

# VGZ EVO



## 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

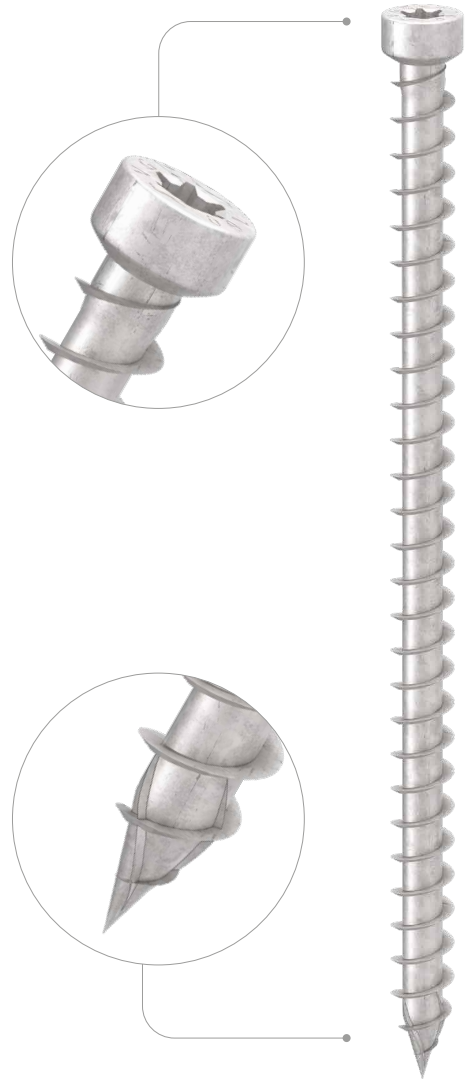
The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use with ACQ-treated timber.

### 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.

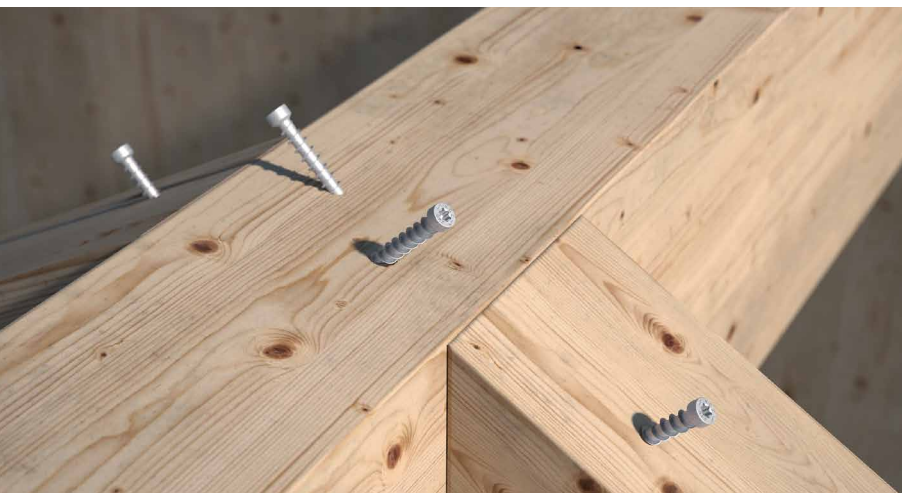
### CYLINDRICAL HEAD

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.



DIAMETER [mm]	5 <b>6</b> 11
LENGTH [mm]	80 <b>80</b> 600 1000
SERVICE CONDITION	<b>EC1</b> EC3
ATMOSPHERIC CORROSIVITY	C1 <b>C2</b> C3 C4
WOOD CORROSIVITY	T1 <b>T2</b> T3
MATERIAL	<b>C4</b> EVO COATING carbon steel with C4 EVO coating
CORE HARDNESS	<b>&lt;390 HV</b> as required in CSA 086:24 <sup>(1)</sup>

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



### FIELDS OF USE

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

<sup>(1)</sup> Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

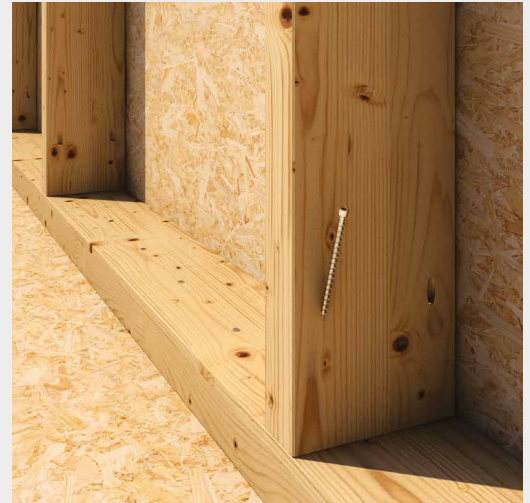


## TRUSS & RAFTER JOINTS

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.

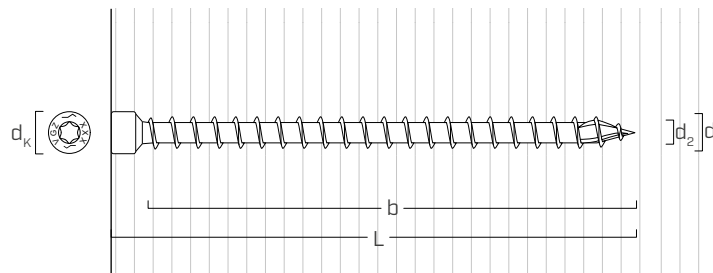


Fastening Wood Trusses outdoors.



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 <sup>(1)</sup>	$d_{v,S}$	[mm]	3,5	3,5	4,0	5,0	6,0
Pre-drilling hole diameter <sup>(2)</sup>	$d_{v,H}$	[mm]	4,0	4,0	5,0	6,0	7,0

<sup>(1)</sup> Pre-drilling valid for softwood.

<sup>(2)</sup> Pre-drilling valid for hardwood and beech LVL.

### MECHANICAL PARAMETERS

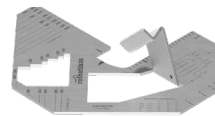
Nominal diameter	$d_1$	[mm]	5,3	5,6	7	9	11	
Factored tensile strength	$\Phi_{f_u}$	[kN]	7,49	8,08	10,64	17,84	23,17	
Bending yield strength	$F_{yb}$	[MPa]	1021	1021	1111	1069	1026	
Factored shear strength of the screw	$\Phi_{v_s}$	[kN]	3,91	4,36	6,38	10,50	13,14	
Specified withdrawal resistance per millimeter 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

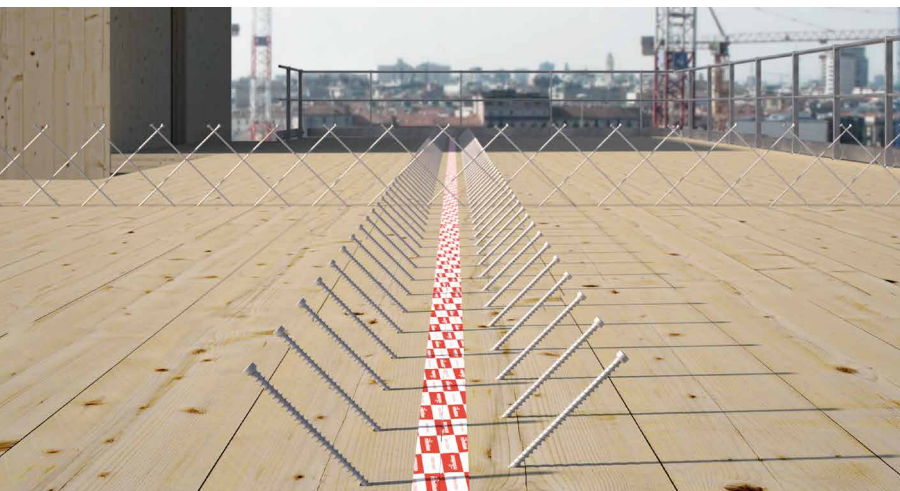
d <sub>1</sub> [mm]	CODE	L [mm]	b [mm]	pcs
5,3 TX 25	VGZEVO580	80	70	50
	VGZEVO5100	100	90	50
	VGZEVO5120	120	110	50
5,6 TX 25	VGZEVO5140	140	130	50
	VGZEVO5150	150	140	50
	VGZEVO5160	160	150	50
7 TX 30	VGZEVO780	80	70	50
	VGZEVO7100	100	90	50
	VGZEVO7120	120	110	50
	VGZEVO7140	140	130	50
	VGZEVO7160	160	150	50
	VGZEVO7180	180	170	50
	VGZEVO7200	200	190	50
	VGZEVO7220	220	210	50
	VGZEVO7240	240	230	50
	VGZEVO7260	260	250	50
	VGZEVO7280	280	270	50
	VGZEVO7300	300	290	50
	VGZEVO7340	340	330	50
	VGZEVO7380	380	370	50
	9 TX 40	VGZEVO9160	160	150
VGZEVO9180		180	170	50
VGZEVO9200		200	190	50
VGZEVO9220		220	210	50
VGZEVO9240		240	230	50
VGZEVO9260		260	250	50
VGZEVO9280		280	270	50
VGZEVO9300		300	290	50
9 TX 40	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 <sub>1</sub> [mm]	CODE	L [mm]	b [mm]	pcs
11 TX 50	VGZEVO11250	250	240	25
	VGZEVO11300	300	290	25
	VGZEVO11350	350	340	25
11 TX 50	VGZEVO11400	400	390	25
	VGZEVO11450	450	440	25
	VGZEVO11500	500	490	25
	VGZEVO11550	550	540	25
11 TX 50	VGZEVO11600	600	590	25

## RELATED PRODUCTS



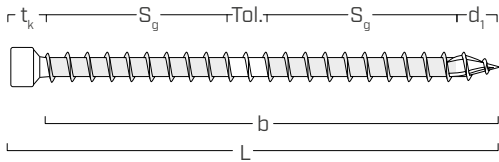
**JIG VGZ 45°**  
TEMPLATE FOR 45° SCREWS



## 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



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

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 the ELC-4645 report.

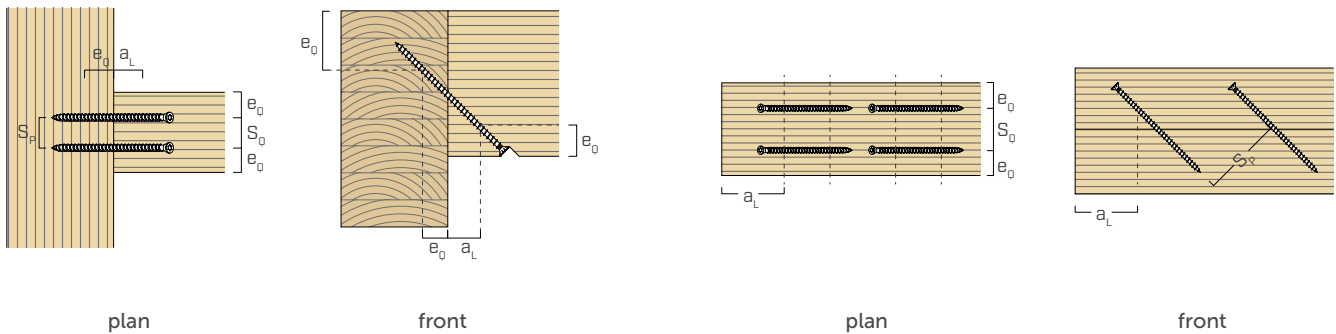
## MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

😊 screws inserted **WITH and WITHOUT pre-drilled hole**

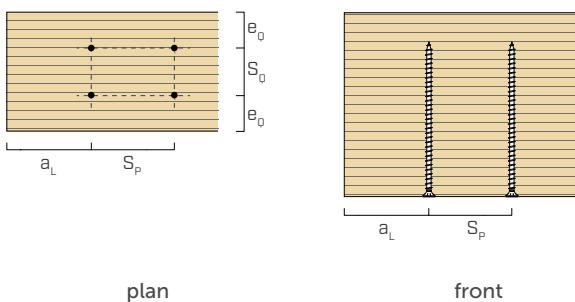
$d_1$		5,3 [mm]	0.21 [in]	5,6 [mm]	0.23 [in]	7 [mm]	0.28 [in]	9 [mm]	0.36 [in]	11 [mm]	0.44 [in]
$S_p$	$7 \cdot d^{\dagger}$	37	1 7/16	40	1 9/16	49	1 15/16	63	2 1/2	77	3 1/16
$S_Q$	$5 \cdot d$	27	1 1/16	28	1 1/8	35	1 3/8	45	1 3/4	55	2 3/16
$a_L$	$10 \cdot d^{\dagger}$	53	2 1/16	56	2 3/16	70	2 3/4	90	3 1/2	110	4 3/8
$a$	$7 \cdot d^{\dagger}$	37	1 7/16	40	1 9/16	49	1 15/16	63	2 1/2	77	3 1/16
$e_Q$	$4 \cdot d$	22	7/8	23	7/8	28	1 1/8	36	1 7/16	44	1 3/4

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

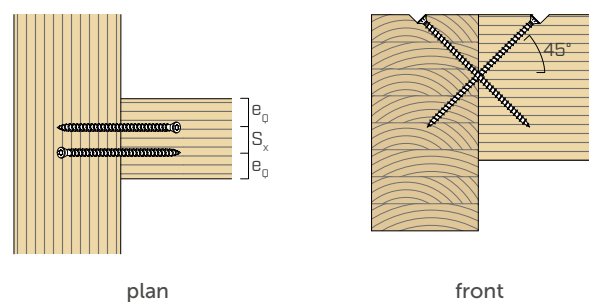
### SCREWS UNDER TENSION INSERTED WITH AN ANGLE $\alpha$ WITH RESPECT TO THE GRAIN



### SCREWS INSERTED WITH $\alpha = 90^\circ$ ANGLE WITH RESPECT TO THE GRAIN

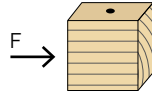


### CROSSED SCREWS INSERTED WITH AN ANGLE $\alpha$ WITH RESPECT TO THE GRAIN



# MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

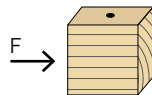
screws inserted **WITHOUT** pre-drilled hole  $G \leq 0.44$



$d_1$		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 <sup>†</sup>	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 <sup>†</sup>	80	3 1/8	84	3 5/16	105	4 1/8	135	5 5/16	165	6 1/2
$a$	10·d <sup>†</sup>	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
$S_x$	2·d	11	7/16	12	1/2	14	9/16	18	11/16	22	7/8

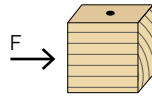
<sup>†</sup> For Western Red Cedar, this minimum spacing shall be increased by 50%.

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



$d_1$		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
$S_x$	3·d	16	5/8	17	11/16	21	13/16	27	1 1/16	33	1 5/16

screws inserted **WITH** pre-drilled hole

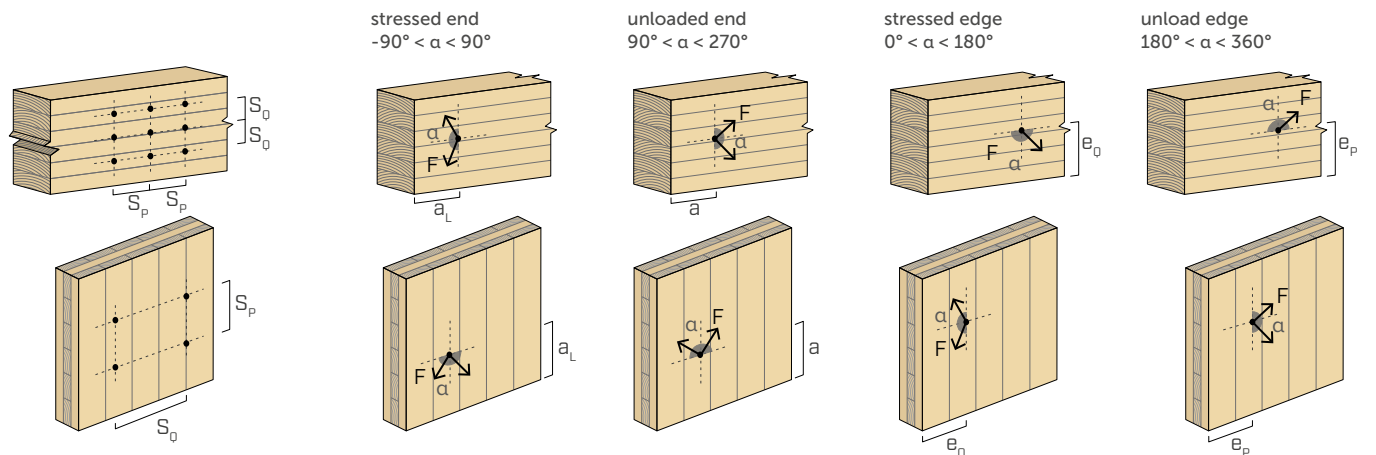


$d_1$		5,3 [mm]	0,21 [in]	5,6 [mm]	0,23 [in]	7 [mm]	0,28 [in]	9 [mm]	0,36 [in]	11 [mm]	0,44 [in]
$S_p$	5·d <sup>†</sup>	27	1 1/16	28	1 1/8	35	1 3/8	45	1 3/4	55	2 3/16
$S_Q$	4·d	22	7/8	23	7/8	28	1 1/8	36	1 7/16	44	1 3/4
$a_L$	12·d <sup>†</sup>	64	2 1/2	68	2 11/16	84	3 5/16	108	4 1/4	132	5 3/16
$a$	7·d <sup>†</sup>	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
$S_x$	1.5·d	8	5/16	9	3/8	11	7/6	14	9/16	17	11/16

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

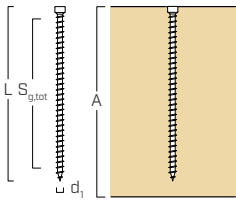
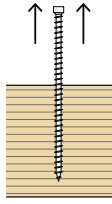
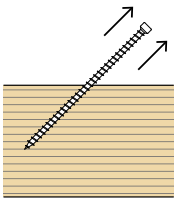
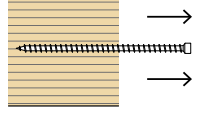
$d$  =  $d_1$  = nominal diameter of the screw

$\alpha$  = 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 <sup>(1)</sup>											
					$\alpha = 90^\circ$				$\alpha = 45^\circ$				end grain $\alpha = 0^\circ$			
																
$d_1$	L		$S_{g,tot}$	$A_{min}$	G				G				G			
	[mm]	[in]			[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
9 0.36	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
	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 <sup>(1)</sup>											
					$\alpha = 90^\circ$				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]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
<b>11</b> <i>0.44</i>	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
	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
	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	

$\alpha$  = screw-to-grain angle

geometry					TENSION/COMPRESSION <sup>(1)</sup>										steel tension	buckling $\alpha = 90^\circ$
					partial thread withdrawal $\alpha = 90^\circ$				end grain $\alpha = 0^\circ$				factored tension resistance $T_{rs}$			
$d_1$ [mm] [in]	L		$S_g$ [mm]	$A_{min}$ [mm]	factored withdrawal resistance $P_{rw}$				factored withdrawal resistance $P_{rw}^{(2)(3)}$				factored tension resistance $T_{rs}$		factored buckling resistance $P_{rb}$	
	[mm]	[in]			G				G				[kN]		[kN]	
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55				
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	5,82		
	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	6,48		
	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	10,34		
	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				
9 0.36	300	11 3/4	135	155	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14	17,84	16,37		
	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				
	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					

geometry					TENSION/COMPRESSION <sup>(1)</sup>									
					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		$S_g$	$A_{min}$	G				G				[kN]	[kN]
	[mm]	[in]	[mm]	[mm]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
<b>11</b> <b>0.44</b>	250	10	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31	23,17	19,66
	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			

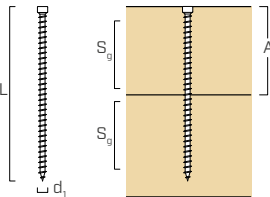
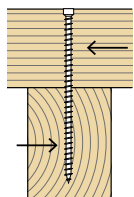
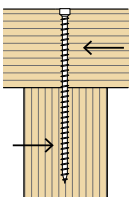
$\alpha$  = screw-to-grain angle

geometry		SLIDING <sup>(4)</sup>								steel tension
		timber-to-timber				factored lateral resistance $N_r^{(5)}$				factored tension resistance $T_{rs}$
$d_1$	L	$S_g$	A	$B_{min}$	G				[kN]	
					0.35	0.42	0.49	0.55		
[mm] [in]	[mm] [in]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	
<b>5.3</b> <b>0.21</b>	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		
<b>5.6</b> <b>0.23</b>	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		
<b>7</b> <b>0.28</b>	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			
<b>9</b> <b>0.36</b>	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<sup>(4)</sup>

geometry		timber-to-timber				steel tension			
d <sub>1</sub>	L	S <sub>g</sub>	A	B <sub>min</sub>	factored lateral resistance N <sub>r</sub> <sup>(5)</sup>				factored tension resistance T <sub>rs</sub>
					G				
[mm] [in]	[mm]    [in]	[mm]	[mm]	[mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	[kN]
<b>11</b> <i>0.44</i>	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 <sup>[6]</sup>							
					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]	[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
9 0.36	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
	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
9 0.36	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

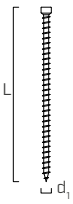
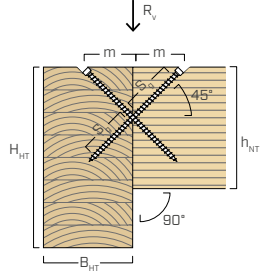
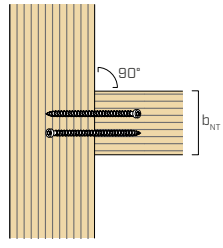
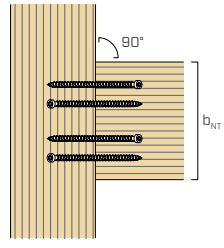
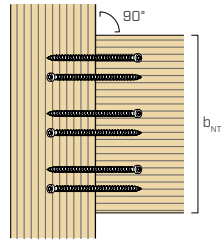
geometry					SHEAR <sup>[6]</sup>							
					timber-to-timber							
					$\alpha = 90^\circ$				$\alpha = 0^\circ$			
					factored lateral resistance $N_r$				factored lateral resistance $N_r^{(2)(3)}$			
					G				G			
$d_1$	L		$S_g$	$A^{(7)}$	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
<b>11</b> <i>0.44</i>	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	

$\alpha$  = screw-to-grain angle

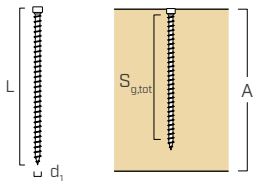
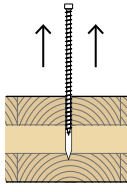
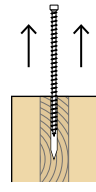
MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION<sup>(8)</sup>

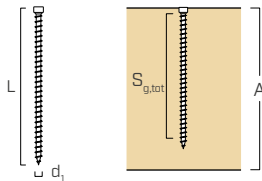
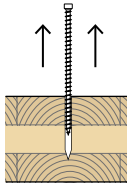
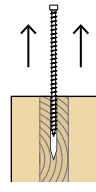
geometry		main beam secondary beam					1 pair		2 pairs			3 pairs			
d1 [mm] [in]	L		BHT,min [mm]	HHT,min hNT,min [mm]	Sg [mm]	m [mm]	bNT,min [mm]	factored shear resistance Rv <sup>(9)</sup>		factored shear resistance Rv <sup>(9)</sup>		factored shear resistance Rv <sup>(9)</sup>			
	[mm]	[in]						G		G		G			
								0.42	0.49	0.42	0.49	0.42	0.49		
								[kN]	[kN]	[kN]	[kN]	[kN]	[kN]		
5,3 0,21	80	3 1/8	45	70	25	31	53	1,44	1,63	80	2,89	3,26	106	4,33	4,90
	100	4	55	85	35	38		2,02	2,29		4,04	4,57		6,06	6,86
	120	4 3/4	60	100	45	45		2,60	2,94		5,19	5,88		7,79	8,81
5,6 0,23	140	5 1/2	70	115	55	53	56	3,35	3,79	84	6,71	7,58	112	10,06	11,37
	150	6	70	120	60	56		3,66	4,13		7,32	8,27		10,98	12,40
	160	6 1/4	75	130	65	60		3,96	4,48		7,93	8,96		11,89	13,44
7 0,28	80	3 1/8	45	70	25	31	70	1,59	1,80	105	3,18	3,60	140	4,77	5,40
	100	4	55	85	35	38		2,23	2,52		4,45	5,04		6,68	7,56
	120	4 3/4	60	100	45	45		2,86	3,24		5,73	6,48		8,59	9,72
	140	5 1/2	70	115	55	53		3,50	3,96		7,00	7,92		10,50	11,88
	160	6 1/4	75	130	65	60		4,14	4,68		8,27	9,36		12,41	14,04
	180	7 1/8	80	140	75	67		4,77	5,40		9,54	10,80		14,32	16,20
	200	8	90	155	85	74		5,41	6,12		10,82	12,24		16,22	18,35
	220	8 5/8	95	170	95	81		6,04	6,84		12,09	13,68		18,13	20,51
	240	9 1/2	105	185	105	88		6,68	7,56		13,36	15,12		20,04	22,67
	260	10 1/4	110	200	115	95		7,32	8,28		14,63	16,56		21,95	24,83
	280	11	120	215	125	102		7,95	9,00		15,91	17,99		23,86	26,99
	300	11 3/4	125	225	135	109		8,59	9,72		17,18	19,43		25,77	29,15
340	13 3/8	140	255	155	123	9,86	11,16	19,72	22,31	29,59	33,47				
380	15	155	285	175	137	11,13	12,60	22,27	25,19	33,40	37,79				
9 0,36	160	6 1/4	75	130	65	60	90	5,32	6,01	135	10,63	12,03	180	15,95	18,04
	180	7 1/8	80	140	75	67		6,14	6,94		12,27	13,88		18,41	20,82
	200	8	90	155	85	74		6,95	7,86		13,91	15,73		20,86	23,59
	220	8 5/8	95	170	95	81		7,77	8,79		15,54	17,58		23,31	26,37
	240	9 1/2	105	185	105	88		8,59	9,71		17,18	19,43		25,77	29,14
	260	10 1/4	110	200	115	95		9,41	10,64		18,82	21,28		28,22	31,92
	280	11	120	215	125	102		10,23	11,56		20,45	23,13		30,68	34,69
	300	11 3/4	125	225	135	109		11,04	12,49		22,09	24,98		33,13	37,47
	320	12 5/8	130	240	145	116		11,86	13,41		23,72	26,83		35,59	40,24
	340	13 3/8	140	255	155	123		12,68	14,34		25,36	28,68		38,04	43,02
	360	14 1/4	145	270	165	130		13,50	15,27		27,00	30,53		40,49	45,80
	380	15	155	285	175	137		14,32	16,19		28,63	32,38		42,95	48,57
400	15 3/4	160	300	185	144	15,13	17,12	30,27	34,23	45,40	51,35				
440	17 1/4	175	325	205	159	16,77	18,97	33,54	37,93	50,31	56,90				
480	19	190	355	225	173	18,41	20,82	36,81	41,63	55,22	62,45				
520	20 1/2	200	385	245	187	20,04	21,49	40,08	42,99	60,13	64,48				

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION<sup>(8)</sup>

geometry		main beam secondary beam					1 pair		2 pairs			3 pairs			
															
d <sub>1</sub> [mm] [in]	L		B <sub>HT,min</sub> [mm]	H <sub>HT,min</sub> h <sub>NT,min</sub> [mm]	S <sub>g</sub> [mm]	m [mm]	b <sub>NT,min</sub> [mm]	factored shear resistance R <sub>v</sub> <sup>(9)</sup>		b <sub>NT,min</sub> [mm]	factored shear resistance R <sub>v</sub> <sup>(9)</sup>		b <sub>NT,min</sub> [mm]	factored shear resistance R <sub>v</sub> <sup>(9)</sup>	
	[mm]	[in]						G			G			G	
11 0.44	250	10	105	190	110	91	110	11,00	12,44	165	22,00	24,89	220	33,00	37,33
	300	11 3/4	125	225	135	109		13,50	15,27		27,00	30,54		40,49	45,82
	350	13 3/4	140	260	160	127		16,00	18,10		32,00	36,20		47,99	54,30
	400	15 3/4	160	300	185	144		18,50	20,93		36,99	41,86		55,49	62,78
	450	17 3/4	180	335	210	162		21,00	23,76		41,99	47,51		62,99	71,27
	500	19 3/4	195	370	235	180		23,50	25,81		46,99	51,63		70,49	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

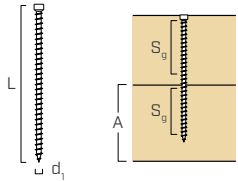
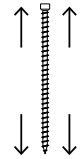
NOTES and GENERAL PRINCIPLES on page 26.

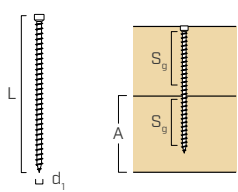
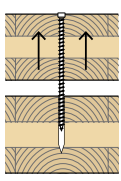
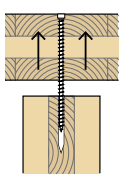
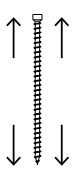
geometry					TENSION <sup>(1)</sup>							
					total thread withdrawal				total thread withdrawal			
					lateral $\alpha=90^\circ$				narrow $\alpha=0^\circ$			
												
					factored withdrawal resistance $P_{rw}$				factored withdrawal resistance $P_{rw}^{(2)(3)}$			
					G				G			
$d_1$	L		$S_{g,tot}$	$A_{min}$	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]
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 <sup>(1)</sup>							
					total thread withdrawal				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]
<b>11</b> <b>0.44</b>	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

$\alpha$  = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 26.

geometry					TENSION <sup>(1)</sup>								steel tension
					partial thread withdrawal				steel tension				
					lateral $\alpha=90^\circ$				narrow $\alpha=0^\circ$				
					factored withdrawal resistance $P_{rw}$				factored withdrawal resistance $P_{rw}^{(2)(3)}$				
$d_1$	L		$S_g$	$A_{min}$	G				G				[kN]
	[mm]	[in]			[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	
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 <sup>(1)</sup>								steel tension
					total thread withdrawal				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		$S_g$	$A_{min}$	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]
<b>11</b> <b>0.44</b>	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	

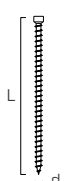
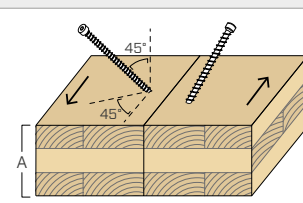
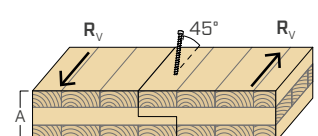
$\alpha$  = screw-to-grain angle

geometry						SLIDING <sup>(4)</sup>				steel tension
						CLT - CLT $\alpha=0^\circ$		CLT - timber $\alpha=45^\circ$		
$d_1$	L	$S_g$	A	$H_{min}$	factored lateral resistance $N_r^{(5)}$		factored lateral resistance $N_r^{(5)}$		[kN]	
[mm] [in]	[mm] [in]	[mm]	[mm]	[mm]	G		G			
					0.42	0.49	0.42	0.49		
					[kN]	[kN]	[kN]	[kN]		
5.3 0.21	80	3 1/8	25	35	50	0,40	0,45	0,79	0,90	5,30
	100	4	35	40	55	0,56	0,63	1,11	1,26	
	120	4 3/4	45	45	60	0,71	0,81	1,43	1,62	
5.6 0.23	140	5 1/2	55	55	70	0,92	1,04	1,84	2,08	5,71
	150	6	60	60	75	1,01	1,14	2,01	2,27	
	160	6 1/4	65	60	75	1,09	1,23	2,18	2,46	
7 0.28	80	3 1/8	25	35	50	0,44	0,49	0,87	0,99	7,52
	100	4	35	40	55	0,61	0,69	1,22	1,39	
	120	4 3/4	45	45	60	0,79	0,89	1,57	1,78	
	140	5 1/2	55	55	70	0,96	1,09	1,92	2,18	
	160	6 1/4	65	60	75	1,14	1,29	2,27	2,57	
	180	7 1/8	75	70	85	1,31	1,48	2,62	2,97	
	200	8	85	75	90	1,49	1,68	2,97	3,36	
	220	8 5/8	95	85	100	1,66	1,88	3,32	3,76	
	240	9 1/2	105	90	105	1,84	2,08	3,67	4,16	
	260	10 1/4	115	95	110	2,01	2,28	4,02	4,55	
	280	11	125	105	120	2,19	2,47	4,37	4,95	
300	11 3/4	135	110	125	2,36	2,67	4,72	5,34		
340	13 3/8	155	125	140	2,71	3,07	5,42	6,14		
380	15	175	140	155	3,06	3,46	6,12	6,93		
9 0.36	160	6 1/4	65	60	75	1,46	1,65	2,92	3,31	12,61
	180	7 1/8	75	70	85	1,69	1,91	3,37	3,82	
	200	8	85	75	90	1,91	2,16	3,82	4,33	
	220	8 5/8	95	85	100	2,14	2,42	4,27	4,83	
	240	9 1/2	105	90	105	2,36	2,67	4,72	5,34	
	260	10 1/4	115	95	110	2,59	2,93	5,17	5,85	
	280	11	125	105	120	2,81	3,18	5,62	6,36	
	300	11 3/4	135	110	125	3,04	3,43	6,07	6,87	
	320	12 5/8	145	120	135	3,26	3,69	6,52	7,38	
	340	13 3/8	155	125	140	3,49	3,94	6,97	7,89	
	360	14 1/4	165	130	145	3,71	4,20	7,42	8,40	
	380	15	175	140	155	3,94	4,45	7,87	8,90	
	400	15 3/4	185	145	160	4,16	4,71	8,32	9,41	
440	17 1/4	205	160	175	4,61	5,22	9,22	10,43		
480	19	225	175	190	5,06	5,72	10,12	11,45		
520	20 1/2	245	190	205	5,51	6,23	11,02	12,47		

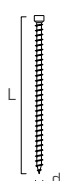
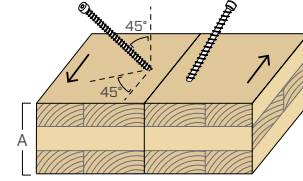
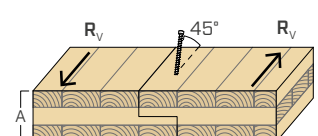
						SLIDING <sup>(4)</sup>				
geometry						CLT - CLT $\alpha=0^\circ$		CLT - timber $\alpha=45^\circ$		steel tension
						factored lateral resistance $N_r^{(5)}$		factored lateral resistance $N_r^{(5)}$		factored tension resistance $T_{rs}$
						G		G		
$d_1$	L		$S_g$	A	$H_{min}$	0.42	0.49	0.42	0.49	
[mm] [in]	[mm]	[in]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
<b>11</b> <i>0.44</i>	250	10	110	95	110	3,02	3,42	6,05	6,84	16,38
	300	11 3/4	135	110	125	3,71	4,20	7,42	8,40	
	350	13 3/4	160	130	145	4,40	4,98	8,80	9,95	
	400	15 3/4	185	145	160	5,09	5,76	10,17	11,51	
	450	17 3/4	210	165	180	5,77	6,53	11,55	13,07	
	500	19 3/4	235	180	195	6,46	7,31	12,92	14,62	
	550	21 5/8	260	200	215	7,15	8,09	14,30	16,18	
	600	23 5/8	285	215	230	7,84	8,87	15,67	17,73	

$\alpha$  = screw-to-grain angle

SLIDING<sup>(4)</sup>

geometry					butt joint (double inclination at 45° + 45°) <sup>(10)</sup>		half-lap joint $\alpha=45^\circ$			
										
$d_1$ [mm] [in]	L		$S_g$ [mm]	A [mm]	G			G		
	[mm]	[in]			0.42	0.49		0.42	0.49	
<b>5.3</b> <b>0.21</b>	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	
<b>5.6</b> <b>0.23</b>	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	
<b>7</b> <b>0.28</b>	80 <sup>(3)</sup>	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			
<b>9</b> <b>0.36</b>	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			

SLIDING<sup>(4)</sup>

geometry					butt joint (double inclination at 45° + 45°) <sup>(10)</sup>					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				
[mm] [in]	[mm]	[in]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]			
<b>11</b> <i>0.44</i>	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				

$\alpha$  = screw-to-grain angle

## 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 the ELC-4645 report. Factor for fastener axis-to-grain angle,  $J_\alpha$ , and the factor for dowel bearing effect for laterally loaded connections,  $J_{wv}$ , 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,  $\alpha$ , 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, head pull-through does not govern the connection capacity, instead, thread withdrawal governs. The governing axial resistance is taken as the minimum of the screw's shear, thread withdrawal, and tensile resistances. In this case, the tensile resistance is always lower than the shear resistance, so the governing value is the minimum between thread withdrawal and tensile 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,  $R_v$ , of crossed screws is determined by taking the minimum of  $2 \cdot P_{rt} \cdot \cos(\beta)$ ,  $2 \cdot P_{rc} \cdot \cos(\beta)$ , and  $V_{rs/\sin(\beta)}$ , where  $P_{rt}$  represents the factored axial resistance of screws loaded in tension,  $P_{rc}$  represents the factored axial resistance of screws loaded in compression, and  $V_{rs}$  represents the factored shear resistance of screws. This approach accounts for the directional component of the axial forces relative to the shear plane and ensures a conservative estimate by considering the governing case among all conditions.
- (10) The sliding strengths of the connectors inserted with double inclination (45°-45°) were evaluated considering an  $\alpha$  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°