VGS PLATE

PAN HEAD HEX SCREW FOR LIFTING

ELC-4645 | ESR-4645 | ETA-11/0030 | REUSABLE

ONE SCREW FOR ALL TRANSPORT APPLICATIONS

The head shape guarantees full compatibility with all screw-based transport and lifting systems (WASP, WASPL, RAPTOR, RAPTOR MINI and RAPTOR MAXI).

REUSABLE: LESS WASTE, IMPROVED COST EFFICIENCY

Unlike traditional single-use solutions, this screw is designed for repeated use in transport and lifting operations. Testing carried out in collaboration with the University of Maine and the University of Bologna confirms that performance is maintained after repeated reuse cycles. Following a practical yet rigorous inspection, the screw can be reused for lifting applications.

USE IN STRUCTURAL CONNECTIONS

The screw is certified for permanent metal-to-timber structural connections in buildings. The optimised head design, featuring a reinforced underhead and no sharp edges, ensures reliable load transfer with an enhanced safety factor, even when used with thick plates.

VIDEO MANUALS

BIT INCLUDED

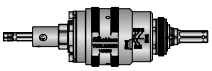
DIAMETER [mm]	9 — 11 — 13
LENGTH [mm]	60 — 60 — 280 — 1500
SERVICE CLASS	SC1 SC2
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn E-COATING electrogalvanised carbon steel with black E-Coating

DOWNLOAD AND READ

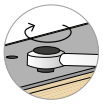
the complete manual before the installation

METAL-TO-TIMBER RECOMMENDED USE:

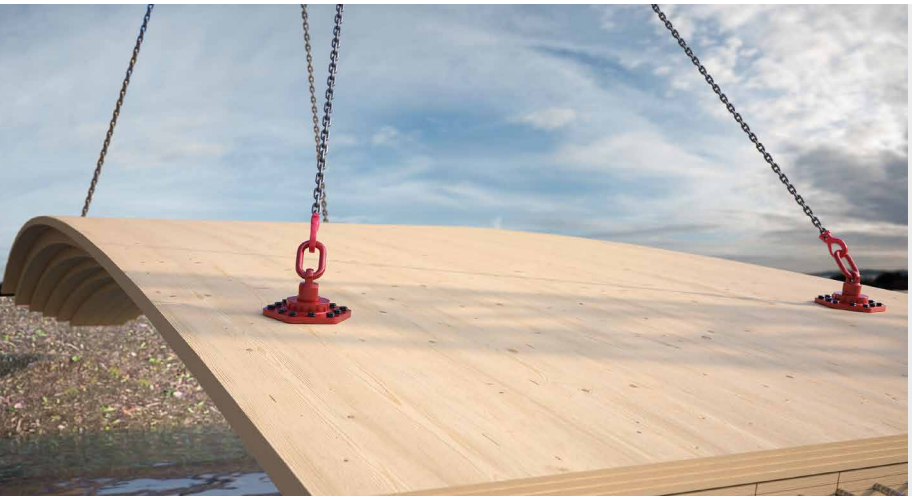
NO IMPACT



TORQUE LIMITER



$M_{ins,rec}$



FIELDS OF USE

- WASP
- RAPTOR
- RAPTOR MINI
- RAPTOR MAXI
- structural metal-to-timber connections

REUSABLE

The reusability of the screw for transporting timber elements has been thoroughly analysed and tested. Follow the instructions for use before installation.

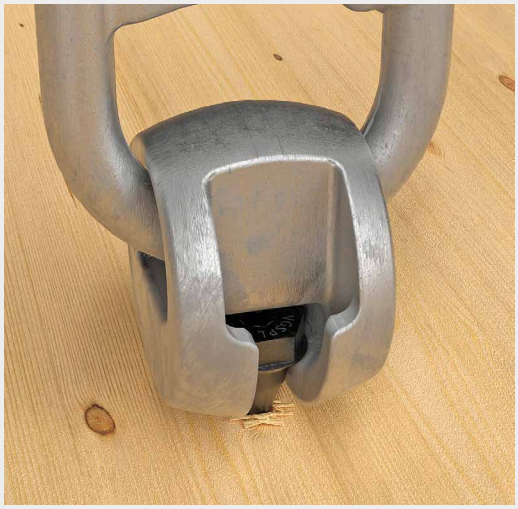
BLACK E-COATING

The black finish and "LIFT" head marking allow easy on-site identification and clear differentiation from screws not approved for lifting. The wear of the coating provides a visual indication of the number of reuse cycles.

HEXAGONAL HEAD WITH TORX DRIVE

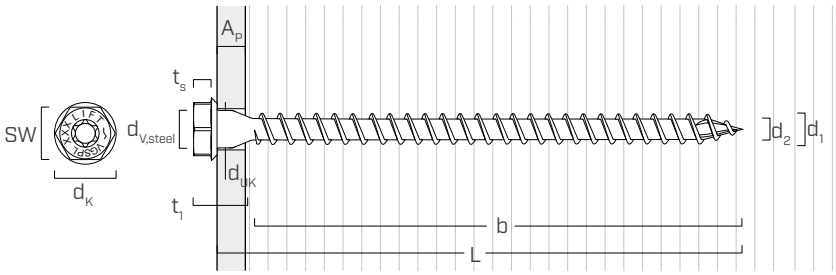
The combination of a robust hexagonal head and TORX drive allows the screw to be repeatedly installed and removed.

The JIG REUSE jig enables verification of plastic deformation, thread wear and coating degradation, ensuring safe reuse.



Despite the hexagonal head, VGS PLATE is fully compatible with lifting hooks such as WASP and WASPL, thanks to the integrated pan head washer.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter		**d_1**	**[mm]**	**11**
Head diameter		d_K	[mm]	20,00
Internal thread diameter		d_2	[mm]	6,60
Head thickness		t_1	[mm]	16,25
Wrench size		SW	-	17
Hexagonal head thickness		t_s	[mm]	5,75
Underhead diameter		d_{UK}	[mm]	12,00
Steel plate thickness		A_p	[mm]	3 - 20
Hole diameter on steel plate		$d_{v,steel}$	[mm]	13,0
Pre-drilling hole diameter(1)		$d_{V,S}$	[mm]	6,0
Pre-drilling hole diameter(2)		$d_{V,H}$	[mm]	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]**	**11**
Characteristic tensile strength		$f_{tens,k}$	[kN]	38,0
Characteristic yield moment		$M_{y,k}$	[Nm]	45,9

			softwood	**LVL softwood**	**hardwood 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*	*460 - 550*	*590 - 750*

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

CODES AND DIMENSIONS

d_1 [mm] *[in]*	CODE	L [mm]	b [mm]	*L [in]*	*b [in]*	pcs
11 *0.44* SW 17 TX 50	**VGSPL1160**	60	50	*1 15/16*	*1 15/16*	25
	VGSPL1180	80	70	*2 3/4*	*2 3/4*	25
	VGSPL11100	100	90	*3 1/2*	*3 1/2*	25
	VGSPL11120	120	110	*4 3/8*	*4 3/8*	25
	VGSPL11140	140	130	*5 1/8*	*5 1/8*	25
	VGSPL11160	160	150	*6*	*6*	25
	VGSPL11180	180	170	*6 3/4*	*6 3/4*	25
	VGSPL11200	200	190	*7 1/2*	*7 1/2*	25
	VGSPL11240	240	230	*9 1/16*	*9 1/16*	25
	VGSPL11280	280	270	*10 5/8*	*10 5/8*	25

RELATED PRODUCTS

TORQUE LIMITER
TORQUE LIMITER

CODE	stop torque [Nm] *[ft·lbs]*	weight [g] *[lbs]*	pcs
TORLIM1235 incl. TORLIMBIT + TX4050	12 - 35 *9 - 26*	730 *1.61*	1
TORLIM3063 incl. TORLIMBITL + TX5050	30 - 63 *22 - 46*	1180 *2.6*	1

JIG REUSE
INSPECTION JIG FOR REUSABLE SCREWS

CODE	description	pcs
JIGREVGSPL11	inspection jig for reusable screws	1

Lifting system

Solutions engineered for the safe lifting and handling of timber elements.
The product range includes devices designed to accommodate different load configurations and on-site handling requirements.

RAPTOR MINI

RAPTOR

RAPTOR MAXI

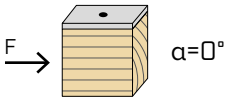
WASP

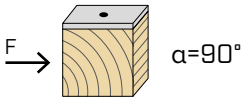
The comprehensive technical documentation is available at www.rothoblaas.com

rothoblaas.com

MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER

screws inserted **WITHOUT pre-drilled hole** — $\rho_k \leq 420$ kg/m³



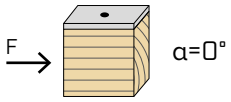


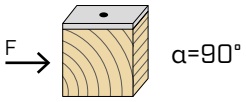
d_1	[mm]		11
a_1	[mm]	12·d·0,7	92
a_2	[mm]	5·d·0,7	39
$a_{3,t}$	[mm]	15·d	165
$a_{3,c}$	[mm]	10·d	110
$a_{4,t}$	[mm]	5·d	55
$a_{4,c}$	[mm]	5·d	55

d_1	[mm]		11
a_1	[mm]	5·d·0,7	39
a_2	[mm]	5·d·0,7	39
$a_{3,t}$	[mm]	10·d	110
$a_{3,c}$	[mm]	10·d	110
$a_{4,t}$	[mm]	10·d	110
$a_{4,c}$	[mm]	5·d	55

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

screws inserted **WITH pre-drilled hole**

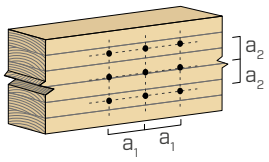




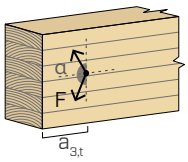
d_1	[mm]		11
a_1	[mm]	5·d·0,7	39
a_2	[mm]	3·d·0,7	23
$a_{3,t}$	[mm]	12·d	132
$a_{3,c}$	[mm]	7·d	77
$a_{4,t}$	[mm]	3·d	33
$a_{4,c}$	[mm]	3·d	33

d_1	[mm]		11
a_1	[mm]	4·d·0,7	31
a_2	[mm]	4·d·0,7	31
$a_{3,t}$	[mm]	7·d	77
$a_{3,c}$	[mm]	7·d	77
$a_{4,t}$	[mm]	7·d	77
$a_{4,c}$	[mm]	3·d	33

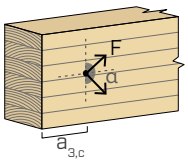
α = load-to-grain angle
d = d_1 = nominal screw diameter



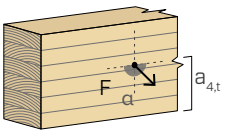
stressed end
-90° < α < 90°



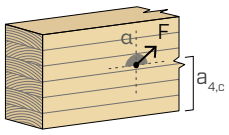
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



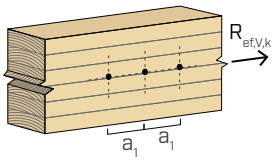
unload edge
180° < α < 360°



NOTE ON page 11.

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 load-bearing capacity is equal to:



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

The n_{ef} value is given in the table below as a function of n and a_1.

		a_1(*)										
		4·d	5·d	6·d	7·d	8·d	9·d	10·d	11·d	12·d	13·d	≥ 14·d
n	2	1,41	1,48	1,55	1,62	1,68	1,74	1,80	1,85	1,90	1,95	2,00
	3	1,73	1,86	2,01	2,16	2,28	2,41	2,54	2,65	2,76	2,88	3,00
	4	2,00	2,19	2,41	2,64	2,83	3,03	3,25	3,42	3,61	3,80	4,00
	5	2,24	2,49	2,77	3,09	3,34	3,62	3,93	4,17	4,43	4,71	5,00

(*)For intermediate a_1 values a linear interpolation is possible.

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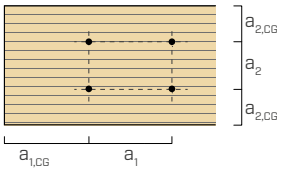
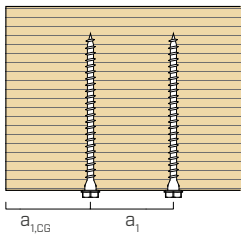
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

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

d_1	[mm]		11
a_1	[mm]	**5·d**	55
a_2	[mm]	**5·d**	55
$a_{2,LIM}$	[mm]	**2,5·d**	28
$a_{1,CG}$	[mm]	**10·d**	110
$a_{2,CG}$	[mm]	**4·d**	44



plan



front

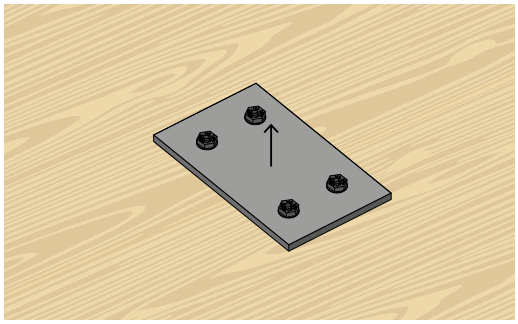
NOTE ON page 11.

EFFECTIVE NUMBER FOR AXIAL STRESSES

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 screws in a metal plate application, the characteristic effective load-bearing capacity is equal to:

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

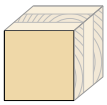


The $n_{ef,ax}$ value is given in the table below as a function of n (number of screws in a row).

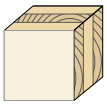
n	2	3	4	5	6	7	8	9	10
$n_{ef,ax}$	1,87	2,70	3,60	4,50	5,40	6,30	7,20	8,10	9,00

MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT

screws inserted **WITHOUT pre-drilled hole**



lateral face

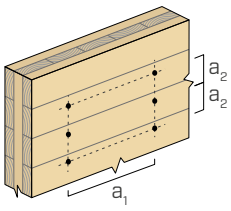


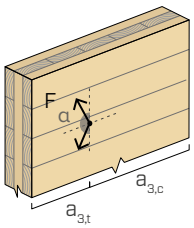
narrow face

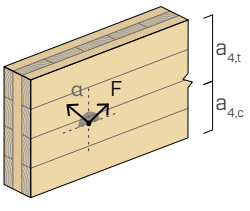
d_1	[mm]		11
a_1	[mm]	**4·d**	44
a_2	[mm]	**2,5·d**	28
$a_{3,t}$	[mm]	**6·d**	66
$a_{3,c}$	[mm]	**6·d**	66
$a_{4,t}$	[mm]	**6·d**	66
$a_{4,c}$	[mm]	**2,5·d**	28

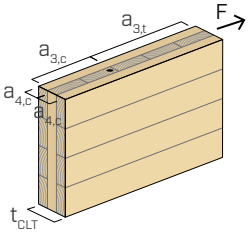
d_1	[mm]		11
a_1	[mm]	**10·d**	110
a_2	[mm]	**4·d**	44
$a_{3,t}$	[mm]	**12·d**	132
$a_{3,c}$	[mm]	**7·d**	77
$a_{4,t}$	[mm]	**6·d**	66
$a_{4,c}$	[mm]	**3·d**	33

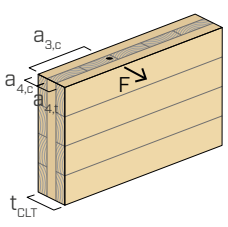
d = d_1 = nominal screw diameter



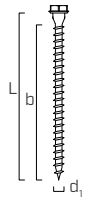
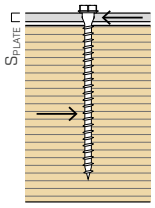
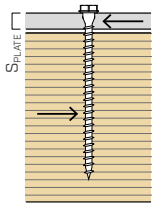
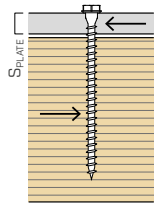
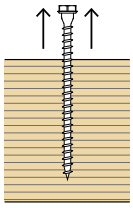
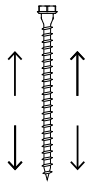




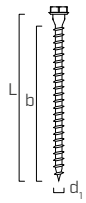
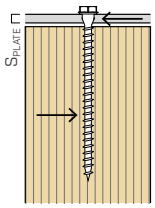
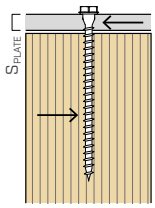
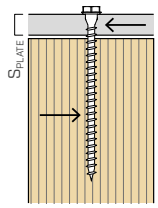
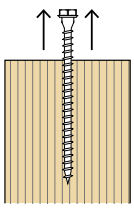
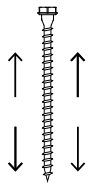




NOTES and GENERAL PRINCIPLES on page 11.

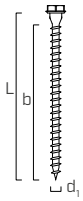
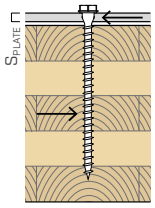
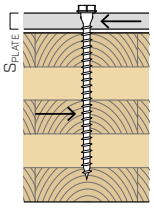
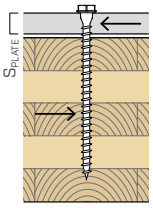
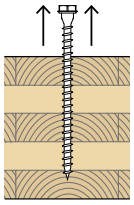
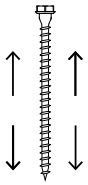
			SHEAR								TENSION	
geometry			steel-to-timber thin plate ε=90°			steel-to-timber intermediate plate ε=90°		steel-to-timber thick plate ε=90°			thread withdrawal ε=90°	steel tension
												
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]			$R_{V,90,k}$ [kN]		$R_{V,90,k}$ [kN]			$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		3 mm	4 mm	5 mm	8 mm	10 mm	12 mm	16 mm	20 mm	-	-
11	60	50	3,86	3,79	3,72	4,91	5,91	6,31	5,99	5,70	6,94	38,00
	80	70	5,21	5,14	5,07	6,64	7,69	8,05	7,69	7,33	9,72	
	100	90	6,56	6,50	6,43	7,91	8,99	9,46	9,33	9,18	12,50	
	120	110	7,92	7,85	7,78	8,97	9,81	10,16	10,02	9,88	15,28	
	140	130	9,05	9,05	9,05	9,90	10,58	10,85	10,71	10,58	18,06	
	160	150	9,06	9,06	9,06	10,22	11,15	11,55	11,41	11,27	20,83	
	180	170	9,06	9,06	9,06	10,54	11,72	12,24	12,24	12,10	23,61	
	200	190	9,06	9,06	9,06	10,77	12,13	12,82	12,80	12,66	26,39	
	240	230	9,06	9,06	9,06	10,77	12,13	12,82	12,82	12,82	31,95	
	280	270	9,06	9,06	9,06	10,77	12,13	12,82	12,82	12,82	37,50	

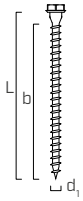
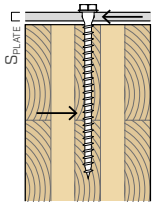
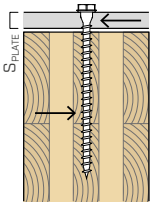
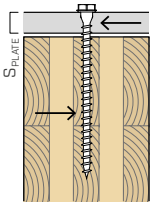
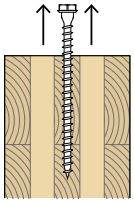
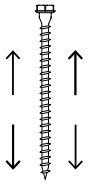
ε = screw-to-grain angle

			SHEAR								TENSION	
geometry			steel-to-timber thin plate ε=0°			steel-to-timber intermediate plate ε=0°		steel-to-timber thick plate ε=0°			thread withdrawal ε=0°	steel tension
												
d_1 [mm]	L [mm]	b [mm]	$R_{V,0,k}$ [kN]			$R_{V,0,k}$ [kN]		$R_{V,0,k}$ [kN]			$R_{ax,0,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		3 mm	4 mm	5 mm	8 mm	10 mm	12 mm	16 mm	20 mm	-	-
11	60	50	1,54	1,52	1,49	2,18	2,77	3,04	2,97	2,71	2,08	38,00
	80	70	2,08	2,06	2,03	2,77	3,29	3,51	3,40	3,30	2,92	
	100	90	2,63	2,60	2,57	3,34	3,88	4,09	3,97	3,85	3,75	
	120	110	3,17	3,14	3,11	3,93	4,51	4,74	4,60	4,47	4,58	
	140	130	3,71	3,68	3,65	4,48	5,10	5,39	5,28	5,14	5,42	
	160	150	4,25	4,22	4,19	4,87	5,37	5,59	5,55	5,51	6,25	
	180	170	4,64	4,64	4,64	5,18	5,61	5,80	5,76	5,72	7,08	
	200	190	4,85	4,85	4,85	5,38	5,82	6,01	5,97	5,93	7,92	
	240	230	5,26	5,26	5,26	5,80	6,23	6,43	6,39	6,34	9,58	
	280	270	5,68	5,68	5,68	6,22	6,65	6,84	6,80	6,76	11,25	

ε = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 11.

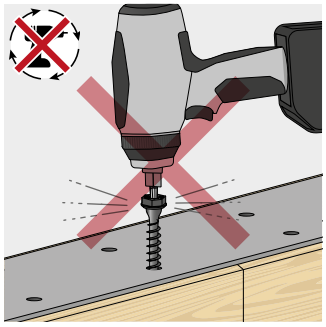
			SHEAR								TENSION	
geometry			steel-to-CLT lateral face thin plate			steel-to-CLT lateral face intermediate plate		steel-to-CLT lateral face thick plate			thread withdrawal lateral face	steel tension
												
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]			$R_{V,90,k}$ [kN]		$R_{V,90,k}$ [kN]			$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		3 mm	4 mm	5 mm	8 mm	10 mm	12 mm	16 mm	20 mm	-	-
11	60	50	3,51	3,44	3,38	4,52	5,49	5,88	5,59	5,33	6,44	38,00
	80	70	4,74	4,67	4,61	6,09	7,09	7,44	7,12	6,79	9,01	
	100	90	5,97	5,90	5,84	7,35	8,45	8,94	8,81	8,46	11,58	
	120	110	7,20	7,13	7,07	8,31	9,20	9,59	9,46	9,33	14,16	
	140	130	8,43	8,36	8,30	9,27	9,95	10,23	10,10	9,97	16,73	
	160	150	8,64	8,64	8,64	9,68	10,52	10,87	10,74	10,61	19,31	
	180	170	8,64	8,64	8,64	9,98	11,05	11,52	11,39	11,26	21,88	
	200	190	8,64	8,64	8,64	10,27	11,57	12,16	12,03	11,90	24,45	
	240	230	8,64	8,64	8,64	10,27	11,57	12,22	12,22	12,22	29,60	
	280	270	8,64	8,64	8,64	10,27	11,57	12,22	12,22	12,22	34,75	

			SHEAR								TENSION	
geometry			steel-to-CLT narrow face thin plate			steel-to-CLT narrow face intermediate plate		steel-to-CLT narrow face thick plate			thread withdrawal narrow face	steel tension
												
d_1 [mm]	L [mm]	b [mm]	$R_{V,0,k}$ [kN]			$R_{V,0,k}$ [kN]		$R_{V,0,k}$ [kN]			$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		3 mm	4 mm	5 mm	8 mm	10 mm	12 mm	16 mm	20 mm	-	-
11	60	50	1,51	1,49	1,46	2,32	2,95	3,18	2,92	2,65	4,60	38,00
	80	70	2,04	2,02	1,99	3,11	3,93	4,28	4,14	3,98	6,23	
	100	90	2,57	2,55	2,52	3,75	4,66	5,04	4,88	4,73	7,82	
	120	110	3,10	3,08	3,05	4,41	5,42	5,85	5,69	5,52	9,36	
	140	130	3,64	3,61	3,58	5,04	6,17	6,70	6,53	6,36	10,88	
	160	150	4,17	4,14	4,11	5,50	6,57	7,07	7,00	6,92	12,38	
	180	170	4,70	4,67	4,64	5,96	6,97	7,44	7,37	7,29	13,85	
	200	190	5,23	5,20	5,17	6,42	7,37	7,80	7,73	7,66	15,31	
	240	230	5,68	5,68	5,68	6,74	7,60	8,03	8,03	8,03	18,18	
	280	270	5,68	5,68	5,68	6,74	7,60	8,03	8,03	8,03	21,01	

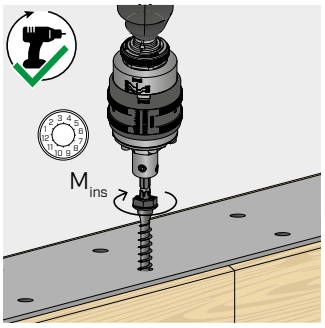
NOTES and GENERAL PRINCIPLES on page 11.

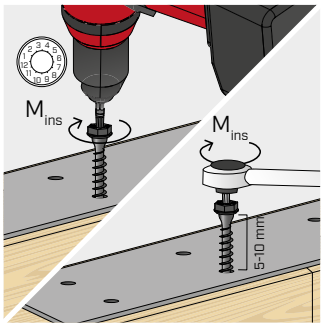
INSTALLATION

MANUALS



The use of pulse screw guns/impact wrenches is not permitted.

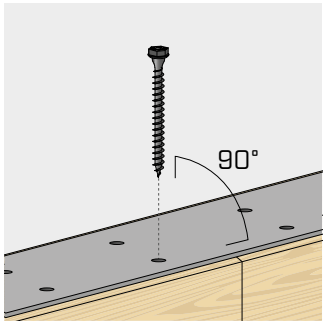




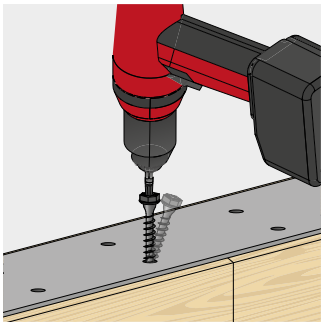
Ensure correct tightening.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.

VGSPL	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø11	11	30

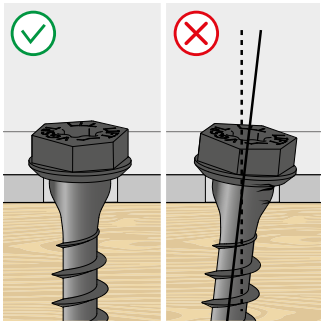
VGSPL	*d_1 [in]*	*$M_{ins,rec}$ [ft·lbs]*
Ø11	*0.44*	*22*



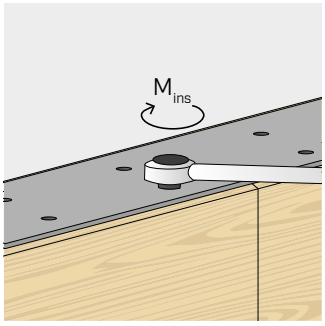
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



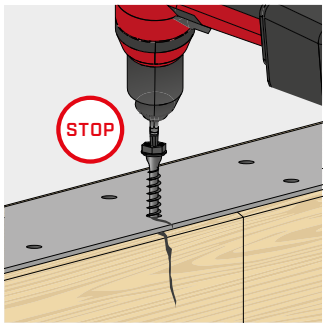
Avoid bending.



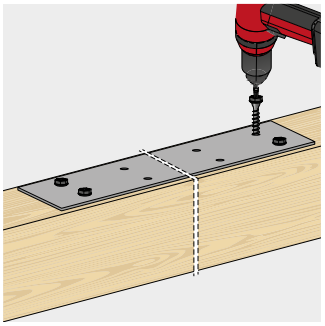
Ensure full contact between the entire surface of the screw head and the metal element.



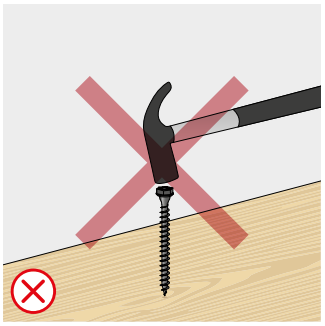
After installation, the fasteners can be inspected using a torque wrench.



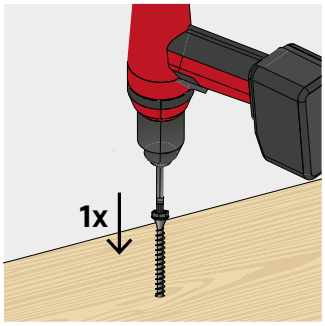
Stop installation if damage to the fastener, timber or metal plates is noticed.



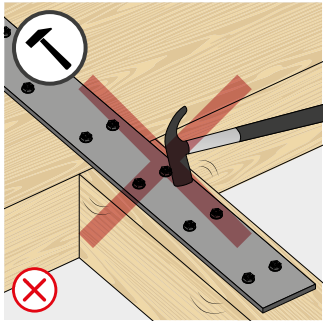
Install the connector assembly by following an installation sequence that ensures uniform tightening of all components.



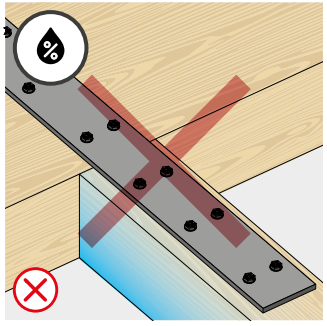
Do not hammer the screw tips into the timber.



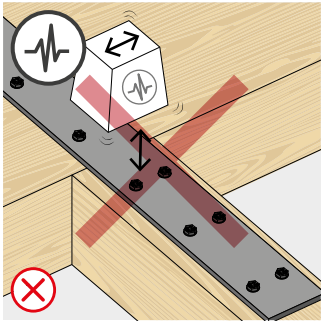
Install screws in one continuous stroke.



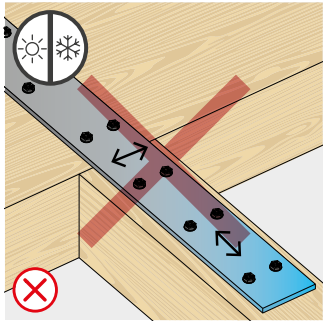
Avoid accidental stress during installation.



Protect the connection and avoid moisture changes and shrinkage and swelling of the timber.



Use not permitted for dynamic loads.

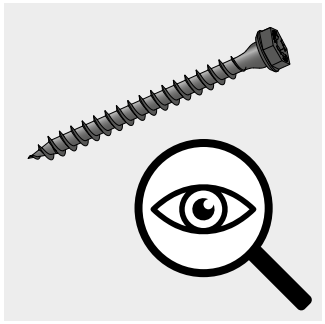


Avoid dimensional changes to the metal.

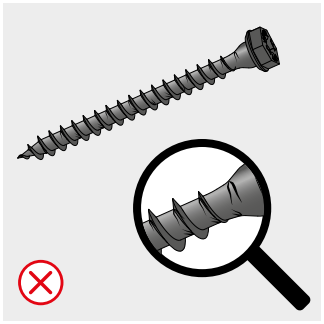
REUSE CRITERIA | LIFTING SCREW

These provisions apply to all lifting screws prior to reuse. Reuse is permitted only if all checks are successfully passed.

VISUAL INSPECTION



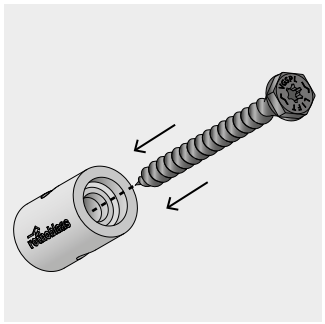
Carefully inspect the condition of the VGS PLATE.



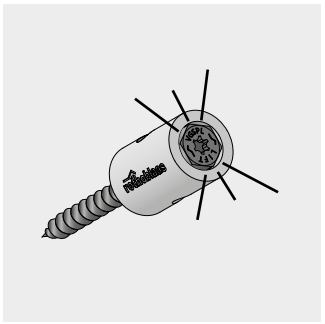
The screw must be fully intact, with no signs of corrosion, coating discontinuity, bending or damage of any kind.

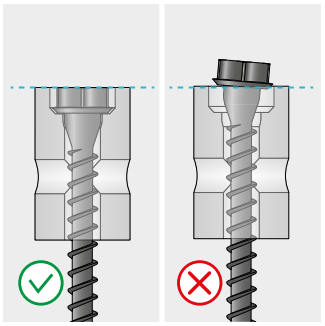
INSPECTIONS WITH JIG REUSE

STRAIGHTNESS (ABSENCE OF PLASTIC DEFORMATION)

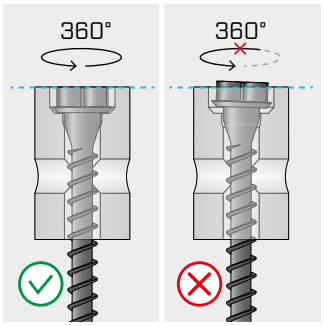


Insert the VGS PLATE into the main bore of the JIG REUSE jig until the head sits firmly against the jig.



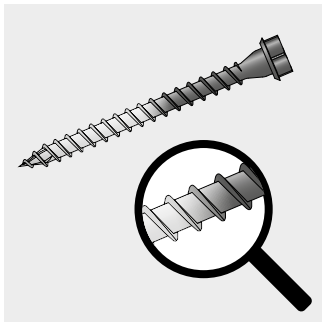


The screw head must be fully seated within the jig.

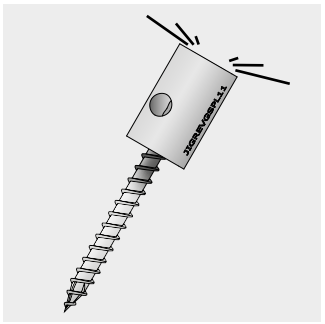


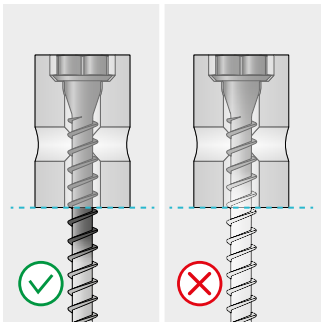
When inserted in the jig, the screw must rotate freely while the head remains fully seated.

NUMBER OF USES

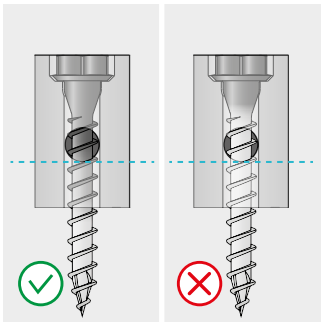


Identify the coating transition zone (wear area) on the VGS PLATE. Carry out this check with the jig and the VGS PLATE in exactly the same position as in the previous inspection.



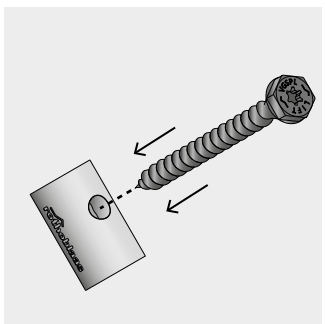


The wear area must remain completely outside the body of the JIG REUSE.

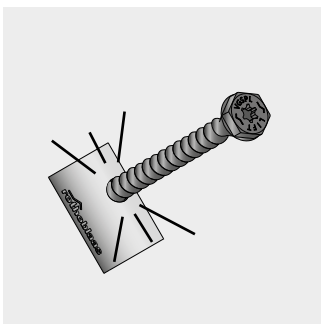


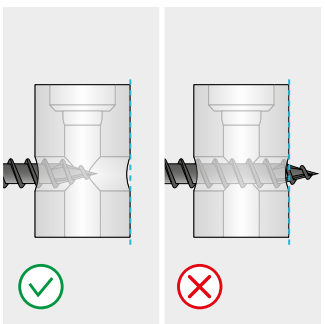
For screws with L ≤ 80 mm, the wear area must be located below the side bore of the JIG REUSE.

THREAD WEAR



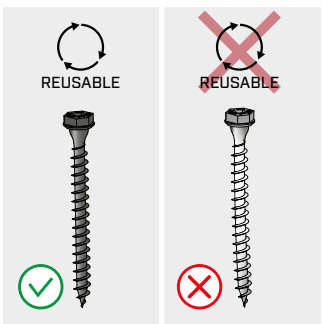
Insert the VGS PLATE into the side bore of the JIG REUSE as deeply as possible.





The tip of the screw must not protrude from the jig.

DISPOSAL



Discard the screw if any one of the above criteria is not met.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- Design values can be obtained from characteristic values as follows:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

  The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- 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 ($R_{tens,d}$).
- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- Sizing and verification of the timber elements, panels and steel plates must be done separately.
- The screws must be positioned in accordance with the minimum distances.
- In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or pull-through.
- The thread withdrawal characteristic strength has been evaluated considering a fixing length equal to b.
- The characteristic shear-strength value has been evaluated for plates with thickness = S_{PLATE}, and considering the thin ($S_{PLATE} \leq 0{,}5\ d_1$), intermediate ($0{,}5\ d_1 < S_{PLATE} < d_1$) or thick ($S_{PLATE} \geq d_1$) plate case scenario.
- In the case of combined shear and tensile stress, the following verification must be satisfied:

$$\left(\frac{F_{v,d}}{R_{v,d}}\right)^2 + \left(\frac{F_{ax,d}}{R_{ax,d}}\right)^2 \leq 1$$

- 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.
- In the case of steel-to-timber connections with a thick plate, it is necessary to assess the effects of timber deformation and install the connectors according to the assembly instructions.

NOTES | TIMBER

- 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.
- 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 and the connector.
- For the calculation process a timber characteristic density ρ_k = 385 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.

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

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

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

NOTES | CLT

- The characteristic values are according to the national specifications ÖNORM EN 1995 - Annex K.
- For the calculation process a mass density ρ_k = 350 kg/m^3 has been considered for CLT elements.
- The characteristics shear resistance are calculated considering a minimum fixing length of 4 d_1.
- The characteristic shear strength is independent from the direction of the grain of the CLT panels outer layer.
- The axial thread withdrawal resistance in the narrow face is valid for minimum CLT thickness $t_{CLT,min} = 10 \cdot d_1$ and minimum screw pull-through depth $t_{pen} = 10 \cdot d_1$.

MINIMUM DISTANCES

NOTES | TIMBER

- The minimum distances comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) can be multiplied by a coefficient of 1,5.
- In the case of joints with elements in Douglas fir (Pseudotsuga menziesii), the minimum spacing and distances parallel to the grain must be multiplied by a coefficient of 1.5.

NOTES | CLT

- 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 $t_{CLT,min} = 10 \cdot d_1$.

INSTALLATION INSTRUCTIONS AND REUSE CRITERIA

The full installation instructions and the reuse guidelines are available at www.rothoblaas.com

REUSE OF LIFTING CONNECTORS

The extensive experimental campaign carried out in collaboration with universities and research institutions has enabled the characterisation of screw behaviour in lifting systems, with a particular focus on safety, sustainability and innovation.

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