VGZ EVO

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

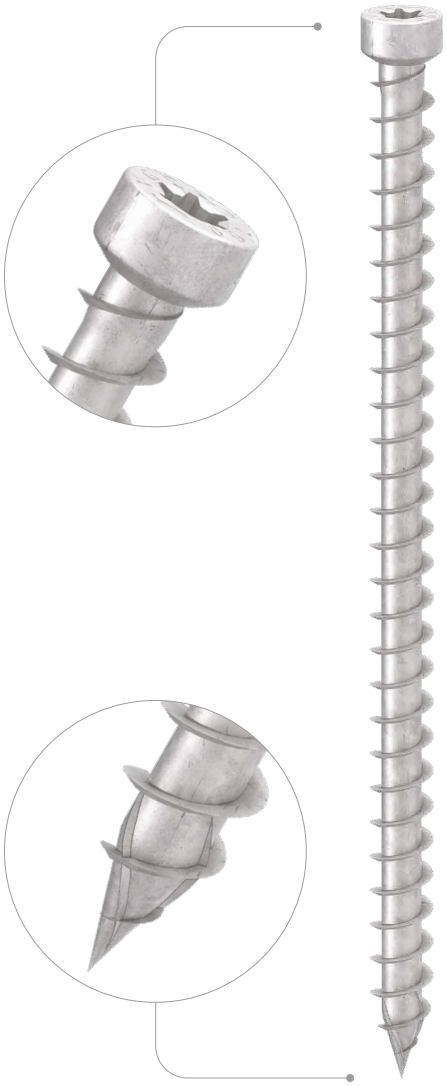
FULLY THREADED SCREW WITH CYLINDRICAL HEAD

C4 EVO COATING
Multilayer coating with a surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, as per ISO 9227. Can be used in exposure condition 3 outdoor applications and under class C4 atmospheric corrosion conditions.

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

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

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

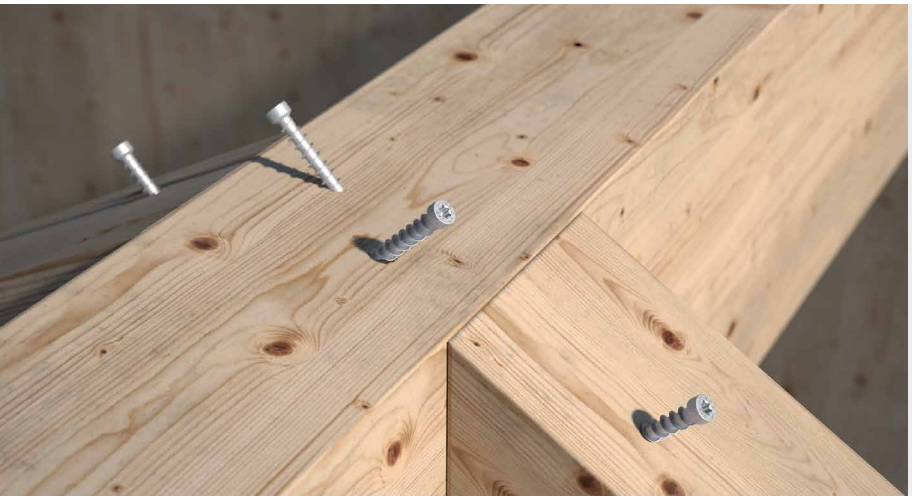


CANADIAN DESIGN VALUES
USA, EU and more design values available online.

VIDEO

BIT INCLUDED

DIAMETER [mm]	5 **5** — **11** 11
LENGTH [mm]	80 **80** — **600** 1000
SERVICE CONDITION	**EC1** **EC3**
ATMOSPHERIC CORROSIVITY	**C1** **C2** **C3** **C4**
WOOD CORROSIVITY	T1 T2 T3
MATERIAL	C4 EVO COATING — carbon steel with C4 EVO coating

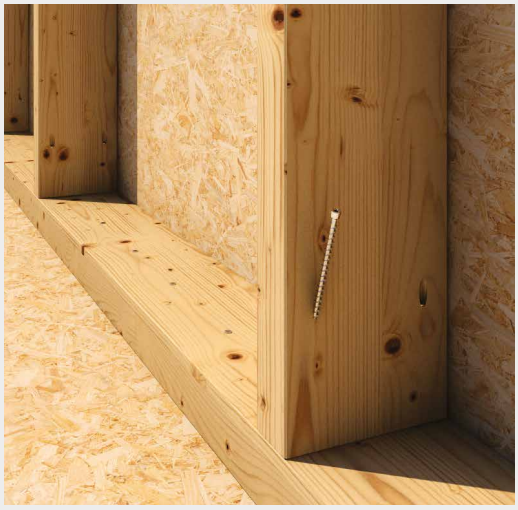


FIELDS OF USE
- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

TRUSS & RAFTER JOINTS

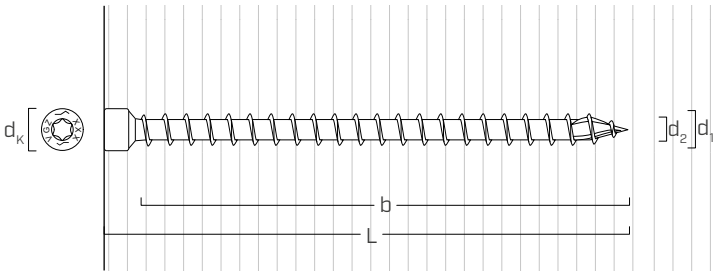
Ideal for joining small timber elements such as the crossbeams and uprights of light frame structures. Certified for application parallel to the grain and with reduced minimum distances.

Fastening Wood Trusses outdoors.



Fastening the uprights of light frame structures with VGZ EVO Ø5 mm.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**5,3**	**5,6**	**7**	**9**	**11**
Head diameter	d_K	[mm]	8,00	8,00	9,50	11,50	13,50
Root diameter	d_2	[mm]	3,60	3,80	4,60	5,90	6,60
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,5	3,5	4,0	5,0	6,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	4,0	4,0	5,0	6,0	7,0

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

MECHANICAL PARAMETERS

Nominal diameter	**d_1**	**[mm]**		**5,3**	**5,6**	**7**	**9**	**11**
Factored tensile strength	Φf_u	[kN]		7,49	8,08	10,64	17,84	23,17
Bending yield strength	F_{yb}	[MPa]		1021	1021	1111	1069	1026
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	55,43	58,56	61,1	78,56	96,02
			G=0.42	64,13	67,76	70,7	90,9	111,1
			G=0.49	72,55	76,56	79,98	102,8	125,7
			G=0.55	79,57	84,07	87,72	112,8	137,9

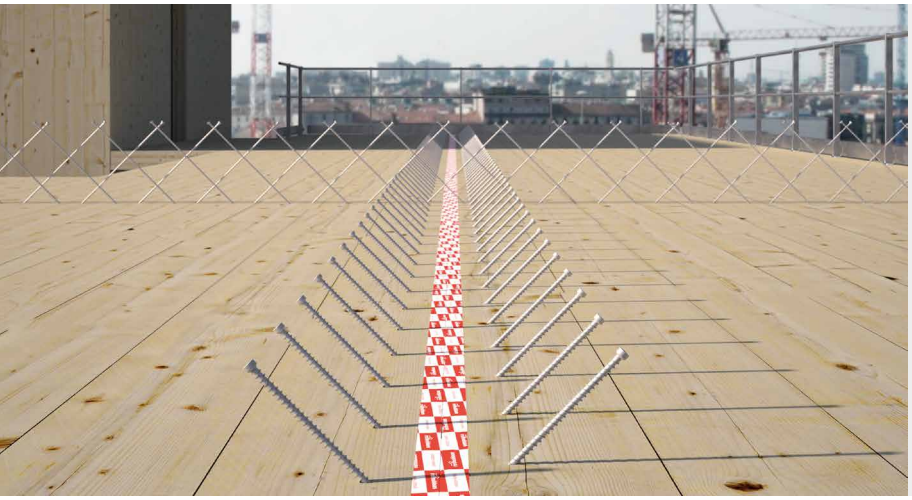
CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5,3 TX 25	VGZEVO580	80	70	50
	VGZEVO5100	100	90	50
	VGZEVO5120	120	110	50
5,6 TX 25	VGZEVO5140	140	130	50
	VGZEVO5150	150	140	50
	VGZEVO5160	160	150	50
7 TX 30	VGZEVO780	80	70	25
	VGZEVO7100	100	90	25
	VGZEVO7120	120	110	25
	VGZEVO7140	140	130	25
	VGZEVO7160	160	150	25
	VGZEVO7180	180	170	25
	VGZEVO7200	200	190	25
	VGZEVO7220	220	210	25
	VGZEVO7240	240	230	25
	VGZEVO7260	260	250	25
	VGZEVO7280	280	270	25
	VGZEVO7300	300	290	25
	VGZEVO7340	340	330	25
	VGZEVO7380	380	370	25
9 TX 40	VGZEVO9160	160	150	25
	VGZEVO9180	180	170	25
	VGZEVO9200	200	190	25
	VGZEVO9220	220	210	25
	VGZEVO9240	240	230	25
	VGZEVO9260	260	250	25
	VGZEVO9280	280	270	25
	VGZEVO9300	300	290	25
	VGZEVO9320	320	310	25
	VGZEVO9340	340	330	25
	VGZEVO9360	360	350	25
	VGZEVO9380	380	370	25
	VGZEVO9400	400	390	25
	VGZEVO9440	440	430	25
	VGZEVO9480	480	470	25
	VGZEVO9520	520	510	25

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
11 TX 50	VGZEVO11250	250	240	25
	VGZEVO11300	300	290	25
	VGZEVO11350	350	340	25
	VGZEVO11400	400	390	25
	VGZEVO11450	450	440	25
	VGZEVO11500	500	490	25
	VGZEVO11550	550	540	25
	VGZEVO11600	600	590	25

RELATED PRODUCTS

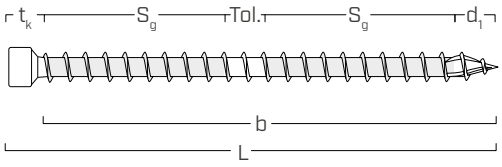
JIG VGZ 45°
TEMPLATE FOR 45° SCREWS



OUTDOOR STRUCTURAL PERFORMANCE

Values also tested, certified and calculated for CLT and high density woods such as Microllam® LVL. Ideal for fastening timber-framed panels and lattice beams (Rafter, Truss).

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

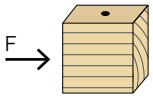
t_K = 10 mm or 20 mm depending on screw length.

NOTES

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

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

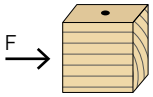
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**12·d‡**	64	*2 1/2*	68	*2 11/16*	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
S_Q	**5·d**	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
a_L	**15·d‡**	80	*3 1/8*	84	*3 5/16*	105	*4 1/8*	135	*5 5/16*	165	*6 1/2*
a	**10·d‡**	53	*2 1/16*	56	*2 3/16*	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
e_Q	**10·d**	53	*2 1/16*	56	*2 3/16*	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
e_P	**5·d**	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*

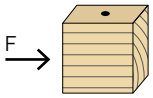
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

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



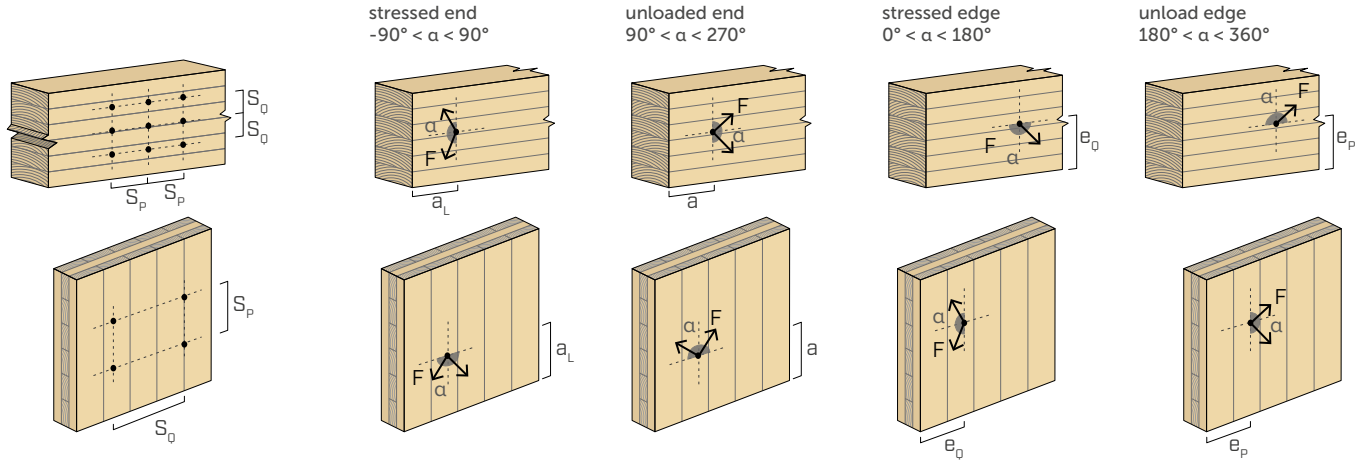
d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**18·d**	96	*3 3/4*	101	*4*	126	*4 15/16*	162	*6 3/8*	198	*7 13/16*
S_Q	**7·d**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
a_L	**22·d**	117	*4 5/8*	124	*4 7/8*	154	*6 1/16*	198	*7 13/16*	242	*9 1/2*
a	**15·d**	80	*3 1/8*	84	*3 5/16*	105	*4 1/8*	135	*5 5/16*	165	*6 1/2*
e_Q	**12·d**	64	*2 1/2*	68	*2 11/16*	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
e_P	**7·d**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*

screws inserted **WITH pre-drilled hole**



d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**5·d†**	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
S_Q	**4·d**	22	*7/8*	23	*7/8*	28	*1 1/8*	36	*1 7/16*	44	*1 3/4*
a_L	**12·d†**	64	*2 1/2*	68	*2 11/16*	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
a	**7·d†**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
e_Q	**7·d**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
e_P	**3·d**	16	*5/8*	17	*11/16*	21	*13/16*	27	*1 1/16*	33	*1 5/16*

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

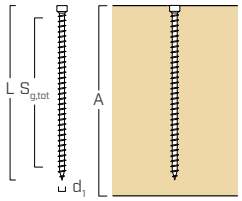
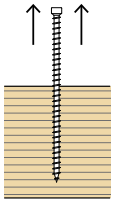
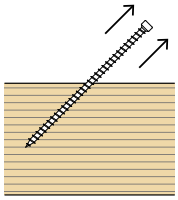
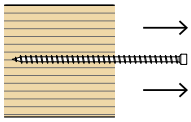


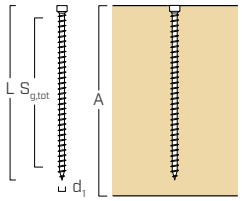
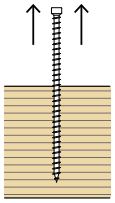
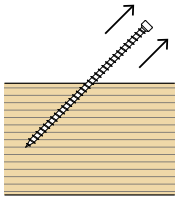
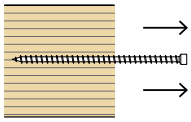
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, 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 O86:24.

TENSION/COMPRESSION[1]

total thread withdrawal

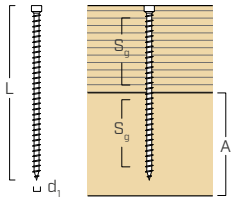
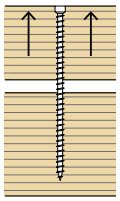
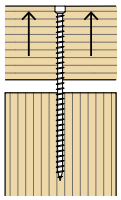
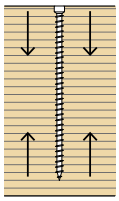
geometry					α = 90°				α = 45°				end grain α = 0°			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	65	90	2,52	2,92	3,30	3,62	2,29	2,65	3,00	3,29	1,26	1,46	1,65	1,81
	100	*4*	85	110	3,30	3,82	4,32	4,73	3,00	3,47	3,92	4,30	1,65	1,91	2,16	2,37
	120	*4 3/4*	105	130	4,07	4,71	5,33	5,85	3,70	4,29	4,85	5,32	2,04	2,36	2,67	2,92
5.6 *0.23*	140	*5 1/2*	125	150	5,12	5,93	6,70	7,36	4,66	5,39	6,09	6,69	2,56	2,96	3,35	3,68
	150	*6*	135	160	5,53	6,40	7,23	7,94	5,03	5,82	6,58	7,22	2,77	3,20	3,62	3,97
	160	*6 1/4*	145	170	5,94	6,88	7,77	8,53	5,40	6,25	7,06	7,76	2,97	3,44	3,89	4,27
7 *0.28*	80	*3 1/8*	63	90	2,69	3,12	3,53	3,87	2,45	2,83	3,21	3,52	1,35	1,56	1,76	1,93
	100	*4*	83	110	3,55	4,11	4,65	5,10	3,23	3,73	4,22	4,63	1,77	2,05	2,32	2,55
	120	*4 3/4*	103	130	4,41	5,10	5,77	6,32	4,00	4,63	5,24	5,75	2,20	2,55	2,88	3,16
	140	*5 1/2*	123	150	5,26	6,09	6,89	7,55	4,78	5,53	6,26	6,87	2,63	3,04	3,44	3,78
	160	*6 1/4*	143	170	6,12	7,08	8,01	8,78	5,56	6,43	7,28	7,98	3,06	3,54	4,00	4,39
	180	*7 1/8*	163	190	6,97	8,07	9,13	10,01	6,34	7,33	8,30	9,10	3,49	4,03	4,56	5,00
	200	*8*	183	210	7,83	9,06	10,25	11,24	7,12	8,23	9,31	10,22	3,91	4,53	5,12	5,62
	220	*8 5/8*	203	230	8,68	10,05	11,37	12,47	7,89	9,13	10,33	11,33	4,34	5,02	5,68	6,23
	240	*9 1/2*	223	250	9,54	11,04	12,48	13,69	8,67	10,03	11,35	12,45	4,77	5,52	6,24	6,85
	260	*10 1/4*	243	270	10,39	12,03	13,60	14,92	9,45	10,93	12,37	13,56	5,20	6,01	6,80	7,46
	280	*11*	263	290	11,25	13,02	14,72	16,15	10,23	11,83	13,39	14,68	5,62	6,51	7,36	8,07
	300	*11 3/4*	283	310	12,10	14,01	15,84	17,38	11,00	12,73	14,40	15,80	6,05	7,00	7,92	8,69
	340	*13 3/8*	323	350	13,81	15,99	18,08	19,83	12,56	14,53	16,44	18,03	6,91	7,99	9,04	9,92
	380	*15*	363	390	15,53	17,96	20,32	22,29	14,11	16,33	18,48	20,26	7,76	8,98	10,16	11,14
9 *0.36*	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

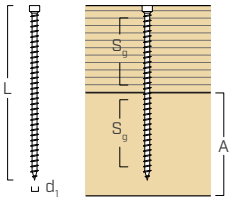
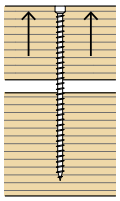
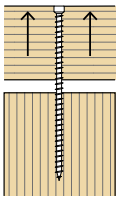
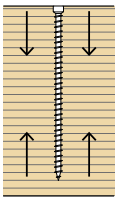
geometry					TENSION/COMPRESSION[1] total thread withdrawal											
					α = 90°				α = 45°				end grain α = 0°			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
d_1	L		$S_{g,tot}$	A_{min}	G				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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	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
	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
	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
11	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
0.44	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
	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
	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
	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

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 26.

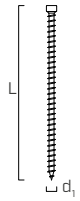
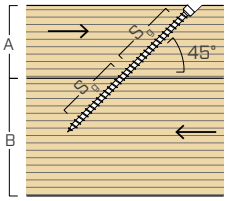
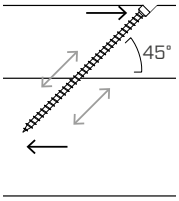
TENSION/COMPRESSION[1]

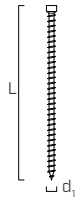
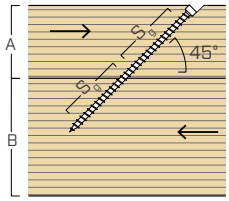
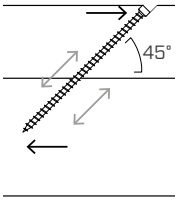
geometry				partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
				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]
5.3 *0.21*	80	*3 1/8*	25	0,97	1,12	1,27	1,39	0,49	0,56	0,63	0,70	7,49	5,82
	100	*4*	35	1,36	1,57	1,78	1,95	0,68	0,79	0,89	0,97		
	120	*4 3/4*	45	1,75	2,02	2,29	2,51	0,87	1,01	1,14	1,25		
5.6 *0.23*	140	*5 1/2*	55	2,25	2,61	2,95	3,24	1,13	1,30	1,47	1,62	8,08	6,48
	150	*6*	60	2,46	2,85	3,22	3,53	1,23	1,42	1,61	1,77		
	160	*6 1/4*	65	2,66	3,08	3,48	3,83	1,33	1,54	1,74	1,91		
7 *0.28*	80	*3 1/8*	25	1,07	1,24	1,40	1,54	0,53	0,62	0,70	0,77	10,64	10,34
	100	*4*	35	1,50	1,73	1,96	2,15	0,75	0,87	0,98	1,07		
	120	*4 3/4*	45	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38		
	140	*5 1/2*	55	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69		
	160	*6 1/4*	65	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00		
	180	*7 1/8*	75	3,21	3,71	4,20	4,61	1,60	1,86	2,10	2,30		
	200	*8*	85	3,64	4,21	4,76	5,22	1,82	2,10	2,38	2,61		
	220	*8 5/8*	95	4,06	4,70	5,32	5,83	2,03	2,35	2,66	2,92		
	240	*9 1/2*	105	4,49	5,20	5,88	6,45	2,25	2,60	2,94	3,22		
	260	*10 1/4*	115	4,92	5,69	6,44	7,06	2,46	2,85	3,22	3,53		
	280	*11*	125	5,35	6,19	7,00	7,68	2,67	3,09	3,50	3,84		
	300	*11 3/4*	135	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14		
	340	*13 3/8*	155	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76		
	380	*15*	175	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37		
9 *0.36*	160	*6 1/4*	65	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57	17,84	16,37
	180	*7 1/8*	75	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96		
	200	*8*	85	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	220	*8 5/8*	95	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75		
	240	*9 1/2*	105	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	260	*10 1/4*	115	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54		
	280	*11*	125	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	300	*11 3/4*	135	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33		
	320	*12 5/8*	145	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	340	*13 3/8*	155	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12		
	360	*14 1/4*	165	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
	380	*15*	175	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91		
	400	*15 3/4*	185	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30		
	440	*17 1/4*	205	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09		
	480	*19*	225	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88		
	520	*20 1/2*	245	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67		

geometry					TENSION/COMPRESSION[1]									
					partial thread withdrawal								steel tension	buckling
					α = 90°				end grain α = 0°					α = 90°
														
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1	L		S_g	A_{min}	G				G					
					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]
	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
11	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93	23,17	19,66
0.44	450	*17 3/4*	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14		
	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	550	*21 5/8*	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55		
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		

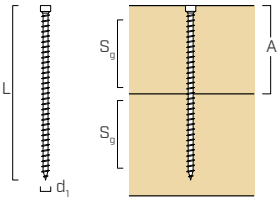
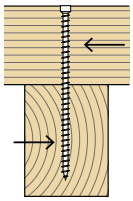
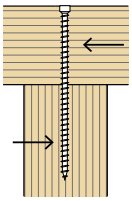
α = screw-to-grain angle

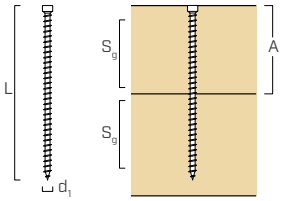
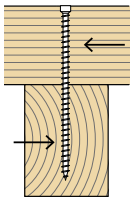
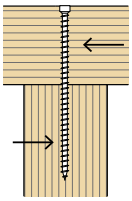
NOTES and GENERAL PRINCIPLES on page 26.

geometry			SLIDING[4]							steel tension
			timber-to-timber							
										
						factored lateral resistance N_r[5]				factored tension resistance T_{rs}
						G				
d_1	L		S_g	A	B_{min}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	35	50	0,75	0,87	0,98	1,07	5,30
	100	*4*	35	40	55	1,05	1,21	1,37	1,50	
	120	*4 3/4*	45	45	60	1,35	1,56	1,76	1,93	
5.6 *0.23*	140	*5 1/2*	55	55	70	1,74	2,01	2,27	2,50	5,71
	150	*6*	60	60	75	1,90	2,20	2,48	2,72	
	160	*6 1/4*	65	60	75	2,06	2,38	2,69	2,95	
7 *0.28*	80	*3 1/8*	25	35	50	0,82	0,95	1,08	1,18	7,52
	100	*4*	35	40	55	1,15	1,34	1,51	1,66	
	120	*4 3/4*	45	45	60	1,48	1,72	1,94	2,13	
	140	*5 1/2*	55	55	70	1,81	2,10	2,38	2,61	
	160	*6 1/4*	65	60	75	2,14	2,48	2,81	3,08	
	180	*7 1/8*	75	70	85	2,47	2,86	3,24	3,55	
	200	*8*	85	75	90	2,80	3,24	3,67	4,03	
	220	*8 5/8*	95	85	100	3,13	3,63	4,10	4,50	
	240	*9 1/2*	105	90	105	3,46	4,01	4,53	4,97	
	260	*10 1/4*	115	95	110	3,79	4,39	4,97	5,45	
	280	*11*	125	105	120	4,12	4,77	5,40	5,92	
	300	*11 3/4*	135	110	125	4,45	5,15	5,83	6,39	
	340	*13 3/8*	155	125	140	5,11	5,92	6,69	7,34	
	380	*15*	175	140	155	5,77	6,68	7,56	8,29	
9 *0.36*	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96	12,61
	180	*7 1/8*	75	70	85	3,18	3,68	4,16	4,57	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18	
	220	*8 5/8*	95	85	100	4,03	4,66	5,27	5,79	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40	
	260	*10 1/4*	115	95	110	4,88	5,64	6,38	7,00	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61	
	300	*11 3/4*	135	110	125	5,73	6,63	7,49	8,22	
	320	*12 5/8*	145	120	135	6,15	7,12	8,05	8,83	
	340	*13 3/8*	155	125	140	6,58	7,61	8,60	9,44	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05	
	380	*15*	175	140	155	7,42	8,59	9,71	10,66	
	400	*15 3/4*	185	145	160	7,85	9,08	10,27	11,27	
	440	*17 1/4*	205	160	175	8,70	10,06	11,38	12,49	
	480	*19*	225	175	190	9,54	11,04	12,49	13,70	
	520	*20 1/2*	245	190	205	10,39	12,03	13,60	14,92	

SLIDING[4]									
geometry			timber-to-timber						steel tension
									
						factored lateral resistance N_r[5]			factored tension resistance T_{rs}
d_1	L		S_g	A	B_{min}	G			
						0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	95	110	5,70	6,60	7,47	8,19	16,38
	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78	
	450	*17 3/4*	210	165	180	10,89	12,60	14,25	15,64	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50	
	550	*21 5/8*	260	200	215	13,48	15,60	17,65	19,36	
	600	*23 5/8*	285	215	230	14,78	17,10	19,34	21,22	

NOTES and GENERAL PRINCIPLES on page 26.

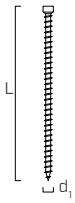
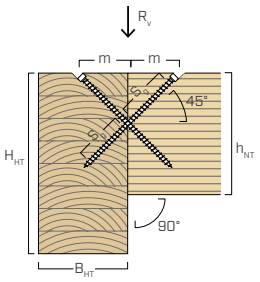
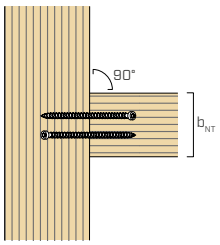
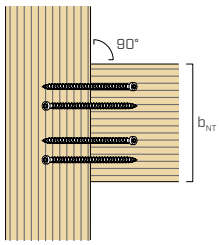
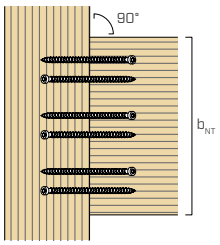
geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
d_1	L		S_g	A[7]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	40	0,96	1,11	1,21	1,30	0,57	0,65	0,73	0,79
	100	*4*	35	50	1,10	1,22	1,34	1,44	0,66	0,75	0,84	0,92
	120	*4 3/4*	45	60	1,19	1,33	1,47	1,57	0,74	0,85	0,96	1,04
5.6 *0.23*	140	*5 1/2*	55	70	1,40	1,57	1,73	1,86	0,88	1,01	1,14	1,23
	150	*6*	60	75	1,45	1,63	1,79	1,93	0,93	1,06	1,18	1,27
	160	*6 1/4*	65	80	1,50	1,69	1,86	2,00	0,97	1,10	1,21	1,30
7 *0.28*	80	*3 1/8*	25	40	1,14	1,36	1,57	1,76	0,76	0,90	1,00	1,08
	100	*4*	35	50	1,47	1,74	1,98	2,11	0,90	1,02	1,13	1,23
	120	*4 3/4*	45	60	1,74	1,93	2,12	2,26	0,99	1,13	1,26	1,38
	140	*5 1/2*	55	70	1,84	2,06	2,26	2,42	1,09	1,25	1,40	1,52
	160	*6 1/4*	65	80	1,95	2,18	2,40	2,57	1,19	1,36	1,53	1,67
	180	*7 1/8*	75	90	2,06	2,30	2,54	2,73	1,29	1,47	1,66	1,79
	200	*8*	85	100	2,16	2,43	2,68	2,88	1,38	1,58	1,74	1,87
	220	*8 5/8*	95	110	2,27	2,55	2,82	3,03	1,47	1,65	1,81	1,94
	240	*9 1/2*	105	120	2,38	2,67	2,96	3,15	1,53	1,71	1,88	2,02
	260	*10 1/4*	115	130	2,49	2,75	2,97	3,15	1,58	1,77	1,95	2,10
	280	*11*	125	140	2,51	2,75	2,97	3,15	1,63	1,83	2,02	2,17
	300	*11 3/4*	135	150	2,51	2,75	2,97	3,15	1,69	1,89	2,09	2,25
	340	*13 3/8*	155	170	2,51	2,75	2,97	3,15	1,79	2,02	2,23	2,38
	380	*15*	175	190	2,51	2,75	2,97	3,15	1,90	2,08	2,25	2,38
9 *0.36*	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

geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
d_1	L		S_g	A[7]	G				G			
					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*	250	*10*	110	125	4,26	4,78	5,27	5,68	2,58	2,97	3,34	3,62
	300	*11 3/4*	135	150	4,68	5,27	5,75	6,09	2,94	3,31	3,65	3,92
	350	*13 3/4*	160	175	4,86	5,32	5,75	6,09	3,17	3,56	3,92	4,22
	400	*15 3/4*	185	200	4,86	5,32	5,75	6,09	3,38	3,80	4,20	4,52
	450	*17 3/4*	210	225	4,86	5,32	5,75	6,09	3,59	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
	550	*21 5/8*	260	275	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

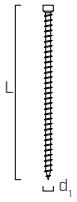
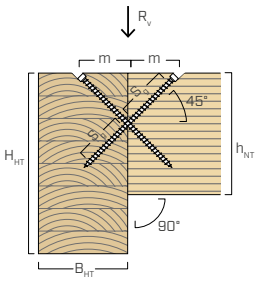
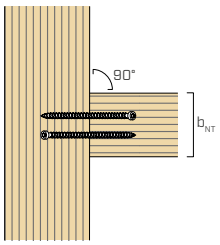
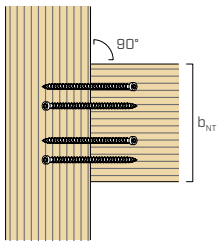
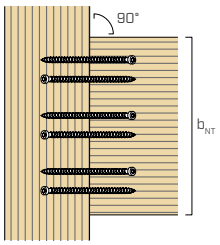
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 26.

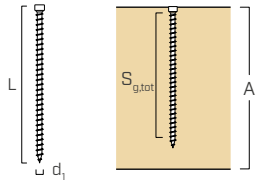
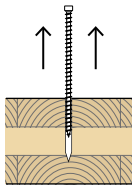
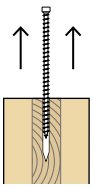
MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION[8]

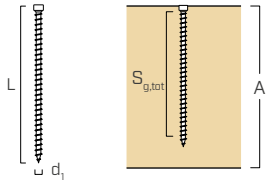
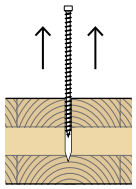
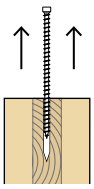
geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d_1	L		$B_{HT,min}$	$H_{HT,min}$ $h_{NT,min}$	S_g	m	$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G	
								0.42	0.49		0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	45	70	25	31	53	1,73	1,96	80	3,46	3,92	106	5,19	5,88
	100	*4*	55	85	35	38		2,42	2,74		4,85	5,48		7,27	8,23
	120	*4 3/4*	60	100	45	45		3,12	3,53		6,23	7,05		9,35	10,58
5.6 *0.23*	140	*5 1/2*	70	115	55	53	56	4,02	4,55	84	8,05	9,09	112	12,07	13,64
	150	*6*	70	120	60	56		4,39	4,96		8,78	9,92		13,17	14,88
	160	*6 1/4*	75	130	65	60		4,76	5,37		9,51	10,75		14,27	16,12
7 *0.28*	80	*3 1/8*	45	70	25	31	70	1,91	2,16	105	3,82	4,32	140	5,73	6,48
	100	*4*	55	85	35	38		2,67	3,02		5,34	6,05		8,02	9,07
	120	*4 3/4*	60	100	45	45		3,44	3,89		6,87	7,77		10,31	11,66
	140	*5 1/2*	70	115	55	53		4,20	4,75		8,40	9,50		12,60	14,25
	160	*6 1/4*	75	130	65	60		4,96	5,61		9,93	11,23		14,89	16,84
	180	*7 1/8*	80	140	75	67		5,73	6,48		11,45	12,96		17,18	19,43
	200	*8*	90	155	85	74		6,49	7,34		12,98	14,68		19,47	22,03
	220	*8 5/8*	95	170	95	81		7,25	8,21		14,51	16,41		21,76	24,62
	240	*9 1/2*	105	185	105	88		8,02	9,07		16,03	18,14		24,05	27,21
	260	*10 1/4*	110	200	115	95		8,78	9,93		17,56	19,87		26,34	29,80
	280	*11*	120	215	125	102		9,54	10,80		19,09	21,59		28,63	32,39
	300	*11 3/4*	125	225	135	109		10,31	11,66		20,62	23,32		30,92	34,98
	340	*13 3/8*	140	255	155	123		11,83	13,39		23,67	26,78		35,50	40,16
	380	*15*	155	285	175	137		13,36	13,58		26,72	27,16		40,08	40,73
9 *0.36*	160	*6 1/4*	75	130	65	60	90	6,38	7,22	135	12,76	14,43	180	19,14	21,65
	180	*7 1/8*	80	140	75	67		7,36	8,33		14,73	16,65		22,09	24,98
	200	*8*	90	155	85	74		8,34	9,44		16,69	18,87		25,03	28,31
	220	*8 5/8*	95	170	95	81		9,33	10,55		18,65	21,09		27,98	31,64
	240	*9 1/2*	105	185	105	88		10,31	11,66		20,62	23,31		30,92	34,97
	260	*10 1/4*	110	200	115	95		11,29	12,77		22,58	25,53		33,87	38,30
	280	*11*	120	215	125	102		12,27	13,88		24,54	27,75		36,81	41,63
	300	*11 3/4*	125	225	135	109		13,25	14,99		26,51	29,97		39,76	44,96
	320	*12 5/8*	130	240	145	116		14,23	16,10		28,47	32,20		42,70	48,29
	340	*13 3/8*	140	255	155	123		15,22	17,21		30,43	34,42		45,65	51,62
	360	*14 1/4*	145	270	165	130		16,20	18,32		32,40	36,64		48,59	54,95
	380	*15*	155	285	175	137		17,18	19,43		34,36	38,86		51,54	58,28
	400	*15 3/4*	160	300	185	144		18,16	20,54		36,32	41,08		54,48	61,62
	440	*17 1/4*	175	325	205	159		20,12	21,49		40,25	42,99		60,37	64,48
	480	*19*	190	355	225	173		21,49	21,49		42,99	42,99		64,48	64,48
	520	*20 1/2*	200	385	245	187		21,49	21,49		42,99	42,99		64,48	64,48

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION[8]

geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d_1	L		$B_{HT,min}$	$H_{HT,min}$ $h_{NT,min}$	S_g	m	$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[mm]	[mm]	0.42 [kN]	0.49 [kN]	[mm]	0.42 [kN]	0.49 [kN]	[mm]	0.42 [kN]	0.49 [kN]
11 *0.44*	250	*10*	105	190	110	91	110	13,20	14,93	165	26,40	29,86	220	39,59	44,80
	300	*11 3/4*	125	225	135	109		16,20	18,33		32,40	36,65		48,59	54,98
	350	*13 3/4*	140	260	160	127		19,20	21,72		38,39	43,44		57,59	65,16
	400	*15 3/4*	160	300	185	144		22,20	25,11		44,39	50,23		66,59	75,34
	450	*17 3/4*	180	335	210	162		25,20	25,81		50,39	51,63		75,59	77,44
	500	*19 3/4*	195	370	235	180		25,81	25,81		51,63	51,63		77,44	77,44
	550	*21 5/8*	215	405	260	197		25,81	25,81		51,63	51,63		77,44	77,44
	600	*23 5/8*	230	440	285	215		25,81	25,81		51,63	51,63		77,44	77,44

NOTES and GENERAL PRINCIPLES on page 26.

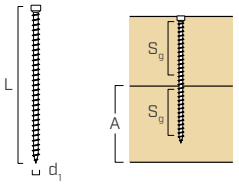
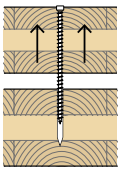
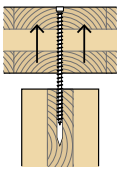
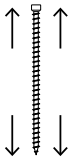
geometry					TENSION[1]							
					total thread withdrawal							
					lateral α=90°				narrow α=0°			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	65	90	2,52	2,92	3,30	3,62	1,26	1,46	1,65	1,81
	100	*4*	85	110	3,30	3,82	4,32	4,73	1,65	1,91	2,16	2,37
	120	*4 3/4*	105	130	4,07	4,71	5,33	5,85	2,04	2,36	2,67	2,92
5.6 *0.23*	140	*5 1/2*	124	150	5,12	5,93	6,70	7,36	2,56	2,96	3,35	3,68
	150	*6*	134	160	5,53	6,40	7,23	7,94	2,77	3,20	3,62	3,97
	160	*6 1/4*	144	170	5,94	6,88	7,77	8,53	2,97	3,44	3,89	4,27
7 *0.28*	80	*3 1/8*	63	90	2,69	3,12	3,53	3,87	1,35	1,56	1,76	1,93
	100	*4*	83	110	3,55	4,11	4,65	5,10	1,77	2,05	2,32	2,55
	120	*4 3/4*	103	130	4,41	5,10	5,77	6,32	2,20	2,55	2,88	3,16
	140	*5 1/2*	123	150	5,26	6,09	6,89	7,55	2,63	3,04	3,44	3,78
	160	*6 1/4*	143	170	6,12	7,08	8,01	8,78	3,06	3,54	4,00	4,39
	180	*7 1/8*	163	190	6,97	8,07	9,13	10,01	3,49	4,03	4,56	5,00
	200	*8*	183	210	7,83	9,06	10,25	11,24	3,91	4,53	5,12	5,62
	220	*8 5/8*	203	230	8,68	10,05	11,37	12,47	4,34	5,02	5,68	6,23
	240	*9 1/2*	223	250	9,54	11,04	12,48	13,69	4,77	5,52	6,24	6,85
	260	*10 1/4*	243	270	10,39	12,03	13,60	14,92	5,20	6,01	6,80	7,46
	280	*11*	263	290	11,25	13,02	14,72	16,15	5,62	6,51	7,36	8,07
	300	*11 3/4*	283	310	12,10	14,01	15,84	17,38	6,05	7,00	7,92	8,69
	340	*13 3/8*	323	350	13,81	15,99	18,08	19,83	6,91	7,99	9,04	9,92
	380	*15*	363	390	15,53	17,96	20,32	22,29	7,76	8,98	10,16	11,14
9 *0.36*	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	7,18	8,30	9,39	10,30
	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	7,73	8,94	10,11	11,09
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	13,78	15,94	18,03	19,78

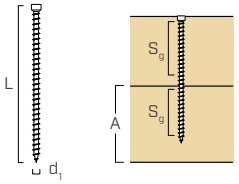
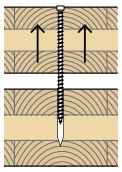
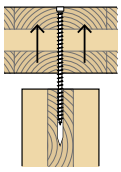
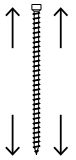
geometry					TENSION[1]							
					total thread withdrawal							
					lateral α=90°				narrow α=0°			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	229	260	15,39	17,81	20,15	22,11	7,70	8,90	10,07	11,05
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	9,38	10,85	12,27	13,47
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	11,06	12,79	14,47	15,88
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	12,74	14,74	16,67	18,29
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	14,42	16,68	18,87	20,71
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	16,10	18,63	21,07	23,12
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	17,78	20,57	23,27	25,53
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	19,46	22,51	25,47	27,95

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 26.

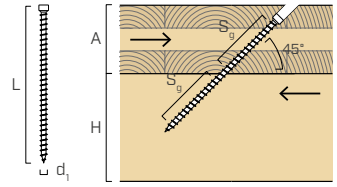
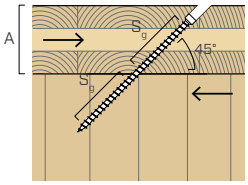
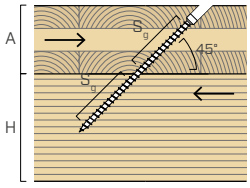
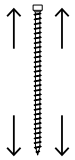
TENSION[1]

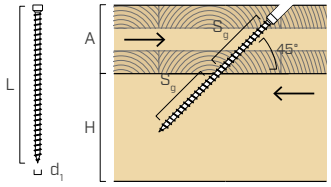
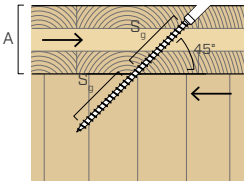
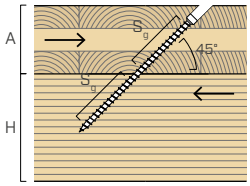
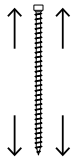
geometry					partial thread withdrawal								steel tension
					lateral α=90°				narrow α=0°				
													
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
					G				G				
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	45	0,97	1,12	1,27	1,39	0,49	0,56	0,63	0,70	7,49
	100	*4*	35	55	1,36	1,57	1,78	1,95	0,68	0,79	0,89	0,97	
	120	*4 3/4*	45	65	1,75	2,02	2,29	2,51	0,87	1,01	1,14	1,25	
5.6 *0.23*	140	*5 1/2*	55	75	2,25	2,61	2,95	3,24	1,13	1,30	1,47	1,62	8,08
	150	*6*	60	80	2,46	2,85	3,22	3,53	1,23	1,42	1,61	1,77	
	160	*6 1/4*	65	85	2,66	3,08	3,48	3,83	1,33	1,54	1,74	1,91	
7 *0.28*	80	*3 1/8*	25	45	1,07	1,24	1,40	1,54	0,53	0,62	0,70	0,77	10,64
	100	*4*	35	55	1,50	1,73	1,96	2,15	0,75	0,87	0,98	1,07	
	120	*4 3/4*	45	65	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38	
	140	*5 1/2*	55	75	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69	
	160	*6 1/4*	65	85	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00	
	180	*7 1/8*	75	95	3,21	3,71	4,20	4,61	1,60	1,86	2,10	2,30	
	200	*8*	85	105	3,64	4,21	4,76	5,22	1,82	2,10	2,38	2,61	
	220	*8 5/8*	95	115	4,06	4,70	5,32	5,83	2,03	2,35	2,66	2,92	
	240	*9 1/2*	105	125	4,49	5,20	5,88	6,45	2,25	2,60	2,94	3,22	
	260	*10 1/4*	115	135	4,92	5,69	6,44	7,06	2,46	2,85	3,22	3,53	
	280	*11*	125	145	5,35	6,19	7,00	7,68	2,67	3,09	3,50	3,84	
	300	*11 3/4*	135	155	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14	
	340	*13 3/8*	155	175	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76	
	380	*15*	175	195	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37	
9 *0.36*	160	*6 1/4*	65	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57	17,84
	180	*7 1/8*	75	95	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96	
	200	*8*	85	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36	
	220	*8 5/8*	95	115	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75	
	240	*9 1/2*	105	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15	
	260	*10 1/4*	115	135	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54	
	280	*11*	125	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94	
	300	*11 3/4*	135	155	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33	
	320	*12 5/8*	145	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72	
	340	*13 3/8*	155	175	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12	
	360	*14 1/4*	165	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51	
	380	*15*	175	195	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91	
	400	*15 3/4*	185	205	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30	
	440	*17 1/4*	205	225	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09	
	480	*19*	225	245	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88	
	520	*20 1/2*	245	265	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67	

geometry					TENSION[1]								steel tension
					total thread withdrawal								
					lateral α=90°				narrow α=0°				
													
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
					G				G				
d_1	L		S_g	A_{min}	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]
11 *0.44*	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31	23,17
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52	
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72	
	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93	
	450	*17 3/4*	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14	
	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34	
	550	*21 5/8*	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55	
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76	

α = screw-to-grain angle

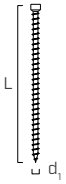
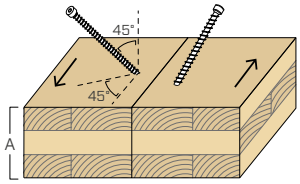
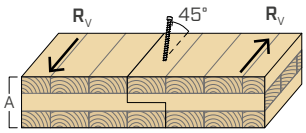
NOTES and GENERAL PRINCIPLES on page 26.

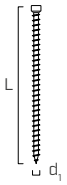
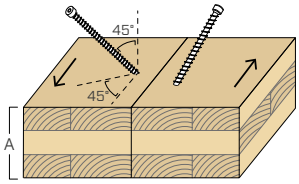
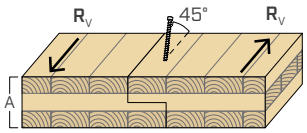
geometry					SLIDING[4]				
					CLT - CLT α=0°		CLT - timber α=45°		steel tension
									
					factored lateral resistance N_r[5]		factored lateral resistance N_r[5]		factored tension resistance T_{rs}
					G		G		
d_1	L		S_g	A	0.42	0.49	0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	35	0,48	0,54	0,87	0,98	5,30
	100	*4*	35	40	0,67	0,75	1,21	1,37	
	120	*4 3/4*	45	45	0,86	0,97	1,56	1,76	
5.6 *0.23*	140	*5 1/2*	55	55	1,11	1,25	2,01	2,27	5,71
	150	*6*	60	60	1,21	1,36	2,20	2,48	
	160	*6 1/4*	65	60	1,31	1,48	2,38	2,69	
7 *0.28*	80	*3 1/8*	25	35	0,52	0,59	0,95	1,08	7,52
	100	*4*	35	40	0,73	0,83	1,34	1,51	
	120	*4 3/4*	45	45	0,94	1,07	1,72	1,94	
	140	*5 1/2*	55	55	1,15	1,31	2,10	2,38	
	160	*6 1/4*	65	60	1,36	1,54	2,48	2,81	
	180	*7 1/8*	75	70	1,57	1,78	2,86	3,24	
	200	*8*	85	75	1,78	2,02	3,24	3,67	
	220	*8 5/8*	95	85	1,99	2,26	3,63	4,10	
	240	*9 1/2*	105	90	2,20	2,49	4,01	4,53	
	260	*10 1/4*	115	95	2,41	2,73	4,39	4,97	
	280	*11*	125	105	2,62	2,97	4,77	5,40	
	300	*11 3/4*	135	110	2,83	3,21	5,15	5,83	
	340	*13 3/8*	155	125	3,25	3,68	5,92	6,69	
	380	*15*	175	140	3,67	4,16	6,68	7,56	
9 *0.36*	160	*6 1/4*	65	60	1,75	1,98	3,19	3,61	12,61
	180	*7 1/8*	75	70	2,02	2,29	3,68	4,16	
	200	*8*	85	75	2,29	2,60	4,17	4,72	
	220	*8 5/8*	95	85	2,56	2,90	4,66	5,27	
	240	*9 1/2*	105	90	2,83	3,21	5,15	5,83	
	260	*10 1/4*	115	95	3,10	3,51	5,64	6,38	
	280	*11*	125	105	3,37	3,82	6,14	6,94	
	300	*11 3/4*	135	110	3,64	4,12	6,63	7,49	
	320	*12 5/8*	145	120	3,91	4,43	7,12	8,05	
	340	*13 3/8*	155	125	4,18	4,73	7,61	8,60	
	360	*14 1/4*	165	130	4,45	5,04	8,10	9,16	
	380	*15*	175	140	4,72	5,34	8,59	9,71	
	400	*15 3/4*	185	145	4,99	5,65	9,08	10,27	
	440	*17 1/4*	205	160	5,53	6,26	10,06	11,38	
	480	*19*	225	175	6,07	6,87	11,04	12,49	
	520	*20 1/2*	245	190	6,61	7,48	12,03	13,60	

geometry					SLIDING[4]				steel tension
					CLT - CLT α=0°		CLT - timber α=45°		
									
					factored lateral resistance N_r[5]		factored lateral resistance N_r[5]		factored tension resistance T_{rs}
					G		G		
d_1	L		S_g	A	0.42	0.49	0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	95	3,63	4,11	6,60	7,47	16,38
	300	*11 3/4*	135	110	4,45	5,04	8,10	9,16	
	350	*13 3/4*	160	130	5,28	5,97	9,60	10,86	
	400	*15 3/4*	185	145	6,10	6,91	11,10	12,56	
	450	*17 3/4*	210	165	6,93	7,84	12,60	14,25	
	500	*19 3/4*	235	180	7,75	8,77	14,10	15,95	
	550	*21 5/8*	260	200	8,58	9,71	15,60	17,65	
	600	*23 5/8*	285	215	9,40	10,64	17,10	19,34	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 26.

geometry					SLIDING[4]				
					butt joint (double inclination at 45° + 45°)[10]			half-lap joint α=45°	
									
					factored lateral resistance N_r[5]		factored tension resistance T_{rs}	factored lateral resistance N_r[5]	factored tension resistance T_{rs}
d_1	L		S_g	A	G			G	
					0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	65	0,69	0,79	3,75	0,87	0,98	5,30
	100	*4*	35	80	0,97	1,10		1,21	1,37	
	120	*4 3/4*	45	95	1,25	1,41		1,56	1,76	
5.6 *0.23*	140	*5 1/2*	55	110	1,61	1,82	4,04	2,01	2,27	5,71
	150	*6*	60	115	1,76	1,99		2,20	2,48	
	160	*6 1/4*	65	125	1,91	2,16		2,38	2,69	
7 *0.28*	80[3]	*3 1/8*	25	65	0,77	0,87	5,32	0,95	1,08	7,52
	100	*4*	35	80	1,07	1,21		1,34	1,51	
	120	*4 3/4*	45	95	1,38	1,56		1,72	1,94	
	140	*5 1/2*	55	110	1,69	1,91		2,10	2,38	
	160	*6 1/4*	65	125	1,99	2,25		2,48	2,81	
	180	*7 1/8*	75	135	2,30	2,60		2,86	3,24	
	200	*8*	85	150	2,60	2,95		3,24	3,67	
	220	*8 5/8*	95	165	2,91	3,29		3,63	4,10	
	240	*9 1/2*	105	180	3,22	3,64		4,01	4,53	
	260	*10 1/4*	115	195	3,52	3,99		4,39	4,97	
	280	*11*	125	210	3,83	4,33		4,77	5,40	
	300	*11 3/4*	135	220	4,14	4,68		5,15	5,83	
	320	*12 5/8*	145	235	4,44	5,03		5,54	6,26	
	340	*13 3/8*	155	250	4,75	5,37		5,92	6,69	
	380	*15*	175	280	5,36	6,07		6,68	7,56	
9 *0.36*	160	*6 1/4*	65	125	2,56	2,90	8,92	3,19	3,61	12,61
	180	*7 1/8*	75	135	2,95	3,34		3,68	4,16	
	200	*8*	85	150	3,35	3,79		4,17	4,72	
	220	*8 5/8*	95	165	3,74	4,23		4,66	5,27	
	240	*9 1/2*	105	180	4,14	4,68		5,15	5,83	
	260	*10 1/4*	115	195	4,53	5,12		5,64	6,38	
	280	*11*	125	210	4,92	5,57		6,14	6,94	
	300	*11 3/4*	135	220	5,32	6,01		6,63	7,49	
	320	*12 5/8*	145	235	5,71	6,46		7,12	8,05	
	340	*13 3/8*	155	250	6,11	6,90		7,61	8,60	
	360	*14 1/4*	165	265	6,50	7,35		8,10	9,16	
	380	*15*	175	280	6,89	7,80		8,59	9,71	
	400	*15 3/4*	185	295	7,29	8,24		9,08	10,27	
	440	*17 1/4*	205	320	8,07	9,13		10,06	11,38	
	480	*19*	225	350	8,86	10,02		11,04	12,49	
	520	*20 1/2*	245	380	9,65	10,91		12,03	13,60	

geometry					SLIDING[4]				
					butt joint (double inclination at 45° + 45°)(10)			half-lap joint α=45°	
									
					factored lateral resistance N_r(5)		factored tension resistance T_{rs}	factored lateral resistance N_r(5)	factored tension resistance T_{rs}
d_1	L		S_g	A	G			G	
					0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	185	5,30	5,99	11,59	6,60	7,47	16,38
	300	*11 3/4*	135	220	6,50	7,35		8,10	9,16	
	350	*13 3/4*	160	255	7,70	8,72		9,60	10,86	
	400	*15 3/4*	185	295	8,91	10,08		11,10	12,56	
	450	*17 3/4*	210	330	10,11	11,44		12,60	14,25	
	500	*19 3/4*	235	365	11,31	12,80		14,10	15,95	
	550	*21 5/8*	260	400	12,52	14,16		15,60	17,65	
	600	*23 5/8*	285	435	13,72	15,52		17,10	19,34	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 26.

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 O86:24 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 as per CSA O86:24 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, greater resistance values can be obtained.
- VGZ screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 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 O86:24 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 2B 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. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}) and the steel strength (T_{rs}). Similarly, the factored compression resistance of the connector (P_{rc}) is determined as the lower value between the withdrawal resistance (P_{rw}) and the buckling capacity (P_{rb}).

(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. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) VGZ screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) 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.

(5) 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.

(6) Lateral resistances are factored and according to CSA O86:24 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).

(8) The number of cross pairs, n_F, has been taken as 2.0 and 3.0 for configurations with two and three screw pairs, respectively, in accordance with CSA O86:24. However, when evaluating the effective number of screws in axially stressed connector pairs, Rothoblaas recommends using reduced values of 1.9 and 2.7 for two and three pairs, respectively. This recommendation accounts for the fact that the load-bearing capacity of a multi-screw connection—with screws of the same size and type—may be lower than the sum of the individual screw capacities, due to group effects and non-uniform load distribution within the connection. Discretion and engineering judgment must be exercised.

(9) The factored shear resistance of crossed screws is determined by taking the minimum between $2.P_{rt}.\cos(\beta)$ and $2.P_{rc}.\cos(\beta)$, where P_{rt} represents the factored axial resistance of screws loaded in tension, and P_{rc} represents the factored axial resistance of screws loaded in compression. This approach accounts for the directional component of the axial forces relative to the shear plane and ensures a conservative estimate by considering the weaker of the two axial load conditions.

(10) The sliding strengths of the connectors inserted with double inclination (45°-45°) were evaluated considering an α angle of 60° between the grain and the connector; in fact, the geometry of the joint requires that the connectors have to 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. The use of the JIG VGZ 45 template is recommended for professional installation of the connectors in this application.

INSTALLATION SUGGESTIONS

TIMBER-TO-TIMBER JOINT WITH CROSSED CONNECTORS

TIGHTENING THE JOINT

For correct installation of the joint, we recommend tightening the elements before inserting the connectors.

Insert a partially threaded screw (e.g. HBS680) to bring the elements closer together.

The HBS screw eliminated the initial gap between the elements.
After positioning the VGZ connectors, it can be removed.

INSERTION OF CONNECTORS

To ensure the correct positioning and inclination of the VGZ screws, we recommend using the JIGVGZ45 template.

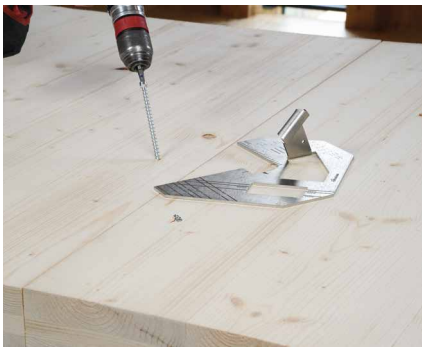
After tightening about one third of the screw, remove the JIGVGZ45 template and continue with the installation.

Repeat the procedure to install the inserted screw from the main beam to the secondary beam.

JOINT BETWEEN CLT PANELS WITH CONNECTORS INCLINED IN BOTH DIRECTIONS (45°-45°)

To ensure the correct positioning and inclination of the VGZ screws, we recommend using the JIGVGZ45 template positioned at 45° to the panel head.

After tightening about one third of the screw, remove the JIGVGZ45 template and continue with the installation.



Repeat the procedure to install the screw in the adjoining panel and continue this alternating sequence according to the distances provided in the design.

RELATED PRODUCTS

HBS

CATCH

BIT

JIG VGZ 45°