VGS A4

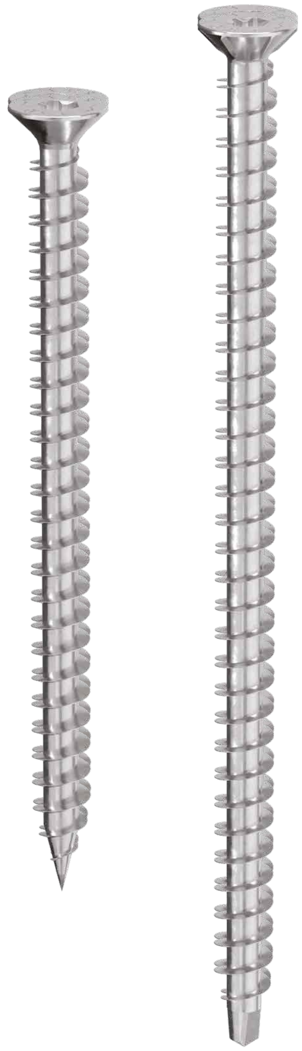
ICC ES ELC-4645 | ICC ES ESR-4645 | CE ETA-11/0030

FULL THREAD CONNECTOR WITH COUNTERSUNK HEAD

A4 | AISI316
A4 | AISI316 austenitic stainless steel for high corrosion resistance. Ideal for environments adjacent to the sea in corrosivity class C5 and for insertion on the most aggressive timbers in class T5.

T5 TIMBER CORROSIVITY
Suitable for use in applications on agressive woods with an acidity (pH) level below 4 such as oak, Douglas fir and chestnut, and in wood moisture conditions above 20%.

EXPOSED STRUCTURAL USE
VGS A4 is the structural wood screw with total thread, perfect for making joints that require high tension or sliding strength in extremely aggressive environments.



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

MANUALS

BIT INCLUDED

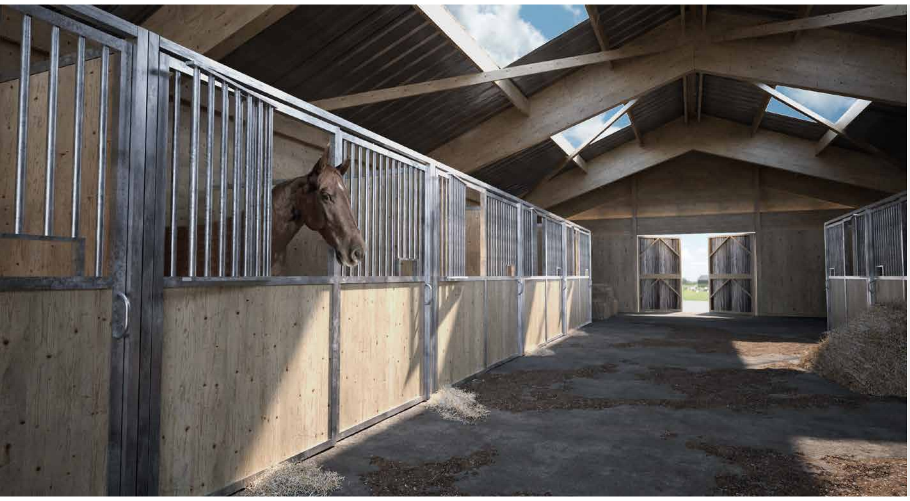
DIAMETER [mm]	9 (9 – 11) 15
LENGTH [mm]	80 (100 – 600) 2000
SERVICE CONDITION	EC4, WET
ATMOSPHERIC CORROSIVITY	C1, C2, C3, C4, C5
WOOD CORROSIVITY	T1, T2, T3, T4, T5
MATERIAL	A4 AISI 316 — A4 | AISI316 austenitic stainless steel (CRC III)

METAL-to-TIMBER recommended use:

NO IMPACT | TORQUE LIMITER | $M_{ins,rec}$

FIELDS OF USE

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



HYBRID STEEL-TIMBER STRUCTURES

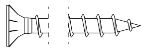
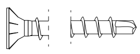
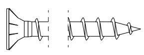
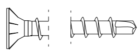
Ideal for steel structures where high-strength customised connections are required, particularly in adverse climatic contexts such as the marine environment and acidic woods.

SWELLING OF TIMBER

Application in combination with polymeric interlayers such as XYLOFON WASHER gives the joint a certain adaptability to mitigate stresses resulting from shrinkage/swelling of the wood.

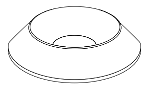
CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
9 TX 40	VGS9120A4	120	110	25
	VGS9160A4	160	150	25
	VGS9200A4	200	190	25
	VGS9240A4	240	230	25
	VGS9280A4	280	270	25
	VGS9320A4	320	310	25
	VGS9360A4	360	350	25
11 TX 50	VGS11100A4	100	90	25
	VGS11150A4	150	140	25
	VGS11200A4	200	190	25
	VGS11250A4	250	240	25
	VGS11300A4	300	290	25
	VGS11350A4	350	340	25
	VGS11400A4	400	390	25
	VGS11500A4	500	490	25
	VGS11600A4	600	590	25

A4
AISI 316

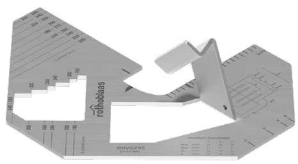
HUS A4 - turned washer



CODE	$d_{VGS\ A4}$ [mm]	pcs
HUS8A4	9	100
HUS10A4	11	50

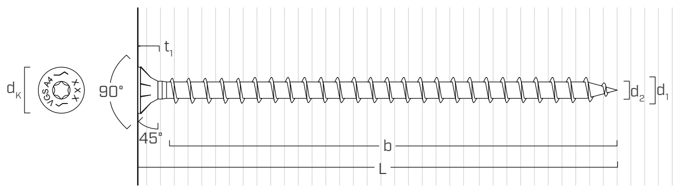
RELATED PRODUCTS

TORQUE LIMITER
TORQUE LIMITER



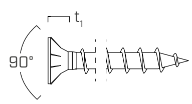
JIG VGZ 45°
TEMPLATE FOR 45° SCREWS

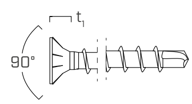
GEOMETRY AND MECHANICAL CHARACTERISTICS



VGS Ø9
L ≤ 240 mm

VGS Ø9
240 mm < L ≤ 360 mm





VGS Ø11
L ≤ 250 mm

VGS Ø11
250 mm < L ≤ 600 mm

Nominal diameter	d_1	[mm]	9	11
Head diameter	d_K	[mm]	16,00	19,30
Head thickness	t_1	[mm]	6,50	8,20
Root diameter	d_2	[mm]	5,90	6,60
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0

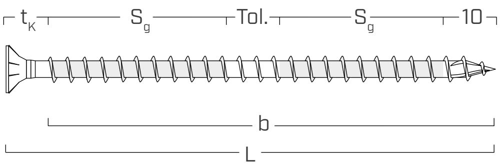
(1) Pre-drilling valid for softwood.
Pre-drilling is mandatory for connectors with L > 400 mm or when fastening to elements with a characteristic density ρ_K>500 kg/m^3.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		9	11
Factored tensile strength	Φf_u	[kN]		12,87	16,36
Bending yield strength	F_{yb}	[MPa]		690	816
Factored shear strength of the screw	Φv_s	[kN]		5,91	7,39
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	78,56	96,02
			G=0.42	90,90	111,10
			G=0.49	102,83	125,68
			G=0.55	112,79	137,85

rothoblaas

EFFECTIVE THREAD USED IN CALCULATION



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

$\mathbf{S_g} = (L - t_K - 10\ \text{mm} - \text{Tol.})/2$ represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

$t_K = 10$ mm (countersunk head)

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.

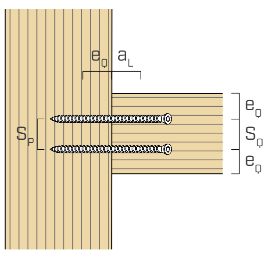
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

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

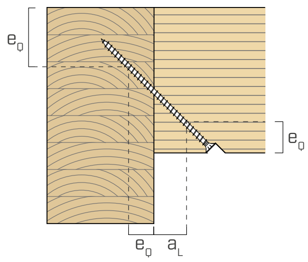
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	7·d†	63	*2 1/2*	77	*3 1/16*
S_Q	5·d	45	*1 3/4*	55	*2 3/16*
a_L	10·d†	90	*3 1/2*	110	*4 3/8*
a	7·d†	63	*2 1/2*	77	*3 1/16*
e_Q	4·d	36	*1 7/16*	44	*1 3/4*

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

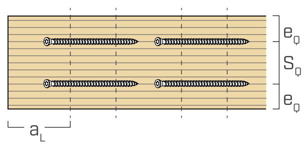
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



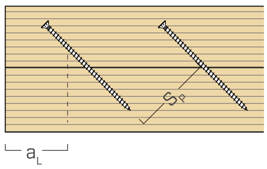
plan



front

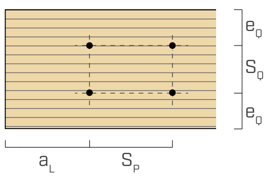


plan

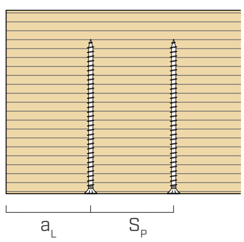


front

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

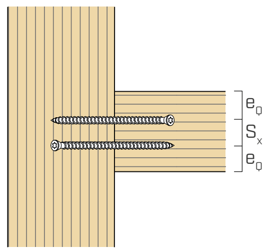


plan

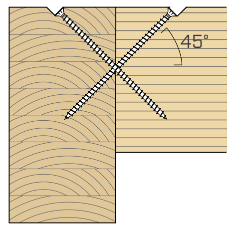


front

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



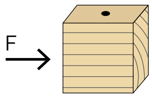
plan



front

MINIMUM DISTANCES FOR SHEAR LOADS

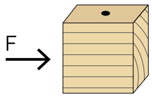
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
s_P	12·d‡	45	*1 3/4*	55	*2 3/16*
s_Q	5·d	36	*1 7/16*	44	*1 3/4*
a_L	15·d‡	108	*4 1/4*	132	*5 3/16*
a	10·d‡	63	*2 1/2*	77	*3 1/16*
e_Q	10·d	63	*2 1/2*	77	*3 1/16*
e_P	5·d	27	*1 1/16*	33	*1 5/16*
s_x	2·d	18	*11/16*	22	*7/8*

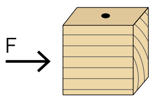
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

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



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
s_P	18·d	108	*4 1/4*	132	*5 3/16*
s_Q	7·d	45	*1 3/4*	55	*2 3/16*
a_L	22·d	135	*5 5/16*	165	*6 1/2*
a	15·d	90	*3 1/2*	110	*4 3/8*
e_Q	12·d	90	*3 1/2*	110	*4 3/8*
e_P	7·d	45	*1 3/4*	55	*2 3/16*
s_x	3·d	27	*1 1/16*	33	*1 5/16*

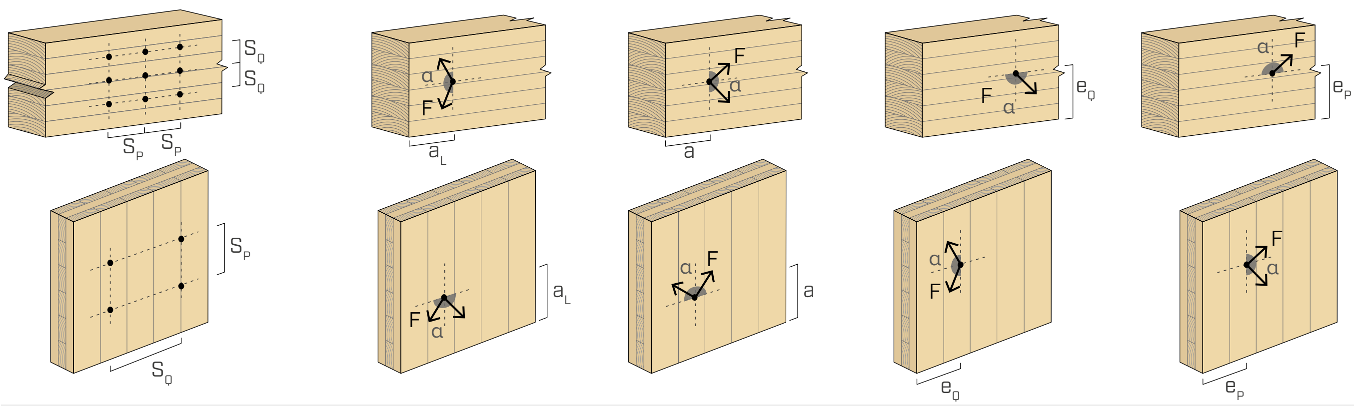
screws inserted **WITH pre-drilled hole**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
s_P	5·d†	162	*6 3/8*	198	*7 13/16*
s_Q	4·d	63	*2 1/2*	77	*3 1/16*
a_L	12·d†	198	*7 13/16*	242	*9 1/2*
a	7·d†	135	*5 5/16*	165	*6 1/2*
e_Q	7·d	108	*4 1/4*	132	*5 3/16*
e_P	3·d	63	*2 1/2*	77	*3 1/16*
s_x	1.5·d	14	*9/16*	17	*11/16*

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

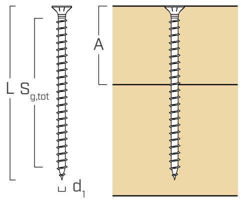
stressed end -90° < α < 90° | unloaded end 90° < α < 270° | stressed edge 0° < α < 180° | unload edge 180° < α < 360°

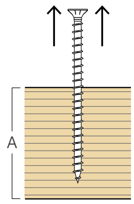


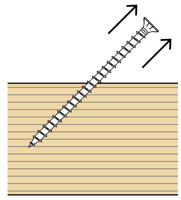
NOTES

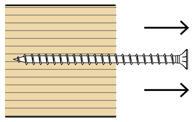
- The minimum spacing and distances comply with Clause 12.12.5 of CSA-O86 2024, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in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

STRUCTURAL VALUES | AXIAL TENSION







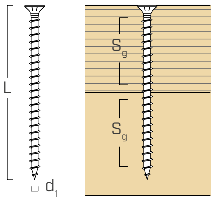
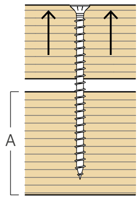
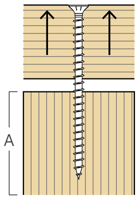
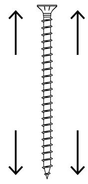
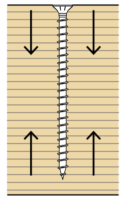


geometry					TENSION/COMPRESSION[1] total thread withdrawal α = 90° factored withdrawal resistance P_{rw} G				α = 45° factored withdrawal resistance P_{rw} G				end grain α = 0° factored withdrawal resistance P_{rw}[2] G			
d_1	L		$S_{g,tot}$	A_{min}	**0.35**	**0.42**	**0.49**	**0.55**	**0.35**	**0.42**	**0.49**	**0.55**	**0.35**	**0.42**	**0.49**	**0.55**
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	101	130	5,55	6,43	7,27	7,97	5,05	5,84	6,61	7,25	2,78	3,21	3,63	3,99
	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
	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
	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
	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
	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
	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
11 *0.44*	100	*4*	79	110	5,31	6,14	6,95	7,63	4,83	5,59	6,32	6,93	2,65	3,07	3,48	3,81
	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
	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
	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
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95

α = screw-to-grain angle

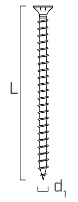
GENERAL PRINCIPLES on page 9.

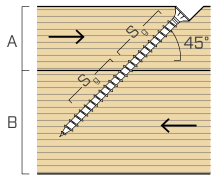
STRUCTURAL VALUES | AXIAL TENSION

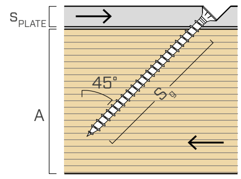
					TENSION/COMPRESSION[1]									
geometry					partial thread withdrawal								steel tension	buckling
					α = 90°				end grain α = 0°					α = 90°
														
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}(2)				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1	L		S_g	A_{min}	G				G					
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	120	*4 3/4*	45,0	65	2,47	2,86	3,24	3,55	1,24	1,43	1,62	1,78		
	160	*6 1/4*	65,0	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57		
	200	*8*	85,0	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
9 *0.36*	240	*9 1/2*	105,0	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15	12,87	10,56
	280	*11*	125,0	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	320	*12 5/8*	145,0	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	360	*14 1/4*	165,0	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
	100	*4*	35,0	55	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69		
	150	*6*	60,0	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90		
	200	*8*	85,0	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	250	*10*	110,0	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
11 *0.44*	300	*11 3/4*	135,0	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52	16,36	15,63
	350	*13 3/4*	160,0	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	400	*15 3/4*	185,0	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	500	*19 3/4*	235,0	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	600	*23 5/8*	285,0	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		

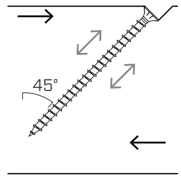
α = screw-to-grain angle

GENERAL PRINCIPLES on page 9.





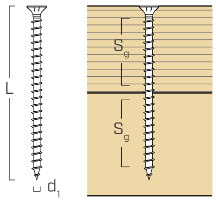


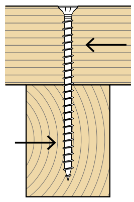


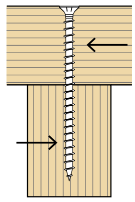
			SLIDING[3]														
geometry			**timber-to-timber**							**steel-to-timber**							**steel tension**
						factored lateral resistance N_r(4)							**factored lateral resistance N_r(4)**				**factored tension resistance T_{rs}**
						G							**G**				
d_1	**L**		S_g	A	B_{min}	**0.35**	**0.42**	**0.49**	**0.55**	S_{PLATE} (5)	S_g	A_{min}	**0.35**	**0.42**	**0.49**	**0.55**	
[mm] ***[in]***	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
9 ***0.36***	120	*4 3/4*	45	45	60	1,91	2,21	2,50	2,74	15,9 *5/8*	90	85	3,82	4,42	5,00	5,48	9,10
	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96		130	115	5,51	6,38	7,22	7,92	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18		170	140	7,21	8,34	9,44	10,35	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40		210	170	8,91	10,31	11,66	12,79	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61		250	200	10,61	12,27	13,88	15,23	
	320	*12 5/8*	145	115	130	6,15	7,12	8,05	8,83		290	225	12,30	14,23	16,10	17,66	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05		330	255	14,00	16,20	18,32	20,10	
11 ***0.44***	100	*4*	35	40	55	1,81	2,10	2,38	2,61	19,1 *3/4*	60	65	3,11	3,60	4,07	4,47	11,57
	150	*6*	60	60	75	3,11	3,60	4,07	4,47		110	100	5,70	6,60	7,47	8,19	
	200	*8*	85	75	90	4,41	5,10	5,77	6,33		160	135	8,30	9,60	10,86	11,91	
	250	*10*	110	95	110	5,70	6,60	7,47	8,19		210	170	10,89	12,60	14,25	15,64	
	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05		260	205	13,48	15,60	17,65	19,36	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91		310	240	16,07	18,60	21,04	23,08	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78		360	275	18,67	21,60	24,43	26,81	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50		460	350	23,85	27,60	31,22	34,25	
	600	*23 5/8*	285	220	235	14,78	17,10	19,34	21,22		560	420	29,03	33,59	38,01	41,70	

GENERAL PRINCIPLES on page 9.

geometry					SHEAR[6] timber-to-timber α = 90°				SHEAR[6] timber-to-timber α = 0°			







d_1	L		S_g	A[7]	factored lateral resistance N_r G 0.35	0.42	0.49	0.55	factored lateral resistance N_r[2] G 0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	45	60	2,18	2,44	2,67	2,86	1,22	1,39	1,55	1,69
	160	*6 1/4*	65	80	2,46	2,75	3,03	3,25	1,46	1,68	1,88	2,05
	200	*8*	85	100	2,74	3,07	3,39	3,65	1,71	1,96	2,18	2,34
	240	*9 1/2*	105	120	3,01	3,39	3,71	3,93	1,92	2,14	2,36	2,53
	280	*11*	125	140	3,14	3,44	3,71	3,93	2,05	2,30	2,54	2,73
	320	*12 5/8*	145	160	3,14	3,44	3,71	3,93	2,19	2,46	2,72	2,93
	360	*14 1/4*	165	180	3,14	3,44	3,71	3,93	2,33	2,60	2,81	2,97
11 *0.44*	100	*4*	35	50	2,07	2,46	2,85	3,18	1,34	1,59	1,76	1,91
	150	*6*	60	75	3,16	3,52	3,86	4,14	1,76	2,01	2,25	2,45
	200	*8*	85	100	3,58	4,01	4,41	4,74	2,12	2,43	2,73	2,98
	250	*10*	110	125	4,00	4,49	4,96	5,35	2,48	2,85	3,14	3,37
	300	*11 3/4*	135	150	4,33	4,75	5,13	5,43	2,76	3,10	3,41	3,67
	350	*13 3/4*	160	175	4,33	4,75	5,13	5,43	2,97	3,34	3,69	3,97
	400	*15 3/4*	185	200	4,33	4,75	5,13	5,43	3,18	3,58	3,88	4,11
	500	*19 3/4*	235	250	4,33	4,75	5,13	5,43	3,27	3,59	3,88	4,11
	600	*23 5/8*	285	300	4,33	4,75	5,13	5,43	3,27	3,59	3,88	4,11

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

NOTES

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

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

(3) For fully threaded screws, 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.

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

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

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

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