VGS EVO

AC233 | AC257 ESR-4645 · BIT INCLUDED · MY PROJECT SOFTWARE · C4 EVO COATING · ETA-11/0030

FULL THREAD CONNECTOR WITH COUNTERSUNK HEAD

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, as per ISO 9227. Can be used in service class 3 outdoor applications and under class C4 atmospheric corrosion conditions.

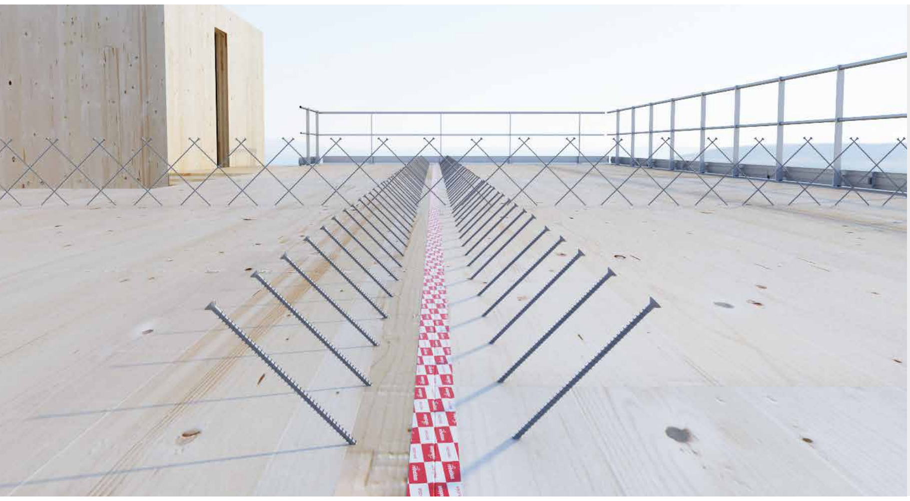
STRUCTURAL APPLICATIONS
Approved for structural applications subject to stresses in any direction vs. the grain (α = 0° - 90°). Safety certified by numerous tests carried out for any direction of insertion.

COUNTERSUNK HEAD
Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements.

PRESSURE-TREATED LUMBER
Ideal for applications with woods containing tannin or treated with impregnating agents. EVO Coating has been certified for use with wood chemically treated with waterborne ACQ.

CHARACTERISTICS

FOCUS	corrosiveness class C4
HEAD	countersunk
DIAMETER	9,0 | 11,0 mm
LENGTH	from 100 to 600 mm

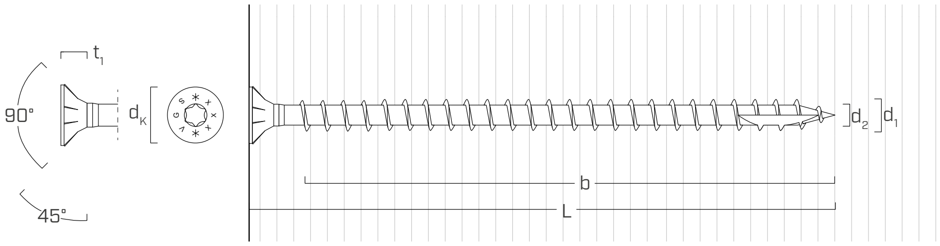


MATERIAL
Carbon steel, with a 20 μm coating, highly resistant to corrosion.

FIELDS OF USE
- timber based panels
- solid timber and glulam
- CLT, LVL
- high density woods
- aggressive woods (containing tannin)
- chemically treated woods

Service classes 1, 2 and 3.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[mm]	9	11
Head diameter	d_K	[mm]	16,00	19,30
Thread diameter	d_2	[mm]	5,90	6,60
Head thickness	t_1	[mm]	6,50	8,20
Pre-drilling hole diameter(1)	d_V	[mm]	5,0	6,0
Characteristic yield moment	$M_{y,k}$	[Nm]	27,2	45,9
Characteristic withdrawal-resistance parameter(2)	$f_{ax,k}$	[N/mm²]	11,7	11,7
Associated density	ρ_a	[kg/m³]	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	25,4	38,0
Characteristic yield strength	$f_{y,k}$	[N/mm²]	1000	1000

(1) Pre-drilling valid for softwood.
(2) Valid for softwood - maximum density 440 kg/m³.
For applications with different materials or with high density please see ETA-11/0030.

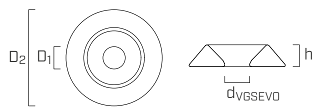
CODES AND DIMENSIONS

d_1 [mm] *[in]*	CODE	L [mm]	L *[in]*	b [mm]	pcs
9 *0.36* TX 40	**VGSEVO9120**	120	*4 3/4*	110	25
	VGSEVO9160	160	*6 1/4*	150	25
	VGSEVO9200	200	*8*	190	25
	VGSEVO9240	240	*9 1/2*	230	25
	VGSEVO9280	280	*11*	270	25
	VGSEVO9320	320	*12 5/8*	310	25
	VGSEVO9360	360	*14 1/4*	350	25

d_1 [mm] *[in]*	CODE	L [mm]	L *[in]*	b [mm]	pcs
11 *0.44* TX 50	**VGSEVO11100**	100	*4*	90	25
	VGSEVO11150	150	*6*	140	25
	VGSEVO11200	200	*8*	190	25
	VGSEVO11250	250	*10*	240	25
	VGSEVO11300	300	*11 3/4*	290	25
	VGSEVO11350	350	*13 3/4*	340	25
	VGSEVO11400	400	*15 3/4*	390	25
	VGSEVO11500	500	*19 3/4*	490	25
	VGSEVO11600	600	*23 5/8*	590	25

HUS EVO TURNED WASHER

d_{VGSEVO} [mm]	d_{VGSEVO} *[in]*	CODE	D_1 [mm]	D_1 *[in]*	D_2 [mm]	D_2 *[in]*	h [mm]	h *[in]*	pcs
9	*0.36*	**HUSEVO8**	8,5	*0.335*	25	*0.984*	5,5	*0.217*	50



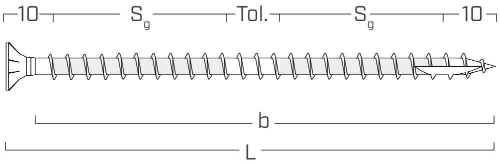
OUTDOOR STRUCTURAL PERFORMANCE

Ideal for fastening timber framed panels and lattice beams (Rafter, Truss). Values also tested, certified and calculated for high density woods. Ideal for fastening timber-framed panels and lattice beams (Rafter, Truss).

TIMBER FRAME

Values also tested, certified and calculated for CLT and high density woods such as Microllam® LVL.

EFFECTIVE THREAD USED IN CALCULATION

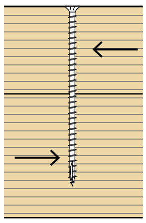


b = L - 10 mm — represents the entire length of the threaded part

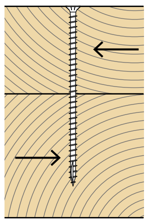
S_g = (L - 10 mm - 10 mm - Tol.)/2 — represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

The timber to timber withdrawal, shear and sliding values were calculated considering the centre of gravity of the connector placed in correspondence with the shear plane.

MINIMUM DISTANCES FOR SHEAR LOADS [1]



Load-to-grain angle α = 0°

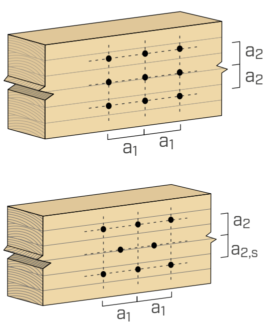


Load-to-grain angle α = 90°

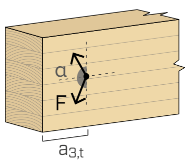
		SCREWS INSERTED WITH PRE-DRILLING HOLE			SCREWS INSERTED WITH PRE-DRILLING HOLE		
d_1	**[mm]**		**9**	**11**		**9**	**11**
a_1	[mm]	**5·d**	45	55	**4·d**	36	44
a_2	[mm]	**3·d**	27	33	**4·d**	36	44
$a_{3,t}$	[mm]	**12·d**	108	132	**7·d**	63	77
$a_{3,c}$	[mm]	**7·d**	63	77	**7·d**	63	77
$a_{4,t}$	[mm]	**3·d**	27	33	**7·d**	63	77
$a_{4,c}$	[mm]	**3·d**	27	33	**3·d**	27	33

		SCREWS INSERTED WITHOUT PRE-DRILLING HOLE			SCREWS INSERTED WITHOUT PRE-DRILLING HOLE		
d_1	**[mm]**		**9**	**11**		**9**	**11**
a_1	[mm]	**12·d**	108	132	**5·d**	45	55
a_2	[mm]	**5·d**	45	55	**5·d**	45	55
$a_{3,t}$	[mm]	**15·d**	135	165	**10·d**	90	110
$a_{3,c}$	[mm]	**10·d**	90	110	**10·d**	90	110
$a_{4,t}$	[mm]	**5·d**	45	55	**10·d**	90	110
$a_{4,c}$	[mm]	**5·d**	45	55	**5·d**	45	55

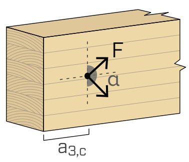
d = nominal screw diameter



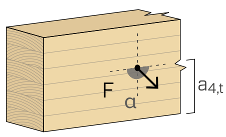
stressed end
-90° < α < 90°



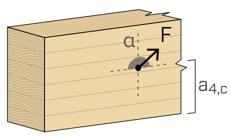
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°

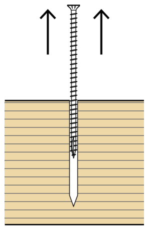


NOTES:

(1) Minimum distances are in accordance with EN 1995:2014 as per ETA-11/0030 considering a timber characteristic density of $\rho_k \leq 420$ kg/m^3.

- 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.

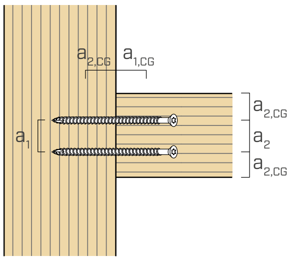
MINIMUM DISTANCES FOR AXIAL STRESSES[2]



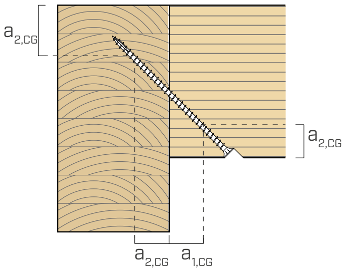
		SCREWS INSERTED WITH AND WITHOUT PRE-DRILLING HOLE		
d_1	**[mm]**		**9**	**11**
a_1	[mm]	**5·d**	45	55
a_2	[mm]	**5·d**	45	55
$a_{2,LIM}$[3]	[mm]	**2.5·d**	23	28
$a_{1,CG}$	[mm]	**10·d**	90	110
$a_{2,CG}$	[mm]	**4·d**	36	44
a_{CROSS}	[mm]	**1.5·d**	14	17

d = nominal screw diameter

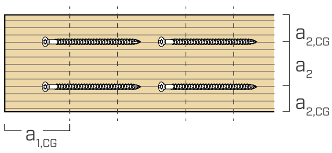
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



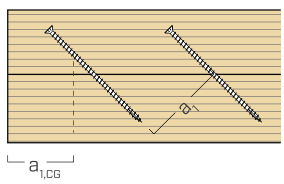
plan



front

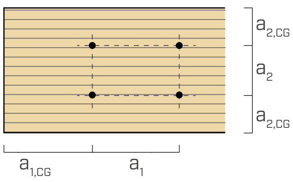


plan

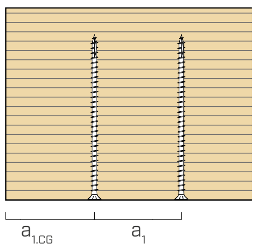


front

SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN

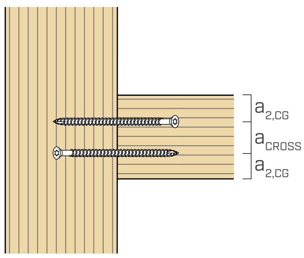


plan

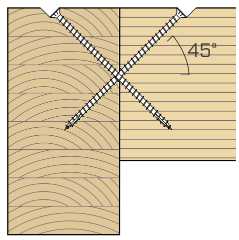


front

CROSS SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



plan



front

NOTES:

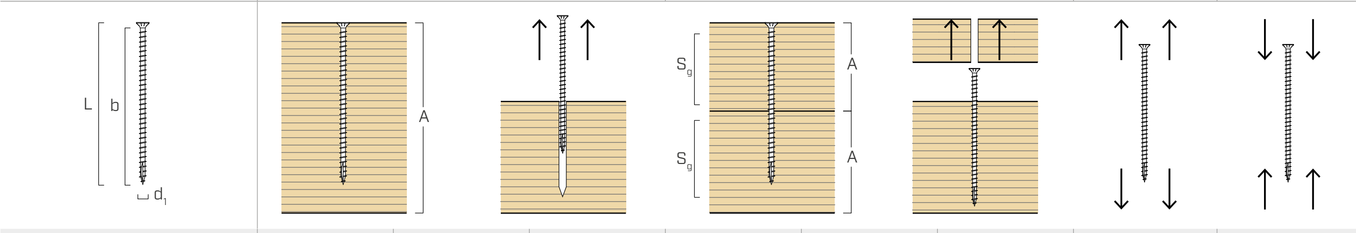
(2) The minimum distances for connectors stressed axially are independent of the insertion angle of the connector and the angle of the force with respect to the grain, in accordance with ETA-11/0030.

(3) The axial distance a_2 can be reduced down to $2{,}5 \cdot d_1$ if for each connector a "joint surface" $a_1 \cdot a_2 = 25 \cdot d_1^2$ is maintained.

STRUCTURAL VALUES

CHARACTERISTIC VALUES
EN 1995:2014

TENSION[1]/COMPRESSION[2]



geometry		total thread withdrawal[3]			partial thread withdrawal[3]			steel tension	instability
d_1 [mm]	L [mm]	b [mm]	A_{min} [mm]	timber $R_{ax,k}$ [kN]	S_g [mm]	A_{min} [mm]	timber $R_{ax,k}$ [kN]	steel $R_{tens,k}$ [kN]	steel $R_{ki,k}$ [kN]
9	120	110	130	13,40	45	65	5,48	25,40	17,56
	160	150	170	18,28	65	85	7,92		
	200	190	210	23,15	85	105	10,36		
	240	230	250	28,02	105	125	12,79		
	280	270	290	32,90	125	145	15,23		
	320	310	330	37,77	145	165	17,67		
	360	350	370	42,64	165	185	20,10		
11	100	90	110	13,40	35	55	5,21	38,00	22,32
	150	140	160	20,85	60	80	8,93		
	200	190	210	28,29	85	105	12,66		
	250	240	260	35,74	110	130	16,38		
	300	290	310	43,18	135	155	20,10		
	350	340	360	50,63	160	180	23,83		
	400	390	410	58,07	185	205	27,55		
	500	490	510	72,97	235	255	34,99		
	600	590	610	87,86	285	305	42,44		

NOTES:

(1) The tensile design strength of the connector is the lower between the wood-side design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

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

(2) The compression design strength of the connector is the lower between the wood-side design strength ($R_{ax,d}$) and the instability design strength ($R_{ki,k}$).

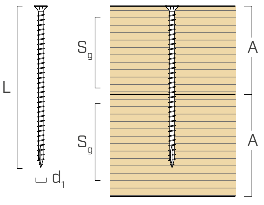
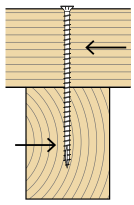
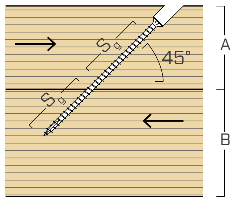
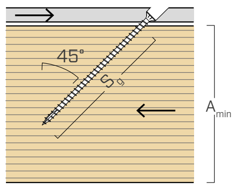
$$R_{ax,d} = min \begin{cases} \dfrac{R_{ax,k} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{ki,k}}{\gamma_{M1}} \end{cases}$$

(3) The axial resistance of the thread to withdrawal was calculated considering a 90° angle between the fibres and the connector and for a effective thread length of b or S_g.

For intermediate values of S_g it is possible to linearly interpolate.

STRUCTURAL VALUES

CHARACTERISTIC VALUES
EN 1995:2014

			SHEAR		SLIDING[4]							
geometry			timber-to-timber		timber-to-timber[5]				steel-to-timber[5]			
												
d_1 [mm]	L [mm]	S_g [mm]	A_{min} [mm]	$R_{V,k}$ [kN]	S_g [mm]	A_{min} [mm]	B_{min} [mm]	timber $R_{V,k}$ [kN]	S_g [mm]	A_{min} [mm]	timber $R_{V,k}$ [kN]	steel $R_{tens,k\ 45°}$[6] [kN]
9	120	45	60	4,50	45	50	60	3,88	100	90	8,62	17,96
	160	65	80	5,38	65	60	75	5,60	140	120	12,06	
	200	85	100	5,99	85	75	90	7,32	180	145	15,51	
	240	105	120	6,59	105	90	105	9,05	220	175	18,95	
	280	125	140	6,79	125	105	120	10,77	260	205	22,40	
	320	145	160	6,79	145	120	135	12,49	300	230	25,85	
	360	165	180	6,79	165	135	145	14,21	340	260	29,29	
11	100	35	50	4,64	35	40	55	3,69	80	75	8,42	26,87
	150	60	75	6,87	60	60	75	6,32	130	110	13,69	
	200	85	100	7,90	85	80	90	8,95	180	145	18,95	
	250	110	125	8,83	110	95	110	11,58	230	185	24,22	
	300	135	150	9,47	135	115	125	14,21	280	220	29,48	
	350	160	175	9,47	160	130	145	16,85	330	255	34,75	
	400	185	200	9,47	185	150	160	19,48	380	290	40,01	
	500	235	250	9,47	235	185	195	24,74	480	360	50,54	
	600	285	300	9,47	285	220	230	30,01	580	430	61,07	

NOTES:

(4) The axial resistance of the thread withdrawal was calculated considering a 45° angle between the fibres and the connector and for an effective thread length of S_g.

(5) The design sliding resistance of the joint is either the timber-side design resistance ($R_{V,d}$) or the steel design resistance ($R_{tens,d}$ 45°), whichever is lower.

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

To properly create the joint, the head of the connector must be completely inserted in the steel plate.

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

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.
- For the calculation process a timber characteristic density ρ_k = 420 kg/m^3 has been considered.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- 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.
- The timber to timber withdrawal, shear and sliding values were calculated considering the centre of gravity of the connector placed in correspondence with the shear plane.