VGS

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

FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD

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. Costs and time for project implementation are reduced.

CERTIFICATION FOR TIMBER AND CONCRETE

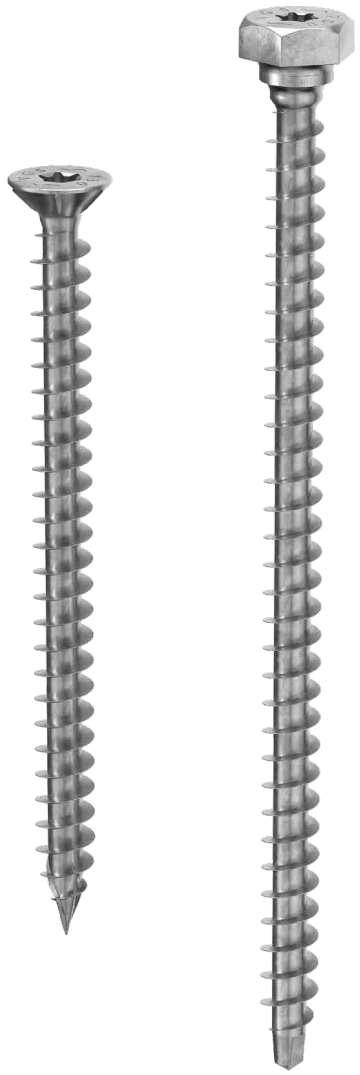
Structural connector approved for timber applications according to ETA-11/0030 and for timber-concrete applications according to ETA-22/0806.

TENSILE STRENGTH

Deep thread and high strength steel for excellent tensile or sliding performance. Approved for structural applications subject to stresses in any direction vs the grain (0° - 90°).
Can be used on steel plates in combination with the VGU and HUS washers.

COUNTERSUNK OR HEXAGONAL HEAD

Countersunk head up to L = 23 5/8" (600 mm), ideal for use on plates or for concealed reinforcements. Hexagonal head L > 23 5/8" (600 mm) to facilitate gripping with screwdriver.



MY PROJECT SOFTWARE | MANUALS

BIT INCLUDED

DIAMETER [in]	0.36	**0.36**			**0.60**	0.60
LENGTH [in]	3 1/8	**3 1/8**			**78 3/4**	78 3/4
EXPOSURE CONDITION	**EC1**	**DRY**				
ATMOSPHERIC CORROSIVITY	**C1**	**C2**				
WOOD CORROSIVITY	T1	T2				
MATERIAL	Zn ELECTRO PLATED	electrogalvanized carbon steel				

METAL-to-TIMBER recommended use:

NO IMPACT

TORQUE LIMITER

$M_{ins,max}$

FIELDS OF USE

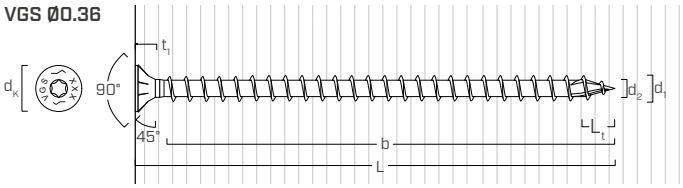
- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

TC FUSION

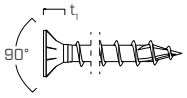
The ETA-22/0806 approval of the TC FUSION system allows the VGS screws to be used together with the reinforcements in the concrete so that the panel floor slabs and the bracing core can be bonded together with a small integration of the casting.

GEOMETRY AND MECHANICAL CHARACTERISTICS

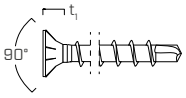
VGS Ø0.36



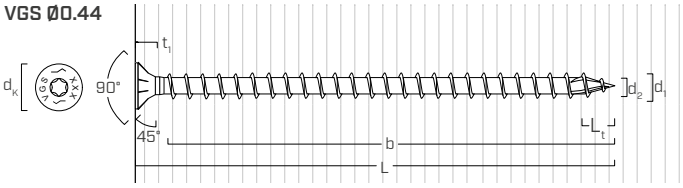
L ≤ 20 1/2 in



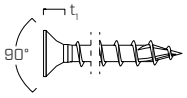
L > 20 1/2 in



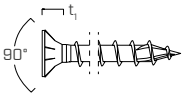
VGS Ø0.44



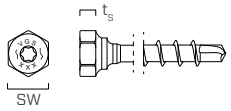
L ≤ 10 in



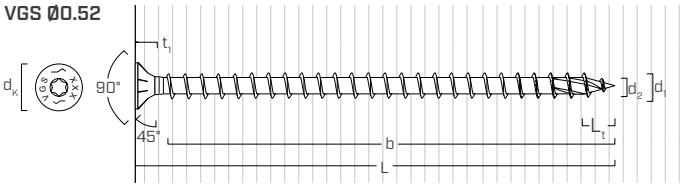
10 in < L ≤ 23 5/8 in



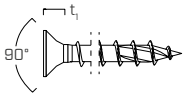
L > 23 5/8 in



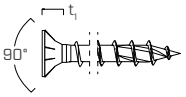
VGS Ø0.52



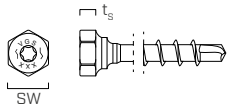
L ≤ 10 in



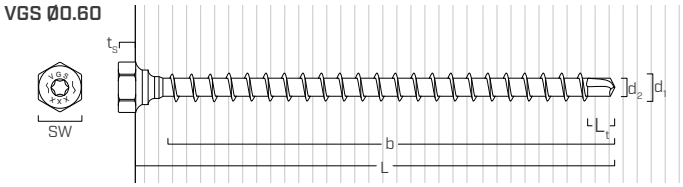
10 in < L ≤ 23 5/8 in



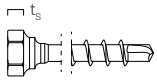
L > 23 5/8 in



VGS Ø0.60



L > 23 5/8 in



GEOMETRY

Nominal diameter	**d_1**	**[in](1)**	**0.36**	**0.44**	**0.44**	**0.52**	**0.52**	**0.60**
Outer thread diameter	**d_1**	[mm]	9	11	11	13	13	15
		[in]	**0.354**	**0.433**	**0.433**	**0.512**	**0.512**	**0.591**
Length	L	[in]	-	≤ 23 5/8	> 23 5/8	≤ 23 5/8	> 23 5/8	-
Head diameter	d_K	[in]	0.630	0.760	-	0.866	-	-
Countersunk head thickness	t_1	[in]	0.256	0.323	-	0.370	-	-
Wrench size	SW	-	-	-	-	SW17	-	SW19	SW22
Exagonal head thickness	t_s	[in]	-	-	0.252	-	0.295	0.346
Root diameter	d_2	[in]	0.232	0.260	0.260	0.315	0.315	0.354
Tip Length	L_t	[in]	0.354	0.433	0.433	0.512	0.512	0.591
Pre-drilling hole diameter(2)	$d_{V,G\leq0.55}$	[in]	13/64	15/64	15/64	5/16	5/16	23/64
Pre-drilling hole diameter(3)	$d_{V,G>0.55}$	[in]	15/64	9/32	9/32	23/64	23/64	13/32

(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

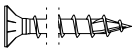
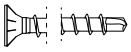
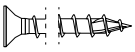
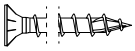
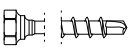
Nominal diameter	**d_1**	[in]	**0.36**	**0.44**	**0.44**	**0.52**	**0.52**	**0.60**
Tensile strength (allowable)	f_{tens}	**[lbf]**	2450	3200	3200	4400	4400	4800
Bending yield strength (specified)	$F_{y,b}$	**[psi]**	180000	170000	170000	161000	161000	135000

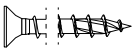
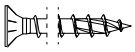
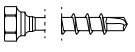
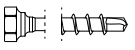
Nominal diameter	**d_1**	[in]		**0.36**	**0.44**	**0.44**	**0.52**	**0.52**	**0.60**
Withdrawal (design value)	W_{90}	[lbf/in]	G = 0.35	192	207	207	235	235	255
			G = 0.42	220	240	240	272	272	295
			G = 0.49	255	272	272	308	308	334
			G = 0.55	280	298	298	338	338	366
minimum embedded length		[in]		2 1/8	2 5/8	2 5/8	3 1/16	3 1/16	3 1/2

NOTE

- The mechanical parameters of the VGS Ø15 (0.60") screws in the tables have been estimated analytically and validated by experimental tests.

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs	
9 **0.36** TX 40	**VGS9100**	100	4	90	3 1/2	50	
	VGS9120	120	4 3/4	110	4 3/8	50	
	VGS9140	140	5 1/2	130	5 1/8	50	
	VGS9160	160	6 1/4	150	6	50	
	VGS9180	180	7 1/8	170	6 3/4	50	
	VGS9200	200	8	190	7 1/2	50	
	VGS9220	220	8 5/8	210	8 1/4	50	
	VGS9240	240	9 1/2	230	9 1/16	50	
	VGS9260	260	10 1/4	250	10	50	
	VGS9280	280	11	270	10 5/8	50	
	VGS9300	300	11 3/4	290	11 7/16	50	
	VGS9320	320	12 5/8	310	12 3/16	50	
	VGS9340	340	13 3/8	330	13	50	
	VGS9360	360	14 1/4	350	13 3/4	50	
	VGS9380	380	15	370	14 9/16	50	
	VGS9400	400	15 3/4	390	15 3/8	50	
	VGS9440	440	17 1/4	430	16 15/16	25	
	VGS9480	480	19	470	18 1/2	25	
	VGS9520	520	20 1/2	510	20 1/16	25	
	VGS9560	560	22	550	21 5/8	25	
	VGS9600	600	23 5/8	590	23 1/4	25	
11 **0.44** TX 50	**VGS1180**	80	3 1/8	70	2 3/4	25	
	VGS11100	100	4	90	3 1/2	25	
	VGS11125	125	4 15/16	115	4 1/2	25	
	VGS11150	150	6	140	5 1/2	25	
	VGS11175	175	6 7/8	165	6 1/2	25	
	VGS11200	200	8	190	7 1/2	25	
	VGS11225	225	8 7/8	215	8 7/16	25	
	VGS11250	250	10	240	9 1/2	25	
	VGS11275	275	10 7/8	265	10 7/16	25	
	VGS11300	300	11 3/4	290	11 7/16	25	
	VGS11325	325	12 3/4	315	12 3/8	25	
	VGS11350	350	13 3/4	340	13 3/8	25	
	VGS11375	375	14 3/4	365	14 3/8	25	
	VGS11400	400	15 3/4	390	15 3/8	25	
	VGS11425	425	16 3/4	415	16 5/16	25	
	VGS11450	450	17 3/4	440	17 1/4	25	
	VGS11475	475	18 11/16	465	18 5/16	25	
	VGS11500	500	19 3/4	490	19 5/16	25	
	VGS11525	525	20 11/16	515	20 1/4	25	
	VGS11550	550	21 5/8	540	21 1/4	25	
	VGS11575	575	22 5/8	565	22 1/4	25	
	VGS11600	600	23 5/8	590	23 1/4	25	
11 **0.44** TX 50 SW 17	**VGS11650**	650	25 9/16	630	24 13/16	25	
	VGS11700	700	27 1/2	680	26 3/4	25	
	VGS11750	750	29 1/2	680	26 3/4	25	
	VGS11800	800	31 1/2	780	30 11/16	25	
	VGS11850	850	33 7/16	830	32 11/16	25	
	VGS11900	900	35 1/2	880	34 5/8	25	
	VGS11950	950	37 3/8	930	36 5/8	25	
	VGS111000	1000	39 3/8	980	38 9/16	25	

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs	
	VGS1380	80	3 1/8	70	2 3/4	25	
	VGS13100	100	4	90	3 1/2	25	
	VGS13150	150	6	140	5 1/2	25	
	VGS13200	200	8	190	7 1/2	25	
	VGS13250	250	10	240	9 1/2	25	
13 **0.52** TX 50	**VGS13300**	300	11 3/4	280	11	25	
	VGS13350	350	13 3/4	330	13	25	
	VGS13400	400	15 3/4	380	15	25	
	VGS13450	450	17 3/4	430	16 15/16	25	
	VGS13500	500	19 3/4	480	19	25	
	VGS13550	550	21 5/8	530	20 7/8	25	
	VGS13600	600	23 5/8	580	22 13/16	25	
	VGS13650	650	25 9/16	630	24 13/16	25	
	VGS13700	700	27 1/2	680	26 3/4	25	
	VGS13750	750	29 1/2	730	28 3/4	25	
	VGS13800	800	31 1/2	780	30 11/16	25	
	VGS13850	850	33 7/16	830	32 11/16	25	
13 **0.52** TX 50 SW 19	**VGS13900**	900	35 1/2	880	34 5/8	25	
	VGS13950	950	37 3/8	930	36 5/8	25	
	VGS131000	1000	39 3/8	980	38 9/16	25	
	VGS131100	1100	43 5/16	1080	42 1/2	25	
	VGS131200	1200	47 1/4	1180	46 7/16	25	
	VGS131300	1300	51 3/16	1280	50 3/8	25	
	VGS131400	1400	55 1/8	1380	54 5/16	25	
	VGS131500	1500	59 1/16	1480	58 1/4	25	
	VGS15600	600	23 5/8	580	22 13/16	25	
	VGS15700	700	27 1/2	680	26 3/4	25	
	VGS15800	800	31 1/2	780	30 11/16	25	
	VGS15900	900	35 1/2	880	34 5/8	25	
15 **0.60** TX 50 SW 22	**VGS151000**	1000	39 3/8	980	38 9/16	25	
	VGS151200	1200	47 1/4	1080	42 1/2	25	
	VGS151400	1400	55 1/8	1380	54 5/16	25	
	VGS151600	1600	63	1580	62 3/16	25	
	VGS151800	1800	70 7/8	1780	70 1/16	25	
	VGS152000	2000	78 3/4	1980	77 15/16	25	

RELATED PRODUCTS

VGU
45° WASHER FOR VGS

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TORQUE LIMITER
TORQUE LIMITER

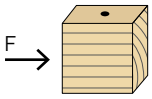
page 436

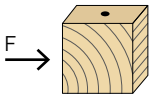
WASP
HOOK FOR TIMBER ELEMENTS TRANSPORT

page 441

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

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

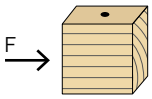


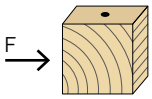


d_1	[in]		0.36	0.44	0.52	0.60
	[mm]		9	11	13	15
a_1	[in]	**15·d**	5 5/16	6 1/2	7 11/16	8 7/8
a_2	[in]	**5·d**	1 3/4	2 3/16	2 9/16	2 15/16
$a_{3,t}$	[in]	**15·d**	5 5/16	6 1/2	7 11/16	8 7/8
$a_{3,c}$	[in]	**10·d**	3 1/2	4 3/8	5 1/8	6
$a_{4,t}$	[in]	**10·d**	3 1/2	4 3/8	5 1/8	6
$a_{4,c}$	[in]	**5·d**	1 3/4	2 3/16	2 9/16	2 15/16

	0.36	0.44	0.52	0.60
	9	11	13	15
10·d	3 1/2	4 3/8	5 1/8	6
5·d	1 3/4	2 3/16	2 9/16	2 15/16
15·d	5 5/16	6 1/2	7 11/16	8 7/8
10·d	3 1/2	4 3/8	5 1/8	6
10·d	3 1/2	4 3/8	5 1/8	6
5·d	1 3/4	2 3/16	2 9/16	2 15/16

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

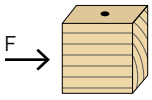


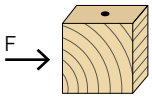


d_1	[in]		0.36	0.44	0.52	0.60
	[mm]		9	11	13	15
a_1	[in]	**15·d**	5 5/16	6 1/2	7 11/16	8 7/8
a_2	[in]	**7·d**	2 1/2	3 1/16	3 9/16	4 1/8
$a_{3,t}$	[in]	**20·d**	7 1/8	8 5/8	10 1/4	11 3/4
$a_{3,c}$	[in]	**15·d**	5 5/16	6 1/2	7 11/16	8 7/8
$a_{4,t}$	[in]	**12·d**	4 1/4	5 3/16	6 1/8	7 1/8
$a_{4,c}$	[in]	**7·d**	2 1/2	3 1/16	3 9/16	4 1/8

	0.36	0.44	0.52	0.60
	9	11	13	15
10·d	3 1/2	4 3/8	5 1/8	6
7·d	2 1/2	3 1/16	3 9/16	4 1/8
20·d	7 1/8	8 5/8	10 1/4	11 3/4
15·d	5 5/16	6 1/2	7 11/16	8 7/8
12·d	4 1/4	5 3/16	6 1/8	7 1/8
7·d	2 1/2	3 1/16	3 9/16	4 1/8

screws inserted **WITH pre-drilled hole**





d_1	[in]		0.36		0.44	0.52	0.60
	[mm]		9		11	13	15
a_1	[in]	**10·d**	3 1/2	**5·d**	2 3/16	2 9/16	2 15/16
a_2	[in]	**4·d**	1 7/16	**5·d**	2 3/16	2 9/16	2 15/16
$a_{3,t}$	[in]	**12·d**	4 1/4	**7·d**	3 1/16	3 9/16	4 1/8
$a_{3,c}$	[in]	**7·d**	2 1/2	**4·d**	1 3/4	2 1/16	2 3/8
$a_{4,t}$	[in]	**7·d**	2 1/2	**4·d**	1 3/4	2 1/16	2 3/8
$a_{4,c}$	[in]	**3·d**	1 1/16	**3·d**	1 5/16	1 9/16	1 3/4

0.36		0.44	0.52	0.60
9		11	13	15
1 3/4	**5·d**	2 3/16	2 9/16	2 15/16
1 7/16	**5·d**	2 3/16	2 9/16	2 15/16
4 1/4	**7·d**	3 1/16	3 9/16	4 1/8
2 1/2	**4·d**	1 3/4	2 1/16	2 3/8
2 1/2	**4·d**	1 3/4	2 1/16	2 3/8
1 1/16	**3·d**	1 5/16	1 9/16	1 3/4

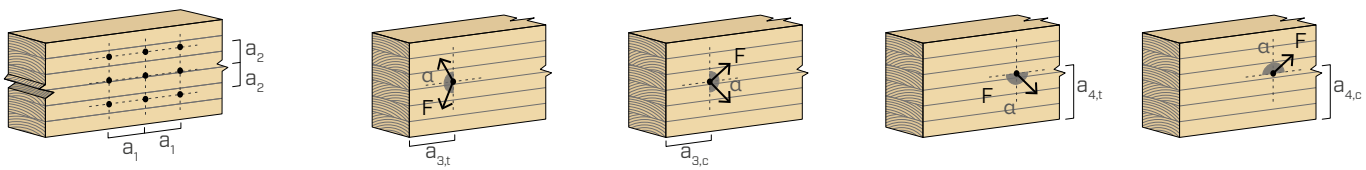
α = load-to-grain angle
d = d_1 = nominal diameter of the screw

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

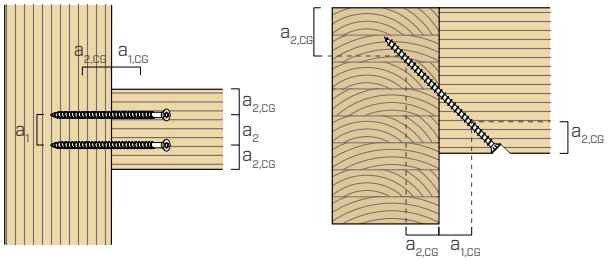
screws inserted **WITHOUT pre-drilled hole**

d_1	[in]		0.36		0.44	0.52	0.60
	[mm]		9		11	13	15
a_1	[in]	**7·d**	2 1/2	**7·d**	3 1/16	3 9/16	4 1/8
a_2	[in]	**4·d**	1 7/16	**5·d**	2 3/16	2 9/16	2 15/16
$a_{1,CG}$	[in]	**10·d**	3 1/2	**10·d**	4 3/8	5 1/8	6
$a_{2,CG}$	[in]	**4·d**	1 7/16	**4·d**	1 3/4	2 1/16	2 3/8
a_{CROSS}	[in]	**1,5·d**	9/16	**1,5·d**	11/16	13/16	7/8

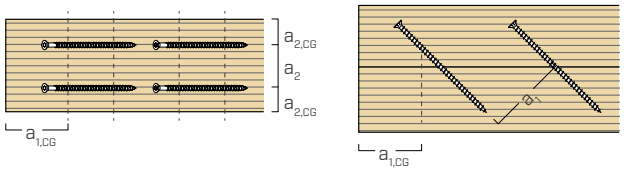
screws inserted **WITH pre-drilled hole**

d_1	[in]		0.36		0.44	0.52	0.60
	[mm]		9		11	13	15
a_1	[in]	**7·d**	2 1/2	**5·d**	2 3/16	2 9/16	2 15/16
a_2	[in]	**3·d**	1 1/16	**5·d**	2 3/16	2 9/16	2 15/16
$a_{1,CG}$	[in]	**7·d**	2 1/2	**4·d**	1 3/4	2 1/16	2 3/8
$a_{2,CG}$	[in]	**3·d**	1 1/16	**3·d**	1 5/16	1 9/16	1 3/4
a_{CROSS}	[in]	**1,5·d**	9/16	**1,5·d**	11/16	13/16	7/8

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

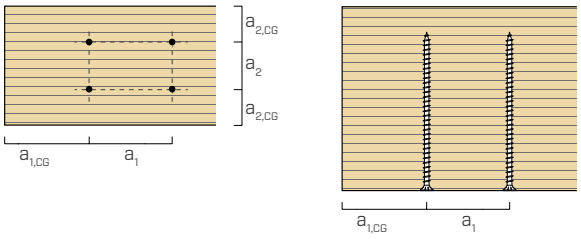


plan front



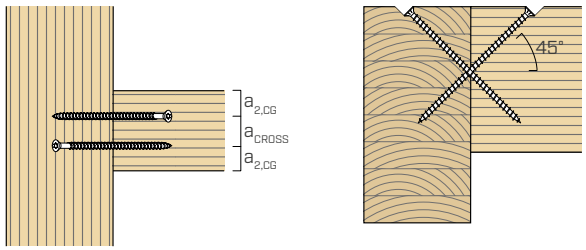
plan front

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



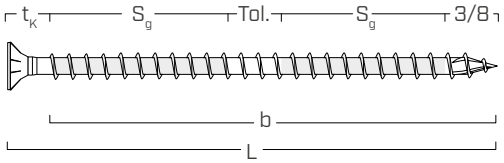
plan front

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



plan front

EFFECTIVE THREAD USED IN CALCULATION



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

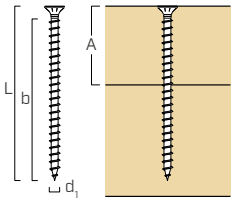
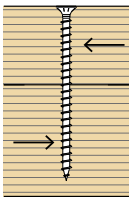
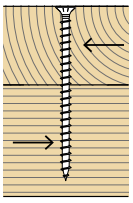
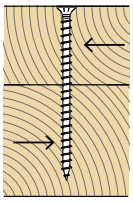
$\mathbf{S_g}$ = (L - t_K - 3/8" - Tol.)/2 represents the partial length of the threaded part net of a laying tolerance (Tol.) of 3/8"

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

NOTES

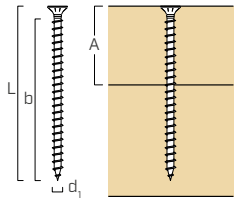
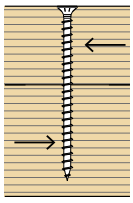
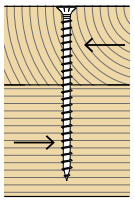
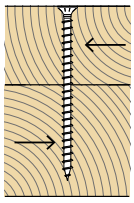
- The minimum spacing and distances comply with Table 8 of ESR-4645, where d refers to the nominal diameter of the screw;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

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]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
9 **0.36**	100	4	3 1/2 1 15/16	154	216	286	345	123	173	229	276	123	173	229	276
	120	4 3/4	4 3/8 2 3/8	187	258	313	348	149	206	250	278	149	206	250	278
	140	5 1/2	5 1/8 2 3/4	219	272	313	348	175	217	250	278	175	217	250	278
	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
	560	22	21 5/8 11	230	272	313	348	184	217	250	278	184	217	250	278
	600	23 5/8	23 1/4 11 3/4	230	272	313	348	184	217	250	278	184	217	250	278
11 **0.44**	80	3 1/8	2 3/4 1 9/16	173	207	242	271	112	140	169	194	92	120	150	177
	100	4	3 1/2 1 15/16	218	262	306	343	143	178	215	247	116	152	190	224
	125	4 15/16	4 1/2 2 3/8	276	331	372	394	182	227	273	299	147	191	239	283
	150	6	5 1/2 2 15/16	314	344	372	394	219	252	278	299	178	232	262	285
	175	6 7/8	6 1/2 3 3/8	314	344	372	394	225	252	278	299	205	234	262	285
	200	8	7 1/2 4	314	344	372	394	225	252	278	299	205	234	262	285
	225	8 7/8	8 7/16 4 3/8	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
	275	10 7/8	10 7/16 5 5/16	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
	325	12 3/4	12 3/8 6 1/4	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
	375	14 3/4	14 3/8 7 1/4	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
	425	16 3/4	16 5/16 8 1/4	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
	475	18 11/16	18 5/16 9 1/4	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
	525	20 11/16	20 1/4 10 1/4	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
	575	22 5/8	22 1/4 11 1/4	314	344	372	394	225	252	278	299	205	234	262	285
	600	23 5/8	23 1/4 11 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	650	25 9/16	24 13/16 12 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	700	27 1/2	26 3/4 13 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	750	29 1/2	26 3/4 14 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	800	31 1/2	30 11/16 15 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	850	33 7/16	32 11/16 16 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	900	35 1/2	34 5/8 17 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	950	37 3/8	36 5/8 18 11/16	314	344	372	394	225	252	278	299	205	234	262	285
	1000	39 3/8	38 9/16 19 3/4	314	344	372	394	225	252	278	299	205	234	262	285

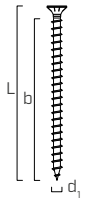
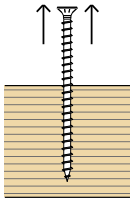
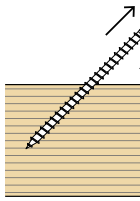
NOTES and **GENERAL PRINCIPLES** on page 205.

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]
13 **0.52**	80	3 1/8	2 3/4	1 9/16	207	248	289	325	127	159	192	221	100	130	163	193
	100	4	3 1/2	1 15/16	262	314	367	412	163	203	245	282	127	165	207	244
	150	6	5 1/2	2 15/16	402	482	532	564	251	313	377	416	195	253	317	375
	200	8	7 1/2	4	450	493	532	564	312	351	387	416	262	319	357	388
	250	10	9 1/2	4 15/16	450	493	532	564	312	351	387	416	280	319	357	388
	300	11 3/4	11	6	450	493	532	564	312	351	387	416	280	319	357	388
	350	13 3/4	13	6 7/8	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
	450	17 3/4	16 15/16	8 7/8	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
	550	21 5/8	20 7/8	10 7/8	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
	650	25 9/16	24 13/16	12 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
	750	29 1/2	28 3/4	14 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
	850	33 7/16	32 11/16	16 3/4	450	493	532	564	312	351	387	416	280	319	357	388
	900	35 1/2	34 5/8	17 3/4	450	493	532	564	312	351	387	416	280	319	357	388
	950	37 3/8	36 5/8	18 11/16	450	493	532	564	312	351	387	416	280	319	357	388
	1000	39 3/8	38 9/16	19 3/4	450	493	532	564	312	351	387	416	280	319	357	388
	1100	43 5/16	42 1/2	21 5/8	450	493	532	564	312	351	387	416	280	319	357	388
	1200	47 1/4	46 7/16	23 5/8	450	493	532	564	312	351	387	416	280	319	357	388
	1300	51 3/16	50 3/8	25 9/16	450	493	532	564	312	351	387	416	280	319	357	388
	1400	55 1/8	54 5/16	27 1/2	450	493	532	564	312	351	387	416	280	319	357	388
	1500	59 1/16	58 1/4	29 1/2	450	493	532	564	312	351	387	416	280	319	357	388
15 **0.60**	600	23 5/8	22 13/16	11 3/4	521	571	617	653	355	399	441	474	315	359	402	437
	700	27 1/2	26 3/4	13 3/4	521	571	617	653	355	399	441	474	315	359	402	437
	800	31 1/2	30 11/16	15 3/4	521	571	617	653	355	399	441	474	315	359	402	437
	900	35 1/2	34 5/8	17 3/4	521	571	617	653	355	399	441	474	315	359	402	437
	1000	39 3/8	38 9/16	19 3/4	521	571	617	653	355	399	441	474	315	359	402	437
	1200	47 1/4	42 1/2	23 5/8	521	571	617	653	355	399	441	474	315	359	402	437
	1400	55 1/8	54 5/16	27 1/2	521	571	617	653	355	399	441	474	315	359	402	437
	1600	63	62 3/16	31 1/2	521	571	617	653	355	399	441	474	315	359	402	437
	1800	70 7/8	70 1/16	35 1/2	521	571	617	653	355	399	441	474	315	359	402	437
	2000	78 3/4	77 15/16	39 3/8	521	571	617	653	355	399	441	474	315	359	402	437

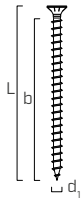
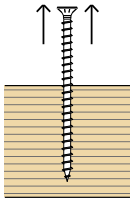
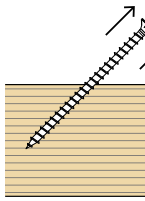
NOTES and **GENERAL PRINCIPLES** on page 205.

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**	100	4	3 1/2	612	702	813	893	557	638	740	813	184	210	244	268
	120	4 3/4	4 3/8	763	875	1014	1113	695	796	923	1013	229	262	304	334
	140	5 1/2	5 1/8	915	1048	1215	1334	832	954	1105	1214	274	314	364	400
	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
	560	22	21 5/8	4089	4686	5431	5964	3721	4264	4942	5427	1227	1406	1629	1789
	600	23 5/8	23 1/4	4392	5032	5833	6405	3997	4579	5308	5828	1318	1510	1750	1921
11 **0.44**	80	3 1/8(1)	2 3/4	481	557	632	692	438	507	575	630	144	167	190	208
	100	4(2)	3 1/2	644	746	846	927	586	679	770	843	193	224	254	278
	125	4 15/16	4 1/2	848	983	1114	1220	771	894	1013	1110	254	295	334	366
	150	6	5 1/2	1051	1219	1381	1513	957	1109	1257	1377	315	366	414	454
	175	6 7/8	6 1/2	1255	1455	1649	1807	1142	1324	1501	1644	377	437	495	542
	200	8	7 1/2	1459	1691	1917	2100	1327	1539	1744	1911	438	507	575	630
	225	8 7/8	8 7/16	1663	1928	2185	2393	1513	1754	1988	2178	499	578	655	718
	250	10	9 1/2	1866	2164	2452	2687	1698	1969	2232	2445	560	649	736	806
	275	10 7/8	10 7/16	2070	2400	2720	2980	1884	2184	2475	2712	621	720	816	894
	300	11 3/4	11 7/16	2274	2636	2988	3273	2069	2399	2719	2979	682	791	896	982
	325	12 3/4	12 3/8	2477	2872	3255	3567	2255	2614	2962	3246	743	862	977	1070
	350	13 3/4	13 3/8	2681	3109	3523	3860	2440	2829	3206	3513	804	933	1057	1158
	375	14 3/4	14 3/8	2885	3345	3791	4153	2625	3044	3450	3779	865	1003	1137	1246
	400	15 3/4	15 3/8	3089	3581	4059	4447	2811	3259	3693	4046	927	1074	1218	1334
	425	16 3/4	16 5/16	3292	3817	4326	4740	2996	3474	3937	4313	988	1145	1298	1422
	450	17 3/4	17 1/4	3496	4054	4594	5033	3182	3689	4181	4580	1049	1216	1378	1510
	475	18 11/16	18 5/16	3700	4290	4862	5326	3367	3904	4424	4847	1110	1287	1459	1598
	500	19 3/4	19 5/16	3904	4526	5129	5620	3552	4119	4668	5114	1171	1358	1539	1686
	525	20 11/16	20 1/4	4107	4762	5397	5913	3738	4334	4911	5381	1232	1429	1619	1774
	550	21 5/8	21 1/4	4311	4998	5665	6206	3923	4549	5155	5648	1293	1500	1699	1862
	575	22 5/8	22 1/4	4515	5235	5933	6500	4109	4764	5399	5915	1354	1570	1780	1950
	600	23 5/8	23 1/4	4719	5471	6200	6793	4294	4978	5642	6182	1416	1641	1860	2038
	650	25 9/16	24 13/16	5045	5849	6629	7262	4591	5322	6032	6609	1513	1755	1989	2179
	700	27 1/2	26 3/4	5452	6321	7164	7849	4961	5752	6519	7142	1636	1896	2149	2355
	750	29 1/2	26 3/4	5452	6321	7164	7849	4961	5752	6519	7142	1636	1896	2149	2355
	800	31 1/2	30 11/16	6267	7266	8235	9022	5703	6612	7494	8210	1880	2180	2470	2707
	850	33 7/16	32 11/16	6675	7739	8770	9609	6074	7042	7981	8744	2002	2322	2631	2883
	900	35 1/2	34 5/8	7082	8211	9306	10195	6445	7472	8468	9278	2125	2463	2792	3059
	950	37 3/8	36 5/8	7489	8683	9841	10782	6815	7902	8956	9812	2247	2605	2952	3235
	1000	39 3/8	38 9/16	7897	9156	10377	11369	7186	8332	9443	10345	2369	2747	3113	3411

NOTES and **GENERAL PRINCIPLES** on page 205.

THREAD WITHDRAWAL (W) | WOOD

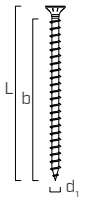
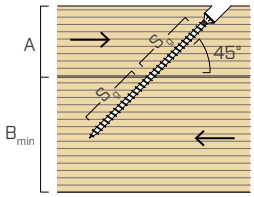
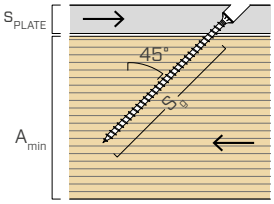
geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°			
															
d_1	L		b	G				G				G			
				0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
13 **0.52**	80	3 1/8	2 3/4	527	610	691	759	480	555	629	690	158	183	207	228
	100	4	3 1/2	712	825	934	1025	648	750	850	932	214	247	280	307
	150	6	5 1/2	1175	1360	1540	1690	1069	1238	1401	1538	353	408	462	507
	200	8	7 1/2	1638	1895	2146	2355	1490	1725	1953	2143	491	569	644	707
	250	10	9 1/2	2100	2431	2753	3021	1911	2212	2505	2749	630	729	826	906
	300	11 3/4	11	2470	2859	3238	3553	2248	2602	2946	3233	741	858	971	1066
	350	13 3/4	13	2933	3395	3844	4218	2669	3089	3498	3839	880	1018	1153	1266
	400	15 3/4	15	3395	3930	4450	4884	3090	3576	4050	4444	1019	1179	1335	1465
	450	17 3/4	16 15/16	3858	4466	5057	5549	3511	4064	4601	5050	1157	1340	1517	1665
	500	19 3/4	19	4321	5001	5663	6214	3932	4551	5153	5655	1296	1500	1699	1864
	550	21 5/8	20 7/8	4783	5536	6269	6880	4353	5038	5705	6261	1435	1661	1881	2064
	600	23 5/8	22 13/16	5246	6072	6875	7545	4774	5525	6257	6866	1574	1822	2063	2264
	650	25 9/16	24 13/16	5708	6607	7482	8210	5195	6013	6808	7472	1713	1982	2245	2463
	700	27 1/2	26 3/4	6171	7143	8088	8876	5616	6500	7360	8077	1851	2143	2426	2663
	750	29 1/2	28 3/4	6634	7678	8694	9541	6037	6987	7912	8682	1990	2303	2608	2862
	800	31 1/2	30 11/16	7096	8214	9301	10207	6458	7474	8464	9288	2129	2464	2790	3062
	850	33 7/16	32 11/16	7559	8749	9907	10872	6879	7962	9015	9893	2268	2625	2972	3262
	900	35 1/2	34 5/8	8021	9284	10513	11537	7300	8449	9567	10499	2406	2785	3154	3461
	950	37 3/8	36 5/8	8484	9820	11120	12203	7720	8936	10119	11104	2545	2946	3336	3661
	1000	39 3/8	38 9/16	8947	10355	11726	12868	8141	9423	10671	11710	2684	3107	3518	3860
	1100	43 5/16	42 1/2	9872	11426	12938	14199	8983	10398	11774	12921	2962	3428	3882	4260
	1200	47 1/4	46 7/16	10797	12497	14151	15529	9825	11372	12877	14132	3239	3749	4245	4659
	1300	51 3/16	50 3/8	11722	13568	15364	16860	10667	12347	13981	15343	3517	4070	4609	5058
	1400	55 1/8	54 5/16	12647	14639	16576	18191	11509	13321	15084	16554	3794	4392	4973	5457
	1500	59 1/16	58 1/4	13573	15710	17789	19521	12351	14296	16188	17765	4072	4713	5337	5856
15 **0.60**	600	23 5/8	22 13/16	5672	6563	7424	8143	5162	5972	6756	7410	1702	1969	2227	2443
	700	27 1/2	26 3/4	6676	7725	8738	9584	6075	7029	7952	8722	2003	2317	2622	2875
	800	31 1/2	30 11/16	7680	8886	10052	11026	6989	8086	9148	10033	2304	2666	3016	3308
	900	35 1/2	34 5/8	8684	10048	11366	12467	7902	9143	10343	11345	2605	3014	3410	3740
	1000	39 3/8	38 9/16	9688	11209	12680	13908	8816	10200	11539	12656	2906	3363	3804	4172
	1200	47 1/4	42 1/2	10692	12371	13995	15349	9730	11258	12735	13968	3208	3711	4198	4605
	1400	55 1/8	54 5/16	13704	15856	17937	19673	12470	14429	16322	17903	4111	4757	5381	5902
	1600	63	62 3/16	15712	18179	20565	22556	14298	16543	18714	20526	4713	5454	6169	6767
	1800	70 7/8	70 1/16	17719	20502	23193	25438	16125	18657	21105	23149	5316	6151	6958	7631
	2000	78 3/4	77 15/16	19727	22825	25821	28321	17952	20771	23497	25772	5918	6848	7746	8496

(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle 0°≤ α <90° to the grain).

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

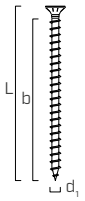
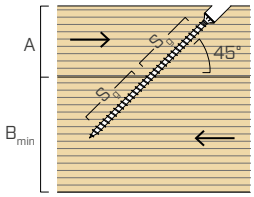
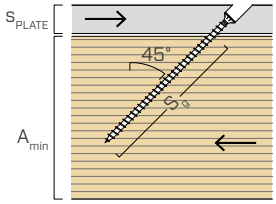
NOTES and GENERAL PRINCIPLES on page 205.

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]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
	100	4[1]	3 1/2	1 3/8	1 9/16	2 1/8	170	195	226	248		2 9/16	3 1/2	317	363	420	462
	120	4 3/4[1]	4 3/8	1 3/4	1 13/16	2 3/8	216	248	287	315		3 3/8	4 1/8	417	478	554	608
	140	5 1/2[1]	5 1/8	2 3/16	2 1/8	2 11/16	270	310	359	394		4 1/8	4 5/8	510	584	677	743
	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
	180	7 1/8	6 3/4	2 15/16	2 11/16	3 1/4	363	416	482	529		5 11/16	5 3/4	703	805	933	1025
	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
	220	8 5/8	8 1/4	3 3/4	3 1/4	3 13/16	463	531	615	676		7 1/4	6 7/8	896	1026	1190	1306
	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
	260	10 1/4	10	4 1/2	3 3/4	4 3/8	556	637	738	811		8 7/8	8 1/16	1096	1256	1456	1599
	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
9	300	11 3/4	11 7/16	5 5/16	4 3/8	4 15/16	656	752	872	957	5/8	10 7/16	9 1/4	1290	1478	1713	1881
0.36	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
	340	13 3/8	13	6 1/8	4 7/8	5 1/2	757	867	1005	1104		12	10 1/4	1483	1699	1969	2162
	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
	380	15	14 9/16	6 7/8	5 7/16	6	849	973	1128	1239		13 9/16	11 7/16	1676	1920	2225	2444
	400	15 3/4	15 3/8	7 1/4	5 11/16	6 1/4	896	1026	1190	1306		14 3/8	12	1776	2035	2359	2590
	440	17 1/4	16 15/16	8 1/16	6 1/4	6 7/8	996	1141	1323	1453		15 15/16	13	1969	2256	2615	2871
	480	19	18 1/2	8 7/8	6 7/8	7 7/16	1096	1256	1456	1599		17 1/2	14 1/4	2162	2477	2871	3153
	520	20 1/2	20 1/16	9 5/8	7 3/8	8 1/16	1189	1363	1579	1734		19 1/8	15 3/8	2363	2707	3138	3446
	560	22	21 5/8	10 7/16	8 1/16	8 5/8	1290	1478	1713	1881		20 11/16	16 5/16	2556	2929	3394	3727
	600	23 5/8	23 1/4	11 1/4	8 5/8	9 1/4	1390	1593	1846	2027		22 1/4	17 1/2	2749	3150	3651	4009
	80	3 1/8[1]	2 3/4	1	1 1/4	1 7/8	133	154	175	192		1 9/16	3	208	241	273	300
	100	4[1]	3 1/2	1 3/8	1 9/16	2 1/8	183	212	241	264		2 3/8	3 1/2	316	367	416	455
	125	4 15/16[1]	4 1/2	1 7/8	1 7/8	2 1/2	250	290	328	360		3 3/8	4 3/16	450	521	591	647
	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
	175	6 7/8[1]	6 1/2	2 13/16	2 5/8	3 3/16	375	434	492	539		5 5/16	5 5/8	708	820	930	1019
	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
	225	8 7/8	8 7/16	3 13/16	3 5/16	3 7/8	508	589	667	731		7 1/4	7	966	1120	1269	1390
	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
	275	10 7/8	10 7/16	4 13/16	4	4 9/16	641	743	842	923		9 1/4	8 7/16	1232	1428	1619	1774
	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
	325	12 3/4	12 3/8	5 13/16	4 11/16	5 1/4	774	898	1017	1115		11 1/4	10	1498	1737	1969	2157
	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
	375	14 3/4	14 3/8	6 3/4	5 3/8	6	899	1042	1181	1294		13 3/16	11 1/4	1757	2037	2308	2529
	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
11	425	16 3/4	16 5/16	7 3/4	6 1/16	6 5/8	1032	1197	1356	1486		15 3/16	12 5/8	2023	2345	2658	2912
0.44	450	17 3/4	17 1/4	8 1/4	6 7/16	7	1099	1274	1444	1582	3/4	16 1/8	13 3/8	2148	2490	2822	3092
	475	18 11/16	18 5/16	8 5/8	6 3/4	7 3/8	1149	1332	1510	1654		17 1/8	14	2281	2645	2997	3284
	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
	525	20 11/16	20 1/4	9 5/8	7 1/2	8 1/16	1282	1486	1685	1846		19 1/8	15 3/8	2547	2954	3347	3667
	550	21 5/8	21 1/4	10 1/4	7 13/16	8 7/16	1365	1583	1794	1965		20 1/16	16 1/8	2672	3098	3511	3847
	575	22 5/8	22 1/4	10 5/8	8 1/4	8 7/8	1415	1641	1860	2037		21 1/16	16 15/16	2805	3253	3686	4039
	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
	650	25 9/16	24 13/16	11 3/4	9 1/4	10	1565	1815	2057	2253		-	-	-	-	-	-
	700	27 1/2	26 3/4	12 3/4	10 1/16	10 5/8	1698	1969	2232	2445		-	-	-	-	-	-
	750	29 1/2	26 3/4	13 3/4	10 5/8	11 1/4	1831	2123	2407	2637		-	-	-	-	-	-
	800	31 1/2	30 11/16	14 3/4	11 7/16	12	1965	2278	2582	2828		-	-	-	-	-	-
	850	33 7/16	32 11/16	15 3/4	12	12 5/8	2098	2432	2757	3020		-	-	-	-	-	-
	900	35 1/2	34 5/8	16 3/4	12 3/4	13 3/8	2231	2587	2932	3212		-	-	-	-	-	-
	950	37 3/8	36 5/8	17 3/4	13 3/8	14	2364	2741	3107	3404		-	-	-	-	-	-
	1000	39 3/8	38 9/16	18 11/16	14 1/4	14 3/4	2489	2886	3271	3583		-	-	-	-	-	-

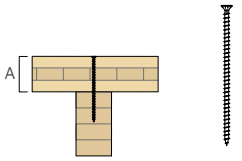
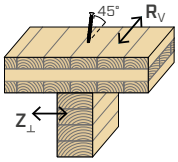
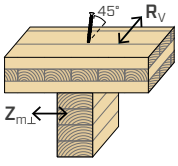
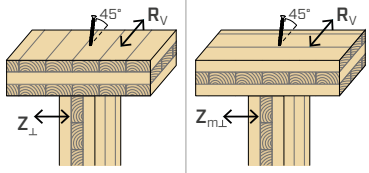
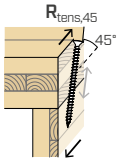
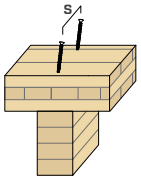
NOTES and **GENERAL PRINCIPLES** on page 205.

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]
13 **0.52**	80	3 1/8[1]	2 3/4	1	1 1/4	1 7/8	151	175	198	217	7/8	1 3/8	3	208	241	273	299
	100	4[1]	3 1/2	1 3/8	1 9/16	2 1/8	208	241	273	299		2 3/16	3 1/2	331	383	434	476
	150	6[1]	5 1/2	2 3/8	2 1/4	2 13/16	359	416	471	517		4 1/8	4 15/16	624	722	818	897
	200	8[1]	7 1/2	3 3/8	2 15/16	3 1/2	510	591	669	734		6 1/8	6 1/4	926	1072	1214	1332
	250	10	9 1/2	4 3/8	3 5/8	4 3/16	662	766	867	952		8 1/16	7 11/16	1219	1411	1598	1754
	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
	350	13 3/4	13	6 1/4	5 1/16	5 5/8	945	1094	1239	1359		12	10 5/8	1815	2100	2378	2610
	400	15 3/4	15	7 1/4	5 11/16	6 1/4	1096	1269	1437	1577		14	12	2117	2450	2775	3045
	450	17 3/4	16 15/16	8 1/4	6 7/16	7	1248	1444	1635	1794		15 15/16	13 3/8	2410	2789	3159	3466
	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
	550	21 5/8	20 7/8	10 1/4	7 13/16	8 7/16	1550	1794	2031	2229		19 7/8	16 1/8	3005	3479	3939	4323
	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
	650	25 9/16	24 13/16	11 3/4	9 1/4	10	1777	2057	2329	2556		-	-	-	-	-	-
	700	27 1/2	26 3/4	12 3/4	10 1/16	10 5/8	1928	2232	2527	2773		-	-	-	-	-	-
	750	29 1/2	28 3/4	13 3/4	10 5/8	11 1/4	2079	2407	2725	2991		-	-	-	-	-	-
	800	31 1/2	30 11/16	14 3/4	11 7/16	12	2230	2582	2923	3208		-	-	-	-	-	-
	850	33 7/16	32 11/16	15 3/4	12	12 5/8	2382	2757	3121	3425		-	-	-	-	-	-
	900	35 1/2	34 5/8	16 3/4	12 3/4	13 3/8	2533	2932	3320	3643		-	-	-	-	-	-
	950	37 3/8	36 5/8	17 3/4	13 3/8	14	2684	3107	3518	3860		-	-	-	-	-	-
	1000	39 3/8	38 9/16	18 11/16	14 1/4	14 3/4	2826	3271	3704	4064		-	-	-	-	-	-
	1100	43 5/16	42 1/2	20 11/16	15 9/16	16 1/8	3128	3621	4100	4499		-	-	-	-	-	-
	1200	47 1/4	46 7/16	22 5/8	16 15/16	17 1/2	3421	3960	4484	4921		-	-	-	-	-	-
	1300	51 3/16	50 3/8	24 5/8	18 5/16	19	3724	4310	4880	5356		-	-	-	-	-	-
	1400	55 1/8	54 5/16	26 9/16	19 3/4	20 1/4	4017	4649	5264	5777		-	-	-	-	-	-
	1500	59 1/16	58 1/4	28 9/16	21 1/16	21 5/8	4319	4999	5661	6212		-	-	-	-	-	-
15 **0.60**	600	23 5/8	22 13/16	11 1/4	8 5/8	9 1/4	1846	2136	2416	2650	-	-	-	-	-	-	-
	700	27 1/2	26 3/4	12 3/4	10 1/16	10 5/8	2092	2421	2738	3003		-	-	-	-	-	-
	800	31 1/2	30 11/16	14 3/4	11 7/16	12	2420	2800	3168	3475		-	-	-	-	-	-
	900	35 1/2	34 5/8	16 3/4	12 3/4	13 3/8	2748	3180	3597	3946		-	-	-	-	-	-
	1000	39 3/8	38 9/16	18 11/16	14 1/4	14 3/4	3066	3548	4013	4402		-	-	-	-	-	-
	1200	47 1/4	42 1/2	22 5/8	16 15/16	17 1/2	3712	4295	4859	5330		-	-	-	-	-	-
	1400	55 1/8	54 5/16	26 9/16	19 3/4	20 1/4	4358	5043	5705	6257		-	-	-	-	-	-
	1600	63	62 3/16	30 1/2	22 7/16	23 1/16	5005	5790	6550	7185		-	-	-	-	-	-
	1800	70 7/8	70 1/16	34 7/16	25 3/16	25 13/16	5651	6538	7396	8112		-	-	-	-	-	-
	2000	78 3/4	77 15/16	38 3/8	28 1/8	28 3/4	6297	7286	8242	9040		-	-	-	-	-	-

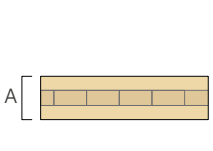
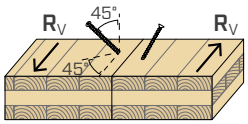
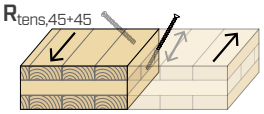
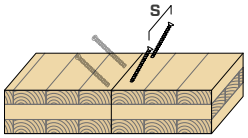
[1] The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

NOTES and **GENERAL PRINCIPLES** on page 205.

				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	VGS9160	345	217	345	217	231	146	231	146	1732	5 5/16	7
			VGS11150	364	232	364	252	244	155	244	169	2263	6 1/2	9
			VGS13150	406	253	406	315	272	170	272	211	3111	7 11/16	11
	79	3 1/8	VGS9220	497	217	497	217	333	146	333	146	1732	5 5/16	7
			VGS11225	533	234	533	252	357	157	357	169	2263	6 1/2	9
			VGS13200	577	319	577	351	387	214	387	235	3111	7 11/16	11
	105	4 1/8	VGS9300	698	217	698	217	467	146	467	146	1732	5 5/16	7
			VGS11300	751	234	751	252	503	157	503	169	2263	6 1/2	9
			VGS13300	842	319	842	351	564	214	564	235	3111	7 11/16	11
	120	4 3/4	VGS9340	818	217	818	217	548	146	548	146	1732	5 5/16	7
			VGS11350	882	234	882	252	591	157	591	169	2263	6 1/2	9
			VGS13350	990	319	990	351	663	214	663	235	3111	7 11/16	11
5 PLY	100	3 15/16	VGS9280	660	217	660	217	442	146	442	146	1732	5 5/16	7
			VGS11275	710	234	710	252	476	157	476	169	2263	6 1/2	9
			VGS13250	721	319	721	351	483	214	483	235	3111	7 11/16	11
	140	5 1/2	VGS9400	973	217	973	217	652	146	652	146	1732	5 5/16	7
			VGS11400	1051	234	1051	252	704	157	704	169	2263	6 1/2	9
			VGS13400	1182	319	1182	351	792	214	792	235	3111	7 11/16	11
	175	6 7/8	VGS9480	1248	217	1248	217	836	146	836	146	1732	5 5/16	7
			VGS11500	1352	234	1352	252	906	157	906	169	2263	6 1/2	9
			VGS13500	1523	319	1523	351	1020	214	1020	235	3111	7 11/16	11
	200	7 7/8	VGS9560	1448	217	1448	217	970	146	970	146	1732	5 5/16	7
			VGS11575	1570	234	1570	252	1052	157	1052	169	2263	6 1/2	9
			VGS13550	1770	319	1770	351	1186	214	1186	235	3111	7 11/16	11
7 PLY	140	5 1/2	VGS9400	975	217	975	217	653	146	653	146	1732	5 5/16	7
			VGS11400	1054	234	1054	252	706	157	706	169	2263	6 1/2	9
			VGS13400	1185	319	1185	351	794	214	794	235	3111	7 11/16	11
	191	7 1/2	VGS9560	1373	217	1373	217	920	146	920	146	1732	5 5/16	7
			VGS11550	1488	234	1488	252	997	157	997	169	2263	6 1/2	9
			VGS13550	1677	319	1677	351	1124	214	1124	235	3111	7 11/16	11
	244	9 5/8	VGS11700	1891	234	1891	252	1267	157	1267	169	2263	6 1/2	9
			VGS13700	2134	319	2134	351	1430	214	1430	235	3111	7 11/16	11
	280	11	VGS11800	2197	234	2197	252	1472	157	1472	169	2263	6 1/2	9
			VGS13800	2481	319	2481	351	1662	214	1662	235	3111	7 11/16	11
9 PLY	180	7 1/16	VGS9520	1291	217	1291	217	865	146	865	146	1732	5 5/16	7
			VGS11500	1398	234	1398	252	937	157	937	169	2263	6 1/2	9
			VGS13500	1575	319	1575	351	1055	214	1055	235	3111	7 11/16	11
	267	10 1/2	VGS11750	2083	234	2083	252	1395	157	1395	169	2263	6 1/2	9
			VGS13750	2351	319	2351	351	1575	214	1575	235	3111	7 11/16	11
	314	12 3/8	VGS11900	2492	234	2492	252	1670	157	1670	169	2263	6 1/2	9
			VGS13900	2815	319	2815	351	1886	214	1886	235	3111	7 11/16	11
	360	14 3/16	VGS111000	2885	234	2885	252	1933	157	1933	169	2263	6 1/2	9
			VGS131000	3260	319	3260	351	2184	214	2184	235	3111	7 11/16	11

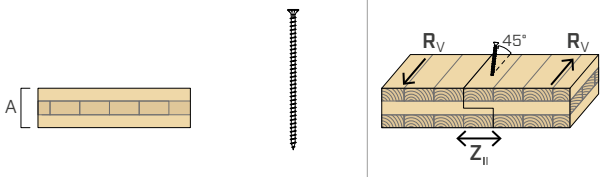
NOTES and GENERAL PRINCIPLES on page 205.

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	VGS9100	96	1225	5 5/16	7
			VGS11100	105	1600	6 1/2	9
			VGS13100	119	2200	7 11/16	11
	105	4 1/8	VGS9120	124	1225	5 5/16	7
			VGS11125	143	1600	6 1/2	9
			VGS13100	119	2200	7 11/16	11
	120	4 3/4	VGS9160	179	1225	5 5/16	7
			VGS11150	180	1600	6 1/2	9
			VGS13150	204	2200	7 11/16	11
5 PLY	100	3 15/16	VGS9120	124	1225	5 5/16	7
			VGS11125	143	1600	6 1/2	9
			VGS13100	119	2200	7 11/16	11
	140	5 1/2	VGS9180	207	1225	5 5/16	7
			VGS11175	218	1600	6 1/2	9
			VGS13150	204	2200	7 11/16	11
	175	6 7/8	VGS9220	262	1225	5 5/16	7
			VGS11225	293	1600	6 1/2	9
			VGS13200	290	2200	7 11/16	11
	200	7 7/8	VGS9260	317	1225	5 5/16	7
			VGS11250	331	1600	6 1/2	9
			VGS13250	375	2200	7 11/16	11
7 PLY	140	5 1/2	VGS9180	207	1225	5 5/16	7
			VGS11175	218	1600	6 1/2	9
			VGS13150	204	2200	7 11/16	11
	191	7 1/2	VGS9240	289	1225	5 5/16	7
			VGS11250	331	1600	6 1/2	9
			VGS13250	375	2200	7 11/16	11
	244	9 5/8	VGS9320	400	1225	5 5/16	7
			VGS11325	444	1600	6 1/2	9
			VGS13300	460	2200	7 11/16	11
	280	11	VGS9380	482	1225	5 5/16	7
			VGS11375	519	1600	6 1/2	9
			VGS13350	545	2200	7 11/16	11
9 PLY	180	7 1/16	VGS9220	262	1225	5 5/16	7
			VGS11225	293	1600	6 1/2	9
			VGS13200	290	2200	7 11/16	11
	267	10 1/2	VGS9360	455	1225	5 5/16	7
			VGS11350	481	1600	6 1/2	9
			VGS13350	545	2200	7 11/16	11
	314	12 3/8	VGS9400	510	1225	5 5/16	7
			VGS11425	594	1600	6 1/2	9
			VGS13400	630	2200	7 11/16	11
	360	14 3/16	VGS9480	620	1225	5 5/16	7
			VGS11475	669	1600	6 1/2	9
			VGS13450	716	2200	7 11/16	11

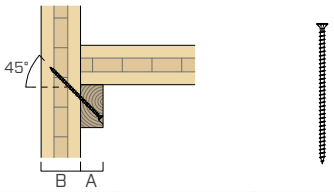
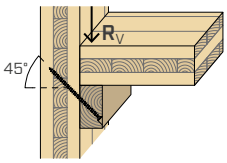
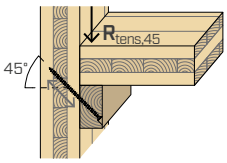
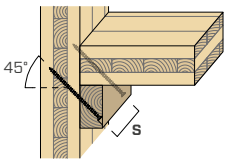
NOTES and GENERAL PRINCIPLES on page 205.

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	79	3 1/8	VGS9100	185	216	185	172	1732	5 5/16	7
			VGS11100	191	262	191	151	2263	6 1/2	9
			VGS13100	208	314	208	165	3111	7 11/16	11
	105	4 1/8	VGS9120	217	242	217	194	1732	5 5/16	7
			VGS11125	277	333	277	192	2263	6 1/2	9
			VGS13100	151	346	151	182	3111	7 11/16	11
	120	4 3/4	VGS9160	345	272	345	217	1732	5 5/16	7
			VGS11150	364	344	364	232	2263	6 1/2	9
			VGS13150	406	482	406	253	3111	7 11/16	11
5 PLY	100	3 15/16	VGS9120	236	251	236	201	1732	5 5/16	7
			VGS11125	280	331	280	191	2263	6 1/2	9
			VGS13100	174	334	174	176	3111	7 11/16	11
	140	5 1/2	VGS9180	414	272	414	217	1732	5 5/16	7
			VGS11175	431	344	431	234	2263	6 1/2	9
			VGS13150	325	449	325	263	3111	7 11/16	11
	175	6 7/8	VGS9220	499	272	499	217	1732	5 5/16	7
			VGS11225	585	344	585	234	2263	6 1/2	9
			VGS13200	500	493	500	319	3111	7 11/16	11
	200	7 7/8	VGS9260	622	272	622	217	1732	5 5/16	7
			VGS11250	628	344	628	234	2263	6 1/2	9
			VGS13250	721	493	721	319	3111	7 11/16	11
7 PLY	140	5 1/2	VGS9180	412	272	412	217	1732	5 5/16	7
			VGS11175	430	344	430	234	2263	6 1/2	9
			VGS13150	324	448	324	263	3111	7 11/16	11
	191	7 1/2	VGS9240	548	272	548	217	1732	5 5/16	7
			VGS11250	668	344	668	234	2263	6 1/2	9
			VGS13250	749	493	749	319	3111	7 11/16	11
	244	9 5/8	VGS9320	781	272	781	217	1732	5 5/16	7
			VGS11325	892	344	892	234	2263	6 1/2	9
			VGS13300	848	493	848	319	3111	7 11/16	11
	280	11	VGS9380	975	272	975	217	1732	5 5/16	7
			VGS11375	1044	344	1044	234	2263	6 1/2	9
			VGS13350	1020	493	1020	319	3111	7 11/16	11
9 PLY	180	7 1/16	VGS9220	478	272	478	217	1732	5 5/16	7
			VGS11225	562	344	562	234	2263	6 1/2	9
			VGS13200	474	493	474	311	3111	7 11/16	11
	267	10 1/2	VGS9360	916	272	916	217	1732	5 5/16	7
			VGS11350	949	344	949	234	2263	6 1/2	9
			VGS13350	1085	493	1085	319	3111	7 11/16	11
	314	12 3/8	VGS9400	952	272	952	217	1732	5 5/16	7
			VGS11425	1200	344	1200	234	2263	6 1/2	9
			VGS13400	1197	493	1197	319	3111	7 11/16	11
	360	14 3/16	VGS9480	1217	272	1217	217	1732	5 5/16	7
			VGS11475	1308	344	1308	234	2263	6 1/2	9
			VGS13450	1319	493	1319	319	3111	7 11/16	11

NOTES and GENERAL PRINCIPLES on page 205.

CLT | LEDGER CONNECTION

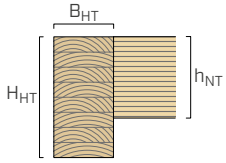
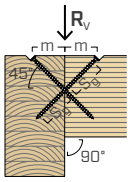
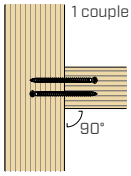
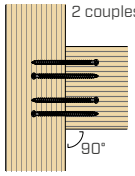
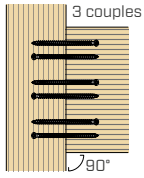
					SHEAR		SPACING	
				geometry	CLT-to-ledger	steel tension	fastener in a row	
								
	main member thickness (wall) = B		side member thickness (ledger) = A	suggested screw	R_v	$R_{tens,45}$	minimum	typical
	[mm]	[in]	[in]	CODE	[lbf]	[lbf]	[in]	[in]
3 PLY	60	2 3/8	1 3/4	VGS9120	340	1732	1 3/4	7
	79	3 1/8	1 3/4	VGS9120	340	1732	1 3/4	7
	105	4 1/8	1 3/4	VGS9120	340	1732	1 3/4	7
	120	4 3/4	1 3/4	VGS9160	340	1732	1 3/4	7
			1 3/4	VGS11150	362	2263	2 3/16	9
5 PLY	100	3 15/16	1 3/4	VGS9120	340	1732	1 3/4	7
			1 3/4	VGS11125	362	2263	2 3/16	9
	140	5 1/2	3 1/2	VGS9260	786	1732	1 3/4	7
			3 1/2	VGS11250	830	2263	2 3/16	9
			3 1/2	VGS13250	941	3111	2 9/16	11
	175	6 7/8	5 1/4	VGS9380	1172	1732	1 3/4	7
			5 1/4	VGS11375	1245	2263	2 3/16	9
			5 1/4	VGS13400	1488	3111	2 9/16	11
	200	7 7/8	5 1/4	VGS9400	1232	1732	1 3/4	7
			5 1/4	VGS11400	1314	2263	2 3/16	9
			5 1/4	VGS13400	1488	3111	2 9/16	11
7 PLY	140	5 1/2	3 1/2	VGS9260	786	1732	1 3/4	7
			3 1/2	VGS11250	830	2263	2 3/16	9
			3 1/2	VGS13250	941	3111	2 9/16	11
	191	7 1/2	5 1/4	VGS9400	1232	1732	1 3/4	7
			5 1/4	VGS11400	1314	2263	2 3/16	9
			5 1/4	VGS13400	1488	3111	2 9/16	11
	244	9 5/8	6 1/2	VGS9480	1510	1732	1 3/4	7
			6 1/2	VGS11500	1654	2263	2 3/16	9
			6 1/2	VGS13500	1873	3111	2 9/16	11
	280	11	6 1/2	VGS9520	1551	1732	1 3/4	7
			6 1/2	VGS11525	1654	2263	2 3/16	9
			6 1/2	VGS13550	1873	3111	2 9/16	11

GENERAL PRINCIPLES and CONNECTIONS GENERAL NOTES on page 205.

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.

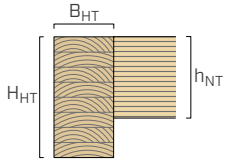
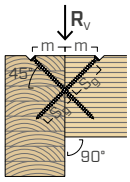
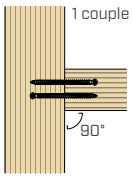
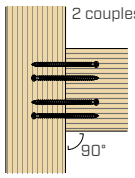
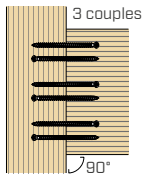
WOOD | CROSSED SCREW CONNECTION

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	VGS9200	2 15/16	1	956	1108	3465
		3 1/2			2	1911	2215	6930
		5 1/8			3	2867	3323	10394
		3 1/2	VGS11200	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	VGS9260	3 3/4	1	1274	1477	3465
		5 1/8			2	2548	2954	6930
		5 1/2			3	3822	4430	10394
		5 1/8	VGS11250	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	VGS9300	4 5/16	1	1504	1743	3465
		5 1/8			2	3008	3487	6930
		5 1/2			3	4512	5230	10394
		5 1/8	VGS11300	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	VGS9360	5 1/8	1	1840	2133	3465
		5 1/8			2	3681	4266	6930
		5 1/2			3	5521	6399	10394
		5 1/8	VGS11350	5	1	1930	2188	4525
		5 1/2			2	3861	4376	9051
		6 3/4			3	5791	6563	13576
12	6 3/4	3 1/2	VGS9400	5 11/16	1	2053	2379	3465
		5 1/8			2	4105	4758	6930
		5 1/2			3	6158	7138	10394
		5 1/8	VGS11400	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	VGS9480	6 13/16	1	2513	2912	3465
		5 1/8			2	5025	5825	6930
		5 1/2			3	7538	8737	10394
		5 1/8	VGS11475	6 13/16	1	2664	3019	4525
		5 1/2			2	5328	6038	9051
		6 3/4			3	7992	9057	13576
15	7 1/2	3 1/2	VGS9520	7 3/8	1	2725	3159	3465
		5 1/8			2	5450	6317	6930
		5 1/2			3	8175	9476	10394
		5 1/8	VGS11525	7 1/2	1	2973	3369	4525
		5 1/2			2	5946	6738	9051
		6 3/4			3	8918	10108	13576
16 1/2	9	3 1/2	VGS9560	7 15/16	1	2955	3425	3465
		5 1/8			2	5910	6851	6930
		5 1/2			3	8865	10276	10394
		5 1/8	VGS11575	8 3/16	1	3282	3719	4525
		5 1/2			2	6563	7438	9051
		6 3/4			3	9845	11158	13576

NOTES and GENERAL PRINCIPLES on page 205.

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		$R_{tens,45}$
						SPF	D.Fir	
[in]	[in]	[in]	CODE	[in]		[lbf]	[lbf]	[lbf]
18	9	3 1/2	VGS9600	8 7/16	1	3185	3692	3465
		5 1/8			2	6370	7384	6930
		5 1/2			3	9555	11076	10394
		5 1/8	VGS11600	8 7/16	1	3475	3938	4525
		5 1/2			2	6949	7876	9051
		6 3/4			3	10424	11814	13576
19 1/2	10 1/2	5 1/8	VGS11700	10	1	3938	4463	4525
		5 1/2			2	7876	8926	9051
		6 3/4			3	11814	13389	13576
21	10 1/2	5 1/8	VGS11750	10 9/16	1	4247	4813	4525
		5 1/2			2	8494	9626	9051
		6 3/4			3	12741	14439	13576
22 1/2	12	5 1/8	VGS11800	11 1/4	1	4556	5163	4525
		5 1/2			2	9111	10326	9051
		6 3/4			3	13667	15490	13576
24	12	5 1/8	VGS11850	12	1	4865	5513	4525
		5 1/2			2	9729	11026	9051
		6 3/4			3	14594	16540	13576
24 1/2	13 1/2	5 1/8	VGS11900	12 5/8	1	5173	5863	4525
		5 1/2			2	10347	11727	9051
		6 3/4			3	15520	17590	13576
27	15	5 1/8	VGS11950	13 3/8	1	5482	6213	4525
		5 1/2			2	10965	12427	9051
		6 3/4			3	16447	18640	13576

GENERAL PRINCIPLES and **CONNECTIONS GENERAL NOTES** on page 205.

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.

INSTALLATION SUGGESTIONS

MANUALS

LONG SCREWS

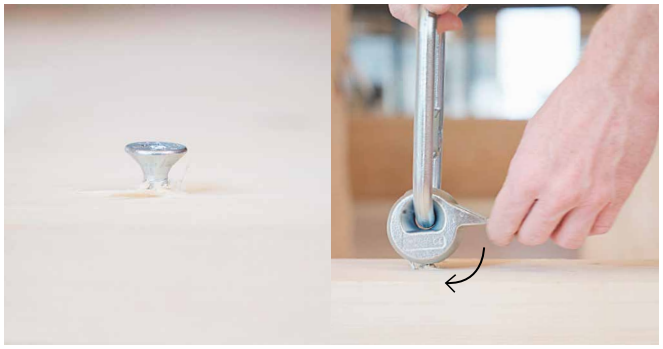
Thanks to CATCH, even longer screws can be screwed on quickly and safely without the risk of the bit slipping. Can be combined with TORQUE LIMITER.

VGS + VGU

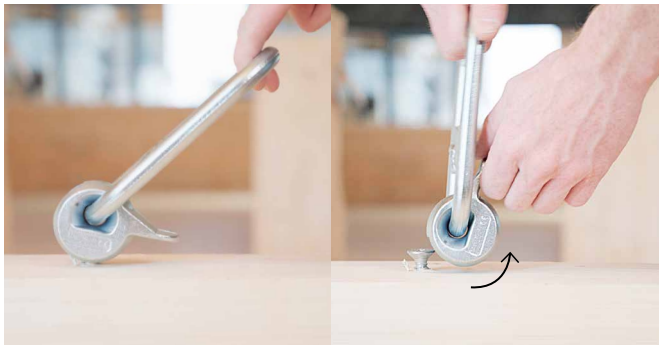
The JIG VGU template makes it easy to prepare a 45° angle pre-drill, thus facilitating subsequent tightening of the VGS screws inside the washer. A pre-drill length of at least 1 inch is recommended.

To ensure control of the applied torque, the correct TORQUE LIMITER model must be used depending on the chosen connector.

VGS +WASPL

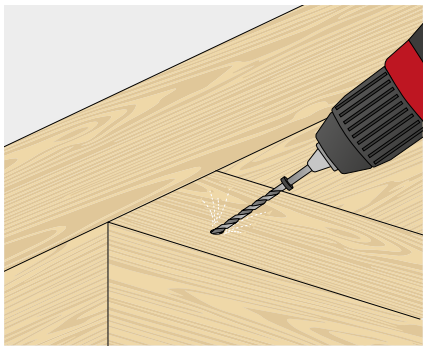


Insert the screw so that the head protrudes 5/8" and engage the WASPL hook.

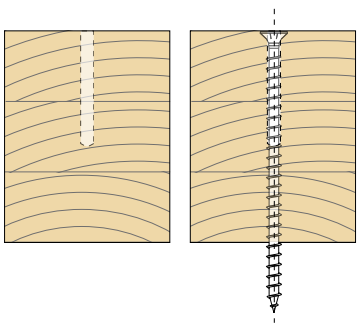


After lifting, the WASPL hook releases quickly and easily ready for use again.

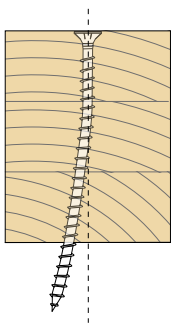
IMPORTANCE OF THE PILOT HOLE



pilot hole



insertion with pilot hole



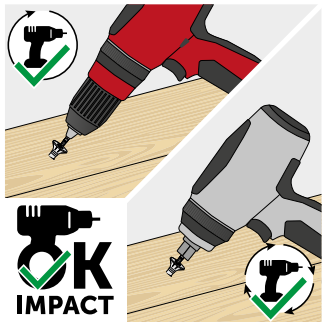
insertion without pilot hole

Deviation of the screw from the direction of screwing often occurs during installation.
This phenomenon is linked to the very conformation of the wood material, which is inhomogeneous and non-uniform, e.g. due to the localised presence of knots or physical properties dependent on grain direction. The operator's skill also plays an important role.

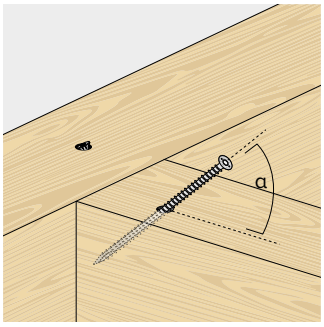
The use of pilot holes facilitates the insertion of screws, particularly long ones, allowing a very precise insertion direction.

INSTALLATION INSTRUCTIONS

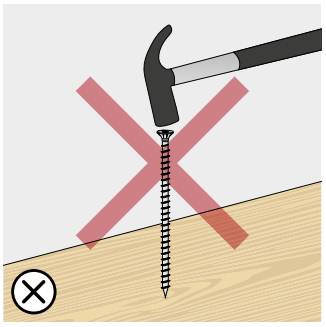
MANUALS



In the case of installation of screws used in timber-to-timber (softwood) structural connections, a pulse screw gun/screwdriver can also be used.

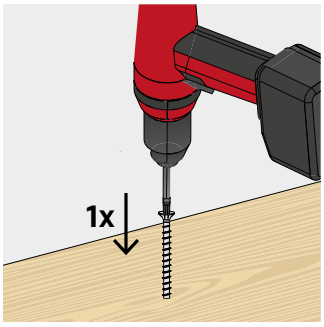


Respect the insertion angle with the help of a pilot hole and/or installation template.



Do not hammer the screw tips into the timber.

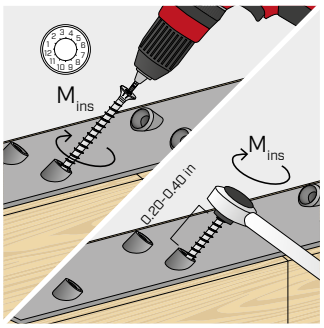
The screw cannot be reused.



In general, it is recommended to install the connector in a single operation, without stopping and restarting which could create additional stress in the screw.

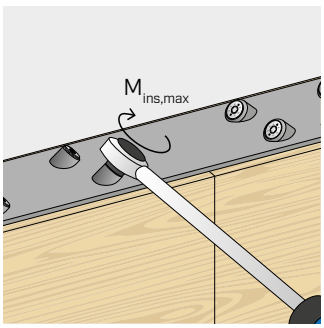
STEEL-TO-TIMBER APPLICATION

The use of pulse screw guns/impact wrenches is not permitted.

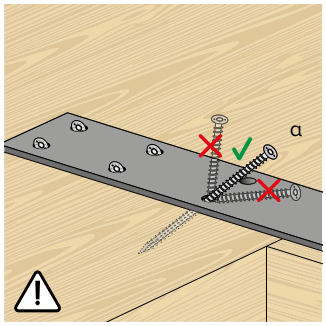


VGS	d_1 [in]	$M_{ins,max}$ [ft·lbs]
Ø0.36	0.36	15
Ø0.44 L < 15 3/4 mm	0.44	22
Ø0.44 L ≥ 15 3/4 mm	0.44	30
Ø0.52	0.52	37

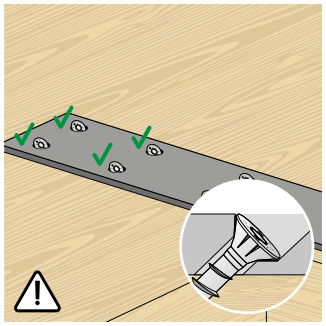
Ensure tightening torque is less than or equal to the maximum recommended tightening torque ($M_{ins,max}$). Stop the insertion when the screw head makes contact with the metal element.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.



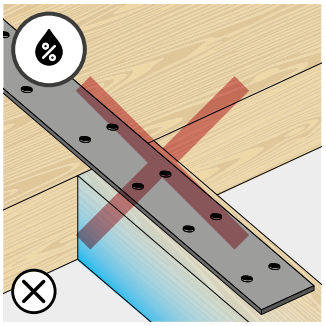
After installation, the fasteners can be inspected using a torque wrench.



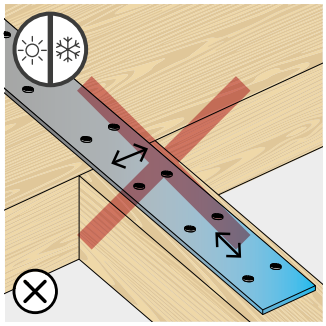
Avoid bending.



The installation of multiple screws must be performed to guarantee that loads are distributed evenly to all fasteners.

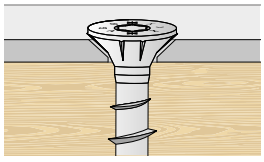


Shrinkage or swelling of timber elements due to changes in moisture content must be avoided.

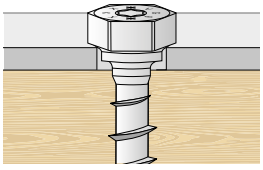


Avoid dimensional changes in the metal, e.g. due to large temperature fluctuations.

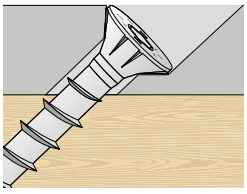
SHAPED PLATE



Countersunk hole.

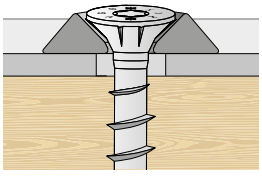


Cylindrical hole.

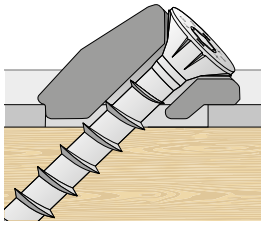


Inclined countersunk hole.

WASHERS



Cylindrical hole with countersunk washer HUS.

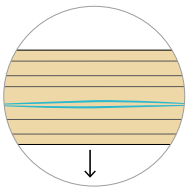


Slotted hole with VGU washer.

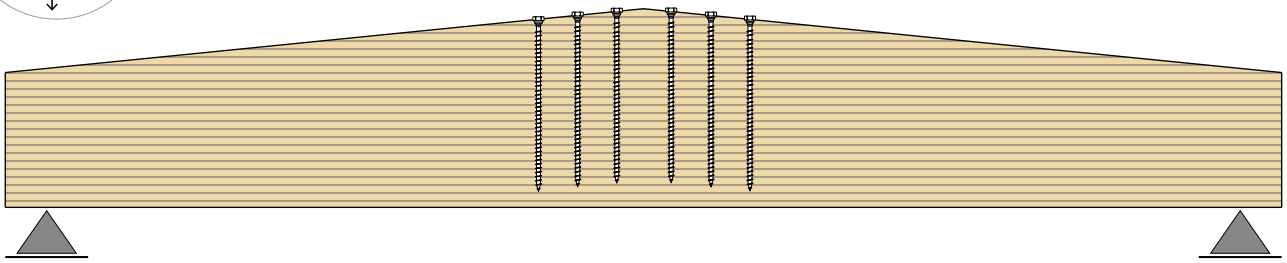
NOTE

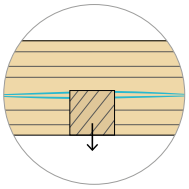
- Check VGS INSTALLATION INSTRUCTIONS on Rothoblaas's website or inside the product box for the complete installation indications.

APPLICATION EXAMPLES: REINFORCEMENT

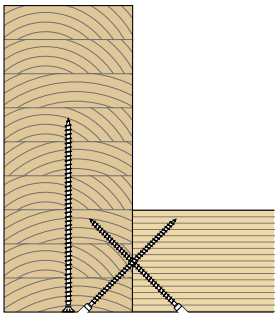


TAPERED BEAMS
apex tension reinforcement perpendicular to grain

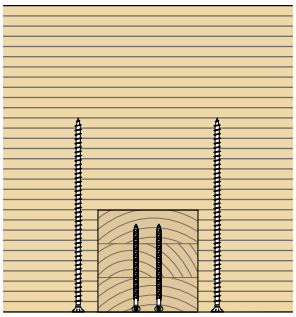




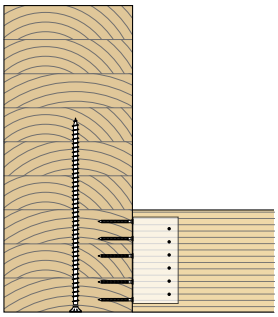
HANGING LOAD
tension reinforcement perpendicular to grain



section



front



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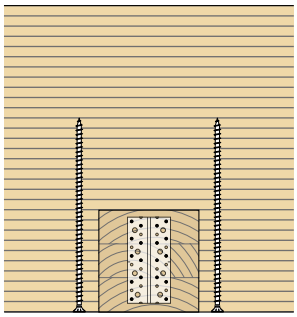
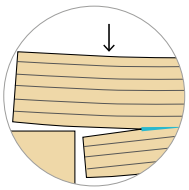
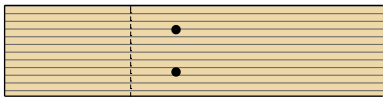


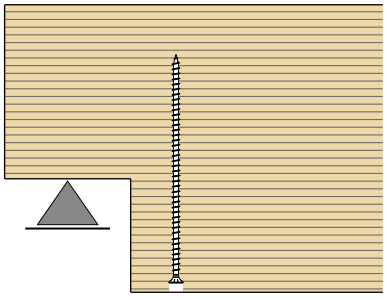
front



NOTCH
tension reinforcement
perpendicular to grain



plan



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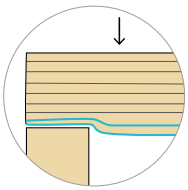
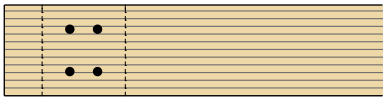
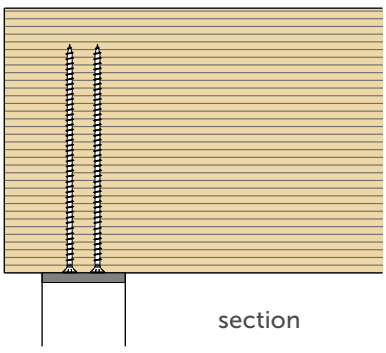


SUPPORT
compression reinforcement
perpendicular to grain



plan



section

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 192 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°.