

FULL THREADED SCREW WITH CYLINDRICAL 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.

STRUCTURAL APPLICATIONS

Structural connector approved for timber applications subjected to stresses in any direction according to ICC ELC-4645 listing report in Canada. Cyclical SEISMIC-REV tests according to EN 12512.

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 to ensure strength in fire conditions.

TIMBER FRAME

Also ideal for joining small timber elements such as the crossbeams and uprights of light frame structures.



CANADIAN DESIGN VALUES

USA, EU and more design values available online.

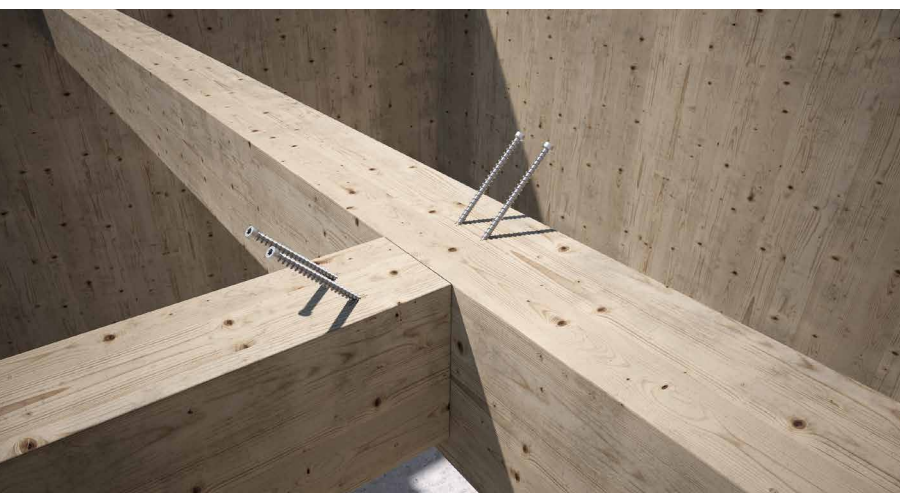
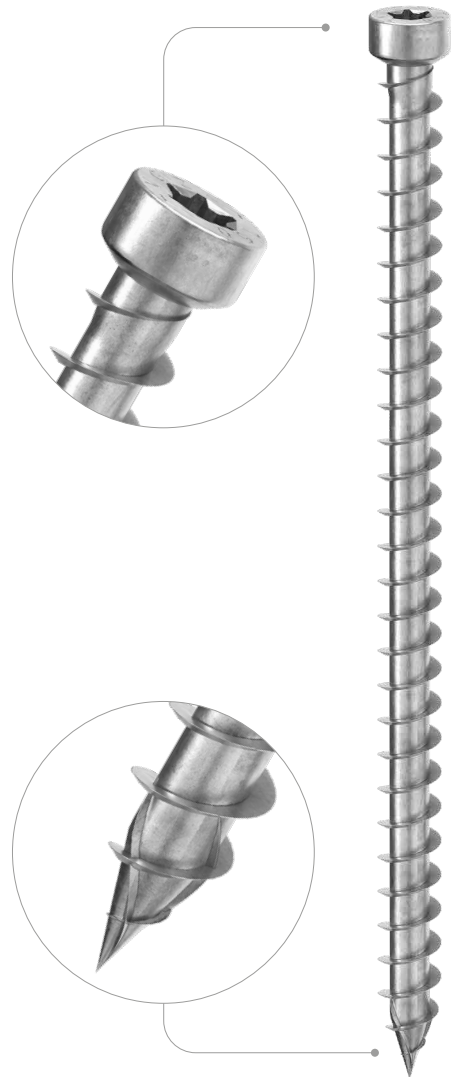


VIDEO



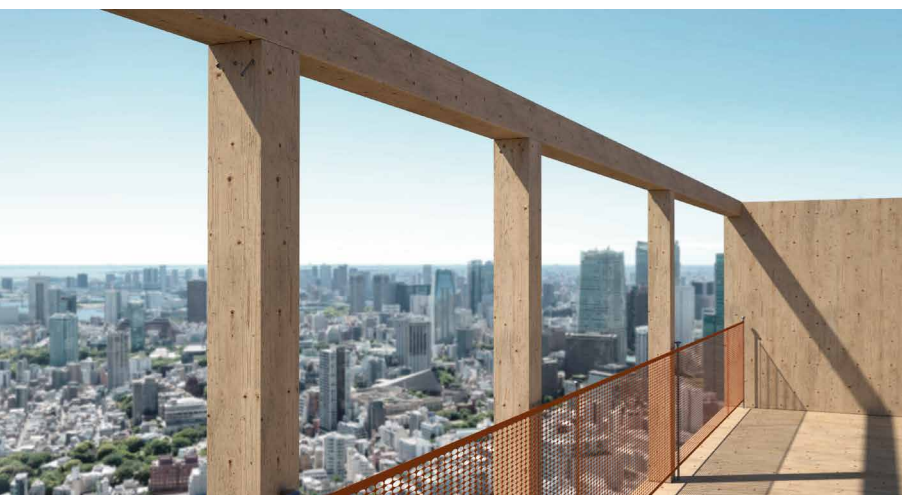
BIT INCLUDED

DIAMETER [mm]	5	☒ 7	☐ 11	11
LENGTH [mm]	80	☒ 80	☐ 1000	1000
SERVICE CONDITION	☒ EC1	☐ DRY		
ATMOSPHERIC CORROSIVITY	☒ C1	☐ C2		
WOOD CORROSIVITY	☒ T1	☐ T2		
MATERIAL	Zn ELECTRO PLATED electrogalvanized carbon steel			



FIELDS OF USE

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

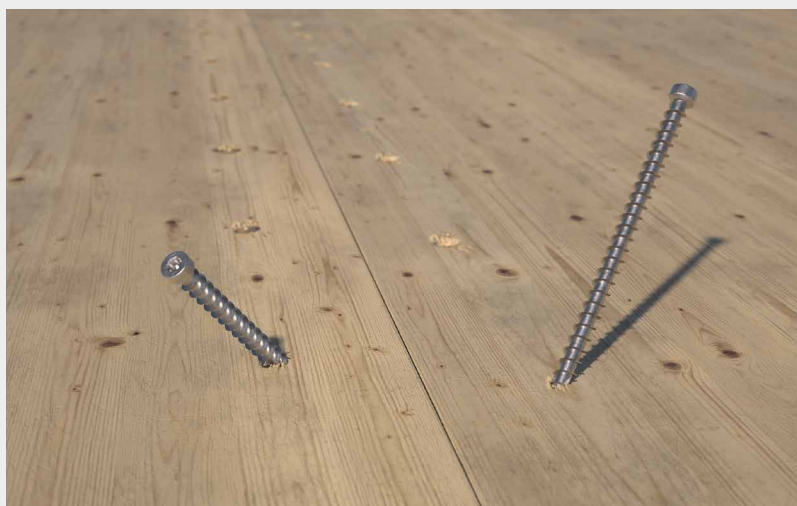


STRUCTURAL RESTORATION

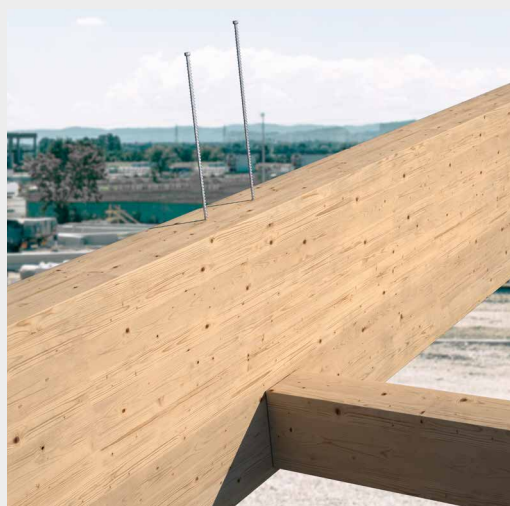
Ideal for coupling beams in structural renovations and new works. Can also be used parallel to the grain thanks to the special approval.

CLT, LVL

Values also tested, certified and calculated for CLT and high density woods such as LVL.

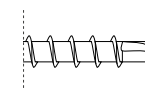
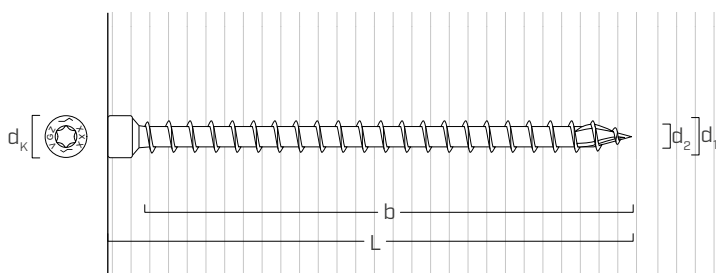


Very high stiffness in side-by-side joining of CLT floors.
Application with double inclination at 45°, perfect combined with the JIG VGZ template.



Reinforcement orthogonal to grain for hanging load due to joining of main-secondary beams.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Ø9 | L > 520 mm
Ø11 | L > 600 mm

GEOMETRY

Nominal diameter	d_1	[mm]	7	9	11
Head diameter	d_K	[mm]	9,50	11,50	13,50
Root diameter	d_2	[mm]	4,60	5,90	6,60
Pre-drilling hole diameter ⁽¹⁾	$d_{V,S}$	[mm]	4,0	5,0	6,0
Pre-drilling hole diameter ⁽²⁾	$d_{V,H}$	[mm]	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]	7	9	11	
Factored tensile strength	Φf _u	[kN]	10,64	17,84	23,17	
Bending yield strength	F _{yb}	[MPa]	1111	1069	1026	
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y _w	[N/mm]	G=0.35	61,1	78,56	96,02
			G=0.42	70,7	90,9	111,1
			G=0.49	79,98	102,8	125,7
			G=0.55	87,72	112,8	137,9

CODES AND DIMENSIONS

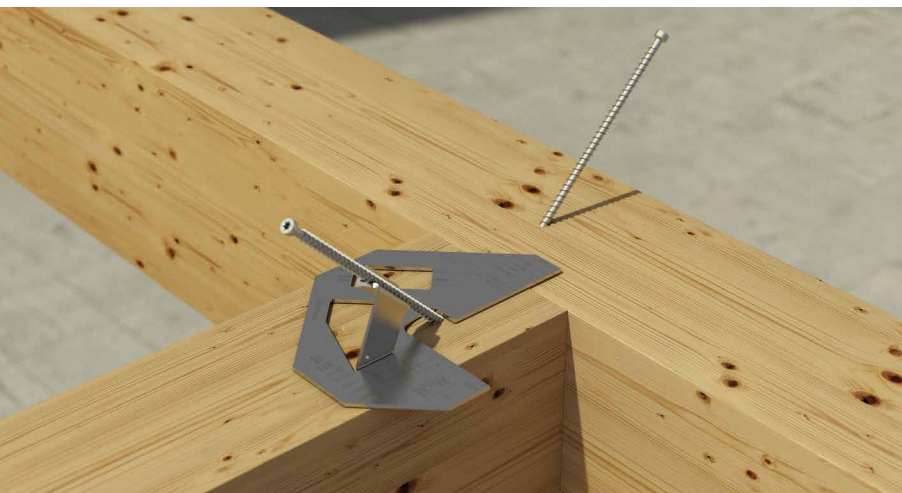
d ₁ [mm]	CODE	L [mm]	b [mm]	pcs
7 TX 30	VGZ780	80	70	25
	VGZ7100	100	90	25
	VGZ7120	120	110	25
	VGZ7140	140	130	25
	VGZ7160	160	150	25
	VGZ7180	180	170	25
	VGZ7200	200	190	25
	VGZ7220	220	210	25
	VGZ7240	240	230	25
	VGZ7260	260	250	25
	VGZ7280	280	270	25
	VGZ7300	300	290	25
	VGZ7320	320	310	25
	VGZ7340	340	330	25
	VGZ7360	360	350	25
	VGZ7380	380	370	25
	VGZ7400	400	390	25
	VGZ9160	160	150	25
	VGZ9180	180	170	25
	VGZ9200	200	190	25
9 TX 40	VGZ9220	220	210	25
	VGZ9240	240	230	25
	VGZ9260	260	250	25
	VGZ9280	280	270	25
	VGZ9300	300	290	25
	VGZ9320	320	310	25
	VGZ9340	340	330	25
	VGZ9360	360	350	25
	VGZ9380	380	370	25
	VGZ9400	400	390	25
	VGZ9440	440	430	25
	VGZ9480	480	470	25
	VGZ9520	520	510	25
	VGZ9560	560	550	25
	VGZ9600	600	590	25

d ₁ [mm]	CODE	L [mm]	b [mm]	pcs
11 TX 50	VGZ11150	150	140	25
	VGZ11200	200	190	25
	VGZ11250	250	240	25
	VGZ11275	275	265	25
	VGZ11300	300	290	25
	VGZ11325	325	315	25
	VGZ11350	350	340	25
	VGZ11375	375	365	25
	VGZ11400	400	390	25
	VGZ11425	425	415	25
	VGZ11450	450	440	25
	VGZ11475	475	465	25
	VGZ11500	500	490	25
	VGZ11525	525	515	25
	VGZ11550	550	540	25
	VGZ11575	575	565	25
	VGZ11600	600	590	25
	VGZ11650	650	630	25
	VGZ11700	700	680	25
	VGZ11750	750	730	25
	VGZ11800	800	780	25
	VGZ11850	850	830	25
	VGZ11900	900	880	25
	VGZ11950	950	930	25
	VGZ111000	1000	980	25

RELATED PRODUCTS



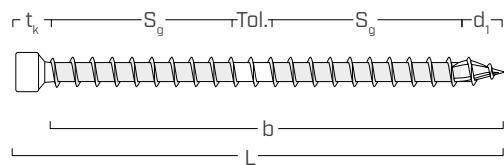
JIG VGZ 45°
TEMPLATE FOR 45° SCREWS



JIG VGZ 45° TEMPLATE

Installation at 45° using the JIG VGZ steel template.

EFFECTIVE THREAD USED IN CALCULATION



$$b = S_{g,tot} = L - t_k$$

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

$$S_g = (b - d_1 - Tol.)/2$$

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

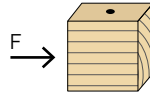
t_k = 10 mm or 20 mm depending on screw length.

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

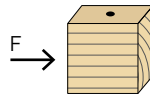
screws inserted **WITHOUT** pre-drilled hole $G \leq 0.44$



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

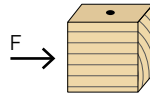
[‡] For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT** pre-drilled hole $0.44 < G \leq 0.50$



d_1		7 [mm]	0.28 [in]	9 [mm]	0.36 [in]	11 [mm]	0.44 [in]
S_P	18·d	126	4 15/16	162	6 3/8	198	7 13/16
S_Q	7·d	49	1 15/16	63	2 1/2	77	3 1/16
a_L	22·d	154	6 1/16	198	7 13/16	242	9 1/2
a	15·d	105	4 1/8	135	5 5/16	165	6 1/2
e_Q	12·d	84	3 5/16	108	4 1/4	132	5 3/16
e_P	7·d	49	1 15/16	63	2 1/2	77	3 1/16

screws inserted **WITH** pre-drilled hole

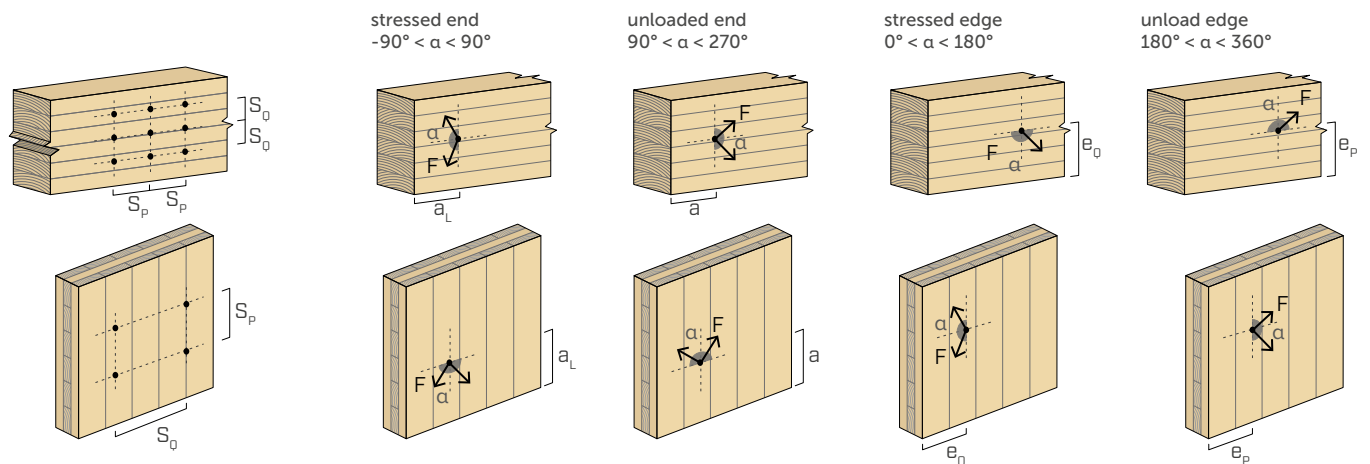


d_1		7 [mm]	0.28 [in]	9 [mm]	0.36 [in]	11 [mm]	0.44 [in]
S_P	5·d [†]	35	1 3/8	45	1 3/4	55	2 3/16
S_Q	4·d	28	1 1/8	36	1 7/16	44	1 3/4
a_L	12·d [†]	84	3 5/16	108	4 1/4	132	5 3/16
a	7·d [†]	49	1 15/16	63	2 1/2	77	3 1/16
e_Q	7·d	49	1 15/16	63	2 1/2	77	3 1/16
e_P	3·d	21	13/16	27	1 1/16	33	1 5/16

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

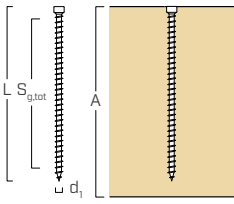
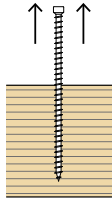
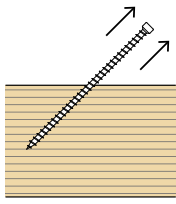
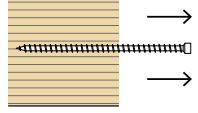
$d = d_1$ = nominal diameter of the screw

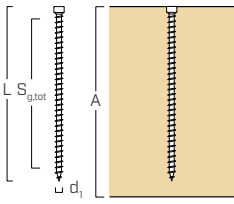
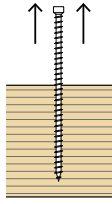
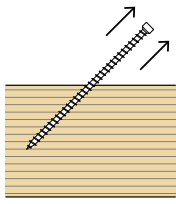
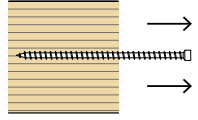
α = load-to-grain angle



NOTES

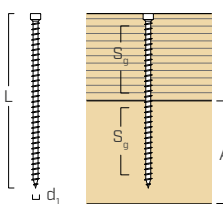
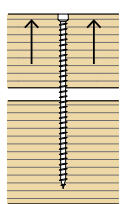
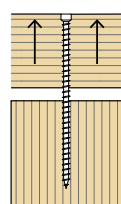
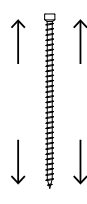
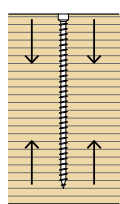
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

geometry					TENSION/COMPRESSION ⁽¹⁾											
					$\alpha = 90^\circ$				total thread withdrawal $\alpha = 45^\circ$				end grain $\alpha = 0^\circ$			
																
					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] [in]	[mm] [in]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
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
	320	12 5/8	303	330	12,96	15,00	16,96	18,61	11,78	13,63	15,42	16,91	6,48	7,50	8,48	9,30
	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
	360	14 1/4	343	370	14,67	16,98	19,20	21,06	13,34	15,43	17,46	19,15	7,34	8,49	9,60	10,53
	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	400	15 3/4	383	410	16,38	18,95	21,44	23,52	14,89	17,23	19,49	21,38	8,19	9,48	10,72	11,76
	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

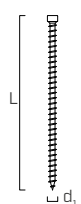
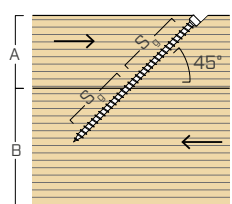
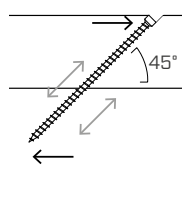
geometry					TENSION/COMPRESSION ⁽¹⁾											
					$\alpha = 90^\circ$				total thread withdrawal $\alpha = 45^\circ$				end grain $\alpha = 0^\circ$			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance $P_{rw}^{(2)(3)}$			
					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] [in]	[mm] [in]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 0.44	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
	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
	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
	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

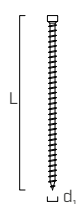
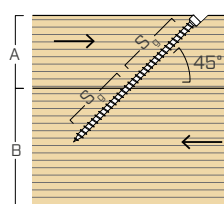
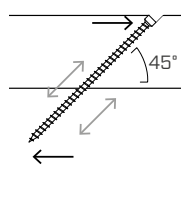
α = screw-to-grain angle

					TENSION/COMPRESSION ⁽¹⁾							
geometry					partial thread withdrawal $\alpha = 90^\circ$				end grain $\alpha = 0^\circ$			
					factored withdrawal resistance P_{rw}				factored withdrawal resistance $P_{rw}^{(2)(3)}$			
					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] [in]	[mm] [in]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
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
	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
	320	12 5/8	145	165	6,20	7,18	8,12	8,90	3,10	3,59	4,06	4,45
	340	13 3/8	155	175	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76
	360	14 1/4	165	185	7,06	8,17	9,24	10,13	3,53	4,08	4,62	5,07
	380	15	175	195	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37
	400	15 3/4	185	205	7,91	9,16	10,36	11,36	3,96	4,58	5,18	5,68
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
	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
	560	22	265	285	14,57	16,86	19,07	20,92	7,29	8,43	9,53	10,46
	600	23 5/8	285	305	15,67	18,13	20,51	22,50	7,84	9,07	10,25	11,25

					TENSION/COMPRESSION ^[1]									
geometry					partial thread withdrawal $\alpha = 90^\circ$				end grain $\alpha = 0^\circ$				steel tension	buckling $\alpha = 90^\circ$
														
					factored withdrawal resistance P_{rw}				factored withdrawal resistance $P_{rw}^{(2)(3)}$				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1 [mm] [in]	L		S_g [mm]	A_{min} [mm]	G				G				[kN]	[kN]
	[mm]	[in]			0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
11 0.44	150	6	60	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90	23,17	19,66
	200	8	85	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	250	10	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	275	10 7/8	120	143	8,07	9,33	10,56	11,58	4,03	4,67	5,28	5,79		
	300	11 3/4	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	325	12 3/4	145	168	9,75	11,28	12,76	14,00	4,87	5,64	6,38	7,00		
	350	13 3/4	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	375	14 3/4	170	193	11,43	13,22	14,96	16,41	5,71	6,61	7,48	8,21		
	400	15 3/4	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	425	16 3/4	195	218	13,11	15,17	17,16	18,82	6,55	7,58	8,58	9,41		
	450	17 3/4	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14		
	475	18 11/16	220	243	14,79	17,11	19,36	21,24	7,39	8,55	9,68	10,62		
	500	19 3/4	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	525	20 11/16	245	268	16,47	19,05	21,56	23,65	8,23	9,53	10,78	11,82		
	550	21 5/8	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55		
	575	22 5/8	270	293	18,15	21,00	23,76	26,06	9,07	10,50	11,88	13,03		
	600	23 5/8	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		
	650	25 9/16	305	330	20,50	23,72	26,84	29,44	10,25	11,86	13,42	14,72		
	700	27 1/2	330	355	22,18	25,66	29,04	31,85	11,09	12,83	14,52	15,93		
	750	29 1/2	355	380	23,86	27,61	31,24	34,27	11,93	13,80	15,62	17,13		
	800	31 1/2	380	405	25,54	29,55	33,44	36,68	12,77	14,78	16,72	18,34		
	850	33 7/16	405	430	27,22	31,50	35,64	39,09	13,61	15,75	17,82	19,55		
	900	35 1/2	430	455	28,90	33,44	37,84	41,51	14,45	16,72	18,92	20,75		
	950	37 3/8	455	480	30,58	35,39	40,04	43,92	15,29	17,69	20,02	21,96		
	1000	39 3/8	480	505	32,26	37,33	42,24	46,33	16,13	18,66	21,12	23,17		

α = screw-to-grain angle

SLIDING ^[4]											
geometry			timber-to-timber							steel tension	
											
d ₁ L			S _g A B _{min}			factored lateral resistance N _r ⁽⁵⁾				factored tension resistance T _{rs}	
						G				[kN]	
[mm] [in]	[mm] [in]	[mm]	[mm]	[mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]			
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		
	320	12 5/8	145	120	135	4,78	5,54	6,26	6,87		
	340	13 3/8	155	125	140	5,11	5,92	6,69	7,34		
	360	14 1/4	165	130	145	5,44	6,30	7,13	7,82		
	380	15	175	140	155	5,77	6,68	7,56	8,29		
	400	15 3/4	185	145	160	6,10	7,06	7,99	8,76		
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		
	560	22	265	205	220	11,24	13,01	14,71	16,14		
600	23 5/8	285	215	230	12,09	13,99	15,82	17,36			

		SLIDING ^[4]								
geometry			timber-to-timber						steel tension	
										
d ₁ [mm] [in]	L		S _g [mm]	A [mm]	B _{min} [mm]	factored lateral resistance N _r ⁽⁵⁾				factored tension resistance T _{rs}
	[mm]	[in]				0.35	0.42	G	0.49	0.55
						[kN]	[kN]	[kN]	[kN]	
11 0.44	150	6	60	60	75	3,11	3,60	4,07	4,47	16,38
	200	8	85	75	90	4,41	5,10	5,77	6,33	
	250	10	110	95	110	5,70	6,60	7,47	8,19	
	275	10 7/8	120	100	115	6,22	7,20	8,14	8,94	
	300	11 3/4	135	110	125	7,00	8,10	9,16	10,05	
	325	12 3/4	145	120	135	7,52	8,70	9,84	10,80	
	350	13 3/4	160	130	145	8,30	9,60	10,86	11,91	
	375	14 3/4	170	135	150	8,81	10,20	11,54	12,66	
	400	15 3/4	185	145	160	9,59	11,10	12,56	13,78	
	425	16 3/4	195	155	170	10,11	11,70	13,24	14,52	
	450	17 3/4	210	165	180	10,89	12,60	14,25	15,64	
	475	18 11/16	220	170	185	11,41	13,20	14,93	16,38	
	500	19 3/4	235	180	195	12,18	14,10	15,95	17,50	
	525	20 11/16	245	190	205	12,70	14,70	16,63	18,24	
	550	21 5/8	260	200	215	13,48	15,60	17,65	19,36	
	575	22 5/8	270	205	220	14,00	16,20	18,33	20,10	
	600	23 5/8	285	215	230	14,78	17,10	19,34	21,22	
	650	25 9/16	305	240	255	15,81	18,30	20,70	22,71	
	700	27 1/2	330	255	270	17,11	19,80	22,40	24,57	
	750	29 1/2	355	275	290	18,41	21,30	24,10	26,43	
	800	31 1/2	380	290	305	19,70	22,80	25,79	28,30	
	850	33 7/16	405	310	325	21,00	24,30	27,49	30,16	
	900	35 1/2	430	325	340	22,29	25,80	29,19	32,02	
	950	37 3/8	455	345	360	23,59	27,30	30,88	33,88	
	1000	39 3/8	480	360	375	24,89	28,80	32,58	35,74	

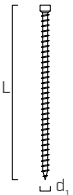
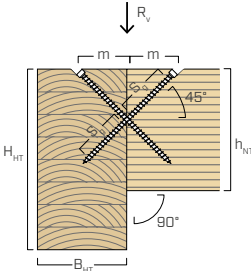
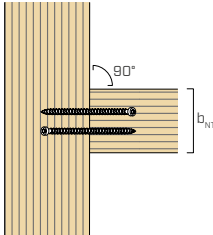
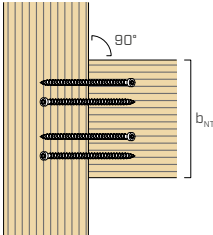
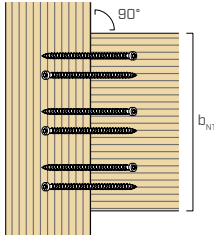
NOTES and GENERAL PRINCIPLES on page 26.

geometry					SHEAR ^[6]							
					timber-to-timber							
					$\alpha = 90^\circ$				$\alpha = 0^\circ$			
					factored lateral resistance N_r				factored lateral resistance $N_r^{(2)(3)}$			
					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] [in]	[mm] [in]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
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
	320	12 5/8	145	160	2,51	2,75	2,97	3,15	1,74	1,96	2,16	2,33
	340	13 3/8	155	170	2,51	2,75	2,97	3,15	1,79	2,02	2,23	2,38
	360	14 1/4	165	180	2,51	2,75	2,97	3,15	1,85	2,08	2,25	2,38
	380	15	175	190	2,51	2,75	2,97	3,15	1,90	2,08	2,25	2,38
	400	15 3/4	185	200	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
	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

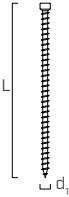
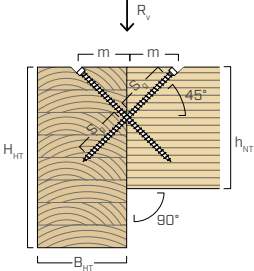
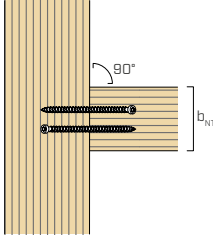
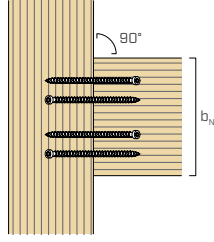
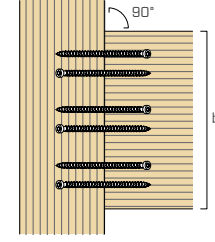
geometry					SHEAR ^[6]							
					timber-to-timber							
					$\alpha = 90^\circ$				$\alpha = 0^\circ$			
					factored lateral resistance N_r				factored lateral resistance $N_r^{(2)(3)}$			
					G				G			
d_1	L	S_g	A ⁽⁷⁾		0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm] [in]	[mm] [in]	[mm] [in]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 0.44	150	6	60	75	3,24	3,81	4,17	4,47	1,86	2,12	2,37	2,57
	200	8	85	100	3,84	4,29	4,72	5,07	2,22	2,54	2,85	3,11
	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
	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

α = screw-to-grain angle

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION⁽⁸⁾

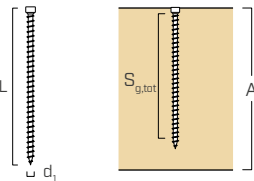
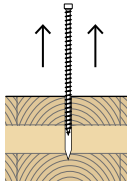
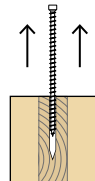
geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d ₁	L		B _{HT,min}	H _{HT,min} h _{NT,min}	S _g	m	b _{NT,min}	factored shear resistance R _v ⁽⁹⁾		b _{NT,min}	factored shear resistance R _v ⁽⁹⁾		b _{NT,min}	factored shear resistance R _v ⁽⁹⁾	
								G			G			G	
[mm] [in]	[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	0.42	0.49	[mm]	0.42	0.49	[mm]	0.42	0.49
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
	320	12 5/8	130	240	145	116		11,07	12,52		22,14	25,05		33,21	37,57
	340	13 3/8	140	255	155	123		11,83	13,39		23,67	26,78		35,50	40,16
	360	14 1/4	145	270	165	130		12,60	13,58		25,20	27,16		37,79	40,73
	380	15	155	285	175	137		13,36	13,58		26,72	27,16		40,08	40,73
	400	15 3/4	160	300	185	144		13,58	13,58		27,16	27,16		40,73	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
	560	22	215	410	265	201		21,49	21,49		42,99	42,99		64,48	64,48
	600	23 5/8	230	440	285	215		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⁾		b _{NT,min}	factored shear resistance R _v ⁽⁹⁾		b _{NT,min}	factored shear resistance R _v ⁽⁹⁾	
								G			G			G	
[mm] [in]	[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	0.42	0.49	[mm]	0.42	0.49	[mm]	0.42	0.49
11 0.44	150	6	70	120	60	56	110	7,20	8,14	165	14,40	16,29	220	21,60	24,43
	200	8	90	155	85	74		10,20	11,54		20,40	23,08		30,60	34,62
	250	10	105	190	110	91		13,20	14,93		26,40	29,86		39,59	44,80
	275	10 7/8	115	210	120	98		14,40	16,29		28,80	32,58		43,19	48,87
	300	11 3/4	125	225	135	109		16,20	18,33		32,40	36,65		48,59	54,98
	325	12 3/4	130	245	145	116		17,40	19,68		34,79	39,37		52,19	59,05
	350	13 3/4	140	260	160	127		19,20	21,72		38,39	43,44		57,59	65,16
	375	14 3/4	150	280	170	134		20,40	23,08		40,79	46,15		61,19	69,23
	400	15 3/4	160	300	185	144		22,20	25,11		44,39	50,23		66,59	75,34
	425	16 3/4	165	315	195	152		23,40	25,81		46,79	51,63		70,19	77,44
	450	17 3/4	180	335	210	162		25,20	25,81		50,39	51,63		75,59	77,44
	475	18 11/16	185	350	220	169		25,81	25,81		51,63	51,63		77,44	77,44
	500	19 3/4	195	370	235	180		25,81	25,81		51,63	51,63		77,44	77,44
	525	20 11/16	200	385	245	187		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
	575	22 5/8	220	420	270	205		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
	650	25 9/16	245	475	305	229		25,81	25,81		51,63	51,63		77,44	77,44
	700	27 1/2	260	510	330	247		25,81	25,81		51,63	51,63		77,44	77,44
	750	29 1/2	280	545	355	265		25,81	25,81		51,63	51,63		77,44	77,44
	800	31 1/2	300	580	380	282		25,81	25,81		51,63	51,63		77,44	77,44
	850	33 7/16	315	615	405	300		25,81	25,81		51,63	51,63		77,44	77,44
	900	35 1/2	335	650	430	318		25,81	25,81		51,63	51,63		77,44	77,44
	950	37 3/8	350	685	455	335		25,81	25,81		51,63	51,63		77,44	77,44
	1000	39 3/8	370	720	480	353		25,81	25,81		51,63	51,63		77,44	77,44

NOTES and GENERAL PRINCIPLES on page 26.

					TENSION ⁽¹⁾							
geometry					total thread withdrawal							
					lateral $\alpha=90^\circ$				narrow $\alpha=0^\circ$			
					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]
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
	320	12 5/8	303	330	12,96	15,00	16,96	18,61	6,48	7,50	8,48	9,30
	340	13 3/8	323	350	13,81	15,99	18,08	19,83	6,91	7,99	9,04	9,92
	360	14 1/4	343	370	14,67	16,98	19,20	21,06	7,34	8,49	9,60	10,53
	380	15	363	390	15,53	17,96	20,32	22,29	7,76	8,98	10,16	11,14
	400	15 3/4	383	410	16,38	18,95	21,44	23,52	8,19	9,48	10,72	11,76
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
	560	22	541	570	29,75	34,42	38,93	42,72	14,88	17,21	19,47	21,36
	600	23 5/8	581	610	31,95	36,97	41,81	45,88	15,98	18,48	20,90	22,94

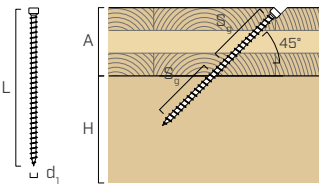
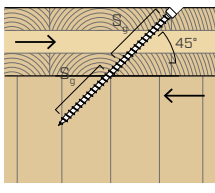
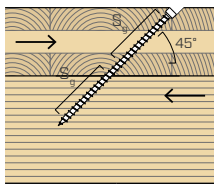
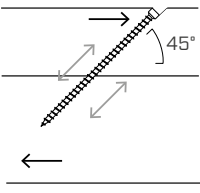
					TENSION ⁽¹⁾							
geometry					total thread withdrawal							
					lateral $\alpha=90^\circ$				narrow $\alpha=0^\circ$			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance $P_{rw}^{(2)(3)}$			
					G				G			
d_1	L	$S_{g,tot}$	A_{min}		0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm] [in]	[mm] [in]	[mm] [in]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 0.44	150	6	129	160	8,67	10,03	11,35	12,45	4,34	5,02	5,68	6,23
	200	8	179	210	12,03	13,92	15,75	17,28	6,02	6,96	7,88	8,64
	250	10	229	260	15,39	17,81	20,15	22,11	7,70	8,90	10,07	11,05
	275	10 7/8	254	285	17,07	19,75	22,35	24,52	8,54	9,88	11,17	12,26
	300	11 3/4	279	310	18,75	21,70	24,55	26,93	9,38	10,85	12,27	13,47
	325	12 3/4	304	335	20,43	23,64	26,75	29,35	10,22	11,82	13,37	14,67
	350	13 3/4	329	360	22,11	25,59	28,95	31,76	11,06	12,79	14,47	15,88
	375	14 3/4	354	385	23,79	27,53	31,15	34,17	11,90	13,77	15,57	17,09
	400	15 3/4	379	410	25,47	29,47	33,35	36,58	12,74	14,74	16,67	18,29
	425	16 3/4	404	435	27,15	31,42	35,55	39,00	13,58	15,71	17,77	19,50
	450	17 3/4	429	460	28,83	33,36	37,75	41,41	14,42	16,68	18,87	20,71
	475	18 11/16	454	485	30,52	35,31	39,95	43,82	15,26	17,65	19,97	21,91
	500	19 3/4	479	510	32,20	37,25	42,15	46,24	16,10	18,63	21,07	23,12
	525	20 11/16	504	535	33,88	39,20	44,35	48,65	16,94	19,60	22,17	24,33
	550	21 5/8	529	560	35,56	41,14	46,55	51,06	17,78	20,57	23,27	25,53
	575	22 5/8	554	585	37,24	43,08	48,75	53,48	18,62	21,54	24,37	26,74
	600	23 5/8	579	610	38,92	45,03	50,95	55,89	19,46	22,51	25,47	27,95
	650	25 9/16	619	660	41,61	48,14	54,47	59,75	20,80	24,07	27,23	29,88
	700	27 1/2	669	710	44,97	52,03	58,87	64,58	22,48	26,01	29,43	32,29
	750	29 1/2	719	760	48,33	55,92	63,26	69,41	24,16	27,96	31,63	34,70
	800	31 1/2	769	810	51,69	59,81	67,66	74,23	25,84	29,90	33,83	37,12
	850	33 7/16	819	860	55,05	63,69	72,06	79,06	27,52	31,85	36,03	39,53
	900	35 1/2	869	910	58,41	67,58	76,46	83,88	29,20	33,79	38,23	41,94
	950	37 3/8	919	960	61,77	71,47	80,86	88,71	30,88	35,74	40,43	44,36
	1000	39 3/8	969	1010	65,13	75,36	85,26	93,54	32,57	37,68	42,63	46,77

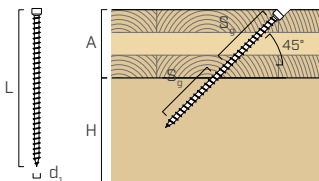
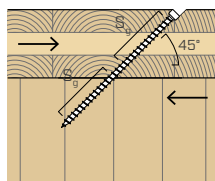
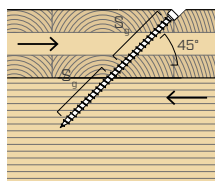
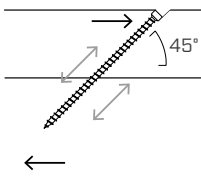
α = screw-to-grain angle

					TENSION ⁽¹⁾									
geometry					partial thread withdrawal								steel tension	
					lateral $\alpha=90^\circ$				narrow $\alpha=0^\circ$					
					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]	
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		
	320	12 5/8	145	165	6,20	7,18	8,12	8,90	3,10	3,59	4,06	4,45		
	340	13 3/8	155	175	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76		
	360	14 1/4	165	185	7,06	8,17	9,24	10,13	3,53	4,08	4,62	5,07		
	380	15	175	195	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37		
	400	15 3/4	185	205	7,91	9,16	10,36	11,36	3,96	4,58	5,18	5,68		
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		
	560	22	265	285	14,57	16,86	19,07	20,92	7,29	8,43	9,53	10,46		
	600	23 5/8	285	305	15,67	18,13	20,51	22,50	7,84	9,07	10,25	11,25		

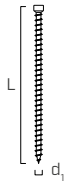
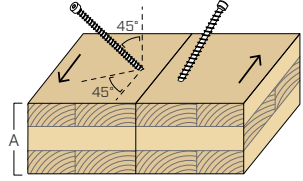
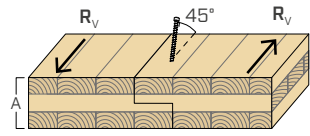
				TENSION ⁽¹⁾									
geometry				total thread withdrawal				steel tension					
				lateral $\alpha=90^\circ$				narrow $\alpha=0^\circ$					
				factored withdrawal resistance P_{rw}				factored withdrawal resistance $P_{rw}^{(2)(3)}$				factored tension resistance T_{rs}	
				G				G					
d_1	L	S_g	A_{min}	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	150	6	60	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90	23,17
	200	8	85	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10	
	250	10	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31	
	275	10 7/8	120	143	8,07	9,33	10,56	11,58	4,03	4,67	5,28	5,79	
	300	11 3/4	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52	
	325	12 3/4	145	168	9,75	11,28	12,76	14,00	4,87	5,64	6,38	7,00	
	350	13 3/4	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72	
	375	14 3/4	170	193	11,43	13,22	14,96	16,41	5,71	6,61	7,48	8,21	
	400	15 3/4	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93	
	425	16 3/4	195	218	13,11	15,17	17,16	18,82	6,55	7,58	8,58	9,41	
	450	17 3/4	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14	
	475	18 11/16	220	243	14,79	17,11	19,36	21,24	7,39	8,55	9,68	10,62	
	500	19 3/4	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34	
	525	20 11/16	245	268	16,47	19,05	21,56	23,65	8,23	9,53	10,78	11,82	
	550	21 5/8	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55	
	575	22 5/8	270	293	18,15	21,00	23,76	26,06	9,07	10,50	11,88	13,03	
	600	23 5/8	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76	
	650	25 9/16	305	330	20,50	23,72	26,84	29,44	10,25	11,86	13,42	14,72	
	700	27 1/2	330	355	22,18	25,66	29,04	31,85	11,09	12,83	14,52	15,93	
	750	29 1/2	355	380	23,86	27,61	31,24	34,27	11,93	13,80	15,62	17,13	
	800	31 1/2	380	405	25,54	29,55	33,44	36,68	12,77	14,78	16,72	18,34	
	850	33 7/16	405	430	27,22	31,50	35,64	39,09	13,61	15,75	17,82	19,55	
	900	35 1/2	430	455	28,90	33,44	37,84	41,51	14,45	16,72	18,92	20,75	
	950	37 3/8	455	480	30,58	35,39	40,04	43,92	15,29	17,69	20,02	21,96	
	1000	39 3/8	480	505	32,26	37,33	42,24	46,33	16,13	18,66	21,12	23,17	

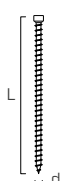
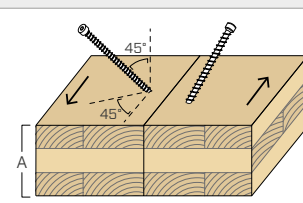
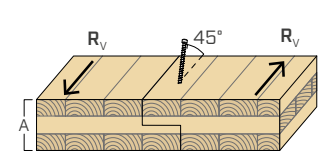
α = screw-to-grain angle

						SLIDING ^[4]				
geometry						CLT - CLT $\alpha=0^\circ$	CLT - timber $\alpha=45^\circ$	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	H_{min}		0.42	0.49	0.42	0.49	
[mm] [in]	[mm] [in]	[mm]	[mm]	[mm]		[kN]	[kN]	[kN]	[kN]	[kN]
7 0.28	80	3 1/8	25	35	50	0,52	0,59	0,95	1,08	7,52
	100	4	35	40	55	0,73	0,83	1,34	1,51	
	120	4 3/4	45	45	60	0,94	1,07	1,72	1,94	
	140	5 1/2	55	55	70	1,15	1,31	2,10	2,38	
	160	6 1/4	65	60	75	1,36	1,54	2,48	2,81	
	180	7 1/8	75	70	85	1,57	1,78	2,86	3,24	
	200	8	85	75	90	1,78	2,02	3,24	3,67	
	220	8 5/8	95	85	100	1,99	2,26	3,63	4,10	
	240	9 1/2	105	90	105	2,20	2,49	4,01	4,53	
	260	10 1/4	115	95	110	2,41	2,73	4,39	4,97	
	280	11	125	105	120	2,62	2,97	4,77	5,40	
	300	11 3/4	135	110	125	2,83	3,21	5,15	5,83	
	320	12 5/8	145	120	135	3,04	3,44	5,54	6,26	
	340	13 3/8	155	125	140	3,25	3,68	5,92	6,69	
	360	14 1/4	165	130	145	3,46	3,92	6,30	7,13	
	380	15	175	140	155	3,67	4,16	6,68	7,56	
	400	15 3/4	185	145	160	3,88	4,39	7,06	7,99	
9 0.36	160	6 1/4	65	60	75	1,75	1,98	3,19	3,61	12,61
	180	7 1/8	75	70	85	2,02	2,29	3,68	4,16	
	200	8	85	75	90	2,29	2,60	4,17	4,72	
	220	8 5/8	95	85	100	2,56	2,90	4,66	5,27	
	240	9 1/2	105	90	105	2,83	3,21	5,15	5,83	
	260	10 1/4	115	95	110	3,10	3,51	5,64	6,38	
	280	11	125	105	120	3,37	3,82	6,14	6,94	
	300	11 3/4	135	110	125	3,64	4,12	6,63	7,49	
	320	12 5/8	145	120	135	3,91	4,43	7,12	8,05	
	340	13 3/8	155	125	140	4,18	4,73	7,61	8,60	
	360	14 1/4	165	130	145	4,45	5,04	8,10	9,16	
	380	15	175	140	155	4,72	5,34	8,59	9,71	
	400	15 3/4	185	145	160	4,99	5,65	9,08	10,27	
	440	17 1/4	205	160	175	5,53	6,26	10,06	11,38	
	480	19	225	175	190	6,07	6,87	11,04	12,49	
	520	20 1/2	245	190	205	6,61	7,48	12,03	13,60	
	560	22	265	205	220	7,15	8,09	13,01	14,71	
	600	23 5/8	285	215	230	7,69	8,70	13,99	15,82	

						SLIDING ^[4]				
geometry						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	H _{min}		0.42	0.49	0.42	0.49	
[mm] [in]	[mm] [in]	[mm]	[mm]	[mm]		[kN]	[kN]	[kN]	[kN]	[kN]
11 0.44	150	6	60	60	75	1,98	2,24	3,60	4,07	16,38
	200	8	85	75	90	2,80	3,17	5,10	5,77	
	250	10	110	95	110	3,63	4,11	6,60	7,47	
	275	10 7/8	120	100	115	3,96	4,48	7,20	8,14	
	300	11 3/4	135	110	125	4,45	5,04	8,10	9,16	
	325	12 3/4	145	120	135	4,78	5,41	8,70	9,84	
	350	13 3/4	160	130	145	5,28	5,97	9,60	10,86	
	375	14 3/4	170	135	150	5,61	6,35	10,20	11,54	
	400	15 3/4	185	145	160	6,10	6,91	11,10	12,56	
	425	16 3/4	195	155	170	6,43	7,28	11,70	13,24	
	450	17 3/4	210	165	180	6,93	7,84	12,60	14,25	
	475	18 11/16	220	170	185	7,26	8,21	13,20	14,93	
	500	19 3/4	235	180	195	7,75	8,77	14,10	15,95	
	525	20 11/16	245	190	205	8,08	9,15	14,70	16,63	
	550	21 5/8	260	200	215	8,58	9,71	15,60	17,65	
	575	22 5/8	270	205	220	8,91	10,08	16,20	18,33	
	600	23 5/8	285	215	230	9,40	10,64	17,10	19,34	
	650	25 9/16	305	240	255	10,06	11,39	18,30	20,70	
	700	27 1/2	330	255	270	10,89	12,32	19,80	22,40	
	750	29 1/2	355	275	290	11,71	13,25	21,30	24,10	
	800	31 1/2	380	290	305	12,54	14,19	22,80	25,79	
	850	33 7/16	405	310	325	13,36	15,12	24,30	27,49	
	900	35 1/2	430	325	340	14,19	16,05	25,80	29,19	
	950	37 3/8	455	345	360	15,01	16,99	27,30	30,88	
	1000	39 3/8	480	360	375	15,84	17,92	28,80	32,58	

α = screw-to-grain angle

					SLIDING ⁽⁴⁾				
geometry					butt joint (double inclination at 45° + 45°) ⁽¹⁰⁾		half-lap joint $\alpha=45^\circ$		
									
					factored lateral resistance $N_r^{(5)}$		factored tension resistance T_{rs}	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
$\frac{[mm]}{[in]}$	[mm]	[in]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
7 0.28	80	3 1/8	25	65	0,77	0,87	5,32	0,95	1,08
	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
	360	14 1/4	165	265	5,06	5,72		6,30	7,13
	380	15	175	280	5,36	6,07		6,68	7,56
9 0.36	400	15 3/4	185	295	5,67	6,41	8,92	7,06	7,99
	160	6 1/4	65	125	2,56	2,90		3,19	3,61
	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
	560	22	265	405	10,44	11,80		13,01	14,71
	600	23 5/8	285	435	11,23	12,70		13,99	15,82

geometry					SLIDING ⁽⁴⁾				
					butt joint (double inclination at 45° + 45°) ⁽¹⁰⁾		half-lap joint $\alpha=45^\circ$		
									
					factored lateral resistance $N_r^{(5)}$		factored tension resistance T_{rs}	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
$\frac{[mm]}{[in]}$	[mm]	[in]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
11 0.44	150	6	60	115	2,89	3,27	11,59	3,60	4,07
	200	8	85	150	4,09	4,63		5,10	5,77
	250	10	110	185	5,30	5,99		6,60	7,47
	275	10 7/8	120	205	5,78	6,54		7,20	8,14
	300	11 3/4	135	220	6,50	7,35		8,10	9,16
	325	12 3/4	145	240	6,98	7,90		8,70	9,84
	350	13 3/4	160	255	7,70	8,72		9,60	10,86
	375	14 3/4	170	275	8,18	9,26		10,20	11,54
	400	15 3/4	185	295	8,91	10,08		11,10	12,56
	425	16 3/4	195	310	9,39	10,62		11,70	13,24
	450	17 3/4	210	330	10,11	11,44		12,60	14,25
	475	18 11/16	220	345	10,59	11,98		13,20	14,93
	500	19 3/4	235	365	11,31	12,80		14,10	15,95
	525	20 11/16	245	380	11,80	13,35		14,70	16,63
	550	21 5/8	260	400	12,52	14,16		15,60	17,65
	575	22 5/8	270	415	13,00	14,71		16,20	18,33
	600	23 5/8	285	435	13,72	15,52		17,10	19,34
	650	25 9/16	305	470	14,68	16,61		18,30	20,70
	700	27 1/2	330	505	15,89	17,98		19,80	22,40
	750	29 1/2	355	540	17,09	19,34		21,30	24,10
	800	31 1/2	380	575	18,29	20,70		22,80	25,79
	850	33 7/16	405	610	19,50	22,06		24,30	27,49
	900	35 1/2	430	645	20,70	23,42		25,80	29,19
	950	37 3/8	455	680	21,91	24,78		27,30	30,88
	1000	39 3/8	480	715	23,11	26,15		28,80	32,58

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_t , as specified in Table 2B of the ELC-4645 report. Factor for fastener axis-to-grain angle, J_a , 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 ($20 d_t$) 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 $2 \cdot P_{rt} \cdot \cos(\beta)$ and $2 \cdot P_{rc} \cdot \cos(\beta)$, 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°