VGS EVO

ELC-4645 ESR-4645 UKTA-0836 22/6195 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 exposure condition 3 outdoor applications and under class C4 atmospheric corrosion conditions.

STRUCTURAL APPLICATIONS

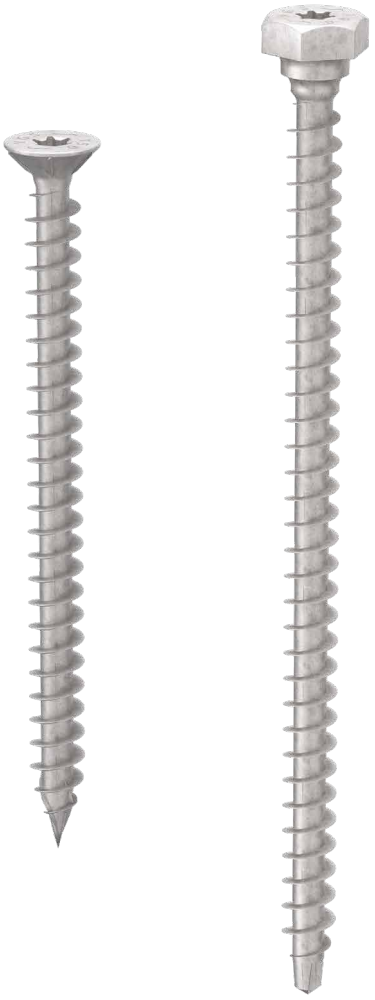
Approved for structural applications subject to stresses in any direction vs the grain (0° - 90°). Safety certified by numerous tests carried out for any direction of insertion. Cyclical SEISMIC-REV tests according to EN 12512. Countersunk head up to L = 23 5/8" (600 mm), ideal for use on plates or for concealed reinforcements.

AUTOCLAVE-TREATED TIMBER

The C4 EVO coating has been certified according to US acceptance criteria 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 [in]	0.36	**0.36**				**0.52**			0.60
LENGTH [in]	3 1/8	**4**					**31 1/2**		78 3/4
EXPOSURE CONDITION	**EC1**	**EC3**							
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:

NO IMPACT

TORQUE LIMITER

$M_{ins,max}$

FIELDS OF USE

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

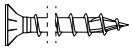
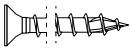
OUTDOOR STRUCTURAL PERFORMANCE

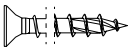
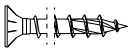
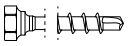
Ideal for fastening timber framed panels and trusses (Rafter, Truss). Values also tested, certified and calculated for high density woods. Ideal for fastening timber-framed panels and lattice beams (Rafter, Truss).

CLT & LVL

Values also tested, certified and calculated for CLT and high density woods such as LVL, Plywood or other laminated veneer products.

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs	
9 **0.36** TX 40	**VGSEVO9120**	120	4 3/4	110	4 3/8	50	
	VGSEVO9160	160	6 1/4	150	6	50	
	VGSEVO9200	200	8	190	7 1/2	50	
	VGSEVO9240	240	9 1/2	230	9 1/16	50	
	VGSEVO9280	280	11	270	10 5/8	50	
	VGSEVO9320	320	12 5/8	310	12 3/16	25	
	VGSEVO9360	360	14 1/4	350	13 3/4	25	
11 **0.44** TX 50	**VGSEVO11100**	100	4	90	3 1/2	25	
	VGSEVO11150	150	6	140	5 1/2	25	
	VGSEVO11200	200	8	190	7 1/2	25	
	VGSEVO11250	250	10	240	9 1/2	25	
	VGSEVO11300	300	11 3/4	290	11 7/16	25	
	VGSEVO11350	350	13 3/4	340	13 3/8	25	
	VGSEVO11400	400	15 3/4	390	15 3/8	25	
	VGSEVO11500	500	19 3/4	490	19 5/16	25	
	VGSEVO11600	600	23 5/8	590	23 1/4	25	

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs	
13 **0.52** TX 50	**VGSEVO13200**	200	8	190	7 1/2	25	
	VGSEVO13300	300	11 3/4	280	11	25	
	VGSEVO13400	400	15 3/4	380	15	25	
	VGSEVO13500	500	19 3/4	480	19	25	
	VGSEVO13600	600	23 5/8	580	22 13/16	25	
13 **0.52** TX 50 SW 19	**VGSEVO13700**	700	27 1/2	680	26 3/4	25	
	VGSEVO13800	800	31 1/2	780	30 11/16	25	

VGU EVO
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TORQUE LIMITER
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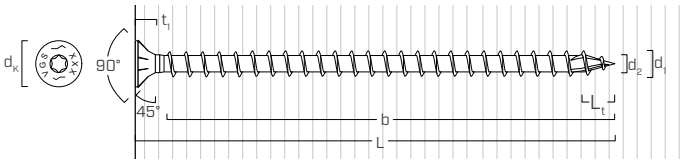
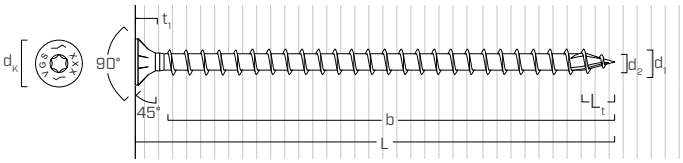
GEOMETRY AND MECHANICAL CHARACTERISTICS

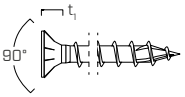
VGS Ø0.36 in - Ø0.44 in



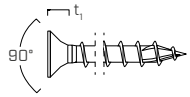
VGS Ø0.52 in



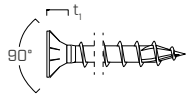
VGS Ø0.36 in
4 3/4 in ≤ L ≤ 14 1/4 in



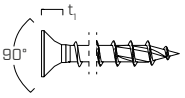
VGS Ø0.44 in
L ≤ 10 in



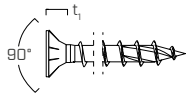
VGS Ø0.44 in
10 in < L ≤ 23 5/8 in



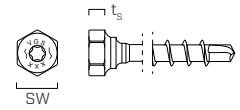
VGS Ø0.52 in
L ≤ 10 in



VGS Ø0.52 in
10 in < L ≤ 23 5/8 in



VGS Ø0.52 in
L > 23 5/8 in



GEOMETRY

Nominal diameter	d_1	[in][1]	**0.36**	**0.44**	**0.52**	**0.52**
Outer thread diameter	d_1	[mm]	9	11	13	13
		[in]	**0.354**	**0.433**	**0.512**	**0.512**
Length	L	[in]	-	-	≤ 23 5/8	> 23 5/8
Head diameter	d_K	[in]	0.630	0.760	0.866	-
Countersunk head thickness	t_S	[in]	0.256	0.323	0.370	-
Wrench size	SW	-	-	-	-	SW19
Exagonal head thickness	t_s	[in]	-	-	-	0.295
Root diameter	d_2	[in]	0.232	0.260	0.315	0.315
Tip Length	L_t	[in]	0.354	0.433	0.512	0.512
Pre-drilling hole diameter[2]	$d_{V,G\leq0.55}$	[in]	13/64	15/64	5/16	5/16
Pre-drilling hole diameter[3]	$d_{V,G>0.55}$	[in]	15/64	9/32	23/64	23/64

[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 timber with G≤0.55 (optional).
[3] Pre-drilling applies to timber with G>0.55 (required).

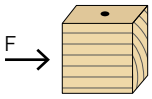
MECHANICAL PARAMETERS

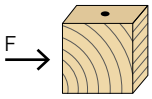
Nominal diameter	d_1	[in]	**0.36**	**0.44**	**0.52**	**0.52**
Tensile strength (allowable)	f_{tens}	**[lbf]**	2450	3200	4400	4400
Bending yield strength (specified)	$F_{y,b}$	**[psi]**	180000	170000	161000	161000

Nominal diameter	d_1	[in]		**0.36**	**0.44**	**0.52**	**0.52**
Withdrawal (design value)	W_{90}	**[lbf/in]**	G = 0.35	192	207	235	235
			G = 0.42	220	240	272	272
			G = 0.49	255	272	308	308
			G = 0.55	280	298	338	338
minimum embedded length		**[in]**		2 1/8	2 5/8	3 1/16	3 1/16

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.50**

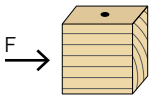


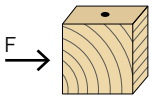


d_1	[in]		0.36	0.44	0.52
	[mm]		9	11	13
a_1	[in]	**15·d**	5 5/16	6 1/2	7 11/16
a_2	[in]	**5·d**	1 3/4	2 3/16	2 9/16
$a_{3,t}$	[in]	**15·d**	5 5/16	6 1/2	7 11/16
$a_{3,c}$	[in]	**10·d**	3 1/2	4 3/8	5 1/8
$a_{4,t}$	[in]	**10·d**	3 1/2	4 3/8	5 1/8
$a_{4,c}$	[in]	**5·d**	1 3/4	2 3/16	2 9/16

	0.36	0.44	0.52
	9	11	13
10·d	3 1/2	4 3/8	5 1/8
5·d	1 3/4	2 3/16	2 9/16
15·d	5 5/16	6 1/2	7 11/16
10·d	3 1/2	4 3/8	5 1/8
10·d	3 1/2	4 3/8	5 1/8
5·d	1 3/4	2 3/16	2 9/16

screws inserted **WITHOUT pre-drilled hole** — **G > 0.50**

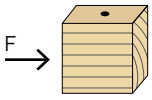


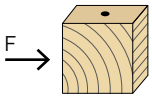


d_1	[in]		0.36	0.44	0.52
	[mm]		9	11	13
a_1	[in]	**15·d**	5 5/16	6 1/2	7 11/16
a_2	[in]	**7·d**	2 1/2	3 1/16	3 9/16
$a_{3,t}$	[in]	**20·d**	7 1/8	8 5/8	10 1/4
$a_{3,c}$	[in]	**15·d**	5 5/16	6 1/2	7 11/16
$a_{4,t}$	[in]	**12·d**	4 1/4	5 3/16	6 1/8
$a_{4,c}$	[in]	**7·d**	2 1/2	3 1/16	3 9/16

	0.36	0.44	0.52
	9	11	13
10·d	3 1/2	4 3/8	5 1/8
7·d	2 1/2	3 1/16	3 9/16
20·d	7 1/8	8 5/8	10 1/4
15·d	5 5/16	6 1/2	7 11/16
12·d	4 1/4	5 3/16	6 1/8
7·d	2 1/2	3 1/16	3 9/16

screws inserted **WITH pre-drilled hole**

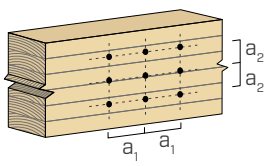




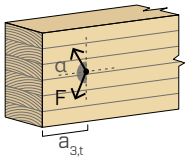
d_1	[in]		0.36		0.44	0.52
	[mm]		9		11	13
a_1	[in]	**10·d**	3 1/2	**5·d**	2 3/16	2 9/16
a_2	[in]	**4·d**	1 7/16	**5·d**	2 3/16	2 9/16
$a_{3,t}$	[in]	**12·d**	4 1/4	**7·d**	3 1/16	3 9/16
$a_{3,c}$	[in]	**7·d**	2 1/2	**4·d**	1 3/4	2 1/16
$a_{4,t}$	[in]	**7·d**	2 1/2	**4·d**	1 3/4	2 1/16
$a_{4,c}$	[in]	**3·d**	1 1/16	**3·d**	1 5/16	1 9/16

	0.36		0.44	0.52
	9		11	13
5·d	1 3/4	**5·d**	2 3/16	2 9/16
4·d	1 7/16	**5·d**	2 3/16	2 9/16
12·d	4 1/4	**7·d**	3 1/16	3 9/16
7·d	2 1/2	**4·d**	1 3/4	2 1/16
7·d	2 1/2	**4·d**	1 3/4	2 1/16
3·d	1 1/16	**3·d**	1 5/16	1 9/16

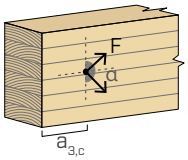
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



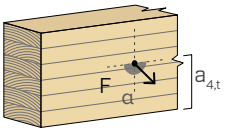
stressed end
-90° < α < 90°



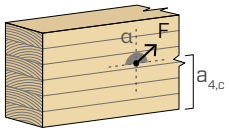
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTE

- The minimum spacing and distances comply with Table 8 of ESR-4645, where d refers to the nominal diameter of the screw;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

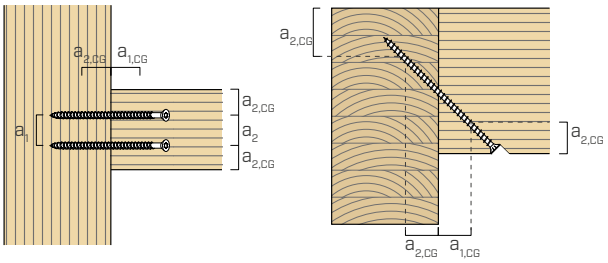
screws inserted **WITHOUT pre-drilled hole**

d_1	[in]		0.36		0.44	0.52
	[mm]		9		11	13
a_1	[in]	**7·d**	2 1/2	**7·d**	3 1/16	3 9/16
a_2	[in]	**4·d**	1 7/16	**5·d**	2 3/16	2 9/16
$a_{1,CG}$	[in]	**10·d**	3 1/2	**10·d**	4 3/8	5 1/8
$a_{2,CG}$	[in]	**4·d**	1 7/16	**4·d**	1 3/4	2 1/16
a_{CROSS}	[in]	**1,5·d**	9/16	**1,5·d**	11/16	13/16

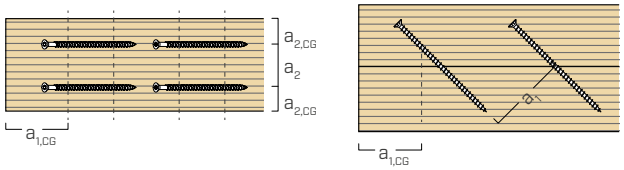
screws inserted **WITH pre-drilled hole**

d_1	[in]		0.36		0.44	0.52
	[mm]		9		11	13
a_1	[in]	**7·d**	2 1/2	**5·d**	2 3/16	2 9/16
a_2	[in]	**3·d**	1 1/16	**5·d**	2 3/16	2 9/16
$a_{1,CG}$	[in]	**7·d**	2 1/2	**4·d**	1 3/4	2 1/16
$a_{2,CG}$	[in]	**3·d**	1 1/16	**3·d**	1 5/16	1 9/16
a_{CROSS}	[in]	**1,5·d**	9/16	**1,5·d**	11/16	13/16

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

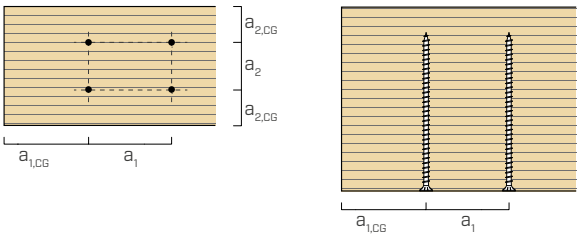


plan front



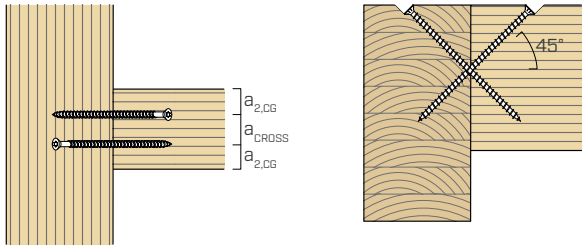
plan front

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



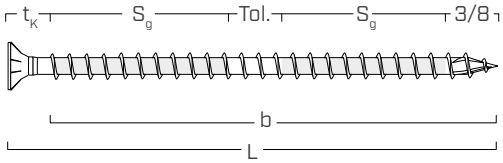
plan front

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



plan front

EFFECTIVE THREAD USED IN CALCULATION



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

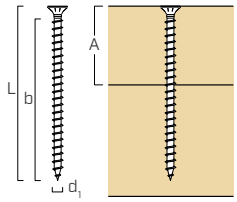
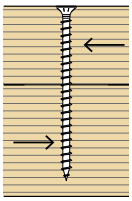
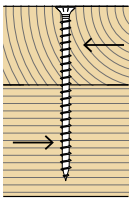
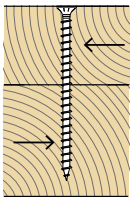
$\mathbf{S_g} = (L - t_K - 3/8" - Tol.)/2$ represents the partial length of the threaded part net of a laying tolerance (Tol.) of 3/8"

t_K = 3/8" (countersunk head)
t_K = 3/4" (hexagonal head)

NOTE

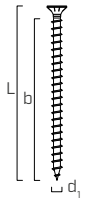
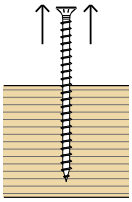
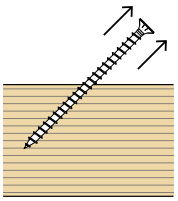
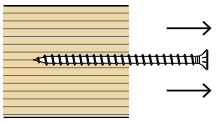
- The minimum spacing and distances comply with Table 8 of ESR-4645, where d refers to the nominal diameter of the screw;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

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

geometry				$Z_{\parallel}$				$Z_{\perp/\parallel}$				$Z_{\perp}$			
															
d_1	L		b	A	G				G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
9 **0.36**	120	4 3/4	4 3/8	2 3/8	187	258	313	348	149	206	250	278	149	206	250	278
	160	6 1/4	6	3 1/8	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 1/8	230	272	313	348	184	217	250	278	184	217	250	278
11 **0.44**	100	4	3 1/2	1 15/16	218	262	306	343	143	178	215	247	116	152	190	224
	150	6	5 1/2	2 15/16	314	344	372	394	219	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	4 15/16	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 7/8	314	344	372	394	225	252	278	299	205	234	262	285
	400	15 3/4	15 3/8	8	314	344	372	394	225	252	278	299	205	234	262	285
	500	19 3/4	19 5/16	10	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
13 **0.52**	200	8	7 1/2	4	450	493	532	564	312	351	387	416	262	319	357	388
	300	11 3/4	11	6	450	493	532	564	312	351	387	416	280	319	357	388
	400	15 3/4	15	8	450	493	532	564	312	351	387	416	280	319	357	388
	500	19 3/4	19	10	450	493	532	564	312	351	387	416	280	319	357	388
	600	23 5/8	22 13/16	11 3/4	450	493	532	564	312	351	387	416	280	319	357	388
	700	27 1/2	26 3/4	13 3/4	450	493	532	564	312	351	387	416	280	319	357	388
	800	31 1/2	30 11/16	15 3/4	450	493	532	564	312	351	387	416	280	319	357	388

NOTES and **GENERAL PRINCIPLES** on page 219.

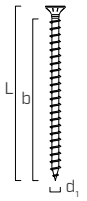
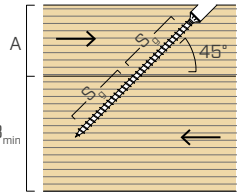
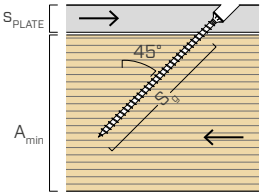
THREAD WITHDRAWAL (W) | WOOD

geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°			
															
d_1	L		b	G				G				G			
				0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
9 **0.36**	120	4 3/4	4 3/8	763	875	1014	1113	695	796	923	1013	229	262	304	334
	160	6 1/4	6	1066	1221	1416	1554	970	1111	1288	1414	320	366	425	466
	200	8	7 1/2	1368	1568	1817	1995	1245	1427	1654	1816	410	470	545	599
	240	9 1/2	9 1/16	1671	1914	2219	2436	1520	1742	2019	2217	501	574	666	731
	280	11	10 5/8	1973	2261	2620	2877	1795	2057	2384	2618	592	678	786	863
	320	12 5/8	12 3/16	2275	2607	3022	3318	2071	2372	2750	3019	683	782	907	995
	360	14 1/4	13 3/4	2578	2954	3423	3759	2346	2688	3115	3421	773	886	1027	1128
11 **0.44**	100	4[(1)]	3 1/2	644	746	846	927	586	679	770	843	193	224	254	278
	150	6	5 1/2	1051	1219	1381	1513	957	1109	1257	1377	315	366	414	454
	200	8	7 1/2	1459	1691	1917	2100	1327	1539	1744	1911	438	507	575	630
	250	10	9 1/2	1866	2164	2452	2687	1698	1969	2232	2445	560	649	736	806
	300	11 3/4	11 7/16	2274	2636	2988	3273	2069	2399	2719	2979	682	791	896	982
	350	13 3/4	13 3/8	2681	3109	3523	3860	2440	2829	3206	3513	804	933	1057	1158
	400	15 3/4	15 3/8	3089	3581	4059	4447	2811	3259	3693	4046	927	1074	1218	1334
	500	19 3/4	19 5/16	3904	4526	5129	5620	3552	4119	4668	5114	1171	1358	1539	1686
	600	23 5/8	23 1/4	4719	5471	6200	6793	4294	4978	5642	6182	1416	1641	1860	2038
13 **0.52**	200	8	7 1/2	1638	1895	2146	2355	1490	1725	1953	2143	491	569	644	707
	300	11 3/4	11	2470	2859	3238	3553	2248	2602	2946	3233	741	858	971	1066
	400	15 3/4	15	3395	3930	4450	4884	3090	3576	4050	4444	1019	1179	1335	1465
	500	19 3/4	19	4321	5001	5663	6214	3932	4551	5153	5655	1296	1500	1699	1864
	600	23 5/8	22 13/16	5246	6072	6875	7545	4774	5525	6257	6866	1574	1822	2063	2264
	700	27 1/2	26 3/4	6171	7143	8088	8876	5616	6500	7360	8077	1851	2143	2426	2663
	800	31 1/2	30 11/16	7096	8214	9301	10207	6458	7474	8464	9288	2129	2464	2790	3062

[(1)] 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°≤ α <90° to the grain).

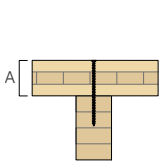
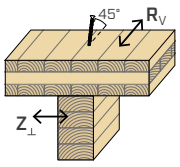
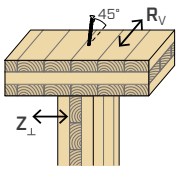
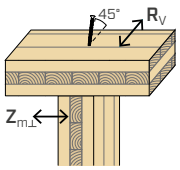
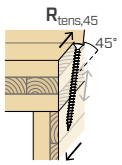
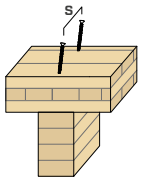
NOTES and GENERAL PRINCIPLES on page 219.

SLIDING RESISTANCE (R_v) | WOOD

geometry				R_v						R_v						
																
d_1	L		b	S_g	A	B_{min}	G				S_{PLATE}	S_g	A_{min}	G			
							0.35	0.42	0.49	0.55				0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
9 **0.36**	120	4 3/4[1]	4 3/8	1 3/4	1 13/16	2 3/8	216	248	287	315	5/8	3 3/8	4 1/8	417	478	554	608
	160	6 1/4[1]	6	2 9/16	2 3/8	3	317	363	420	462		4 15/16	5 3/16	610	699	810	890
	200	8	7 1/2	3 3/8	2 15/16	3 1/2	417	478	554	608		6 1/2	6 1/4	803	920	1067	1171
	240	9 1/2	9 1/16	4 1/8	3 1/2	4 1/8	510	584	677	743		8 1/16	7 7/16	996	1141	1323	1453
	280	11	10 5/8	4 15/16	4 1/16	4 5/8	610	699	810	890		9 5/8	8 5/8	1189	1363	1579	1734
	320	12 5/8	12 3/16	5 11/16	4 5/8	5 3/16	703	805	933	1025		11 1/4	9 5/8	1390	1593	1846	2027
	360	14 1/4	13 3/4	6 1/2	5 3/16	5 3/4	803	920	1067	1171		12 3/4	10 7/8	1575	1805	2092	2297
11 **0.44**	100	4[1]	3 1/2	1 3/8	1 9/16	2 1/8	183	212	241	264	3/4	2 3/8	3 1/2	316	367	416	455
	150	6[1]	5 1/2	2 3/8	2 1/4	2 13/16	316	367	416	455		4 3/8	4 15/16	583	676	766	839
	200	8[1]	7 1/2	3 3/8	2 15/16	3 1/2	450	521	591	647		6 1/4	6 1/4	832	965	1094	1198
	250	10	9 1/2	4 3/8	3 5/8	4 3/16	583	676	766	839		8 1/4	7 11/16	1099	1274	1444	1582
	300	11 3/4	11 7/16	5 5/16	4 3/8	4 15/16	708	820	930	1019		10 1/4	9 1/4	1365	1583	1794	1965
	350	13 3/4	13 3/8	6 1/4	5 1/16	5 5/8	832	965	1094	1198		12 3/16	10 5/8	1623	1882	2133	2337
	400	15 3/4	15 3/8	7 1/4	5 11/16	6 1/4	966	1120	1269	1390		14 1/4	12	1898	2201	2494	2732
	500	19 3/4	19 5/16	9 1/4	7 1/8	7 11/16	1232	1428	1619	1774		18 1/8	14 3/4	2414	2799	3172	3476
	600	23 5/8	23 1/4	11 1/4	8 5/8	9 1/4	1498	1737	1969	2157		22	17 1/2	2930	3398	3851	4219
13 **0.52**	200	8[1]	7 1/2	3 3/8	2 15/16	3 1/2	510	591	669	734	7/8	6 1/8	6 1/4	926	1072	1214	1332
	300	11 3/4	11	5 5/16	4 3/8	4 15/16	803	930	1053	1155		10 1/16	9 1/4	1522	1761	1994	2189
	400	15 3/4	15	7 1/4	5 11/16	6 1/4	1096	1269	1437	1577		14	12	2117	2450	2775	3045
	500	19 3/4	19	9 1/4	7 1/8	7 11/16	1399	1619	1833	2012		17 15/16	14 3/4	2712	3139	3555	3901
	600	23 5/8	22 13/16	11 1/4	8 5/8	9 1/4	1701	1969	2230	2447		21 7/8	17 1/2	3308	3829	4335	4758
	700	27 1/2	26 3/4	12 3/4	10 1/16	10 5/8	1928	2232	2527	2773		-	-	-	-	-	-
	800	31 1/2	30 11/16	14 3/4	11 7/16	12	2230	2582	2923	3208		-	-	-	-	-	-

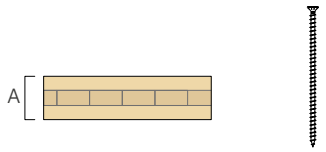
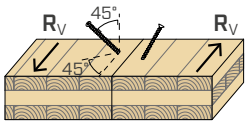
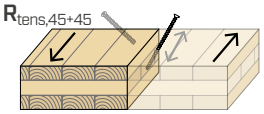
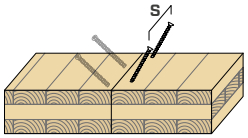
[1] The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

NOTES and **GENERAL PRINCIPLES** on page 219.

				SHEAR								SPACING	
geometry				CLT-to-wood				CLT-to-CLT				steel tension	fastener in a row	
														
side member thickness (wall/floor) = A		suggested screw	R_v	$Z_\perp$	R_v	$Z_{m\perp}$	R_v	$Z_\perp$	R_v	$Z_{m\perp}$	$R_{tens,45}$	minimum	typical
[mm]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]
3 PLY	60	2 3/8	VGSEVO9160	345	217	345	217	231	146	231	146	1732	5 5/16	7
			VGSEVO11150	364	232	364	252	244	155	244	169	2263	6 1/2	9
	79	3 1/8	VGSEVO9200	450	217	450	217	302	146	302	146	1732	5 5/16	7
			VGSEVO11200	501	234	501	252	336	157	336	169	2263	6 1/2	9
			VGSEVO13200	577	319	577	351	387	214	387	235	3111	7 11/16	11
	105	4 1/8	VGSEVO9280	696	217	696	217	466	146	466	146	1732	5 5/16	7
			VGSEVO11300	751	234	751	252	503	157	503	169	2263	6 1/2	9
			VGSEVO13300	842	319	842	351	564	214	564	235	3111	7 11/16	11
	120	4 3/4	VGSEVO9360	818	217	818	217	548	146	548	146	1732	5 5/16	7
			VGSEVO11350	882	234	882	252	591	157	591	169	2263	6 1/2	9
5 PLY	100	3 15/16	VGSEVO9280	660	217	660	217	442	146	442	146	1732	5 5/16	7
			VGSEVO11300	710	234	710	252	476	157	476	169	2263	6 1/2	9
			VGSEVO13300	795	319	795	351	533	214	533	235	3111	7 11/16	11
	140	5 1/2	VGSEVO11400	1051	234	1051	252	704	157	704	169	2263	6 1/2	9
			VGSEVO13400	1182	319	1182	351	792	214	792	235	3111	7 11/16	11
	175	6 7/8	VGSEVO11500	1352	234	1352	252	906	157	906	169	2263	6 1/2	9
			VGSEVO13500	1523	319	1523	351	1020	214	1020	235	3111	7 11/16	11
7 PLY	140	5 1/2	VGSEVO11400	1054	234	1054	252	706	157	706	169	2263	6 1/2	9
			VGSEVO13400	1185	319	1185	351	794	214	794	235	3111	7 11/16	11
	191	7 1/2	VGSEVO11500	1369	234	1369	252	918	157	918	169	2263	6 1/2	9
			VGSEVO13500	1561	319	1561	351	1046	214	1046	235	3111	7 11/16	11
	244	9 5/8	VGSEVO13700	2134	319	2134	351	1430	214	1430	235	3111	7 11/16	11
	280	11	VGSEVO13800	2481	319	2481	351	1662	214	1662	235	3111	7 11/16	11
9 PLY	180	7 1/16	VGSEVO11500	1398	234	1398	252	937	157	937	169	2263	6 1/2	9
			VGSEVO13500	1575	319	1575	351	1055	214	1055	235	3111	7 11/16	11
	267	10 1/2	VGSEVO13800	2351	319	2351	351	1575	214	1575	235	3111	7 11/16	11

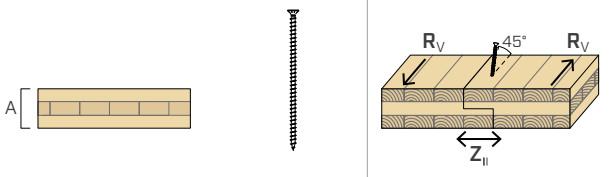
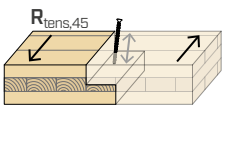
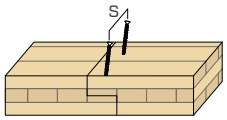
NOTES and GENERAL PRINCIPLES on page 219.

CLT | BUTT JOINT (double 45° inclination)

				SHEAR		SPACING	
geometry				butt joint	steel tension	fastener in a row	
							
	panel thickness = A		suggested screw	R_v	$R_{tens,45+45}$	minimum	typical
	[mm]	[in]	CODE	[lbf]	[lbf]	[in]	[in]
3 PLY	79	3 1/8	VGSEVO11100	105	1600	6 1/2	9
	105	4 1/8	VGSEVO9120	124	1225	5 5/16	7
	120	4 3/4	VGSEVO9160	179	1225	5 5/16	7
			VGSEVO11150	180	1600	6 1/2	9
5 PLY	100	3 15/16	VGSEVO9120	124	1225	5 5/16	7
	140	5 1/2	VGSEVO9160	179	1225	5 5/16	7
			VGSEVO11150	180	1600	6 1/2	9
	175	6 7/8	VGSEVO9200	234	1225	5 5/16	7
			VGSEVO11200	256	1600	6 1/2	9
			VGSEVO13200	290	2200	7 11/16	11
7 PLY	200	7 7/8	VGSEVO9240	289	1225	5 5/16	7
			VGSEVO11250	331	1600	6 1/2	9
	140	5 1/2	VGSEVO9160	179	1225	5 5/16	7
			VGSEVO11150	180	1600	6 1/2	9
	191	7 1/2	VGSEVO9240	289	1225	5 5/16	7
			VGSEVO11250	331	1600	6 1/2	9
	244	9 5/8	VGSEVO9320	400	1225	5 5/16	7
			VGSEVO11300	406	1600	6 1/2	9
			VGSEVO13300	460	2200	7 11/16	11
	280	11	VGSEVO9360	455	1225	5 5/16	7
			VGSEVO11350	481	1600	6 1/2	9
	180	7 1/16	VGSEVO9240	289	1225	5 5/16	7
			VGSEVO11250	331	1600	6 1/2	9
9 PLY	267	10 1/2	VGSEVO9360	455	1225	5 5/16	7
			VGSEVO11350	481	1600	6 1/2	9
	314	12 3/8	VGSEVO11400	556	1600	6 1/2	9
			VGSEVO13400	630	2200	7 11/16	11
	360	14 3/16	VGSEVO11500	707	1600	6 1/2	9
			VGSEVO13500	801	2200	7 11/16	11

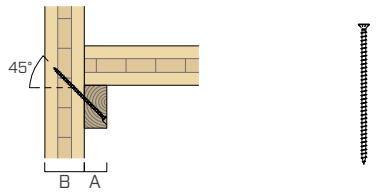
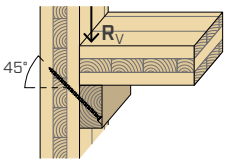
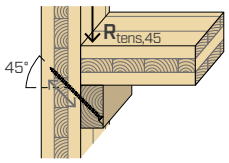
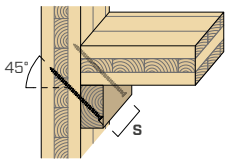
NOTES and GENERAL PRINCIPLES on page 219.

CLT | HALF LAP

				SHEAR					SPACING	
geometry				half lap orientation 1		half lap orientation 2		steel tension	fastener in a row	
											
panel thickness (wall/floor) = A		suggested screw	R_v	Z_{II}	R_v	$Z_\perp$	$R_{tens,45}$	minimum	typical	
[mm]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]	
3 PLY	79	3 1/8	VGSEVO11100	191	262	191	151	2263	6 1/2	9
	105	4 1/8	VGSEVO9120	217	242	217	194	1732	5 5/16	7
	120	4 3/4	VGSEVO9160	345	272	345	217	1732	5 5/16	7
			VGSEVO11150	364	344	364	232	2263	6 1/2	9
5 PLY	100	3 15/16	VGSEVO9120	236	251	236	201	1732	5 5/16	7
	140	5 1/2	VGSEVO9160	302	272	302	217	1732	5 5/16	7
			VGSEVO11150	279	344	279	213	2263	6 1/2	9
	175	6 7/8	VGSEVO9200	387	272	387	217	1732	5 5/16	7
			VGSEVO11200	433	344	433	234	2263	6 1/2	9
			VGSEVO13200	500	493	500	319	3111	7 11/16	11
	200	7 7/8	VGSEVO9240	510	272	510	217	1732	5 5/16	7
			VGSEVO11250	628	344	628	234	2263	6 1/2	9
7 PLY	140	5 1/2	VGSEVO9160	301	272	301	217	1732	5 5/16	7
			VGSEVO11150	278	344	278	213	2263	6 1/2	9
	191	7 1/2	VGSEVO9240	548	272	548	217	1732	5 5/16	7
			VGSEVO11250	668	344	668	234	2263	6 1/2	9
	244	9 5/8	VGSEVO9320	781	272	781	217	1732	5 5/16	7
			VGSEVO11300	740	344	740	234	2263	6 1/2	9
			VGSEVO13300	848	493	848	319	3111	7 11/16	11
	280	11	VGSEVO9360	864	272	864	217	1732	5 5/16	7
			VGSEVO11350	892	344	892	234	2263	6 1/2	9
9 PLY	180	7 1/16	VGSEVO9240	581	272	581	217	1732	5 5/16	7
			VGSEVO11250	624	344	624	234	2263	6 1/2	9
	267	10 1/2	VGSEVO9360	916	272	916	217	1732	5 5/16	7
			VGSEVO11350	949	344	949	234	2263	6 1/2	9
	314	12 3/8	VGSEVO11400	1048	344	1048	234	2263	6 1/2	9
			VGSEVO13400	1197	493	1197	319	3111	7 11/16	11
	360	14 3/16	VGSEVO11500	1398	344	1398	234	2263	6 1/2	9
			VGSEVO13500	1575	493	1575	319	3111	7 11/16	11

NOTES and GENERAL PRINCIPLES on page 219.

CLT | LEDGER CONNECTION

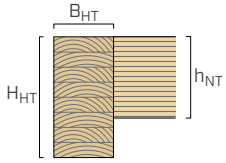
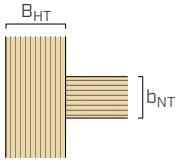
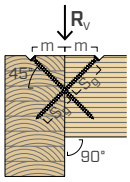
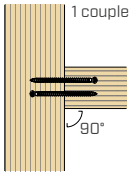
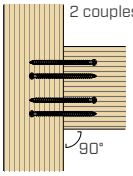
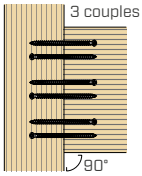
					SHEAR		SPACING	
				geometry	CLT-to-ledger	steel tension	fastener in a row	
								
	main member thickness (wall) = B		side member thickness (ledger) = A	suggested screw	R_v	$R_{tens,45}$	minimum	typical
	[mm]	[in]	[in]	CODE	[lbf]	[lbf]	[in]	[in]
3 PLY	60	2 3/8	1 3/4	VGSEVO9120	340	1732	1 3/4	7
3 PLY	79	3 1/8	1 3/4	VGSEVO9120	340	1732	1 3/4	7
3 PLY	105	4 1/8	1 3/4	VGSEVO9120	340	1732	1 3/4	7
3 PLY	120	4 3/4	1 3/4	VGSEVO9160	340	1732	1 3/4	7
			1 3/4	VGSEVO11150	362	2263	2 3/16	9
5 PLY	100	3 15/16	1 3/4	VGSEVO9120	340	1732	1 3/4	7
			1 3/4	VGSEVO11150	362	2263	2 3/16	9
	140	5 1/2	3 1/2	VGSEVO9280	786	1732	1 3/4	7
			3 1/2	VGSEVO11250	830	2263	2 3/16	9
	175	6 7/8	5 1/4	VGSEVO9360	1050	1732	1 3/4	7
			5 1/4	VGSEVO11350	1078	2263	2 3/16	9
			5 1/4	VGSEVO13400	1488	3111	2 9/16	11
	200	7 7/8	5 1/4	VGSEVO9360	1050	1732	1 3/4	7
			5 1/4	VGSEVO11400	1314	2263	2 3/16	9
			5 1/4	VGSEVO13400	1488	3111	2 9/16	11
7 PLY	140	5 1/2	3 1/2	VGSEVO9240	700	1732	1 3/4	7
			3 1/2	VGSEVO11250	830	2263	2 3/16	9
			3 1/2	VGSEVO13300	949	3111	2 9/16	11
	191	7 1/2	5 1/4	VGSEVO11400	1314	2263	2 3/16	9
			5 1/4	VGSEVO13400	1488	3111	2 9/16	11
	244	9 5/8	6 1/2	VGSEVO11500	1654	2263	2 3/16	9
			6 1/2	VGSEVO13500	1873	3111	2 9/16	11
	280	11	6 1/2	VGSEVO11500	1654	2263	2 3/16	9
			6 1/2	VGSEVO13500	1873	3111	2 9/16	11

GENERAL PRINCIPLES and CONNECTIONS GENERAL NOTES on page 219.

NOTES:

- Ledger Specific Gravity is considered as G = 0.49.
- The thread axial resistance to withdrawal has been evaluated considering an effective thread length equal to S_g. The connectors must be inserted at 45° with respect to the shear plane.
- Force-to-fastener angle is considered as 45°.
- The use of the JIG VGZ 45 template is recommended for professional installation of the connectors in this application.

WOOD | CROSSED SCREW CONNECTION

geometry			crossed screws				
							

$H_{HT,min}$ $h_{NT,min}$ [in]	$B_{HT,min}$ [in]	$b_{NT,min}$ [in]	suggested screw CODE	m [in]	number of couples	R_v SPF [lbf]	R_v D.Fir [lbf]	$R_{tens,45}$ [lbf]
6	3 1/8	3 1/8	VGSEVO9200	2 15/16	1	956	1108	3465
		3 1/2			2	1911	2215	6930
		5 1/8			3	2867	3323	10394
		3 1/2	VGSEVO11200	2 15/16	1	1042	1181	4525
		5 1/8			2	2085	2363	9051
		5 1/2			3	3127	3544	13576
7 1/2	3 1/2	3 1/2	VGSEVO9240	3 3/4	1	1168	1354	3465
		5 1/8			2	2336	2707	6930
		5 1/2			3	3504	4061	10394
		5 1/8	VGSEVO11250	3 9/16	1	1351	1531	4525
		5 1/2			2	2703	3063	9051
		6 3/4			3	4054	4594	13576
9	5 1/8	3 1/2	VGSEVO9280	4 5/16	1	1398	1620	3465
		5 1/8			2	2796	3241	6930
		5 1/2			3	4194	4861	10394
		5 1/8	VGSEVO11300	4 5/16	1	1641	1860	4525
		5 1/2			2	3282	3719	9051
		6 3/4			3	4923	5579	13576
10 1/2	5 1/2	3 1/2	VGSEVO9360	5 1/8	1	1840	2133	3465
		5 1/8			2	3681	4266	6930
		5 1/2			3	5521	6399	10394
		5 1/8	VGSEVO11350	5	1	1930	2188	4525
		5 1/2			2	3861	4376	9051
		6 3/4			3	5791	6563	13576
12	6 3/4	5 1/8	VGSEVO11400	5 11/16	1	2239	2538	4525
		5 1/2			2	4479	5076	9051
		6 3/4			3	6718	7614	13576
13 1/2	6 3/4	5 1/8	VGSEVO11500	6 13/16	1	2857	3238	4525
		5 1/2			2	5714	6476	9051
		6 3/4			3	8571	9714	13576
15	7 1/2	5 1/8	VGSEVO11500	7 1/2	1	2857	3238	4525
		5 1/2			2	5714	6476	9051
		6 3/4			3	8571	9714	13576
16 1/2	9	5 1/8	VGSEVO11500	8 3/16	1	2857	3238	4525
		5 1/2			2	5714	6476	9051
		6 3/4			3	8571	9714	13576
18	9	5 1/8	VGSEVO11600	8 7/16	1	3475	3938	4525
		5 1/2			2	6949	7876	9051
		6 3/4			3	10424	11814	13576

GENERAL PRINCIPLES and CONNECTIONS GENERAL NOTES on page 219.

NOTES:

- The thread axial resistance to withdrawal has been evaluated considering an effective thread length equal to S_g. The connectors must be inserted at 45° with respect to the shear plane.
- The connector compression design strength is the lower between the withdrawal-side design strength and the instability design strength.
- Force-to-fastener angle is considered as 45°.
- The use of the JIG VGZ 45 template is recommended for professional installation of the connectors in this application.

GENERAL PRINCIPLES

- Tabulated values comply with NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION in accordance with ESR-4645.
- To determine allowable loads for use with ASD, design loads for use with LRFD or both, tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners.
- As part of the connection design, the structural wood members, the steel plates must be sized and verified in accordance with the corresponding Section of the NDS and must be done separately by the designer.
- Connections with multiple screws must be designed in accordance with the corresponding Sections of the NDS and ESR-4645.
- VGZ screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection CM is 1.0).
- VGZ screws must be positioned in accordance with the minimum distances.
- In the case of combined axial and shear forces on a screw, for the determination of the load-bearing capacity refer to the Hankinson formula found in the NDS section 12.4.1.

REFERENCE LATERAL DESIGN VALUES

- Tabulated values are determined from the yield model equations in the corresponding Section of the NDS.
- Unless otherwise noted, the screw is intended to be inserted half in the main member and half in the side member.
- 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 corresponding Section of NDS and 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 minus 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 the ESR-4645.
- 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.

  Tabulated values at page 212 are valid for L_{eff} equal to the screw thread length b minus the tip length L_t and $k_\alpha = 1$ for α=90°, $k_\alpha = 0.91$ for α= 45°, $k_\alpha = 0.3$ for α = 0°.
- 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 inferior to f_{tens} of the screw.

REFERENCE WITHDRAWAL DESIGN VALUES

For fully-threaded screws the head pull-through resistanche is not relevant for the connection resistance, thread withdrawalis governing. these values must be compared with the tensile resistance of the screw; the lower value is the governing one.

SLIDING RESISTANCE

- Unless otherwise noted, the screws is inend to be inserted half in the main member and half in the side member.
- The 45° inclined screw is intended to work in withrawal and the resulting resistance of the connection is given by the projection of the withrawal resistance (along screw axis) onto the shear plane.
- The design values must be inferior to f_{tens} of the screw projected onto the shear plane.

CONNECTIONS

GENERAL NOTES

- Designed connections must respect all requirements on general principles and minimum distances.
- Calculations comply with the NDS in accordance with ESR 4645.
- Tabulated values, that are referred to a single fastener, are valid for Allowable Stress Design (ASD) considering a standard loading ($C_D = 1.0$).
- Timber element specific gravity is considered as G = 0.42, unless otherwise noted.
- $Z_{||}$: Force-to-grain angle in the shear plane is considered as 0°.
- $Z_{\perp}$: Force-to-grain angle in the shear plane is considered as 90°.
- $Z_{m\perp}$: Force-to-grain angle in the shear plane is considered as 0° for side member and as 90° for main member.
- R_v: withrawal resistance of the screws projected on the shear force axis.
- For the connectors inserted in the panel's face, it has been considered the same grain direction as the layer in the shear plane. For the connectors inserted in the panel's narrow edge, it has been considered the same grain direction as the layer in which the connector is installed.
- For lateral design values the force-to-fastener angle is always considered 90°.

FLOOR-TO-BEAM | FLOOR-TO-WALL

- The main grain direction of the CLT floor panel is considered both parallel and perpendicular to the beam's axis or wall plane.
- The main grain direction of the CLT wall panel is always considered as vertical.
- The threaded part of the screw has been always considered inserted in the central layer of the CLT panel.
- According to NDS, an end grain coefficient C_{eg}=0.67 is considered for the lateral resistance calculation due to fastener in narrow edge of CLT (FLOOR-TO-WALL).
- Beam element can be considered both solid wood or glulam.
- The width of the beams must comply with the minimum distance requirements.
- The proposed screw's length does not exceed the total thickness of the connection.
- The CLT side R_v resistance is calculated taking into account a screw-to-grain angle as the lowest between the involved layers. In this case the considered angle is 45°.

BUTT JOINT

- Force-to-fastener angle is considered to be 60°. The geometry of the joint requires that the connectors be inserted at an angle of 45° with respect to the face of the CLT panel, and at an angle of 45° with respect to the shear plane between the two panels.
- An end grain coefficient C_{eg}=0.67 is considered for the withrawal resistance calculation due to fastener in narrow edge of CLT.
- Reported values represent the shear resistance of the connection along the shear plane for a single fastener.
- The proposed screw's length does not exceed the total thickness of the connection.
- The use of the JIG VGZ 45 template is recommended to ensure precise installation of the connectors in this application.

HALF LAP

- The main grain direction of the CLT floor panel is considered both parallel and perpendicular to the machining's direction.
- Force-to-fastener angle is considered as 45°. The screw are considered inserted at an angle of 45° with respect to the face of the CLT panel in the machining's direction. In this direction the the screw is intended to work in withrawal. In the opposite direction the screws are intended to work in shear.
- The width of half-lap machining on CLT panel must comply with the minimum distance requirements.
- The proposed screw's length does not exceed the total thickness of the connection.
- R_v resistance is calculated by taking into account the screw-to-grain angle as the lowest among the involved layers. In this case, the angle considered is 45°.