ICC ES
AC233 | AC257
ESR-4645

CE
ETA-11/0030

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.

MY PROJECT SOFTWARE | MANUALS | BIT INCLUDED

DIAMETER [mm]

3,5 | 5 – 12 | 12

LENGTH [mm]

25 | 50 – 200 | 200

SERVICE CLASS

SC1 SC2 SC3

ATMOSPHERIC CORROSIVITY

C1 C2 C3 C4

WOOD CORROSIVITY

T1 T2 T3

MATERIAL

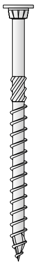
C4 EVO COATING — carbon steel with C4 EVO coating

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

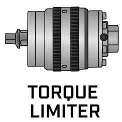


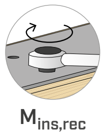
d_1 [mm]	CODE	L [mm]	b [mm]	A_T [mm]	A_P [mm]	pcs
5 TX 25	**HBSPEVO550**	50	30	20	1÷10	200
	HBSPEVO560	60	35	25	1÷10	200
	HBSPEVO570	70	40	30	1÷10	100
	HBSPEVO580	80	50	30	1÷10	100
6 TX 30	**HBSPEVO680**	80	50	30	1÷10	100
	HBSPEVO690	90	55	35	1÷10	100

RAPTOR

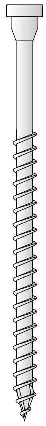
TRANSPORT PLATE FOR TIMBER ELEMENTS

METAL-to-TIMBER recommended use:





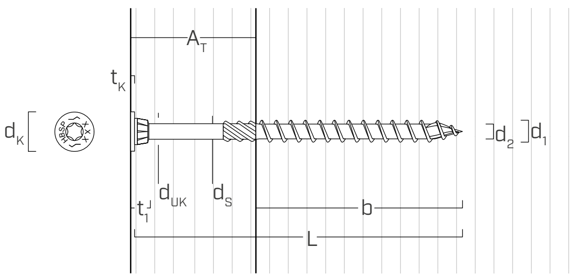
HBS PLATE EVO



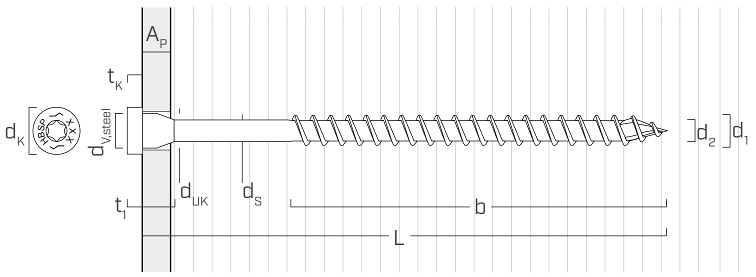
d_1 [mm]	CODE	L [mm]	b [mm]	A_T [mm]	A_P [mm]	pcs
8 TX 40	**HBSPLEVO840**	40	32	8	1÷10	100
	HBSPLEVO860	60	52	8	1÷15	100
	HBSPLEVO880	80	55	25	1÷15	100
	HBSPLEVO8100	100	75	25	1÷15	100
	HBSPLEVO8120	120	95	25	1÷15	100
	HBSPLEVO8140	140	110	30	1÷20	100
	HBSPLEVO8160	160	130	30	1÷20	100
10 TX 40	**HBSPLEVO1060**	60	52	8	1÷15	50
	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
12 TX 50	**HBSPLEVO12120**	120	90	30	1÷15	25
	HBSPLEVO12140	140	110	30	1÷20	25
	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

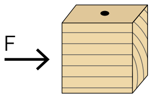
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

			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.

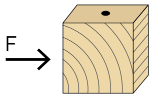
MINIMUM DISTANCES FOR SHEAR LOADS

screws inserted **WITHOUT pre-drilled hole** — $\rho_k \leq 420$ kg/m³



α=0°

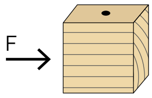
d_1	[mm]		5	6	8	10	12
a_1	[mm]	10·d	50	60	80	100	120
a_2	[mm]	5·d	25	30	40	50	60
$a_{3,t}$	[mm]	15·d	75	90	120	150	180
$a_{3,c}$	[mm]	10·d	50	60	80	100	120
$a_{4,t}$	[mm]	5·d	25	30	40	50	60
$a_{4,c}$	[mm]	5·d	25	30	40	50	60



α=90°

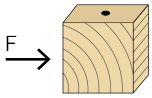
d_1	[mm]		5	6	8	10	12
a_1	[mm]	5·d	25	30	40	50	60
a_2	[mm]	5·d	25	30	40	50	60
$a_{3,t}$	[mm]	10·d	50	60	80	100	120
$a_{3,c}$	[mm]	10·d	50	60	80	100	120
$a_{4,t}$	[mm]	10·d	50	60	80	100	120
$a_{4,c}$	[mm]	5·d	25	30	40	50	60

screws inserted **WITHOUT pre-drilled hole** — 420 kg/m³ $< \rho_k \leq 500$ kg/m³



α=0°

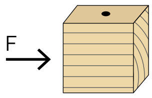
d_1	[mm]		5	6	8	10	12
a_1	[mm]	15·d	75	90	120	150	180
a_2	[mm]	7·d	35	42	56	70	84
$a_{3,t}$	[mm]	20·d	100	120	160	200	240
$a_{3,c}$	[mm]	15·d	75	90	120	150	180
$a_{4,t}$	[mm]	7·d	35	42	56	70	84
$a_{4,c}$	[mm]	7·d	35	42	56	70	84



α=90°

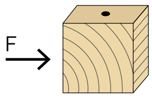
d_1	[mm]		5	6	8	10	12
a_1	[mm]	7·d	35	42	56	70	84
a_2	[mm]	7·d	35	42	56	70	84
$a_{3,t}$	[mm]	15·d	75	90	120	150	180
$a_{3,c}$	[mm]	15·d	75	90	120	150	180
$a_{4,t}$	[mm]	12·d	60	72	96	120	144
$a_{4,c}$	[mm]	7·d	35	42	56	70	84

screws inserted **WITH pre-drilled hole**



α=0°

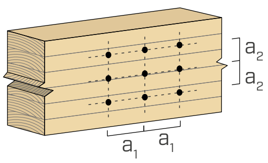
d_1	[mm]		5	6	8	10	12
a_1	[mm]	5·d	25	30	40	50	60
a_2	[mm]	3·d	15	18	24	30	36
$a_{3,t}$	[mm]	12·d	60	72	96	120	144
$a_{3,c}$	[mm]	7·d	35	42	56	70	84
$a_{4,t}$	[mm]	3·d	15	18	24	30	36
$a_{4,c}$	[mm]	3·d	15	18	24	30	36



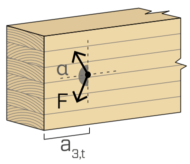
α=90°

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

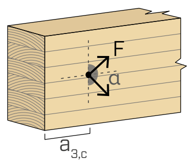
α = load-to-grain angle
d = d_1 = nominal screw diameter



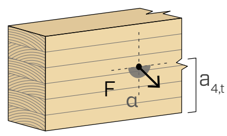
stressed end
-90° < α < 90°



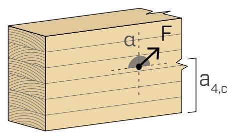
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



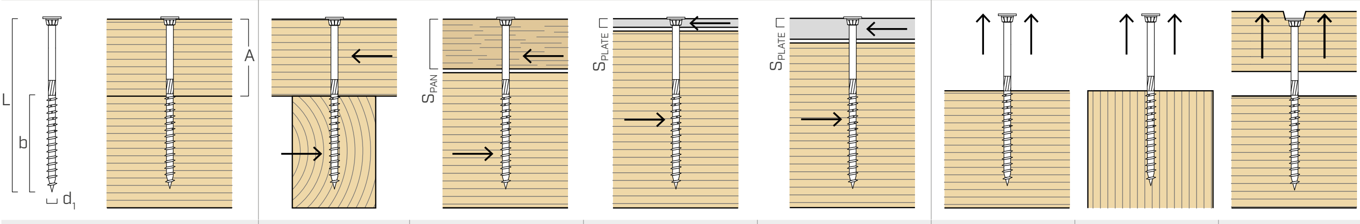
NOTES

- 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.
- 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/m³ 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.

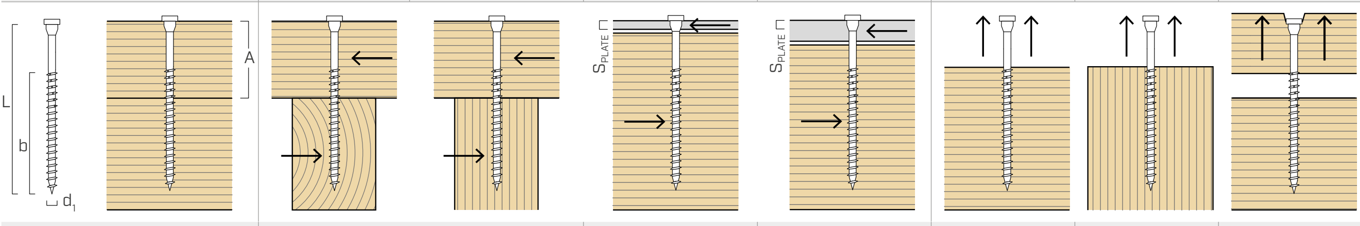
rothoblaas

STRUCTURAL VALUES

CHARACTERISTIC VALUES
EN 1995:2014



geometry				SHEAR							TENSION		
				timber-to-timber ε=90°	panel-to-timber		steel-to-timber thin plate		steel-to-timber thick plate		thread withdrawal ε=90°	thread withdrawal ε=0°	head pull-through
d_1	L	b	A	$R_{V,k}$	S_{PAN}	$R_{V,k}$	S_{PLATE}	$R_{V,k}$	S_{PLATE}	$R_{V,k}$	$R_{ax,90,k}$	$R_{ax,0,k}$	$R_{head,k}$
[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]	[kN]	[kN]	[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

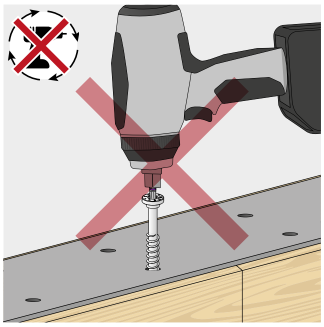


geometry				SHEAR						TENSION		
				timber-to-timber ε=90°	timber-to-timber ε=0°	steel-to-timber thin plate		steel-to-timber thick plate		thread withdrawal ε=90°	thread withdrawal ε=0°	head pull-through
d_1	L	b	A	$R_{V,k}$	$R_{V,k}$	S_{PLATE}	$R_{V,k}$	S_{PLATE}	$R_{V,k}$	$R_{ax,90,k}$	$R_{ax,0,k}$	$R_{head,k}$
[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]
8	40	32	8	1,62	0,85	4	1,95	8	3,83	2,83	0,85	2,07
	60	52	8	1,62	1,35		3,03		5,00	4,85	1,45	2,07
	80	55	25	2,83	1,70		4,11		6,07	5,56	1,67	2,07
	100	75	25	2,83	2,13		5,20		6,78	7,58	2,27	2,07
	120	95	25	2,83	2,33		5,86		7,29	9,60	2,88	2,07
	140	110	30	2,93	2,42		6,24		7,67	11,11	3,33	2,07
	160	130	30	2,93	2,42		6,74		8,17	13,13	3,94	2,07
10	60	52	8	2,37	1,56	5	3,48	10	5,91	5,68	1,70	3,09
	80	60	20	3,16	2,07		4,75		7,37	7,58	2,27	3,09
	100	75	25	3,65	2,59		6,01		8,50	9,47	2,84	3,09
	120	95	25	3,65	3,01		7,28		9,14	12,00	3,60	3,09
	140	110	30	3,75	3,11		7,81		9,61	13,89	4,17	3,09
	160	130	30	3,75	3,11		8,44		10,24	16,42	4,92	3,09
	180	150	30	3,75	3,11		8,68		10,87	18,94	5,68	3,09
12	120	90	30	4,69	3,54	6	8,20	12	11,27	13,64	4,09	3,88
	140	110	30	4,69	3,88		9,64		12,03	16,67	5,00	3,88
	160	120	40	4,97	4,15		10,11		12,41	18,18	5,45	3,88
	180	140	40	4,97	4,15		10,86		13,17	21,21	6,36	3,88
	200	160	40	4,97	4,15		11,12		13,92	24,24	7,27	3,88

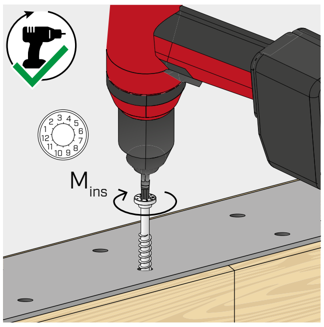
ε = screw-to-grain angle

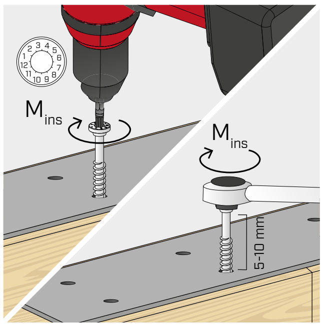
NOTES and GENERAL PRINCIPLES on page 6.

INSTALLATION



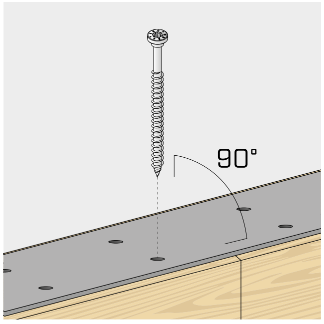
The use of pulse screw guns/impact wrenches is not permitted.



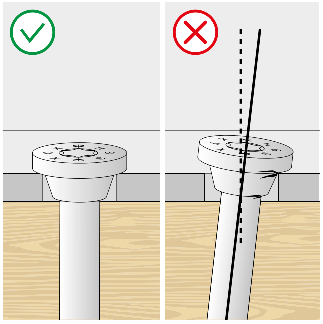


HBSP HBSPL	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø8	8	18
Ø10	10	25
Ø12	12	40

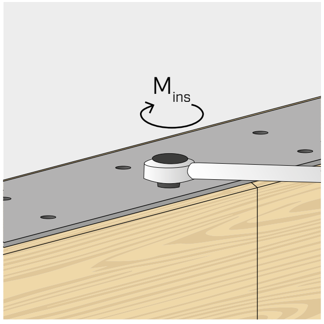
Ensure correct tightening.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.



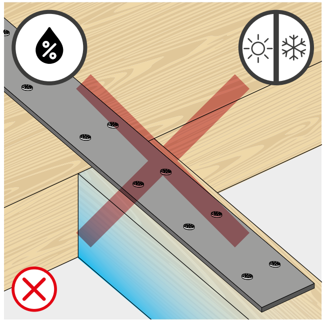
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



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:

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

- 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.
- 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 ρk = 500 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 ρ_k = 385 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.