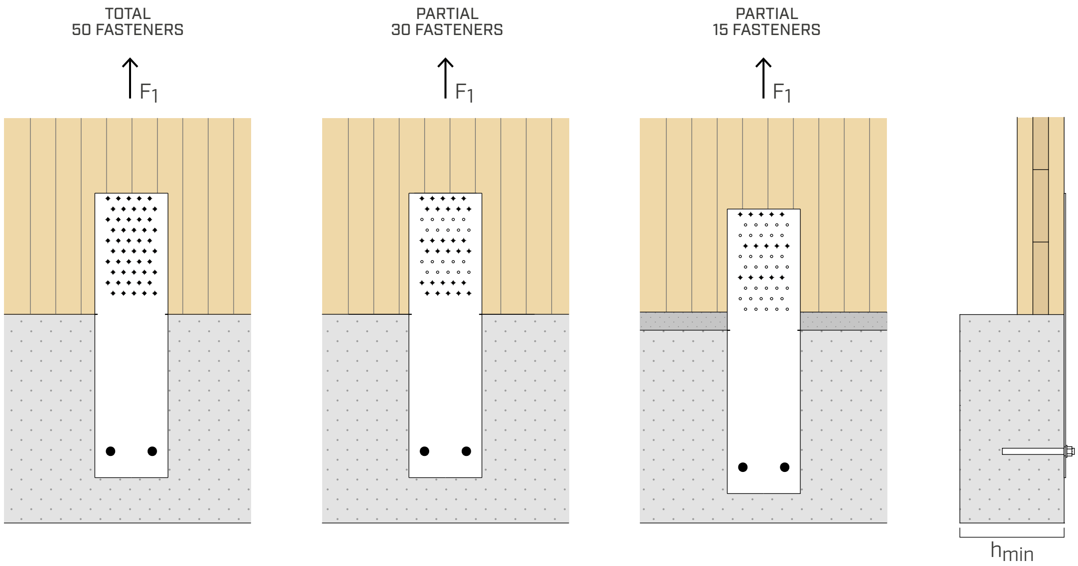
	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	**holes fastening Ø5**			**$R_{1,k\ timber}$**	**$R_{1,k\ steel}$**		**$R_{1,d\ uncracked}$**		**$R_{1,d\ cracked}$**		**$R_{1,d\ seismic}$**	
	type	**Ø x L**	**n_v**				EPO-FIX PLUS **Ø x L**		EPO-FIX PLUS **Ø x L**		EPO-FIX PLUS **Ø x L**	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• $c_{2\ min}$ = **130 mm** • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 136	**20,2**	M16 x 136	**14,3**	M16 x 136	**14,3**
	LBS screws	Ø5,0 x 60	18	**31,8**								
• $c_{2\ max}$ = **200 mm** • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 136	**28,8**	M16 x 136	**20,4**	M16 x 136	**17,6**
	LBS screws	Ø5,0 x 60	15 (1)	**27,5**								

NOTES:

(1) For the configuration in the table it is recommended not to install the screws of the lower row at a distance of $a_{3,t}$ (stressed end) = 15d = 75 mm.

STATIC VALUES | TENSILE JOINT | TIMBER-TO-CONCRETE

WHTPLATE540



MINIMUM CONCRETE THICKNESS $h_{min} \geq 200$ mm

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE[3]					
configuration	holes fastening Ø5			$R_{1,k}$ timber	$R_{1,k}$ steel		$R_{1,d}$ uncracked		$R_{1,d}$ cracked		$R_{1,d}$ seismic	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• **total fastening** • 2 anchors M16	LBA nails	Ø4,0 x 60	50	**83,5**	**70,6**	γ_{M2}	M16 x 190	**48,2**	M16 x 190	**34,2**	M16 x 190	**29,0**
	LBS screws	Ø5,0 x 60	50	**81,6**								
• **partial fastening**[2] 30 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	30	**70,8**								
	LBS screws	Ø5,0 x 60	30	**69,9**								
• **partial fastening**[2] 15 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	15	**35,4**								
	LBS screws	Ø5,0 x 60	15	**35,0**								

MINIMUM CONCRETE THICKNESS $h_{min} \geq 150$ mm

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE[3]					
configuration	holes fastening Ø5			$R_{1,k}$ timber	$R_{1,k}$ steel		$R_{1,d}$ uncracked		$R_{1,d}$ cracked		$R_{1,d}$ seismic	
	type	Ø x L	n_v				EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• **total fastening** • 2 anchors M16	LBA nails	Ø4,0 x 60	50	**83,5**	**70,6**	γ_{M2}	M16 x 136	**39,6**	M16 x 136	**28,0**	M16 x 136	**23,8**
	LBS screws	Ø5,0 x 60	50	**81,6**								
• **partial fastening**[2] 30 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	30	**70,8**								
	LBS screws	Ø5,0 x 60	30	**69,9**								
• **partial fastening**[2] 15 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	15	**35,4**								
	LBS screws	Ø5,0 x 60	15	**35,0**								

NOTES:

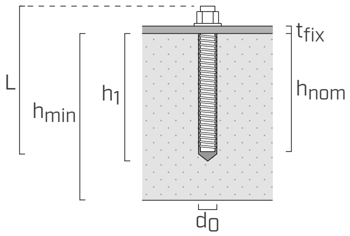
(2) In the case of configurations with partial nailing, the strength values in the table are valid for the installation of fasteners in timber in accordance with $a_1 > 10d$ ($n_{ef} = n$)

(3) The concrete strength values are valid if the assembly notches of the WHT-PLATE540 plate are positioned at the timber-to-concrete interface (c_x = 260 mm).

CHEMICAL ANCHORS INSTALLATION PARAMETERS[1]

anchor type		t_{fix}	$h_{nom} = h_{ef}$	h_1	d_0	h_{min}
type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
EPO-FIX PLUS 5.8	M16 x min 136	3	114	120	18	**150**
VIN-FIX PRO EPO-FIX PLUS 5.8	M16 x 190	3	164	170		**200**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534



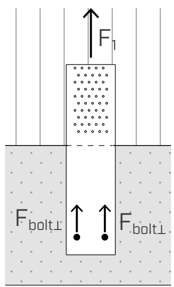
t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

DIMENSIONING OF ALTERNATIVE ANCHORS

Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchor and evaluable through the coefficients $k_{t\perp}$. The lateral shear load acting on the anchor can be obtained as follows:

$$F_{bolt\perp,d} = k_{t\perp} \cdot F_{1,d}$$

$k_{t\perp}$ coefficient of eccentricity
F_1 tensile stress acting on the WHT PLATE



	$k_{t\perp}$
WHTPLATE440	1,00
WHTPLATE540	0,50

The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_{bolt\ \perp,d} \geq F_{bolt\ \perp,d}$.

NOTES FOR SEISMIC DESIGN

Particular attention has to be paid to the "capacity design" applied at different scale levels: the global structure and the connection system. Experimentally the ultimate strength of the LBA nail (and of the LBS screw) is notably larger than the characteristic strength evaluated according to EN 1995.
E.g. LBA nail Ø4 x 60 mm: $R_{v,k}$ =2,8 - 3,6 kN by experimental tests (variable according to the type of timber and plate thickness).

Experimental data derive from tests carried out within the Seismic-Rev research project and are reported in the scientific report: "Connection systems for timber buildings: experimental campaign to characterize stiffness, strength and ductility" (DICAM - Department of Civil, Environmental and Mechanical Engineering - UniTN).

NOTES:

[1] Valid for the strength values shown in the table.

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.

  The connection design strength value is obtained from the values on the table as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\ steel}}{\gamma_{steel}} \\ R_{d,\ concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.

- The timber strength values $R_{1,k\ timber}$ are calculated considering the effective number according to Table 8.1 (EN 1995-1-1)
- The calculation process used a timber characteristic density of ρ_k = 350 kg/m^3 and C25/30 concrete with a thin reinforcing layer and minimum thickness indicated in the relative tables.
- Concrete design strength values are supplied for uncracked ($R_{1,d\ uncracked}$), cracked ($R_{1,d\ cracked}$) concrete and in case of seismic verification ($R_{1,d\ seismic}$) for use of chemical anchor with threaded rod in steel class 5.8.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2 elastic design according to EOTA TR045). For chemical anchors it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchor-to-concrete group can be verified using MyProject calculation software according to the design requirements.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

WHT PLATE T TIMBER

CE
EN 14545

PLATES FOR TENSILE LOADS

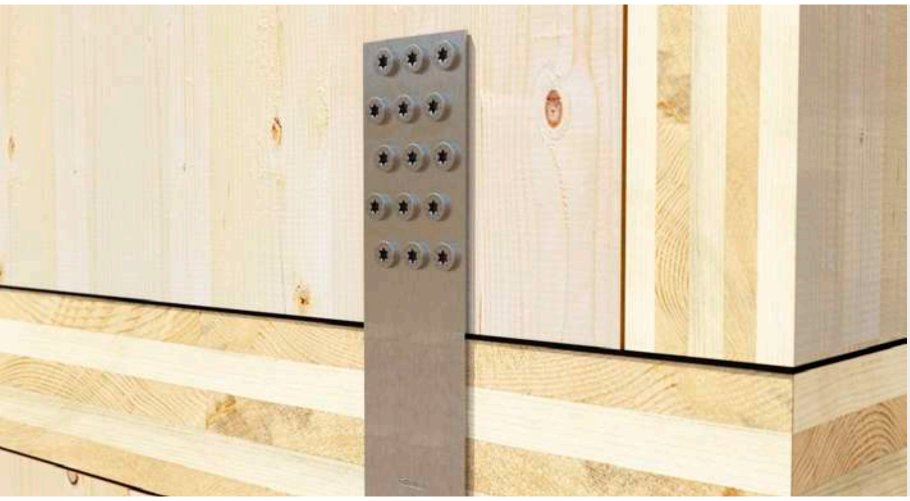
COMPLETE RANGE
Available in three versions of different thickness, material and height. The Pythagorean triple provides different levels of tensile strength.

TENSION
Ready-to-use plates: calculated, certified for tensile loads on timber-to-timber joints. Available in three different strength levels.

EARTHQUAKE AND MULTISTORY
Ideal for the design of multi-storey buildings for different floor thickness values. Characteristic tensile strength of more than 150 kN.

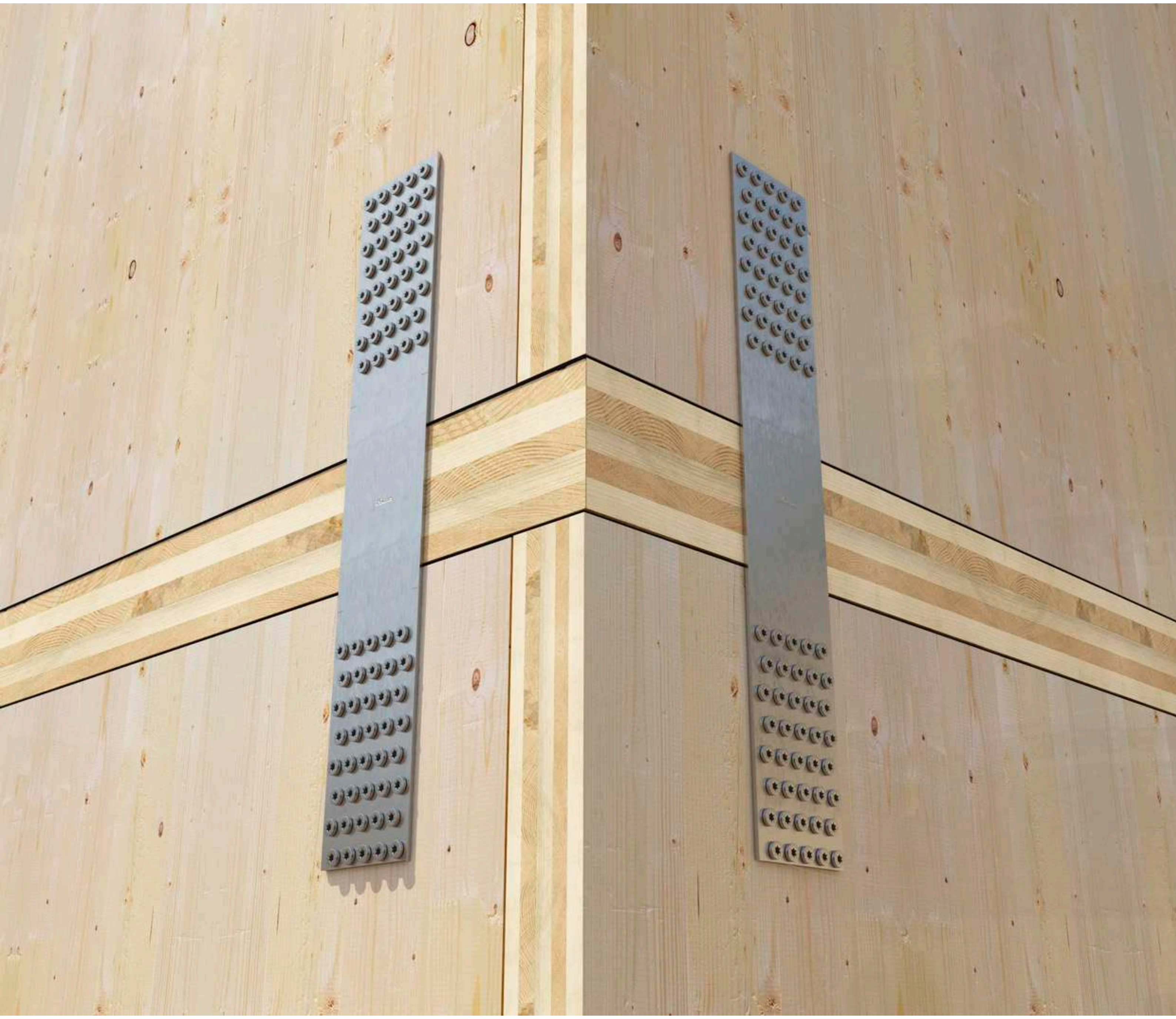
CHARACTERISTICS

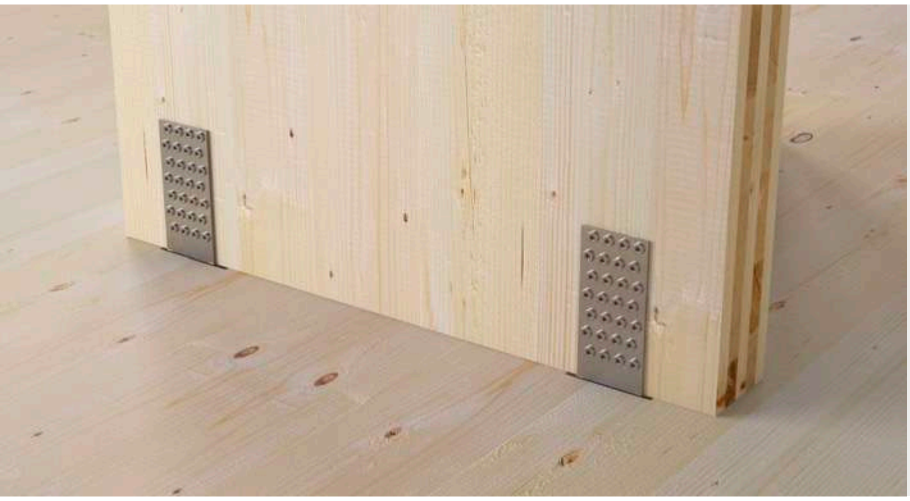
FOCUS	tensile joints on timber
HEIGHT	from 600 to 820 mm
THICKNESS	from 3,0 to 5,0 mm
FASTENERS	HBS PLATE, HBS PLATE EVO



MATERIAL
Bright zinc plated carbon steel, two dimensional perforated plate.

FIELDS OF USE
Timber-to-timber tensile joints for panels and timber beams
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels





MULTI-STOREY

Ideal for tensile joints in CLT multi-storey buildings where high tensile strengths are required. Optimised geometry for secure fastening.

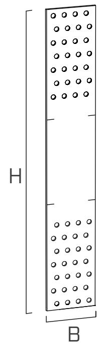
HBS PLATE

Ideal in combinations with HBS PLATE or HBS PLATE EVO screws. The head of the screws has a shoulder and the thickness is increased for the plates completely safe, reliable fastening to the timber.

CODES AND DIMENSIONS

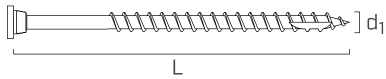
WHT PLATE T

CODE	H [mm]	B [mm]	n_v Ø11 [pcs]	s [mm]	pcs
WHTPT600	594	91	30	3	10
WHTPT720	722	118	56	4	5
WHTPT820	826	145	80	5	1



HBS PLATE

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSP880	8	80	55	TX40	100
HBSP8100	8	100	75	TX40	100



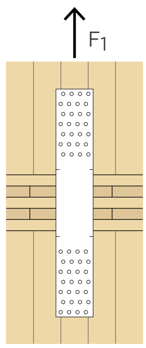
MATERIAL AND DURABILITY

WHT PLATE T: S355 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

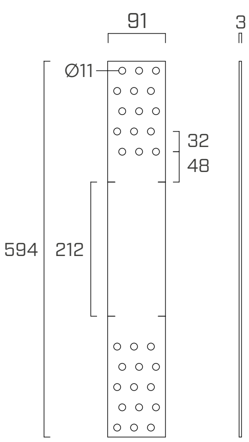
- Timber-to-timber joints

EXTERNAL LOADS

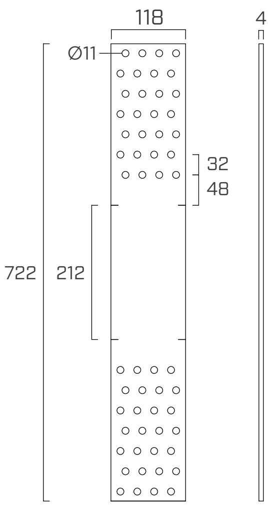


GEOMETRY

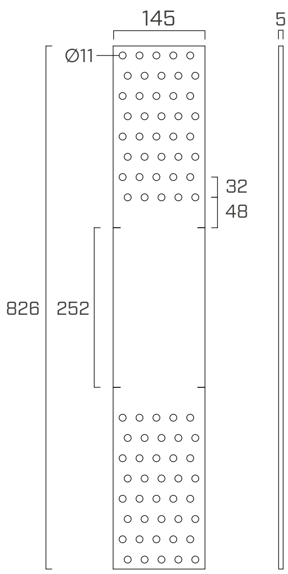
WHTPT600



WHTPT720

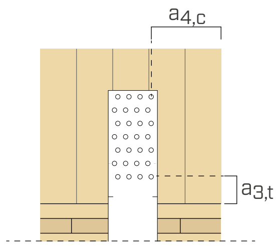


WHTPT820



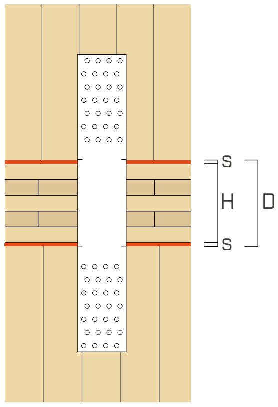
INSTALLATION

TIMBER minimum distances			screws HBS PLATE Ø8
CLT	$a_{4,c}$	[mm]	≥ 20
	$a_{3,t}$	[mm]	≥ 48



WHT PLATE T plates are designed for different floor thickness values including resilient acoustic profile. The positioning notches, as an assembly aid, indicate the maximum permitted distance (D) between the CLT wall panels in compliance with the minimum distances for HBS PLATE Ø8 mm screws. This distance includes the space required for the acoustic profile housing ($s_{acoustic}$).

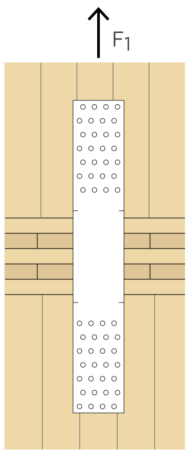
CODE	D [mm]	H_{max} floor [mm]	$s_{acoustic}$ [mm]
WHTPT600	212	200	6 + 6
WHTPT720	212	200	6 + 6
WHTPT820	252	240	6 + 6



STATIC VALUES | TIMBER-TO-TIMBER TENSILE JOINT

WHT PLATE T

	$R_{1,K}$ TIMBER			$R_{1,K}$ STEEL	
	holes fastening Ø11		$R_{1,k\ timber}$	$R_{1,k\ steel}$	
CODE	HBS PLATE Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
WHTPT600	Ø8,0 x 80	15 + 15	**56,8**	**80,3**	γ_{M2}
	Ø8,0 x 100	15 + 15	**62,1**		
WHTPT720	Ø8,0 x 80	28 + 28	**104,7**	**135,9**	γ_{M2}
	Ø8,0 x 100	28 + 28	**115,8**		
WHTPT820	Ø8,0 x 80	40 + 40	**158,5**	**206,6**	γ_{M2}
	Ø8,0 x 100	40 + 40	**176,1**		



GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995 1-1 and ETA-11/0030.
  The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{k\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k\ steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.

TITAN PLATE C CONCRETE

PLATES FOR SHEAR LOADS

VERSATILE
Suitable for a continuous fastening of both CLT (Cross Laminated Timber) panels and framed panels to the sub-structure.

INNOVATIVE
Designed to be partially or completely fastened with nails or screws. Possibility of installation even in the presence of bedding mortar.

CALCULATED AND CERTIFIED
CE marking according to EN 14545. Available in 2 versions. TCP300 with increased thickness optimised for CLT.

CHARACTERISTICS

FOCUS	shear joints on concrete
HEIGHT	200 | 300 mm
THICKNESS	3,0 | 4,0 mm
FASTENERS	LBA, LBS, VIN-FIX PRO, EPO-FIX PLUS, AB1, SKR

MATERIAL
Bright zinc plated carbon steel, two dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete shear joints for panels and timber beams
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels

ADDED STOREYS

Ideal for making flat joints between concrete or masonry elements and CLT panels. Construction of continuous shear connections.

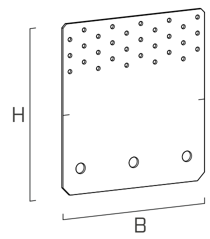
CONCRETE KERB

Versatile fastening configurations. Solutions designed, calculated, tested and certified with partial and total fastening, with horizontal or vertical fibre direction.

CODES AND DIMENSIONS

TITAN PLATE TCP

CODE	B [mm]	H [mm]	holes	n_v Ø5 [pcs]	s [mm]	concrete	pcs
TCP200	200	214	Ø13	30	3	●	10
TCP300	300	240	Ø17	21	4	●	5



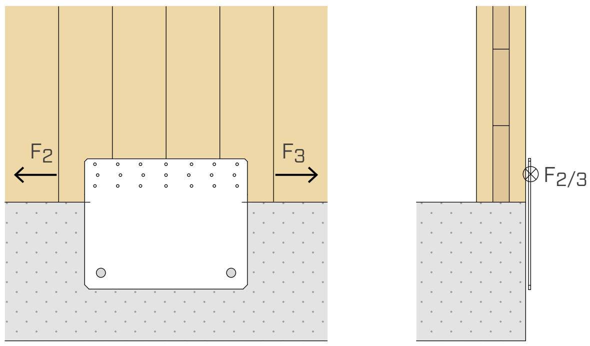
MATERIAL AND DURABILITY

TCP200: carbon steel DX51D+Z275.
TCP300: S355 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber to concrete joints

EXTERNAL LOADS

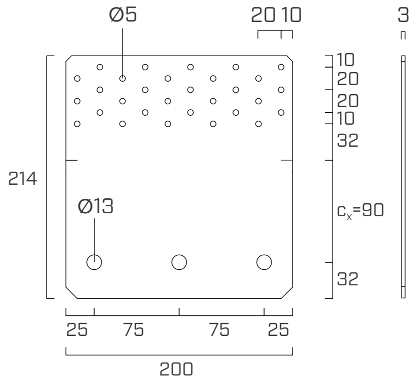


ADDITIONAL PRODUCTS - FASTENING

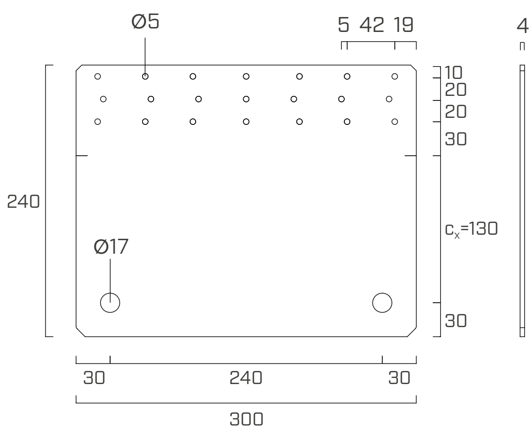
type	description		d [mm]	support	page
LBA	Anker nail		4	timber	548
LBS	screw for plates		5	timber	552
SKR	screw anchor		12 - 16	concrete	488
VIN-FIX PRO	chemical anchor		M12 - M16	concrete	511
EPO-FIX PLUS	chemical anchor		M12 - M16	concrete	517

GEOMETRY

TCP200



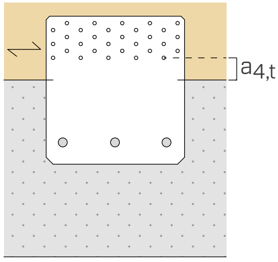
TCP300

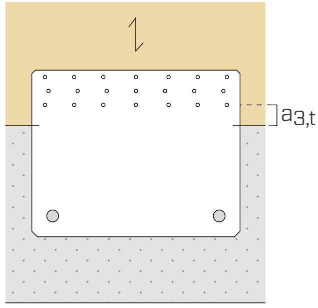


INSTALLATION

TIMBER minimum distances			nails LBA Ø4	screws LBS Ø5
C/GL	$a_{4,t}$	[mm]	≥ 20	≥ 25
CLT	$a_{3,t}$	[mm]	≥ 28	≥ 30

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420$ kg/m^3
- CLT minimum distances for Cross Laminated Timber according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA 11/0030 for screws

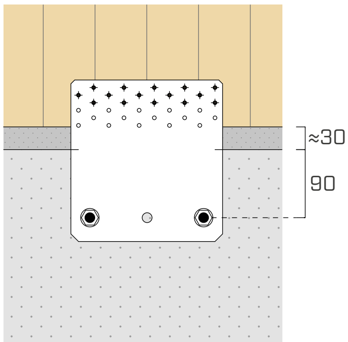




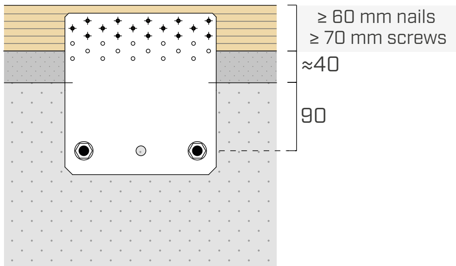
PARTIAL FASTENING

In the presence of design requirements such as varying stress values or the presence of a levelling layer between the wall and the support surface, it is possible to use pre-calculated **partial nailing** or to position the plates as required (e.g. lowered plates) taking care to respect the minimum distances indicated in the table and verify the strength of the anchor-to-concrete group taking into account the increase in distance from the edge (c_x). Below there are some examples of possible limit configurations:

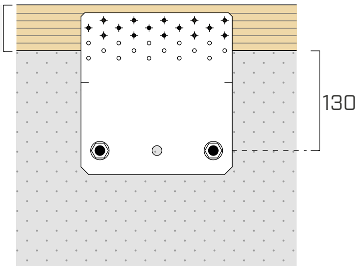
TCP200



PARTIAL 15 FASTENINGS - CLT

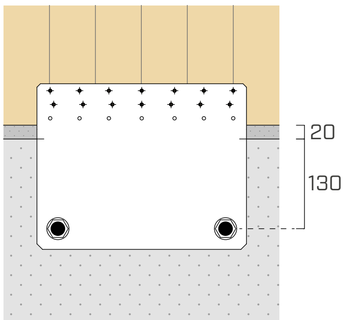


PARTIAL 15 FASTENINGS - C/GL

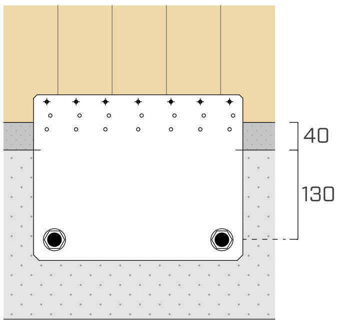


LOWERED PLATE - C/GL

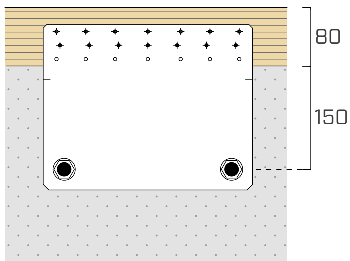
TCP300



PARTIAL 14 FASTENINGS - CLT

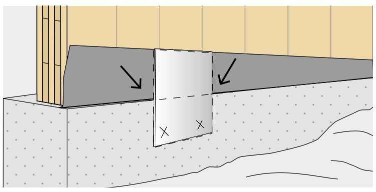


PARTIAL 7 FASTENINGS - CLT

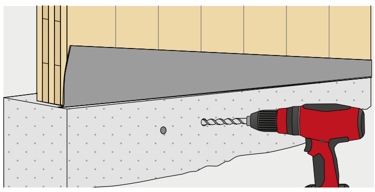


LOWERED PLATE - C/GL

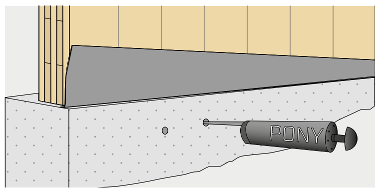
ASSEMBLY



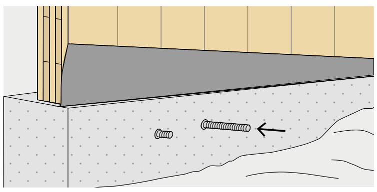
Positioning of the TITAN TCP with the dashed line at the timber-concrete interface and hole marking



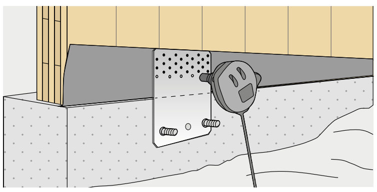
Removal of the TITAN TCP plate and drilling of the concrete support



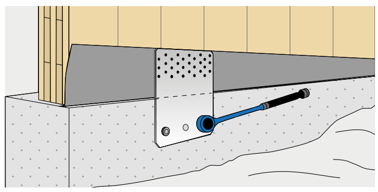
Accurate hole cleaning



Injection of the anchor and insertion of the threaded rods into the holes



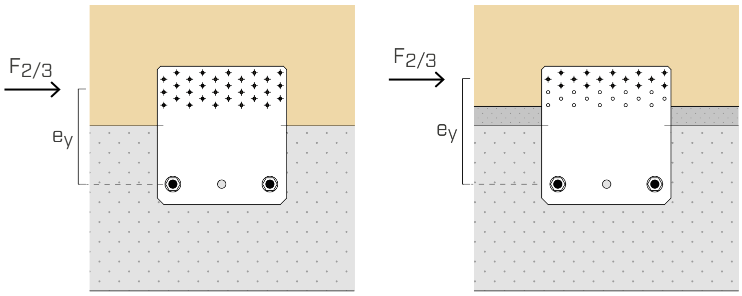
Installation of the TITAN TCP and nailing



Positioning of nuts and washers by adequate tightening

STATIC VALUES | TIMBER-TO-CONCRETE SHEAR JOINT

TCP200



TOTAL PARTIAL

TIMBER STRENGTH

	TIMBER					STEEL		CONCRETE		
configuration on timber	holes fastening Ø5			$R_{2/3,k\ timber}$ [1]	$R_{2/3,k\ CLT}$ [2]	$R_{2/3,k\ steel}$		holes fastening Ø13		
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_v [pcs]	e_y [3] [mm]
• total fastening	LBA nails	Ø4,0 x 60	30	**55,6**	**70,8**	**21,8**	γ_{M2}	M12	2	147
	LBS screws	Ø5,0 x 60	30	**54,1**	**69,9**					
• partial fastening	LBA nails	Ø4,0 x 60	15	**27,8**	**35,4**	**20,5**	γ_{M2}			162
	LBS screws	Ø5,0 x 60	15	**27,0**	**35,0**					

CONCRETE STRENGTH

Concrete strength values of some of the possible anchoring solutions, according to the configurations adopted for fastening on timber (e_y). It is assumed that the plate is positioned with the assembly notches at the timber-to-concrete interface (distance between anchor and concrete edge c_x = 90 mm).

			total fastening (e_y = 147 mm)	partial fastening (e_y = 162 mm)
configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$	
	type	Ø x L [mm]	[kN]	[kN]
• **uncracked**	VIN-FIX PRO 5.8	M12 x 130	**14,3**	**13,0**
	SKR-E	12 x 90	**12,6**	**11,4**
	AB1	M12 x 100	**13,1**	**11,9**
• **cracked**	VIN-FIX PRO 5.8	M12 x 130	**10,1**	**9,2**
	SKR-E	12 x 90	**8,9**	**8,1**
	AB1	M12 x 100	**9,2**	**8,4**
• **seismic**	EPO-FIX PLUS 5.8	M12 x 130	**6,5**	**6,1**
	EPO-FIX PLUS 5.8	M12 x 180	**9,3**	**8,4**

NOTES:

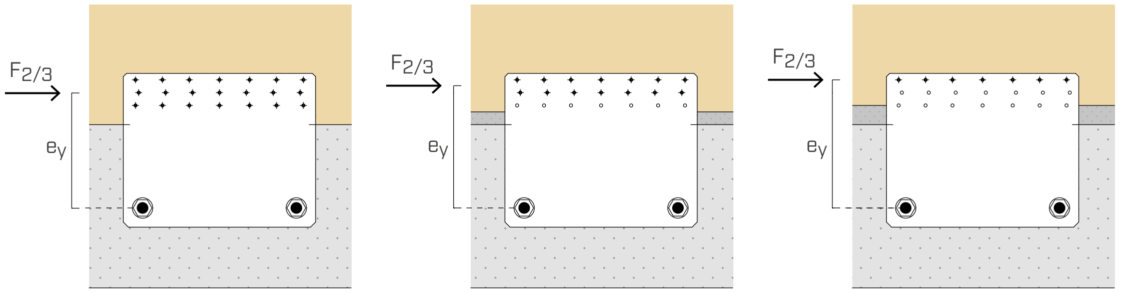
(1) Strength values for use on solid timber or glulam platform beam, calculated considering the effective number according to Table 8.1 (EN 1995 -1-1).

(2) Strength values for use on CLT.

(3) Eccentricity of calculation for verification of the anchor-to-concrete group.

STATIC VALUES | TIMBER-TO-CONCRETE SHEAR JOINT

TCP300



TOTAL

PARTIAL
14 FASTENERS

PARTIAL
7 FASTENERS

TIMBER STRENGTH

	TIMBER					STEEL		CONCRETE		
configuration on timber	**holes fastening Ø5** type	**Ø x L** [mm]	**n_v** [pcs]	**$R_{2/3,k\ timber}$** (1) [kN]	**$R_{2/3,k\ CLT}$** (2) [kN]	**$R_{2/3,k\ steel}$** [kN]	γ_{steel}	**holes fastening Ø17** **Ø** [mm]	**n_v** [pcs]	**e_y** (3) [mm]
• total fastening	LBA nails	Ø4,0 x 60	21	**38,4**	**49,6**	**64,0**	γ_{M2}	M16	2	180
	LBS screws	Ø5,0 x 60	21	**36,9**	**48,9**					
• partial fastening 14 fasteners	LBA nails	Ø4,0 x 60	14	**25,6**	**33,0**	**60,5**	γ_{M2}			190
	LBS screws	Ø5,0 x 60	14	**24,6**	**32,6**					
• partial fastening 7 fasteners	LBA nails	Ø4,0 x 60	7	**12,8**	**16,5**	**57,6**	γ_{M2}			200
	LBS screws	Ø5,0 x 60	7	**12,3**	**16,3**					

CONCRETE STRENGTH

Concrete strength values of some of the possible anchoring solutions, according to the configurations adopted for fastening on timber (e_y). It is assumed that the plate is positioned with the assembly notches at the timber-to-concrete interface (distance between anchor and concrete edge c_x = 130 mm).

			total fastening (e_y = 180 mm)	partial fastening (e_y = 190 mm)	partial fastening (e_y = 200 mm)
configuration on concrete	**holes fastening Ø17** type	**Ø x L** [mm]	**$R_{2/3,d\ concrete}$** [kN]	[kN]	[kN]
• uncracked	VIN-FIX PRO 5.8	M16 x 190	**34,4**	**32,7**	**31,1**
	SKR-E	16 x 130	**29,7**	**28,2**	**26,8**
	AB1	M16 x 145	**30,2**	**28,7**	**27,3**
• cracked	VIN-FIX PRO 5.8	M16 x 190	**24,4**	**23,2**	**22,0**
	SKR-E	16 x 130	**21,0**	**19,9**	**19,0**
	AB1	M16 x 145	**21,4**	**20,3**	**19,3**
• seismic	EPO-FIX PLUS 5.8	M16 x 190	**16,6**	**16,0**	**15,4**
	EPO-FIX PLUS 8.8	M16 x 230	**21,1**	**20,3**	**19,4**

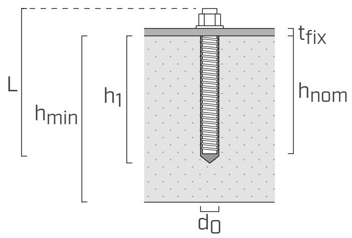
GENERAL PRINCIPLES:

General calculation principles see page 260.

ANCHORS INSTALLATION PARAMETERS | TCP200 - TCP300

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCP200	VIN-FIX PRO EPO-FIX PLUS 5.8	M12 x 130	3	112	112	120	14	**150**
	SKR-E	12 x 90	3	64	87	110	10	
	AB1	M12 x 100	3	70	80	85	12	
	EPO-FIX PLUS 5.8	M12 x 180	3	161	161	170	14	**200**
TCP300	VIN-FIX PRO EPO-FIX PLUS 5.8	M16 x 190	4	164	164	170	18	**200**
	SKR-E	16 x 130	4	85	126	150	14	
	AB1	M16 x 145	4	85	97	105	16	
	EPO-FIX PLUS 8.8	M16 x 230	4	200	200	205	14	**240**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534



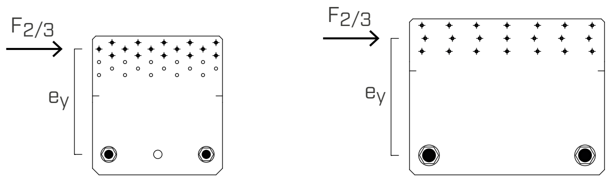
t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

ANCHORS FOR CONCRETE VERIFICATION | TCP200 - TCP300

Fastening to concrete using anchors must be verified on the basis of the stressing forces of the anchors, which depend on the timber fastening configuration.
The position and number of nails/screws determine the e_y eccentricity value, understood as the distance between the centre of gravity of the nailing and that of the anchors.

The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_y$



GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.

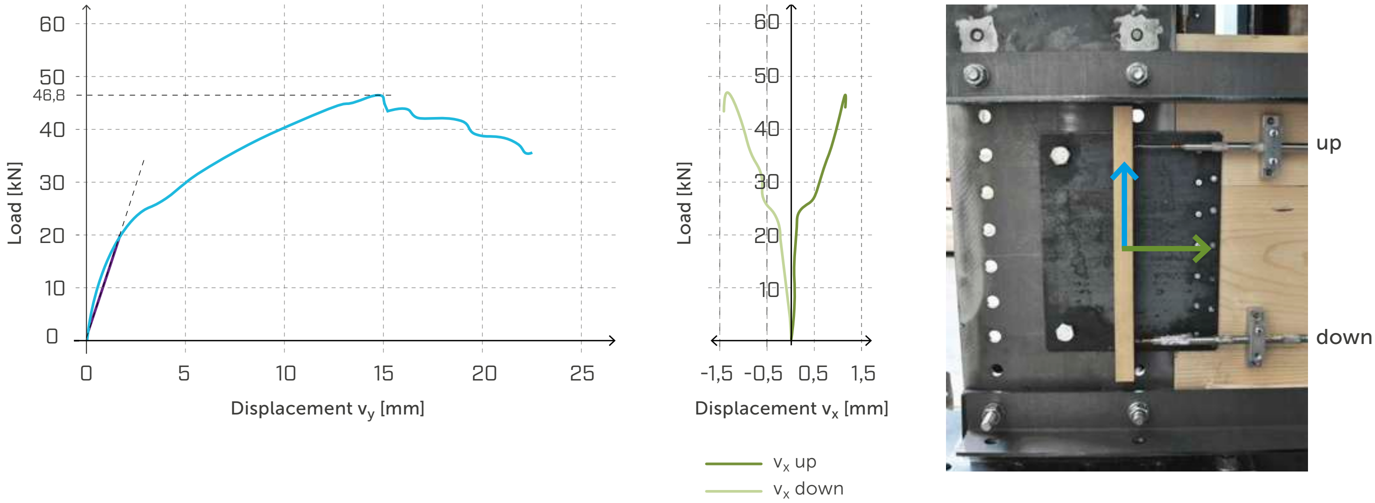
  The connection design strength value is obtained from the values on the table as follows:

$$R_d = \min \begin{cases} \dfrac{(R_{k,\,timber} \text{ or } R_{k,\,CLT}) \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\,steel}}{\gamma_{steel}} \\ R_{d,\,concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.
- The calculation process used a timber characteristic density of ρ_k = 350 kg/m^3 and C25/30 concrete with a thin reinforcing layer and minimum thickness indicated in the table.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchors-to-concrete can be verified using MyProject calculation software according to the design requirements.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045. For chemical anchors it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).

EXPERIMENTAL INVESTIGATIONS | TCP300

In order to calibrate the numerical models used for the design and verification of the TCP300 plate, an experimental campaign was carried out in collaboration with the Institute for BioEconomy (IBE) - San Michele all'Adige.
The connection system, nailed or screwed to CLT panels, has been shear stressed through monotonic tests in displacement control registering the load, displacement in the two main directions and collapse mode.
The results obtained were used to validate the analytical calculation model for the TCP300 plate, based on the hypothesis that the shear centre is placed at the centre of gravity of the fastenings on timber and therefore that the anchors, usually the weak point of the system, are stressed not only by the shear actions but also by the local moment.
The study in different fastening configurations (Ø4 nails/Ø5 screws, full nailing, partial nailing with 14 connectors, partial nailing with 7 connectors) shows that the mechanical behaviour of the plate is strongly influenced by the **relative stiffness of the connectors** on timber compared to that of the anchors, in tests simulated by bolting on steel.
In all cases a shear failure mode of the timber fasteners has been observed that does not result in evident plate rotation. Only in some cases (full nailing) the non-negligible rotation of the plate leads to an increase in stress on the timber fasteners resulting from a redistribution of the local moment with consequent stress relief on the anchors, which represent the limiting point of the overall strength of the system.

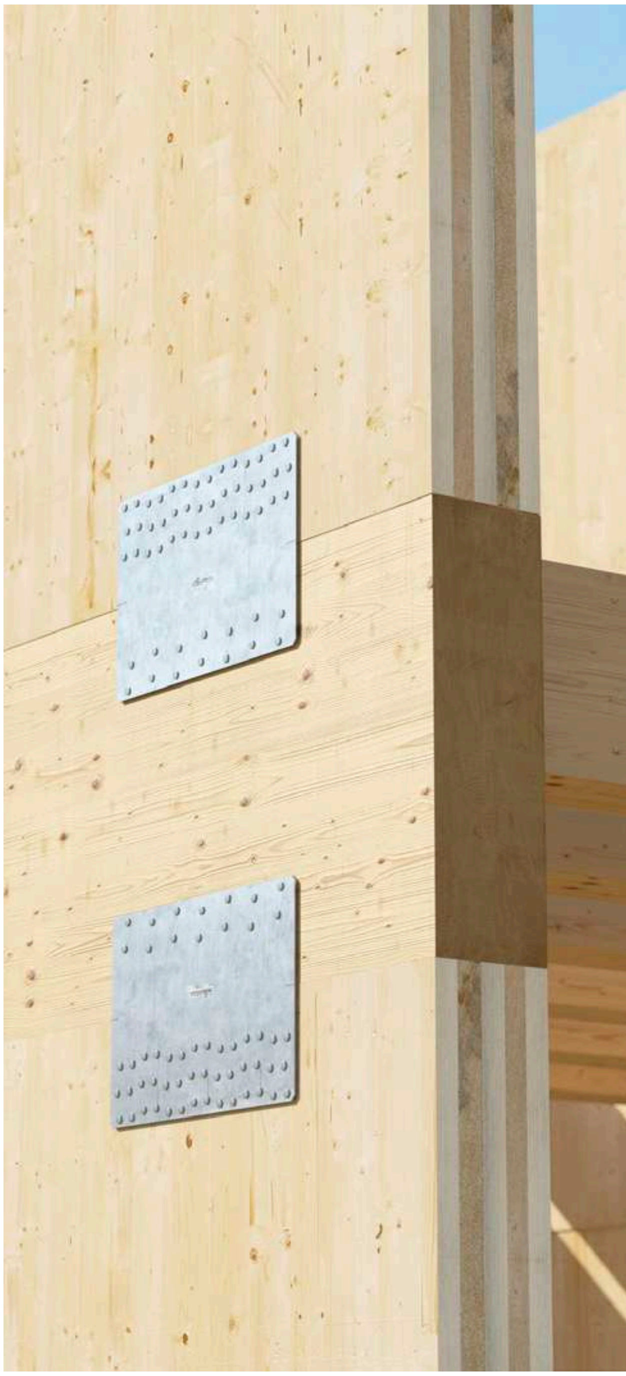


Load-to-displacement diagrams for TCP300 specimen with partial nailing (no. 14 LBA Ø4 x 60 mm nails).

Further investigations are necessary in order to define an analytical model that can be generalized to the different configurations of use of the plate that is able to provide the actual stiffness of the system and the redistribution of stresses as the boundary conditions (connectors and base materials) vary.

TITAN PLATE T TIMBER

PLATES FOR SHEAR LOADS



TIMBER-TO-TIMBER
These plates are ideal for the flat connection of the timber platform beams to load-bearing timber panels.

SHEAR PLATES
Shear strengths calculated with both partial and total fastening for solid timber, glulam and CLT.

CALCULATED AND CERTIFIED
CE marking according to European standard EN 14545. Available in 2 versions. TTP300 version ideal for CLT.

CHARACTERISTICS

FOCUS	timber-to-timber shear joint
HEIGHT	200 | 300 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS

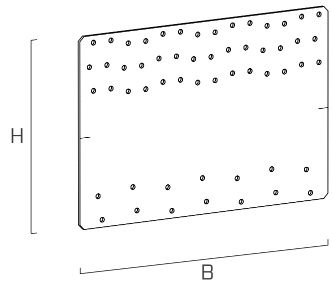
MATERIAL
Bright zinc plated carbon steel, two dimensional perforated plate.

FIELDS OF USE
Timber-to-timber shear joints for panels and timber beams
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)

CODES AND DIMENSIONS

TITAN PLATE TTP

CODE	B	H	n_{v1} Ø5	n_{v2} Ø5	s		pcs
	[mm]	[mm]	[pcs]	[pcs]	[mm]		
TTP200	200	105	7	7	3	●	10
TTP300	300	200	42	14	3	●	5



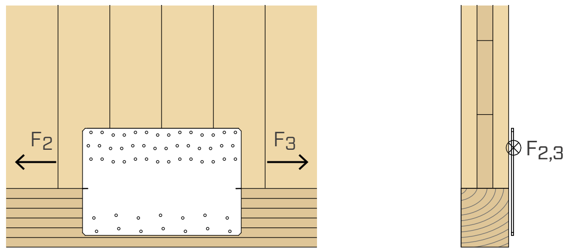
MATERIAL AND DURABILITY

TTP200: bright zinc plated carbon steel.
TTP300: bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints

EXTERNAL LOADS

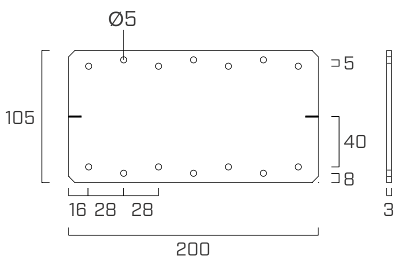


ADDITIONAL PRODUCTS - FASTENING

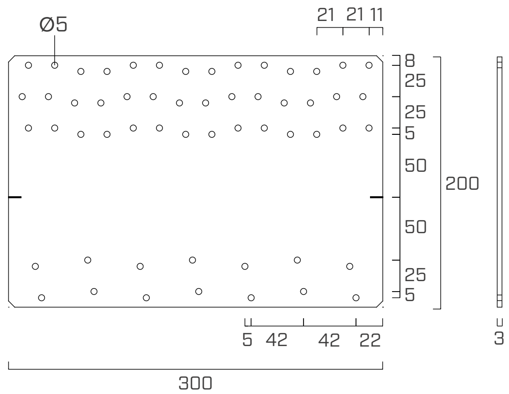
type	description		d	support	page
			[mm]		
LBA	Anker nail		4		548
LBS	screw for plates		5		552

GEOMETRY

TTP200



TTP300



CLT

The 300 mm version is specially designed to maximise shear strength in CLT structures. Ideal for the connection of the floor platform beams to the load-bearing walls.

TIMBER FRAME

The 200 mm version also allows fastening the platform beams in the foundation (height higher than 8 cm) to the upper supporting panel, both in CLT and TIMBER FRAME structures.

INSTALLATION

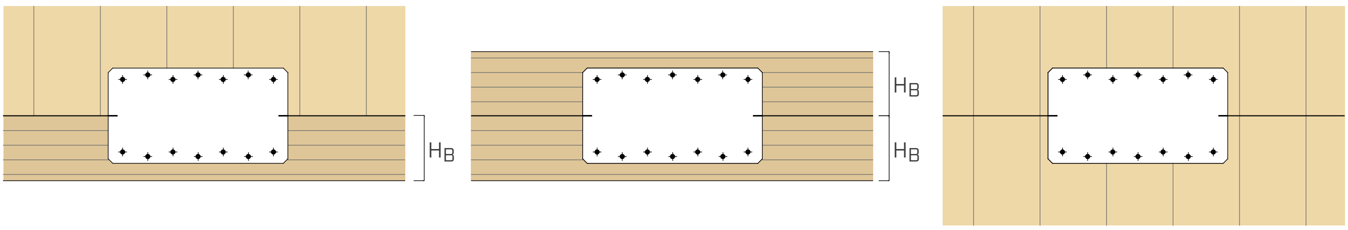
TTP plates can be used on both CLT and solid timber/glulam elements and must be positioned with the assembly notches at the timber-to-timber interface.

In the case of fastening on beam/platform beam, the minimum H_B dimension of the elements is shown in the table with reference to the installation diagrams.

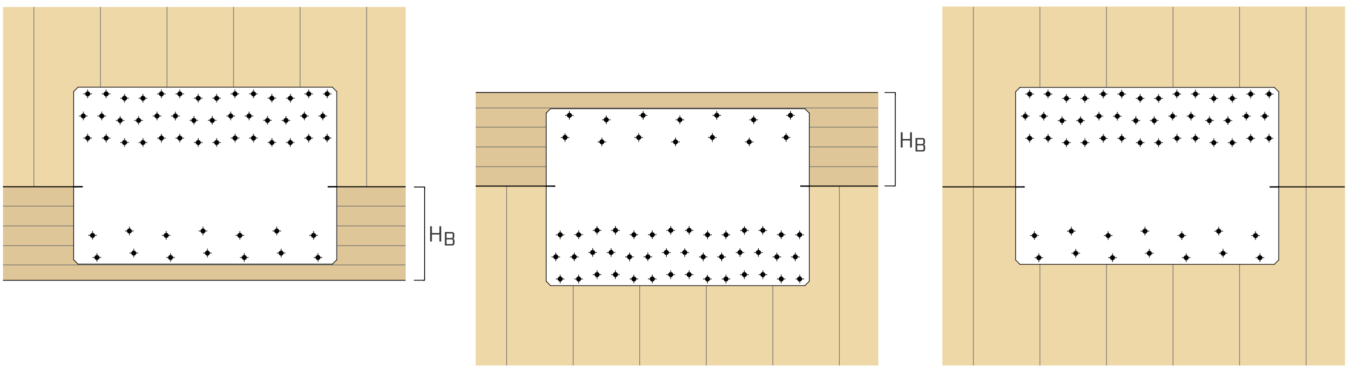
		$H_{B\ MIN}$ [mm]	
		nails	**screws**
		LBA Ø4	**LBS Ø5**
TTP200	**total fastening**	75	-
TTP300	**total fastening**	100	105
	partial fastening	110	130

The H_B height is determined taking into account the minimum distances for solid timber or glulam consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420\ kg/m^3$

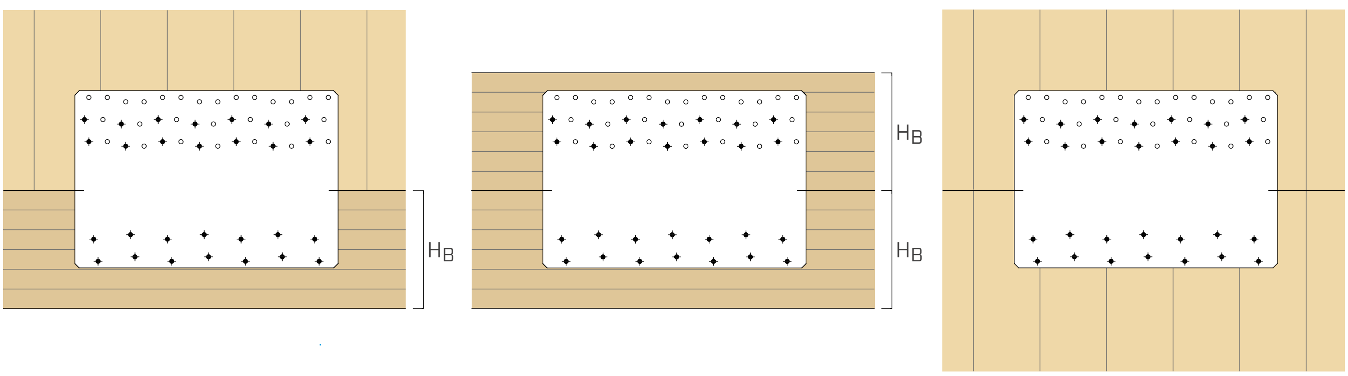
TTP200 | TOTAL FASTENING



TTP300 | TOTAL FASTENING

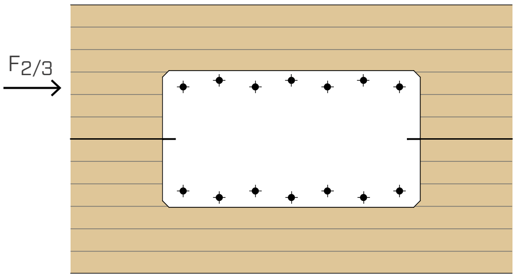


TTP300 | PARTIAL FASTENING



STATIC VALUES | SHEAR JOINT | TIMBER-TO-TIMBER

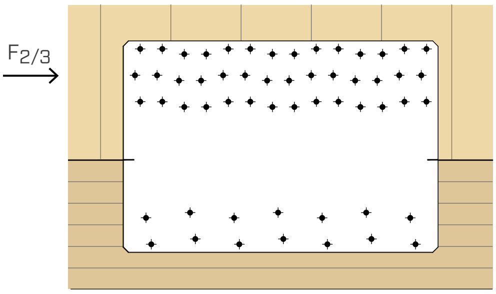
TTP200



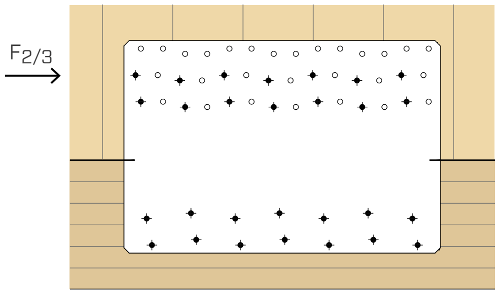
TOTAL

configuration	TIMBER				
	holes fastening Ø5				$R_{2/3,k\ timber}$ [1]
	type	Ø x L [mm]	n_{v1} [pcs]	n_{v2} [pcs]	[kN]
• total fastening	LBA nails	Ø4,0 x 60	7	7	**7,8**

TTP300



TOTAL



PARTIAL

configuration	TIMBER				
	holes fastening Ø5				$R_{2/3,k\ timber}$ [1]
	type	Ø x L [mm]	n_{v1} [pcs]	n_{v2} [pcs]	[kN]
• total fastening	LBA nails	Ø4,0 x 60	42	14	**28,0**
	LBS screws	Ø5,0 x 60	42	14	**27,7**
• partial fastening	LBA nails	Ø4,0 x 60	14	14	**15,3**
	LBS screws	Ø5,0 x 60	14	14	**15,1**

NOTES:

[1] Strength values are valid for all full/partial configurations indicated in the INSTALLATION section.

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1.

  The connection design strength values are obtained from the values on the table as follows:

$$R_d = \frac{R_{k\ timber} \cdot k_{mod}}{\gamma_M}$$

  The coefficients k_{mod}, γ_M should be taken according to the current regulations used for the calculation.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.

ALU START

ALUMINIUM SYSTEM FOR THE CONNECTION OF BUILDINGS TO THE GROUND

VIDEO

ETA

CE MARK ACCORDING TO ETA

The profile is capable of transferring shear, tensile and compressive forces into the foundation. The strengths are tested, calculated and certified according to specific ETA.

RISE FROM THE FOUNDATION

The profile allows to eliminates contact between the timber panels (CLT or TIMBER FRAME) and the concrete substructure. Excellent durability of the building connection to the ground.

SUPPORT SURFACE LEVELLING

Thanks to the special assembly templates, the supporting surface level is easy to adjust. The "levelling" of the entire building is simple, precise and fast.

CHARACTERISTICS

FOCUS	raising and levelling of CLT and TIMBER FRAME panels
WIDTH	from 100 to 160 mm
STRENGTH	in all stress directions
FASTENERS	LBA, LBS, SKR-E, AB1, VIN-FIX PRO, EPO-FIX PLUS

VIDEO

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

MATERIAL

Aluminium alloy three dimensional perforated plate.

FIELDS OF USE

Connection to the ground of timber buildings with riser from the foundation and levelling of the supporting surface

- CLT walls
- TIMBER FRAME walls

DURABILITY

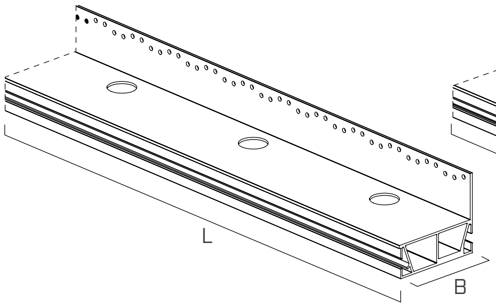
Thanks to the rise from the foundation and the aluminium material, the building base is protected against capillary rising. The ground connection provides durability and health to the structure.

SHEAR STRENGTH ACCORDING TO AGE

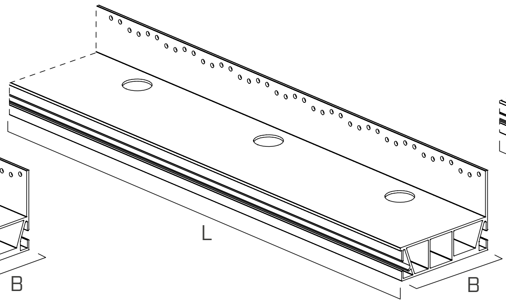
Thanks to the side flange, the profile can be fastened to the timber wall by means of nails or screws which guarantee excellent shear strength certified by CE marking according to ETA.

CODES AND DIMENSIONS

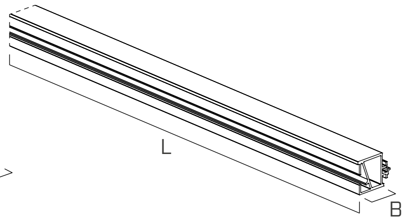
ALU START



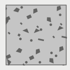
ALUSTART100



ALUSTART120



ALUSTART35

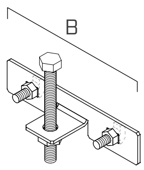
CODE	B [mm]	L [mm]		pcs
ALUSTART100	100	2400	●	1
ALUSTART120	120	2400	●	1
ALUSTART35 *	35	2400	●	1

* side extension for ALUSTART100 and ALUSTART120.

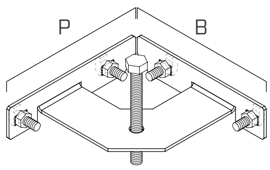
ASSEMBLY ACCESSORIES - JIG START TEMPLATES

CODE	description	B [mm]	P [mm]	pcs
JIGSTARTI	levelling template for linear joint	160	-	25
JIGSTARTL	levelling template for angle joint	160	160	10

The templates are supplied complete with M12 bolt for height adjustment, ALUSBOLT bolts and ALUSMUT nuts.



JIGSTARTI

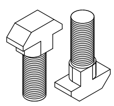


JIGSTARTL

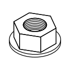
COMPLEMENTARY PRODUCTS

CODE	description	pcs
ALUSBOLT	hammer head bolt for template fastening	100
ALUSMUT	hammer bolt nut	100
ALUSPIN	ISO 8752 sping pins for ALUSTART35 assembly	50

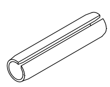
ALUSBOLT and ALUSPIN can be ordered separately from the templates as spare parts.



ALUSBOLT



ALUSMUT

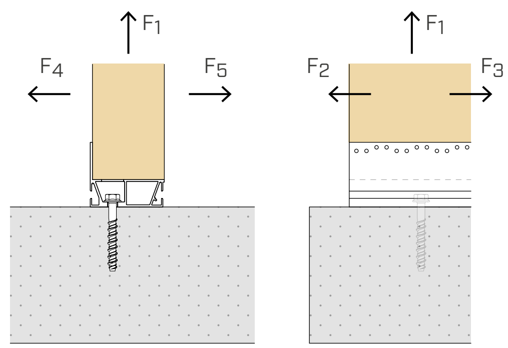


ALUSPIN

MATERIAL AND DURABILITY

ALU START: EN AW-6060 aluminium alloy.
To be used in service classes 1 and 2 (EN 1995-1-1).

EXTERNAL LOADS



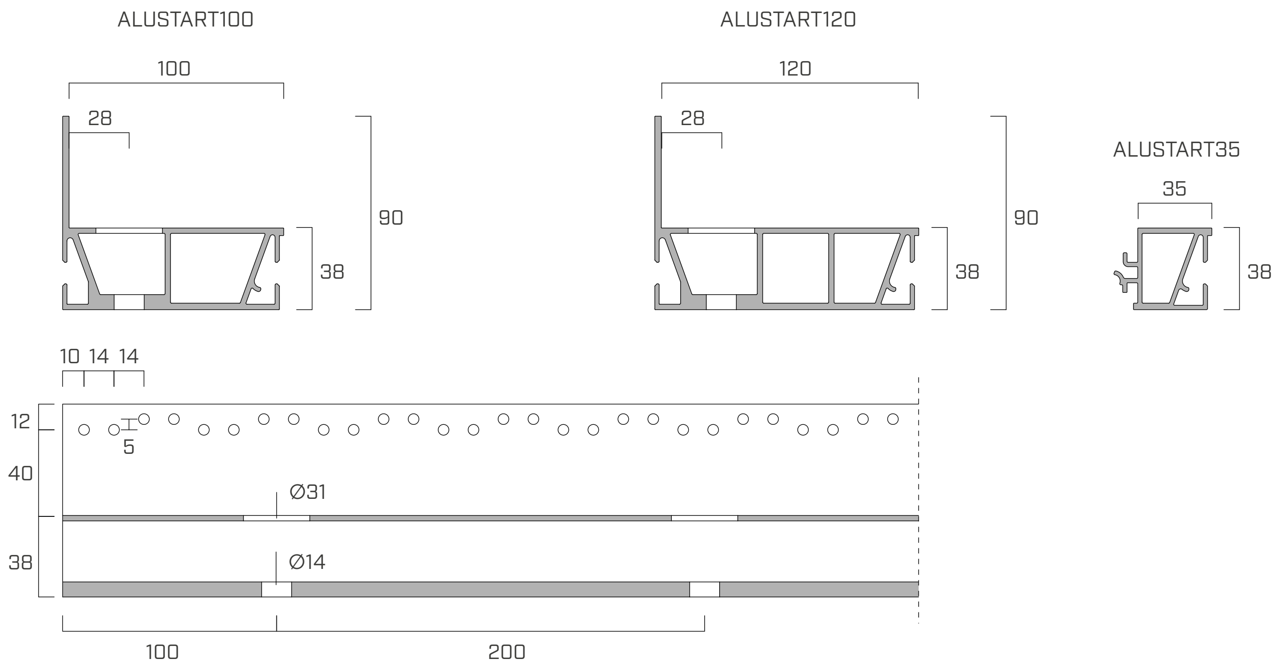
FIELD OF USE

- CLT/TIMBER FRAME wall joints - foundation

ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
LBA	Anker nail	4		548
LBS	screw	5		552
SKR-E	screw mechanical anchor	12		491
AB1	expansion mechanical anchor	M12		496
VIN-FIX PRO	chemical anchor	M12		511
EPO-FIX PLUS	chemical anchor	M12		517

GEOMETRY



CODE	B [mm]	H [mm]	L [mm]	n_v Ø5 [pcs]	n_H Ø14 [pcs]
ALUSTART100	100	90	2400	171	12
ALUSTART120	120	90	2400	171	12
ALUSTART35	35	38	2400	-	-

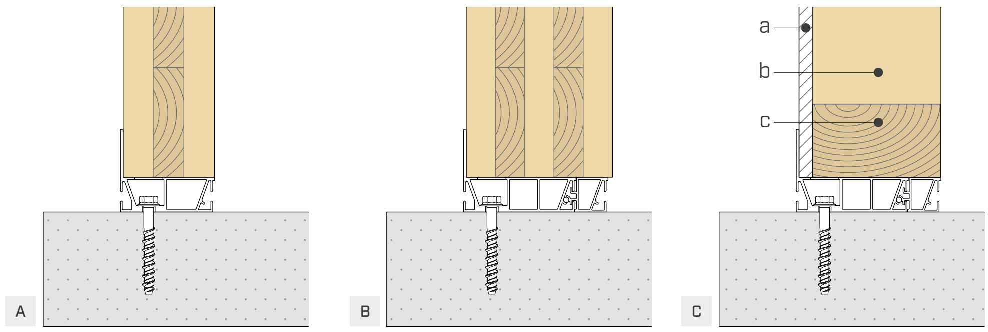
INSTALLATION | TIMBER

ALU START is an extruded aluminium profile designed to house the walls and to solve the foundation-wall node in timber.

The profile is certified to withstand all the stresses typical for a timber wall, i.e. F_1, $F_{2/3}$, F_4 and F_5.

ALU START profiles, in their two sizes, are designed to fit CLT walls of 100 and 120 mm (A) thickness.

The use of the lateral extension ALUSTART35 allows its use with CLT (B) and TIMBER FRAME (C) walls having greater thickness.

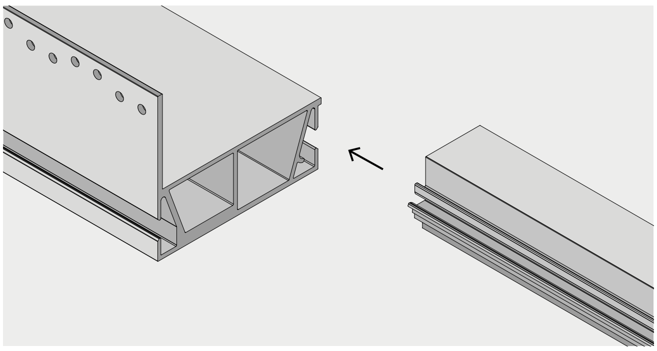


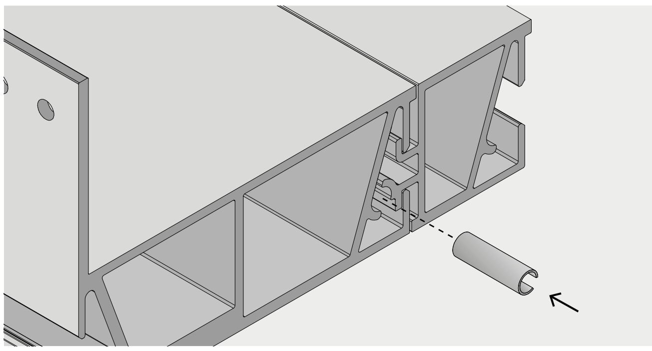
a. bracing sheet

b. strut

c. abeam

The ALUSTART35 side extension is easily inserted into the ALUSTART100 and ALUSTART120 profiles. The compound profile is then stopped in position by two ALUSPIN pins to be inserted at the ends.





PROFILE SELECTION

profile	profile bottom	wall minimum thickness	
	[mm]	CLT	TIMBER FRAME
ALUSTART100	100	100 mm	-
ALUSTART120	120	120 mm	strut 100 mm + sheet ≥ 20 mm
ALUSTART100 + ALUSTART35	135	140 mm	strut 120 mm + sheet ≥ 15 mm
ALUSTART120 + ALUSTART35	155	160 mm	strut ≥ 140 mm + sheet ≥ 15 mm

INSTALLATION | TIMBER

NAILING

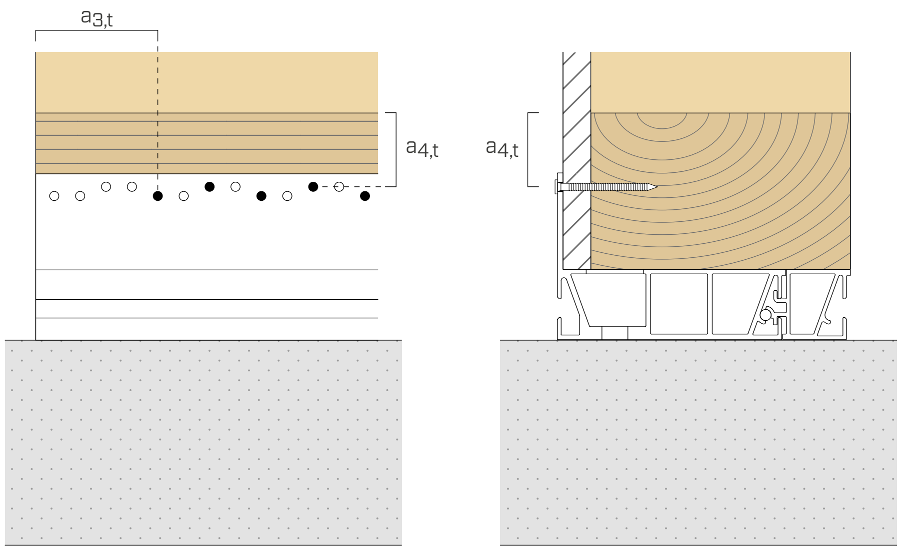
ALU START profiles can be used for different building systems (CLT / TIMBER FRAME).
Depending on the construction technology, different nailings can be used in accordance with the minimum distances.

MINIMUM DISTANCES

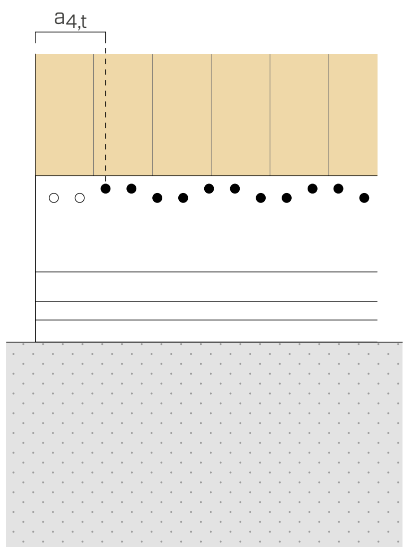
TIMBER minimum distances			nails LBA Ø4	screws LBS Ø5
C/GL	$a_{4,t}$	[mm]	$\geq$ 28	-
	$a_{3,t}$	[mm]	$\geq$ 60	-
CLT	$a_{4,t}$	[mm]	$\geq$ 28	$\geq$ 30

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420$ kg/m^3.
- CLT minimum distances for Cross Laminated Timber according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA 11/0030 for screws.

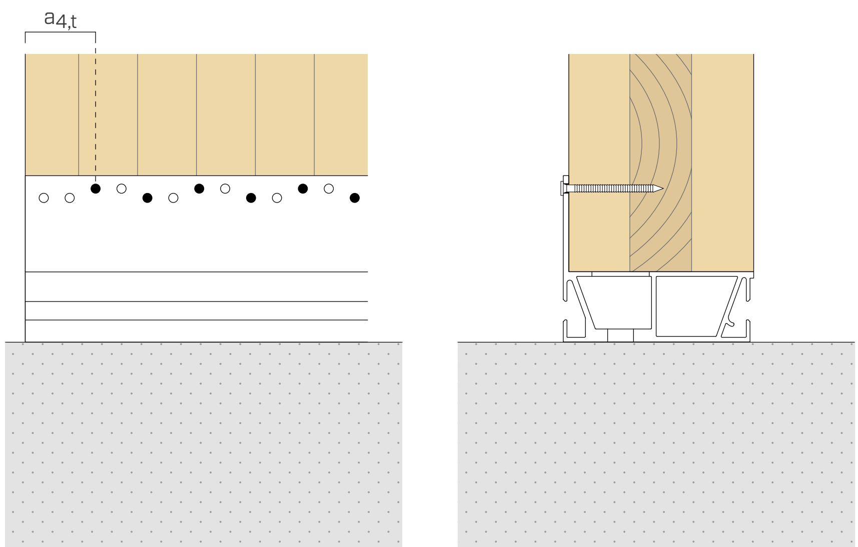
PARTIAL NAILING FOR NAILS ON SOLID TIMBER (C) OR GLULAM (GL)



FULL NAILING ON CLT

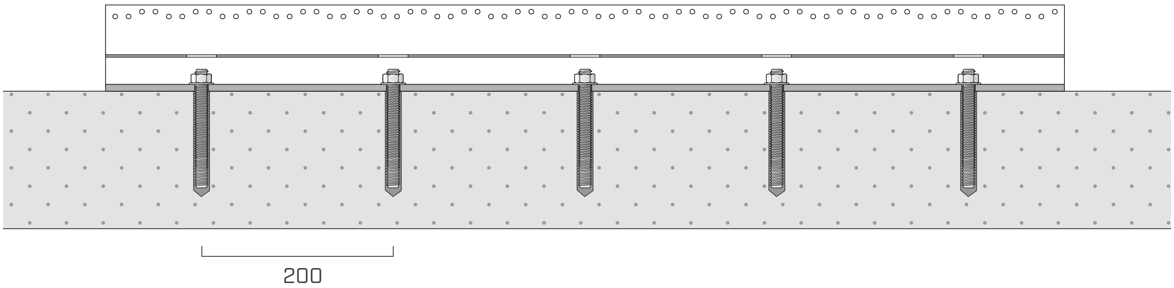


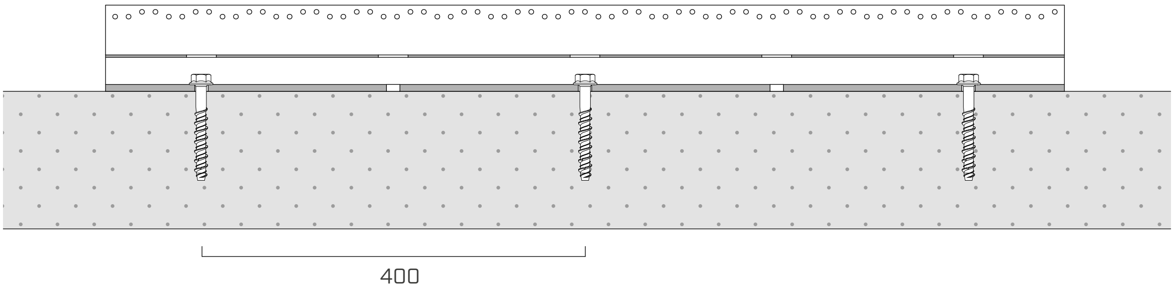
PARTIAL NAILING ON CLT



INSTALLATION | CONCRETE

The ALU START profiles must be fastened on concrete with a number of anchors suitable for the design loads. It is possible to arrange the anchors in all the holes, or choose larger installation spacing.





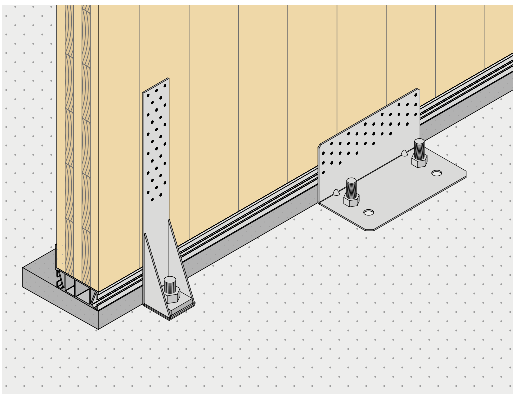
Details of the assembly phase in the "POSITIONING" section.

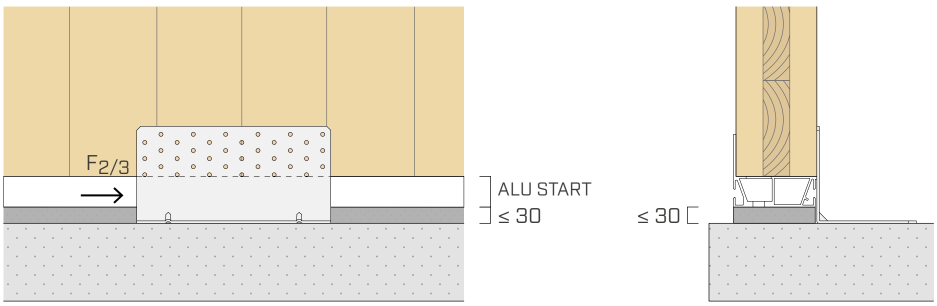
ADDITIONAL CONNECTION SYSTEMS

The ALU START geometry allows using additional connection systems such as TITAN TCN and WHT, even with a levelling layer between the profile and the foundation.

Certified partial nailings are available for TITAN TCN installation which allow laying bedding mortar with a thickness up to 30 mm.

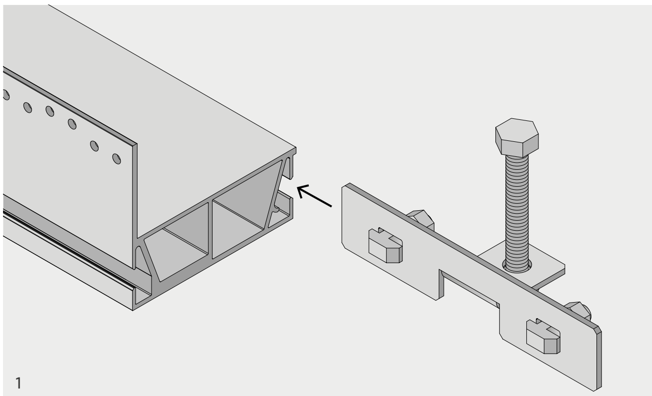
For the static values and nailings of the TITAN TCN angle brackets and the WHT hold downs, see the respective pages of this catalogue.



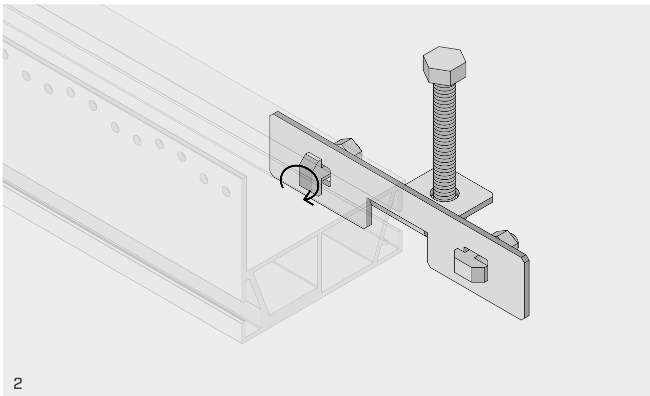


POSITIONING

Assembly includes the use of special JIG START templates for the height levelling of the profiles, for the linear joint and for creating 90° angles.



1



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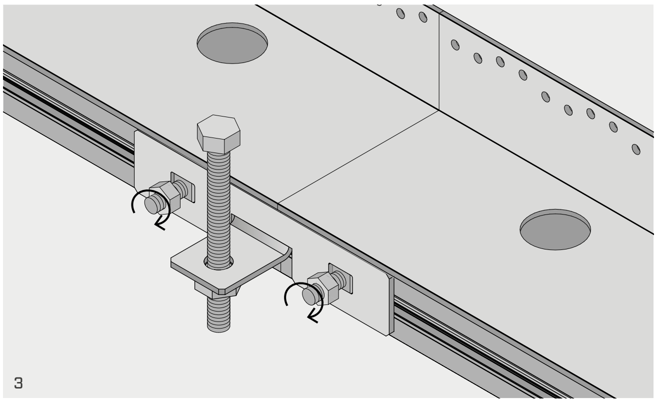
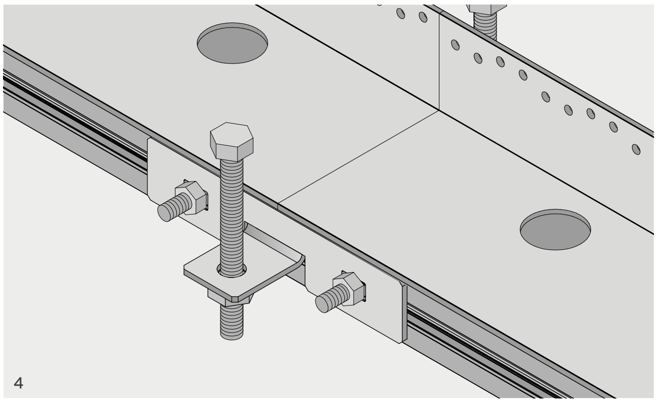
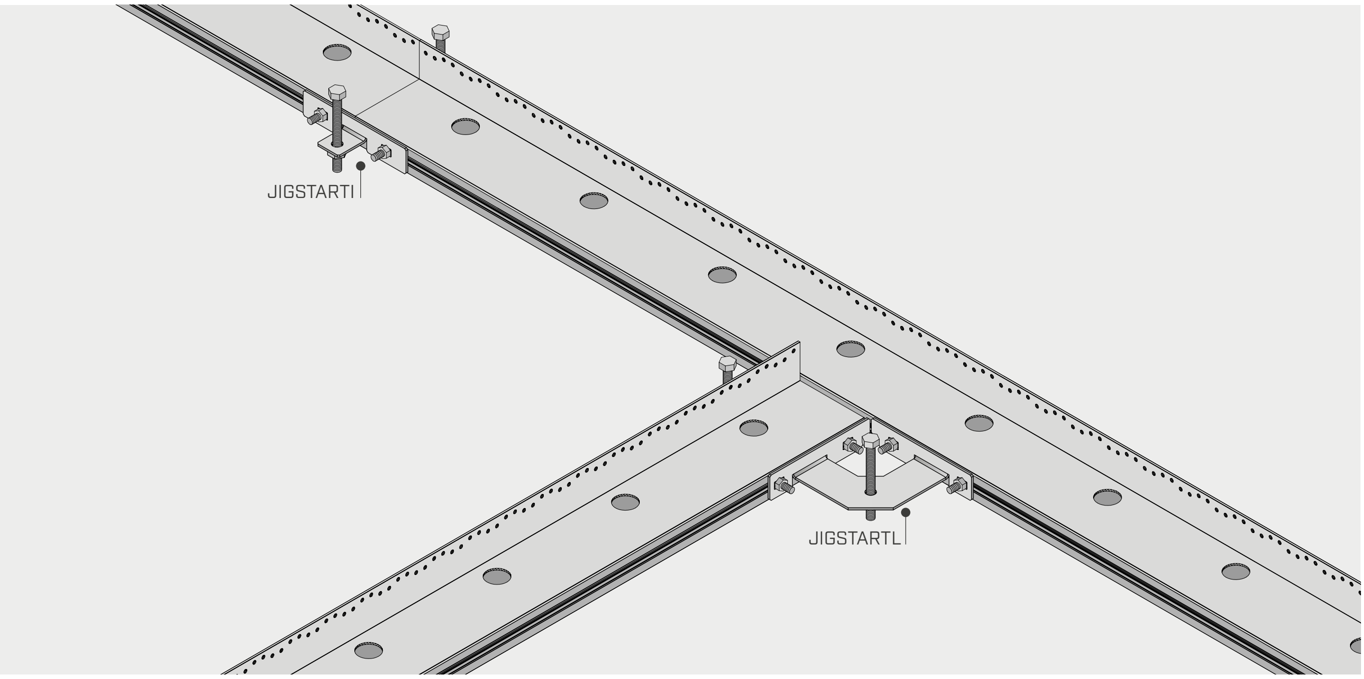


3

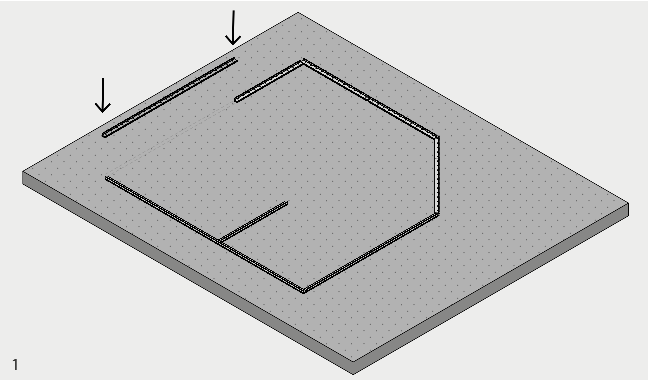


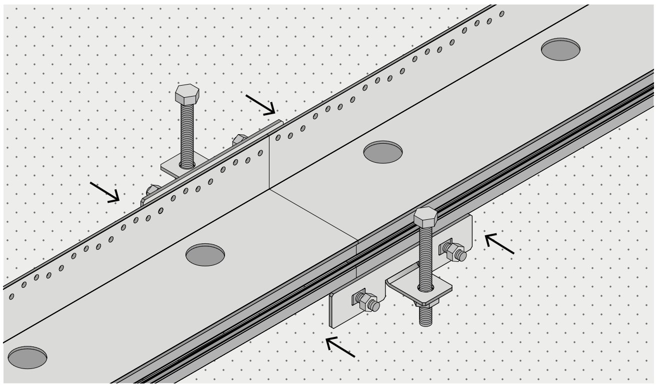
4

JIGSTARTI templates can connect two consecutive profiles and must be positioned on both sides of ALUSTART, without positioning constraints along the development.
JIGSTARTL templates can be used for 90° angle connection.
On each template there is a hexagonal head bolt, which allows the height adjustment of the aluminium profiles.

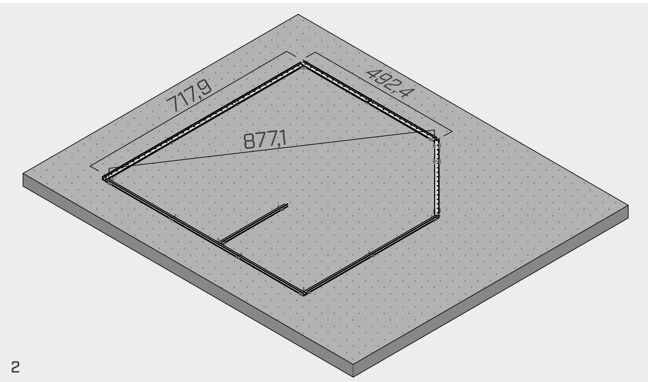


ASSEMBLY

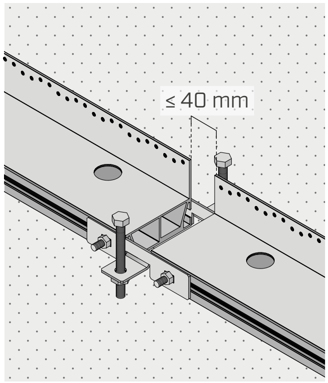


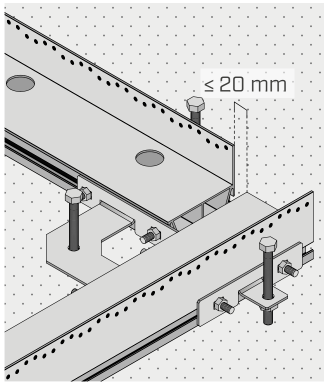


Preliminary positioning of the profiles on the laying surface using the templates and cutting the elements to size, if necessary.

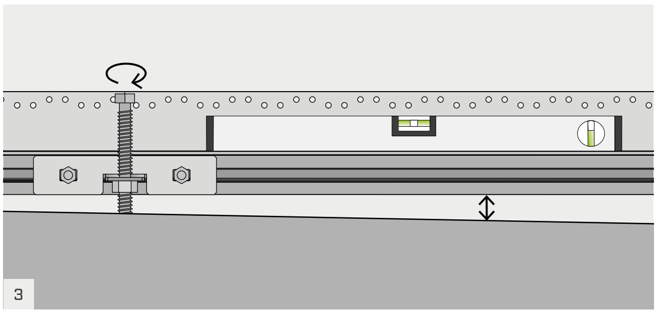


Definitive planimetric drawing with verification of lengths and diagonals.

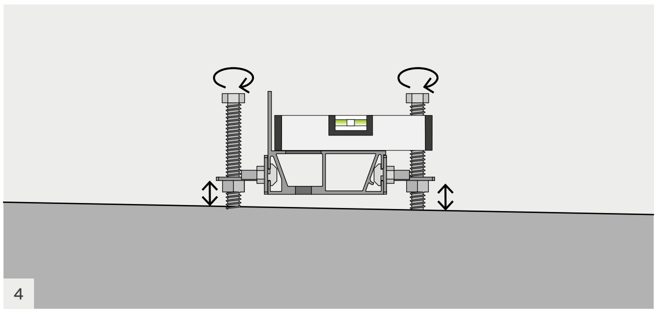




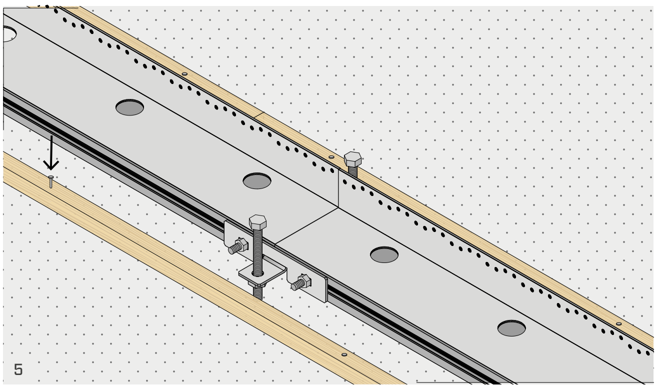
Fine adjustment with JIG START templates of the total length of the wall, compensating the tolerances of the profiles cut to size.



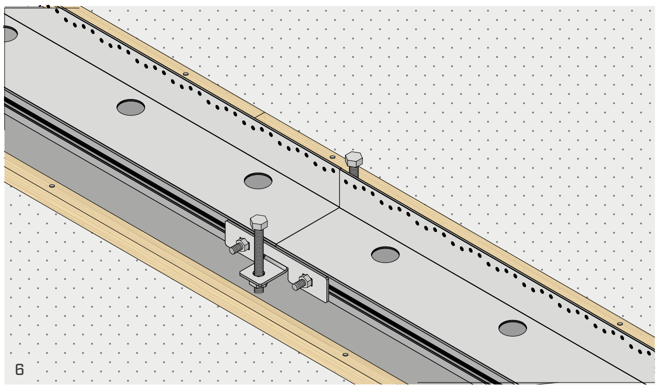
Longitudinal levelling of ALU START rods.



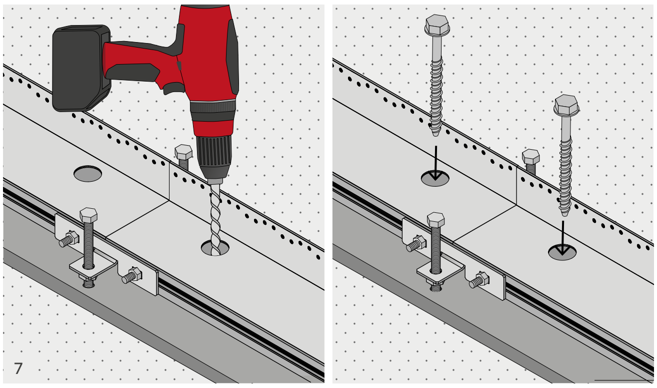
Lateral levelling of the rods.



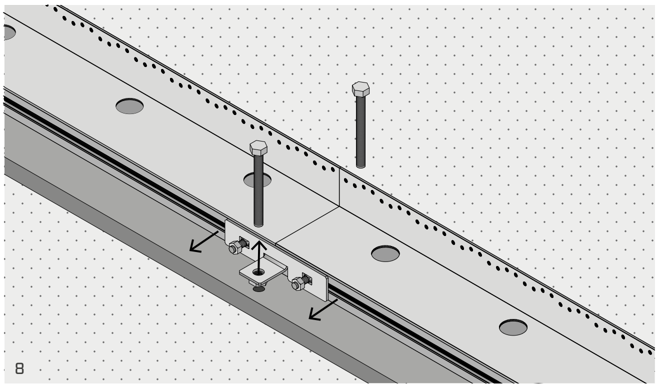
Construction of formwork with timber battens.



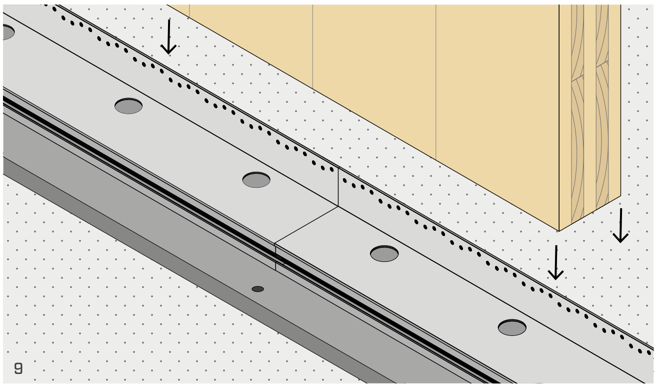
Creation of the bedding layer between the profile and the concrete support.



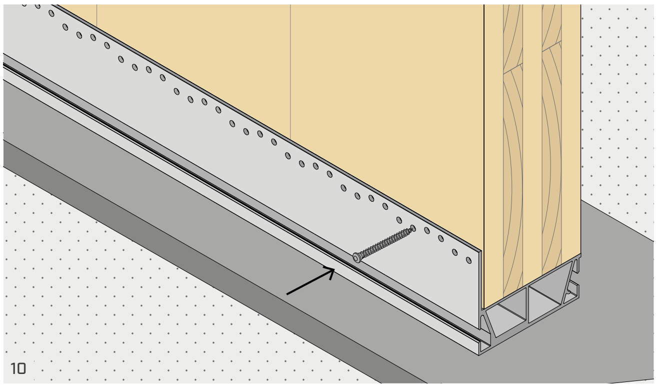
Insert the concrete anchors following the anchor installation instructions.



Removal of JIG START templates, which can be reused.



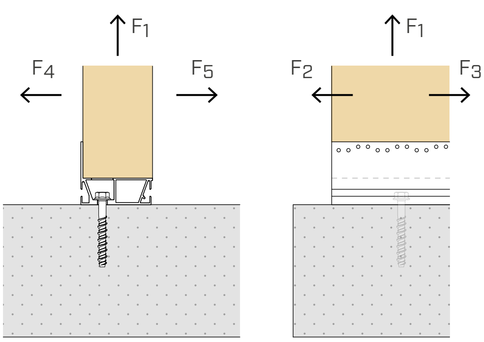
Timber walls positioning.



Profiles fastening with nails or screws.

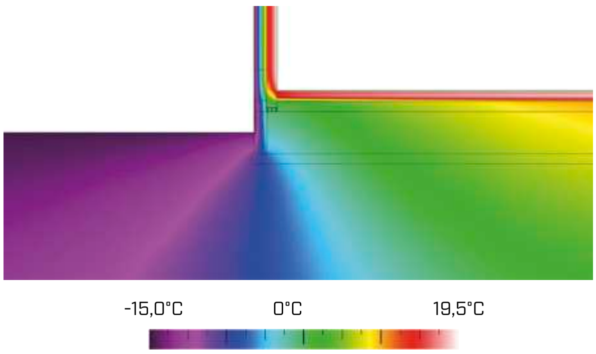
WANT TO KNOW MORE?

For further technical information on the ALU START product, see the technical data sheet at www.rothoblaas.com.



STATIC PERFORMANCE

Timber and concrete static values certified according to ETA.



THERMO-HYGROMETRIC PERFORMANCE

Linear thermal bridge modelling and calculation with FEM software.

SLOT

VIDEO

MY PROJECT SOFTWARE

CE ETA 19/0167

CONNECTOR FOR STRUCTURAL PANELS

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

HANDY
The wedge shape makes the insertion easy into the groove. The honeycomb geometry maximizes the resistance. Made of aluminium, it is light and easy to handle.

FAST INSTALLATION
Possibility of assembly with inclined auxiliary screws that make tightening between panels easy. Excellent performance: one connector can replace up to 60 screws with Ø6.

CHARACTERISTICS

FOCUS	walls and floors joints
PANELS	thickness from 90 to 160 mm
STRENGTH	$R_{v,k}$ from 35 to 120 kN
FASTENERS	HBS

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

MATERIAL
Aluminium alloy three dimensional perforated plate.

FIELDS OF USE
Wall and floor panels joint
- CLT, LVL
- glulam (Glued Laminated Timber)

MULTI-STOREY

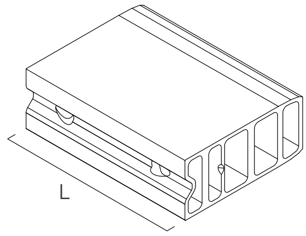
Ideal for joining walls and floors of multi-storey buildings. It allows to restore on the construction site the panels built in the factory with small dimensions for transport needs.

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

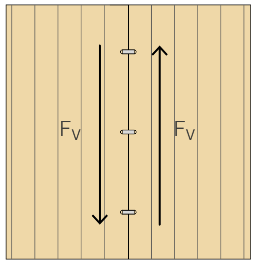
CODE	L [mm]	pcs
SLOT90	120	10



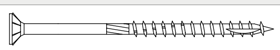
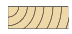
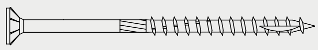
MATERIAL AND DURABILITY
SLOT: EN AW-6005A aluminium alloy.
To be used in service classes 1 and 2 (EN 1955-1-1).

FIELD OF USE
- CLT panels
- Glulam panels
- LVL softwood panels with crossed or parallel veneers
- LVL hardwood panels with crossed or parallel veneers

EXTERNAL LOADS
Shear stress in the panel plane.



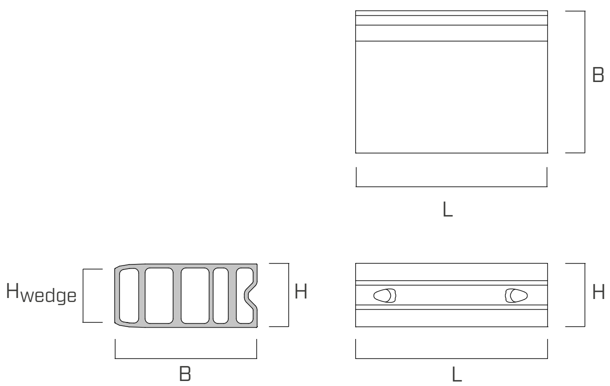
ADDITIONAL PRODUCTS - FASTENING

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

For further details refer to the "Screws and connectors for timber" catalogue.

GEOMETRY

CONNECTOR



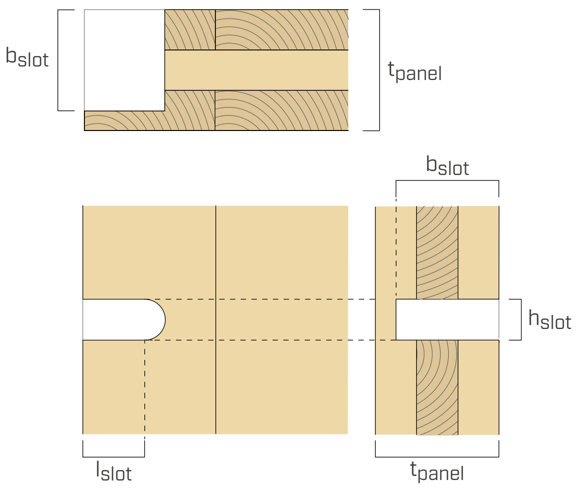
B [mm]	H [mm]	H_{wedge} [mm]	L [mm]	n_{screws} [pcs]
89	40	34	120	2

The screws are optional and not included in the package.

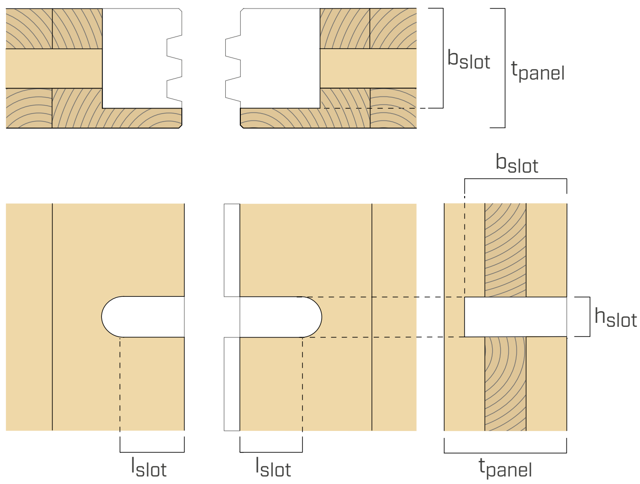
GEOMETRY

GROOVING IN THE PANEL

PANEL WITH FLAT EDGE



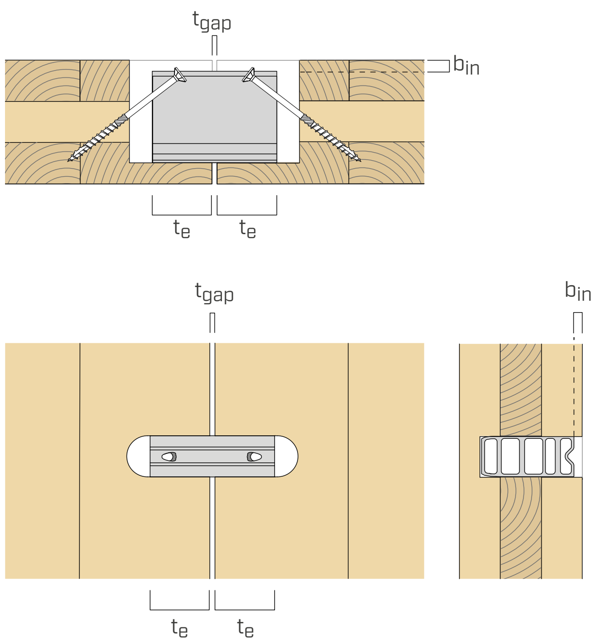
PANEL WITH TAPPED EDGE



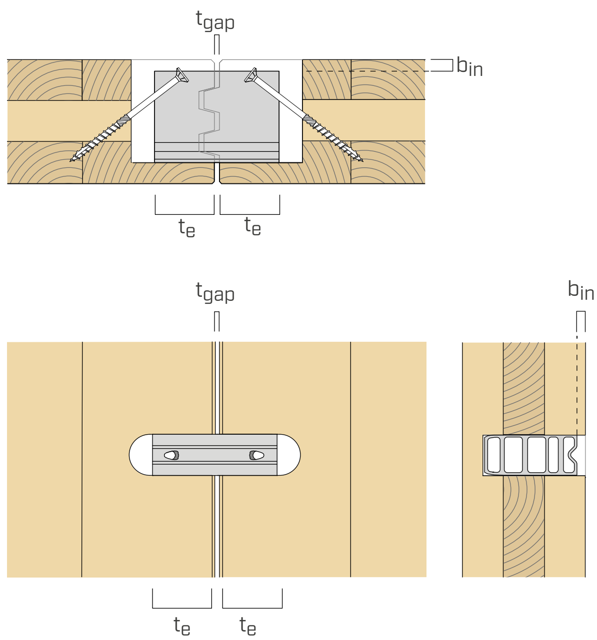
$b_{slot,min}$ [mm]	$l_{slot,min}$ [mm]	$t_{panel,min}$ [mm]	h_{slot} (1) [mm]
90	60	90	40 ± 0,5

INSTALLATION

PANEL WITH FLAT EDGE



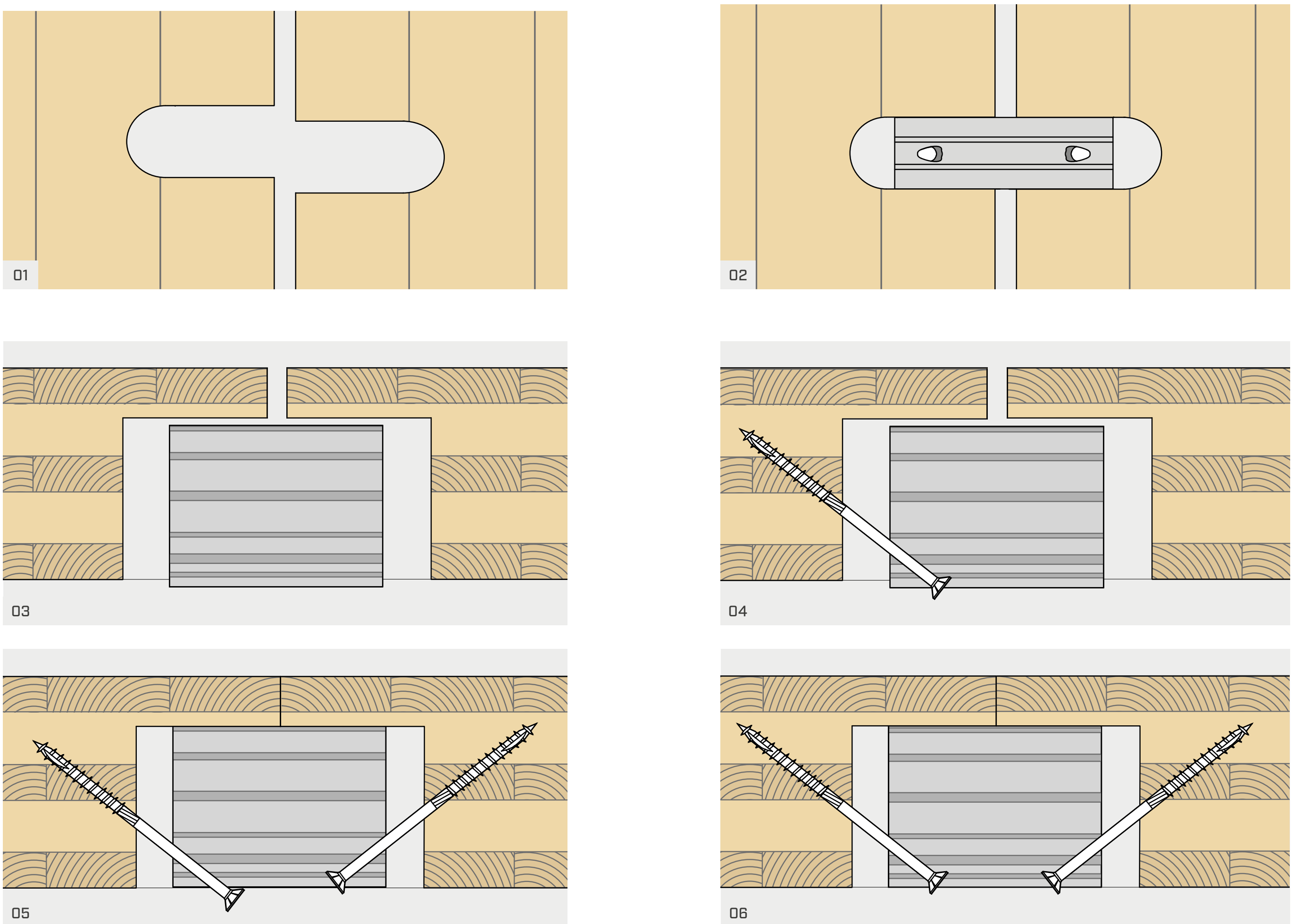
PANEL WITH TAPPED EDGE



$t_{gap,max}$ (2) [mm]	$b_{in,max}$ [mm]	$t_{e,min}$ [mm]
5	t_{panel}-90 (3)	57.5

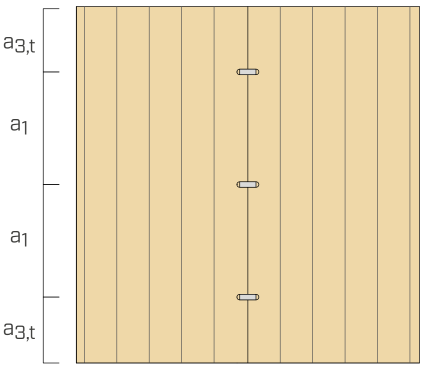
USE OF THE CONNECTOR AS ASSEMBLY EQUIPMENT

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

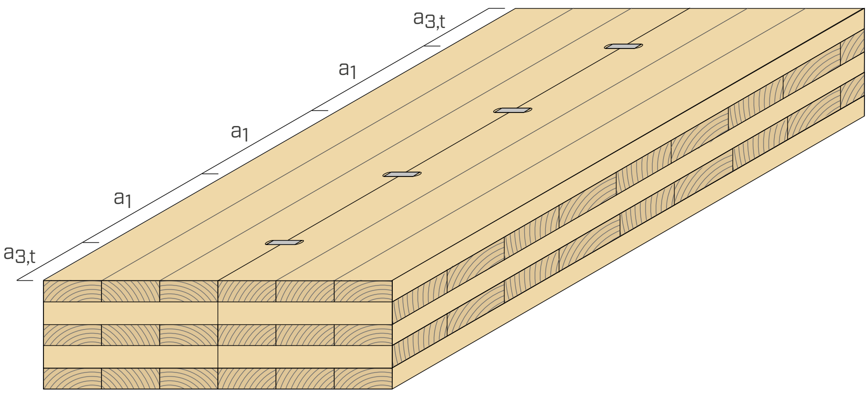


MINIMUM DISTANCES

PARETE



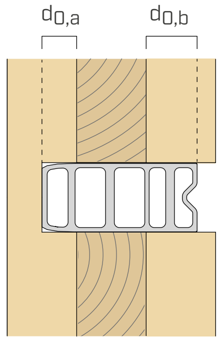
FLOOR

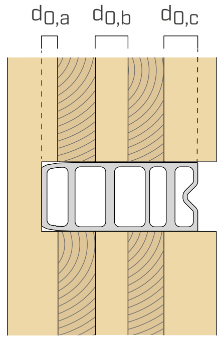


		CLT	LVL		glulam
			cross grain veneer	parallel grain veneer	
a_1	[mm]	320 (4)	320 (4)	480	480
$a_{3,t}$	[mm]	320 (4)	320 (4)	480	480

STATIC VALUES

				$R_{v,k}$ [kN]	k_{ser} [kN/mm]
CLT (5)	Σd_0(6) =	40	[mm]	**34.37**	17,50
		45	[mm]	**37.81**	
		49	[mm]	**40.57**	
		50	[mm]	**41.26**	
		55	[mm]	**44,70**	
		59	[mm]	**47.46**	
		60	[mm]	**48.15**	
		65	[mm]	**51.59**	
		69	[mm]	**54.35**	
LVL softwood	cross grain veneer (7)			**52.72**	24,00
	parallel grain veneer (8)			**70.97**	
LVL hardwood	cross grain veneer (9)			**125.71**	48.67
	parallel grain veneer (10)			**116.59**	
glulam (11)				**68.13**	25.67





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

NOTES:

(1) The recommended tolerance of $\pm$0.5 mm is to be considered as indicative. A grooving with insufficient h_{slot} can make it difficult to insert the connector; a grooving with excessive h_{slot} can decrease the initial stiffness of the connection. Before cutting the first batch of panels, it is advisable to make test grooves in order to verify the quality of the grooves made by the specific machine used to cut the panels.

(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 Σd_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} = 0mm.

(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:

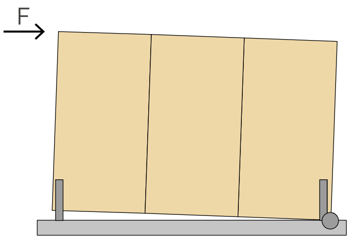
- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-19/0167.
- The design values are obtained from the characteristic values as follows: The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

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

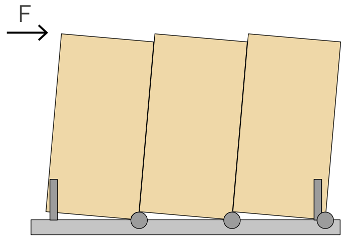
  Dimensioning and verification of the timber elements must be carried out separately.
- Resistance values for the fastening system are valid for the calculation examples shown in the table. For different calculation methods, the MyProject software is available free of charge (www.rothoblaas.com).
- The 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.

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

SINGLE-WALL BEHAVIOUR



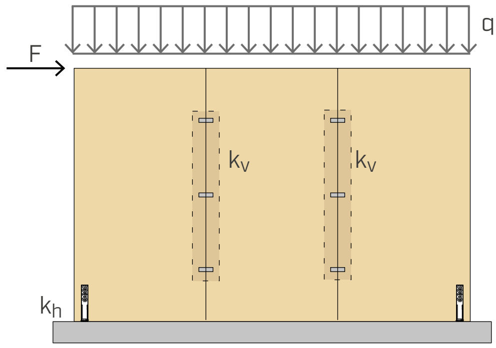
COUPLED PANEL BEHAVIOUR



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:

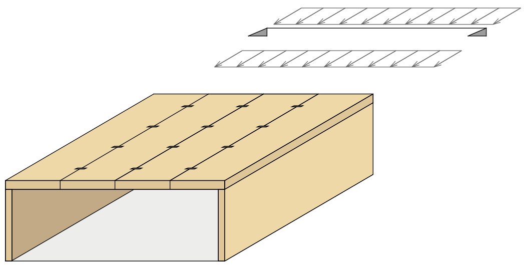
- k_v= total shear stiffness of the connection between panels;
- k_h= tensile strength of the hold-down.

At equal conditions, it can be stated that for high k_v/k_h values (i.e. for high kv_{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.



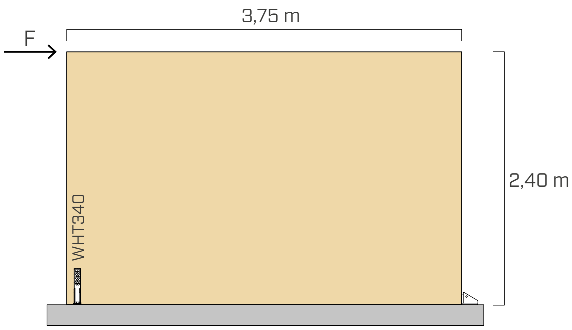
THE ADVANTAGE OF HIGH STIFFNESS CERTIFIED BY TEST

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.

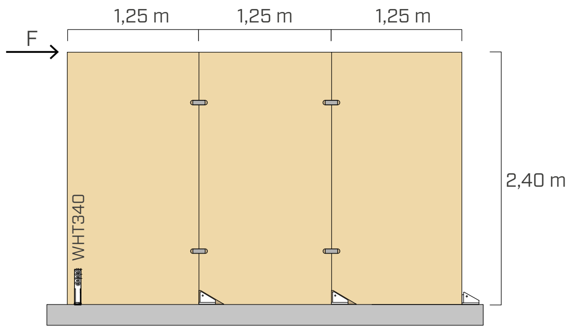
EXPERIMENTAL COMPARISON BETWEEN CONNECTION SYSTEMS

In 2019, an experimental campaign on full-scale walls was carried out at the CNR-IBE laboratories in S.Michele All'Adige. The aim of the campaign is to determine the rotational behaviour of multi-panel walls, assembled using different connection systems. The tests are monotonic in displacement control.

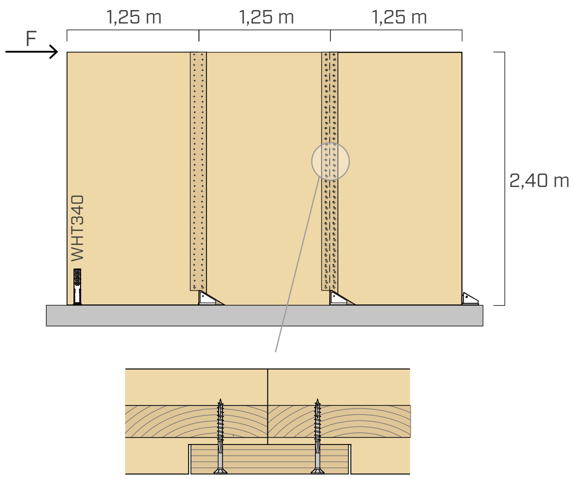
TEST 1A: SINGLE PANEL WHT340



TEST 2A: 2 SLOT CONNECTORS

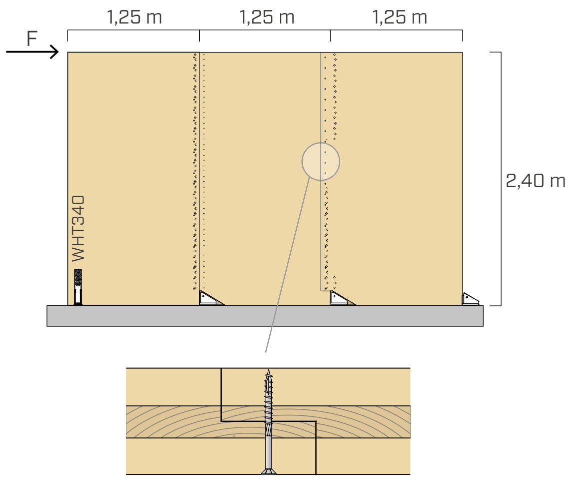


TEST 3: SPLINE JOINT



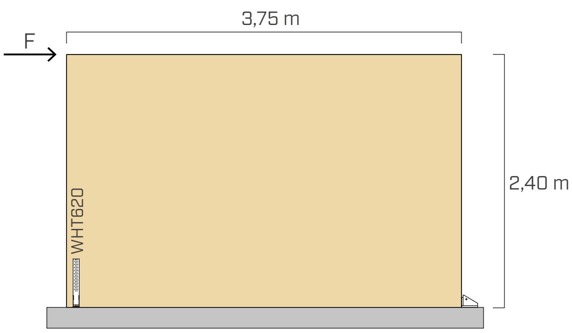
2 x HBS Ø6 x 70 spacing 50 mm

TEST 4: HALF-LAP JOINT

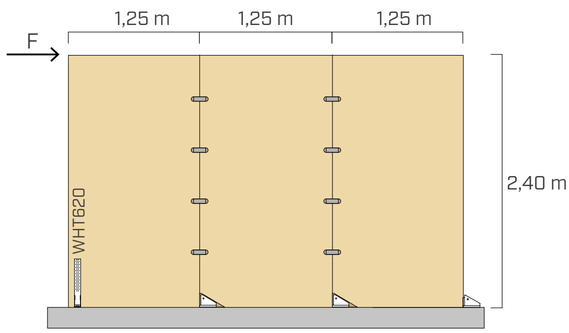


HBS Ø8 x 100 spacing 100 mm

TEST 1B: SINGLE PANEL WHT620



TEST 2B: 4 SLOT CONNECTORS



Two series of tests were carried out, the first one fastening the wall to the ground using 1 WHT340 with washer and 20 Anker Ø4 x 60 nails:

- TEST 1A: full panel.
- TEST 2A: three panels connected together with 2 SLOT connectors.
- TEST 3: three panels connected to each other with LVL joint covers and pairs of HBS Ø6 x 70 screws with 50 mm spacing (88 screws for each connection).
- TEST 4: three panels connected to each other with half lap joint and HBS Ø8 x 100 screws with 100 mm spacing (22 screws for each connection).

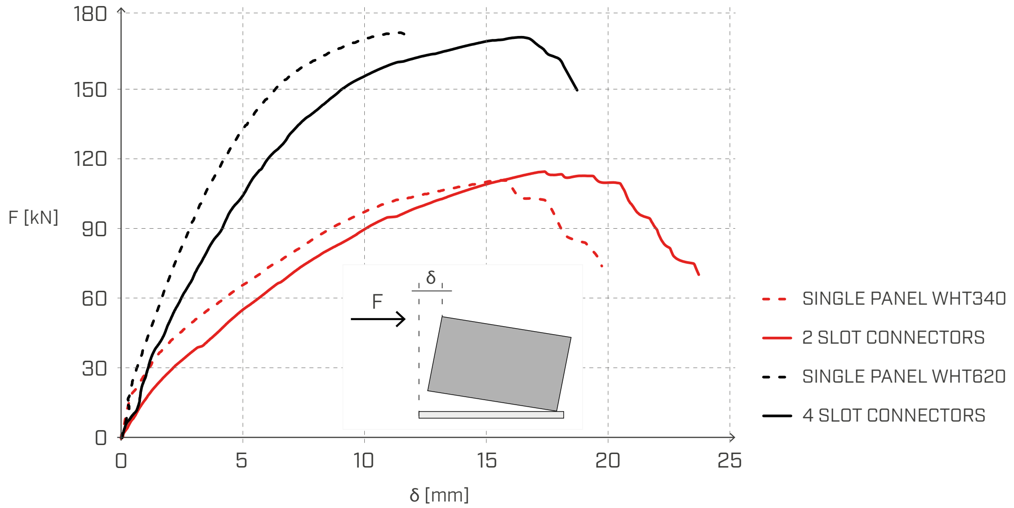
In the second series of tests, the walls are fastened to the ground using 1 WHT620 with washer and 55 Anker Ø4 x 60 nails:

- TEST 1B: full panel.
- TEST 2B: three panels connected together with 4 SLOT connectors for each connection.

Experimental comparisons are shown on the following page.

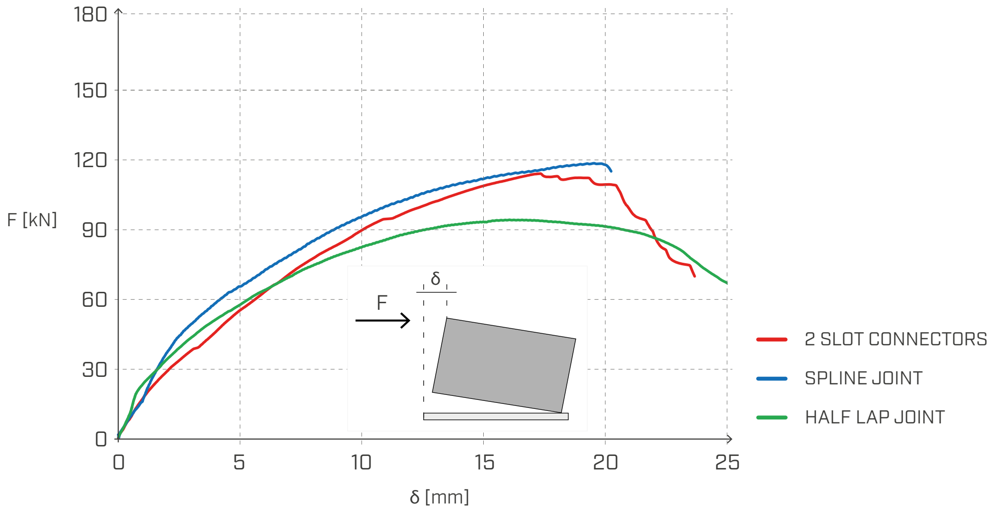
EXPERIMENTAL COMPARISON BETWEEN CONNECTION SYSTEMS

SLOT - SINGLE PANEL COMPARISON



The graph shows the comparison between single panel and panels connected with the SLOT connector. Both tests with SLOT connectors have a **marked single-wall behaviour**, with a single pivot point located in the compressed edge of the wall. The SLOT connectors remained in the elastic field in both tests, while the hold-down failure occured. The walls connected with the SLOT connector show a 20-30% loss of stiffness compared to the single panel. By increasing the number of connectors, **it is possible to bring the stiffness of the multi-panel wall even closer to the corresponding stiffness of the single panel.** For example, on a 2,40 m high wall it is possible to install up to a maximum of 6 SLOTs for each connection, tripling the stiffness of the vertical joints for the 2A configuration.

SLOT - SPLINE JOINT - HALF LAP JOINT COMPARISON



The graph shows a comparison between test 2A (2 SLOT connectors) and the other connection systems (tests 3 and 4). The tests have been designed to represent two borderline cases:

- for **TEST 2A**, using the minimum number of SLOT connectors (2 connectors);
- for **TEST 3 and 4**, using a very large number of screws (22 screws for the half-lap joint and 88 screws for the spline joint). The wall connected with 2 SLOT connectors, can show a behaviour comparable to that of walls connected with a very large number of screws.

This means that, in case the designer decides to further approximate the behaviour of the multi-panel wall to that of the single panel, **the SLOT system has wide margins in terms of increased stiffness, while the other connection systems tested already reach their maximum stiffness limit** due to the difficulty in further increasing the number of screws.

ANALYTICAL COMPARISON BETWEEN CONNECTION SYSTEMS

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

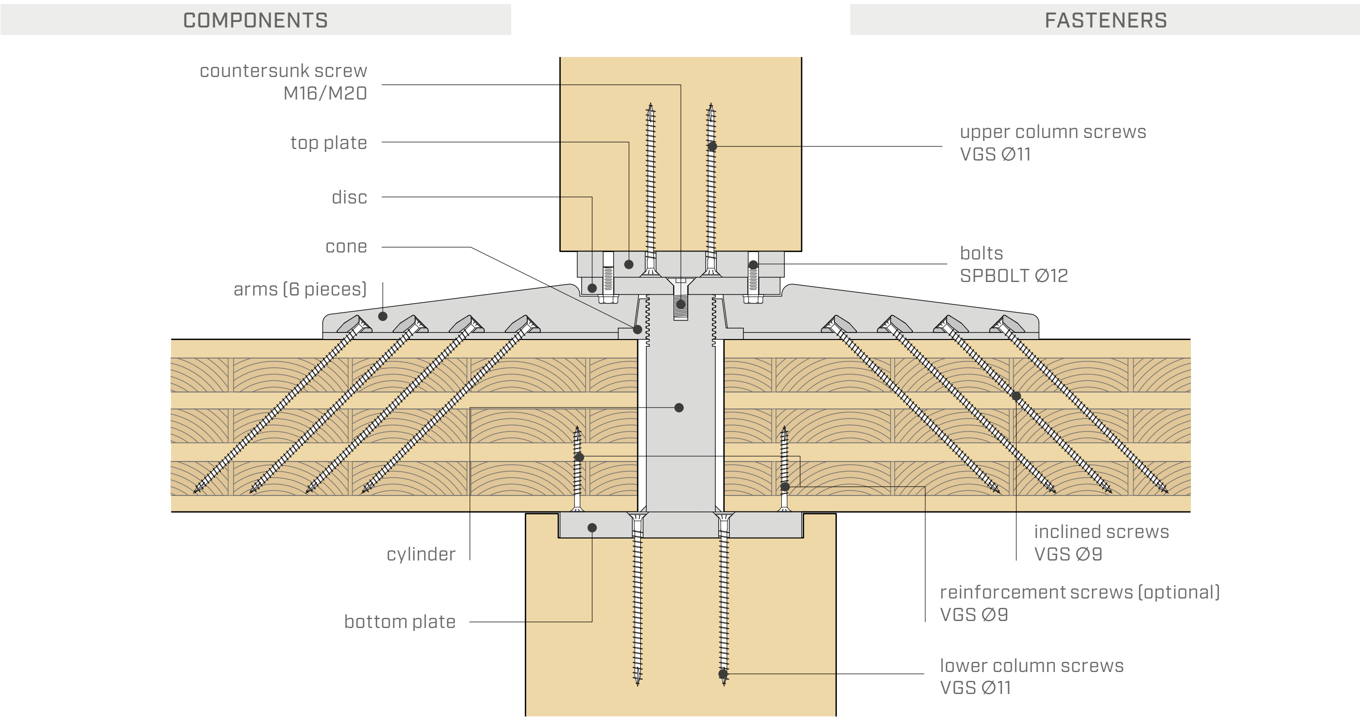
The strength values are calculated according to ETA-19/0167, ETA-11/0030 and EN 1995-1-1.

The tables show a comparison in terms of strength between the three types of 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.

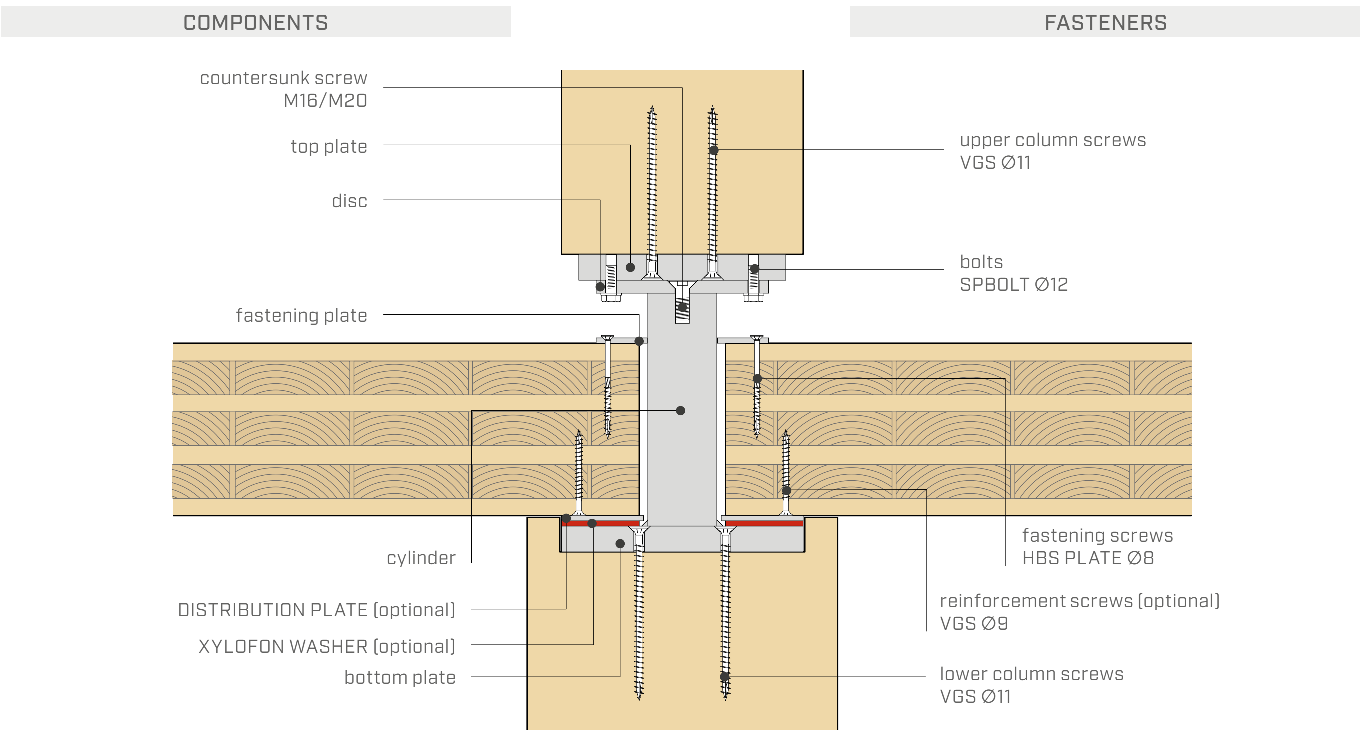
SPIDER AND PILLAR CONNECTORS

The SPIDER connector is the result of an idea born within the Arbeitsbereich für Holzbau of the University of Innsbruck and realised through close collaboration with Rothoblaas. The ambitious research project, co-financed by the Österreichische Forschungsförderungsgesellschaft (FFG), led to the development, for the first time in the world, of a metal connector for the construction of flat CLT floors that are placed precisely. The experimental campaign allowed the development of 10 models, suitable for different applications.
The PILLAR connector is a simplified version of the SPIDER connector, suitable for columns with smaller spacing; it can adapt with versatility to different types of applications.

SPIDER



PILLAR



PREDIMENSIONING TABLES

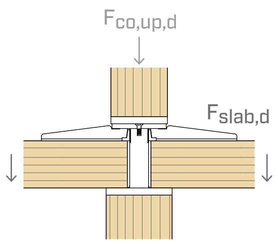
SPIDER CONNECTOR DESIGN STRENGTHS

MODEL	CLT floor thickness [mm]							COLUMNS
	160	180	200	220	240	280	160 + 160	
	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	
SPI60S	345 + 296	290 + 349	240 + 401	185 + 454	135 + 506	135 + 506	245 + 394	GL32h
SPI80S	630 + 296	575 + 349	525 + 401	470 + 454	420 + 506	420 + 506	530 + 394	GL32h
SPI80M	920 + 296	865 + 349	815 + 401	760 + 454	710 + 506	710 + 506	820 + 394	GL32h
SPI80L	1215 + 296	1185 + 349	1135 + 401	1080 + 454	1030 + 506	1030 + 506	1140 + 394	GL32h
SPI100S	1515 + 296	1515 + 349	1515 + 401	1515 + 454	1475 + 506	1475 + 506	1515 + 394	LVL BEECH
SPI100M	1965 + 296	1930 + 349	1895 + 401	1855 + 454	1820 + 506	1820 + 506	2030 + 394	LVL BEECH
SPI120S	2490 + 296	2440 + 349	2385 + 401	2335 + 454	2280 + 506	2280 + 506	2395 + 394	LVL BEECH
SPI120M	2855 + 296	2855 + 349	2855 + 401	2855 + 454	2855 + 506	2855 + 506	2855 + 394	LVL BEECH
SPI100L	3805 + 296	3805 + 349	3805 + 401	3805 + 454	3805 + 506	3805 + 506	3805 + 394	STEEL
SPI120L	4840 + 296	4840 + 349	4840 + 401	4840 + 454	4840 + 506	4840 + 506	4840 + 394	STEEL

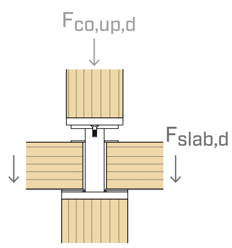
PILLAR CONNECTOR DESIGN STRENGTHS

MODEL	CLT floor thickness [mm]					COLUMNS
	160	180	200	220	240	
	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	$F_{co,up,d}$ + $F_{slab,d}$ [kN]	
PIL60S	470 + 132	470 + 145	470 + 157	470 + 157	470 + 184	GL32h
PIL80S	815 + 167	815 + 181	815 + 195	815 + 195	815 + 225	GL32h
PIL80M	1005 + 208	990 + 223	975 + 239	975 + 239	940 + 272	GL32h
PIL80L	1325 + 208	1310 + 223	1295 + 239	1295 + 239	1265 + 272	GL32h
PIL100S	1515 + 162	1515 + 175	1515 + 190	1515 + 190	1515 + 220	LVL BEECH
PIL100M	2205 + 202	2205 + 218	2205 + 234	2205 + 234	2205 + 266	LVL BEECH
PIL120S	2675 + 196	2660 + 211	2645 + 227	2645 + 227	2610 + 260	LVL BEECH
PIL120M	3200 + 196	3185 + 211	3170 + 227	3170 + 227	3140 + 260	LVL BEECH
PIL100L	4435 + 202	4435 + 218	4435 + 234	4435 + 234	4435 + 266	STEEL
PIL120L	5480 + 196	5480 + 211	5480 + 227	5480 + 227	5480 + 260	STEEL

SPIDER



PILLAR



NOTES:

The strengths shown in the table refer to the design values, calculated in accordance with EN 1993-1-1, EN 1993-1-12 and EN 1995-1-1 considering an average life class load (k_{mod}=0.8).

For safety reasons, an CLT floor height of 320 mm has been considered.

All strength refers to the situation "with reinforcement". For the PILLAR connector, the configuration shown is the one with central support (see the specific chapter).

The values shown in the table are to be considered as connector pre-dimensioning values. The structural verification must be carried out in accordance with the tables on the following pages. Dimensioning and verification of the timber elements must be carried out separately.

PREDIMENSIONING ABACUS

The abacus can be used for an initial selection of the connector to be used in each position and for each floor.
In the abacus, each column refers to a different area of influence A_i of the column in question, while each row refers to a different level, the levels are numbered starting from the roof floor and going downwards.
By crossing influence area and level, it is possible to determine the most suitable connector for each level. The calculation is performed with reference to a design load on the floor at the Ultimate Limit State of 8,0 kN/m^2 with average load duration class (k_{mod}=0,8). The final selection and structural verification must be carried out in accordance with the tables shown on the following pages. Dimensioning and verification of the timber elements must be carried out separately.

The colours of the various cells make it possible to determine the most suitable material for the construction of the column on which the SPIDER or PILLAR connector will be placed. In any case, a more refined calculation, as well as the choice of a different column type, can be performed in accordance with the tables on the following pages.

Glulam column

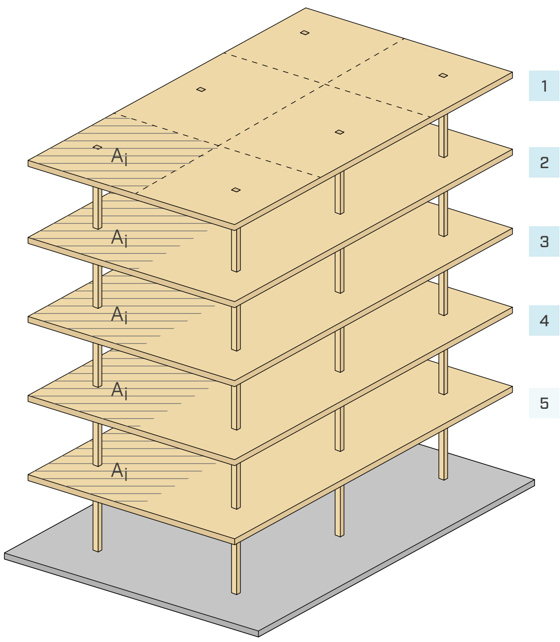
LVL hardwood column

Steel column

EXAMPLE

With reference to the 5-storey building shown in the drawing and to the column highlighted, an area of influence of about 40 m^2 is assumed. First of all, the connectors and columns to be used are the following:

Floor	1	SPI60S **connector** on glulam column
Floor	2	SPI80S **connector** on glulam column
Floor	3	SPI80M **connector** on glulam column
Floor	4	SPI80L **connector** on glulam column
Floor	5	SPI100S **connector** on LVL hardwood column



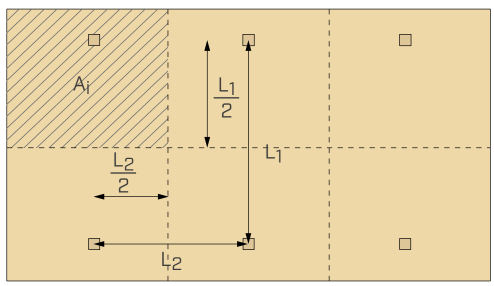


Diagram of floor areas of influence.

PREDIMENSIONING ABACUS

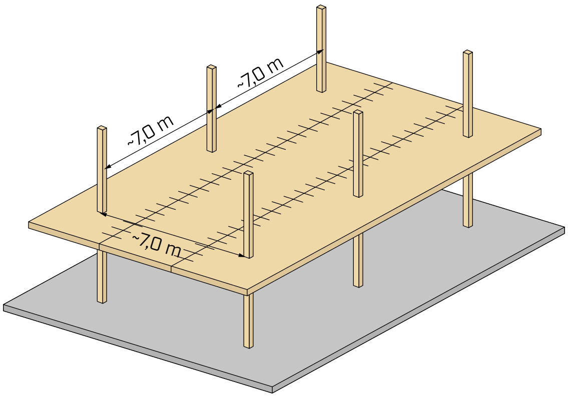
floor number	A_i [m^2]								
	10	15	20	25	30	35	40	45	50
1	PIL60S	PIL60S	PIL80S	PIL80M	SPI60S	SPI60S	SPI60S	SPI60S	SPI60S
2	PIL60S	PIL60S	PIL80S	PIL80M	SPI80S	SPI80S	SPI80S	SPI80S	SPI80S
3	PIL60S	PIL60S	PIL80S	PIL80M	SPI80S	SPI80M	SPI80M	SPI80L	SPI80L
4	PIL60S	PIL60S	PIL80S	PIL80M	SPI80M	SPI80L	SPI80L	SPI100S	SPI100S
5	PIL60S	PIL80S	PIL80S	PIL80M	SPI80L	SPI80L	SPI100S	SPI100S	SPI100M
6	PIL60S	PIL80S	PIL80S	PIL80L	SPI100S	SPI100S	SPI100M	SPI100M	SPI120S
7	PIL80S	PIL80S	PIL80M	PIL80L	SPI100S	SPI100M	SPI120S	SPI120S	SPI120M
8	PIL80S	PIL80M	PIL80L	PIL100M	SPI100M	SPI120S	SPI120S	SPI120M	SPI120M
9	PIL80S	PIL80M	PIL80L	PIL100M	SPI120S	SPI120S	SPI120M	SPI100L	SPI100L
10	PIL80S	PIL80L	PIL100S	PIL100M	SPI120S	SPI120M	SPI100L	SPI100L	SPI100L
11	PIL80S	PIL80L	PIL100M	PIL100M	SPI120M	SPI120M	SPI100L	SPI100L	SPI120L
12	PIL80M	PIL100S	PIL100M	PIL100M	SPI120M	SPI100L	SPI100L	SPI120L	SPI120L
13	PIL80M	PIL100S	PIL100M	PIL120S	SPI100L	SPI100L	SPI120L	SPI120L	SPI120L
14	PIL80L	PIL100M	PIL100M	PIL120S	SPI100L	SPI100L	SPI120L	SPI120L	-
15	PIL80L	PIL100M	PIL120S	PIL120M	SPI100L	SPI120L	SPI120L	-	-
16	PIL80L	PIL100M	PIL120S	PIL120M	SPI100L	SPI120L	SPI120L	-	-
17	PIL80L	PIL100M	PIL120S	PIL100L	SPI120L	SPI120L	-	-	-
18	PIL100S	PIL100M	PIL120M	PIL100L	SPI120L	SPI120L	-	-	-
19	PIL100S	PIL100M	PIL120M	PIL100L	SPI120L	-	-	-	-
20	PIL100M	PIL120S	PIL120M	PIL100L	SPI120L	-	-	-	-
21	PIL100M	PIL120S	PIL100L	PIL100L	SPI120L	-	-	-	-
22	PIL100M	PIL120S	PIL100L	PIL100L	-	-	-	-	-
23	PIL100M	PIL120S	PIL100L	PIL100L	-	-	-	-	-
24	PIL100M	PIL120M	PIL100L	PIL120L	-	-	-	-	-
25	PIL100M	PIL120M	PIL100L	PIL120L	-	-	-	-	-
26	PIL100M	PIL120M	PIL100L	PIL120L	-	-	-	-	-
27	PIL100M	PIL120M	PIL100L	PIL120L	-	-	-	-	-
28	PIL100M	PIL100L	PIL100L	PIL120L	-	-	-	-	-
29	PIL120S	PIL100L	PIL120L	-	-	-	-	-	-
30	PIL120S	PIL100L	PIL120L	-	-	-	-	-	-

FLOOR CONSTRUCTION MODES

There are two different installation modes for the SPIDER connector and two for the PILLAR connector.
It is possible to adopt mixed solutions in which both connectors are used on the same floor, in order to optimize performance and costs.

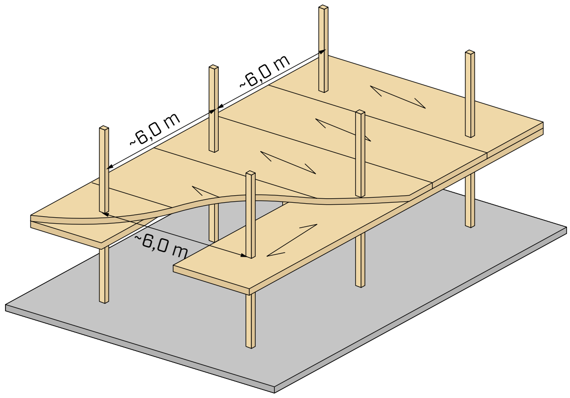
SPIDER

PLATE FLOOR



- maximum spacing between the columns
- it exploits the two-dimensional behaviour of the panel

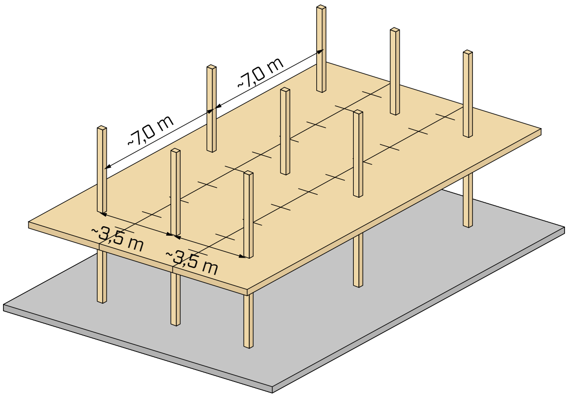
CROSSED PANELS



- services duct at the bottom of beam
- no moment connections

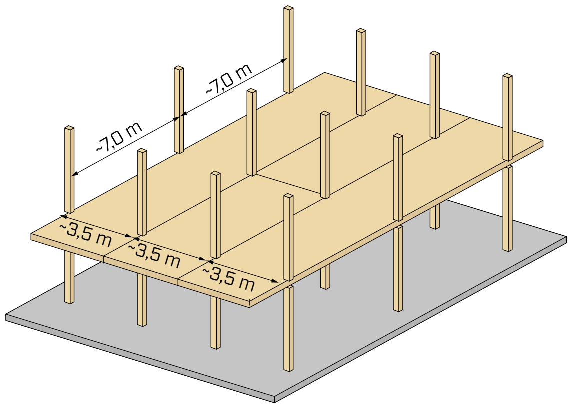
PILLAR

CENTRAL SUPPORTS



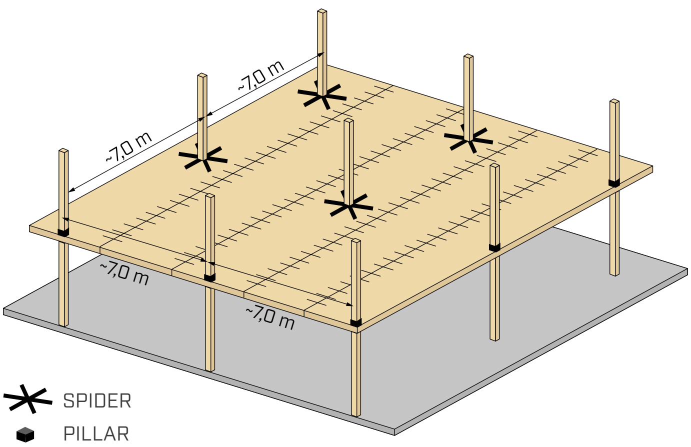
- fewer columns than the edge/angle supports
- external walls free of columns

EDGE/ANGLE SUPPORTS



- no props
- no moment connections

SPIDER + PILLAR



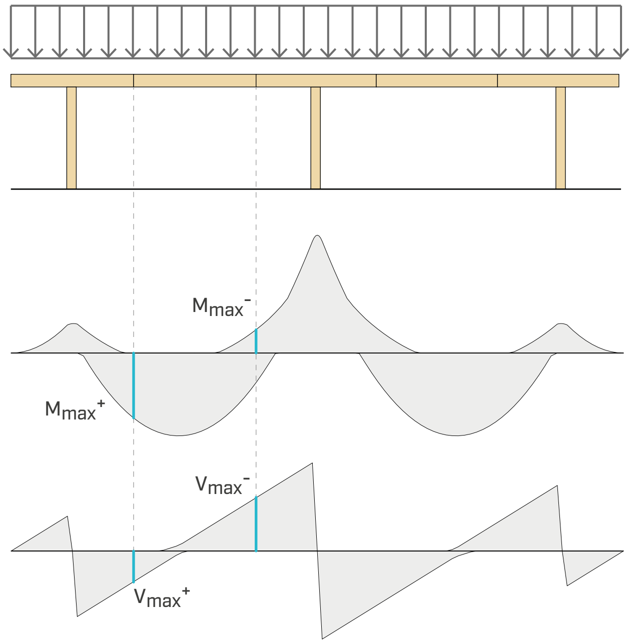
The PILLAR connector can be used together with the SPIDER connector in the less stressed supports or in the edge and angle areas, in order to optimize performance and costs.
This solution allows greater architectural freedom in the positioning of the columns in the base area.

- maximum architectural freedom in the columns positioning
- optimization of performance and costs

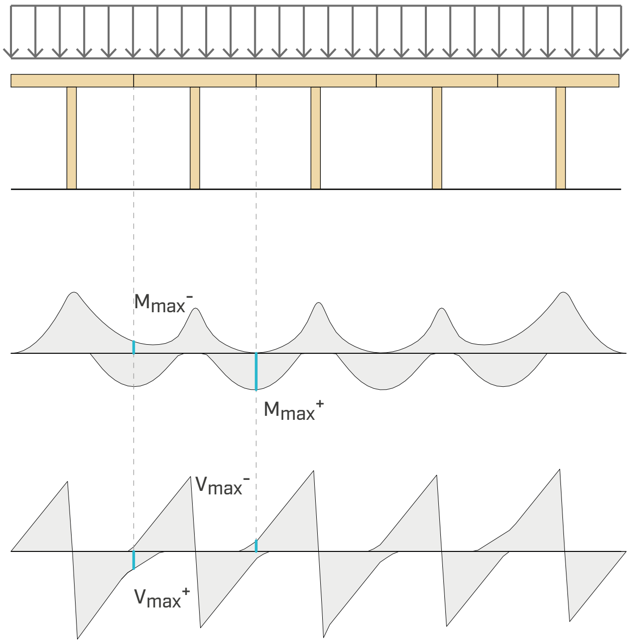
STRESSES ON CONNECTIONS BETWEEN CLT PANELS

The plate behaviour of the CLT floor can be achieved by means of special moment resisting connections. The connections, normally positioned at 1/4 of the span for the SPIDER WITH PLATE FLOOR system, are never subject to the maximum stress moment. In the case of the PILLAR WITH CENTRAL SUPPORTS system, the connections are positioned approximately in the middle, where the moment is however reduced due to the reduced spacing between the columns.
Vertical sections are represented in correspondence to a column in the following patterns.

SPIDER WITH PLATE FLOOR

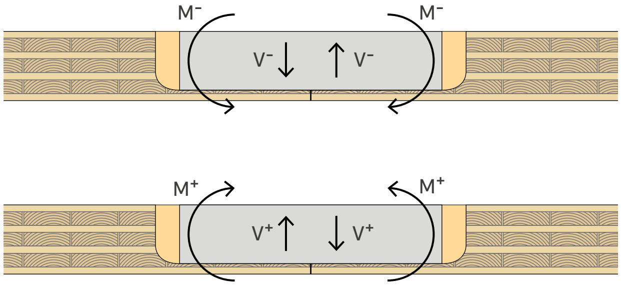


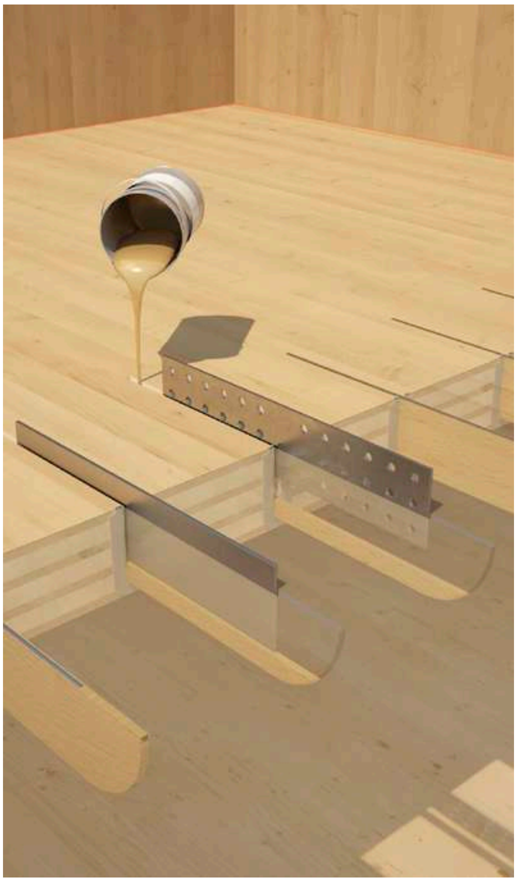
PILLAR WITH CENTRAL SUPPORTS



SPECIAL CONNECTION BETWEEN CLT PANELS

Moment connection made with steel plates glued in vertical grooving into the panel. The connection geometry ensures positive and negative moment strength, adapting to typical envelope stresses. The use of a high-performance material such as steel in combination with epoxy resin guarantees excellent performance in terms of strength and flexural stiffness.





SPIDER

VIDEO

ETA 19/0700

CONNECTION AND REINFORCEMENT SYSTEM FOR COLUMNS AND FLOORS

MULTI-STOREY BUILDINGS

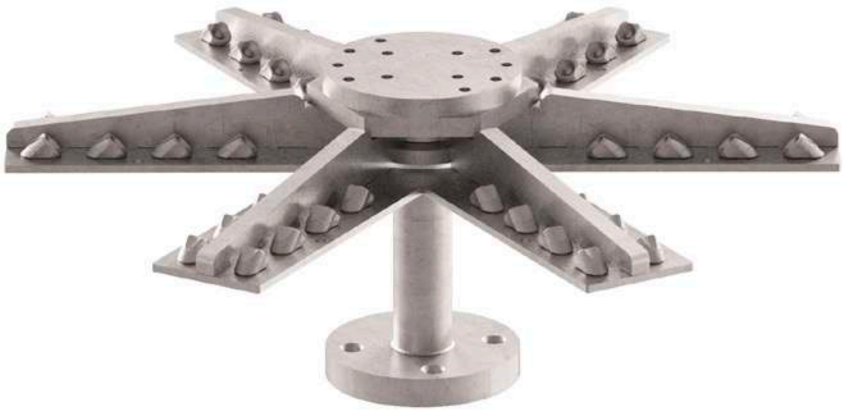
It allows the construction of multi-storey buildings with a column-to-floor structure. Certified, calculated and optimised for glulam, LVL, steel and reinforced concrete columns. New architectural and structural horizons.

COLUMN-TO-COLUMN

The steel core of the system prevents the CLT panels from being crushed and allows more than 5000 kN of vertical load to be transferred between the columns.

REINFORCEMENT SYSTEM FOR CLT

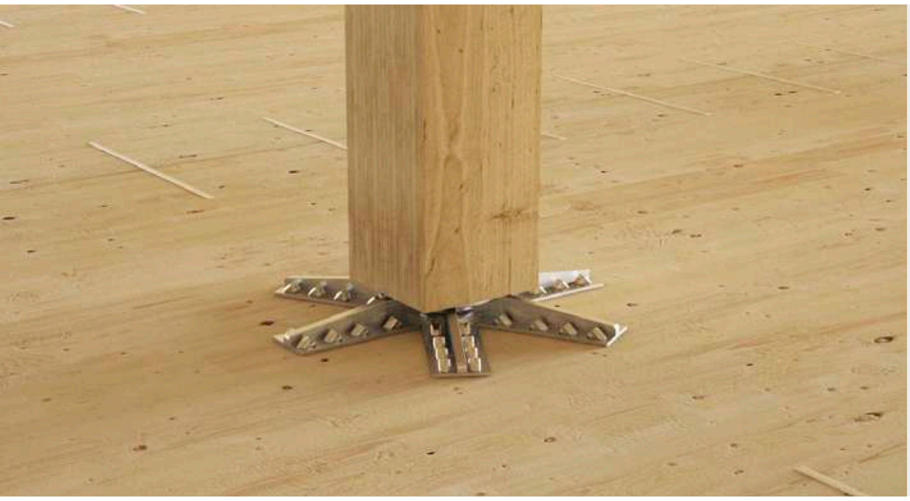
The arms of the system ensure the punching shear reinforcement of the CLT panels, allowing exceptional shear strength values. Column spacing greater than 7,0 x 7,0 m structural mesh.



CHARACTERISTICS

FOCUS	multi-storey buildings
COLUMNS	from 200 x 200 mm to 280 x 280 mm
STRUCTURAL MESH	greater than 7,0 x 7,0 m
STRENGTH	R_k compression greater than 5000 kN

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

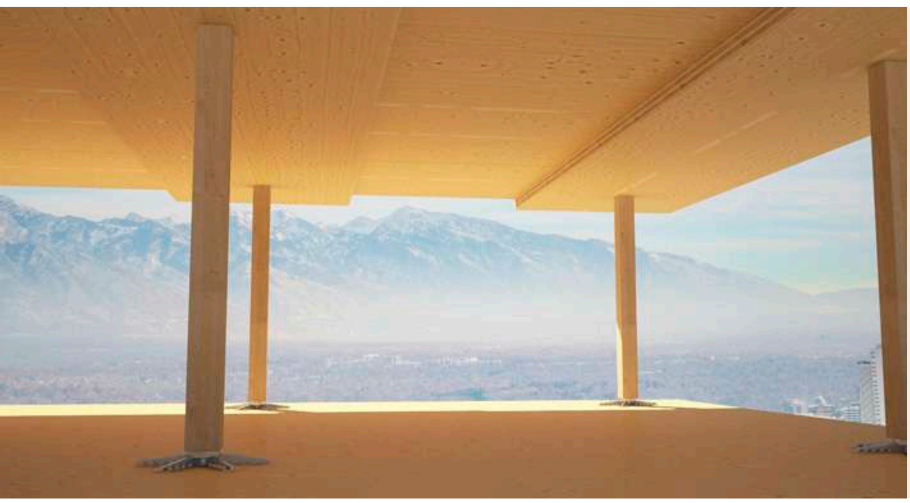


MATERIAL

S355-S690 zinc plated steel.

FIELDS OF USE

Multi-storey buildings with column-to-floor system. Solid timber, glulam, high density timber, CLT, LVL, steel and concrete columns.



WOODEN SKYCRAPERS

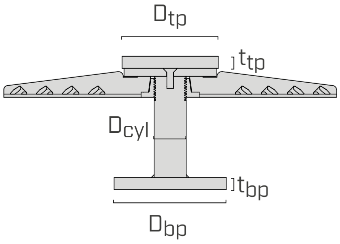
Standard connection and reinforcement system to build wooden skyscrapers with column-to-floor system. New architectural possibilities in construction.

CROSS CLT PANELS

Exceptional strength and stiffness of the structure with crossed arrangement of the CLT floors. It is possible to create free spans greater than 6,0 x 6,0 m even without the use of moment joints.

CODES AND DIMENSIONS

SPIDER CONNECTOR

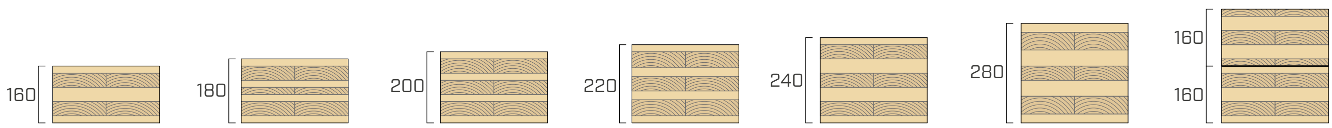


The code consists of the respective CLT panel thickness in mm (XXX = t_{CLT}).
SPI80MXXX for CLT panels with XXX = t_{CLT} = 200 mm : code **SPI80M200**.

CODE	cylinder D_{cyl} [mm]	bottom plate D_{bp} x t_{bp} [mm]	top plate D_{tp} x t_{tp} [mm]	weight [kg]	pcs
SPI60SXXX	60	200 x 30	200 x 20	57,7	1
SPI80SXXX	80	240 x 30	200 x 20	66,0	1
SPI80MXXX	80	280 x 30	240 x 30	76,4	1
SPI80LXXX	80	280 x 40	280 x 30	90,3	1
SPI100SXXX	100	240 x 30	240 x 20	78,3	1
SPI100MXXX	100	280 x 30	280 x 30	90,3	1
SPI120SXXX	120	280 x 30	280 x 30	95,3	1
SPI120MXXX	120	280 x 40	280 x 40	115,3	1
SPI100LXXX	100	240 x 20	not provided	67,9	1
SPI120LXXX	120	240 x 20	not provided	74,7	1

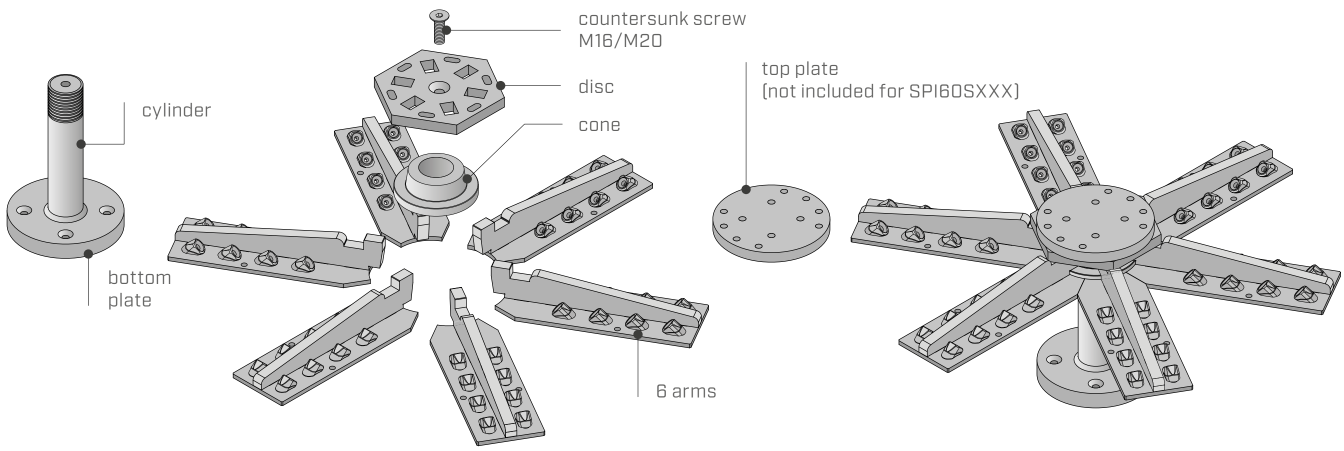
SPI60S is supplied without top plate. This can be ordered separately with the code STP20020C.

XXX = t_{CLT} [mm]						
160	180	200	220	240	280	320



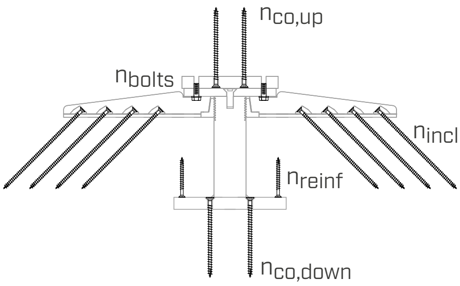
Also available for t_{CLT} thickness values not shown in the table.

Each code includes the following components:



CODES AND DIMENSIONS

NUMBER OF SCREWS FOR EACH CONNECTOR



	SPI60S - SPI80S - SPI100S-SPI100L - SPI120L	SPI80M - SPI80L - SPI100M - SPI120S - SPI120M	
n_{incl}	48	48	VGS Ø9
$n_{co,up}$	4	4	VGS Ø11
$n_{co,down}$	4	4	VGS Ø11
n_{bolts}	4	4	SPBOLT1235
n_{reinf}	14	16	VGS Ø9

Screws and bolts not included in the package.
The n_{reinf} reinforcement screws are optional.

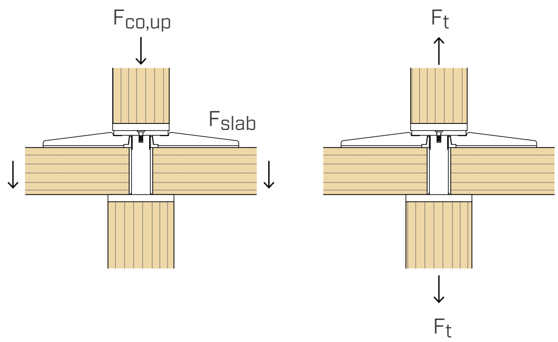
MATERIAL AND DURABILITY

SPIDER: S355-S690 zinc plated steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- CLT floors placed precisely on columns
- Solid timber, glulam, LVL softwood or LVL hardwood columns
- Steel or reinforced concrete columns

EXTERNAL LOADS

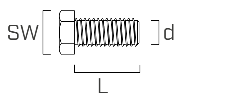


ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
HBS PLATE	screw for timber	8		556
VGS	full thread connector	9-11		564

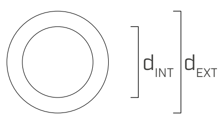
BOLT - hexagonal head steel 8.8 EN 15048

CODE	d [mm]	L [mm]	SW [mm]	pcs
SPBOLT1235	M12	35	19	100

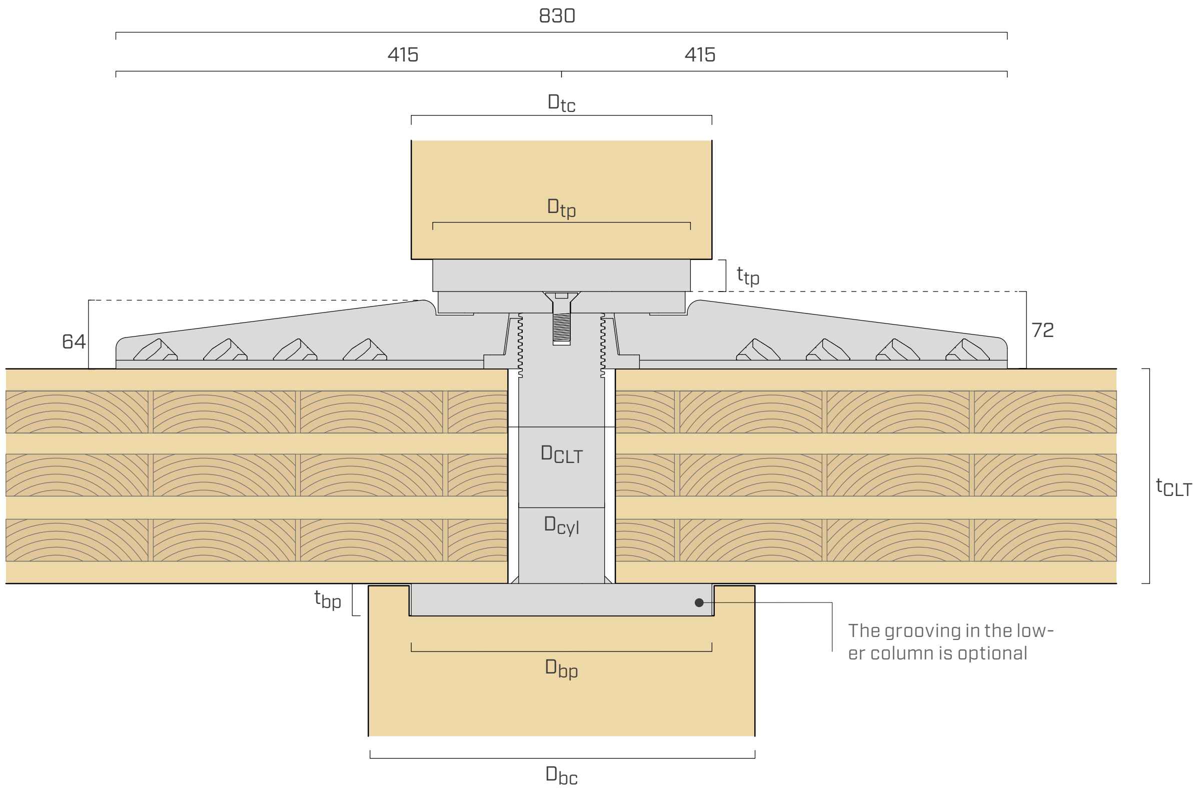


ULS 125 - washer

CODE	rod [mm]	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
ULS13242	M12	13	24	2.5	500



GEOMETRY AND MATERIALS



CONNECTOR

MODEL	bottom plate			cylinder		disc	top plate		
	D_{bp} x t_{bp} [mm]	shape	material	D_{cyl} [mm]	material	material	D_{tp} x t_{tp} [mm]	shape	material
SPI60S	200 x 30	○	S355	60	S355	S355	200 x 20	○	S355
SPI80S	240 x 30	○	S355	80	S355	S355	200 x 20	○	S355
SPI80M	280 x 30	○	S690	80	S355	S355	240 x 30	○	S355
SPI80L	280 x 40	□	S690	80	S355	S355	280 x 30	○	S690
SPI100S	240 x 30	○	S690	100	S355	S355	240 x 20	○	S690
SPI100M	280 x 30	○	S690	100	S355	S355	280 x 30	○	S690
SPI120S	280 x 30	○	S690	120	S355	S355	280 x 30	○	S690
SPI120M	280 x 40	□	S690	120	S355	S355	280 x 40	□	S690
SPI100L	240 x 20	○	S690	100	1,7225	S690		-	
SPI120L	240 x 20	○	S690	120	1,7225	S690		-	

SPI100L and SPI120L provide for fastening on steel columns without using the top plate.

COLUMNS AND CLT PANELS

MODEL	upper column	lower column	CLT panel	reinforcement (optional)	
	$D_{tc,min}$ [mm]	$D_{bc,min}$ [mm]	D_{CLT} [mm]	D_{reinf} [mm]	n_{reinf}
SPI60S	200	200	80	170	14
SPI80S	200	240	100	210	14
SPI80M	240	280	100	240	16
SPI80L	280	280	100	240	16
SPI100S	240	240	120	210	14
SPI100M	280	280	120	240	16
SPI120S	280	280	140	240	16
SPI120M	280	280	140	240	16
SPI100L	240	240	120	210	14
SPI120L	240	240	140	220	14

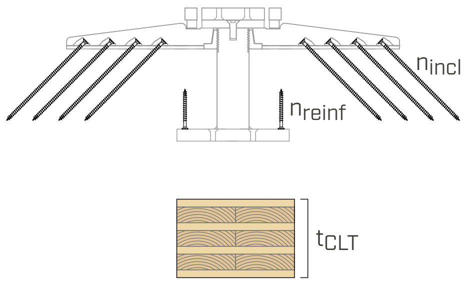
GEOMETRY AND MATERIALS

CHARACTERISTICS OF CLT PANELS

Parameter	160 mm ≤ t_{CLT} < 200 mm	t_{CLT} ≥ 200 mm
EI_x/EI_y	0,68 - 1,46	0,84 - 1,19
$GA_{z,x}/GA_{z,y}$	0,71 - 1,40	0,76 - 1,31
Min (EI_x, EI_y)	1525 kNm^2/m	3344 kNm^2/m
Max (EI_x, EI_y)	2229 kNm^2/m	3989 kNm^2/m
Min ($GA_{z,x}$, $GA_{z,y}$)	11945 kNm/m	17708 kNm/m
Max ($GA_{z,x}$, $GA_{z,y}$)	16769 kNm/m	23261 kNm/m
Lamellas thickness	≤ 40 mm	≤ 40 mm
B/t lamellas width - thickness ratio	≥ 3,5	≥ 3,5
Minimum strength class according to EN 338	C24/T14	C24/T14
Dimensional tolerance on CLT panel thickness	± 2 mm	± 2 mm
EI_x, EI_y	Flexural stiffness for x and y directions for the 1 m wide CLT panel	
$GA_{z,x}$, $GA_{z,y}$	Shear stiffness for x and y directions for the 1 m wide CLT panel	
x	Direction parallel to the upper lamellas grain	
y	Direction perpendicular to the upper lamellas grain	

CLT PANEL SCREWS

t_{CLT} [mm]	inclined screws n_{incl} [pcs - ØxL]	optional reinforcement screws n_{reinf} [pcs - ØxL]
160	48 VGS Ø9x200	VGS Ø9x100
180	48 VGS Ø9x240	VGS Ø9x100
200	48 VGS Ø9x280	VGS Ø9x100
220	48 VGS Ø9x280	VGS Ø9x120
240	48 VGS Ø9x320	VGS Ø9x120
280	48 VGS Ø9x360	VGS Ø9x140
320 (160 + 160)	48 VGS Ø9x400	VGS Ø9x160

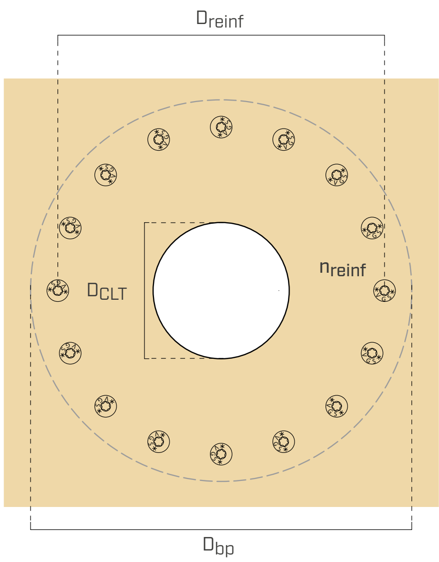


Rules for panel thickness values not included in the table:
- for inclined screws use the length provided for the panel with lower thickness;
- for the reinforcement screws use the length provided for the panel with greater thickness.

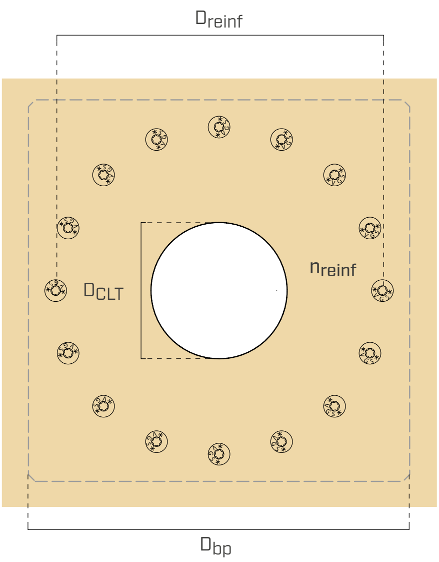
Example: for CLT panels with thickness of 250 mm we will use VGS Ø9x320 inclined screws and VGS Ø9x140 reinforcement screws.

REINFORCEMENT SCREWS (OPTIONAL)

circular bottom plate

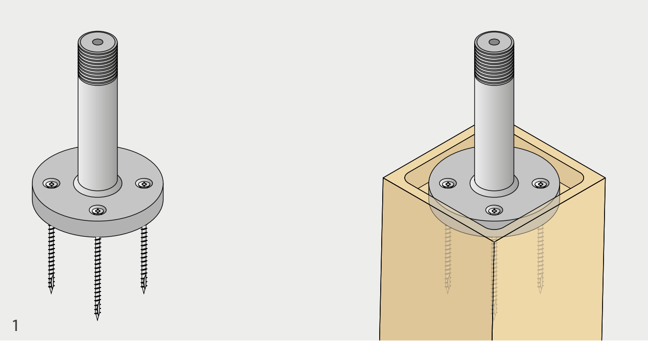


rectangular bottom plate



ASSEMBLY

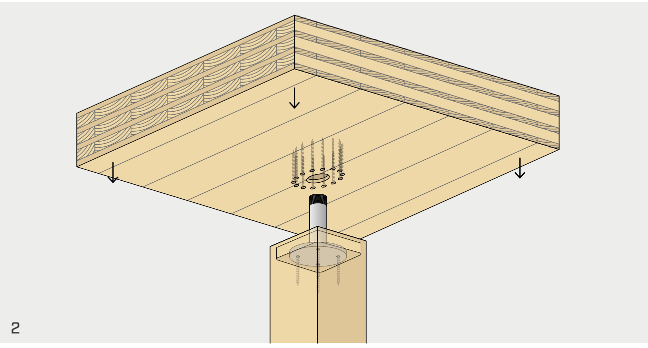
VIDEO



1

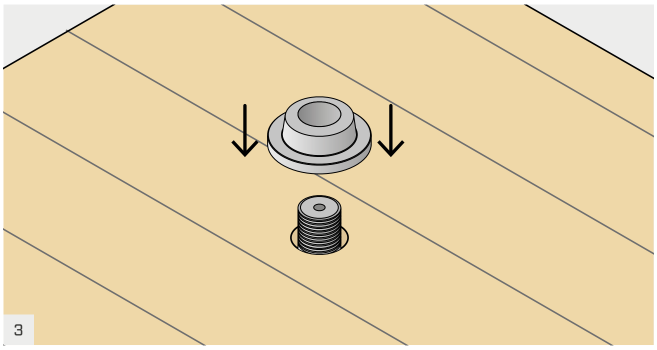
Fasten the bottom plate to the upper face of the column using the VGS Ø11 screws in accordance with the relevant installation instructions. It is possible to conceal the bottom plate in a grooving prepared in the column.

For installation on steel columns it is possible to use M12 countersunk head bolts. Use suitable countersunk head connectors in case of installation on reinforced concrete columns.



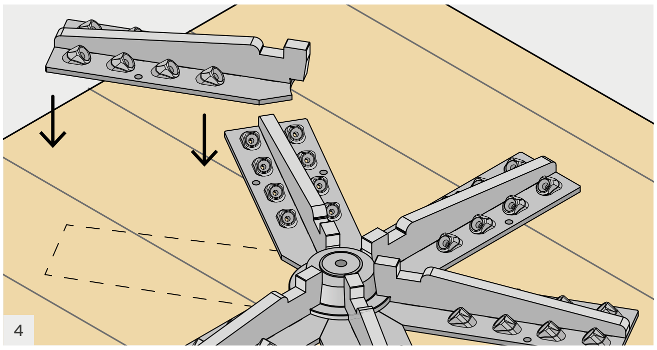
2

Fit the pre-drilled CLT panel with a circular hole of D_{CLT} diameter onto the cylinder. A compression reinforcement can be provided to the panel bottom of beam to increase strength.



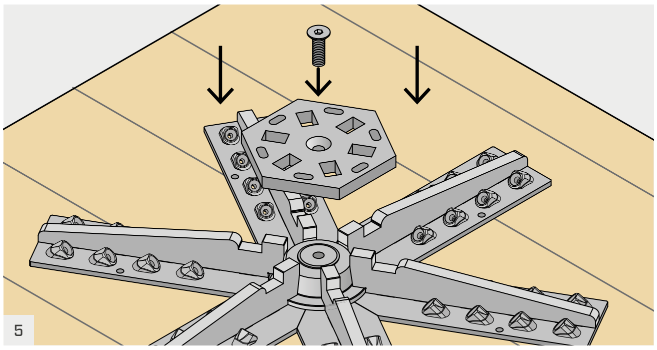
3

Screw the cone to the cylinder until it makes contact with the CLT panel surface.



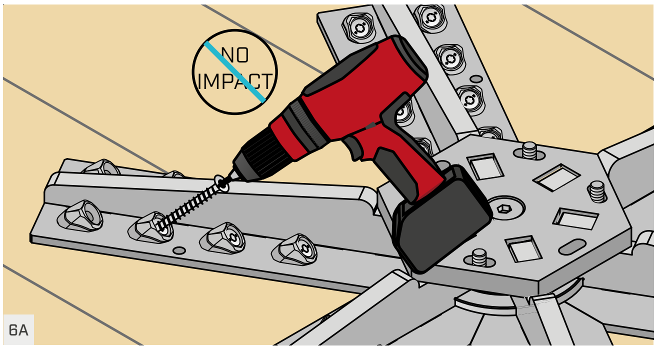
4

Place the 6 arms on the top surface of the CLT panel and cone.

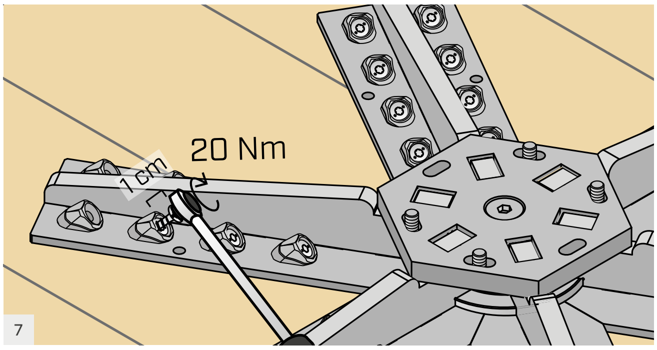


5

Insert the hexagonal disc in order to fit the 6 arms and fasten the countersunk head screw with a 10 or 12 mm male hexagonal wrench.



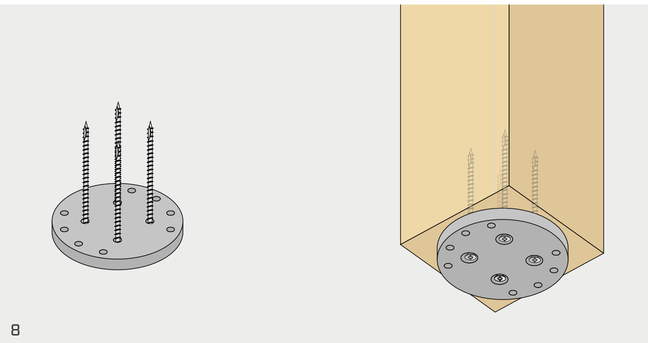
6A



7

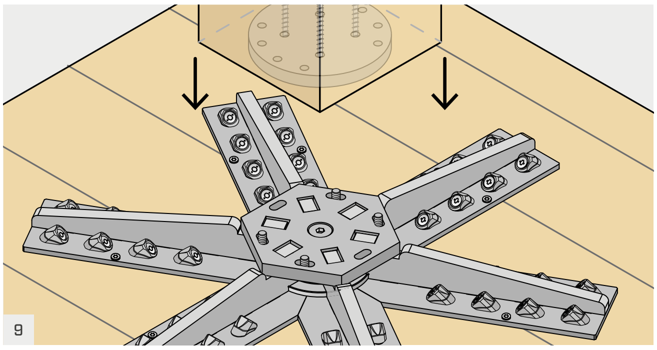
With a NON-PULSE screwdriver, insert the 48 VGS Ø9 screws inside the inclined washers, respecting the 45° insertion angle (if necessary use the JIGVGU945 pre-drilling template). Tighten by stopping about 1 cm from the washer and complete the screwing using a torque wrench by applying an insertion torque of 20 Nm.

ASSEMBLY



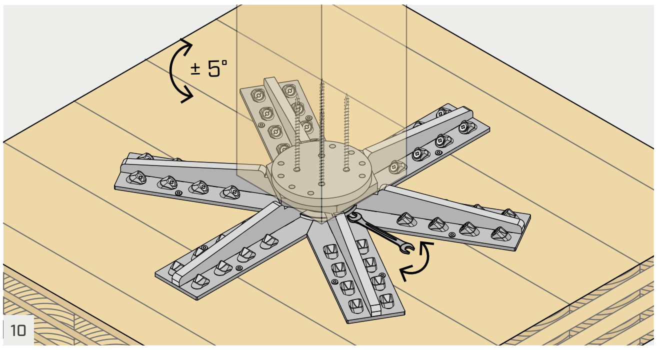
8

Fasten the upper plate to the lower face of the column using the VGS Ø11 screws, in accordance with the relevant installation instructions. The top plate is equipped with suitable threaded holes for fastening to the hexagonal disc.



9

Place the upper column on the hexagonal disc and fasten it using 4 SPBOLT1235 bolts with ULS125 washer. In the case of an upper steel column, the upper plate must not be used and the column must be equipped with a suitable steel plate with holes for fastening the 4 SPBOLT1235 bolts.

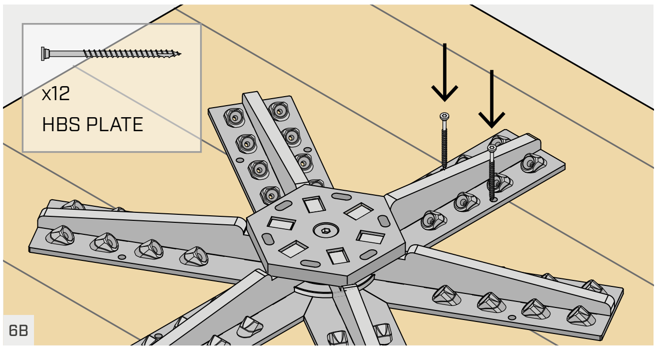


10

The slotted holes in the hexagonal disc allow the column to be rotated ±5°. Turn the column into the correct position and tighten the 4 bolts SPBOLT1235 using a side wrench.

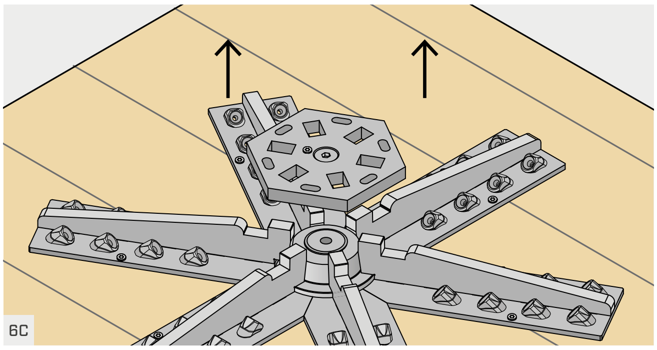
SPECIAL INSTRUCTIONS FOR SPI100S - SPI100M - SPI100L - SPI120S - SPI120M - SPI120L

For SPIDER connectors with cylinder diameter D_{cyl} = 100 or 120 mm, the hexagonal disc dimension is increased.
In this case, the phase 6A must be replaced with phases 6B - 6F.



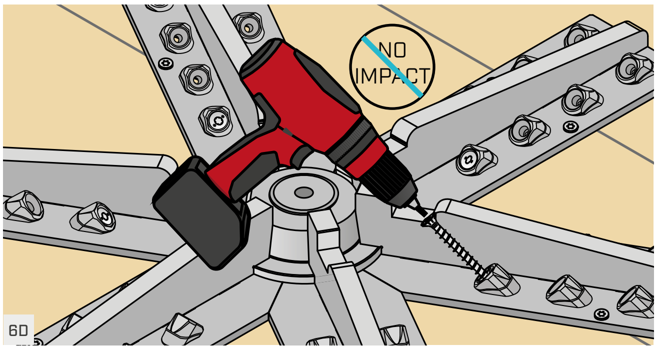
6B

After inserting the hexagonal disc and countersunk head screw, insert 12 HBSP8120 screws into the 12 vertical holes provided in the 6 arms. These screws will hold the arms in place in the following phases.



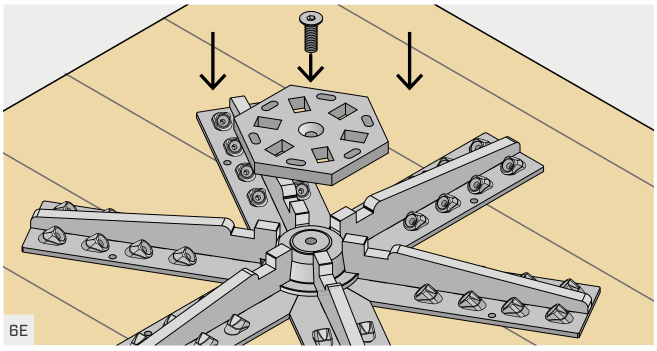
6C

Unscrew the countersunk head screw and remove the hexagonal disc.



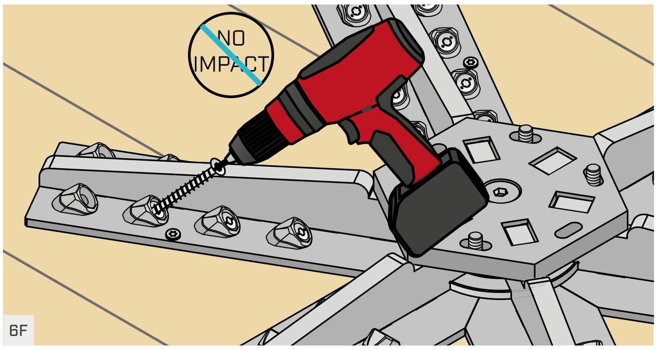
6D

With a NON-PULSE screwdriver, insert the 12 VGS Ø9 screws inside the inclined washers closest to the cylinder, respecting the 45° insertion angle (if necessary use the JIG-VGU945 pre-drilling template). Screw it in stopping about 1 cm from the washer.



6E

Insert the hexagonal disc and secure the countersunk head screw with a 10 or 12 mm male hexagonal wrench.



6F

With a NON-PULSE screwdriver, insert the remaining 36 VGS Ø9 screws inside the inclined washers, respecting the 45° insertion angle (if necessary use the JIGVGU945 pre-drilling template). Screw it in stopping about 1 cm from the washer.

CLT PANEL PRODUCTION AND INSTALLATION TOLERANCES

The connector is designed to adapt to CLT panel production and installation tolerances.
The actual thickness of CLT panels may be slightly different from the nominal thickness due to a production tolerance.

1. PRODUCTION TOLERANCE ON CLT PANEL THICKNESS of ±2 mm

   The cone must be screwed until it touches the surface of the CLT panel (surface C), while the disc must be installed in way to ensure contact with the cylinder (surface A).

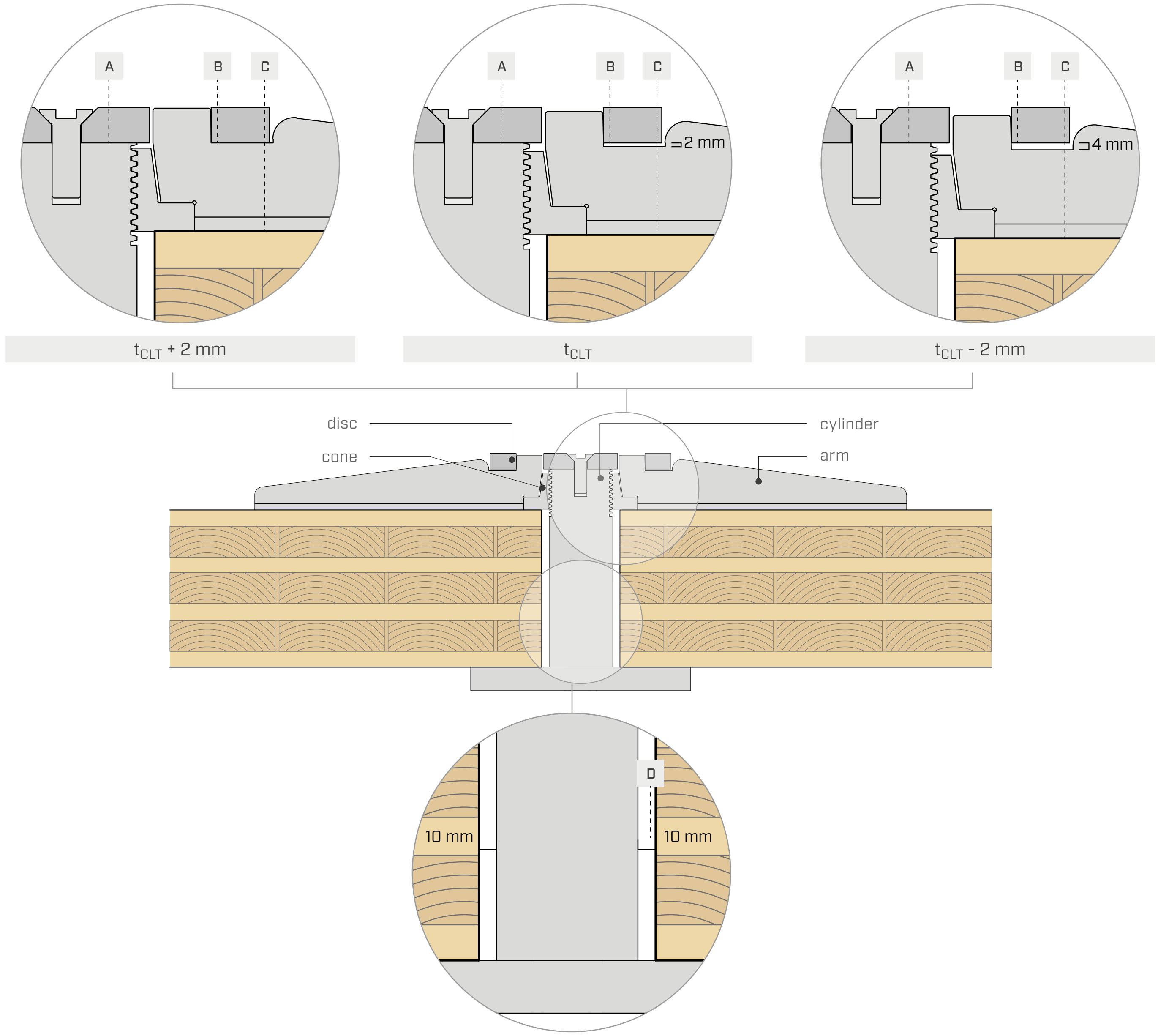
   The tolerance of ±2 mm is absorbed in the area B:

   - CLT thickness tolerance +2 mm ⟶ contact between disc and arm in the area B;
   - CLT tolerance thickness 0 mm ⟶ joint of 2 mm in the area B;
   - CLT tolerance thickness -2 mm ⟶ joint of 4 mm in the area B.

   The total height of the SPIDER remains constant regardless of the CLT panel production tolerance.
   In this way, the length of the columns is not affected by the CLT panels production tolerance.

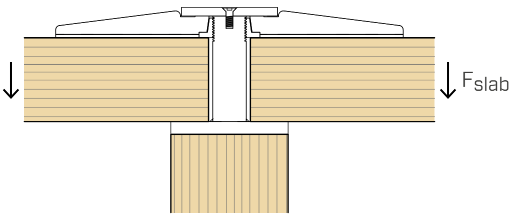
2. TOLERANCE OF ±10 mm ON THE FLOOR POSITIONING (area D)

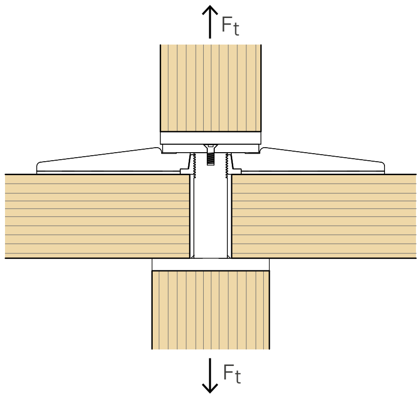
   The hole in the CLT panel is increased by 20 mm to allow a slight offset between SPIDER and hole.



STATIC VALUES | PUNCHING SHEAR AND TENSION

STRESSES ON THE CONNECTOR





PUNCHING SHEAR STRENGTH - VALUES VALID FOR ALL SPIDER MODELS

t_{CLT}	with reinforcement		without reinforcement	
	$R_{slab,k}$	k_{sus} (2)	$R_{slab,k}$	k_{sus} (2)
[mm]	[kN]		[kN]	
160	463	0,60	419	0,70
180	545	0,60	494	0,70
200	627	0,60	568	0,70
220	709	0,60	642	0,70
240	791	0,60	717	0,70
280	791	0,60	717	0,70
160 + 160 (1)	616	0.36	558	0.46

TENSILE STRENGTH - VALUES VALID FOR ALL SPIDER MODELS

Upper/lower column screws	$F_{t,k}$ [kN]			
[pcs - ØxL]	C24 (3)	GL24h (4)	GL28h (5)	GL32h (6)
4 VGS Ø11x250	34,60	37,32	40,38	41,54
4 VGS Ø11x400	56,20	60,65	65,64	67,49

NOTES:

(1) The 160 + 160 configuration refers to installation with crossed CLT panels.

(2) The k_{sus} coefficient expresses the ratio between the load applied by the inclined screws by tension and the load discharged on the bottom plate by compression.

(3) Values calculated according to ETA-11/0030. A C24 solid timber column with ρ_k = 350 kg/m^3 has been considered in the calculation.

(4) Values calculated according to ETA-11/0030. A GL24h glulam column with ρ_k = 385 kg/m^3 has been considered in the calculation.

(5) Values calculated according to ETA-11/0030. A GL28h glulam column with ρ_k = 425kg/m^3 has been considered in the calculation.

(6) Values calculated according to ETA-11/0030. A GL32h glulam column with ρ_k = 440kg/m^3 has been considered in the calculation.

GENERAL PRINCIPLES:

- For t_{CLT} panel thickness intermediate to those listed in the table, it is recommended to use the strength values provided for the lower thickness.
- The design values are obtained from the characteristic values as follows: The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation. The γ_M coefficient is the relevant safety coefficient on connections side.

$$R_{slab,d} = \frac{R_{slab,k} \cdot k_{mod}}{\gamma_M}$$

$$R_{t,d} = \frac{R_{t,k} \cdot k_{mod}}{\gamma_M}$$

- The following expressions must be fulfilled for the verifications:

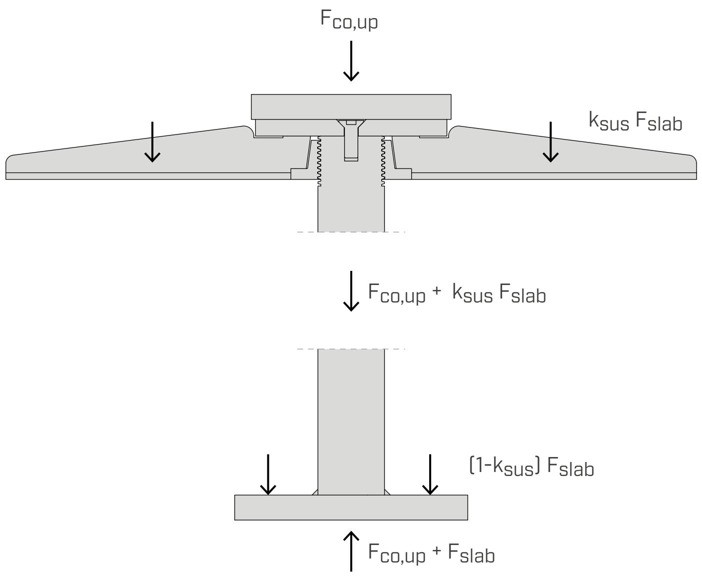
$$\frac{F_{slab,d}}{R_{slab,d}} \leq 1{,}0$$

$$\frac{F_{t,d}}{R_{t,d}} \leq 1{,}0$$

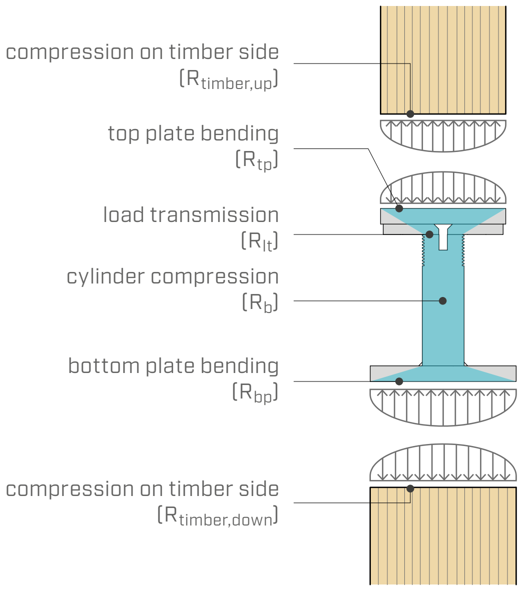
- The punching shear strength of the floor ($F_{slab,d}$) includes the verification of all the SPIDER reinforcement components (reinforcement arms and screws) as well as the shear and rolling shear strength of the CLT panel in the area affected by the presence of the support. The Ultimate Limit State and the Service Limit State on the floor panels must be checked by the designer.

STATIC VALUES | LOAD TRANSMISSION

STRESSES ON THE CONNECTOR



FAILURE MECHANISMS AND VERIFICATIONS



SPIDER SPI60S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(5)	450	γ_{M0}(1)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	663	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	907	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\,F_{slab,d}$
Bottom plate	$R_{bp,k}$(5)	706	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\,F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
C24	595	660
GL24h	680	754
GL28h	794	880
GL32h(3)	907	1005

SPIDER SPI80S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(6)	655	γ_{M0}(1)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	1286	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	1626	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\,F_{slab,d}$
Bottom plate	$R_{bp,k}$(6)	939	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\,F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	754	1086
GL28h	880	1267
GL32h(3)	1005	1448

SPIDER SPI80M

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$ (6)	939	γ_{M0} (1)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	1286	γ_{M0} (1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	1626	γ_{M0} (1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$ (6)	1761	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	1086	1426
GL28h	1267	1663
GL32h (3)	1448	1901

SPIDER SPI80L

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$ (6)	1761	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	1286	γ_{M0} (1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	1626	γ_{M0} (1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$ (6)	2350	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	1426	1802
GL28h	1663	2102
GL32h (3)	1901	2402

SPIDER SPI100S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$ (7)	1689	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2031	γ_{M0} (1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	2474	γ_{M0} (1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$ (7)	2519	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	1163	1267
GL32h	1330	1448
LVL GL75 (4)	2280	2977

SPIDER SPI100M

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$ (7)	2394	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2031	γ_{M0} (1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	2474	γ_{M0} (1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$ (7)	2394	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	1724	1724
GL32h	1970	1970
LVL GL75 (4)	3748	3748

SPIDER SPI120S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$ (7)	3034	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2856	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	3336	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$ (7)	3034	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	1724	1724
GL32h	1970	1970
LVL GL75(4)	4184	4184

SPIDER SPI120M

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$ (7)	3976	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2856	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	3336	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$ (7)	3976	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	2188	2188
GL32h	2501	2501
LVL GL75(4)	5101	5101

SPI100L and SPI120L are optimised for use with steel columns. In this case the top plate is not present.

SPIDER SPI100L

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate(9)	$R_{tp,k}$	-	-	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	4190	γ_{M0}*(2)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	5010	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate(10)	$R_{bp,k}$	-	-	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

SPIDER SPI120L

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate(9)	$R_{tp,k}$	-	-	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	5325	γ_{M0}*(2)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	6220	γ_{M0}*(2)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate(10)	$R_{bp,k}$	-	-	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

NOTES:

(1) The coefficient γ_{M0} corresponds to the partial coefficient for steel S355 sections strength and it should be taken according to the current regulations used for the calculation. For example, according to EN 1995-1-1 it is to be considered as 1,00.

(2) The coefficient γ_{M0}* corresponds to the partial coefficient for steels section strength not covered by EN 1993-1-1. This should be taken according to the current regulations used for the calculation. In the absence of normative indications, it is recommended to use a value γ_{M0}* = 1,10.

(3) The SPIDER connector model in question is optimized for use with GL32h glulam columns. Materials of inferior characteristics may be used; in this case, the metal components of the connector will be oversized.

(4) The SPIDER connector model in question is optimized for use with LVL GL75 timber columns in accordance with ETA-14/0354. Materials of inferior characteristics may be used; in this case, the metal components of the connector will be oversized.

(5) For safety reasons, the strength is calculated using a k_{steel} coefficient valid for timber columns C24. The same value can be used for GL24h, GL28h and GL32h columns.

(6) The strength is calculated using a k_{steel} coefficient valid for GL32h timber columns. If other materials are used for columns, the strength must be calculated with reference to ETA-19/0700.

(7) The strength is calculated using a k_{steel} coefficient valid for GL75 timber columns. If other materials are used for columns, the strength must be calculated with reference to ETA-19/0700.

(8) The compressive strength of the cylinder has been calculated for a panel height of 320 mm. In all other cases, the same value can be used for safety purposes.

(9) The connector is supplied without top plate. The steel column can be connected directly to the SPIDER connector through 4 M12 bolts. The top column must be equipped with a plate, dimensioned by the designer, suitable to transfer the load to the SPIDER connector.

(10) The bottom plate of the SPIDER connector is not dimensioned to spread the load on the lower steel column. This must be equipped with a plate, dimensioned by the designer, suitable to receive the load from the SPIDER connector.

GENERAL PRINCIPLES:

- The design values on timber side can be obtained from the characteristic values as follows. The coefficients γ_{MT} and k_{mod} should be taken according to the current regulations used for the calculation. The coefficient γ_{MT} is the relevant safety coefficient of timber.

$$R_{timber,up,d} = \frac{R_{timber,up,k} \cdot k_{mod}}{\gamma_{MT}}$$

$$R_{timber,down,d} = \frac{R_{timber,down,k} \cdot k_{mod}}{\gamma_{MT}}$$

- The design values on steel side can be obtained from the characteristic values as follows. The coefficients γ_{steel} should be taken according to the current regulations used for the calculation (see notes 1 and 2).

$$R_{tp,d} = \frac{R_{tp,k}}{\gamma_{steel}} \qquad R_{lt,d} = \frac{R_{lt,k}}{\gamma_{steel}}$$

$$R_{b,d} = \frac{R_{b,k}}{\gamma_{steel}} \qquad R_{bp,d} = \frac{R_{bp,k}}{\gamma_{steel}}$$

- The following expressions must be fulfilled for the verifications:

$$\frac{F_{co,up,d}}{min\left\{R_{timber,up,d}\,;R_{tp,d}\,;R_{lt,d}\right\}} \leq 1,0$$

$$\frac{F_{co,up,d} + k_{sus} \cdot F_{slab,d}}{min\left\{R_{b,d}\,;R_{bp,d}\right\}} \leq 1,0$$

$$\frac{F_{co,up,d} + F_{slab,d}}{R_{timber,down,d}} \leq 1,0$$

- The checks on the column side refer to the compressive strength parallel to the fiber, at the SPIDER connector. Column instability must be verified separately.

PILLAR

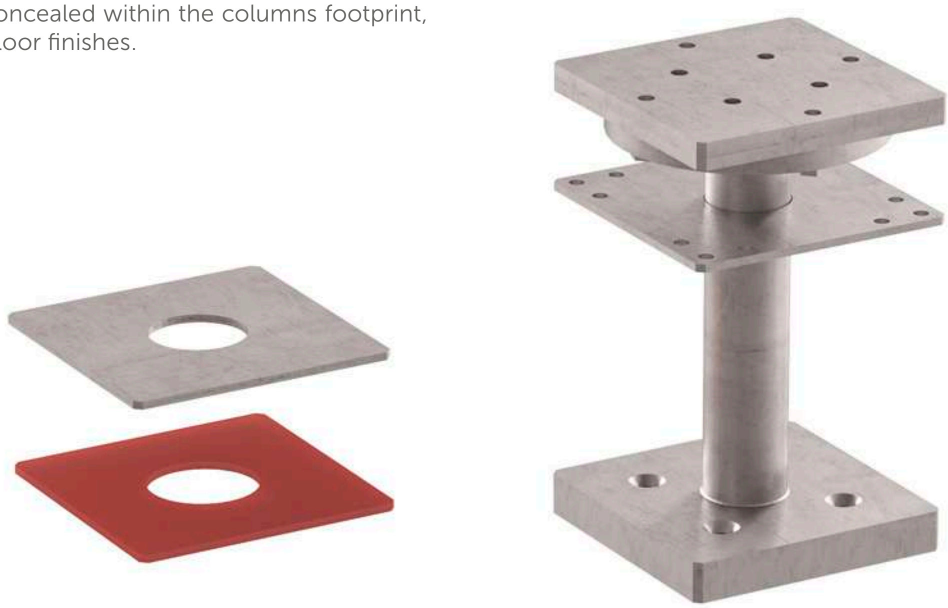
ETA 19/0700

COLUMN-TO-FLOOR CONNECTION SYSTEM

BUILDINGS ON COLUMNS
The system allows the construction of buildings with a column-to-floor system. Distance between columns up to 3,5 x 7,0 m. inside the SPIDER system is ideal for use on columns in the corners or on the perimeter of the structural mesh.

COLUMN-TO-COLUMN
The steel core of the system prevents the CLT panels from being crushed and allows more than 5000 kN of vertical load to be transferred between the columns.

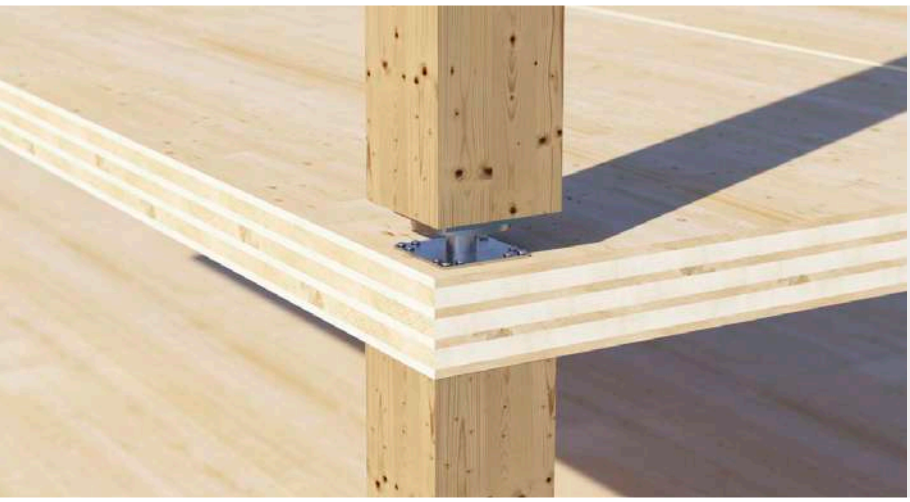
CONSTRUCTION SITE SAFETY
Integrating the CLT panels with the parapets avoids the use of scaffolding in corners and perimeters. Concealed within the columns footprint, allows reduced thickness of the floor finishes.



CHARACTERISTICS

FOCUS	multi-storey buildings
COLUMNS	from 200 x 200 mm to 280 x 280 mm
STRUCTURAL MESH	up to 3,5 x 7,0 m
STRENGTH	R_k compression greater than 5000 kN

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



MATERIAL
S355-S690 zinc plated steel.

FIELDS OF USE
Multi-storey buildings with column-to-floor system. Solid timber, glulam, high density timber, CLT, LVL, steel and reinforced concrete columns.

MULTI-STOREY

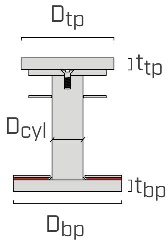
Connection system for large point-to-point compression loads on timber, concrete or steel columns. Ideal for multi-storey CLT buildings. Compression strength greater than 500 tons.

STEEL AND CONCRETE

Versatile connection calculated and certified also for joints between CLT panels and concrete or steel columns.

CODES AND DIMENSIONS

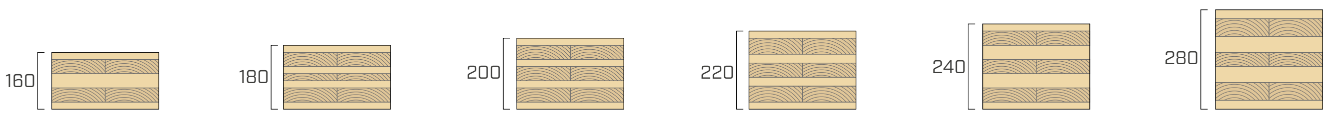
PILLAR CONNECTOR



The code consists of the respective CLT panel thickness in mm (XXX = t_{CLT}).
Example: the **PIL80M** for CLT panels with XXX = t_{CLT} = 200 mm has the code **PIL80M200**.

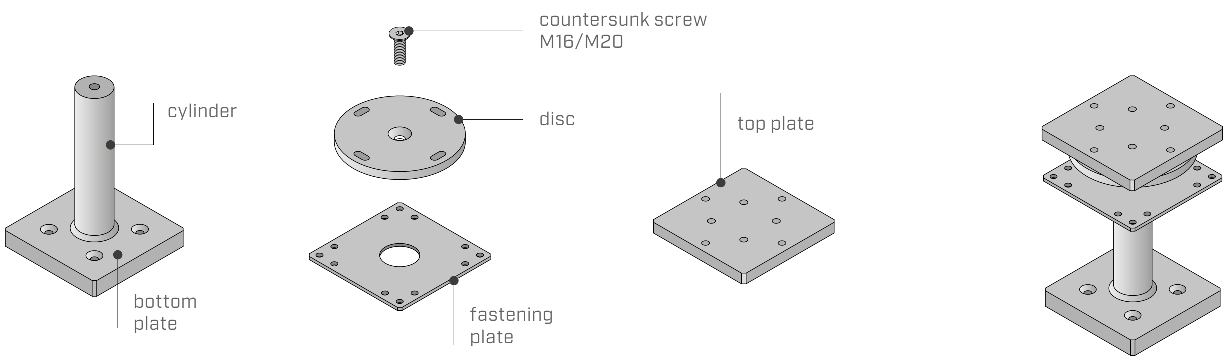
CODE	cylinder	bottom plate	top plate	weight	pcs
	D_{cyl}	D_{bp} x t_{bp}	D_{tp} x t_{tp}		
	[mm]	[mm]	[mm]	[kg]	
SPI60SXXX	60	200 x 30	200 x 20	26,4	1
PIL80SXXX	80	240 x 30	200 x 30	38,2	1
PIL80MXXX	80	280 x 30	240 x 30	47,2	1
PIL80LXXX	80	280 x 40	280 x 40	64,3	1
PIL100SXXX	100	240 x 30	240 x 20	42,0	1
PIL100MXXX	100	280 x 30	280 x 30	59,0	1
PIL120SXXX	120	280 x 30	280 x 30	66,1	1
PIL120MXXX	120	280 x 40	280 x 40	78,3	1
PIL100LXXX	100	280 x 20	not provided	34,7	1
PIL120LXXX	120	280 x 20	not provided	41,8	1

XXX = t_{CLT} [mm]					
160	180	200	220	240	280



Also available for t_{CLT} thickness values not shown in the table.

Each code includes the following components:



XYLOFON WASHER (optional)

CODE	suitable for	pcs
XYLWXX**60200**	PIL60S	1
XYLWXX**80240**	PIL80S	1
XYLWXX**80280**	PIL80M - PIL80L	1
XYLWXX**100240**	PIL100S	1
XYLWXX**100280**	PIL100M - PIL100L	1
XYLWXX**120280**	PIL120S - PIL120M - PIL120L	1

The code consists of the respective XYLOFON shore (35, 50, 70, 80 or 90).

XYLOFON WASHER 35 shore for PIL80M: code **XYLW3580280**

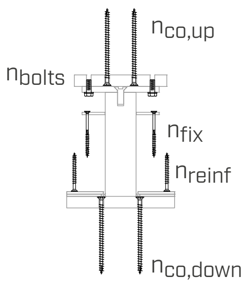
DISTRIBUTION PLATE (optional)

CODE	suitable for	pcs
SP60200	PIL60S	1
SP80240	PIL80S	1
SP80280	PIL80M - PIL80L	1
SP100240	PIL100S	1
SP100280	PIL100M - PIL100L	1
SP120280	PIL120S - PIL120M - PIL120L	1

The distribution plate is to be used only in the presence of XYLOFON WASHER + reinforcement screws.

CODES AND DIMENSIONS

NUMBER OF SCREWS FOR EACH CONNECTOR



$n_{co,up}$	4	VGS Ø11
$n_{co,down}$	4	VGS Ø11
n_{bolts}	4	SPBOLT1235
n_{fix}	12	HBS PLATE Ø8
n_{reinf}	refer to the GEOMETRY AND MATERIALS section on page 312	VGS Ø9

Screws and bolts not included in the package.
The n_{reinf} reinforcement screws are optional.

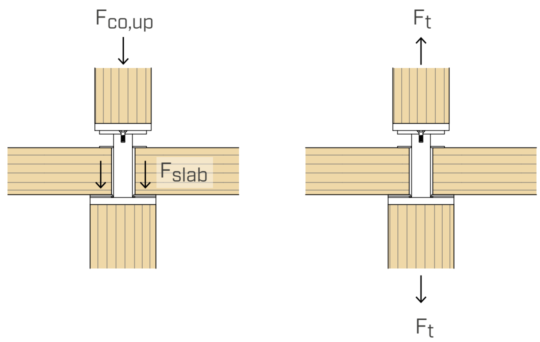
MATERIAL AND DURABILITY

PILLAR: S355-S690 zinc plated steel.
Use for service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- CLT floors placed precisely on columns
- Solid timber, glulam, LVL softwood or LVL hardwood columns
- Steel or reinforced concrete columns

EXTERNAL LOADS

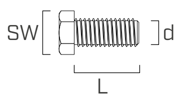


ADDITIONAL PRODUCTS - FASTENERS

type	description	d [mm]	support	page
HBS PLATE	screw for timber	8		556
VGS	full thread connector	9-11		564

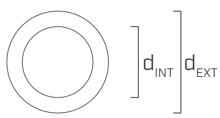
BOLT - hexagonal head steel 8.8 EN 15048

CODE	d [mm]	L [mm]	SW [mm]	pcs
SPBOLT1235	M12	35	19	100

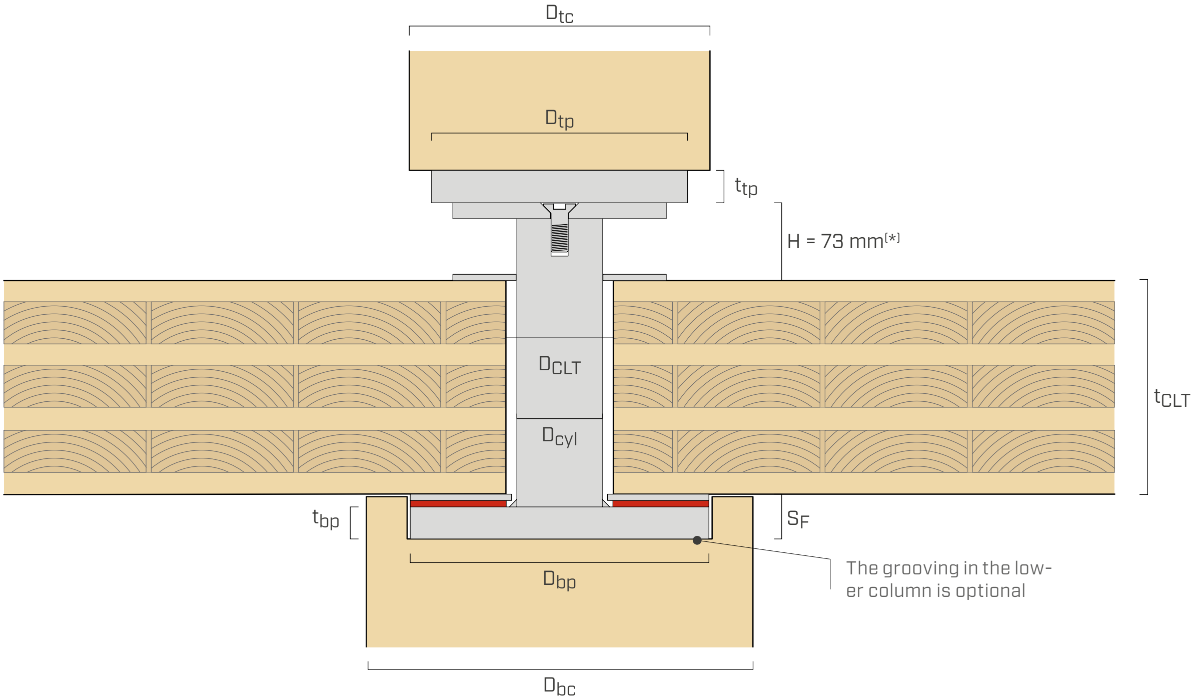


ULS 125 - washer

CODE	rod [mm]	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
ULS13242	M12	13	24	2,5	500



GEOMETRY AND MATERIALS



(*) To the dimension 6 mm must be added when using XYLOFON WASHER (H = 79 mm) and 12 mm when using XYLOFON WASHER + distribution plate (H = 85 mm).

CONNECTOR

MODEL	bottom plate D_{bp} x t_{bp} [mm]	bottom plate shape	bottom plate material	cylinder D_{cyl} [mm]	cylinder material	disc material	top plate D_{tp} x t_{tp} [mm]	top plate shape	top plate material
PIL60S	200 x 30	□	S355	60	S355	S355	200 x 20	□	S355
PIL80S	240 x 30	□	S355	80	S355	S355	200 x 30	□	S355
PIL80M	280 x 30	□	S690	80	S355	S355	240 x 30	□	S690
PIL80L	280 x 40	□	S690	80	S355	S355	280 x 40	□	S690
PIL100S	240 x 30	□	S690	100	S355	S355	240 x 20	□	S690
PIL100M	280 x 30	□	S690	100	S355	S355	280 x 30	□	S690
PIL120S	280 x 30	□	S690	120	S355	S355	280 x 30	□	S690
PIL120M	280 x 40	□	S690	120	S355	S355	280 x 40	□	S690
PIL100L	280 x 20	□	S690	100	1,7225	S690	-	-	-
PIL120L	280 x 20	□	S690	120	1,7225	S690	-	-	-

PIL100L and PIL120L provide for fastening on steel columns without using the top plate.

COLUMNS AND CLT PANELS

MODEL	upper column $D_{tc,min}$ [mm]	lower column $D_{bc,min}$ [mm]	lower column S_F* [mm]	CLT panel D_{CLT} [mm]	reinforcement (optional) R_{screws} [mm]	reinforcement (optional) n_{reinf} central	reinforcement (optional) n_{reinf} edge	reinforcement (optional) n_{reinf} angle
PIL60S	200	200	30	80	85	14	6	2
PIL80S	200	240	30	100	105	14	6	2
PIL80M	240	280	30	100	120	16	7	3
PIL80L	280	280	40	100	120	16	7	3
PIL100S	240	240	30	120	105	14	6	2
PIL100M	280	280	30	120	120	16	7	3
PIL120S	280	280	30	140	120	16	7	3
PIL120M	280	280	40	140	120	16	7	3
PIL100L	200	280	-	120	120	16	7	3
PIL120L	200	280	-	140	120	16	7	3

* The thickness of the S_F grooving in the lower column must be increased by 6 mm when using XYLOFON WASHER and by 12 mm when using XYLOFON WASHER + distribution plate.

GEOMETRY AND MATERIALS

CHARACTERISTICS OF CLT PANELS

Parameter	160 mm ≤ t_{CLT}
Lamellas thickness	≤ 40 mm
Minimum strength class according to EN 338	C24/T14

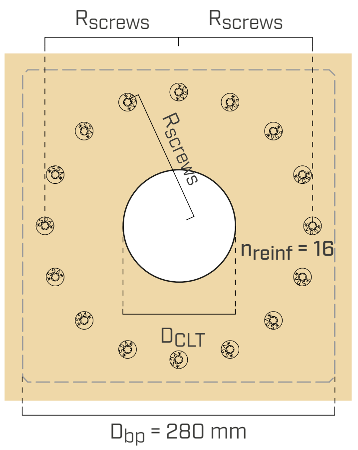
REINFORCEMENT SCREWS FOR CLT PANEL

t_{CLT} [mm]	reinforcement screws (optional) [pcs - ØxL]
160	VGS Ø9x100
180	VGS Ø9x100
200	VGS Ø9x100
220	VGS Ø9x120
240	VGS Ø9x120
280	VGS Ø9x140

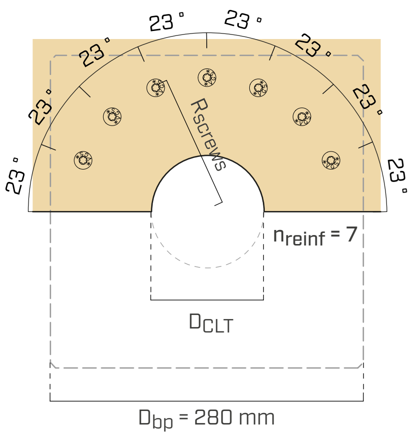
For intermediate panel thickness values use the length provided for the top panel.
Example: for CLT panels with thickness of 210 mm, VGS Ø9x120 reinforcement screws will be used.

REINFORCEMENT SCREWS (OPTIONAL)

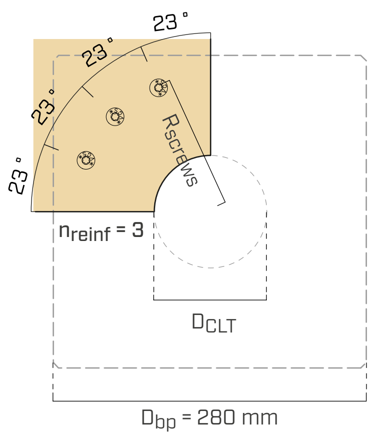
CENTRAL SUPPORT



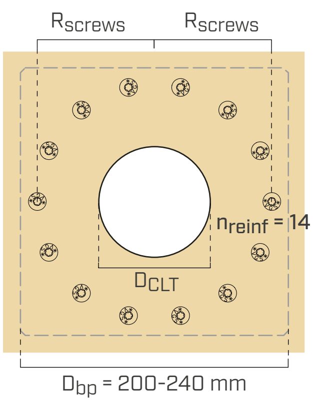
EDGE SUPPORT



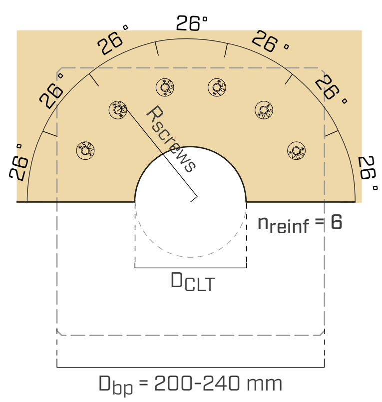
CORNER SUPPORT



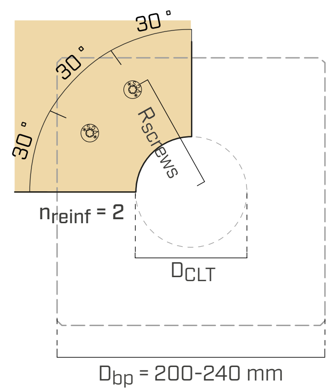
CENTRAL SUPPORT



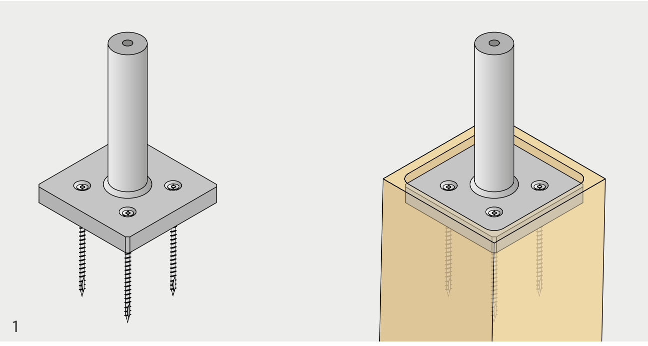
EDGE SUPPORT



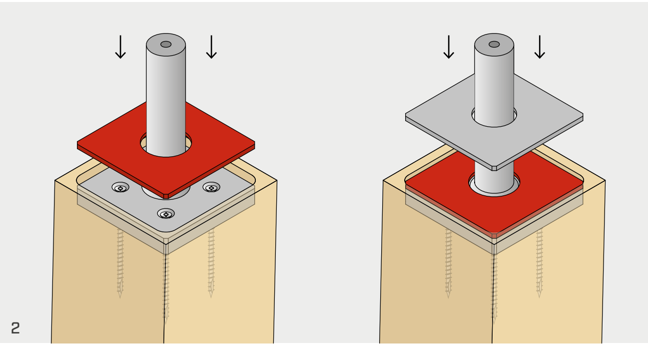
CORNER SUPPORT



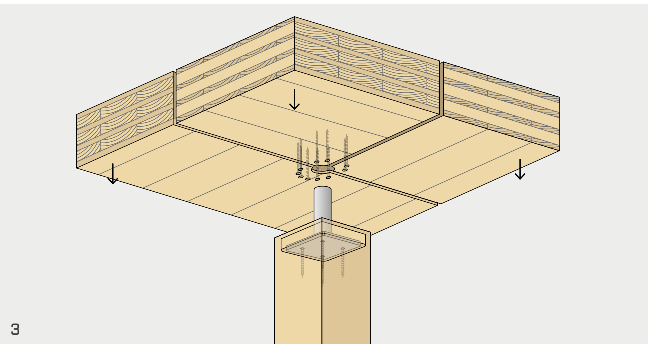
ASSEMBLY



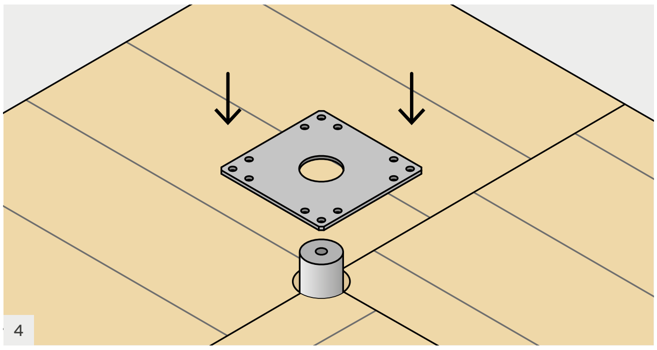
Fasten the bottom plate to the upper face of the column using the VGS Ø11 screws in accordance with the relevant installation instructions. It is possible to conceal the bottom plate in a grooving prepared in the column.
For installation on steel columns it is possible to use M12 countersunk head bolts. Use suitable countersunk head connectors in case of installation on reinforced concrete columns.



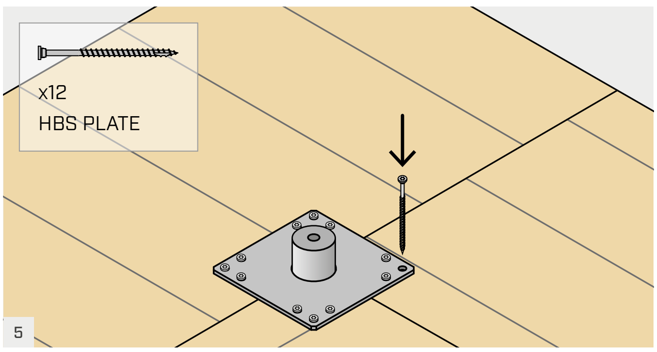
Insert the XYLOFON WASHER (optional) and/or the DISTRIBUTION PLATE (optional) on the cylinder.



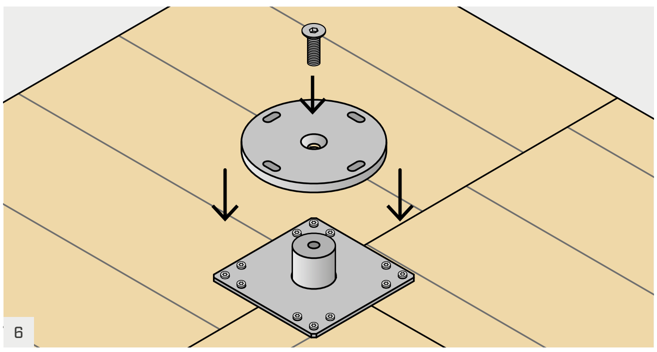
Fit pre-drilled CLT panels with a circular hole of D_{CLT} diameter onto the cylinder. A compression reinforcement can be provided to the panel bottom of beam to increase strength.



Insert the FASTENING PLATE onto the cylinder.

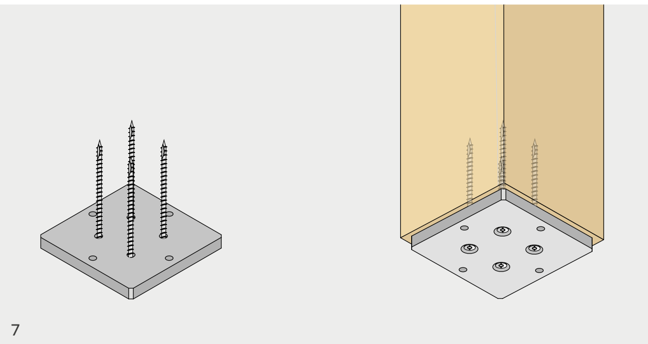


Connect the FASTENING PLATE to the CLT panels with 12 HBS PLATE 8x120 screws.

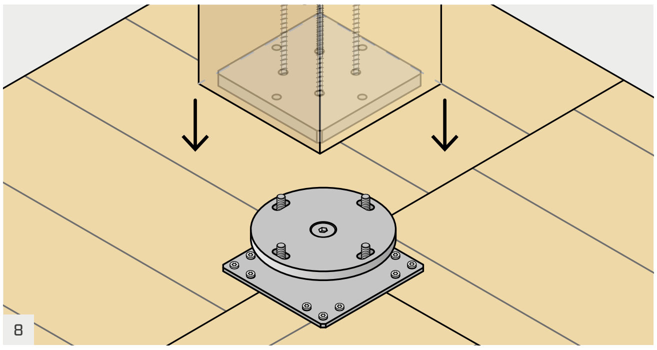


Place the DISC on the CYLINDER and fasten the countersunk head screw with a 10 or 12 mm male hexagonal wrench.

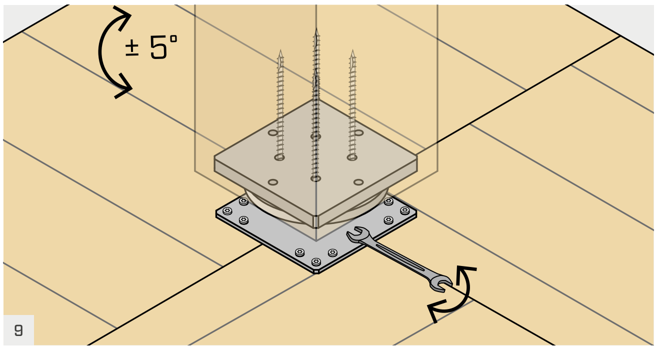
ASSEMBLY



Fasten the upper plate to the lower face of the column using the VGS Ø11 screws, in accordance with the relevant installation instructions. The top plate is equipped with suitable threaded holes for fastening to the disc.



Place the upper column on the disc and fasten it using 4 SPBOLT1235 bolts with ULS125 washer.
In the case of upper steel column, the upper plate must not be used and the column must be equipped with a suitable steel plate with holes for fastening the 4 SPBOLT1235 bolts.



The slotted holes in the hexagonal disc allow the column to be rotated ±5°. Turn the column into the correct position and tighten the 4 bolts SPBOLT1235 using a side wrench.

CLT PANEL PRODUCTION AND INSTALLATION TOLERANCES

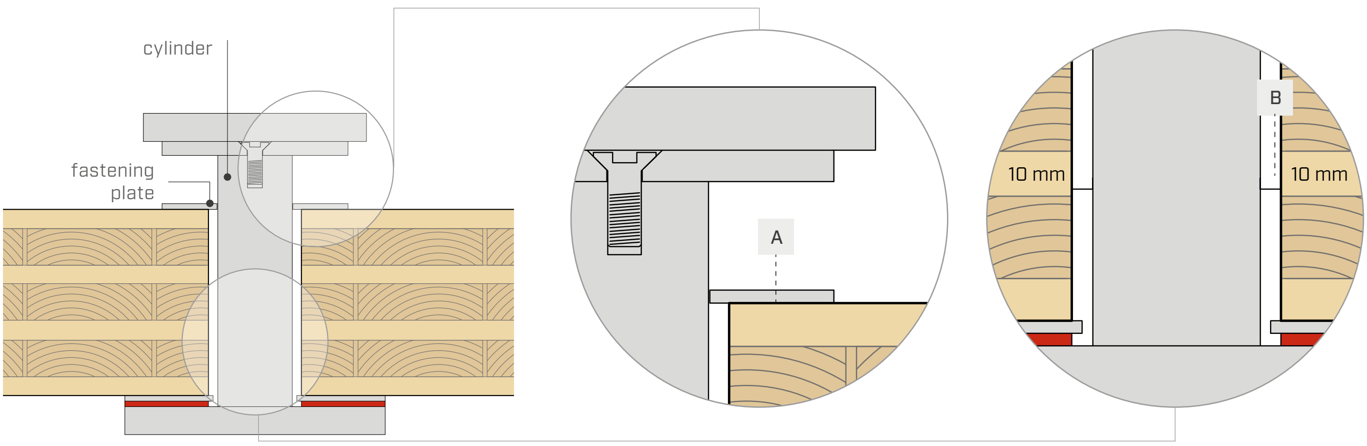
The connector is designed to adapt to CLT panel production and installation tolerances.

1. PRODUCTION TOLERANCE ON CLT PANEL THICKNESS

   If there is any tolerance on the thickness of the CLT floor, it is absorbed by the fastening plate (area A), which can slide on the steel cylinder.

   The total height of the PILLAR connector remains constant regardless of the CLT panel production tolerance.

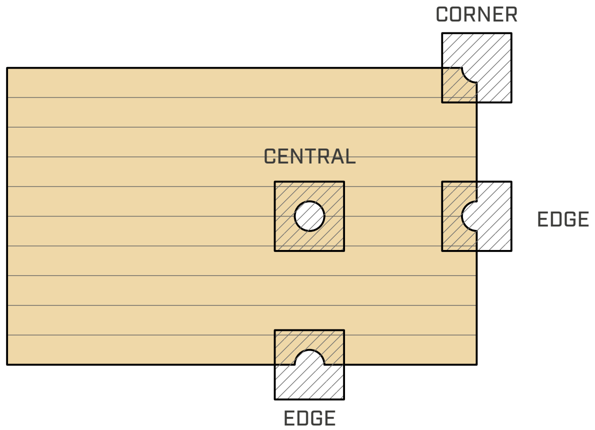
2. TOLERANCE OF ±10 mm ON THE FLOOR POSITIONING (area B)



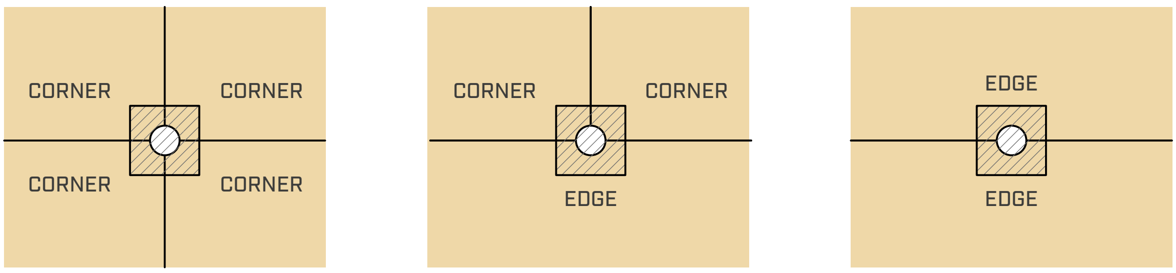
STATIC VALUES

The PILLAR connector allows the columns to be positioned at a point inside the CLT panel (CENTRAL), on the edge of the CLT panel (EDGE) or on the corner of the panel (CORNER).
It is possible to combine different types of support on the same column. In this case, the verification with compression perpendicular to the fiber must be performed separately for each panel.
The following tables show all strength values for cases with and without reinforcement, depending on the thickness of the CLT panel.

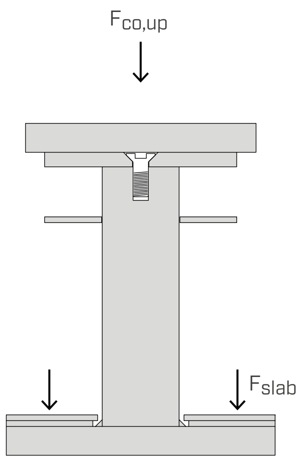
POSSIBLE SUPPORT CONFIGURATIONS



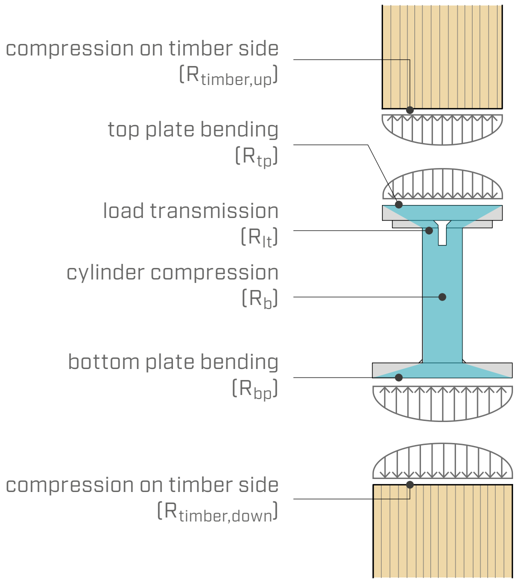
COMBINED SUPPORT CONFIGURATIONS



STRESSES ON THE CONNECTOR



FAILURE MECHANISMS AND VERIFICATIONS



PILLAR PIL60S

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT} [mm]	layers	with reinforcement			without reinforcement		
		central	edge	angle	central	edge	angle
160	5	207	103	46	154	68	29
180	5	226	113	48	154	68	29
200	7	246	123	55	197	83	33
220(11)	7	246	123	55	197	83	33
240	7	288	144	59	197	83	33
280(12)	7	288	144	59	197	83	33

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}
Top plate	$R_{tp,k}$(5)	450	γ_{M0}(1)
Load transmission	$R_{lt,k}$	871	γ_{M0}(1)
Cylinder compression	$R_{b,k}$(8)	923	γ_{M0}(1)
Bottom plate	$R_{bp,k}$(5)	690	γ_{M0}(1)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
C24	595	823
GL24h	680	941
GL28h	794	1097
GL32h(3)	907	1254

PILLAR PIL80S

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT} [mm]	layers	with reinforcement			without reinforcement		
		central	edge	angle	central	edge	angle
160	5	261	131	58	219	96	41
180	5	283	141	60	219	96	41
200	7	305	153	69	281	118	48
220(11)	7	305	153	69	281	118	48
240	7	352	176	73	281	118	48
280(12)	7	352	176	73	281	118	48

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}
Top plate	$R_{tp,k}$(6)	994	γ_{M0}(1)
Load transmission	$R_{lt,k}$	1560	γ_{M0}(1)
Cylinder compression	$R_{b,k}$(8)	1634	γ_{M0}(1)
Bottom plate	$R_{bp,k}$(6)	928	γ_{M0}(1)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	959	1273
GL28h	1118	1485
GL32h(3)	1278	1697

PILLAR PIL80M

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	325	162	81	305	134	57
180	5	349	174	85	305	134	57
200	7	373	187	93	373	164	66
220(11)	7	373	187	93	373	164	66
240	7	425	212	104	391	164	66
280(12)	7	425	212	104	391	164	66

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$	
		[kN]	γ_{steel}
Top plate	$R_{tp,k}$(6)	1804	γ_{M0}*(2)
Load transmission	$R_{lt,k}$	1560	γ_{M0}(1)
Cylinder compression	$R_{b,k}$(8)	1634	γ_{M0}(1)
Bottom plate	$R_{bp,k}$(6)	1777	γ_{M0}*(2)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$	$R_{timber,down,k}$
	[kN]	[kN]
GL24h	1273	1426
GL28h	1485	1663
GL32h(3)	1697	1901

PILLAR PIL80L

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	325	162	81	305	134	57
180	5	349	174	85	305	134	57
200	7	373	187	93	373	164	66
220(11)	7	373	187	93	373	164	66
240	7	425	212	104	391	164	66
280(12)	7	425	212	104	391	164	66

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$	
		[kN]	γ_{steel}
Top plate	$R_{tp,k}$(6)	2350	γ_{M0}*(2)
Load transmission	$R_{lt,k}$	1560	γ_{M0}(1)
Cylinder compression	$R_{b,k}$(8)	1634	γ_{M0}(1)
Bottom plate	$R_{bp,k}$(6)	2350	γ_{M0}*(2)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$	$R_{timber,down,k}$
	[kN]	[kN]
GL24h	1802	1802
GL28h	2102	2102
GL32h(3)	2402	2402

PILLAR PIL100S

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	253	126	55	203	89	38
180	5	274	137	57	203	89	38
200	7	297	148	65	260	109	44
220 (11)	7	297	148	65	260	109	44
240	7	343	172	69	260	109	44
280 (12)	7	343	172	69	260	109	44

STRENGTH ON STEEL SIDE

Controls		strength	
		$R_{steel,k}$	
		[kN]	γ_{steel}
Top plate	$R_{tp,k}$ (7)	1709	γ_{M0}* (2)
Load transmission	$R_{lt,k}$	2365	γ_{M0} (1)
Cylinder compression	$R_{b,k}$ (8)	2474	γ_{M0} (1)
Bottom plate	$R_{bp,k}$ (7)	2498	γ_{M0}* (2)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$	$R_{timber,down,k}$
	[kN]	[kN]
GL28h	1330	1776
GL32h	2280	3381
LVL GL75 (4)	2280	3381

PILLAR PIL100M

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	316	158	79	289	127	54
180	5	340	170	82	289	127	54
200	7	365	182	91	365	155	63
220 (11)	7	365	182	91	365	155	63
240	7	416	208	101	370	155	63
280 (12)	7	416	208	101	370	155	63

STRENGTH ON STEEL SIDE

Controls		strength	
		$R_{steel,k}$	
		[kN]	γ_{steel}
Top plate	$R_{tp,k}$ (7)	2429	γ_{M0}* (2)
Load transmission	$R_{lt,k}$	2365	γ_{M0} (1)
Cylinder compression	$R_{b,k}$ (8)	2474	γ_{M0} (1)
Bottom plate	$R_{bp,k}$ (7)	2429	γ_{M0}* (2)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$	$R_{timber,down,k}$
	[kN]	[kN]
GL28h	1861	1861
GL32h	2127	2127
LVL GL75 (4)	3748	3748

PILLAR PIL120S

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	306	158	76	270	118	50
180	5	330	165	79	270	118	50
200	7	354	177	89	346	145	59
220 (11)	7	354	177	89	346	145	59
240	7	406	203	96	346	145	59
280 (12)	7	406	203	96	346	145	59

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}
Top plate	$R_{tp,k}$ (7)	3067	γ_{M0} * (2)
Load transmission	$R_{lt,k}$	3234	γ_{M0} (1)
Cylinder compression	$R_{b,k}$ (8)	3336	γ_{M0} (1)
Bottom plate	$R_{bp,k}$ (7)	3067	γ_{M0} * (2)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	1991	1991
GL32h	2276	2276
LVL GL75 (4)	4311	4311

PILLAR PIL120M

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	306	153	76	270	118	50
180	5	330	165	79	270	118	50
200	7	354	177	89	346	145	59
220 (11)	7	354	177	89	346	145	59
240	7	406	203	96	346	145	59
280 (12)	7	406	203	96	346	145	59

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}
Top plate	$R_{tp,k}$ (7)	3976	γ_{M0} * (2)
Load transmission	$R_{lt,k}$	3234	γ_{M0} (1)
Cylinder compression	$R_{b,k}$ (8)	3336	γ_{M0} (1)
Bottom plate	$R_{bp,k}$ (7)	3976	γ_{M0} * (2)

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	2188	2188
GL32h	2501	2501
LVL GL75 (4)	5101	5101

PILLAR PIL100L

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	316	158	79	289	127	54
180	5	340	170	82	289	127	54
200	7	365	182	91	365	155	63
220(11)	7	365	182	91	365	155	63
240	7	416	208	101	370	155	63
280(12)	7	416	208	101	370	155	63

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$	
		[kN]	γ_{steel}
Top plate	$R_{tp,k}$(9)	-	-
Load transmission	$R_{lt,k}$	4880	γ_{M0}*(2)
Cylinder compression	$R_{b,k}$(8)	5084	γ_{M0}*(2)
Bottom plate	$R_{bp,k}$(10)	-	-

PILLAR PIL120L

COMPRESSIVE STRENGTH PERPENDICULAR TO THE FIBER FOR THE CLT FLOOR

CLT panel		$R_{slab,k}$ [kN]					
t_{CLT}	layers	with reinforcement			without reinforcement		
[mm]		central	edge	angle	central	edge	angle
160	5	306	153	76	270	118	50
180	5	330	165	79	270	118	50
200	7	354	177	89	346	145	59
220(11)	7	354	177	89	346	145	59
240	7	406	203	96	346	145	59
280(12)	7	406	203	96	346	145	59

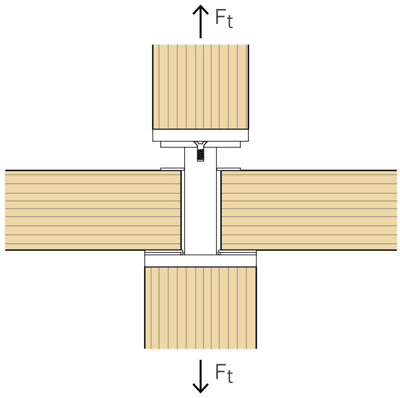
STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$	
		[kN]	γ_{steel}
Top plate	$R_{tp,k}$(9)	-	-
Load transmission	$R_{lt,k}$	6030	γ_{M0}*(2)
Cylinder compression	$R_{b,k}$(8)	6220	γ_{M0}*(2)
Bottom plate	$R_{bp,k}$(10)	-	-

TENSILE STRENGTH

VALUES VALID FOR ALL PILLAR MODELS

Upper/lower column screws	$F_{t,k}$			
	C24(13)	GL24h(14)	GL28h(15)	GL32h(16)
[pcs - ØxL]	[kN]	[kN]	[kN]	[kN]
4 VGS Ø11x250	34,60	37,32	40,38	41,54
4 VGS Ø11x400	56,20	60,65	65,64	67,49



NOTES:

(1) The coefficient γ_{M0} corresponds to the partial coefficient for steel S355 sections strength and it should be taken according to the current regulations used for the calculation. For example, according to EN 1995-1-1 it is to be considered as 1,00.

(2) The coefficient γ_{M0}* corresponds to the partial coefficient for steels section strength not covered by EN1993-1-1. This should be taken according to the current regulations used for the calculation. In the absence of normative indications, it is recommended to use a value γ_{M0}*=1,10.

(3) The PILLAR connector model in question is optimized for use with GL32h glulam columns. Use of materials with inferior characteristics leads to overdimensioning of the connector metal components.

(4) The PILLAR connector model in question is optimized for use with LVL GL75 timber columns in accordance with ETA-14/0354. Use of materials with inferior characteristics leads to overdimensioning of the connector metal components.

(5) For safety reasons, the strength is calculated using a k_{steel} coefficient valid for timber columns C24. The same value can be used for GL24h, GL28h and GL32h columns.

(6) The strength is calculated using a k_{steel} coefficient valid for GL32h timber columns. If other materials are used for columns, the strength must be calculated with reference to ETA-19/0700.

(7) The strength is calculated using a k_{steel} coefficient valid for GL75 timber columns. If other materials are used for columns, the strength must be calculated with reference to ETA-19/0700.

(8) The compressive strength of the cylinder has been calculated for a panel height of 280 mm. In all other cases, the same value can be used for safety purposes.

(9) The connector is supplied without top plate. The steel column can be connected directly to the PILLAR connector through 4 M12 bolts. The top column must be equipped with a plate, dimensioned by the designer, suitable to transfer the load to the PILLAR connector.

(10) The bottom plate of the PILLAR connector is not dimensioned to spread the load on the lower steel column. This must be equipped with a plate, dimensioned by the designer, suitable to receive the load from the PILLAR connector.

(11) The strength values for 220 mm thick CLT slabs are not indicated in ETA-19/0700. For safety reasons, the table shows the values provided for 200 mm thick floors.

(12) The strength values for 280 mm thick CLT slabs are not indicated in ETA-19/0700. For safety reasons, the table shows the values provided for 240 mm thick floors.

(13) Values calculated according to ETA-11/0030. A C24 solid timber column with ρ_k = 350 kg/m^3 has been considered in the calculation.

(14) Values calculated according to ETA-11/0030. A GL24h glulam column with ρ_k = 385 kg/m^3 has been considered in the calculation.

(15) Values calculated according to ETA-11/0030. A GL28h glulam column with ρ_k = 425 kg/m^3 has been considered in the calculation.

(16) Values calculated according to ETA-11/0030. A GL32h glulam column with ρ_k = 440 kg/m^3 has been considered in the calculation.

GENERAL PRINCIPLES:

- For t_{CLT} panel thickness intermediate to those listed in the table, it is recommended to use the $F_{slab,k}$ strength values provided for the lower thickness.
- The design values on timber side can be obtained from the characteristic values as follows. The coefficients γ_M,γ_{MT} and k_{mod} should be taken according to the current regulations used for the calculation. The γ_M coefficient is the relevant safety coefficient on connection side while the γ_{MT} coefficient is the relevant safety coefficient on timber side.

$$R_{slab,d} = \frac{R_{slab,k} \cdot k_{mod}}{\gamma_M} \qquad R_{t,d} = \frac{R_{t,k} \cdot k_{mod}}{\gamma_M}$$

$$R_{timber,up,d} = \frac{R_{timber,up,k} \cdot k_{mod}}{\gamma_{MT}}$$

$$R_{timber,down,d} = \frac{R_{timber,down,k} \cdot k_{mod}}{\gamma_{MT}}$$

- The design values on steel side can be obtained from the characteristic values as follows. The coefficients γ_{steel} should be taken according to the current regulations used for the calculation (see notes 1 and 2).

$$R_{tp,d} = \frac{R_{tp,k}}{\gamma_{steel}} \qquad R_{lt,d} = \frac{R_{lt,k}}{\gamma_{steel}}$$

$$R_{b,d} = \frac{R_{b,k}}{\gamma_{steel}} \qquad R_{bp,d} = \frac{R_{bp,k}}{\gamma_{steel}}$$

- The following expressions must be fulfilled for the verifications:

$$\frac{F_{slab,d}}{R_{slab,d}} \leq 1,0$$

$$\frac{F_{co,up,d}}{min\left\{R_{timber,up,d}\, ;\, R_{tp,d}\, ;\, R_{lt,d}\, ;\, R_{b,d}\, ;\, R_{bp,d}\right\}} \leq 1,0$$

$$\frac{F_{co,up,d} + F_{slab,d}}{R_{timber,down,d}} \leq 1,0$$

$$\frac{F_{t,d}}{R_{t,d}} \leq 1,0$$

- The compression strength perpendicular to the fiber in the floor ($F_{slab,d}$) does not include the shear and rolling shear strength of the CLT panel in the area affected by the presence of the support. The floor at the Ultimate Limit State and the Service Limit State must be verified separately.
- The checks on the column side refer to the compressive strength parallel to the fiber, at the PILLAR connector. Column instability must be verified separately.

X-RAD

X-RAD CONNECTION SYSTEM

VIDEO

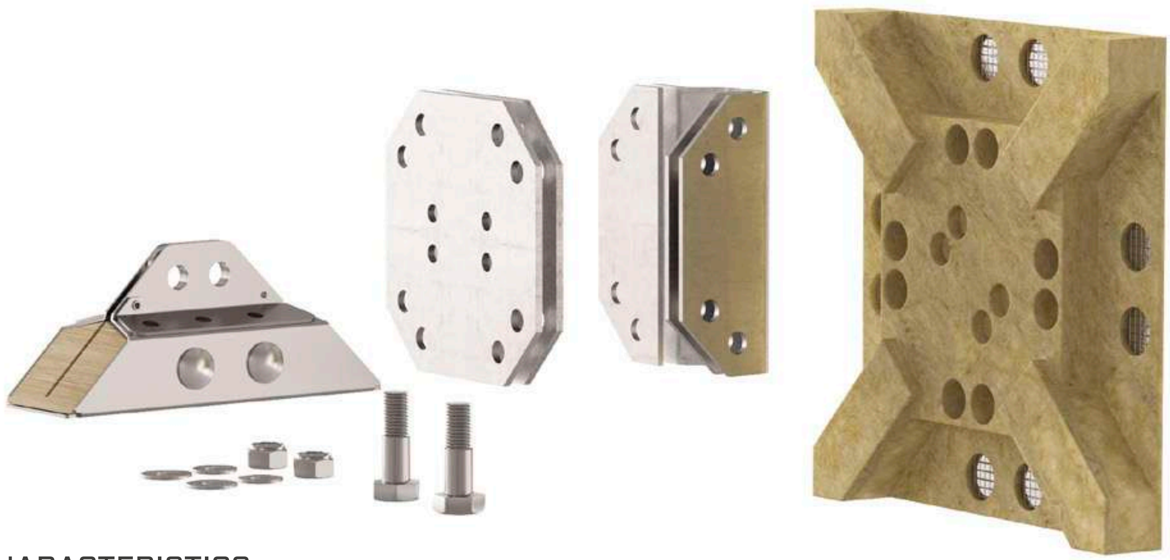
MY PROJECT SOFTWARE

ETA 15/0632

REVOLUTIONARY
A radical innovation in timber constructions. It redefines the standard for shear, resistance, transportation the assembling and resistance of CLT panels. X-RAD offers excellent static and seismic performance.

PATENTED
Handling and assembly of ultra-rapid CLT walls and floors. Drastic reduction of assembly time, construction site errors and risk of injury.

STRUCTURAL SAFETY
Ideal connection system for seismic design with tested and certified ductility values (CE - ETA 15/0632).



CHARACTERISTICS

FOCUS	CLT buildings fastening
CLT WALLS	from 100 to 200 mm
STRENGTH	R_K up to 280 kN
FASTENERS	XVGS, XBOLT, MGS

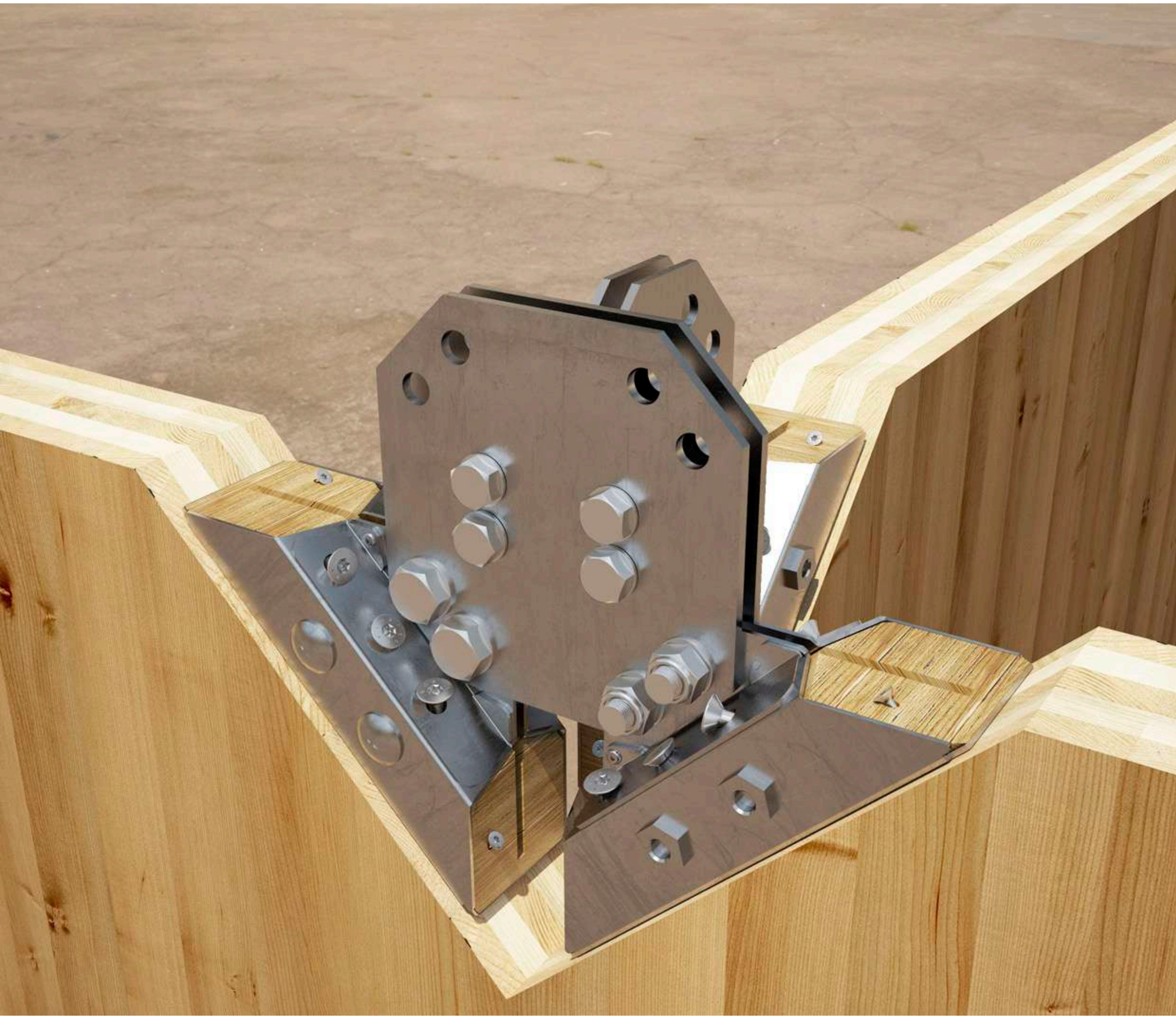
VIDEO
Scan the QR Code and watch the video on our YouTube channel

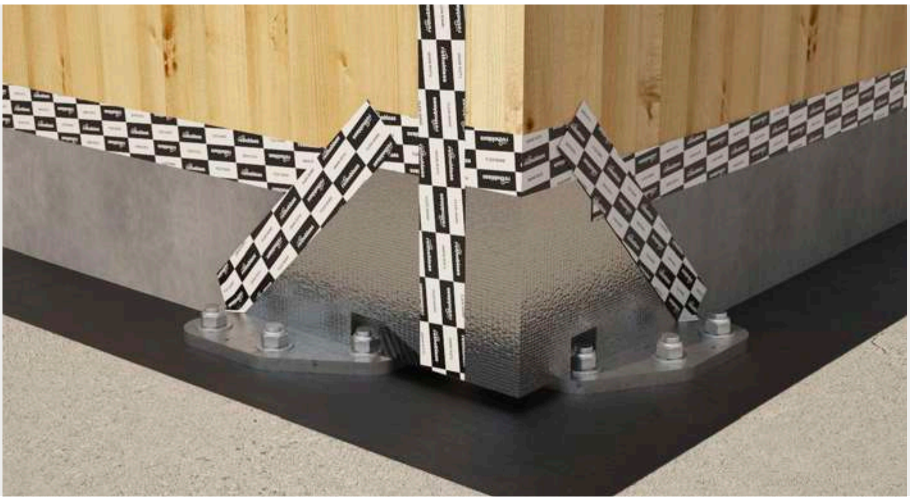
MATERIAL

Steel perforated plates and beechwood laminated veneered lumber.

FIELDS OF USE

Transportation, assembling and realization of timber buildings with CLT (Cross Laminated Timber) structure.





INNOVATION

The metal box element incorporates a multi-layer beechwood profile which is connected to the angles of the CLT walls with full thread screws.

PROTECTION

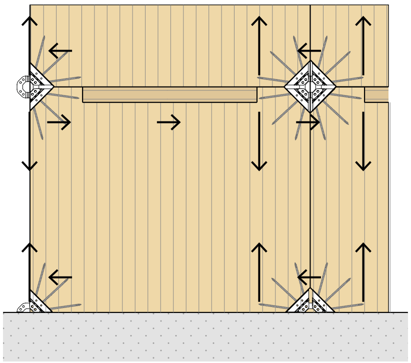
The use of X-SEAL and self-adhesive protection membranes for CLT walls at the ground connection ensures the structure durability.

CONSTRUCTION SITE SET UP TIMES

The standardisation and the reduction of the total number of joints make the X-RAD system successful when the construction site set up times are a determining factor for the construction of the work. These advantages were demonstrated during the construction of the first X-RAD system buildings, when comparing the X-RAD system and all the necessary operations to the traditional use of anchors it was much quicker.

COMPARISON OF FASTENING TIMES BETWEEN X-RAD SOLUTION AND TRADITIONAL ANGLE BRACKETS

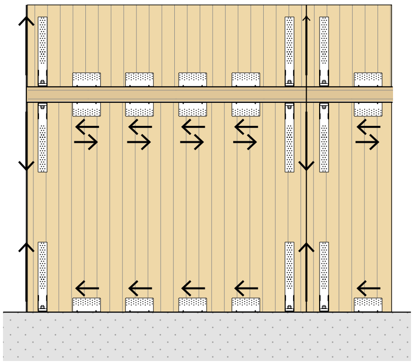
X-RAD SYSTEM



Average time needed to install 1 X-ONE: **about 5 minutes.**

Total time required for positioning and complete assembly of a wall (no. 4 X-ONE in the factory + n. 4 X-PLATE on site): **about 30 minutes.**

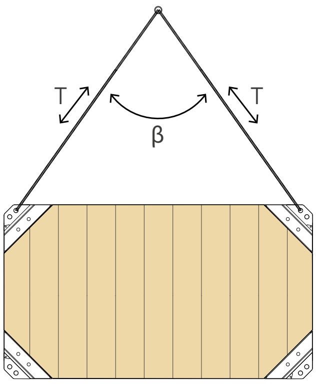
TRADITIONAL SYSTEM



Total time required for positioning and complete assembly of a wall on site (fastening of no. 4 WHT440 + no. 4 TCN240 + no. 4 TTN200): **about. 60 - 70 minutes.**

VERTICAL LIFTING

The CLT walls are assembled on site using bolted joints and specific plates, specially developed to allow any geometric configuration of the panels. The X-RAD system allows lifting, handling and assembling CLT panels directly from the transport vehicle to the structure under construction, avoiding warehousing and storage phases.
The X-RAD system is certified according to the Machinery Directive 2006/42/EC for additional use as a vertical lifting point for the transport of CLT panels.



FIRE BEHAVIOR

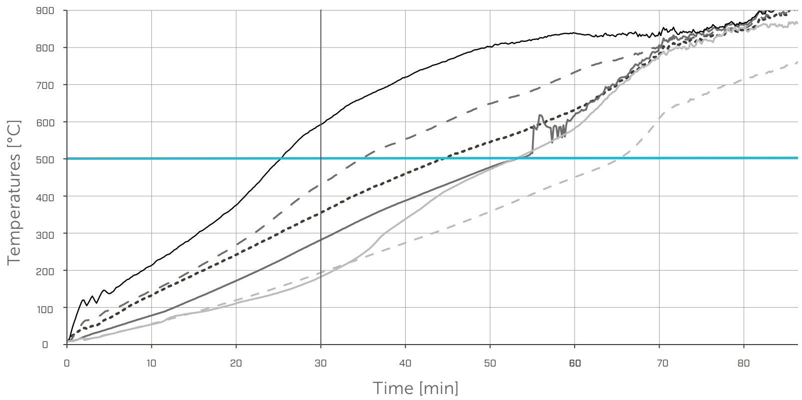
The X-RAD system provides for the positioning of the structural connection, consisting of X-ONE and X-PLATE, in axis to the wall. This allows the perfectly shaped components of the X-SEAL system to adhere to the metal components of the connection, guaranteeing airtightness and thermal-acoustic insulation. In order to understand the fire behaviour of this system, a research programme has been initiated at the Technical University of Munich (TUM). At this stage, an MI inter-storey node complete with X-ONE, X-PLATE and X-SEAL and their sealing with acrylic tape, assembled inside a CLT panel 100 mm thick, was studied. Two different types of specimens were tested:

- **(A)** structural wall with X-RAD system without any coating on fire side;
- **(B)** structural wall with X-RAD system covered with plasterboard sheets according to DIN EN520 assembled in adherence.

To monitor the temperature evolution during the test, thermocouples have been installed in 6 different positions inside the connection. As described in Eurocode EN 1993:1-2, steel components show a significant reduction in yield strength, modulus of elasticity and proportionality limit above 400°C. At 500°C, the yield strength has been reduced by 20% and the modulus of elasticity by 40%. The temperature of 500°C will be considered as a reference value during the test.

EVOLUTION OF AVERAGE TEMPERATURES REGISTERED

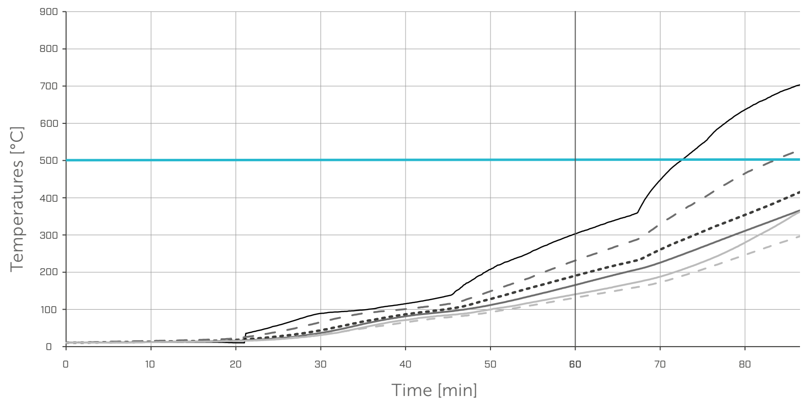
SPECIMEN (A)
UNCOATED (SIDE EXPOSED TO FIRE)



The analysis of the results shows that most of the components of the X-RAD system (except the most external parts of the X-ONE) maintain a temperature below 500°C for at least 30 minutes, while still showing good fire behaviour, thanks to the protection offered by the X-SEAL system.

X-PLATE F (1/3/5)
X-ONE BASESCREW FA (8/10)
X-PLATE FA (2/4/6)
X-ONE - X-PLATE (11/12/13/14)
X-ONE BASESCREW F (7/9)
X-ONE - CRACK (17/18)

SPECIMEN (B)
COATED (SIDE EXPOSED TO FIRE)



The analysis of the results shows that all the components of the X-RAD system maintain a temperature below 500°C for over 60 minutes, thus showing excellent fire behaviour, thanks to the protection offered by the X-SEAL system and the coated plasterboards.

X-PLATE F (3/5)
X-ONE BASESCREW FA (8/10)
X-PLATE FA (2/4/6)
X-ONE - X-PLATE (11/12/13/14)
X-ONE BASESCREW F (7/9)
X-ONE - CRACK (17/18)

X-ONE

CODES AND DIMENSIONS

X-ONE

CODE	L [mm]	B [mm]	H [mm]	pcs
XONE	273	90	113	1

X-VGS SCREW

CODE	L [mm]	b [mm]	d_1 [mm]	TX	pcs
XVGS11350	350	340	11	TX50	25

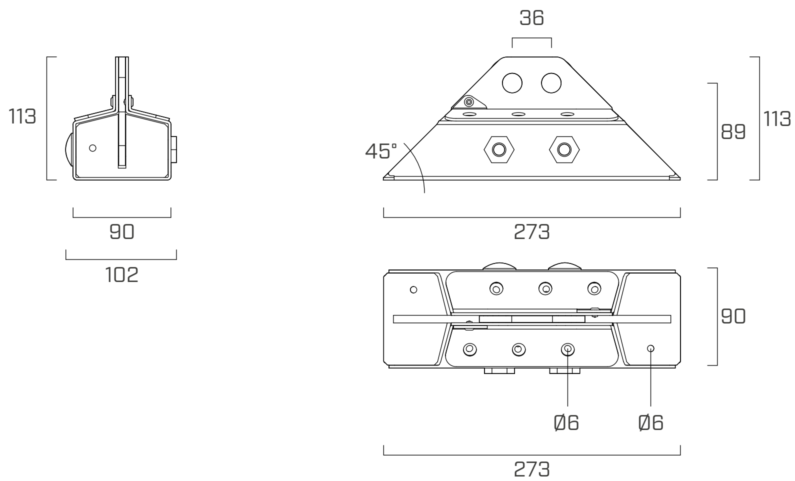
MANUAL TEMPLATE

CODE	description	pcs
ATXONE	manual template for X-ONE assembly	1

AUTOMATIC TEMPLATE

CODE	description	pcs
JIGONE	automatic template for X-ONE assembly	1

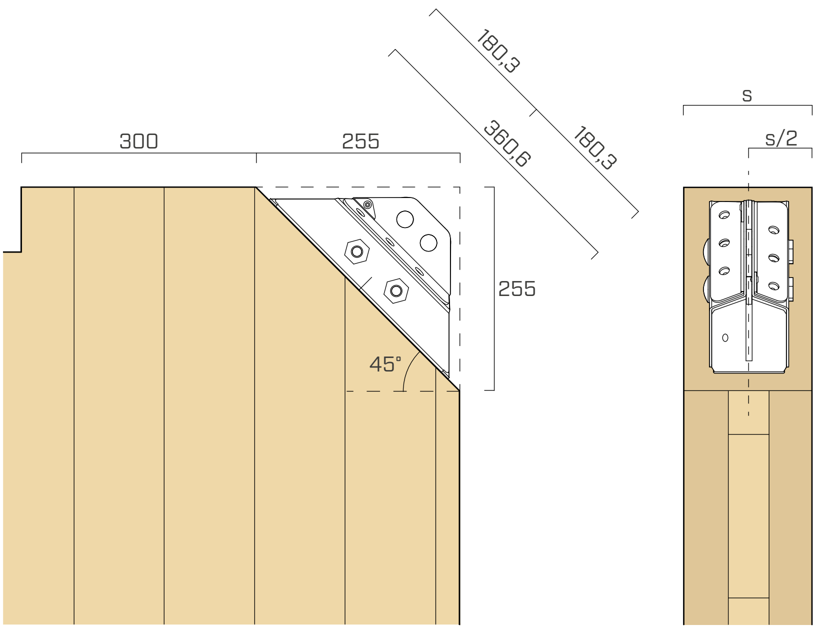
GEOMETRY



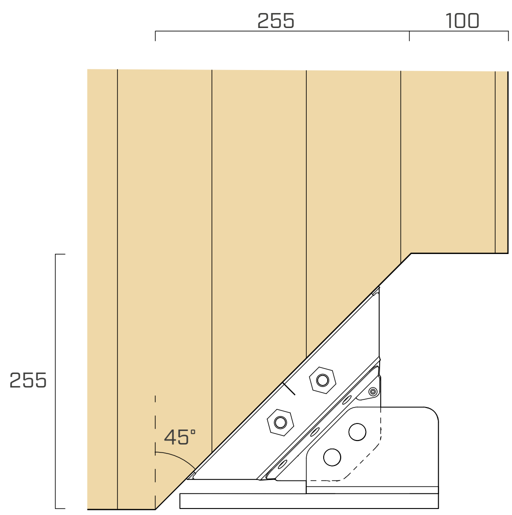
POSITIONING

Regardless of the panel thickness and its location on the construction site, the shear for fastening X-ONE is made at the top of the walls at 45°, and has a length of 360,6 mm.

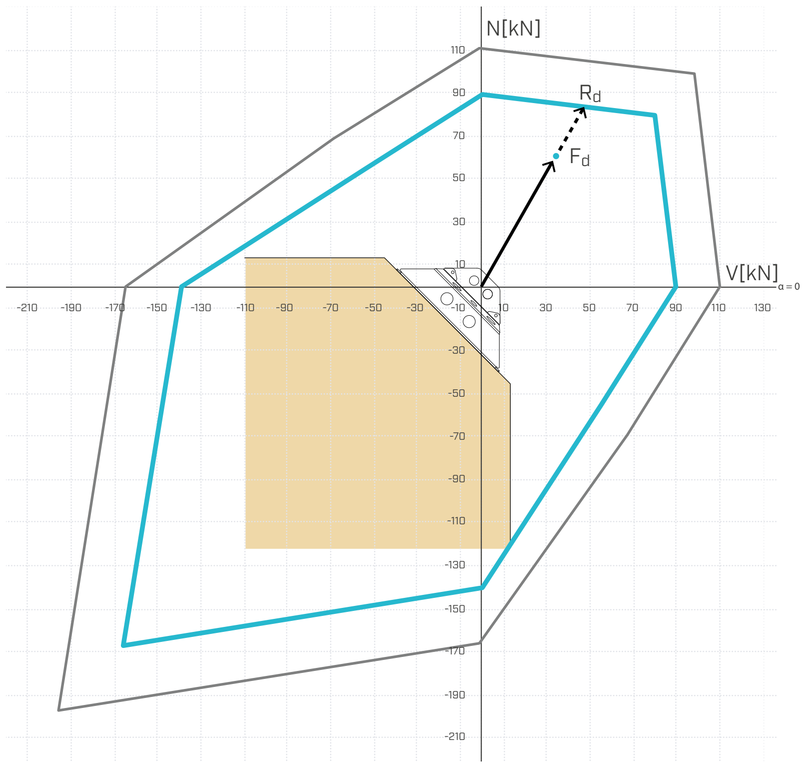
INTER-STOREY AND TOP NODES SPECIAL STANDARD SHEAR



BOTTOM NODES SPECIAL STANDARD SHEAR



DESIGN STRENGTHS



Design strength domain according to EN 1995-1-1 and EN 1993-1-8

The verification of the X-ONE connection is considered successful when the representative point of the F_d stress falls within the design strength domain:

$$F_d \leq R_d$$

The X-ONE design domain refers to the strength values and γ_M coefficients shown in the table and for loads with instantaneous life class (earthquake and wind).

LEGEND:

- R_k (grey line)
- R_d EN 1995-1-1 (blue line)

A table summarizing the **characteristic strengths** in the various stress configurations and a reference to the relative safety coefficient according to the failure mode (steel or timber) is shown.

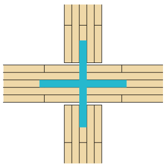
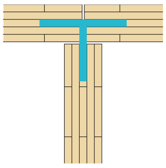
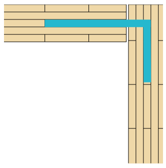
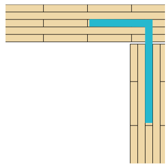
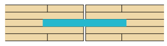
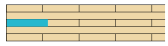
	GLOBAL STRENGTH	STRENGTH COMPONENTS		FAILURE MODES	PARTIAL SAFETY COEFFICIENTS [1]
α	R_k [kN]	V_k [kN]	N_k [kN]		γ_M
0°	**111,6**	111,6	111,6	VGS tension	γ_{M2} = 1,25
45°	**141,0**	99,7	99,7	block tearing on M16 holes	γ_{M2} = 1,25
90°	**111,6**	0,0	111,6	VGS tension	γ_{M2} = 1,25
135°	**97,0**	-68,6	68,6	VGS tension	γ_{M2} = 1,25
180°	**165,9**	-165,9	0,0	VGS thread extract	$\gamma_{M,timber}$ = 1,3
225°	**279,6**	-197,7	-197,7	timber compression	$\gamma_{M,timber}$ = 1,3
270°	**165,9**	0,0	-165,9	thread withdrawal VGS	$\gamma_{M,timber}$ = 1,3
315°	**97,0**	68,6	-68,6	VGS tension	γ_{M2} = 1,25
360°	**111,6**	111,6	0,0	VGS tension	γ_{M2} = 1,25

NOTES:

[1] The partial safety coefficients should be taken according to the current regulations used for the calculation. The table shows the values on steel side according to EN 1993-1-8 and on the timber side according to EN 1995-1-1.

X-PLATE

CODES AND DIMENSIONS

X-SHAPE	T-SHAPE	G-SHAPE	J-SHAPE	I-SHAPE	O-SHAPE
					
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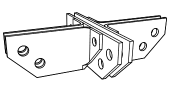	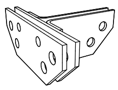	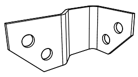	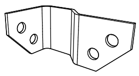	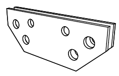	
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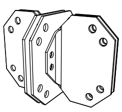
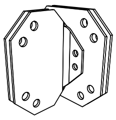
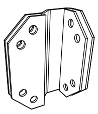
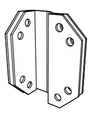
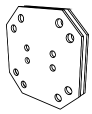
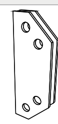
4 XONE 24 XVGS11350 8 XBOLT1660 2 XBOLT1260	3 XONE 18 XVGS11350 6 XBOLT1660 2 XBOLT1260	2 XONE 12 XVGS11350 4 XBOLT1660	2 XONE 12 XVGS11350 4 XBOLT1660	2 XONE 12 XVGS11350 4XBOLT1660	
X-PLATE MID					
					
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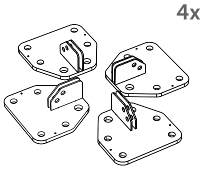
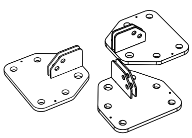
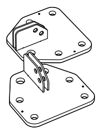
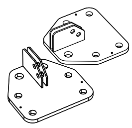
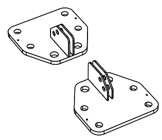
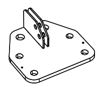
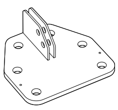
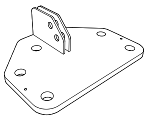
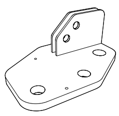
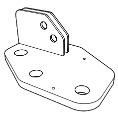
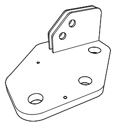
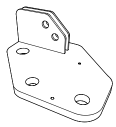
8 XONE 48 XVGS11350 8 XBOLT1665 8 XBOLT1660 4 XBOLT1260	6 XONE 36 XVGS11350 8 XBOLT1665 4 XBOLT1660 4 XBOLT1260	4 XONE 24 XVGS11350 8 XBOLT1660	4 XONE 24 XVGS11350 8 XBOLT1660	4 XONE 24 XVGS11350 8 XBOLT1665	2 XONE 12 XVGS11350 4 XBOLT1660
X-PLATE BASE					
4x 	3x 	2x 	2x 	2x 	1x 
					
BMINI	**BMAXI**	**BMINIL**	**BMINIR**	**BMAXIL**	**BMAXIR**
1 XONE 6 XVGS11350 2 XBOLT1660	1 XONE 6 XVGS11350 2 XBOLT1660	1 XONE 6 XVGS11350 2 XBOLT1660	1 XONE 6 XVGS11350 2 XBOLT1660	1 XONE 6 XVGS11350 2 XBOLT1660	1 XONE 6 XVGS11350 2 XBOLT1660

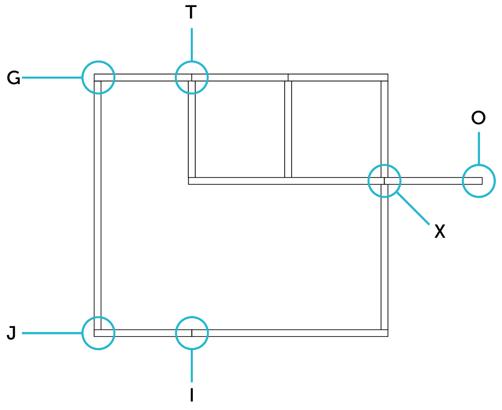
X-PLATE SYSTEM

X-ONE makes the CLT panel a module with specific connections for fastening. X-PLATE allows modules to become buildings. Panels with thickness between 100 and 200 mm can be connected.
X-PLATE plates are the ideal solution for every construction site situation, developed for all geometric configurations. The X-PLATE plates are identified according to their positioning on the building level (X-BASE, X-MID, X-TOP) and according to the geometric configuration of the node and the thickness of the connected panels.

X-PLATE MID-TOP CODE COMPOSITION

LEVEL + NODE + THICKNESS

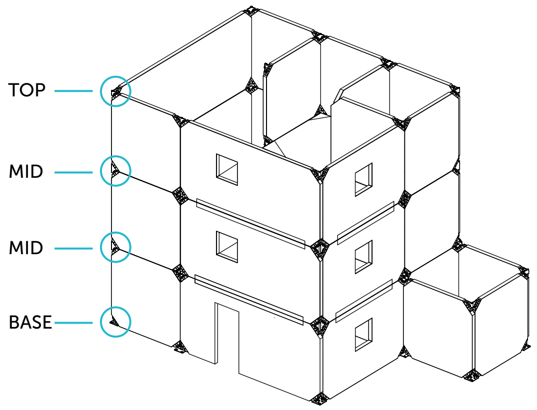
- **LEVEL**: indicates that they are MID (M) and TOP (T) inter-storey plates
- **NODE**: indicates the type of node (X, T, G, J, I, O)
- **THICKNESS**: indicates the thickness of the panel that can be used with that plate. There are three families of standard thickness values, 100 mm - 120 mm - 140 mm. All panel thickness values between 100 and 200 mm can be used, using universal plates for G, J, T and X nodes, in combination with specially developed SPACER shimming plates. The universal plates are available in the MID-S and TOP-S versions for panels with thickness between 100 and 140 mm and in the MID-SS and TOP-SS versions for panels with thickness between 140 and 200 mm.



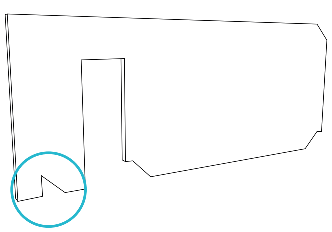
BASE X-PLATE CODE COMPOSITION

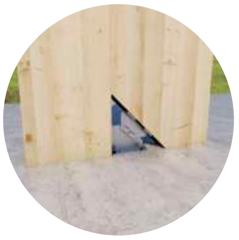
LEVEL + THICKNESS + ORIENTATION

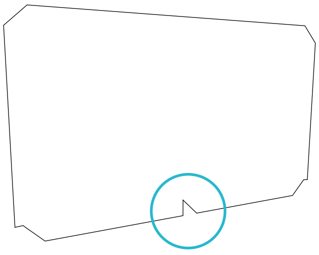
- **LEVEL**: B indicates that they are base plates.
- **THICKNESS**: indicates the thickness interval of the panel that can be used with that plate. There are two families of plates, the first designed for thickness values from 100 to 130 mm (BMINI code), the second for thickness values from 130 to 200 mm (BMAXI code).
- **ORIENTATION**: indicates the orientation of the plate with respect to the wall, right/left (R/L), indication present only for asymmetrical plates.

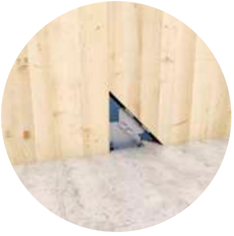


ACCESSORIES: X-PLATE BASE EASY PLATES FOR NON-STRUCTURAL FASTENINGS









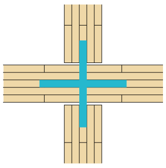
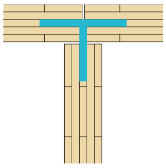
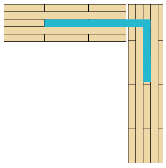
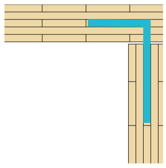
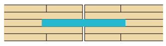
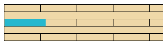
Where a foundation fastening is required for non-structural walls or temporary fastening for correct wall alignment (e.g. walls with very long length), it is possible to install the BEASYT plate (as an alternative to the X-ONE plate) on the bottom corner of the CLT panel (with simplified 45° shear without horizontal sawing) and the BEASYC plate (as an alternative to X-PLATE BASE plates) on the foundation slab.

CODES AND DIMENSIONS

CODE	s [mm]	$Ø_{SUP}$ [mm]	n. $Ø_{SUP}$	$Ø_{INT}$ [mm]	n. $Ø_{INT}$	pcs
BEASYT	5	9	3	17	2	1
BEASYC	5	17	2	13	2	1

X-SEAL

CODES AND DIMENSIONS

X-SHAPE	T-SHAPE	G-SHAPE	J-SHAPE	I-SHAPE	O-SHAPE
					
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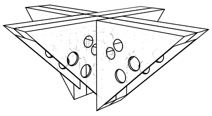	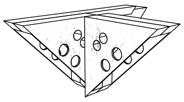	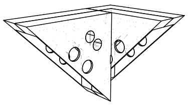	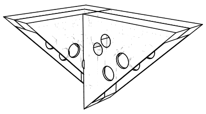	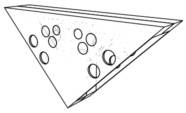	
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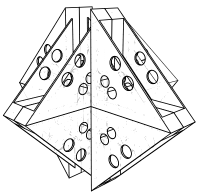	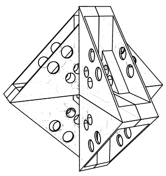	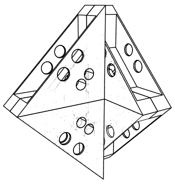	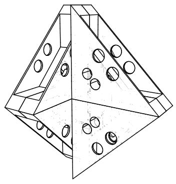	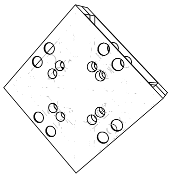	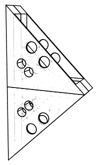
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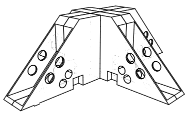
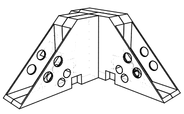
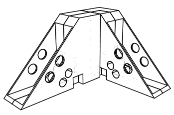
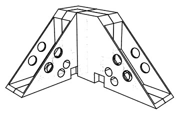
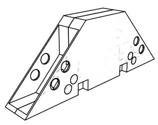
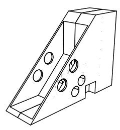
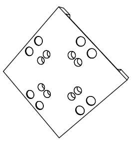
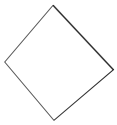
X-SEAL BASE					
					
XSEALBX100 **XSEALBX120** **XSEALBX140** 8 COMPONENTS	**XSEALBT100** **XSEALBT120** **XSEALBT140** 5 COMPONENTS	**XSEALBG100** **XSEALBG120** **XSEALBG140** 4 COMPONENTS	**XSEALBJ100** **XSEALBJ120** **XSEALBJ140** 4 COMPONENTS	**XSEALBI100** **XSEALBI120** **XSEALBI140** 2 COMPONENTS	**XSEALBO100** **XSEALBO120** **XSEALBO140** 2 COMPONENTS

X-SEAL BASE	X-SEAL SPACER
	
XSEALSPARE50 **XSEALSPARE60** **XSEALSPARE70**	**XSEALSPACER5** **XSEALSPACER10**

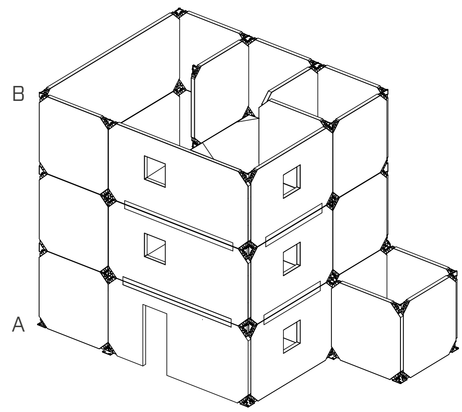
The X-SEAL system uses the same logic as the X-PLATE plates. Each configuration is characterized and described by:

- **LEVEL**: indicates whether it is base B (BASE), inter-storey M (MID) or T coverage (TOP) level.
- **NODE**: indicates the type of node (X, T, G, J, I, O).
- **THICKNESS**: indicates the thickness of the panel that can be used. There are three families of standard thickness values: 100 mm - 120 mm - 140 mm. All panel thickness values between 100 mm and 200 mm can be used, combining the basic components for standard thickness values with SPACER elements having thickness values of 5 and 10 mm.

THERMO-HYGROMETRIC BEHAVIOUR

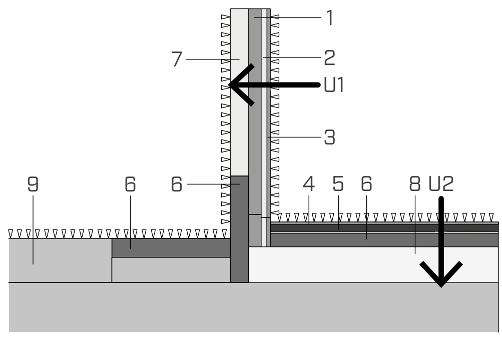
The X-RAD system thermal analysis is carried out in order to quantify and verify the point-to-point thermal bridge.
The most unfavourable conditions in which to concentrate the study and verification are the ground connection of the BASE G element and the node of the wall and floor connection of the roof, TOP G.
The study is performed using a FEM - 3D model. The reference stratigraphy considered represents a possible standard situation in current building practice. The image shows the construction panels and the materials considered. The choice of specific materials allows to contextualize the verifications and does not exclude the use of different products.

An overview of the study with some of the results obtained is given below. To obtain the full study report or for more information contact the Rothoblaas technical office.



NODE A | Ground connection

coefficient	description	value
X Chi (16 cm)	heat flow	- 0,330 W/node
fRsi $_{(Te\ =\ -\ 5\ °C)}$	temperature factor	0,801



1. CLT 10 cm
2. Timber fibre insulation 5 cm
3. Plasterboard
4. Timber floor
5. Concrete screed
6. Extruded polystyrene XPS 12 cm
7. Timber fibre insulation 12 cm
8. Concrete
9. Ground

NODE A | Thermal flow (Chi)

insulation	wall transmittance	value
12 + 5 cm	0,190 W/m^{2}K	- 0,380 W/node
16 + 5 cm	0,160 W/m^{2}K	- 0,330 W/node
24 + 5 cm	0,121 W/m^{2}K	- 0,260 W/node

NODE A | Danger of mould (Tsi)

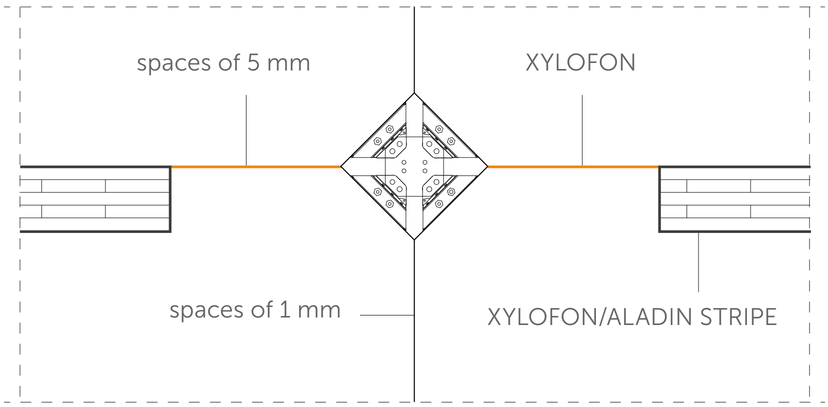
temperature (te)	Tsi insulation 12 cm	Tsi insulation 16 cm	Tsi insulation 24 cm
fRsi-average	*0,801*	*0,811*	*0,824*
- 5,0 °C	15,2 °C	15,5 °C	15,8 °C
0,0 °C	16,0 °C	16,2 °C	16,5 °C
5,0 °C	16,8 °C	16,9 °C	17,1 °C

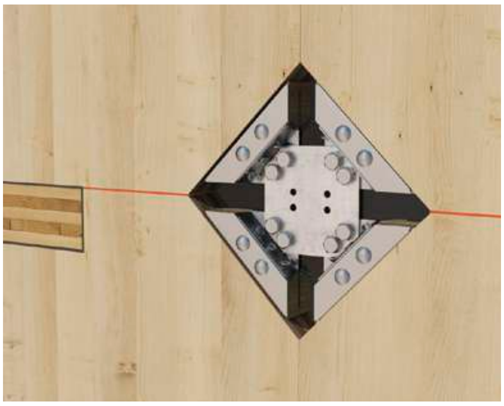
ACOUSTIC BEHAVIOUR

With X-RAD, structural nodes are concentrated in individual and distinct points. With regard to acoustics, a study was carried out within the Flanksound Project in order to achieve the acoustic characterization of structural nodes made with X-RAD. Rothoblaas has therefore promoted research aimed at measuring the K_{ij} vibration reduction index for a variety of CLT panel joints, with the dual objective of providing specific experimental data for the acoustic design of CLT buildings and contributing to the development of calculation methods.
For further information and details on the project and measurement methods, refer to the SOUNDPROOFING SOLUTIONS catalogue.

ATTENTION TO DETAILS

Thanks to the point-to-point positioning of the structural nodes at the top of the CLT walls, X-RAD allows the non-interposition of floors between the walls. This brings important benefits from an acoustic point of view, which increase with the use of special profiles, providing the spaces indicated in the figure.





SPECIAL APPLICATIONS

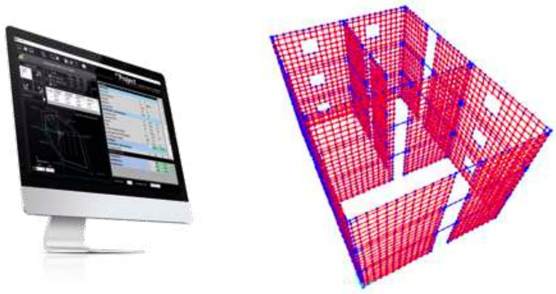
The X-RAD system opens new frontiers in the CLT structures connections field.
The high strength and extreme stiffness allow to increase the CLT panels exploitation level, optimizing the performance of timber and connections.
Innovative solutions can be created such as hybrid structures (timber-to-concrete, timber-to-steel), stiffening core structures and modular structures.

WANT TO KNOW MORE?

X-RAD is a complete construction system in every detail. A brief overview of the system is presented in this catalogue. For further information and details on the construction system, see the technical data sheet on the website www.rothoblaas.com, which contains, among other information, sections dedicated to the following topics.

MY PROJECT: X-ONE MODULE

Calculation of the X-ONE connector through the MyProject software.

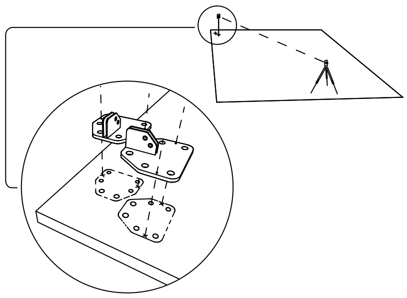


X-RAD SYSTEM MODELLING GUIDELINES

Proposal for a FEM modelling method for buildings made with X-RAD.

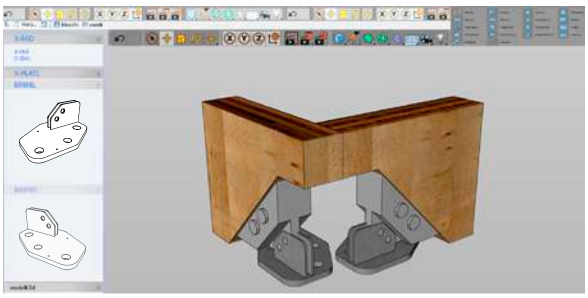
INSTALLATION

Details on manual and automated connector installation.



FROM MODELLING TO CONSTRUCTION SITE

Procedure for optimized design and execution.



CAD/CAM CONSTRUCTION DESIGN

Details of the nodes and geometries to be drawn in the CAD/CAM model.

POSSIBILITY OF ADVANCED PREFABRICATION

Possibility of advanced prefabrication of buildings made with X-RAD.

ANGLE BRACKETS, HANGERS AND PERFORATED PLATES

ANGLE BRACKETS, HANGERS AND PERFORATED PLATES

ANGLE BRACKETS, HANGERS AND PERFORATED PLATES

WBR

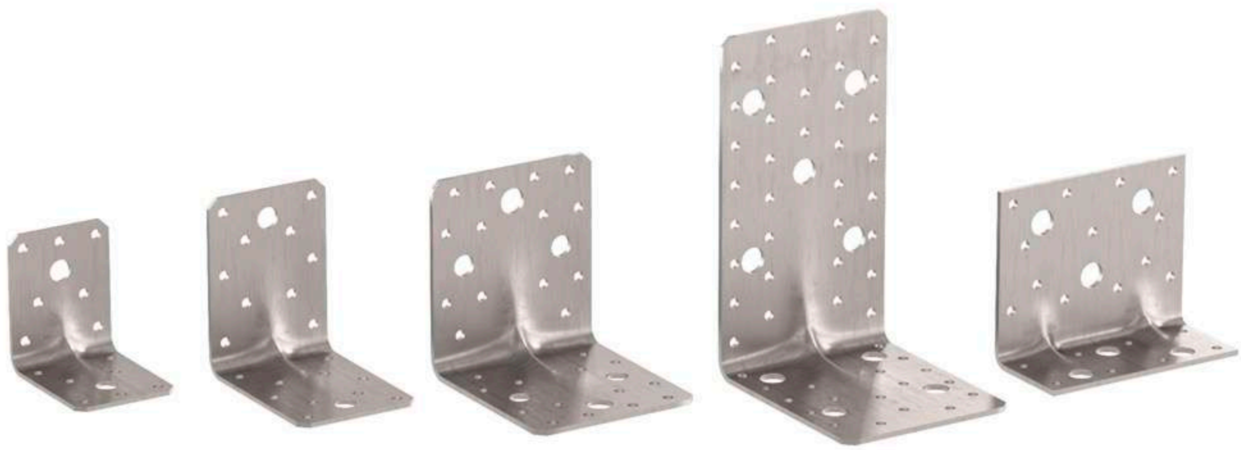
CE
ETA

ANGLE BRACKETS FOR BUILDINGS

COMPLETE RANGE
A simple but effective component. Available in a full range of sizes, making it suitable for numerous applications.

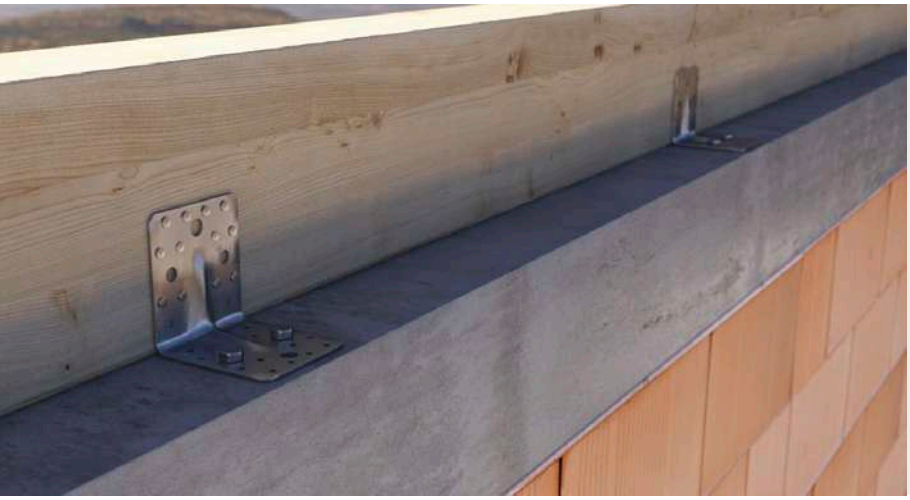
CERTIFIED STRENGTH
Ideal for structural joints which require tensile,shear and rocking capacity.

TIMBER AND CONCRETE
Due to the quantity and arrangement of the fastening holes, it can be used for both timber to timber, and timber to concrete connections.



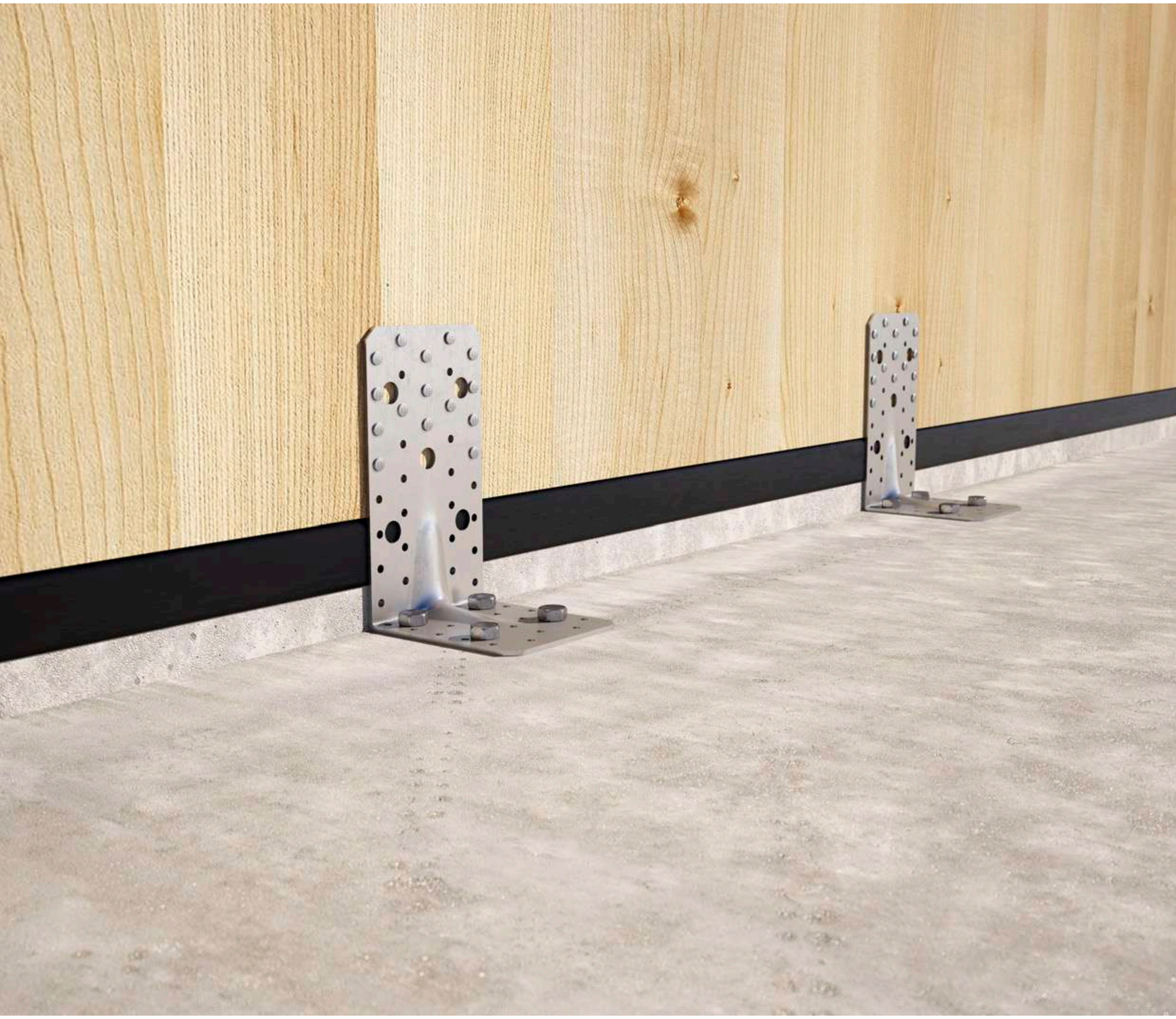
CHARACTERISTICS

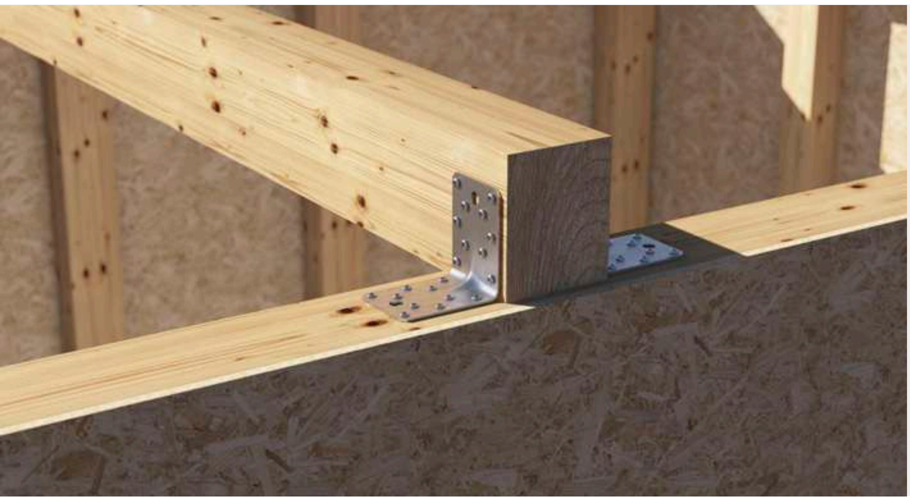
FOCUS	shear and tension fastening
HEIGHT	from 70 to 170 mm
THICKNESS	from 1,5 to 3,0 mm
FASTENERS	LBA, LBS, SKR, VIN-FIX PRO



MATERIAL
Bright zinc plated carbon steel three dimensional perforated plate.

FIELD OF USE
Timber-to-concrete and timber-to-timber joints
- solid timber and glulam
- CLT, LVL
- framed structures (platform frame)
- timber based panels





POINT-TO-POINT SOLUTION

The wide selection of sizes makes it a perfect solution for point-to-point applications, even for the most unusual ones.

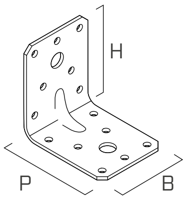
SAFE

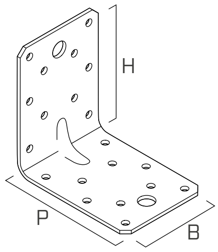
Suitability of use and safety are guaranteed by the CE mark according to the ETA. Values certified on the basis of tests on the product.

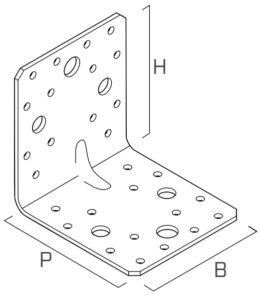
CODES AND DIMENSIONS

WBR 70-90-100

S250
GALV

1


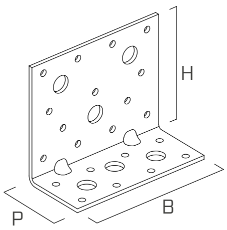
2


3


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø11 pcs	n Ø13 pcs	timber	concrete	pcs
1	**WBR070**	55	70	70	2,0	14	2	-	●	●	100
2	**WBR090**	65	90	90	2,5	20	2	-	●	●	100
3	**WBR100**	90	100	100	3,0	28	4	2	●	●	50

WBR 90110-170

DX510
GALV

1


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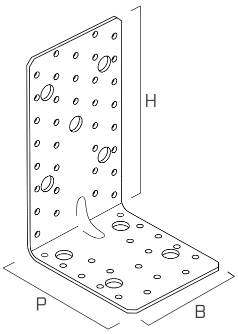
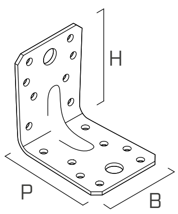


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø13 pcs	timber	concrete	pcs
1	**WBR90110**	110	50	90	3,0	21	6	●	●	50
2	**WBR170**	95	114	174	3,0	53	9	●	●	25

WBR THIN 70-90-100

S250
GALV

1


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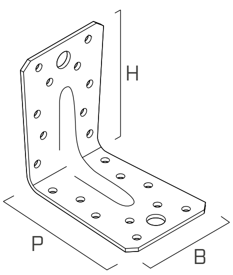

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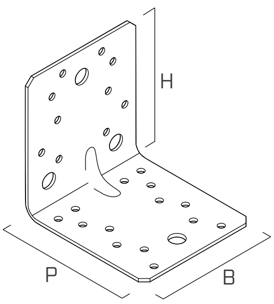


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø11 pcs	timber	concrete	pcs
1	**WBR07015**	55	70	70	1,5	16	2	●	●	100
2	**WBR09015**	65	90	90	1,5	20	2	●	●	100
3	**WBR10020**	90	100	100	2,0	24	4	●	●	50

MATERIAL AND DURABILITY

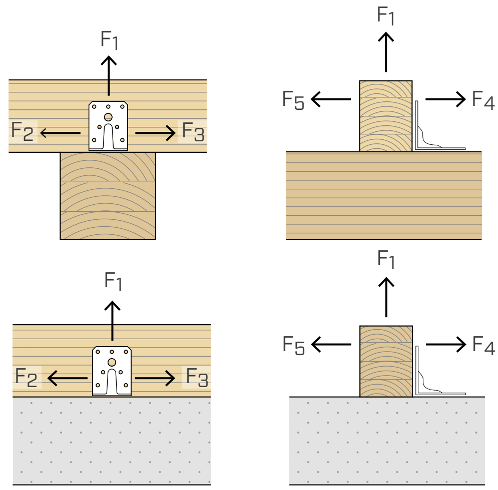
WBR - WBR THIN 70-90-110:
carbon steel S250GD+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

WBR 90110-170: carbon steel DX51D+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

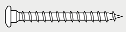
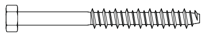
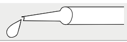
FIELD OF USE

- Timber-to-timber joints
- Timber-to-concrete joints
- Timber-to-steel joints

EXTERNAL LOADS

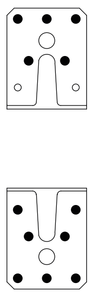


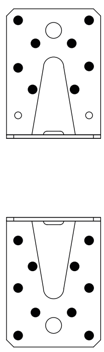
ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
SKR	screw anchor		10		488
EPO-FIX PLUS	chemical anchor		M10 - M12		517

STATIC VALUES | TIMBER-TO-TIMBER JOINT

WBR 70-90-100


1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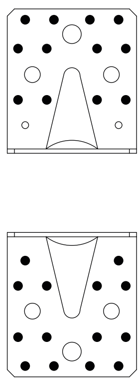
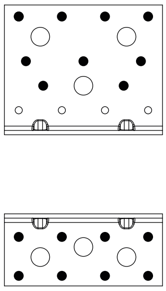

3

	FASTENING NUMBER			CHARACTERISTIC VALUES		
	holes fastening Ø5					
CODE	type	Ø x L [mm]	n_v pcs	$R_{2/3,k}$ [kN]	$R_{1,k}$ [kN]	$R_{4/5,k}$* [kN]
1 **WBR070**	LBA nails	Ø4,0 x 60	12	**3,9**	**1,7**	**2,0**
2 **WBR090**	LBA nails	Ø4,0 x 60	18	**5,6**	**3,1**	**3,7**
3 **WBR100**	LBA nails	Ø4,0 x 60	26	**8,9**	**3,8**	**4,6**

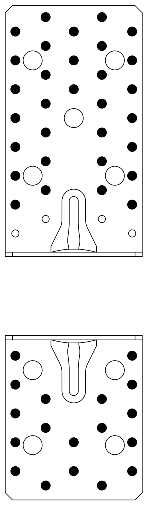
* 2 angle brackets per joint

STATIC VALUES | TIMBER-TO-TIMBER JOINT

WBR 90110-170



1

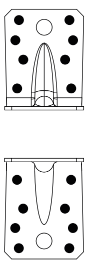


2

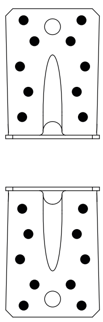
	FASTENING NUMBER			CHARACTERISTIC VALUES				
	holes fastening Ø5			$R_{2/3,k}$	$R_{1,k}$		$R_{4/5,k}$ *	
CODE	type	Ø x L	n_v	$R_{2/3,k\ timber}$	$R_{1,k\ timber}$	$R_{1,k\ steel}$	$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$
		[mm]	pcs	[kN]	[kN]	[kN]	[kN]	[kN]
1 **WBR90110**	LBA nails	Ø4,0x60	17	**7,1**	**2,5**	**3,4**	**10,4**	**10,9**
2 **WBR170**	LBA nails	Ø4,0x60	49	**11,0**	**1,7**	**3,7**	**12,4**	**9,2**

* 2 angle brackets per joint

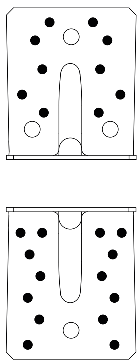
WBR THIN 70-90-100



1



2

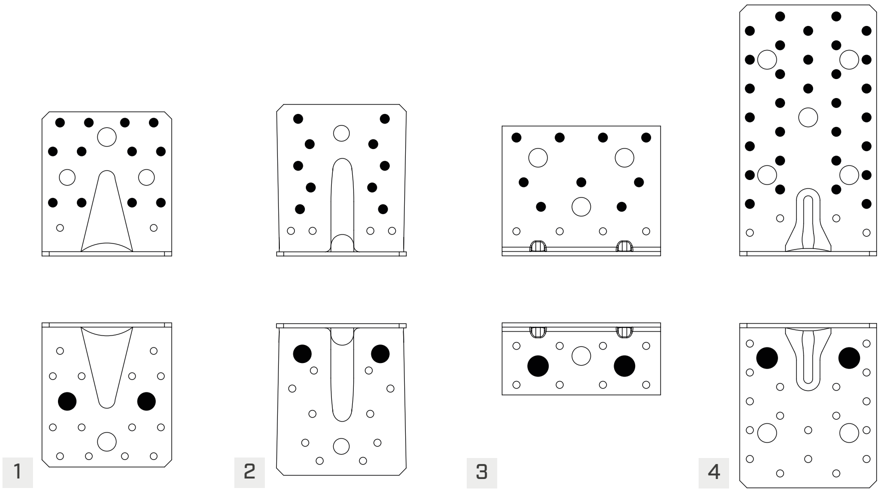


3

	FASTENING NUMBER			CHARACTERISTIC VALUES		
	holes fastening Ø5					
CODE	type	Ø x L	n_v	$R_{2/3,k}$	$R_{1,k}$	$R_{4/5,k}$ *
		[mm]	pcs	[kN]	[kN]	[kN]
1 **WBR07015**	LBA nails	Ø4,0x60	16	**5,1**	**4,8**	**11,1**
2 **WBR09015**	LBA nails	Ø4,0x60	20	**6,7**	**5,3**	**11,7**
3 **WBR10020**	LBA nails	Ø4,0x60	24	**10,2**	**7,5**	**12,4**

* 2 angle brackets per joint

STATIC VALUES | TIMBER-TO-CONCRETE JOINT



		FASTENING NUMBER				CHARACTERISTIC VALUES	
		holes fastening Ø5		holes fastening Ø11	holes fastening Ø13	$R_{2/3,k}$	
CODE	type	Ø x L	n_v	n_H	n_H	$R_{2/3,k}$	Bolt $_{2/3}$ (1)
		[mm]	pcs	pcs	pcs	[kN]	$k_{t\perp}$
1 **WBR100**	LBA nails	Ø4,0x60	26	2	-	**8,9**	**1,11**
2 **WBR10020**	LBA nails	Ø4,0x60	26	2	-	**10,2**	**0,63**
3 **WBR90110**	LBA nails	Ø4,0x60	17	-	2	**7,1**	**0,71**
4 **WBR170**	LBA nails	Ø4,0x60	49	-	4	**11,0**	**0,65**

Characteristic values calculated by distributing part of the moment given by eccentricity on the nails. Other hypotheses can be calculated by the designer.

NOTES:

(1) Fastening to concrete supports shall be verified according to anchor load which can be evaluated through the coefficients $k_{t//}$ and $k_{t\perp}$ listed in the table. The load acting on the anchor can be obtained as follows:

$$F_{bolt,d} = k_t \cdot F_d$$

k_t coefficient of eccentricity
F_d design external load acting on the angle bracket

The group of anchors check is satisfied when the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_d \geq F_d$.

- The strength values of the connection system are valid under the calculation hypotheses listed in the table; for different boundary conditions shall be verified.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{k,timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,steel}}{\gamma_{steel}} \end{cases}$$

γ_{steel} should be taken as γ_{M0}

- Coefficients γ_{M0}, γ_M and k_{mod} must be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

WBR A2 | AISI304

A2
AISI 304

STAINLESS STEEL ANGLE BRACKETS

OUTDOOR
A2 | AISI304 stainless steel for outdoor use in service classes 1, 2 and 3 and for excellent durability.

VERSATILE FASTENING
Fasten with stainless steel nails and anchors. The arrangement and size of the fastening holes ensure optimal application and performance in any situation.

CHARACTERISTICS

FOCUS	outdoor use
HEIGHT	from 70 to 100 mm
THICKNESS	2,0 | 2,5 mm
FASTENERS	LBAI, SCA A2, SKR-E, AB1 A4

MATERIAL
A2 | AISI304 stainless steel.

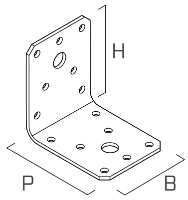
FIELD OF USE
Outdoor joints. Suitable for service class 1, 2 and 3

- solid timber and glulam
- CLT, LVL

CODES AND DIMENSIONS

WBR A2 70-90-100

A2 AISI 304

1


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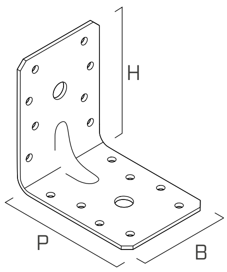

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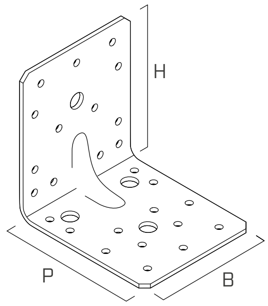
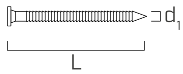


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø11 pcs			pcs
1	**AI7055**	55	70	70	2,0	14	2	●	●	100
2	**AI9065**	65	90	90	2,5	16	2	●	●	100
3	**AI10090**	90	105	105	2,5	26	4	●	●	50

LBAI A4 | AISI316

A4 AISI 316

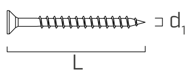
CODE	d_1 [mm]	L [mm]	b [mm]	pcs
LBAI450	4	50	40	250



SCA A2 | AISI304

A2 AISI 304

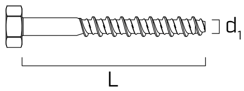
CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
SCA4550	4,5	50	30	TX20	200



SKR-E

C4 EVO COATING

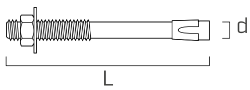
CODE	d_1 [mm]	L [mm]	SW [mm]	pcs
SKREVO1080	10	80	16	50



AB1 A4 | AISI316

A4 AISI 316

CODE	d [mm]	L [mm]	SW [mm]	pcs
AB11092A4	M10	92	17	50



EXCELLENT DURABILITY

Thanks to the A2 | AISI304 stainless steel and its stainless steel fasteners, the angle brackets are ideal for outdoor use.

WKR

CE ETA

REINFORCED ANGLE BRACKETS FOR BUILDINGS

STRENGTH
A thick bracket with a reinforced base to provide high tensile strength and rocking capacity.

VERSATILE FASTENING
Fastening can be performed using screws, nails and anchors. The arrangement and size of the fastening holes ensure optimal application and performance in any situation.

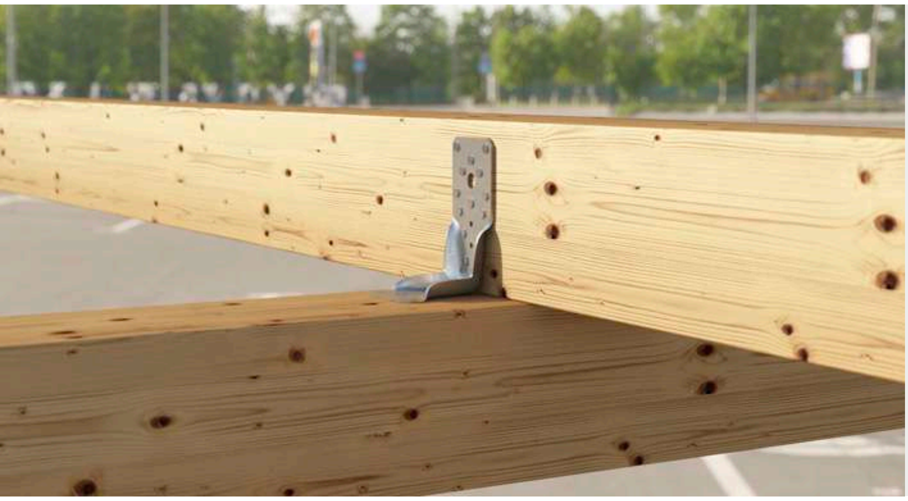
SLOTTED HOLE
Can be fastened to the ground using either screws or anchors. The slotted hole in the base allows for the selection of various fastening solutions.

CHARACTERISTICS

FOCUS	tension fastening
HEIGHT	from 95 to 285 mm
THICKNESS	3,0 | 3,5 mm
FASTENERS	LBA, LBS, SKR, VIN-FIX PRO

MATERIAL
Carbon steel, three dimensional perforated plate.

FIELD OF USE
Timber-to-concrete and timber-to-timber joints
- solid timber and glulam
- CLT, LVL
- framed structures (platform frame)
- timber based panels



REINFORCEMENT

The shape of the WKR bracket “foot” ensures both improved tensile strength and rocking capacity. Additionally, the angle bracket also supports the wall in a vertical position."

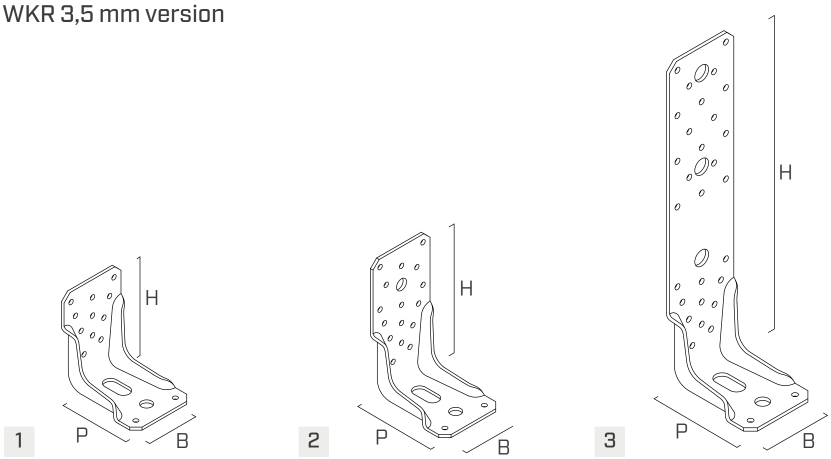
TENSION

Ideal for most common joints and all applications that require “normal” values of tensile strength.

CODES AND DIMENSIONS

WKR 3,5 mm version

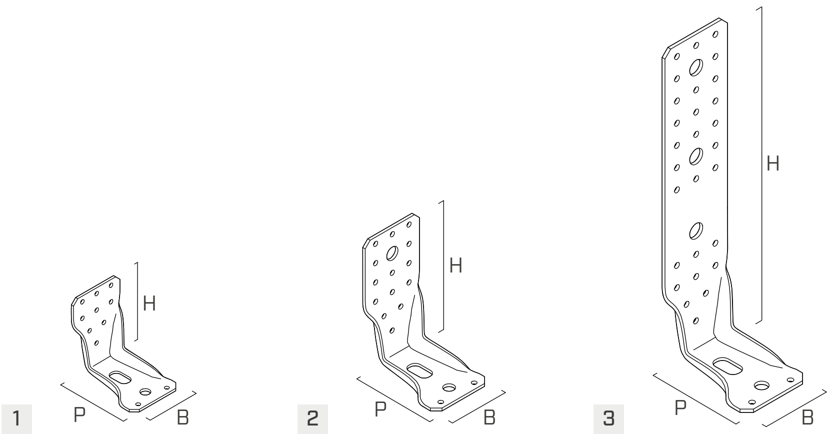
DX51D
GALV



	CODE	B	P	H	s	n Ø5	n Ø11	n_V Ø14	n_H Ø12,5	timber	concrete	pcs
		[mm]	[mm]	[mm]	[mm]	pcs	pcs	pcs	pcs			
1	**WKR095**	65	85	95	3,5	13	1	-	1	●	●	25
2	**WKR135**	65	85	135	3,5	18	1	1	1	●	●	25
3	**WKR285**	65	85	285	3,5	30	1	3	1	●	●	25

WKR 3 mm version

S250
GALV



	CODE	B	P	H	s	n Ø5	n Ø11	n Ø13,5	n_V Ø13,5	n_H Ø13,5	timber	concrete	pcs
		[mm]	[mm]	[mm]	[mm]	pcs	pcs	pcs	pcs	pcs			
1	**WKR09530**	65	88	95	3	11	1	1	-	1	●	●	25
2	**WKR13530**	65	88	135	3	16	1	2	1	1	●	●	25
3	**WKR28530**	65	88	285	3	30	1	4	3	1	●	●	25

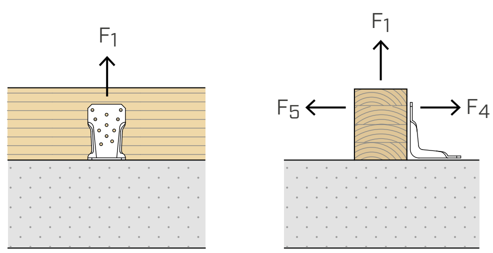
MATERIAL AND DURABILITY

WKR: steel DX51D+Z275.
WKR 3 mm: steel S250GD+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints
- Timber-to-concrete joints
- Timber-to-steel joints

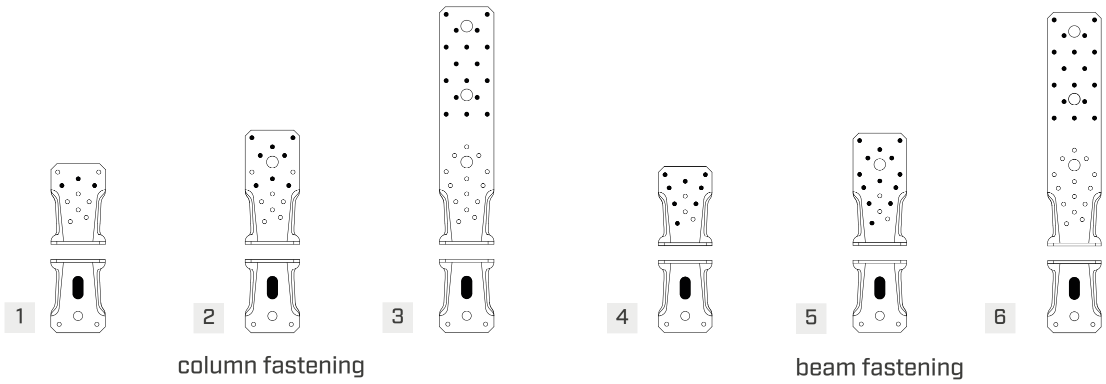
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
LBA	Anker nail	4		548
LBS	screw for plates	5		552
VGS	full thread screw	11		564
SKR	screw anchor	10		488
EPO-FIX PLUS	chemical anchor	M10 - M12		517

STATIC VALUES | TIMBER-TO-CONCRETE JOINT



CODE	FASTENING NUMBER holes fastening Ø5			CHARACTERISTIC VALUES COLUMN FASTENING $R_{1,k}$		
	type	Ø x L [mm]	n_v pcs	$R_{1,k\ timber}$ [kN]	$R_{1,k\ steel}$ [kN]	$Bolt_1$ (1) $k_{t//}$
1 **WKR095**	LBA nails	Ø4,0 x 60	3	**5,6**	**10,1**	**1,44**
2 **WKR135**	LBA nails	Ø4,0 x 60	8	**15,0**	**10,1**	**1,44**
3 **WKR285**	LBA nails	Ø4,0 x 60	17	**31,8**	**10,1**	**1,44**

CODE	FASTENING NUMBER holes fastening Ø5			CHARACTERISTIC VALUES BEAM FASTENING $R_{1,k}$			$R_{4/5,k}$*			
	type	Ø x L [mm]	n_v pcs	$R_{1,k\ timber}$ [kN]	$R_{1,k\ steel}$ [kN]	$Bolt_1$ (1) $k_{t//}$	$R_{4/5,k\ timber}$ [kN]	$R_{4/5,k\ steel}$ [kN]	$Bolt_{4/5}$ (1) $k_{t\perp}$	$k_{t//}$
4 **WKR095**	LBA nails	Ø4,0 x 60	8	**15,0**	**10,1**	**1,44**	**9,05**	**9,95**	**0,70**	**0,38**
5 **WKR135**	LBA nails	Ø4,0 x 60	13	**24,4**	**10,1**	**1,44**	**9,49**	**9,97**	**0,69**	**0,34**
6 **WKR285**	LBA nails	Ø4,0 x 60	17	**31,8**	**10,1**	**1,44**	-	-	-	-

* 2 angle brackets per joint

For NOTES and GENERAL PRINCIPLES please see p. 345.

WZU

ANGLE BRACKET FOR TENSILE LOADS

COMPLETE RANGE
Available in different thicknesses. The capacity can also be increased with the inclusion of the washer, according to the loads.

CERTIFIED STRENGTH
Tensile strength values are certified by the CE marking in accordance with the ETA.

STRUTS
Ideal for the fastening of timber struts in frame structures to concrete.

CHARACTERISTICS

FOCUS	timber frame struts fastening
HEIGHT	from 90 to 480 mm
THICKNESS	from 2,0 to 4,0 mm
FASTENERS	LBA, LBS, VIN-FIX PRO

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELD OF USE
Timber-to-concrete and timber-to-timber tensile joints for panels and timber beams
- solid timber and glulam
- CLT, LVL
- framed structures (platform frame)
- timber based panels

TIMBER FRAME

The reduced width of the vertical flange (40 mm) facilitates installation on the struts of the frame panels.

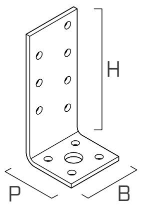
TENSION

The washer that is included in the WZU STRONG bracket packages, guarantees excellent tensile strength performance. Values are certified according to ETA.

CODES AND DIMENSIONS

WZU 90 / 155

S250
GALV



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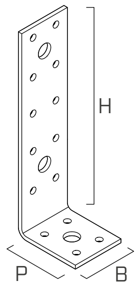

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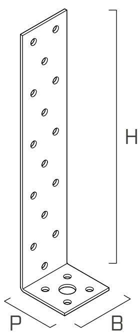
	CODE	B	P	H	s	n Ø5	n Ø11			pcs
		[mm]	[mm]	[mm]	[mm]	pcs	pcs			
1	**WZU090**	40	35	90	3,0	11	1	●	●	100
2	**WZU155**	40	50	155	3,0	14	3	●	●	100

WZU 200 / 300 / 400

S250
GALV



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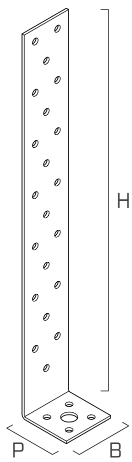

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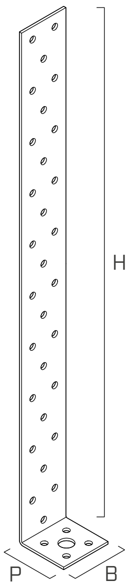

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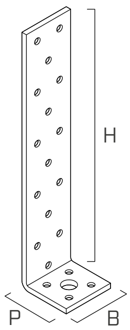

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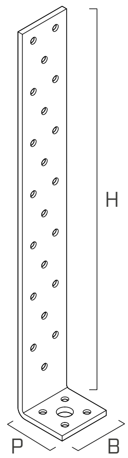

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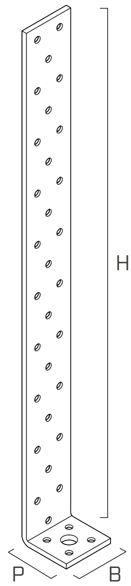

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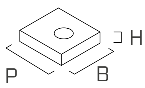
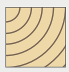


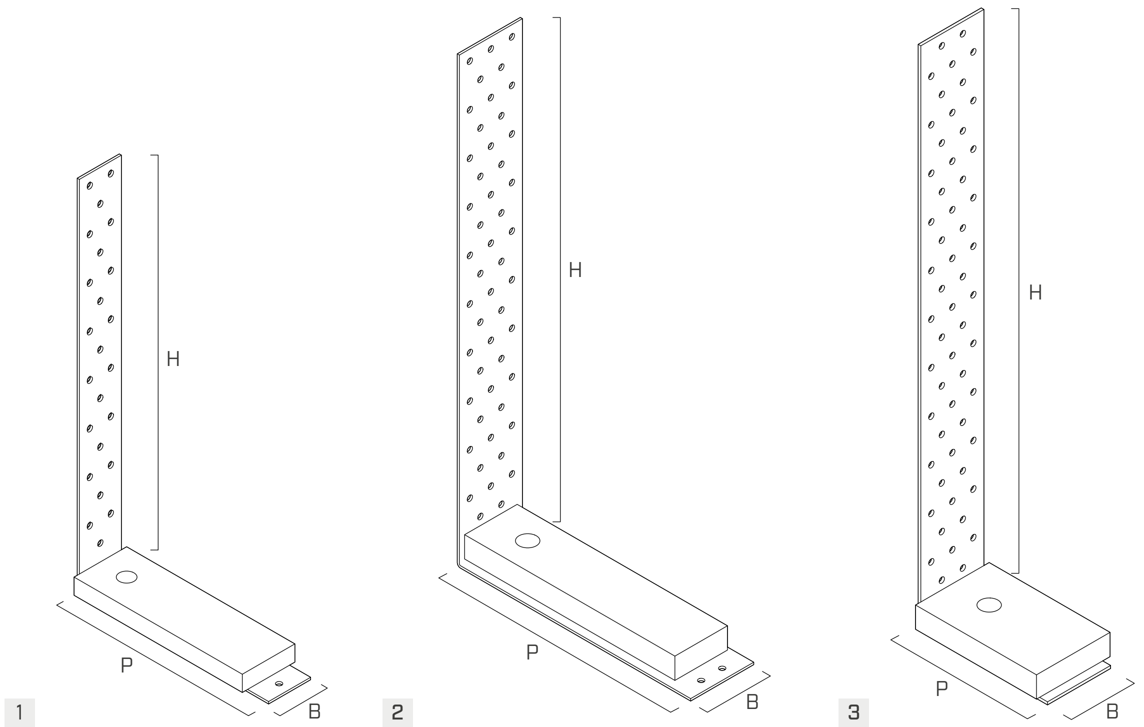
7

	CODE	B	P	H	s	n Ø5	n Ø14			pcs
		[mm]	[mm]	[mm]	[mm]	pcs	pcs			
1	**WZU2002**	40	40	200	2,0	19	1	●	●	100
2	**WZU3002**	40	40	300	2,0	25	1	●	●	50
3	**WZU4002**	40	40	400	2,0	34	1	●	●	50
4	**WZU2004**	40	40	200	4,0	19	1	●	●	50
5	**WZU3004**	40	40	300	4,0	25	1	●	●	50
6	**WZU4004**	40	40	400	4,0	34	1	●	●	25
7	**WZUW**	40	43	10	-	-	1	●	●	50

CODES AND DIMENSIONS

WZU STRONG

S250 GALV

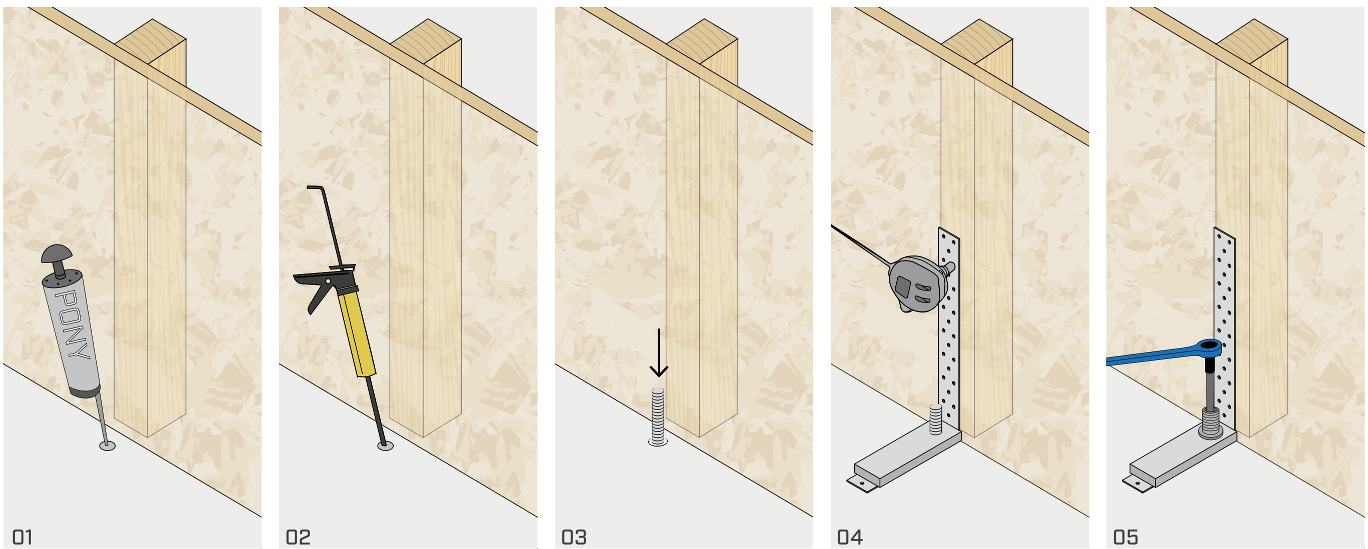


	CODE	B	P	H	s	n Ø5	n Ø13	n Ø18	n Ø22	washer*			pcs
		[mm]	[mm]	[mm]	[mm]	pcs	pcs	pcs	pcs				
1	**WZU342**	40	182	340	2,0	39	1	-	-	160 x 50 x 15 Ø12,5	●	●	10
2	**WZU422**	60	222	420	2,0	79	-	1	-	200 x 60 x 20 Ø16,5	●	●	10
3	**WZU482**	60	123	480	2,5	72	-	-	1	115 x 70 x 20 Ø20,5	●	●	10

* Washer included in the package

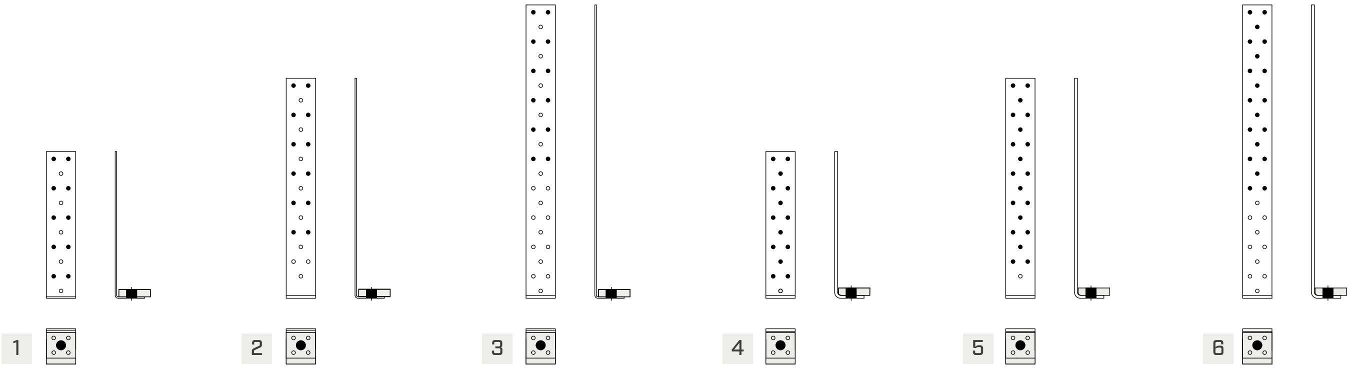
ASSEMBLY

Fastening to concrete with threaded rods and chemical anchor.



STATIC VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

WZU 200/300/400 WITH WASHER*

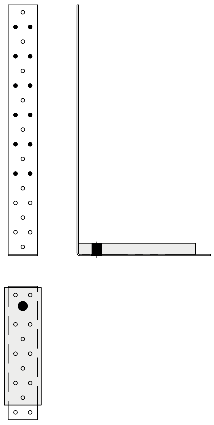


	CODE	FASTENING NUMBER			CHARACTERISTIC VALUES				
		holes fastening Ø5			$R_{1,K}$ TIMBER	$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE	
					$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$ VIN-FIX PRO[(1)]	
		type	Ø x L	n_v				Ø x L	
			[mm]	pcs	[kN]	[kN]	γ_{steel}	[mm]	[kN]
1	WZU2002 with washer WZUW	LBA nails	Ø4,0 x 40	10	**15,7**	**11,6**	$\gamma_{M,0}$	M12 x 180	**8,8**
			Ø4,0 x 60		**19,3**				
		LBS screws	Ø5,0 x 40		**15,7**				
			Ø5,0 x 50		**19,3**				
2	WZU3002 with washer WZUW	LBA nails	Ø4,0 x 40	12	**18,8**	**11,6**	$\gamma_{M,0}$	M12 x 180	**8,8**
			Ø4,0 x 60		**23,2**				
		LBS screws	Ø5,0 x 40		**18,8**				
			Ø5,0 x 50		**23,2**				
3	WZU4002 with washer WZUW	LBA nails	Ø4,0 x 40	12	**18,8**	**11,6**	$\gamma_{M,0}$	M12 x 180	**8,8**
			Ø4,0 x 60		**23,2**				
		LBS screws	Ø5,0 x 40		**18,8**				
			Ø5,0 x 50		**23,2**				
4	WZU2004 with washer WZUW	LBA nails	Ø4,0 x 40	14	**22,0**	**23,1**	$\gamma_{M,0}$	M12 x 180	**7,0**
			Ø4,0 x 60		**27,0**				
		LBS screws	Ø5,0 x 40		**22,0**				
			Ø5,0 x 50		**27,0**				
5	WZU3004 with washer WZUW	LBA nails	Ø4,0 x 40	20	**31,4**	**23,1**	$\gamma_{M,0}$	M12 x 180	**7,0**
			Ø4,0 x 60		**38,6**				
		LBS screws	Ø5,0 x 40		**31,4**				
			Ø5,0 x 50		**38,6**				
6	WZU4004 with washer WZUW	LBA nails	Ø4,0 x 40	20	**31,4**	**23,1**	$\gamma_{M,0}$	M12 x 180	**7,0**
			Ø4,0 x 60		**38,6**				
		LBS screws	Ø5,0 x 40		**31,4**				
			Ø5,0 x 50		**38,6**				

* Washer to be ordered separately

STATIC VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

WZU STRONG WITH WASHER*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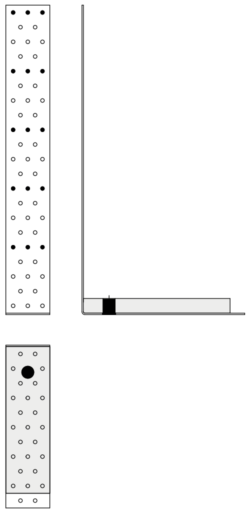
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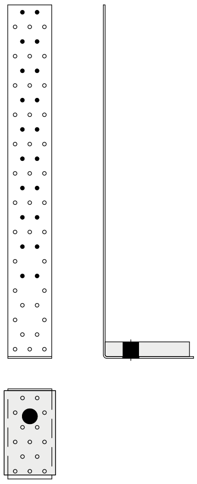
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	CODE	FASTENING NUMBER: holes fastening Ø5 – type	Ø x L [mm]	n_v [pcs]	CHARACTERISTIC VALUES: $R_{1,K}$ TIMBER – $R_{1,k\ timber}$ [kN]	$R_{1,K}$ STEEL – $R_{1,k\ steel}$ [kN]	γ_{steel}	$R_{1,d}$ CONCRETE – $R_{1,d\ uncracked}$ VIN-FIX PRO(1) Ø x L, cl.5.8 [mm]	[kN]
1	WZU342	LBA nails	Ø 4,0 x 40	12	18,8	11,60	$\gamma_{M,0}$	M12 x 180	23,2
			Ø 4,0 x 60		23,2				
		LBS screws	Ø 5,0 x 40		18,8				
			Ø 5,0 x 50		23,2				
2	WZU422	LBA nails	Ø 4,0 x 40	15	23,6	17,30	$\gamma_{M,0}$	M16 x 190	29,1
			Ø 4,0 x 60		29,0				
		LBS screws	Ø 5,0 x 40		23,6				
			Ø 5,0 x 50		29,0				
3	WZU482	LBA nails	Ø 4,0 x 40	20	31,4	21,70	$\gamma_{M,0}$	M20 x 240	37,9
			Ø 4,0 x 60		38,6				
		LBS screws	Ø 5,0 x 40		31,4				
			Ø 5,0 x 50		38,6				

* Washer included in the package

NOTES:

(1) Precut INA threaded rod, with nut and washer.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA.
- The design values are obtained from the characteristic values as follows:

$$R_d = \min \begin{cases} \dfrac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,\ steel}}{\gamma_{steel}} \\ R_{d,\ concrete} \end{cases}$$

  Coefficients γ_{steel}, γ_M and k_{mod} shall be taken depending on the applicable regulation used for the calculation.
- The calculation process used a timber characteristic density of $\rho_k = 350\ kg/m^3$ and C25/30 concrete with a thin reinforcing layer, minimum thickness of 240 mm, where edge-distance is not a limiting factor.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- The strength values of the connection system are valid under the calculation hypotheses listed in the table; for different boundary conditions (e.g. minimum edge distances) shall be verified.

WKF

ANGLE BRACKETS FOR FACADES

CE MARKING
It is ideal for installing façade insulation on new and existing structures. Values are certified by CE marking according to ETA.

SPECIAL STEEL
S350 high strength steel provides high flexural capacity.

ROBUST
Reinforcements are designed to ensure high levels of stiffness. Fast and easy installation.

CHARACTERISTICS

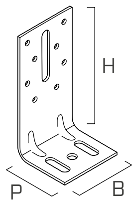
FOCUS	batten fastening on the façade
HEIGHT	from 120 to 200 mm
THICKNESS	2,5 mm
FASTENERS	LBA, LBS, SKR

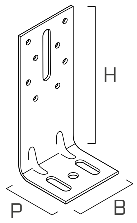
MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

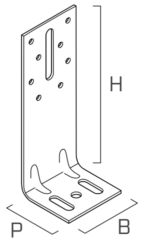
FIELD OF USE
Joints for secondary timber elements with function of cladding support
- solid timber and glulam
- CLT, LVL
- framed structures (platform frame)
- timber based panels

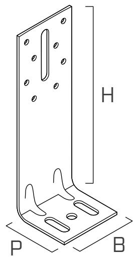
CODES AND DIMENSIONS

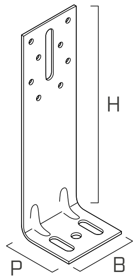
S350
GALV

1 

2 

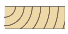
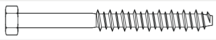
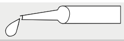
3 

4 

5 

	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø8,5 pcs	n $Ø_V$ pcs	n $Ø_H$ pcs	pcs
1	**WKF120**	60	54	120	2,5	8	1	1 - Ø8,5 x 41,5	2 - Ø8,5 x 16,5	100
2	**WKF140**	60	54	140	2,5	8	1	1 - Ø8,5 x 41,5	2 - Ø8,5 x 16,5	100
3	**WKF160**	60	54	160	2,5	8	1	1 - Ø8,5 x 41,5	2 - Ø8,5 x 16,5	100
4	**WKF180**	60	54	180	2,5	8	1	1 - Ø8,5 x 41,5	2 - Ø8,5 x 16,5	100
5	**WKF200**	60	54	200	2,5	8	1	1 - Ø8,5 x 41,5	2 - Ø8,5 x 16,5	100

ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
SKR	screw anchor		10		488
VIN-FIX PRO	chemical anchor		M8		514

EXTERNAL INSULATION

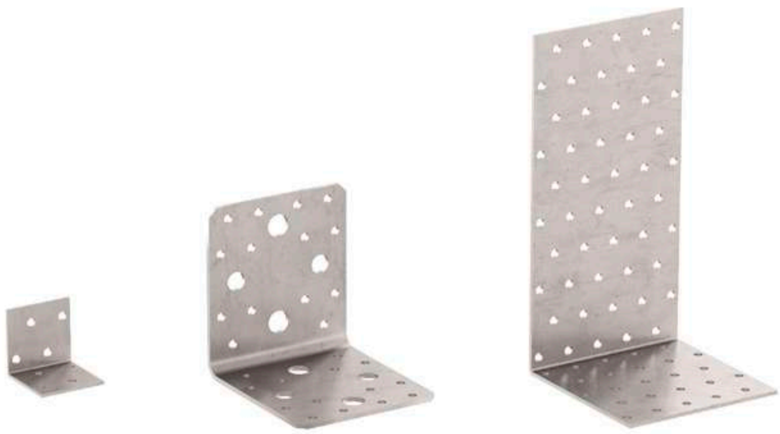
To fix the timber framing to the wall, while creating the space to accommodate the thermal insulation and the waterproofing membrane.

WBO - WVS - WHO

VARIOUS ANGLE BRACKETS

DIMENSIONS
Various shapes and sizes are available for all manner of applications.

CERTIFICATION
Suitability of use is guaranteed by the CE marking according to ETA.



CHARACTERISTICS

FOCUS	versatile fastening
HEIGHT	from 40 to 200 mm
THICKNESS	from 2,0 to 4,0 mm
FASTENERS	LBA, LBS, SKR

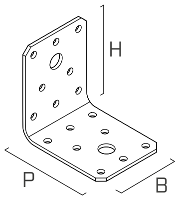
MATERIAL
Bright zinc plated carbon steel three dimensional perforated plate.

FIELD OF USE
Timber-to-timber and timber-to-concrete joints solid timber and glulam
- CLT, LVL
- framed structures (platform frame)
- timber based panels

CODES AND DIMENSIONS

WBO 70 - 90 - 100

S250
GALV



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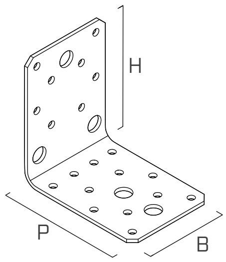

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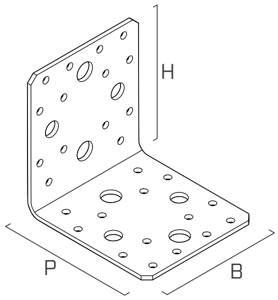
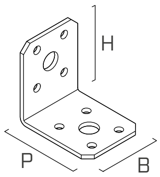


3

	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø11 pcs	n Ø13 pcs			pcs
1	**WBO070**	55	70	70	2,0	16	2	-	●	●	100
2	**WBO090**	65	90	90	2,5	20	5	-	●	●	100
3	**WBO100**	90	100	100	3,0	28	6	2	●	●	50

WBO 50 - 60 - 90

S250
GALV



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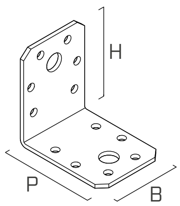

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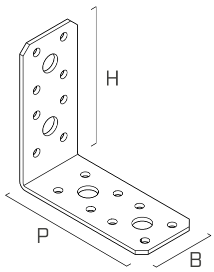
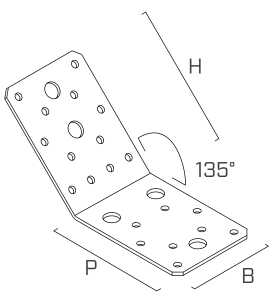


3

	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø11 pcs			pcs
1	**WBO5040**	40	50	50	2,5	8	2	●	●	150
2	**WBO6045**	45	60	60	2,5	12	2	●	●	50
3	**WBO9040**	40	90	90	3,0	16	4	●	●	100

WBO 135°

S250
GALV



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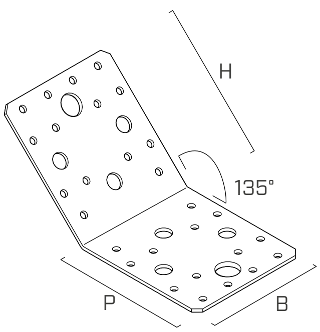


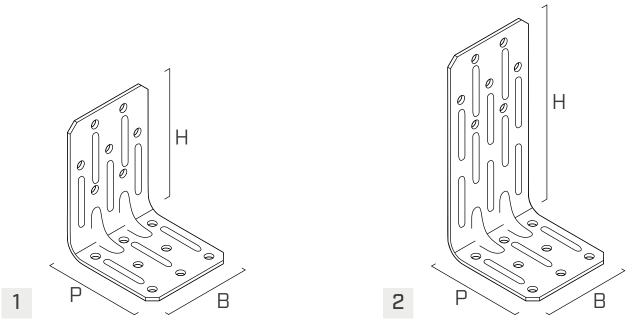
2

	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø11 pcs	n Ø13 pcs			pcs
1	**WBO13509**	65	90	90	2,5	20	5	-	●	●	100
2	**WBO13510**	90	100	100	3,0	28	6	2	●	●	40

CODES AND DIMENSIONS

WVS 80 - 120

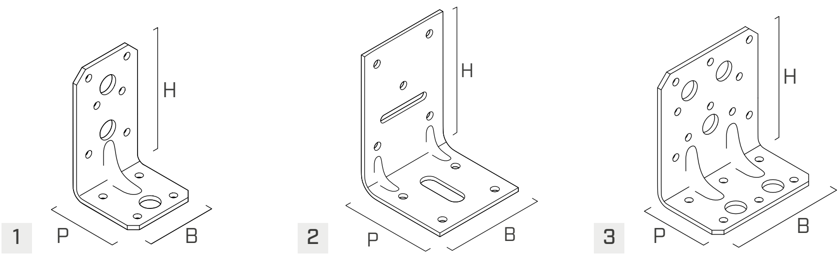
S250
GALV



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs			pcs
1	**WVS8060**	55	60	80	2,0	15	●	-	100
2	**WVS12060**	55	60	120	2,0	15	●	-	100

WVS 90

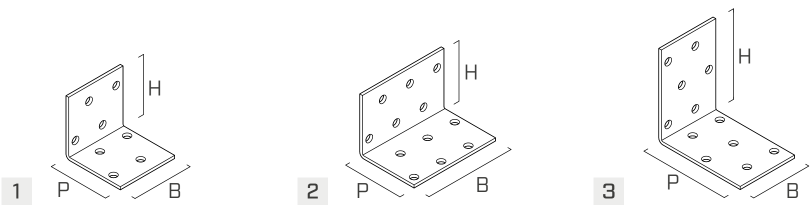
S250
GALV



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n Ø13 pcs	n $Ø_V$ pcs	n $Ø_H$ pcs			pcs
1	**WVS9050**	50	50	90	3,0	10	3	-	-	●	●	100
2	**WVS9060**	60	60	90	2,5	9	-	1 - Ø5 x 30	1 - Ø10 x 30	●	-	100
3	**WVS9080**	80	50	90	3,0	16	5	-	-	●	●	100

WHO 40 - 60

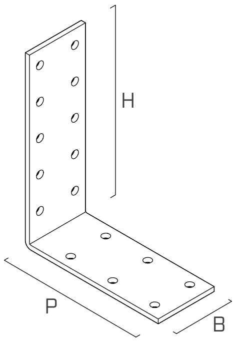
S250
GALV



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n_V Ø5 pcs	n_H Ø5 pcs			pcs
1	**WHO4040**	40	40	40	2,0	8	4	4	●	-	200
2	**WHO4060**	60	40	40	2,0	12	6	6	●	-	150
3	**WHO6040**	40	60	60	2,0	12	6	6	●	-	150

WHO 120 - 160 - 200

S250
GALV

1


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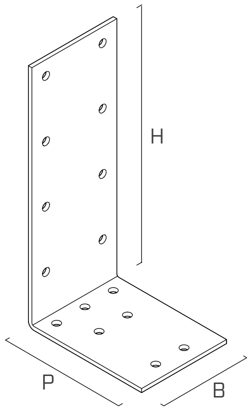

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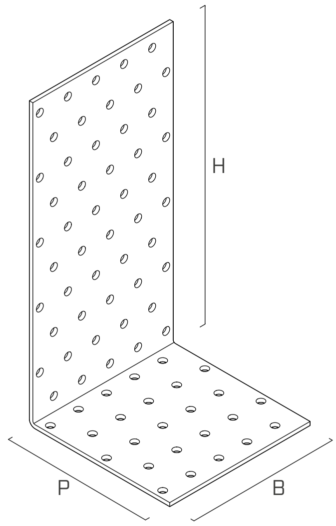
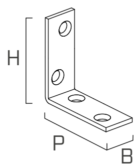


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 pcs	n_V Ø5 pcs	n_H Ø5 pcs			pcs
1	**WHO12040**	40	95	120	3,0	16	10	6	●	-	100
2	**WHO16060**	60	80	160	4,0	15	8	7	●	-	50
3	**WHO200100**	100	100	200	2,5	75	50	25	●	-	25

WHO A2 | AISI304 - LBV A2 | AISI304

A2
AISI 304

1


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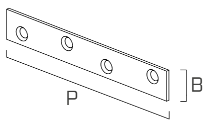


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø4,5 pcs	pcs
1	**WHOI1540**	15	40	40	1,75	4	50
2	**LBVI15100**	15	100	-	1,75	4	50

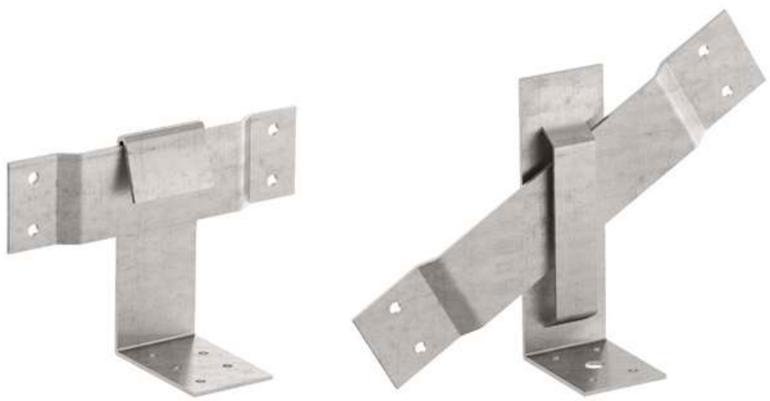
LOG

ANGLE BRACKETS FOR LOG HOUSE

EFFECTIVE
The unique geometry and design of the bracket, supports the hygrometric deformation of wooden elements.

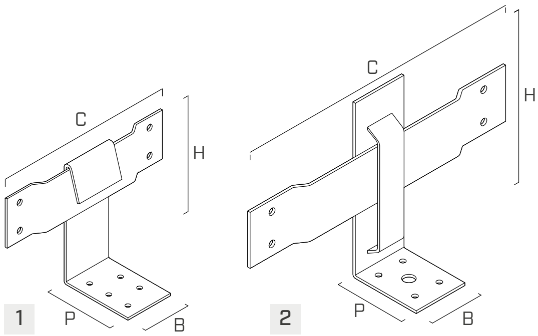
STRUTS
LOG210 version is ideal for the fastening of wooden struts to horizontal wooden blocks.

BEAMS
LOG250 is highly suited for the fastening of wooden joists to horizontal wooden blocks.



CODES AND DIMENSIONS

	CODE	B	P	H	C	s	n Ø5	n Ø8,5	pcs
		[mm]	[mm]	[mm]	[mm]	[mm]	pcs	pcs	
1	**LOG210**	40	65	78	210	2	9	-	25
2	**LOG250**	40	52	125	250	2	8	1	25



MATERIAL
Bright zinc plated carbon steel three dimensional perforated plate.

FIELD OF USE
Timber-to-timber joints
- solid timber and glulam
- CLT, LVL
- framed structures (platform frame)
- timber based panels
- Log House and Blockbau systems

SPU

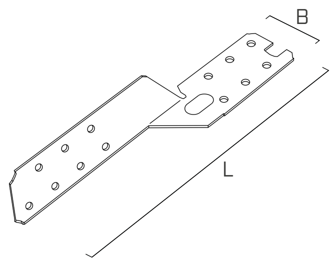
UNI ANCHOR PLATE FOR JOISTS

TIMBER-TO-TIMBER
Ideal for fastening joists to platform beams. Two anchors are recommended for each joint.

CERTIFICATION
Suitability of use is guaranteed by the CE marking according to ETA.

CODES AND DIMENSIONS

CODE	L [mm]	B [mm]	s [mm]	n Ø5 pcs	pcs
SPU170	170	36	2	9	100
SPU210	210	36	2	13	100
SPU250	250	36	2	17	100



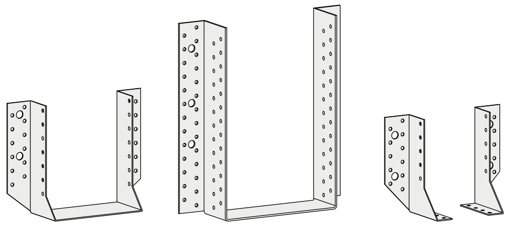
MATERIAL
Bright zinc plated carbon steel three dimensional perforated plate.

FIELD OF USE
Timber-to-timber joints
- solid timber and glulam

Roofs and pergolas construction

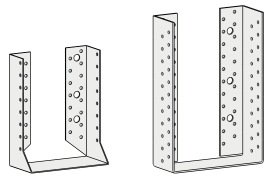
METAL HANGERS

RANGE



BSAS BSAG BSAD

BSA - hangers with external wings



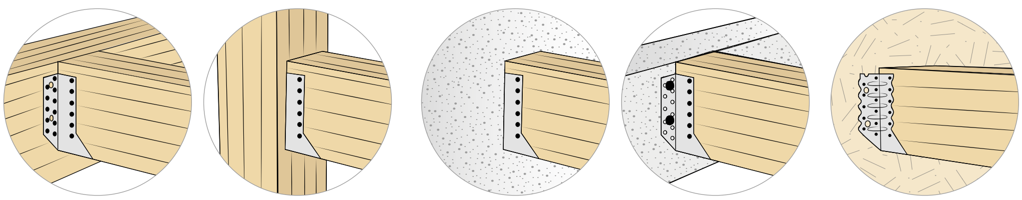
BSIS BSIG

BSI - hangers with internal wings

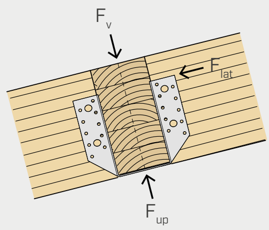
APPLICATIONS

The strength values achieved depend on the method of installation on-site and the type of support.
The main configurations are:

TIMBER-TO-TIMBER		TIMBER-CONCRETE		TIMBER-OSB
beam-beam	beam-column	beam-wall	beam-beam	beam-wall



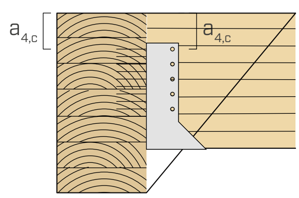
The hanger can be applied to horizontal or inclined beams and subjected to combined loading.



INSTALLATION - MINIMUM DISTANCES

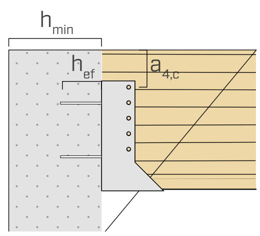
TIMBER-TO-TIMBER

			nail LBA Ø4	screw LBS Ø5
First connector - top of beam	$a_{4,c}$ [mm]	≥ 5d	≥ 20	≥ 25



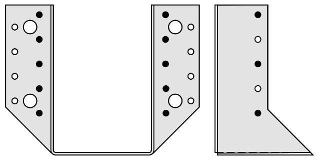
TIMBER-CONCRETE

			VIN-FIX PRO anchor		
			Ø8	Ø10	Ø12
Minimum support thickness	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100		
Concrete hole diameter	d_0	[mm]	10	12	14
Tightening torque	T_{inst}	[Nm]	10	20	40

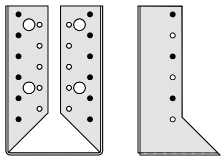


INSTALLATION - FASTENERS

TIMBER-TO-TIMBER



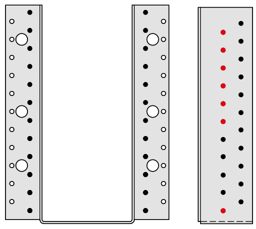
BSAS



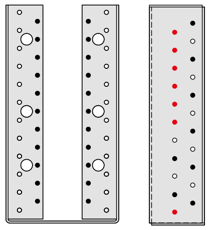
BSIS

	main beam (n_H)	secondary beam (n_J)
PARTIAL NAILING ●	n_H nails positioned on the column closest to the lateral wing of the hanger	n_J nails with alternate pattern
FULL NAILING ● + ○	n_H nails in all the holes	n_J nails in all the holes

TIMBER-TO-TIMBER | large size



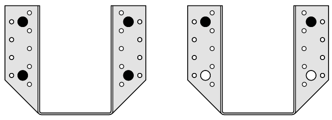
BSAG



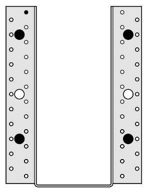
BSIG

	main beam (n_H)	secondary beam (n_J)
PARTIAL NAILING ●	n_H nails positioned on the column closest to the lateral wing of the hanger	(●) n_J nails with alternate pattern, avoiding the holes marked in red
FULL NAILING ● + ○	n_H nails in all the holes	(●) $n_J$nails with alternate pattern, avoiding the holes marked in red

TIMBER-TO-CONCRETE



BSAS



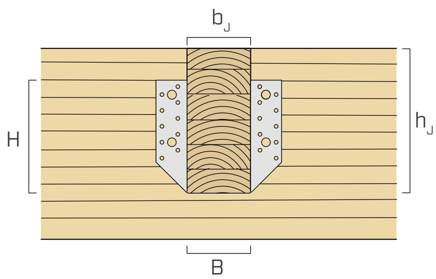
BSAG

	main beam (n_H)	secondary beam (n_J)
FASTENING OF THE ANCHORS n_{BOLT} ●	the n_{bolt} anchors shall be placed symmetrically with respect to the vertical axis. At least two anchors should be positioned in the top holes	n_J nails positioned according to full nailing patterns as shown above

INSTALLATION - RECOMMENDED DIMENSIONS

SECONDARY BEAM

			nail LBA Ø4	screw LBS Ø5
Secondary beam height	h_{JMIN}	[mm]	H + 12 mm	H + 17 mm
	h_{JMAX}	[mm]	1,5H	



BSA

CE ETA

METAL HANGERS WITH EXTERNAL WINGS

FAST USE
Standardized, certified, fast and inexpensive system.

MIXED MODE BENDING
Suitable for the fasting of joints in mixed mode bending.

TIMBER AND CONCRETE
Can be used on both timber and concrete.

CHARACTERISTICS

FOCUS	visible joint
DIMENSIONS	from 40 x 110 mm to 200 x 240 mm
THICKNESS	2,0 | 2,5 mm
FASTENERS	LBA, LBS, SKR, VIN-FIX PRO

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELD OF USE
Timber-to-timber and timber-to-concrete shear joints, both at vertical and lateral bending
- solid timber and glulam
- CLT, LVL
- timber based panels

WOOD TRUSSES

Also ideal for the fastening of TRUSS and RAFTER with small cross-sections. Certified values also allow for the direct fastening of TIMBER STUD to OSB panels.

I-JOIST

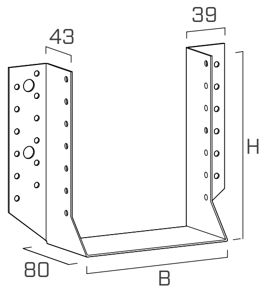
Versions homologated for direct fastening on OSB panels, for joining „I" beams and for timber-to-concrete joints.

CODES AND DIMENSIONS

BSAS - smooth

S250
GALV

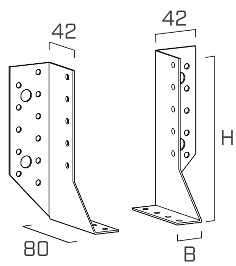
CODE	B [mm]	H [mm]	s [mm]			pcs
BSAS40110	40	110	2,0	●	●	50
BSAS46117	46	117	2,0	●	-	50
BSAS46137	46	137	2,0	●	●	50
BSAS46207	46	207	2,0	●	-	25
BSAS5070	50	70	2,0	●	-	50
BSAS51105	51	105	2,0	●	●	50
BSAS51135	51	135	2,0	●	●	50
BSAS60100	60	100	2,0	●	●	50
BSAS64128	64	128	2,0	●	●	50
BSAS64158	64	158	2,0	●	●	50
BSAS70125	70	125	2,0	●	●	50
BSAS70155	70	155	2,0	●	●	50
BSAS7690	76	90	2,0	●	-	50
BSAS76152	76	152	2,0	●	●	50
BSAS80120	80	120	2,0	●	●	50
BSAS80140	80	140	2,0	●	●	50
BSAS80150	80	150	2,0	●	●	50
BSAS80180	80	180	2,0	●	●	25
BSAS80210	80	210	2,0	●	●	50
BSAS90145	90	145	2,0	●	●	50
BSAS92184	92	184	2,0	●	-	25
BSAS10090	100	90	2,0	●	-	50
BSAS100120	100	120	2,0	●	-	50
BSAS100140	100	140	2,0	●	●	50
BSAS100160	100	160	2,0	●	-	50
BSAS100170	100	170	2,0	●	●	25
BSAS100200	100	200	2,0	●	●	25
BSAS120120	120	120	2,0	●	●	25
BSAS120160	120	160	2,0	●	●	50
BSAS120190	120	190	2,0	●	●	25
BSAS140140	140	140	2,0	●	●	25
BSAS140160	140	160	2,0	●	-	25
BSAS140180	140	180	2,0	●	●	25



BSAD - 2 pieces

S250
GALV

CODE	B [mm]	H [mm]	s [mm]			pcs
BSAD25100	25	100	2,0	●	-	25
BSAD25140	25	140	2,0	●	-	25
BSAD25180	25	180	2,0	●	-	25

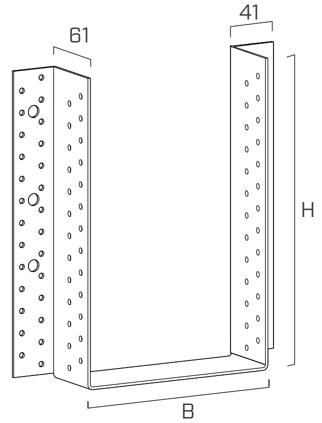


CODES AND DIMENSIONS

BSAG - large size

S250
GALV

CODE	B [mm]	H [mm]	s [mm]			pcs
BSAG100240	100	240	2,5	●	●	20
BSAG100280	100	280	2,5	●	●	20
BSAG120240	120	240	2,5	●	●	20
BSAG120280	120	280	2,5	●	●	20
BSAG140240	140	240	2,5	●	●	20
BSAG140280	140	280	2,5	●	●	20
BSAG160160	160	160	2,5	●	●	15
BSAG160200	160	200	2,5	●	●	15
BSAG160240	160	240	2,5	●	●	15
BSAG160280	160	280	2,5	●	●	15
BSAG160320	160	320	2,5	●	●	15
BSAG180220	180	220	2,5	●	●	10
BSAG180280	180	280	2,5	●	●	10
BSAG200200	200	200	2,5	●	●	10
BSAG200240	200	240	2,5	●	●	10



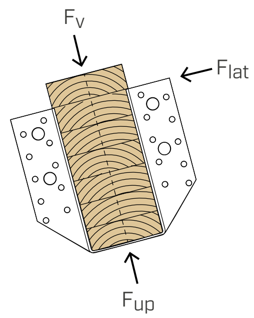
MATERIAL AND DURABILITY

BSA: carbon steel S250GD+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints
- Timber-to-OSB joints (BSAS)
- Timber-to-concrete joints
- Timber-to-steel joints

EXTERNAL LOADS

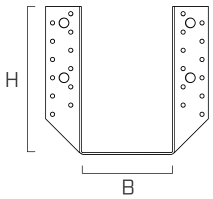


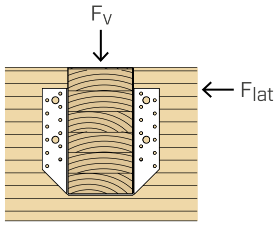
ADDITIONAL PRODUCTS - FASTENING

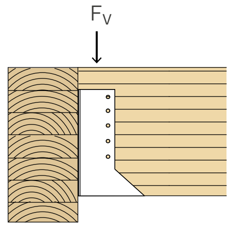
type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
AB1	mechanical anchor		M8 - M10 -M12		494
VIN-FIX PRO	chemical anchor		M8 - M10 -M12		511
EPO-FIX PLUS	chemical anchor		M8 - M10 -M12		517

STATIC VALUES | TIMBER-TO-TIMBER JOINT

PARTIAL/TOTAL NAILING[1]







BSAS - SMOOTH			PARTIAL NAILING				FULL NAILING			
			fastening number		characteristic values		fastening number		characteristic values	
B	H	LBA nails	n_H(2)	n_J(3)	$R_{v,k}$	$R_{lat,k}$	n_H(2)	n_J(3)	$R_{v,k}$	$R_{lat,k}$
[mm]	[mm]	d x L [mm]	pcs	pcs	[kN]	[kN]	pcs	pcs	[kN]	[kN]
40 *	110	Ø4 x 40	8	4	**8,7**	1,9	-	-	**-**	-
46 *	117	Ø4 x 40	8	4	**9,0**	2,1	-	-	**-**	-
46 *	137	Ø4 x 40	10	6	**11,8**	2,4	-	-	**-**	-
46 *	207	Ø4 x 40	14	8	**16,9**	2,9	-	-	**-**	-
50 *	70	Ø4 x 40	4	2	**3,6**	1,3	-	-	**-**	-
51 *	105	Ø4 x 40	8	4	**8,1**	2,3	-	-	**-**	-
51 *	135	Ø4 x 40	10	6	**11,5**	2,6	-	-	**-**	-
60	100	Ø4 x 40	8	4	**7,6**	2,6	14	8	**13,0**	4,9
64	128	Ø4 x 40	10	6	**10,9**	3,6	18	10	**19,2**	5,9
64	158	Ø4 x 40	12	6	**15,0**	3,6	22	12	**26,3**	6,7
70	125	Ø4 x 40	10	6	**10,5**	3,7	18	10	**18,6**	6,2
70	155	Ø4 x 40	12	6	**15,0**	3,8	22	12	**26,3**	7,1
76	90	Ø4 x 40	6	4	**5,9**	2,9	12	6	**10,4**	4,4
76	152	Ø4 x 40	12	6	**15,0**	3,9	22	12	**26,3**	7,4
80	120	Ø4 x 40	10	6	**9,9**	4,0	18	10	**17,5**	6,6
80	140	Ø4 x 40	10	6	**12,3**	4,0	20	10	**22,5**	6,7
80	150	Ø4 x 40	12	6	**14,8**	4,0	22	12	**26,3**	7,6
80	180	Ø4 x 40	14	8	**18,8**	4,8	26	14	**30,0**	8,4
80	210	Ø4 x 40	16	8	**18,8**	4,8	30	16	**33,8**	9,1
90	145	Ø4 x 40	12	6	**14,2**	4,2	22	12	**25,7**	8,0
92	184	Ø4 x 40	14	8	**18,8**	5,2	26	14	**30,0**	9,0
100	90	Ø4 x 60	6	4	**8,7**	4,8	12	6	**15,2**	7,2
100	120	Ø4 x 60	10	6	**15,3**	7,0	18	10	**27,1**	11,7
100	140	Ø4 x 60	12	6	**18,9**	6,5	22	12	**33,1**	12,3
100	160	Ø4 x 60	12	6	**18,9**	6,5	22	12	**33,1**	12,3
100	170	Ø4 x 60	14	8	**23,6**	7,7	26	14	**37,8**	13,5
100	200	Ø4 x 60	16	8	**23,6**	7,7	30	16	**42,5**	14,6
120	120	Ø4 x 60	10	6	**15,3**	7,0	18	10	**27,1**	11,7
120	160	Ø4 x 60	14	8	**23,6**	8,5	26	14	**37,8**	14,9
120	190	Ø4 x 60	16	8	**23,6**	8,5	30	16	**42,5**	16,2
140	140	Ø4 x 60	12	6	**18,9**	7,4	22	12	**33,1**	14,3
140	160	Ø4 x 60	14	8	**23,6**	9,1	26	14	**37,8**	16,0
140	180	Ø4 x 60	16	8	**23,6**	9,1	30	16	**42,5**	17,5

* It cannot be to completely nailed

STATIC VALUES | TIMBER-TO-TIMBER JOINT

PARTIAL/TOTAL NAILING[1]

BSAG - LARGE SIZE			PARTIAL NAILING				FULL NAILING			
			fastening number		characteristic values		fastening number		characteristic values	
B [mm]	H [mm]	LBA nails d x L [mm]	n_H[2] pcs	n_J[3] pcs	$R_{v,k}$ [kN]	$R_{lat,k}$ [kN]	n_H[2] pcs	n_J[3] pcs	$R_{v,k}$ [kN]	$R_{lat,k}$ [kN]
100	240	Ø4 x 60	24	16	**40,7**	10,7	46	30	**75,6**	19,9
100	280	Ø4 x 60	28	18	**47,3**	10,8	54	34	**85,1**	20,3
120	240	Ø4 x 60	24	16	**40,7**	12,3	46	30	**75,6**	22,9
120	280	Ø4 x 60	28	18	**47,3**	12,6	54	34	**85,1**	23,5
140	240	Ø4 x 60	24	16	**40,7**	13,7	46	30	**75,6**	25,6
140	280	Ø4 x 60	28	18	**47,3**	14,1	54	34	**85,1**	26,4
160	160	Ø4 x 60	16	10	**21,2**	11,1	30	18	**41,6**	19,9
160	200	Ø4 x 60	20	12	**30,7**	12,3	38	22	**56,7**	22,4
160	240	Ø4 x 60	24	16	**40,7**	15,0	46	30	**75,6**	27,9
160	280	Ø4 x 60	28	18	**47,3**	15,5	54	34	**85,1**	29,0
160	320	Ø4 x 60	32	20	**52,0**	15,9	62	38	**94,6**	30,0
180	220	Ø4 x 60	22	14	**35,7**	15,2	42	26	**66,2**	27,0
180	280	Ø4 x 60	28	18	**47,3**	16,7	54	34	**85,1**	31,3
200	200	Ø4 x 60	20	12	**30,7**	13,7	38	22	**56,7**	25,0
200	240	Ø4 x 60	24	16	**40,7**	16,9	46	30	**75,6**	31,3

NOTES:

[1] For total or partial nailing patterns please refer to the guidelines reported at p. 367.

[2] n_H = number of fasteners on the main beam.

[3] n_J = number of fasteners on the secondary beam.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA.
- The design values are obtained from the characteristic values as follows:

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

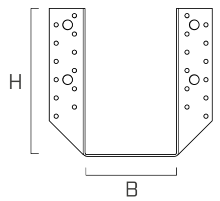
The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

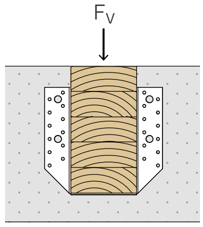
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.
- In case of $F_{v,k}$ parallel to the grain, partial nailing is required.
- In case of combined loading the following verification shall be satisfied:

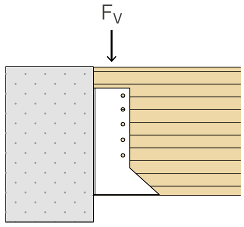
$$\left(\frac{F_{v,d}}{R_{v,d}}\right)^2 + \left(\frac{F_{lat,d}}{R_{lat,d}}\right)^2 \leq 1$$

STATIC VALUES | TIMBER-TO-CONCRETE JOINT

CHEMICAL ANCHOR[1]







BSAS - SMOOTH		FASTENERS		CHARACTERISTIC VALUES	
B [mm]	H [mm]	anchor VIN-FIX PRO[2] [n_{bolt} - Ø x L] [3]	nails LBA [n_J - Ø x L] [4]	$R_{v,k}$ timber [kN]	$R_{v,k}$ steel [kN]
40 *	110	2 - M8 x 110	4 - Ø4 x 40	**11,3**	**10,6**
46 *	137	2 - M10 x 110	6 - Ø4 x 40	**15,0**	**13,2**
51 *	105	2 - M8 x 110	4 - Ø4 x 40	**11,3**	**10,6**
51 *	135	2 - M10 x 110	6 - Ø4 x 40	**15,0**	**13,2**
60	100	2 - M8 x 110	8 - Ø4 x 40	**18,8**	**10,6**
64	128	4 - M10 x 110	10 - Ø4 x 40	**22,5**	**26,4**
64	158	4 - M10 x 110	12 - Ø4 x 40	**26,3**	**26,4**
70	125	4 - M10 x 110	10 - Ø4 x 40	**22,5**	**26,4**
70	155	4 - M10 x 110	12 - Ø4 x 40	**26,3**	**26,4**
76	152	4 - M10 x 110	12 - Ø4 x 40	**26,3**	**26,4**
80	120	4 - M10 x 110	10 - Ø4 x 40	**22,5**	**26,4**
80	140	4 - M10 x 110	10 - Ø4 x 40	**22,5**	**26,4**
80	150	4 - M10 x 110	12 - Ø4 x 40	**26,3**	**26,4**
80	180	4 - M10 x 110	14 - Ø4 x 40	**30,0**	**26,4**
80	210	4 - M10 x 110	16 - Ø4 x 40	**33,8**	**26,4**
90	145	4 - M10 x 110	12 - Ø4 x 40	**26,3**	**26,4**
100	140	4 - M10 x 110	12 - Ø4 x 60	**33,1**	**26,4**
100	170	4 - M10 x 110	14 - Ø4 x 60	**37,8**	**26,4**
100	200	4 - M10 x 110	16 - Ø4 x 60	**42,6**	**26,4**
120	120	4 - M10 x 110	10 - Ø4 x 60	**28,4**	**26,4**
120	160	4 - M10 x 110	14 - Ø4 x 60	**37,8**	**26,4**
120	190	4 - M10 x 110	16 - Ø4 x 60	**42,6**	**26,4**
140	140	2 - M10 x 110	12 - Ø4 x 60	**33,1**	**13,2**
140	180	4 - M10 x 110	16 - Ø4 x 60	**42,6**	**26,4**

* Partial nailing

STATIC VALUES | TIMBER-TO-CONCRETE JOINT

CHEMICAL ANCHOR[1]

BSAG - LARGE SIZE		FASTENERS		CHARACTERISTIC VALUES	
B [mm]	H [mm]	anchor VIN-FIX PRO[2] [n_{bolt} - Ø x L] [3]	nails LBA [n_J - Ø x L] [4]	$R_{v,k\ timber}$ [kN]	$R_{v,k\ steel}$ [kN]
100	240	6 - M12 x 130	30 - Ø4 x 60	**75,6**	**59,4**
100	280	6 - M12 x 130	34 - Ø4 x 60	**85,1**	**59,4**
120	240	6 - M12 x 130	30 - Ø4 x 60	**75,6**	**59,4**
120	280	6 - M12 x 130	34 - Ø4 x 60	**85,1**	**59,4**
140	240	6 - M12 x 130	30 - Ø4 x 60	**75,6**	**59,4**
140	280	6 - M12 x 130	34 - Ø4 x 60	**85,1**	**59,4**
160	160	4 - M12 x 130	18 - Ø4 x 60	**47,3**	**39,6**
160	200	6 - M12 x 130	22 - Ø4 x 60	**56,7**	**59,4**
160	240	6 - M12 x 130	30 - Ø4 x 60	**75,6**	**59,4**
160	280	6 - M12 x 130	34 - Ø4 x 60	**85,1**	**59,4**
160	320	6 - M12 x 130	38 - Ø4 x 60	**94,6**	**59,4**
180	220	6 - M12 x 130	26 - Ø4 x 60	**66,2**	**59,4**
180	280	6 - M12 x 130	34 - Ø4 x 60	**85,1**	**59,4**
200	200	6 - M12 x 130	22 - Ø4 x 60	**56,7**	**59,4**
200	240	6 - M12 x 130	30 - Ø4 x 60	**75,6**	**59,4**

NOTES:

(1) For fixing on the concrete the two top holes must always be fixed and the anchors shall be positioned symmetrically with respect to the vertical axis of the hanger.

(2) Chemical anchor VIN-FIX PRO with threaded rods (type INA) of minimum strength grade equal to 5.8. with $h_{ef} \geq 8d$.

(3) n_{bolt} = number of anchors on the concrete support.

(4) n_J = number of fasteners on the secondary beam.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA.
- The connection design strength is the minimum between the design strength pertaining to the timber side ($R_{v,d\ timber}$) and the design strength of the steel part ($R_{v,d\ steel}$):

$$R_{v,d} = min \begin{cases} \dfrac{R_{v,k\ timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{v,k\ steel}}{\gamma_{steel}} \end{cases}$$

  γ_{steel} should be taken as γ_{M2}

  The coefficients γ_M,γ_{M2} and k_{mod} should be taken according to the current regulations used for the calculation.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- The strength values of the connection system are valid under the calculation hypotheses listed in the table.

BSI

METAL HANGERS WITH INTERNAL WINGS

FAST USE
Standardized, certified, fast and inexpensive system.

MIXED MODE BENDING
Suitable for the fasting of joints in mixed mode bending.

AESTHETICS
Thanks to the internal wings, the junction is almost entirely “concealed”.

CHARACTERISTICS

FOCUS	visible joint
DIMENSIONS	from 40 x 110 mm to 200 x 240 mm
THICKNESS	2,0 | 2,5 mm
FASTENERS	LBA, LBS, SKR, VIN-FIX PRO

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELD OF USE
Timber-to-timber and timber-to-concrete shear joints, both for simple and mixed-mode bending

- solid timber and glulam
- CLT, LVL
- timber based panels

CONCEALED

Thanks to the internal wings, the junction is almost entirely concealed. Additionally, the distribution of the nailing on the secondary beam makes the system light, highly effective and relatively inexpensive.

LARGE SCALE STRUCTURES

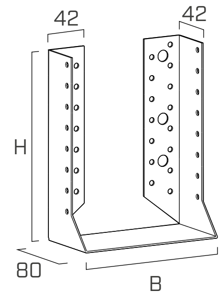
A quick and economical system, it offers a method for the fastening of large size beams using hangers with a minimal thickness.

CODES AND DIMENSIONS

BSIS - smooth

S250
GALV

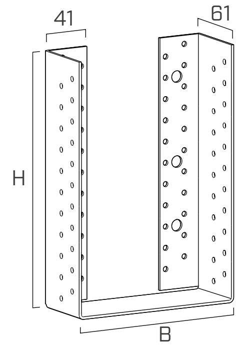
CODE	B [mm]	H [mm]	s [mm]			pcs
BSIS40110	40	110	2,0	●	-	50
BSIS60100	60	100	2,0	●	-	50
BSIS60160	60	160	2,0	●	-	50
BSIS70125	70	125	2,0	●	-	50
BSIS80120	80	120	2,0	●	-	50
BSIS80150	80	150	2,0	●	-	50
BSIS80180	80	180	2,0	●	-	25
BSIS90145	90	145	2,0	●	-	50
BSIS10090	100	90	2,0	●	-	50
BSIS100120	100	120	2,0	●	-	50
BSIS100140	100	140	2,0	●	-	50
BSIS100170	100	170	2,0	●	-	50
BSIS100200	100	200	2,0	●	-	25
BSIS120120	120	120	2,0	●	-	25
BSIS120160	120	160	2,0	●	-	25
BSIS120190	120	190	2,0	●	-	25
BSIS140140	140	140	2,0	●	-	25
BSIS140180	140	180	2,0	●	-	25



BSIG - large size

S250
GALV

CODE	B [mm]	H [mm]	s [mm]			pcs
BSIG120240	120	240	2,5	●	-	20
BSIG140240	140	240	2,5	●	-	20
BSIG160160	160	160	2,5	●	-	15
BSIG160200	160	200	2,5	●	-	15
BSIG180220	180	220	2,5	●	-	10
BSIG200200	200	200	2,5	●	-	10
BSIG200240	200	240	2,5	●	-	10



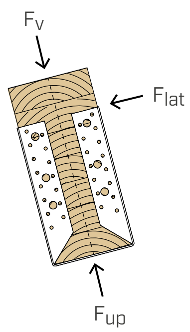
MATERIAL AND DURABILITY

BSI: carbon steel S250GD+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints
- Timber-to-OSB joints (BSIS)

EXTERNAL LOADS

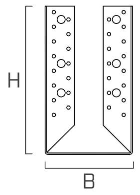


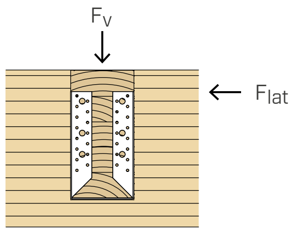
ADDITIONAL PRODUCTS - FASTENING

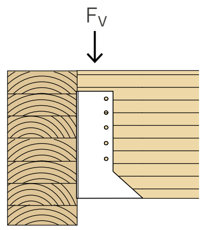
type	description	d [mm]	support	page
LBA	Anker nail	4		548
LBS	screw for plates	5		552

STATIC VALUES | TIMBER-TO-TIMBER JOINT

PARTIAL/TOTAL NAILING[1]







BSIS - SMOOTH			PARTIAL NAILING				FULL NAILING			
			fastening number		characteristic values		fastening number		characteristic values	
B	H	LBA nails	n_H (2)	n_J (3)	$R_{v,k}$	$R_{lat,k}$	n_H (2)	n_J (3)	$R_{v,k}$	$R_{lat,k}$
[mm]	[mm]	d x L [mm]	pcs	pcs	[kN]	[kN]	pcs	pcs	[kN]	[kN]
40 *	110	Ø4 x 40	8	4	**8,7**	1,9	-	-	**-**	-
60 *	100	Ø4 x 40	8	4	**7,6**	2,6	-	-	**-**	-
60 *	160	Ø4 x 40	12	6	**15,0**	3,4	-	-	**-**	-
70 *	125	Ø4 x 40	10	6	**10,5**	3,7	-	-	**-**	-
80	120	Ø4 x 40	10	6	**10,4**	4,0	18	10	**18,3**	6,7
80	150	Ø4 x 40	12	6	**14,8**	4,0	22	12	**26,3**	7,6
80	180	Ø4 x 40	14	8	**12,8**	4,8	26	14	**30,0**	8,4
90	145	Ø4 x 40	12	6	**14,2**	4,2	22	12	**25,7**	8,0
100	90	Ø4 x 60	6	4	**8,7**	4,8	12	6	**16,8**	7,2
100	120	Ø4 x 60	10	6	**16,5**	7,7	16	10	**28,4**	12,5
100	140	Ø4 x 60	12	6	**18,9**	6,5	22	12	**33,1**	12,3
100	170	Ø4 x 60	14	8	**23,6**	7,7	26	14	**37,8**	13,5
100	200	Ø4 x 60	16	8	**23,6**	7,7	30	16	**42,5**	14,6
120	120	Ø4 x 60	10	6	**15,6**	7,0	18	10	**27,5**	11,7
120	160	Ø4 x 60	14	8	**23,6**	8,5	26	14	**37,8**	14,9
120	190	Ø4 x 60	16	8	**23,6**	8,5	30	16	**42,5**	16,2
140	140	Ø4 x 60	12	6	**18,9**	7,4	22	12	**33,1**	14,3
140	180	Ø4 x 60	16	8	**23,6**	9,1	30	16	**42,5**	17,5

* It cannot be to completely nailed

BSIG - LARGE SIZE			PARTIAL NAILING				FULL NAILING			
			fastening number		characteristic values		fastening number		characteristic values	
B	H	LBA nails	n_H (2)	n_J (3)	$R_{v,k}$	$R_{lat,k}$	n_H (2)	n_J (3)	$R_{v,k}$	$R_{lat,k}$
[mm]	[mm]	d x L [mm]	pcs	pcs	[kN]	[kN]	pcs	pcs	[kN]	[kN]
120	240	Ø4 x 60	24	16	**40,7**	12,3	46	30	**75,6**	22,9
140	240	Ø4 x 60	24	16	**40,7**	13,3	46	30	**75,6**	25,6
160	160	Ø4 x 60	16	10	**21,2**	11,1	30	18	**41,6**	19,9
160	200	Ø4 x 60	20	12	**30,7**	12,3	38	22	**56,7**	22,4
180	220	Ø4 x 60	22	14	**35,7**	15,2	42	26	**66,2**	27,0
200	200	Ø4 x 60	20	12	**30,7**	13,7	38	22	**56,7**	25,0
200	240	Ø4 x 60	24	16	**40,7**	16,9	46	30	**75,6**	31,6

NOTES:

(1) For total or partial nailing patterns please refer to the guidelines reported at p. 367.

(2) n_H = number of fasteners on the main beam.

(3) n_J = number of fasteners on the secondary beam.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA.
- The design values are obtained from the characteristic values as follows:

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

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.
- In case of $F_{V,k}$ parallel to the grain, partial nailing is required.
- In case of combined loading the following verification shall be satisfied:

$$\left(\frac{F_{v,d}}{R_{v,d}}\right)^2 + \left(\frac{F_{lat,d}}{R_{lat,d}}\right)^2 \leq 1$$

LBV

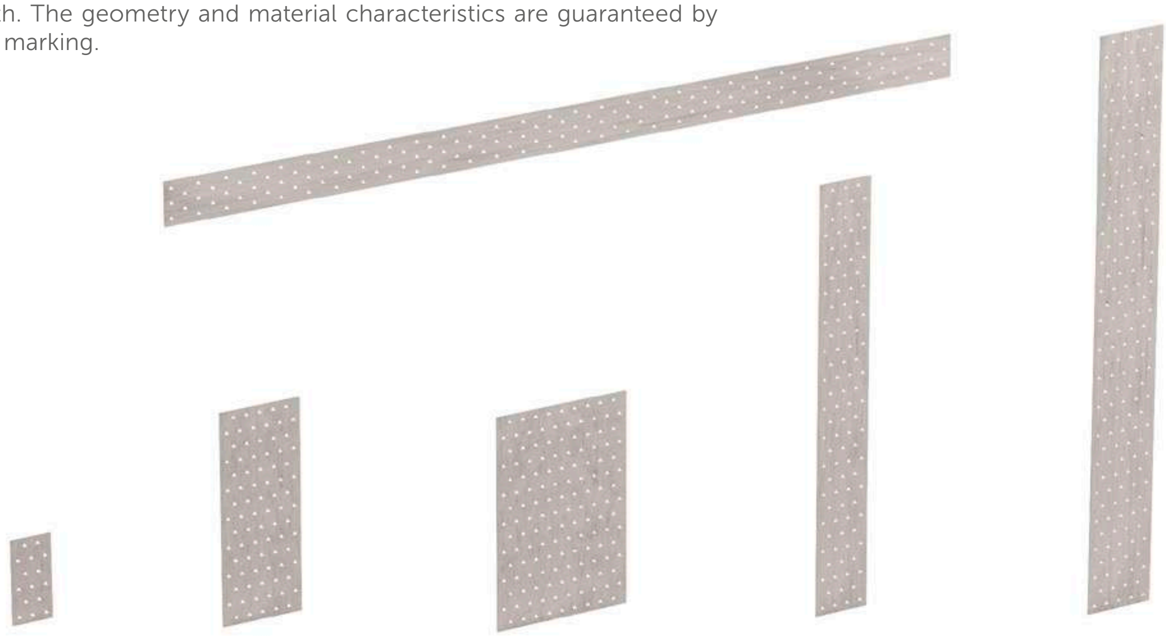
PERFORATED PLATES

EN 14545

WIDE RANGE
Several versions are available, designed to face all timber construction needs. The LBV plates can realise simple beam and joist joints through to the most important inter-story connections.

READY FOR USE
An "off the shelf solution" that meets the most common requirements and minimises installation times. It offers an excellent cost to performance ratio.

CERTIFIED
Perfect for wide range of structural joints in timber that require tensile strength. The geometry and material characteristics are guaranteed by the CE marking.



CHARACTERISTICS

FOCUS	tension fastening
HEIGHT	from 120 to 1200 mm
THICKNESS	from 1,5 to 2,5 mm
FASTENERS	LBA, LBS

MATERIAL
Carbon steel with bright zinc plated perforated plate.

FIELD OF USE
Timber-to-timber joints
- solid timber and glulam
- CLT, LVL
- timber based panels

TENSION

The range is dimensioned for most common timber joints and applications that require tensile capacity. The 1200 mm long versions are ideal for structural joints.

TIMBER-TO-TIMBER

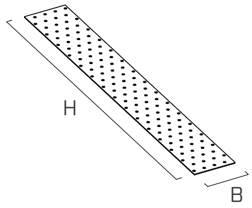
Solves situations that require the transfer of tensile forces between timber elements, including, beams, structural panels and claddings.

CODES AND DIMENSIONS

LBV 1,5 mm

S250 GALV

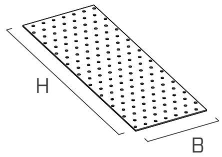
CODE	B [mm]	H [mm]	n Ø5 pcs	s [mm]		pcs
LBV60600	60	600	75	1,5	●	10
LBV60800	60	800	100	1,5	●	10
LBV80600	80	600	105	1,5	●	10
LBV80800	80	800	140	1,5	●	10
LBV100800	100	800	180	1,5	●	10



LBV 2,0 mm

S250 GALV

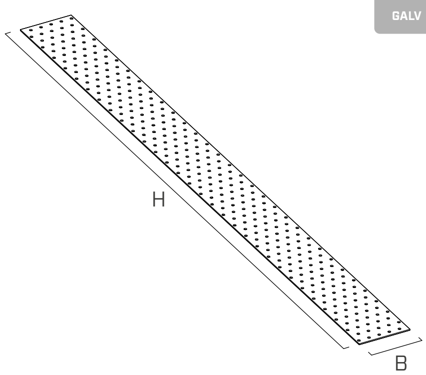
CODE	B [mm]	H [mm]	n Ø5 pcs	s [mm]		pcs
LBV40120	40	120	9	2,0	●	200
LBV40160	40	160	12	2,0	●	50
LBV60140	60	140	18	2,0	●	50
LBV60200	60	200	25	2,0	●	100
LBV60240	60	240	30	2,0	●	100
LBV80200	80	200	35	2,0	●	50
LBV80240	80	240	42	2,0	●	50
LBV80300	80	300	53	2,0	●	50
LBV100140	100	140	32	2,0	●	50
LBV100200	100	200	45	2,0	●	50
LBV100240	100	240	54	2,0	●	50
LBV100300	100	300	68	2,0	●	50
LBV100400	100	400	90	2,0	●	20
LBV100500	100	500	112	2,0	●	20
LBV120200	120	200	55	2,0	●	50
LBV120240	120	240	66	2,0	●	50
LBV120300	120	300	83	2,0	●	50
LBV140400	140	400	130	2,0	●	15
LBV160400	160	400	150	2,0	●	15
LBV200300	200	300	142	2,0	●	15



LBV 2,0 x 1200 mm

S250 GALV

CODE	B [mm]	H [mm]	n Ø5 pcs	s [mm]		pcs
LBV401200	40	1200	90	2,0	●	20
LBV601200	60	1200	150	2,0	●	20
LBV801200	80	1200	210	2,0	●	20
LBV1001200	100	1200	270	2,0	●	10
LBV1201200	120	1200	330	2,0	●	10
LBV1401200	140	1200	390	2,0	●	10
LBV1601200	160	1200	450	2,0	●	10
LBV1801200	180	1200	510	2,0	●	10
LBV2001200	200	1200	570	2,0	●	5
LBV2201200	220	1200	630	2,0	●	5
LBV2401200	240	1200	690	2,0	●	5
LBV2601200	260	1200	750	2,0	●	5
LBV2801200	280	1200	810	2,0	●	5
LBV3001200	300	1200	870	2,0	●	5
LBV4001200	400	1200	1170	2,0	●	5



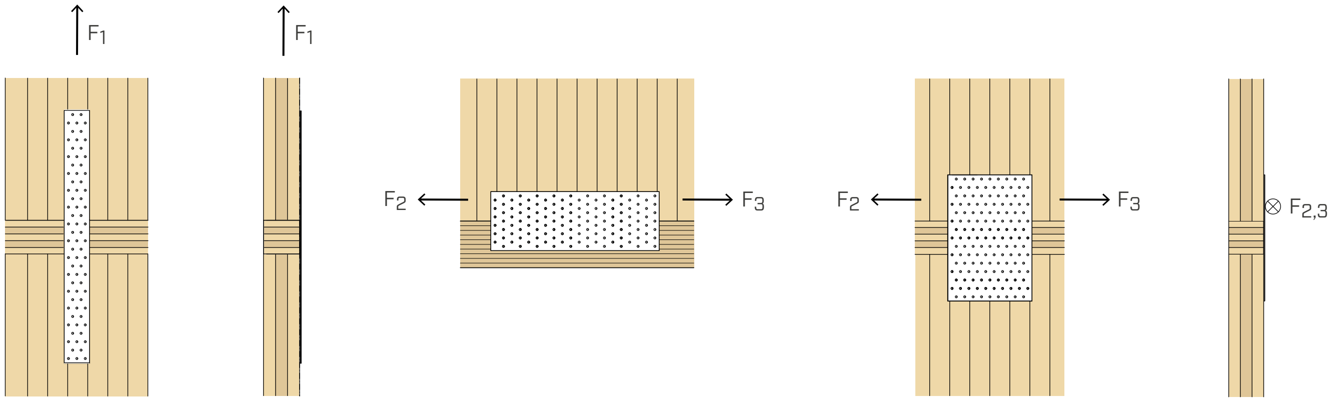
MATERIAL AND DURABILITY

LBV: carbon steel S250GD+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints

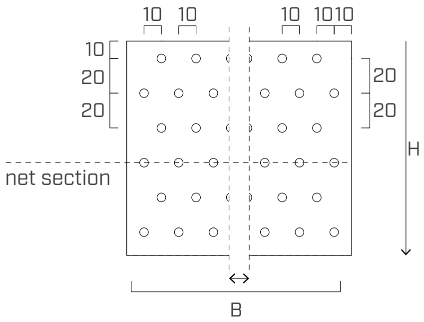
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552

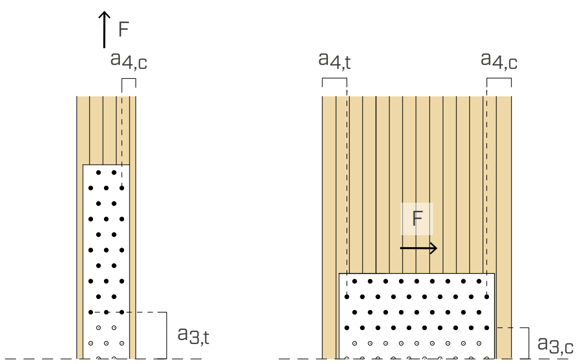
GEOMETRY



B	net area holes	B	net area holes	B	net area holes
[mm]	pcs	[mm]	pcs	[mm]	pcs
40	2	140	7	240	12
60	3	160	8	260	13
80	4	180	9	280	14
100	5	200	10	300	15
120	6	220	11	400	20

INSTALLATION

TIMBER - MINIMUM DISTANCES



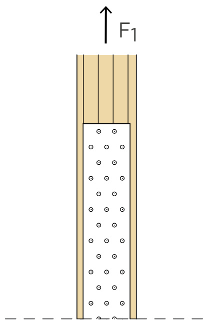
Load-to-grain angle α = 0°			**Anker nail LBA Ø4**	**screw LBS Ø5**
Lateral connector - unloaded edge	$a_{4,c}$	[mm]	≥ 20	≥ 25
Connector - loaded end	$a_{3,t}$	[mm]	≥ 60	≥ 75

Load-to-grain angle α = 90°			**Anker nail LBA Ø4**	**screw LBS Ø5**
Lateral connector - loaded edge	$a_{4,t}$	[mm]	≥ 28	≥ 50
Lateral connector - unloaded edge	$a_{4,c}$	[mm]	≥ 20	≥ 25
Connector - unloaded end	$a_{3,c}$	[mm]	≥ 40	≥ 50

STATIC VALUES | TIMBER-TO-TIMBER TENSILE JOINT

STRENGTH OF THE SYSTEM

The tensile strength of the $R_{1,d}$ system is the minimum between the $R_{ax,d}$ plate side tensile strength and the shear resistance of the connectors used for fastening $n_{tot} \cdot R_{v,d}$.
If the connectors are placed in several consecutive rows and the load direction is parallel to the grain, the following sizing criteria must be applied.



$$R_{1,d} = min \begin{cases} R_{ax,d} \\ \sum n_i \cdot m_i^k \cdot R_{v,d} \end{cases} \qquad k = \begin{cases} 0{,}85 & LBA \quad Ø = 4 \\ 0{,}75 & LBA \quad Ø = 5 \end{cases}$$

Where m_i is the number of rows of connectors parallel to the grain and n_i is the number of connectors arranged in the same row.

PLATE - TENSILE STRENGTH

				CHARACTERISTIC VALUES
type	**B**	**s**	**net area holes**	**$R_{ax,k}$**
	[mm]	[mm]	pcs	[kN]
LBV 1,5 mm	60	1,5	3	**20,0**
	80	1,5	4	**26,7**
	100	1,5	5	**33,4**
LBV 2,0 mm	40	2,0	2	**17,8**
	60	2,0	3	**26,7**
	80	2,0	4	**35,6**
	100	2,0	5	**44,6**
	120	2,0	6	**53,5**
	140	2,0	7	**62,4**
	160	2,0	8	**71,3**
	180	2,0	9	**80,2**
	200	2,0	10	**89,1**
	220	2,0	11	**98,0**
	240	2,0	12	**106,9**
	260	2,0	13	**115,8**
	280	2,0	14	**124,7**
	300	2,0	15	**133,7**
	400	2,0	20	**178,2**

CALCULATION EXAMPLE | TIMBER-TO-TIMBER JOINT

An example of joint type calculation is shown in the figure on page 391, using also a perforated tape LBB in comparison.

GENERAL PRINCIPLES:

- The plate design strength values can be obtained as follows:

$$R_{ax,d} = \frac{R_{ax,k}}{\gamma_{steel}}$$

γ_{steel} should be taken as γ_{M2}
The coefficients γ_{M2} should be taken according to the current regulations used for the calculation.

- Dimensioning and verification of the timber elements must be carried out separately.
- It is recommended to place the connectors symmetrically with respect to the load direction.

LBB

EN 14545

PERFORATED TAPE

TWO THICKNESSES
Simple and effective system to achieve floor bracing. It is available in thicknesses of 1,5 and 3,0 mm.

CLIPSET
Simply and effortlessly secures the ends of the tape in many applications of floor and roof bracing.

SPECIAL STEEL
Made with S350 GD high strength steel. The 1,5 mm thick version offers extreme resistance to tensile forces with minimal thickness.

CHARACTERISTICS

FOCUS	tension fastening
WIDTH	from 40 to 80 mm
THICKNESS	1,5 | 3,0 mm
FASTENERS	LBA, LBS

MATERIAL
Carbon steel with bright zinc plated perforated tape.

FIELD OF USE
Timber-to-timber joints
- solid timber and glulam
- CLT, LVL
- timber based panels

BRACINGS

This system is ideal for creating safe, quick and effective bracing. The use of high quality steel ensures that the tapes reduced thickness does not compromise the tensile strength.

STABILITY

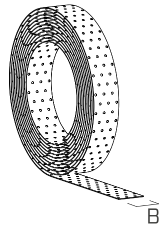
The CLIPSET can be added to the ends of the 60 mm version to achieve secure and safe fastening on any structure.

CODES AND DIMENSIONS

LBB 1,5 mm

S350 GALV

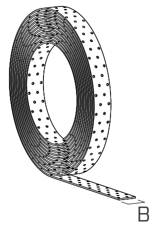
CODE	B [mm]	H [m]	n Ø5 pcs	s [mm]		pcs
LBB40	40	50	75 / m	1,5	●	1
LBB60	60	50	125 / m	1,5	●	1
LBB80	80	25	175 / m	1,5	●	1



LBB 3,0 mm

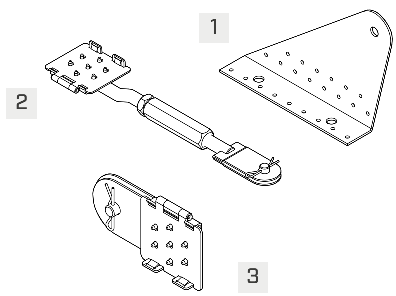
S250 GALV

CODE	B [mm]	H [m]	n Ø5 pcs	s [mm]		pcs
LBB4030	40	50	75 / m	3	●	1



CLIPSET

CODE	LBB type	LBB width	pcs
CLIPSET60	perforated tape LBB60	B=60 mm	1



SET COMPRISED OF:	B [mm]	H [mm]	L [mm]	n Ø5 pcs	n Ø13 pcs	s [mm]	pcs
1 Terminal plate	254	181	43	9 + 14	2	3	4
2 Clip-Fix tensioner	76	20	334-404	-	-	2	2
3 Clip-Fix Terminal	76	20	150	-	-	2	2

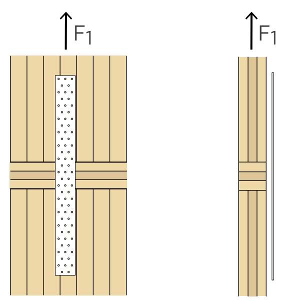
MATERIAL AND DURABILITY

LBB 1,5 mm: carbon steel S350GD+Z275.
LBB 3,0 mm: carbon steel S250GD+Z275.
CLIPSE : carbon steel DX51D+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints

EXTERNAL LOADS

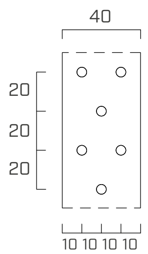


ADDITIONAL PRODUCTS - FASTENING

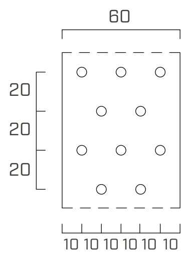
type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552

GEOMETRY

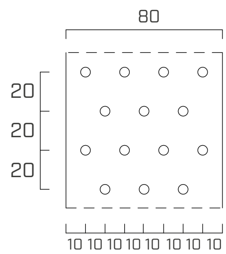
LBB40 / LBB4030



LBB60

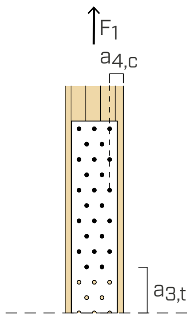


LBB80



INSTALLATION

LBB ASSEMBLING

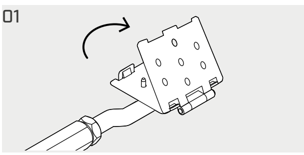


TIMBER - MINIMUM DISTANCES

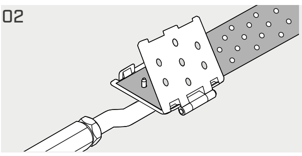
Load-to-grain angle α = 0°				Anker nail LBA Ø4	screw LBA Ø4
Lateral connector - unloaded edge	$a_{4,c}$	[mm]	≥ 5 d	≥ 20	≥ 25
Connector - loaded end	$a_{3,t}$	[mm]	≥ 15 d	≥ 60	≥ 75

CLIPSET ASSEMBLING

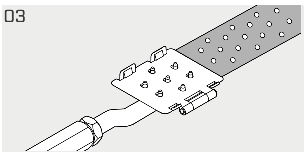
CLIP-FIX TENSIONER



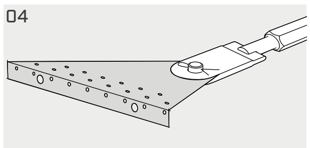
Open the Clip-Fix



Insert the perforated tape

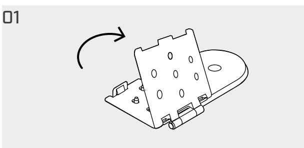


Close the Clip-Fix

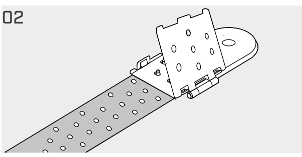


Fix it to the plate

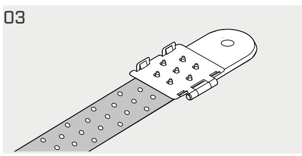
CLIP-FIX TERMINAL



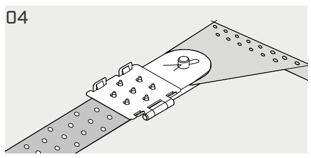
Open the Clip-Fix



Insert the perforated tape

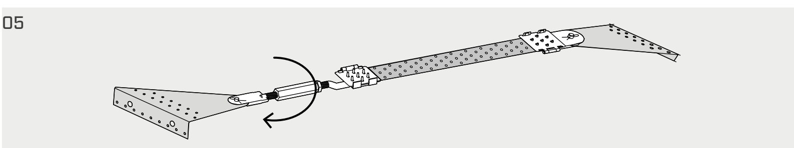


Close the Clip-Fix



Fix it to the plate

ADJUSTING THE SYSTEM

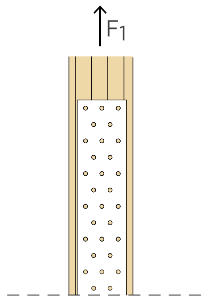


Use the tensioner to regulate the length of the bracing system

STATIC VALUES | TIMBER-TO-TIMBER TENSILE JOINT

STRENGTH OF THE SYSTEM

The tensile strength of the $R_{1,d}$ system is the minimum between the $R_{ax,d}$ plate side tensile strength and the shear resistance of the connectors used for fastening $n_{tot} \cdot R_{v,d}$.
If the connectors are placed in several consecutive rows and the load direction is parallel to the grain, the following sizing criteria must be applied.



$$R_{1,d} = min \begin{cases} R_{ax,d} \\ \Sigma n_i \cdot m_i^k \cdot R_{v,d} \end{cases} \qquad k = \begin{cases} 0{,}85 \quad LBA \quad Ø = 4 \\ 0{,}75 \quad LBA \quad Ø = 5 \end{cases}$$

Where m_i is the number of rows of connectors parallel to the grain and n_i is the number of connectors arranged in the same row.

TAPE -TENSILE STRENGTH

				CHARACTERISTIC VALUES
type	B	s	net area holes	$R_{ax,k}$
	[mm]	[mm]	pcs	[kN]
LBB 1,5 mm	40	1,5	2	**17,0**
	60	1,5	3	**25,5**
	80	1,5	4	**34,0**
LBB 3,0 mm	40	3,0	2	**26,7**

CONNECTORS SHEAR RESISTANCE

For the strength $R_{v,k}$ of the LBA Anker nails and of the LBS screws, refer to SCREWS AND NAILS FOR PLATES chapter.

NOTES FOR SEISMIC DESIGN

Particular attention has to be paid to the "capacity design" applied at different scale levels: the global structure and the connection system. Experimentally the ultimate strength of the LBA nail (and of the LBS screw) is notably larger than the characteristic strength evaluated according to EN 1995.
E.g. LBA nail Ø4 x 60 mm: $R_{v,k}$ =2,8 - 3,6 kN by experimental tests (variable according to the type of timber and plate thickness).

Experimental data derive from tests carried out within the Seismic-Rev research project and are reported in the scientific report: "Connection systems for timber buildings: experimental campaign to characterize stiffness, strength and ductility" (DICAM - Department of Civil, Environmental and Mechanical Engineering - UniTN).

GENERAL PRINCIPLES:

- Characteristic values according to EN 1993 and EN 1995-1-1 standards.
- The plate design strength values can be obtained as follows:

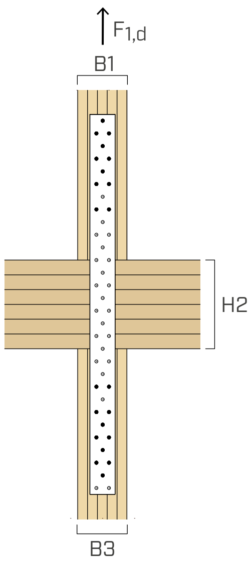
$$R_{ax,d} = \frac{R_{ax,k}}{\gamma_{steel}}$$

- The connectors design strength values can be obtained as follows:

$$R_{v,d} = \frac{R_{v,k} \cdot k_{mod}}{\gamma_M}$$

  Coefficients γ_{M2}, γ_M and k_{mod} must be taken according to the current standard adopted for the design.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.
- It is recommended to place the connectors symmetrically with respect to the load direction.

CALCULATION EXAMPLE | TIMBER-TO-TIMBER TENSIL JOINT WITH LBV AND LBB



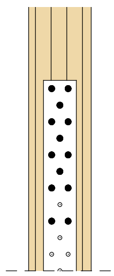
PROJECT DATA		
Strength	$F_{1,d}$	12,0 kN
Service class		2
Load duration		short
Solid timber CL24		
Element 1	**B1**	80 mm
Element 2	**H2**	140 mm
Element 3	**B3**	80 mm

USABLE PRODUCTS	
perforated tape LBB40	**perforated plate LBV401200[2]**
B = 40 mm	B = 40 mm
s = 1,5 mm	s = 2 mm
	H = 600 mm
Anker nail LBA440[1]	**Anker nail LBA440[1]**
d_1 = 4,0 mm	d_1 = 4,0 mm
L = 40 mm	L = 40 mm

EVALUATION OF THE STRENGTH OF THE SYSTEM

TAPE/PLATE - TENSILE STRENGTH

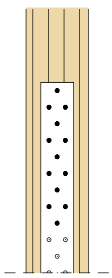
perforated tape LBB40				perforated plate LBV401200[2]			
$R_{ax,k}$	=	17,0	kN	$R_{ax,k}$	=	17,8	kN
γ_{M2}	=	1,25		γ_{M2}	=	1,25	
$R_{ax,d}$	=	**13,60**	**kN**	$R_{ax,d}$	=	**14,24**	**kN**



PERFORATED TAPE LBB4015

CONNECTOR - SHEAR STRENGTH

perforated tape LBB40				perforated plate LBV401200[2]			
$R_{v,k}$	=	1,89	kN	$R_{v,k}$	=	1,89	kN
n_{tot}	=	13	pcs	n_{tot}	=	13	pcs
n_1	=	5	pcs	n_1	=	4	pcs
m_1	=	2	lines	m_1	=	2	lines
n_2	=	3	pcs	n_2	=	5	pcs
m_2	=	1	lines	m_2	=	1	lines
k_{LBA}	=	0,85		k_{LBA}	=	0,85	
k_{mod}	=	0,90		k_{mod}	=	0,90	
γ_M	=	1,30		γ_M	=	1,30	
$R_{v,d}$	=	1,31	kN	$R_{v,d}$	=	1,31	kN
$\sum m_i \bullet n_i^k \bullet R_{v,d}$	=	**13,61**	**kN**	$\sum m_i \bullet n_i^k \bullet R_{v,d}$	=	**13,64**	**kN**



PERFORATED PLATE LBV401200

STRENGTH OF THE SYSTEM

$$R_{1,d} = min \begin{cases} R_{ax,d} \\ \sum n_i \cdot m_i^k \cdot R_{v,d} \end{cases}$$

perforated tape LBB40				perforated plate LBV401200[2]			
$R_{1,d}$	=	13,61	kN	$R_{1,d}$	=	13,64	kN

VERIFICATION	$R_{1,d} \geq F_{1,d}$	**13,6 kN**	$\geq$	**12,0**	**kN** ✓	**13,64**	$\geq$	**12,0**	**kN** ✓
		verification passed				**verification passed**			

NOTES:

(1) In the calculation example LBA Anker nails are used. The fastening can also be made with LBS screws (page 552).

(2) Plate LBV401200 is considered cut to length 600 mm.

GENERAL PRINCIPLES:

- To optimize the connection system, it is recommended to use a number of connectors which can provide a shear capacity that does not exceed the tensile strength of the tape/plate.
- It is recommended to place the connectors symmetrically with respect to the load direction.

POST BASES AND JOINTS FOR TERRACES

POST BASES AND JOINTS FOR TERRACES

POST BASES AND JOINTS FOR TERRACES

POST BASES

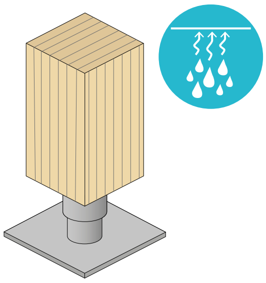
The wide selection of post bases allows to meet diversified design and aesthetic needs.
The combination of different geometrical features and coatings offer a complete range of solutions.

CONSTRUCTION DETAIL

Attention to details provides durability, aesthetics and stability to the timber structures.

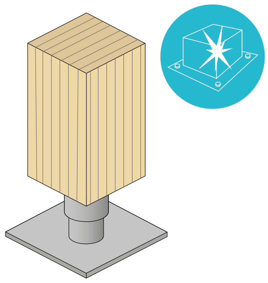
DISTANCE FROM THE GROUND

An adequate distance from the ground eliminates the risk of wood deterioration due to water splashes and stagnation.



AESTHETICS

The homogeneous coating and the attention to details (e.g. the closing sleeve in **TYP R**) create an elegant and aesthetically pleasing joint.



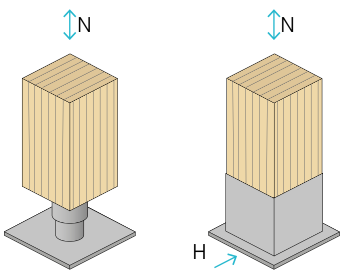
STRENGTH

Strength values certified and calculated for all the product typologies (ETA-10/0422).

CE
ETA

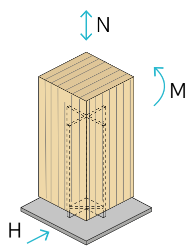
HINGE

Transfer of compression, tension (**N**) and base shear (**H**) axial stresses depending on the type of post base.



ENCASTRE

Transfer of bending moment (**M**), compression and tension (**N**) and base shear (**H**) axial stresses with the **TYP X** post base.



BRACINGS REQUIRED

BRACINGS NOT REQUIRED

RANGE - GEOMETRY

TYP R
adjustable

R10 | R20 | R30 | R40L | R40S | R70 | R90

TYP X
cross
shaped

XS10 | XR10

F70
"T" shaped

F70 | F70L

TYP S
various

S50 | S40

TYP P
tubular

P10 | P20

TYP F
fixed

F10 | F50 | F12 | F11 | F51 | F69 | F20

TYP FD
double - fixed

FD10 | FD70 | FD20 | FD30 | FD50 | FD60

TYP M
fixed

M70 S | M70 R | M50 | M53 | M52 | M51

M60 | M10 | M20 | M30

RANGE - COATINGS

DAC COAT
Special high quality coating, for optimal aesthetics and resistance to impact.

HOT DIP GALVANISING
An adequate zinc plated-coating thickness ensures durability without need of maintenance.

STAINLESS STEEL
Stainless steel provides a high corrosion resistance also in remarkably aggressive environments.

HOT DIP GALVANISING WITH THERMO DUST
High durability surface treatment. It combines the qualities of hot dip galvanizing with those of a special thermosetting powder coating.

CORROSION

Proper design and quality coating are indispensable requirements for the elements durability. To monitor the products behaviour and compare the various coatings, numerous coating qualification and accelerated ageing (e.g.: ISO9227 salt spray) tests have been carried out.

Coating:
ZINC PLATED

Coating:
DAC COAT

R10 - R20 - R30

S235 DAC COAT | VIDEO | CE ETA 10/0422

ADJUSTABLE POST BASE

ADJUSTABLE
Adjustable height, also after the product has been assembled. The regulation system is concealed by the sleeve, for optimal aesthetics.

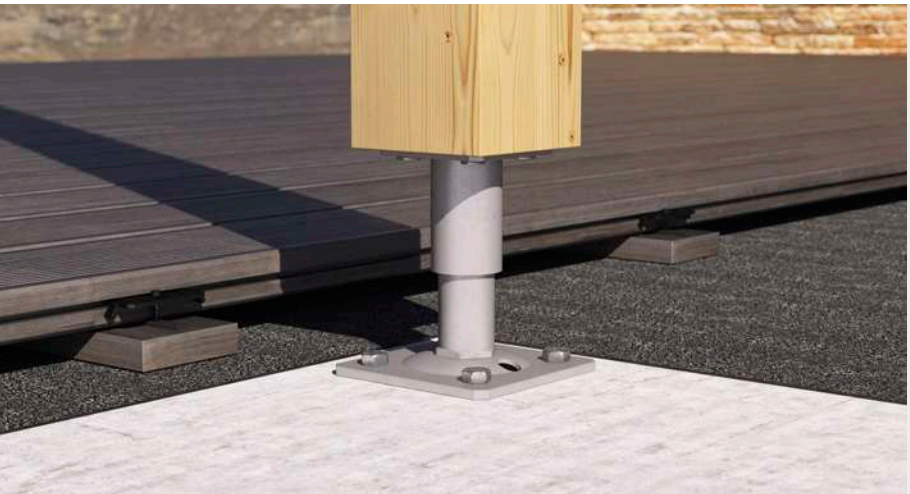
RAISED
Outdistanced from the ground to avoid water splash and stagnation and guarantee high durability. Concealed fastening on the timber element.

ATTENTION TO DETAILS
The base is characterized by an auxiliary hole allowing to insert the screws HBS PLATE EVO (included in the package).

CHARACTERISTICS

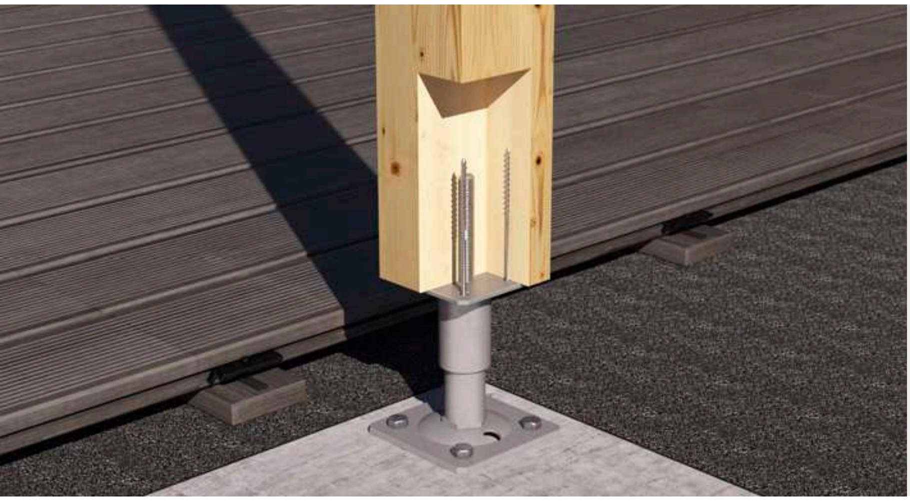
FOCUS	adjustable height after assembly
COLUMNS	from 80 x 80 mm to 240 x 240 mm
HEIGHT	adjustable from 140 to 250 mm
FASTENERS	HBS PLATE EVO, SKR, VIN-FIX PRO

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



MATERIAL
Bright zinc plated carbon steel Dac Coat.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3
- solid timber and glulam
- CLT, LVL



STATICS

High compressive strength from the bigger product-versions. The versions with the pass-through rod ensures high resistance to tensile and compressive loading.

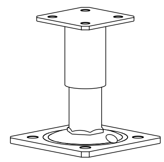
FUNCTIONALITY

Once the assembly is completed, the adjustable height allows to correct any possible unevenness occurred during the installation phase.

CODES AND DIMENSIONS

R10

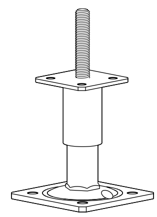
CODE	H	top plate	top holes	bottom plate	lower holes	screws HBS PLATE EVO	pcs
	[mm]	[mm]	[n. x mm]	[mm]	[n. x mm]		
R1080	140-165	80 x 80 x 6	4 x Ø9	120 x 120 x 6	4 x Ø11,5	Ø6 x 90	4
R10100	170-205	100 x 100 x 6	4 x Ø11	160 x 160 x 6	4 x Ø11,5	Ø8 x 100	4
R10140	200-250	140 x 140 x 8	4 x Ø11	200 x 200 x 8	4 x Ø11,5	Ø8 x 100	4



Screws included in the package.

R20

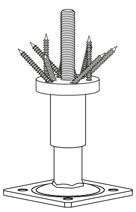
CODE	H	top plate	top holes	bottom plate	lower holes	rod Ø x L	screws HBS PLATE EVO	pcs
	[mm]	[mm]	[n. x mm]	[mm]	[n. x mm]	[mm]		
R2080	140-165	80 x 80 x 6	4 x Ø9	120 x 120 x 6	4 x Ø11,5	16 x 80	Ø6 x 90	4
R20100	170-205	100 x 100 x 6	4 x Ø11	160 x 160 x 6	4 x Ø11,5	20 x 120	Ø8 x 100	4
R20140	200-250	140 x 140 x 8	4 x Ø11	200 x 200 x 8	4 x Ø11,5	24 x 150	Ø8 x 100	4



Screws included in the package.

R30 - DISC FLAT

CODE	H	top plate	bottom plate	lower holes	rod Ø	LBS screws	pcs
	[mm]	[mm]	[mm]	[n. x mm]	[mm]		
R3080	150-170	Ø80 x 15	120 x 120 x 6	4 x Ø11,5	16	Ø7 x 60	4
R30120	180-210	Ø120 x 15	160 x 160 x 6	4 x Ø11,5	20	Ø7 x 80	4



Screws included in the package.

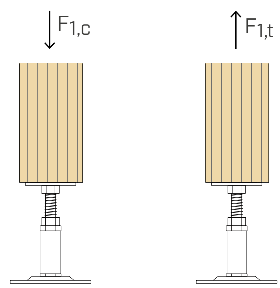
MATERIAL AND DURABILITY

TYP R: S235 carbon steel with special coating Dac Coat.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).
Upper plate R30: bright zinc plated carbon steel.

FIELD OF USE

- Timber columns
- Timber beams

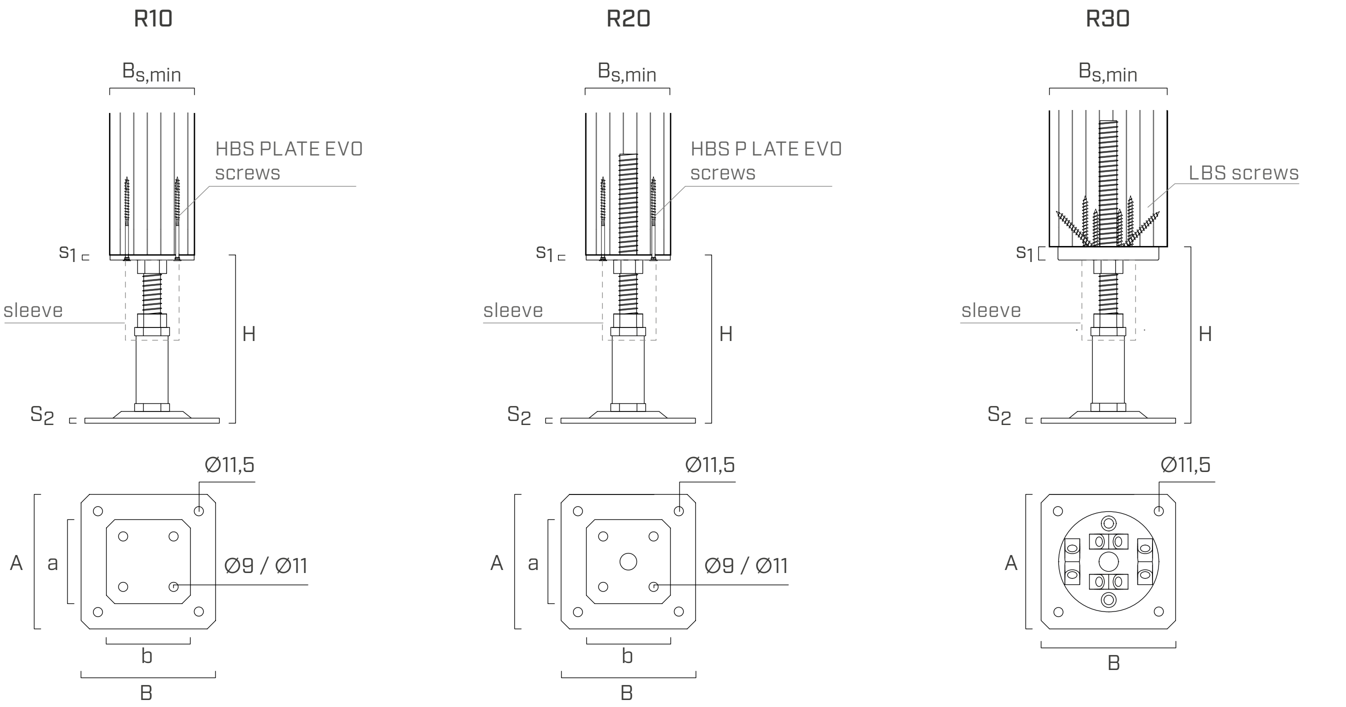
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
XEPOX D	epoxy adhesive	-		146
AB1 - AB1 A4	metal anchor	10		494 - 496
SKR	screw anchor	10		488
VIN-FIX PRO	chemical anchor	M10		511
EPO-FIX PLUS	chemical anchor	M10		517

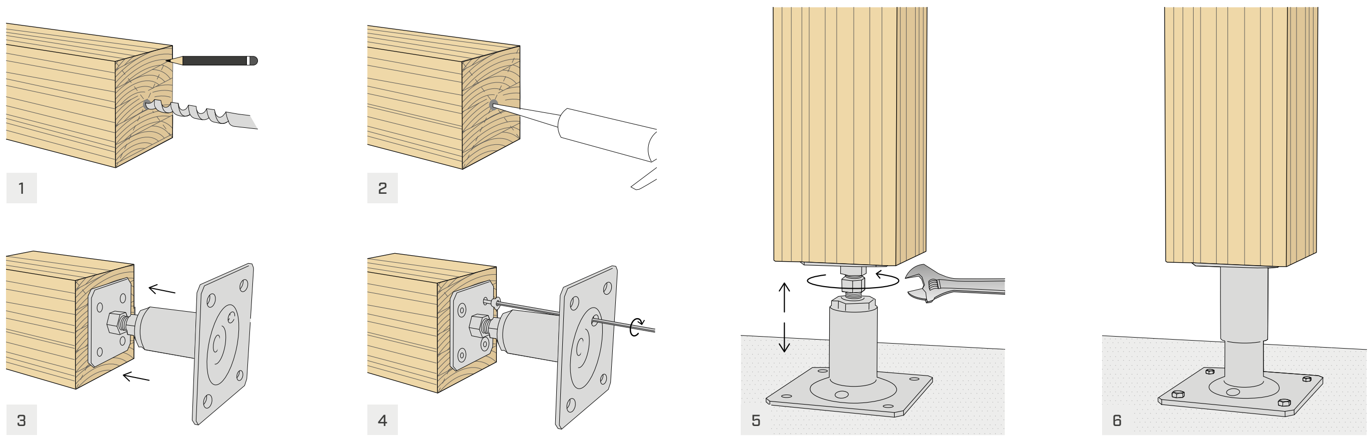
GEOMETRY



	CODE	$B_{s,min}$	A x B x S_2	H	a x b x s_1
		[mm]	[mm]	[mm]	[mm]
R10	**R1080**	80	120 x 120 x 6	140-165	80 x 80 x 6
	R10100	100	160 x 160 x 6	170-205	100 x 100 x 6
	R10140	140	200 x 200 x 8	200-250	140 x 140 x 8
R20	**R2080**	80	120 x 120 x 6	140-165	80 x 80 x 6
	R20100	100	160 x 160 x 6	170-205	100 x 100 x 6
	R20140	140	200 x 200 x 8	200-250	140 x 140 x 8
R30	**R3080**	120	120 x 120 x 6	150-170	Ø80 x 15
	R30120	160	160 x 160 x 6	180-210	Ø120 x 15

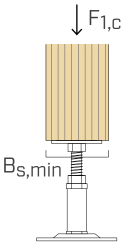
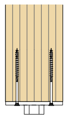
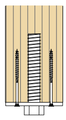
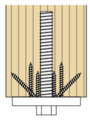
ASSEMBLY

VIDEO

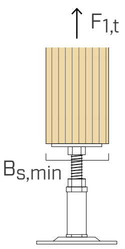
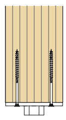
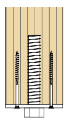
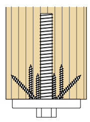


STATIC VALUES

COMPRESSION STRENGTH

stress	TYP R		fastening	column $B_{s,min}$ [mm]	$R_{1,c\ k\ timber}$ [kN]	γ_{timber} (1)	$R_{1,c\ k\ steel}$ [kN]	γ_{steel}
	R10	**R1080**		80	**71,2**	γ_{MT}	**48,3**	γ_{M1}
		R10100		100	**111,8**		**75,4**	
		R10140		140	**222,8**		**108,6**	
	R20	**R2080**		80	**55,8**		**48,3**	
		R20100		100	**90,4**		**75,4**	
		R20140		140	**189,0**		**108,6**	
	R30	**R3080**		120	**-**	-	**48,3**	
		R30120		160	**-**	-	**75,4**	

TENSILE STRENGTH

stress	TYP R		fastening	column $B_{s,min}$ [mm]	$R_{1,t\ k\ timber}$ [kN]	γ_{timber} (1)	$R_{1,t\ k\ steel}$ [kN]	γ_{steel}
	R10	**R1080**		100	**4,2**	γ_{MC}	-	-
		R10100		120	**5,3**		-	-
		R10140		160	**5,3**		-	-
	R20	**R2080**		100	**16,1**	γ_{MT}	-	-
		R20100		120	**30,2**		-	-
		R20140		160	**45,2**		-	-
	R30	**R3080**		120	**18,7**	γ_{MC}	**24,3**	γ_{M0}
		R30120		160	**62,4**		**36,4**	

NOTES:

(1) γ_{MT} partial coefficient of the timber; γ_{MC} partial coefficient for connections.

GENERAL PRINCIPLES:

- The characteristic values are in accordance with ETA-10/0422, except for the tensile values of R10 and R20 calculated as follows:
  - for R10 they are calculated considering the withdrawal resistance of HBS PLATE EVO screws parallel to the grain according to ETA-11/0030;
  - for R20 they are calculated considering only the withdrawal resistance of the threaded rod fixed with epoxy adhesive (XEPOXD400) and in accordance with DIN 1052: 2008.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{i,k\ timber} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{i,k\ steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod} and γ should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

R40

A2 AISI 304

S235 DAC COAT

ETA 10/0422

ADJUSTABLE POST BASE

VARIABLE HEIGHT

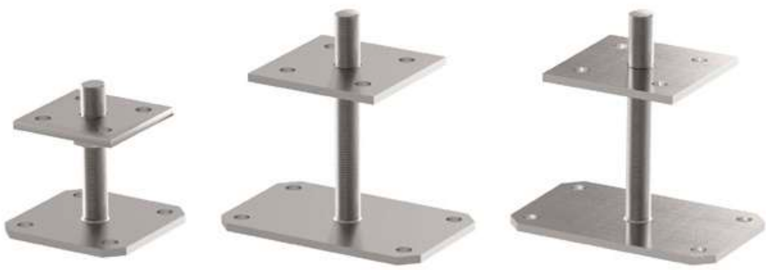
Height adjustable according to functional or aesthetic needs.

RAISED

Outdistanced from the ground to avoid water splash and stagnation and guarantee high durability. Concealed fastening on the timber element.

FACILITATED FASTENING

Convenient installation of the anchors in the rectangular base version.



CHARACTERISTICS

FOCUS	adjustable height
COLUMNS	from 70 x 70 mm to 200 x 200 mm
HEIGHT	adjustable from 50 to 200 mm
FASTENERS	HBS PLATE EVO, SKR, VIN-FIX PRO

MATERIAL

Bright zinc plated carbon steel Dac Coat and stainless steel A2 | AISI304.

FIELDS OF USE

Outdoor joints. Suitable for service class 1, 2 and 3

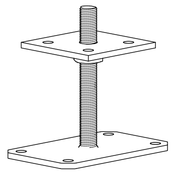
- solid timber and glulam
- CLT, LVL

CODES AND DIMENSIONS

R40 L - Long - rectangular base

S235 DAC COAT

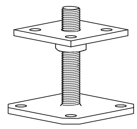
CODE	top plate [mm]	top holes [n. x mm]	bottom plate [mm]	lower holes [n. x mm]	rod Ø x L [mm]	pcs
R40L150	100 x 100 x 6	4 x Ø11	160 x 100 x 6	4 x Ø11,5	20 x 150	1
R40L250	100 x 100 x 6	4 x Ø11	160 x 100 x 6	4 x Ø11,5	24 x 250	1



R40 S - Square - square base

S235 DAC COAT

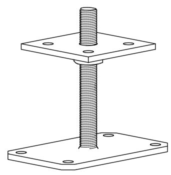
CODE	top plate [mm]	top holes [n. x mm]	bottom plate [mm]	lower holes [n. x mm]	rod Ø x L [mm]	pcs
R40S70	70 x 70 x 6	2 x Ø6	100 x 100 x 6	4 x Ø11,5	16 x 99	1
R40S80	80 x 80 x 6	4 x Ø11	100 x 100 x 6	4 x Ø11,5	20 x 99	1



RI40 L A2| AISI304 - Long - rectangular base

A2 AISI 304

CODE	top plate [mm]	top holes [n. x mm]	bottom plate [mm]	lower holes [n. x mm]	rod Ø x L [mm]	pcs
RI40L150	100 x 100 x 6	4 x Ø11	160 x 100 x 6	4 x Ø11,5	20 x 150	1
RI40L250	100 x 100 x 6	4 x Ø11	160 x 100 x 6	4 x Ø11,5	24 x 250	1

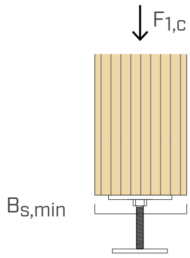


RI40 A2 | AISI304

Available in the rectangular base version also in A2 | AISI304 stainless steel for excellent durability.

STATIC VALUES

COMPRESSION STRENGTH



R40 L - Long

CODE	$B_{s,min}$	$R_{1,c\,k\,timber}$		$R_{1,c\,k\,steel}$			
	[mm]	[kN]	γ_{timber}	[kN]	γ_{steel}	[kN]	γ_{steel}
R40L150	100	**100,0**	γ_{MT}(1)	**41,9**	γ_{M0}	**57,1**	γ_{M1}
R40L250	100	**100,0**		**50,7**		**65,3**	

R40 S - Square

CODE	$B_{s,min}$	$R_{1,c\,k\,timber}$		$R_{1,c\,k\,steel}$			
	[mm]	[kN]	γ_{timber}	[kN]	γ_{steel}	[kN]	γ_{steel}
R40S70	80	**50,7**	γ_{MT}(1)	**23,3**	γ_{M0}	**39,6**	γ_{M1}
R40S80	100	**64,0**		**38,1**		**61,8**	

NOTES:

(1) Partial coefficient of the timber.

GENERAL PRINCIPLES:

- Characteristic values according to ETA-10/0422.
- The design values are obtained from the characteristic values as follows:

$$R_d = \min \begin{cases} \dfrac{R_{i,k\,timber} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{i,k\,steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod} and γ should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

R70

S235
DAC COAT

ETA 10/0422

ADJUSTABLE POST BASE

CODES AND DIMENSIONS

CODE	plate [mm]	holes [n. x mm]	rod Ø x L [mm]	pcs
R70100	100 x 100 x 8	4 x Ø11	20 x 350	1
R70140	140 x 140 x 8	4 x Ø11	24 x 450	1

R90

GALV

ETA 10/0422

ADJUSTABLE POST BASE

CODES AND DIMENSIONS

CODE	bottom plate [mm]	lower holes [n. x mm]	top plate [mm]	height [mm]	screw Ø x L [mm]	pcs
R90100	100 x 100 x 5	4 x Ø11,5	Ø80 x 6	130-170	16 x 90	1

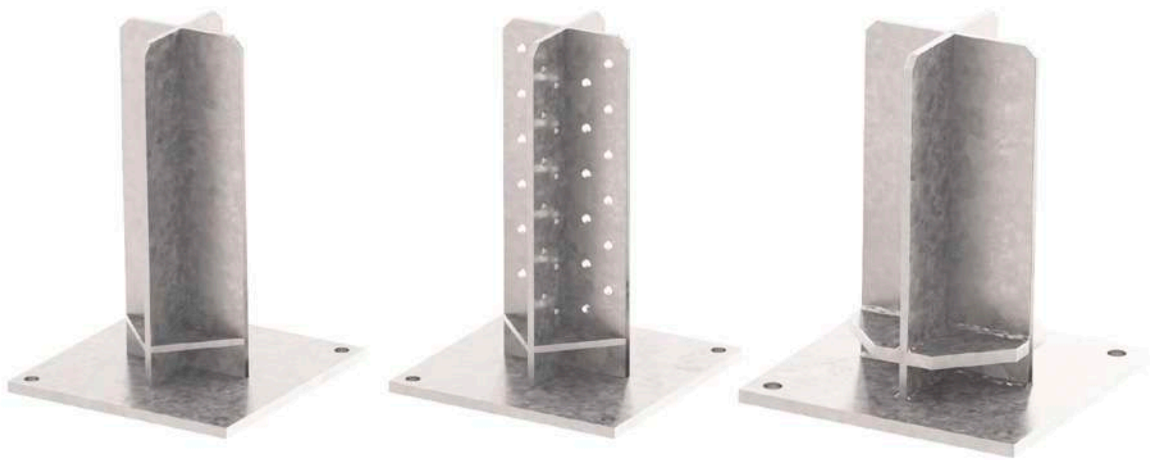
X10

CROSS-SHAPED POST BASE

TWO VERSIONS
Without holes for use with self drilling dowels, smooth dowels or bolts; with holes, for use with epoxy adhesive.

CONCEALED JOINT
Totally concealed installation. Different strength levels depending on the fastening configuration selected.

FIXED-END
Moment-resisting joint for fixed-end constraints. Values of the characteristic moment certified in both directions.



CHARACTERISTICS

FOCUS	concealed joints
COLUMNS	from 120 x 120 mm to 240 x 240 mm
HEIGHT	adjustable from 50 to 200 mm
FASTENERS	SBD, STA, XEPOX, VIN-FIX PRO

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

MATERIAL
Hot dip bright zinc plated carbon steel.

FIELDS OF USE
Moment resisting joints for outdoor use. Suitable for outdoor use (service classes 1, 2 and 3)
- solid timber and glulam
- CLT, LVL

FREE STRUCTURES

The base constraint can absorb horizontal loads allowing to realize pergolas or gazebos which do not require bracings and are open on all sides.

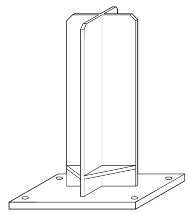
XEPOX

The cross shaped configuration and the fastener disposition are designed to guarantee a moment-resisting capacity, creating a semi-rigid constraint at the base.

CODES AND DIMENSIONS

XS10 - fastening with dowels or bolts

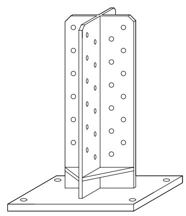
CODE	bottom plate [mm]	lower holes [n. x mm]	H [mm]	knife plate thickness [mm]	cross shaped blades	pcs
XS10120	220 x 220 x 10	4 x Ø13	310	6	smooth	1
XS10160	260 x 260 x 12	4 x Ø17	312	8	smooth	1



XR10 - fastening with resin for wood

CODE	bottom plate [mm]	lower holes [n. x mm]	H [mm]	knife plate thickness [mm]	cross shaped blades	pcs
XR10120	220 x 220 x 10	4 x Ø13	310	6	holes Ø8	1

Not holding CE marking.



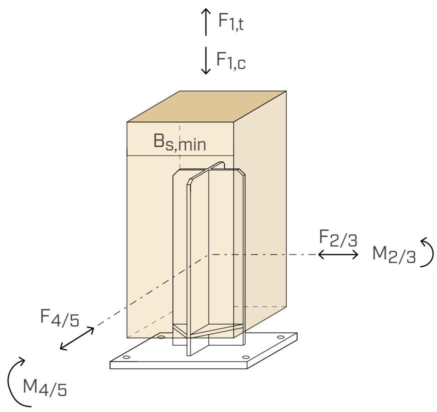
MATERIAL AND DURABILITY

TYP X: S235 hot dip bright zinc plated carbon steel.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

FIELD OF USE

- Solid timber or glulam columns

EXTERNAL LOADS

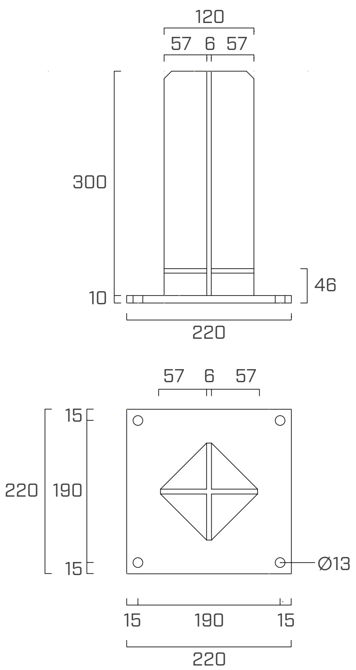


ADDITIONAL PRODUCTS - FASTENING

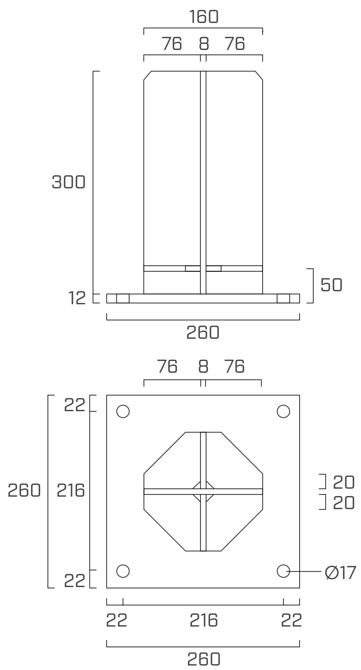
type	description	d [mm]	support	page
SBD	self-drilling dowel	7,5		48
STA	smooth dowel	12		54
KOS	bolt	M12		526
XEPOX F	epoxy adhesive	-		146
AB1	metal anchor	12-16		494
SKR	screw anchor	12-16		488
VIN-FIX PRO	chemical anchor	M12-M16		511
EPO-FIX PLUS	chemical anchor	M12-M16		517

GEOMETRY

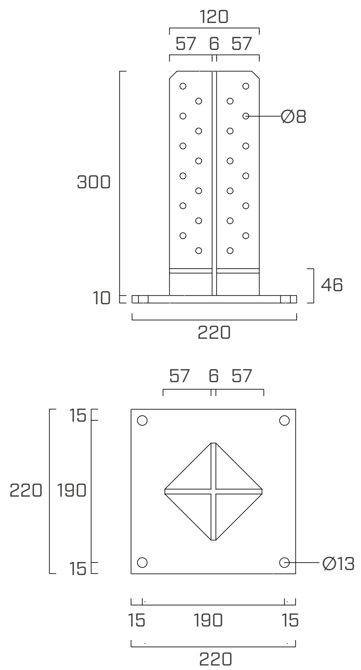
XS10120



XS10160



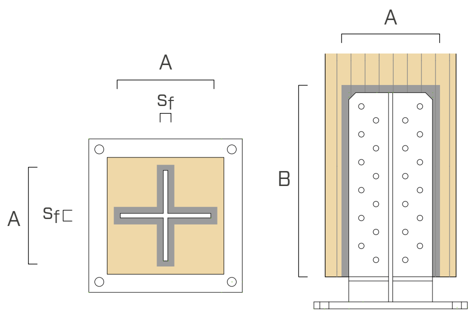
XR10120



INSTALLATION

ESTIMATE OF THE REQUIRED AMOUNT OF XEPOX RESIN - XR10

	grooving thickness s_f	[mm]	10	12
Examples of d imensions of the grooving	A horizontal grooving	[mm]	140	140
	B horizontal grooving	[mm]	280	280
	V grooving	[mm^3]	756000	900480
	V plate holes	[mm^3]	14476	
	V plate	[mm^3]	353780	
	Δ V	[mm^3]	402220	546700
	waste coefficient		1,4	
	amount of resin required	[mm^3]	563109	765381
		[litre]	**0,60**	**0,80**

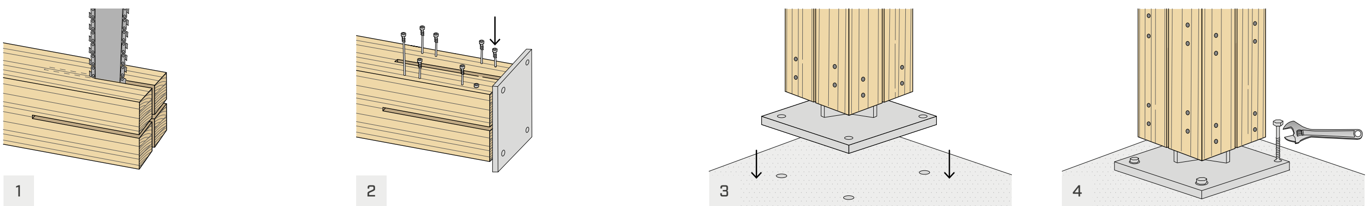


The evaluation of the right amount of resin is an approximate estimate for the installer.
Verify the variability of the data shown in the table
depending on the effective grooving thickness realized.

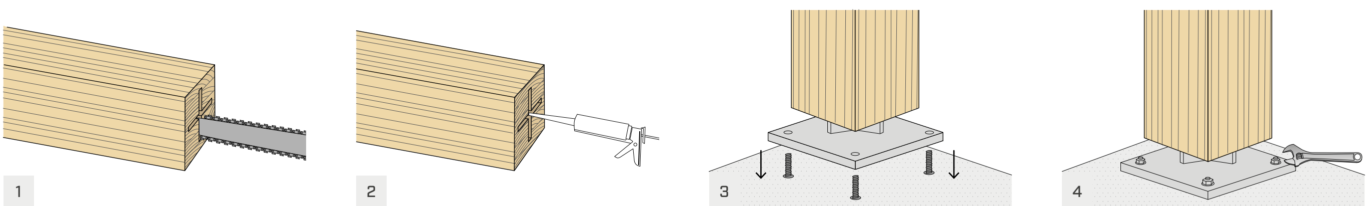
ASSEMBLY

VIDEO

XS10

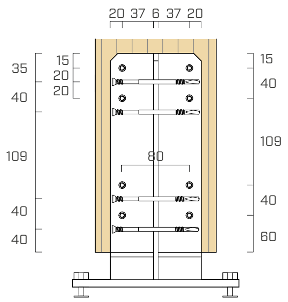


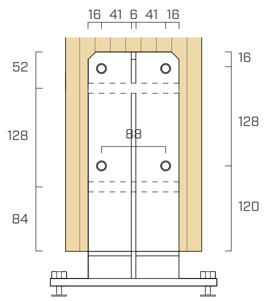
XR10

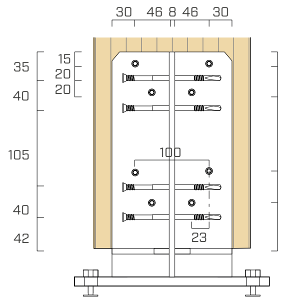


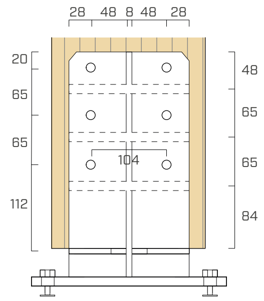
XS10 FASTENING CONFIGURATIONS

XS10120		XS10160	
S1 - SBD SBD self-drilling dowels	**S1 - STA** smooth dowels STA	**S2 - SBD** SBD self-drilling dowels	**S2 - STA** smooth dowels STA

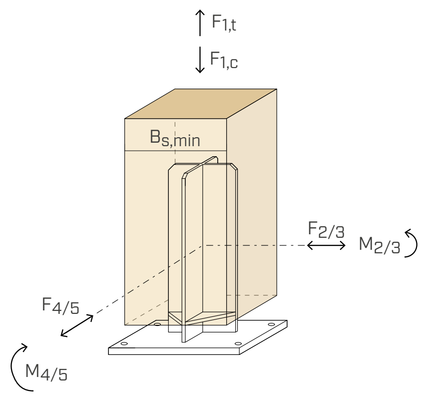








STATIC VALUES



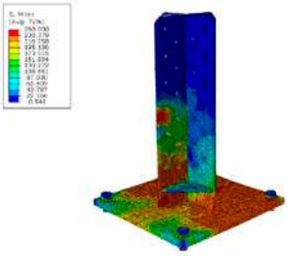
XS10

CODE	config.	fasteners for timber type	pcs - Ø x L [mm]	column $B_{s,min}$ [mm]	COMPRESSION $R_{1,c\ k\ timber}$ [kN]	TENSION $R_{1,t\ k\ steel}$ [kN]	γ_{steel}	SHEAR[1] [2] $R_{2/3\ k\ steel} = R_{4/5\ k\ steel}$ [kN]	γ_{steel}	MOMENT[1] $M_{2/3\ k\ timber} = M_{4/5\ k\ timber}$ [kNm]	$M_{2/3\ k\ steel} = M_{4/5\ k\ steel}$ [kNm]	γ_{steel}
XS10120	S1 - SBD	SBD Ø7,5	16 - Ø7,5 x 115	140 x 140	**133,0**	**32,6**	γ_{M0}	**3,97**	γ_{M0}	**3,03**	**0,90**	γ_{M0}
			16 - Ø7,5 x 135	160 x 160	**149,0**	**32,6**		**3,97**		**3,34**	**0,90**	
	S1 - STA	STA Ø12	8 - Ø12 x 120	160 x 160	**125,0**	**32,6**		**4,01**		**2,09**	**0,90**	
XS10160	S2 - SBD	SBD Ø7,5	16 - Ø7,5 x 135	160 x 160	**197,0**	**59,0**	γ_{M0}	**7,99**	γ_{M0}	**3,33**	**1,83**	γ_{M0}
			16 - Ø7,5 x 155	200 x 200	**213,0**	**59,0**		**7,99**		**3,68**	**1,83**	
	S2 - STA	STA Ø12	12 - Ø12 x 160	200 x 200	**182,0**	**59,0**		**8,29**		**6,74**	**1,83**	

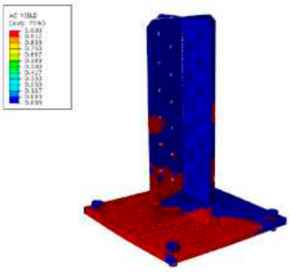
XR10

CODE	fastening type	column $B_{s,min}$ [mm]	COMPRESSION $R_{1,c\ k\ timber}$ [kN]	TENSION $R_{1,t\ k\ steel}$ [kN]	γ_{steel}	SHEAR[1] [2] $R_{2/3\ k\ steel} = R_{4/5\ k\ steel}$ [kN]	γ_{steel}	MOMENT[1] $M_{2/3\ k\ timber} = M_{4/5\ k\ timber}$ [kNm]	$M_{2/3\ k\ steel} = M_{4/5\ k\ steel}$ [kNm]	γ_{steel}
XR10120	XEPOX adhesive[3]	160 x 160	**105,0**	**32,6**	γ_{M0}	**3,97**	γ_{M0}	**4,35**	**0,90**	γ_{M0}

XR10 NUMERICAL MODELING



Mises stress in the plate and the anchors.



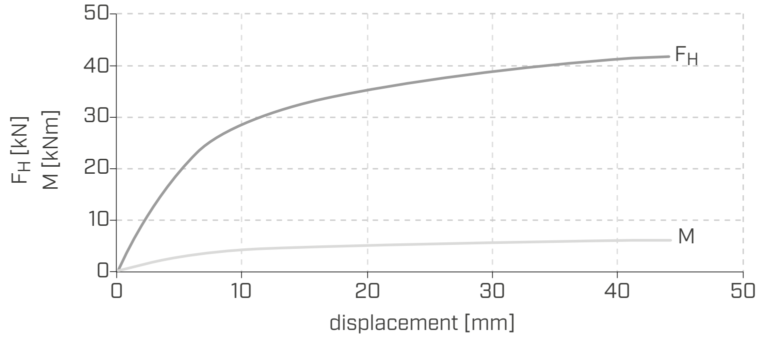
Yield stress in the plate and in the anchors.

Investigation on the load bearing capacity and plastic deformation history of XR10 post base via finite element analysis.

JOINT LOAD BEARING CAPACITY - STEEL SIDE

vertical load	**N**	[kN]	50	25	0
horizontal load(*)	$\mathbf{F_{H,max}}$	[kN]	40,77	49,49	50,64
bending capacity	$\mathbf{M_{max}}$	[kNm]	6,12	7,42	7,60

(*) Shear force application point F_H at a height e = 150 mm.



The analyses show how the application of a compression load (N) does not significantly affect the overall strength of the connection upon reaching the bending limit value of the bottom plate (M = Max).

NOTES:

(1) Provide orthogonal reinforcement to the grain for each load direction, installing 2 screws VGZ Ø7 x $B_{s,min}$ above the vertical flanges.

(2) Limit value of the bottom plate for shear stress application at a height of e = 220 ÷ 230 mm.

(3) We recommend using XEPOX F.

GENERAL PRINCIPLES:

- The strength values indicated in the table are valid in compliance with the fasteners installation according to the configurations indicated.
- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-10/0422 (XS10).
- The design values are obtained as follows:

$$R_d = min \begin{cases} \dfrac{R_{i,k\ timber} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{i,k\ steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod} and γ should be taken according to the current regulations used for the calculation.

The verification of the fastener-to-concrete connection must be carried out separately.

- The moment and shear strength values are calculated individually not taking into account the stabilizing contributions, if any, deriving from the compressive stress that influence the overall strength of the connection. In case of combined loading the verification must be carried out separately.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

F70

"T" SHAPED POST BASE

S235 HOT DIP

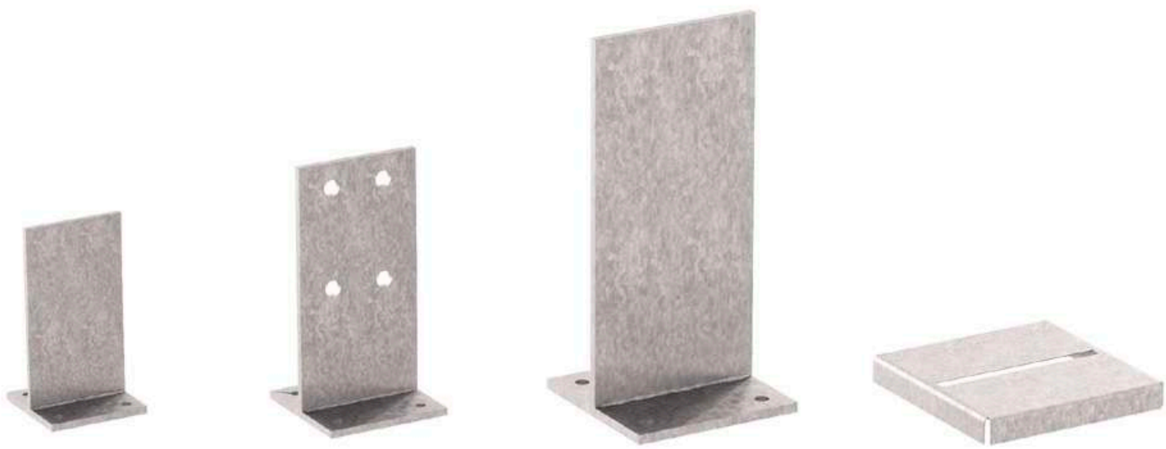
VIDEO

ETA 10/0422

INVISIBLE
The internal knife plate is used to create a totally concealed joint. Designed to accommodate columns of all dimensions.

TWO VERSIONS
Without holes, to be used with self-drilling dowels; with holes, to be used with smooth dowels or bolts.

FIXED-END
Moment-resisting joint for fixed-end constraints. Different strength levels depending on the fastening configuration selected.



CHARACTERISTICS

FOCUS	concealed joints
COLUMNS	from 70 x 70 mm to 240 x 240 mm
HEIGHT	from 150 to 300 mm
FASTENERS	SBD, STA, SKR, VIN-FIX PRO

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

MATERIAL
Hot dip bright zinc plated carbon steel.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3

- solid timber and glulam
- CLT, LVL

STATICS

Different fastening configurations, each calculated and certified according to ETA. Resistant to compression, tension, shearing and moment.

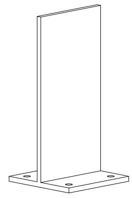
AESTHETICS AND DURABILITY

For excellent durability, it can be integrated with F70 LIFT plate to generate a riser from the ground and protect the anchors from moisture.

CODES AND DIMENSIONS

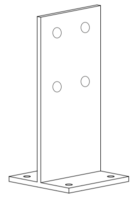
F70

CODE	bottom plate [mm]	base holes [n. x mm]	H [mm]	knife plate thickness [mm]	pcs
F7080	80 x 80 x 6	4 x Ø9	156	4	1
F70100	100 x 100 x 6	4 x Ø9	206	6	1
F70140	140 x 140 x 8	4 x Ø11,5	308	8	1



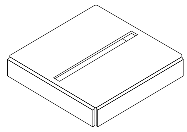
F70 L - with holes

CODE	bottom plate [mm]	base holes [n. x mm]	H [mm]	knife plate thickness [mm]	knife plate hole [n. x mm]	pcs
F70100L	100 x 100 x 6	4 x Ø9	206	6	4 x Ø13	1
F70140L	140 x 140 x 8	4 x Ø11,5	308	8	6 x Ø13	1



F70 LIFT

CODE	plate [mm]	H [mm]	thickness [mm]	pcs
F70100LIFT	120 x 120	20	2	1
F70140LIFT	160 x 160	22	2	1



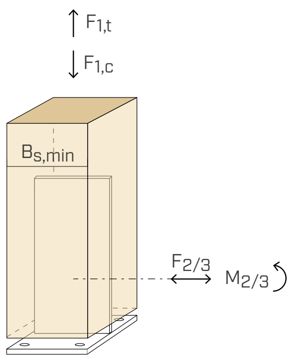
MATERIAL AND DURABILITY

F70: S235 carbon steel with hot galvanising.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

FIELD OF USE

- Concealed joint for timber columns

EXTERNAL LOADS

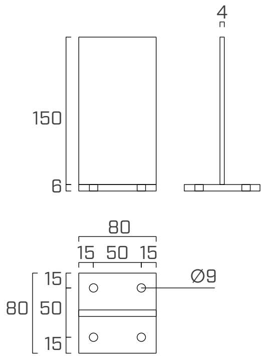


ADDITIONAL PRODUCTS - FASTENING

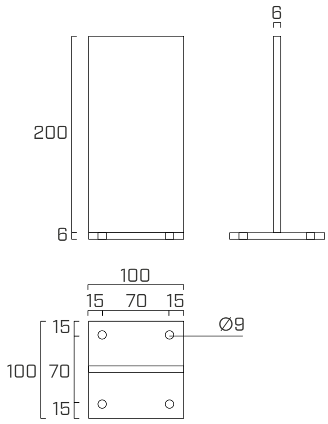
type	description	d [mm]	support	page
SBD	self-drilling dowel	7,5		48
STA	smooth dowel	12		54
KOS/KOT	bolt	M12		526 - 531
SKR	screw anchor	7,5 - 8 - 10		488
VIN-FIX PRO	chemical anchor	M8 - M10		511
EPO-FIX PLUS	chemical anchor	M8 - M10		517

GEOMETRY

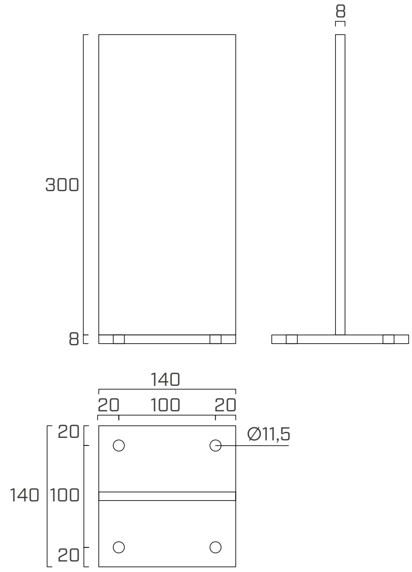
F7080



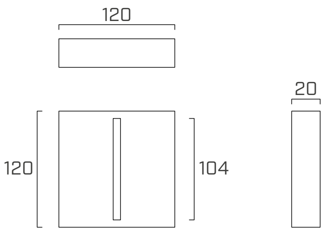
F70100



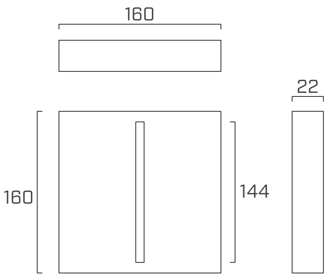
F70140



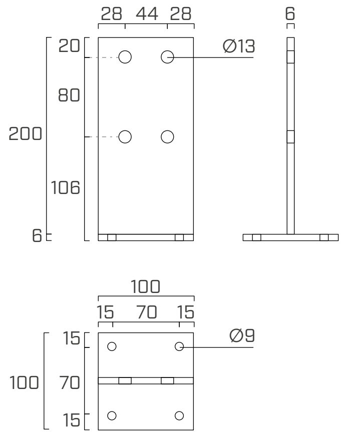
F70100LIFT



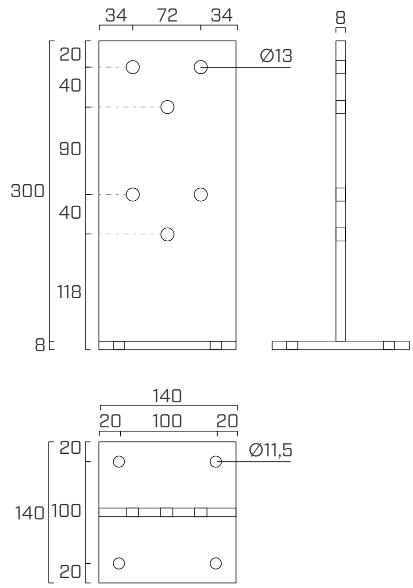
F70140LIFT



F70100L

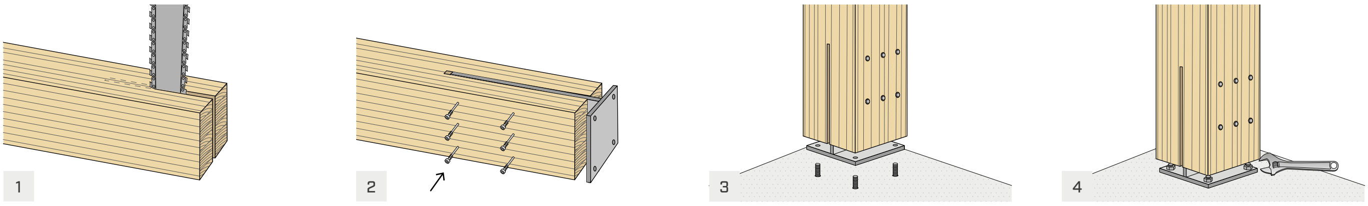


F70140L

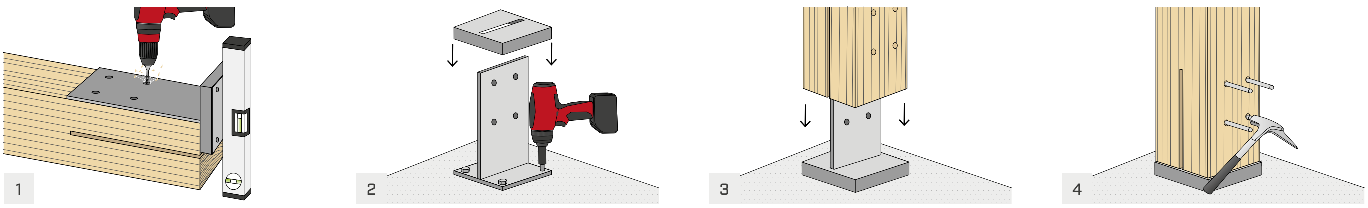


ASSEMBLY

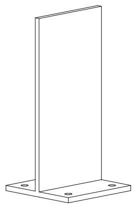
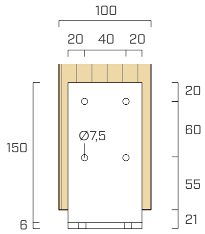
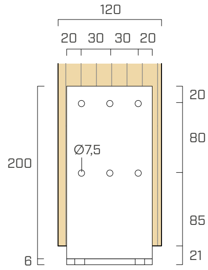
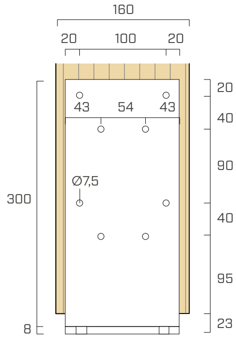
F70 WITH SBD SELF-DRILLING DOWELS



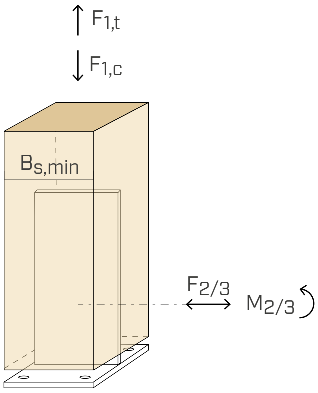
F70 L WITH STA DOWELS



F70 FASTENING CONFIGURATIONS WITH SBD SELF-DRILLING DOWELS

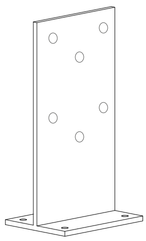
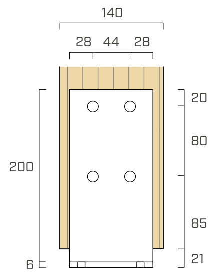
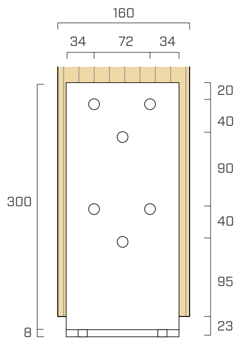
CODE	F7080	F70100	F70140
			

STATIC VALUES F70

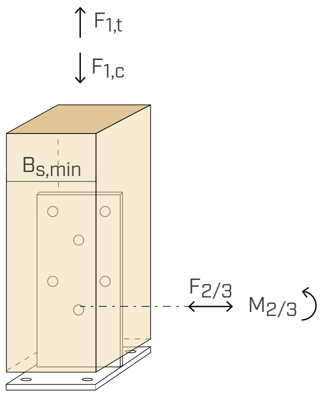


				COMPRESSION			TENSION			SHEAR		MOMENT		
CODE	fasteners for timber		column $B_{s,min}$	$R_{1,c\ k\ timber}$	$R_{1,c\ k\ steel}$		$R_{1,t\ k\ timber}$	$R_{1,t\ k\ steel}$		$R_{2/3,t\ k\ steel}$		$M_{2/3\ k\ timber}$	$M_{2/3\ k\ steel}$	
	type	pcs - Ø x L [mm]	[mm]	[kN]	[kN]	γ_{steel}	[kN]	[kN]	γ_{steel}	[kN]	γ_{steel}	[kNm]	[kNm]	γ_{steel}
F7080	SBD Ø7,5	4 - Ø7,5 x 75	100 x 100	29,6	32,7		17,9	18,3		3,4		0,36	0,46	
F70100	SBD Ø7,5	6 - Ø7,5 x 95	120 x 120	52,6	67,8	γ_{M1}	52,6	15,7	γ_{M0}	3,8	γ_{M0}	1,98	0,55	γ_{M0}
F70140	SBD Ø7,5	8 - Ø7,5 x 115	160 x 160	87,7	103,0		87,7	25,7		6,5		4,22	1,28	

F70L FASTENING CONFIGURATIONS WITH STA SMOOTH DOWELS OR BOLTS

CODE	F70100L	F70140L
		

STATIC VALUES F70L



				COMPRESSION			TENSION			SHEAR		MOMENT		
CODE	fasteners for timber		column $B_{s,min}$	$R_{1,c\ k\ timber}$	$R_{1,c\ k\ steel}$		$R_{1,t\ k\ timber}$	$R_{1,t\ k\ steel}$		$R_{2/3,t\ k\ steel}$		$M_{2/3\ k\ timber}$	$M_{2/3\ k\ steel}$	
	type	pcs - Ø x L [mm]	[mm]	[kN]	[kN]	γ_{steel}	[kN]	[kN]	γ_{steel}	[kN]	γ_{steel}	[kNm]	[kNm]	γ_{steel}
F70100L	STA Ø12[(1)]	4 - Ø12 x 120	140 x 140	55,7	67,8	γ_{M1}	55,7	15,7	γ_{M0}	3,8	γ_{M0}	2,46	0,55	γ_{M0}
F70140L	STA Ø12[(1)]	6 - Ø12 x 140	160 x 160	104,0	103,0		104,0	25,7		6,2		4,88	1,28	

NOTES:

[(1)] The strength values are also valid in case of alternative fastening using M12 bolts according to ETA-10/0422.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-10/0422.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{i,k\ timber} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{i,k\ steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod} and γ should be taken according to the current regulations used for the calculation.

The verification of the fastener-to-concrete connection must be carried out separately.

- The strength values indicated in the table are valid in compliance with the fasteners positioning and the timber column according to the configurations indicated.
- The moment and shear strength values are calculated individually not taking into account the stabilizing contributions, if any, deriving from the compressive stress that influence the overall strength of the connection. In case of combined loading the verification must be carried out separately.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

S50

S235 HOT DIP

CE ETA 10/0422

HIGHLY-RESISTANT POST BASE

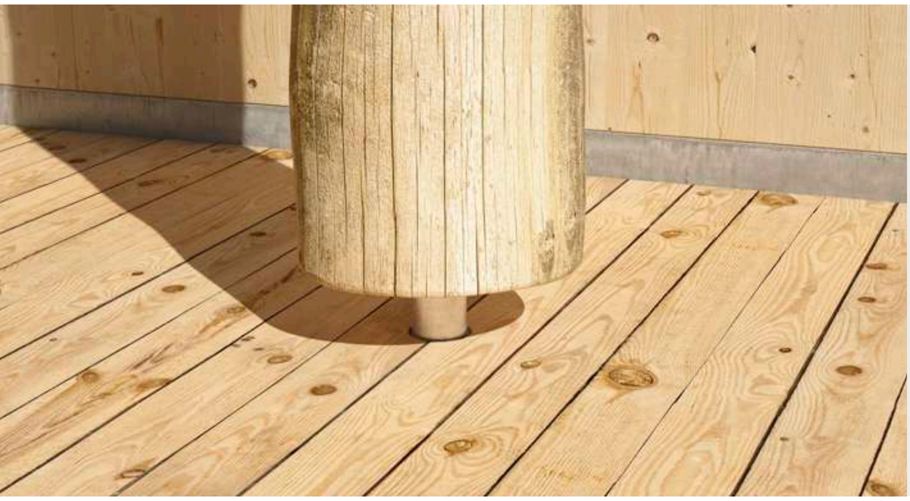
MIGHTY
Characteristic compression strength of more than 300 kN. Ideal for large columns.

RAISED
Outdistanced from the ground to avoid water splash and stagnation and guarantee high durability. Concealed fastening on the timber element.

CERTIFIED SAFETY
Exceptional compression strength values calculated and certified according to ETA.

CHARACTERISTICS

FOCUS	exceptional compression strength
COLUMNS	starting from 120 x 120 mm
HEIGHT	120 | 180 | 240 mm
FASTENERS	HBS PLATE EVO, SKR, VIN-FIX PRO



MATERIAL
Hot dip bright zinc plated carbon steel.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3

- solid timber and glulam
- CLT, LVL

POINT-TO-POINT LOAD

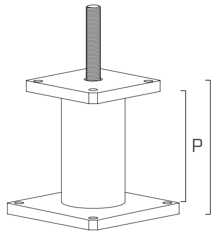
Ideal for transferring high compression forces deriving from large columns. Excellent durability of the column thanks to the tubular that generates the riser.

LARGE SCALE STRUCTURES

Ideal for beam and column construction systems of large dimensions and large spans.

CODES AND DIMENSIONS

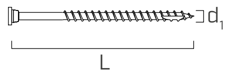
CODE	H [mm]	P [mm]	top plate [mm]	top holes [n. x mm]	bottom plate [mm]	lower holes [n. x mm]	rod Ø x L [mm]	pcs
S50120120	144	120	120 x 120 x 12	4 x Ø11	160 x 160 x 12	4 x Ø13	M20 x 120	1
S50120180	204	180	120 x 120 x 12	4 x Ø11	160 x 160 x 12	4 x Ø13	M20 x 120	1
S50160180	212	180	160 x 160 x 16	4 x Ø11	200 x 200 x 16	4 x Ø13	M24 x 150	1
S50160240	272	240	160 x 160 x 16	4 x Ø11	200 x 200 x 16	4 x Ø13	M24 x 150	1



HBS PLATE EVO

C4 EVO COATING

CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSPEVO880	8	80	55	TX 40	100



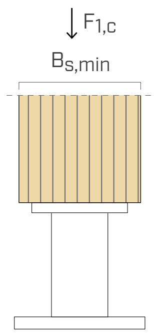
MATERIAL AND DURABILITY

S50: S235 carbon steel with hot galvanising.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

FIELD OF USE

- Timber columns

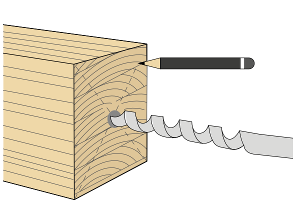
EXTERNAL LOADS



ADDITIONAL PRODUCTS - FASTENING

type	description	d [mm]	support	page
HBS PLATE EVO	screw for timber	8		560
SKR	screw anchor	12		488
AB1 - AB1 A4	metal anchor	12		488 - 496
VIN-FIX PRO	chemical anchor	M12		511
EPO-FIX PLUS	chemical anchor	M12		517

ASSEMBLY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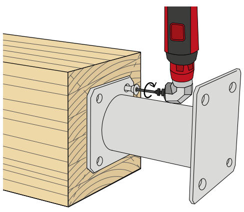
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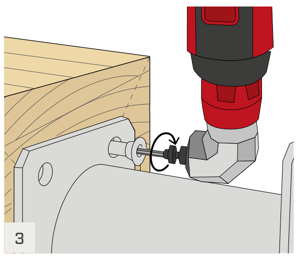
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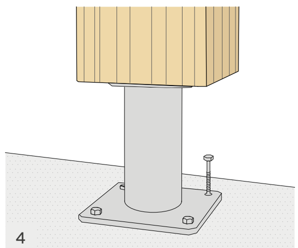
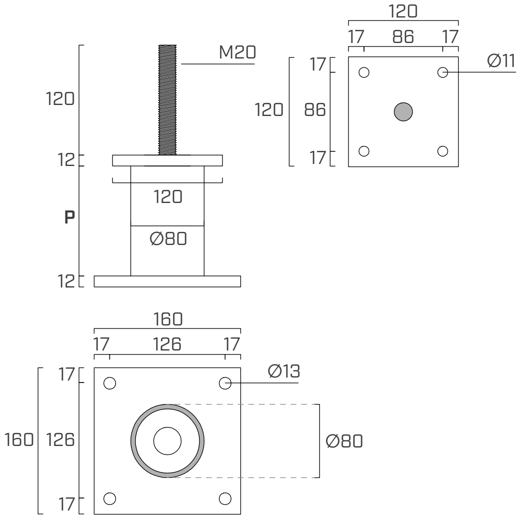
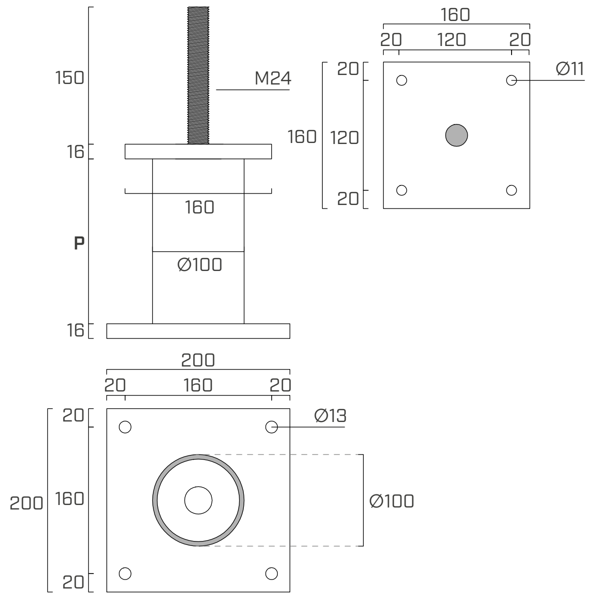

4

GEOMETRY

S50120120
S50120180

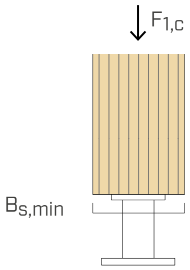


S50160180
S50160240



STATIC VALUES

COMPRESSION STRENGTH



CODE	$B_{s,min}$	$R_{1,c\ k\ timber}$		$R_{1,c\ k\ steel}$			
	[mm]	[kN]	γ_{timber}	[kN]	γ_{steel}	[kN]	γ_{steel}
S50120120	120 x 120	**193,0**	γ_{MT} (1)	**127,0**	γ_{M0}	**277,0**	γ_{M1}
S50120180		**193,0**		**127,0**		**277,0**	
S50160180	160 x 160	**324,0**		**247,0**		**351,0**	
S50160240		**324,0**		**247,0**		**351,0**	

NOTES:

(1) γ_{MT} partial coefficient of the timber.

GENERAL PRINCIPLES:

- Characteristic values according to ETA-10/0422.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{i,k\ timber} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{i,k\ steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod} and γ should be taken according to the current regulations used for the calculation.

The verification of the fastener-to-concrete connection must be carried out separately.

- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

P10 - P20

S235 DAC COAT

S235 HOT DIP

ETA 10/0422

EMBEDDED TUBULAR POST BASE

RAISED
To be embedded in concrete, it allows keep the column distant from the ground ensuring high durability of the timber.

H ≥ 300 mm
The column can be installed at a distance of more than 300 mm from the ground in accordance with DIN 68800.

ADJUSTABLE
In the P20 version, the height can be adjusted as required.

CHARACTERISTICS

FOCUS	raised structures
COLUMNS	from 70 x 70 mm to 160 x 160 mm
HEIGHT	300 | 500 mm
FASTENERS	HBS PLATE EVO, XEPOX

MATERIAL
Hot dip bright zinc plated carbon steel (P10) and Dac Coat zinc plating (P20).

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3

- solid timber and glulam
- CLT, LVL

BALCONIES AND TERRACES

Ideal for creating high durability concealed joints for outdoor wooden columns.

DISTANCE 300 mm

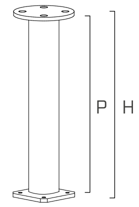
In the 500 mm height versions it guarantees a distance between the ground and the column head greater than 300 mm.

CODES AND DIMENSIONS

P10

S235 HOT DIP

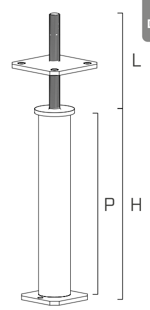
CODE	H	P	top plate	top holes	bottom plate	pcs
	[mm]	[mm]	[mm]	[n. x mm]	[mm]	
P10300	312	300	Ø100 x 6	4 x Ø11,0	80 x 80 x 6	1
P10500	512	500	Ø100 x 6	4 x Ø11,0	80 x 80 x 6	1



P20

S235 DAC COAT

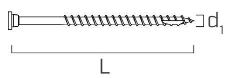
CODE	H	P	top plate	top holes	bottom plate	rod Ø x L	pcs
	[mm]	[mm]	[mm]	[n. x mm]	[mm]	[mm]	
P20300	312	300	100 x 100 x 8	4 x Ø11,0	80 x 80 x 6	M24 x 170	1
P20500	512	500	100 x 100 x 8	4 x Ø11,0	80 x 80 x 6	M24 x 170	1



HBS PLATE EVO

C4 EVO COATING

CODE	d_1	L	b	TX	pcs
	[mm]	[mm]	[mm]		
HBSPEVO880	8	80	55	TX 40	100



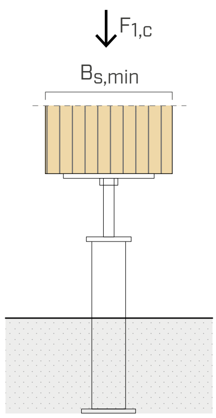
MATERIAL AND DURABILITY

P10: S235 carbon steel with hot galvanising.
P20: S235 carbon steel with special coating Dac Coat.
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

FIELD OF USE

- Timber column drowned in the casting

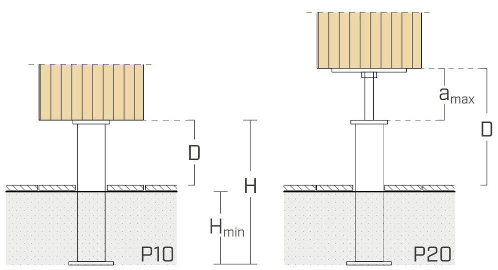
EXTERNAL LOADS



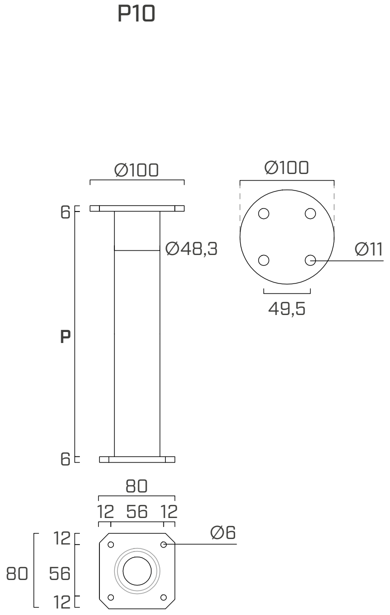
INSTALLATION ON CONCRETE

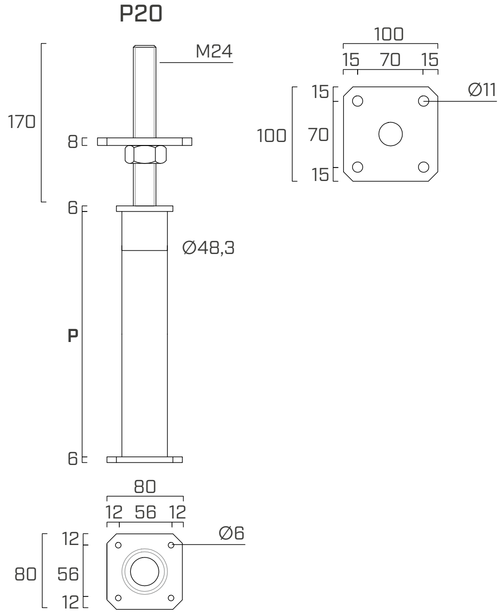
	CODE	H	H_{min}	a_{max}*	D_{max}
		[mm]	[mm]	[mm]	[mm]
P10	**P10300**	312	156	-	**156**
	P10500	512	256	-	**256**
P20	**P20300**	312	156	70	**226**
	P20500	512	256	70	**326**

* $a_{min} \approx 25 \div 30$ mm (upper plate + nut)



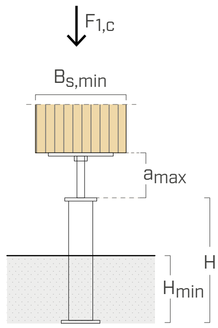
GEOMETRY





STATIC VALUES

COMPRESSION STRENGTH



P10

CODE	$B_{s,min}$ [mm]	H [mm]	H_{min} [mm]	$R_{1,c\,k\,timber}$ [kN]	γ_{timber}	$R_{1,c\,k\,steel}$ [kN]	γ_{steel}	[kN]	γ_{steel}
P10300	□ 100 x 100	312	156	**98,6**	γ_{MT} (1)	**78,7**	γ_{M0}	**107,0**	γ_{M1}
P10500	○ Ø100	512	256					**99,3**	

P20

CODE	$B_{s,min}$ [mm]	H [mm]	H_{min} [mm]	a_{max} [mm]	$R_{1,c\,k\,timber}$ [kN]	γ_{timber}	$R_{1,c\,k\,steel}$ [kN]	γ_{steel}	[kN]	γ_{steel}
P20300	□ 100 x 100	312	156	70	**93,7**	γ_{MT} (1)	**59,5**	γ_{M0}	**106,0**	γ_{M1}
P20500		512	256	70					**106,0**	

NOTES:

(1) γ_{MT} partial coefficient of the timber.

GENERAL PRINCIPLES:

- The characteristic values are in accordance with ETA-10/0422 and valid for a minimum anchoring depth in the concrete casting of H_{min}.
- The design values are obtained from the characteristic values as follows:

$$R_d = min \begin{cases} \dfrac{R_{i,k\ timber} \cdot k_{mod}}{\gamma_{timber}} \\ \dfrac{R_{i,k\ steel}}{\gamma_{steel}} \end{cases}$$

The coefficients k_{mod} and γ should be taken according to the current regulations used for the calculation.

The verification of the fastener-to-concrete connection must be carried out separately.

- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- Dimensioning and verification of timber and concrete elements must be carried out separately.

TYP F

FIXED POST BASES

OUTDOOR
Hot dip galvanizing for use in service classes 1, 2 and 3. Stainless steel A2 | AISI304 versions for excellent durability.

WATER OUTFLOW
Internal holes designed to allow the accumulated water to drain. Versions with integrated riser.






CHARACTERISTICS

FOCUS	fast installation
COLUMNS	from 70 x 70 mm to 200 x 200 mm
ROUND COLUMN	from Ø80 to Ø140 mm
FASTENERS	HBS PLATE EVO, SKR, VIN-FIX PRO

MATERIAL
Hot dip bright zinc plated carbon steel or stainless steel three dimensional perforated plate.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3. Construction of pergolas and fences.

F10

S235 HOT DIP

ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
F1070	71 x 71	150	2,0	150 x 150	4 x Ø11,5	4 x Ø11	1
F1080	81 x 81	150	2,0	150 x 150	4 x Ø11,5	4 x Ø11	1
F1090	91 x 91	150	2,0	150 x 150	4 x Ø11,5	4 x Ø11	1

F1080 not included in the ETA document.

FI10 A2 | AISI304

A2 AISI 304

CE ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FI1070	71 x 71	150	2,0	150 x 150	4 x Ø11,5	4 x Ø11	1
FI1090	91 x 91	150	2,0	150 x 150	4 x Ø11,5	4 x Ø11	1

F50

S235 HOT DIP

ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

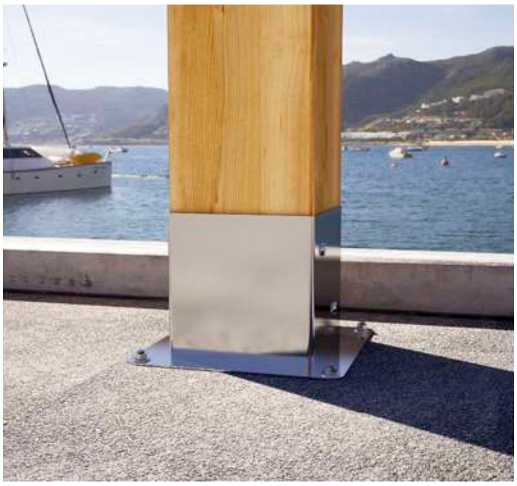
CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
F50100	101 x 101	150	2,5	150 x 150	4 x Ø11,5	4 x Ø11	1
F50120	121 x 121	150	2,5	200 x 200	4 x Ø11,5	4 x Ø11	1
F50140	141 x 141	150	2,5	200 x 200	4 x Ø11,5	4 x Ø11	1
F50160	161 x 161	200	2,5	240 x 240	4 x Ø11,5	4 x Ø11	1
F50180	181 x 181	200	2,5	280 x 280	4 x Ø11,5	4 x Ø11	1
F50200	201 x 201	200	2,5	300 x 300	4 x Ø11,5	4 x Ø11	1

FI50 A2 | AISI304

A2 AISI 304

CE ETA 10/0422

SLEEVE POST BASE



CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FI50100	101 x 101	150	2,5	150 x 150	4 x Ø11,5	4 x Ø11	1
FI50120	121 x 121	150	2,5	200 x 200	4 x Ø11,5	4 x Ø11	1
FI50140	141 x 141	150	2,5	200 x 200	4 x Ø11,5	4 x Ø11	1
FI50160	161 x 161	200	2,5	240 x 240	4 x Ø11,5	4 x Ø11	1
FI50200	201 x 201	200	2,5	300 x 300	4 x Ø11,5	4 x Ø11	1

FM50 COLOR

THERMO DUST | S235 HOT DIP | ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FM50100	101 x 101	150	2,5	150 x 150	4 x Ø11,5	4 x Ø11	1
FM50120	121 x 121	150	2,5	200 x 200	4 x Ø11,5	4 x Ø11	1
FM50160	161 x 161	200	2,5	240 x 240	4 x Ø11,5	4 x Ø11	1
FM50200	201 x 201	200	2,5	300 x 300	4 x Ø11,5	4 x Ø11	1

Fastenings for timber and concrete included.

FR50 COLOR

THERMO DUST | S235 HOT DIP | ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FR50100	101 x 101	150	2,5	150 x 150	4 x Ø11,5	4 x Ø11	1
FR50120	121 x 121	150	2,5	200 x 200	4 x Ø11,5	4 x Ø11	1

Fastenings for timber and concrete included.

F12

S235
HOT DIP

POST BASE WITH CONCEALED BASE

CODES AND DIMENSIONS

CODE	base [mm]	height [mm]	thickness [mm]	base holes [n. x mm]	wings holes [n. x mm]	pcs
F1270	72 x 60	100	2,5	4 x Ø8	4 x Ø11	1
F1280	82 x 60	100	2,5	4 x Ø8	4 x Ø11	1
F1290	92 x 70	120	2,5	4 x Ø8	4 x Ø11	1
F12100	102 x 80	120	2,5	4 x Ø8	4 x Ø11	1
F12120	122 x 100	140	2,5	4 x Ø8	4 x Ø11	1
F12140	142 x 120	160	3,0	4 x Ø13	4 x Ø11	1
F12160	162 x 140	180	3,0	4 x Ø13	4 x Ø11	1
LIFT20	60 x 60	20	3,0	-	-	1

LIFT not included in the box.

F11

S235
HOT DIP

POST BASE WITH CONCEALED BASE

CODES AND DIMENSIONS

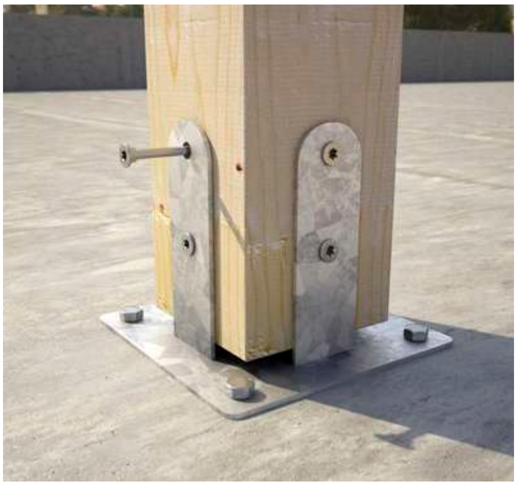
CODE	sleeve [mm]	height [mm]	thickness [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
F1190	91 x 91	150	2,5	4 x Ø8	4 x Ø11	1
F11100	101 x 101	150	2,5	4 x Ø8	4 x Ø11	1
F11120	121 x 121	150	2,5	4 x Ø8	4 x Ø11	1
F11140	141 x 141	200	3,0	4 x Ø13	4 x Ø11	1
F11160	161 x 161	200	3,0	4 x Ø13	4 x Ø11	1
LIFT20	60 x 60	20	3,0	-	-	1

LIFT not included in the box.

F51

S235
HOT DIP

POST BASE WITH FLANGES



CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	flange holes [n. x mm]	pcs
F51120	121 x 121	150	3,0	187 x 187	4 x Ø11,5	8 x Ø11	1
F51140	141 x 141	200	3,0	207 x 207	4 x Ø11,5	8 x Ø11	1
F51160	161 x 161	200	4,0	227 x 227	4 x Ø13,0	8 x Ø11	1
F51180	181 x 181	225	4,0	247 x 247	4 x Ø13,0	8 x Ø11	1
F51200	201 x 201	225	4,0	267 x 267	4 x Ø13,0	8 x Ø11	1

F69

S235
HOT DIP

POST BASE WITH FLANGES

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	flange holes [n. x mm]	pcs
F69100	101 x 101	150	2,5	150 x 150	4 x Ø11,5	8 x Ø11	1
F69120	121 x 121	150	2,5	200 x 200	4 x Ø11,5	8 x Ø11	1
F69160	161 x 161	200	3,0	240 x 240	4 x Ø11,5	8 x Ø11	1
F69200	201 x 201	220	3,0	300 x 300	4 x Ø11,5	8 x Ø11	1
LIFT20	60 x 60	20	3,0	-	-	-	1

LIFT not included in the box.

F20

S235 HOT DIP

ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
F2080	Ø81	150	2,0	160 x 160	4 x Ø11,5	4 x Ø11	1
F20100	Ø101	150	2,0	160 x 160	4 x Ø11,5	4 x Ø11	1
F20120	Ø121	150	2,0	180 x 180	4 x Ø11,5	4 x Ø11	1
F20140	Ø141	150	2,0	200 x 200	4 x Ø11,5	4 x Ø11	1

FR20 COLOR

THERMO DUST

S235 HOT DIP

ETA 10/0422

SLEEVE POST BASE

CODES AND DIMENSIONS

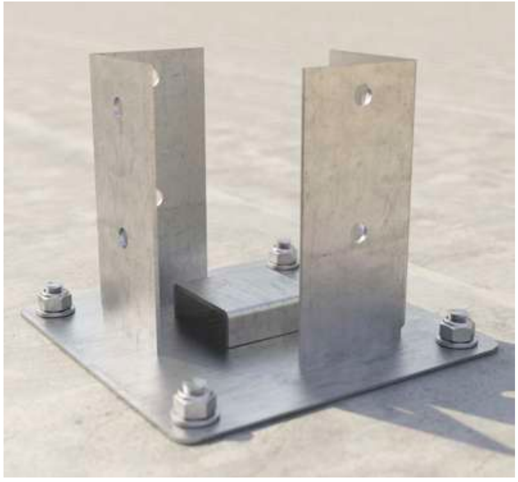
CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FR20100	Ø101	150	2,0	160 x 160	4 x Ø11,5	4 x Ø11	1
FR20120	Ø121	150	2,0	180 x 180	4 x Ø11,5	4 x Ø11	1

Fastenings for timber and concrete included.

LIFT

S235
HOT DIP

RISER FOR POST BASES



CODES AND DIMENSIONS

CODE	type	width [mm]	height [mm]	thickness [mm]	depth [mm]	pcs
LIFT20	STANDOFF	60	20	3,0	60	1

HUT

S235
HOT DIP

CAPS FOR POST BASES

1

2

CODES AND DIMENSIONS

	CODE	size [mm]	height [mm]	pcs
1	**HUTS70**	70 x 70	20	10
1	**HUTS90**	90 x 90	20	10
1	**HUTS100**	100 x 100	20	10
1	**HUTS120**	120 x 120	20	10
2	**HUTR80**	Ø80	20	10
2	**HUTR100**	Ø100	20	10
2	**HUTR120**	Ø120	20	10

TYP FD

DOUBLE FIXED POST BASES

OUTDOOR
Hot dip galvanizing for use in service classes 1, 2 and 3.
Stainless steel A2 | AISI304 versions for excellent durability.

RECTANGULAR SECTIONS
Ideal for use with rectangular columns or non-standard sizes.

CHARACTERISTICS

FOCUS	versatility of use
COLUMNS	rectangular or square sections from 70 to 200 mm
HEIGHT	from 120 to 220 mm
FASTENERS	HBS PLATE EVO, SKR, VIN-FIX PRO

MATERIAL
Hot dip bright zinc plated carbon steel and A2 | AISI304 stainless steel three dimensional perforated plates.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3. Construction of pergolas and fences.

FD10

S235 HOT DIP

ETA 10/0422

DOUBLE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FD10120	121 x 56	200	2,5	200 x 95	2 x Ø11,5	2 x Ø11	1
FD10140	141 x 66	200	2,5	220 x 105	2 x Ø11,5	2 x Ø11	1
FD10160	161 x 76	200	2,5	240 x 115	2 x Ø11,5	2 x Ø11	1
FD10180	181 x 86	200	2,5	260 x 125	2 x Ø11,5	2 x Ø11	1
FD10200	201 x 96	200	2,5	280 x 135	2 x Ø11,5	2 x Ø11	1

FD70

S235 HOT DIP

DOUBLE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FD7080	81 x 81	180	3,0	120 x 65	2 x Ø11,5	4 x Ø11	1
FD70100	101 x 101	220	3,0	150 x 80	2 x Ø11,5	4 x Ø11	1

FD20

ETA 10/0422

DOUBLE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FD20120	121 x 38	200	4,0	200 x 78	2 x Ø11,5	2 x Ø11	1
FD20140	141 x 46	200	4,0	200 x 85	2 x Ø11,5	2 x Ø11	1
FD20160	161 x 54	200	4,0	240 x 92	2 x Ø11,5	2 x Ø11	1
FD20200	201 x 66	200	4,0	280 x 105	2 x Ø11,5	2 x Ø11	1

FDI20 A2 | AISI304

DOUBLE POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	sleeve holes [n. x mm]	pcs
FDI20100	100 x 30	230	3,0	180 x 85	2 x Ø12,5	2 x Ø12,5	1
FDI20120	120 x 40	250	3,0	190 x 85	2 x Ø12,5	2 x Ø12,5	1
FDI20140	140 x 40	250	3,0	210 x 85	2 x Ø12,5	2 x Ø12,5	1
FDI20160	160 x 40	280	3,0	230 x 85	2 x Ø12,5	2 x Ø12,5	1
FDI20200	200 x 50	300	3,0	270 x 95	2 x Ø12,5	2 x Ø12,5	1

FD30

DOUBLE POST BASE

S235 HOT DIP

CE ETA 10/0422

CODES AND DIMENSIONS

CODE	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	column holes [n. x mm]	pcs
FD3060	180	4,0	60 x 50	1 x Ø11,5	2 x Ø11	1
FD3080	240	4,0	80 x 50	1 x Ø11,5	2 x Ø11	1

FD50

DOUBLE POST BASE

S235 HOT DIP

CE ETA 10/0422

CODES AND DIMENSIONS

CODE	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	column holes [n. x mm]	pcs
FD5050	185	4,0	46 x 46	1 x Ø11,5	2 x Ø11	1
FD5080	220	4,0	76 x 76	1 x Ø11,5	2 x Ø11	1

FD60

DOUBLE POST BASE

S235 HOT DIP

CE ETA 10/0422

CODES AND DIMENSIONS

CODE	height [mm]	thickness [mm]	base internal [mm]	base holes [n. x mm]	column holes [n. x mm]	wings [mm]	pcs
FD6050	185	4,0	46 x 46	2 x Ø11,5	2 x Ø11	40 x 43	1
FD6080	220	4,0	76 x 76	2 x Ø11,5	2 x Ø11	50 x 73	1

TYP M

MIXED POST BASES

OUTDOOR
Hot dip galvanizing for use in service classes 1, 2 and 3.

APPLICATION
Specific solutions for fastening in the ground, on the wall or in concrete. Inclinable versions.

CHARACTERISTICS

FOCUS	specific applications
COLUMNS	from 70 x 70 mm to 160 x 160 mm
ROUND COLUMN	from Ø80 to Ø120 mm
FASTENERS	HBS PLATE EVO, SKR, VIN-FIX PRO

MATERIAL
Hot bright zinc plated carbon steel three dimensional perforated plate.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3. Construction of pergolas and fences.

M70 S

S235 HOT DIP

ETA 10/0422

SPIKED POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	sleeve height [mm]	thickness [mm]	sleeve holes [n. x mm]	tip length [mm]	pcs
M70S70	71 x 71	150	2,0	4 x Ø11	600	1
M70S90	91 x 91	150	2,0	4 x Ø11	600	1
M70S100	101 x 101	150	2,0	4 x Ø11	750	1
M70S120	121 x 121	150	2,0	4 x Ø11	750	1

M70S100 and M70S120 not included in the ETA document.

M70 R

S235 HOT DIP

ETA 10/0422

SPIKED POST BASE

CODES AND DIMENSIONS

CODE	sleeve [mm]	sleeve height [mm]	thickness [mm]	sleeve holes [n. x mm]	tip length [mm]	pcs
M70R80	Ø81	150	2,0	4 x Ø11	450	1
M70R100	Ø101	150	2,0	4 x Ø11	450	1
M70R120	Ø121	150	2,0	4 x Ø11	600	1

M70R120 not included in the ETA document.

M50

POST BASE WITH ROD

CODES AND DIMENSIONS

CODE	base [mm]	height [mm]	thickness [mm]	column holes [n. x mm]	rod Ø x L [mm]	pcs
M5070	71 x 60	150	5,0	6 x Ø11	20 x 200	1
M5090	91 x 60	150	5,0	6 x Ø11	20 x 200	1
M50100	101 x 60	150	5,0	6 x Ø11	20 x 200	1
M50120	121 x 60	150	5,0	6 x Ø11	20 x 200	1

M53

POST BASE WITH ROD

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	base holes [n. x mm]	rod Ø x L [mm]	pcs
M5380	Ø81	150	3	4 x Ø12,5	20 x 200	1
M53100	Ø101	150	3	4 x Ø12,5	20 x 200	1
M53120	Ø121	150	3	4 x Ø12,5	20 x 200	1

M52

S235
HOT DIP

POST BASE WITH ROD

CODES AND DIMENSIONS

CODE	base [mm]	height [mm]	thickness [mm]	base holes [n. x mm]	wings holes [n. x mm]	rod Ø x L [mm]	pcs
M5290	91 x 70	120	2,5	4 x Ø8	4 x Ø11	20 x 200	1
M52100	101 x 80	120	2,5	4 x Ø8	4 x Ø11	20 x 200	1
M52120	121 x 100	140	2,5	4 x Ø8	4 x Ø11	20 x 200	1

M51

S235
HOT DIP

POST BASE WITH ROD

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	base holes [n. x mm]	wings holes [n. x mm]	rod Ø x L [mm]	pcs
M51100	Ø101	150	3,0	2 x Ø8	4 x Ø11	20 x 200	1
M51120	Ø121	150	3,0	2 x Ø8	4 x Ø11	20 x 200	1

M60

S235 HOT DIP

ETA 10/0422

POST BASE WITH ROD

CODES AND DIMENSIONS

CODE	base [mm]	height [mm]	thickness [mm]	column holes [n. x mm]	rod Ø x L [mm]	pcs
M6080	80 x 80	130	8,0	4 x Ø11	20 x 250	1

S40

HOT DIP

INCLINABLE POST BASE

CODES AND DIMENSIONS

CODE	internal size [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	column holes [n. x mm]	pcs
S4070	71 x 60	100	5,0	100 x 100	4 x Ø12	6 x Ø11	1
S4090	91 x 60	100	5,0	100 x 100	4 x Ø12	6 x Ø11	1

M10

WALL-MOUNTED POST BASE

S235 HOT DIP

ETA 10/0422

CODES AND DIMENSIONS

CODE	sleeve [mm]	height [mm]	thickness [mm]	width [mm]	wall holes [n. x mm]	sleeve holes [n. x mm]	pcs
M1070	71 x 71	150	2,0	151	6 x Ø11	4 x Ø11	1
M1090	91 x 91	150	2,0	175	6 x Ø11	4 x Ø11	1

M20

“U” SHAPED POST BASE

S235 HOT DIP

CE
ETA 10/0422

CODES AND DIMENSIONS

CODE	base [mm]	height [mm]	thickness [mm]	base holes [n. x mm]	column holes [n. x mm]	pcs
M2070	71 x 60	150	5,0	1 x Ø13 + 2 x Ø11,5	6 x Ø11	1
M2090	91 x 60	150	5,0	1 x Ø13 + 2 x Ø11,5	6 x Ø11	1
M20100	101 x 60	150	5,0	1 x Ø13 + 2 x Ø11,5	6 x Ø11	1
M20120	121 x 60	150	5,0	1 x Ø13 + 2 x Ø11,5	6 x Ø11	1

M30

POST BASE BRACKET

S235 HOT DIP

CE
ETA 10/0422

CODES AND DIMENSIONS

CODE	internal size [mm]	height [mm]	thickness [mm]	bottom plate [mm]	base holes [n. x mm]	column holes [n. x mm]	pcs
M3070	71 x 50	200	5,0	160 x 60	2 x Ø11,5	4 x Ø11	1
M3080	81 x 50	200	5,0	170 x 60	2 x Ø11,5	4 x Ø11	1
M3090	91 x 50	200	5,0	180 x 60	2 x Ø11,5	4 x Ø11	1
M30100	101 x 50	200	5,0	190 x 60	2 x Ø11,5	4 x Ø11	1
M30120	121 x 50	200	5,0	210 x 60	2 x Ø11,5	4 x Ø11	1

M30120 not holding CE marking.

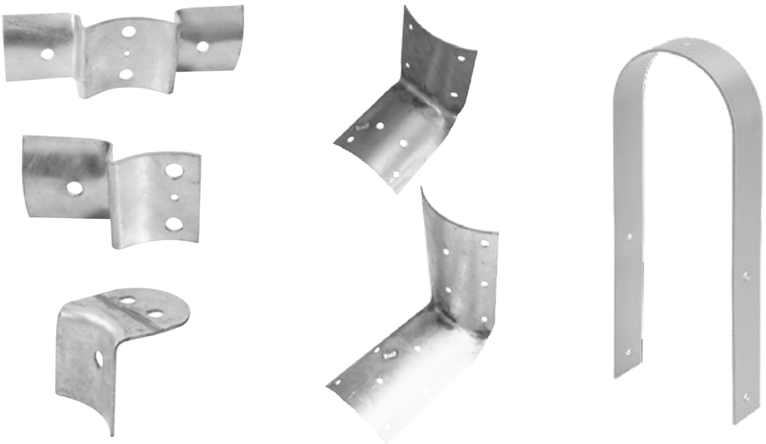
ROUND

S235
HOT DIP

JOINTS FOR ROUND POSTS

OUTDOOR
Hot dip galvanizing for outdoor use in service classes 1, 2 and 3.

ROUND COLUMNS
Ideal for fences with circular section timber elements.



CHARACTERISTICS

FOCUS	round columns fastening
COLUMNS	from Ø60 to Ø140 mm
THICKNESS	from 1,5 to 3,0 mm
FASTENERS	HBS PLATE EVO, LBA

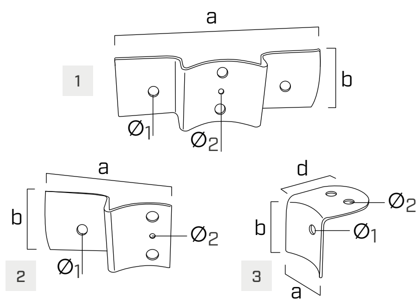
MATERIAL
Hot dip bright zinc plated carbon steel.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3. Construction of fences.

CODES AND DIMENSIONS

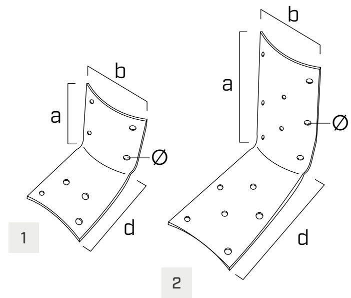
ROUND

	CODE	a x b [mm]	d [mm]	s [mm]	Ø pole [mm]	$Ø_1$ [mm]	$Ø_2$ [mm]	pcs
1	**ROUND100**	205 x 65	-	2,5	Ø100	Ø11	Ø5	10
2	**ROUNDE100**	117 x 70	-	2,5	Ø100	Ø11	Ø5	10
3	**ROUNDH100**	70 x 65	70	2,5	Ø100	Ø11	Ø11	10



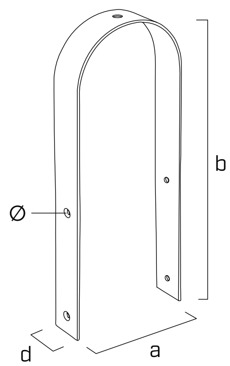
ROUND L

	CODE	a [mm]	d [mm]	b [mm]	s [mm]	Ø pole [mm]	Ø [mm]	pcs
1	**ROUNDL80**	80	80	57	1,5	Ø60-Ø80	Ø5	100
2	**ROUNDL120**	123	123	74	1,5	Ø100-Ø120	Ø5	100



ROUND U

CODE	a [mm]	b [mm]	d [mm]	s [mm]	Ø [mm]	pcs
ROUNDU80	80	345	40	3,0	Ø6	1
ROUNDU100	100	345	40	3,0	Ø6	1
ROUNDU120	120	345	40	3,0	Ø6	1



FENCES

Ideal for joining round section timber:

- ROUND100 for pass-through joints;
- ROUNDE100 for end joints;
- ROUNDH100 for the handrail joint.

BRACE

HINGED PLATE

PILES
Ideal for reciprocal fastening with variable inclination of rectangular or round columns.

A2 | AISI304
Available in A2 | AISI304 stainless steel to for use in aggressive environments.

CHARACTERISTICS

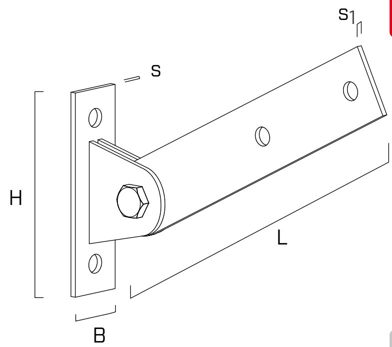
FOCUS	concealed joints
COLUMNS	from 80 x 80 mm to 200 x 200 mm
ROUND COLUMN	from Ø80 to Ø160 mm
FASTENERS	HBS PLATE EVO, KOS, KOT A2

MATERIAL
Hot dip bright zinc plated carbon steel and stainless steel A2 | AISI304.

FIELDS OF USE
Outdoor joints. Suitable for service class 1, 2 and 3. Construction of pergolas, fences and stilts.

CODES AND DIMENSIONS

BRACE

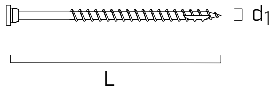


S235 HOT DIP

CODE	B [mm]	H [mm]	L [mm]	s [mm]	s_1 [mm]	Ø [mm]	pcs
BRF140	40	140	235	5	4	13	1

HBS PLATE EVO

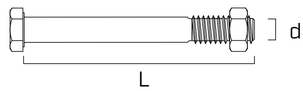
C4 EVO COATING



CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
HBSPEVO10100	10	100	75	TX 40	100

KOS

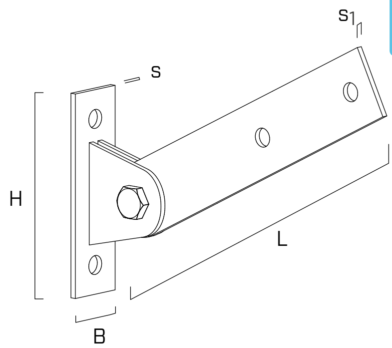
GALV



CODE	d [mm]	L [mm]	pcs
KOS12120B	M12	120	25

BRACE A2 | AISI304

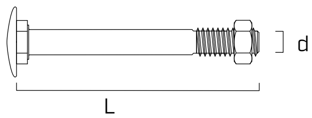
A2 AISI 304



CODE	B [mm]	H [mm]	L [mm]	s [mm]	s_1 [mm]	Ø [mm]	pcs
BRFI140	40	140	235	5	4	13	1

KOT A2 | AISI304

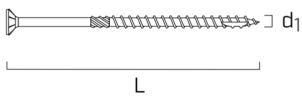
A2 AISI 304



CODE	d [mm]	L [mm]	pcs
AI60112120	M12	120	25

SCI A2 | AISI305

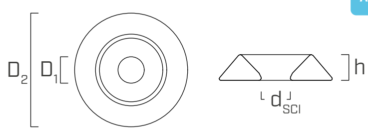
A2 AISI 305



CODE	d_1 [mm]	L [mm]	b [mm]	TX	pcs
SCI80120	8	120	60	TX 40	100

SCB A4 | AISI316

A4 AISI 316



CODE	D_1 [mm]	D_2 [mm]	h [mm]	d_{SCI} [mm]	pcs
SCB8	8,5	25,0	5,0	8	100

GATE

GATE FASTENERS

OUTDOOR
Hot dip galvanizing for outdoor use in service classes 1, 2 and 3.

VERSATILE
Available in several sizes for creating also large gates.

GATE LATCH

GATE HOOK

GATE BAND

GATE FLOOR

CHARACTERISTICS

GATE LATCH	closing bolt
GATE FLOOR	cane bolt
GATE HOOK	pin for strap
GATE BAND	strap with groove
GATE HINGE	hinge

MATERIAL

Hot dip bright zinc plated carbon steel.

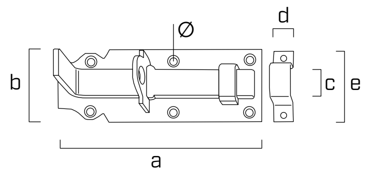
FIELDS OF USE

Outdoor joints. Suitable for service class 1, 2 and 3. Construction of wooden garden gates.

CODES AND DIMENSIONS

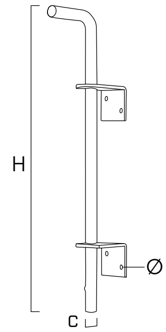
GATE LATCH

CODE	a x b [mm]	c [mm]	d [mm]	e [mm]	Ø [mm]	pcs
GATEL100	100 x 44	16	13	45	Ø5/3,5	10
GATEL120	120 x 44	16	13	45	Ø5/3,5	10
GATEL140	140 x 52	20	16	55	Ø5/4,5	10



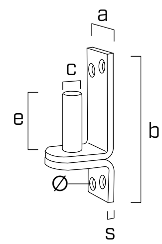
GATE FLOOR

CODE	H [mm]	c [mm]	Ø [mm]	pcs
GATEF400	400	Ø16	Ø6,5	5
GATEF500	500	Ø16	Ø6,5	5



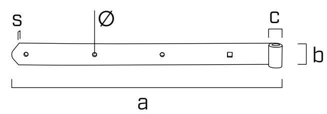
GATE HOOK

CODE	a x b [mm]	c [mm]	s [mm]	e [mm]	Ø [mm]	pcs
GATEH13	35 x 100	Ø13	4,0	40	Ø6,5	10
GATEH16	40 x 115	Ø16	4,5	45	Ø7,2	10
GATEH20	60 x 167	Ø20	6,0	45	Ø7,2	4



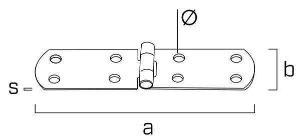
GATE BAND

CODE	a x b [mm]	c [mm]	s [mm]	Ø [mm]	pcs
GATEB13300	300 x 40	Ø13	5,0	Ø7	10
GATEB13500	500 x 40	Ø13	5,0	Ø7	10
GATEB16400	400 x 45	Ø16	5,0	Ø9	10
GATEB16700	700 x 45	Ø16	5,0	Ø9	10
GATEB201200	1200 x 60	Ø20	8,0	Ø9	1



GATE HINGE

CODE	a x b [mm]	s [mm]	Ø [mm]	pcs
HINGE140	135 x 35	2	Ø5,5	20
HINGE160	156 x 35	2	Ø5,5	20
HINGE200	195 x 35	2	Ø5,5	20



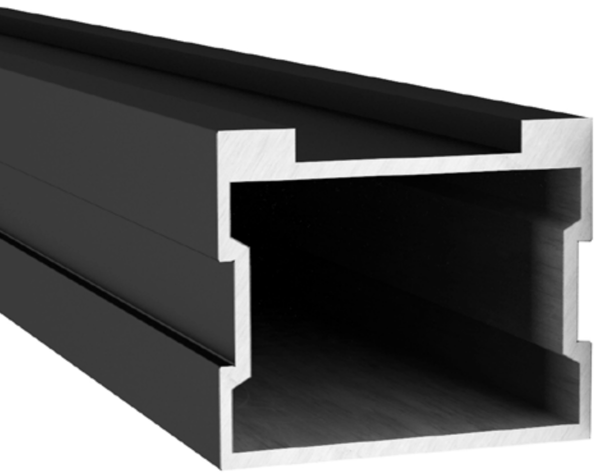
ALU TERRACE

ALUMINIUM PROFILE FOR PATIOS

TWO VERSIONS
ALUTERRA30 version for standard loads. ALUTERRA50 version, in black, for very high loads; can be used on both sides.

SUPPORT EVERY 1,10 m
ALUTERRA50 is designed with a very high inertia so that the SUPPORTS can be positioned every 1,10 m (along the profile midline), even with high loads (4,0 kN/m^2).

DURABILITY
The substructure made of aluminium profiles guarantees excellent patio durability. The drainage channel allows water to run off and generates effective micro-ventilation.



CHARACTERISTICS

FOCUS	excellent durability and strength
SECTIONS	53 x 30 mm and 60 x 50 mm
THICKNESS	1,8 mm | 2,2 mm

MATERIAL
Versions in aluminium and in anodized aluminium (class 15) in graphite black.

FIELDS OF USE
Patio substructure. Outdoor use. Suitable for service classes 1, 2 and 3.

DISTANCE 1,10 m

With a spacing of 80 cm between the profiles (load: 4,0 kN/m^2), the SUPPORT elements can be spaced 1,10 m apart and placed in the mid-line of the ALUTERRACE50 profile.

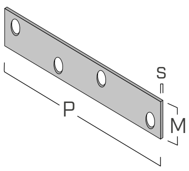
COMPLETE SYSTEM

Ideal for use in combination with SUPPORT, fixed laterally with KKA screws. System with excellent durability.

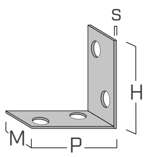
Stabilization of ALUTERRA50 with stainless steel plates and KKA screws.

Aluminium substructure made with ALUTERRA30 and resting on GRANULO PAD

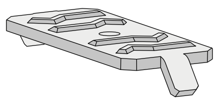
ACCESSORY CODES AND DIMENSIONS



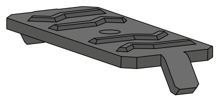
LBVI15100



WHOI1540



FLIP

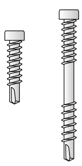


FLAT

CODE	material	s [mm]	M [mm]	P [mm]	H [mm]	pcs
LBVI15100	A2 | AISI304	1,75	15	100	--	200
WHOI1540	A2 | AISI304	1,75	15	40	40	200

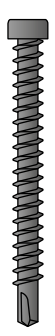
CODE	material	pcs
FLAT	black alluminum	200
FLIP	zinc-plated steel	200

KKA AISI410



d_1 [mm]	CODE	L [mm]	pcs
4 TX 20	**KKA420**	20	200
5 TX 25	**KKA540**	40	100
	KKA550	50	100

KKA COLOR



d_1 [mm]	CODE	L [mm]	pcs
4 TX 20	**KKAN420**	20	200
	KKAN430	30	200
	KKAN440	40	200
5 TX 25	**KKAN540**	40	200

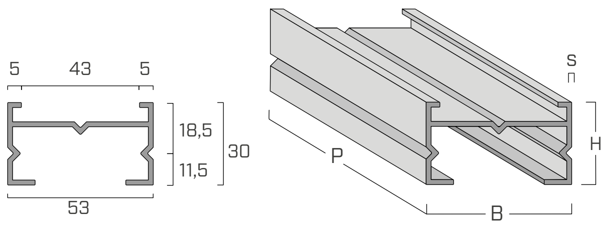
CODES AND DIMENSIONS

CODE	s [mm]	B [mm]	P [mm]	H [mm]	pcs
ALUTERRA30	1,8	53	2200	30	1

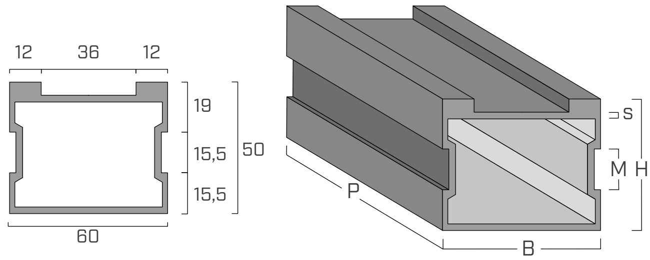
CODE	s [mm]	B [mm]	P [mm]	H [mm]	pcs
ALUTERRA50	2,5	60	2200	50	1

NOTES: upon request, P = 3000 mm version is available.

GEOMETRY

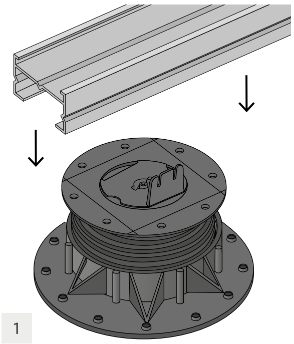


ALU TERRACE 30



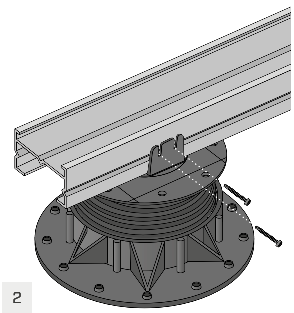
ALU TERRACE 50

EXAMPLE OF FASTENING WITH SCREWS AND ALUTERRA30



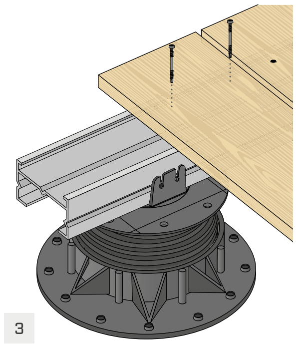
1

Place the ALU TERRACE pro-file on the SUP-S support fit with head SUPSLHEAD1.



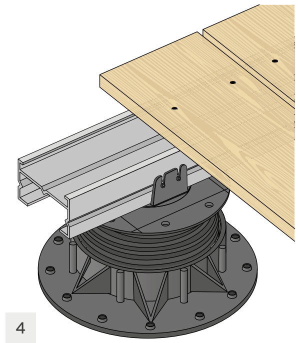
2

Fix the ALU TERRACE profile with 4,0 mm diameter screws KKAN.



3

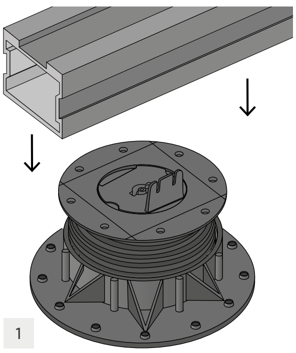
Fix the timber or WPC boards directly on the ALU TERRACE profile with 5,0 mm diameter KKA screws.



4

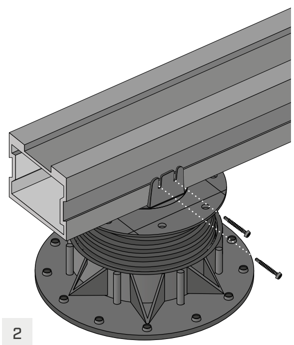
Repeat the operations for the remaining boards.

EXAMPLE OF FASTENING WITH CLIP AND ALUTERRA50



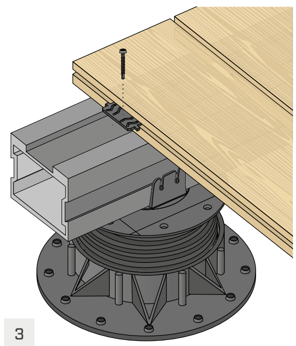
1

Place the ALU TERRACE pro-file on the SUP-S support fit with head SUPSLHEAD1.



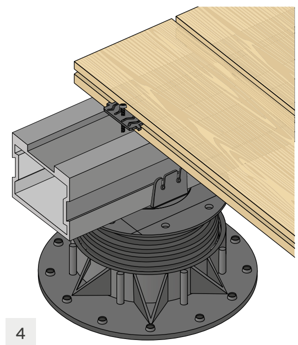
2

Fix the ALU TERRACE profile with 4,0 mm diameter screws KKAN.



3

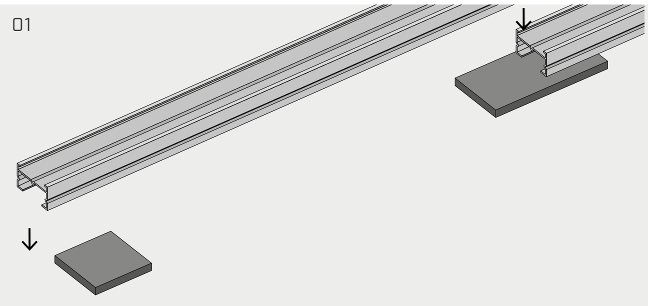
Fix the boards using FLAT concealed clips and 4,0 mm diameter KKAN screws.



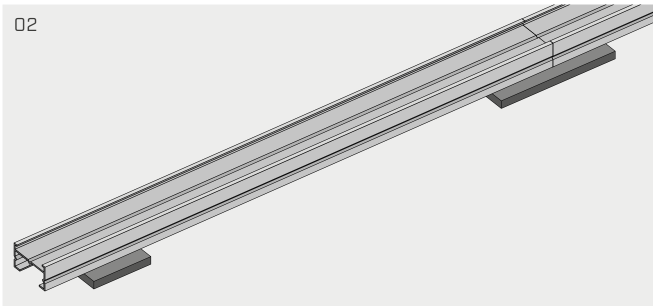
4

Repeat the operations for the remaining boards.

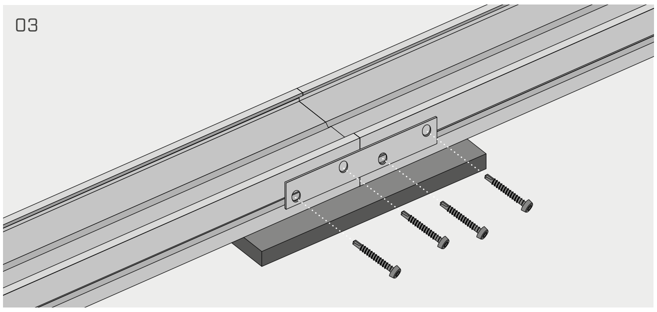
EXAMPLE PLACEMENT ON GRANULO PAD



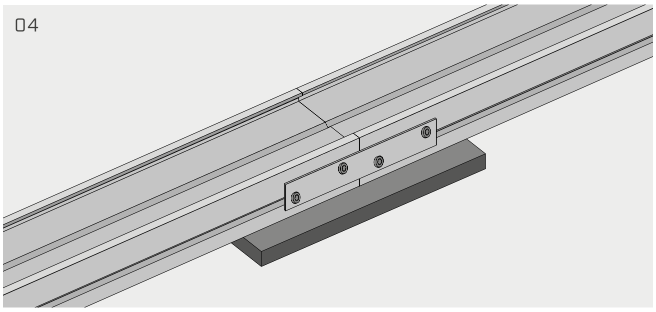
Several ALUTERRA30 units can be connected lengthwise using stainless steel plates. Connection is optional.



Align two head-to-head profiles.

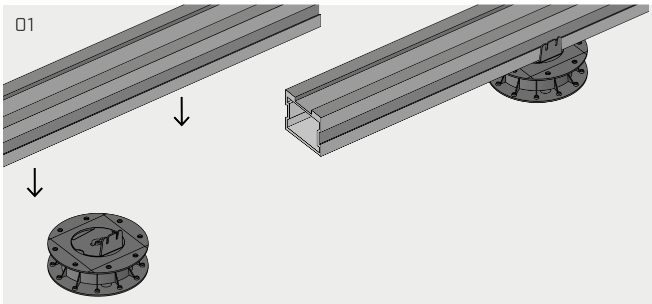


Place the LBVI15100 stainless steel plate on the aluminium profiles and fix with 4,0 x 20 mm diameter KKA screws.

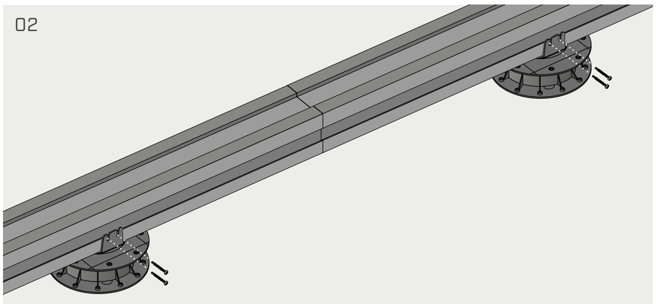


Do this on both sides to maximize stability.

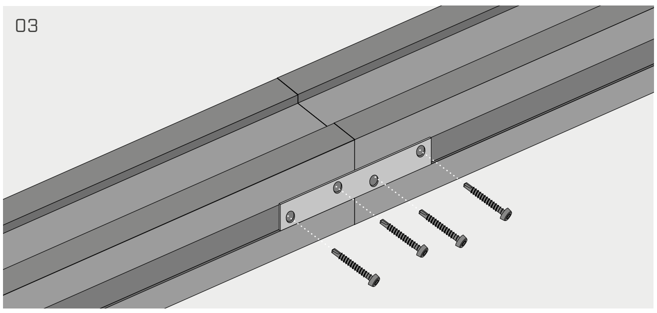
EXAMPLE PLACEMENT ON SUPPORT



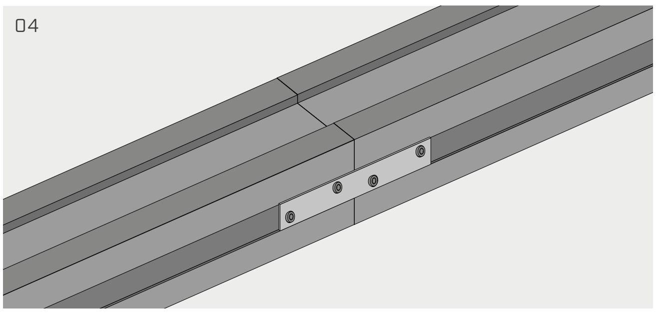
Several ALUTERRA50 units can be connected lengthwise using stainless steel plates. Connection is optional if the joint coincides with placement on the SUPPORT element.



Connect the aluminium profiles with KKAN screws (diameter: 4,0 mm) and align two head-to-head profiles.



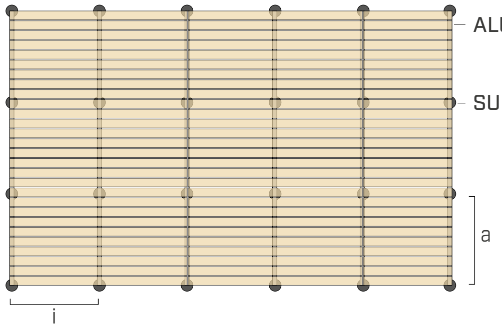
Place the LBVI15100 stainless steel plate on the lateral holes in the aluminium profiles and fix with 4,0 x 20 mm diameter KKA screws or KKAN 4,0 mm diameter.



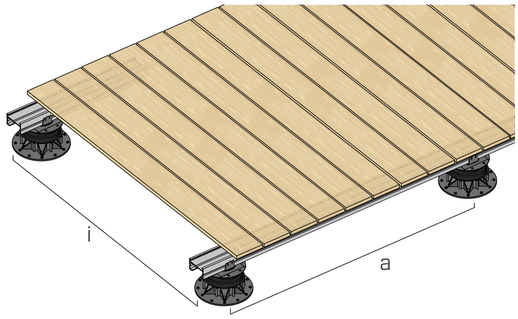
Do this on both sides to maximize stability.

MAXIMUM DISTANCE BETWEEN SUPPORTS (a)

ALU TERRACE 30

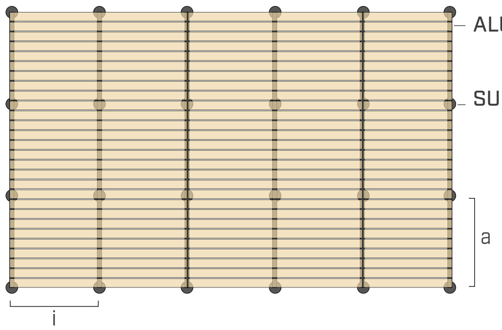


i = joists spacing
a = distance between supports

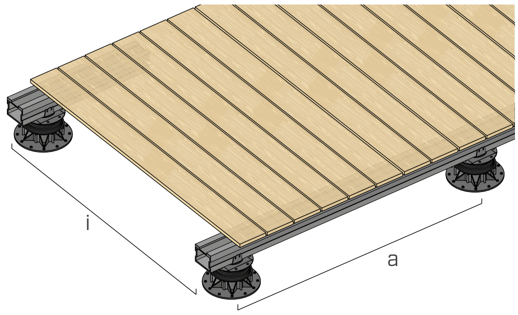


OPERATING LOAD [kN/m^2]	i [m]								
	0,4	**0,45**	**0,5**	**0,55**	**0,6**	**0,7**	**0,8**	**0,9**	**1,0**
2,0	0,77	0,74	0,71	0,69	0,67	0,64	0,61	0,59	0,57
3,0	0,67	0,65	0,62	0,60	0,59	0,56	0,53	0,51	0,49
4,0	0,61	0,59	0,57	0,55	0,53	0,51	0,48	0,47	0,45
5,0	0,57	0,54	0,53	0,51	0,49	0,47	0,45	0,43	0,42

ALU TERRACE 50



i = joists spacing
a = distance between supports



OPERATING LOAD [kN/m^2]	i [m]								
	0,4	**0,45**	**0,5**	**0,55**	**0,6**	**0,7**	**0,8**	**0,9**	**1,0**
2,0	1,70	1,64	1,58	1,53	1,49	1,41	1,35	1,30	1,25
3,0	1,49	1,43	1,38	1,34	1,30	1,23	1,18	1,14	1,10
4,0	1,35	1,30	1,25	1,22	1,18	1,12	1,07	1,03	1,00
5,0	1,25	1,21	1,16	1,13	1,10	1,04	1,00	0,96	0,92

NOTES:

- Example with deformation L/300;
- Useful load according to EN 1991-1-1:
  - Category A areas = 2,0 ÷ 4,0 kN /m^2;
  - Areas susceptible to category C2 crowding = 3,0 ÷ 4,0 kN/m^2;
  - Areas susceptible to category C3 crowding = 3,0 ÷ 5,0 kN/m^2;

The calculation was performed with a static diagram on a simple support span and considering a uniformly distributed load.

SUPPORT

ADJUSTABLE SUPPORT FOR TERRACES

THREE VERSIONS

The Small version (SUP-S) can be raised by up to 37 mm, the Medium version (SUP-M) by up to 220 mm and the Large version (SUP-L) by up to 1020 mm. All versions are height adjustable.

RESISTANT

Sturdy system suitable for heavy loads. The Small (SUP-S) and Medium (SUP-M) versions can handle up to 400 kg. The Large version (SUP-L) can handle up to 800 kg.

COMBINABLE

All versions can be combined with a special head to facilitate lateral fastening to the joist, which may be made of either timber or aluminium. A tile adapter is also available on request.

CHARACTERISTICS

FOCUS	extreme versatility in levelling
HEIGHT	from 22 to 1020 mm
LOWER BASE	SUP-S Ø150 mm SUP-M and SUP-L Ø200 mm
STRENGTH	from 400 to 800 kg

MATERIAL

Polypropylene (PP).

FIELDS OF USE

Raising and levelling of the substructure. Outdoor use. Suitable for service classes 1, 2 and 3.

DURABILITY

UV-resistant and suitable also for aggressive environment conditions. Ideal for use in combination with ALU TERRACE.

ALU TERRACE

Ideal for use in combination with SUPPORT, fixed laterally with KKA screws. System with excellent durability.

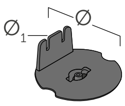
Fastening wooden joists on SUP-M support with head.

Patio made with ceramic tiles on SUP-M with special adapter (code SUPMHEAD4 available upon request).

ACCESSORY CODES AND DIMENSIONS

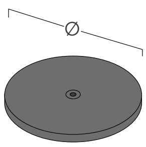
HEAD FOR SUP-S

CODE	Ø [mm]	$Ø_1$ [mm]	pcs
SUPSLHEAD1	70	3 x 14	20



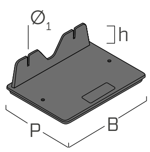
HEAD FOR SUP-M

CODE	Ø [mm]	pcs
SUPMHEAD1	120	25



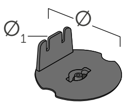
HEAD FOR SUP-M

CODE	B x P [mm]	H [mm]	$Ø_1$ [mm]	pcs
SUPMHEAD2	120 x 90	30	3 x 14	25



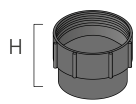
HEAD FOR SUP-L

CODE	Ø [mm]	$Ø_1$ [mm]	pcs
SUPSLHEAD1	70	3 x 14	20



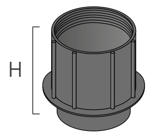
EXTENSION FOR SUP-M

CODE	H [mm]	pcs
SUPMEXT30	30	25



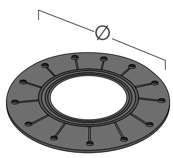
EXTENSION FOR SUP-L

CODE	H [mm]	pcs
SUPLEXT100	100	20

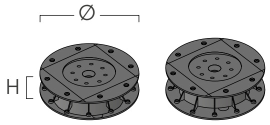


SLOPE ADAPTER FOR SUP-M AND SUP-L

CODE	Ø [mm]		pcs
SUPCORRECT1	200	1%	20
SUPCORRECT2	200	2%	20
SUPCORRECT3	200	3%	20

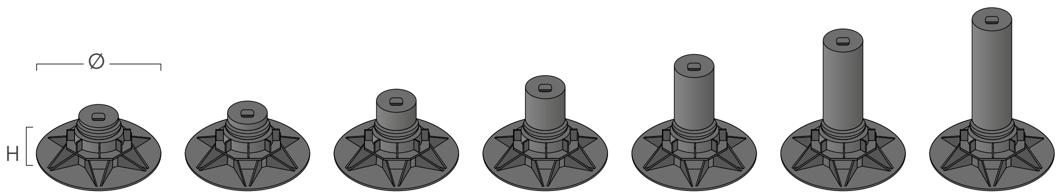


CODES AND DIMENSIONS - SUP-S



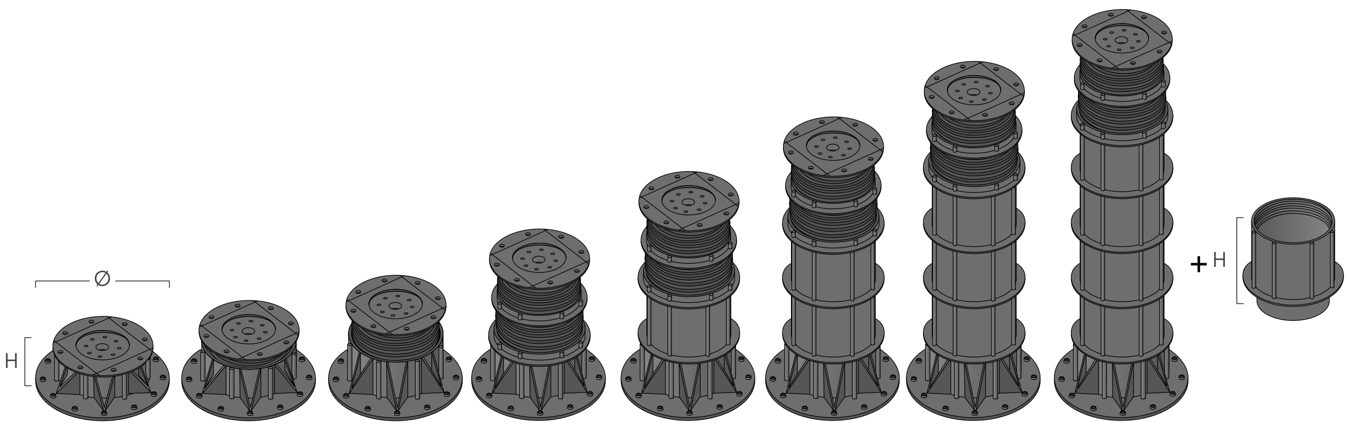
CODE	Ø [mm]	H [mm]	pcs
SUPS2230	150	22 - 30	20
SUPS2840	150	28 - 40	20

CODES AND DIMENSIONS - SUP-M



CODE	Ø [mm]	H [mm]	pcs
SUPM3550	200	35 -50	25
SUPM5070	200	50 - 70	25
SUPM65100	200	65 - 100	25
SUPM95130	200	95 - 130	25
SUPM125160	200	125 - 160	25
SUPM155190	200	155 - 190	25
SUPM185220	200	185 - 220	25

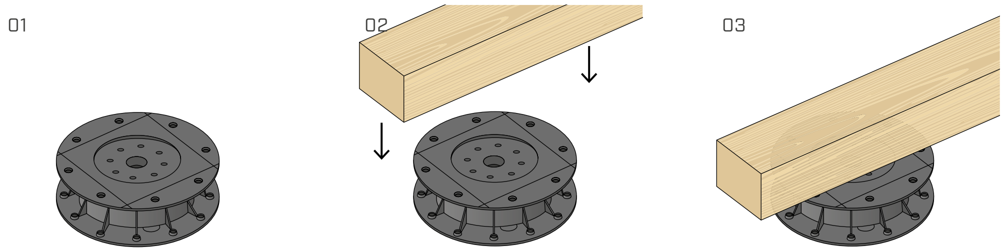
CODES AND DIMENSIONS - SUP-L



CODE	Ø [mm]	H [mm]	pcs
SUPL3550	200	35 - 50	20
SUPL5075	200	50 - 75	20
SUPL75120	200	75 - 120	20
SUPL115220	200	115 - 220	20
SUPL215320	200	215 - 320	20
SUPL315420	200	315 - 420	20

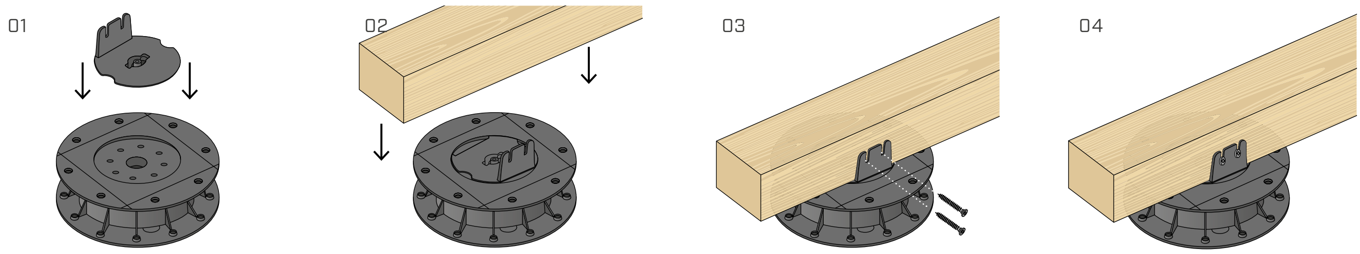
CODE	Ø [mm]	H [mm]	pcs
SUPL415520	200	415 - 520	20
SUPL515620	200	515 - 620	20
SUPL615720	200	615 - 720	20
SUPL715820	200	715 - 820	20
SUPL815920	200	815 - 920	20
SUPL9151020	200	915 - 1020	20

SUP-S INSTALLATION



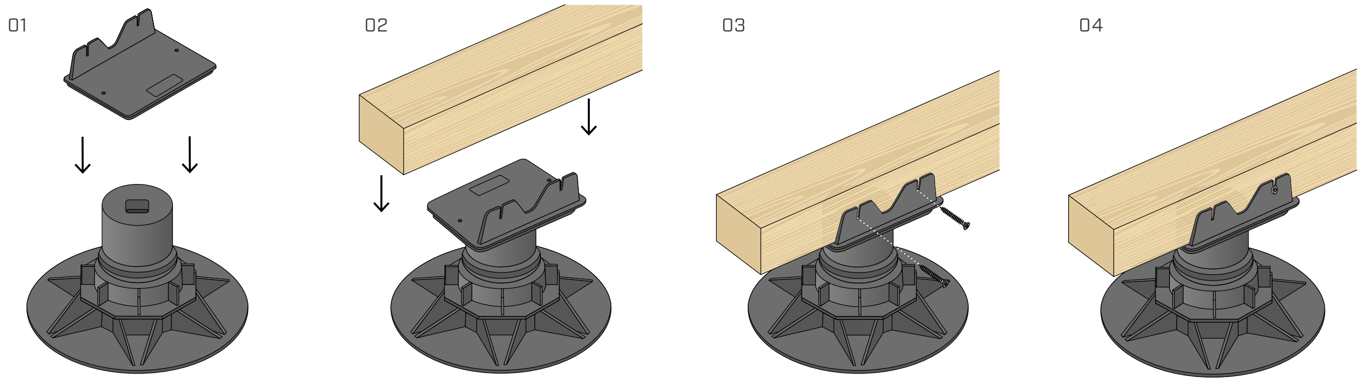
Simply set the joist on the SUP-S support or fix it with 4,5 mm diameter KKF screws.

INSTALLATION OF SUP-S WITH SUPSLHEAD1



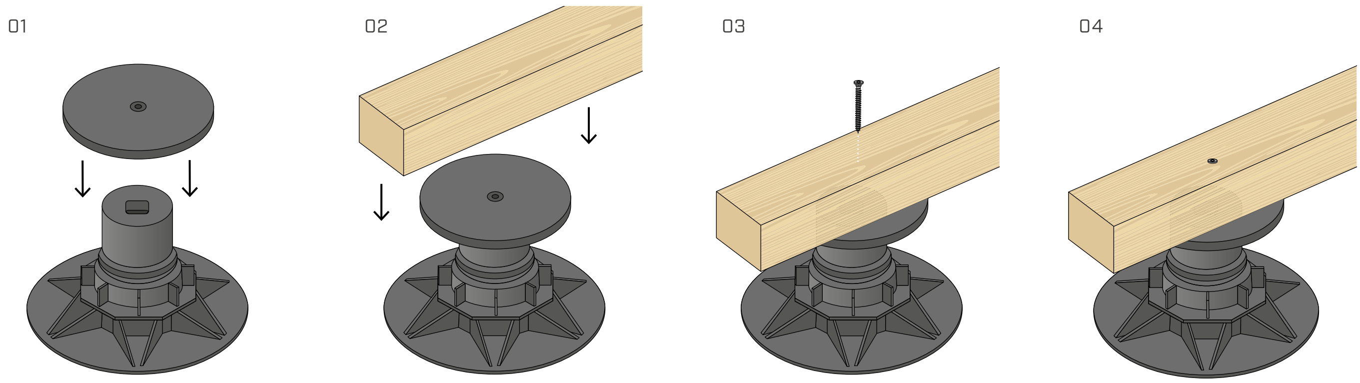
Place the head SUPSLHEAD1 on the SUP-S support and fix the batten with 4,5 mm diameter KKF screws.

INSTALLATION OF SUP-M WITH SUPMHEAD2



Place the head SUPMHEAD2 on the SUP-M support and fix the joist laterally with 4,5 mm diameter KKF screws.

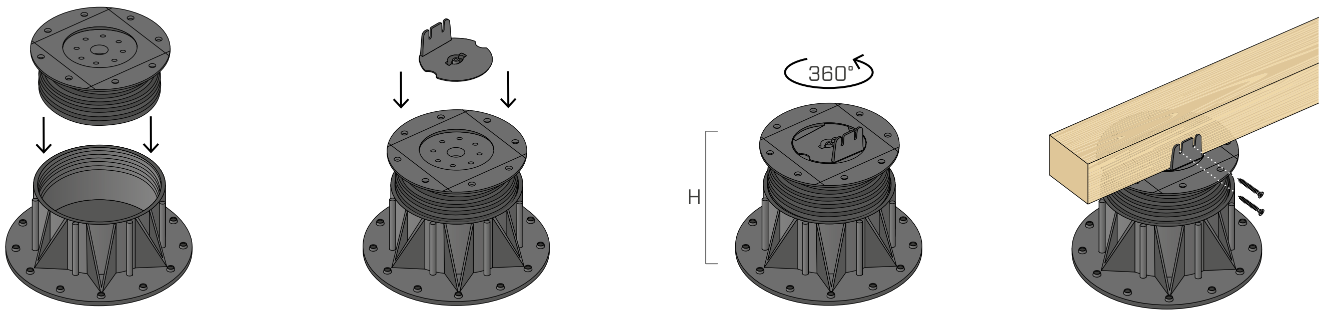
INSTALLATION OF SUP-M WITH SUPMHEAD1



Place the head SUPMHEAD1 on the SUP-M and fix the batten with KKF 4,5 mm diameter screws.

INSTALLATION OF SUP-L WITH SUPSLHEAD1

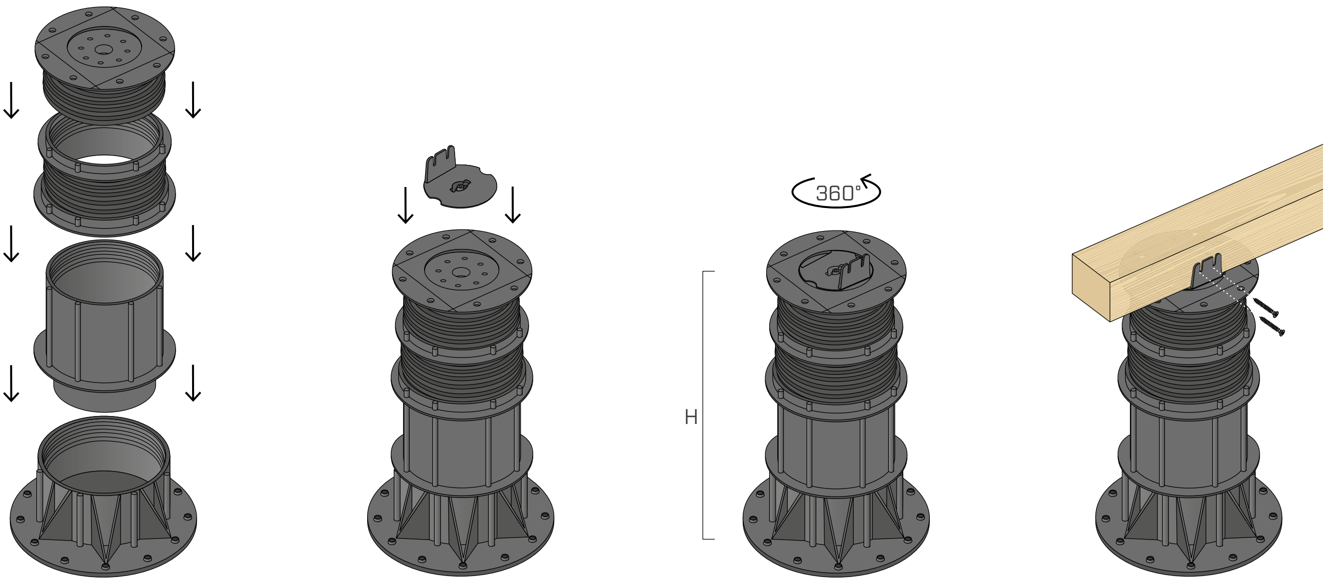
01 02 03 04



Place the head SUPSLHEAD1 on the SUP-L support, adjust the height of the base as needed and fix the batten laterally with 4,5 mm diameter KKF screws.

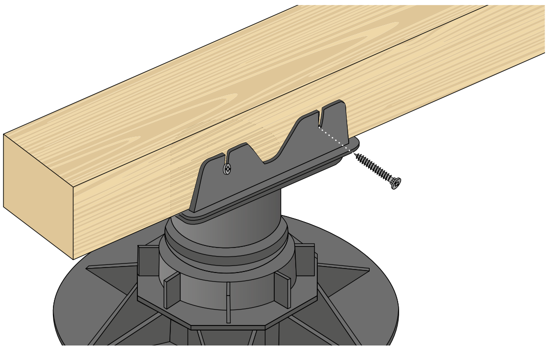
INSTALLATION OF SUP-L WITH SUPSLHEAD1

01 02 03 04

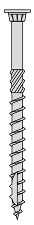


Add the SUPLEXT100 extension to the SUP-L support and then position the SUPSLHEAD1 head. Adjust the height of the base as needed and fix the batten laterally with 4,5 mm diameter KKF screws.

CODES AND DIMENSIONS - FASTENING



KKF AISI410



d_1 [mm]	CODE	L [mm]	pcs
4,5 TX 20	**KKF4520**	20	200
	KKF4540	40	200
	KKF4545	45	200
	KKF4550	50	200
	KKF4560	60	200
	KKF4570	70	200

JFA

ADJUSTABLE SUPPORT FOR TERRACES

LEVELLING
The height-adjustable support can easily adapt to variations in substrate level. The rise also allows for ventilation under the joists.

DOUBLE REGULATION
Can be adjusted both from below, with a SW 10 wrench, or from above, using a flat-tip screwdriver. Fast, practical, versatile system.

SUPPORT
The TPE plastic support base reduces the noise produced by footsteps. The ball-joint can adapt to uneven surfaces.

CHARACTERISTICS

FOCUS	can be adjusted from above and below
HEIGHT	4,0 | 6,0 | 8,0 mm
DIMENSIONS	Ø8 mm
USE	raising and levelling of the structure

MATERIAL
Bright zinc plated carbon steel and austenitic stainless steel A2 | AISI304.

FIELDS OF USE
Raising and levelling of the substructure. Outdoor use. Suitable for service classes 1, 2 and 3.

CODES AND DIMENSIONS

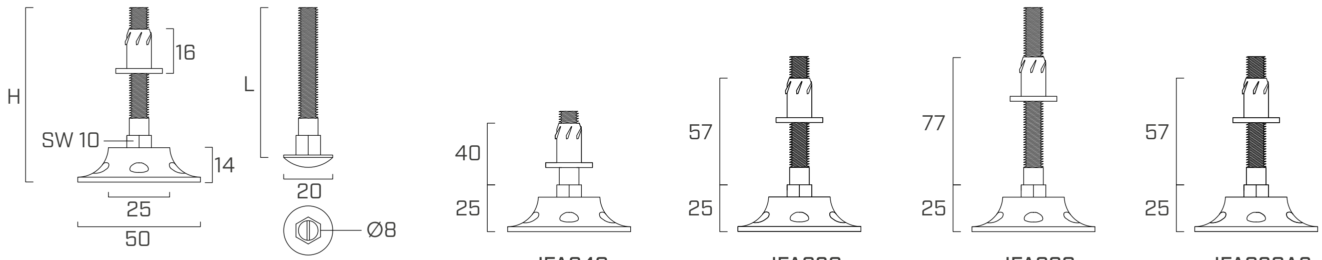
JFA

CODE	material	screw Ø x L [mm]	pcs
JFA840	carbon steel	8 x 40	100
JFA860	carbon steel	8 x 60	100
JFA880	carbon steel	8 x 80	100

JFA A2 | AISI304

CODE	material	screw Ø x L [mm]	pcs
JFA860A2	stainless steel	8 x 60	100

GEOMETRY



JFA840 JFA860 JFA880 JFA860A2

TECHNICAL SPECIFICATIONS

CODE			JFA840	JFA860	JFA880	JFA860A2
Material			carbon steel	carbon steel	carbon steel	A2 | AISI304
Screw Ø x L		[mm]	8 x 40	8 x 60	8 x 80	8 x 40
Assembly height	R	[mm]	$25 \leq R \leq 40$	$25 \leq R \leq 57$	$25 \leq R \leq 77$	$25 \leq R \leq 57$
Angle			+/- 5°	+/- 5°	+/- 5°	+/- 5°
Pre-drill for bush		[mm]	Ø10	Ø10	Ø10	Ø10
Adjustment nut			SW 10	SW 10	SW 10	SW 10
Total height	H	[mm]	51	71	91	71
Admissible capacity	F_{adm}	kN	0,8	0,8	0,8	0,8

STAINLESS STEEL

Available also in A2 | AISI304 stainless steel to for particularly aggressive environments.

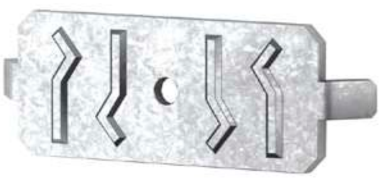
FLAT | FLIP

CONNECTOR FOR TERRACES

INVISIBLE
Completely concealed. The version in aluminium with black coating guarantees an attractive result; the galvanized steel version offers good performance at low cost.

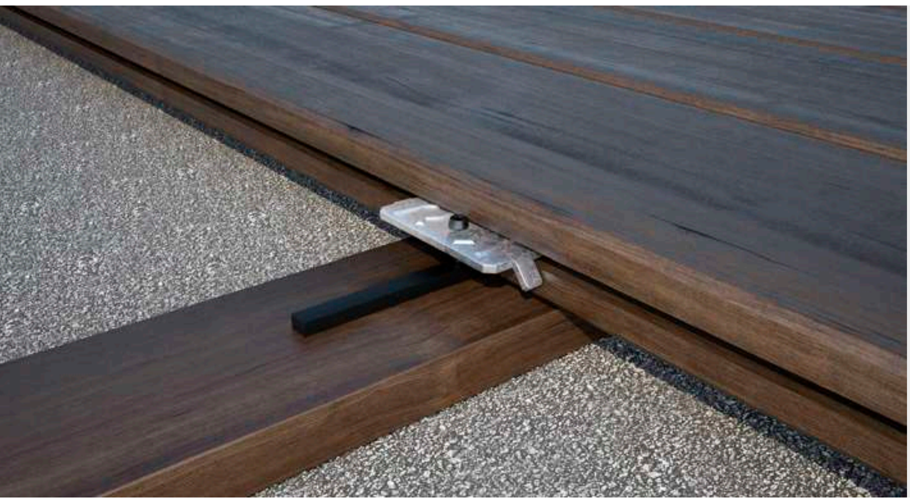
QUICK INSTALLATION
Fast, easy installation thanks to the single-screw fastening and the integrated spacer-tab for precise spacing. Ideal application with the PROFID spacer.

SYMMETRICAL GROOVING
Makes it possible to install deck planks regardless of the position of the grooving (symmetrical). Ribbed surface provides high mechanical strength.



CHARACTERISTICS

FOCUS	extremely precise joints
CLADDING	black anti-rust coating | zinc plated
BOARDS	symmetrical grooving
JOINTS	7,0 mm
FASTENERS	KKTN540 , KKAN440



MATERIAL
Aluminium with coloured organic coating and bright zinc plated carbon steel.

FIELDS OF USE
Outdoor use. Fastening timber or WPC boards on substructures in timber, WPC or aluminium. Suitable for service classes 1, 2 and 3.

CODES AND DIMENSIONS

FLAT COLOR

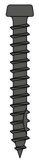
CODE	material	P x B x s [mm]	pcs
FLAT	black alluminum	64 x 27 x 4	200

FLIP

CODE	material	P x B x s [mm]	pcs
FLIP	zinc-plated steel	66 x 27 x 4	200

KKT COLOR

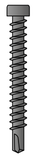
fastening on wood and WPC for FLAT and FLIP



d_1 [mm]	CODE	L [mm]	pcs
5 TX 20	**KKTN540**	40	200

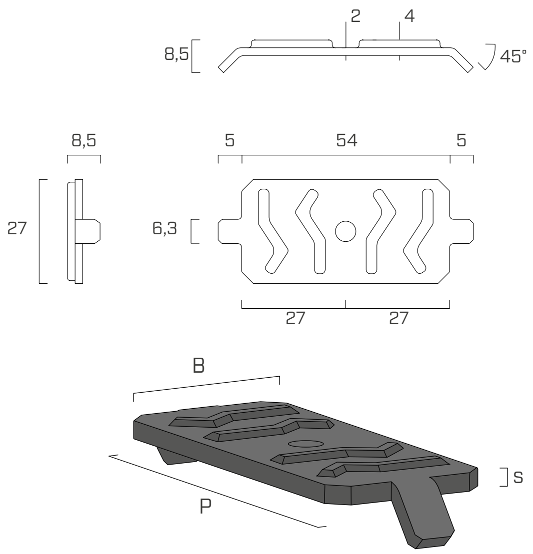
KKA COLOR

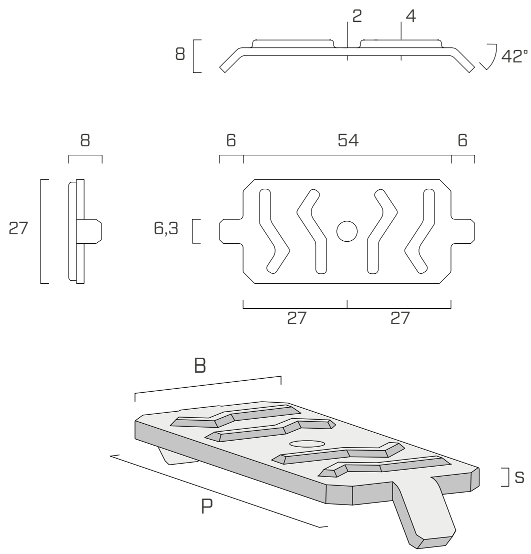
fastening on aluminium for FLAT and FLIP



d_1 [mm]	CODE	L [mm]	pcs
4 TX 20	**KKAN420**	20	200
	KKAN430	30	200
	KKAN440	40	200
5 TX 25	**KKAN540**	40	200

GEOMETRY





WOOD PLASTIC COMPOSITE (WPC)

Ideal for fastening WPC boards. Can also be used for fastening on aluminium using KKA COLOR screws (KKAN440).

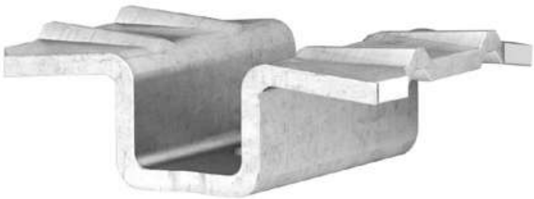
TVM

CONNECTOR FOR TERRACES

FOUR VERSIONS
Different sizes for applications on boards with different thickness and gaps of varying width. Black version for complete concealment.

DURABILITY
The stainless steel ensures high corrosion-resistance. The micro-ventilation between the boards helps the durability of the wooden elements.

ASYMMETRIC GROOVING
Ideal for boards with asymmetrical "female-female" groove cuts. Ribbing on the surface of the connector ensures excellent stability.



CHARACTERISTICS

FOCUS	extremely versatile grooves
BOARDS	symmetrical grooving
JOINTS	from 7,0 to 9,0 mm
FASTENERS	KKTX520A4, KKA420, KKAN420

MATERIAL
A2 | AISI304 austenitic stainless steel and aluminium with coloured organic coating.

FIELDS OF USE
Use in aggressive outdoor environments. Fastening timber or WPC boards on substructures in timber, WPC or aluminium. Suitable for service classes 1, 2 and 3.

CODES AND DIMENSIONS

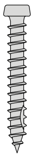
TVM A2 | AISI304

CODE	material	P x B x s [mm]	pcs
TVM1	A2 | AISI304	22,5 x 31 x 3	250
TVM2	A2 | AISI304	22,5 x 33 x 2,5	250
TVM3	A2 | AISI304	30 x 29,4 x 2,5	200

TVM COLOR

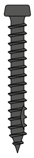
CODE	material	P x B x s [mm]	pcs
TVMN4	black alluminum	23 x 36 x 2,5	200

KKT X
fastening on wood and WPC for TVM A2 | AISI304



d_1 [mm]	CODE	L [mm]	pcs
5 TX 20	**KKTX520A4**	20	200
	KKTX525A4	25	200
	KKTX530A4	30	200
	KKTX540A4	40	200

KKT COLOR
fastening on wood and WPC for per TVM COLOR

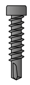


d_1 [mm]	CODE	L [mm]	pcs
5 TX 20	**KKTN540**	40	200

KKA AISI410
fastening on aluminium for TVM A2 | AISI304

d_1 [mm]	CODE	L [mm]	pcs
4 TX 20	**KKA420**	20	200

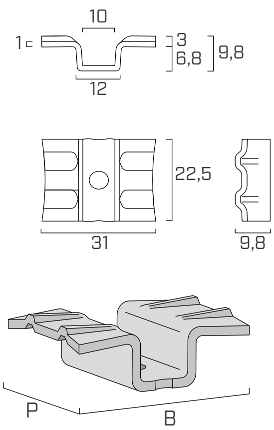
KKA COLOR
fastening on aluminium for TVM COLOR



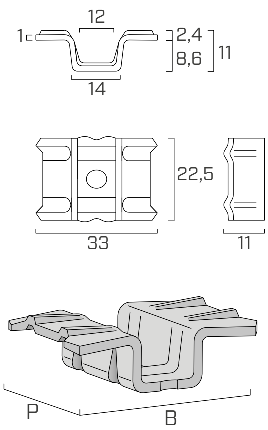
d_1 [mm]	CODE	L [mm]	pcs
4 TX 20	**KKAN420**	20	200

GEOMETRY

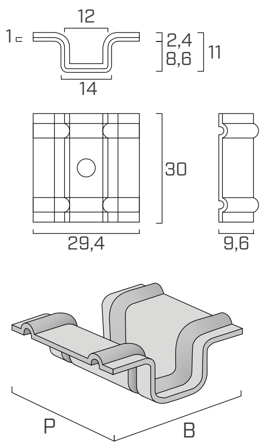
TVM1



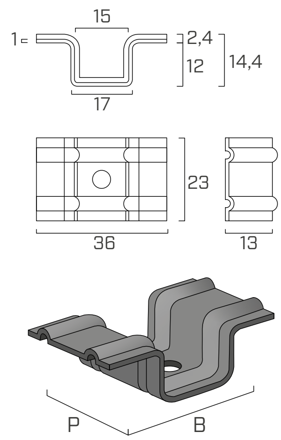
TVM2



TVM3



TVMN4



KKA

Can also be used for fastening on aluminium profiles using KKA AISI410 or KKA COLOR screws.

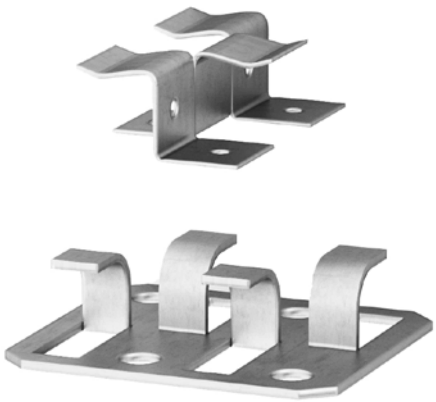
GAP

CONNECTOR FOR TERRACES

TWO VERSIONS
Available in A2 | AISI304 stainless steel for excellent corrosion strength (GAP3) or in bright zinc plated carbon steel (GAP4) for good performance at a low cost.

NARROW JOINTS
Ideal for making floors with narrow joints between boards (from 3,0 mm). Fastening is performed before the board is positioned.

WPC AND HARDWOODS
Ideal for symmetrically grooved boards such as those in WPC or high-density wood.



CHARACTERISTICS

FOCUS	narrow joints
BOARDS	symmetrical grooving
JOINTS	from 3,0 to 5,0 mm
FASTENERS	SCA3525, SBA3932

MATERIAL
Austenitic stainless steel A2 | AISI304 and bright zinc plated carbon steel.

FIELDS OF USE
Outdoor use. Fastening timber or WPC boards on substructures in timber, WPC or aluminium. Suitable for service classes 1, 2 and 3.

CODES AND DIMENSIONS

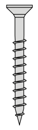
GAP 3 A2 | AISI304

CODE	material	P x B x s [mm]	pcs
GAP3	A2 | AISI304	40 x 32 x 11	200

GAP 4

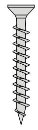
CODE	material	P x B x s [mm]	pcs
GAP4	zinc-plated steel	42 x 42 x 11	100

SCA A2 | AISI304
fastening on timber and WPC for GAP 3



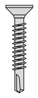
d_1 [mm]	CODE	L [mm]	pcs
3,5 TX 15	SCA3525	25	500
	SCA3535	35	500

HTS
fastening on timber and WPC for GAP 4



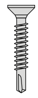
d_1 [mm]	CODE	L [mm]	pcs
3,5 TX 15	HTS3525	25	1000
	HTS3535	35	500

SBN A2 | AISI304
fastening on aluminium for GAP 3



d_1 [mm]	CODE	L [mm]	pcs
3,5 TX 15	SBNA23525	25	1000

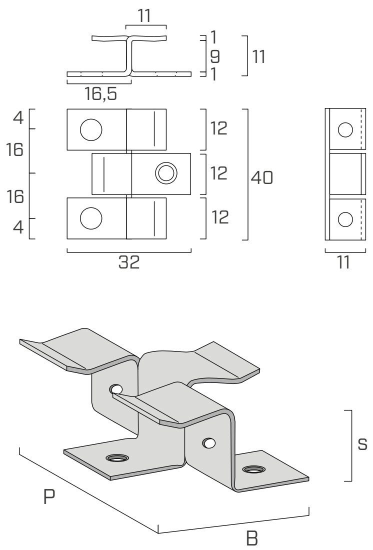
SBN
fastening on aluminium for GAP 4



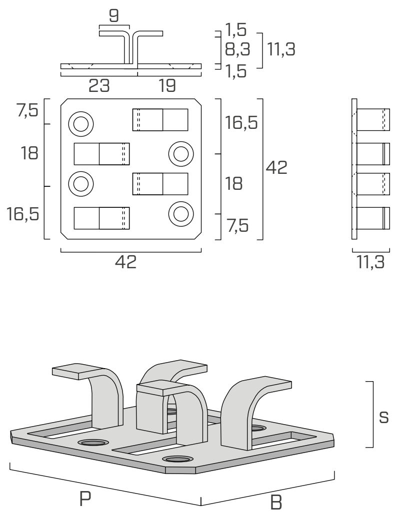
d_1 [mm]	CODE	L [mm]	pcs
3,5 TX 15	SBN3525	25	500

GEOMETRY

GAP 3 A2 | AISI304



GAP 4



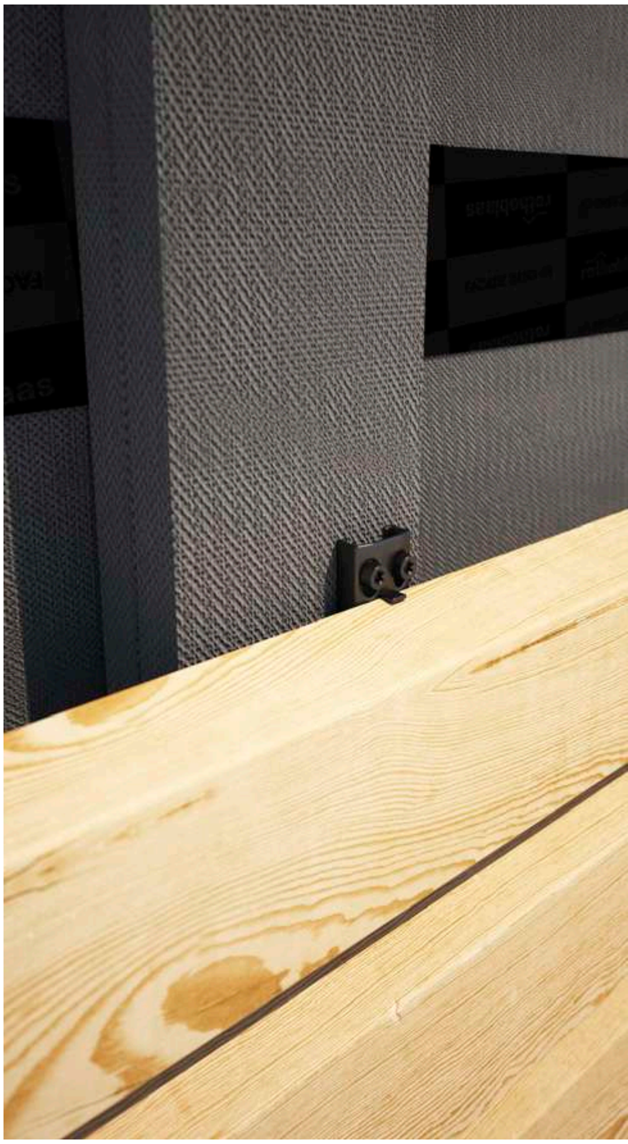
WOOD PLASTIC COMPOSITE (WPC)

Ideal for fastening WPC boards. Can also be used for fastening on aluminium using SBN A2 | AISI304 screws.

TERRALOCK

VIDEO

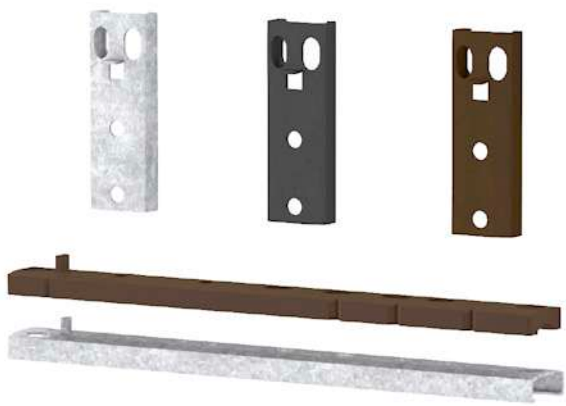
CONNECTOR FOR TERRACES



INVISIBLE
Completely concealed, guarantees a highly attractive result. Ideal for both terraces and façades. Available in metal or plastic.

VENTILATION
The TERRALOCK connector creates a micro-ventilation gap between the boards and the joist. This prevents water from being trapped, and improves durability. The larger bearing surface ensures that the substructure is not crushed.

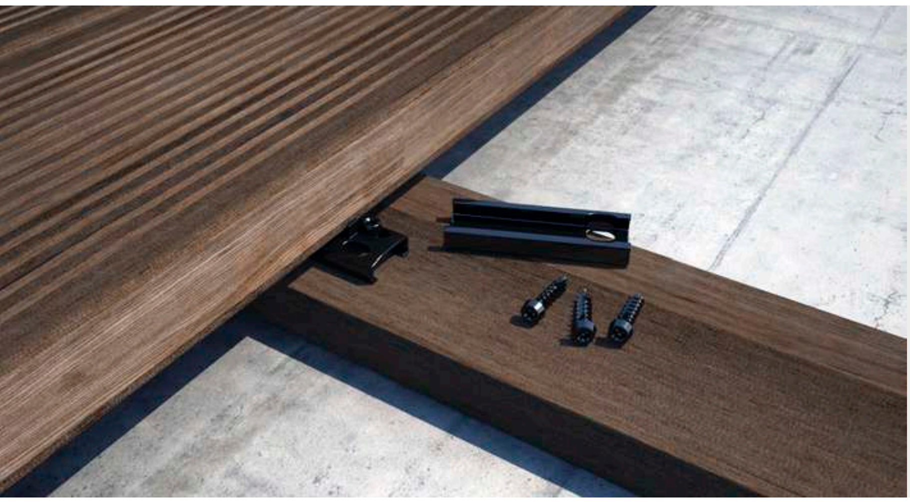
INGENIOUS
Assembly stop for an accurate and simple installation of the connector. Slotted holes to follow movements of the wood. Allows replacement of individual boards.



CHARACTERISTICS

FOCUS	extremely versatile joints and grooves
CLADDING	aluminium coating, grey, black
BOARDS	without grooving
JOINTS	from 2,0 to 10,0 mm
FASTENERS	KKTX520A4, KKAN430, KKF4520

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



MATERIAL
Carbon steel, with coloured anti-rust coating, and brown polypropylene.

FIELDS OF USE
Outdoor use. Fastening timber or WPC boards on substructures in timber, WPC or aluminium. Suitable for service classes 1, 2 and 3.

CODES AND DIMENSIONS

TERRALOCK

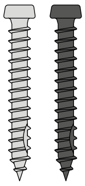
CODE	material	P x B x s [mm]	pcs
TER60ALU	zinc-plated steel	60 x 20 x 8	100
TER180ALU	zinc-plated steel	180 x 20 x 8	50
TER60ALUN	zinc-plated steel, black	60 x 20 x 8	100
TER180ALUN	zinc-plated steel, black	180 x 20 x 8	50

TERRALOCK PP

CODE	material	P x B x s [mm]	pcs
TER60PPM	brown nylon	60 x 20 x 8	100
TER180PPM	brown nylon	180 x 20 x 8	50

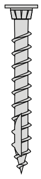
Upon request also available in A2 | AISI304 stainless steel for quantities over 20.000 pcs. (code **TER60A2** e **TER180A2**).

KKT A4 | AISI316 / KKT COLOR
fastening on wood and WPC for TERRALOCK



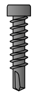
d_1 [mm]	CODE	L [mm]	pcs
5 TX 20	**KKTX520A4**	20	200
	KKTX525A4	25	200
	KKTX530A4	30	200
	KKTX540A4	40	200
	KKTN540	40	200

KKF AISI410
fastening on wood and WPC for TERRALOCK PP



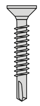
d_1 [mm]	CODE	L [mm]	pcs
4,5 TX 20	**KKF4520**	20	200
	KKF4540	40	200

KKA COLOR
fastening on aluminium for TERRALOCK



d_1 [mm]	CODE	L [mm]	pcs
4 TX 20	**KKAN430**	30	200

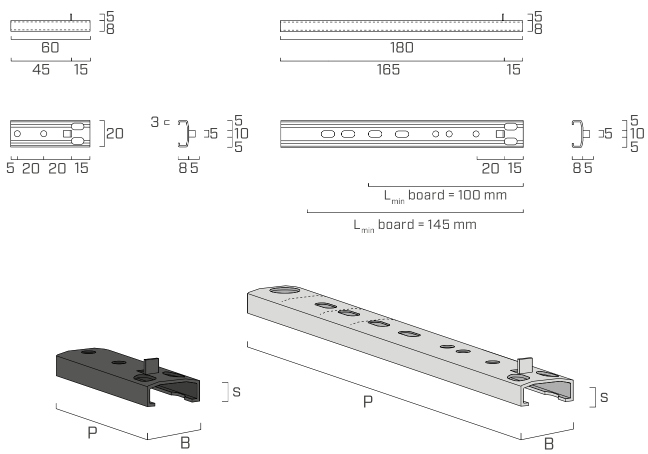
SBN A2 | AISI304
fastening on aluminium for TERRALOCK PP



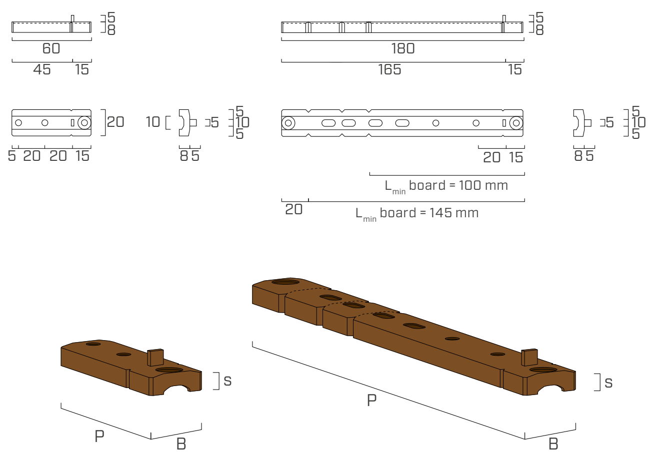
d_1 [mm]	CODE	L [mm]	pcs
3,5 TX 15	**SBN3525**	25	1000

GEOMETRY

TERRALOCK



TERRALOCK PP

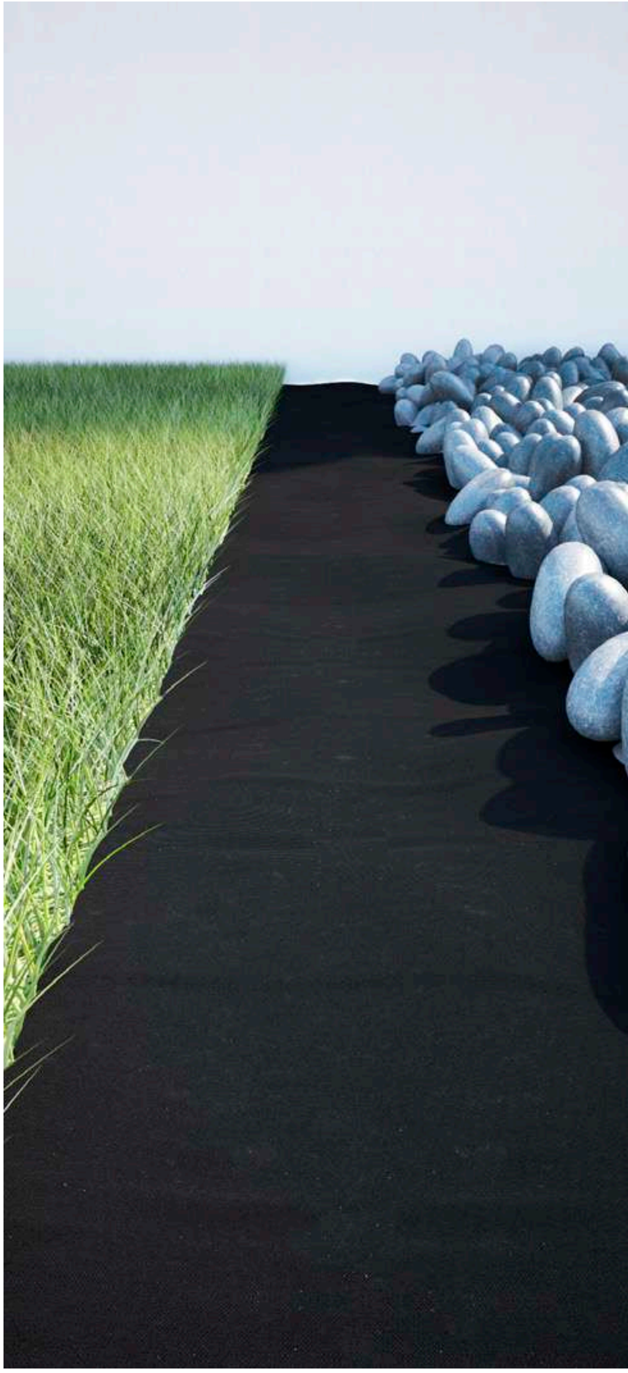


TERRALOCK PP

Version in plastic, ideal for decking near aquatic environments. Durability in time guaranteed by microventilation under the boards. Completely concealed fastening.

GROUND COVER

ANTI-VEGETATION TARP FOR SUBSTRATES



WATER PERMEABLE

The anti-vegetation tarp prevents the growth of grasses and roots, protecting the patio substructure from the ground. Permeable to water, allowing it to flow off.

RESISTANT

The polypropylene non-woven fabric (50 g/m^2) effectively separates the patio substructure from the ground. Dimensions optimised for patios (1,6 m x 10 m).

CODES AND DIMENSIONS

CODE	material	g/m^2	H x L [m]	A [m^2]	pcs
COVER50	TNT	50	1,6 x 10	10	1

Tensile strength	MD/CD	95 / 55 N
Elongation	MD/CD	35 / 80 %

MATERIAL

Non-woven fabric (NWF) in polypropylene (PP).

FIELDS OF USE

Separates the substructure from the ground.

NAG

LEVELLING PAD

OVERLAPPABLE

Available in 3 thicknesses (2,0, 3,0 and 5,0 mm), can also be overlapped to obtain different thicknesses and thus effectively level the patio substructure.

DURABILITY

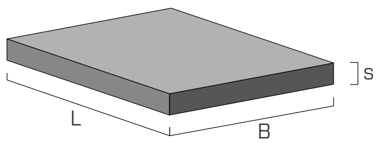
The EPDM material guarantees excellent durability, is not subject to sagging in time and does not suffer from exposure to sunlight.

CODES AND DIMENSIONS

CODE	B x L x s [mm]	density kg/m^3	shore	pcs
NAG60602	60 x 60 x 2	1220	65	50
NAG60603	60 x 60 x 3	1220	65	30
NAG60605	60 x 60 x 5	1220	65	20

Operating temperature -35 °C | +90 °C

GEOMETRY



MATERIAL

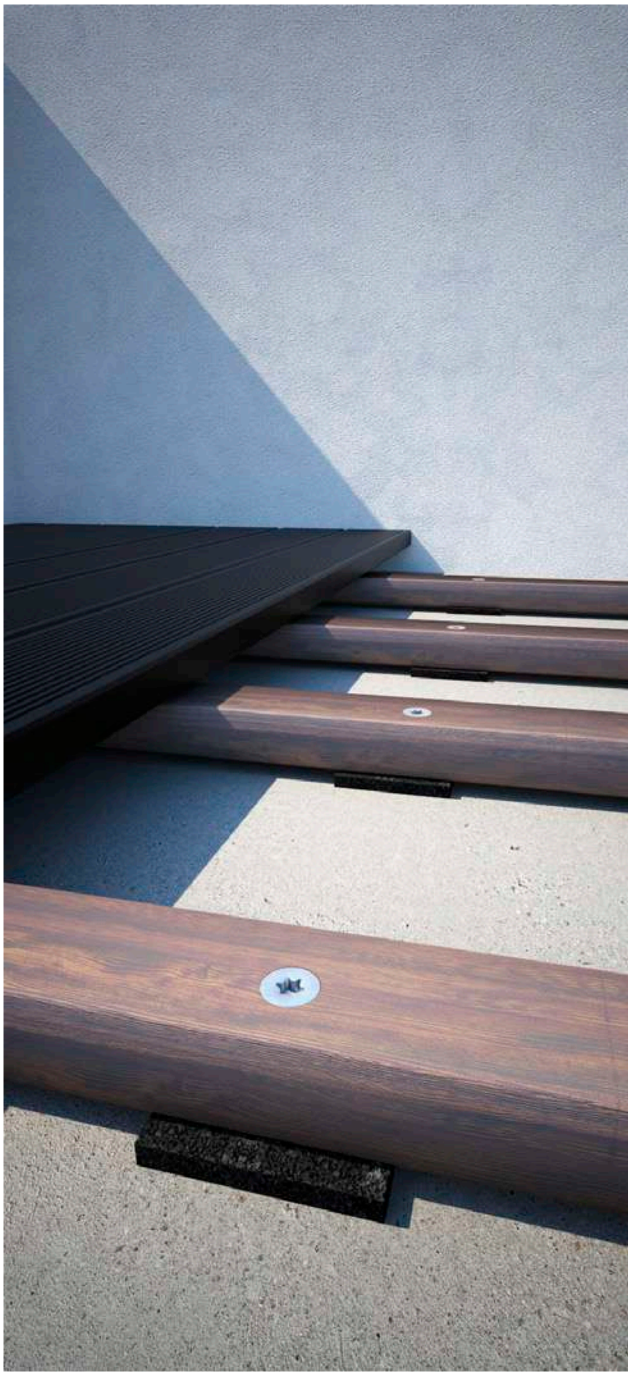
EPDM, black.

FIELDS OF USE

Substructure levelling.

GRANULO

GRANULAR RUBBER SUBSTRATE



THREE FORMATS

Available in sheet (GRANULOMAT 1,25 x 10 m), roll (GRANULOROLL and GRANULO100) or pad (GRANULOPAD 8 x 8 cm). Extremely versatile thanks to the variety of formats.

GRAINY RUBBER

Made of granules of recycled rubber thermal-bonded with polyurethane. Resistant to chemical interactions, maintains its characteristics in time and is 100% recyclable.

ANTI-VIBRATION

The thermal-bonded rubber granules dampen vibrations, thus insulating the noise produced by footsteps. Also ideal as a wall barrier and resilient strip for acoustic separation.

CHARACTERISTICS

FOCUS	water-permeability and vibration-dampening
THICKNESS	from 4,0 to 10,0 mm
DIMENSIONS	mat, roll, PAD
USE	substrate for substructures in wood, aluminium, WPC and PVC

MATERIAL

Rubber granules thermo-bound with PU.

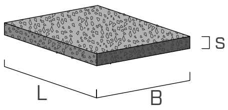
FIELDS OF USE

Substrate for substructures in timber, aluminium, WPC and PVC. Outdoor use. Suitable for service classes 1, 2 and 3.

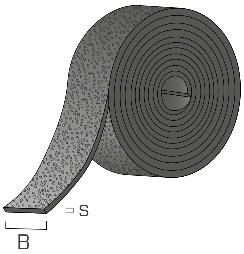
CODES AND DIMENSIONS

CODE	s [mm]	B [mm]	L [m]	pcs
GRANULOPAD	10	80	0,08	20
GRANULOROLL	8	80	6	1
GRANULO100	4	100	15	1
GRANULOMAT	6	1250	10	1

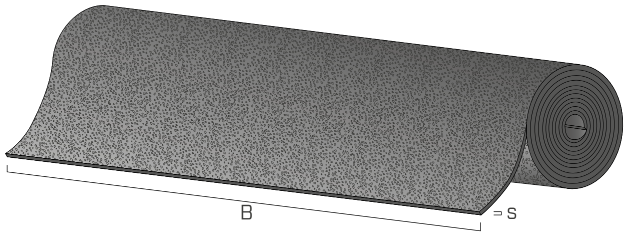
GEOMETRY



GRANULO PAD



GRANULO ROLL - GRANULO 100



GRANULO MAT

TECHNICAL SPECIFICATIONS

PROPERTIES	standard	value
Hardness	-	50 shore A
Density	-	750 kg/m^3
Apparent dynamic stiffness s't	ISO 29052-1	66 MN/m^3
Theoretical estimate of the degree of impact sound attenuation ΔL_w [(1)]	ISO 12354-2	22,6 dB
System resonance frequency f_0 [(1)]	ISO 12354-2	116,3 Hz
Compression deformation stress		
10% deformation	-	21 kPa
25% deformation	-	145 kPa
Elongation at failure	-	27 %
Thermal conductivity (λ)	UNI EN 12667	0,033 W/mK

[(1)] The load considered is m'=125 kg/m^2.

SOUNDPROOFING

Ideal as a substrate for patio substructures. Permeable to water, perfect for outdoor use.

TERRA BAND UV

BUTYL ADHESIVE TAPE

DECKS AND FACADES

Ideal for protecting joists from water and UV rays. Can be used for both patios and façades, protecting and extending the life of the wooden joists.

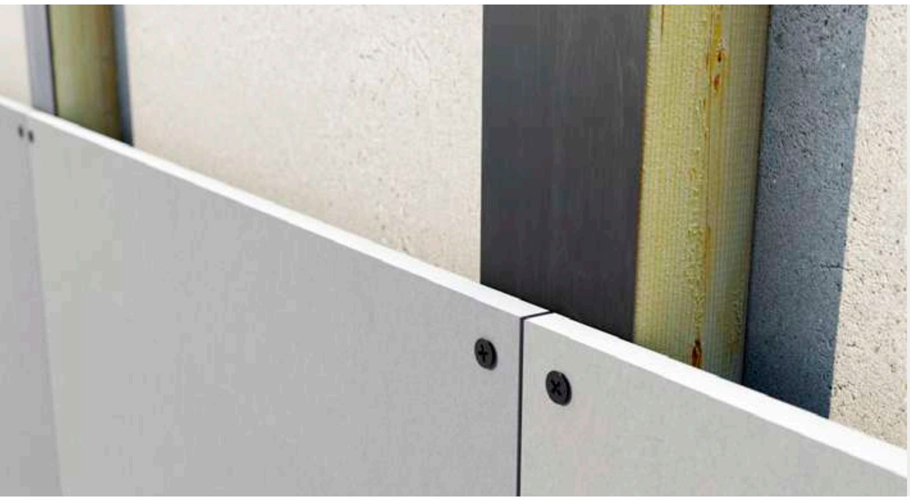
PERMANENT UV STABILITY

The black aluminized butyl-based compound guarantees unlimited resistance to UV radiation that can penetrate between the joints between patio and façade boards.

CODES AND DIMENSIONS

CODE	s [mm]	B [mm]	L [m]	pcs
TERRAUV75	0,8	75	10	8
TERRAUV100	0,8	100	10	6
TERRAUV200	0,8	200	10	4

s: thickness | **B:** base| **L:** length



MATERIAL

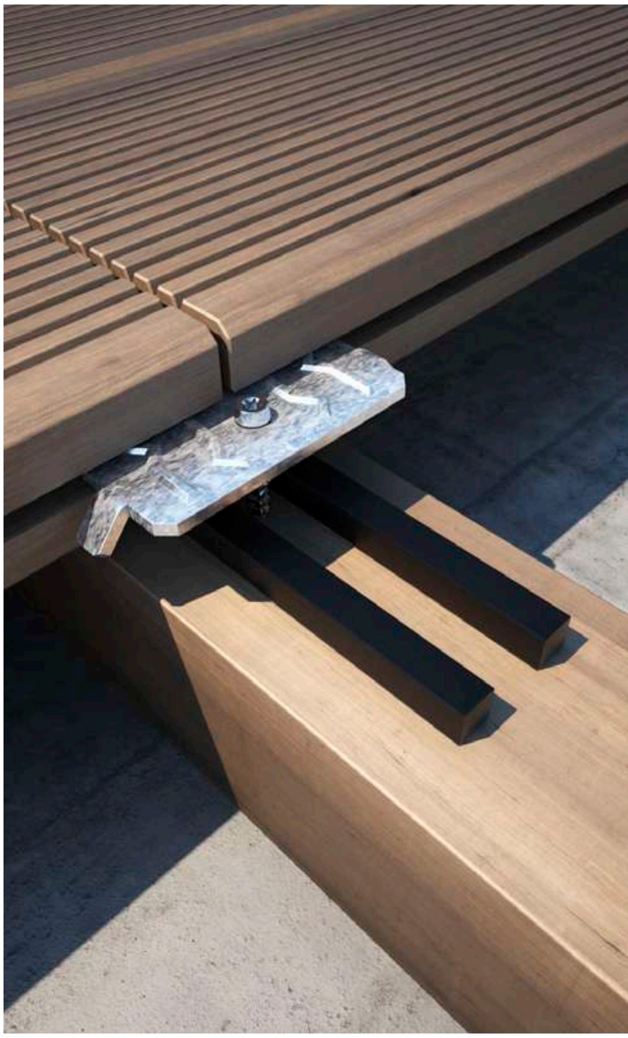
Butyl-based compound coated with black aluminium separating film.

FIELDS OF USE

Protection against water and UV radiation.

PROFID

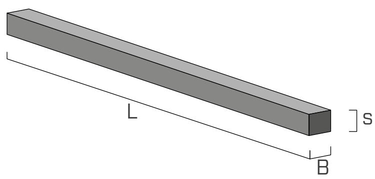
SPACER PROFILE



VENTILATION
Square EPDM profile for application over joists. Creates micro-ventilation under the boards and thus prevents water stagnation and ensures excellent patio durability.

STRENGTH
The EPDM guarantees excellent durability. With a density of over 1200 kg/ m^3, it guarantees high crushing resistance and is also ideal for high loads.

GEOMETRY



CODES AND DIMENSIONS

CODE	s [mm]	B [mm]	L [m]	density kg/m^3	shore	pcs
PROFID	8	8	40	1220	65	8

s: thickness | **B:** base| **L:** length

MATERIAL
EPDM.

FIELDS OF USE
Microventilation under the board.

ANCHORS FOR CONCRETE

ANCHORS FOR CONCRETE

ANCHORS FOR CONCRETE

ANCHOR CHOICE

The different combination of mechanical characteristics and installation parameters of the anchors allow to comply with many design needs. The use combined with our connection systems offers a complete range of solutions.

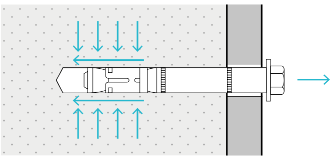
SCREW ANCHORS		PAGE
SKR	Screw Anchor with hexagonal head	488
SKS	Screw Anchor with countersunk head	488
SKR EVO	Screw Anchor with hexagonal head	488
SKS EVO	Screw Anchor with countersunk head	488
SKR-E	Screw Anchor with hexagonal head CE1	491
SKS-E	Screw Anchor with countersunk head CE1	491
HEAVY-DUTY METAL ANCHORS		
AB1	Heavy duty expansion anchor CE1	494
AB1 A4	CE1 stainless steel heavy-duty expansion anchor	496
AB7	Heavy duty expansion anchor CE7	498
ABS	Heavy-duty expansion anchor with clamp CE1	500
ABU	Heavy duty expansion anchor	502
AHZ	Medium heavy anchor	503
AHS	Heavy-duty anchor for non-through fastening	503
LIGHT ANCHOR		
NDC	Extra-long nylon anchor CE with screw	504
NDS	Extra-long anchor with screw	506
NDB	Extra-long anchor with impact screw	506
NDK	Universal nylon anchor	507
NDL	Universal prolonged nylon anchor	507
MBS	Self-tapping screw with cylindrical head for masonry	508
CHEMICAL ANCHOR		
VIN-FIX	Vinyl ester chemical anchor without styrene	509
VIN-FIX PRO	Vinyl ester chemical anchor without styrene	511
VIN-FIX PRO NORDIC	Vinyl ester chemical anchor for low temperatures	514
EPO-FIX PLUS	High-performance epoxy chemical anchor	517
INA	5.8 steel class threaded rod for chemical anchors	520
IHP - IHM	Bushings for perforated materials	521

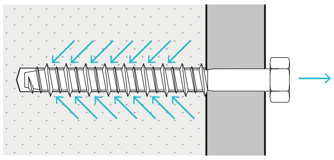
ANCHOR MATERIAL				SUPPORT MATERIAL				d [mm]	t_{fix} [mm]	CERTIFICATION					INSTALLATION		FUNCTIONING		
zinc-plated steel	zinc plated steel C4 EVO	stainless steel	nylon	cracked concrete	uncracked concrete	solid masonry	hollow masonry	diameter	max thickness tofasten	CE (ETA)	seismic	fire	LEED (IEQ 4.1)	VOC emission class	through	non-through	by friction (expandable)	by shape (undercut)	by adhesion
●	-	-	-	-	●	-	-	7,5 ÷ 12	320	-	-	-	-	-	●	-	-	●	-
●	-	-	-	-	●	-	-	7,5	80	-	-	-	-	-	●	-	-	●	-
-	●	-	-	-	●	-	-	7,5 ÷ 12	30	-	-	-	-	-	●	-	-	●	-
-	●	-	-	-	●	-	-	7,5	40	-	-	-	-	-	●	-	-	●	-
●	-	-	-	●	●	-	-	8 ÷ 16	210	Opt. 1	C2	R120	-	-	●	-	-	●	-
●	-	-	-	●	●	-	-	8 ÷ 10	40	Opt. 1	C2	R120	-	-	●	-	-	●	-
●	-	-	-	●	●	-	-	M8 ÷ M16	84	Opt. 1	C2	R120	-	-	●	-	●	-	-
-	-	●	-	●	●	-	-	M8 ÷ M16	50	Opt. 1	C1	R120	-	-	●	-	●	-	-
●	-	-	-	-	●	-	-	M10 ÷ M20	245	Opt. 7	-	-	-	-	●	-	●	-	-
●	-	-	-	●	●	-	-	10 ÷ 16	60	Opt. 1	C2	R120	-	-	●	-	●	-	-
●	-	-	-	-	●	-	-	M8 ÷ M16	80	-	-	-	-	-	●	-	●	-	-
●	-	-	-	-	●	-	-	M8 ÷ M12	70	-	-	-	-	-	●	-	●	-	-
●	-	-	-	-	●	-	-	M12 ÷ M16	20	-	-	-	-	-	-	●	●	-	-
-	-	-	●	●	●	●	●	8 ÷ 10	170	CE	-	R90	-	-	●	-	●	-	-
-	-	-	●	-	●	●	●	10	125	-	-	-	-	-	●	-	●	-	-
-	-	-	●	-	●	●	●	6 ÷ 8	100	-	-	-	-	-	●	-	●	-	-
-	-	-	●	-	●	●	●	6 ÷ 14	-	-	-	-	-	-	-	●	●	-	-
-	-	-	●	-	●	●	●	12 ÷ 16	-	-	-	-	-	-	●	-	●	-	-
●	-	-	-	-	●	●	●	7,5	-	-	-	-	-	-	●	-	-	●	-
●	-	●	-	-	●	●	-	M8 ÷ M24	1500	Opt. 1	C2	-	-	A+	●	●	-	-	●
●	-	●	-	●	●	●	●	M8 ÷ M30	1500	Opt. 1	C1	F120	●	A+	●	●	-	-	●
●	-	●	-	●	●	●	●	M8 ÷ M30	1500	Opt. 1	C1	-	●	-	●	●	-	-	●
●	-	●	-	●	●	-	-	M8 ÷ M30	1500	Opt. 1	C2	F120	-	A+	●	●	-	-	●
●	-	-	-	●	●	●	●	M8 ÷ M27	-	-	-	-	-	-	●	●	-	-	●
●	-	-	●	-	-	●	●	M12 ÷ M22	-	-	-	-	-	-	●	●	-	-	●

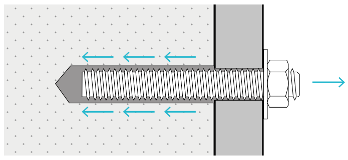
WORKING PRINCIPLES

FUNCTIONING

The loads acting on the anchor are transferred to the support via three different mechanisms depending on the anchor geometry.







BY FRICTION (EXPANSION) - (e.g. AB1)

The pull-out capacity is provided by the friction force generated by the anchor expansion within the support.

BY SHAPE - (e.g. SKR)

The anchor geometry allows interlocking with the support, ensuring a reliable fastening.

BY ADHERENCE - (e.g. chemical anchors)

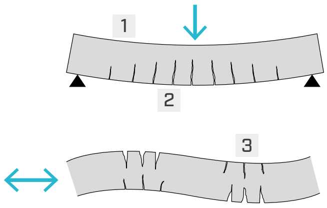
The tensile loads are transferred to the support by the bond stress along the whole hole surface.

MATERIAL OF THE SUPPORT

CONCRETE

1 UNCRACKED
compression area
(option 7)

2 CRACKED
tension area
(option 1)



3 SEISMIC LOAD
Cyclic loading: alternation between compressed/stretched area
(C1-C2)

MASONRY

SOLID BRICK

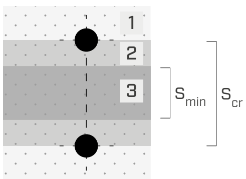
The mechanical properties of masonry are highly influenced by the type of mortar and blocks.

HOLLOW BRICK

Hence the strength values expected for the various applications are subjected to significant variability.

INSTALLATION

ANCHORS SPACING s

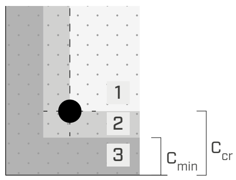


1 maximum-strength area: $s \geq s_{cr}$

2 reduced-strength area: $s_{min} \leq s < s_{cr}$

3 no-fix area: $s < s_{min}$

DISTANCE FROM EDGE c



1 maximum-strength area: $c \geq c_{cr}$

2 reduced-strength area: $c_{min} \leq c < c_{cr}$

3 no-fix area: $c < c_{min}$

For edge distance and spacing bigger than the critical values, there is no interaction between the failure mechanisms of the single anchors. The failure cone can develop entirely providing the maximum strength possible. For edge distance and spacing smaller than the critical values, a reduction of the anchor performance should be accounted for by adopting the coefficients listed in the product certificate. It is not allowed to install anchors with edge distance and spacing smaller than the minimal values.

MINIMUM SUPPORT THICKNESS h_{min}

In order to avoid splitting phenomena and consequent significant strength reduction, it is not allowed to install anchors in supports with thickness $h < h_{min}$.

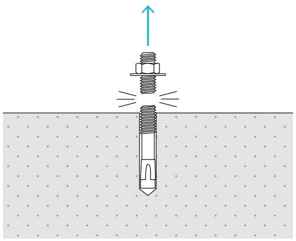
ANCHORAGE DEPTH h_{ef}

The anchors have to be installed ensuring an anchorage depth h_{ef} not less than the prescribed one. Mechanical anchors: generally a single pull-through-depth is adopted for each diameter selected. Chemical anchors: varying pull-through depths according to the boundary conditions in order to optimize the performarce.

FAILURE MECHANISMS

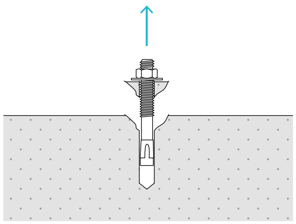
TENSION

STEEL

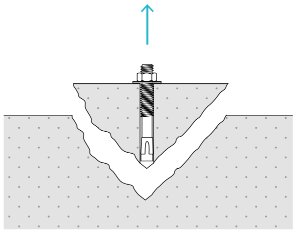


Steel failure

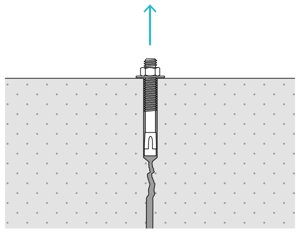
CONCRETE



Pull-out failure
(pull-out)



Concrete cone failure

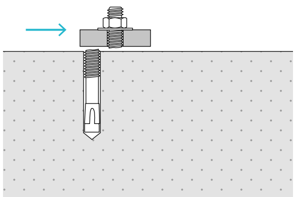


Splitting failure
(splitting)

In case chemical anchors are used, a mechanism with combined pull-out and concrete cone failure is possible.

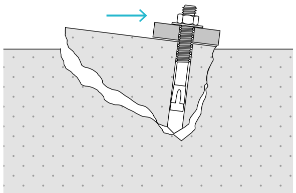
SHEAR

STEEL

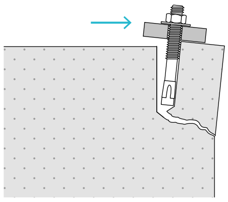


Steel failure with or without lever arm

CONCRETE

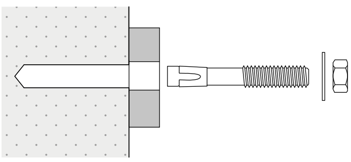


Pry-out failure
(pry-out)



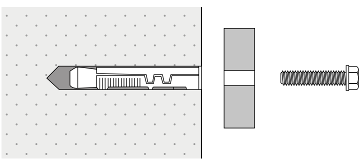
Concrete edge failure

INSTALLATION



THROUGH

The anchor is inserted into the hole through the element to be fastened. Subsequently the anchor is expanded by applying the prescribed tightening torque. The hole in the element to be fastened is equal to or bigger than the hole in the support material (e.g. AB1).



NON-PASS-THROUGH

The anchor is inserted into the hole before positioning the element to be fastened. The hole in the element to be fastened can be smaller than the hole in the support material depending on the tightening screw that is used (e.g. AHS).

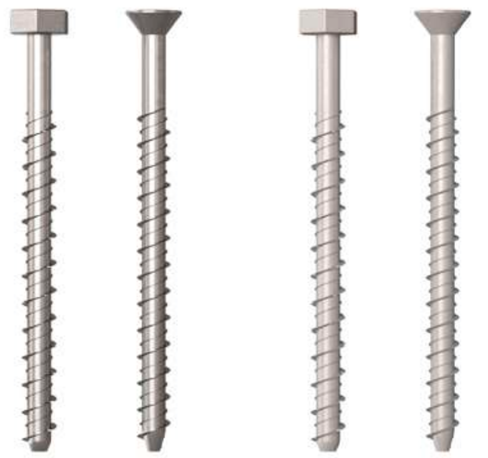
SPACED

The element to be fastened is anchored at a certain distance from the support. To select the most suitable anchors, please see the product certificates.

SKR | SKS

SCREW ANCHOR FOR CONCRETE

- Suitable for uncracked concrete
- Hexagonal head of increased size
- Thread is suitable for dry fastening
- Double version: zinc plated and C4 EVO coating
- Electrogalvanized carbon steel
- Through fastening
- No fastener expansion



CODES AND DIMENSIONS SKR - SKS

SKR hexagonal head

CODE	d_1 [mm]	L [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	d_0 [mm]	$d_{f\ timber}$ [mm]	$d_{f\ steel}$ [mm]	SW [mm]	T_{inst} [Nm]	pcs
SKR7560	7,5	60	10	60	50	6	8	8-10	13	15	50
SKR7580		80	30	60	50	6	8	8-10	13	15	50
SKR75100		100	20	90	80	6	8	8-10	13	15	50
SKR1080	10	80	30	65	50	8	10	10-12	16	25	50
SKR10100		100	20	95	80	8	10	10-12	16	25	25
SKR10120		120	40	95	80	8	10	10-12	16	25	25
SKR10140		140	60	95	80	8	10	10-12	16	25	25
SKR10160		160	80	95	80	8	10	10-12	16	25	25
SKR12100	12	100	20	100	80	10	12	12-14	18	50	25
SKR12120		120	40	100	80	10	12	12-14	18	50	25
SKR12140		140	60	100	80	10	12	12-14	18	50	25
SKR12160		160	80	100	80	10	12	12-14	18	50	25
SKR12200		200	120	100	80	10	12	12-14	18	50	25
SKR12240		240	160	100	80	10	12	12-14	18	50	25
SKR12280		280	200	100	80	10	12	12-14	18	50	25
SKR12320		320	240	100	80	10	12	12-14	18	50	25
SKR12400		400	320	100	80	10	12	12-14	18	50	25

SKS countersunk head

CODE	d_1 [mm]	L [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	d_0 [mm]	$d_{f\ timber}$ [mm]	d_k [mm]	TX	T_{inst} [Nm]	pcs
SKS7560	7,5	60	10	60	50	6	8	13	TX40	-	50
SKS7580		80	30	60	50	6	8	13	TX40	-	50
SKS75100		100	20	90	80	6	8	13	TX40	-	50
SKS75120		120	40	90	80	6	8	13	TX40	-	50
SKS75140		140	60	90	80	6	8	13	TX40	-	50
SKS75160		160	80	90	80	6	8	13	TX40	-	50

CODES AND DIMENSIONS SKR - SKS EVO VERSION

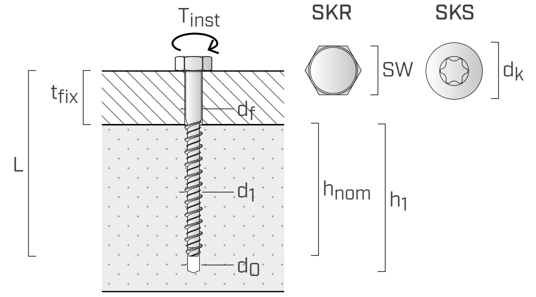
C4 EVO COATING

SKR EVO hexagonal head

CODE	d_1 [mm]	L [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	d_0 [mm]	$d_{f\,timber}$ [mm]	$d_{f\,steel}$ [mm]	SW [mm]	T_{inst} [Nm]	pcs
SKREVO7560	**7,5**	**60**	10	60	50	6	8	8-10	13	15	50
SKREVO1080	**10**	**80**	30	65	50	8	10	10-12	16	25	50
SKREVO12100	**12**	**100**	20	100	80	10	12	12-14	18	50	25

SKS EVO countersunk head

CODE	d_1 [mm]	L [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	d_0 [mm]	$d_{f\,timber}$ [mm]	d_k [mm]	TX	T_{inst} [Nm]	pcs
SKSEVO7580		**80**	30	60	50	6	8	13	TX40	-	50
SKSEVO75100	7,5	**100**	20	90	80	6	8	13	TX40	-	50
SKSEVO75120		**120**	40	90	80	6	8	13	TX40	-	50

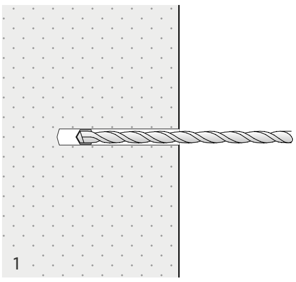


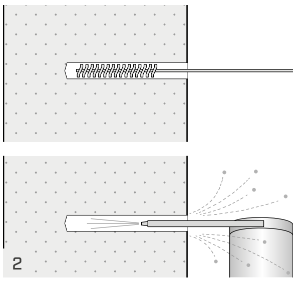
d_1	external diameter of anchor
L	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth
h_{nom}	nominal anchoring depth
d_0	hole diameter in the concrete support
d_f	maximum hole diameter in the element to be fastened
SW	wrench size SKR
d_k	SKS head diameter
T_{inst}	tightening torque

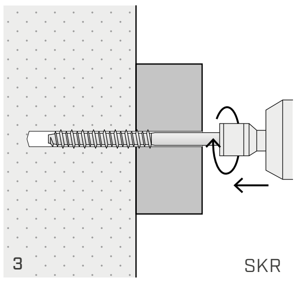
ADDITIONAL PRODUCTS - ACCESSORIES

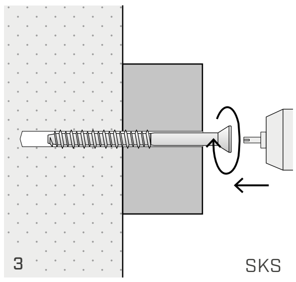
CODE	description	pcs
SOCKET13	SW 13 bushing 1/2" connection	1
SOCKET16	SW 16 bushing 1/2" connection	1
SOCKET18	SW 18 bushing 1/2" connection	1

ASSEMBLY





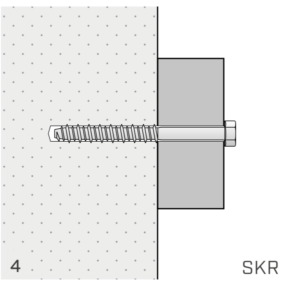


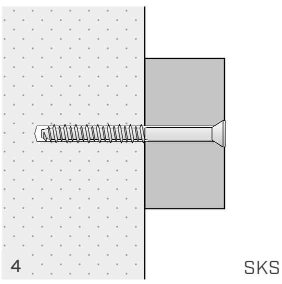


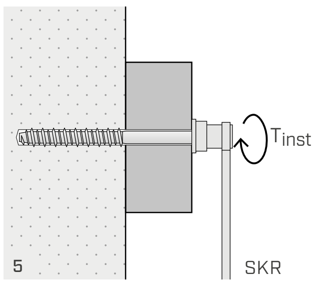
Drill a hole in rotary percussion mode

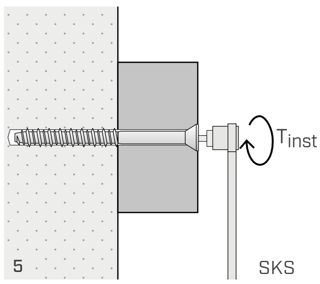
Clean the hole

Position the object to be fixed and install the screw with a pulse screw gun





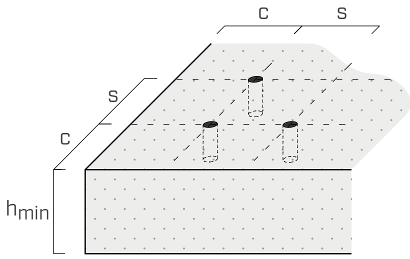




Ensure the anchor head is in complete contact with the object to be fixed

Check the tightening torque T_{inst}

INSTALLATION



Spacing and distances for tensile loads			SKR Ø7,5	SKR Ø10	SKR Ø12	SKS Ø7,5
Minimum spacing	$s_{min,N}$	[mm]	50	60	65	50
Minimum edge distance	$c_{min,N}$	[mm]	50	60	65	50
Minimum thickness of concrete support	h_{min}	[mm]	100	110	130	100
Critical spacing	$s_{cr,N}$	[mm]	100	150	180	100
Critical edge distance	$c_{cr,N}$	[mm]	50	70	80	50

Spacing and distances for shear loads			Ø7,5	Ø10	Ø12	Ø7,5
Minimum spacing	$s_{min,V}$	[mm]	50	60	70	50
Minimum edge distance	$c_{min,V}$	[mm]	50	60	70	50
Minimum thickness of concrete support	h_{min}	[mm]	100	110	130	100
Critical spacing	$s_{cr,V}$	[mm]	140	200	240	140
Critical edge distance	$c_{cr,V}$	[mm]	70	110	130	70

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

STATIC VALUES

Valid for a single anchor in thickened C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

ADMISSIBLE VALUES

UNCRACKED CONCRETE

		tension $N_{1,rec}$ [kN]	*shear*[1] V_{rec} [kN]	*head pull-through* $N_{2,rec}$ [kN]
SKR	***7,5***	*2,13*	*2,50*	*1,19* [2]
	10	*6,64*	*6,65*	*1,86* [2]
	12	*8,40*	*8,18*	*2,83* [2]
SKS	***7,5***	*2,13*	*2,50*	*0,72*

NOTES:

[1] When evaluating the anchor global-strength, the shear strength on the element to be fastened (e.g. timber, concrete, ...) must be considered separately based on the material adopted.

[2] All values refer to SKR installed with DIN 9021 (ISO 9073) washer.

GENERAL PRINCIPLES:

- Recommended admissible shear and tensile values are compliant with Certificate Nr. 2006/5205/1 released from Politecnico di Milano and obtained by considering a safety factor of 4 for the failure load.

SKR-E | SKS-E

R120 SEISMIC C2 ETA 19/0100

SCREW ANCHOR FOR CONCRETE CE1

- CE option 1 for cracked and uncracked concrete
- Seismic performance category C1 (M10-M16) and C2 (M12-M16)
- Electrogalvanized carbon steel
- Flanged head with self-locking knurling (SKR-E)
- Fire resistance R120
- Through fastening
- No fastener expansion

SKR-E SKS-E

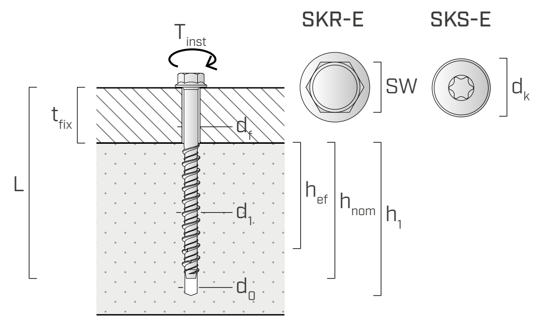
CODES AND DIMENSIONS

SKR-E hexagonal head with mock washer

CODE	d_1 [mm]	L [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_0 [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
SKR8100CE	**8**	**100**	40	75	60	48	6	9	10	20	50
SKR1080CE	**10**	**80**	10	85	70	56	8	12	13	50	50
SKR10100CE		**100**	30	85	70	56	8	12	13	50	25
SKR10120CE		**120**	50	85	70	56	8	12	13	50	25
SKR1290CE	**12**	**90**	10	100	80	64	10	14	15	80	xx
SKR12110CE		**110**	30	100	80	64	10	14	15	80	25
SKR12150CE		**150**	70	100	80	64	10	14	15	80	25
SKR12210CE		**210**	130	100	80	64	10	14	15	80	20
SKR12250CE		**250**	170	100	80	64	10	14	15	80	15
SKR12290CE		**290**	210	100	80	64	10	14	15	80	15
SKR16130CE	**16**	**130**	20	140	110	85	14	18	21	160	10

SKS-E countersunk head

CODE	d_1 [mm]	L [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_0 [mm]	d_f [mm]	d_k [mm]	TX	T_{inst} [Nm]	pcs
SKS75100CE	**8**	**100**	40	75	60	48	6	9	16	TX30	20	50
SKS10100CE	**10**	**100**	30	85	70	56	8	12	20	TX40	50	50

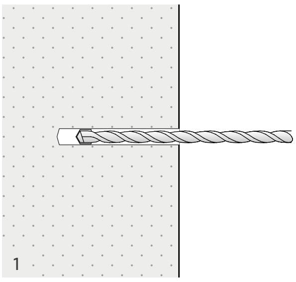


d_1	external diameter of anchor
L	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
d_0	hole diameter in the concrete support
d_f	maximum hole diameter in the element to be fastened
SW	wrench size SKR-E
d_k	SKS-E head diameter
T_{inst}	tightening torque

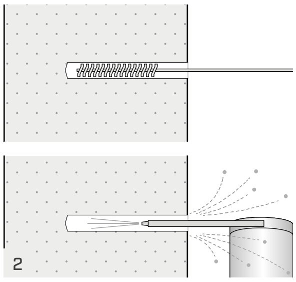
ADDITIONAL PRODUCTS - ACCESSORIES

CODE	description	pcs
SOCKET10	SW 10 bushing 1/2" connection	1
SOCKET13	SW 13 bushing 1/2" connection	1
SOCKET15	SW 15 bushing 1/2" connection	1
SOCKET21	SW 21 bushing 1/2" connection	1

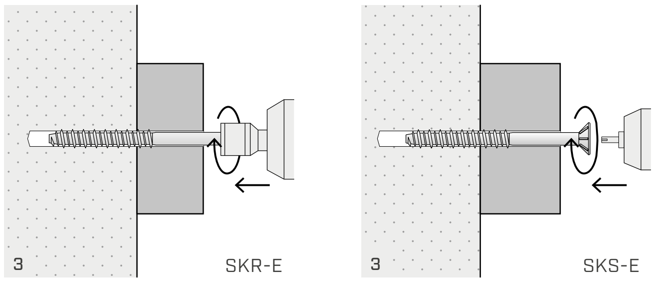
ASSEMBLY



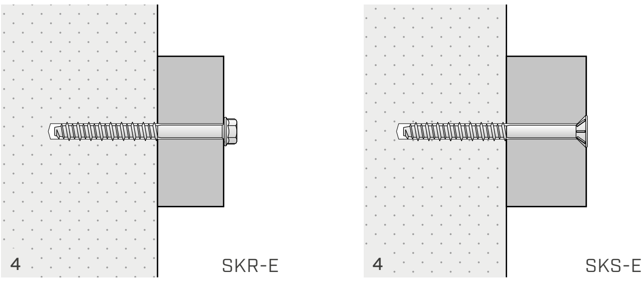
Drill a hole in rotary percus-sion mode



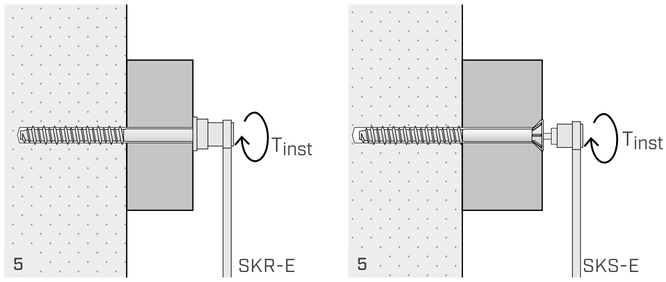
Clean the hole



Position the object to be fixed and install the screw with a pulse screw gun

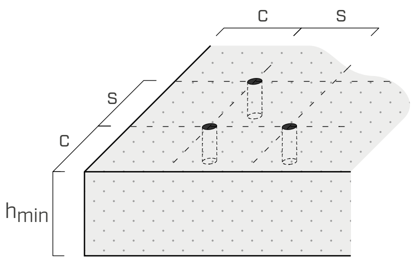


Make certain that the screw head is in complete contact with the object to be fixed



Check the tightening torque T_{inst}

INSTALLATION



			SKR-E / SKS-E			
Spacing and minimum distances			**Ø8**	**Ø10**	**Ø12**	**Ø16**
Minimum spacing	s_{min}	[mm]	45	50	60	80
Minimum edge distance	c_{min}	[mm]	45	50	60	80
Minimum thickness of concrete support	h_{min}	[mm]	100	110	130	170
Spacing and critical distances			**Ø8**	**Ø10**	**Ø12**	**Ø16**
Critical spacing	$s_{cr,N}^{(1)}$	[mm]	144	168	192	255
	$s_{cr,sp}^{(2)}$	[mm]	160	175	195	255
Critical edge distance	$c_{cr,N}^{(1)}$	[mm]	72	84	96	128
	$c_{cr,sp}^{(2)}$	[mm]	80	85	95	130

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

STATIC VALUES

Valid for a single anchor in thickened C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

CHARACTERISTIC VALUES

		UNCRACKED CONCRETE				CRACKED CONCRETE			
		tension(3)		shear(4)		tension(3)		shear	
		$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s}$ [kN]	γ_{Ms}	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s/Rk,cp}$ [kN]	$\gamma_{Ms,Mc}$
SKR-E	**8**	16	2,1	9,4	1,5	4	2,1	9,4 (4)	1,5
	10	20	1,8	20,1	1,5	7,5	1,8	15,1 (5)	1,5
	12	25	2,1	32,4	1,5	9	2,1	32,4 (4)	1,5
	16	40	2,1	56,9	1,5	16	2,1	56,4 (5)	1,5
SKS-E	**8**	16	2,1	9,4	1,5	4	2,1	9,4 (4)	1,5
	10	20	1,8	20,1	1,5	7,5	1,8	20,1 (4)	1,5

incremental factor for $N_{Rk,p}$ (6)		
ψ_c	C30/37	1,22
	C40/50	1,41
	C50/60	1,58

NOTES:

(1) Concrete cone failure mode.
(2) Splitting failure mode.
(3) Pull-out failure mode.
(4) Steel failure mode ($V_{Rk,s}$).
(5) Pry-out failure mode ($V_{Rk,cp}$).
(6) Tensile-strength increment factor (excluding steel failure).

GENERAL PRINCIPLES:

- Characteristic values according to ETA-19/0100.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$.
  Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- When designing anchors under seismic load please refer to the ETA referral document and information in the EOTA Technical Report 045.
- For the calculation of anchors subjected to fire refer to the ETA and the Technical Report 020.

AB1

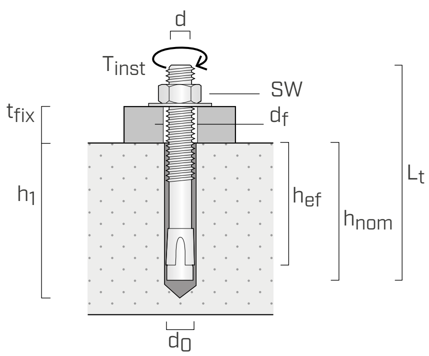
HEAVY DUTY EXPANSION ANCHOR CE1

R120 SEISMIC C2 MY PROJECT SOFTWARE CE

- CE option 1 for cracked and uncracked concrete
- Seismic performance category C1 (M10-M16) and C2 (M12-M16)
- Electrogalvanized carbon steel
- Fire resistance R120
- Complete with nut and washer
- Suitable for dense materials
- Through fastening
- Torque-controlled expansion

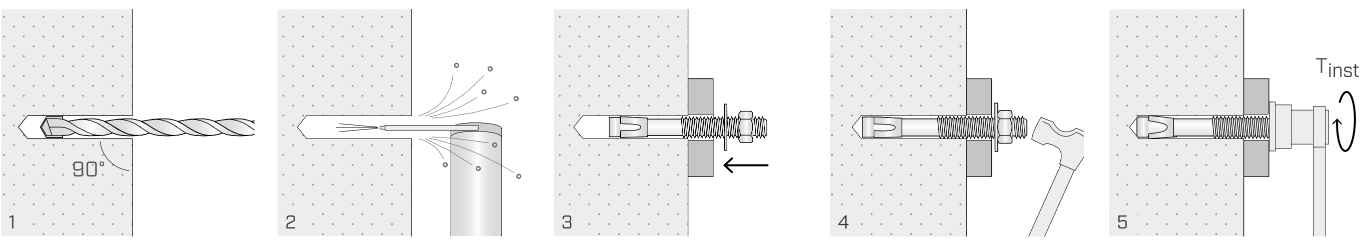
CODES AND DIMENSIONS

CODE	$d = d_0$ [mm]	L_t [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
AB1875	**M8**	**75**	9	60	55	48	9	13	15	100
AB1895	**M8**	**95**	29	60	55	48	9	13	15	50
AB18115	**M8**	**115**	49	60	55	48	9	13	15	50
AB110115	**M10**	**115**	35	75	68	60	12	17	40	25
AB110135	**M10**	**135**	55	75	68	60	12	17	40	25
AB112100	**M12**	**100**	4	85	80	70	14	19	60	25
AB112120	**M12**	**120**	24	85	80	70	14	19	60	25
AB112150	**M12**	**150**	54	85	80	70	14	19	60	25
AB112180	**M12**	**180**	84	85	80	70	14	19	60	25
AB116145	**M16**	**145**	28	105	97	85	18	24	100	10

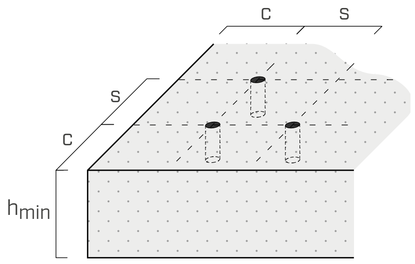


d	anchor diameter
d_0	hole diameter in the concrete support
L_t	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
d_f	maximum hole diameter in the element to be fastened
SW	wrench size
T_{inst}	tightening torque

ASSEMBLY



INSTALLATION



			AB1			
Spacing and minimum distances			**M8**	**M10**	**M12**	**M16**
Minimum spacing	s_{min}	[mm]	50	60	70	85
Minimum edge distance	c_{min}	[mm]	50	60	70	85
Minimum thickness of concrete support	h_{min}	[mm]	100	120	140	170
Spacing and critical distances			**M8**	**M10**	**M12**	**M16**
Critical spacing	$s_{cr,N}$ (1)	[mm]	144	180	210	255
	$s_{cr,sp}$ (2)	[mm]	288	300	350	425
Critical edge distance	$c_{cr,N}$ (1)	[mm]	72	90	105	128
	$c_{cr,sp}$ (2)	[mm]	144	150	175	213

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

STATIC VALUES

Valid for a single anchor in thickened C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

CHARACTERISTIC VALUES

	UNCRACKED CONCRETE				CRACKED CONCRETE			
	tension(3)		**shear**(4)		**tension**(3)		**shear**	
	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s}$ [kN]	γ_{Ms}	$N_{Rk,p}$ [kN]	γ_{Mp}	V_{Rk} [kN]	γ_M
M8	9	1,8	11,0	1,25	6	1,8	12,0	γ_{Mc} = 1,5(5)
M10	16	1,5	17,4	1,25	9	1,5	17,4	γ_{Ms} = 1,25(4)
M12	25	1,5	25,3	1,25	16	1,5	25,3	γ_{Ms} = 1,25(4)
M16	35	1,5	47,1	1,25	25	1,5	47,1	γ_{Ms} = 1,25(4)

incremental factor for $N_{Rk,p}$(6)		
ψ_c	C30/37	1,16
	C40/50	1,31
	C50/60	1,41

NOTES:

(1) Breakage characteristics for formation of concrete cone for tensile loads.
(2) Splitting failure mode for tensile loads.
(3) Pull-out failure mode.
(4) Steel failure mode.
(5) Pry-out failure mode.
(6) Tensile-strength increment factor (excluding steel failure).

GENERAL PRINCIPLES:

- Characteristic values according to ETA-17/0481.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$
  Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- When designing anchors under seismic load please refer to the ETA referral document and information in the EOTA Technical Report 045.
- For the calculation of anchors subjected to fire refer to the ETA and the Technical Report 020.

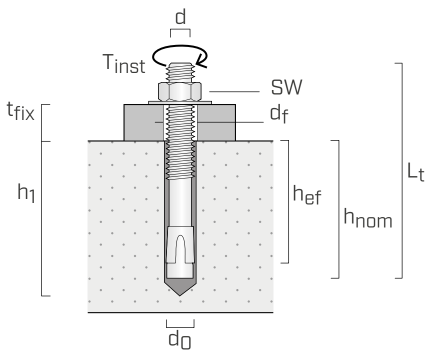
AB1 A4

CE1 STAINLESS STEEL HEAVY-DUTY EXPANSION ANCHOR

- CE option 1 for cracked and uncracked concrete
- Seismic performance category C1
- A4 stainless steel
- Fire resistance R120
- Complete with nut and washer
- Suitable for dense materials
- Through fastening
- Torque-controlled expansion

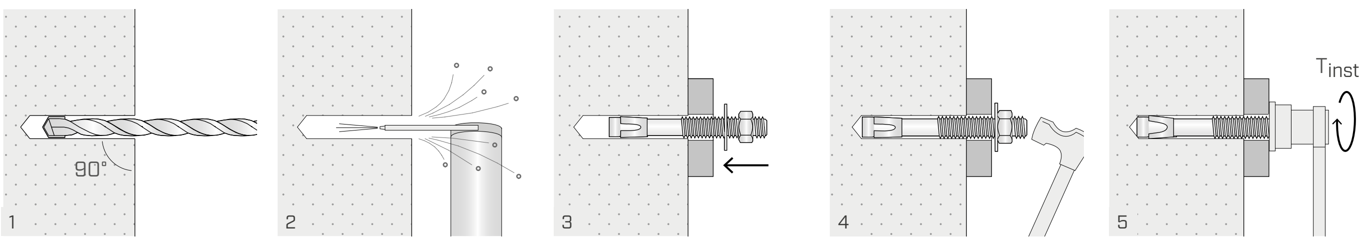
CODES AND DIMENSIONS

CODE	$d = d_0$ [mm]	L_t [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
AB1892A4	**M8**	**92**	30	60	50	45	9	13	20	50
AB18112A4		**112**	50	60	50	45	9	13	20	50
AB11092A4	**M10**	**92**	10	75	68	60	12	17	35	50
AB110132A4		**132**	50	75	68	60	12	17	35	25
AB112118A4	**M12**	**118**	20	90	81	70	14	19	70	20
AB116138A4	**M16**	**138**	20	110	96	85	18	24	120	10

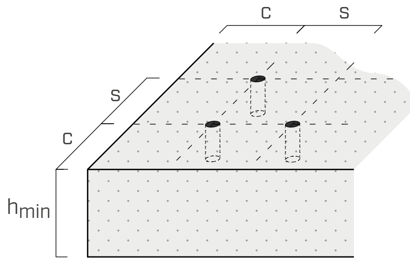


d anchor diameter
d_0 hole diameter in the concrete support
L_t anchor length
t_{fix} maximum fastening thickness
h_1 minimum hole depth
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
d_f maximum hole diameter in the element to be fastened
SW wrench size
T_{inst} tightening torque

ASSEMBLY



INSTALLATION



			AB1 A4			
Spacing and minimum distances			**M8**	**M10**	**M12**	**M16**
Minimum spacing	s_{min}	[mm]	50	55	60	70
	for $c \geq$	[mm]	50	80	90	120
Minimum edge distance	c_{min}	[mm]	50	50	55	85
	for $s \geq$	[mm]	50	100	145	150
Minimum thickness of concrete support	h_{min}	[mm]	100	120	140	170
Spacing and critical distances			**M8**	**M10**	**M12**	**M16**
Critical spacing	$s_{cr,N}$ (1)	[mm]	135	180	210	255
	$s_{cr,sp}$ (2)	[mm]	180	240	280	340
Critical edge distance	$c_{cr,N}$ (1)	[mm]	68	90	105	128
	$c_{cr,sp}$ (2)	[mm]	90	120	140	170

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

STATIC VALUES

Valid for a single anchor in thickened C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

CHARACTERISTIC VALUES

	UNCRACKED CONCRETE				CRACKED CONCRETE			
	tension(3)		shear(4)		tension(3)		shear	
rod	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s}$ [kN]	γ_{Ms}	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s}$ [kN]	γ_M
M8	9	1,8	11	1,25	5	1,8	11	γ_{Mc} = 1,5(5)
M10	16	1,8	17	1,25	9	1,8	17	γ_{Ms} = 1,25(4)
M12	20	1,8	25	1,25	12	1,8	25	γ_{Ms} = 1,25(4)
M16	35	1,5	47	1,25	20	1,5	47	γ_{Ms} = 1,25(4)

incremental factor for $N_{Rk,p}$ (6)		
ψ_c	C25/30	1,04
	C30/37	1,10
	C40/50	1,20
	C50/60	1,28

NOTES:

(1) Breakage characteristics for formation of concrete cone for tensile loads.
(2) Splitting failure mode for tensile loads.
(3) Pull-out failure mode.
(4) Steel failure mode.
(5) Pry-out failure mode.
(6) Tensile-strength increment factor (excluding steel failure).

GENERAL PRINCIPLES:

- Characteristic values according to ETA-10/0076.
- The design values are obtained from the characteristic values as follows: $R_d=R_k/\gamma_M$
  Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- When designing anchors under seismic load please refer to the ETA referral document and information in the EOTA Technical Report 045.
- For the calculation of anchors subjected to fire refer to the ETA and the Technical Report 020.

AB7

HEAVY DUTY EXPANSION ANCHOR CE7

- CE option 7 for uncracked concrete
- Electrogalvanized carbon steel
- Complete with nut and washer
- Long thread
- Extra-long multiway expansion clamp
- Suitable for dense materials
- Through fastening
- Torque-controlled expansion

AB7
STANDARD

AB7
EXTRALONG

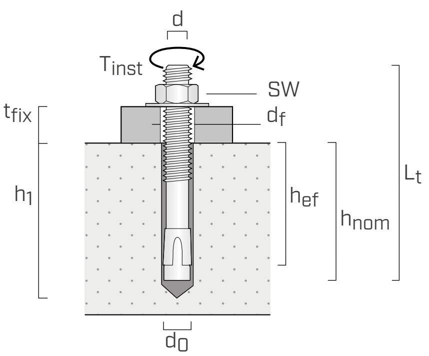
CODES AND DIMENSIONS

AB7 STANDARD washer ISO 7089

CODE	$d = d_0$ [mm]	L_t [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
AB71075	**10**	**75**	10	65	55	50	12	17	35	50
AB712100	**12**	**100**	18	80	70	60	14	19	55	50
AB712120		**120**	38	80	70	60	14	19	55	20
AB716145	**16**	**145**	30	110	100	85	18	24	100	15
AB716220		**220**	105	110	100	85	18	24	100	10
AB720170	**20**	**170**	35	125	115	100	22	30	150	5

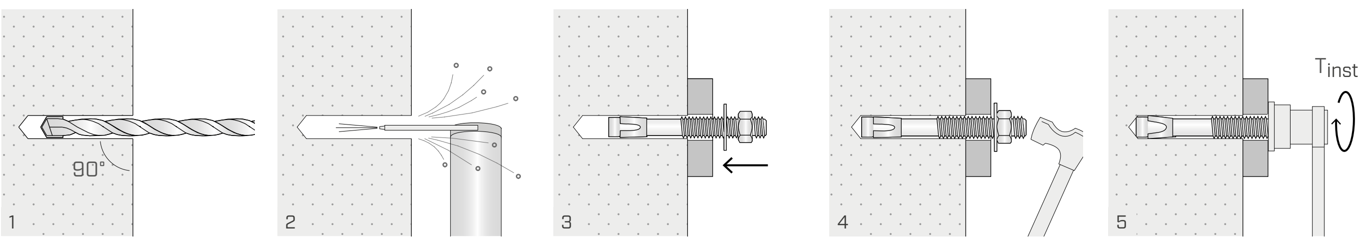
AB7 EXTRALONG large size washer ISO 7093

CODE	$d = d_0$ [mm]	L_t [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
AB716300	**16**	**300**	185	110	100	85	18	24	100	5
AB716400		**400**	245	110	100	85	18	24	100	5

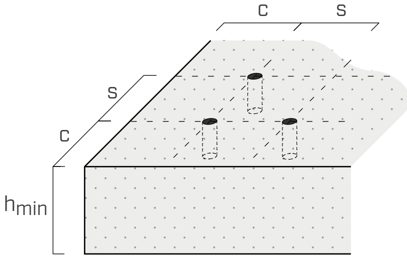


d	anchor diameter
d_0	hole diameter in the concrete support
L_t	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
d_f	maximum hole diameter in the element to be fastened
SW	wrench size
T_{inst}	tightening torque

ASSEMBLY



INSTALLATION



			AB7			
Spacing and minimum distances			**M10**	**M12**	**M16**	**M20**
Minimum spacing	s_{min}	[mm]	68	81	115	135
Minimum edge distance	c_{min}	[mm]	68	81	115	135
Minimum thickness of concrete support	h_{min}	[mm]	100	120	170	200
Spacing and critical distances			**M10**	**M12**	**M16**	**M20**
Critical spacing	$s_{cr,N}$ (1)	[mm]	150	180	255	300
	$s_{cr,sp}$ (2)	[mm]	250	300	425	500
Critical edge distance	$c_{cr,N}$ (1)	[mm]	75	90	128	150
	$c_{cr,sp}$ (2)	[mm]	125	150	213	250

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

STATIC VALUES

Valid for a single anchor in thickened C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

CHARACTERISTIC VALUES

	UNCRACKED CONCRETE			
rod	**tension**(3)		**shear**(4)	
	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s}$ [kN]	γ_{Ms}
M10	12,0	1,8	14,5	1,25
M12	16,0	1,8	21,1	1,25
M16	16,0	1,8	39,3	1,25
M20	30,0	1,5	58,8	1,25

incremental factor for $N_{Rk,p}$(5)		
Ψ_c	C30/37	1,22
	C40/50	1,41
	C50/60	1,55

NOTES:

(1) Breakage characteristics for formation of concrete cone for tensile loads.
(2) Splitting failure mode for tensile loads.
(3) Pull-out failure mode.
(4) Steel failure mode.
(5) Tensile-strength increment factor (excluding steel failure).

GENERAL PRINCIPLES:

- Characteristic values according to ETA-17/0237.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$.
  Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.

ABS

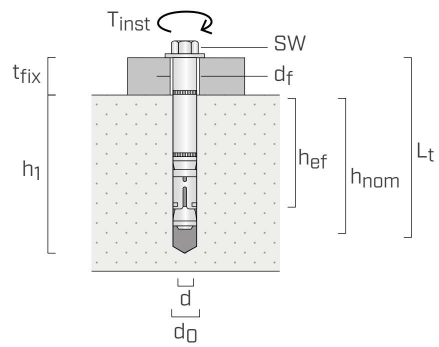
HEAVY-DUTY EXPANSION ANCHOR WITH CLAMP CE1

R120 SEISMIC C2 MY PROJECT SOFTWARE

- CE option 1 for cracked and uncracked concrete
- Seismic performance category C1 and C2
- Electrogalvanized carbon steel
- Fire resistance R120
- 8.8 grade screw with hexagonal head and washer
- Suitable for dense materials
- Through fastening
- Torque-controlled expansion

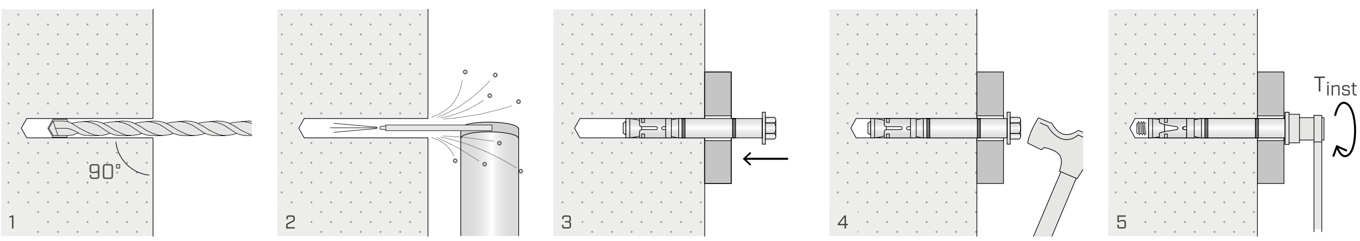
CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	d_{screw} [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{nom} [mm]	h_{ef} [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
ABS1070	**10**	**70**	M6	5	80	65	55	12	10	15	50
ABS10100		**100**	M6	35	80	65	55	12	10	15	50
ABS12100	**12**	**100**	M8	30	90	70	60	14	13	30	50
ABS12120		**120**	M8	50	90	70	60	14	13	30	25
ABS16120	**16**	**120**	M10	40	100	80	70	18	17	50	25
ABS16140		**140**	M10	60	100	80	70	18	17	50	20

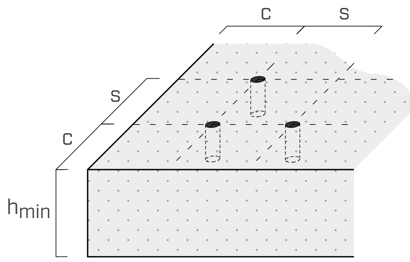


d_0 anchor diameter = hole diameter in the concrete support
d screw diameter
L_t anchor length
t_{fix} maximum fastening thickness
h_1 minimum hole depth
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
d_f maximum hole diameter in the element to be fastened
SW wrench size
T_{inst} tightening torque

ASSEMBLY



INSTALLATION



			ABS		
Spacing and minimum distances			**10/M6**	**12/M8**	**16/M10**
Minimum spacing	s_{min}	[mm]	55	110	80
	for c ≥	[mm]	110	145	120
Minimum edge distance	c_{min}	[mm]	70	100	90
	for s ≥	[mm]	110	160	175
Minimum thickness of concrete support	h_{min}	[mm]	110	120	140
Spacing and critical distances			**10/M6**	**12/M8**	**16/M10**
Critical spacing	$s_{cr,N}$[1]	[mm]	165	180	210
	$s_{cr,sp}$[2]	[mm]	220	320	240
Critical edge distance	$c_{cr,N}$[1]	[mm]	85	90	105
	$c_{cr,sp}$[2]	[mm]	110	160	120

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

STATIC VALUES

Valid for a single anchor in thickened C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

CHARACTERISTIC VALUES

	UNCRACKED CONCRETE				CRACKED CONCRETE			
	tension[3]		shear[4]		tension[3]		shear	
	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s}$ [kN]	γ_{Ms}	$N_{Rk,p}$ [kN]	γ_{Mp}	$V_{Rk,s/Rk,cp}$ [kN]	$\gamma_{Ms,Mc}$
10/M6	16,0	1,5	16,0	1,45	5	1,5	15,6 [5]	1,5
12/M8	16,0	1,5	25,0	1,45	6	1,5	25,0 [4]	1,45
16/M10	20,0	1,5	43,0	1,45	16	1,5	42,2 [5]	1,5

incremental factor for $N_{Rk,p}$[6]		
ψ_c	C30/37	1,22
	C40/50	1,41
	C50/60	1,55

NOTES:

(1) Breakage characteristics for formation of concrete cone for tensile loads.
(2) Splitting failure mode for tensile loads.
(3) Pull-out failure mode.
(4) Steel failure mode ($V_{Rk,s}$).
(5) Pry-out failure mode ($V_{Rk,cp}$).
(6) Tensile-strength increment factor (excluding steel failure).

GENERAL PRINCIPLES:

- Characteristic values according to ETA-11/0181.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$.
  Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- When designing anchors under seismic load please refer to the ETA referral document and information in the EOTA Technical Report 045.
- For the calculation of anchors subjected to fire refer to the ETA and the Technical Report 020.

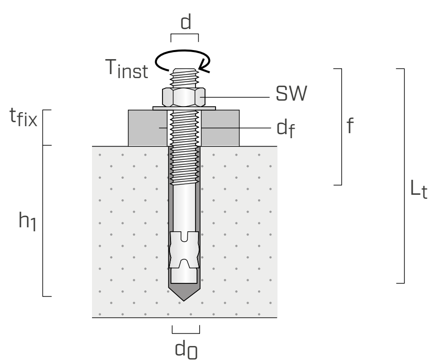
ABU

HEAVY DUTY EXPANSION ANCHOR

- Complete with nut and washer
- Long thread
- Electrogalvanized carbon steel
- Through fastening
- Torque-controlled expansion
- Suitable for dense materials

CODES AND DIMENSIONS

CODE	$d = d_0$ [mm]	L_t [mm]	t_{fix} [mm]	f [mm]	$h_{1,min}$ [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
ABU895	**8**	**95**	40	55	40	9	13	20	50
ABU8115		**115**	60	70	40	9	13	20	50
ABU1090	**10**	**90**	30	50	50	12	17	30	50
ABU10100		**100**	40	60	50	12	17	30	50
ABU10120		**120**	60	70	50	12	17	30	25
ABU1295	**12**	**95**	5	55	65	14	19	80	25
ABU12110		**110**	30	70	65	14	19	80	25
ABU12160		**160**	80	110	65	14	19	80	25
ABU14130	**14**	**130**	30	80	90	16	22	100	15
ABU16125	**16**	**125**	20	75	85	18	24	140	15
ABU16145		**145**	40	95	85	18	24	140	15



d anchor diameter
d_0 hole diameter in the concrete support
L_t anchor length
t_{fix} maximum fastening thickness
f thread length
h_1 minimum hole depth
SW wrench size
T_{inst} tightening torque

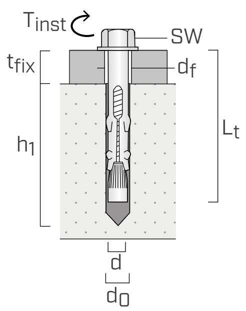
AHZ

MEDIUM HEAVY ANCHOR

- 8.8 grade screw with hexagonal head
- DIN 9021 large size washer
- Electrogalvanized carbon steel
- Through fastening
- Torque-controlled expansion
- Suitable for dense materials

CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	d_{screw} [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
AHZ870	**8**	**70**	M6	30	40	10	10	15	100
AHZ1080		**80**	M8	30	50	12	13	20	50
AHZ10100	**10**	**100**	M8	50	50	12	13	20	50
AHZ10120		**120**	M8	70	50	12	13	20	50
AHZ12100	**12**	**100**	M10	40	60	14	17	35	25



d_0 anchor diameter = hole diameter in the concrete support
d screw diameter
L_t anchor length
t_{fix} maximum fastening thickness
h_1 minimum hole depth
d_f maximum hole diameter in the element to be fastened
SW wrench size
T_{inst} tightening torque

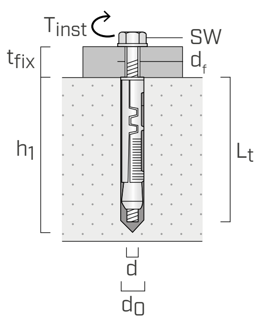
AHS

HEAVY-DUTY ANCHOR FOR NON-THROUGH FASTENING

- 8.8 grade screw with hexagonal head
- DIN 9021 large size washer
- Electrogalvanized carbon steel
- Non-Through fastening
- Torque-controlled expansion
- Suitable for dense materials

CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	d_{screw} [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	d_f [mm]	SW [mm]	T_{inst} [Nm]	pcs
AHS1242	**12**	**42**	M6	5	55	7	10	13	50
AHS1450	**14**	**50**	M8	8	65	9	13	25	50
AHS1660	**16**	**60**	M10	20	85	12	17	50	25



d_0 anchor diameter = hole diameter in the concrete support
d screw diameter
L_t anchor length
t_{fix} maximum fastening thickness
h_1 minimum hole depth
d_f maximum hole diameter in the element to be fastened
SW wrench size
T_{inst} tightening torque

NDC

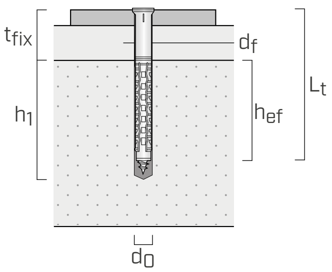
EXTRA-LONG NYLON ANCHOR CE WITH SCREW

R90

- Certified use for cracked and uncracked concrete, solid and hollow brick masonry (category of use a, b, c)
- R90 fire resistance for Ø10 mm
- Plastic anchor for use in concrete and masonry, in non-structural applications
- Complete with zinc plated steel screw with countersunk head
- Through fastening

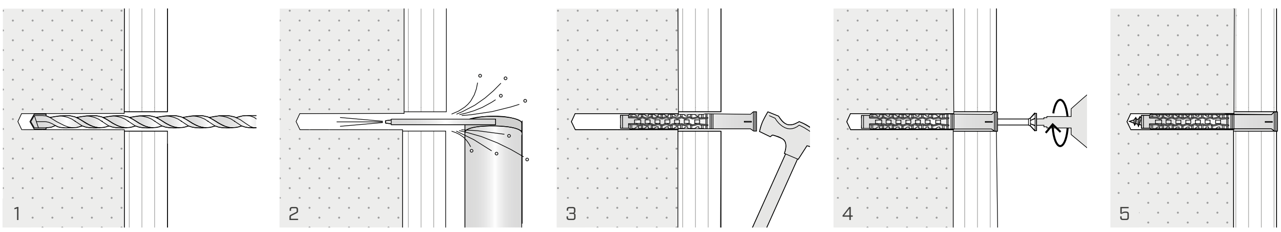
CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	d_v x L_v [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{ef} [mm]	d_f [mm]	bit	pcs
NDC880	**8**	**80**	5,5 x 85	10	80	70	8,5	TX30	50
NDC8100		**100**	5,5 x 105	30	80	70	8,5	TX30	50
NDC8120		**120**	5,5 x 125	50	80	70	8,5	TX30	50
NDC8140		**140**	5,5 x 145	70	80	70	8,5	TX30	50
NDC10100	**10**	**100**	7 x 105	30	80	70	10,5	TX40	50
NDC10120		**120**	7 x 125	50	80	70	10,5	TX40	50
NDC10140		**140**	7 x 145	70	80	70	10,5	TX40	25
NDC10160		**160**	7 x 165	90	80	70	10,5	TX40	25
NDC10200		**200**	7 x 205	130	80	70	10,5	TX40	25
NDC10240		**240**	7 x 245	170	80	70	10,5	TX40	20

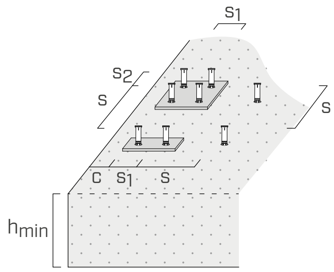


d_0 anchor diameter = hole diameter in the concrete support
L_t anchor length
d_v x L_v screw diameter x screw length
t_{fix} maximum fastening thickness
h_1 minimum hole depth
h_{ef} effective anchor depth
d_f maximum hole diameter in the element to be fastened

ASSEMBLY



INSTALLATION



Spacing and minimum distances on concrete				NDC Ø8	NDC Ø10
Minimum spacing	concrete C12/15	s_{min}	[mm]	70	85
	concrete ≥ C16/20			50	60
Minimum edge distance	concrete C12/15	c_{min}	[mm]	70	70
	concrete ≥ C16/20			50	50
Critical edge distance	concrete C12/15	$c_{cr,N}$	[mm]	100	140
	concrete ≥ C16/20			70	100
Minimum thickness of concrete support		h_{min}	[mm]	100	100

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.

Spacing and distances on masonry				NDC Ø8 Ø10
Minimum edge distance		c_{min}	[mm]	100
Minimum spacing for single anchor		s_{min}	[mm]	250
Minimum perpendicular spacing of the group of anchors to the free edge		$s_{1,min}$	[mm]	200
Minimum parallel spacing of a group of anchors to the free edge		$s_{2,min}$	[mm]	400
Minimum support thickness	solid brick EN 771-1	h_{min}	[mm]	115
	solid brick in calcareous sandstone EN 771-2			115
	brick with vertical holes EN 771-1 (e.g. Doppio Uni)			115
	hollow brick EN 771-1 (560 x 200 x 274 mm)			200
	calcareous sandstone hollow brick DIN106 / EN 771-2			240

STATIC VALUES ON CONCRETE[1]

Valid for a single anchor in thick grade concrete when spacing and edge-distance are not limiting parameters.

CHARACTERISTIC VALUES

	tension[2]			shear[3]	
	$N_{Rk,p}$ [kN]		γ_{Mc}	$V_{Rk,s}$ [kN]	γ_{Ms}
	C12/15	≥ C16/20			
Ø8	1,2	2,0	1,8	4,8	1,25
Ø10	2,0	3,0	1,8	6,4	1,5

NOTES:

[1] For the anchor calculation in masonry applications, see ETA.
[2] Pull-out failure mode.
[3] Steel failure mode (screw).

GENERAL PRINCIPLES:

- Characteristic values according to ETA-12/0261.
- The design values are obtained from the characteristic values as follows: $R_d=R_k/\gamma_M$.
  Coefficients γ_M are listed in the table and are in accordance with the product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade or limited thickness please see ETA.

NDS

EXTRA-LONG ANCHOR WITH SCREW

- Plastic anchor for applications on semi-hollow and hollow brick
- Through fastening
- Complete with 5.8 grade zinc plated steel screw with countersunk head
- Anti-rotational wings

CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	d_v x L_v [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	bit	pcs
NDS10100		**100**	7 x 105	25	85	TX40	25
NDS10120		**120**	7 x 125	45	85	TX40	25
NDS10140	**10**	**140**	7 x 145	65	85	TX40	25
NDS10160		**160**	7 x 165	85	85	TX40	25
NDS10200		**200**	7 x 205	125	85	TX40	25

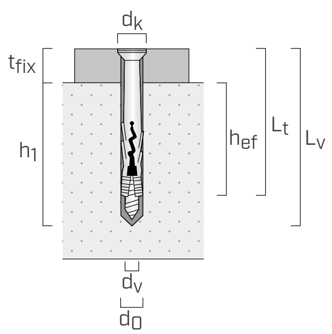
NDB

EXTRA-LONG ANCHOR WITH IMPACT SCREW

- Plastic anchor with countersunk collar
- Through fastening
- Complete with zinc plated steel impact-screw with countersunk head

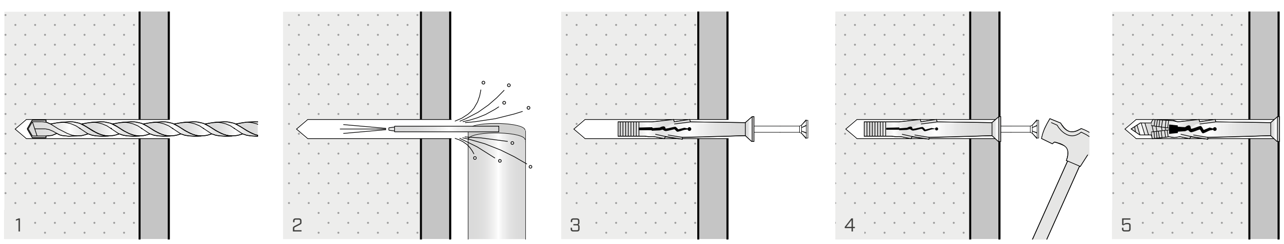
CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	d_v x L_v [mm]	t_{fix} [mm]	$h_{1,min}$ [mm]	h_{ef} [mm]	d_k [mm]	bit	pcs
NDB640		**40**	3,8 x 45	10	30	27	10,0	PZ 2	200
NDB655	6	**55**	3,8 x 60	25	30	27	10,0	PZ 2	100
NDB667		**67**	3,8 x 72	37	30	27	10,0	PZ 2	100
NDB860		**60**	4,8 x 65	25	40	35	12,2	PZ 3	100
NDB875		**75**	4,8 x 80	40	40	35	12,2	PZ 3	100
NDB8100	8	**100**	4,8 x 105	65	40	35	12,2	PZ 3	50
NDB8120		**120**	4,8 x 125	85	40	35	12,2	PZ 3	50
NDB8135		**135**	4,8 x 140	100	40	35	12,2	PZ 3	50



d_0 anchor diameter = hole diameter in the concrete support
L_t anchor length
d_v x L_v screw diameter x screw length
t_{fix} maximum fastening thickness
h_1 minimum hole depth
h_{ef} effective anchor depth
d_k head diameter

ASSEMBLY



NDK

UNIVERSAL NYLON ANCHOR

CODES AND DIMENSIONS

UNIVERSAL - with collar

CODE	d_0 [mm]	L_t [mm]	d_{screw} [mm]	pcs
NDKU635	6	35	4 - 5	100
NDKU850	8	50	4,5 - 6	100
NDKU1060	10	60	6 - 8	50

GL - 4 sectors

CODE	d_0 [mm]	L_t [mm]	d_{screw} [mm]	pcs
NDKG840	8	40	4,5 - 6	100
NDKG1260	12	60	8 - 10	50
NDKG1470	14	70	10 - 12	25

NDL

UNIVERSAL PROLONGED NYLON ANCHOR

CODES AND DIMENSIONS

CODE	d_0 [mm]	L_t [mm]	$d_{coach\ screw}$ [mm]	pcs
NDL12160		160	10	25
NDL12200	12	200	10	25
NDL12240		240	10	25
NDL14100		100	12	50
NDL14130	14	130	12	50
NDL14160		160	12	25
NDL16140		140	12	25
NDL16160		160	12	20
NDL16200	16	200	12	20
NDL16240		240	12	20

Ø12 - Ø14

Ø16

MBS

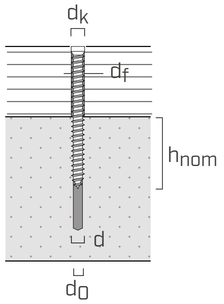
SELF-TAPPING SCREW WITH CYLINDRICAL HEAD FOR MASONRY

- Electrogalvanized carbon steel
- Suitable for dense and semi-hollow materials
- Fastening of doors and windows (head diameter = 8 mm)
- Fast installation
- Reduced expansion-stress in the support
- Through fastening

CODES AND DIMENSIONS

CODE	d [mm]	L [mm]	d_k [mm]	d_0 [mm]	d_f [mm]	bit	pcs
MBS7572	7,5	**72**	8	6	6,2	TX30	100
MBS7592		**92**	8	6	6,2	TX30	100
MBS75112		**112**	8	6	6,2	TX30	100
MBS75132		**132**	8	6	6,2	TX30	100
MBS75152		**152**	8	6	6,2	TX30	100
MBS75182		**182**	8	6	6,2	TX30	100

Available also with countersunk flat head: suitable for of PVC and aluminum profile fastening.

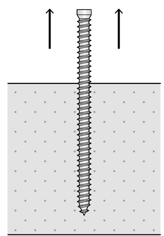


d screw diameter
d_k head diameter
d_0 diameter of pre-drilling hole concrete/brickwork
d_f hole diameter in the element to be fastened
h_{nom} nominal anchoring depth

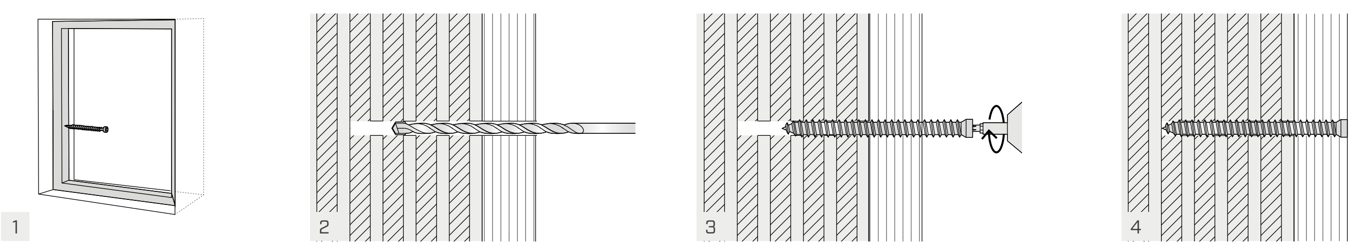
STATIC VALUES

WITHDRAWAL RESISTANCE

Type of support	$h_{nom,min}$ [mm]	N_{rec} [kN]
Concrete	30	0,76
Solid brick	40	0,29
	80	1,79
Hollow brick	40	0,05
	60	0,21
Light concrete	80	0,12



ASSEMBLING ON MASONRY



VIN-FIX

VINYL ESTER CHEMICAL ANCHOR WITHOUT STYRENE

- CE option 1 for cracked and uncracked concrete
- C2 Seismic performance category (M12-M16)
- Comply with LEED ®, IEQ Credit 4.1
- A+ Class: emission of volatile organic compounds (VOC) in lived environments
- Dry or wet concrete
- Concrete with submerged holes
- Without styrene

CODES AND DIMENSIONS

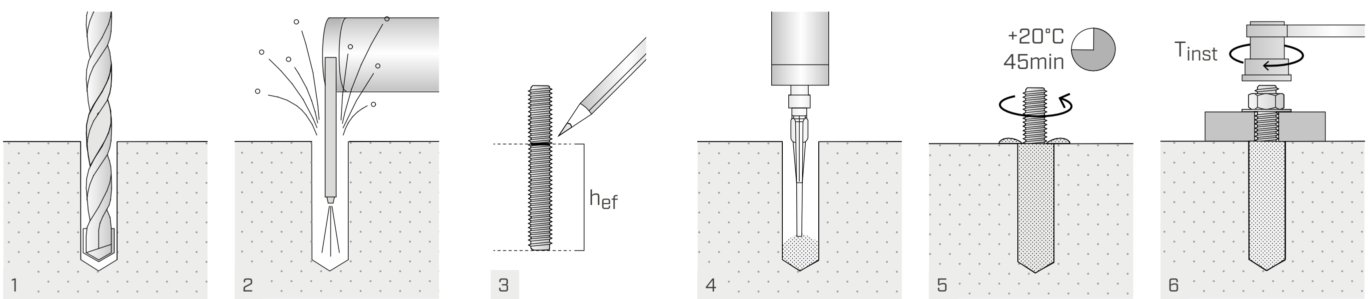
CODE	format [ml]	pcs
FIX300	300	12
FIX420	420	12

Expiry from date of manufacturing: 12 months for 300 ml, 18 months for 420 ml.
Storage temperature between +5 and +25° C.

ADDITIONAL PRODUCTS - ACCESSORIES

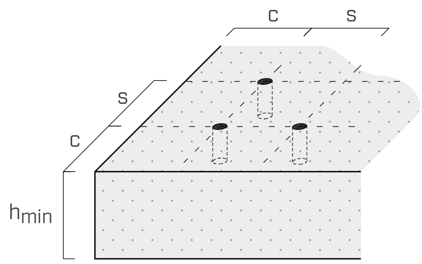
type	description	format [ml]	pcs
MAM400	gun for cartridge	420	1
FLY	gun for cartridge	300	1
STING	nozzle	-	12
PONY	blow pump	-	1

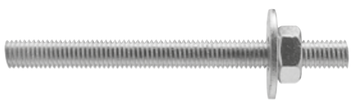
ASSEMBLY



INSTALLATION

INSTALLATION GEOMETRY ON CONCRETE | THREADED RODS

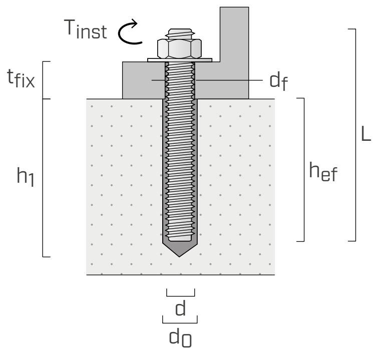




d	[mm]	M8	M10	M12	M16	M20	M24
d_0	[mm]	10	12	14	18	24	28
$h_{ef,min}$	[mm]	60	60	70	80	90	96
$h_{ef,max}$	[mm]	160	200	240	320	400	480
d_f	[mm]	9	12	14	18	22	26
T_{inst}	[Nm]	10	20	40	80	120	160

			M8	M10	M12	M16	M20	M24
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120
Minimum thickness of concrete support	h_{min}	[mm]	$h_{ef} + 30 \geq 100$ mm			$h_{ef} + 2\ d_0$		

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.



d anchor diameter
d_0 hole diameter in the concrete support
h_{ef} effective anchor depth
d_f hole diameter in the element to be fastened
T_{inst} maximum tightening torque
L anchor length
t_{fix} maximum fastening thickness
h_1 minimum hole depth

INSTALLATION TIME AND TEMPERATURE

support temperature	cartridge temperature	workability time	curing time before loading
-5 ÷ -1 °C	+5 ÷ +40 °C	90 min	6 h
0 ÷ +4 °C		45 min	3 h
+5 ÷ +9 °C		25 min	2 h
+10 ÷ +14 °C		20 min	100 min
+15 ÷ +19 °C		15 min	80 min
+20 ÷ +29 °C		6 min	45 min
+30 ÷ +34 °C		4 min	25 min
+35 ÷ +39 °C		2 min	20 min

Component A classification: Eye Irrit. 2; Skin Sens. 1.   Component B classification: Eye Irrit. 2; Skin Sens. 1.

VIN-FIX PRO

VINYL ESTER CHEMICAL ANCHOR WITHOUT STYRENE

- CE option 1 for cracked and uncracked concrete
- Certified for use in masonry (category c, w/d)
- C1 Seismic performance category (M12-M24)
- Certified fire resistance F120
- Complies with LEED ®, IEQ Credit 4.1
- A+ Class: emission of volatile organic compounds (VOC) in lived environments
- Dry or wet concrete
- Concrete with submerged holes (M8-M16)
- No stress in the support
- Without styrene - odourless

CODES AND DIMENSIONS

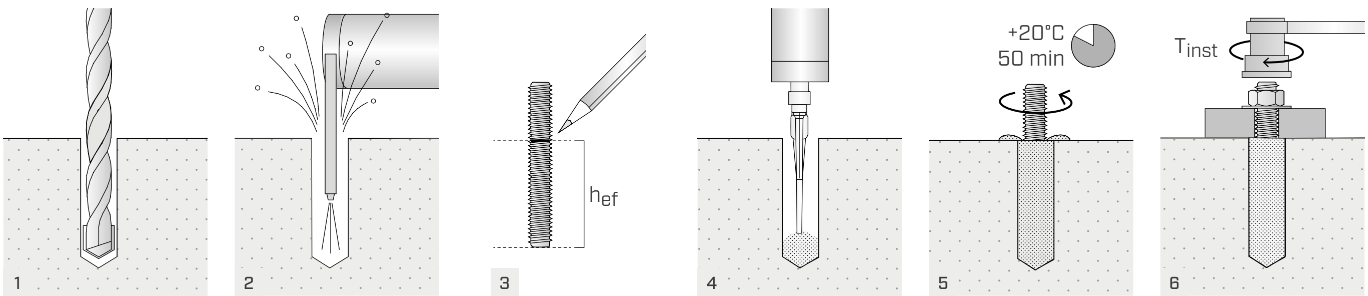
CODE	format [ml]	pcs
VIN300	300	12
VIN410	410	12

Expiry from date of manufacturing: 12 months for 300 ml, 18 months for 410 ml.
Storage temperature between +5 and +25° C.

ADDITIONAL PRODUCTS - ACCESSORIES

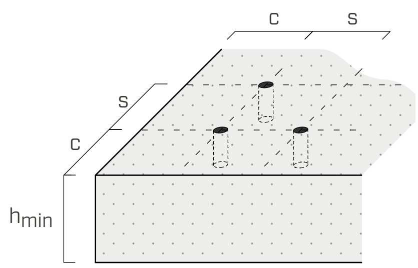
type	description	format [ml]	pcs
MAM400	gun for cartridge	410	1
FLY	gun for cartridge	300	1
STING	nozzle	-	12
PONY	blow pump	-	1

ASSEMBLY



INSTALLATION

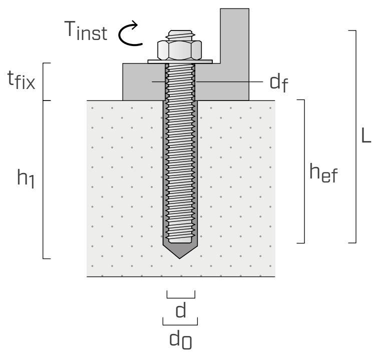
INSTALLATION GEOMETRY ON CONCRETE | THREADED RODS (TYPE INA or MGS)



d	[mm]	M8	M10	M12	M16	M20	M24	M27	M30
d_0	[mm]	10	12	14	18	22	26	30	35
$h_{ef,min}$	[mm]	64	80	96	128	160	192	216	240
$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
d_f	[mm]	9	12	14	18	22	26	30	33
T_{inst}	[Nm]	10	20	40	80	150	200	240	275

			M8	M10	M12	M16	M20	M24	M27	M30
Minimum spacing	s_{min}	[mm]	h_{ef} / 2							
Minimum edge distance	c_{min}	[mm]	h_{ef} / 2							
Minimum thickness of concrete support	h_{min}	[mm]	$h_{ef} + 30 \geq 100$ mm				$h_{ef} + 2\ d_0$			

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.



d	anchor diameter
d_0	hole diameter in the concrete support
h_{ef}	effective anchor depth
d_f	maximum hole diameter in the element to be fastened
T_{inst}	tightening torque
L	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth

INSTALLATION TIME AND TEMPERATURE

support temperature	cartridge temperature	workability time	curing time before loading	
			dry support	wet support
-10 ÷ +4 °C *	+5 ÷ +20 °C	20 min *	24 h *	48 h *
+5 ÷ +9 °C		10 min	145 min	290 min
+10 ÷ +19 °C		6 min	85 min	170 min
+20 ÷ +29 °C		4 min	50 min	100 min
+30 °C		4 min	40 min	80 min

* use not included in certification.

STATIC CHARACTERISTIC VALUES

Valid for a single threaded rod (INA or MGS) in very thick C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

UNCRACKED CONCRETE[1]

TENSION

rod	$h_{ef,standard}$	$N_{Rk,p}$[2] [kN]				$h_{ef,max}$	$N_{Rk,s/Rk,p}$[3] [kN]			
	[mm]	5.8 steel	γ_{Mp}	8.8 steel	γ_{Mp}	[mm]	5.8 steel	γ_M	8.8 steel	γ_M
M8	**80**	17,1	1,8	17,1	1,8	**160**	18,0	γ_{Ms} = 1,5	29,0	γ_{Ms} = 1,5
M10	**90**	28,3		28,3		**200**	29,0		46,0	
M12	**110**	39,4		39,4		**240**	42,0		67,0	
M16	**128**	57,9		57,9		**320**	78,0		144,8	γ_{Mp} = 1,8
M20	**170**	90,8		90,8		**400**	122,0		213,6	
M24	**210**	126,7		126,7		**480**	176,0		289,5	
M27	**240**	132,3	2,1	132,3	2,1	**540**	297,7	γ_{Mp} = 2,1	297,7	γ_{Mp} = 2,1
M30	**270**	140,0		140,0		**600**	311,0		311,0	

SHEAR

rod	h_{ef}	$V_{Rk,s}$[4] [kN]			
	[mm]	5.8 steel	γ_{Ms}	8.8 steel	γ_{Ms}
M8	**≥ 64**	9,0	1,25	15,0	1,25
M10	**≥ 80**	15,0		23,0	
M12	**≥ 96**	21,0		34,0	
M16	**≥ 128**	39,0		63,0	
M20	**≥ 160**	61,0		98,0	
M24	**≥ 192**	88,0		141,0	
M27	**≥ 216**	115,0		184,0	
M30	**≥ 240**	140,0		224,0	

incremental factor for $N_{Rk,p}$[5]		
Ψ_c	C25/30	1,02
	C30/37	1,04
	C40/50	1,08
	C50/60	1,10

CRACKED CONCRETE[1]

TENSION

rod	$h_{ef,standard}$	$N_{Rk,p}$[2] [kN]				$h_{ef,max}$	$N_{Rk,p}$[2] [kN]			
	[mm]	5.8 steel	γ_{Mp}	8.8 steel	γ_{Mp}	[mm]	5.8 steel	γ_{Mp}	8.8 steel	γ_{Mp}
M12	**110**	18,7	1,8	18,7	1,8	**240**	40,7	1,8	40,7	1,8
M16	**128**	29,0		29,0		**320**	72,4		72,4	
M20	**170**	48,1		48,1		**400**	113,1		113,1	
M24	**210**	71,3		71,3		**480**	162,9		162,9	

SHEAR

rod	$h_{ef,standard}$	V_{Rk} [kN]				$h_{ef,max}$	$V_{Rk,s}$[4] [kN]			
	[mm]	5.8 steel	γ_{Ms}	8.8 steel	γ_{Mc}	[mm]	5.8 steel	γ_{Ms}	8.8 steel	γ_{Ms}
M12	**110**	21,0	1,25 [4]	37,3	1,5 [6]	**240**	21,0	1,25	34,0	1,25
M16	**128**	39,0		57,9		**320**	39,0		63,0	
M20	**170**	61,0		96,1		**400**	61,0		98,0	
M24	**210**	88,0		142,5		**480**	88,0		141,0	

NOTES:

(1) For the calculation of anchors in masonry or in case of high bond rods, please see ETA document.

(2) Pull-out and concrete cone failure.

(3) Steel failure for 5.8 grade rods and variable failure mode (steel failure / pull-out) for 8.8 grade rods.

(4) Steel failure mode.

(5) Tensile-strength increment factor (excluding steel failure) for both cracked and uncracked concrete.

(6) Pry-out failure mode.

Component A classification: Eye Irrit. 2; Skin Sens. 1; Aquatic Chronic 3. Component B classification: Eye Irrit. 2; Skin Sens. 1; Aquatic Acute 1; Aquatic Chronic 1.

GENERAL PRINCIPLES:

- Characteristic values according to ETA-16/0600.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$. Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- For the design of anchors subjected to seismic loading refer to ETA and to ETAG 001 (Annex E and TR045).
- For specifications of the diameters covered by the various certifications (cracked concrete, uncracked concrete, seismic applications, masonry), please refer to ETA.

VIN-FIX PRO NORDIC

LEED® According to LEED® IEQ 4.1 | SEISMIC C1 | MY PROJECT SOFTWARE | CE

VINYL ESTER CHEMICAL ANCHOR FOR LOW TEMPERATURES

- CE option 1 for cracked and uncracked concrete
- Certified for use in masonry (category c, w/d)
- C1 Seismic performance category (M12-M24)
- Maintains workability at low temperatures (- 10 °C)
- Complies with LEED ®, IEQ Credit 4.1
- Dry or wet concrete
- Concrete with submerged holes
- No stress in the support
- Without styrene - odourless

CODES AND DIMENSIONS

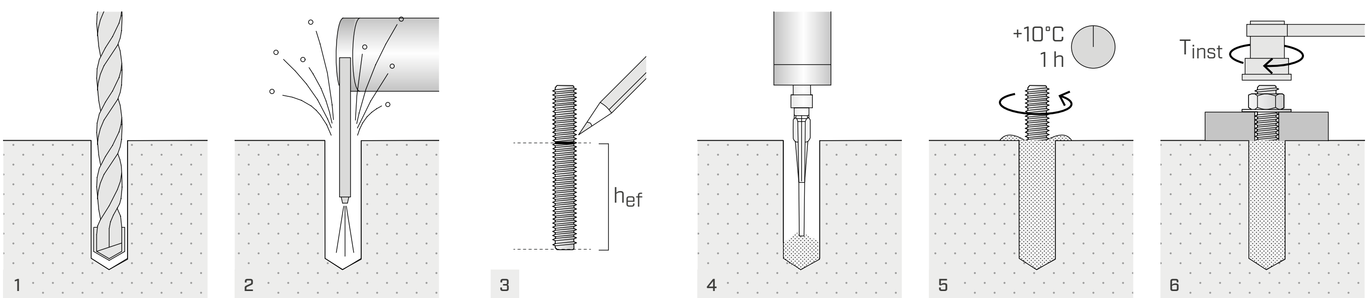
CODE	format [ml]	pcs
VIN410N	410	12

Expiry from date of manufacturing: 18 months.
Storage temperature between 0 and +25° C.

ADDITIONAL PRODUCTS - ACCESSORIES

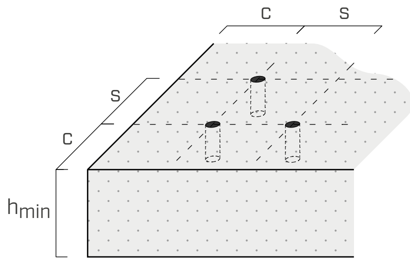
type	description	format [ml]	pcs
MAM400	gun for cartridge	410	1
STING	nozzle	-	12
PONY	blow pump	-	1

ASSEMBLY



INSTALLATION

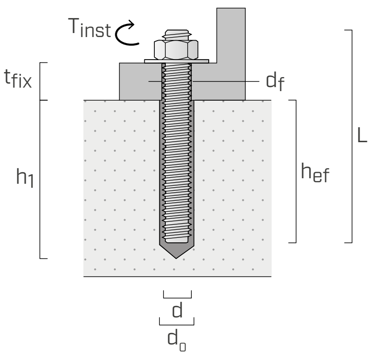
INSTALLATION GEOMETRY ON CONCRETE | THREADED RODS (TYPE INA or MGS)



d	[mm]	M8	M10	M12	M16	M20	M24	M27	M30
d_0	[mm]	10	12	14	18	22	26	30	35
$h_{ef,min}$	[mm]	64	80	96	128	160	192	216	240
$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
d_f	[mm]	9	12	14	18	22	26	30	33
T_{inst}	[Nm]	10	20	40	80	150	200	240	275

			M8	M10	M12	M16	M20	M24	M27	M30
Minimum spacing	s_{min}	[mm]	h_{ef} / 2							
Minimum edge distance	c_{min}	[mm]	h_{ef} / 2							
Minimum thickness of concrete support	h_{min}	[mm]	$h_{ef} + 30 \geq 100$ mm				$h_{ef} + 2\ d_0$			

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.



d	anchor diameter
d_0	hole diameter in the concrete support
h_{ef}	effective anchor depth
d_f	maximum hole diameter in the element to be fastened
T_{inst}	tightening torque
L	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth

INSTALLATION TIME AND TEMPERATURE

support temperature	cartridge temperature	workability time	curing time before loading	
			dry support	wet support
-20 ÷ -11 °C*	0 ÷ +20 °C	45 min *	35 h *	70 h *
-10 ÷ -6 °C		35 min	12 h	24 h
-5 ÷ -1 °C		15 min	5 h	10 h
0 ÷ +4 °C		10 min	2,5 h	5 h
+5 ÷ +9 °C		6 min	80 min	160 min
+10 °C		6 min	60 min	120 min

* use not included in certification.

STATIC CHARACTERISTIC VALUES

Valid for a single threaded rod (INA or MGS) in very thick C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

UNCRACKED CONCRETE[1]

TENSION

rod	$h_{ef,standard}$ [mm]	$N_{Rk,p}$[2] [kN] 5.8 steel	γ_{Mp}	8.8 steel	γ_{Mp}
M8	**80**	17,1	1,8	17,1	1,8
M10	**90**	28,3		28,3	
M12	**110**	39,4		39,4	
M16	**128**	57,9		57,9	
M20	**170**	90,8		90,8	
M24	**210**	126,7		126,7	
M27	**240**	132,3	2,1	132,3	2,1
M30	**270**	140,0		140,0	

SHEAR

rod	h_{ef} [mm]	$V_{Rk,s}$[3] [kN] 5.8 steel	γ_{Ms}	8.8 steel	γ_{Ms}
M8	**≥ 64**	9,0	1,25	15,0	1,25
M10	**≥ 80**	15,0		23,0	
M12	**≥ 96**	21,0		34,0	
M16	**≥ 128**	39,0		63,0	
M20	**≥ 160**	61,0		98,0	
M24	**≥ 192**	88,0		141,0	
M27	**≥ 216**	115,0		184,0	
M30	**≥ 240**	140,0		224,0	

CRACKED CONCRETE[1]

TENSION

rod	$h_{ef,standard}$ [mm]	$N_{Rk,p}$[2] [kN] 5.8 steel	γ_{Mp}	8.8 steel	γ_{Mp}
M12	**110**	18,7	1,8	18,7	1,8
M16	**128**	29,0		29,0	
M20	**170**	48,1		48,1	
M24	**210**	71,3		71,3	

SHEAR

rod	$h_{ef,standard}$ [mm]	V_{Rk} [kN] 5.8 steel	γ_{Ms}	8.8 steel	γ_{Mc}
M12	**110**	21,0	1,25 [3]	37,3	1,5 [5]
M16	**128**	39,0		57,9	
M20	**170**	61,0		96,1	
M24	**210**	88,0		142,5	

incremental factor for $N_{Rk,p}$[4]		
Ψ_c	C25/30	1,02
	C30/37	1,04
	C40/50	1,08
	C50/60	1,10

NOTES:

[1] For the calculation of anchors in masonry or in case of high bond rods, please see ETA document.

[2] Pull-out and concrete cone failure.

[3] Steel failure mode.

[4] Tensile-strength increment factor (excluding steel failure) for both cracked and uncracked concrete.

[5] Pry-out failure mode.

Component A classification: Flam. Liq. 3; Eye Irrit. 2; Skin Sens. 1; Aquatic Chronic 3. Component B classification: Eye Irrit. 2; Skin Sens. 1; Aquatic Acute 1; Aquatic Chronic 1.

GENERAL PRINCIPLES:

- Characteristic values according to ETA-16/0600.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$. Coefficients γ_M are listed in the table in accordance with the failure characteristics and product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- For the design of anchors subjected to seismic loading refer to ETA and to ETAG 001 (Annex E and TR045).
- For specifications of the diameters covered by the various certifications (cracked concrete, uncracked concrete, seismic applications, masonry), please refer to ETA.

EPO-FIX PLUS

HIGH-PERFORMANCE EPOXY CHEMICAL ANCHOR

- CE option 1 for cracked and uncracked concrete
- C2 Seismic performance category (M12-M16-M20)
- A+ Class: emission of volatile organic compounds (VOC) in lived environments
- Dry or damp concrete
- Concrete with submerged holes

CODES AND DIMENSIONS

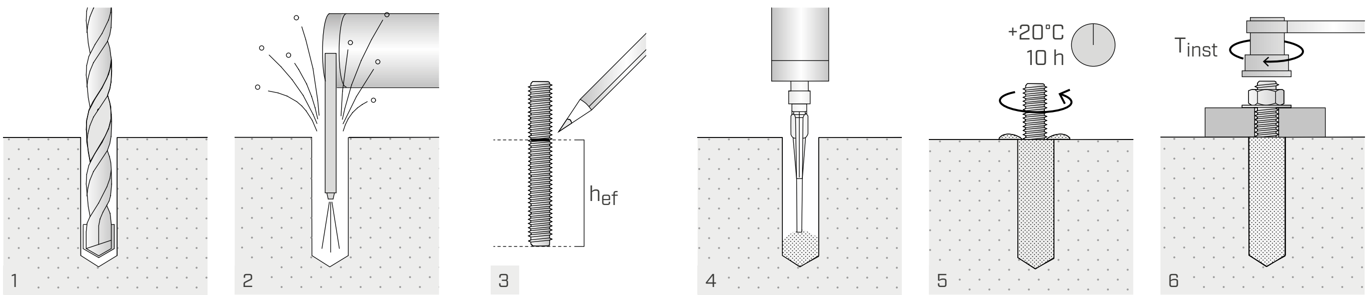
CODE	format [ml]	pcs
EPO385	385	12

Expiry from date of manufacturing: 24 months.
Storage temperature between +5 and +25° C.

ADDITIONAL PRODUCTS - ACCESSORIES

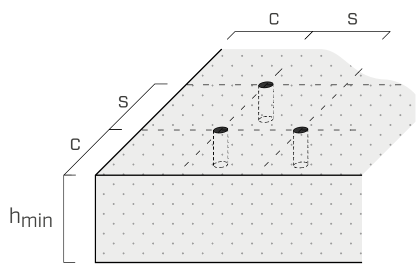
type	description	format [ml]	pcs
MAMDB	double cartridge gun	385	1
STING	nozzle	-	12
PONY	blow pump	-	1

ASSEMBLY



INSTALLATION

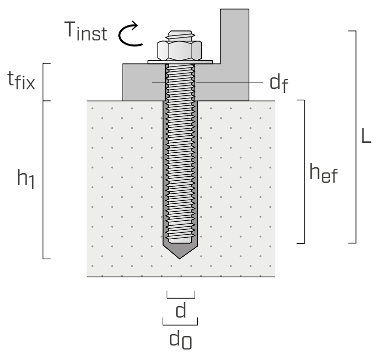
INSTALLATION GEOMETRY ON CONCRETE | THREADED RODS (TYPE INA or MGS)



d	[mm]	M8	M10	M12	M16	M20	M24	M27	M30
d_0	[mm]	10	12	14	18	22	26	30	35
$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120
$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
d_f	[mm]	9	12	14	18	22	26	30	33
T_{inst}	[Nm]	10	20	40	80	120	160	180	200

			M8	M10	M12	M16	M20	M24	M27	M30
Minimum spacing	s_{min}	[mm]	max (h_{ef} / 2; 5d)							
Minimum edge distance	c_{min}	[mm]	max (h_{ef} / 2; 5d)							
Minimum thickness of concrete support	h_{min}	[mm]	h_{ef} + 30 ≥ 100 mm			h_{ef} + 2 d_0				

For spacing and distances smaller than the critical ones, strength values have to be reduced depending on the installation parameters.



d	anchor diameter
d_0	hole diameter in the concrete support
h_{ef}	effective anchor depth
d_f	maximum hole diameter in the element to be fastened
T_{inst}	tightening torque
L	anchor length
t_{fix}	maximum fastening thickness
h_1	minimum hole depth

INSTALLATION TIME AND TEMPERATURE

support temperature	workability time	curing time before loading	
		dry support	wet support
+5 ÷ +9 °C	120 min	50 h	100 h
+10 ÷ +14 °C	45 min	30 h	60 h
+15 ÷ +19 °C	25 min	18 h	36 h
+20 ÷ +29 °C	12 min	10 h	20 h
+30 ÷ +39 °C	6 min	6 h	12 h
+40 °C	5 min	4 h	8 h

Cartridge storage temperature +5 ÷ +25° C.

STATIC CHARACTERISTIC VALUES

Valid for a single threaded rod (INA or MGS) in very thick C20/25 grade concrete with a thin reinforcing layer when spacing and edge-distance are not limiting parameters.

UNCRACKED CONCRETE[1]

TENSION

rod	$h_{ef,standard}$ [mm]	N_{Rk}[(2)] [kN] 5.8 steel	γ_M	8.8 steel	γ_M	$h_{ef,max}$ [mm]	$N_{Rk,s}$[(2)] [kN] 5.8 steel	γ_{Ms}	8.8 steel	γ_{Ms}
M8	**80**	18,0	γ_{Ms} = 1,5	29,0	γ_{Ms} = 1,5	**160**	18,0	1,5	29,0	1,5
M10	**90**	29,0		42,4	γ_{Mp} = 1,5	**200**	29,0		46,0	
M12	**110**	42,0		58,3	γ_{Mc} = 1,5	**240**	42,0		67,0	
M16	**128**	73,1	γ_{Mc} = 1,5	73,1		**320**	78,0		125,0	
M20	**170**	111,9		111,9		**400**	122,0		196,0	
M24	**210**	153,7		153,7		**480**	176,0		282,0	
M27	**240**	187,8		187,8		**540**	230,0		368,0	
M30	**270**	224,0		224,0		**600**	280,0		449,0	

SHEAR

rod	$h_{ef,standard}$ [mm]	$V_{Rk,s}$ [kN] 5.8 steel	γ_{Ms}	8.8 steel	γ_{Ms}
M8	**80**	9,0	1,25	15,0	1,25
M10	**90**	15,0		23,0	
M12	**110**	21,0		34,0	
M16	**128**	39,0		63,0	
M20	**170**	61,0		98,0	
M24	**210**	88,0		141,0	
M27	**240**	115,0		184,0	
M30	**270**	140,0		224,0	

CRACKED CONCRETE[1]

TENSION

rod	$h_{ef,standard}$ [mm]	N_{Rk}[(2)] [kN] 5.8 steel	γ_{Mp}	8.8 steel	γ_{Mp}	$h_{ef,max}$ [mm]	N_{Rk}[(2)] [kN] 5.8 steel	γ_{Ms}	8.8 steel	γ_M
M12	**110**	31,1	1,5	31,1	1,5	**240**	42,0	1,5	67,0	γ_{Ms} = 1,5
M16	**128**	41,8		41,8		**320**	78,0		104,5	γ_{Mp} = 1,5
M20	**170**	64,1		64,1		**400**	122,0		150,8	
M24	**210**	87,1		87,1		**480**	176,0		199,0	
M27	**240**	112,0		112,0		**540**	230,0		251,9	
M30	**270**	140,0		140,0		**600**	280,0		311,0	

SHEAR

rod	$h_{ef,min}$ [mm]	$V_{Rk,s}$[(3)] [kN] 5.8 steel	γ_{Ms}	8.8 steel	γ_{Ms}
M12	**110**	21,0	1,25 [(4)]	34,0	1,25
M16	**128**	39,0		63,0	
M20	**170**	61,0		98,0	
M24	**210**	88,0		141,0	
M27	**240**	115,0		184,0	
M30	**270**	140,0		224,0	

incremental factor for concrete[(4)]		
ψ_c	C25/30	1,02
	C30/37	1,04
	C40/50	1,07
	C50/60	1,09

NOTES:

(1) For the calculation of anchors in masonry or in case of high bond rods, please refer to ETA document.

(2) The table shows the characteristic values N_{Rk} and the related partial safety coefficient in accordance with the key failure characteristics.

(3) Steel failure mode.

(4) Tensile-strength increment factor (excluding steel failure) for both cracked and uncracked concrete.

Component A classification: Skin Irrit. 2; Eye Irrit. 2; Skin Sens. 1; Aquatic Chronic 2. Component B classification: Acute Tox. 4; Skin Corr. 1A; Eye Dam. 1; Skin Sens. 1; Aquatic Chronic 3.

GENERAL PRINCIPLES:

- Characteristic values according to ETA-17/0347.
- The design values are obtained from the characteristic values as follows: $R_d = R_k/\gamma_M$. Coefficients γ_M are listed in the table and are in accordance with the product certificates.
- For the calculation of anchors with reduced spacing, or too close to the edge, please refer to ETA. Similarly, in case of fastening on concrete-supports with a better-grade, limited thickness or a thick reinforcing layer please see ETA.
- For the design of anchors subjected to seismic loading refer to ETA and to TR045.
- For specifications of the diameters covered by the various certifications (cracked concrete, uncracked concrete, seismic applications), please refer to ETA.

INA

5.8 STEEL CLASS THREADED ROD FOR CHEMICAL ANCHORS

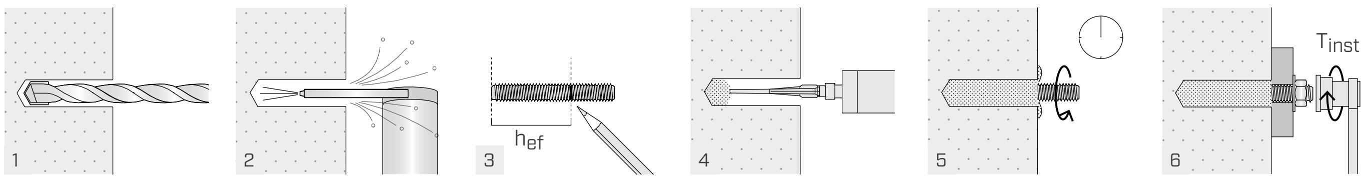
- Complete with nut (ISO4032) and washer (ISO7089)
- 5.8 grade zinc plated steel

CODES AND DIMENSIONS

CODE	d [mm]	L_t [mm]	d_0 [mm]	d_f [mm]	pcs
INA8110	M8	110	10	≤ 9	10
INA10110	M10	110	12	≤ 12	10
INA10130		130	12	≤ 13	10
INA12130	M12	130	14	≤ 14	10
INA12180		180	14	≤ 15	10
INA16160	M16	160	18	≤ 18	10
INA16190		190	18	≤ 18	10
INA16230		230	18	≤ 18	10
INA20240	M20	240	24	≤ 22	10
INA24270	M24	270	28	≤ 26	10
INA27400	M27	400	32	≤ 30	10

d_0 = hole diameter in the support / d_f = hole diameter in the element to be fastened

ASSEMBLY



IHP - IHM

BUSHINGS FOR PERFORATED MATERIALS

CODES AND DIMENSIONS

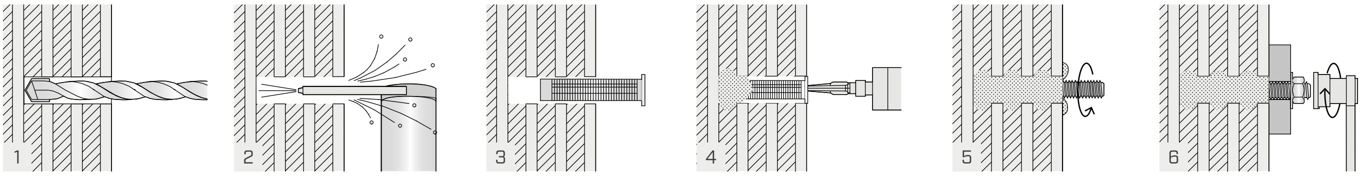
IHP - PLASTIC MESH

CODE	d_0 [mm]	L [mm]	rod [mm]	pcs
IHP1685	**16**	**85**	M10 (M8)	10
IHP16130	**16**	**130**	M10 (M8)	10
IHP2085	**20**	**85**	M12/M16	10

IHM - METAL NET

CODE	d_0 [mm]	L [mm]	rod [mm]	pcs
IHM121000	**12**	**1000**	M8	50
IHM161000	**16**	**1000**	M8/M10	50
IHM221000	**22**	**1000**	M12/M16	25

ASSEMBLY



BOLTS AND RODS

BOLTS AND RODS

BOLTS AND RODS

KOS

HEXAGONAL HEAD BOLT

CE
EN 14592

- Cylindrical metal connector with CE marking according to EN 14592
- Carbon steel of strength grade 8.8 for all hexagonal head bolts (KOS)
- Hexagonal head bolt supplied with an incorporated nut (for the carbon steel version)
- Available also in A2 | AISI304 stainless steel for outdoor applications (service class 3)

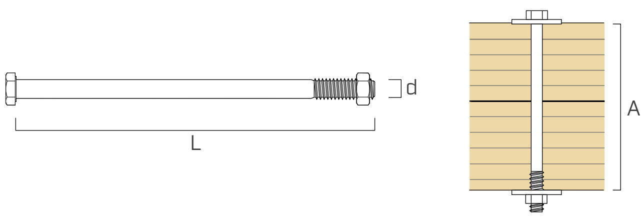
CODES AND DIMENSIONS

KOS – hexagonal head bolt with nut and CE marking

Steel class 8.8 - zinc plated
DIN 601 (ISO 4016*)

d [mm]	CODE	L [mm]	A_{max} [mm]	pcs
M12	KOS12100B	100	75	25
	KOS12120B	120	95	25
	KOS12140B	140	115	25
	KOS12160B	160	135	25
	KOS12180B	180	155	25
	KOS12200B	200	175	25
	KOS12220B	220	195	25
	KOS12240B	240	215	25
	KOS12260B	260	235	25
	KOS12280B	280	255	25
	KOS12300B	300	275	25
	KOS12320B	320	295	25
	KOS12340B	340	315	25
	KOS12360B	360	335	25
	KOS12380B	380	355	25
	KOS12400B	400	375	25
M16	KOS16140B	140	105	15
	KOS16160B	160	125	15
	KOS16180B	180	145	15
	KOS16200B	200	165	15
	KOS16220B	220	185	15
	KOS16240B	240	205	15
	KOS16260B	260	225	15
	KOS16280B	280	245	15
	KOS16300B	300	265	15
	KOS16320B	320	285	15
	KOS16340B	340	305	15
	KOS16360B	360	325	15
	KOS16380B	380	345	15
	KOS16400B	400	365	15
	KOS16420B	420	385	15
	KOS16440B	440	405	15
	KOS16460B	460	425	15
	KOS16500B	500	465	15

d [mm]	CODE	L [mm]	A_{max} [mm]	pcs
M20	KOS20120B	120	75	10
	KOS20140B	140	95	10
	KOS20160B	160	115	10
	KOS20180B	180	135	10
	KOS20200B	200	155	10
	KOS20220B	220	175	10
	KOS20240B	240	195	10
	KOS20260B	260	215	10
	KOS20280B	280	235	10
	KOS20300B	300	255	10
	KOS20320B	320	275	10
	KOS20340B	340	295	10
	KOS20360B	360	315	10
	KOS20380B	380	335	10
	KOS20400B	400	355	10
	KOS20420B	420	375	10
	KOS20440B	440	395	10
	KOS20460B	460	415	10



The maximum thickness A is evaluated considering a nut MUT934 and two ULS 440 washers.

* Standard ISO 4016 differs from standard DIN 601 in the M12 diameter for parameter SW.

KOS A2 | AISI304 - hexagonal head bolt

A2 | AISI304 stainless steel
DIN 931 (ISO 4014*)

d [mm]	CODE	L [mm]	pcs
M12	AI60112100	100	25
	AI60112120	120	25
	AI60112140	140	25
	AI60112160	160	10
	AI60112180	180	10
	AI60112200	200	10
	AI60112220	220	10
	AI60112240	240	10
	AI60112260	260	10
M16	AI60116120	120	25
	AI60116140	140	25
	AI60116150	150	25
	AI60116160	160	10
	AI60116180	180	10
	AI60116200	200	10
	AI60116220	220	10
	AI60116240	240	10
	AI60116260	260	10
	AI60116280	280	10
	AI60116300	300	10

d [mm]	CODE	L [mm]	pcs
M20	AI60120160	160	10
	AI60120180	180	10
	AI60120200	200	10
	AI60120220	220	10
	AI60120240	240	10
	AI60120260	260	10
	AI60120280	280	10
	AI60120300	300	5
	AI60120320	320	5
	AI60120340	340	5
	AI60120360	360	5
	AI60120380	380	5
	AI60120400	400	5

* Standard ISO 4014 differs from standard DIN 931 in the M12 diameter for parameter SW.

MATERIAL AND DURABILITY

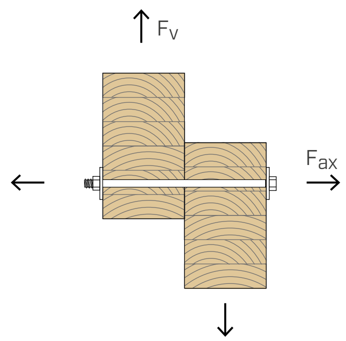
KOS: strength grade 8.8 bright zinc plated carbon steel.
Use for service classes 1 and 2 (EN 1995-1-1).

KOS A2 | AISI304: A2 | AISI304 stainless steel.
To be used in service class 3 (EN 1995-1-1).

FIELD OF USE

- Timber-to-timber joints
- Timber-to-steel joints

EXTERNAL LOADS



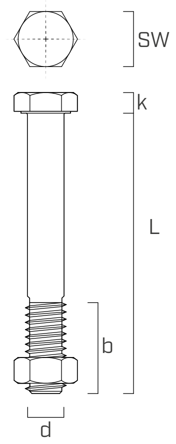
GEOMETRY AND MECHANICAL CHARACTERISTICS | KOS

Nominal diameter	d	[mm]		M12	M16	M20
Wrench	SW	[mm]		19	24	30
Head thickness	k	[mm]		7,5	10,0	12,5
Thread length	b	[mm]	$L \leq 125$ mm	30	38	46
		[mm]	$125 < L \leq 200$ mm	36	44	52
		[mm]	$L > 200$ mm	49	57	65

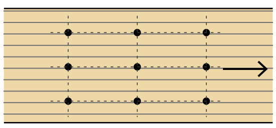
Design according to standard DIN 601 (ISO 4016) and DIN 931 (ISO 4014).

Material	steel		8,8	8,8	8,8
	$f_{u,k}$	[N/mm²]	800	800	800
	$f_{y,k}$	[N/mm²]	640	640	640
Characteristic yield moment	$M_{y,k}$	[Nmm]	153000	324000	579000

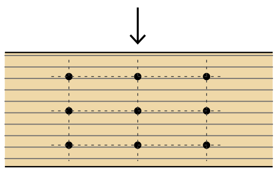
Mechanical parameters according to CE marking, in accordance with EN 14592.



MINIMUM DISTANCES FOR CONNECTORS SUBJECTED TO SHEAR STRESS[1]

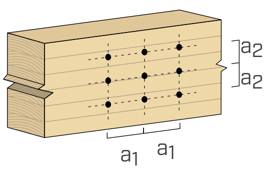


Load-to-grain angle α = 0°

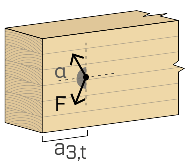


Load-to-grain angle α = 90°

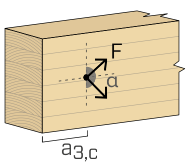
		α = 0° 12	α = 0° 16	α = 0° 20	α = 90° 12	α = 90° 16	α = 90° 20
a_1	[mm]	60	80	100	48	64	80
a_2	[mm]	48	64	80	48	64	80
$a_{3,t}$	[mm]	84	112	140	84	112	140
$a_{3,c}$	[mm]	48	64	80	84	112	140
$a_{4,t}$	[mm]	36	48	60	48	64	80
$a_{4,c}$	[mm]	36	48	60	36	48	60



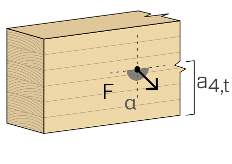
stressed end
-90° < α < 90°



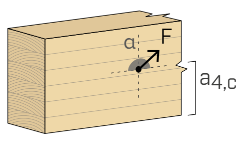
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°

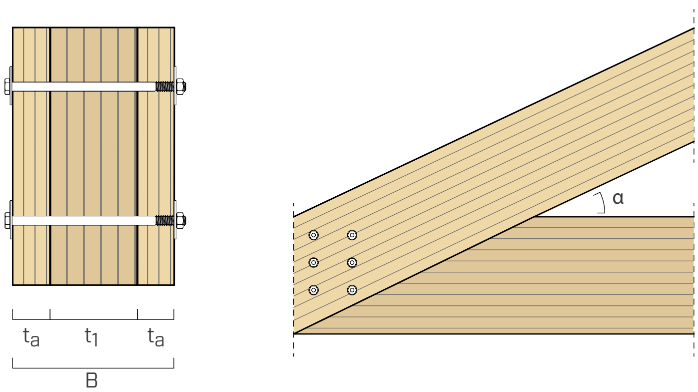


NOTES:

[1] The minimum distances are compliant with EN 1995-1-1.

STATIC VALUES | KOS

NODE WITH 3 WOODEN ELEMENTS



d [mm]	L [mm]	t_a [mm]	t_1 [mm]	$R_{vk,0°}$ [kN]	$R_{vk,30°}$ [kN]	$R_{vk,45°}$ [kN]	$R_{vk,60°}$ [kN]	$R_{vk,90°}$ [kN]
12	220	60	60	20,0	20,0	20,0	19,3	18,5
	240	60	80	22,5	21,2	20,2	19,3	18,5
	260	60	100	22,5	21,2	20,2	19,3	18,5
	280	60	120	22,5	21,2	20,2	19,3	18,5
	300	80	100	26,0	24,3	22,9	21,7	20,7
	320	80	120	26,0	24,3	22,9	21,7	20,7
	340	80	140	26,0	24,3	22,9	21,7	20,7
	360	80	160	26,0	24,3	22,9	21,7	20,7
	≥ 380	-	-	26,8	26,1	25,4	24,4	23,2
16	280	80	80	33,9	33,9	33,8	32,2	30,5
	300	80	100	38,1	35,7	33,8	32,2	30,5
	320	80	120	38,1	35,7	33,8	32,2	30,5
	340	80	140	38,1	35,7	33,8	32,2	30,5
	360	80	160	38,1	35,7	33,8	32,2	30,5
	380	100	140	42,7	39,6	37,2	35,2	33,5
	400	100	160	42,7	39,6	37,2	35,2	33,5
	420	100	180	42,7	39,6	37,2	35,2	33,5
	440	100	200	42,7	39,6	37,2	35,2	33,5
	460	120	180	44,7	43,3	40,9	38,5	36,4
	500	120	220	44,7	43,3	40,9	38,5	36,4
20	380	100	120	55,8	51,9	48,9	46,4	44,0
	400	100	140	55,8	51,9	48,9	46,4	44,0
	420	100	160	55,8	51,9	48,9	46,4	44,0
	440	100	180	55,8	51,9	48,9	46,4	44,0
	460	120	160	61,2	56,4	52,7	49,7	47,2

GENERAL PRINCIPLES:

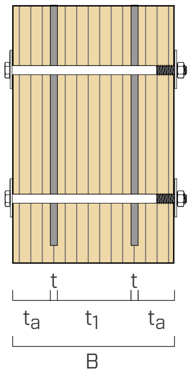
- Characteristic values according to EN 1995-1-1.
- The design values are obtained from the characteristic values as follows:

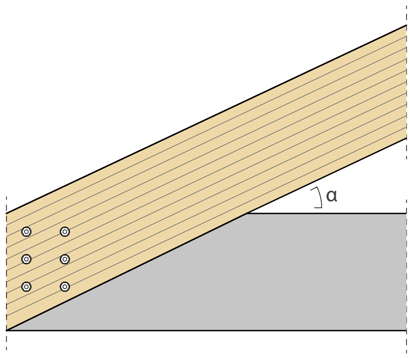
$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

  The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- For the calculation process a timber density ρ_k = 385 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.
- The calculation was made taking into account the hollow effect of the bolt with DIN 9021 washers.
- The angle of inclination indicated for R_{vk} is referred to the two external elements.

STATIC VALUES | KOS

NODE WITH 2 METAL BITS IN A WOODEN ELEMENT





d [mm]	L [mm]	B [mm]	t_a [mm]	t_1 [mm]	$R_{vk,0°}$ [kN]	$R_{vk,30°}$ [kN]	$R_{vk,45°}$ [kN]	$R_{vk,60°}$ [kN]	$R_{vk,90°}$ [kN]
12	140	100	29	45	34,3	30,3	27,1	24,6	22,4
	160	120	39	45	39,1	36,0	32,4	29,3	26,8
	180	140	39	65	45,8	41,9	37,7	34,1	31,2
	200	160	39	85	50,9	47,8	43,0	38,9	35,5
	220	180	49	85	52,0	48,6	44,6	41,4	38,7
	240	200	49	105	52,0	48,9	46,4	44,3	42,6
	260	220	59	105	53,6	50,2	47,5	45,2	43,3
	280	240	59	125	53,6	50,2	47,5	45,2	43,3
16	140	100	29	35	39,5	34,4	30,5	27,4	24,8
	160	120	29	55	47,9	41,8	37,0	33,2	30,2
	180	140	39	55	56,4	49,2	43,6	39,1	35,5
	200	160	39	75	64,9	56,6	50,1	45,0	40,8
	220	180	39	95	73,4	64,0	56,7	50,9	46,2
	240	200	49	95	80,5	71,4	63,2	56,8	51,5
	260	220	59	95	81,7	73,7	67,5	62,5	56,8
	280	240	59	115	86,1	80,7	74,0	68,4	62,2
20	160	100	28	47	52,0	44,8	39,3	35,0	31,5
	180	120	29	65	62,1	53,4	46,9	41,8	37,7
	200	140	29	85	72,2	62,1	54,5	48,6	43,8
	220	160	39	85	82,3	70,8	62,1	55,4	49,9
	240	180	49	85	92,4	79,5	69,8	62,1	56,0
	260	200	49	105	102,5	88,2	77,4	68,9	62,1
	280	220	59	105	111,2	96,9	85,0	75,7	68,3
	300	240	59	125	121,3	105,6	92,6	82,5	74,4

CORRECTIVE COEFFICIENT k_F FOR DIFFERENT DENSITIES ρ_k

Strength class	**C24**	**GL22h**	**C30**	**GL24h**	**C40 / GL32c**	**GL28h**	**D24**	**D30**
ρ_k [kg/m^3]	350	370	380	385	400	425	485	530
k_F	0,91	0,96	0,99	1,00	1,02	1,04	1,17	1,23

For different densities ρ_k the wood-side design resistance is calculated as: $R'_{v,d} = R_{v,d} \cdot k_F$.

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1.
- The design values are obtained from the characteristic values as follows:

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

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- The values provided are calculated using 5 mm thick plates, a 6 mm thick milled cut in the timber and a single KOS bolt.
- For the calculation process a timber density ρ_k = 385 kg/m^3 has been considered.
- Dimensioning and verification of the timber elements must be carried out separately.
- The calculation was made taking into account the hollow effect of the bolt with DIN 9021 washers.
- The angle of inclination indicated for R_{vk} is referred to the two external elements.

KOT

ROUND HEAD BOLT

- Round head bolt supplied with an incorporated nut (for the carbon steel version)
- Carbon steel of strength grade 4.8 for all hexagonal head bolts (KOT)
- Available also in A2 | AISI304 stainless steel for outdoor applications (service class 3)


KOT KOT A2

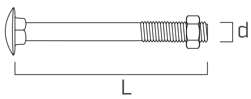
CODES AND DIMENSIONS

KOT - round head bolt with nut

Steel class 4.8 - zinc plated
DIN 603 (ISO 8677)

d [mm]	CODE	L [mm]	pcs
M8	**KOT850**	50	200
	KOT860	60	200
	KOT870	70	200
	KOT880	80	200
	KOT890	90	200
	KOT8100	100	100
	KOT8120	120	100
	KOT8140	140	50
M10	**KOT10100**	100	100
	KOT10120	120	50
	KOT10130	130	50
	KOT10140	140	50
	KOT10150	150	50
	KOT10160	160	50
	KOT10180	180	50
	KOT10200	200	50
	KOT10220	220	50

d [mm]	CODE	L [mm]	pcs
M12	**KOT12200**	200	25
	KOT12220	220	25
	KOT12240	240	25
	KOT12260	260	25
	KOT12280	280	25
	KOT12300	300	25



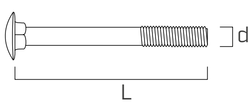
KOT A2 | AISI304 - round head bolt

A2 AISI 304

A2 | AISI304 stainless steel
DIN 603 (ISO 8677)

d [mm]	CODE	L [mm]	pcs
M8	**AI603850**	50	100
	AI603860	60	100
	AI603870	70	50
	AI603880	80	50
	AI603890	90	50
	AI6038100	100	50
	AI6038120	120	50
	AI6038140	140	50
M10	**AI60310120**	120	50
	AI60310130	130	50
	AI60310140	140	50
	AI60310150	150	50
	AI60310160	160	50
	AI60310180	180	50
	AI60310200	200	50
	AI60310220	220	50

d [mm]	CODE	L [mm]	pcs
M12	**AI60312140**	140	50
	AI60312160	160	50
	AI60312180	180	50
	AI60312200	200	50
	AI60312220	220	50
	AI60312240	240	50
	AI60312280	280	50
	AI60312300	300	50



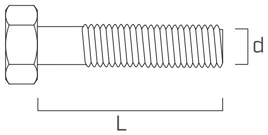
EKS

HEXAGONAL HEAD BOLT

Steel class 8.8 - zinc plated
DIN 933 (ISO 4017) - fully threaded (•)
DIN 931 (ISO 4014) - partially threaded (• •)

CODES AND DIMENSIONS

d [mm]	CODE	thread	L [mm]	pcs
M20	EKS2040	•	40	25
	EKS2050	•	50	25
	EKS2060	•	60	25
	EKS2070	• •	70	25
	EKS2080	• •	80	25
	EKS20100	• •	100	25
M24	EKS2440	•	40	25
	EKS2450	•	50	25
	EKS2460	•	60	25
	EKS2465	•	65	25
	EKS2470	•	70	25
	EKS2480	• •	80	25
	EKS2485	• •	85	25



MET

THREADED RODS, NUTS AND WASHERS

- Metric threaded products for creating connections and joints
- Available in carbon steel and stainless steel for use in service classes 1, 2 and 3 (EN 1995 1-1)

MGS 1000

THREADED ROD

CODE	rod	L [mm]	pcs
MGS10008	M8	1000	10
MGS100010	M10	1000	10
MGS100012	M12	1000	10
MGS100014	M14	1000	10
MGS100016	M16	1000	10
MGS100018	M18	1000	10
MGS100020	M20	1000	10
MGS100022	M22	1000	10
MGS100024	M24	1000	10
MGS100027	M27	1000	10
MGS100030	M30	1000	10

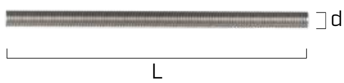
Steel class 4.8 - zinc plated
DIN 975

MGS 1000

THREADED ROD

CODE	rod	L [mm]	pcs
MGS10888	M8	1000	1
MGS11088	M10	1000	1
MGS11288	M12	1000	1
MGS11488	M14	1000	1
MGS11688	M16	1000	1
MGS11888	M18	1000	1
MGS12088	M20	1000	1
MGS12488	M24	1000	1
MGS12788	M27	1000	1

Steel class 8.8 - zinc plated
DIN 975

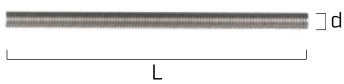


MGS 2200

THREADED ROD

CODE	rod	L [mm]	pcs
MGS220012	M12	2200	1
MGS220016	M16	2200	1
MGS220020	M20	2200	1

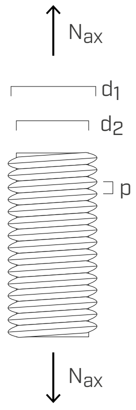
Steel class 4.8 - zinc plated
DIN 975



MGS RODS STATIC VALUES

TENSILE STRENGTH

rod	d_1 [mm]	d_2 [mm]	p [mm]	A_{resist} [mm^2]	CHARACTERISTIC VALUES steel class 4,8 $N_{ax,k}$ [kN]	8,8 $N_{ax,k}$ [kN]
M8	8,0	6,47	1,25	36,6	**13,2**	**26,4**
M10	10,0	8,16	1,50	58,0	**20,9**	**41,8**
M12	12,0	9,85	1,75	84,3	**30,3**	**60,7**
M14	14,0	11,55	2,00	115,0	**41,4**	**82,8**
M16	16,0	13,55	2,00	157,0	**56,5**	**113,0**
M18	18,0	14,93	2,50	192,0	**69,1**	**138,2**
M20	20,0	16,93	2,50	245,0	**88,2**	**176,4**
M22	22,0	18,93	2,50	303,0	**109,1**	**218,2**
M24	24,0	20,32	3,00	353,0	**127,1**	**254,2**
M27	27,0	23,32	3,00	459,0	**165,2**	**330,5**
M30	30,0	25,71	3,50	561,0	**202,0**	**403,9**

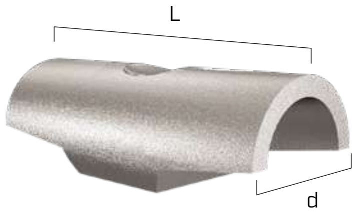


Characteristic values according to EN 1993.
The design values are obtained from the characteristic values as follows: $N_{ax,d} = N_{ax,k} / \gamma_{M2}$.

DADO SIMPLEX

Cast iron

CODE	rod	L [mm]	d [mm]	hole [mm]	pcs
SIMPLEX12	**M12**	54	22	24	100
SIMPLEX16	**M16**	72	28,5	32	100



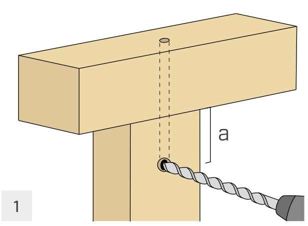
STATIC VALUES WITH SIMPLEX NUT WITHDRAWAL

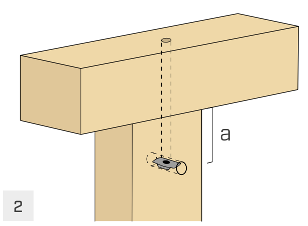
BEARING STRESS RESISTANCE OF WOOD

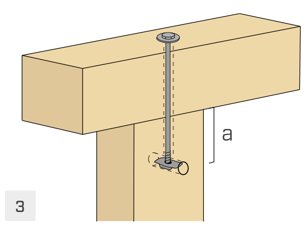
CODE	rod	d [mm]	L_{ef} [mm]	$R_{v,k}$ [kN]	a [mm]
SIMPLEX12	**M12**	22	32,0	**6,4**	155
SIMPLEX16	**M16**	28,5	43,5	**10,4**	200

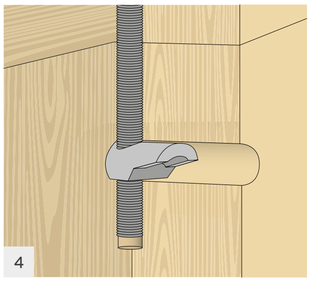
a = minimum distance from the end of the element
The strength values have been determined according to EN 1995 1-1, with $\rho_k = 350\ kg/m^3$

INSTALLATION







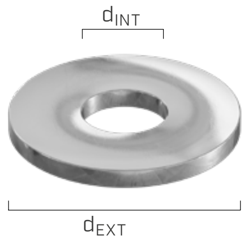


ULS 9021
WASHER

CODE	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
ULS8242	**M8**	8,4	24	2	200
ULS10302	**M10**	10,5	30	2,5	200
ULS13373	**M12**	13	37	3	100
ULS15443	**M14**	15	44	3	100
ULS17503	**M16**	17	50	3	100
ULS20564	**M18**	20	56	4	50
ULS22604	**M20**	22	60	4	50

* ISO 7093 differs from DIN 9021 in the surface hardness.

S235 steel - zinc plated
DIN 9021 (ISO 7093*)

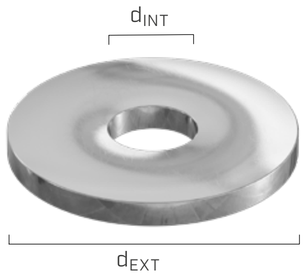


ULS 440
WASHER

CODE	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
ULS11343	**M10**	11	34	3	200
ULS13444	**M12**	13,5	44	4	200
ULS17565	**M16**	17,5	56	5	50
ULS22726	**M20**	22	72	6	50
ULS24806	**M22**	24	80	6	25

* ISO 7094 differs from DIN 440 R in the surface hardness.

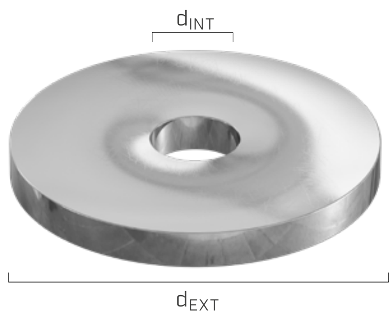
S235 steel - zinc plated
DIN 440 R (ISO 7094*)



ULS 1052
WASHER

CODE	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
ULS14586	**M12**	14	58	6	50
ULS18686	**M16**	18	68	6	50
ULS22808	**M20**	22	80	8	25
ULS25928	**M22**	25	92	8	20
ULS271058	**M24**	27	105	8	20

S235 steel - zinc plated
DIN 1052



ULS 125
WASHER

CODE	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
ULS81616	**M8**	8,4	16	1,6	1000
ULS10202	**M10**	10,5	20	2	500
ULS13242	**M12**	13	24	2,5	500
ULS17303	**M16**	17	30	3	250
ULS21373	**M20**	21	37	3	250
ULS25444	**M24**	25	44	4	200
ULS28504	**M27**	28	50	4	100
ULS31564	**M30**	31	56	4	20

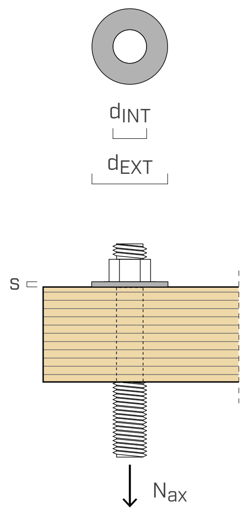
* ISO 7089 differs from DIN 125 A in the surface hardness.

S235 steel - zinc plated
DIN 125 A (ISO 7089*)

ULS WASHERS STATIC VALUES

PULL-THROUGH RESISTANCE IN THE TIMBER

rod	standard	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	CHARACTERISTIC VALUES $N_{ax,k}$ [kN]
M10	DIN 125 A	10,5	20,0	2,0	**1,71**
	DIN 9021	10,5	30,0	2,5	**4,65**
	DIN 440 R	11,0	34,0	3,0	**6,10**
	DIN 1052	-	-	-	**-**
M12	DIN 125 A	13,0	24,0	2,5	**2,40**
	DIN 9021	13,0	37,0	3,0	**7,07**
	DIN 440 R	13,5	44,0	4,0	**10,33**
	DIN 1052	14,0	58,0	6,0	**18,66**
M16	DIN 125 A	17,0	30,0	3,0	**3,60**
	DIN 9021	17,0	50,0	3,0	**13,02**
	DIN 440 R	17,5	56,0	5,0	**16,67**
	DIN 1052	18,0	68,0	6,0	**25,33**
M20	DIN 125 A	21,0	37,0	3,0	**5,47**
	DIN 9021	22,0	60,0	4,0	**18,35**
	DIN 440 R	22,0	72,0	6,0	**27,69**
	DIN 1052	22,0	80,0	8,0	**34,85**
M24	DIN 125 A	25,0	44,0	4,0	**7,72**
	DIN 9021	-	-	-	**-**
	DIN 440 R	24,0	80,0	6,0	**34,31**
	DIN 1052	27,0	105,0	8,0	**60,65**



CRITICALITY: WASHER HEAD PULL-THROUGH INTO TIMBER

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1.
- The design values are obtained from the characteristic values as follows:

$$N_{ax,d} = \frac{N_{ax,k} \cdot k_{mod}}{\gamma_M}$$

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- For the calculation process a timber density ρ_k = 385 kg/m^3 has been considered.
- The pull-through resistance of a washer is proportional to its contact surface with the timber element.

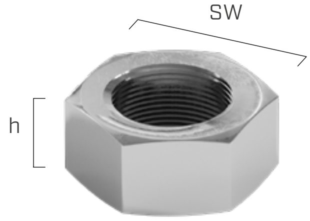
MUT 934

HEXAGONAL NUT

CODE	rod	h [mm]	SW [mm]	pcs
MUT9348	**M8**	6,5	13	400
MUT93410	**M10**	8	17	500
MUT93412	**M12**	10	19	500
MUT93414	**M14**	11	22	200
MUT93416	**M16**	13	24	200
MUT93418	**M18**	15	27	100
MUT93420	**M20**	16	30	100
MUT93422	**M22**	18	32	50
MUT93424	**M24**	19	36	50
MUT93427	**M27**	22	41	25
MUT93430	**M30**	24	46	25

* ISO 4032 differs from DIN 934 in diameters M10 and M12 for parameters h and SW and diameters M10, M12, M14 and M22.

Steel class 8 - zinc plated
DIN 934 (ISO 4032*)

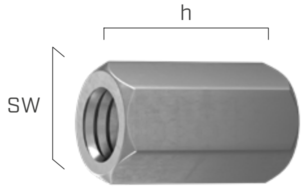


MUT 6334

CONNECTING NUT

CODE	rod	h [mm]	SW [mm]	pcs
MUT633410	**M10**	30	17	10
MUT633412	**M12**	36	19	10
MUT633416	**M16**	48	24	25
MUT633420	**M20**	60	30	10

Steel class 8 - zinc plated
DIN 6334



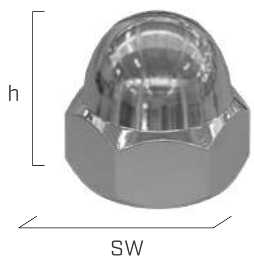
MUT 1587

BLIND NUT

CODE	rod	h [mm]	SW [mm]	pcs
MUT15878S	**M8**	15	13	200
MUT158710S	**M10**	18	17	50
MUT158712S	**M12**	22	19	50
MUT158714S	**M14**	25	22	50
MUT158716S	**M16**	28	24	50
MUT158718S	**M18**	32	27	50
MUT158720S	**M20**	34	30	25
MUT158722S	**M22**	39	32	25
MUT158724S	**M24**	42	36	25

Single-piece turned nut.

Steel class 8 - zinc plated
DIN 1587



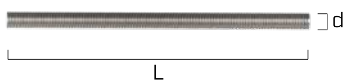
A2
AISI 304

MGS AI 975

THREADED ROD

CODE	rod	L [mm]	pcs
AI9758	**M8**	1000	1
AI97510	**M10**	1000	1
AI97512	**M12**	1000	1
AI97516	**M16**	1000	1
AI97520	**M20**	1000	1

A2 | AISI304 stainless steel
DIN 975



ULS AI 9021

A2 AISI 304

WASHER

CODE	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs
AI90218	**M8**	8,4	24	2	500
AI902110	**M10**	10,5	30	2,5	500
AI902112	**M12**	13	37	3	200
AI902116	**M16**	17	50	3	100
AI902120	**M20**	22	60	4	50

* ISO 7093 differs from DIN 9021 in the surface hardness.

A2 | AISI304 stainless steel
DIN 9021 (ISO 7093*)

MUT AI 934

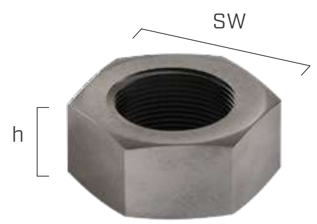
A2 AISI 304

HEXAGONAL NUT

CODE	rod	h [mm]	SW [mm]	pcs
AI9348	**M8**	6,5	13	500
AI93410	**M10**	8	16	200
AI93412	**M12**	10	18	200
AI93416	**M16**	13	24	100
AI93420	**M20**	16	30	50

* ISO 4032 differs from DIN 934 in diameters M10 and M12 for parameters h and SW.

A2 | AISI304 stainless steel
DIN 934 (ISO 4032*)



MUT AI 985

A2 AISI 304

SELF-LOCKING NUT

CODE	rod	h [mm]	SW [mm]	pcs
AI9858	**M8**	8	13	500
AI98510	**M10**	10	17	200
AI98512	**M12**	12	19	200
AI98516	**M16**	16	24	100

* ISO 10511 differs from DIN 985 in diameters M10 and M12 for parameters h and SW.

A2 | AISI304 stainless steel
DIN 985 (ISO 10511*)

MUT AI 1587

A2 AISI 304

BLIND NUT

CODE	rod	h [mm]	SW [mm]	pcs
AI158710	**M10**	18	17	100
AI158712	**M12**	22	19	100
AI158716	**M16**	28	24	50
AI158720	**M20**	34	30	25

Single-piece turned nut.

A2 | AISI304 stainless steel
DIN 1587

DBB

SURFACE CONNECTORS DIN 1052

- Surface connectors for shear connections, available in different sizes
- Circular metal elements ideal for connections with two shear planes

APPEL

TYPE A1 DOWEL - BILATERAL

EN 912

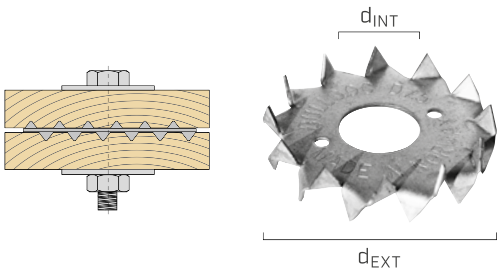
CODE	d_{EXT} [mm]	pcs
APPD80	80	1
APPD95	95	1
APPD126	126	1
APPD190	190	1

PRESS

TYPE C1 DOWEL - BILATERAL

EN 912

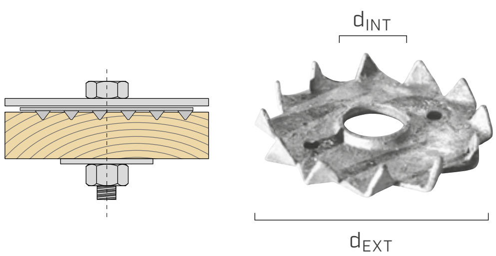
CODE	d_{EXT} [mm]	d_{INT} [mm]	s [mm]	pcs
PRESSD48	50	17	1,00	200
PRESSD62	62	21	1,20	200
PRESSD75	75	26	1,25	100
PRESSD95	95	33	1,35	40
PRESSD117	117	48	1,50	25



TYPE C2 DOWEL - MONOLATERAL

EN 912

CODE	d_{EXT} [mm]	rod	s [mm]	pcs
PRESSE48	50	M12	1,00	300
PRESSE62	62	M12	1,20	200
PRESSE75	75	M16	1,25	100
PRESSE95	95	M16	1,35	50
PRESSE117	117	M20	1,50	40

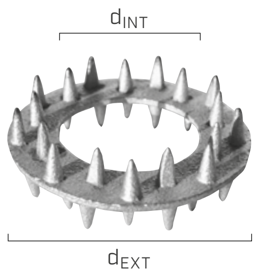


GEKA

TYPE C10 DOWEL - BILATERAL

EN 912

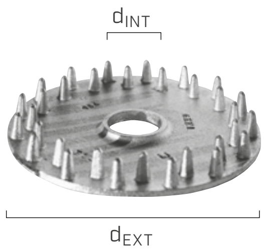
CODE	d_{EXT} [mm]	d_{INT} [mm]	s [mm]	pcs
GEKAD50	50	30,5	3,00	50
GEKAD65	65	35,5	3,00	50
GEKAD80	80	49,5	3,00	25
GEKAD95	95	65,5	3,00	25



TYPE C11 DOWEL - MONOLATERAL

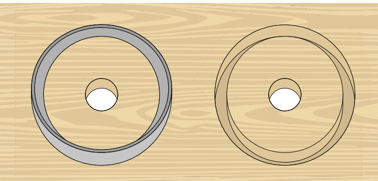
EN 912

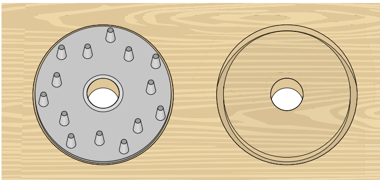
CODE	d_{EXT} [mm]	d_{INT} [mm]	rod	s [mm]	pcs
GEKAE50	50	12,5	M12	3,00	50
GEKAE65	65	16,5	M16	3,00	50
GEKAE80	80	20,5	M20	3,00	25
GEKAE95	95	24,5	M24	3,00	25



ADDITIONAL PRODUCTS

On request, a cutter for creating APPEL and GEKA notches can be supplied.





For further information please see the "Tools for timber construction" catalogue.

ZVB

HOOKS FOR BRACINGS

- Hooks, disks and tensioners for the construction of bracing systems
- Bracing rods are not supplied

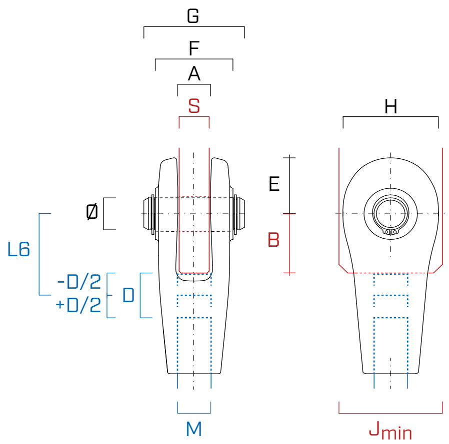
HOOK FOR BRACINGS

Spheroidal gusset GJS-400-18-LT

CODE	rod	thread*	S plate [mm]	pcs
ZVBDX10	M10	R	8	1
ZVBSX10	M10	L	8	1
ZVBDX12	M12	R	10	1
ZVBSX12	M12	L	10	1
ZVBDX16	M16	R	15	1
ZVBSX16	M16	L	15	1
ZVBDX20	M20	R	18	1
ZVBSX20	M20	L	18	1
ZVBDX24	M24	R	20	1
ZVBSX24	M24	L	20	1
ZVBDX30	M30	R	25	1
ZVBSX30	M30	L	25	1

Hook for M27 rod available upon request.
Cover for thread available upon request.

* R = right-hand thread | L = left-hand thread



	HOOK				PIN		ROD			PLATE			
	A [mm]	E [mm]	F [mm]	H [mm]	Ø [mm]	G [mm]	M [mm]	D [mm]	L6 [mm]	S [mm]	B [mm]	J_{min} [mm]	hole [mm]
M10	9,2	17,5	23,0	29,0	10	32,3	M10	16	28	8	20	35	11
M12	11,2	21,0	27,2	35,4	12	38,4	M12	18	32	10	23	41	13
M16	16,4	27,5	38,5	45,6	16	48,4	M16	22	42	15	31	52	17
M20	19,6	35,0	46,5	56,0	20	59,9	M20	28	51	18	37	62	21
M24	21,8	42,0	54,5	69,0	24	67,8	M24	36	63	20	45	75	25
M30	27,0	52,5	67,6	86,0	30	82,1	M30	44	78	25	56	93	31

DISK FOR BRACINGS

S355 carbon steel

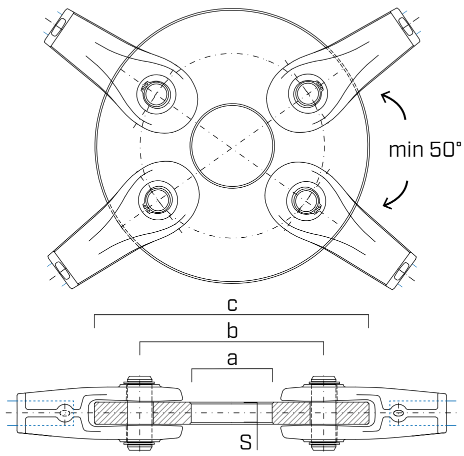
CODE	hook	holes per hook* [pcs]	pcs
ZVBDISC10	M10	2	1
ZVBDISC12	M12	2	1
ZVBDISC16	M16	2	1
ZVBDISC20	M20	2	1
ZVBDISC24	M24	2	1
ZVBDISC30	M30	2	1

* Depending on the number of hooks converging on the disk, additional holes must be provided with diameter suitable to accommodate the joining pin.

Disk for M27 hook available upon request.

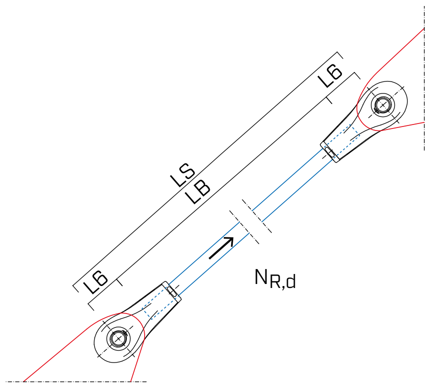
	a [mm]	b [mm]	c [mm]	S [mm]	f [mm]
M10	36	78	118	8	11
M12	42	94	140	10	13
M16	54	122	184	15	17
M20	66	150	224	18	21
M24	78	178	264	20	25
M30	98	222	334	25	31

f = hole diameter to join disk and hook



STATIC VALUES - TENSILE STRENGTH

$N_{R,d}$ FOR DIFFERENT ROD-DISK-JOINING PLATE COMBINATIONS



Rod

Hook

Plate

LS = system length

LB = rod length = LS – 2 · L6

hook for Rothoblaas bracings	disk for Rothoblaas bracings	steel rod $f_{y,k}$ [N/mm^2]	joining plate - steel *	$N_{R,d}$ [kN] M10	M12	M16	M20	M24	M30
GJS-400-18-LT	S355	≥ 540	S355	30,1	43,7	81,4	127,0	183,0	290,8
		≥ 540	S235	25,6	38,5	76,9	110,5	147,3	230,1
		≥ 355	S235	19,6	28,5	53,1	82,9	119,5	189,8
		≥ 235	S235	15,0	21,9	40,7	63,5	91,5	144,6

NOTES:

* The plate connecting the bracing system to the main structure needs to be dimensioned case by case, hence it cannot be provided by Rothoblaas.

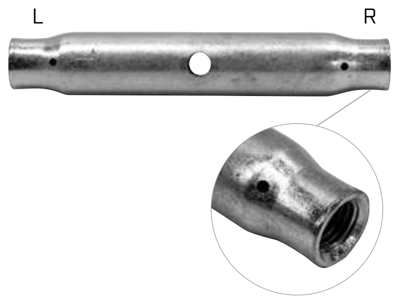
- Design values are consistent with EN 1993.
- The rod shall be dimensioned case by case.
- Dimensioning and verification of the connection between the bracing system and the main structure has to be carried out separately.

TENSIONER WITH INSPECTION HOLE

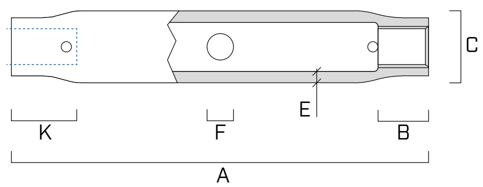
S355 bright zinc plated carbon steel
DIN 1478

CODE	rod	length [mm]	pcs
ZVBTEN12	M12	125	1
ZVBTEN16	M16	170	1
ZVBTEN20	M20	200	1
ZVBTEN24	M24	255	1
ZVBTEN27	M27	255	1
ZVBTEN30	M30	255	1

R = right-hand thread | L = left-hand thread



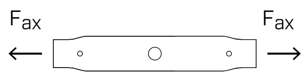
GEOMETRY OF THE TENSIONER ACCORDING TO DIN 1478



		M12	M16	M20	M24	M27*	M30
C	[mm]	25,0	30,0	33,7	42,4	42,4	51,0
F	[mm]	10	10	12	12	12	16
E	[mm]	4,0	4,5	5,0	5,6	5,6	6,3
A	[mm]	125	170	200	255	255	255
B	[mm]	15	20	24	29	40	36
K	[mm]	35	45	55	70	85	85

* size not included in DIN 1478.
K = pull-through depth of the threaded rod

STATIC VALUES - TENSILE STRENGTH



		M12	M16	M20	M24	M27	M30
$\mathbf{N_{ax,k}}$	[kN]	66,20	97,38	119,09	184,69	184,69	245,92

$N_{ax,k}$ are characteristic values according to EN 1993.
The design values are obtained from the characteristic values as follows: $N_{ax,d} = N_{ax,k} / \gamma_{M0}$

SCREWS AND NAILS FOR PLATES

SCREWS AND NAILS FOR PLATES

SCREWS AND NAILS FOR PLATES

LBA

HIGH BOND NAIL

CE ETA

ANKER NAIL
Threaded annular ring nail for improved pull-out strength.

CE MARKING
Nails with CE marking, in accordance with ETA for fastening metallic plates to timber structures.

STAINLESS STEEL
Also available in A4 | AISI316 stainless steel.

CHARACTERISTICS

FOCUS	threaded, annular ring nail
HEAD	flat
DIAMETER	4,0 | 6,0 mm
LENGTH	from 40 to 100 mm

MATERIAL
Carbon steel with bright zinc plated or A4 stainless steel.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL
- timber based panels
- fibre board and MDF panels

Service classes 1 and 2.

CODES AND DIMENSIONS

LBA

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
4	**LBA440**	40	30	250
	LBA450	50	40	250
	LBA460	60	50	250
	LBA475	75	60	250
	LBA4100	100	80	250
6	**LBA660**	60	50	250
	LBA680	80	70	250
	LBA6100	100	80	250

LBAI A4 | AISI316

A4 AISI 316

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
4	**LBAI450**	50	40	250

MATERIAL AND DURABILITY

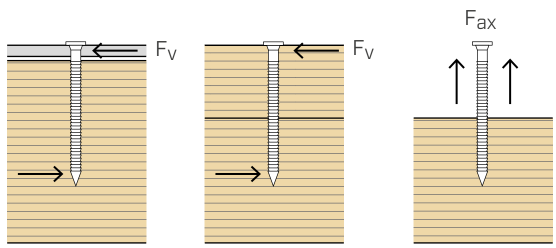
LBA: bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

LBAI: A4 stainless steel (V4A).
To be used in service classes 1, 2 and 3 (EN 1995-1-1).

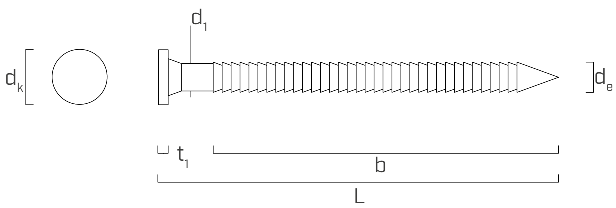
FIELD OF USE

- Steel-to-timber joints
- Timber-to-timber joints

EXTERNAL LOADS



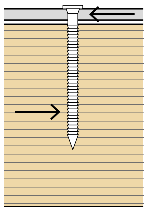
GEOMETRY AND MECHANICAL CHARACTERISTICS | LBA

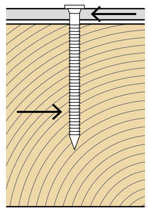


Nominal diameter	**d_1**	**[mm]**	**4**	**6**
Head diameter	d_k	[mm]	8,00	12,00
External diameter	d_e	[mm]	4,40	6,65
Head thickness	t_1	[mm]	1,40	2,00
Pre-drilling hole diameter	d_V	[mm]	3,0	4,5
Characteristic yield moment	$M_{y,k}$	[Nmm]	6500	19000
Characteristic withdrawal-resistance parameter	$f_{ax,k}$	[N/mm^2]	7,5	7,5
Characteristic tensile strength	$f_{tens,k}$	[kN]	6,9	11,4

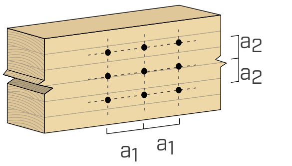
MINIMUM DISTANCES FOR NAILS SUBJECT TO SHEAR | STEEL-TO-TIMBER JOINTS[1]

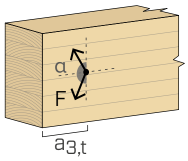
NAILS INSERTED WITHOUT PRE-DRILLING HOLE

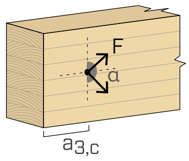


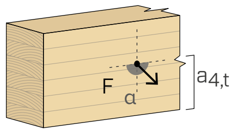


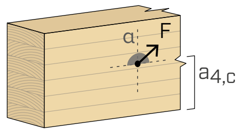
		Load-to-grain angle α = 0°		Load-to-grain angle α = 90°	
d_1	[mm]	4	6	4	6
a_1	[mm]	28	50	14	21
a_2	[mm]	14	21	14	21
$a_{3,t}$	[mm]	60	90	40	60
$a_{3,c}$	[mm]	40	60	40	60
$a_{4,t}$	[mm]	20	30	28	60
$a_{4,c}$	[mm]	20	30	20	30





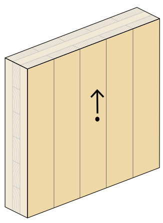


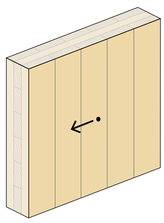




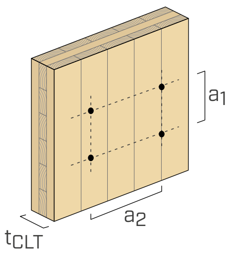
MINIMUM DISTANCES FOR NAILS SUBJECT TO SHEAR | CLT[2]

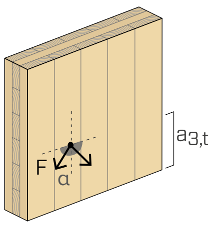
NAILS INSERTED WITHOUT PRE-DRILLING HOLE | LATERAL FACE [3]

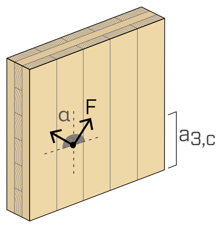


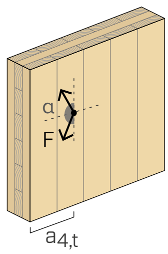


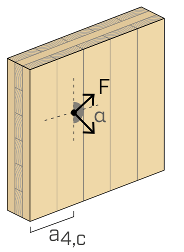
		Load-to-grain angle (4) α = 0°		Load-to-grain angle (4) α = 90°	
d_1	[mm]	4	6	4	6
a_1	[mm]	24	36	12	18
a_2	[mm]	12	18	12	18
$a_{3,t}$	[mm]	40	60	28	42
$a_{3,c}$	[mm]	24	36	24	36
$a_{4,t}$	[mm]	12	18	28	42
$a_{4,c}$	[mm]	12	18	12	18











NOTES:

(1) The minimum distances are compliant with EN 1995-1-1, according to ETA, considering a wood characteristic density of $\rho_k \leq 420\ kg/m^3$ and calculation diameter of d = nominal nail diameter.

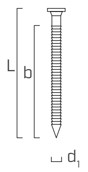
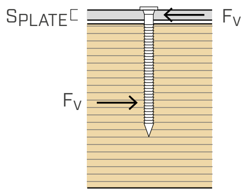
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) can be multiplied by a coefficient of 1,5.

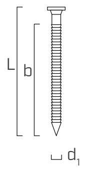
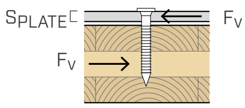
(2) The minimum distances are compliant with national specification ÖNORM EN 1995-1-1 - Annex K and are to be considered valid unless otherwise specified in the technical documents for the CLT panels.

(3) CLT panel minimum thickness $t_{CLT,min} = 10 \cdot d$ - single layer minimum thickness t_i = 9 mm.

(4) Angle between force and direction of the grain of the CLT panel outer layer.

STATIC VALUES | STEEL-TO-TIMBER SHEAR JOINT[1]

geometry of the nail			steel-to-timber[2]						
									
d_1 [mm]	L [mm]	b [mm]	$R_{v,k}$ [kN]						
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm
4	**40**	30	1,89	1,88	1,86	1,85	1,83	1,80	1,78
	50	40	2,21	2,21	2,21	2,21	2,21	2,21	2,18
	60	50	2,36	2,36	2,36	2,36	2,36	2,36	2,36
	75	60	2,51	2,51	2,51	2,51	2,51	2,51	2,51
	100	80	2,81	2,81	2,81	2,81	2,81	2,81	2,81
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm
6	**60**	50	3,96	3,92	3,89	3,86	3,79	3,73	3,62
	80	70	4,75	4,75	4,75	4,75	4,75	4,75	4,71
	100	80	4,98	4,98	4,98	4,98	4,98	4,98	4,98

geometry of the nail			steel-to-CLT[3]						
									
d_1 [mm]	L [mm]	b [mm]	$R_{v,k}$ [kN]						
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm
4	**40**	30	2,23	2,23	2,23	2,23	2,23	2,19	2,15
	50	40	2,30	2,30	2,30	2,30	2,30	2,30	2,30
	60	50	2,36	2,36	2,36	2,36	2,36	2,36	2,36
	75	60	2,43	2,43	2,43	2,43	2,43	2,43	2,43
	100	80	2,55	2,55	2,55	2,55	2,55	2,55	2,55
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm
6	**60**	50	4,35	4,35	4,34	4,29	4,18	4,08	3,96
	80	70	4,55	4,55	4,55	4,55	4,55	4,55	4,53
	100	80	4,66	4,66	4,66	4,66	4,66	4,66	4,66

NOTES:

(1) The characteristic shear-strength value for LBA Ø4 nails has been evaluated assuming a plate thickness = S_{PLATE}, always considering the case of thick plate according to ETA ($S_{PLATE} \geq 1,5$ mm).

The characteristic shear-strength value for LBA Ø6 nails has been evaluated assuming a plate thickness = S_{PLATE} , always considering the case of thick plate according to ETA ($S_{PLATE} \geq 3,0$ mm).

(2) The characteristic values for the steel-wood joint are according to EN 1995-1-1 according to ETA and valid for solid timber and glulam (softwood).

(3) The characteristic values for the steel-CLT joint are according to EN 1995-1-1 according to the national ÖNORM EN 1995 - Annex K specifications, to be considered valid unless otherwise specified in the technical documents of the CLT panels.

The table values are valid for CLT panels with minimum thickness $t_{CLT,min}$ = 10·d and with minimum thickness of the single layer t_i = 9 mm.

GENERAL PRINCIPLES:

- The design values are obtained from the characteristic values as follows:

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

  The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- For the mechanical strength values and the geometry of the nails, reference was made to ETA.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered.
- The values in the table are independent of the load-to-grain angle.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- The shear characteristic resistances are calculated for nails inserted without pre-drilling holes. In the case of nails inserted with pre-drilling holes, greater resistance values can be obtained.
- For further details please see the "Screws and connectors for timber" catalogue available on www.rothoblaas.com.

LBS

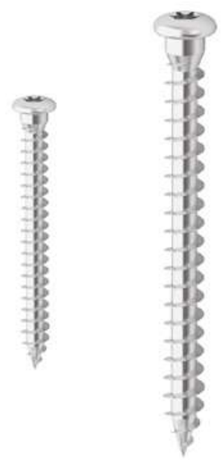
BIT INCLUDED　ETA 11/0030

ROUND HEAD SCREW FOR PLATES

SCREW FOR PERFORATED PLATES
Cylindrical shoulder designed for fastening metal elements. Achieves an interlocking effect with the hole in the plate, thus guaranteeing excellent static performance.

STATICS
Can be calculated according to Eurocode 5 under thick plate timber-to-steel connections, even with thin metal elements.
Excellent shear strength values.

DUCTILITY
The bending angle is 20° greater than standard, certified according to ETA 11/0030. Cyclical SEISMIC-REV tests according to EN 12512.



CHARACTERISTICS

FOCUS	screw for perforated plates
HEAD	round with cylindrical underhead
DIAMETER	5,0 | 7,0 mm
LENGTH	from 25 to 100 mm

MATERIAL
Bright zinc plated carbon steel.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL
- timber based panels
- high density woods

Service classes 1 and 2.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5 TX 20	LBS525	25	21	500
	LBS540	40	36	500
	LBS550	50	46	200
	LBS560	60	56	200
	LBS570	70	66	200

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
7 TX 30	LBS760	60	55	100
	LBS780	80	75	100
	LBS7100	100	95	100

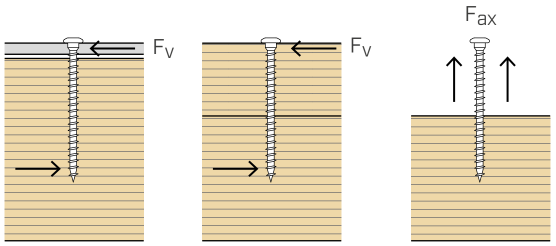
MATERIAL AND DURABILITY

LBS: bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

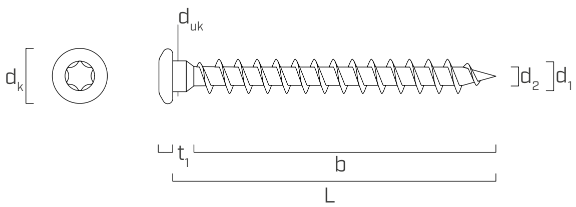
FIELD OF USE

- Steel-to-timber joints
- Timber-to-timber joints

EXTERNAL LOADS



GEOMETRY AND MECHANICAL CHARACTERISTICS

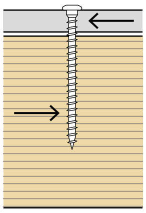


Nominal diameter	d_1	[mm]	5	7
Head diameter	d_k	[mm]	7,80	11,00
Tip diameter	d_2	[mm]	3,00	4,40
Underhead diameter	d_{uk}	[mm]	4,90	7,00
Head thickness	t_1	[mm]	2,40	3,50
Pre-drilling hole diameter	d_V	[mm]	3,0	4,0
Characteristic yield moment	$M_{y,k}$	[Nm]	5,4	14,2
Characteristic withdrawal-resistance parameter*	$f_{ax,k}$	[N/mm^2]	11,7	11,7
Associated density	ρ_a	[kg/m^3]	350	350
Characteristic head-pull-through parameter*	$f_{head,k}$	[N/mm^2]	10,5	10,5
Associated density	ρ_a	[kg/m^3]	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	7,9	15,4

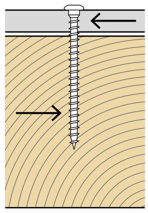
* Valid for softwood - maximum density 440 kg/m^3.
For applications with different materials (e.g. LVL) or with high density please see ETA-11/0030.

MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER JOINTS[1]

SCREWS INSERTED WITHOUT PRE-DRILLING HOLE

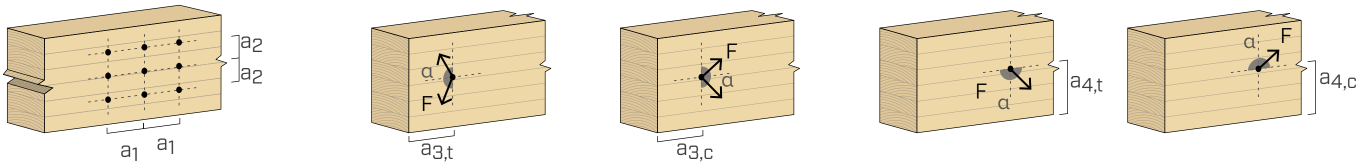


Load-to-grain angle α = 0°



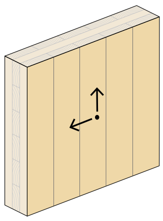
Load-to-grain angle α = 90°

		Load-to-grain angle α = 0°		Load-to-grain angle α = 90°	
d_1	[mm]	5	7	5	7
a_1	[mm]	42	59	18	25
a_2	[mm]	18	25	18	25
$a_{3,t}$	[mm]	75	105	50	70
$a_{3,c}$	[mm]	50	70	50	70
$a_{4,t}$	[mm]	25	35	50	70
$a_{4,c}$	[mm]	25	35	25	35

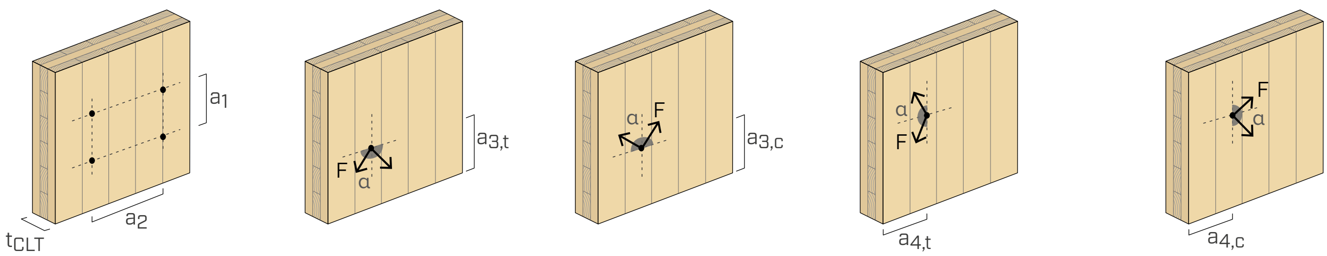


MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT[2]

SCREWS INSERTED WITHOUT PRE-DRILLING HOLE | LATERAL FACE[3]



d_1	[mm]	5	7
a_1	[mm]	20	28
a_2	[mm]	13	18
$a_{3,t}$	[mm]	30	42
$a_{3,c}$	[mm]	30	42
$a_{4,t}$	[mm]	30	42
$a_{4,c}$	[mm]	13	18



NOTES:

(1) The minimum distances are compliant with EN 1995-1-1, according to ETA-11/0030, considering a wood characteristic density of $\rho_k \leq 420$ kg/m^3 and calculation diameter of d = nominal screw diameter.

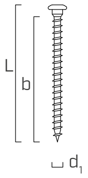
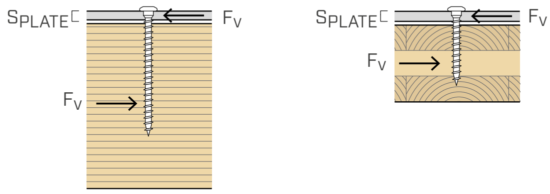
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) can be multiplied by a coefficient of 1,5.

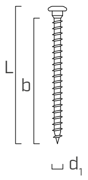
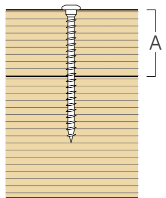
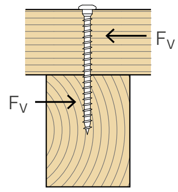
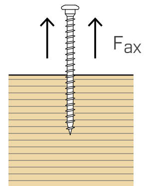
(2) The minimum distances are compliant with ETA-11/0030 and are to be considered valid unless otherwise specified in the technical documents for the CLT panels.

- The minimum distances are independent of the load-to-grain angle.

(3) Minimum CLT thickness $t_{CLT,min} = 10 \cdot d_1$.

STATIC VALUES

screw geometry			steel-to-timber shear(1)						
									
d_1 [mm]	L [mm]	b [mm]	$R_{v,k}$ [kN]						
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm
5	25	21	1,48	1,47	1,45	-	-	-	-
	40	36	2,12	2,12	2,10	2,09	2,05	-	-
	50	46	2,26	2,26	2,26	2,26	2,26	2,25	2,23
	60	56	2,41	2,41	2,41	2,41	2,41	2,39	2,38
	70	66	2,56	2,56	2,56	2,56	2,56	2,54	2,53
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm
7	60	55	2,55	2,73	3,13	3,53	3,86	3,74	3,62
	80	75	3,45	3,55	3,82	4,10	4,38	4,33	4,29
	100	95	4,00	4,12	4,36	4,58	4,79	4,74	4,70

screw geometry			timber-to-timber shear		tension(2)
					
d_1 [mm]	L [mm]	b [mm]	A [mm]	$R_{v,k}$ [kN]	$R_{ax,k}$ [kN]
5	25	21	-	-	1,23
	40	36	15	0,93	2,11
	50	46	20	1,04	2,69
	60	56	25	1,15	3,28
	70	66	30	1,27	3,86
7	60	55	25	1,74	4,50
	80	75	35	2,09	6,14
	100	95	45	2,37	7,78

NOTES:

(1) The characteristic shear-strength value for LBS Ø5 nails has been evaluated assuming a plate thickness = S_{PLATE}, always considering the case of thick plate according to ETA-11/0030 ($S_{PLATE} \geq 1{,}5$ mm).

The characteristic shear-strength value for LBS Ø7 screws has been evaluated assuming a plate thickness = S_{PLATE} , and considering the thin ($S_{PLATE} \leq 0{,}5\ d_1$), intermediate ($0{,}5\ d_1 < S_{PLATE} < d_1$) or thick ($S_{PLATE} \geq d_1$) plate case scenario.

(2) The axial thread withdrawal resistance was calculated considering a 90° angle between the grain and the connector and for a fixing length of b.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0030.
- The design values are obtained from the characteristic values as follows:

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

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- For the calculation process a timber density ρk = 350 kg/m^3 has been considered.
- The values in the table are also valid for application on CLT (minimum panel thickness $t_{CLT,min} = 10 \cdot d_1$).
- The values in the table are independent of the load-to-grain angle.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- The shear characteristic resistances are calculated for screws inserted without pre-drilling holes. In the case of screws inserted with pre-drilling holes, greater resistance values can be obtained.
- For further details please see the "Screws and connectors for timber" catalogue available on www.rothoblaas.com.

HBS PLATE

PAN HEAD SCREW FOR PLATES

BIT INCLUDED | MY PROJECT SOFTWARE | CE ETA 11/0030

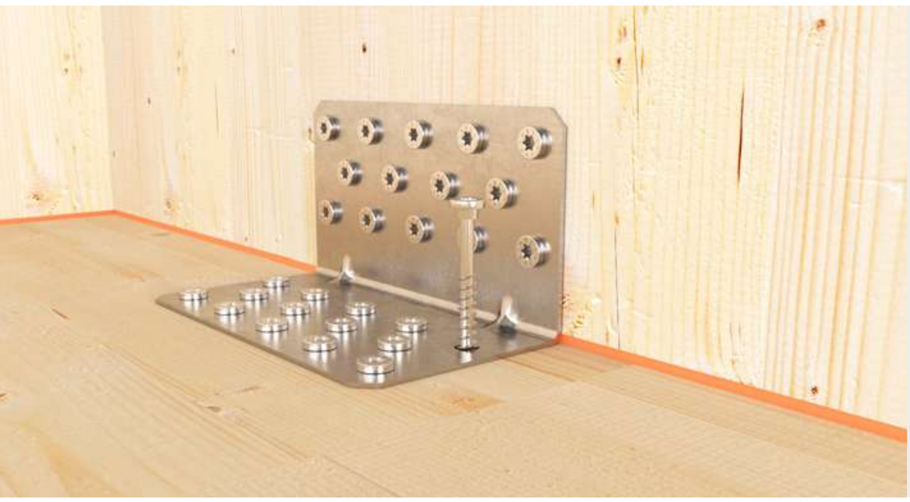
HBSP
Designed for steel-to-timber joints: the head has a shoulder and the thickness is increased for completely safe, reliable fastening plates to the timber.

PLATE FASTENING
The under-head shoulder achieves an interlocking effect with the circular hole in the plate, thus guaranteeing excellent static performance.

LONGER THREAD
Increased thread length for excellent shear strength and tensile strength in steel-to-timber joints. Values higher than ordinary.

CHARACTERISTICS

FOCUS	steel-to-timber joints
HEAD	shoulder for plate
DIAMETER	from 8,0 to 12,0 mm
LENGTH	from 80 to 200 mm



MATERIAL
Bright zinc plated carbon steel.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL
- timber based panels
- high density woods

Service classes 1 and 2.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A_p [mm]	pcs
8 TX 40	**HBSP880**	80	55	1,0 ÷ 15,0	100
	HBSP8100	100	75	1,0 ÷ 15,0	100
	HBSP8120	120	95	1,0 ÷ 15,0	100
	HBSP8140	140	110	1,0 ÷ 20,0	100
	HBSP8160	160	130	1,0 ÷ 20,0	100
10 TX 40	**HBSP10100**	100	75	1,0 ÷ 15,0	50
	HBSP10120	120	95	1,0 ÷ 15,0	50
	HBSP10140	140	110	1,0 ÷ 20,0	50
	HBSP10160	160	130	1,0 ÷ 20,0	50
	HBSP10180	180	150	1,0 ÷ 20,0	50

d_1 [mm]	CODE	L [mm]	b [mm]	A_p [mm]	pcs
12 TX 50	**HBSP12120**	120	90	1,0 ÷ 20,0	25
	HBSP12140	140	110	1,0 ÷ 20,0	25
	HBSP12160	160	120	1,0 ÷ 30,0	25
	HBSP12180	180	140	1,0 ÷ 30,0	25
	HBSP12200	200	160	1,0 ÷ 30,0	25

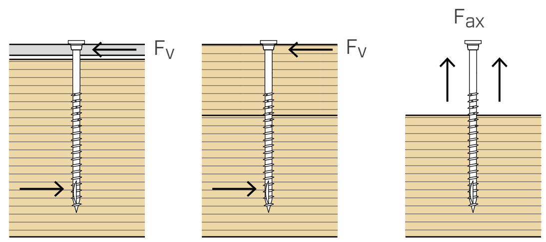
MATERIAL AND DURABILITY

HBS PLATE: bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

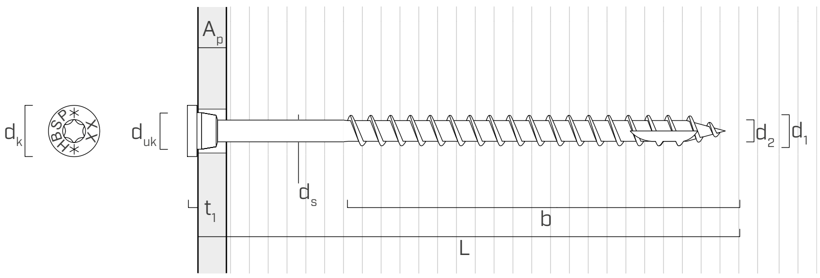
FIELD OF USE

- Steel-to-timber joints
- Timber-to-timber joints

EXTERNAL LOADS



GEOMETRY AND MECHANICAL CHARACTERISTICS



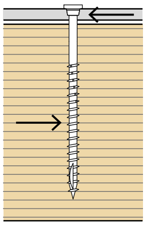
Nominal diameter	d_1	**[mm]**	**8**	**10**	**12**
Head diameter	d_k	[mm]	14,50	18,25	20,75
Tip diameter	d_2	[mm]	5,40	6,40	6,80
Shank diameter	d_s	[mm]	5,80	7,00	8,00
Head thickness	t_1	[mm]	3,40	4,35	5,00
Underhead diameter	d_{uk}	[mm]	10,00	12,00	14,00
Pre-drilling hole diameter	d_V	[mm]	5,0	6,0	7,0
Characteristic yield moment	$M_{y,k}$	[Nm]	20,1	35,8	48,0
Characteristic withdrawal-resistance parameter*	$f_{ax,k}$	[N/mm^2]	11,7	11,7	11,7
Associated density	ρ_a	[kg/m^3]	350	350	350
Characteristic head-pull-through parameter*	$f_{head,k}$	[N/mm^2]	10,5	10,5	10,5
Associated density	ρ_a	[kg/m^3]	350	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	20,1	31,4	33,9

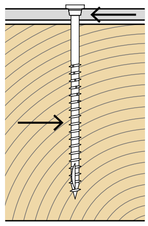
* Valid for softwood - maximum density 440 kg/m^3.

For applications with different materials (e.g. LVL) or with high density please see ETA-11/0030.

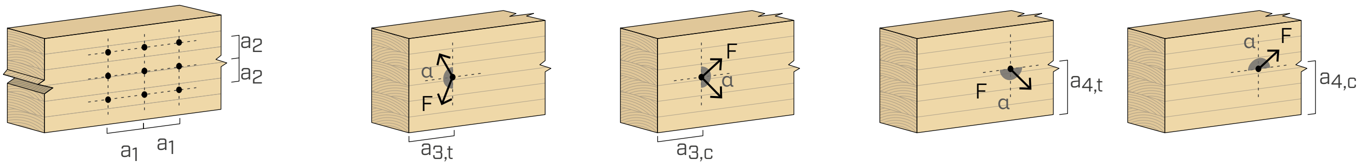
MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER JOINTS[1]

SCREWS INSERTED WITHOUT PRE-DRILLING HOLE



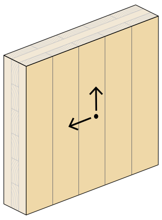


		Load-to-grain angle α = 0°			Load-to-grain angle α = 90°		
d_1	[mm]	8	10	12	8	10	12
a_1	[mm]	67	84	101	28	35	42
a_2	[mm]	28	35	42	28	35	42
$a_{3,t}$	[mm]	120	150	180	80	100	120
$a_{3,c}$	[mm]	80	100	120	80	100	120
$a_{4,t}$	[mm]	40	50	60	80	100	120
$a_{4,c}$	[mm]	40	50	60	40	50	60

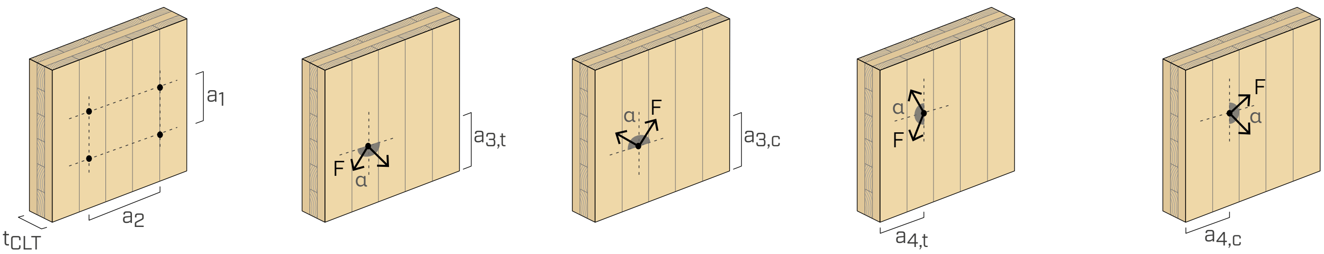


MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT[2]

SCREWS INSERTED WITHOUT PRE-DRILLING HOLE | LATERAL FACE[3]



d_1	[mm]	8	10	12
a_1	[mm]	32	40	48
a_2	[mm]	20	25	30
$a_{3,t}$	[mm]	48	60	72
$a_{3,c}$	[mm]	48	60	72
$a_{4,t}$	[mm]	48	60	72
$a_{4,c}$	[mm]	20	25	30



NOTES:

[1] The minimum distances are compliant with EN 1995-1-1, according to ETA, considering a wood characteristic density of $\rho_k \leq 420$ kg/m^3 and calculation diameter of d = nominal screw diameter.

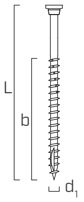
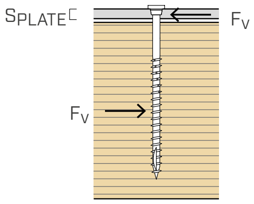
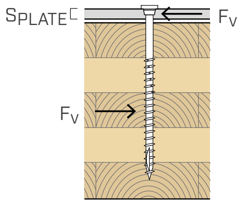
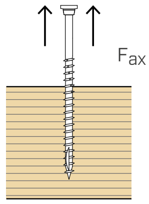
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) can be multiplied by a coefficient of 1,5.

[2] The minimum distances are compliant with ETA-11/0030 and are to be considered valid unless otherwise specified in the technical documents for the CLT panels.

- The minimum distances are independent of the load-to-grain angle.

[3] Minimum CLT thickness $t_{CLT,min} = 10 \cdot d_1$.

STATIC VALUES

screw geometry			steel-to-timber shear(1)						withdrawal
									
d_1 [mm]	L [mm]	b [mm]	$R_{v,k}$ [kN]						$R_{ax,k}$ (2) [kN]
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	
8	**80**	55	3,79	3,74	3,99	4,27	4,90	4,90	5,15
	100	75	4,31	4,31	4,58	4,84	5,37	5,37	7,02
	120	95	4,78	4,78	5,05	5,31	5,84	5,84	8,89
	140	110	5,12	5,12	5,38	5,65	6,19	6,19	10,30
	160	130	5,12	5,12	5,50	5,89	6,66	6,66	12,17
	S_{PLATE}		4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm	
10	**100**	75	5,52	5,47	5,81	6,57	7,41	7,41	8,78
	120	95	6,47	6,47	6,78	7,38	8,00	8,00	11,12
	140	110	6,91	6,91	7,21	7,83	8,44	8,44	12,87
	160	130	7,38	7,38	7,71	8,37	9,02	9,02	15,21
	180	150	7,38	7,38	7,83	8,72	9,61	9,61	17,55
	S_{PLATE}		5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm	15,0 mm	
12	**120**	90	7,52	7,45	8,08	8,80	9,60	9,60	12,64
	140	110	8,42	8,42	9,04	9,67	10,30	10,30	15,44
	160	120	8,77	8,77	9,40	10,02	10,65	10,65	16,85
	180	140	9,11	9,11	9,86	10,61	11,36	11,36	19,66
	200	160	9,11	9,11	10,09	11,08	12,06	12,06	22,46

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0030.
- The design values are obtained from the characteristic values as follows:

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

  The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- For the calculation process a timber density ρk = 350 kg/m^3 has been considered.
- The values in the table are also valid for application on CLT (minimum panel thickness $t_{CLT,min} = 10 \cdot d_1$).
- The values in the table are independent of the load-to-grain angle.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- The shear characteristic resistances are calculated for screws inserted without pre-drilling holes. In the case of screws inserted with pre-drilling holes, greater resistance values can be obtained.
- For different calculation configurations, the MyProject software is available (www.rothoblaas.com).
- For further details please see the "Screws and connectors for timber" catalogue available on www.rothoblaas.com.

NOTES:

(1) The characteristic shear-strength value for HBS PLATE screws has been evaluated assuming a plate thickness = S_{PLATE} , and considering the thin ($S_{PLATE} \leq 0,5\ d_1$), intermediate ($0,5\ d_1 < S_{PLATE} < d_1$) or thick ($S_{PLATE} \geq d_1$) plate case scenario.

(2) The axial thread withdrawal resistance was calculated considering a 90° angle between the grain and the connector and for a fixing length of b.

In the case of steel-wood connections, generally the steel tensile strength is binding with respect to head separation or pull-through.

HBS PLATE EVO

BIT INCLUDED | MY PROJECT SOFTWARE | C4 EVO COATING | ETA 11/0030

PAN HEAD SCREW

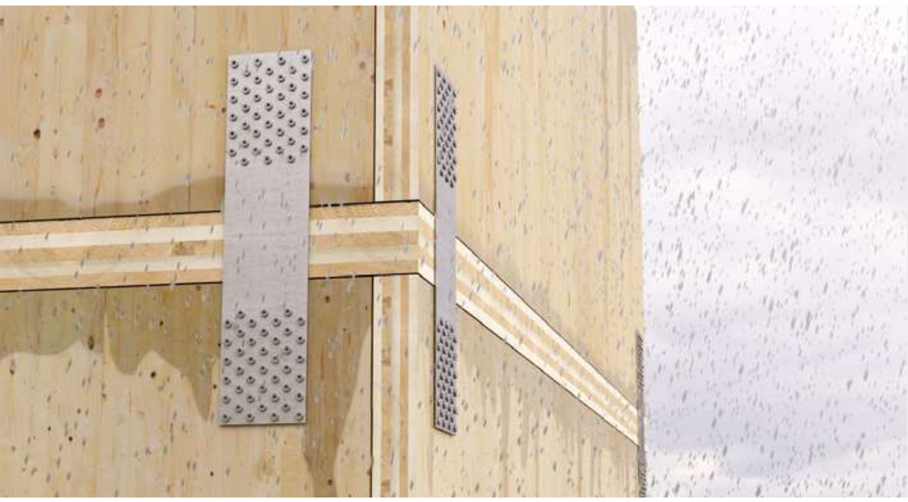
HBS PLATE EVO
Designed for outdoor steel-to-timber joints: the thickness of the shoulder screw is increased for completely safe, reliable fastening plates to the timber. The small sizes (5,0 and 6,0 mm) are also ideal for timber-to-timber joints.

C4 EVO COATING
20 μm multilayer coating with a surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure testing according to ISO 9227. Can be used in service class 3 outdoor applications and under class C4 atmospheric corrosion conditions.

AGGRESSIVE WOODS
Ideal for applications with woods containing tannin or treated with impregnating agents or other chemical processes.

CHARACTERISTICS

FOCUS	C4 corrosion class
HEAD	shoulder for plate
DIAMETER	from 5,0 to 10,0 mm
LENGTH	from 40 to 180 mm



MATERIAL
Carbon steel, with a 20 μm coating, highly resistant to corrosion.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL
- timber based panels
- high density woods
- aggressive woods (containing tannin)
- chemically treated woods

Service classes 1, 2 and 3.

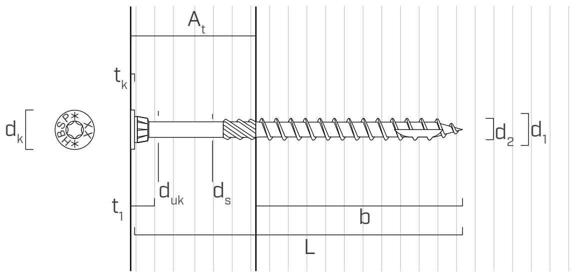
CODES AND DIMENSIONS

d1 [mm]	CODE	L [mm]	b [mm]	A_t [mm]	A_p [mm]	pcs
5 TX 25	**HBSPEVO550**	50	30	20	1,0 ÷ 10,0	200
	HBSPEVO560	60	35	25	1,0 ÷ 10,0	200
	HBSPEVO570	70	40	30	1,0 ÷ 10,0	100
	HBSPEVO580	80	50	30	1,0 ÷ 10,0	100
6 TX 30	**HBSPEVO680**	80	50	30	1,0 ÷ 10,0	100
	HBSPEVO690	90	55	35	1,0 ÷ 10,0	100
8 TX 40	**HBSPEVO840**	40	32	-	1,0 ÷ 15,0	100
	HBSPEVO860	60	52	-	1,0 ÷ 15,0	100
	HBSPEVO880	80	55	-	1,0 ÷ 15,0	100
	HBSPEVO8100	100	75	-	1,0 ÷ 15,0	100

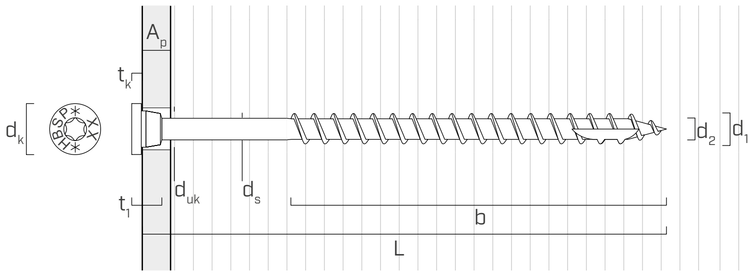
d1 [mm]	CODE	L [mm]	b [mm]	A_p [mm]	pcs
8 TX 40	**HBSPEVO8120**	120	95	1,0 ÷ 15,0	100
	HBSPEVO8140	140	110	1,0 ÷ 20,0	100
	HBSPEVO8160	160	130	1,0 ÷ 20,0	100
10 TX 40	**HBSPEVO1060**	60	52	1,0 ÷ 15,0	50
	HBSPEVO1080	80	60	1,0 ÷ 15,0	50
	HBSPEVO10100	100	75	1,0 ÷ 15,0	50
	HBSPEVO10120	120	95	1,0 ÷ 15,0	50
	HBSPEVO10140	140	110	1,0 ÷ 20,0	50
	HBSPEVO10160	160	130	1,0 ÷ 20,0	50
	HBSPEVO10180	180	150	1,0 ÷ 20,0	50

For further details please see the "Screws and connectors for timber" catalogue.

GEOMETRY AND MECHANICAL CHARACTERISTICS



HBS P EVO - 5,0 | 6,0 mm



HBS P EVO - 8,0 | 10,0 mm

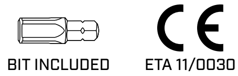
Nominal diameter	d_1	**[mm]**	**5**	**6**	**8**	**10**
Head diameter	d_k	[mm]	9,65	12,00	14,50	18,25
Tip diameter	d_2	[mm]	3,40	3,95	5,40	6,40
Shank diameter	d_s	[mm]	3,65	4,30	5,80	7,00
Head thickness	t_1	[mm]	5,50	6,50	8,00	10,00
Washer thickness	t_k	[mm]	1,00	1,50	3,40	4,35
Underhead diameter	d_{uk}	[mm]	6,0	8,0	10,00	12,00
Pre-drilling hole diameter	d_v	[mm]	3,0	4,0	5,0	6,0
Characteristic yield moment	$M_{y,k}$	[Nm]	5,4	9,5	20,1	35,8
Characteristic withdrawal-resistance parameter*	$f_{ax,k}$	[N/mm²]	11,7	11,7	11,7	11,7
Associated density	ρ_a	[kg/m³]	350	350	350	350
Characteristic head-pull-through parameter*	$f_{head,k}$	[N/mm²]	10,5	10,5	10,5	10,5
Associated density	ρ_a	[kg/m³]	350	350	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	7,9	11,3	20,1	31,4

* Valid for softwood - maximum density 440 kg/m³.

For applications with different materials (e.g. LVL) or with high density please see ETA-11/0030.

KKF AISI410

PAN HEAD SCREW



PAN HEAD
The flat under-head accompanies absorption of the shavings, preventing the wood from cracking and thus ensuring excellent surface finish.

LONGER THREAD
Special asymmetric "umbrella" thread with increased length (60%) for higher grip. Fine thread for the utmost precision when tightening is complete.

AISI410
Martensitic stainless steel with an excellent balance between mechanical resistance and corrosion resistance. Can be inserted without requiring a pre-drill.

CHARACTERISTICS

FOCUS	excellent versatility of use
HEAD	pan head
DIAMETER	from 4,0 to 6,0 mm
LENGTH	from 20 to 120 mm

MATERIAL
AISI410 martensitic stainless steel.

FIELDS OF USE
Ideal for outdoor use in combination with DISC FLAT A2, LOCK T EVO and TERRALOCK PP products.

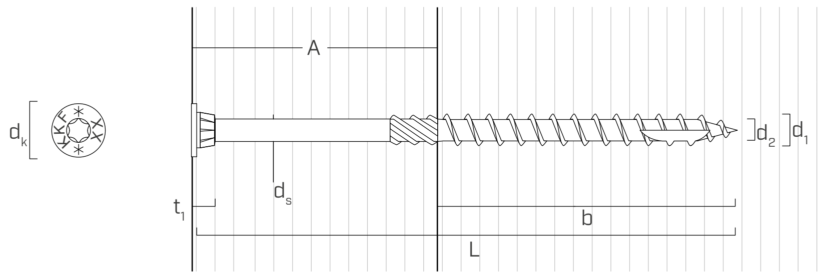
CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
4 TX 20	**KKF430**	30	18	12	500
	KKF435	35	20	15	500
	KKF440	40	24	16	500
	KKF445	45	30	15	200
	KKF450	50	30	20	200
4.5 TX 20	**KKF4520**	20	15	5	200
	KKF4540	40	24	16	200
	KKF4545	45	30	15	200
	KKF4550	50	30	20	200
	KKF4560	60	35	25	200
	KKF4570	70	40	30	200

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
5 TX 25	**KKF540**	40	24	16	200
	KKF550	50	30	20	200
	KKF560	60	35	25	200
	KKF570	70	40	30	100
	KKF580	80	50	30	100
	KKF590	90	55	35	100
	KKF5100	100	60	40	100
6 TX 30	**KKF680**	80	50	30	100
	KKF6100	100	60	40	100
	KKF6120	120	75	45	100

For further details please see the "Screws and connectors for timber" catalogue.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	**[mm]**	**4**	**4.5**	**5**	**6**
Head diameter	d_k	[mm]	7,70	8,70	9,65	11,65
Tip diameter	d_2	[mm]	2,60	3,05	3,25	4,05
Shank diameter	d_s	[mm]	2,90	3,35	3,60	4,30
Head thickness	t_1	[mm]	5,00	5,00	5,70	7,00
Pre-drilling hole diameter	d_V	[mm]	2,5	2,5	3,0	4,0
Characteristic yield moment	$M_{y,k}$	[Nm]	3,0	4,1	5,4	9,5
Characteristic withdrawal-resistance parameter*	$f_{ax,k}$	[N/mm^2]	11,7	11,7	11,7	11,7
Associated density	ρ_a	[kg/m^3]	350	350	350	350
Characteristic head-pull-through parameter*	$f_{head,k}$	[N/mm^2]	16,5	16,5	16,5	16,5
Associated density	ρ_a	[kg/m^3]	350	350	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	5,0	6,4	7,9	11,3

* Valid for softwood - maximum density 440 kg/m^3.

For applications with different materials (e.g. LVL) or with high density please see ETA-11/0030.

VGS

BIT INCLUDED

MY PROJECT SOFTWARE

ETA 11/0030

FULL THREAD SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD

TENSION

Deep thread and high resistance steel ($f_{y,k}$ = 1000 N/mm^2) for excellent tensile performance. Approved for structural applications subject to stresses in any direction vs. the grain (α = 0° - 90°).

COUNTERSUNK OR HEXAGONAL HEAD

Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements. Hexagonal head L > 600 mm to facilitate gripping with screwdriver.

CHROMIUM (VI) FREE

Total absence of hexavalent chromium. Compliance with the strictest regulations governing chemical substances (SVHC).
REACH information available.

9,0 | 11,0 | 13,0 mm L ≤ 600 mm

13,0 mm L > 600 mm

CHARACTERISTICS

FOCUS	45° connections, lifting and reinforcements
HEAD	countersunk with ribs for L ≤ 600 mm hexagonal for L > 600 mm
DIAMETER	9,0 | 11,0 | 13,0 mm
LENGTH	from 100 to 1200 mm

MATERIAL

Bright zinc plated carbon steel.

FIELDS OF USE

- solid timber and glulam
- CLT, LVL
- timber based panels
- high density woods

Service classes 1 and 2.

CODES AND DIMENSIONS

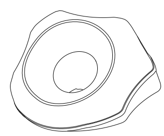
d_1 [mm]	CODE	L [mm]	b [mm]	pcs
9 TX 40	**VGS9100**	100	90	25
	VGS9120	120	110	25
	VGS9140	140	130	25
	VGS9160	160	150	25
	VGS9180	180	170	25
	VGS9200	200	190	25
	VGS9220	220	210	25
	VGS9240	240	230	25
	VGS9260	260	250	25
	VGS9280	280	270	25
	VGS9300	300	290	25
	VGS9320	320	310	25
	VGS9340	340	330	25
	VGS9360	360	350	25
	VGS9380	380	370	25
	VGS9400	400	390	25
	VGS9440	440	430	25
	VGS9480	480	470	25
	VGS9520	520	510	25
11 TX 50	**VGS11100**	100	90	25
	VGS11125	125	115	25
	VGS11150	150	140	25
	VGS11175	175	165	25
	VGS11200	200	190	25
	VGS11225	225	215	25
	VGS11250	250	240	25

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
11 TX 50	**VGS11275**	275	265	25
	VGS11300	300	290	25
	VGS11325	325	315	25
	VGS11350	350	340	25
	VGS11375	375	365	25
	VGS11400	400	390	25
	VGS11450	450	440	25
	VGS11500	500	490	25
	VGS11550	550	540	25
	VGS11600	600	590	25
	VGS11700	700	690	25
	VGS11800	800	790	25
13 TX 50	**VGS13100** (NO RIBS)	100	90	25
	VGS13150 (NO RIBS)	150	140	25
	VGS13200 (NO RIBS)	200	190	25
	VGS13300	300	280	25
	VGS13400	400	380	25
	VGS13500	500	480	25
	VGS13600	600	580	25
13 SW 19 TX 50	**VGS13700**	700	680	25
	VGS13800	800	780	25
	VGS13900	900	880	25
	VGS131000	1000	980	25
	VGS131100	1100	1080	25
	VGS131200	1200	1180	25

For further details please see the "Screws and connectors for timber" catalogue.

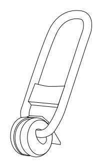
VGU WASHER

CODE	screw [mm]	d_V [mm]	pcs
VGU945	VGS Ø9	5	25
VGU1145	VGS Ø11	6	25
VGU1345	VGS Ø13	8	25



WASP HOOK

CODE	max. capacity [kg]	pcs
WASP	1300	2



TENSILE STRENGTH

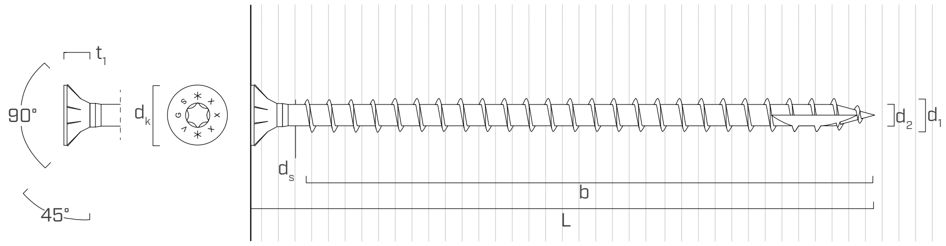
Ideal for joints requiring high tensile or sliding strength. Can be used on steel plates in combination with the VGU washer.

TITAN V

Values also tested, certified and calculated for fastening standard Rothoblaas plates.

GEOMETRY AND MECHANICAL CHARACTERISTICS

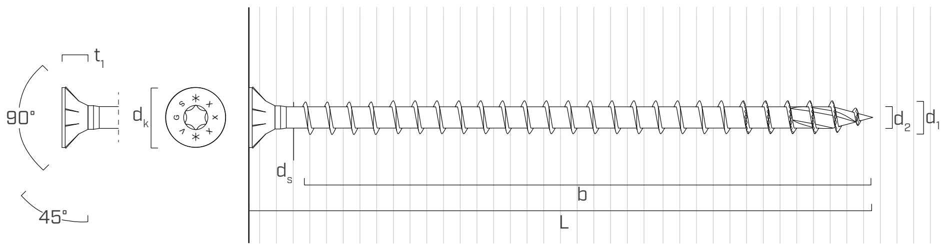
VGS Ø9 - Ø11



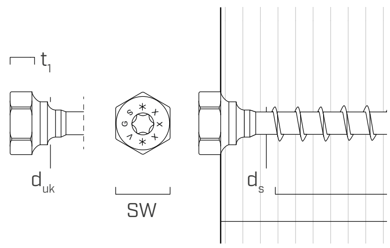
Nominal diameter	d_1	[mm]	9	11
Head diameter	d_k	[mm]	16,00	19,30
Tip diameter	d_2	[mm]	5,90	6,60
Head thickness	t_1	[mm]	6,50	8,20
Pre-drilling hole diameter	d_V	[mm]	5,0	6,0
Characteristic yield moment	$M_{y,k}$	[Nm]	27,2	45,9
Characteristic withdrawal-resistance parameter*	$f_{ax,k}$	[N/mm^2]	11,7	11,7
Associated density	ρ_a	[kg/m^3]	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	25,4	38,0
Characteristic yield strength	$f_{y,k}$	[N/mm^2]	1000	1000

* Valid for softwood - maximum density 440 kg/m^3.
For applications with different materials (e.g. LVL) or with high density please see ETA-11/0030.

VGS Ø13



L ≤ 600 mm



L > 600 mm

Nominal diameter	d_1	[mm]	**13** [L ≤ 600 mm]	**13** [L > 600 mm]
Head diameter	d_k	[mm]	22,00	-
Wrench size	SW		-	SW 19
Tip diameter	d_2	[mm]	8,00	8,00
Head thickness	t_1	[mm]	9,40	7,50
Underhead diameter	d_{uk}	[mm]	-	15,0
Pre-drilling hole diameter (*)	d_V	[mm]	8,0	
Characteristic yield moment	$M_{y,k}$	[Nm]	70,9	
Characteristic withdrawal-resistance parameter*	$f_{ax,k}$	[N/mm^2]	11,7	
Associated density	ρ_a	[kg/m^3]	350	
Characteristic tensile strength	$f_{tens,k}$	[kN]	53,0	
Characteristic yield strength	$f_{y,k}$	[N/mm^2]	1000	

* Valid for softwood - maximum density 440 kg/m^3.
For applications with different materials (e.g. LVL) or with high density please see ETA-11/0030.

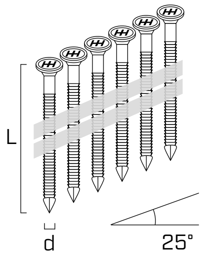
COLLATED FASTENERS FOR TIMBER

3522 ANKER NAILER 25°

CODE	Ø nail [mm]	taping	trigger	weight [kg]
HH3522	4	plastic	single	4,1

CLIP-HEAD ANKER NAILS - K25°

CE



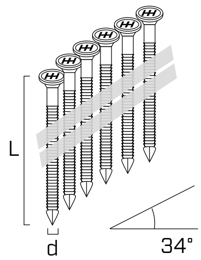
CODE	d x L [mm]		taping	HH3522	pcs
HH10401443	4,0 x 40	galvanized	plastic	•	1000
HH10401445	4,0 x 50	galvanized	plastic	•	1000
HH10401446	4,0 x 60	galvanized	plastic	•	1000

0116 ANKER NAILER 34°

CODE	Ø nail [mm]	taping	trigger	weight [kg]
ATEU0116	4	plastic	single	2,36

CLIP-HEAD ANKER NAILS - K34°

CE



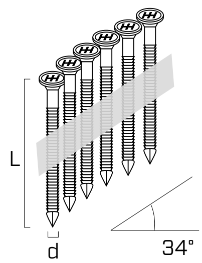
CODE	d x L [mm]		taping	ATEU0116	pcs
HH20006080	4,0 x 40	galvanized	plastic	•	2000
HH20006085	4,0 x 50	galvanized	plastic	•	2000
HH20006090	4,0 x 60	galvanized	plastic	•	2000

3822 ANKER NAILER

CODE	Ø nail [mm]	taping	trigger	weight [kg]
HH3822	4	paper/plastic	single	3,6

CLIP-HEAD ANKER NAILS - P34°

CE



CODE	d x L [mm]		taping	HH3822	pcs
HH10401741	4,0 x 40	galvanized	paper	•	1250
HH10401742	4,0 x 50	galvanized	paper	•	1250
HH10401743	4,0 x 60	galvanized	paper	•	1250

3731 PALM NAILER

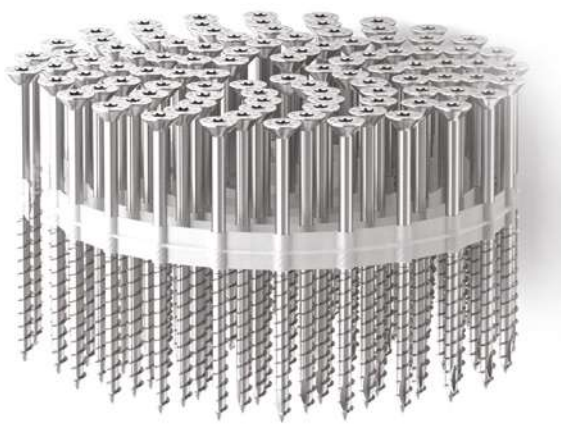
CODE	nail head $_{max}$ Ø [mm]	compatible nails	trigger	weight [kg]
HH3731	9	loose nails LBA	single	2,5

HBS COIL

HBS BOUND SCREWS

QUICK, IN SERIES USE
Quick and precise installation. Fast and safe execution thanks to the special binding.

HBS 6,0 mm
Also available in a diameter of 6,0 mm, ideal for quick wall-to-wall fastening in CLT structures.



CHARACTERISTICS

FOCUS	HBS bound screw
HEAD	countersunk with under-head ribs
DIAMETER	from 4,0 to 6,0 mm
LENGTH	from 30 to 80 mm

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

MATERIAL
Bright zinc plated carbon steel.

FIELDS OF USE
- solid timber and glulam
- CLT, LVL
- timber based panels
- high density woods

Service classes 1 and 2.

CODES AND DIMENSIONS

d1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
4 TX 20	**HZB430**	30	16	14	3000
	HZB440	40	24	16	2000
	HZB450	50	24	26	1500
4.5 TX 20	**HZB4550**	50	24	26	1500

d1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
5 TX 25	**HZB560**	60	30	30	1250
	HZB570	70	35	35	625
	HZB580	80	40	40	625
6 TX 30	**HZB670**	70	40	30	625
	HZB680	80	40	40	625

ADDITIONAL PRODUCTS

CODE	description	d1 [mm]	lengths [mm]	pcs
HH3373	automatic loader for cordless screwdriver A 18 M BL	4,0	25-50	1
HH3372	automatic loader for cordless screwdriver A 18 M BL	4,5 - 6,0	40-80	1
HH3352	powered screwdriver	4,0	25-50	1
HH3338	powered screwdriver	4,5 - 6,0	40-80	1
HH14411591	extension	-	-	1
HZB6PLATE	adapter plate for HZB Ø6	-	-	1
HH14000621	TX30 M6 bit for HZB Ø6	-	-	1


HH3372


HH3338


HH14411591

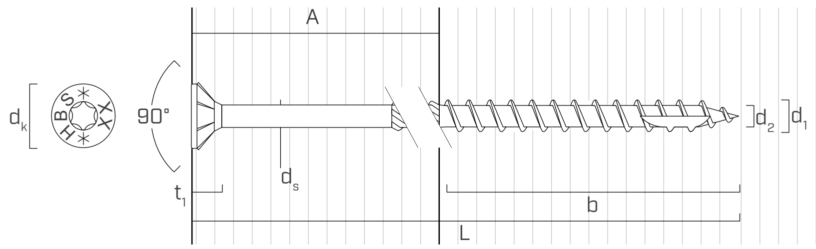

HZB6PLATE


HH14000621

Ø6 mm HBS COIL APPLICATION

The adapter plates for use of 4,0, 4,5 and 5,0 diameter HBS COIL screws are already supplied with the respective screwdriver loaders. To use HBS COIL screws with a diameter of 6.0, the adapter plates supplied must be replaced with the adapter plate HZB6PLATE. For HBS COIL screws diameter 6,0 it is also necessary to use the appropriate TX30 bit (code HH14000621).
We recommend using the extension HH14411591 for an easier installation of the screws on horizontal planes.

GEOMETRY



Nominal diameter	d_1	[mm]	4	4.5	5	6
Head diameter	d_K	[mm]	8,00	9,00	10,00	12,00
Tip diameter	d_2	[mm]	2,55	2,80	3,40	3,95
Shank diameter	d_S	[mm]	2,75	3,15	3,65	4,30
Head thickness	t_1	[mm]	2,80	2,80	3,10	4,50
Pre-drilling hole diameter	d_V	[mm]	2,5	2,5	3,0	4,0

PRODUCT LIST

PRODUCT LIST

PLATES AND CONNECTORS FOR TIMBER

PLATES AND CONNECTORS FOR TIMBER

ANCHORS FOR CONCRETE

BOLTS AND RODS

SCREWS AND NAILS FOR PLATES

rothoblaas | Solutions for Building Technology

- FASTENING
- AIRTIGHTNESS AND WATERPROOFING
- SOUNDPROOFING
- FALL PROTECTION
- TOOLS AND MACHINES

Rothoblaas is the multinational Italian company that has made innovative technology its mission, making its way to the forefront for timber buildings and construction safety in just a few years. Thanks to its comprehensive product range and the technically-prepared and widespread sales network, the company promotes the transfer of its know-how to the customers and aims to be a prominent and reliable partner for developing and innovating products and building methods. All of this contributes to a new culture of sustainable construction, focused on increasing comfortable living and reducing CO_2 emissions.

Rotho Blaas Srl

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