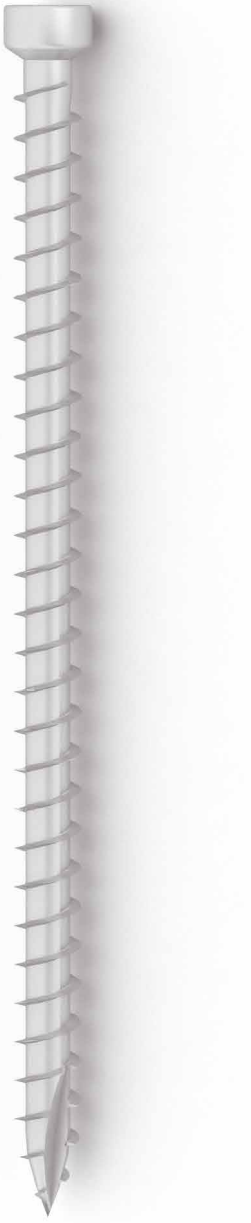
VGZ EVO

FULL THREADED SCREW WITH CYLINDRICAL HEAD

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



C4 EVO COATING

C4 EVO 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. Tested for use in outdoor applications under C4 atmospheric corrosion class conditions (ISO 12944-2).

PRESSURE - TREATED LUMBER

Ideal for applications with timber containing tannin or treatment agents. EVO Coating has been evaluated by ICC-ES according to Acceptance Criteria AC 257 for use with ACQ treated lumber for durable structures in challenging conditions.

SUPERIOR STRENGTH

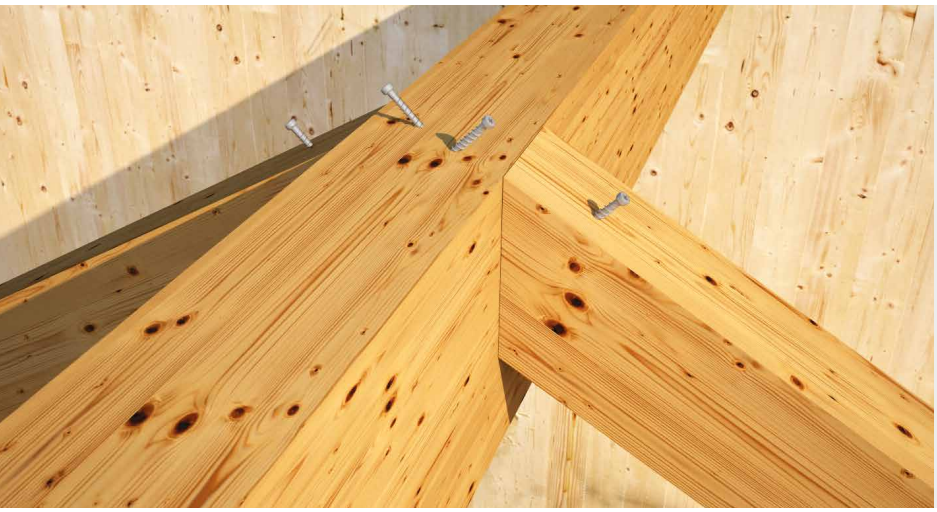
Steel with superb bending yield strength (minimum of F_{yb} = 1158 N/mm² | **168,000 psi**). Very high torsional strength $f_{tor,k}$ for safer screwing.

STRUCTURAL APPLICATIONS

Evaluated by ICC-ES according to Acceptance Criteria AC 233. Withdrawal values for any angle between the screw axis and the grain (including end-grain).

CHARACTERISTICS

FOCUS	corrosiveness class C4	
HEAD	cylindrical, countersunk	
DIAMETER	5,3 | 5,6 | 7,0 | 9,0 mm	**0.21 | 0.23 | 0.28 | 0.36 inches**
LENGTH	from 80 to 360 mm	**3 1/8 to 14 1/4 inches**



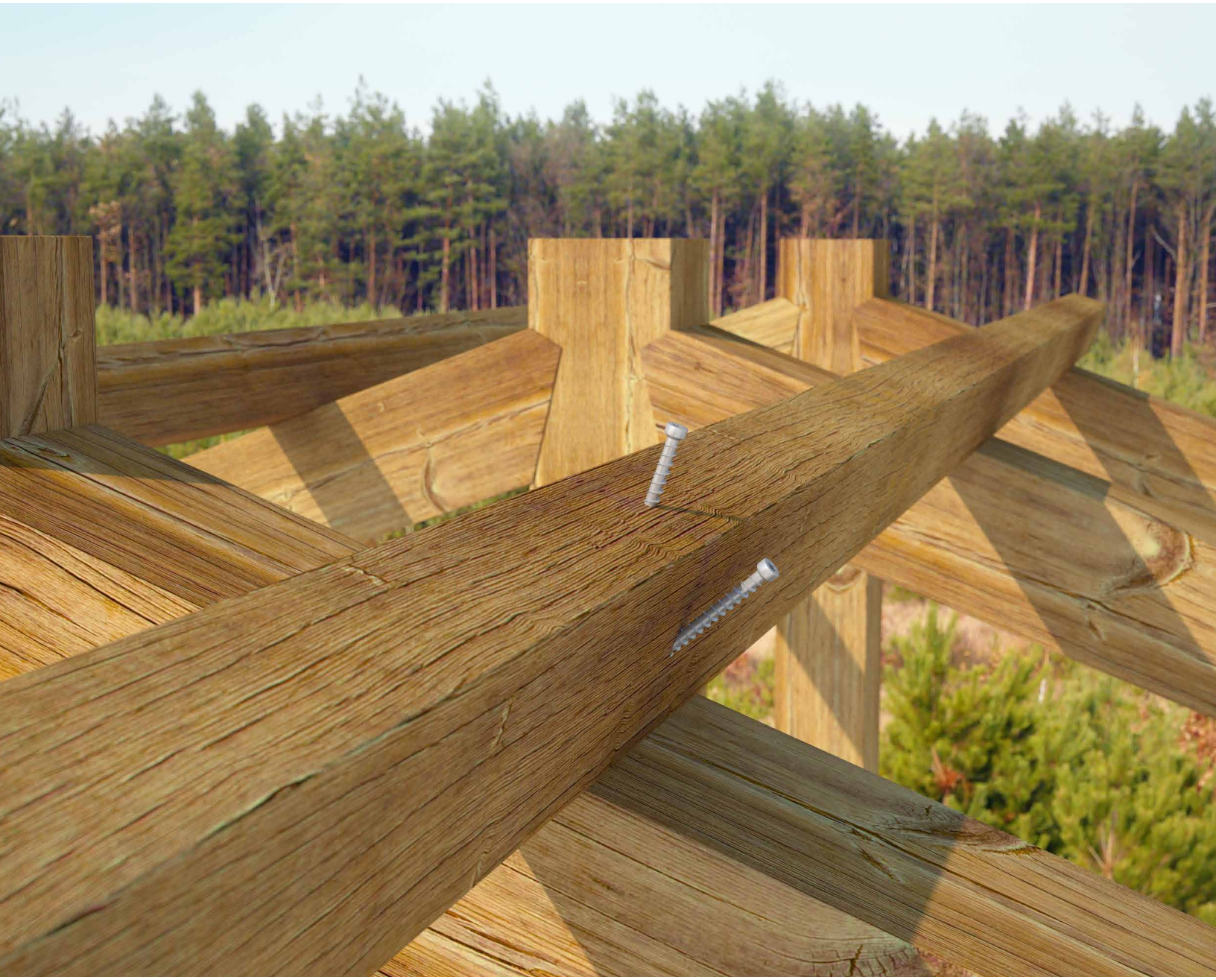
MATERIAL

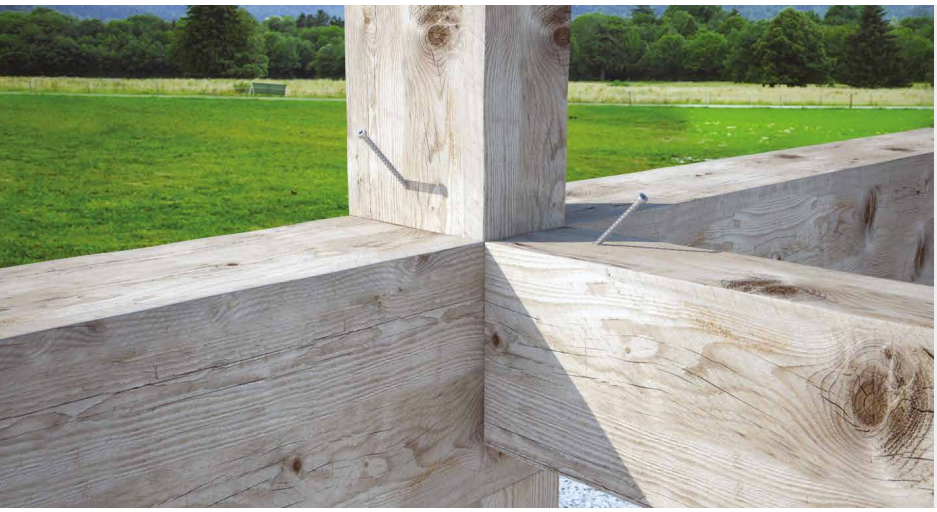
Carbon steel, with a 20 µm coating, highly resistant to corrosion.

FIELDS OF USE

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

Dry in-service conditions.





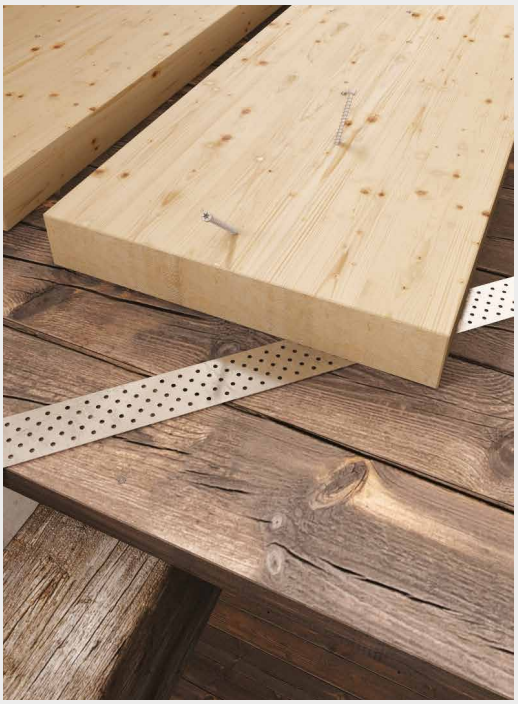
EXPOSURE CONDITIONS 3

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.

TIMBER FRAME

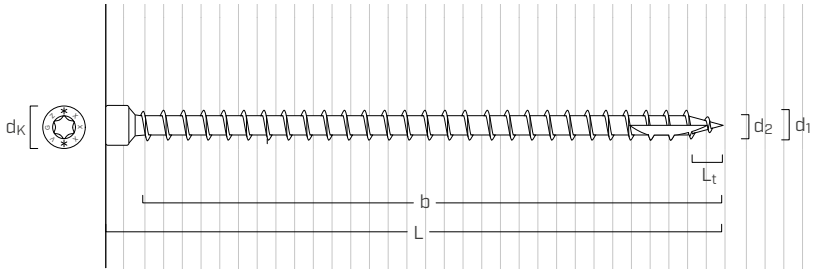
Values also tested, certified and calculated for CLT and high density woods such as Microllam R LVL.

Fastening Wood Trusses outdoors.



Restoration of existing timber floor using glulam beams and VGZ connectors.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[in](1)	0.21	0.23	0.28	0.36
Outer thread diameter	**d_1**	[mm]	5,3	5,6	7,0	9,0
		[in]	0.209	0.220	0.276	0.354
Head diameter	d_K	[in]	0.315	0.315	0.374	0.453
Root diameter	d_2	[in]	0.142	0.150	0.181	0.232
Tip length	L_t	[in]	0.209	0.220	0.276	0.354
Pre-drilling hole diameter(2)	d_V	[in]	0.14	0.14	0.16	0.20
Bending yield strength(3)	$F_{y,b}$	[psi]	168,000	168,000	195,000	180,000
Tensile strength	f_{tens}	[lbf]	1000	1100	1450	2450

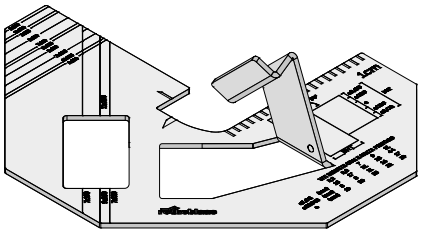
(1) The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.
(2) Pre-drilling applies to softwood timber.
(3) Bending yield strengths are determined in accordance with ASTM F1575 using the root diameter d_2.

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
5,3 **0.21 TX 25**	**VGZEVO580**	80	3 1/8	70	2 3/4	50
	VGZEVO5100	100	4	90	3 1/2	50
	VGZEVO5120	120	4 3/4	110	4 3/8	50
5,6 **0.23 TX 25**	**VGZEVO5140**	140	5 1/2	130	5 1/8	50
	VGZEVO5160	160	6 1/4	150	6	50
7 **0.28 TX 30**	**VGZEVO7140**	140	5 1/2	130	5 1/8	25
	VGZEVO7180	180	7 1/8	170	6 3/4	25
	VGZEVO7220	220	8 5/8	210	8 1/4	25
	VGZEVO7260	260	10 1/4	250	10	25
	VGZEVO7300	300	11 3/4	290	11 7/16	25

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
9 **0.36 TX 40**	**VGZEVO9200**	200	8	190	7 1/2	25
	VGZEVO9240	240	9 1/2	230	9 1/16	25
	VGZEVO9280	280	11	270	10 5/8	25
	VGZEVO9320	320	12 5/8	310	12 3/16	25
	VGZEVO9360	360	14 1/4	350	13 3/4	25

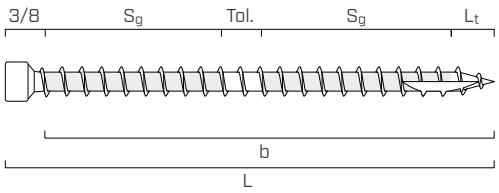
JIG VGZ 45° TEMPLATE



VIDEO

CODE	description	pcs
JIGVGZ45	steel template for VGZ screws at 45°	1

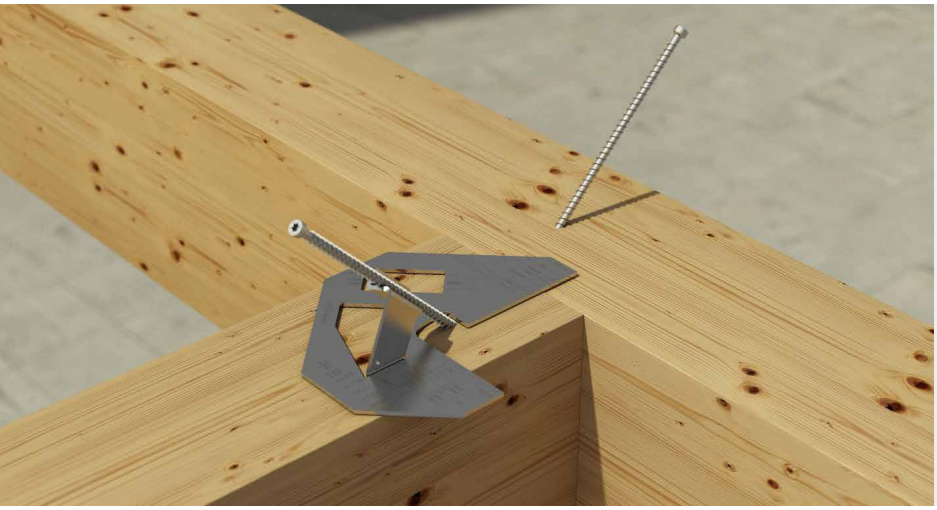
EFFECTIVE THREAD USED IN CALCULATION



b = L - 3/8 inch — represents the entire length of the threaded part

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.

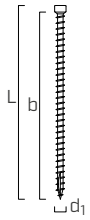
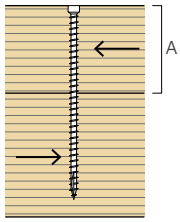
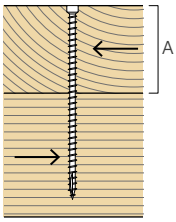
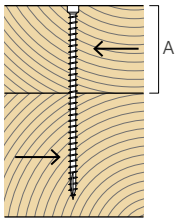


JIG VGZ 45° TEMPLATE

Installation at 45° using the JIG VGZ steel template.

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

VGZ EVO Ø5,3 | 0.21 inch - VGZ EVO Ø5,6 | 0.23 inch - VGZ EVO Ø7 | 0.28 inch - VGZ EVO Ø9 | 0.36 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]
5,3 **0.21**	*80*	3 1/8	2 3/4	1 1/2	98	125	144	161	98	125	144	161	98	125	144	161
	100	4	3 1/2	2	106	125	144	161	106	125	144	161	106	125	144	161
	120	4 3/4	4 3/8	2 1/4	106	125	144	161	106	125	144	161	106	125	144	161
5,6 **0.23**	*140*	5 1/2	5 1/8	2 3/4	118	140	161	179	118	140	161	179	118	140	161	179
	160	6 1/4	6	3	118	140	161	179	118	140	161	179	118	140	161	179
7 **0.28**	*140*	5 1/2	5 1/8	2 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	180	7 1/8	6 3/4	3 1/2	177	210	242	269	142	168	193	215	142	168	193	215
	220	8 5/8	8 1/4	4 1/4	177	210	242	269	142	168	193	215	142	168	193	215
	260	10 1/4	10	5	177	210	242	269	142	168	193	215	142	168	193	215
	300	11 3/4	11 7/16	6	177	210	242	269	142	168	193	215	142	168	193	215
9 **0.36**	*200*	8	190	4	230	272	313	348	184	217	250	278	184	217	250	278
	240	9 1/2	230	4 3/4	230	272	313	348	184	217	250	278	184	217	250	278
	280	11	270	5 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	320	12 5/8	310	6 1/4	230	272	313	348	184	217	250	278	184	217	250	278
	360	14 1/4	350	7	230	272	313	348	184	217	250	278	184	217	250	278

NOTES:

Tabulated reference lateral design values 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.

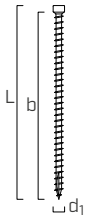
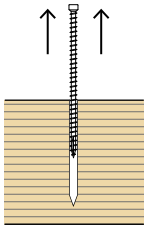
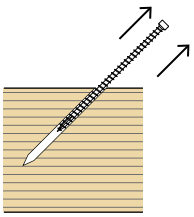
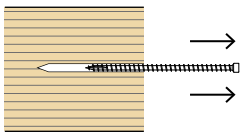
(2) $Z_{\perp/\parallel}$ side member loaded perpendicular to the grain; main member loaded parallel to the grain.

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

Refer to page 9 for the general calculation principles.

STRUCTURAL VALUES | THREAD WITHDRAWAL (W) | WOOD

VGZ EVO Ø5,3 | 0.21 inch - VGZ EVO Ø5,6 | 0.23 inch - VGZ EVO Ø7 | 0.28 inch - VGZ EVO Ø9 | 0.36 inch

geometry				$W^{(1)}$ α = 90°				$W^{(1)}$ α = 45°				$W^{(1)}$ α = 0°			
															
d_1	L		b	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]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
5,3 **0.21**	*80*	3 1/8	2 3/4	260	301	336	369	236	274	306	336	78	90	101	111
	100	4	3 1/2	340	393	440	484	310	358	401	440	102	118	132	145
	120	4 3/4	4 3/8	420	486	544	598	383	443	495	544	126	146	163	179
5,6 **0.23**	*140*	5 1/2	5 1/8	524	602	681	744	477	548	620	677	157	181	204	223
	160	6 1/4	6	608	699	790	864	554	636	719	786	182	210	237	259
7 **0.28**	*140*	5 1/2	5 1/8	625	717	804	881	568	652	732	802	187	215	241	264
	180	7 1/8	6 3/4	828	950	1065	1168	753	864	969	1063	248	285	320	350
	220	8 5/8	8 1/4	1031	1183	1327	1455	938	1076	1207	1324	309	355	398	436
	260	10 1/4	10	1234	1416	1588	1741	1123	1288	1445	1584	370	425	476	522
	300	11 3/4	11 7/16	1437	1649	1850	2028	1308	1501	1683	1845	431	495	555	608
9 **0.36**	*200*	8	190	919	1062	1233	1347	837	966	1122	1226	276	319	370	404
	240	9 1/2	230	1122	1296	1505	1644	1021	1180	1370	1496	337	389	452	493
	280	11	270	1326	1531	1778	1942	1206	1393	1618	1767	398	459	533	583
	320	12 5/8	310	1529	1766	2050	2240	1391	1607	1866	2038	459	530	615	672
	360	14 1/4	350	1732	2000	2323	2537	1576	1820	2114	2309	520	600	697	761

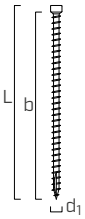
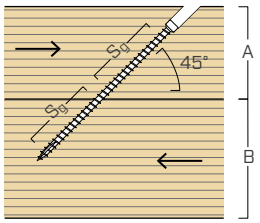
NOTES:

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

Refer to page 9 for the general calculation principles.

STRUCTURAL VALUES | SLIDING RESISTANCE (R_V) | WOOD-TO-WOOD

VGZ EVO Ø5,3 | 0.21 inch - VGZ EVO Ø5,6 | 0.23 inch - VGZ EVO Ø7 | 0.28 inch - VGZ EVO Ø9 | 0.36 inch

geometry					R_v			
								
d_1	L		b	A_{min}	B_{min}	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	*[mm]*	[in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5,3 **0.21**	*80*[1]	3 1/8	2 3/4	1 1/2	1 7/8	65	75	84	92
	100[1]	4	3 1/2	2	2 3/16	90	105	117	129
	120	4 3/4	4 3/8	2 1/4	2 7/16	116	135	150	165
5,6 **0.23**	*140*	5 1/2	5 1/8	2 3/4	2 3/4	149	171	194	212
	160	6 1/4	6	3	3	176	203	229	250
7 **0.28**	*140*[1]	5 1/2	5 1/8	2 3/4	2 3/4	180	206	231	254
	180	7 1/8	6 3/4	3 1/2	3 5/16	245	281	315	346
	220	8 5/8	8 1/4	4 1/4	4 1/4	310	356	400	438
	260	10 1/4	10	5	4 7/16	376	431	484	530
	300	11 3/4	11 7/16	6	4 15/16	441	506	568	622
9 **0.36**	*200*	8	7 1/2	4	3 9/16	278	321	373	407
	240	9 1/2	9 1/16	4 3/4	4 1/8	343	396	460	503
	280	11	10 5/8	5 1/2	4 11/16	409	472	548	599
	320	12 5/8	12 3/16	6 1/4	5 1/4	474	547	635	694
	360	14 1/4	13 3/4	7	5 13/16	539	623	723	790

NOTES:

[1] The embedded thread length in the main and side member 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).

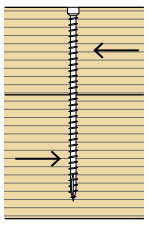
- The connector tensile strenght must be evaluated and verified considering a 45° angle between the fibers and the connector.

Refer to page 9 for the general calculation principles.

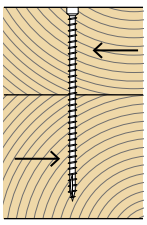
MINIMUM DISTANCES FOR LATERAL LOADING

ESR-4645

For the table "Minimum distances for axial stresses", see VGZ Technical data sheets USA.



Load-to-grain angle α = 0°

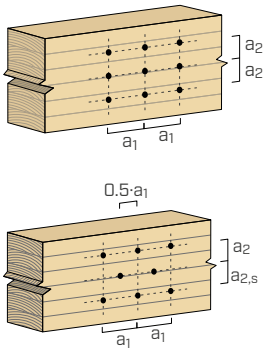


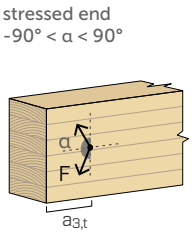
Load-to-grain angle α = 90°

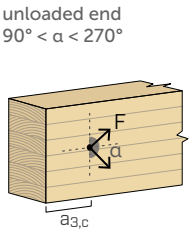
		Screws inserted without pre-drilling hole **G < 0.50**					Screws inserted without pre-drilling hole **G < 0.50**				
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*5,3*	*5,6*	*7*	*9*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.21**	**0.23**	**0.28**	**0.36**
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2
a_2	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	11/16	13/16	7/8	1
$a_{2,s}$	[in]	**2.5·d**	9/16	9/16	11/16	7/8	**2.5·d**	3/8	3/8	1/2	1/2
$a_{3,t}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**10·d**	1 3/8	1 9/16	1 3/4	1 15/16
$a_{3,c}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	1 3/8	1 9/16	1 3/4	1 15/16
$a_{4,t}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**10·d**	1 3/8	1 9/16	1 3/4	1 15/16
$a_{4,c}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	11/16	13/16	7/8	1

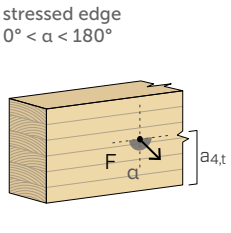
		Screws inserted without pre-drilling hole **G ≥ 0.50**					Screws inserted without pre-drilling hole **G ≥ 0.50**				
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*5,3*	*5,6*	*7*	*9*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.21**	**0.23**	**0.28**	**0.36**
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2
a_2	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2
$a_{2,s}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**3·d**	5/8	11/16	13/16	1 1/16
$a_{3,t}$	[in]	**20·d**	4 3/16	4 7/16	5 1/2	7 1/8	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16
$a_{3,c}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16
$a_{4,t}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4
$a_{4,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2

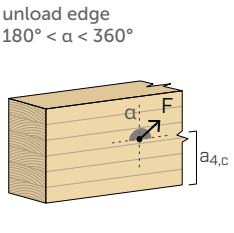
d = nominal screw diameter







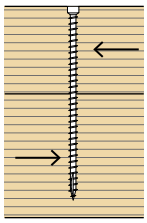




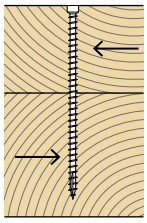
NOTES:

- 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]*		*5,3*	*5,6*	*7*	*9*		*5,3*	*5,6*	*7*	*9*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.21**	**0.23**	**0.28**	**0.36**
a_1	[in]	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4
a_2	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4
$a_{3,t}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2
$a_{3,c}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2
$a_{4,t}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2
$a_{4,c}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4

		Screws inserted without pre-drilling hole **G > 0.47**					Screws inserted without pre-drilling hole **G > 0.47**				
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*5,3*	*5,6*	*7*	*9*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.21**	**0.23**	**0.28**	**0.36**
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2
a_2	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2
$a_{3,t}$	[in]	**20·d**	4 3/16	4 7/16	5 1/2	7 1/8	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16
$a_{3,c}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16
$a_{4,t}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4
$a_{4,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2

		Screws inserted **with** pre-drilling hole					Screws inserted **with** pre-drilling hole				
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*5,3*	*5,6*	*7*	*9*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.21**	**0.23**	**0.28**	**0.36**
a_1	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**4·d**	7/8	7/8	1 1/8	1 7/16
a_2	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**4·d**	7/8	7/8	1 1/8	1 7/16
$a_{3,t}$	[in]	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2
$a_{3,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2
$a_{4,t}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2
$a_{4,c}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**3·d**	5/8	11/16	13/16	1 1/16

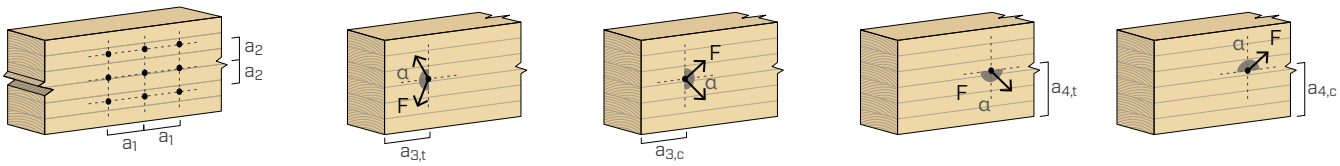
d = nominal screw diameter

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.

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.
- VGZ 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.

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]
5,3 **0.21**	102	118	132	145
5,6 **0.23**	107	123	139	152
7 **0.28**	129	148	166	182
9 **0.36**	129	149	173	189

- 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.