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

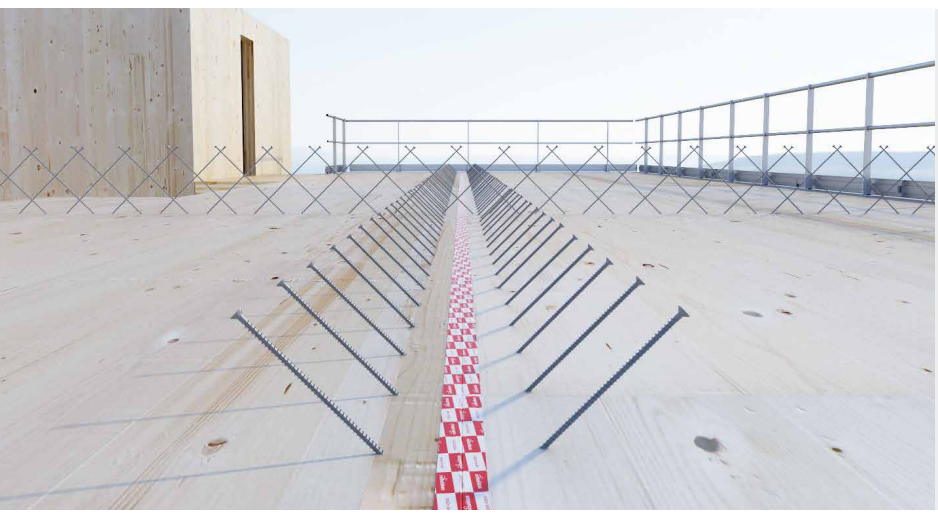
Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements.

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	0.36 | 0.44 inches
LENGTH	from 100 to 600 mm	4 to 23 5/8 inches



MATERIAL

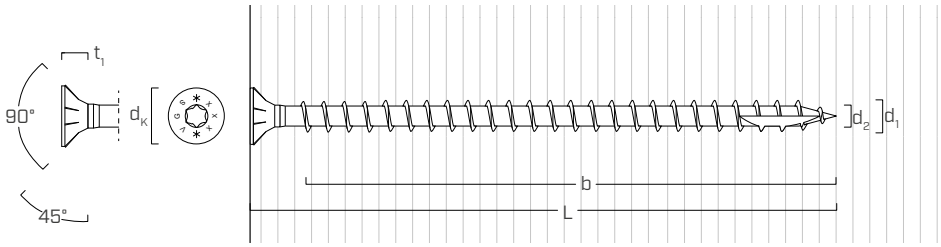
Carbon steel, with a 20 µm coating, highly resistant to corrosion.

FIELDS OF USE

- sawn lumber and timber
- Glued Laminated Timber
- CLT
- high density woods
- Pressure-treated lumber (ACQ)

Dry in-service applications.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[in](1)	0.36	0.44
Outer thread diameter	d_1	[mm]	9	11
		[in]	0.354	0.433
Head diameter	d_K	[in]	0.630	0.760
Root diameter	d_2	[in]	0.232	0.260
Head thickness	t_1	[in]	0.256	0.323
Tip length	L_t	[in]	0.354	0.433
Pre-drilling hole diameter(2)	d_V	[in]	0.20	0.24
Bending yield strength(3)	$F_{y,b}$	[psi]	180,000	170,000
Tensile strength	f_{tens}	[lbf]	2450	3200

(1) The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.
(2) Pre-drilling applies to softwood timber.
(3) Bending yield strengths are determined in accordance with ASTM F1575 using the root diameter d_2.

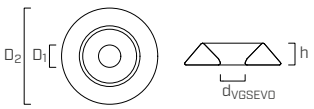
CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [in]	A [mm]	A [in]	pcs
9 **0.36** **TX 40**	**VGSEVO9120**	120	4 3/4	4 3/8	57	2 1/4	25
	VGSEVO9160	160	6 1/4	6	76	3	25
	VGSEVO9200	200	8	7 1/2	102	4	25
	VGSEVO9240	240	9 1/2	9 1/16	121	4 3/4	25
	VGSEVO9280	280	11	10 5/8	140	5 1/2	25
	VGSEVO9320	320	12 5/8	12 3/16	159	6 1/4	25
	VGSEVO9360	360	14 1/4	13 3/4	178	7	25

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [in]	A [mm]	A [in]	pcs
11 **0.44** **TX 50**	**VGSEVO11100**	100	4	3 1/2	25	1	25
	VGSEVO11150	150	6	5 1/2	76	3	25
	VGSEVO11200	200	8	7 1/2	102	4	25
	VGSEVO11250	250	10	9 1/2	127	5	25
	VGSEVO11300	300	11 3/4	11 7/16	152	6	25
	VGSEVO11350	350	13 3/4	13 3/8	171	6 3/4	25
	VGSEVO11400	400	15 3/4	15 3/8	197	7 3/4	25
	VGSEVO11500	500	19 3/4	19 5/16	248	9 3/4	25
	VGSEVO11600	600	23 5/8	23 1/4	298	11 3/4	25

HUS EVO TURNED WASHER

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



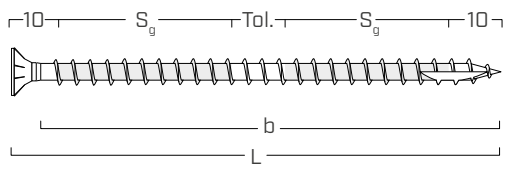
OUTDOOR STRUCTURAL PERFORMANCE

Values also tested, certified and calculated for high density timber. The EVO coating protects the fastener from aggressive species with elevated tannin content.

EXPOSURE CONDITIONS 3

Approved for use in exposure condition 3 outdoor applications according to Acceptance Criteria AC 257, and tested for use under class C4 atmospheric corrosion conditions.

EFFECTIVE THREAD USED IN CALCULATION



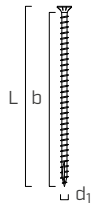
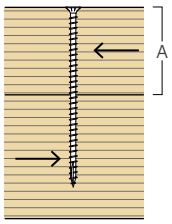
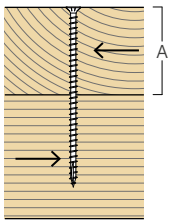
$\mathbf{b} = L - t_h$ represents the entire length of the threaded part

$\mathbf{S_g} = (b - L_t - Tol.) / 2$ represents the partial length of the threaded part net of a laying tolerance (Tol.) of 3/8 inch

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.

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES (Z) | WOOD-TO-WOOD

VGS EVO Ø9 | 0.36 inch - VGS EVO Ø11 | 0.44 inch

geometry					$Z_{\parallel}$ (1)				$Z_{\perp/\parallel}$ (2)				$Z_{\perp}$ (3)			
																
d_1	L		b	A	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	*[mm]*	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
9 **0.36 TX 40**	*120*	4 3/4	4 3/8	2 1/4	186	261	313	348	149	209	250	278	149	209	250	278
	160	6 1/4	6	3	230	272	313	348	184	217	250	278	184	217	250	278
	200	8	7 1/2	4	230	272	313	348	184	217	250	278	184	217	250	278
	240	9 1/2	9 1/16	4 3/4	230	272	313	348	184	217	250	278	184	217	250	278
	280	11	10 5/8	5 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	320	12 5/8	12 3/16	6 1/4	230	272	313	348	184	217	250	278	184	217	250	278
	360	14 1/4	13 3/4	7	230	272	313	348	184	217	250	278	184	217	250	278
11 **0.44 TX 50**	*100*	4	3 1/2	1	227	252	276	297	136	177	201	219	136	168	190	210
	150	6	5 1/2	3	314	344	372	394	217	252	278	299	178	232	262	285
	200	8	7 1/2	4	314	344	372	394	225	252	278	299	205	234	262	285
	250	10	9 1/2	5	314	344	372	394	225	252	278	299	205	234	262	285
	300	11 3/4	11 7/16	6	314	344	372	394	225	252	278	299	205	234	262	285
	350	13 3/4	13 3/8	6 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	400	15 3/4	15 3/8	7 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	500	19 3/4	19 5/16	9 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	600	23 5/8	23 1/4	11 3/4	314	344	372	394	225	252	278	299	205	234	262	285

NOTES:

Tabulated reference lateral design values (Z) are applicable to screws installed perpendicular to the faces of the wood members and loaded as follows:

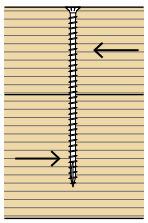
(1) $Z_{\parallel}$ both side and main members loaded parallel to the grain.

(2) $Z_{\perp/\parallel}$ side member loaded perpendicular to the grain; main member loaded parallel to the grain.

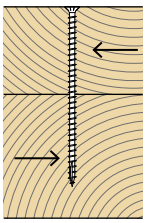
(3) $Z_{\perp}$ both side and main members loaded perpendicular to the grain.

Refer to page 10 for the general calculation principles.

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°

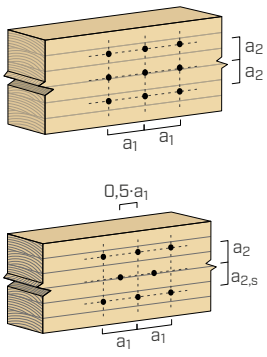


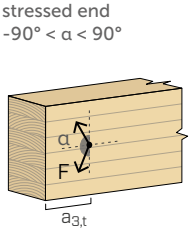
Load-to-grain angle α = 90°

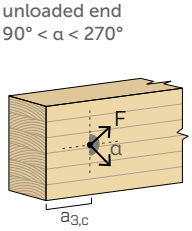
		Screws inserted without pre-drilling hole **G < 0.50**				Screws inserted without pre-drilling hole **G < 0.50**			
d_1	*[mm]*	*9*		*11*		*9*		*11*	
	[in]	**0.36**		**0.44**		**0.36**		**0.44**	
a_1	[in]	**15·d**	5 5/16	**15·d**	6 1/2	**10·d**	3 1/2	**10·d**	4 3/8
a_2	[in]	**5·d**	1 3/4	**5·d**	2 3/16	**5·d**	1 3/4	**5·d**	2 3/16
$a_{2,s}$	[in]	**2.5·d**	7/8	**5·d**	2 3/16	**2.5·d**	7/8	**5·d**	2 3/16
$a_{3,t}$	[in]	**15·d**	5 5/16	**15·d**	6 1/2	**10·d**	3 1/2	**10·d**	4 3/8
$a_{3,c}$	[in]	**10·d**	3 1/2	**10·d**	4 3/8	**10·d**	3 1/2	**10·d**	4 3/8
$a_{4,t}$	[in]	**5·d**	1 3/4	**5·d**	2 3/16	**10·d**	3 1/2	**10·d**	4 3/8
$a_{4,c}$	[in]	**5·d**	1 3/4	**5·d**	2 3/16	**5·d**	1 3/4	**5·d**	2 3/16

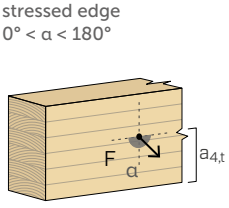
		Screws inserted without pre-drilling hole **G ≥ 0.50**				Screws inserted without pre-drilling hole **G ≥ 0.50**			
d_1	*[mm]*	*9*		*11*		*9*		*11*	
	[in]	**0.36**		**0.44**		**0.36**		**0.44**	
a_1	[in]	**15·d**	5 5/16	**15·d**	6 1/2	**10·d**	3 1/2	**10·d**	4 3/8
a_2	[in]	**7·d**	2 1/2	**7·d**	3 1/16	**7·d**	2 1/2	**7·d**	3 1/16
$a_{2,s}$	[in]	**3·d**	1 1/16	**5·d**	2 3/16	**3·d**	1 1/16	**5·d**	2 3/16
$a_{3,t}$	[in]	**20·d**	7 1/8	**20·d**	8 5/8	**15·d**	5 5/16	**15·d**	6 1/2
$a_{3,c}$	[in]	**15·d**	5 5/16	**15·d**	6 1/2	**15·d**	5 5/16	**15·d**	6 1/2
$a_{4,t}$	[in]	**7·d**	2 1/2	**7·d**	3 1/16	**12·d**	4 1/4	**12·d**	5 3/16
$a_{4,c}$	[in]	**7·d**	2 1/2	**7·d**	3 1/16	**7·d**	2 1/2	**7·d**	3 1/16

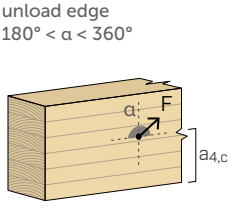
d = nominal screw diameter







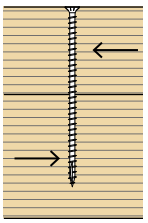




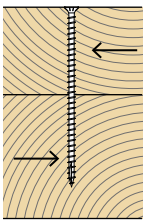
NOTES:

- The minimum spacing and distances comply with Table 9 of ESR-4645, where d refers to the nominal diameter of the screw.
- Values for spacing between staggered rows $a_{2,s}$ apply where fasteners in adjacent rows are offset by half of the spacing between fasteners in a row ($0.5 \cdot a_1$).
- Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°



Load-to-grain angle α = 90°

		Screws inserted without pre-drilling hole **G ≤ 0.47**			Screws inserted without pre-drilling hole **G ≤ 0.47**		
d_1	*[mm]*		*9*	*11*		*9*	*11*
	[in]		**0.36**	**0.44**		**0.36**	**0.44**
a_1	[in]	**12·d**	4 1/4	5 3/16	**5·d**	1 3/4	2 3/16
a_2	[in]	**5·d**	1 3/4	2 3/16	**5·d**	1 3/4	2 3/16
$a_{3,t}$	[in]	**15·d**	5 5/16	6 1/2	**10·d**	3 1/2	4 3/8
$a_{3,c}$	[in]	**10·d**	3 1/2	4 3/8	**10·d**	3 1/2	4 3/8
$a_{4,t}$	[in]	**5·d**	1 3/4	2 3/16	**10·d**	3 1/2	4 3/8
$a_{4,c}$	[in]	**5·d**	1 3/4	2 3/16	**5·d**	1 3/4	2 3/16

		Screws inserted without pre-drilling hole **G > 0.47**			Screws inserted without pre-drilling hole **G > 0.47**		
d_1	*[mm]*		*9*	*11*		*9*	*11*
	[in]		**0.36**	**0.44**		**0.36**	**0.44**
a_1	[in]	**15·d**	5 5/16	6 1/2	**7·d**	2 1/2	3 1/16
a_2	[in]	**7·d**	2 1/2	3 1/16	**7·d**	2 1/2	3 1/16
$a_{3,t}$	[in]	**20·d**	7 1/8	8 5/8	**15·d**	5 5/16	6 1/2
$a_{3,c}$	[in]	**15·d**	5 5/16	6 1/2	**15·d**	5 5/16	6 1/2
$a_{4,t}$	[in]	**7·d**	2 1/2	3 1/16	**12·d**	4 1/4	5 3/16
$a_{4,c}$	[in]	**7·d**	2 1/2	3 1/16	**7·d**	2 1/2	3 1/16

		Screws inserted **with** pre-drilling hole			Screws inserted **with** pre-drilling hole		
d_1	*[mm]*		*9*	*11*		*9*	*11*
	[in]		**0.36**	**0.44**		**0.36**	**0.44**
a_1	[in]	**5·d**	1 3/4	2 3/16	**4·d**	1 7/16	1 3/4
a_2	[in]	**3·d**	1 1/16	1 5/16	**4·d**	1 7/16	1 3/4
$a_{3,t}$	[in]	**12·d**	4 1/4	5 3/16	**7·d**	2 1/2	3 1/16
$a_{3,c}$	[in]	**7·d**	2 1/2	3 1/16	**7·d**	2 1/2	3 1/16
$a_{4,t}$	[in]	**3·d**	1 1/16	1 5/16	**7·d**	2 1/2	3 1/16
$a_{4,c}$	[in]	**3·d**	1 1/16	1 5/16	**3·d**	1 1/16	1 5/16

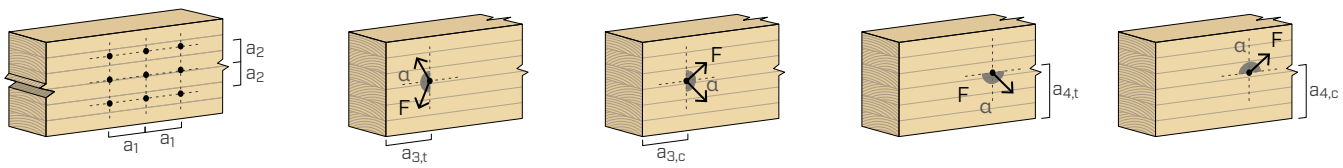
d = nominal screw diameter

stressed end
-90° < α < 90°

unloaded end
90° < α < 270°

stressed edge
0° < α < 180°

unload edge
180° < α < 360°

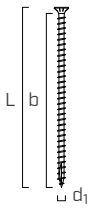
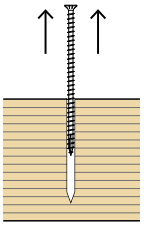
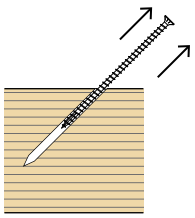


NOTES:

- The tabulated values for the minimum spacing and distances are according to the European Technical Assessment ETA-11/0030. The values from ETA-11/0030 are based on extensive research studies carried out in Europe and are according to the well-established provisions from EN 1995:2014 (Eurocode 5). Designers may adopt, under their responsibility, the minimum spacing and distances from ETA-11/0030.
- Specific gravity of G = 0.47 is equivalent to a characteristic density of ρ_k = 420 kg/m^3.
- The minimum spacing for all steel-to-timber connections (a_1 and a_2) can be multiplied by a coefficient of 0.7.

STRUCTURAL VALUES | THREAD WITHDRAWAL (W) | WOOD

VGS EVO Ø9 | 0.36 inch - VGS EVO Ø11 | 0.44 inch

geometry				W(1) α = 90°				W(1) α = 45°				W(1) α = 0°			
															
d_1 [mm] [in]	L [mm]	L [in]	b [in]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]
9 **0.36 TX 40**	120	4 3/4	4 3/8	513	592	688	752	467	539	626	684	154	178	206	225
	160	6 1/4	6	716	827	960	1049	652	753	874	955	215	248	288	315
	200	8	7 1/2	919	1062	1233	1347	837	966	1122	1226	276	319	370	404
	240	9 1/2	9 1/16	1122	1296	1505	1644	1021	1180	1370	1496	337	389	452	493
	280	11	10 5/8	1326	1531	1778	1942	1206	1393	1618	1767	398	459	533	583
	320	12 5/8	12 3/16	1529	1766	2050	2240	1391	1607	1866	2038	459	530	615	672
	360	14 1/4	13 3/4	1732	2000	2323	2537	1576	1820	2114	2309	520	600	697	761
11 **0.44 TX 50**	100(2)	4	3 1/2	460	532	597	653	419	484	543	594	138	160	179	196
	150	6	5 1/2	752	868	975	1067	684	790	887	971	225	261	293	320
	200	8	7 1/2	1043	1205	1353	1480	949	1097	1231	1347	313	362	406	444
	250	10	9 1/2	1334	1542	1731	1893	1214	1403	1575	1723	400	463	519	568
	300	11 3/4	11 7/16	1626	1878	2109	2307	1479	1709	1919	2099	488	563	633	692
	350	13 3/4	13 3/8	1917	2215	2487	2720	1744	2016	2263	2475	575	664	746	816
	400	15 3/4	15 3/8	2208	2552	2865	3133	2010	2322	2607	2851	663	765	859	940
	500	19 3/4	19 5/16	2791	3225	3621	3960	2540	2935	3295	3604	837	967	1086	1188
	600	23 5/8	23 1/4	3374	3898	4377	4787	3070	3547	3983	4356	1012	1169	1313	1436

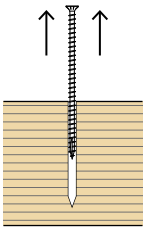
NOTES:

(1) The tabulated values refer to the effective thread penetration length of the screw in the wood member (b - L_t).

(2) The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

Refer to page 10 for the general calculation principles.

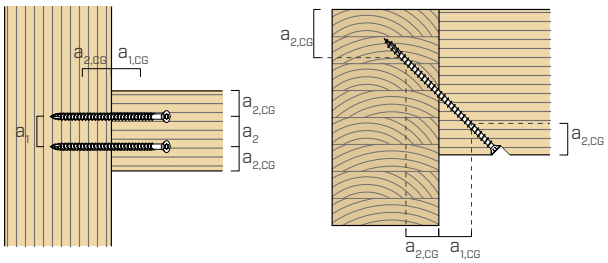
MINIMUM DISTANCES FOR AXIAL STRESSES



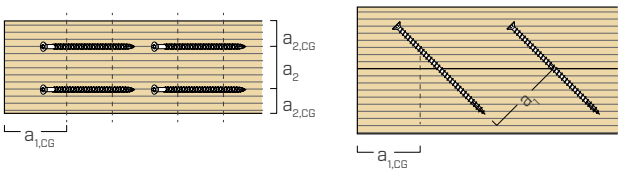
		Screws inserted with and without pre-drilling hole **G ≤ 0.55**			
d_1	*[mm]*	*9*		*11*	
	[in]	**0.36**		**0.44**	
a_1	[in]	**7·d**	2 1/2	**7·d**	3 1/16
a_2	[in]	**4·d**	1 7/16	**5·d**	2 3/16
$a_{1,CG}$	[in]	**10·d**	3 1/2	**10·d**	4 3/8
$a_{2,CG}$	[in]	**4·d**	1 7/16	**4·d**	1 3/4
$a_{2,CROSS}$	[in]	**1.5·d**	9/16	**1.5·d**	11/16

d = nominal screw diameter

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

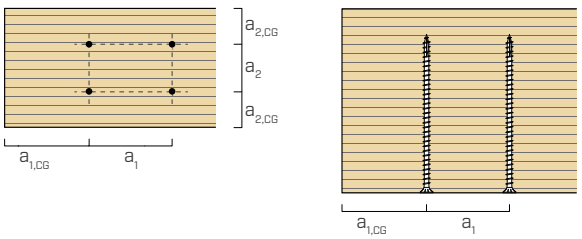


plan front



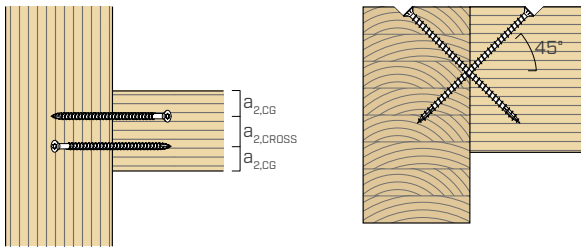
plan front

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

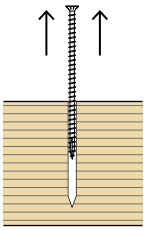


plan front

NOTES:

- The minimum spacing and distances comply with Table 9 of ESR-4645, where d refers to the nominal diameter of the screw.
- Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

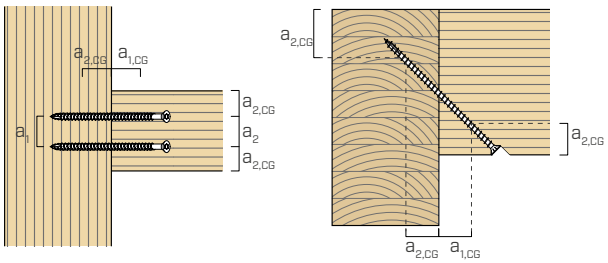
MINIMUM DISTANCES FOR AXIAL STRESSES



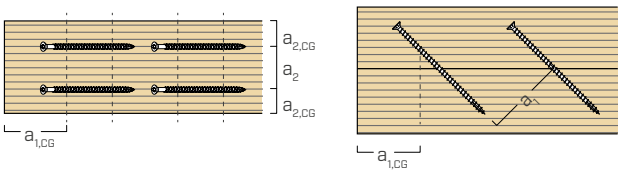
		Screws inserted with and without pre-drilling hole **G ≤ 0.55**		
d_1	*[mm]*		*9*	*11*
	[in]		**0.36**	**0.44**
a_1	[in]	**5·d**	1 3/4	2 3/16
a_2	[in]	**5·d**	1 3/4	2 3/16
$a_{2,LIM}$ (1)	[in]	**2.5·d**	*7/8*	*1 1/8*
$a_{1,CG}$	[in]	**10·d**	3 1/2	4 3/8
$a_{2,CG}$	[in]	**4·d**	1 7/16	1 3/4
a_{CROSS}	[in]	**1.5·d**	9/16	11/16

d = nominal screw diameter

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

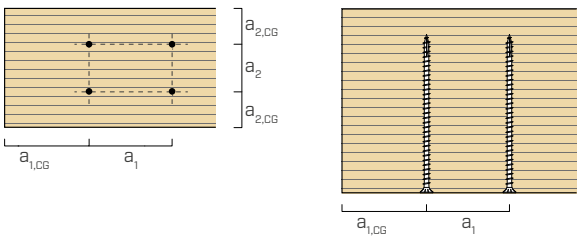


plan front



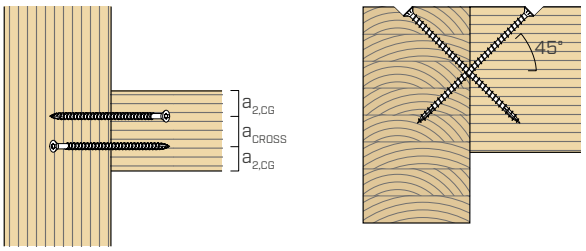
plan front

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

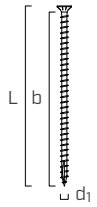
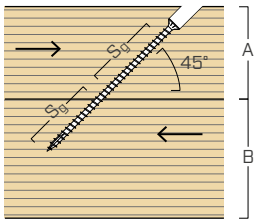
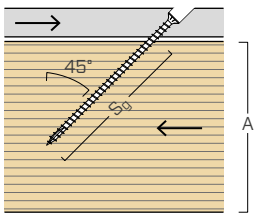
NOTES:

- The tabulated values for the minimum spacing and distances are according to the European Technical Assessment ETA-11/0030. The values from ETA-11/0030 are based on extensive research studies carried out in Europe and are according to the well-established provisions from EN 1995:2014 (Eurocode 5). Designers may adopt, under their responsibility, the minimum spacing and distances from ETA-11/0030.

(1) 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 | SLIDING RESISTANCE (R_V)

VGS EVO Ø9 | 0.36 inch - VGS EVO Ø11 | 0.44 inch

geometry			R_v							R_v					
															
d_1	L		S_g	A_{min}	B_{min}	G=0.35	G=0.42	G=0.49	G=0.55	S_g	A_{min}	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
9 **0.36 TX 40**	120[1]	4 3/4	1 3/4	1 15/16	2 3/8	149	172	199	218	4	3 1/2	330	381	443	484
	160[1]	6 1/4	2 9/16	2 3/8	2 15/16	214	247	287	314	5 9/16	4 3/4	461	532	618	675
	200	8	3 3/8	2 15/16	3 1/2	279	323	375	409	7 1/8	6	592	683	793	867
	240	9 1/2	4 1/8	3 1/2	4 1/8	345	398	462	505	8 5/8	6 7/8	722	834	969	1058
	280	11	4 15/16	4 1/8	4 3/4	410	474	550	601	10 1/4	8 1/16	853	985	1144	1250
	320	12 5/8	5 11/16	4 3/4	5 5/16	475	549	638	697	11 3/4	9 1/4	984	1136	1319	1441
	360	14 1/4	6 1/2	5 5/16	5 11/16	541	625	725	792	13 3/8	10 1/4	1114	1287	1494	1633
11 **0.44 TX 50**	100[1]	4	1 5/16	1 9/16	2 3/16	129	149	168	184	3 1/8	2 15/16	296	342	384	420
	150	6	2 5/16	2 3/8	2 15/16	223	258	289	317	5 1/16	4 3/8	484	559	627	686
	200	8	3 5/16	3 1/8	3 1/2	317	366	411	450	7 1/16	5 11/16	671	775	871	952
	250	10	4 5/16	3 3/4	4 3/8	411	474	533	583	9 1/16	7 1/8	859	992	1114	1218
	300	11 3/4	5 1/4	4 1/2	4 15/16	504	583	654	716	11	8 7/16	1046	1209	1357	1484
	350	13 3/4	6 1/4	5 1/8	5 11/16	598	691	776	849	13	10 1/16	1234	1425	1600	1750
	400	15 3/4	7 1/4	6	6 1/4	692	799	897	982	15	11 7/16	1421	1642	1843	2016
	500	19 3/4	9 1/16	7 1/4	7 11/16	879	1016	1141	1248	19	14 1/4	1796	2075	2330	2548
	600	23 5/8	11	8 5/8	9 1/16	1067	1232	1384	1514	22 13/16	16 15/16	2171	2508	2816	3080

NOTES:

(1) The embedded thread length in the main and side member for timber-to-timber connection and in the main member for steel-to-timber connection does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle α = 45° to the grain).

Refer to page 10 for the general calculation principles.

GENERAL PRINCIPLES:

- Tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD, design loads for use with LRFD or both.
- As part of the connection design, the structural wood members must be checked for load-carrying capacity in accordance with Section 11.1.2 of the NDS and local stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and fastener group.
- The design of connection with steel side plate must comply with Section 11.2.3 of the NDS.
- Connections with multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of the NDS and the requirements in Section 4.1.7.3.1 of ESR-4645.
- VGS EVO screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection C_M is 1.0).
- Sizing and verification of the timber elements and steel plates must be done separately by the designer.
- 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.

REFERENCE LATERAL DESIGN VALUES:

- Tabulated values are determined from the yield model equations in Section 12.3 and Table 12.3.1A of the NDS.
- The screw penetration into the main member is minimum 6 times the outer thread diameter unless otherwise noted.
- The reference lateral design values may be determined for other connection configurations in accordance with the NDS and Section 4.1.6.2 of ESR-4645.
- The reference lateral design values 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.

WOOD-TO-WOOD

- The wood main member thickness must be greater than the screw length less the thickness of the wood side member.
- The tabulated lateral design values are based on both wood members having the same specific gravity G.

STEEL-TO-WOOD

- The steel side member must have a minimum tensile strength equal to 58 ksi (400 MPa) and comply with the minimum requirements of ASTM A36.
- The wood main member thickness must be greater than the screw length less the thickness of the steel side member.

REFERENCE WITHDRAWAL DESIGN VALUES:

The reference withdrawal design values (W_{ref}) expressed in pounds-force per inch of thread penetration into the main member for screws installed at an angle of 90° to the grain can be found in Table 7 of ESR-4645 and are reported below.

d_1	Reference withdrawal design values W_{ref}			
	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[lbf/in]	[lbf/in]	[lbf/in]	[lbf/in]
9 **0.36**	129	149	173	189
11 **0.44**	148	171	192	210

- The values for screws installed at an angle α to the grain are determined by multiplying the reference withdrawal design values with the effective thread penetration L_{eff} of the screw in the wood member and with the factor k_α:

$$W_\alpha = W_{ref} \cdot k_\alpha \cdot L_{eff}$$

Where:

- W_{ref} is the reference withdrawal design value for screws installed at an angle of 90° to the grain, as shown in the table on the left;
- k_α factor is calculated as:

$$k_\alpha = \begin{cases} 35^\circ < \alpha \leq 90^\circ & \dfrac{1}{1.2 \cdot \cos^2(\alpha) + \sin^2(\alpha)} \\ 0^\circ \leq \alpha \leq 35^\circ & 0.3 + 0.7 \cdot \dfrac{\alpha}{45} \end{cases}$$

- α is the angle between the grain direction and screw axis.

- The minimum embedded thread length is 6 times the outer thread diameter for screws installed at 90° to the grain, unless otherwise noted.
- The minimum embedded thread length for screws installed at an angle $0° \leq \alpha < 90°$ to the grain is 8 times the outer thread diameter, unless otherwise noted.
- At least four screws must be used in a connection with screws installed in the wood member with an angle between the grain direction and screw axis $\alpha \leq 15°$.
- The reference withdrawal design values must be less than f_{tens} of the screw.