

FULL THREADED SCREW WITH CYLINDRICAL HEAD

3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

STRUCTURAL APPLICATIONS

Approved for structural applications subject to stresses in any direction vs the grain ($0^\circ \div 90^\circ$). Cyclical SEISMIC-REV tests according to EN 12512.

CYLINDRICAL HEAD

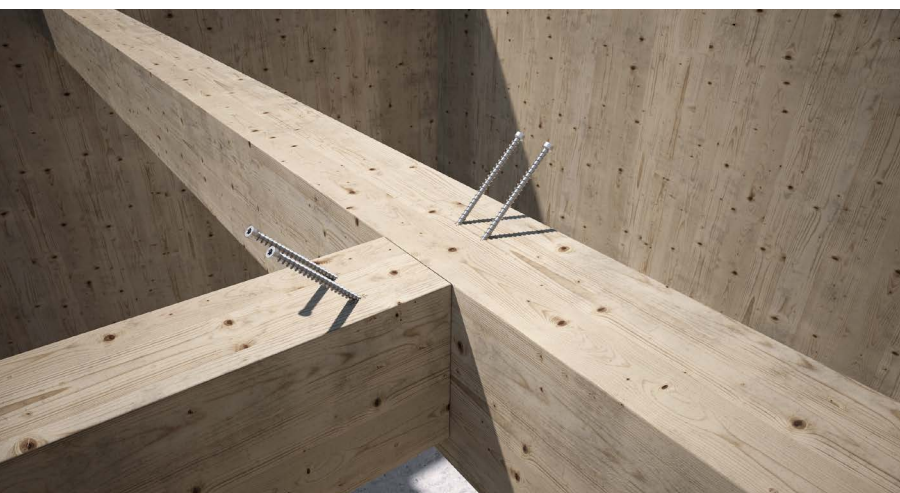
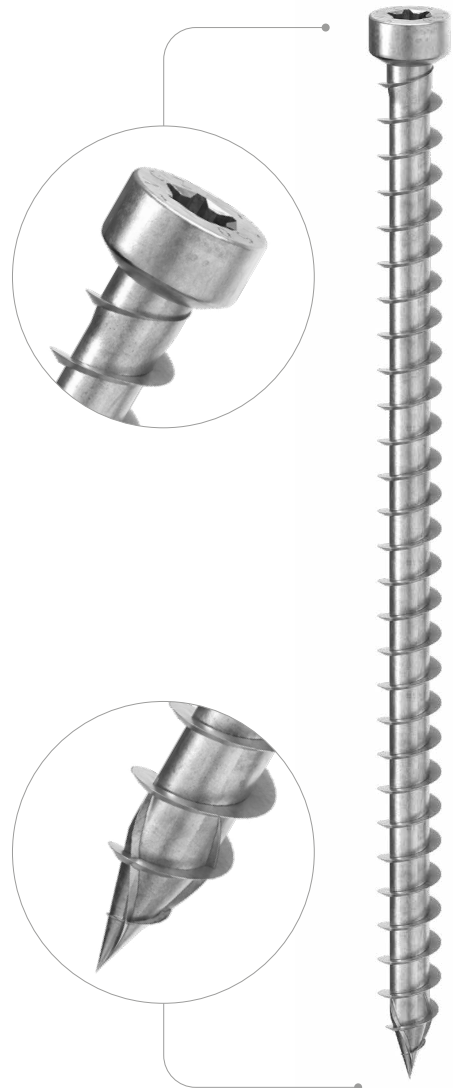
It allows the screw to penetrate and pass through the surface of the wood substrate. Ideal for concealed joints, timber couplings and structural reinforcements. It is the right choice to ensure strength in fire conditions.

TIMBER FRAME

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

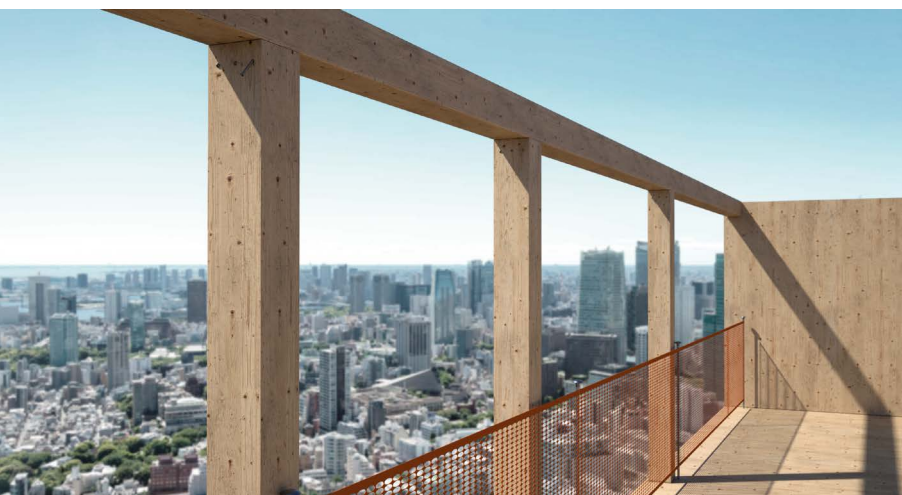


DIAMETER [mm]	5	7	11	11
LENGTH [mm]	80	80	1000	1000
SERVICE CLASS	SC1	SC2		
ATMOSPHERIC CORROSIVITY	C1	C2		
WOOD CORROSIVITY	T1	T2		
MATERIAL	Zn ELECTRO PLATED electrogalvanized carbon steel			



FIELDS OF USE

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



STRUCTURAL RESTORATION

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

CLT, LVL

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

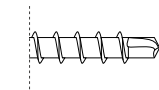
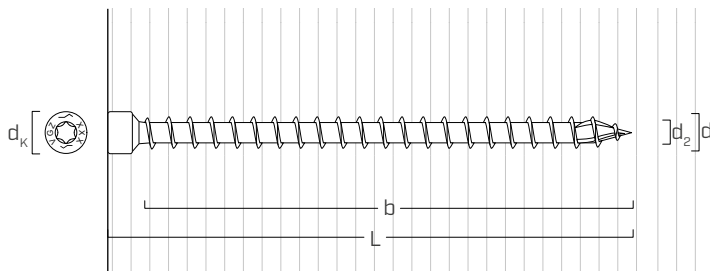


Very high stiffness in side-by-side joining of CLT floors.
Application with double inclination at 45°, perfect combined with the JIG VGZ template.



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

GEOMETRY AND MECHANICAL CHARACTERISTICS



Ø9 | L > 520 mm
Ø11 | L > 600 mm

GEOMETRY

Nominal diameter	d_1	[mm]	7	9	11
Head diameter	d_k	[mm]	9,50	11,50	13,50
Thread diameter	d_2	[mm]	4,60	5,90	6,60
Pre-drilling hole diameter ⁽¹⁾	$d_{v,s}$	[mm]	4,0	5,0	6,0
Pre-drilling hole diameter ⁽²⁾	$d_{v,h}$	[mm]	5,0	6,0	7,0

⁽¹⁾ Pre-drilling valid for softwood.

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

CHARACTERISTIC MECHANICAL PARAMETERS

Nominal diameter	d_1	[mm]	7	9	11
Tensile strength	$f_{tens,k}$	[kN]	15,4	25,4	38,0
Yield strength	$f_{y,k}$	[N/mm ²]	1000	1000	1000
Yield moment	$M_{y,k}$	[Nm]	14,2	27,2	45,9

			softwood (softwood)	LVL softwood (LVL softwood)	pre-drilled beech LVL (beech LVL predrilled)
Withdrawal resistance parameter	$f_{ax,k}$	[N/mm ²]	11,7	15,0	29,0
Associated density	ρ_a	[kg/m ³]	350	500	730
Calculation density	ρ_k	[kg/m ³]	≤ 440	410 ÷ 550	590 ÷ 750

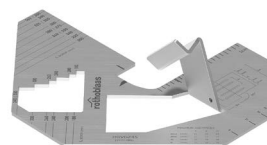
For applications with different materials please see ETA-11/0030.

CODES AND DIMENSIONS

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

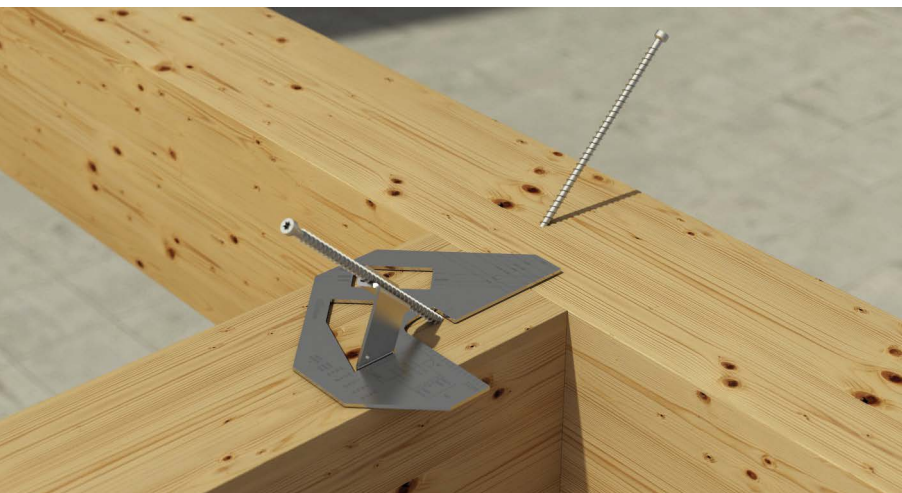
d ₁ [mm]	CODE	L [mm]	b [mm]	pcs
11 TX 50	VGZ11150	150	140	25
	VGZ11200	200	190	25
	VGZ11250	250	240	25
	VGZ11275	275	265	25
	VGZ11300	300	290	25
	VGZ11325	325	315	25
	VGZ11350	350	340	25
	VGZ11375	375	365	25
	VGZ11400	400	390	25
	VGZ11425	425	415	25
	VGZ11450	450	440	25
	VGZ11475	475	465	25
	VGZ11500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

RELATED PRODUCTS



JIG VGZ 45°
TEMPLATE FOR 45° SCREWS

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JIG VGZ 45° TEMPLATE

Installation at 45° using the JIG VGZ steel template.

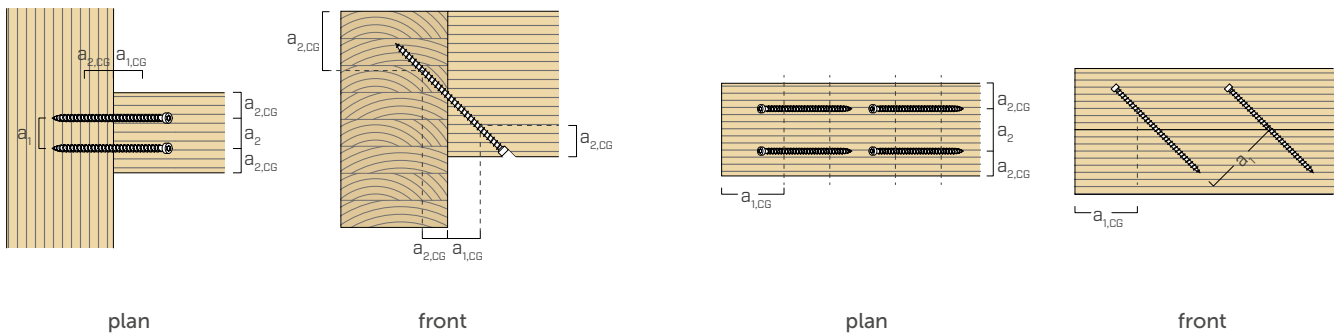
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER



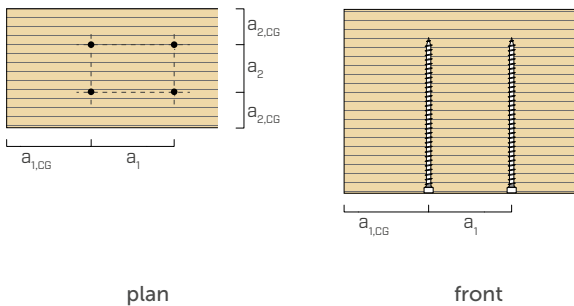
screws inserted **WITH** and **WITHOUT** pre-drilled hole

d_1	[mm]	7	9	11
a_1	[mm] 5·d	35	45	55
a_2	[mm] 5·d	35	45	55
$a_{2,LIM}$	[mm] 2,5·d	18	23	28
$a_{1,CG}$	[mm] 10·d	70	90	110
$a_{2,CG}$	[mm] 4·d	28	36	44
a_{CROSS}	[mm] 1,5·d	11	14	17

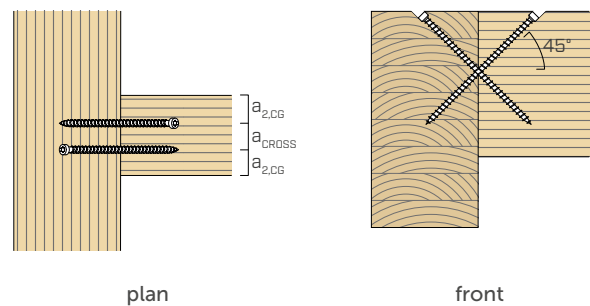
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



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



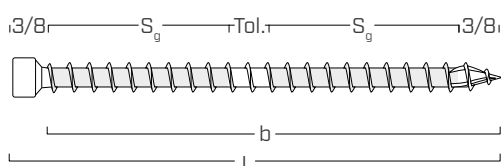
CROSSED SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



NOTES

- Minimum distances according to ETA-11/0030.
- The minimum distances are independent of the insertion angle of the connector and the angle of the force with respect to the grain.
- The axial distance a_2 can be reduced down to $a_{2,LIM}$ if for each connector a "joint surface" $a_1 a_2 = 25 d_1^2$ is maintained.
- 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 $a_{1,CG}$ can be taken equal to $8 \cdot d_1$ and the minimum distance $a_{2,CG}$ equal to $3 \cdot d_1$.

EFFECTIVE THREAD USED IN CALCULATION



$$b = S_{g,tot} = L - 10 \text{ mm}$$

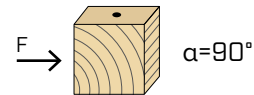
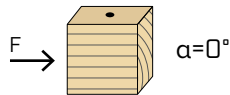
represents the entire length of the threaded part

$$S_g = (L - 10 \text{ mm} - 10 \text{ mm} - \text{Tol.}) / 2$$

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

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

 screws inserted **WITHOUT** pre-drilled hole $\rho_k \leq 420 \text{ kg/m}^3$

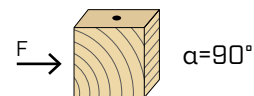
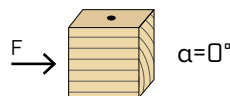


d_1 [mm]		7	9	11
a_1 [mm]	10·d	70	90	110
a_2 [mm]	5·d	35	45	55
$a_{3,t}$ [mm]	15·d	105	135	165
$a_{3,c}$ [mm]	10·d	70	90	110
$a_{4,t}$ [mm]	5·d	35	45	55
$a_{4,c}$ [mm]	5·d	35	45	55

d_1 [mm]		7	9	11
a_1 [mm]	5·d	35	45	55
a_2 [mm]	5·d	35	45	55
$a_{3,t}$ [mm]	10·d	70	90	110
$a_{3,c}$ [mm]	10·d	70	90	110
$a_{4,t}$ [mm]	10·d	70	90	110
$a_{4,c}$ [mm]	5·d	35	45	55

α = load-to-grain angle
 $d = d_1$ = nominal screw diameter

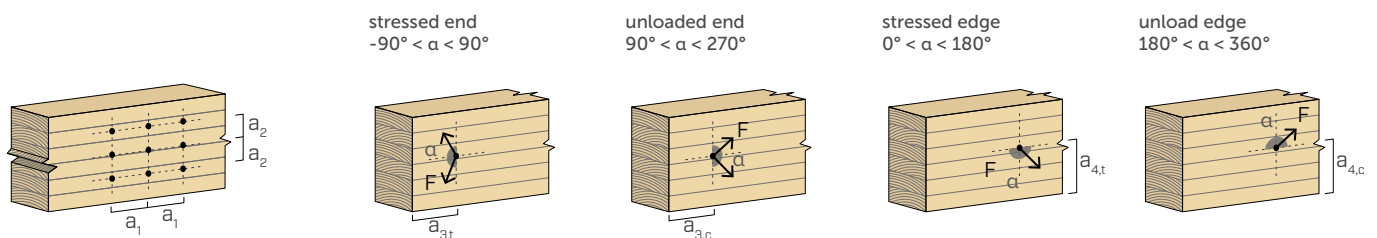
 screws inserted **WITH** pre-drilled hole



d_1 [mm]		7	9	11
a_1 [mm]	5·d	35	45	55
a_2 [mm]	3·d	21	27	33
$a_{3,t}$ [mm]	12·d	84	108	132
$a_{3,c}$ [mm]	7·d	49	63	77
$a_{4,t}$ [mm]	3·d	21	27	33
$a_{4,c}$ [mm]	3·d	21	27	33

d_1 [mm]		7	9	11
a_1 [mm]	4·d	28	36	44
a_2 [mm]	4·d	28	36	44
$a_{3,t}$ [mm]	7·d	49	63	77
$a_{3,c}$ [mm]	7·d	49	63	77
$a_{4,t}$ [mm]	7·d	49	63	77
$a_{4,c}$ [mm]	3·d	21	27	33

α = load-to-grain angle
 $d = d_1$ = nominal screw diameter



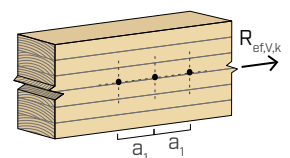
NOTES

- The minimum distances comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- The minimum spacing for all panel-to-timber connections (a_1 , a_2) can be multiplied by a coefficient of 0,85.
- The spacing a_1 in the table for screws with 3 THORNS tip and $d_1 \geq 5$ mm inserted without pre-drilling hole in timber elements with density $\rho_k \leq 420 \text{ kg/m}^3$ with minimum height and width equal to $10 \cdot d$ and load-to-grain angle $\alpha = 0^\circ$ equal to $10 \cdot d$. Alternatively, adopt $12 \cdot d$ in accordance with EN 1995:2014.

EFFECTIVE NUMBER FOR SHEAR LOADS

The load-bearing capacity of a connection made with several screws, all of the same type and size, may be lower than the sum of the load-bearing capacities of the individual connection system.

For a row of n screws arranged parallel to the direction of the grain at a distance a_1 , the characteristic effective shear bearing capacity $R_{ef,V,k}$ can be calculated by means of the effective number n_{ef} (see page 169).



TENSION / COMPRESSION											
geometry		total thread withdrawal				partial thread withdrawal				steel tension	instability $\varepsilon=90^\circ$
		$\varepsilon=90^\circ$		$\varepsilon=0^\circ$		$\varepsilon=90^\circ$		$\varepsilon=0^\circ$			
d_1 [mm]	L [mm]	$S_{g,tot}$ [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	S_g [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	$R_{tens,k}$ [kN]	$R_{ki,90,k}$ [kN]
7	80	70	90	6,19	1,86	-	-	-	-	15,40	10,30
	100	90	110	7,96	2,39	35	55	3,09	0,93		
	120	110	130	9,72	2,92	45	65	3,98	1,19		
	140	130	150	11,49	3,45	55	75	4,86	1,46		
	160	150	170	13,26	3,98	65	85	5,75	1,72		
	180	170	190	15,03	4,51	75	95	6,63	1,99		
	200	190	210	16,79	5,04	85	105	7,51	2,25		
	220	210	230	18,56	5,57	95	115	8,40	2,52		
	240	230	250	20,33	6,10	105	125	9,28	2,78		
	260	250	270	22,10	6,63	115	135	10,16	3,05		
	280	270	290	23,87	7,16	125	145	11,05	3,31		
	300	290	310	25,63	7,69	135	155	11,93	3,58		
	320	310	330	27,40	8,22	145	165	12,82	3,84		
	340	330	350	29,17	8,75	155	175	13,70	4,11		
	360	350	370	30,94	9,28	165	185	14,58	4,38		
	380	370	390	32,70	9,81	175	195	15,47	4,64		
	400	390	410	34,47	10,34	185	205	16,35	4,91		
9	160	150	170	17,05	5,11	65	85	7,39	2,22	25,40	17,25
	180	170	190	19,32	5,80	75	95	8,52	2,56		
	200	190	210	21,59	6,48	85	105	9,66	2,90		
	220	210	230	23,87	7,16	95	115	10,80	3,24		
	240	230	250	26,14	7,84	105	125	11,93	3,58		
	260	250	270	28,41	8,52	115	135	13,07	3,92		
	280	270	290	30,68	9,21	125	145	14,21	4,26		
	300	290	310	32,96	9,89	135	155	15,34	4,60		
	320	310	330	35,23	10,57	145	165	16,48	4,94		
	340	330	350	37,50	11,25	155	175	17,61	5,28		
	360	350	370	39,78	11,93	165	185	18,75	5,63		
	380	370	390	42,05	12,61	175	195	19,89	5,97		
	400	390	410	44,32	13,30	185	205	21,02	6,31		
	440	430	450	48,87	14,66	205	225	23,30	6,99		
	480	470	490	53,41	16,02	225	245	25,57	7,67		
	520	510	530	57,96	17,39	245	265	27,84	8,35		
	560	550	570	62,50	18,75	265	285	30,12	9,03		
	600	590	610	67,05	20,11	285	305	32,39	9,72		

ε = screw-to-grain angle

TENSION / COMPRESSION											
geometry		total thread withdrawal				partial thread withdrawal				steel tension	instability
		$\varepsilon=90^\circ$		$\varepsilon=0^\circ$		$\varepsilon=90^\circ$		$\varepsilon=0^\circ$			$\varepsilon=90^\circ$
d_1 [mm]	L [mm]	$S_{g,tot}$ [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	S_g [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	$R_{tens,k}$ [kN]	$R_{ki,90,k}$ [kN]
11	150	140	160	19,45	5,83	60	80	8,33	2,50	38,00	21,93
	200	190	210	26,39	7,92	85	105	11,81	3,54		
	250	240	260	33,34	10,00	110	130	15,28	4,58		
	275	265	285	36,81	11,04	123	143	17,01	5,10		
	300	290	310	40,28	12,08	135	155	18,75	5,63		
	325	315	335	43,75	13,13	148	168	20,49	6,15		
	350	340	360	47,22	14,17	160	180	22,22	6,67		
	375	365	385	50,70	15,21	173	193	23,96	7,19		
	400	390	410	54,17	16,25	185	205	25,70	7,71		
	425	415	435	57,64	17,29	198	218	27,43	8,23		
	450	440	460	61,11	18,33	210	230	29,17	8,75		
	475	465	485	64,59	19,38	223	243	30,90	9,27		
	500	490	510	68,06	20,42	235	255	32,64	9,79		
	525	515	535	71,53	21,46	248	268	34,38	10,31		
	550	540	560	75,00	22,50	260	280	36,11	10,83		
	575	565	585	78,48	23,54	273	293	37,85	11,35		
	600	590	610	81,95	24,58	285	305	39,59	11,88		
	650	630	660	87,51	26,25	305	325	42,36	12,71		
	700	680	710	94,45	28,33	330	350	45,84	13,75		
	750	730	760	101,39	30,42	355	375	49,31	14,79		
	800	780	810	108,34	32,50	380	400	52,78	15,83		
	850	830	860	115,28	34,59	405	425	56,25	16,88		
	900	880	910	122,23	36,67	430	450	59,73	17,92		
	950	930	960	129,17	38,75	455	475	63,20	18,96		
	1000	980	1010	136,12	40,84	480	500	66,67	20,00		

ε = screw-to-grain angle

NOTES

- The characteristic thread withdrawal resistances were evaluated considering both an ε angle of 90° ($R_{ax,90,k}$) and of 0° ($R_{ax,0,k}$) between the grains of the timber element and the connector.
- For the calculation process a timber characteristic density $\rho_k = 385 \text{ kg/m}^3$ has been considered. For different ρ_k values, the strength values in the table can be converted by the k_{dens} coefficient.

$$R'_{ax,k} = k_{dens,ax} \cdot R_{ax,k}$$

$$R'_{ki,k} = k_{dens,ki} \cdot R_{ki,k}$$

ρ_k [kg/m ³]	350	380	385	405	425	430	440
C-GL	C24	C30	GL24h	GL26h	GL28h	GL30h	GL32h
$k_{dens,ax}$	0,92	0,98	1,00	1,04	1,08	1,09	1,11
$k_{dens,ki}$	0,97	0,99	1,00	1,00	1,01	1,02	1,02

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

GENERAL PRINCIPLES on page 143.

		SLIDING					SHEAR			
geometry		timber-to-timber			steel tension		timber-to-timber	timber-to-timber $\varepsilon=90^\circ$	timber-to-timber $\varepsilon=0^\circ$	
d_1 [mm]	L [mm]	S_g [mm]	A [mm]	B_{min} [mm]	$R_{V,k}$ [kN]	$R_{tens,45,k}$ [kN]	A [mm]	S_g [mm]	$R_{V,90,k}$ [mm]	$R_{V,0,k}$ [kN]
7	80	-	-	-	-	10,89	40	25	2,59	1,34
	100	35	40	55	2,19		50	35	2,93	1,53
	120	45	45	60	2,81		60	45	3,15	1,74
	140	55	55	70	3,44		70	55	3,37	1,97
	160	65	60	75	4,06		80	65	3,59	2,06
	180	75	70	85	4,69		90	75	3,81	2,12
	200	85	75	90	5,31		100	85	4,03	2,19
	220	95	85	100	5,94		110	95	4,25	2,26
	240	105	90	105	6,56		120	105	4,30	2,32
	260	115	95	110	7,19		130	115	4,30	2,39
	280	125	105	120	7,81		140	125	4,30	2,46
	300	135	110	125	8,44		150	135	4,30	2,52
	320	145	120	135	9,06		160	145	4,30	2,59
	340	155	125	140	9,69		170	155	4,30	2,65
	360	165	130	145	10,31		180	165	4,30	2,72
	380	175	140	155	10,94		190	175	4,30	2,79
	400	185	145	160	11,56		200	185	4,30	2,85
9	160	65	60	75	5,22	17,96	80	65	5,10	2,81
	180	75	70	85	6,03		90	75	5,38	3,08
	200	85	75	90	6,83		100	85	5,67	3,18
	220	95	85	100	7,63		110	95	5,95	3,27
	240	105	90	105	8,44		120	105	6,23	3,35
	260	115	95	110	9,24		130	115	6,50	3,44
	280	125	105	120	10,04		140	125	6,50	3,52
	300	135	110	125	10,85		150	135	6,50	3,61
	320	145	120	135	11,65		160	145	6,50	3,69
	340	155	125	140	12,46		170	155	6,50	3,78
	360	165	130	145	13,26		180	165	6,50	3,86
	380	175	140	155	14,06		190	175	6,50	3,95
	400	185	145	160	14,87		200	185	6,50	4,03
	440	205	160	175	16,47		220	205	6,50	4,21
	480	225	175	190	18,08		240	225	6,50	4,38
	520	245	190	205	19,69		260	245	6,50	4,55
	560	265	205	220	21,29		280	265	6,50	4,72
	600	285	215	230	22,90		300	285	6,50	4,89

ε = screw-to-grain angle

		SLIDING					SHEAR			
geometry		timber-to-timber			steel tension		timber-to-timber	timber-to-timber $\epsilon=90^\circ$	timber-to-timber $\epsilon=0^\circ$	
d_1 [mm]	L [mm]	S_g [mm]	A [mm]	B_{min} [mm]	$R_{V,k}$ [kN]	$R_{tens,45,k}$ [kN]	A [mm]	S_g [mm]	$R_{V,90,k}$ [kN]	$R_{V,0,k}$ [kN]
11	150	60	60	75	5,89	26,87	75	60	6,61	3,33
	200	85	75	90	8,35		100	85	7,48	4,10
	250	110	95	110	10,80		125	110	8,35	4,57
	275	123	100	115	12,03		138	123	8,79	4,70
	300	135	110	125	13,26		150	135	9,06	4,83
	325	148	120	135	14,49		163	148	9,06	4,96
	350	160	130	145	15,71		175	160	9,06	5,09
	375	173	140	155	16,94		188	173	9,06	5,22
	400	185	145	160	18,17		200	185	9,06	5,35
	425	198	155	170	19,40		213	198	9,06	5,48
	450	210	165	180	20,63		225	210	9,06	5,61
	475	223	175	190	21,85		238	223	9,06	5,74
	500	235	180	195	23,08		250	235	9,06	5,87
	525	248	190	205	24,31		263	248	9,06	6,00
	550	260	200	215	25,54		275	260	9,06	6,13
	575	273	210	225	26,76		288	273	9,06	6,26
	600	285	215	230	27,99		300	285	9,06	6,39
	650	29182	230	245	29,96		320	305	9,06	6,60
	700	30651	250	265	32,41		345	330	9,06	6,85
	750	32122	265	280	34,87		370	355	9,06	6,85
	800	33595	285	300	37,32		395	380	9,06	6,85
	850	35068	300	315	39,78		420	405	9,06	6,85
	900	36542	320	335	42,23		445	430	9,06	6,85
	950	38016	335	350	44,69		470	455	9,06	6,85
	1000	39491	355	370	47,14		495	480	9,06	6,85

ϵ = screw-to-grain angle

NOTES

- The characteristic sliding strengths were evaluated by considering an angle ϵ of 45° between the grains of the timber element and the connector.
- The characteristic timber-to-timber shear strengths were evaluated considering both an ϵ angle of 90° ($R_{V,90,k}$) and 0° ($R_{V,0,k}$) between the grains of the second element and the connector.
- For the calculation process a timber characteristic density $\rho_k = 385 \text{ kg/m}^3$ has been considered.
For different ρ_k values, the strength values in the table can be converted by the k_{dens} coefficient.

$$R'_{V,k} = k_{dens,ax} \cdot R_{V,k}$$

$$R'_{V,90,k} = k_{dens,v} \cdot R_{V,90,k}$$

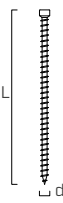
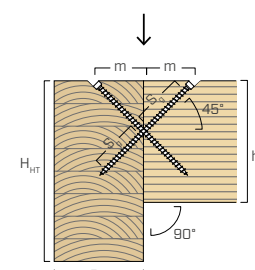
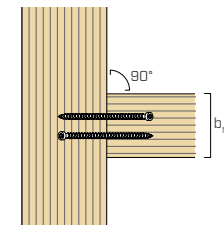
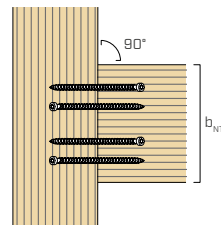
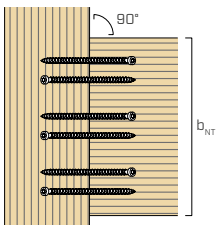
$$R'_{V,0,k} = k_{dens,v} \cdot R_{V,0,k}$$

ρ_k [kg/m ³]	350	380	385	405	425	430	440
C-GL	C24	C30	GL24h	GL26h	GL28h	GL30h	GL32h
$k_{dens,ax}$	0,92	0,98	1,00	1,04	1,08	1,09	1,11
$k_{dens,v}$	0,90	0,98	1,00	1,02	1,05	1,05	1,07

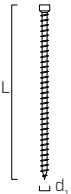
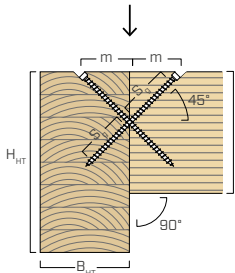
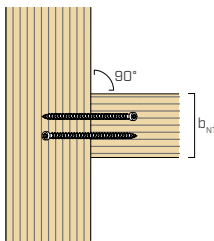
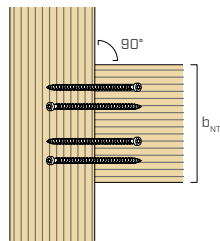
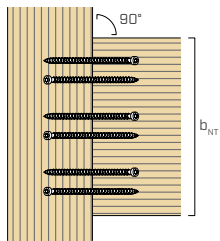
Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

GENERAL PRINCIPLES on page 143.

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION

geometry	main beam secondary beam					1 pair			2 pairs			3 pairs		
														
d ₁	L	B _{HT,min}	H _{HT,min} h _{NT,min}	S _g	m	b _{NT,min}	R _{V1,k}	R _{V2,k}	b _{NT,min}	R _{V1,k}	R _{V2,k}	b _{NT,min}	R _{V1,k}	R _{V2,k}
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]
7	160	75	130	65	60	53	8,13	13,63	88	15,16	25,44	123	21,84	36,64
	180	80	140	75	67	53	9,38		88	17,49		123	25,20	
	200	90	155	85	74	53	10,63		88	19,83		123	28,56	
	220	95	170	95	81	53	11,88		88	22,16		123	31,92	
	240	100	185	105	88	53	13,13		88	24,49		123	35,28	
	260	110	200	115	95	53	14,38		88	26,82		123	38,64	
	280	115	210	125	102	53	15,63		88	29,16		123	42,00	
	300	125	225	135	109	53	16,88		88	31,49		123	45,36	
	320	130	240	145	116	53	18,13		88	33,82		123	48,72	
	340	140	255	155	123	53	19,38		88	36,16		123	52,08	
	360	145	270	165	130	53	20,63		88	38,49		123	55,44	
	380	150	285	175	137	53	21,78		88	40,64		123	58,54	
400	160	295	185	144	53	21,78	88	40,64	123	58,54				
9	200	90	155	85	74	86	13,66	22,88	131	25,49	42,69	176	36,72	61,50
	220	95	170	95	81	86	15,27		131	28,49		176	41,04	
	240	100	185	105	88	86	16,88		131	31,49		176	45,36	
	260	110	200	115	95	86	18,48		131	34,49		176	49,68	
	280	115	210	125	102	86	20,09		131	37,49		176	54,00	
	300	125	225	135	109	86	21,70		131	40,49		176	58,32	
	320	130	240	145	116	86	23,30		131	43,49		176	62,64	
	340	140	255	155	123	86	24,91		131	46,49		176	66,96	
	360	145	270	165	130	86	26,52		131	49,48		176	71,28	
	380	150	285	175	137	86	28,13		131	52,48		176	75,60	
	400	160	295	185	144	86	29,73		131	55,48		176	79,92	
	440	175	325	205	159	86	32,95		131	61,48		176	88,56	
	480	185	355	225	173	86	35,92		131	67,03		176	96,55	
	520	200	380	245	187	86	35,92		131	67,03		176	96,55	
	560	215	410	265	201	86	35,92		131	67,03		176	96,55	
	600	230	440	285	215	86	35,92		131	67,03		176	96,55	

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION

geometry		main beam secondary beam					1 pair			2 pairs			3 pairs		
															
d ₁	L	B _{HT,min}	H _{HT,min} h _{NT,min}	S _g	m	b _{NT,min}	R _{V1,k}	R _{V2,k}	b _{NT,min}	R _{V1,k}	R _{V2,k}	b _{NT,min}	R _{V1,k}	R _{V2,k}	
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	
11	250	105	190	110	91	105	21,61	29,15	160	40,32	54,40	215	58,08	78,35	
	275	115	210	125	102	105	24,55		160	45,82		215	66,00		
	300	125	225	135	109	105	26,52		160	49,48		215	71,28		
	325	135	250	150	120	105	29,46		160	54,98		215	79,20		
	350	140	260	160	127	105	31,43		160	58,65		215	84,48		
	375	150	285	175	137	105	34,38		160	64,15		215	92,40		
	400	160	295	185	144	105	36,34		160	67,81		215	97,68		
	425	170	320	200	155	105	39,29		160	73,31		215	105,60		
	450	175	335	210	162	105	41,25		160	76,98		215	110,88		
	475	185	355	225	173	105	44,20		160	82,47		215	118,80		
	500	195	370	235	180	105	46,16		160	86,14		215	124,08		
	525	205	390	250	190	105	49,11		160	91,64		215	131,99		
	550	210	405	260	197	105	51,07		160	95,30		215	137,27		
	575	225	425	275	208	105	53,74		160	100,28		215	144,45		
	600	230	440	285	215	105	53,74		160	100,28		215	144,45		
	650	245	475	310	233	105	53,74		160	100,28		215	144,45		
	700	265	510	335	251	105	53,74		160	100,28		215	144,45		
	750	285	545	360	268	105	53,74		160	100,28		215	144,45		
	800	300	580	385	286	105	53,74		160	100,28		215	144,45		
	850	320	615	410	304	105	53,74		160	100,28		215	144,45		
	900	335	650	435	321	105	53,74		160	100,28		215	144,45		
	950	355	685	460	339	105	53,74		160	100,28		215	144,45		
	1000	370	720	485	357	105	53,74		160	100,28		215	144,45		

NOTES

- The compression design strength of the connectors is the lower between the withdrawal-side design strength ($R_{V1,d}$) and the instability design strength ($R_{V2,d}$).

$$R_{V,d} = \min \left\{ \begin{array}{l} \frac{R_{V1,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{V2,k}}{\gamma_{M1}} \end{array} \right.$$

- The values given are calculated considering a distance $a_{1,CG} \geq 5d$.
- For the calculation process a timber characteristic density $\rho_k = 385 \text{ kg/m}^3$ has been considered.
For different ρ_k values, the strength values in the table can be converted by the k_{dens} coefficients previously indicated:

$$R'_{V1,k} = k_{dens,ax} \cdot R_{V1,k}$$

$$R'_{V2,k} = k_{dens,ki} \cdot R_{V2,k}$$

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

- The assembly figure (m) is valid in the case of symmetrical installation of the connectors flush over the elements.
- The connectors must be inserted at 45° with respect to the shear plane.
- The strength values in the table for connections with several pairs of crossed screws are already inclusive of $n_{ef,ax}$.

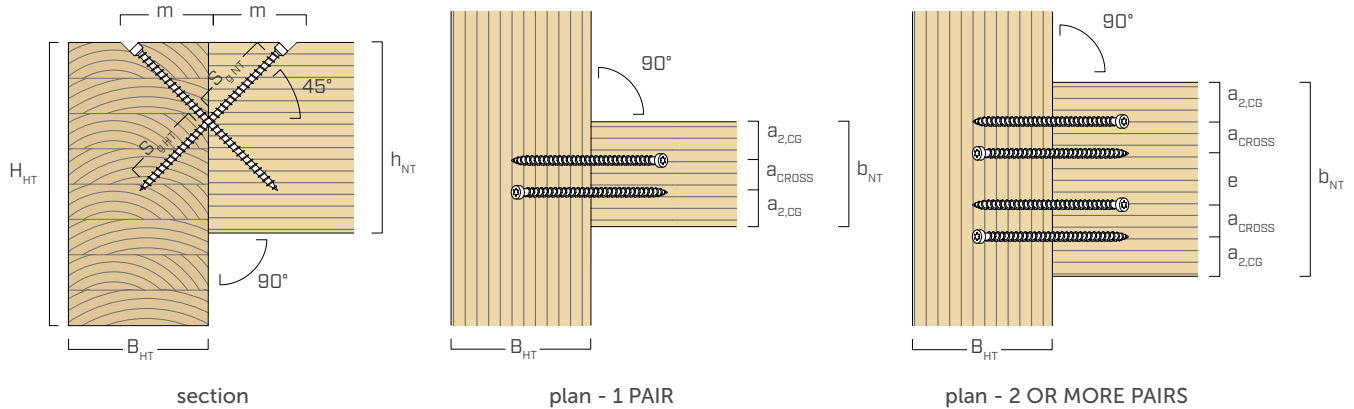
GENERAL PRINCIPLES on page 143.

MINIMUM DISTANCES FOR CROSSED CONNECTORS

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

d_1	[mm]	7	9	11
$a_{2,CG}$	[mm]	4·d	21	36
a_{CROSS}	[mm]	1,5·d	11	14
e	[mm]	3,5·d	25	32

d = d_1 = nominal screw diameter



NOTES

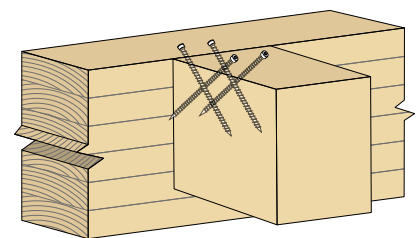
- For main beam-secondary beam joints with VGZ screws d = 7 mm inclined or crossed, inserted at an angle of 45° to the secondary beam head, with a minimum secondary beam height of 18 d, the minimum distance $a_{1,CG}$ can be taken equal to 8·d₁ and the minimum distance $a_{2,CG}$ equal to 3·d₁.

EFFECTIVE NUMBER FOR AXIALLY STRESSED CONNECTOR PAIRS

The load-bearing capacity of a connection made with several screws, all of the same type and size, may be lower than the sum of the load-bearing capacities of the individual connection system.

For a connection with n pairs of crossed screws, the characteristic effective load-bearing capacity is equal to:

$$R_{ef,V,k} = n_{ef,ax} \cdot R_{V,k}$$



The n_{ef} value is given in the table below as a function of n (number of pairs).

n _{PAIRS}	2	3	4	5	6	7	8	9	10
$n_{ef,ax}$	1,87	2,70	3,60	4,50	5,40	6,30	7,20	8,10	9,00



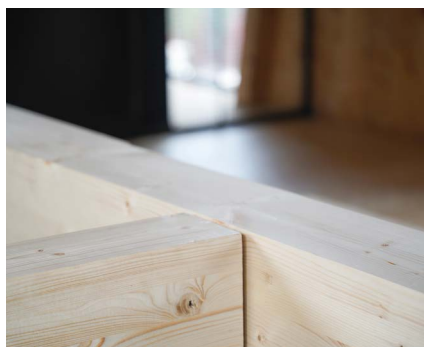
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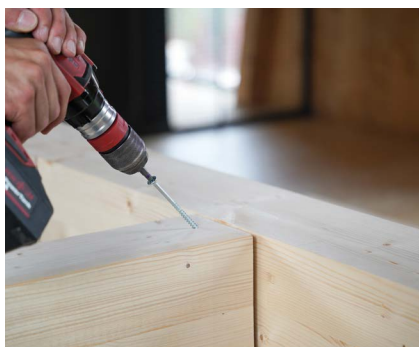
■ INSTALLATION SUGGESTIONS

TIMBER-TO-TIMBER JOINT WITH CROSSED CONNECTORS

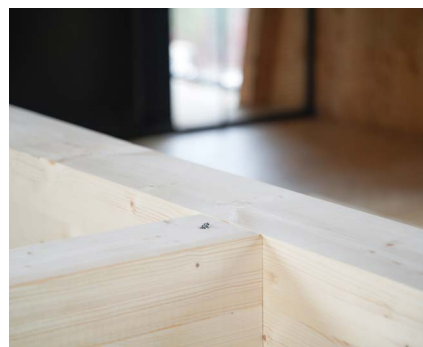
TIGHTENING THE JOINT



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

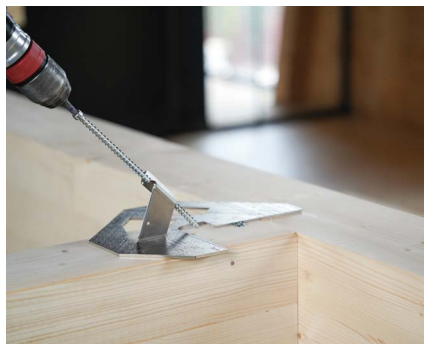


Insert a partially threaded screw (e.g. HBS680) to bring the elements closer together.



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

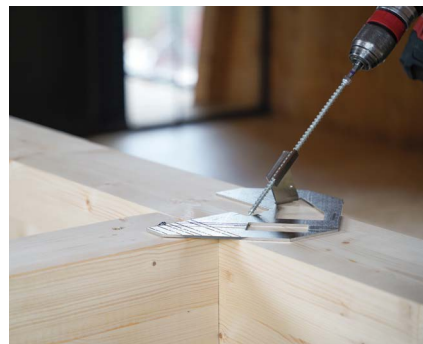
INSERTION OF CONNECTORS



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.

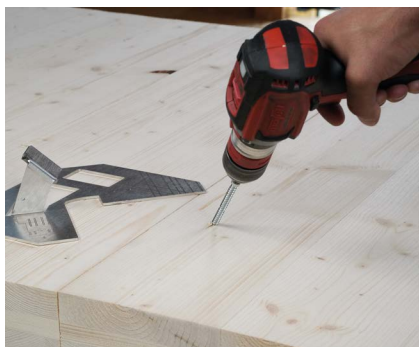


Repeat the procedure to install the inserted screw from the main beam to the secondary beam.

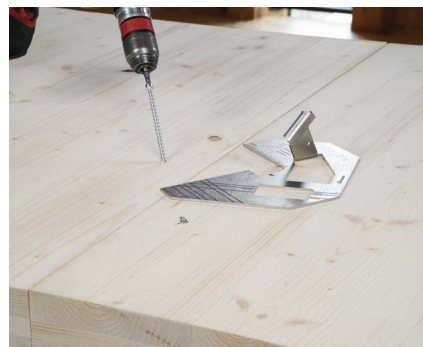
JOINT BETWEEN CLT PANELS WITH CONNECTORS INCLINED IN BOTH DIRECTIONS [45°-45°]



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
page 30



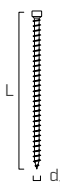
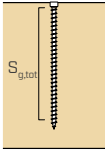
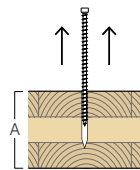
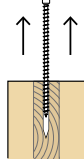
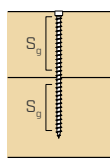
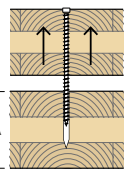
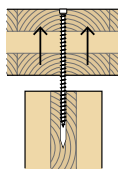
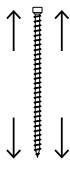
CATCH
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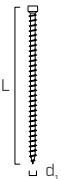
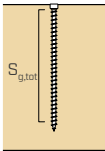
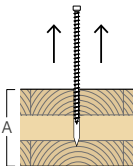
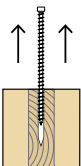
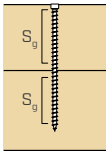
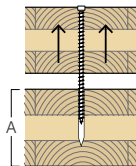
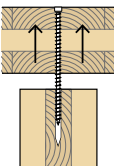
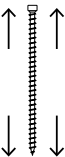


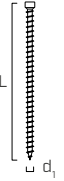
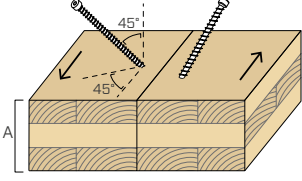
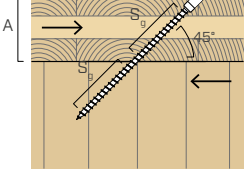
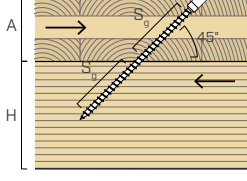
BIT
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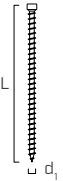
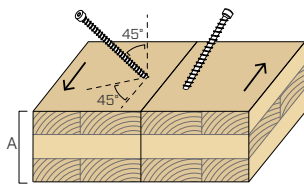
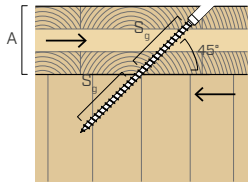
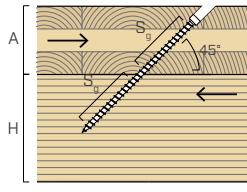


JIG VGZ 45°
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		TENSION								
geometry		total thread withdrawal				partial thread withdrawal				steel tension
		lateral		narrow	lateral		narrow			
										
d ₁ [mm]	L [mm]	S _{g,tot} [mm]	A _{min} [mm]	R _{ax,90,k} [kN]	R _{ax,0,k} [kN]	S _g [mm]	A _{min} [mm]	R _{ax,90,k} [kN]	R _{ax,0,k} [kN]	R _{tens,k} [kN]
7	80	70	90	5,73	4,34	-	-	-	-	15,40
	100	90	110	7,37	5,44	35	55	2,87	2,33	
	120	110	130	9,01	6,52	45	65	3,69	2,92	
	140	130	150	10,65	7,58	55	75	4,50	3,49	
	160	150	170	12,29	8,62	65	85	5,32	4,06	
	180	170	190	13,92	9,65	75	95	6,14	4,62	
	200	190	210	15,56	10,67	85	105	6,96	5,17	
	220	210	230	17,20	11,67	95	115	7,78	5,72	
	240	230	250	18,84	12,67	105	125	8,60	6,25	
	260	250	270	20,48	13,65	115	135	9,42	6,79	
	280	270	290	22,11	14,63	125	145	10,24	7,32	
	300	290	310	23,75	15,61	135	155	11,06	7,84	
	320	310	330	25,39	16,57	145	165	11,88	8,36	
	340	330	350	27,03	17,53	155	175	12,69	8,88	
	360	350	370	28,67	18,48	165	185	13,51	9,39	
	380	370	390	30,30	19,43	175	195	14,33	9,90	
	400	390	410	31,94	20,37	185	205	15,15	10,41	
9	160	150	170	15,80	10,54	65	85	6,84	4,97	25,40
	180	170	190	17,90	11,80	75	95	7,90	5,65	
	200	190	210	20,01	13,04	85	105	8,95	6,32	
	220	210	230	22,11	14,27	95	115	10,00	6,99	
	240	230	250	24,22	15,49	105	125	11,06	7,65	
	260	250	270	26,33	16,69	115	135	12,11	8,30	
	280	270	290	28,43	17,89	125	145	13,16	8,95	
	300	290	310	30,54	19,08	135	155	14,22	9,59	
	320	310	330	32,64	20,26	145	165	15,27	10,22	
	340	330	350	34,75	21,43	155	175	16,32	10,86	
	360	350	370	36,86	22,60	165	185	17,37	11,49	
	380	370	390	38,96	23,76	175	195	18,43	12,11	
	400	390	410	41,07	24,91	185	205	19,48	12,73	
	440	430	450	45,28	27,20	205	225	21,59	13,96	
	480	470	490	49,49	29,47	225	245	23,69	15,18	
	520	510	530	53,70	31,71	245	265	25,80	16,39	
	560	550	570	57,92	33,94	265	285	27,90	17,59	
	600	590	610	62,13	36,16	285	305	30,01	18,78	

		TENSION								
geometry		total thread withdrawal				partial thread withdrawal				steel tension
		lateral		narrow		lateral		narrow		
										
d1 [mm]	L [mm]	Sg,tot [mm]	Amin [mm]	Rax,90,k [kN]	Rax,0,k [kN]	Sg [mm]	Amin [mm]	Rax,90,k [kN]	Rax,0,k [kN]	Rtens,k [kN]
11	150	140	160	18,02	11,63	60	80	7,72	5,43	38,00
	200	190	210	24,45	15,31	85	105	10,94	7,42	
	250	240	260	30,89	18,89	110	130	14,16	9,36	
	275	265	285	34,11	20,66	123	143	15,77	10,31	
	300	290	310	37,32	22,40	135	155	17,37	11,26	
	325	315	335	40,54	24,13	148	168	18,98	12,19	
	350	340	360	43,76	25,85	160	180	20,59	13,12	
	375	365	385	46,98	27,56	173	193	22,20	14,04	
	400	390	410	50,19	29,25	185	205	23,81	14,95	
	425	415	435	53,41	30,93	198	218	25,42	15,85	
	450	440	460	56,63	32,60	210	230	27,03	16,75	
	475	465	485	59,85	34,27	223	243	28,64	17,65	
	500	490	510	63,06	35,92	235	255	30,24	18,54	
	525	515	535	66,28	37,56	248	268	31,85	19,43	
	550	540	560	69,50	39,20	260	280	33,46	20,31	
	575	565	585	72,72	40,83	273	293	35,07	21,18	
	600	590	610	75,93	42,45	285	305	36,68	22,05	
	650	630	660	81,08	45,04	305	325	39,25	23,44	
	700	680	710	87,52	48,24	330	350	42,47	25,17	
	750	730	760	93,95	51,42	355	375	45,69	26,88	
	800	780	810	100,39	54,58	380	400	48,91	28,57	
	850	830	860	106,82	57,72	405	425	52,12	30,26	
	900	880	910	113,26	60,84	430	450	55,34	31,93	
	950	930	960	119,69	63,94	455	475	58,56	33,60	
	1000	980	1010	126,13	67,03	480	500	61,78	35,26	

		SLIDING											
geometry		CLT - CLT 45° + 45°				CLT - CLT				CLT - timber			
													
d ₁	L	S _g	A _{min}	R _{V,k}	R _{tens,45+45,k}	A	R _{V,k}	R _{tens,45,k}	A	H _{min}	R _{V,k}	R _{tens,45,k}	
[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[mm]	[kN]	[kN]	
7	80	25	65	0,86	7,70	35	1,22	10,89	35	50	1,45	10,89	
	100	35	80	1,16		40	1,65		40	55	2,03		
	120	45	95	1,46		45	2,06		45	60	2,61		
	140	55	110	1,75		55	2,47		55	70	3,19		
	160	65	125	2,03		60	2,87		60	75	3,76		
	180	75	135	2,31		70	3,27		70	85	4,34		
	200	85	150	2,59		75	3,66		75	90	4,92		
	220	95	165	2,86		85	4,04		85	100	5,50		
	240	105	180	3,13		90	4,42		90	105	6,08		
	260	115	195	3,39		95	4,80		95	110	6,66		
	280	125	210	3,66		105	5,17		105	120	7,24		
	300	135	220	3,92		110	5,54		110	125	7,82		
	320	145	235	4,18		120	5,91		120	135	8,40		
	340	155	250	4,44		125	6,28		125	140	8,98		
	360	165	265	4,70		130	6,64		130	145	9,56		
	380	175	280	4,95		140	7,00		140	155	10,13		
	400	185	295	5,21		145	7,36		145	160	10,71		
9	160	65	125	2,48	12,70	60	3,51	17,96	60	75	4,84	17,96	
	180	75	135	2,82		70	3,99		70	85	5,58		
	200	85	150	3,16		75	4,47		75	90	6,33		
	220	95	165	3,49		85	4,94		85	100	7,07		
	240	105	180	3,82		90	5,41		90	105	7,82		
	260	115	195	4,15		95	5,87		95	110	8,56		
	280	125	210	4,47		105	6,33		105	120	9,31		
	300	135	220	4,79		110	6,78		110	125	10,05		
	320	145	235	5,11		120	7,23		120	135	10,80		
	340	155	250	5,43		125	7,68		125	140	11,54		
	360	165	265	5,74		130	8,12		130	145	12,29		
	380	175	280	6,06		140	8,56		140	155	13,03		
	400	185	295	6,37		145	9,00		145	160	13,77		
	440	205	320	6,98		160	9,87		160	175	15,26		
	480	225	350	7,59		175	10,74		175	190	16,75		
	520	245	380	8,20		190	11,59		190	205	18,24		
	560	265	405	8,80		205	12,44		205	220	19,73		
	600	285	435	9,39		215	13,28		215	230	21,22		

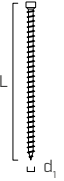
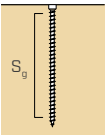
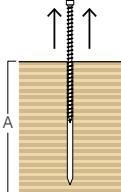
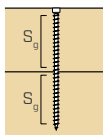
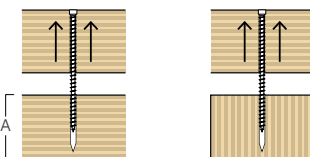
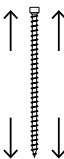
			SLIDING									
geometry			CLT - CLT 45° + 45°			CLT - CLT			CLT - timber			
												
d ₁	L	S _g	A _{min}	R _{V,k}	R _{tens,45+45,k}	A	R _{V,k}	R _{tens,45,k}	A	H _{min}	R _{V,k}	R _{tens,45,k}
[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[mm]	[kN]	[kN]
11	150	60	115	2,71	19,00	60	3,84	26,87	60	75	5,46	26,87
	200	85	150	3,71		75	5,25		75	90	7,74	
	250	110	185	4,68		95	6,62		95	110	10,01	
	275	123	205	5,16		100	7,29		100	115	11,15	
	300	135	220	5,63		110	7,96		110	125	12,29	
	325	148	240	6,10		120	8,62		120	135	13,42	
	350	160	255	6,56		130	9,28		130	145	14,56	
	375	173	275	7,02		140	9,93		140	155	15,70	
	400	185	295	7,47		145	10,57		145	160	16,84	
	425	198	310	7,93		155	11,21		155	170	17,97	
	450	210	330	8,38		165	11,85		165	180	19,11	
	475	223	345	8,82		175	12,48		175	190	20,25	
	500	235	365	9,27		180	13,11		180	195	21,39	
	525	248	380	9,71		190	13,74		190	205	22,52	
	550	260	400	10,15		200	14,36		200	215	23,66	
	575	273	415	10,59		210	14,98		210	225	24,80	
	600	285	435	11,03		215	15,60		215	230	25,94	
	650	305	470	11,72		230	16,58		230	245	27,76	
	700	330	505	12,58		250	17,79		250	265	30,03	
	750	355	540	13,44		265	19,00		265	280	32,31	
	800	380	575	14,29		285	20,20		285	300	34,58	
	850	405	610	15,13		300	21,40		300	315	36,86	
	900	430	645	15,97		320	22,58		320	335	39,13	
	950	455	680	16,80		335	23,76		335	350	41,41	
	1000	480	715	17,63		355	24,93		355	370	43,68	

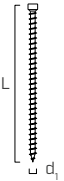
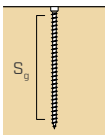
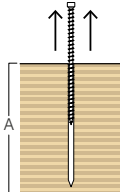
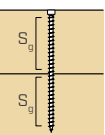
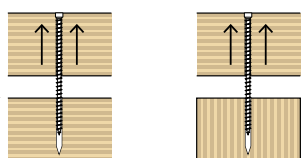
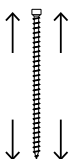
NOTES | CLT

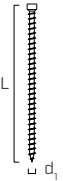
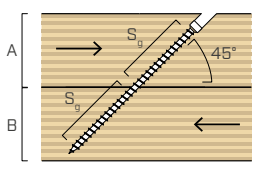
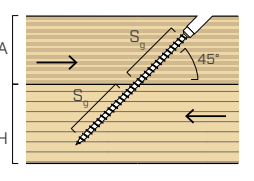
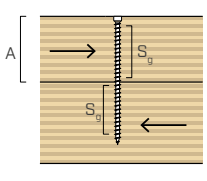
- The characteristic values are according to the national specifications ÖNORM EN 1995 - Annex K.
- For the calculation process, a mass density of $\rho_k = 350 \text{ kg/m}^3$ has been considered for CLT elements and a mass density of $\rho_k = 385 \text{ kg/m}^3$ has been considered for timber elements.
- The axial thread withdrawal resistance in the narrow face is valid for minimum CLT thickness $t_{\text{CLT,min}} = 10 \cdot d_1$ and minimum screw pull-through depth $t_{\text{pen}} = 10 \cdot d_1$.
- The characteristic sliding strengths of the connectors inserted in the lateral face of the CLT panel were evaluated considering an angle ϵ of 45° between the grains and the connector, since it was not possible to define the thickness and orientation of the individual layers in advance.

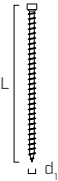
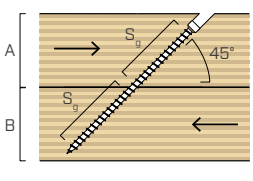
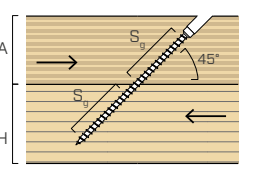
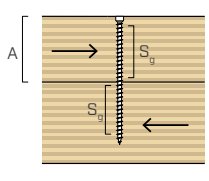
- The characteristic sliding strengths of the connectors inserted with double inclination (45°-45°) were evaluated considering an ϵ angle of 60° between the grains and the connector; in fact, the geometry of the joint requires that the connectors have to be inserted at an angle of 45° with respect to 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.
- Connectors instability must be verified separately.

GENERAL PRINCIPLES on page 143.

TENSION										
geometry		total thread withdrawal				partial thread withdrawal				steel tension
		wide		edge		wide		edge		
										
d ₁ [mm]	L [mm]	S _{g,tot} [mm]	A _{min} [mm]	R _{ax,90,k} [kN]	R _{ax,0,k} [kN]	S _g [mm]	A _{min} [mm]	R _{ax,90,k} [kN]	R _{ax,0,k} [kN]	R _{tens,k} [kN]
7	80	70	90	7,11	4,74	-	-	-	-	15,40
	100	90	110	9,15	5,44	35	55	3,56	2,37	
	120	110	130	11,18	6,52	45	65	4,57	3,05	
	140	130	150	13,21	7,58	55	75	5,59	3,73	
	160	150	170	15,24	8,62	65	85	6,61	4,40	
	180	170	190	17,28	9,65	75	95	7,62	5,08	
	200	190	210	19,31	10,67	85	105	8,64	5,76	
	220	210	230	21,34	11,67	95	115	9,65	6,44	
	240	230	250	23,37	12,67	105	125	10,67	7,11	
	260	250	270	25,41	13,65	115	135	11,69	7,79	
	280	270	290	27,44	14,63	125	145	12,70	8,47	
	300	290	310	29,47	15,61	135	155	13,72	9,15	
	320	310	330	31,50	16,57	145	165	14,74	9,82	
	340	330	350	33,54	17,53	155	175	15,75	10,50	
	360	350	370	35,57	18,48	165	185	16,77	11,18	
	380	370	390	37,60	19,43	175	195	17,78	11,86	
	400	390	410	39,63	20,37	185	205	18,80	12,53	
9	160	150	170	19,60	10,54	65	85	8,49	5,66	25,40
	180	170	190	22,21	11,80	75	95	9,80	6,53	
	200	190	210	24,83	13,04	85	105	11,11	7,40	
	220	210	230	27,44	14,27	95	115	12,41	8,28	
	240	230	250	30,05	15,49	105	125	13,72	9,15	
	260	250	270	32,67	16,69	115	135	15,03	10,02	
	280	270	290	35,28	17,89	125	145	16,33	10,89	
	300	290	310	37,89	19,08	135	155	17,64	11,76	
	320	310	330	40,51	20,26	145	165	18,95	12,63	
	340	330	350	43,12	21,43	155	175	20,25	13,50	
	360	350	370	45,73	22,60	165	185	21,56	14,37	
	380	370	390	48,35	23,76	175	195	22,87	15,24	
	400	390	410	50,96	24,91	185	205	24,17	16,12	
	440	430	450	56,18	27,20	205	225	26,79	17,86	
	480	470	490	61,41	29,47	225	245	29,40	19,60	
	520	510	530	66,64	31,71	245	265	32,01	21,34	
	560	550	570	71,86	33,94	265	285	34,63	23,08	
	600	590	610	77,09	36,16	285	305	37,24	24,83	

		TENSION								
geometry		total thread withdrawal				partial thread withdrawal				steel tension
		wide		edge		wide		edge		
										
d ₁	L	S _{g,tot}	A _{min}	R _{ax,90,k}	R _{ax,0,k}	S _g	A _{min}	R _{ax,90,k}	R _{ax,0,k}	R _{tens,k}
[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[mm]	[kN]	[kN]	[kN]
11	150	140	160	22,36	11,63	60	80	9,58	6,39	38,00
	200	190	210	30,34	15,31	85	105	13,57	9,05	
	250	240	260	38,33	18,89	110	130	17,57	11,71	
	275	265	285	42,32	20,66	123	143	19,56	13,04	
	300	290	310	46,31	22,40	135	155	21,56	14,37	
	325	315	335	50,31	24,13	148	168	23,56	15,70	
	350	340	360	54,30	25,85	160	180	25,55	17,03	
	375	365	385	58,29	27,56	173	193	27,55	18,37	
	400	390	410	62,28	29,25	185	205	29,54	19,70	
	425	415	435	66,27	30,93	198	218	31,54	21,03	
	450	440	460	70,27	32,60	210	230	33,54	22,36	
	475	465	485	74,26	34,27	223	243	35,53	23,69	
	500	490	510	78,25	35,92	235	255	37,53	25,02	
	525	515	535	82,24	37,56	248	268	39,53	26,35	
	550	540	560	86,24	39,20	260	280	41,52	27,68	
	575	565	585	90,23	40,83	273	293	43,52	29,01	
	600	590	610	94,22	42,45	285	305	45,51	30,34	
	650	630	660	100,61	67,07	305	325	48,71	32,47	
	700	680	710	108,60	72,40	330	350	52,70	35,13	
	750	730	760	116,58	77,72	355	375	56,69	37,80	
	800	780	810	124,56	83,04	380	400	60,69	40,46	
	850	830	860	132,55	88,37	405	425	64,68	43,12	
	900	880	910	140,53	93,69	430	450	68,67	45,78	
	950	930	960	148,52	99,01	455	475	72,66	48,44	
	1000	980	1010	156,50	104,34	480	500	76,66	51,10	

		SLIDING								SHEAR		
geometry			LVL-LVL				LVL-timber				LVL-LVL wide	
												
d ₁	L	S _g	A	B _{min}	R _{V,k}	R _{tens,45,k}	A	H _{min}	R _{V,k}	R _{tens,45,k}	A	R _{V,90,k}
[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]
7	100	35	40	55	2,01	10,89	40	45	2,01	10,89	50	3,29
	120	45	45	60	2,59		45	50	2,59		60	3,55
	140	55	55	70	3,16		55	60	3,16		70	3,80
	160	65	60	75	3,74		60	65	3,74		80	4,05
	180	75	70	85	4,31		70	75	4,31		90	4,31
	200	85	75	90	4,89		75	80	4,89		100	4,56
	220	95	85	100	5,46		85	90	5,46		110	4,81
	240	105	90	105	6,04		90	95	6,04		120	4,81
	260	115	95	110	6,61		95	100	6,61		130	4,81
	280	125	105	120	7,19		105	110	7,19		140	4,81
	300	135	110	125	7,76		110	115	7,76		150	4,81
	320	145	120	135	8,34		120	125	8,34		160	4,81
	340	155	125	140	8,91		125	130	8,91		170	4,81
	360	165	130	145	9,49		130	135	9,49		180	4,81
	380	175	140	155	10,06		140	145	10,06		190	4,81
	400	185	145	160	10,64		145	150	10,64		200	4,81
9	160	65	60	75	4,80	17,96	60	65	4,80	17,96	80	5,75
	180	75	70	85	5,54		70	75	5,54		90	6,08
	200	85	75	90	6,28		75	80	6,28		100	6,41
	220	95	85	100	7,02		85	90	7,02		110	6,73
	240	105	90	105	7,76		90	95	7,76		120	7,06
	260	115	95	110	8,50		95	100	8,50		130	7,26
	280	125	105	120	9,24		105	110	9,24		140	7,26
	300	135	110	125	9,98		110	115	9,98		150	7,26
	320	145	120	135	10,72		120	125	10,72		160	7,26
	340	155	125	140	11,46		125	130	11,46		170	7,26
	360	165	130	145	12,20		130	135	12,20		180	7,26
	380	175	140	155	12,93		140	145	12,93		190	7,26
	400	185	145	160	13,67		145	150	13,67		200	7,26
	440	205	160	175	15,15		160	165	15,15		220	7,26
	480	225	175	190	16,63		175	180	16,63		240	7,26
	520	245	190	205	18,11		190	195	18,11		260	7,26
	560	265	205	220	19,59		205	210	19,59		280	7,26
	600	285	215	230	21,07		215	220	21,07		300	7,26

		SLIDING								SHEAR		
geometry			LVL-LVL				LVL-timber				LVL-LVL wide	
												
d1	L	Sg	A	Bmin	RV,k	Rtens,45,k	A	Hmin	RV,k	Rtens,45,k	A	RV,90,k
[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]
11	150	60	60	75	5,42	26,87	60	65	5,42	26,87	75	7,46
	200	85	75	90	7,68		75	80	7,68		100	8,45
	250	110	95	110	9,94		95	100	9,94		125	9,45
	275	123	100	115	11,07		100	105	11,07		138	9,95
	300	135	110	125	12,20		110	115	12,20		150	10,12
	325	148	120	135	13,33		120	125	13,33		163	10,12
	350	160	130	145	14,45		130	135	14,45		175	10,12
	375	173	140	155	15,58		140	145	15,58		188	10,12
	400	185	145	160	16,71		145	150	16,71		200	10,12
	425	198	155	170	17,84		155	160	17,84		213	10,12
	450	210	165	180	18,97		165	170	18,97		225	10,12
	475	223	175	190	20,10		175	180	20,10		238	10,12
	500	235	180	195	21,23		180	185	21,23		250	10,12
	525	248	190	205	22,36		190	195	22,36		263	10,12
	550	260	200	215	23,49		200	205	23,49		275	10,12
	575	273	210	225	24,62		210	215	24,62		288	10,12
	600	285	215	230	25,75		215	220	25,75		300	10,12
	650	305	230	245	27,55		230	245	27,55		320	10,12
	700	330	250	265	29,81		250	260	29,81		345	10,12
	750	355	265	280	32,07		265	280	32,07		370	10,12
	800	380	285	300	34,33		285	295	34,33		395	10,12
	850	405	300	315	36,59		300	315	36,59		420	10,12
	900	430	320	335	38,85		320	330	38,85		445	10,12
	950	455	335	350	41,10		335	350	41,10		470	10,12
	1000	480	355	370	43,36		355	365	43,36		495	10,12

NOTES

- For the calculation process, a mass density of $\rho_k = 480 \text{ kg/m}^3$ has been considered for the softwood LVL elements and a mass density of $\rho_k = 385 \text{ kg/m}^3$ has been considered for timber elements.
- The axial "wide" thread withdrawal resistance was evaluated considering an angle of 90° between the fibers and the connector and is valid in application with LVLs in both parallel and cross grain veneer beams.
- The axial "edge" thread withdrawal resistance was evaluated considering an angle of 90° between the fibers and the connector and is valid in application with parallel veneer LVLs.
- Minimum height LVL $h_{LVL,min} = 100 \text{ mm}$ for VGZ connectors $\varnothing 7$ and $h_{LVL,min} = 120 \text{ mm}$ for VGZ connectors $\varnothing 9$.

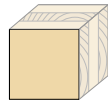
- The characteristic sliding strengths were evaluated by considering, for individual timber elements, a 45° angle between the connector and the grain and a 45° angle between the connector and the side face of the LVL element.
- The characteristic shear strengths were evaluated by considering, for individual timber elements, a 90° angle between the connector and the grain, a 90° angle between the connector and the side face of the LVL element and a 0° angle between the force and the grain.
- Connectors instability must be verified separately.

GENERAL PRINCIPLES on page 143.

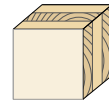
■ MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT



screws inserted **WITHOUT** pre-drilled hole



lateral face

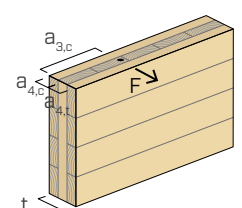
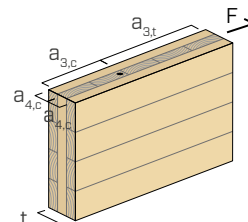
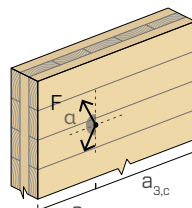
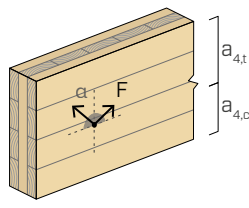
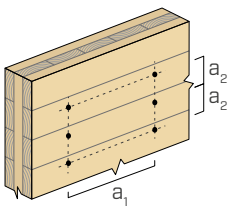


narrow face

d_1 [mm]		7	9	11
a_1 [mm]	4·d	28	36	44
a_2 [mm]	2,5·d	18	23	28
$a_{3,t}$ [mm]	6·d	42	54	66
$a_{3,c}$ [mm]	6·d	42	54	66
$a_{4,t}$ [mm]	6·d	42	54	66
$a_{4,c}$ [mm]	2,5·d	18	23	28

d_1 [mm]		7	9	11
a_1 [mm]	10·d	70	90	110
a_2 [mm]	4·d	28	36	44
$a_{3,t}$ [mm]	12·d	84	108	132
$a_{3,c}$ [mm]	7·d	49	63	77
$a_{4,t}$ [mm]	6·d	42	54	66
$a_{4,c}$ [mm]	3·d	21	27	33

$d = d_1$ = nominal screw diameter



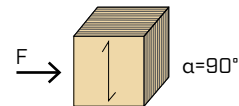
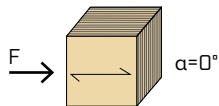
NOTES

- The minimum distances are compliant with ETA-11/0030 and are to be considered valid unless otherwise specified in the technical documents for the CLT panels.
- Minimum distances are valid for minimum CLT thickness $t_{CLT,min} = 10 \cdot d_1$.
- The minimum distances referred to "narrow face" are valid for minimum screw pull-through depth $t_{pen} = 10 \cdot d_1$.

■ MINIMUM DISTANCES FOR SHEAR LOADS | LVL



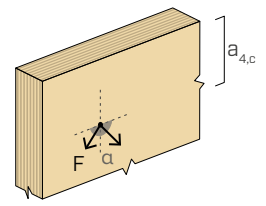
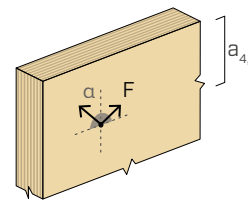
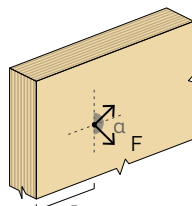
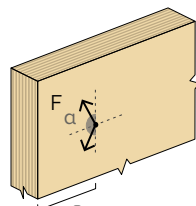
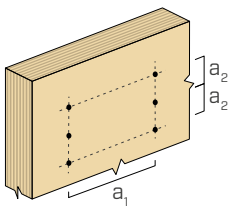
screws inserted **WITHOUT** pre-drilled hole



d_1 [mm]		7	9	11
a_1 [mm]	15·d	105	135	165
a_2 [mm]	7·d	49	63	77
$a_{3,t}$ [mm]	20·d	140	180	220
$a_{3,c}$ [mm]	15·d	105	135	165
$a_{4,t}$ [mm]	7·d	49	63	77
$a_{4,c}$ [mm]	7·d	49	63	77

d_1 [mm]		7	9	11
a_1 [mm]	7·d	49	63	77
a_2 [mm]	7·d	49	63	77
$a_{3,t}$ [mm]	15·d	105	135	165
$a_{3,c}$ [mm]	15·d	105	135	165
$a_{4,t}$ [mm]	12·d	84	108	132
$a_{4,c}$ [mm]	7·d	49	63	77

α = load-to-grain angle
 $d = d_1$ = nominal screw diameter



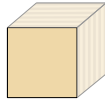
NOTES

- Minimum distances are obtained from experimental tests carried out at Eurofins Expert Services Oy, Espoo, Finland (Report EUFI29-19000819-T1/T2).

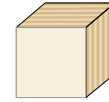
MINIMUM DISTANCES FOR AXIAL STRESSES | LVL



screws inserted **WITHOUT** pre-drilled hole



wide face



edge face

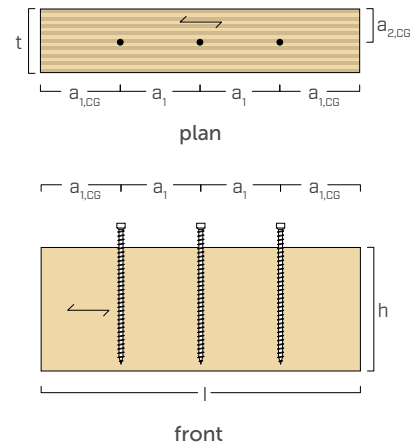
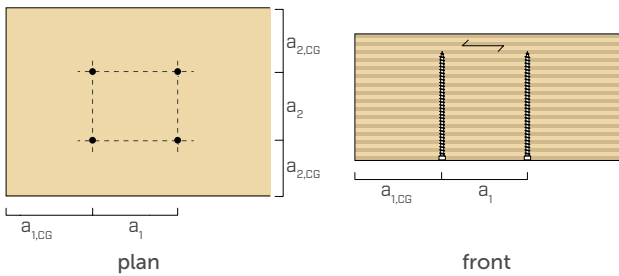
d_1	[mm]	7	9	11	
a_1	[mm]	5·d	35	45	55
a_2	[mm]	5·d	35	45	55
$a_{1,CG}$	[mm]	10·d	70	90	110
$a_{2,CG}$	[mm]	4·d	28	36	44

$d = d_1 =$ nominal screw diameter

d_1	[mm]	7	9	11	
a_1	[mm]	$10 \cdot d$	70	90	110
a_2	[mm]	$5 \cdot d$	35	45	55
$a_{1,CG}$	[mm]	$12 \cdot d$	84	108	132
$a_{2,CG}$	[mm]	$3 \cdot d$	21	27	33

SCREWS INSERTED WITH $\alpha = 90^\circ$ ANGLE WITH RESPECT TO THE GRAIN (wide face)

SCREWS INSERTED WITH $\alpha = 90^\circ$ ANGLE WITH RESPECT TO THE GRAIN (edge face)



NOTES

- The minimum distances for Ø7 and Ø9 screws with 3 THORNS bit are compliant with ETA-11/0030 and are to be considered valid unless otherwise specified in the technical documents for the LVL panels. For Ø11 or self-drilling bit screws, the minimum distances are obtained from experimental tests carried out at Eurofins Expert Services Oy, Espoo, Finland (Report EU-FI29-19000819-T1/T2).
- The minimum distances referred to edge face for screws $d = 7$ mm are valid for minimum thickness LVL $t_{LVL,min} = 45$ mm and minimum height LVL $h_{LVL,min} = 100$ mm. The minimum distances referred to edge face for screws $d = 9$ mm are valid for minimum thickness LVL $t_{LVL,min} = 57$ mm and minimum height LVL $h_{LVL,min} = 120$ mm.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- The tensile design strength of the connector is the lower between the timber-side design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

$$R_{ax,d} = \min \left\{ \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M}, \frac{R_{tens,k}}{\gamma_{M2}} \right\}$$

- The compression design strength of the connector is the lower between the timber-side design strength ($R_{ax,d}$) and the instability design strength ($R_{ki,d}$).

$$R_{ax,d} = \min \left\{ \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M}, \frac{R_{ki,k}}{\gamma_{M1}} \right\}$$

- The design sliding strength of the joint is either the timber-side design strength ($R_{V,d}$) and the design strength on the steel side projected at 45° . ($R_{tens,45,d}$), whichever is lower:

$$R_{V,d} = \min \left\{ \frac{R_{V,k} \cdot k_{mod}}{\gamma_M}, \frac{R_{tens,45,k}}{\gamma_{M2}} \right\}$$

- The design shear strength of the connector is obtained from the characteristic value as follows:

$$R_{V,d} = \frac{R_{V,k} \cdot k_{mod}}{\gamma_M}$$

- The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- Dimensioning and verification of the timber elements must be carried out separately.
- The screws must be positioned in accordance with the minimum distances.
- The characteristic thread withdrawal strengths 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. A minimum penetration length of $4 \cdot d_1$ is considered.
- The shear strength and sliding values were evaluated considering the centre of gravity of the connector placed in correspondence with the shear plane.
- 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.
- For different calculation configurations, the MyProject software is available (www.rothoblaas.com).