VGS EVO

ICC ES ELC-4645 | ICC ES ESR-4645 | UKCA UKTA-0836 22/6195 | CE ETA-11/0030

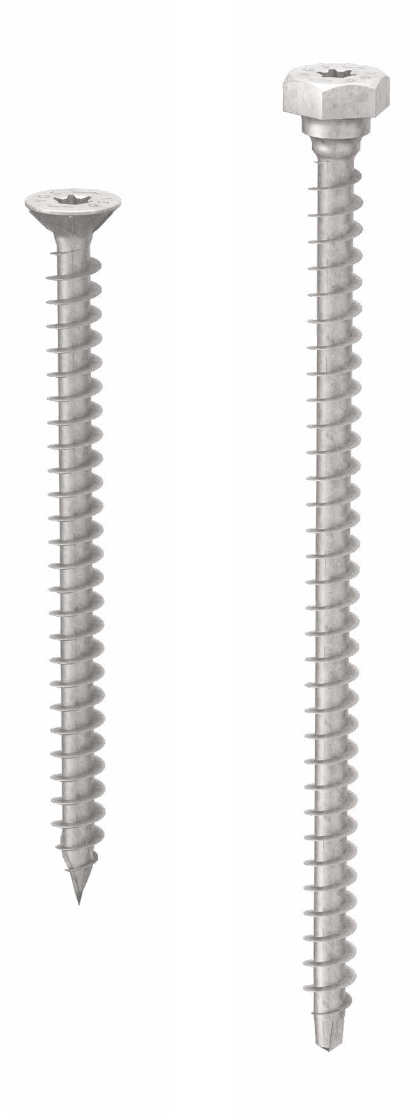
FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD

C4 EVO COATING
Surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, 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 (0° - 90°). Safety certified by numerous tests carried out for any direction of insertion. Cyclical SEISMIC-REV tests according to EN 12512. Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements.

AUTOCLAVE-TREATED TIMBER
The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use with ACQ-treated timber.

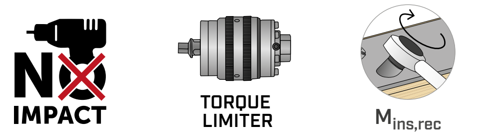
3 THORNS TIP
Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements.



MY PROJECT SOFTWARE | VIDEO | MANUALS | BIT INCLUDED

DIAMETER [mm]	9 – 13 (range 9 – 13)
LENGTH [mm]	100 – 800 (range 80 – 1500)
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

METAL-to-TIMBER recommended use:



FIELDS OF USE

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

OUTDOOR STRUCTURAL PERFORMANCE

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

CLT & LVL

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

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
9 TX 40	**VGSEVO9120**	120	110	25
	VGSEVO9160	160	150	25
	VGSEVO9200	200	190	25
	VGSEVO9240	240	230	25
	VGSEVO9280	280	270	25
	VGSEVO9320	320	310	25
	VGSEVO9360	360	350	25
11 TX 50	**VGSEVO11100**	100	90	25
	VGSEVO11150	150	140	25
	VGSEVO11200	200	190	25
	VGSEVO11250	250	240	25
	VGSEVO11300	300	290	25
	VGSEVO11350	350	340	25
	VGSEVO11400	400	390	25
	VGSEVO11500	500	490	25
	VGSEVO11600	600	590	25

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
13 TX 50	**VGSEVO13200**	200	190	25
	VGSEVO13300	300	280	25
	VGSEVO13400	400	380	25
	VGSEVO13500	500	480	25
	VGSEVO13600	600	580	25
13 SW 19 TX 50	**VGSEVO13700**	700	680	25
	VGSEVO13800	800	780	25

RELATED PRODUCTS

VGU EVO
page 190

TORQUE LIMITER
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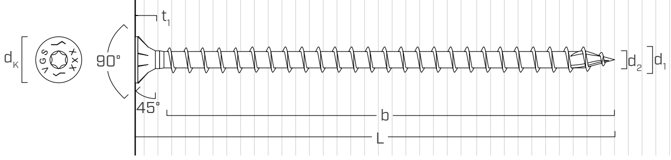
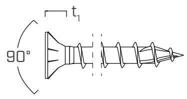
GEOMETRY AND MECHANICAL CHARACTERISTICS

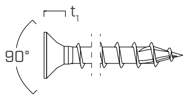
VGS Ø9-Ø11



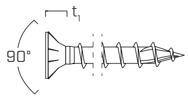
VGS Ø9
120 mm ≤ L ≤ 360 mm



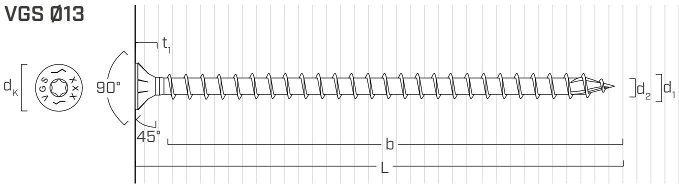
VGS Ø11
L ≤ 250 mm



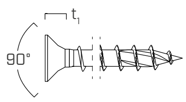
VGS Ø11
250 mm < L ≤ 600 mm



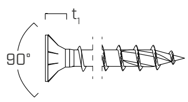
VGS Ø13



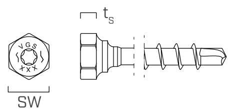
VGS Ø13
L ≤ 250 mm



VGS Ø13
250 mm < L ≤ 600 mm



VGS Ø13
L > 600 mm



Nominal diameter	d_1	**[mm]**	**9**	**11**	**13**	**13**
Length	L	[mm]	-	-	≤ 600 mm	> 600 mm
Countersunk head diameter	d_K	[mm]	16,00	19,30	22,00	-
Countersunk head thickness	t_1	[mm]	6,50	8,20	9,40	-
Wrench size	SW	-	-	-	-	SW 19
Hexagonal head thickness	t_s	[mm]	-	-	-	7,50
Thread diameter	d_2	[mm]	5,90	6,60	8,00	8,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	8,0	8,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0	7,0	9,0	9,0
Characteristic tensile strength	$f_{tens,k}$	[kN]	25,4	38,0	53,0	53,0
Characteristic yield moment	$M_{y,k}$	[Nm]	27,2	45,9	70,9	70,9
Characteristic yield strength	$f_{y,k}$	[N/mm²]	1000	1000	1000	1000

(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
Associated density	ρ_a	[kg/m³]	350	500	730
Calculation density	ρ_k	*[kg/m³]*	*≤ 440*	*410 ÷ 550*	*590 ÷ 750*

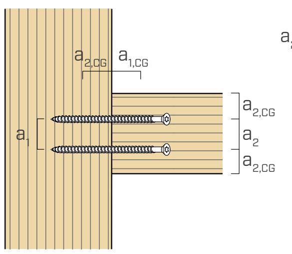
For applications with different materials please see ETA-11/0030.

MINIMUM DISTANCES FOR AXIAL STRESSES

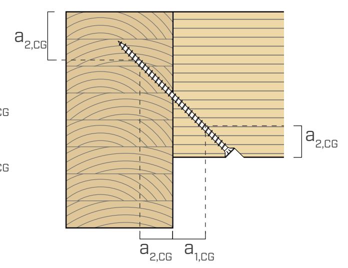
screws inserted **WITH and WITHOUT pre-drilled hole**

d_1	[mm]		9	11	13
a_1	[mm]	5·d	45	55	65
a_2	[mm]	5·d	45	55	65
$a_{2,LIM}$	[mm]	2,5·d	23	28	33
$a_{1,CG}$	[mm]	10·d	90	110	130
$a_{2,CG}$	[mm]	4·d	36	44	52
a_{CROSS}	[mm]	1,5·d	14	17	20

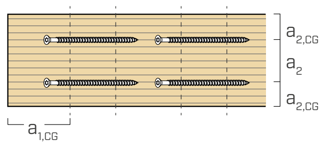
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



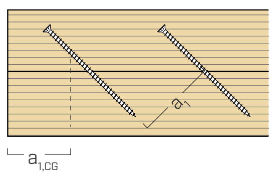
plan



front

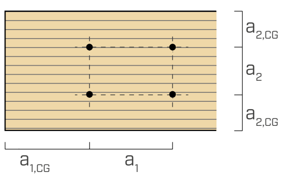


plan

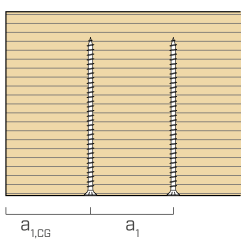


front

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



plan



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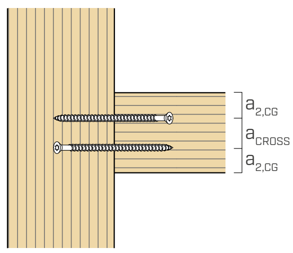
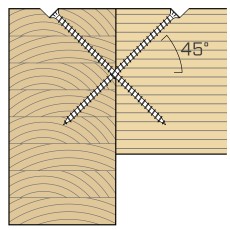
CROSS SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



plan



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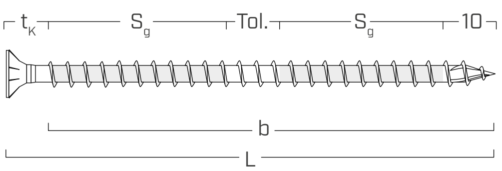
NOTES

- Minimum distances according to ETA-11/0030.
- The minimum distances are independent of the insertion angle of the connector and the angle of the force with respect to the grain.
- The axial distance a_2 can be reduced down to $a_{2,LIM}$ if for each connector a "joint surface" $a_1\ a_2 = 25\ d_1^2$ is maintained.
- For minimum distances for shear load screws see VGS on page 169.

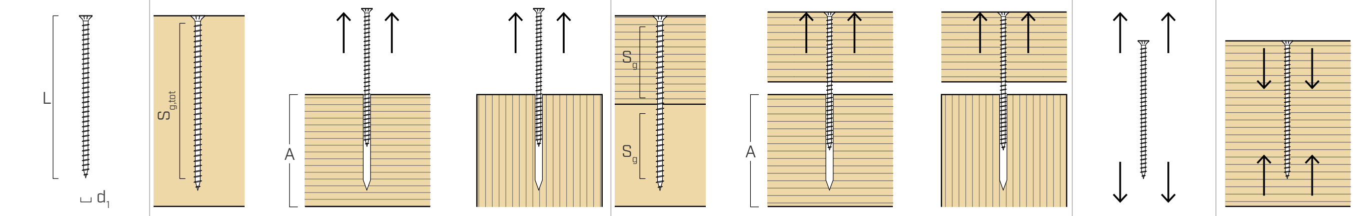
EFFECTIVE THREAD USED IN CALCULATION



$b = S_{g,tot} = L - t_K$ represents the entire length of the threaded part

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

t_K = 10 mm (countersunk head)
t_K = 20 mm (hexagonal head)



geometry		TENSION / COMPRESSION									
		total thread withdrawal				partial thread withdrawal				steel tension	instability ε=90°
		ε=90°			ε=0°	ε=90°			ε=0°		
d_1 [mm]	L [mm]	$S_{g,tot}$ [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	S_g [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	$R_{tens,k}$ [kN]	$R_{ki,90,k}$ [kN]
9	120	110	130	12,50	3,75	45	65	5,11	1,53	25,40	17,25
	160	150	170	17,05	5,11	65	85	7,39	2,22		
	200	190	210	21,59	6,48	85	105	9,66	2,90		
	240	230	250	26,14	7,84	105	125	11,93	3,58		
	280	270	290	30,68	9,21	125	145	14,21	4,26		
	320	310	330	35,23	10,57	145	165	16,48	4,94		
	360	350	370	39,78	11,93	165	185	18,75	5,63		
11	100	90	110	12,50	3,75	35	55	4,86	1,46	38,00	21,93
	150	140	160	19,45	5,83	60	80	8,33	2,50		
	200	190	210	26,39	7,92	85	105	11,81	3,54		
	250	240	260	33,34	10,00	110	130	15,28	4,58		
	300	290	310	40,28	12,08	135	155	18,75	5,63		
	350	340	360	47,22	14,17	160	180	22,22	6,67		
	400	390	410	54,17	16,25	185	205	25,70	7,71		
	500	490	510	68,06	20,42	235	255	32,64	9,79		
	600	590	610	81,95	24,58	285	305	39,59	11,88		
13	200	190	210	31,19	9,36	85	105	13,95	4,19	53,00	32,69
	300	280	310	45,96	13,79	130	150	21,34	6,40		
	400	380	410	62,38	18,71	180	200	29,55	8,86		
	500	480	510	78,79	23,64	230	250	37,75	11,33		
	600	580	610	95,21	28,56	280	300	45,96	13,79		
	700	680	710	111,62	33,49	330	350	54,17	16,25		
	800	780	810	128,04	38,41	380	400	62,38	18,71		

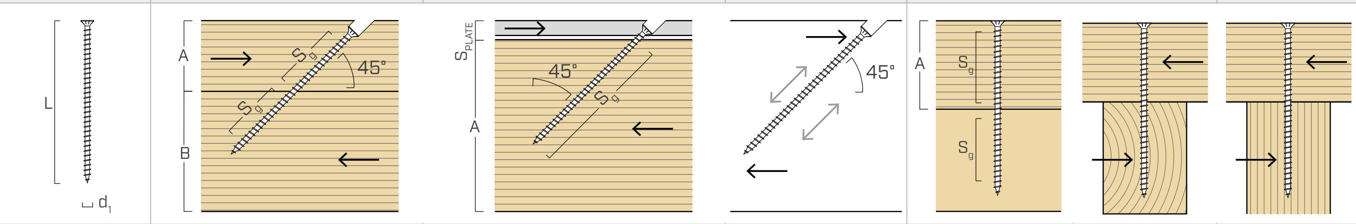
NOTES

- 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.
- The characteristic sliding strengths were evaluated by considering an angle ε of 45° between the grains of the timber element and the connector.
- The plate thickness (S_{PLATE}) are understood to be the minimum values to allow the head of the screw to be accommodated.
- 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.
- 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 (withdrawal, compression, sliding and shear) can be converted via the k_{dens} coefficient.

$$R'_{ax,k} = k_{dens,ax} \cdot R_{ax,k}$$
$$R'_{ki,k} = k_{dens,ki} \cdot R_{ki,k}$$
$$R'_{V,k} = k_{dens,ax} \cdot R_{V,k}$$
$$R'_{V,90,k} = k_{dens,V} \cdot R_{V,90,k}$$
$$R'_{V,0,k} = k_{dens,V} \cdot R_{V,0,k}$$

ρ_k [kg/m^3]	350	380	**385**	405	425	430	440
C-GL	C24	C30	GL24h	GL26h	GL28h	GL30h	GL32h
$k_{dens,ax}$	0,92	0,98	1,00	1,04	1,08	1,09	1,11
$k_{dens,ki}$	0,97	0,99	1,00	1,00	1,01	1,02	1,02
$k_{dens,v}$	0,90	0,98	1,00	1,02	1,05	1,05	1,07

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



		SLIDING									SHEAR			
geometry		timber-to-timber				steel-to-timber				steel tension			timber-to-timber ε=90°	timber-to-timber ε=0°
d_1 [mm]	L [mm]	S_g [mm]	A [mm]	B_{min} [mm]	$R_{V,k}$ [kN]	S_{PLATE} [mm]	S_g [mm]	A_{min} [mm]	$R_{V,k}$ [kN]	$R_{tens,45,k}$ [kN]	S_g [mm]	A [mm]	$R_{V,90,k}$ [mm]	$R_{V,0,k}$ [kN]
9	120	45	45	60	3,62	15	105	95	8,44	17,96	45	60	4,53	2,30
	160	65	60	75	5,22		145	125	11,65		65	80	5,10	2,81
	200	85	75	90	6,83		185	150	14,87		85	100	5,67	3,18
	240	105	90	105	8,44		225	180	18,08		105	120	6,23	3,35
	280	125	105	120	10,04		265	205	21,29		125	140	6,50	3,52
	320	145	120	135	11,65		305	235	24,51		145	160	6,50	3,69
	360	165	130	145	13,26		345	265	27,72		165	180	6,50	3,86
11	100	35	40	55	3,44	18	80	75	7,86	26,87	35	50	4,72	2,69
	150	60	60	75	5,89		130	110	12,77		60	75	6,61	3,33
	200	85	75	90	8,35		180	145	17,68		85	100	7,48	4,10
	250	110	95	110	10,80		230	185	22,59		110	125	8,35	4,57
	300	135	110	125	13,26		280	220	27,50		135	150	9,06	4,83
	350	160	130	145	15,71		330	255	32,41		160	175	9,06	5,09
	400	185	145	160	18,17		380	290	37,32		185	200	9,06	5,35
	500	235	180	195	23,08		480	360	47,14		235	250	9,06	5,87
	600	285	215	230	27,99		580	430	56,96		285	300	9,06	6,39
13	200	85	75	90	9,87	20	180	145	20,89	37,48	85	100	9,46	4,88
	300	130	110	125	15,09		280	220	32,50		130	145	11,31	6,11
	400	180	145	160	20,89		380	290	44,11		180	195	11,94	6,73
	500	230	180	195	26,70		480	360	55,71		230	245	11,94	7,35
	600	280	215	230	32,50		580	430	67,32		280	295	11,94	7,96
	700	330	250	265	38,30		-	-	-		330	345	11,94	8,58
	800	380	285	300	44,11		-	-	-		380	395	11,94	9,03

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- 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 ($R_{tens,d}$).

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

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

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

- The design sliding strength of the joint is either the timber-side design strength ($R_{V,d}$) and the design strength on the steel side projected ($R_{tens,45,d}$), whichever is lower:

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

- The design shear strength of the connector is obtained from the characteristic value as follows:

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

- 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.
- Dimensioning and verification of the timber elements must be carried out separately.
- The screws must be positioned in accordance with the minimum distances.
- The characteristic thread withdrawal strengths were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table.
  For intermediate values of S_g it is possible to linearly interpolate.
- The shear srength and sliding values were evaluated considering the centre of gravity of the connector placed in correspondence with the shear plane.
- 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.
- For different calculation configurations, the MyProject software is available (www.rothoblaas.com).
- For minimum distances and structural values for cross connectors in shear connection main beam - secondary beam see VGZ on page 130.
- For minimum distances and structural values on CLT and LVL see VGZ on page 134.