VGZ

AC233 ESR-4645 | BIT INCLUDED | MY PROJECT SOFTWARE | ETA-11/0030

FULL THREADED SCREW WITH CYLINDRICAL HEAD

SUPERIOR STRENGTH

Steel with superb bending yield strength (minimum of F_{yb} = 1158 N/mm² | **168,000 psi**). Very high torsional strength $f_{tor,k}$ for safer screwing.

STRUCTURAL APPLICATIONS

Evaluated by ICC-ES according to Acceptance Criteria AC 233. Withdrawal values for any angle between the screw axis and the grain (including end-grain).

CYLINDRICAL HEAD

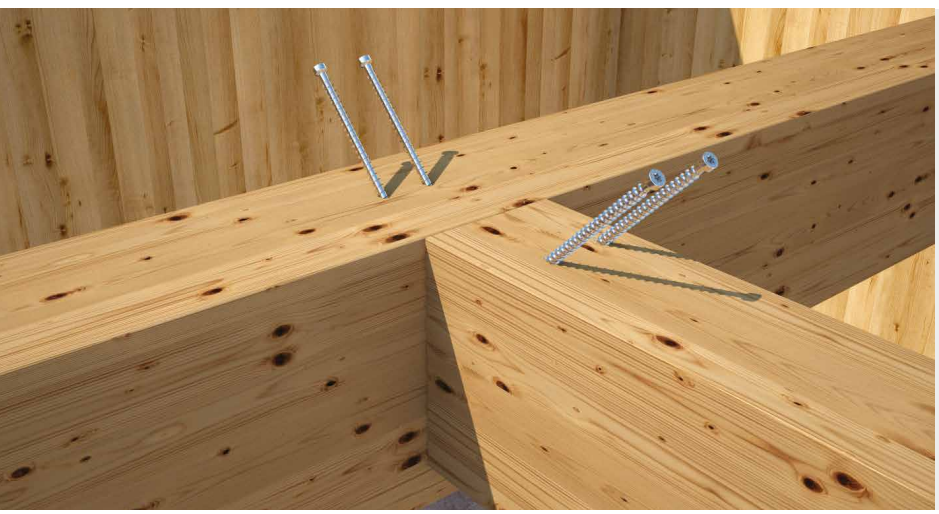
Ideal for concealed joints, timber couplings and structural reinforcements. Guarantees fire protection and earthquake suitability. Cyclical SEISMIC-REV tests according to EN 12512.

CHROMIUM (VI) FREE

Total absence of hexavalent chromium. Compliance with the strictest regulations governing chemical substances (SVHC).
REACH information available.

CHARACTERISTICS

FOCUS	45° connections, reinforcements and couplings	
HEAD	cylindrical, countersunk	
DIAMETER	5,3 | 5,6 | 7,0 | 9,0 | 11,0 mm	**0.21 | 0.23 | 0.28 | 0.36 | 0.44 inches**
LENGTH	from 80 to 600 mm	**3 1/8 to 23 5/8 inches**



MATERIAL

Bright zinc plated carbon steel.

FIELDS OF USE

- sawn lumber and timber
- Glued Laminated Timber
- CLT
- high density woods

Dry in-service conditions.

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.

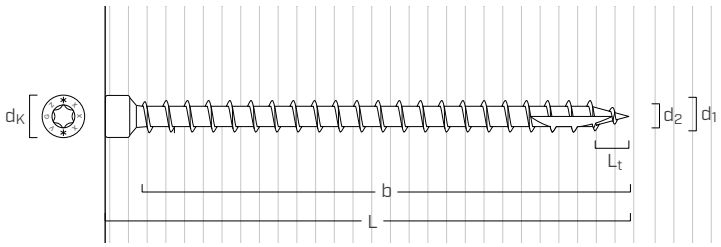
CLT, LVL

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

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

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

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[in](1)	0.21	0.23	0.28	0.36	0.44
Outer thread diameter	**d_1**	[mm]	5,3	5,6	7,0	9,0	11,0
		[in]	0.209	0.220	0.276	0.354	0.433
Head diameter	d_K	[in]	0.315	0.315	0.374	0.453	0.531
Root diameter	d_2	[in]	0.142	0.150	0.181	0.232	0.260
Tip length	L_t	[in]	0.209	0.220	0.276	0.354	0.433
Pre-drilling hole diameter(2)	d_V	[in]	0.14	0.14	0.16	0.20	0.24
Bending yield strength(3)	$F_{y,b}$	[psi]	168,000	168,000	195,000	180,000	170,000
Tensile strength	f_{tens}	[lbf]	1000	1100	1450	2450	3200

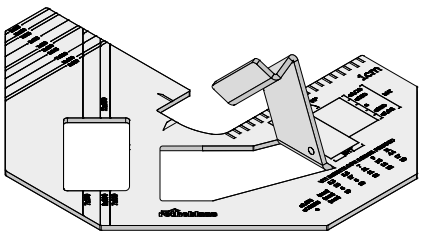
(1) The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.
(2) Pre-drilling applies to softwood timber.
(3) Bending yield strengths are determined in accordance with ASTM F1575 using the root diameter d_2.

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
5,3 **0.21 TX 25**	**VGZ580**	80	3 1/8	70	2 3/4	50
	VGZ5100	100	4	90	3 1/2	50
	VGZ5120	120	4 3/4	110	4 3/8	50
5,6 **0.23 TX 25**	**VGZ5140**	140	5 1/2	130	5 1/8	50
	VGZ5160	160	6 1/4	150	6	50
7 **0.28 TX 30**	**VGZ780**	80	3 1/8	70	2 3/4	25
	VGZ7100	100	4	90	3 1/2	25
	VGZ7120	120	4 3/4	110	4 3/8	25
	VGZ7140	140	5 1/2	130	5 1/8	25
	VGZ7160	160	6 1/4	150	6	25
	VGZ7180	180	7 1/8	170	6 3/4	25
	VGZ7200	200	8	190	7 1/2	25
	VGZ7220	220	8 5/8	210	8 1/4	25
	VGZ7240	240	9 1/2	230	9 1/16	25
	VGZ7260	260	10 1/4	250	10	25
	VGZ7280	280	11	270	10 5/8	25
	VGZ7300	300	11 3/4	290	11 7/16	25
	VGZ7340	340	13 3/8	330	13	25
	VGZ7380	380	15	370	14 9/16	25

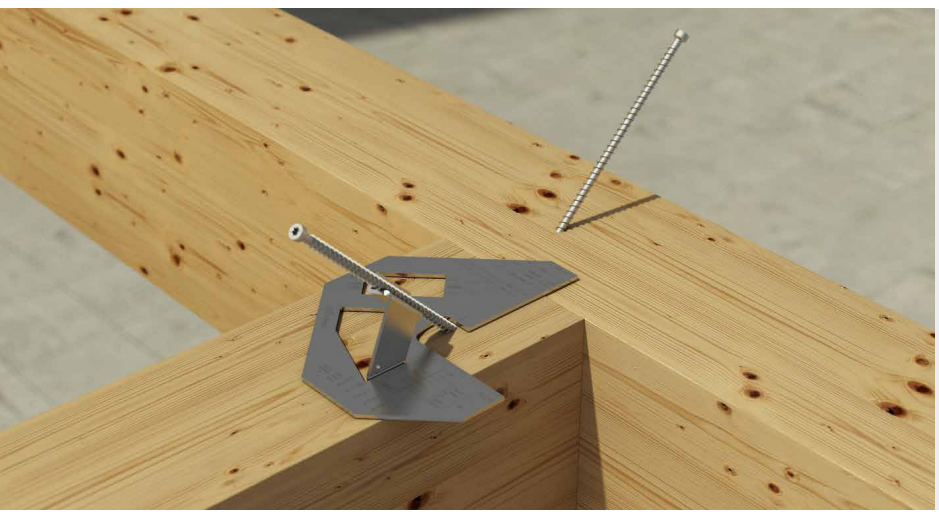
d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
9 **0.36 TX 40**	**VGZ9160**	160	6 1/4	150	6	25
	VGZ9180	180	7 1/8	170	6 3/4	25
	VGZ9200	200	8	190	7 1/2	25
	VGZ9220	220	8 5/8	210	8 1/4	25
	VGZ9240	240	9 1/2	230	9 1/16	25
	VGZ9260	260	10 1/4	250	10	25
	VGZ9280	280	11	270	10 5/8	25
	VGZ9300	300	11 3/4	290	11 7/16	25
	VGZ9320	320	12 5/8	310	12 3/16	25
	VGZ9340	340	13 3/8	330	13	25
	VGZ9360	360	14 1/4	350	13 3/4	25
	VGZ9380	380	15	370	14 9/16	25
	VGZ9400	400	15 3/4	390	15 3/8	25
	VGZ9440	440	17 1/4	430	16 15/16	25
	VGZ9480	480	19	470	18 1/2	25
	VGZ9520	520	20 1/2	510	20 1/16	25
11 **0.44 TX 50**	**VGZ11250**	250	10	240	9 1/2	25
	VGZ11300	300	11 3/4	290	11 7/16	25
	VGZ11350	350	13 3/4	340	13 3/8	25
	VGZ11400	400	15 3/4	390	15 3/8	25
	VGZ11450	450	17 3/4	440	17 1/4	25
	VGZ11500	500	19 3/4	490	19 5/16	25
	VGZ11550	550	21 5/8	540	21 1/4	25
	VGZ11600	600	23 5/8	590	23 1/4	25

JIG VGZ 45° TEMPLATE



VIDEO

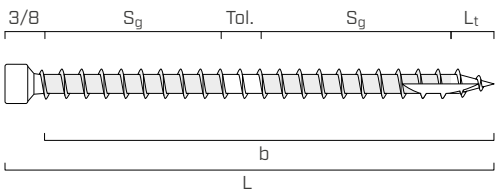
CODE	description	pcs
JIGVGZ45	steel template for VGZ screws at 45°	1



JIG VGZ 45° TEMPLATE

Installation at 45° using the JIG VGZ steel template.

EFFECTIVE THREAD USED IN CALCULATION



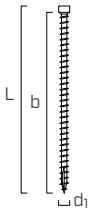
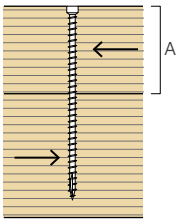
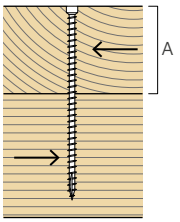
b = L - 3/8 inch — represents the entire length of the threaded part

S_g = (b - L_t - Tol.) / 2 — represents the partial length of the threaded part net of a laying tolerance (Tol.) of 3/8 inch

The timber to timber withdrawal, shear and sliding values were calculated considering the centre of gravity of the connector placed in correspondence with the shear plane.

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES (Z) | WOOD-TO-WOOD

VGZ Ø5,3 | 0.21 inch - VGZ Ø5,6 | 0.23 inch - VGZ Ø7 | 0.28 inch

geometry					$Z_{\parallel}$ (1)				$Z_{\perp/\parallel}$ (2)				$Z_{\perp}$ (3)			
																
d_1	L		b	A	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
5,3 **0.21**	80	3 1/8	2 3/4	1 1/2	98	125	144	161	98	125	144	161	98	125	144	161
	100	4	3 1/2	2	106	125	144	161	106	125	144	161	106	125	144	161
	120	4 3/4	4 3/8	2 1/4	106	125	144	161	106	125	144	161	106	125	144	161
5,6 **0.23**	140	5 1/2	5 1/8	2 3/4	118	140	161	179	118	140	161	179	118	140	161	179
	160	6 1/4	6	3	118	140	161	179	118	140	161	179	118	140	161	179
7 **0.28**	80	3 1/8	2 3/4	1 1/4	120	168	206	242	96	135	165	194	96	135	165	194
	100	4	3 1/2	2	149	202	242	269	119	161	193	215	119	161	193	215
	120	4 3/4	4 3/8	2 1/4	176	210	242	269	141	168	193	215	141	168	193	215
	140	5 1/2	5 1/8	2 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	160	6 1/4	6	3	177	210	242	269	142	168	193	215	142	168	193	215
	180	7 1/8	6 3/4	3 1/2	177	210	242	269	142	168	193	215	142	168	193	215
	200	8	7 1/2	4	177	210	242	269	142	168	193	215	142	168	193	215
	220	8 5/8	8 1/4	4 1/4	177	210	242	269	142	168	193	215	142	168	193	215
	240	9 1/2	9 1/16	4 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	260	10 1/4	10	5	177	210	242	269	142	168	193	215	142	168	193	215
	280	11	10 5/8	5 1/2	177	210	242	269	142	168	193	215	142	168	193	215
	300	11 3/4	11 7/16	6	177	210	242	269	142	168	193	215	142	168	193	215
	340	13 3/8	13	6 3/4	177	210	242	269	142	168	193	215	142	168	193	215
	380	15	14 9/16	7 1/4	177	210	242	269	142	168	193	215	142	168	193	215

NOTES:

Tabulated reference lateral design values (Z) are applicable to screws installed perpendicular to the faces of the wood members and loaded as follows:

(1) $Z_{\parallel}$ both side and main members loaded parallel to the grain.

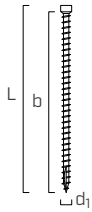
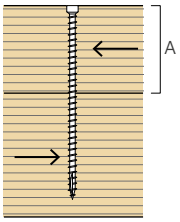
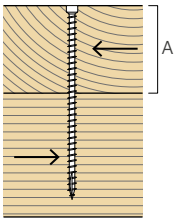
(2) $Z_{\perp/\parallel}$ side member loaded perpendicular to the grain; main member loaded parallel to the grain.

(3) $Z_{\perp}$ both side and main members loaded perpendicular to the grain.

Refer to page 22 for the general calculation principles.

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES (Z) | WOOD-TO-WOOD

VGZ Ø9 | 0.36 inch - VGZ Ø11 | 0.44 inch

geometry					$Z_{\parallel}$ (1)				$Z_{\perp/\parallel}$ (2)				$Z_{\perp}$ (3)			
																
d_1	L		b	A	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
	160	6 1/4	6	3	230	272	313	348	184	217	250	278	184	217	250	278
	180	7 1/8	6 3/4	3 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	200	8	7 1/2	4	230	272	313	348	184	217	250	278	184	217	250	278
	220	8 5/8	8 1/4	4 1/4	230	272	313	348	184	217	250	278	184	217	250	278
	240	9 1/2	9 1/16	4 3/4	230	272	313	348	184	217	250	278	184	217	250	278
	260	10 1/4	10	5	230	272	313	348	184	217	250	278	184	217	250	278
	280	11	10 5/8	5 1/2	230	272	313	348	184	217	250	278	184	217	250	278
9 0.36	300	11 3/4	11 7/16	6	230	272	313	348	184	217	250	278	184	217	250	278
	320	12 5/8	12 3/16	6 1/4	230	272	313	348	184	217	250	278	184	217	250	278
	340	13 3/8	13	6 3/4	230	272	313	348	184	217	250	278	184	217	250	278
	360	14 1/4	13 3/4	7	230	272	313	348	184	217	250	278	184	217	250	278
	380	15	14 9/16	7 1/4	230	272	313	348	184	217	250	278	184	217	250	278
	400	15 3/4	15 3/8	7 3/4	230	272	313	348	184	217	250	278	184	217	250	278
	440	17 1/4	16 15/16	8 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	480	19	18 1/2	9 1/2	230	272	313	348	184	217	250	278	184	217	250	278
	520	20 1/2	20 1/16	10 1/4	230	272	313	348	184	217	250	278	184	217	250	278
	250	10	9 1/2	5	314	344	372	394	225	252	278	299	205	234	262	285
	300	11 3/4	11 7/16	6	314	344	372	394	225	252	278	299	205	234	262	285
	350	13 3/4	13 3/8	6 3/4	314	344	372	394	225	252	278	299	205	234	262	285
11 0.44	400	15 3/4	15 3/8	7 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	450	17 3/4	17 1/4	8 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	500	19 3/4	19 5/16	9 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	550	21 5/8	21 1/4	10 3/4	314	344	372	394	225	252	278	299	205	234	262	285
	600	23 5/8	23 1/4	11 3/4	314	344	372	394	225	252	278	299	205	234	262	285

NOTES:

Tabulated reference lateral design values (Z) are applicable to screws installed perpendicular to the faces of the wood members and loaded as follows:

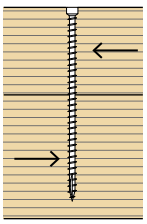
(1) $Z_{\parallel}$ both side and main members loaded parallel to the grain.

(2) $Z_{\perp/\parallel}$ side member loaded perpendicular to the grain; main member loaded parallel to the grain.

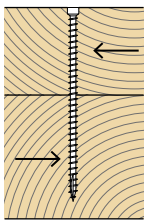
(3) $Z_{\perp}$ both side and main members loaded perpendicular to the grain.

Refer to page 22 for the general calculation principles.

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°

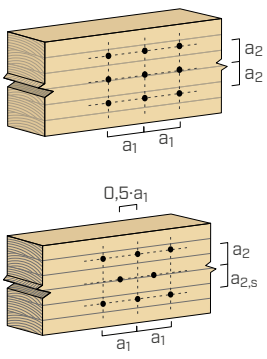


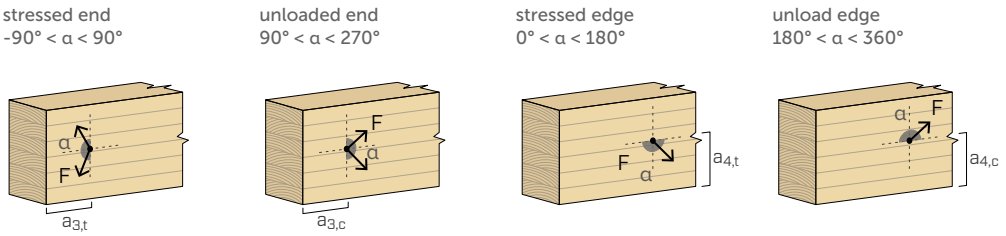
Load-to-grain angle α = 90°

		Screws inserted without pre-drilling hole **G < 0.50**							Screws inserted without pre-drilling hole **G < 0.50**						
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*11*		*5,3*	*5,6*	*7*	*9*		*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.44**		**0.21**	**0.23**	**0.28**	**0.36**		**0.44**
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	**12·d**	5 3/16
a_2	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	2 3/16	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	2 3/16
$a_{2,s}$	[in]	**2.5·d**	9/16	9/16	11/16	7/8	**5·d**	2 3/16	**2.5·d**	9/16	9/16	11/16	7/8	**5·d**	2 3/16
$a_{3,t}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	4 3/8
$a_{3,c}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	4 3/8	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	4 3/8
$a_{4,t}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	2 3/16	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	4 3/8
$a_{4,c}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	2 3/16	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	**5·d**	2 3/16

		Screws inserted without pre-drilling hole **G ≥ 0.50**							Screws inserted without pre-drilling hole **G ≥ 0.50**						
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*11*		*5,3*	*5,6*	*7*	*9*		*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.44**		**0.21**	**0.23**	**0.28**	**0.36**		**0.44**
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2
a_2	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16
$a_{2,s}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	**5·d**	2 3/16	**3·d**	5/8	11/16	13/16	1 1/16	**5·d**	2 3/16
$a_{3,t}$	[in]	**20·d**	4 3/16	4 7/16	5 1/2	7 1/8	**20·d**	8 5/8	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2
$a_{3,c}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	**15·d**	6 1/2
$a_{4,t}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	**12·d**	5 3/16
$a_{4,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16

d = nominal screw diameter

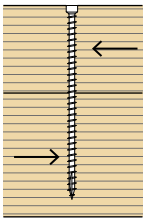




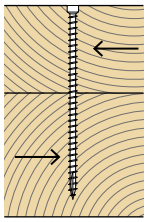
NOTES:

- The minimum spacing and distances comply with Table 9 of ESR-4645, where d refers to the nominal diameter of the screw.
- Values for spacing between staggered rows $a_{2,s}$ apply where fasteners in adjacent rows are offset by half of the spacing between fasteners in a row ($0.5 \cdot a_1$).
- Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°



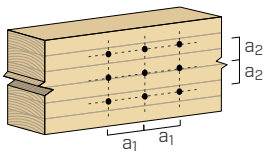
Load-to-grain angle α = 90°

		Screws inserted without pre-drilling hole **G ≤ 0.47**						Screws inserted without pre-drilling hole **G ≤ 0.47**					
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
a_1	[in]	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	5 3/16	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16
a_2	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16
$a_{3,t}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
$a_{3,c}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
$a_{4,t}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
$a_{4,c}$	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16

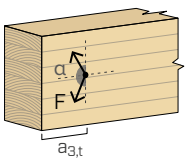
		Screws inserted without pre-drilling hole **G > 0.47**						Screws inserted without pre-drilling hole **G > 0.47**					
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
a_1	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16
a_2	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16
$a_{3,t}$	[in]	**20·d**	4 3/16	4 7/16	5 1/2	7 1/8	8 5/8	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
$a_{3,c}$	[in]	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2	**15·d**	3 1/8	3 5/16	4 1/8	5 5/16	6 1/2
$a_{4,t}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	5 3/16
$a_{4,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16

		Screws inserted **with** pre-drilling hole						Screws inserted **with** pre-drilling hole					
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
a_1	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16	**4·d**	7/8	7/8	1 1/8	1 7/16	2 3/16
a_2	[in]	**3·d**	5/8	11/16	13/16	1 1/16	1 5/16	**4·d**	7/8	7/8	1 1/8	1 7/16	1 5/16
$a_{3,t}$	[in]	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	5 3/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	5 3/16
$a_{3,c}$	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16
$a_{4,t}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	1 5/16	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	1 5/16
$a_{4,c}$	[in]	**3·d**	5/8	11/16	13/16	1 1/16	1 5/16	**3·d**	5/8	11/16	13/16	1 1/16	1 5/16

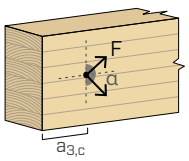
d = nominal screw diameter



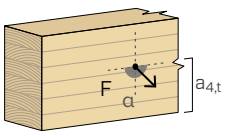
stressed end
-90° < α < 90°



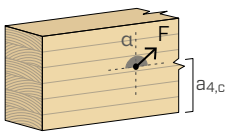
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°

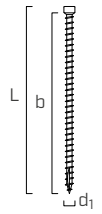
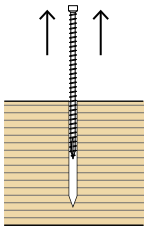
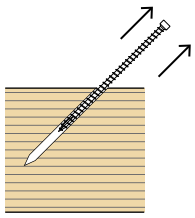


NOTES:

- The tabulated values for the minimum spacing and distances are according to the European Technical Assessment ETA-11/0030. The values from ETA-11/0030 are based on extensive research studies carried out in Europe and are according to the well-established provisions from EN 1995:2014 (Eurocode 5). Designers may adopt, under their responsibility, the minimum spacing and distances from ETA-11/0030.
- Specific gravity of G = 0.47 is equivalent to a characteristic density of ρ_k = 420 kg/m^3.
- The minimum spacing for all steel-to-timber connections (a_1 and a_2) can be multiplied by a coefficient of 0.7.

STRUCTURAL VALUES | THREAD WITHDRAWAL (W) | WOOD

VGZ Ø5,3 | 0.21 inch - VGZ Ø5,6 | 0.23 inch - VGZ Ø7 | 0.28 inch - VGZ Ø9 | 0.36 inch

geometry				$W^{(1)}$ α = 90°				$W^{(1)}$ α = 45°				$W^{(1)}$ α = 0°			
															
d_1	L		b	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	*[mm]*	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
5,3 **0.21**	*80*	3 1/8	2 3/4	260	301	336	369	236	274	306	336	78	90	101	111
	100	4	3 1/2	340	393	440	484	310	358	401	440	102	118	132	145
	120	4 3/4	4 3/8	420	486	544	598	383	443	495	544	126	146	163	179
5,6 **0.23**	*140*	5 1/2	5 1/8	524	602	681	744	477	548	620	677	157	181	204	223
	160	6 1/4	6	608	699	790	864	554	636	719	786	182	210	237	259
7 **0.28**	*80*	3 1/8	2 3/4	320	367	412	451	291	334	375	411	96	110	124	135
	100	4	3 1/2	422	484	542	595	384	440	494	541	126	145	163	178
	120	4 3/4	4 3/8	523	600	673	738	476	546	613	672	157	180	202	221
	140	5 1/2	5 1/8	625	717	804	881	568	652	732	802	187	215	241	264
	160	6 1/4	6	726	833	935	1025	661	758	850	932	218	250	280	307
	180	7 1/8	6 3/4	828	950	1065	1168	753	864	969	1063	248	285	320	350
	200	8	7 1/2	929	1066	1196	1311	846	970	1088	1193	279	320	359	393
	220	8 5/8	8 1/4	1031	1183	1327	1455	938	1076	1207	1324	309	355	398	436
	240	9 1/2	9 1/16	1133	1299	1457	1598	1031	1182	1326	1454	340	390	437	479
	260	10 1/4	10	1234	1416	1588	1741	1123	1288	1445	1584	370	425	476	522
	280	11	10 5/8	1336	1532	1719	1884	1215	1395	1564	1715	401	460	516	565
	300	11 3/4	11 7/16	1437	1649	1850	2028	1308	1501	1683	1845	431	495	555	608
	340	13 3/8	13	1640	1882	2111	2314	1493	1713	1921	2106	492	565	633	694
	380	15	14 9/16	1844	2115	2372	2601	1678	1925	2159	2367	553	635	712	780
9 **0.36**	*160*	6 1/4	6	716	827	960	1049	652	753	874	955	215	248	288	315
	180	7 1/8	6 3/4	818	944	1097	1198	744	859	998	1090	245	283	329	359
	200	8	7 1/2	919	1062	1233	1347	837	966	1122	1226	276	319	370	404
	220	8 5/8	8 1/4	1021	1179	1369	1496	929	1073	1246	1361	306	354	411	449
	240	9 1/2	9 1/16	1122	1296	1505	1644	1021	1180	1370	1496	337	389	452	493
	260	10 1/4	10	1224	1414	1641	1793	1114	1287	1494	1632	367	424	492	538
	280	11	10 5/8	1326	1531	1778	1942	1206	1393	1618	1767	398	459	533	583
	300	11 3/4	11 7/16	1427	1648	1914	2091	1299	1500	1742	1903	428	495	574	627
	320	12 5/8	12 3/16	1529	1766	2050	2240	1391	1607	1866	2038	459	530	615	672
	340	13 3/8	13	1630	1883	2186	2389	1484	1714	1990	2174	489	565	656	717
	360	14 1/4	13 3/4	1732	2000	2323	2537	1576	1820	2114	2309	520	600	697	761
	380	15	14 9/16	1833	2118	2459	2686	1668	1927	2237	2444	550	635	738	806
	400	15 3/4	15 3/8	1935	2235	2595	2835	1761	2034	2361	2580	581	671	779	851
	440	17 1/4	16 15/16	2138	2470	2867	3133	1946	2247	2609	2851	641	741	860	940
	480	19	18 1/2	2341	2704	3140	3430	2131	2461	2857	3122	702	811	942	1029
	520	20 1/2	20 1/16	2544	2939	3412	3728	2315	2674	3105	3392	763	882	1024	1118

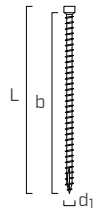
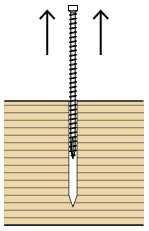
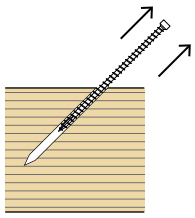
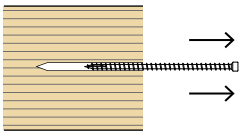
NOTES:

(1) The tabulated values refer to the effective thread penetration length of the screw in the wood member ($b-L_t$).

Refer to page 22 for the general calculation principles.

STRUCTURAL VALUES | THREAD WITHDRAWAL (W) | WOOD

VGZ Ø11 | 0.44 inch

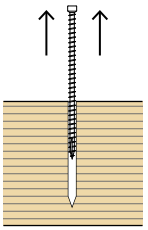
geometry				$W^{(1)}$ α = 90°				$W^{(1)}$ α = 45°				$W^{(1)}$ α = 0°			
															
															
d_1	L		b	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	*[mm]*	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
	250	10	9 1/2	1334	1542	1731	1893	1214	1403	1575	1723	400	463	519	568
	300	11 3/4	11 7/16	1626	1878	2109	2307	1479	1709	1919	2099	488	563	633	692
	350	13 3/4	13 3/8	1917	2215	2487	2720	1744	2016	2263	2475	575	664	746	816
11	*400*	15 3/4	15 3/8	2208	2552	2865	3133	2010	2322	2607	2851	663	765	859	940
0.44	*450*	17 3/4	17 1/4	2500	2888	3243	3547	2275	2628	2951	3228	750	866	973	1064
	500	19 3/4	19 5/16	2791	3225	3621	3960	2540	2935	3295	3604	837	967	1086	1188
	550	21 5/8	21 1/4	3082	3561	3999	4374	2805	3241	3639	3980	925	1068	1200	1312
	600	23 5/8	23 1/4	3374	3898	4377	4787	3070	3547	3983	4356	1012	1169	1313	1436

NOTES:

(1) The tabulated values refer to the effective thread penetration length of the screw in the wood member ($b\text{-}L_t$).

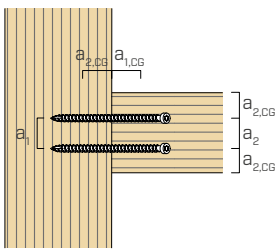
Refer to page 22 for the general calculation principles.

MINIMUM DISTANCES FOR AXIAL STRESSES

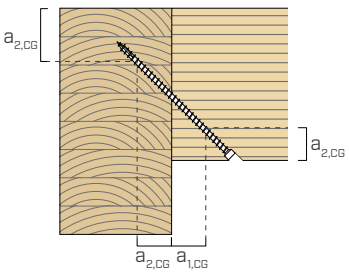


		Screws inserted with and without pre-drilling hole **G ≤ 0.55**						
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*		*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**		**0.44**
a_1	[in]	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	**7·d**	3 1/16
a_2	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	**5·d**	2 3/16
$a_{1,CG}$	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	**10·d**	4 3/8
$a_{2,CG}$	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	**4·d**	1 3/4
$a_{2,CROSS}$	[in]	**1.5·d**	5/16	3/8	7/16	9/16	**1.5·d**	11/16

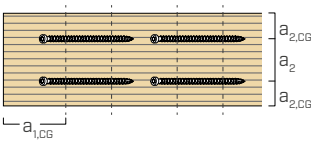
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



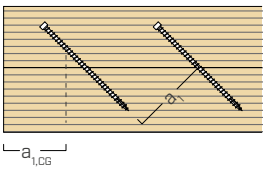
plan



front

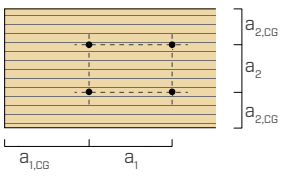


plan

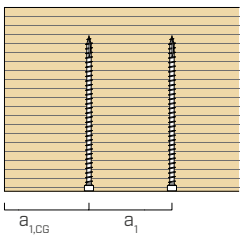


front

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

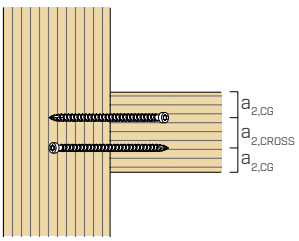


plan

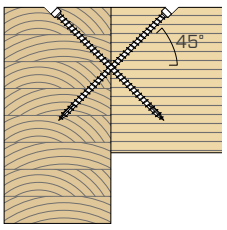


front

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



plan

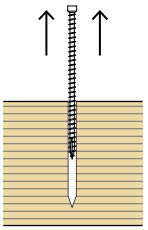


front

NOTES:

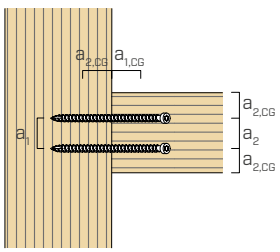
- The minimum spacing and distances comply with Table 9 of ESR-4645, where d refers to the nominal diameter of the screw.
- Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

MINIMUM DISTANCES FOR AXIAL STRESSES

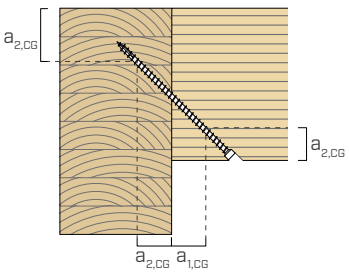


			Screws inserted with and without pre-drilling hole **G ≤ 0.55**				
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
a_1	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16
a_2	[in]	**5·d**	1 1/16	1 1/8	1 3/8	1 3/4	2 3/16
$a_{2,LIM}$ (1)	[in]	**2.5·d**	*9/16*	*9/16*	*11/16*	*7/8*	*1 1/8*
$a_{1,CG}$ (2)	[in]	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
$a_{2,CG}$ (3)	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	1 3/4
a_{CROSS}	[in]	**1.5·d**	5/16	3/8	7/16	9/16	11/16

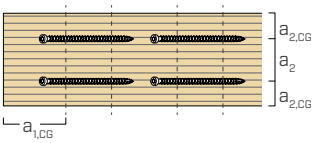
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



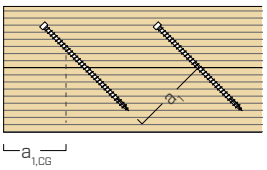
plan



front

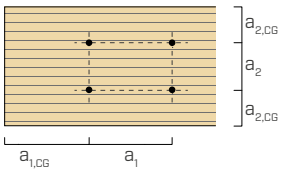


plan

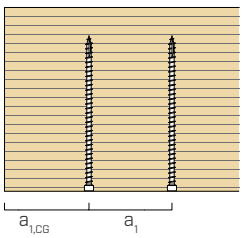


front

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

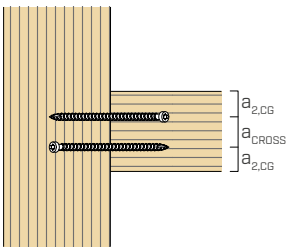


plan

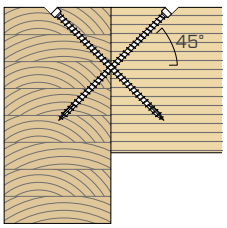


front

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



plan



front

NOTES:

- The tabulated values for the minimum spacing and distances are according to the European Technical Assessment ETA-11/0030. The values from ETA-11/0030 are based on extensive research studies carried out in Europe and are according to the well-established provisions from EN 1995:2014 (Eurocode 5). Designers may adopt, under their responsibility, the minimum spacing and distances from ETA-11/0030.

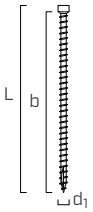
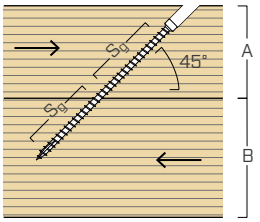
(1) The axial distance a_2 can be reduced down to 2,5 d_1 if for each connector a "joint surface" $a_1 \cdot a_2 = 25 \cdot d_1^2$ is maintained.

(2) For main beam-secondary beam joints with VGZ screws d = 7 mm inclined or crossed, inserted at an angle of 45° to the secondary beam, with a minimum secondary beam height of 18 d, the minimum distance $a_{1,CG}$ can be taken equal to $8 \cdot d_1$.

(3) For main beam-secondary beam joints with VGZ screws d = 7 mm inclined or crossed, inserted at an angle of 45° to the secondary beam, with a minimum secondary beam height of 18 d, the minimum distance $a_{2,CG}$ can be taken equal to $3 \cdot d_1$.

STRUCTURAL VALUES | SLIDING RESISTANCE (R_v) | WOOD-TO-WOOD

VGZ Ø5,3 | 0.21 inch - VGZ Ø5,6 | 0.23 inch - VGZ Ø7 | 0.28 inch - VGZ Ø9 | 0.36 inch - VGZ Ø11 | 0.44 inch

geometry						R_v			
									
d_1	L		b	A_{min}	B_{min}	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	*[mm]*	[in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5,3 **0.21**	*80*[1]	3 1/8	2 3/4	1 3/16	1 15/16	71	82	91	100
	100[1]	4	3 1/2	1 9/16	2 3/16	97	112	125	137
	120	4 3/4	4 3/8	1 3/4	2 3/8	122	142	158	174
5,6 **0.23**	*140*	5 1/2	5 1/8	1 15/16	2 3/4	155	178	201	220
	160	6 1/4	6	2 3/8	2 15/16	182	209	237	259
7 **0.28**	*80*[1]	3 1/8	2 3/4	1 3/16	1 15/16	87	99	111	122
	100[1]	4	3 1/2	1 9/16	2 3/16	119	137	153	168
	120[1]	4 3/4	4 3/8	1 3/4	2 3/8	152	174	196	214
	140	5 1/2	5 1/8	2 3/16	2 3/4	185	212	238	261
	160	6 1/4	6	2 3/8	2 15/16	217	249	280	307
	180	7 1/8	6 3/4	2 9/16	3 3/8	250	287	322	353
	200	8	7 1/2	2 15/16	3 1/2	283	324	364	399
	220	8 5/8	8 1/4	3 1/8	4	315	362	406	445
	240	9 1/2	9 1/16	3 1/2	4 1/8	348	399	448	491
	260	10 1/4	10	3 3/4	4 3/8	381	437	490	537
	280	11	10 5/8	4	4 3/4	413	474	532	583
	300	11 3/4	11 7/16	4 3/8	4 15/16	446	512	574	629
	340	13 3/8	13	4 15/16	5 1/2	511	587	658	722
	380	15	14 9/16	5 1/2	6 1/8	577	662	742	814
9 **0.36**	*160*	6 1/4	6	2 3/8	2 15/16	214	247	287	314
	180	7 1/8	6 3/4	2 3/4	3 3/8	247	285	331	361
	200	8	7 1/2	2 15/16	3 1/2	279	323	375	409
	220	8 5/8	8 1/4	3 1/8	4	312	360	419	457
	240	9 1/2	9 1/16	3 1/2	4 1/8	345	398	462	505
	260	10 1/4	10	3 3/4	4 3/8	377	436	506	553
	280	11	10 5/8	4 1/8	4 3/4	410	474	550	601
	300	11 3/4	11 7/16	4 3/8	4 15/16	443	511	594	649
	320	12 5/8	12 3/16	4 1/2	5 5/16	475	549	638	697
	340	13 3/8	13	4 15/16	5 1/2	508	587	682	745
	360	14 1/4	13 3/4	5 1/8	5 11/16	541	625	725	792
	380	15	14 9/16	5 1/2	6 1/8	574	662	769	840
	400	15 3/4	15 3/8	5 11/16	6 1/4	606	700	813	888
	440	17 1/4	16 15/16	6 1/4	6 7/8	672	776	901	984
	480	19	18 1/2	6 7/8	7 1/2	737	851	988	1080
	520	20 1/2	20 1/16	7 1/2	8 1/16	802	927	1076	1175
11 **0.44**	*250*	10	9 1/2	3 3/4	4 3/8	409	472	530	580
	300	11 3/4	11 7/16	4 1/2	4 15/16	502	580	652	713
	350	13 3/4	13 3/8	5 1/8	5 11/16	596	689	773	846
	400	15 3/4	15 3/8	6	6 1/4	690	797	895	979
	450	17 3/4	17 1/4	6 1/2	7 1/8	784	905	1017	1112
	500	19 3/4	19 5/16	7 1/4	7 11/16	877	1014	1138	1245
	550	21 5/8	21 1/4	8	8 7/16	971	1122	1260	1378
	600	23 5/8	23 1/4	8 5/8	9 1/16	1065	1230	1381	1511

NOTES:

[1] The embedded thread length in the main and side member does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle α=45° to the grain).

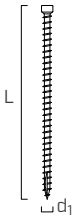
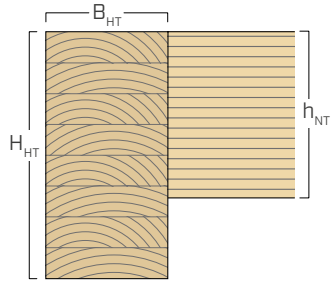
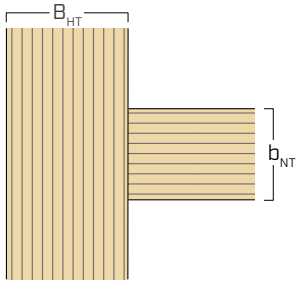
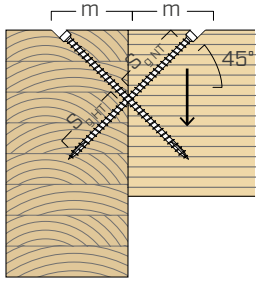
The connector tensile strenght must be evaluated and verified considering a 45° angle between the fibers and the connector.

Refer to page 22 for the general calculation principles.

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES (R_V) WITH CROSSED CONNECTORS

RIGHT - ANGLE JOINT - MAIN BEAM / SECONDARY BEAM

VGZ Ø5,3 | 0.21 inch - VGZ Ø5,6 | 0.23 inch - VGZ Ø7 | 0.28 inch

geometry			main beam / secondary beam						R_V[2]				
													
d_1 [mm] [in]	L [mm]	L [in]	$S_{g\,HT}$[1] [in]	$S_{g\,NT}$[1] [in]	$B_{HT,min}$ [in]	$H_{HT,min} = h_{NT,min}$ [in]	$b_{NT,min}$ [in]	no. pairs	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]	m[3] [in]
5,3 **0.21**	*120*	4 3/4	1 3/16	2 3/8	2 3/8	4 3/4	1 15/16	1	171	198	222	244	2 3/16
							3 1/8	2	320	370	414	454	
							4 1/4	3	463	535	599	657	
5,6 **0.23**	*140*	5 1/2	1 3/4	2 9/16	2 9/16	5 1/8	2 1/16	1	265	304	344	376	2 5/16
							3 5/16	2	494	568	642	702	
							4 1/2	3	715	822	929	1016	
	160	6 1/4	2 9/16	2 9/16	2 15/16	5 1/8	2 1/16	1	353	406	458	501	2 5/16
							3 5/16	2	658	757	855	935	
							4 1/2	3	953	1095	1238	1353	
7 **0.28**	*160*	6 1/4	1 3/4	3 3/8	2 15/16	6 1/4	2 5/8	1	319	366	411	450	2 15/16
							4 1/8	2	596	684	767	841	
							5 5/8	3	862	989	1109	1216	
	180	7 1/8	2 9/16	3 3/8	3 1/8	6 1/4	2 5/8	1	467	536	602	660	2 15/16
							4 1/8	2	872	1001	1123	1231	
							5 5/8	3	1262	1448	1624	1781	
	200	8	3 3/8	3 3/8	3 1/2	6 1/4	2 5/8	1	560	643	721	790	2 15/16
							4 1/8	2	1046	1200	1345	1475	
							5 5/8	3	1513	1736	1947	2134	
	220	8 5/8	3 3/4	3 3/4	3 3/4	6 3/4	2 5/8	1	623	714	801	878	3 3/16
							4 1/8	2	1162	1333	1495	1639	
							5 5/8	3	1681	1928	2163	2371	
	240	9 1/2	4 1/8	4 1/8	4	7 1/4	2 5/8	1	685	786	881	966	3 7/16
							4 1/8	2	1278	1466	1644	1803	
							5 5/8	3	1849	2121	2379	2609	
	260	10 1/4	4 1/2	4 1/2	4 3/8	8	2 5/8	1	747	857	961	1054	3 3/4
							4 1/8	2	1394	1599	1794	1967	
							5 5/8	3	2017	2314	2596	2846	
	280	11	4 15/16	4 15/16	4 1/2	8 7/16	2 5/8	1	820	940	1055	1156	4
							4 1/8	2	1530	1755	1968	2158	
							5 5/8	3	2213	2539	2848	3122	
	300	11 3/4	5 5/16	5 5/16	4 15/16	9 1/16	2 5/8	1	882	1012	1135	1244	4 5/16
							4 1/8	2	1646	1888	2118	2322	
							5 5/8	3	2381	2732	3064	3360	
	340	13 3/8	6 1/8	6 1/8	5 1/2	10 1/16	2 5/8	1	1017	1167	1308	1435	4 7/8
							4 1/8	2	1897	2177	2442	2677	
							5 5/8	3	2745	3150	3533	3873	
	380	15	6 7/8	6 7/8	6	11 1/4	2 5/8	1	1141	1309	1469	1610	5 7/16
							4 1/8	2	2130	2444	2741	3005	
							5 5/8	3	3082	3536	3966	4348	

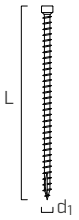
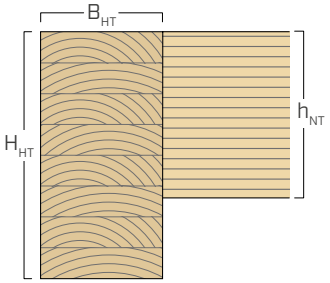
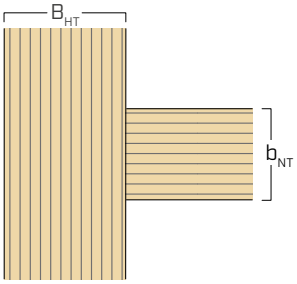
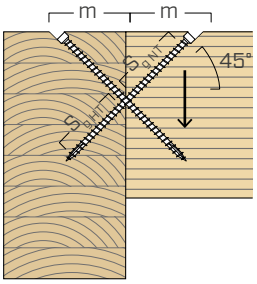
NOTES:

Refer to page 16 for more informations.

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES (R_V) WITH CROSSED CONNECTORS

RIGHT - ANGLE JOINT - MAIN BEAM / SECONDARY BEAM

VGZ Ø9 | 0.28 inch

geometry			main beam / secondary beam						R_v[2]				
													
d_1 [mm] [in]	L [mm]	L [in]	$S_{g\,HT}$[1] [in]	$S_{g\,NT}$[1] [in]	$B_{HT,min}$ [in]	$H_{HT,min} = h_{NT,min}$ [in]	$b_{NT,min}$ [in]	no. pairs	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]	m[3] [in]
9 **0.36**	*200*	8	2 3/16	4 1/2	3 1/2	8	3 3/8	1	399	461	535	585	3 3/4
							5 5/16	2	745	860	999	1091	
							7 1/4	3	1077	1245	1445	1579	
	220	8 5/8	2 15/16	4 1/2	3 3/4	8	3 3/8	1	536	619	719	785	3 3/4
							5 5/16	2	1000	1155	1341	1465	
							7 1/4	3	1447	1671	1940	2120	
	240	9 1/2	3 3/4	4 1/2	4	8	3 3/8	1	684	790	917	1002	3 3/4
							5 5/16	2	1277	1475	1712	1870	
							7 1/4	3	1847	2134	2477	2706	
	260	10 1/4	4 1/2	4 1/2	4 3/8	8	3 3/8	1	747	863	1002	1095	3 3/4
							5 5/16	2	1394	1610	1870	2042	
							7 1/4	3	2017	2330	2705	2955	
	280	11	4 15/16	4 15/16	4 1/2	8 7/16	3 3/8	1	820	947	1099	1201	4 1/16
							5 5/16	2	1530	1767	2051	2241	
							7 1/4	3	2213	2556	2968	3243	
	300	11 3/4	5 5/16	5 5/16	4 15/16	9 1/16	3 3/8	1	882	1019	1183	1292	4 3/8
							5 5/16	2	1646	1901	2207	2411	
							7 1/4	3	2381	2750	3193	3489	
	320	12 5/8	5 11/16	5 11/16	5 1/8	9 5/8	3 3/8	1	944	1091	1266	1383	4 5/8
							5 5/16	2	1762	2035	2363	2581	
							7 1/4	3	2549	2945	3419	3735	
	340	13 3/8	6 1/8	6 1/8	5 1/2	10 1/4	3 3/8	1	1017	1174	1364	1490	4 7/8
							5 5/16	2	1897	2192	2545	2780	
							7 1/4	3	3541	4090	4749	5188	
	360	14 1/4	6 1/2	6 1/2	5 11/16	10 5/8	3 3/8	1	1079	1246	1447	1581	5 3/16
							5 5/16	2	2014	2326	2700	2950	
							7 1/4	3	2914	3365	3907	4269	
	380	15	6 7/8	6 7/8	6	11 1/4	3 3/8	1	1141	1318	1531	1672	5 7/16
							5 5/16	2	2130	2460	2856	3120	
							7 1/4	3	3082	3559	4133	4515	
	400	15 3/4	7 1/4	7 1/4	6 1/4	11 3/4	3 3/8	1	1204	1390	1614	1763	5 11/16
							5 5/16	2	2246	2594	3012	3291	
							7 1/4	3	3250	3754	4358	4761	
	440	17 1/4	8 1/16	8 1/16	6 7/8	13	3 3/8	1	1338	1546	1795	1961	6 1/4
							5 5/16	2	2498	2885	3350	3659	
							7 1/4	3	3614	4174	4847	5295	
	480	19	8 7/8	8 7/8	7 1/4	14	3 3/8	1	1473	1702	1976	2159	6 7/8
							5 5/16	2	2749	3176	3687	4028	
							7 1/4	3	3978	4595	5335	5828	
	520	20 1/2	9 5/8	9 5/8	8	15 3/16	3 3/8	1	1598	1846	2143	2341	7 3/8
							5 5/16	2	2982	3444	3999	4369	
							7 1/4	3	4314	4983	5786	6321	

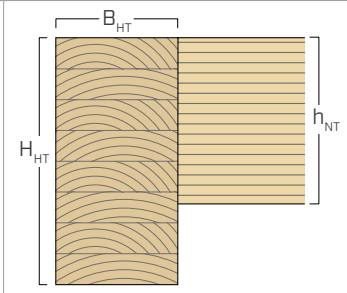
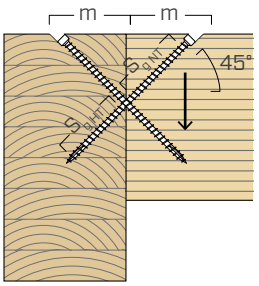
NOTES:

Refer to page 16 for more informations.

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES (R_V) WITH CROSSED CONNECTORS

RIGHT - ANGLE JOINT - MAIN BEAM / SECONDARY BEAM

VGZ Ø11 | 0.44 inch

geometry			main beam / secondary beam						R_v[2]				
													
d_1	L		$S_{g\,HT}$ [1]	$S_{g\,NT}$ [1]	$B_{HT,min}$	$H_{HT,min} = h_{NT,min}$	$b_{NT,min}$	no. pairs	G=0.35	G=0.42	G=0.49	G=0.55	m[3]
[mm] [in]	[mm]	[in]	[in]	[in]	[in]	[in]	[in]		[lbf]	[lbf]	[lbf]	[lbf]	[in]
11 **0.44**	250	10	2 15/16	5 11/16	4 1/8	9 5/8	4 1/8	1	615	710	798	872	4 5/8
							6 1/2	2	1147	1326	1488	1628	
							8 7/8	3	1660	1918	2154	2355	
	300	11 3/4	4 15/16	5 11/16	4 15/16	9 5/8	4 1/8	1	1033	1194	1341	1466	4 5/8
							6 1/2	2	1928	2228	2502	2736	
							8 7/8	3	2790	3224	3620	3959	
	350	13 3/4	6 1/4	6 1/4	5 1/2	10 7/16	4 1/8	1	1190	1375	1544	1689	5 1/16
							6 1/2	2	2221	2567	2882	3152	
							8 7/8	3	3214	3714	4170	4561	
	400	15 3/4	7 1/4	7 1/4	6 1/4	11 3/4	4 1/8	1	1381	1595	1791	1959	5 3/4
							6 1/2	2	2577	2977	3343	3656	
							8 7/8	3	3728	4308	4837	5290	
	450	17 3/4	8 1/4	8 1/4	6 7/8	13 3/16	4 1/8	1	1571	1816	2039	2230	6 7/16
							6 1/2	2	2932	3388	3804	4161	
							8 7/8	3	4243	4902	5504	6020	
	500	19 3/4	9 1/4	9 1/4	7 11/16	14 9/16	4 1/8	1	1762	2036	2286	2500	7 3/16
							6 1/2	2	3288	3799	4265	4665	
							8 7/8	3	4757	5496	6171	6750	
	550	21 5/8	10 1/4	10 1/4	8 1/4	15 15/16	4 1/8	1	1952	2256	2533	2770	7 13/16
							6 1/2	2	3643	4209	4726	5169	
							8 7/8	3	5271	6090	6838	7479	
	600	23 5/8	11 1/4	11 1/4	9 1/16	17 1/2	4 1/8	1	2143	2476	2780	3040	8 7/16
							6 1/2	2	3999	4620	5187	5674	
							8 7/8	3	5785	6684	7505	8209	

NOTES:

(1) The values given are calculated considering a distance $a_{1,CG} \geq 5 \cdot d$. In some cases the asymmetrical laying of connectors is needed ($S_{g\,HT} \neq S_{g\,NT}$).

(2) The thread axial resistance to withdrawal has been evaluated considering an effective thread length equal to S_g. The connectors must be inserted at 45° with respect to the shear plane.

(3) Dimension (m) applies to symmetrical installation of the connectors ($S_{gHT} = S_{gNT}$) where the top edges of the main and secondary beams are aligned. In case of asymmetric installation, the connetor in the main beam is to be embedded to ensure the effetive lengths (S_{gHT}, S_{gNT}) indicated in the table.

- The connector compression design strenght is the lower between the withdrawal-side design strenght and the instability design strenght.
- The connector tensile strength must be evaluated and verified considering a 45° angle between the grain and the screw axis.

MINIMUM DISTANCES FOR CROSSED SCREWS

ESR-4645

		Screws inserted with and without pre-drilling hole					
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
$a_{2,CG}$	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	1 3/4
$a_{2,CROSS}$	[in]	**1.5·d**	5/16	3/8	7/16	9/16	11/16
e	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	1 3/4

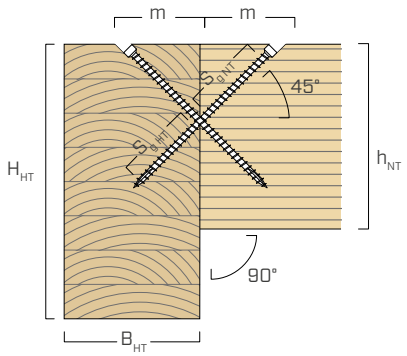
MINIMUM DISTANCES FOR CROSSED SCREWS

ETA-11/0030

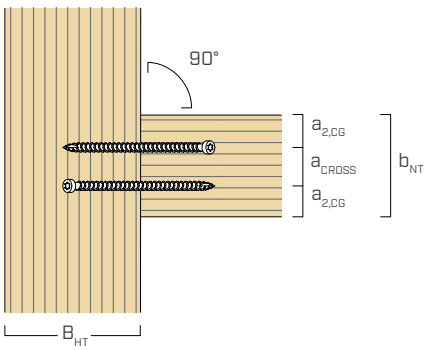
		Screws inserted with and without pre-drilling hole					
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
$a_{2,CG}$	[in]	**4·d**	7/8	7/8	1 1/8(*)	1 7/16	1 3/4
a_{CROSS}	[in]	**1.5·d**	5/16	3/8	7/16	9/16	11/16
e	[in]	**3.5·d**	3/4	13/16	1	1 1/4	1 9/16

(*) For main beam-secondary beam joints with VGZ screws d = 7 mm inclined or crossed, inserted at an angle of 45° to the secondary beam head, with a minimum secondary beam height of 18 d, the minimum distance $a_{2,CG}$ can be taken equal to $3 \cdot d_1$.

SHEAR CONNECTION WITH CROSSED CONNECTORS - 1 PAIR

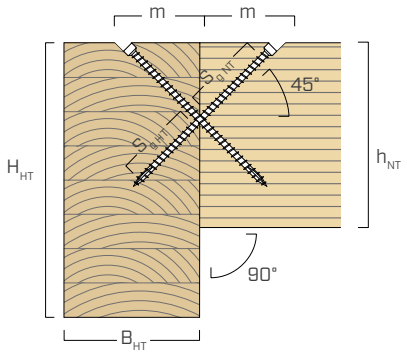


section

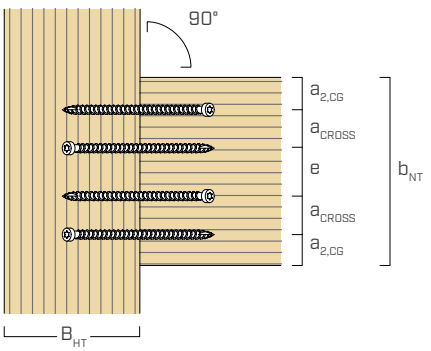


plan

SHEAR CONNECTION WITH CROSSED CONNECTORS - 2 OR MORE PAIRS



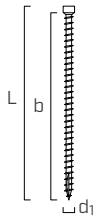
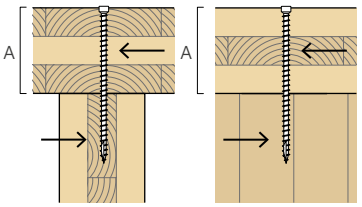
section



plan

STRUCTURAL VALUES | REFERENCE LATERAL DESIGN VALUES ($Z_{\perp}$) | CLT-TO-CLT

VGZ Ø7 | 0.28 inch - VGZ Ø9 | 0.36 inch - VGZ Ø11 | 0.44 inch

geometry				$Z_{\perp}$ lateral face - lateral face			$Z_{\perp}$ lateral face - narrow face		
									
d_1	L		b	A_{min}	G=0.42	G=0.49	A_{min}	G=0.42	G=0.49
[mm] [in]	*[mm]*	[in]	[in]	[in]	[lbf]	[lbf]	[in]	[lbf]	[lbf]
	80[(1)]	3 1/8	2 3/4	1 4/7	135	165	1 4/7	154	182
	100[(1)]	4	3 1/2	2	161	193	2	185	207
	120	4 3/4	4 3/8	2 3/8	168	193	2 3/8	185	207
	140	5 1/2	5 1/8	2 3/4	168	193	2 3/4	185	207
	160	6 1/4	6	3 1/8	168	193	3 1/8	185	207
	180	7 1/8	6 3/4	3 4/7	168	193	3 4/7	185	207
7	*200*	8	7 1/2	4	168	193	4	185	207
0.28	*220*	8 5/8	8 1/4	4 1/3	168	193	4 1/3	185	207
	240	9 1/2	9 1/16	4 3/4	168	193	4 3/4	185	207
	260	10 1/4	10	5 1/8	168	193	5 1/8	185	207
	280	11	10 5/8	5 1/2	168	193	5 1/2	185	207
	300	11 3/4	11 7/16	5 7/8	168	193	5 7/8	185	207
	340	13 3/8	13	6 2/3	168	193	6 2/3	185	207
	380	15	14 9/16	7 1/2	168	193	7 1/2	185	207
	160	6 1/4	6	3 1/8	217	250	3 1/8	225	251
	180	7 1/8	6 3/4	3 4/7	217	250	3 4/7	225	251
	200	8	7 1/2	4	217	250	4	225	251
	220	8 5/8	8 1/4	4 1/3	217	250	4 1/3	225	251
	240	9 1/2	9 1/16	4 3/4	217	250	4 3/4	225	251
	260	10 1/4	10	5 1/8	217	250	5 1/8	225	251
	280	11	10 5/8	5 1/2	217	250	5 1/2	225	251
9	*300*	11 3/4	11 7/16	5 7/8	217	250	5 7/8	225	251
0.36	*320*	12 5/8	12 3/16	6 1/3	217	250	6 1/3	225	251
	340	13 3/8	13	6 2/3	217	250	6 2/3	225	251
	360	14 1/4	13 3/4	7 1/8	217	250	7 1/8	225	251
	380	15	14 9/16	7 1/2	217	250	7 1/2	225	251
	400	15 3/4	15 3/8	7 7/8	217	250	7 7/8	225	251
	440	17 1/4	16 15/16	8 5/8	217	250	8 5/8	225	251
	480	19	18 1/2	9 1/2	217	250	9 1/2	225	251
	520	20 1/2	20 1/16	10 1/4	217	250	10 1/4	225	251
	250	10	9 1/2	5	234	262	5	234	262
	300	11 3/4	11 7/16	5 7/8	234	262	5 7/8	234	262
	350	13 3/4	13 3/8	6 7/8	234	262	6 7/8	234	262
11	*400*	15 3/4	15 3/8	7 7/8	234	262	7 7/8	234	262
0.44	*450*	17 3/4	17 1/4	8 7/8	234	262	8 7/8	234	262
	500	19 3/4	19 5/16	9 7/8	234	262	9 7/8	234	262
	550	21 5/8	21 1/4	10 4/5	234	262	10 4/5	234	262
	600	23 5/8	23 1/4	11 4/5	234	262	11 4/5	234	262

NOTES:

[(1)] The screw penetration in the main member is lower than 6 times the outer thread diameter.

- Shear values were calculated considering the centre of gravity of the connector placed in correspondence with the shear plane and considering both plies at the shear plane with grain orientation perpendicular to the screw axis.
- The screws must be positioned in accordance with the minimum distances.

Refer to page 22 for the general calculation principles.

STRUCTURAL VALUES | THREAD WITHDRAWAL (W) | CLT

VGZ Ø7 | 0.28 inch - VGZ Ø9 | 0.36 inch - VGZ Ø11 | 0.44 inch

geometry				W lateral face α = 90°(1)			W narrow face α = 0°(2)	
								
d_1 [mm] [in]	L [mm]	L [in]	b [in]	A_{min} [in]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]
	80	3 1/8	2 3/4	3 1/2	367	412	110	124
	100	4	3 1/2	4 3/8	484	542	145	163
	120	4 3/4	4 3/8	5 1/8	600	673	180	202
	140	5 1/2	5 1/8	6	717	804	215	241
	160	6 1/4	6	6 3/4	833	935	250	280
	180	7 1/8	6 3/4	7 1/2	950	1065	285	320
7	200	8	7 1/2	8 1/4	1066	1196	320	359
0.28	220	8 5/8	8 1/4	9 1/16	1183	1327	355	398
	240	9 1/2	9 1/16	10	1299	1457	390	437
	260	10 1/4	10	10 5/8	1416	1588	425	476
	280	11	10 5/8	11 7/16	1532	1719	460	516
	300	11 3/4	11 7/16	12 3/16	1649	1850	495	555
	340	13 3/8	13	13 3/4	1882	2111	565	633
	380	15	14 9/16	15 3/8	2115	2372	635	712
	160	6 1/4	6	6 3/4	827	960	248	288
	180	7 1/8	6 3/4	7 1/2	944	1097	283	329
	200	8	7 1/2	8 1/4	1062	1233	319	370
	220	8 5/8	8 1/4	9 1/16	1179	1369	354	411
	240	9 1/2	9 1/16	10	1296	1505	389	452
	260	10 1/4	10	10 5/8	1414	1641	424	492
	280	11	10 5/8	11 7/16	1531	1778	459	533
9	300	11 3/4	11 7/16	12 3/16	1648	1914	495	574
0.36	320	12 5/8	12 3/16	13	1766	2050	530	615
	340	13 3/8	13	13 3/4	1883	2186	565	656
	360	14 1/4	13 3/4	14 9/16	2000	2323	600	697
	380	15	14 9/16	15 3/8	2118	2459	635	738
	400	15 3/4	15 3/8	16 1/8	2235	2595	671	779
	440	17 1/4	16 15/16	17 3/4	2470	2867	741	860
	480	19	18 1/2	19 5/16	2704	3140	811	942
	520	20 1/2	20 1/16	20 7/8	2939	3412	882	1024
	250	10	9 1/2	10 1/4	1542	1731	463	519
	300	11 3/4	11 7/16	12 3/16	1878	2109	563	633
	350	13 3/4	13 3/8	14 1/4	2215	2487	664	746
11	400	15 3/4	15 3/8	16 1/8	2552	2865	765	859
0.44	450	17 3/4	17 1/4	18 1/8	2888	3243	866	973
	500	19 3/4	19 5/16	20 1/16	3225	3621	967	1086
	550	21 5/8	21 1/4	22	3561	3999	1068	1200
	600	23 5/8	23 1/4	24	3898	4377	1169	1313

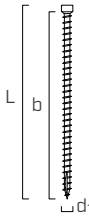
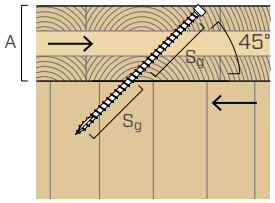
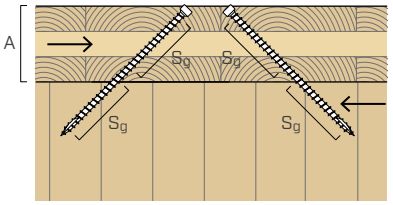
NOTES:

(1) The tabulated values refer to the effective thread penetration length of the screw in the wood member (b-L_t).The withdrawal resistance was calculated considering a 90° angle between the grain and the screw axis.

(2) The tabulated values refer to the effective thread penetration length of the screw in the wood member (b-L_t). The withdrawal resistance was calculated considering a 0° angle between the grain and the screw axis.

STRUCTURAL VALUES | SLIDING (R_V) | CLT-TO-CLT

VGZ Ø7 | 0.28 inch - VGZ Ø9 | 0.36 inch - VGZ Ø11 | 0.44 inch

geometry					R_v lateral face - narrow face[2]		R_v lateral face - narrow face[3]	
								
d_1 [mm] [in]	L [mm]	L [in]	b [in]	A_{min} [in]	S_g [in]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]
7 **0.28**	80[1]	3 1/8	2 3/4	1 3/16	1	99	111	199	223
	100[1]	4	3 1/2	1 9/16	1 3/8	137	153	274	307
	120[1]	4 3/4	4 3/8	1 3/4	1 3/4	174	196	349	391
	140	5 1/2	5 1/8	2 3/16	2 3/16	212	238	424	475
	160	6 1/4	6	2 3/8	2 9/16	249	280	499	559
	180	7 1/8	6 3/4	2 9/16	2 15/16	287	322	574	643
	200	8	7 1/2	2 15/16	3 3/8	324	364	649	728
	220	8 5/8	8 1/4	3 1/8	3 3/4	362	406	724	812
	240	9 1/2	9 1/16	3 1/2	4 1/8	399	448	799	896
	260	10 1/4	10	3 3/4	4 1/2	437	490	874	980
	280	11	10 5/8	4	4 15/16	474	532	949	1064
	300	11 3/4	11 7/16	4 3/8	5 5/16	512	574	1024	1148
	340	13 3/8	13	4 15/16	6 1/8	587	658	1174	1316
	380	15	14 9/16	5 1/2	6 7/8	662	742	1324	1484
9 **0.36**	160[1]	6 1/4	6	2 3/8	2 9/16	247	287	494	574
	180	7 1/8	6 3/4	2 3/4	2 15/16	285	331	570	662
	200	8	7 1/2	2 15/16	3 3/8	323	375	645	749
	220	8 5/8	8 1/4	3 1/8	3 3/4	360	419	721	837
	240	9 1/2	9 1/16	3 1/2	4 1/8	398	462	796	925
	260	10 1/4	10	3 3/4	4 1/2	436	506	872	1012
	280	11	10 5/8	4 1/8	4 15/16	474	550	947	1100
	300	11 3/4	11 7/16	4 3/8	5 5/16	511	594	1023	1188
	320	12 5/8	12 3/16	4 1/2	5 11/16	549	638	1098	1275
	340	13 3/8	13	4 15/16	6 1/8	587	682	1174	1363
	360	14 1/4	13 3/4	5 1/8	6 1/2	625	725	1249	1451
	380	15	14 9/16	5 1/2	6 7/8	662	769	1325	1538
	400	15 3/4	15 3/8	5 11/16	7 1/4	700	813	1400	1626
	440	17 1/4	16 15/16	6 1/4	8 1/16	776	901	1551	1801
	480	19	18 1/2	6 7/8	8 7/8	851	988	1702	1977
	520	20 1/2	20 1/16	7 1/2	9 5/8	927	1076	1853	2152
11 **0.44**	250	10	9 1/2	3 3/4	4 5/16	472	530	944	1060
	300	11 3/4	11 7/16	4 1/2	5 1/4	580	652	1161	1304
	350	13 3/4	13 3/8	5 1/8	6 1/4	689	773	1378	1547
	400	15 3/4	15 3/8	6	7 1/4	797	895	1594	1790
	450	17 3/4	17 1/4	6 1/2	8 1/4	905	1017	1811	2033
	500	19 3/4	19 5/16	7 1/4	13 3/16	1014	1138	2027	2276
	550	21 5/8	21 1/4	8	10 1/4	1122	1260	2244	2520
	600	23 5/8	23 1/4	8 5/8	11 1/4	1230	1381	2461	2763

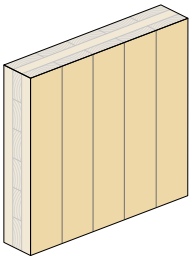
NOTES:

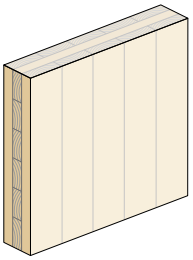
(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle α =45° to the grain).

(2) The connector tensile strenght must be evaluated and verified considering a 45° angle between the grain and the screw axis.

(3) Buckling resistance for shear connections with crossed connectors can be evaluated in accordance with ETA- 11/0030.
Refer to page 22 for the general calculation.

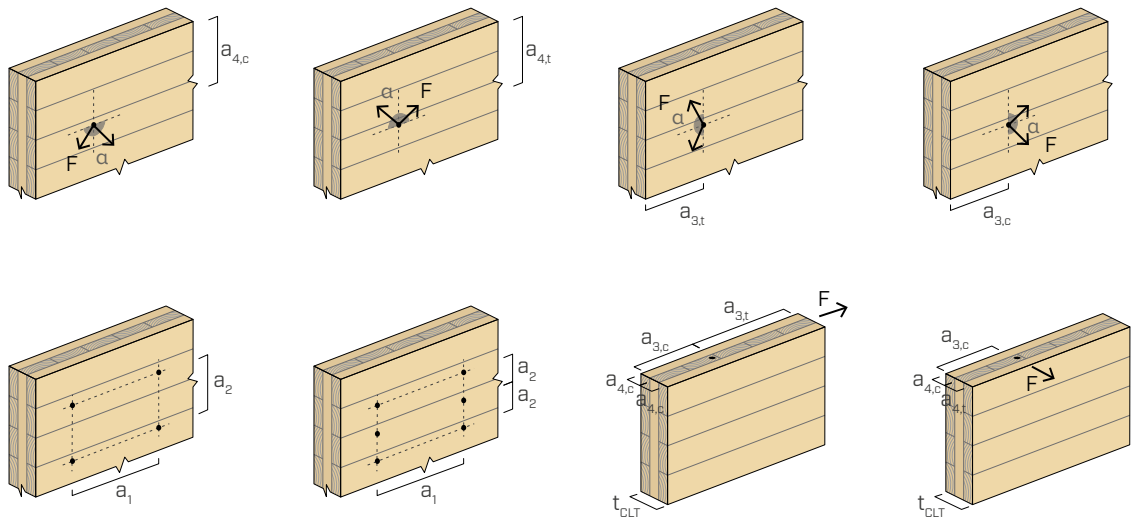
MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT





		Screws inserted without pre-drilling hole lateral face[1]						Screws inserted without pre-drilling hole narrow face[2]					
d_1	*[mm]*		*5,3*	*5,6*	*7*	*9*	*11*		*5,3*	*5,6*	*7*	*9*	*11*
	[in]		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**		**0.21**	**0.23**	**0.28**	**0.36**	**0.44**
a_1	[in]	**4·d**	7/8	7/8	1 1/8	1 7/16	1 3/4	**10·d**	2 1/16	2 3/16	2 3/4	3 1/2	4 3/8
a_2	[in]	**2.5·d**	9/16	9/16	11/16	7/8	1 1/8	**4·d**	7/8	7/8	1 1/8	1 7/16	1 3/4
$a_{3,t}$	[in]	**6·d**	1 1/4	1 5/16	1 5/8	2 1/8	2 5/8	**12·d**	2 1/2	2 11/16	3 5/16	4 1/4	5 3/16
$a_{3,c}$	[in]	**6·d**	1 1/4	1 5/16	1 5/8	2 1/8	2 5/8	**7·d**	1 1/2	1 9/16	1 15/16	2 1/2	3 1/16
$a_{4,t}$	[in]	**6·d**	1 1/4	1 5/16	1 5/8	2 1/8	2 5/8	**6·d**	1 1/4	1 5/16	1 5/8	2 1/8	2 5/8
$a_{4,c}$	[in]	**2.5·d**	9/16	9/16	11/16	7/8	1 1/8	**3·d**	5/8	11/16	13/16	1 1/16	1 5/16

d = nominal screw diameter



NOTES:

The minimum distances are comply with ETA-11/0030 and are to be considered valid unless otherwise specified in the technical documents for the CLT panels.

(1) Minimum CLT thickness t_{min} = 10·d.

(2) Minimum CLT thickness t_{min} = 10·d and minimum screw penetration length t_{pen} = 10·d.

GENERAL PRINCIPLES:

- Tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD, design loads for use with LRFD or both.
- As part of the connection design, the structural wood members must be checked for load-carrying capacity in accordance with Section 11.1.2 of the NDS and local stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and fastener group.
- The design of connection with steel side plate must comply with Section 11.2.3 of the NDS.
- Connections with multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of the NDS and the requirements in Section 4.1.7.3.1 of ESR-4645.
- VGZ screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection C_M is 1.0).
- Sizing and verification of the timber elements and steel plates must be done separately by the designer.
- The characteristic shear resistances are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.

REFERENCE LATERAL DESIGN VALUES:

- Tabulated values are determined from the yield model equations in Section 12.3 and Table 12.3.1A of the NDS.
- The screw penetration into the main member is minimum 6 times the outer thread diameter unless otherwise noted.
- The reference lateral design values may be determined for other connection configurations in accordance with the NDS and Section 4.1.6.2 of ESR-4645.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.

WOOD-TO-WOOD

- The wood main member thickness must be greater than the screw length less the thickness of the wood side member.
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- Buckling resistance for shear connections with crossed connectors can be evaluated in accordance with ETA- 11/0030.

REFERENCE WITHDRAWAL DESIGN VALUES:

The reference withdrawal design values (W_{ref}) expressed in pounds-force per inch of thread penetration into the main member for screws installed at an angle of 90° to the grain can be found in Table 7 of ESR-4645 and are reported below.

d_1	Reference withdrawal design values W_{ref}			
	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[lbf/in]	[lbf/in]	[lbf/in]	[lbf/in]
5,3 **0.21**	102	118	132	145
5,6 **0.23**	107	123	139	152
7 **0.28**	129	148	166	182
9 **0.36**	129	149	173	189
11 **0.44**	148	171	192	210

- The values for screws installed at an angle α to the grain are determined by multiplying the reference withdrawal design values with the effective thread penetration L_{eff} of the screw in the wood member and with the factor k_α:

$$W_\alpha = W_{ref} \cdot k_\alpha \cdot L_{eff}$$

Where:

- W_{ref} is the reference withdrawal design value for screws installed at an angle of 90° to the grain, as shown in the table on the left;
- k_α factor is calculated as:

$$k_\alpha = \begin{cases} 35^\circ < \alpha \le 90^\circ & \dfrac{1}{1.2 \cdot \cos^2(\alpha) + \sin^2(\alpha)} \\ 0^\circ \le \alpha \le 35^\circ & 0.3 + 0.7 \cdot \dfrac{\alpha}{45} \end{cases}$$

- α is the angle between the grain direction and screw axis.

- The minimum embedded thread length is 6 times the outer thread diameter for screws installed at 90° to the grain, unless otherwise noted.
- The minimum embedded thread length for screws installed at an angle $0° \le \alpha < 90°$ to the grain is 8 times the outer thread diameter, unless otherwise noted.
- At least four screws must be used in a connection with screws installed in the wood member with an angle between the grain direction and screw axis $\alpha \le 15°$.
- The reference withdrawal design values must be less than f_{tens} of the screw.