VGZ EVO

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

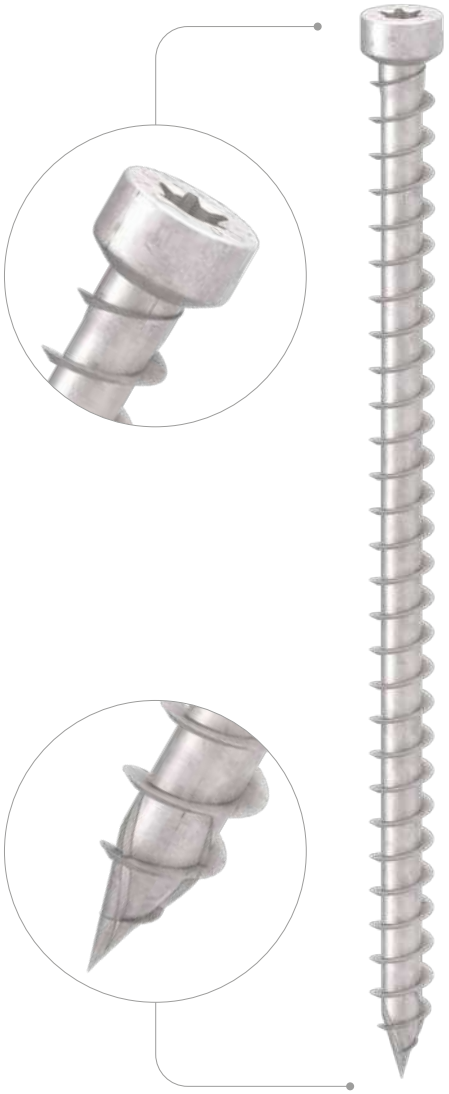
FULLY THREADED SCREW WITH CYLINDRICAL HEAD

C4 EVO COATING
Multilayer coating with a 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.

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

STRUCTURAL APPLICATIONS
Deep thread and high resistance steel for excellent tensile performance. Approved for structural applications subject to stresses in any direction vs the grain (0° - 90°). Reduced minimum distances.

CYLINDRICAL HEAD
It allows the screw to penetrate and pass through the surface of the wood substrate. Ideal for concealed joints, timber couplings and structural reinforcements. It is the right choice for increased fire performance.



MY PROJECT SOFTWARE | MANUALS

BIT INCLUDED

DIAMETER [in]	0.20 (0.21 – 0.44) 0.44
LENGTH [in]	3 1/8 (3 1/8 – 23 5/8) 39 3/8
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

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

TRUSS & RAFTER JOINTS

Ideal for joining small timber elements such as the crossbeams and uprights of light frame structures. Certified for application parallel to the grain and with reduced minimum distances.

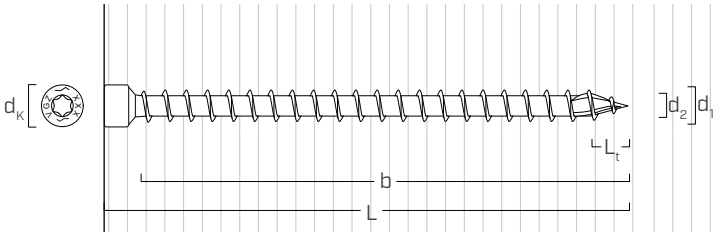
TIMBER STUDS

Values also tested, certified and calculated for CLT and high density woods such as LVL, Plywood or other laminated veneer products. Ideal for fastening I-Joist beams.

Fastening Wood Trusses outdoors.

Fastening the uprights of light frame structures with VGZ EVO #11 (0.21 inch) and #12 (0.23 inch).

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[in]**[1]	**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
Outer thread diameter	**d_1**	[mm]	5,3	5,6	7	9	11
		[in]	**0.209**	**0.220**	**0.276**	**0.354**	**0.433**
Head diameter	d_K	[in]	0.315	0.315	0.374	0.453	0.531
Root diameter	d_2	[in]	0.142	0.142	0.181	0.232	0.260
Tip Length	L_t	[in]	0.209	0.220	0.276	0.354	0.433
Pre-drilling hole diameter[2]	$d_{V,G\leq0.55}$	[in]	9/64	9/64	5/32	13/64	15/64
Pre-drilling hole diameter[3]	$d_{V,G>0.55}$	[in]	5/32	5/32	13/64	15/64	9/32

[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]	0.21	0.23	0.28	0.36	0.44
Tensile strength (allowable)	f_{tens}	[lbf]	1000	1100	1450	2450	3200
Bending yield strength (specified)	$F_{y,b}$	[psi]	168000	168000	195000	180000	170000

Nominal diameter	**d_1**	[in]		0.21	0.23	0.28	0.36	0.44
Withdrawal (design value)	W_{90}	[lbf/in]	G = 0.35	102	107	141	192	207
			G = 0.42	118	123	164	220	240
			G = 0.49	132	139	185	255	272
			G = 0.55	145	152	203	280	298
minimum embedded length		[in]		1 1/4	1 5/16	1 5/8	2 1/8	2 5/8

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
5,3 **0.21 #11 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 #12 TX 25**	VGZEVO5140	140	5 1/2	130	5 1/8	50
	VGZEVO5150	150	6	140	5 1/2	50
	VGZEVO5160	160	6 1/4	150	6	50
7 **0.27 #16 TX 30**	VGZEVO780	80	3 1/8	70	2 3/4	50
	VGZEVO7100	100	4	90	3 1/2	50
	VGZEVO7120	120	4 3/4	110	4 3/8	50
	VGZEVO7140	140	5 1/2	130	5 1/8	50
	VGZEVO7160	160	6 1/4	150	6	50
	VGZEVO7180	180	7 1/8	170	6 3/4	50
	VGZEVO7200	200	8	190	7 1/2	50
	VGZEVO7220	220	8 5/8	210	8 1/4	50
	VGZEVO7240	240	9 1/2	230	9 1/16	50
	VGZEVO7260	260	10 1/4	250	10	50
	VGZEVO7280	280	11	270	10 5/8	50
	VGZEVO7300	300	11 3/4	290	11 7/16	50
	VGZEVO7340	340	13 3/8	330	13	50
	VGZEVO7380	380	15	370	14 9/16	50
9 **0.36 TX 40**	VGZEVO9160	160	6 1/4	150	6	50
	VGZEVO9180	180	7 1/8	170	6 3/4	50
	VGZEVO9200	200	8	190	7 1/2	50
	VGZEVO9220	220	8 5/8	210	8 1/4	50
	VGZEVO9240	240	9 1/2	230	9 1/16	50
	VGZEVO9260	260	10 1/4	250	10	50
	VGZEVO9280	280	11	270	10 5/8	50
	VGZEVO9300	300	11 3/4	290	11 7/16	50
	VGZEVO9320	320	12 5/8	310	12 3/16	25
	VGZEVO9340	340	13 3/8	330	13	25
	VGZEVO9360	360	14 1/4	350	13 3/4	25
	VGZEVO9380	380	15	370	14 9/16	25
	VGZEVO9400	400	15 3/4	390	15 3/8	25
	VGZEVO9440	440	17 1/4	430	16 15/16	25
	VGZEVO9480	480	19	470	18 1/2	25
	VGZEVO9520	520	20 1/2	510	20 1/16	25

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
11 **0.44 TX 50**	VGZEVO11250	250	10	240	9 1/2	25
	VGZEVO11300	300	11 3/4	290	11 7/16	25
	VGZEVO11350	350	13 3/4	340	13 3/8	25
	VGZEVO11400	400	15 3/4	390	15 3/8	25
	VGZEVO11450	450	17 3/4	440	17 1/4	25
	VGZEVO11500	500	19 3/4	490	19 5/16	25
	VGZEVO11550	550	21 5/8	540	21 1/4	25
	VGZEVO11600	600	23 5/8	590	23 1/4	25

RELATED PRODUCTS

JIG VGZ 45°

TEMPLATE FOR 45° SCREWS

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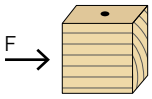
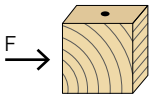
OUTDOOR STRUCTURAL PERFORMANCE

Values also tested, certified and calculated for CLT and high density woods such as LVL, Plywood or other laminated veneer products. Ideal for fastening timber-framed panels and lattice beams (Rafter, Truss).

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

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

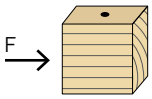


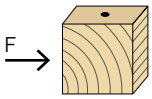


d_1	[in]		0.21	0.23	0.28	0.36	0.44
	[mm]		5,3	5,6	7	9	11
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
a_2	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16
$a_{3,t}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
$a_{3,c}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
$a_{4,t}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
$a_{4,c}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16

	0.21	0.23	0.28	0.36	0.44
	5,3	5,6	7	9	11
10·d	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
5·d	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16
15·d	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
10·d	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
10·d	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
5·d	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16

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

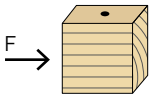


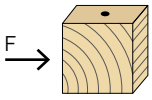


d_1	[in]		0.21	0.23	0.28	0.36	0.44
	[mm]		5,3	5,6	7	9	11
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
a_2	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16
$a_{3,t}$	[in]	**20·d**	4 3/16	4 7/16	5 1/2	7 1/8	8 5/8
$a_{3,c}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
$a_{4,t}$	[in]	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	5 3/16
$a_{4,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16

	0.21	0.23	0.28	0.36	0.44
	5,3	5,6	7	9	11
10·d	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
7·d	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16
20·d	4 3/16	4 7/16	5 1/2	7 1/8	8 5/8
15·d	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
12·d	2 1/2	2 11/16	3 5/16	4 1/4	5 3/16
7·d	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16

screws inserted **WITH pre-drilled hole**

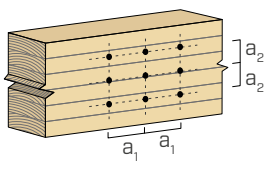




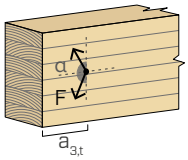
d_1	[in]		0.21	0.23	0.28	0.36		0.44
	[mm]		5,3	5,6	7	9		11
a_1	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**5·d**	2 3/16
a_2	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	**5·d**	2 3/16
$a_{3,t}$	[in]	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	**7·d**	3 1/16
$a_{3,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**4·d**	1 3/4
$a_{4,t}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**4·d**	1 3/4
$a_{4,c}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**3·d**	1 5/16

	0.21	0.23	0.28	0.36		0.44
	5,3	5,6	7	9		11
5·d	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	2 3/16
4·d	7/8	7/8	1 1/8	1 7/16	**5·d**	2 3/16
12·d	2 1/2	2 11/16	3 5/16	4 1/4	**7·d**	3 1/16
7·d	1 1/2	1 9/16	1 15/16	2 1/2	**4·d**	1 3/4
7·d	1 1/2	1 9/16	1 15/16	2 1/2	**4·d**	1 3/4
3·d	5/8	11/16	13/16	1 1/16	**3·d**	1 5/16

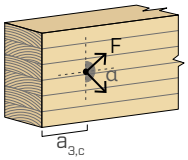
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



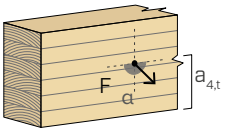
stressed end
-90° < α < 90°



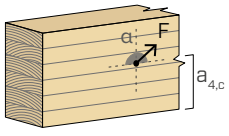
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTES

- 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

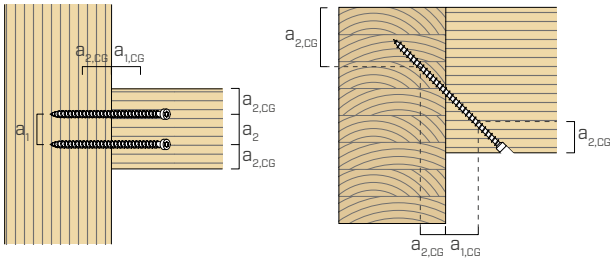
screws inserted **WITHOUT pre-drilled hole**

d_1	[in]		0.21	0.23	0.28	0.36		0.44
	[mm]		5,3	5,6	7	9		11
a_1	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16
a_2	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	**5·d**	2 3/16
$a_{1,CG}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	4 3/8
$a_{2,CG}$	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	**4·d**	1 3/4
a_{CROSS}	[in]	**1,5·d**	5/16	3/8	7/16	9/16	**1,5·d**	11/16

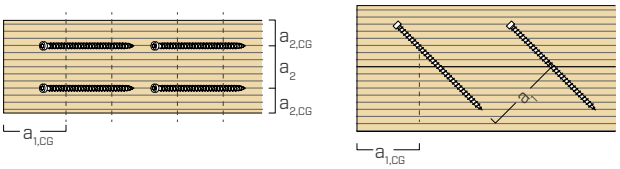
screws inserted **WITH pre-drilled hole**

d_1	[in]		0.21	0.23	0.28	0.36		0.44
	[mm]		5,3	5,6	7	9		11
a_1	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**5·d**	2 3/16
a_2	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**5·d**	2 3/16
$a_{1,CG}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**4·d**	1 3/4
$a_{2,CG}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**3·d**	1 5/16
a_{CROSS}	[in]	**1,5·d**	5/16	3/8	7/16	9/16	**1,5·d**	11/16

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

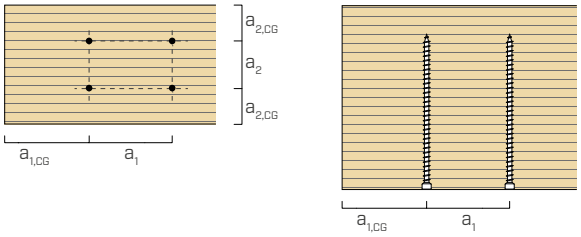


plan front



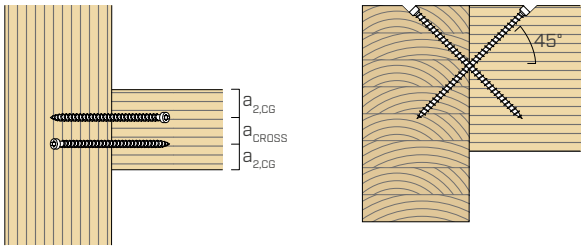
plan front

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



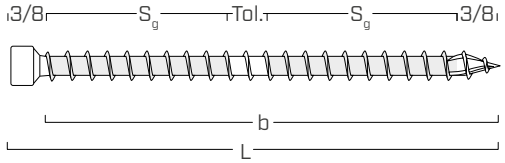
plan front

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



plan front

EFFECTIVE THREAD USED IN CALCULATION



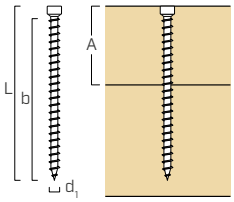
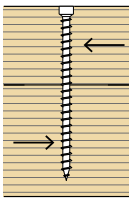
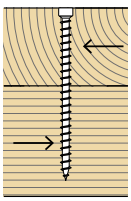
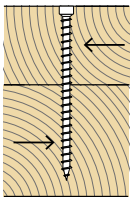
b = $S_{g,tot}$ = L - 3/8" represents the entire length of the threaded part

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

NOTES

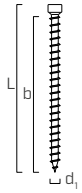
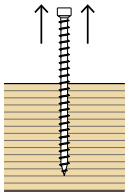
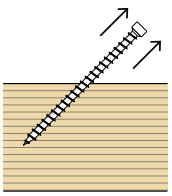
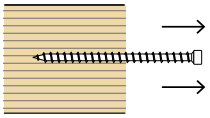
- The minimum spacing and distances comply with Table 8 of ESR-4645, where d refers to the nominal diameter of the screw;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

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

geometry				Z_{II}				$Z_{\perp/II}$				$Z_{\perp}$			
															
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]
5,3 **0.21**	80	3 1/8	2 3/4	1 9/16	98	125	144	161	98	125	144	161	98	125	144	161
	100	4	3 1/2	1 15/16	106	125	144	161	106	125	144	161	106	125	144	161
	120	4 3/4	4 3/8	2 3/8	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	106	125	144	161	106	125	144	161	106	125	144	161
	150	6	5 1/2	2 15/16	106	125	144	161	106	125	144	161	106	125	144	161
	160	6 1/4	6	3 1/8	106	125	144	161	106	125	144	161	106	125	144	161
7 **0.28**	80	3 1/8	2 3/4	1 9/16	118	165	219	263	94	132	175	211	94	132	175	211
	100	4	3 1/2	1 15/16	148	206	242	269	119	165	193	215	119	165	193	215
	120	4 3/4	4 3/8	2 3/8	174	210	242	269	140	168	193	215	140	168	193	215
	140	5 1/2	5 1/8	2 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	160	6 1/4	6	3 1/8	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
	200	8	7 1/2	4	177	210	242	269	142	168	193	215	142	168	193	215
	220	8 5/8	8 1/4	4 3/8	177	210	242	269	142	168	193	215	142	168	193	215
	240	9 1/2	9 1/16	4 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	260	10 1/4	10	5 1/8	177	210	242	269	142	168	193	215	142	168	193	215
	280	11	10 5/8	5 1/2	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
	340	13 3/8	13	6 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	380	15	14 9/16	7 1/2	177	210	242	269	142	168	193	215	142	168	193	215
9 **0.36**	160	6 1/4	6	3 1/8	230	272	313	348	184	217	250	278	184	217	250	278
	180	7 1/8	6 3/4	3 1/2	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
	220	8 5/8	8 1/4	4 3/8	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
	260	10 1/4	10	5 1/8	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
	300	11 3/4	11 7/16	6	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
	340	13 3/8	13	6 3/4	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
	380	15	14 9/16	7 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	400	15 3/4	15 3/8	8	230	272	313	348	184	217	250	278	184	217	250	278
	440	17 1/4	16 15/16	8 5/8	230	272	313	348	184	217	250	278	184	217	250	278
	480	19	18 1/2	9 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	520	20 1/2	20 1/16	10 1/4	230	272	313	348	184	217	250	278	184	217	250	278
11 **0.44**	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
	450	17 3/4	17 1/4	8 7/8	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
	550	21 5/8	21 1/4	10 7/8	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

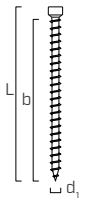
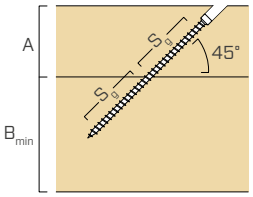
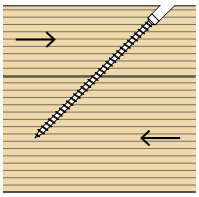
NOTES and GENERAL PRINCIPLES on page 179.

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]
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
	150	6	5 1/2	566	651	735	804	515	592	669	732	170	195	221	241
	160	6 1/4	6	608	699	790	864	554	636	719	786	182	210	237	259
7 **0.28**	80	3 1/8	2 3/4	350	407	459	504	318	370	418	458	105	122	138	151
	100	4	3 1/2	461	536	605	663	419	488	550	604	138	161	181	199
	120	4 3/4	4 3/8	572	665	750	823	520	605	683	749	172	200	225	247
	140	5 1/2	5 1/8	683	794	896	983	621	723	815	895	205	238	269	295
	160	6 1/4	6	794	923	1042	1143	722	840	948	1040	238	277	312	343
	180	7 1/8	6 3/4	905	1052	1187	1303	823	958	1080	1185	271	316	356	391
	200	8	7 1/2	1016	1182	1333	1463	924	1075	1213	1331	305	354	400	439
	220	8 5/8	8 1/4	1127	1311	1479	1622	1025	1193	1345	1476	338	393	444	487
	240	9 1/2	9 1/16	1238	1440	1624	1782	1127	1310	1478	1622	371	432	487	535
	260	10 1/4	10	1349	1569	1770	1942	1228	1428	1611	1767	405	471	531	583
	280	11	10 5/8	1460	1698	1916	2102	1329	1545	1743	1913	438	509	575	631
	300	11 3/4	11 7/16	1571	1827	2061	2262	1430	1663	1876	2058	471	548	618	679
	340	13 3/8	13	1793	2086	2353	2581	1632	1898	2141	2349	538	626	706	774
	380	15	14 9/16	2015	2344	2644	2901	1834	2133	2406	2640	605	703	793	870
9 **0.36**	160	6 1/4	6	1066	1221	1416	1554	970	1111	1288	1414	320	366	425	466
	180	7 1/8	6 3/4	1217	1394	1616	1775	1107	1269	1471	1615	365	418	485	532
	200	8	7 1/2	1368	1568	1817	1995	1245	1427	1654	1816	410	470	545	599
	220	8 5/8	8 1/4	1519	1741	2018	2216	1383	1584	1836	2016	456	522	605	665
	240	9 1/2	9 1/16	1671	1914	2219	2436	1520	1742	2019	2217	501	574	666	731
	260	10 1/4	10	1822	2087	2419	2657	1658	1900	2202	2418	547	626	726	797
	280	11	10 5/8	1973	2261	2620	2877	1795	2057	2384	2618	592	678	786	863
	300	11 3/4	11 7/16	2124	2434	2821	3098	1933	2215	2567	2819	637	730	846	929
	320	12 5/8	12 3/16	2275	2607	3022	3318	2071	2372	2750	3019	683	782	907	995
	340	13 3/8	13	2426	2780	3223	3539	2208	2530	2933	3220	728	834	967	1062
	360	14 1/4	13 3/4	2578	2954	3423	3759	2346	2688	3115	3421	773	886	1027	1128
	380	15	14 9/16	2729	3127	3624	3980	2483	2845	3298	3621	819	938	1087	1194
	400	15 3/4	15 3/8	2880	3300	3825	4200	2621	3003	3481	3822	864	990	1148	1260
	440	17 1/4	16 15/16	3182	3646	4227	4641	2896	3318	3846	4223	955	1094	1268	1392
	480	19	18 1/2	3485	3993	4628	5082	3171	3634	4212	4625	1045	1198	1388	1525
	520	20 1/2	20 1/16	3787	4339	5030	5523	3446	3949	4577	5026	1136	1302	1509	1657
11 **0.44**	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
	450	17 3/4	17 1/4	3496	4054	4594	5033	3182	3689	4181	4580	1049	1216	1378	1510
	500	19 3/4	19 5/16	3904	4526	5129	5620	3552	4119	4668	5114	1171	1358	1539	1686
	550	21 5/8	21 1/4	4311	4998	5665	6206	3923	4549	5155	5648	1293	1500	1699	1862
	600	23 5/8	23 1/4	4719	5471	6200	6793	4294	4978	5642	6182	1416	1641	1860	2038

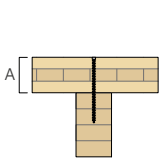
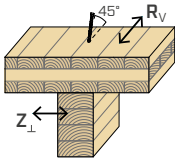
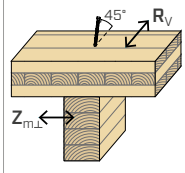
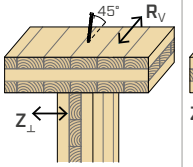
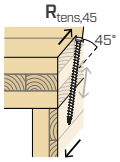
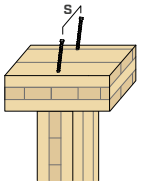
NOTES and GENERAL PRINCIPLES on page 179.

SLIDING RESISTANCE (R_v) | WOOD

geometry							R_v			
										
d_1	L		b	S_g	A	B_{min}	G			
							0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5,3 **0.21**	80	3 1/8(1)	2 3/4	1	1 1/4	1 7/8	66	76	85	93
	100	4(1)	3 1/2	1 3/8	1 9/16	2 1/8	90	104	117	128
	120	4 3/4	4 3/8	1 3/4	1 13/16	2 3/8	115	133	149	163
5,6 **0.23**	140	5 1/2	5 1/8	2 3/16	2 1/8	2 11/16	151	173	196	214
	150	6	5 1/2	2 3/8	2 1/4	2 13/16	164	188	212	232
	160	6 1/4	6	2 9/16	2 3/8	3	176	203	229	251
7 **0.28**	80	3 1/8(1)	2 3/4	1	1 1/4	1 7/8	91	106	119	131
	100	4(1)	3 1/2	1 3/8	1 9/16	2 1/8	125	145	164	180
	120	4 3/4(1)	4 3/8	1 3/4	1 13/16	2 3/8	159	185	208	229
	140	5 1/2(1)	5 1/8	2 3/16	2 1/8	2 11/16	198	231	260	286
	160	6 1/4	6	2 9/16	2 3/8	3	232	270	305	335
	180	7 1/8	6 3/4	2 15/16	2 11/16	3 1/4	267	310	350	384
	200	8	7 1/2	3 3/8	2 15/16	3 1/2	306	356	402	441
	220	8 5/8	8 1/4	3 3/4	3 1/4	3 13/16	340	396	446	490
	240	9 1/2	9 1/16	4 1/8	3 1/2	4 1/8	374	435	491	539
	260	10 1/4	10	4 1/2	3 3/4	4 3/8	408	475	536	588
	280	11	10 5/8	4 15/16	4 1/16	4 5/8	448	521	588	645
	300	11 3/4	11 7/16	5 5/16	4 3/8	4 15/16	482	561	632	694
	340	13 3/8	13	6 1/8	4 7/8	5 1/2	556	646	729	800
	380	15	14 9/16	6 7/8	5 7/16	6	624	726	818	898
9 **0.36**	160	6 1/4(1)	6	2 9/16	2 3/8	3	317	363	420	462
	180	7 1/8	6 3/4	2 15/16	2 11/16	3 1/4	363	416	482	529
	200	8	7 1/2	3 3/8	2 15/16	3 1/2	417	478	554	608
	220	8 5/8	8 1/4	3 3/4	3 1/4	3 13/16	463	531	615	676
	240	9 1/2	9 1/16	4 1/8	3 1/2	4 1/8	510	584	677	743
	260	10 1/4	10	4 1/2	3 3/4	4 3/8	556	637	738	811
	280	11	10 5/8	4 15/16	4 1/16	4 5/8	610	699	810	890
	300	11 3/4	11 7/16	5 5/16	4 3/8	4 15/16	656	752	872	957
	320	12 5/8	12 3/16	5 11/16	4 5/8	5 3/16	703	805	933	1025
	340	13 3/8	13	6 1/8	4 7/8	5 1/2	757	867	1005	1104
	360	14 1/4	13 3/4	6 1/2	5 3/16	5 3/4	803	920	1067	1171
	380	15	14 9/16	6 7/8	5 7/16	6	849	973	1128	1239
	400	15 3/4	15 3/8	7 1/4	5 11/16	6 1/4	896	1026	1190	1306
	440	17 1/4	16 15/16	8 1/16	6 1/4	6 7/8	996	1141	1323	1453
	480	19	18 1/2	8 7/8	6 7/8	7 7/16	1096	1256	1456	1599
	520	20 1/2	20 1/16	9 5/8	7 3/8	8 1/16	1189	1363	1579	1734
11 **0.44**	250	10	9 1/2	4 3/8	3 5/8	4 3/16	583	676	766	839
	300	11 3/4	11 7/16	5 5/16	4 3/8	4 15/16	708	820	930	1019
	350	13 3/4	13 3/8	6 1/4	5 1/16	5 5/8	832	965	1094	1198
	400	15 3/4	15 3/8	7 1/4	5 11/16	6 1/4	966	1120	1269	1390
	450	17 3/4	17 1/4	8 1/4	6 7/16	7	1099	1274	1444	1582
	500	19 3/4	19 5/16	9 1/4	7 1/8	7 11/16	1232	1428	1619	1774
	550	21 5/8	21 1/4	10 1/4	7 13/16	8 7/16	1365	1583	1794	1965
	600	23 5/8	23 1/4	11 1/4	8 5/8	9 1/4	1498	1737	1969	2157

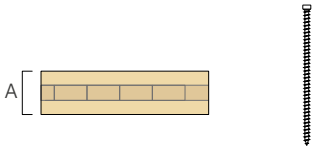
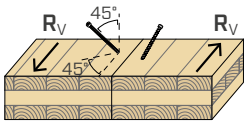
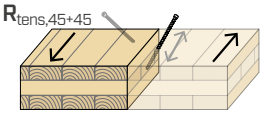
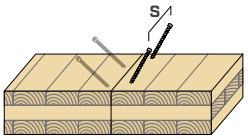
(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

NOTES and **GENERAL PRINCIPLES** on page 179.

geometry				SHEAR								SPACING	
				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	VGZEVO5160	193	125	193	125	129	84	129	84	778	3 5/16	4
			VGZEVO7160	259	168	259	168	174	112	174	112	1025	4 1/8	6
			VGZEVO9160	352	217	352	217	236	146	236	146	1732	5 5/16	7
	79	3 1/8	VGZEVO7220	394	168	394	168	264	112	264	112	1025	4 1/8	6
			VGZEVO9220	526	217	526	217	352	146	352	146	1732	5 5/16	7
			VGZEVO11250	571	234	571	252	383	157	383	169	2263	6 1/2	9
	105	4 1/8	VGZEVO7300	544	168	544	168	364	112	364	112	1025	4 1/8	6
			VGZEVO9300	726	217	726	217	486	146	486	146	1732	5 5/16	7
			VGZEVO11300	790	234	790	252	529	157	529	169	2263	6 1/2	9
	120	4 3/4	VGZEVO7340	633	168	633	168	424	112	424	112	1025	4 1/8	6
			VGZEVO9340	846	217	846	217	567	146	567	146	1732	5 5/16	7
			VGZEVO11350	921	234	921	252	617	157	617	169	2263	6 1/2	9
5 PLY	100	3 15/16	VGZEVO7280	516	168	516	168	346	112	346	112	1025	4 1/8	6
			VGZEVO9280	688	217	688	217	461	146	461	146	1732	5 5/16	7
			VGZEVO11300	749	234	749	252	502	157	502	169	2263	6 1/2	9
	140	5 1/2	VGZEVO7380	705	168	705	168	472	112	472	112	1025	4 1/8	6
			VGZEVO9400	1001	217	1001	217	671	146	671	146	1732	5 5/16	7
			VGZEVO11400	1090	234	1090	252	730	157	730	169	2263	6 1/2	9
	175	6 7/8	VGZEVO9480	1232	217	1232	217	825	146	825	146	1732	5 5/16	7
			VGZEVO11500	1390	234	1390	252	931	157	931	169	2263	6 1/2	9
	200	7 7/8	VGZEVO9520	1255	217	1255	217	841	146	841	146	1732	5 5/16	7
			VGZEVO11550	1553	234	1553	252	1041	157	1041	169	2263	6 1/2	9
7 PLY	140	5 1/2	VGZEVO7380	703	168	703	168	471	112	471	112	1025	4 1/8	6
			VGZEVO9400	1003	217	1003	217	672	146	672	146	1732	5 5/16	7
			VGZEVO11400	1093	234	1093	252	732	157	732	169	2263	6 1/2	9
	191	7 1/2	VGZEVO9520	1329	217	1329	217	891	146	891	146	1732	5 5/16	7
			VGZEVO11550	1527	234	1527	252	1023	157	1023	169	2263	6 1/2	9

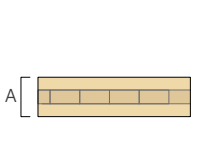
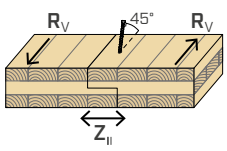
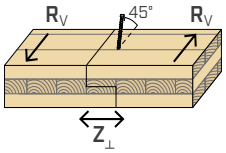
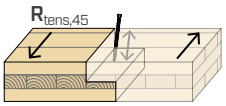
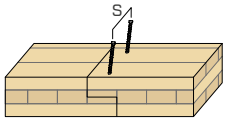
NOTES and GENERAL PRINCIPLES on page 179.

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	60	2 3/8	VGZEVO580	37	500	3 1/8	4
			VGZEVO780	51	725	4 1/8	6
	79	3 1/8	VGZEVO5100	52	500	3 1/8	4
			VGZEVO7100	72	725	4 1/8	6
	105	4 1/8	VGZEVO5120	67	500	3 1/8	4
			VGZEVO7120	92	725	4 1/8	6
	120	4 3/4	VGZEVO5160	100	550	3 5/16	4
			VGZEVO7160	134	725	4 1/8	6
			VGZEVO9160	179	1225	5 5/16	7
5 PLY	100	3 15/16	VGZEVO5120	67	500	3 1/8	4
			VGZEVO7120	92	725	4 1/8	6
	140	5 1/2	VGZEVO7180	154	725	4 1/8	6
			VGZEVO9180	207	1225	5 5/16	7
	175	6 7/8	VGZEVO7220	195	725	4 1/8	6
			VGZEVO9220	262	1225	5 5/16	7
	200	7 7/8	VGZEVO7260	236	725	4 1/8	6
			VGZEVO9260	317	1225	5 5/16	7
			VGZEVO11250	331	1600	6 1/2	9
7 PLY	140	5 1/2	VGZEVO7180	154	725	4 1/8	6
			VGZEVO9180	207	1225	5 5/16	7
	191	7 1/2	VGZEVO7240	216	725	4 1/8	6
			VGZEVO9240	289	1225	5 5/16	7
			VGZEVO11250	331	1600	6 1/2	9
	244	9 5/8	VGZEVO7340	319	725	4 1/8	6
			VGZEVO9320	400	1225	5 5/16	7
			VGZEVO11300	406	1600	6 1/2	9
	280	11	VGZEVO7380	360	725	4 1/8	6
			VGZEVO9380	482	1225	5 5/16	7
			VGZEVO11350	481	1600	6 1/2	9
9 PLY	180	7 1/16	VGZEVO7220	195	725	4 1/8	6
			VGZEVO9220	262	1225	5 5/16	7
			VGZEVO11250	331	1600	6 1/2	9
	267	10 1/2	VGZEVO7340	319	725	4 1/8	6
			VGZEVO9360	455	1225	5 5/16	7
			VGZEVO11350	481	1600	6 1/2	9
	314	12 3/8	VGZEVO9400	510	1225	5 5/16	7
			VGZEVO11400	556	1600	6 1/2	9
	360	14 3/16	VGZEVO9480	620	1225	5 5/16	7
			VGZEVO11450	631	1600	6 1/2	9

NOTES and GENERAL PRINCIPLES on page 179.

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	$Z_{\parallel}$	R_v	$Z_{\perp}$	$R_{tens,45}$	minimum	typical
	[mm]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]
3 PLY	60	2 3/8	VGZEVO580	73	125	73	125	707	3 1/8	4
			VGZEVO780	103	165	103	132	1025	4 1/8	6
	79	3 1/8	VGZEVO5100	92	125	92	125	707	3 1/8	4
			VGZEVO7100	130	194	130	155	1025	4 1/8	6
	105	4 1/8	VGZEVO5120	98	125	98	125	707	3 1/8	4
			VGZEVO7120	138	199	138	159	1025	4 1/8	6
	120	4 3/4	VGZEVO5140	131	125	131	125	778	3 5/16	4
			VGZEVO7140	176	210	176	168	1025	4 1/8	6
			VGZEVO9160	352	272	352	217	1732	5 5/16	7
5 PLY	100	3 15/16	VGZEVO5120	108	125	108	125	707	3 1/8	4
			VGZEVO7120	152	208	152	166	1025	4 1/8	6
	140	5 1/2	VGZEVO7180	285	210	285	168	1025	4 1/8	6
			VGZEVO9180	385	272	385	217	1732	5 5/16	7
	175	6 7/8	VGZEVO7220	348	210	348	168	1025	4 1/8	6
			VGZEVO9220	471	272	471	217	1732	5 5/16	7
	200	7 7/8	VGZEVO7260	440	210	440	168	1025	4 1/8	6
			VGZEVO9260	594	272	594	217	1732	5 5/16	7
			VGZEVO11250	589	344	589	234	2263	6 1/2	9
7 PLY	140	5 1/2	VGZEVO7180	284	210	284	168	1025	4 1/8	6
			VGZEVO9180	384	272	384	217	1732	5 5/16	7
	191	7 1/2	VGZEVO7240	385	210	385	168	1025	4 1/8	6
			VGZEVO9240	520	272	520	217	1732	5 5/16	7
			VGZEVO11250	630	344	630	234	2263	6 1/2	9
	244	9 5/8	VGZEVO9320	753	272	753	217	1732	5 5/16	7
			VGZEVO11300	702	344	702	234	2263	6 1/2	9
	280	11	VGZEVO7380	703	210	703	168	1025	4 1/8	6
			VGZEVO9380	947	272	947	217	1732	5 5/16	7
			VGZEVO11350	853	344	853	234	2263	6 1/2	9
9 PLY	180	7 1/16	VGZEVO7220	332	210	332	168	1025	4 1/8	6
			VGZEVO9220	450	272	450	217	1732	5 5/16	7
	267	10 1/2	VGZEVO9360	888	272	888	217	1732	5 5/16	7
			VGZEVO11350	910	344	910	234	2263	6 1/2	9
	314	12 3/8	VGZEVO9400	923	272	923	217	1732	5 5/16	7
			VGZEVO11400	1010	344	1010	234	2263	6 1/2	9
	360	14 3/16	VGZEVO9480	1189	272	1189	217	1732	5 5/16	7
			VGZEVO11450	1117	344	1117	234	2263	6 1/2	9

NOTES and GENERAL PRINCIPLES on page 179.

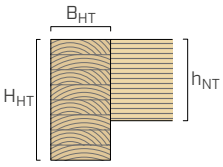
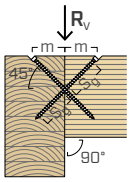
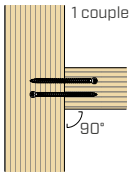
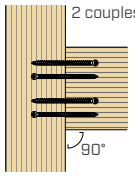
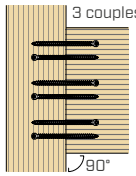
CLT | LEDGER CONNECTION

					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	VGZEVO5120	176	707	1 1/16	4
			1 3/4	VGZEVO7120	246	1025	1 3/8	6
	79	3 1/8	1 3/4	VGZEVO5120	176	707	1 1/16	4
			1 3/4	VGZEVO7120	246	1025	1 3/8	6
	105	4 1/8	1 3/4	VGZEVO5120	176	707	1 1/16	4
			1 3/4	VGZEVO7120	246	1025	1 3/8	6
	120	4 3/4	1 3/4	VGZEVO7160	246	1025	1 3/8	6
			1 3/4	VGZEVO9160	340	1732	1 3/4	7
5 PLY	100	3 15/16	1 3/4	VGZEVO7120	246	1025	1 3/8	6
	140	5 1/2	3 1/2	VGZEVO7260	570	1025	1 3/8	6
			3 1/2	VGZEVO9260	786	1732	1 3/4	7
			3 1/2	VGZEVO11250	830	2263	2 3/16	9
	175	6 7/8	5 1/4	VGZEVO7380	874	1025	1 3/8	6
			5 1/4	VGZEVO9380	1172	1732	1 3/4	7
			5 1/4	VGZEVO11400	1314	2263	2 3/16	9
	200	7 7/8	5 1/4	VGZEVO7380	874	1025	1 3/8	6
			5 1/4	VGZEVO9400	1232	1732	1 3/4	7
			5 1/4	VGZEVO11400	1314	2263	2 3/16	9
7 PLY	140	5 1/2	3 1/2	VGZEVO7260	570	1025	1 3/8	6
			3 1/2	VGZEVO9260	786	1732	1 3/4	7
			3 1/2	VGZEVO11250	830	2263	2 3/16	9
	191	7 1/2	5 1/4	VGZEVO7380	874	1025	1 3/8	6
			5 1/4	VGZEVO9400	1232	1732	1 3/4	7
			5 1/4	VGZEVO11400	1314	2263	2 3/16	9
	244	9 5/8	6 1/2	VGZEVO9480	1510	1732	1 3/4	7
			6 1/2	VGZEVO11500	1654	2263	2 3/16	9
	280	11	6 1/2	VGZEVO9520	1551	1732	1 3/4	7
			6 1/2	VGZEVO11550	1654	2263	2 3/16	9

GENERAL PRINCIPLES and CONNECTIONS GENERAL NOTES on page 179.

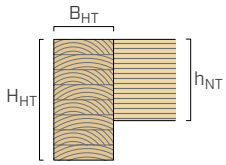
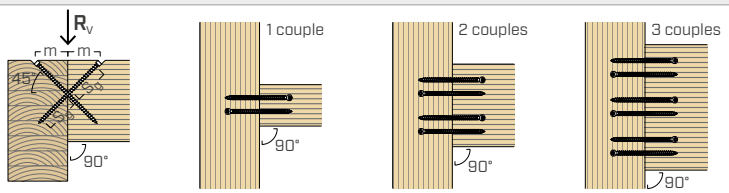
NOTES

- 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.

geometry				crossed screws				
								
$H_{HT,min}$ $h_{NT,min}$	$B_{HT,min}$	$b_{NT,min}$	suggested screw	m	number of couples	R_v		$R_{tens,45}$
						SPF	D.Fir	
[in]	[in]	[in]	CODE	[in]		[lbf]	[lbf]	[lbf]
6	3 1/8	3 1/8	VGZEVO7200	2 15/16	1	712	804	2051
		3 1/2			2	1425	1607	4101
		5 1/8			3	2137	2411	6152
		3 1/2	VGZEVO9200	2 15/16	1	956	1108	3465
		5 1/8			2	1911	2215	6930
		5 1/2			3	2867	3323	10394
7 1/2	3 1/2	3 1/8	VGZEVO7260	3 3/4	1	950	1071	2051
		3 1/2			2	1900	2143	4101
		5 1/8			3	2849	3214	6152
		3 1/2	VGZEVO9260	3 3/4	1	1274	1477	3465
		5 1/8			2	2548	2954	6930
		5 1/2			3	3822	4430	10394
		5 1/8	VGZEVO11250	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 1/8	VGZEVO7300	4 5/16	1	1121	1265	2051
		3 1/2			2	2242	2530	4101
		5 1/8			3	3364	3794	6152
		3 1/2	VGZEVO9300	4 5/16	1	1504	1743	3465
		5 1/8			2	3008	3487	6930
		5 1/2			3	4512	5230	10394
		5 1/8	VGZEVO11300	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 1/8	VGZEVO7340	5 1/8	1	1293	1458	2051
		3 1/2			2	2585	2917	4101
		5 1/8			3	3878	4375	6152
		3 1/2	VGZEVO9360	5 1/8	1	1840	2133	3465
		5 1/8			2	3681	4266	6930
		5 1/2			3	5521	6399	10394
		5 1/8	VGZEVO11350	5	1	1930	2188	4525
		5 1/2			2	3861	4376	9051
		6 3/4			3	5791	6563	13576
12	6 3/4	3 1/8	VGZEVO7380	5 11/16	1	1451	1637	2051
		3 1/2			2	2902	3274	4101
		5 1/8			3	4353	4910	6152
		3 1/2	VGZEVO9400	5 11/16	1	2053	2379	3465
		5 1/8			2	4105	4758	6930
		5 1/2			3	6158	7138	10394
		5 1/8	VGZEVO11400	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	3 1/2	VGZEVO9480	6 13/16	1	2513	2912	3465
		5 1/8			2	5025	5825	6930
		5 1/2			3	7538	8737	10394
		5 1/8	VGZEVO11450	6 13/16	1	2548	2888	4525
		5 1/2			2	5096	5776	9051
		6 3/4			3	7644	8664	13576

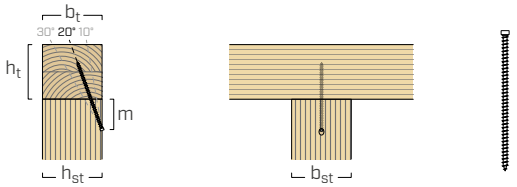
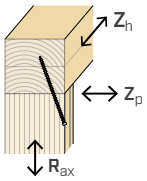
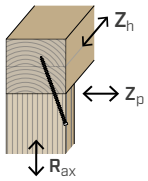
NOTES and GENERAL PRINCIPLES on page 179.

WOOD | CROSSED SCREW CONNECTION

geometry				crossed screws				
								

$H_{HT,min}$ $h_{NT,min}$	$B_{HT,min}$	$b_{NT,min}$	suggested screw	m	number of couples	R_v SPF	R_v D.Fir	$R_{tens,45}$
[in]	[in]	[in]	CODE	[in]		[lbf]	[lbf]	[lbf]
15	7 1/2	3 1/2	VGZEVO9520	7 3/8	1	2725	3159	3465
		5 1/8			2	5450	6317	6930
		5 1/2			3	8175	9476	10394
		5 1/8	VGZEVO11500	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	VGZEVO11550	8 3/16	1	3166	3588	4525
		5 1/2			2	6332	7176	9051
		6 3/4			3	9498	10764	13576
18	9	5 1/8	VGZEVO11600	8 7/16	1	3475	3938	4525
		5 1/2			2	6949	7876	9051
		6 3/4			3	10424	11814	13576

WOOD | TOE-NAIL CONNECTION

geometry				wooden frame (Northern species)			wooden frame (SPF)		
									

$b_{st,min}$	$h_{st}=b_{t,min}$	$h_{t,min}$	m	suggested screw	R_{ax}	Z_h	Z_p	R_{ax}	Z_h	Z_p
[in]	[in]	[in]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
2	4	4	3	VGZEVO5120	109	100	96	126	125	125
			3	VGZEVO5140	160	106	106	184	125	125
			3	VGZEVO5150	160	106	106	184	125	125
			3	VGZEVO5160	160	106	106	184	125	125
			3	VGZEVO7160	211	142	142	245	168	168
			3	VGZEVO7180	211	142	142	245	168	168
2	4	4	4	VGZEVO7200	297	142	142	346	168	168
			4 3/4	VGZEVO7220	362	142	142	421	168	168
			5 1/2	VGZEVO7240	424	142	142	493	168	168
			6	VGZEVO7260	458	142	142	532	168	168

GENERAL PRINCIPLES and CONNECTIONS GENERAL NOTES on page 179.

CROSSED SCREW CONNECTION

- 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.

TOE-NAIL CONNECTION

- The static values were calculated assuming an insertion angle of the screw with respect to the vertical of 20°.
- For uplift loads, the screw is assumed to resist with an axial mechanism. For the other load directions (Z_h and Z_p) the screw is assumed to resist with pure shear.
- The density considered is G = 0.35 for Northern Species, G = 0.42 for SPF.
- For simultaneous loads, in different directions, on a screw, the allowable load must be evaluated using the following equation: (Design Uplift ÷ Allowable Uplift) + (Design F_1 ÷ Allowable F_1) + (Design F_2 ÷ Allowable F_2) ≤ 1.0, where the three terms in the unity equation represent the possible generated force directions. The number of terms that must be considered for simultaneous loading is the sole discretion of the designer and depends on the method of calculating wind forces and the utilization of the screws within the structural system.

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 171 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 $\alpha < 15°$.
- 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°.