

HBS PLATE EVO

PAN HEAD SCREW

C4 EVO COATING

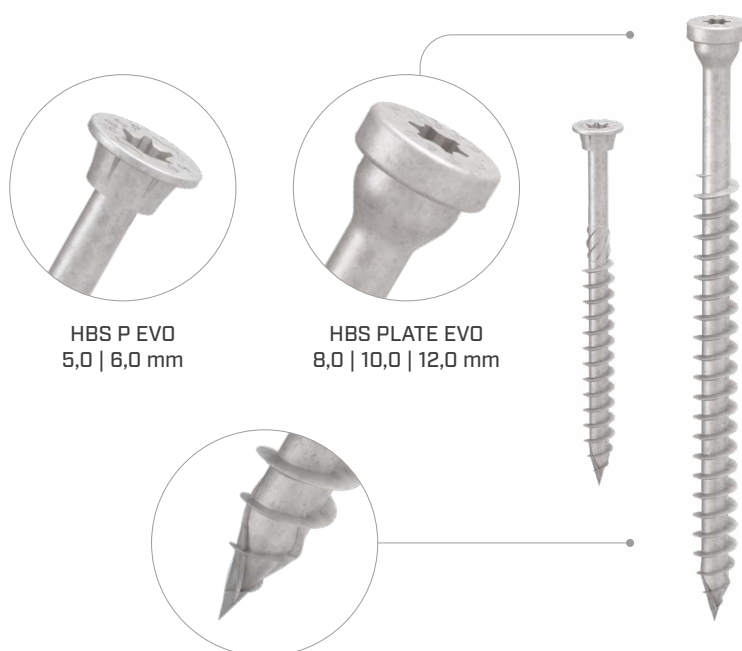
HBS PLATE EVO version designed for steel-timber joints outdoors. Atmospheric corrosion resistance class (C4) tested by the Research Institutes of Sweden - RISE. Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch and pine (see page 314).

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.



DIAMETER [mm]

3,5 **5** 12 12

LENGTH [mm]

25 **40** 200 200

SERVICE CLASS

SC1 SC2 SC3

ATMOSPHERIC CORROSIVITY

C1 **C2** C3 C4

WOOD CORROSIVITY

T1 **T2** T3

MATERIAL

C4
EVO
COATING

carbon steel with C4 EVO coating



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

CODES AND DIMENSIONS

HBS P EVO

	d ₁ [mm]	CODE	L [mm]	b [mm]	A _T [mm]	A _P [mm]	pcs
5 TX 25		HBSPEVO550	50	30	20	1÷10	200
		HBSPEVO560	60	35	25	1÷10	200
		HBSPEVO570	70	40	30	1÷10	100
		HBSPEVO580	80	50	30	1÷10	100
6 TX 30		HBSPEVO680	80	50	30	1÷10	100
		HBSPEVO690	90	55	35	1÷10	100



RAPTOR

TRANSPORT PLATE FOR TIMBER ELEMENTS

page 413

METAL-to-TIMBER recommended use:

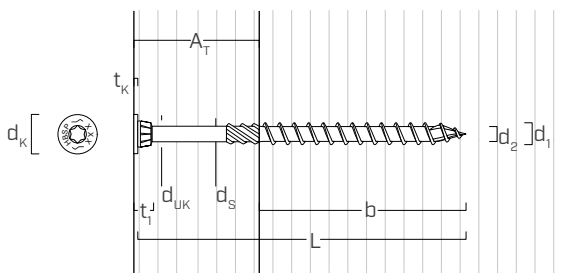


HBS PLATE EVO

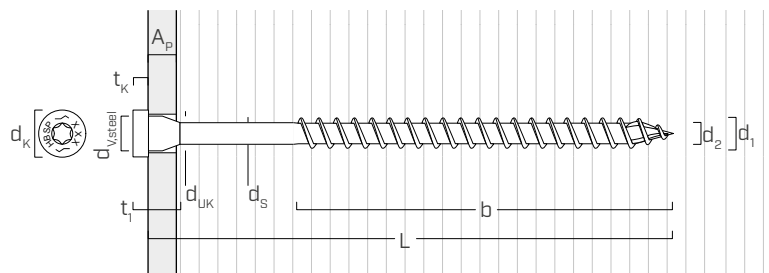
	d ₁ [mm]	CODE	L [mm]	b [mm]	A _T [mm]	A _P [mm]	pcs
8 TX 40		HBSPLEVO840	40	32	8	1÷10	100
		HBSPLEVO860	60	52	8	1÷15	100
		HBSPLEVO880	80	55	25	1÷15	100
		HBSPLEVO8100	100	75	25	1÷15	100
		HBSPLEVO8120	120	95	25	1÷15	100
		HBSPLEVO8140	140	110	30	1÷20	100
		HBSPLEVO8160	160	130	30	1÷20	100
		HBSPLEVO1060	60	52	8	1÷15	50
10 TX 40		HBSPLEVO1080	80	60	20	1÷15	50
		HBSPLEVO10100	100	75	25	1÷15	50
		HBSPLEVO10120	120	95	25	1÷15	50
		HBSPLEVO10140	140	110	30	1÷20	50
		HBSPLEVO10160	160	130	30	1÷20	50
		HBSPLEVO10180	180	150	30	1÷20	50
		HBSPLEVO12120	120	90	30	1÷15	25
		HBSPLEVO12140	140	110	30	1÷20	25
12 TX 50		HBSPLEVO12160	160	120	40	1÷20	25
		HBSPLEVO12180	180	140	40	1÷30	25
		HBSPLEVO12200	200	160	40	1÷30	25

GEOMETRY AND MECHANICAL CHARACTERISTICS

HBS P EVO - 5,0 | 6,0 mm



HBS PLATE EVO - 8,0 | 10,0 | 12,0 mm



Nominal diameter	d ₁	[mm]	5	6	8	10	12
Head diameter	d _k	[mm]	9,65	12,00	13,50	16,50	18,50
Thread diameter	d ₂	[mm]	3,40	3,95	5,90	6,60	7,30
Shank diameter	d _S	[mm]	3,65	4,30	6,30	7,20	8,55
Head thickness	t ₁	[mm]	5,50	6,50	13,50	16,50	19,50
Washer thickness	t _k	[mm]	1,00	1,50	4,50	5,00	5,50
Underhead diameter	d _{UK}	[mm]	6,00	8,00	10,00	12,00	13,00
Hole diameter on steel plate	d _{V,steel}	[mm]	7,0	9,0	11,0	13,0	14,0
Pre-drilling hole diameter ⁽¹⁾	d _{V,S}	[mm]	3,0	4,0	5,0	6,0	7,0
Pre-drilling hole diameter ⁽²⁾	d _{V,H}	[mm]	4,0	5,0	6,0	7,0	8,0
Characteristic tensile strength	f _{tens,k}	[kN]	7,9	11,3	32,0	40,0	50,0
Characteristic yield moment	M _{y,k}	[Nm]	5,4	9,5	33,4	45,0	65,0

(1) Pre-drilling valid for softwood.

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

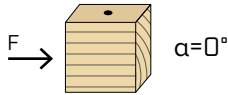
The mechanical parameters are obtained analytically and validated by experimental tests (HBS PLATE EVO Ø10 and Ø12).

			softwood (softwood)	LVL softwood (LVL softwood)	pre-drilled beech LVL (beech LVL predrilled)
Withdrawal resistance parameter	f _{ax,k}	[N/mm ²]	11,7	15,0	29,0
Head-pull-through parameter	f _{head,k}	[N/mm ²]	10,5	20,0	-
Associated density	ρ _a	[kg/m ³]	350	500	730
Calculation density	ρ _k	[kg/m ³]	≤ 440	410 ÷ 550	590 ÷ 750

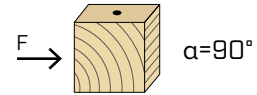
For applications with different materials please see ETA-11/0030.

MINIMUM DISTANCES FOR SHEAR LOADS

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

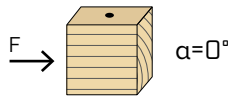


d_1 [mm]		5	6	8	10	12
a_1 [mm]	12·d	60	72	96	120	144
a_2 [mm]	5·d	25	30	40	50	60
$a_{3,t}$ [mm]	15·d	75	90	120	150	180
$a_{3,c}$ [mm]	10·d	50	60	80	100	120
$a_{4,t}$ [mm]	5·d	25	30	40	50	60
$a_{4,c}$ [mm]	5·d	25	30	40	50	60

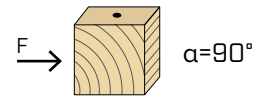


d_1 [mm]		5	6	8	10	12
a_1 [mm]	5·d	25	30	40	50	60
a_2 [mm]	5·d	25	30	40	50	60
$a_{3,t}$ [mm]	10·d	50	60	80	100	120
$a_{3,c}$ [mm]	10·d	50	60	80	100	120
$a_{4,t}$ [mm]	10·d	50	60	80	100	120
$a_{4,c}$ [mm]	5·d	25	30	40	50	60

 screws inserted **WITHOUT** pre-drilled hole $420 \text{ kg/m}^3 < \rho_k \leq 500 \text{ kg/m}^3$

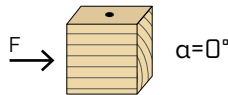


d_1 [mm]		5	6	8	10	12
a_1 [mm]	15·d	75	90	120	150	180
a_2 [mm]	7·d	35	42	56	70	84
$a_{3,t}$ [mm]	20·d	100	120	160	200	240
$a_{3,c}$ [mm]	15·d	75	90	120	150	180
$a_{4,t}$ [mm]	7·d	35	42	56	70	84
$a_{4,c}$ [mm]	7·d	35	42	56	70	84

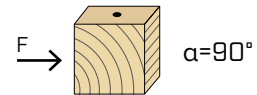


d_1 [mm]		5	6	8	10	12
a_1 [mm]	7·d	35	42	56	70	84
a_2 [mm]	7·d	35	42	56	70	84
$a_{3,t}$ [mm]	15·d	75	90	120	150	180
$a_{3,c}$ [mm]	15·d	75	90	120	150	180
$a_{4,t}$ [mm]	12·d	60	72	96	120	144
$a_{4,c}$ [mm]	7·d	35	42	56	70	84

 screws inserted **WITH** pre-drilled hole

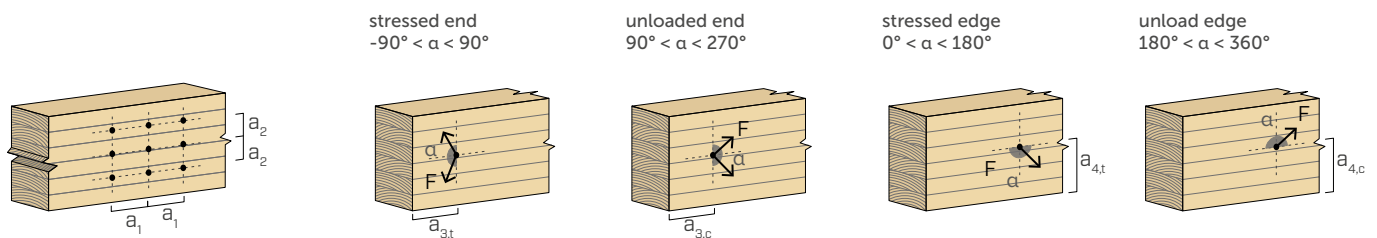


d_1 [mm]		5	6	8	10	12
a_1 [mm]	5·d	25	30	40	50	60
a_2 [mm]	3·d	15	18	24	30	36
$a_{3,t}$ [mm]	12·d	60	72	96	120	144
$a_{3,c}$ [mm]	7·d	35	42	56	70	84
$a_{4,t}$ [mm]	3·d	15	18	24	30	36
$a_{4,c}$ [mm]	3·d	15	18	24	30	36



d_1 [mm]		5	6	8	10	12
a_1 [mm]	4·d	20	24	32	40	48
a_2 [mm]	4·d	20	24	32	40	48
$a_{3,t}$ [mm]	7·d	35	42	56	70	84
$a_{3,c}$ [mm]	7·d	35	42	56	70	84
$a_{4,t}$ [mm]	7·d	35	42	56	70	84
$a_{4,c}$ [mm]	3·d	15	18	24	30	36

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



NOTES

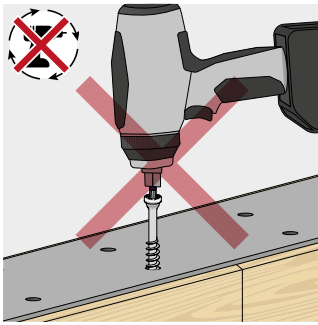
- The minimum distances comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- The minimum spacing for all steel-to-timber connections (a_1 , a_2) can be multiplied by a coefficient of 0,7.
- The minimum spacing for all panel-to-timber connections (a_1 , a_2) can be multiplied by a coefficient of 0,85.
- 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.

geometry				SHEAR						TENSION			
				timber-to-timber $\varepsilon=90^\circ$	panel-to-timber	steel-to-timber thin plate	steel-to-timber thick plate	thread withdrawal $\varepsilon=90^\circ$	thread withdrawal $\varepsilon=0^\circ$	head pull-through			
d_1 [mm]	L [mm]	b [mm]	A [mm]	$R_{V,k}$ [kN]	S_{SPAN} [mm]	$R_{V,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	$R_{\text{ax},90,k}$ [kN]	$R_{\text{ax},0,k}$ [kN]	$R_{\text{head},k}$ [kN]
5	50	30	20	1,20	12	1,10	2,5	1,65	5	2,14	1,89	0,57	1,06
	60	35	25	1,33		1,10		1,73		2,22	2,21	0,66	1,06
	70	40	30	1,44		1,10		1,81		2,30	2,53	0,76	1,06
	80	50	30	1,44		1,10		1,97		2,46	3,16	0,95	1,06
6	80	50	30	1,88	15	1,55	3	2,61	6	3,31	3,79	1,14	1,63
	90	55	35	2,03		1,55		2,71		3,40	4,17	1,25	1,63

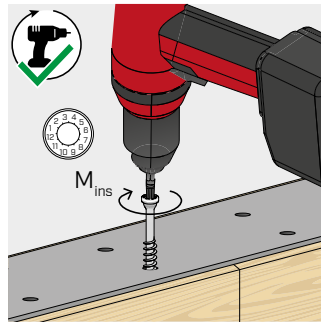
geometry				SHEAR				TENSION		
				timber-to-timber $\varepsilon=90^\circ$	timber-to-timber $\varepsilon=0^\circ$	steel-to-timber thin plate	steel-to-timber thick plate	thread withdrawal $\varepsilon=90^\circ$	thread withdrawal $\varepsilon=0^\circ$	head pull-through
d_1 [mm]	L [mm]	b [mm]	A [mm]	$R_{V,k}$ [kN]	$R_{V,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	$R_{head,k}$ [kN]
8	40	32	8	1,62	0,85	4	1,95	2,83	0,85	2,07
	60	52	8	1,62	1,35		3,03	4,85	1,45	2,07
	80	55	25	2,83	1,70		4,11	5,56	1,67	2,07
	100	75	25	2,83	2,13		5,20	6,78	2,27	2,07
	120	95	25	2,83	2,33		5,86	7,29	2,88	2,07
	140	110	30	2,93	2,42		6,24	7,67	3,33	2,07
	160	130	30	2,93	2,42		6,74	8,17	3,94	2,07
10	60	52	8	2,37	1,56	5	3,48	5,91	1,70	3,09
	80	60	20	3,16	2,07		4,75	7,37	2,27	3,09
	100	75	25	3,65	2,59		6,01	8,50	2,84	3,09
	120	95	25	3,65	3,01		7,28	9,14	3,60	3,09
	140	110	30	3,75	3,11		7,81	9,61	4,17	3,09
	160	130	30	3,75	3,11		8,44	10,24	4,92	3,09
	180	150	30	3,75	3,11		8,68	10,87	5,68	3,09
12	120	90	30	4,69	3,54	6	8,20	11,27	4,09	3,88
	140	110	30	4,69	3,88		9,64	12,03	5,00	3,88
	160	120	40	4,97	4,15		10,11	12,41	5,45	3,88
	180	140	40	4,97	4,15		10,86	13,17	6,36	3,88
	200	160	40	4,97	4,15		11,12	13,92	7,27	3,88

ε = screw-to-grain angle

INSTALLATION

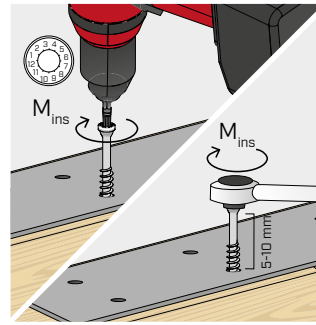


The use of pulse screw guns/impact wrenches is not permitted.

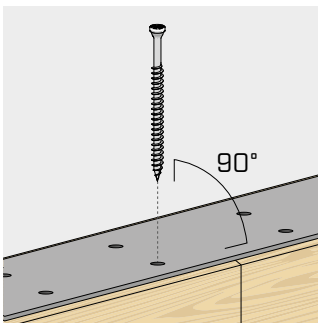


Ensure correct tightening.

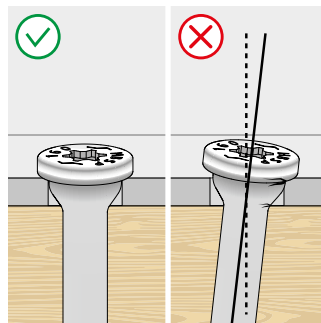
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.



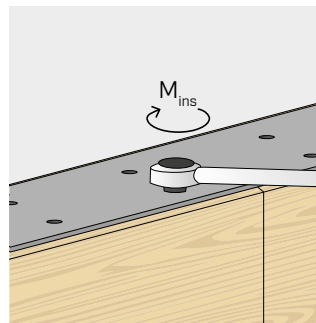
HBSP HBSP L	d ₁ [mm]	M _{ins,rec} [Nm]
Ø8	8	25
Ø10	10	35
Ø12	12	50



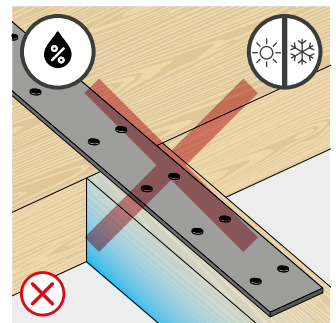
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



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.



Avoid dimensional changes to the metal and shrinkage and swelling of timber.

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:

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

- The coefficients Y_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.
- Sizing and verification of the timber elements, panels 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 panel-timber shear strengths are calculated considering an OSB3 or OSB4 panel, as per EN 300, or a particle board panel, as per EN 312, with thickness S_{PAN} and density $\rho_k = 500 \text{ kg/m}^3$.
- The thread withdrawal characteristic strength has been evaluated considering a fixing length equal to b .
- The head pull-through characteristic strength was calculated using timber elements.
In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or pull-through.
- 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 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 HBS PLATE EVO Ø10 and Ø12 screws obtained analytically and validated by experimental tests.
- For different calculation configurations, the MyProject software is available (www.rothoblaas.com).

NOTES

- 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 panel-timber and steel-timber shear strengths were evaluated by considering an ϵ angle of 90° between the grains of the timber element and the connector.
- The characteristic plate shear strengths are evaluated considering the case of thin plate ($S_{PLATE} = 0.5 d_1$) and thick plate ($S_{PLATE} = d_1$).
- 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 of the timber element and the connector.
- For the calculation process a timber characteristic density $\rho_k = 385 \text{ kg/m}^3$ has been considered.
For different values of ρ_k , the strength values in the table (timber-to-timber shear, steel-to-timber shear and tensile) can be converted by means of the coefficient k_{dens} (see page 215).
- For further calculation configurations and for applications on different materials, see page 212.