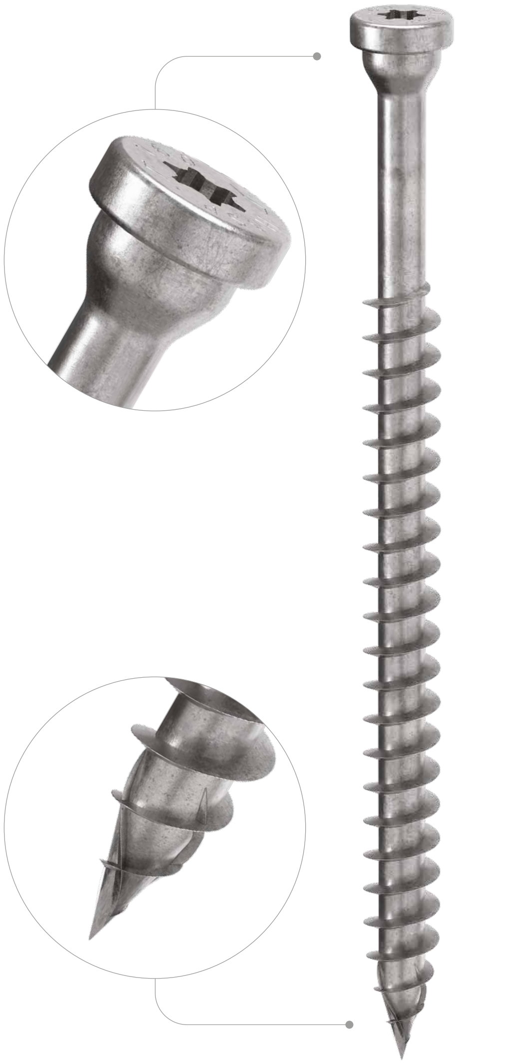
ICC ES
AC233
ESR-4645

CE
ETA-11/0030

HBS PLATE

PAN HEAD SCREW FOR PLATES



NEW GEOMETRY

The inner core diameter of the Ø8, Ø10 and Ø12 mm screws has been increased to ensure higher performance in thick plate applications. In steel-timber connections, the new geometry achieves a strength increase of more than 15%.

PLATE FASTENING

The under-head shoulder achieves an interlocking effect with the circular hole in the plate, thus guaranteeing excellent static performance. The edgeless geometry of the head reduces stress concentration points and gives the screw strength.

3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

MY PROJECT SOFTWARE | MANUALS | BIT INCLUDED

DIAMETER [mm]	3 – **8** – **12** – 12
LENGTH [mm]	25 – **60** – **200** – 200
SERVICE CLASS	SC1 SC2
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED – electrogalvanized carbon steel

METAL-to-TIMBER recommended use:

NO IMPACT | TORQUE LIMITER | $M_{ins,rec}$

FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

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MULTISTOREY

Ideal for steel-to-timber joints with large customized plates, designed for multi-story timber buildings.

TITAN

Values also tested, certified and calculated for fastening standard Rothoblaas plates.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A_P [mm]	pcs
8 TX 40	**HBSPL860**	60	52	1÷10	100
	HBSPL880	80	55	1÷15	100
	HBSPL8100	100	75	1÷15	100
	HBSPL8120	120	95	1÷15	100
	HBSPL8140	140	110	1÷20	100
	HBSPL8160	160	130	1÷20	100
10 TX 40	**HBSPL1080**	80	60	1÷10	50
	HBSPL10100	100	75	1÷15	50
	HBSPL10120	120	95	1÷15	50
	HBSPL10140	140	110	1÷20	50
	HBSPL10160	160	130	1÷20	50
	HBSPL10180	180	150	1÷20	50

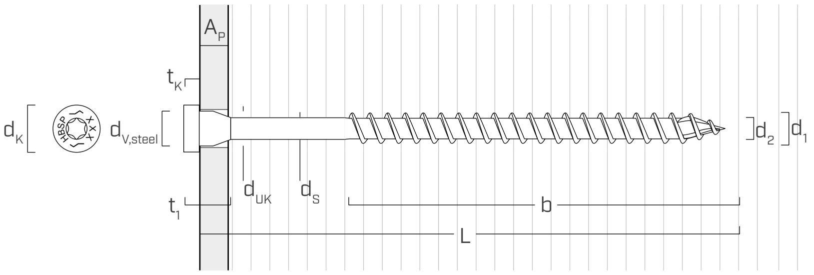
d_1 [mm]	CODE	L [mm]	b [mm]	A_P [mm]	pcs
12 TX 50	**HBSPL12100**	100	75	1÷15	25
	HBSPL12120	120	90	1÷20	25
	HBSPL12140	140	110	1÷20	25
	HBSPL12160	160	120	1÷30	25
	HBSPL12180	180	140	1÷30	25
	HBSPL12200	200	160	1÷30	25

RELATED PRODUCTS

TORQUE LIMITER

TORQUE LIMITER

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	d_1	**[mm]**	**8**	**10**	**12**
Head diameter	d_K	[mm]	13,50	16,50	18,50
Thread diameter	d_2	[mm]	5,90	6,60	7,30
Shank diameter	d_S	[mm]	6,30	7,20	8,55
Head thickness	t_1	[mm]	13,50	16,50	19,50
Washer thickness	t_K	[mm]	4,50	5,00	5,50
Underhead diameter	d_{UK}	[mm]	10,00	12,00	13,00
Hole diameter on steel plate	$d_{V,steel}$	[mm]	11,0	13,0	14,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	7,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0	7,0	8,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

CHARACTERISTIC MECHANICAL PARAMETERS

Nominal diameter	d_1	**[mm]**	**8**	**10**	**12**
Tensile strength	$f_{tens,k}$	[kN]	32,0	40,0	50,0
Yield moment	$M_{y,k}$	[Nm]	33,4	45,0	65,0

			softwood *(softwood)*	**LVL softwood** *(LVL softwood)*	**pre-drilled beech LVL** *(beech LVL predrilled)*
Withdrawal resistance parameter	$f_{ax,k}$	[N/mm²]	11,7	15,0	29,0
Head-pull-through parameter	$f_{head,k}$	[N/mm²]	10,5	20,0	-
Associated density	ρ_a	[kg/m³]	350	500	730
Calculation density	ρ_k	*[kg/m³]*	*≤ 440*	*410 ÷ 550*	*590 ÷ 750*

For applications with different materials please see ETA-11/0030.

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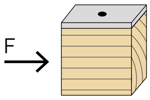
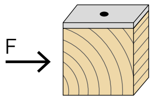
MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER

screws inserted **WITHOUT pre-drilled hole** — $\rho_k \leq 420\ kg/m^3$



α=0°

d_1	[mm]		8	10	12
a_1	[mm]	**10·d·0,7**	56	70	84
a_2	[mm]	**5·d·0,7**	28	35	42
$a_{3,t}$	[mm]	**15·d**	120	150	180
$a_{3,c}$	[mm]	**10·d**	80	100	120
$a_{4,t}$	[mm]	**5·d**	40	50	60
$a_{4,c}$	[mm]	**5·d**	40	50	60

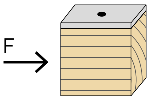


α=90°

d_1	[mm]		8	10	12
a_1	[mm]	**5·d·0,7**	28	35	42
a_2	[mm]	**5·d·0,7**	28	35	42
$a_{3,t}$	[mm]	**10·d**	80	100	120
$a_{3,c}$	[mm]	**10·d**	80	100	120
$a_{4,t}$	[mm]	**10·d**	80	100	120
$a_{4,c}$	[mm]	**5·d**	40	50	60

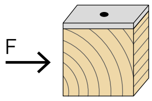
α = load-to-grain angle
d = d_1 = nominal screw diameter

screws inserted **WITH pre-drilled hole**



α=0°

d_1	[mm]		8	10	12
a_1	[mm]	**5·d·0,7**	28	35	42
a_2	[mm]	**3·d·0,7**	17	21	25
$a_{3,t}$	[mm]	**12·d**	96	120	144
$a_{3,c}$	[mm]	**7·d**	56	70	84
$a_{4,t}$	[mm]	**3·d**	24	30	36
$a_{4,c}$	[mm]	**3·d**	24	30	36



α=90°

d_1	[mm]		8	10	12
a_1	[mm]	**4·d·0,7**	22	28	34
a_2	[mm]	**4·d·0,7**	22	28	34
$a_{3,t}$	[mm]	**7·d**	56	70	84
$a_{3,c}$	[mm]	**7·d**	56	70	84
$a_{4,t}$	[mm]	**7·d**	56	70	84
$a_{4,c}$	[mm]	**3·d**	24	30	36

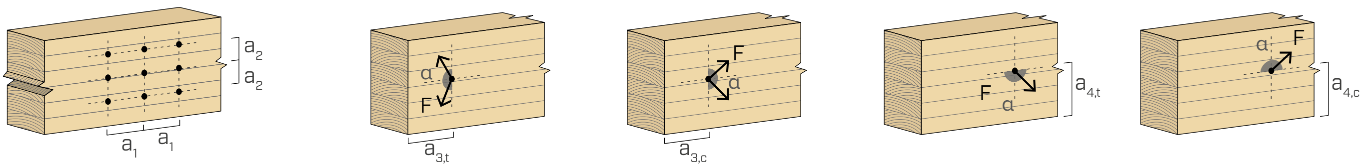
α = load-to-grain angle
d = d_1 = nominal screw diameter

stressed end
-90° < α < 90°

unloaded end
90° < α < 270°

stressed edge
0° < α < 180°

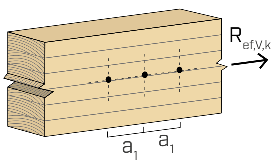
unload edge
180° < α < 360°



NOTE on page 11.

EFFECTIVE NUMBER FOR SHEAR LOADS

The load-bearing capacity of a connection made with several screws, all of the same type and size, may be lower than the sum of the load-bearing capacities of the individual connection system.
For a row of n screws arranged parallel to the direction of the grain at a distance a_1, the characteristic effective load-bearing capacity is equal to:



$$R_{ef,V,k} = n_{ef} \cdot R_{V,k}$$

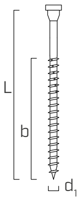
The n_{ef} value is given in the table below as a function of n and a_1.

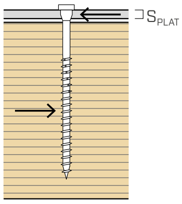
		a_1(*)										
		4·d	5·d	6·d	7·d	8·d	9·d	10·d	11·d	12·d	13·d	≥ 14·d
n	2	1,41	1,48	1,55	1,62	1,68	1,74	1,80	1,85	1,90	1,95	2,00
	3	1,73	1,86	2,01	2,16	2,28	2,41	2,54	2,65	2,76	2,88	3,00
	4	2,00	2,19	2,41	2,64	2,83	3,03	3,25	3,42	3,61	3,80	4,00
	5	2,24	2,49	2,77	3,09	3,34	3,62	3,93	4,17	4,43	4,71	5,00

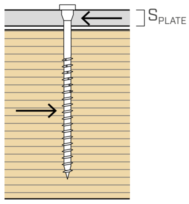
(*)For intermediate a_1 values a linear interpolation is possible.

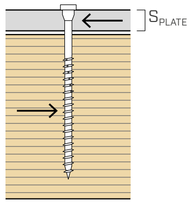
STRUCTURAL VALUES | STEEL-TO-TIMBER

CHARACTERISTIC VALUES
EN 1995:2014









			SHEAR							
geometry			steel-to-timber thin plate $\varepsilon=90°$			steel-to-timber intermediate plate $\varepsilon=90°$		steel-to-timber thick plate $\varepsilon=90°$		
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]			$R_{V,90,k}$ [kN]		$R_{V,90,k}$ [kN]		
	S_{PLATE}		2 mm	3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm
8	60	52	3,14	3,09	3,03	3,64	4,13	5,12	5,12	5,12
	80	55	4,22	4,17	4,11	4,72	5,22	6,21	6,21	6,21
	100	75	5,31	5,25	5,20	5,68	6,04	6,78	6,78	6,78
	120	95	5,86	5,86	5,86	6,22	6,57	7,29	7,29	7,29
	140	110	6,24	6,24	6,24	6,59	6,95	7,67	7,67	7,67
	160	130	6,74	6,74	6,74	7,10	7,46	8,17	8,17	8,17
	S_{PLATE}		3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	16 mm
10	80	60	4,87	4,81	4,75	5,42	6,50	7,58	7,58	7,58
	100	75	6,14	6,08	6,01	6,61	7,56	8,50	8,50	8,50
	120	95	7,34	7,34	7,28	7,70	8,42	9,14	9,14	9,14
	140	110	7,81	7,81	7,81	8,17	8,89	9,61	9,61	9,61
	160	130	8,44	8,44	8,44	8,80	9,52	10,24	10,24	10,24
	180	150	8,68	8,68	8,68	9,12	10,00	10,87	10,87	10,87
	S_{PLATE}		4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	16 mm	20 mm
12	100	75	6,90	6,83	6,76	8,16	9,41	10,67	10,67	10,67
	120	90	8,34	8,27	8,20	9,32	10,29	11,27	11,27	11,27
	140	110	9,73	9,71	9,64	10,49	11,26	12,03	12,03	12,03
	160	120	10,11	10,11	10,11	10,87	11,64	12,41	12,41	12,41
	180	140	10,86	10,86	10,86	11,63	12,40	13,17	13,17	13,17
	200	160	11,12	11,12	11,12	12,05	12,99	13,92	13,92	13,92

ε = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 11.

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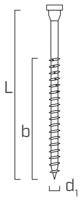
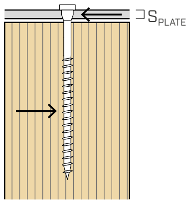
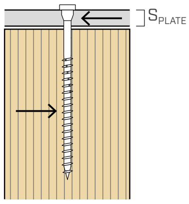
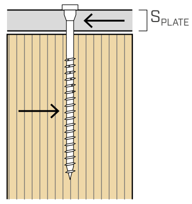
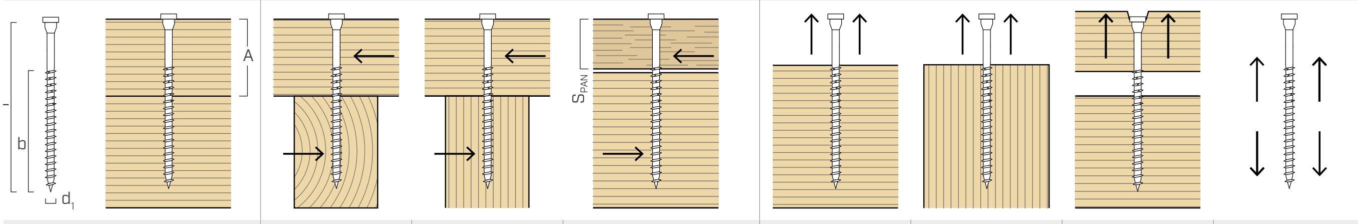
geometry			SHEAR steel-to-timber thin plate ε=0°			steel-to-timber intermediate plate ε=0°		steel-to-timber thick plate ε=0°		
										
d_1 [mm]	L [mm]	b [mm]	$R_{V,0,k}$ [kN]			$R_{V,0,k}$ [kN]		$R_{V,0,k}$ [kN]		
	S_{PLATE}		**2 mm**	**3 mm**	**4 mm**	**5 mm**	**6 mm**	**8 mm**	**10 mm**	**12 mm**
8	60	52	1,26	1,23	1,21	1,54	1,82	2,38	2,38	2,38
	80	55	1,69	1,67	1,65	1,94	2,19	2,70	2,70	2,70
	100	75	2,12	2,10	2,08	2,39	2,65	3,18	3,18	3,18
	120	95	2,56	2,53	2,51	2,84	3,13	3,70	3,70	3,70
	140	110	2,99	2,97	2,95	3,22	3,46	3,93	3,93	3,93
	160	130	3,17	3,17	3,17	3,40	3,62	4,08	4,08	4,08
	S_{PLATE}		**3 mm**	**4 mm**	**5 mm**	**6 mm**	**8 mm**	**10 mm**	**12 mm**	**16 mm**
10	80	60	1,95	1,92	1,90	2,22	2,77	3,32	3,32	3,32
	100	75	2,46	2,43	2,41	2,73	3,28	3,83	3,83	3,83
	120	95	2,96	2,94	2,91	3,26	3,84	4,43	4,43	4,43
	140	110	3,47	3,44	3,42	3,76	4,34	4,92	4,92	4,92
	160	130	3,97	3,95	3,92	4,20	4,66	5,11	5,11	5,11
	180	150	4,17	4,17	4,17	4,39	4,85	5,30	5,30	5,30
	S_{PLATE}		**4 mm**	**5 mm**	**6 mm**	**8 mm**	**10 mm**	**12 mm**	**16 mm**	**20 mm**
12	100	75	2,76	2,73	2,70	3,36	3,95	4,54	4,54	4,54
	120	90	3,34	3,31	3,28	3,94	4,55	5,15	5,15	5,15
	140	110	3,91	3,88	3,85	4,56	5,21	5,86	5,86	5,86
	160	120	4,49	4,46	4,43	5,10	5,72	6,34	6,34	6,34
	180	140	5,06	5,03	5,00	5,56	6,06	6,56	6,56	6,56
	200	160	5,33	5,33	5,33	5,82	6,31	6,79	6,79	6,79

ε = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 11.

STRUCTURAL VALUES | TIMBER

CHARACTERISTIC VALUES
EN 1995:2014



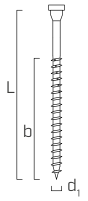
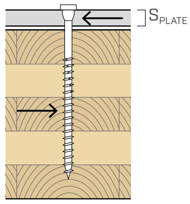
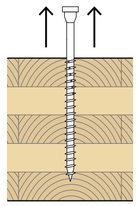
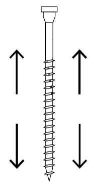
geometry				SHEAR				TENSION			
				timber-to-timber ε=90°	timber-to-timber ε=0°	panel-to-timber		thread withdrawal ε=90°	thread withdrawal ε=0°	head pull-through	steel tension
d_1	L	b	A	$R_{V,90,k}$	$R_{V,0,k}$	S_{PAN}	$R_{V,k}$	$R_{ax,90,k}$	$R_{ax,0,k}$	$R_{head,k}$	$R_{tens,k}$
[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
8	60	52	8	1,62	1,35	22	2,40	4,85	1,45	2,07	32,00
	80	55	25	2,83	1,70		2,94	5,56	1,67	2,07	
	100	75	25	2,83	2,13		2,94	7,58	2,27	2,07	
	120	95	25	2,83	2,33		2,94	9,60	2,88	2,07	
	140	110	30	2,93	2,42		2,94	11,11	3,33	2,07	
	160	130	30	2,93	2,42		2,94	13,13	3,94	2,07	
10	80	60	20	3,16	2,07	25	3,76	7,58	2,27	3,09	40,00
	100	75	25	3,65	2,59		3,76	9,47	2,84	3,09	
	120	95	25	3,65	3,01		3,76	12,00	3,60	3,09	
	140	110	30	3,75	3,11		3,76	13,89	4,17	3,09	
	160	130	30	3,75	3,11		3,76	16,42	4,92	3,09	
	180	150	30	3,75	3,11		3,76	18,94	5,68	3,09	
12	100	75	25	4,49	2,99	25	4,65	11,36	3,41	3,88	50,00
	120	90	30	4,69	3,54		4,65	13,64	4,09	3,88	
	140	110	30	4,69	3,88		4,65	16,67	5,00	3,88	
	160	120	40	4,97	4,15		4,65	18,18	5,45	3,88	
	180	140	40	4,97	4,15		4,65	21,21	6,36	3,88	
	200	160	40	4,97	4,15		4,65	24,24	7,27	3,88	

ε = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 11.

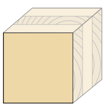
STRUCTURAL VALUES | CLT

CHARACTERISTIC VALUES
EN 1995:2014

			SHEAR								TENSION	
geometry			steel-to-CLT lateral face								thread withdrawal lateral face	steel tension
												
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]								$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		2 mm	3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	-	-
8	60	52	2,85	2,81	2,76	3,33	3,80	4,75	4,75	4,75	4,49	32,00
	80	55	3,84	3,79	3,74	4,31	4,78	5,72	5,72	5,72	5,15	
	100	75	4,82	4,77	4,72	5,22	5,62	6,42	6,42	6,42	7,02	
	120	95	5,52	5,52	5,52	5,86	6,20	6,89	6,89	6,89	8,89	
	140	110	5,87	5,87	5,87	6,21	6,55	7,24	7,24	7,24	10,30	
	160	130	6,34	6,34	6,34	6,68	7,02	7,70	7,70	7,70	12,17	
	S_{PLATE}		3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	16 mm	-	-
10	80	60	4,43	4,37	4,32	4,94	5,97	7,00	7,00	7,00	7,02	40,00
	100	75	5,58	5,52	5,47	6,07	7,06	8,05	8,05	8,05	8,78	
	120	95	6,73	6,67	6,62	7,11	7,87	8,63	8,63	8,63	11,12	
	140	110	7,36	7,36	7,36	7,70	8,38	9,07	9,07	9,07	12,87	
	160	130	7,94	7,94	7,94	8,28	8,97	9,65	9,65	9,65	15,21	
	180	150	8,28	8,28	8,28	8,67	9,45	10,24	10,24	10,24	17,55	
	S_{PLATE}		4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	16 mm	20 mm	-	-
12	100	75	6,28	6,21	6,14	7,46	8,65	9,84	9,84	9,84	10,53	50,00
	120	90	7,58	7,52	7,45	8,61	9,63	10,66	10,66	10,66	12,64	
	140	110	8,89	8,82	8,76	9,71	10,53	11,36	11,36	11,36	15,44	
	160	120	9,51	9,51	9,51	10,24	10,98	11,71	11,71	11,71	16,85	
	180	140	10,21	10,21	10,21	10,95	11,68	12,41	12,41	12,41	19,66	
	200	160	10,60	10,60	10,60	11,44	12,28	13,11	13,11	13,11	22,46	

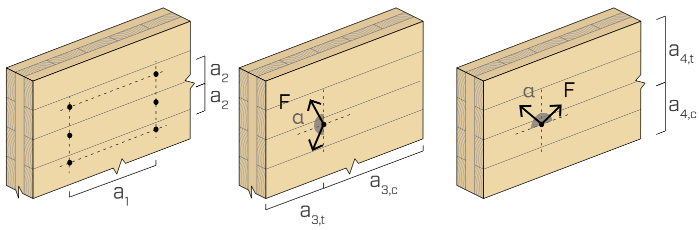
MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT

screws inserted **WITHOUT pre-drilled hole**



lateral face

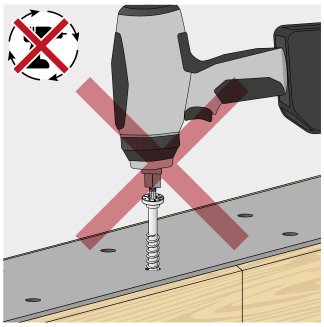
d_1	[mm]		8	10	12
a_1	[mm]	4·d	32	40	48
a_2	[mm]	2,5·d	20	25	30
$a_{3,t}$	[mm]	6·d	48	60	72
$a_{3,c}$	[mm]	6·d	48	60	72
$a_{4,t}$	[mm]	6·d	48	60	72
$a_{4,c}$	[mm]	2,5·d	20	25	30



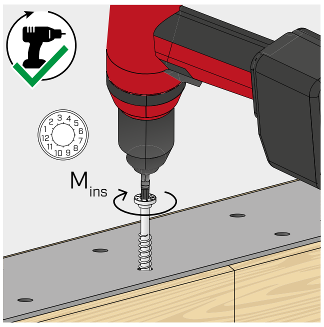
d = d_1 = nominal screw diameter

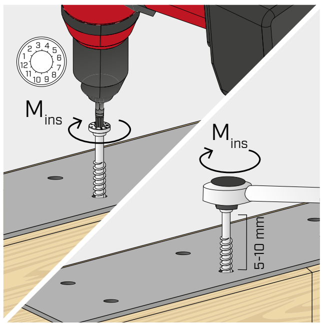
NOTES and GENERAL PRINCIPLES on page 11.

INSTALLATION



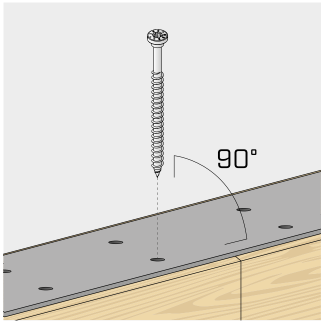
The use of pulse screw guns/impact wrenches is not permitted.



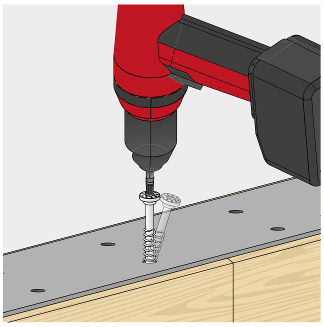


HBSPL	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø8	8	18
Ø10	10	25
Ø12	12	40

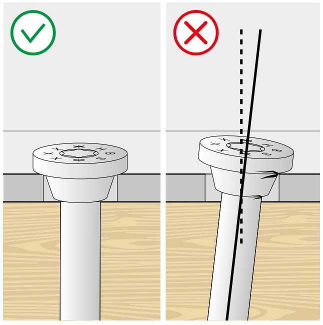
Ensure correct tightening.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.



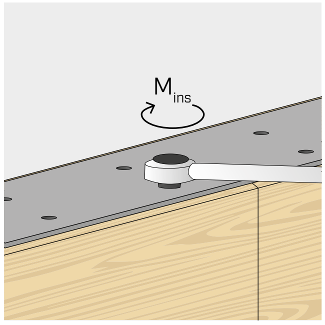
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



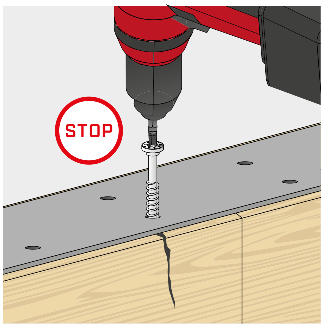
Avoid bending.



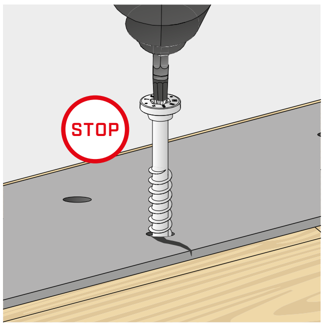
Ensure full contact between the entire surface of the screw head and the metal element



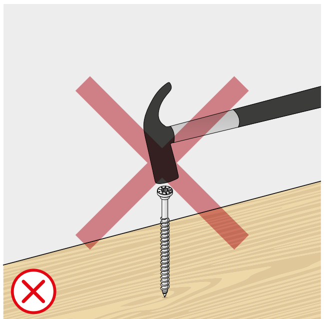
After installation, the fasteners can be inspected using a torque wrench.



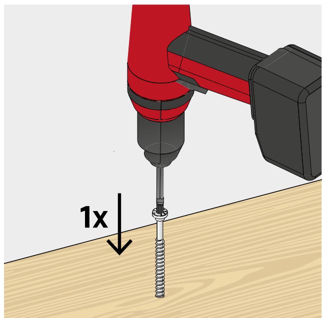
Stop installation if damage to the fastener or timber is noticed.



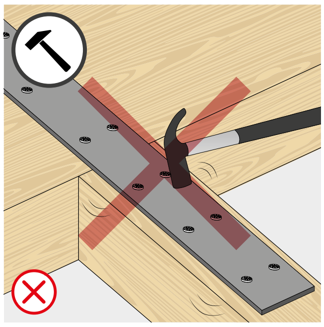
Stop installation if damage to the fastener or metal plates is noticed.



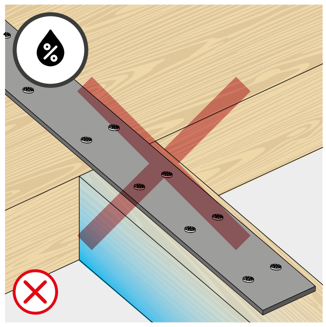
Do not hammer the screw tips into the timber.



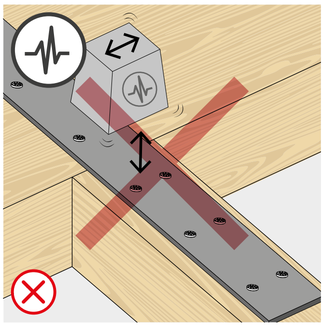
Install screws in one continuous stroke.



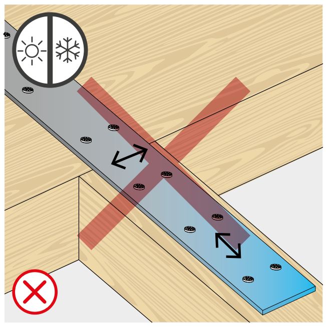
Avoid accidental stress during installation.



Protect the connection and avoid moisture changes and shrinkage and swelling of the timber.



Use not permitted for dynamic loads.



Avoid dimensional changes to the metal.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- Design values can be obtained from 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 tensile design strength of the connector is the lower between the timber-side design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

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

- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- Sizing and verification of the timber elements and metal plates must be done separately.
- The screws must be positioned in accordance with the minimum distances.
- The characteristic shear resistances are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- Shear strengths were calculated considering the threaded part fully inserted in the second element.
- The characteristic shear-strength value has been evaluated for plates with 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.
- In the case of combined shear and tensile stress, the following verification must be satisfied:

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

- In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or pull-through.
- The thread withdrawal characteristic strength has been evaluated considering a fixing length equal to b.
- In the case of steel-to-timber connections with a thick plate, it is necessary to assess the effects of timber deformation and install the connectors according to the assembly instructions.
- The values in the table are evaluated considering mechanical strength parameters of the Ø10 and Ø12 HBS PLATE screws obtained analytically and validated by experimental tests.
- For different calculation configurations, the MyProject software is available (www.rothoblaas.com).

NOTES | TIMBER

- The characteristic timber-to-timber shear strengths were evaluated considering both an ε angle of 90° ($R_{V,90,k}$) and 0° ($R_{V,0,k}$) between the grains of the second element and the connector.
- The characteristic thread withdrawal resistances were evaluated considering both an ε angle of 90° ($R_{ax,90,k}$) and of 0° ($R_{ax,0,k}$) between the grains and the connector.
- For the calculation process a timber characteristic density ρ_k = 385 kg/m^3 has been considered.
  For different ρ_k values, the strength values in the table can be converted by the k_{dens} coefficient.

$$R'_{V,k} = k_{dens,v} \cdot R_{V,k}$$
$$R'_{ax,k} = k_{dens,ax} \cdot R_{ax,k}$$
$$R'_{head,k} = k_{dens,ax} \cdot R_{head,k}$$

ρ_k [kg/m^3]	350	380	**385**	405	425	430	440
C-GL	*C24*	*C30*	*GL24h*	*GL26h*	*GL28h*	*GL30h*	*GL32h*
$k_{dens,v}$	0,90	0,98	1,00	1,02	1,05	1,05	1,07
$k_{dens,ax}$	0,92	0,98	1,00	1,04	1,08	1,09	1,11

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

NOTES | CLT

- The characteristic values are according to the national specifications ÖNORM EN 1995 - Annex K.
- For the calculation process a mass density ρ_k = 350 kg/m^3 has been considered for CLT elements.
- The characteristics shear resistance are calculated considering a minimum fixing length of 4 d_1.
- The characteristic shear strength is independent from the direction of the grain of the CLT panels outer layer.

MINIMUM DISTANCES

NOTES | TIMBER

- The minimum distances comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) can be multiplied by a coefficient of 1,5.
- In the case of joints with elements in Douglas fir (Pseudotsuga menziesii), the minimum spacing and distances parallel to the grain must be multiplied by a coefficient of 1.5.
- The spacing a_1 in the table for screws with 3 THORNS tip inserted without pre-drilling hole in timber elements with density $\rho_k \leq$ 420 kg/m^3 and load-to-grain angle α=0° was assumed to be 10·d based on experimental tests; alternatively, adopt 12·d in accordance with EN 1995:2014.

NOTES | CLT

- 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.
- Minimum distances are valid for minimum CLT thickness $t_{CLT,min}$ =10·d_1.
- Minimum distances for narrow face application can be found on page 39.