

45° WASHER FOR VGS

SAFETY

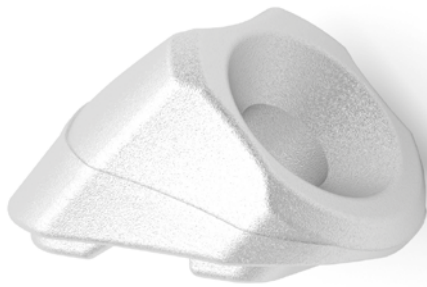
The VGU washer makes possible to install VGS screws at a 45° angle on steel plates. Washer marked CE as per ETA-11/0030.

STRENGTH

Using the VGU washer with VGS screws inclined at a 45° angle on steel plates restores the sliding strength.

PRACTICALITY

The ergonomic shape ensures a firm, precise grip during installation. Three versions of washer, compatible with VGS Ø9, Ø11 and Ø13 mm, for plates of variable thickness.



CHARACTERISTICS

FOCUS	45°steel-to-timber joints
PLATE THICKNESS	from 3,0 to 20,0 mm
PLATE HOLES	slotted
WASHER HOLE	9,0 11,0 13,0 mm



VIDEO

Scan the QR Code and watch the video on our YouTube channel



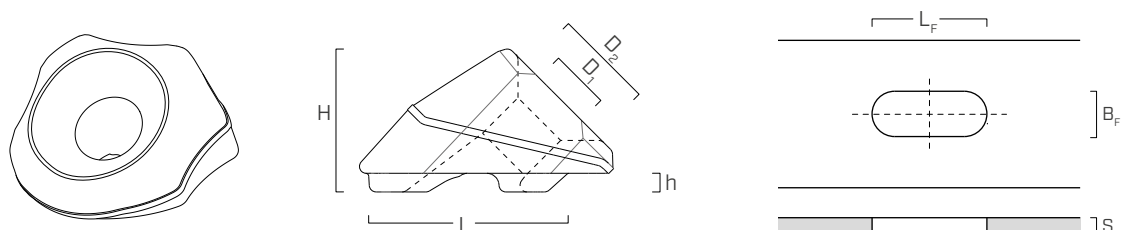
MATERIAL

Galvanized carbon steel.

FIELDS OF USE

- timber based panels
 - solid timber
 - glulam (Glued Laminated Timber)
 - CLT, LVL
 - high density woods
- Service classes 1 and 2.

GEOMETRY



Washer			VGU945	VGU1145	VGU1345
VGS screw diameter	d_1	[mm]	9,0	11,0	13,0
VGS screw pre-drilling hole diameter ⁽¹⁾	d_v	[mm]	5,0	6,0	8,0
Internal diameter	D_1	[mm]	9,7	11,8	14,0
External diameter	D_2	[mm]	19,0	23,0	27,4
Base length	L	[mm]	31,8	38,8	45,8
Base height	h	[mm]	3,0	3,6	4,3
Global height	H	[mm]	23,0	28,0	33,0
Slotted-hole length	L_f	[mm]	min. 33.0 max. 34.0	min. 41.0 max. 42.0	min. 49.0 max. 50.0
Slotted-hole width	B_f	[mm]	min. 14.0 max. 15.0	min. 17.0 max. 18.0	min. 20.0 max. 21.0
Steel plate thickness	S_{PLATE}	[mm]	min. 3.0 max. 12,0*	min. 4.0 max. 15,0*	min. 5.0 max. 15,0*

(1) Pre-drilling valid for softwood.

(*) For thicker plates it is necessary to realize a countersink in the lower part of the steel plate.

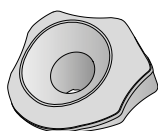
For VGS screw-lengths $L > 300$ mm a $\varnothing 5$ pre-drill is recommended.

The assembly must be performed so as to guarantee that the stress is evenly distributed among all the installed VGU washers.

CODES AND DIMENSIONS

VGU WASHER

CODE	screw [mm]	d_v [mm]	pcs
VGU945	VGS $\varnothing 9$	5	25
VGU1145	VGS $\varnothing 11$	6	25
VGU1345	VGS $\varnothing 13$	8	25



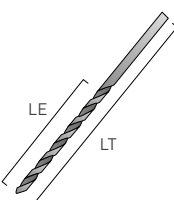
JIG VGU TEMPLATE

CODE	washer [mm]	d_h [mm]	d_v [mm]	pcs
JIGVGU945	VGU945	5,5	5	1
JIGVGU1145	VGU1145	6,5	6	1
JIGVGU1345	VGU1345	8,5	8	1



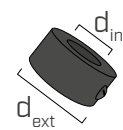
HSS WOOD DRILL BIT

CODE	d_v [mm]	TL [mm]	SL [mm]	pcs
F1599105	5	150	100	1
F1599106	6	150	100	1
F1599108	8	150	100	1



LOCKING RING FOR HSS BITS

CODE	d_v [mm]	d_{int} [mm]	d_{ext} [mm]	pcs
F2108005	5	5	10	10
F2108006	6	6	12	10
F2108008	8	8	16	10

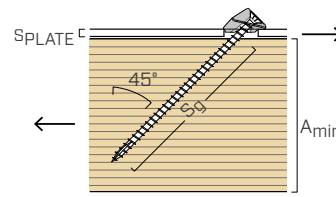
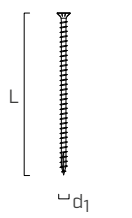


HELPS WITH INSTALLATION

The JIG VGU template makes it easy to pre-pare a 45° angle pre-drill, thus facilitating subsequent tightening of the VGS screws inside the washer. A pre-drill length of at least 20 mm is recommended.

■ STATIC VALUES | STEEL-TO-TIMBER JOINT

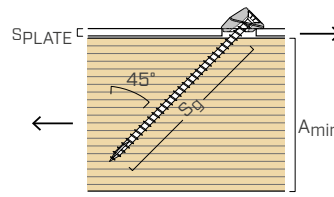
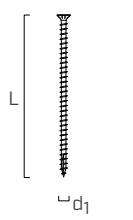
SLIDING RESISTANCE R_V



VGS			timber			timber			timber			steel
d ₁	L		S _g	A _{min}	R _{V,k} ⁽¹⁾	S _g	A _{min}	R _{V,k} ⁽¹⁾	S _g	A _{min}	R _{V,k} ⁽¹⁾	R _{tens,k 45°} ⁽²⁾
[mm]	[mm]		[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[kN]
S _{PLATE}			3 mm			7 mm			12 mm			
VGU945	9	100	80	75	6,43	75	75	6,03	65	65	5,22	17,96
		120	100	90	8,04	95	85	7,63	85	80	6,83	
		140	120	105	9,64	115	100	9,24	105	95	8,44	
		160	140	120	11,25	135	115	10,85	125	110	10,04	
		180	160	135	12,86	155	130	12,46	145	125	11,65	
		200	180	145	14,46	175	145	14,06	165	135	13,26	
		220	200	160	16,07	195	160	15,67	185	150	14,87	
		240	220	175	17,68	215	170	17,28	205	165	16,47	
		260	240	190	19,29	235	185	18,88	225	180	18,08	
		280	260	205	20,89	255	200	20,49	245	195	19,69	
		300	280	220	22,50	275	215	22,10	265	205	21,29	
		320	300	230	24,11	295	230	23,71	285	220	22,90	
		340	320	245	25,71	315	245	25,31	305	235	24,51	
		360	340	260	27,32	335	255	26,92	325	250	26,12	
		380	360	275	28,93	355	270	28,53	345	265	27,72	
		400	380	290	30,54	375	285	30,13	365	280	29,33	
		440	420	315	33,75	415	315	33,35	405	305	32,54	
		480	460	345	36,96	455	340	36,56	445	335	35,76	
520	500	375	40,18	495	370	39,78	485	365	38,97			
S _{PLATE}			4 mm			10 mm			15 mm			
VGU1145	11	100	75	75	7,37	70	70	6,88	60	60	5,89	26,87
		125	100	90	9,82	95	85	9,33	85	80	8,35	
		150	125	110	12,28	120	105	11,79	110	100	10,80	
		175	150	125	14,73	145	125	14,24	135	115	13,26	
		200	175	145	17,19	170	140	16,70	160	135	15,71	
		225	200	160	19,64	195	160	19,15	185	150	18,17	
		250	225	180	22,10	220	175	21,61	210	170	20,63	
		275	250	195	24,55	245	195	24,06	235	185	23,08	
		300	275	215	27,01	270	210	26,52	260	205	25,54	
		325	300	230	29,46	295	230	28,97	285	220	27,99	
		350	325	250	31,92	320	245	31,43	310	240	30,45	
		375	350	265	34,38	345	265	33,88	335	255	32,90	
		400	375	285	36,83	370	280	36,34	360	275	35,36	
		450	425	320	41,74	420	315	41,25	410	310	40,27	
		500	475	355	46,65	470	350	46,16	460	345	45,18	
		550	525	390	51,56	520	390	51,07	510	380	50,09	
		600	575	425	56,47	570	425	55,98	560	415	55,00	

■ STATIC VALUES | STEEL-TO-TIMBER JOINT

SLIDING RESISTANCE R_V



VGU	VGS		timber			timber			timber			steel
	d_1	L	S_g	A_{min}	$R_{V,k}^{(1)}$	S_g	A_{min}	$R_{V,k}^{(1)}$	S_g	A_{min}	$R_{V,k}^{(1)}$	$R_{tens,k 45^\circ}^{(2)}$
	[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[kN]
S_{PLATE}			5 mm			10 mm			15 mm			37,48
VGU1345	13	100	65	65	7,54	60	60	6,96	50	55	5,80	
		150	115	100	13,35	110	100	12,77	100	90	11,61	
		200	165	135	19,15	160	135	18,57	150	125	17,41	
		300	265	205	30,76	260	205	30,18	250	195	29,02	
		400	365	280	42,37	360	275	41,79	350	265	40,63	
		500	465	350	53,97	460	345	53,39	450	340	52,23	
		600	565	420	65,58	560	415	65,00	550	410	63,84	

NOTES:

- (1) The connector pull-out strength has been evaluated by considering a 45° angle to the grain and an effective length of the threaded part equal to S_g .
- (2) The connector tensile strength was calculated considering a 45° angle between the fibres and the connector.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0030.
- The design sliding strength of the joint is either the timber-side design strength ($R_{V,d}$) or the steel design strength ($R_{tens,d 45^\circ}$), whichever is lower:

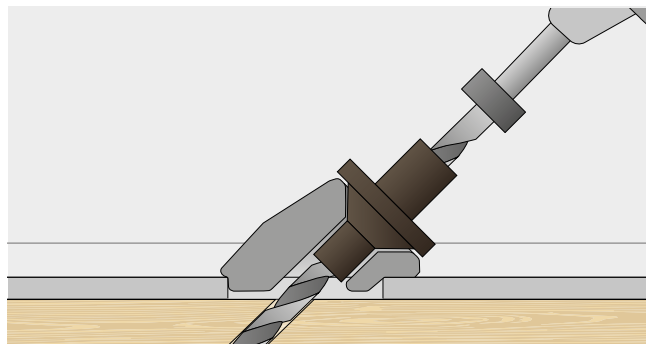
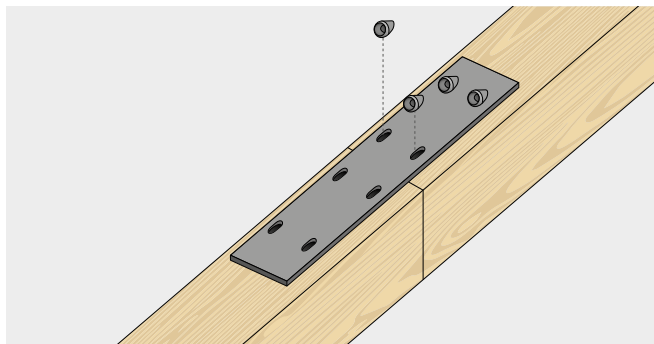
$$R_{V,d} = \min \left\{ \begin{array}{l} \frac{R_{V,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{tens,k 45^\circ}}{\gamma_{M2}} \end{array} \right.$$

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

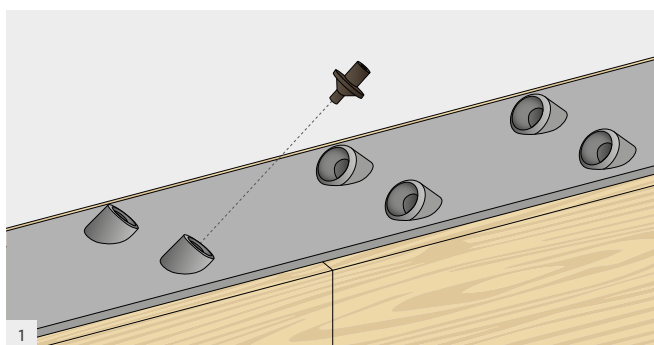
- For the correct realization of the joint, the fastener head should be fully embedded into the VGU washer.

- For intermediate values of S_{PLATE} linear interpolation is allowed.
- For the calculation process a timber characteristic density $\rho_k = 385 \text{ kg/m}^3$ has been considered.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- For a row of n connectors parallel to the F_V stress, it is recommended that the effective load-bearing capacity is evaluated as :
 $R_{V,d,tot} = n_{ef} \cdot R_{V,d}$ with $n_{ef} = \max \{ 0,9 n ; n^{0,9} \}$

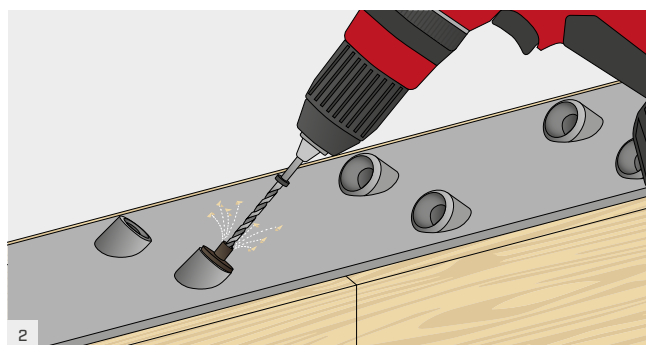
■ INSTALLATION WITH THE AID OF A PRE-DRILL TEMPLATE



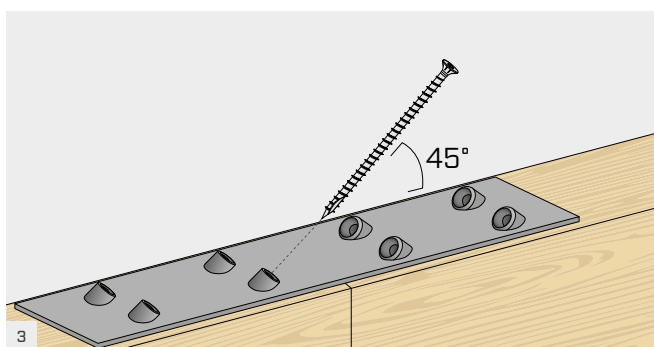
The pre-drill template makes it possible to prepare a 45° angle pre-drill to facilitate screwing.



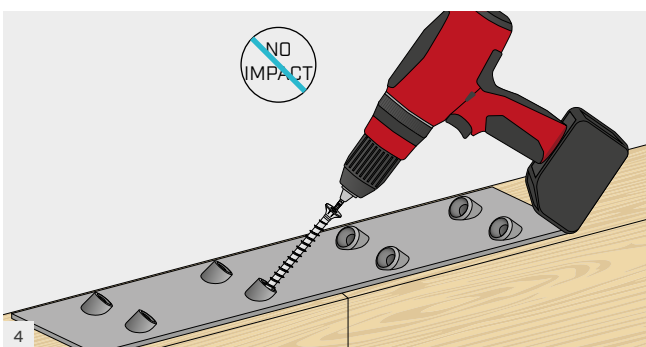
Place the VGU washer in the slot provided and use the JIG-VGU template of the correct diameter.



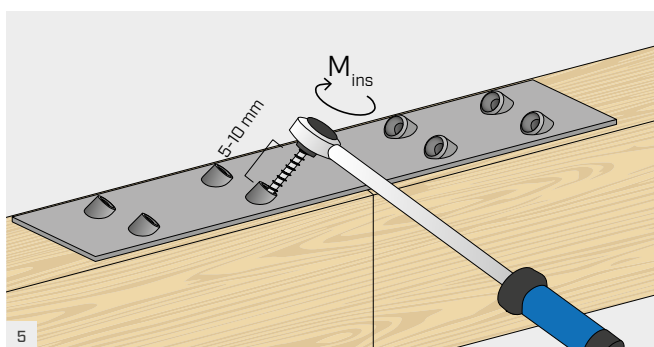
Using the template, prepare a pre-drill using a special bit (at least 20 mm).



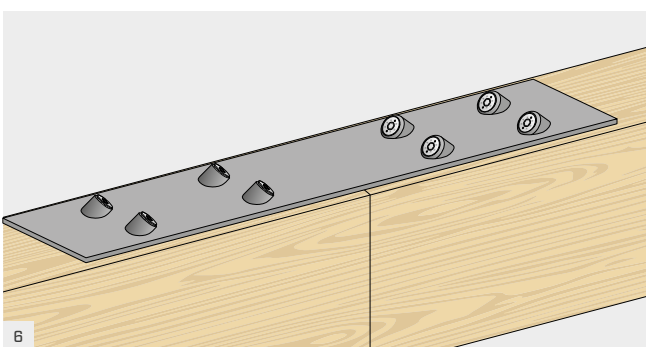
Position the screw and respect the 45° angle of insertion.



Screw down with a NON-PULSED screw gun, stopping at about 1 cm from the washer.

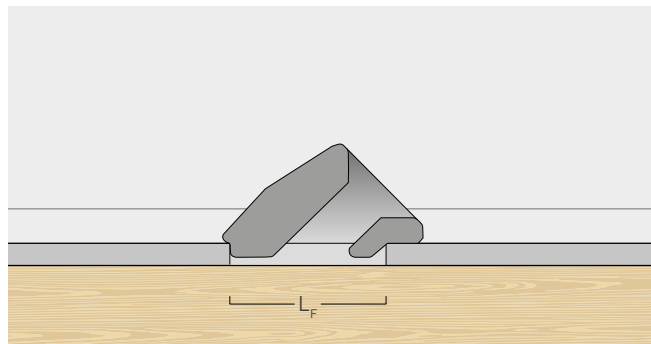
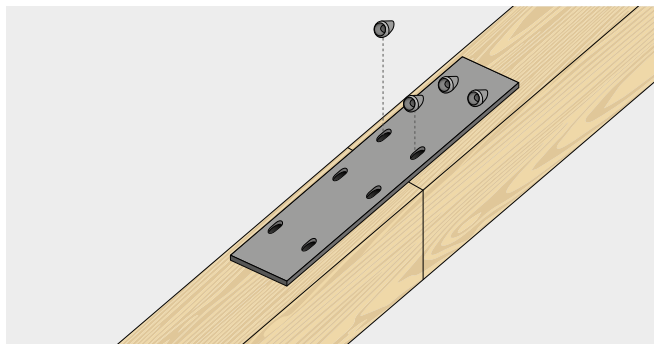


Complete screwing using a torque wrench, applying the correct maximum insertion moment.

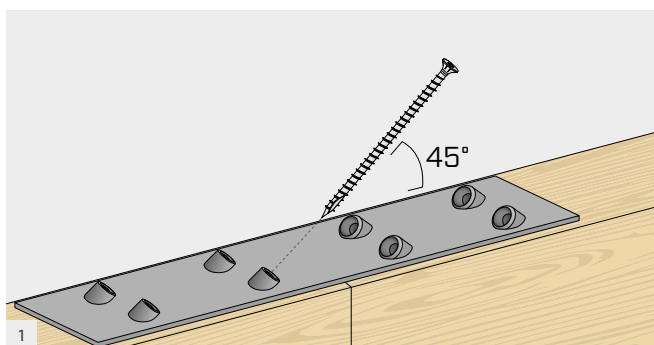


Perform the operation for all washers.

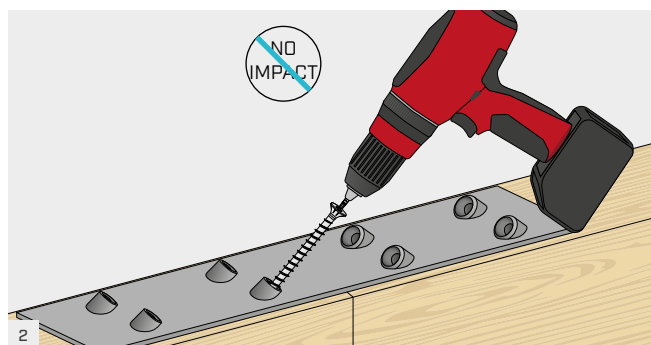
■ INSTALLATION WITHOUT PRE-DRILL



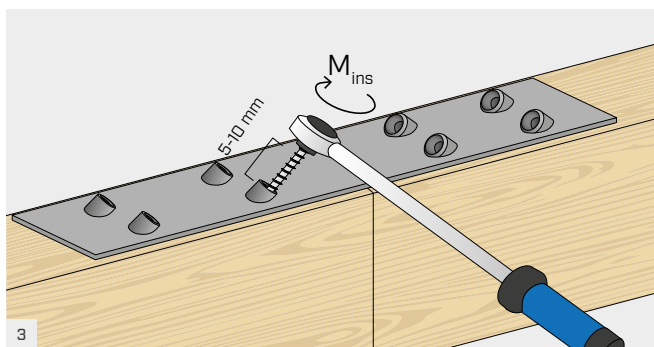
Place the steel plate on the wood and set the VGU washers in the slots provided.



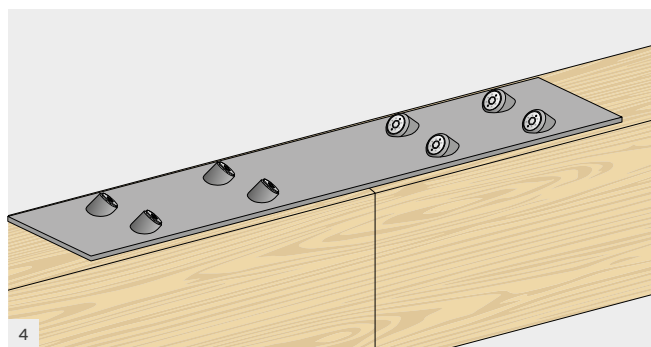
Position the screw and respect the 45° angle of insertion.



Screw down with a NON-PULSED screw gun, stopping at about 1 cm from the washer.



Complete screwing using a torque wrench, applying the correct maximum insertion moment.



Perform the operation for all washers.

■ TIMBER-TO-STEEL APPLICATION

RECOMMENDED INSERTION MOMENT: M_{ins}

VGS Ø9

$M_{ins} = 20 \text{ Nm}$

VGS Ø11 L < 400 mm

$M_{ins} = 30 \text{ Nm}$

VGS Ø11 L ≥ 400 mm

$M_{ins} = 40 \text{ Nm}$

VGS Ø13

$M_{ins} = 50 \text{ Nm}$

