VGS

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

FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD

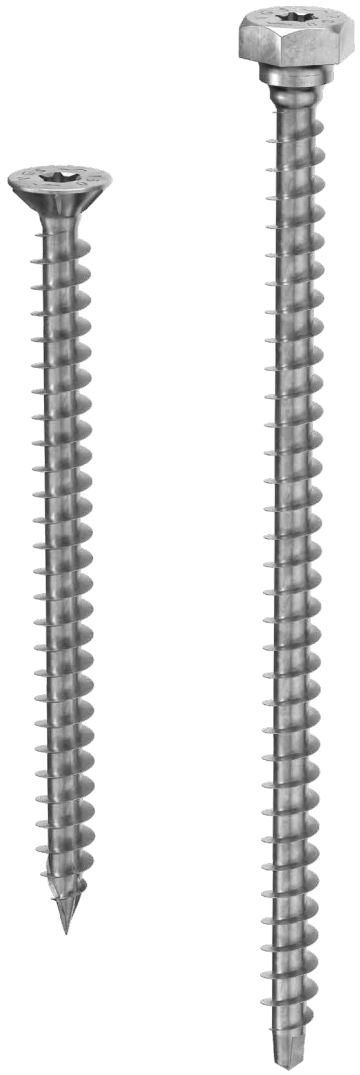
3 THORNS TIP
Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

CERTIFICATION FOR TIMBER AND CONCRETE
Structural connector approved for timber applications according to ICC ELC-4645 listing report in Canada 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 or HUS washers.

COUNTERSUNK OR HEXAGONAL HEAD
Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements. Hexagonal head L > 600 mm to facilitate gripping with screwdriver.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



MANUALS

BIT INCLUDED

DIAMETER [mm]	9 (9 – 13) 13
LENGTH [mm]	80 (80 – 1500) 1500
SERVICE 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

$M_{ins,rec}$

FIELDS OF USE

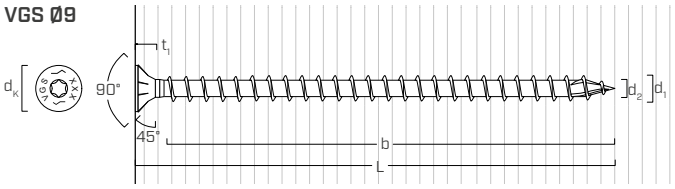
- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

TC FUSION

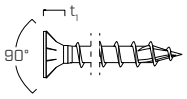
The ETA-22/0806 approval of the TC FUSION system allows the VGS screws to be used together with the reinforcements in the concrete so that the panel floor slabs and the bracing core can be bonded together with a small integration of the casting.

GEOMETRY AND MECHANICAL CHARACTERISTICS

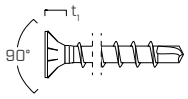
VGS Ø9



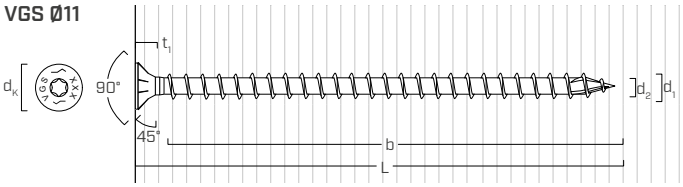
L ≤ 520 mm



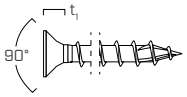
L > 520 mm



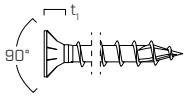
VGS Ø11



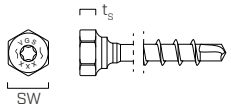
L ≤ 250 mm



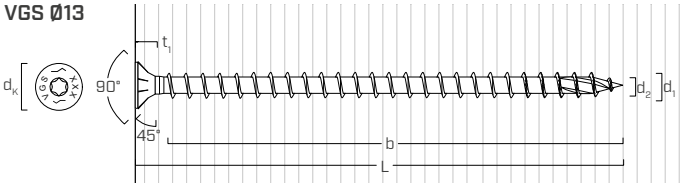
250 mm < L ≤ 600 mm



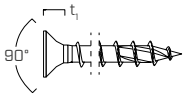
L > 600 mm



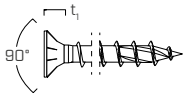
VGS Ø13



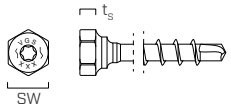
L ≤ 250 mm



250 mm < L ≤ 600 mm



L > 600 mm



GEOMETRY

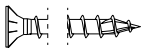
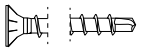
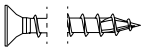
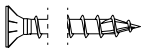
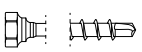
Nominal diameter	**d_1**	**[mm]**	**9**	**11**	**11**	**13**	**13**
Length	L	[mm]	-	≤ 600 mm	> 600 mm	≤ 600 mm	> 600 mm
Countersunk head diameter	d_K	[mm]	16,00	19,30	-	22,00	-
Countersunk head thickness	t_1	[mm]	6,50	8,20	-	9,40	-
Wrench size	SW	-	-	-	SW 17	-	SW 19
Hexagonal head thickness	t_s	[mm]	-	-	6,40	-	7,50
Thread diameter	d_2	[mm]	5,90	6,60	6,60	8,00	8,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	6,0	8,0	8,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0	7,0	7,0	9,0	9,0

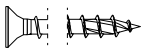
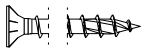
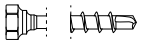
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

Nominal diameter	**d_1**	**[mm]**		**9**	**11**	**13**
Factored tensile strength	Φf_u	[kN]		17,84	23,17	31,96
Bending yield strength	F_{yb}	[MPa]		1069	1026	960
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	78,56	96,02	113,5
			G=0.42	90,9	111,1	131,3
			G=0.49	102,8	125,7	148,5
			G=0.55	112,8	137,9	162,9

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
9 TX40	VGS9100	100	90	25	
	VGS9120	120	110	25	
	VGS9140	140	130	25	
	VGS9160	160	150	25	
	VGS9180	180	170	25	
	VGS9200	200	190	25	
	VGS9220	220	210	25	
	VGS9240	240	230	25	
	VGS9260	260	250	25	
	VGS9280	280	270	25	
	VGS9300	300	290	25	
	VGS9320	320	310	25	
	VGS9340	340	330	25	
	VGS9360	360	350	25	
	VGS9380	380	370	25	
	VGS9400	400	390	25	
	VGS9440	440	430	25	
	VGS9480	480	470	25	
	VGS9520	520	510	25	
	VGS9560	560	550	25	
	VGS9600	600	590	25	
11 TX 50	VGS1180	80	70	25	
	VGS11100	100	90	25	
	VGS11125	125	115	25	
	VGS11150	150	140	25	
	VGS11175	175	165	25	
	VGS11200	200	190	25	
	VGS11225	225	215	25	
	VGS11250	250	240	25	
	VGS11275	275	265	25	
	VGS11300	300	290	25	
	VGS11325	325	315	25	
	VGS11350	350	340	25	
	VGS11375	375	365	25	
	VGS11400	400	390	25	
	VGS11425	425	415	25	
	VGS11450	450	440	25	
	VGS11475	475	465	25	
	VGS11500	500	490	25	
	VGS11525	525	515	25	
	VGS11550	550	540	25	
	VGS11575	575	565	25	
	VGS11600	600	590	25	
11 SW 17 TX 50	VGS11650	650	630	25	
	VGS11700	700	680	25	
	VGS11750	750	730	25	
	VGS11800	800	780	25	
	VGS11850	850	830	25	
	VGS11900	900	880	25	
	VGS11950	950	930	25	
	VGS111000	1000	980	25	

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
13 TX 50	VGS1380	80	70	25	
	VGS13100	100	90	25	
	VGS13150	150	140	25	
	VGS13200	200	190	25	
	VGS13250	250	240	25	
	VGS13300	300	280	25	
	VGS13350	350	330	25	
	VGS13400	400	380	25	
	VGS13450	450	430	25	
	VGS13500	500	480	25	
	VGS13550	550	530	25	
	VGS13600	600	580	25	
13 SW 19 TX 50	VGS13650	650	630	25	
	VGS13700	700	680	25	
	VGS13750	750	730	25	
	VGS13800	800	780	25	
	VGS13850	850	830	25	
	VGS13900	900	880	25	
	VGS13950	950	930	25	
	VGS131000	1000	980	25	
	VGS131100	1100	1080	25	
	VGS131200	1200	1180	25	
	VGS131300	1300	1280	25	
	VGS131400	1400	1380	25	
	VGS131500	1500	1480	25	

RELATED PRODUCTS

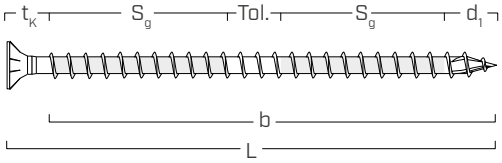
HUS
TURNED WASHER

VGU
45° WASHER FOR VGS

TORQUE LIMITER
TORQUE LIMITER

WASP
HOOK FOR TIMBER ELEMENTS TRANSPORT

EFFECTIVE THREAD USED IN CALCULATION



b = $\mathbf{S_{g,tot}}$ = L - t_K

represents the entire length of the threaded part (see table above)

$\mathbf{S_g}$ = (b - d_1 - Tol.)/2

represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

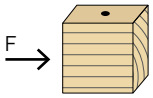
t_K = 10 mm or 20mm depending on head type and diameter

NOTES

- The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in Table 2C of the ELC-4645 report.

MINIMUM DISTANCES FOR SHEAR LOADS

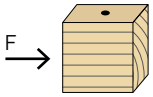
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	**12·d‡**	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
S_Q	**5·d**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
a_L	**15·d‡**	135	*5 5/16*	165	*6 1/2*	195	*7 11/16*
a	**10·d‡**	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_Q	**10·d**	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_P	**5·d**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*

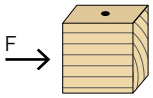
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



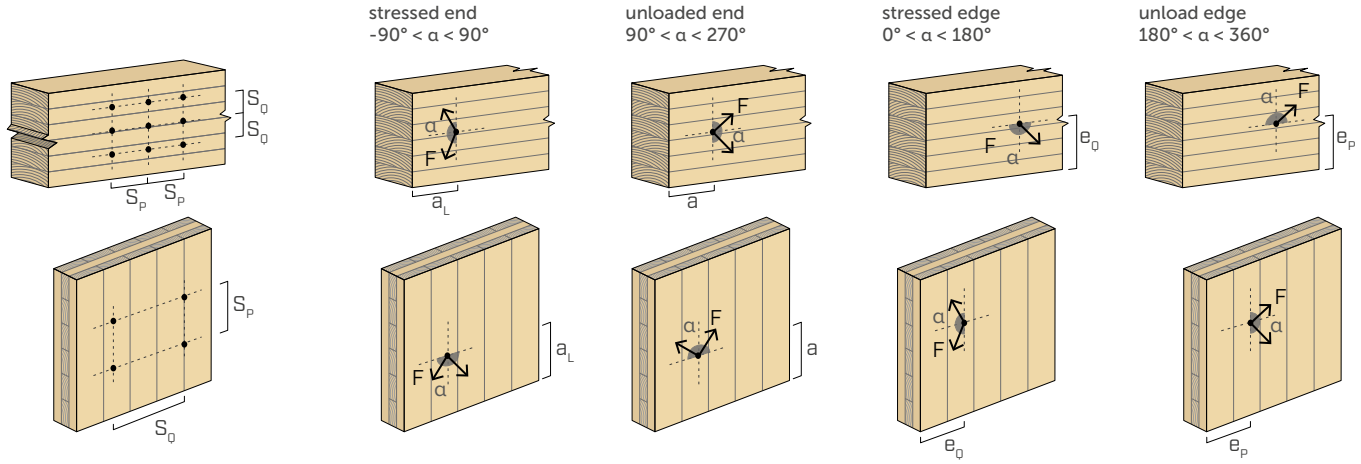
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	**18·d**	162	*6 3/8*	198	*7 13/16*	234	*9 1/4*
S_Q	**7·d**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
a_L	**22·d**	198	*7 13/16*	242	*9 1/2*	286	*11 1/4*
a	**15·d**	135	*5 5/16*	165	*6 1/2*	195	*7 11/16*
e_Q	**12·d**	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
e_P	**7·d**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*

screws inserted **WITH pre-drilled hole**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	**5·d†**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
S_Q	**4·d**	36	*1 7/16*	44	*1 3/4*	52	*2 1/16*
a_L	**12·d†**	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
a	**7·d†**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
e_Q	**7·d**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
e_P	**3·d**	27	*1 1/16*	33	*1 5/16*	39	*1 9/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.
α = load-to-grain angle
d = d_1 = nominal diameter of the screw

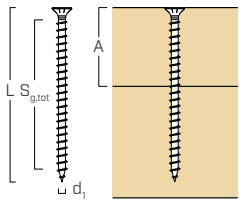
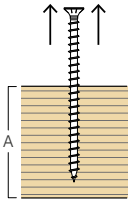
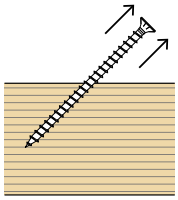
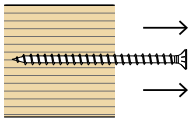


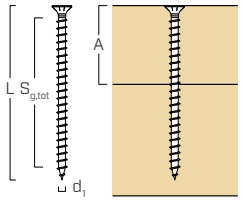
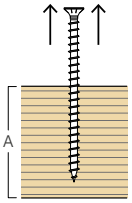
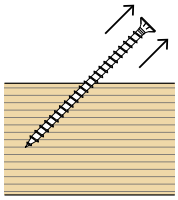
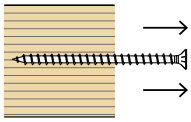
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA-O86 2024, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA-O86:2024.

TENSION/COMPRESSION[1]

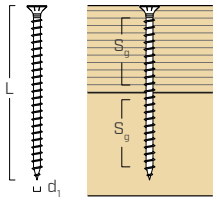
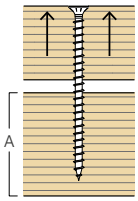
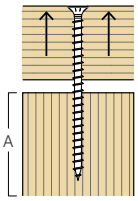
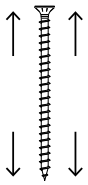
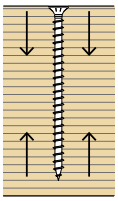
total thread withdrawal

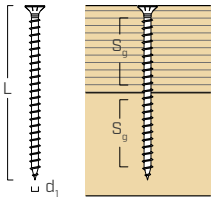
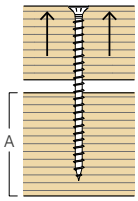
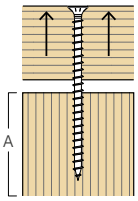
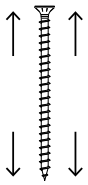
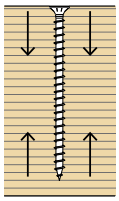
geometry				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			
				G				G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	100	*4*	81	110	4,45	5,15	5,83	6,40	4,05	4,69	5,30	5,81	2,23	2,58	2,91	3,20
	120	*4 3/4*	101	130	5,55	6,43	7,27	7,97	5,05	5,84	6,61	7,25	2,78	3,21	3,63	3,99
	140	*5 1/2*	121	150	6,65	7,70	8,71	9,55	6,05	7,00	7,92	8,69	3,33	3,85	4,35	4,78
	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	7,05	8,16	9,22	10,12	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	8,05	9,31	10,53	11,56	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	9,05	10,47	11,84	12,99	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	10,05	11,63	13,15	14,43	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	11,05	12,78	14,46	15,86	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	12,05	13,94	15,77	17,30	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	13,05	15,10	17,07	18,74	7,18	8,30	9,39	10,30
	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	14,05	16,25	18,38	20,17	7,73	8,94	10,11	11,09
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	15,05	17,41	19,69	21,61	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	16,05	18,57	21,00	23,04	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	17,05	19,73	22,31	24,48	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	18,05	20,88	23,62	25,91	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	19,05	22,04	24,92	27,35	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	21,05	24,35	27,54	30,22	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	23,05	26,67	30,16	33,09	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	25,05	28,98	32,77	35,96	13,78	15,94	18,03	19,78
	560	*22*	541	570	29,75	34,42	38,93	42,72	27,05	31,29	35,39	38,83	14,88	17,21	19,47	21,36
	600	*23 5/8*	581	610	31,95	36,97	41,81	45,88	29,05	33,61	38,01	41,71	15,98	18,48	20,90	22,94
11 *0.44*	80	*3 1/8*	59	90	3,97	4,59	5,19	5,70	3,61	4,17	4,72	5,18	1,98	2,29	2,60	2,85
	100	*4*	79	110	5,31	6,14	6,95	7,63	4,83	5,59	6,32	6,93	2,65	3,07	3,48	3,81
	125	*4 15/16*	104	135	6,99	8,09	9,15	10,04	6,35	7,35	8,32	9,13	3,50	4,04	4,58	5,02
	150	*6*	129	160	8,67	10,03	11,35	12,45	7,88	9,12	10,32	11,32	4,34	5,02	5,68	6,23
	175	*6 7/8*	154	185	10,35	11,98	13,55	14,87	9,41	10,89	12,32	13,51	5,18	5,99	6,78	7,43
	200	*8*	179	210	12,03	13,92	15,75	17,28	10,94	12,66	14,32	15,71	6,02	6,96	7,88	8,64
	225	*8 7/8*	204	235	13,71	15,87	17,95	19,69	12,47	14,42	16,32	17,90	6,86	7,93	8,97	9,85
	250	*10*	229	260	15,39	17,81	20,15	22,11	13,99	16,19	18,32	20,10	7,70	8,90	10,07	11,05
	275	*10 7/8*	254	285	17,07	19,75	22,35	24,52	15,52	17,96	20,32	22,29	8,54	9,88	11,17	12,26
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	17,05	19,73	22,32	24,48	9,38	10,85	12,27	13,47
	325	*12 3/4*	304	335	20,43	23,64	26,75	29,35	18,58	21,49	24,32	26,68	10,22	11,82	13,37	14,67
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	20,10	23,26	26,32	28,87	11,06	12,79	14,47	15,88
	375	*14 3/4*	354	385	23,79	27,53	31,15	34,17	21,63	25,03	28,32	31,07	11,90	13,77	15,57	17,09
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	23,16	26,80	30,32	33,26	12,74	14,74	16,67	18,29
	425	*16 3/4*	404	435	27,15	31,42	35,55	39,00	24,69	28,56	32,32	35,45	13,58	15,71	17,77	19,50
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	26,21	30,33	34,32	37,65	14,42	16,68	18,87	20,71
	475	*18 11/16*	454	485	30,52	35,31	39,95	43,82	27,74	32,10	36,32	39,84	15,26	17,65	19,97	21,91
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	29,27	33,87	38,32	42,03	16,10	18,63	21,07	23,12
	525	*20 11/16*	504	535	33,88	39,20	44,35	48,65	30,80	35,63	40,32	44,23	16,94	19,60	22,17	24,33
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	32,32	37,40	42,32	46,42	17,78	20,57	23,27	25,53

geometry				TENSION/COMPRESSION[1] total thread withdrawal α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			
				G				G				G			
d_1	L		$S_{g,tot}$	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	554	585	37,24	43,08	48,75	53,48	33,85	39,17	44,31	48,62	18,62	21,54	24,37	26,74
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95
	650	*25 9/16*	619	660	41,61	48,14	54,47	59,75	37,82	43,76	49,51	54,32	20,80	24,07	27,23	29,88
	700	*27 1/2*	669	710	44,97	52,03	58,87	64,58	40,88	47,30	53,51	58,71	22,48	26,01	29,43	32,29
	750	*29 1/2*	719	760	48,33	55,92	63,26	69,41	43,93	50,83	57,51	63,10	24,16	27,96	31,63	34,70
	800	*31 1/2*	769	810	51,69	59,81	67,66	74,23	46,99	54,37	61,51	67,48	25,84	29,90	33,83	37,12
	850	*33 7/16*	819	860	55,05	63,69	72,06	79,06	50,04	57,90	65,51	71,87	27,52	31,85	36,03	39,53
	900	*35 1/2*	869	910	58,41	67,58	76,46	83,88	53,10	61,44	69,51	76,26	29,20	33,79	38,23	41,94
	950	*37 3/8*	919	960	61,77	71,47	80,86	88,71	56,15	64,97	73,51	80,65	30,88	35,74	40,43	44,36
	1000	*39 3/8*	969	1010	65,13	75,36	85,26	93,54	59,21	68,51	77,51	85,03	32,57	37,68	42,63	46,77
13 *0.52*	80	*3 1/8*	57	90	4,53	5,25	5,93	6,50	4,12	4,77	5,39	5,91	2,26	2,62	2,96	3,25
	100	*4*	77	110	6,12	7,09	8,00	8,78	5,56	6,44	7,28	7,98	3,06	3,54	4,00	4,39
	150	*6*	127	160	10,09	11,69	13,20	14,48	9,17	10,63	12,00	13,17	5,05	5,85	6,60	7,24
	200	*8*	177	210	14,06	16,29	18,40	20,18	12,78	14,81	16,73	18,35	7,03	8,15	9,20	10,09
	250	*10*	227	260	18,04	20,90	23,60	25,88	16,40	19,00	21,45	23,53	9,02	10,45	11,80	12,94
	300	*11 3/4*	267	310	21,21	24,58	27,75	30,45	19,28	22,34	25,23	27,68	10,61	12,29	13,88	15,22
	350	*13 3/4*	317	360	25,19	29,18	32,95	36,15	22,90	26,53	29,96	32,86	12,59	14,59	16,48	18,07
	400	*15 3/4*	367	410	29,16	33,78	38,15	41,85	26,51	30,71	34,68	38,04	14,58	16,89	19,07	20,92
	450	*17 3/4*	417	460	33,13	38,38	43,35	47,55	30,12	34,90	39,41	43,23	16,57	19,19	21,67	23,78
	500	*19 3/4*	467	510	37,10	42,99	48,54	53,25	33,73	39,08	44,13	48,41	18,55	21,49	24,27	26,63
	550	*21 5/8*	517	560	41,08	47,59	53,74	58,95	37,34	43,26	48,86	53,59	20,54	23,79	26,87	29,48
	600	*23 5/8*	567	610	45,05	52,19	58,94	64,66	40,95	47,45	53,58	58,78	22,52	26,10	29,47	32,33
	650	*25 9/16*	617	660	49,02	56,79	64,14	70,36	44,56	51,63	58,31	63,96	24,51	28,40	32,07	35,18
	700	*27 1/2*	667	710	52,99	61,40	69,33	76,06	48,18	55,82	63,03	69,14	26,50	30,70	34,67	38,03
	750	*29 1/2*	717	760	56,97	66,00	74,53	81,76	51,79	60,00	67,76	74,33	28,48	33,00	37,27	40,88
	800	*31 1/2*	767	810	60,94	70,60	79,73	87,46	55,40	64,18	72,48	79,51	30,47	35,30	39,86	43,73
	850	*33 7/16*	817	860	64,91	75,20	84,93	93,16	59,01	68,37	77,21	84,69	32,46	37,60	42,46	46,58
	900	*35 1/2*	867	910	68,88	79,81	90,12	98,86	62,62	72,55	81,93	89,88	34,44	39,90	45,06	49,43
	950	*37 3/8*	917	960	72,86	84,41	95,32	104,57	66,23	76,74	86,66	95,06	36,43	42,20	47,66	52,28
	1000	*39 3/8*	967	1010	76,83	89,01	100,52	110,27	69,84	80,92	91,38	100,24	38,41	44,51	50,26	55,13
	1100	*43 5/16*	1067	1110	84,77	98,22	110,91	121,67	77,07	89,29	100,83	110,61	42,39	49,11	55,46	60,84
	1200	*47 1/4*	1167	1210	92,72	107,42	121,31	133,07	84,29	97,66	110,28	120,98	46,36	53,71	60,65	66,54
	1300	*51 3/16*	1267	1310	100,66	116,63	131,70	144,48	91,51	106,02	119,73	131,34	50,33	58,31	65,85	72,24
	1400	*55 1/8*	1367	1410	108,61	125,83	142,10	155,88	98,73	114,39	129,18	141,71	54,30	62,92	71,05	77,94
	1500	*59 1/16*	1467	1510	116,55	135,04	152,49	167,28	105,96	122,76	138,63	152,07	58,28	67,52	76,25	83,64

α = screw-to-grain angle

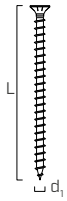
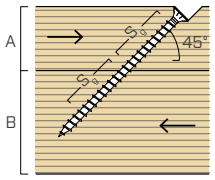
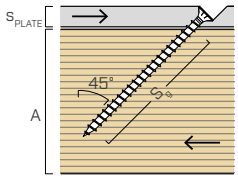
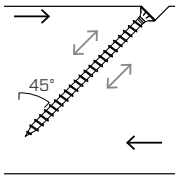
NOTES and GENERAL PRINCIPLES on page 17.

geometry				TENSION/COMPRESSION[1]									
				partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
				G				G					
d_1	L		S_g	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
[mm] *[in]*	[mm]	*[in]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	100	*4*	35,0	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38	17,84	16,37
	120	*4 3/4*	45,0	2,47	2,86	3,24	3,55	1,24	1,43	1,62	1,78		
	140	*5 1/2*	55,0	3,02	3,50	3,96	4,34	1,51	1,75	1,98	2,17		
	160	*6 1/4*	65,0	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57		
	180	*7 1/8*	75,0	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96		
	200	*8*	85,0	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	220	*8 5/8*	95,0	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75		
	240	*9 1/2*	105,0	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	260	*10 1/4*	115,0	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54		
	280	*11*	125,0	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	300	*11 3/4*	135,0	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33		
	320	*12 5/8*	145,0	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	340	*13 3/8*	155,0	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12		
	360	*14 1/4*	165,0	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
	380	*15*	175,0	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91		
	400	*15 3/4*	185,0	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30		
	440	*17 1/4*	205,0	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09		
	480	*19*	225,0	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88		
	520	*20 1/2*	245,0	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67		
	560	*22*	265,0	14,57	16,86	19,07	20,92	7,29	8,43	9,53	10,46		
	600	*23 5/8*	285,0	15,67	18,13	20,51	22,50	7,84	9,07	10,25	11,25		
11 *0.44*	80	*3 1/8*	25,0	1,68	1,94	2,20	2,41	0,84	0,97	1,10	1,21	23,17	19,66
	100	*4*	35,0	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69		
	125	*4 15/16*	45,0	3,02	3,50	3,96	4,34	1,51	1,75	1,98	2,17		
	150	*6*	60,0	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90		
	175	*6 7/8*	70,0	4,70	5,44	6,16	6,76	2,35	2,72	3,08	3,38		
	200	*8*	85,0	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	225	*8 7/8*	95,0	6,39	7,39	8,36	9,17	3,19	3,69	4,18	4,59		
	250	*10*	110,0	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	275	*10 7/8*	120,0	8,07	9,33	10,56	11,58	4,03	4,67	5,28	5,79		
	300	*11 3/4*	135,0	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	325	*12 3/4*	145,0	9,75	11,28	12,76	14,00	4,87	5,64	6,38	7,00		
	350	*13 3/4*	160,0	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	375	*14 3/4*	170,0	11,43	13,22	14,96	16,41	5,71	6,61	7,48	8,21		
	400	*15 3/4*	185,0	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	425	*16 3/4*	195,0	13,11	15,17	17,16	18,82	6,55	7,58	8,58	9,41		
	450	*17 3/4*	210,0	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14		
	475	*18 11/16*	220,0	14,79	17,11	19,36	21,24	7,39	8,55	9,68	10,62		
	500	*19 3/4*	235,0	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	525	*20 11/16*	245,0	16,47	19,05	21,56	23,65	8,23	9,53	10,78	11,82		
	550	*21 5/8*	260,0	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55		

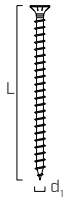
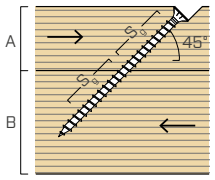
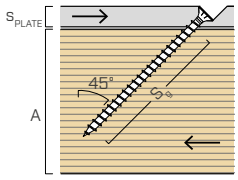
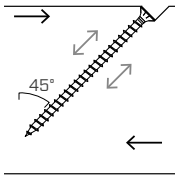
geometry				TENSION/COMPRESSION[1]									
				partial thread withdrawal α = 90°				end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
				G				G					
d_1	L		S_g	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
[mm] *[in]*	[mm]	*[in]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	270,0	293	18,15	21,00	23,76	26,06	9,07	10,50	11,88	13,03	23,17	19,66
	600	*23 5/8*	285,0	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		
	650	*25 9/16*	305,0	330	20,50	23,72	26,84	29,44	10,25	11,86	13,42	14,72		
	700	*27 1/2*	330,0	355	22,18	25,66	29,04	31,85	11,09	12,83	14,52	15,93		
	750	*29 1/2*	355,0	380	23,86	27,61	31,24	34,27	11,93	13,80	15,62	17,13		
	800	*31 1/2*	380,0	405	25,54	29,55	33,44	36,68	12,77	14,78	16,72	18,34		
	850	*33 7/16*	405,0	430	27,22	31,50	35,64	39,09	13,61	15,75	17,82	19,55		
	900	*35 1/2*	430,0	455	28,90	33,44	37,84	41,51	14,45	16,72	18,92	20,75		
	950	*37 3/8*	455,0	480	30,58	35,39	40,04	43,92	15,29	17,69	20,02	21,96		
	1000	*39 3/8*	480,0	505	32,26	37,33	42,24	46,33	16,13	18,66	21,12	23,17		
13 *0.52*	80	*3 1/8*	25,0	45	1,99	2,30	2,60	2,85	0,99	1,15	1,30	1,43	31,96	27,02
	100	*4*	35,0	55	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00		
	150	*6*	60,0	80	4,77	5,52	6,24	6,84	2,38	2,76	3,12	3,42		
	200	*8*	85,0	105	6,75	7,82	8,84	9,69	3,38	3,91	4,42	4,85		
	250	*10*	110,0	130	8,74	10,13	11,43	12,54	4,37	5,06	5,72	6,27		
	300	*11 3/4*	130,0	155	10,33	11,97	13,51	14,82	5,16	5,98	6,76	7,41		
	350	*13 3/4*	155,0	180	12,31	14,27	16,11	17,67	6,16	7,13	8,06	8,84		
	400	*15 3/4*	180,0	205	14,30	16,57	18,71	20,53	7,15	8,28	9,36	10,26		
	450	*17 3/4*	205,0	230	16,29	18,87	21,31	23,38	8,14	9,44	10,65	11,69		
	500	*19 3/4*	230,0	255	18,27	21,17	23,91	26,23	9,14	10,59	11,95	13,11		
	550	*21 5/8*	255,0	280	20,26	23,47	26,51	29,08	10,13	11,74	13,25	14,54		
	600	*23 5/8*	280,0	305	22,25	25,77	29,11	31,93	11,12	12,89	14,55	15,96		
	650	*25 9/16*	305,0	330	24,23	28,08	31,70	34,78	12,12	14,04	15,85	17,39		
	700	*27 1/2*	330,0	355	26,22	30,38	34,30	37,63	13,11	15,19	17,15	18,81		
	750	*29 1/2*	355,0	380	28,20	32,68	36,90	40,48	14,10	16,34	18,45	20,24		
	800	*31 1/2*	380,0	405	30,19	34,98	39,50	43,33	15,10	17,49	19,75	21,67		
	850	*33 7/16*	405,0	430	32,18	37,28	42,10	46,18	16,09	18,64	21,05	23,09		
	900	*35 1/2*	430,0	455	34,16	39,58	44,70	49,03	17,08	19,79	22,35	24,52		
	950	*37 3/8*	455,0	480	36,15	41,88	47,30	51,88	18,07	20,94	23,65	25,94		
	1000	*39 3/8*	480,0	505	38,14	44,18	49,90	54,73	19,07	22,09	24,95	27,37		
	1100	*43 5/16*	530,0	555	42,11	48,79	55,09	60,44	21,05	24,39	27,55	30,22		
	1200	*47 1/4*	580,0	605	46,08	53,39	60,29	66,14	23,04	26,69	30,15	33,07		
	1300	*51 3/16*	630,0	655	50,05	57,99	65,49	71,84	25,03	29,00	32,74	35,92		
	1400	*55 1/8*	680,0	705	54,03	62,59	70,69	77,54	27,01	31,30	35,34	38,77		
	1500	*59 1/16*	730,0	755	58,00	67,20	75,88	83,24	29,00	33,60	37,94	41,62		

α = screw-to-grain angle

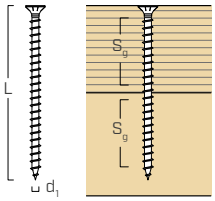
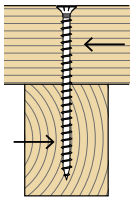
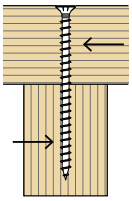
NOTES and GENERAL PRINCIPLES on page 17.

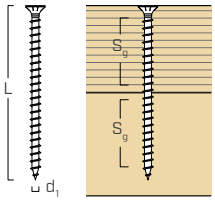
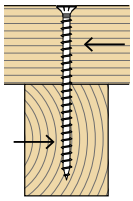
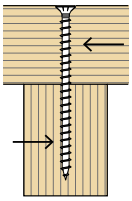
geometry			SLIDING[3] timber-to-timber							steel-to-timber							steel tension
																	
						factored lateral resistance N_r[4]							factored lateral resistance N_r[4]				factored tension resistance T_{rs}
						G							G				
d_1	L		S_g	A	B_{min}	0.35	0.42	0.49	0.55	S_{PLATE}[5]	S_g	A_{min}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
	100	*4*	35	40	55	1,48	1,72	1,94	2,13		70	70	2,97	3,44	3,89	4,26	
	120	*4 3/4*	45	45	60	1,91	2,21	2,50	2,74		90	85	3,82	4,42	5,00	5,48	
	140	*5 1/2*	55	55	70	2,33	2,70	3,05	3,35		110	100	4,67	5,40	6,11	6,70	
	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96		130	115	5,51	6,38	7,22	7,92	
	180	*7 1/8*	75	70	85	3,18	3,68	4,16	4,57		150	125	6,36	7,36	8,33	9,14	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18		170	140	7,21	8,34	9,44	10,35	
	220	*8 5/8*	95	80	95	4,03	4,66	5,27	5,79		190	155	8,06	9,33	10,55	11,57	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40		210	170	8,91	10,31	11,66	12,79	
	260	*10 1/4*	115	95	110	4,88	5,64	6,38	7,00		230	185	9,76	11,29	12,77	14,01	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61		250	200	10,61	12,27	13,88	15,23	
9	300	*11 3/4*	135	110	125	5,73	6,63	7,49	8,22	15,9	270	210	11,45	13,25	14,99	16,45	12,61
0.36	320	*12 5/8*	145	115	130	6,15	7,12	8,05	8,83	*5/8*	290	225	12,30	14,23	16,10	17,66	
	340	*13 3/8*	155	125	140	6,58	7,61	8,60	9,44		310	240	13,15	15,22	17,21	18,88	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05		330	255	14,00	16,20	18,32	20,10	
	380	*15*	175	140	155	7,42	8,59	9,71	10,66		350	270	14,85	17,18	19,43	21,32	
	400	*15 3/4*	185	145	160	7,85	9,08	10,27	11,27		370	285	15,70	18,16	20,54	22,54	
	440	*17 1/4*	205	160	175	8,70	10,06	11,38	12,49		410	310	17,39	20,12	22,76	24,97	
	480	*19*	225	175	190	9,54	11,04	12,49	13,70		450	340	19,09	22,09	24,98	27,41	
	520	*20 1/2*	245	190	205	10,39	12,03	13,60	14,92		490	370	20,79	24,05	27,20	29,85	
	560	*22*	265	200	215	11,24	13,01	14,71	16,14		530	395	22,48	26,01	29,42	32,28	
	600	*23 5/8*	285	215	230	12,09	13,99	15,82	17,36		570	425	24,18	27,98	31,64	34,72	
	80	*3 1/8*	25	35	50	1,30	1,50	1,70	1,86		40	50	2,07	2,40	2,71	2,98	
	100	*4*	35	40	55	1,81	2,10	2,38	2,61		60	65	3,11	3,60	4,07	4,47	
	125	*4 15/16*	45	50	65	2,33	2,70	3,05	3,35		85	85	4,41	5,10	5,77	6,33	
	150	*6*	60	60	75	3,11	3,60	4,07	4,47		110	100	5,70	6,60	7,47	8,19	
	175	*6 7/8*	70	65	80	3,63	4,20	4,75	5,21		135	120	7,00	8,10	9,16	10,05	
	200	*8*	85	75	90	4,41	5,10	5,77	6,33		160	135	8,30	9,60	10,86	11,91	
	225	*8 7/8*	95	85	100	4,93	5,70	6,45	7,07		185	155	9,59	11,10	12,56	13,78	
	250	*10*	110	95	110	5,70	6,60	7,47	8,19		210	170	10,89	12,60	14,25	15,64	
	275	*10 7/8*	120	100	115	6,22	7,20	8,14	8,94		235	190	12,18	14,10	15,95	17,50	
11	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05	19,1	260	205	13,48	15,60	17,65	19,36	16,38
0.44	325	*12 3/4*	145	120	135	7,52	8,70	9,84	10,80	*3/4*	285	225	14,78	17,10	19,34	21,22	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91		310	240	16,07	18,60	21,04	23,08	
	375	*14 3/4*	170	135	150	8,81	10,20	11,54	12,66		335	260	17,37	20,10	22,74	24,94	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78		360	275	18,67	21,60	24,43	26,81	
	425	*16 3/4*	195	155	170	10,11	11,70	13,24	14,52		385	295	19,96	23,10	26,13	28,67	
	450	*17 3/4*	210	165	180	10,89	12,60	14,25	15,64		410	315	21,26	24,60	27,83	30,53	
	475	*18 11/16*	220	170	185	11,41	13,20	14,93	16,38		435	330	22,55	26,10	29,53	32,39	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50		460	350	23,85	27,60	31,22	34,25	
	525	*20 11/16*	245	190	205	12,70	14,70	16,63	18,24		485	365	25,15	29,10	32,92	36,11	
	550	*21 5/8*	260	200	215	13,48	15,60	17,65	19,36		510	385	26,44	30,60	34,62	37,98	

SLIDING[3]

geometry			timber-to-timber							steel-to-timber							steel tension
																	
						factored lateral resistance N_r[4]							factored lateral resistance N_r[4]				factored tension resistance T_{rs}
d_1	L		S_g	A	B_{min}	G				S_{PLATE}[5]	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]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	270	205	220	14,00	16,20	18,33	20,10	19,1 *3/4*	535	400	27,74	32,10	36,31	39,84	16,38
	600	*23 5/8*	285	220	235	14,78	17,10	19,34	21,22		560	420	29,03	33,59	38,01	41,70	
	650	*25 9/16*	305	230	245	15,81	18,30	20,70	22,71		-	-	-	-	-	-	
	700	*27 1/2*	330	250	265	17,11	19,80	22,40	24,57		-	-	-	-	-	-	
	750	*29 1/2*	355	265	280	18,41	21,30	24,10	26,43		-	-	-	-	-	-	
	800	*31 1/2*	380	285	300	19,70	22,80	25,79	28,30		-	-	-	-	-	-	
	850	*33 7/16*	405	305	320	21,00	24,30	27,49	30,16		-	-	-	-	-	-	
	900	*35 1/2*	430	320	335	22,29	25,80	29,19	32,02		-	-	-	-	-	-	
	950	*37 3/8*	455	340	355	23,59	27,30	30,88	33,88		-	-	-	-	-	-	
	1000	*39 3/8*	480	355	370	24,89	28,80	32,58	35,74		-	-	-	-	-	-	
13 *0.52*	80	*3 1/8*	25	35	50	1,53	1,78	2,00	2,20	22,2 *7/8*	35	50	2,15	2,49	2,81	3,08	22,60
	100	*4*	35	40	55	2,15	2,49	2,81	3,08		55	65	3,37	3,91	4,41	4,84	
	150	*6*	60	60	75	3,68	4,26	4,81	5,28		105	100	6,44	7,46	8,42	9,24	
	200	*8*	85	80	95	5,21	6,04	6,82	7,48		155	135	9,50	11,01	12,43	13,63	
	250	*10*	110	95	110	6,74	7,81	8,82	9,68		205	170	12,56	14,56	16,44	18,03	
	300	*11 3/4*	130	110	125	7,97	9,23	10,42	11,43		255	205	15,63	18,11	20,45	22,43	
	350	*13 3/4*	155	125	140	9,50	11,01	12,43	13,63		305	240	18,69	21,66	24,46	26,83	
	400	*15 3/4*	180	145	160	11,03	12,78	14,43	15,83		355	275	21,76	25,21	28,47	31,23	
	450	*17 3/4*	205	165	180	12,56	14,56	16,44	18,03		405	310	24,82	28,76	32,48	35,62	
	500	*19 3/4*	230	180	195	14,10	16,33	18,44	20,23		455	345	27,89	32,31	36,48	40,02	
	550	*21 5/8*	255	200	215	15,63	18,11	20,45	22,43		505	380	30,95	35,86	40,49	44,42	
	600	*23 5/8*	280	215	230	17,16	19,88	22,45	24,63		555	415	34,01	39,41	44,50	48,82	
	650	*25 9/16*	305	235	250	18,69	21,66	24,46	26,83		-	-	-	-	-	-	
	700	*27 1/2*	330	250	265	20,22	23,43	26,46	29,03		-	-	-	-	-	-	
	750	*29 1/2*	355	270	285	21,76	25,21	28,47	31,23		-	-	-	-	-	-	
	800	*31 1/2*	380	285	300	23,29	26,98	30,47	33,43		-	-	-	-	-	-	
	850	*33 7/16*	405	305	320	24,82	28,76	32,48	35,62		-	-	-	-	-	-	
	900	*35 1/2*	430	320	335	26,35	30,53	34,48	37,82		-	-	-	-	-	-	
	950	*37 3/8*	455	340	355	27,89	32,31	36,48	40,02		-	-	-	-	-	-	
	1000	*39 3/8*	480	355	370	29,42	34,08	38,49	42,22		-	-	-	-	-	-	
	1100	*43 5/16*	530	390	405	32,48	37,63	42,50	46,62		-	-	-	-	-	-	
	1200	*47 1/4*	580	430	445	35,55	41,18	46,51	51,02		-	-	-	-	-	-	
	1300	*51 3/16*	630	465	480	38,61	44,73	50,52	55,42		-	-	-	-	-	-	
	1400	*55 1/8*	680	500	515	41,68	48,28	54,53	59,81		-	-	-	-	-	-	
	1500	*59 1/16*	730	535	550	44,74	51,83	58,54	64,21		-	-	-	-	-	-	

NOTES and GENERAL PRINCIPLES on page 17.

geometry				SHEAR[6] timber-to-timber							
				α = 90°				α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2]			
				G				G			
d_1	L		S_g	A[7]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	100	*4*	35	50	1,78	2,12	2,45	2,74	1,16	1,38	1,56	1,69
	120	*4 3/4*	45	60	2,18	2,59	3,00	3,34	1,37	1,55	1,73	1,87
	140	*5 1/2*	55	70	2,58	3,01	3,30	3,53	1,49	1,69	1,89	2,05
	160	*6 1/4*	65	80	2,85	3,17	3,48	3,73	1,61	1,83	2,05	2,23
	180	*7 1/8*	75	90	2,98	3,33	3,66	3,93	1,73	1,98	2,21	2,41
	200	*8*	85	100	3,12	3,49	3,84	4,13	1,85	2,12	2,38	2,59
	220	*8 5/8*	95	110	3,26	3,65	4,02	4,32	1,97	2,26	2,54	2,77
	240	*9 1/2*	105	120	3,40	3,81	4,20	4,52	2,09	2,40	2,70	2,90
	260	*10 1/4*	115	130	3,53	3,97	4,38	4,72	2,21	2,54	2,79	3,00
	280	*11*	125	140	3,67	4,13	4,56	4,90	2,33	2,62	2,88	3,09
	300	*11 3/4*	135	150	3,81	4,28	4,62	4,90	2,41	2,70	2,97	3,19
	320	*12 5/8*	145	160	3,91	4,28	4,62	4,90	2,48	2,78	3,06	3,29
	340	*13 3/8*	155	170	3,91	4,28	4,62	4,90	2,55	2,86	3,15	3,39
	360	*14 1/4*	165	180	3,91	4,28	4,62	4,90	2,62	2,94	3,24	3,49
	380	*15*	175	190	3,91	4,28	4,62	4,90	2,69	3,02	3,33	3,59
	400	*15 3/4*	185	200	3,91	4,28	4,62	4,90	2,76	3,10	3,42	3,69
	440	*17 1/4*	205	220	3,91	4,28	4,62	4,90	2,89	3,24	3,49	3,70
	480	*19*	225	240	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	520	*20 1/2*	245	260	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	560	*22*	265	280	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	600	*23 5/8*	285	300	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
11 *0.44*	80	*3 1/8*	25	40	1,60	1,91	2,21	2,47	1,04	1,24	1,44	1,61
	100	*4*	35	50	2,07	2,46	2,85	3,18	1,34	1,59	1,84	2,03
	125	*4 15/16*	45	63	2,66	3,15	3,65	4,07	1,68	1,91	2,12	2,30
	150	*6*	60	75	3,24	3,81	4,17	4,47	1,86	2,12	2,37	2,57
	175	*6 7/8*	70	88	3,63	4,05	4,45	4,77	2,04	2,33	2,61	2,84
	200	*8*	85	100	3,84	4,29	4,72	5,07	2,22	2,54	2,85	3,11
	225	*8 7/8*	95	113	4,05	4,54	5,00	5,37	2,40	2,75	3,09	3,38
	250	*10*	110	125	4,26	4,78	5,27	5,68	2,58	2,97	3,34	3,62
	275	*10 7/8*	120	138	4,47	5,02	5,55	5,98	2,76	3,18	3,51	3,77
	300	*11 3/4*	135	150	4,68	5,27	5,75	6,09	2,94	3,31	3,65	3,92
	325	*12 3/4*	145	163	4,86	5,32	5,75	6,09	3,07	3,44	3,78	4,07
	350	*13 3/4*	160	175	4,86	5,32	5,75	6,09	3,17	3,56	3,92	4,22
	375	*14 3/4*	170	188	4,86	5,32	5,75	6,09	3,28	3,68	4,06	4,37
	400	*15 3/4*	185	200	4,86	5,32	5,75	6,09	3,38	3,80	4,20	4,52
	425	*16 3/4*	195	213	4,86	5,32	5,75	6,09	3,49	3,92	4,33	4,60
	450	*17 3/4*	210	225	4,86	5,32	5,75	6,09	3,59	4,02	4,35	4,60
	475	*18 11/16*	220	238	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	500	*19 3/4*	235	250	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	525	*20 11/16*	245	263	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	550	*21 5/8*	260	275	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60

geometry				SHEAR[6] timber-to-timber							
				α = 90°				α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2]			
				G				G			
d_1	L		S_g	A[7]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	270	288	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	600	*23 5/8*	285	300	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	650	*25 9/16*	300	325	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	700	*27 1/2*	325	350	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	750	*29 1/2*	350	375	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	800	*31 1/2*	375	400	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	850	*33 7/16*	400	425	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	900	*35 1/2*	425	450	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	950	*37 3/8*	450	475	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	1000	*39 3/8*	475	500	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
13 *0.52*	80	*3 1/8*	20	40	1,79	2,13	2,46	2,75	1,16	1,39	1,61	1,80
	100	*4*	30	50	2,32	2,76	3,19	3,56	1,50	1,78	2,07	2,31
	150	*6*	55	75	3,66	4,35	5,02	5,60	2,33	2,64	2,94	3,18
	200	*8*	80	100	4,95	5,53	6,06	6,50	2,75	3,13	3,50	3,80
	250	*10*	105	125	5,45	6,10	6,71	7,22	3,16	3,62	4,06	4,43
	300	*11 3/4*	125	150	5,81	6,52	7,18	7,73	3,58	4,11	4,62	5,03
	350	*13 3/4*	150	175	6,30	7,09	7,83	8,33	4,00	4,56	5,01	5,39
	400	*15 3/4*	175	200	6,65	7,28	7,87	8,33	4,32	4,85	5,34	5,74
	450	*17 3/4*	200	225	6,65	7,28	7,87	8,33	4,57	5,13	5,66	6,10
	500	*19 3/4*	225	250	6,65	7,28	7,87	8,33	4,82	5,42	5,95	6,30
	550	*21 5/8*	250	275	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	600	*23 5/8*	275	300	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	650	*25 9/16*	300	325	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	700	*27 1/2*	325	350	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	750	*29 1/2*	350	375	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	800	*31 1/2*	375	400	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	850	*33 7/16*	400	425	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	900	*35 1/2*	425	450	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	950	*37 3/8*	450	475	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1000	*39 3/8*	475	500	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1100	*43 5/16*	525	550	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1200	*47 1/4*	575	600	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1300	*51 3/16*	625	650	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1400	*55 1/8*	675	700	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1500	*59 1/16*	725	750	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30

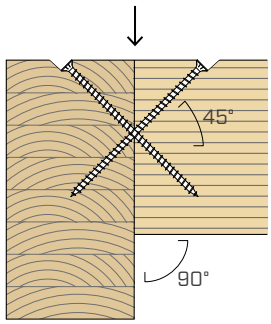
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 17.

STRUCTURAL VALUES | FURTHER APPLICATIONS

SHEAR CONNECTION WITH CROSSED CONNECTORS

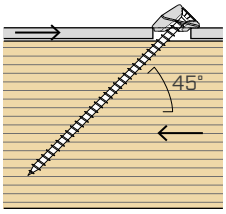
VGS Ø9 - 11 mm



STRUCTURAL VALUES in the Canadian VGZ datasheet.

SLIDING CONNECTION WITH VGU WASHER

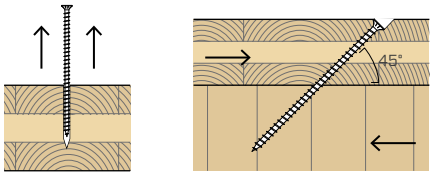
VGS Ø9 - 11 - 13 mm



STRUCTURAL VALUES in the Canadian VGU datasheet.

CONNECTIONS WITH CLT ELEMENTS

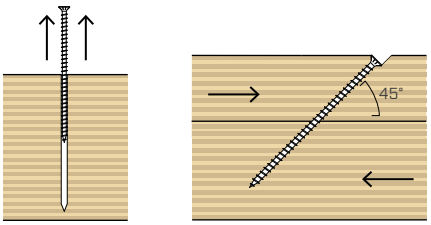
VGS Ø9 - 11 mm



STRUCTURAL VALUES in the Canadian VGZ datasheet.

CONNECTIONS WITH LVL ELEMENTS

VGS Ø9 - 11 mm

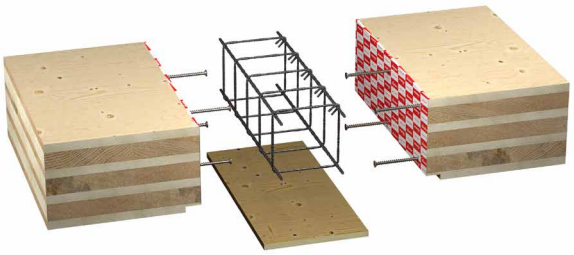


STRUCTURAL VALUES in the European VGZ datasheet.

TC FUSION

TIMBER-TO-CONCRETE JOINT SYSTEM

The innovation of VGS, VGZ and RTR all-thread connectors for timber-concrete applications.



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STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole as per CSA-O86 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- VGS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA-O86 2024 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA-O86 2024 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}.The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in Table 2C of the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(3) For fully threaded screws, the head pull-through resistance is not relevant to the connection capacity, instead, thread withdrawal governs. These values must be compared to the tensile resistance of the screw, with the lower value determining the governing resistance.

(4) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane.

(5) The plate thickness (S_{PLATE}) are understood to be the minimum values to allow the countersunk head of the screw to be accommodated.

(6) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(7) The fixable thickness (A) is considered as half the length of the screw (L/2).

RELATED PRODUCTS

JIG VGU

LEWIS

CATCH

TORQUE LIMITER

B 13 B

INSTALLATION SUGGESTIONS

MANUALS

LONG SCREWS

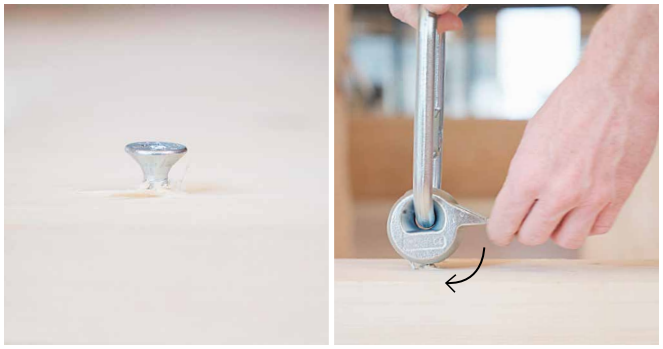
Thanks to CATCH, even longer screws can be screwed on quickly and safely without the risk of the bit slipping. Can be combined with TORQUE LIMITER.

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 20 mm is recommended.

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

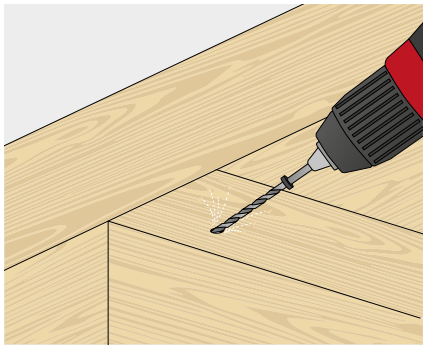
VGS +WASPL



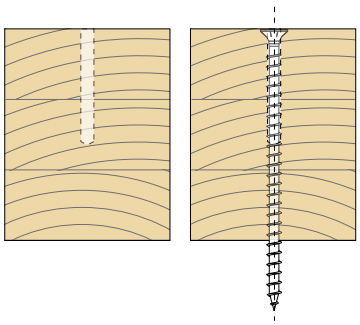
Insert the screw so that the head protrudes 15 mm and engage the WASPL hook.

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

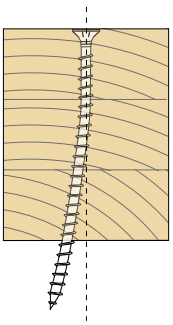
IMPORTANCE OF THE PILOT HOLE



pilot hole



insertion with pilot hole

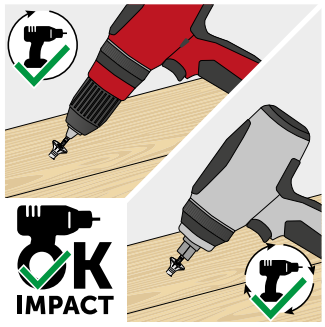


insertion without pilot hole

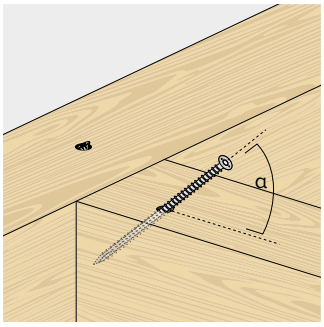
Deviation of the screw from the direction of screwing often occurs during installation.
This phenomenon is linked to the very conformation of the wood material, which is inhomogeneous and non-uniform, e.g. due to the localised presence of knots or physical properties dependent on grain direction. The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

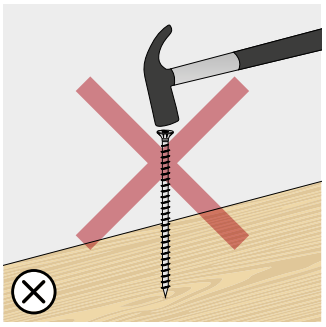
INSTALLATION INSTRUCTIONS



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

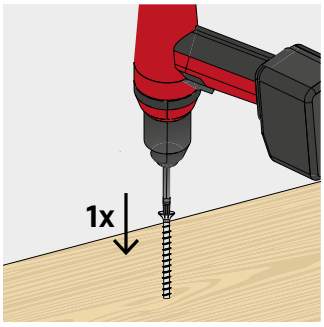


Respect the insertion angle with the help of a pilot hole and/or installation template.



Do not hammer the screw tips into the timber.

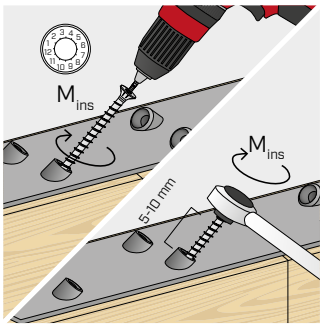
The screw cannot be reused.



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.

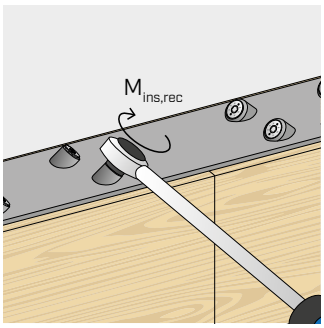
STEEL-TO-TIMBER APPLICATION

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

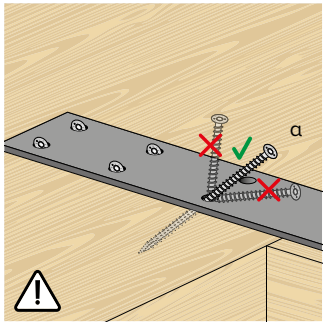


Ensure correct tightening. We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.

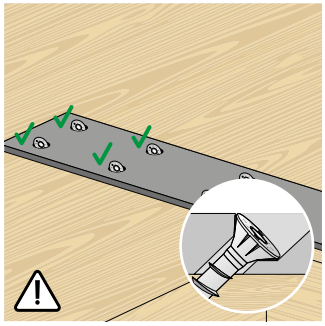
VGS	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø9	9	20
Ø11 L < 400 mm	11	30
Ø11 L ≥ 400 mm	11	40
Ø13	13	50



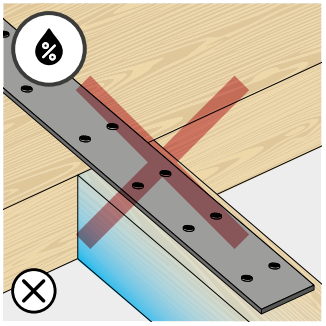
After installation, the fasteners can be inspected using a torque wrench.



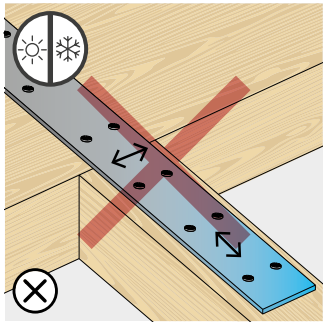
Avoid bending.



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

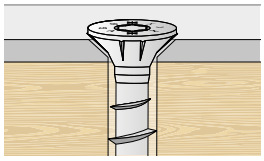


Shrinkage or swelling of timber elements due to changes in moisture content must be avoided.

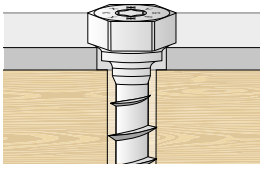


Avoid dimensional changes in the metal, e.g. due to large temperature fluctuations.

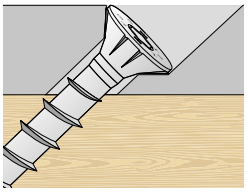
SHAPED PLATE



Countersunk hole.

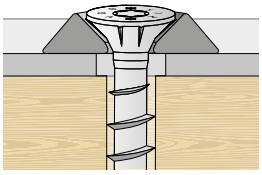


Cylindrical hole.

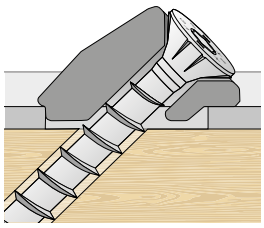


Inclined countersunk hole.

WASHERS

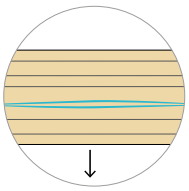


Cylindrical hole with countersunk washer HUS.

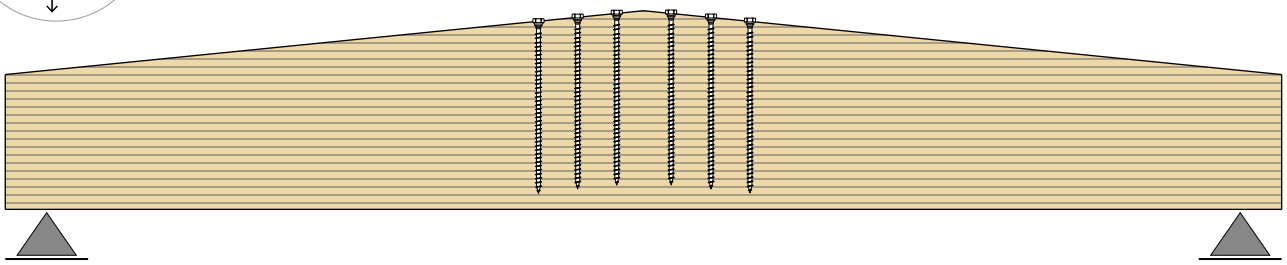


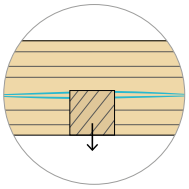
Slotted hole with VGU washer.

APPLICATION EXAMPLES: REINFORCEMENT

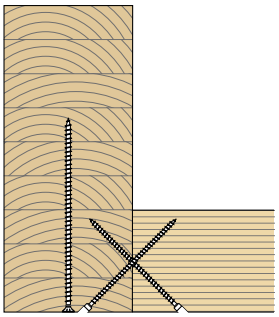


TAPERED BEAMS
apex tension reinforcement perpendicular to grain

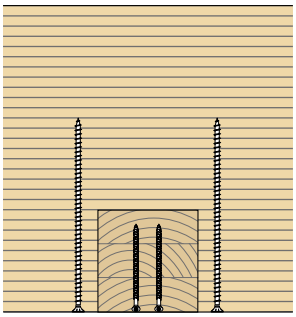




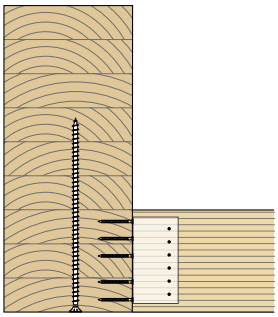
HANGING LOAD
tension reinforcement perpendicular to grain



section



front



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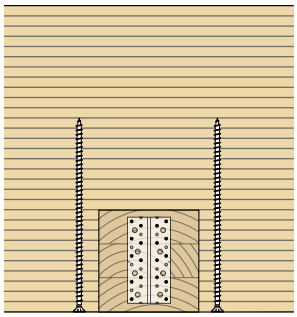
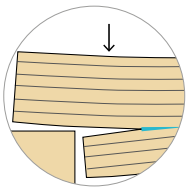
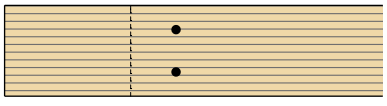


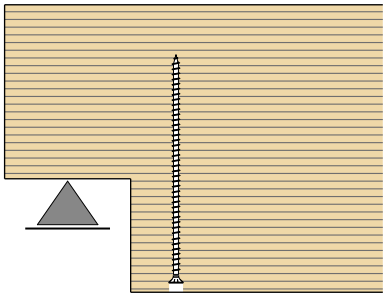
front



NOTCH
tension reinforcement
perpendicular to grain



plan



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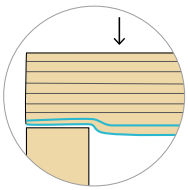
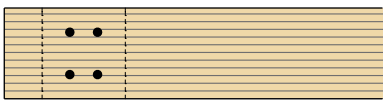
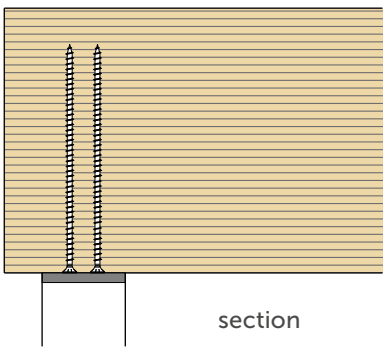


SUPPORT
compression reinforcement
perpendicular to grain



plan



section