

45° WASHER FOR VGS

SAFETY

The VGU washer makes possible to install VGS screws at a 45° angle on steel plates. Washer head assessed in ELC-4645 listing report.

PRACTICALITY

The ergonomic shape ensures a firm, precise grip during installation. Three versions of washer, compatible with VGS in diameter 9, 11 and 13 mm, are available for plates of variable thickness. The use of the VGU allows the use of inclined screws on plate without resorting to countersunk holes on the plate, which is generally a time-consuming and costly operation.

C4 EVO COATING

VGU EVO is coated with a surface treatment resistant to high atmospheric corrosivity. Compatible with VGS EVO diameter 9, 11 and 13 mm.



VGU



VGU EVO



CANADIAN DESIGN VALUES

USA, EU and more design values available online.



VIDEO



MANUALS

DIAMETER [mm]

9 13

MATERIAL

VGU WASHER



electrogalvanized carbon steel



C2

T2

VGU EVO WASHER



carbon steel with C4 EVO coating



C4

T3

METAL-to-TIMBER recommended use:



VIDEO

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



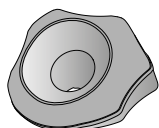
FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods
- steel construction
- metal plates and profiles

CODES AND DIMENSIONS

VGU WASHER

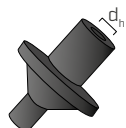
CODE	screw [mm]	d _{V,S} [mm]	pcs
VGU945	VGS Ø9	5	25
VGU1145	VGS Ø11	6	25
VGU1345	VGS Ø13	8	25



d_{V,S} = pre-drilling hole diameter (G< 0.55).

JIG VGU TEMPLATE

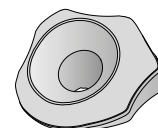
CODE	washer [mm]	d _h [mm]	d _V [mm]	pcs
JIGVGU945	VGU945	5,5	5	1
JIGVGU1145	VGU1145	6,5	6	1
JIGVGU1345	VGU1345	8,5	8	1



See www.rothoblaas.com for the technical data sheet.

VGU EVO WASHER

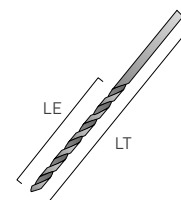
CODE	screw [mm]	d _{V,S} [mm]	pcs
VGUEVO945	VGSEVO Ø9	5	25
VGUEVO1145	VGSEVO Ø11	6	25
VGUEVO1345	VGSEVO Ø13	8	25



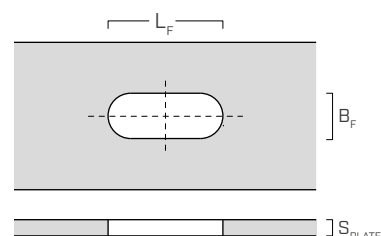
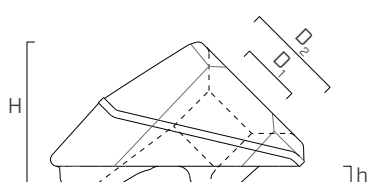
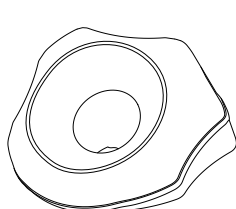
d_{V,S} = pre-drilling hole diameter (G< 0.55).

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



GEOMETRY



Washer			VGU945 VGUEVO945	VGU1145 VGUEVO1145	VGU1345 VGUEVO1345
VGS screw diameter	d ₁	[mm]	9,0	11,0	13,0
VGS screw pre-drilling hole diameter ⁽¹⁾	d _{V,S}	[mm]	5,0	6,0	8,0
Internal diameter	D ₁	[mm]	9,70	11,80	14,00
External diameter	D ₂	[mm]	19,00	23,00	27,40
Base height	h	[mm]	3,00	3,60	4,30
Global height	H	[mm]	23,00	28,00	33,00
Slotted-hole length	L _F	[mm]	33,0 ÷ 34,0	41,0 ÷ 42,0	49,0 ÷ 50,0
Slotted-hole width	B _F	[mm]	14,0 ÷ 15,0	17,0 ÷ 18,0	20,0 ÷ 21,0
Steel plate thickness ⁽²⁾	S _{PLATE}	[mm]	3,2 ÷ 12,7	4,8 ÷ 14,3	4,8 ÷ 14,3

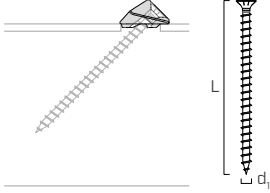
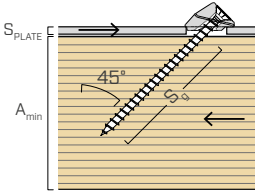
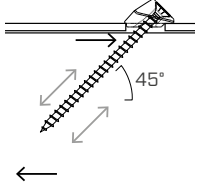
⁽¹⁾Pre-drilling valid for wood with G< 0.55.

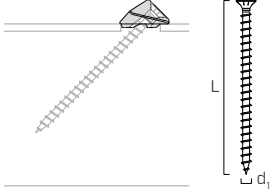
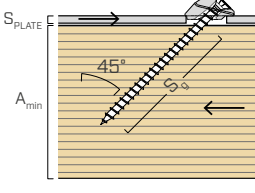
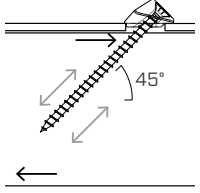
⁽²⁾For thicker plates than those indicated in the table it is necessary to carry out a countersink in the lower part of the steel plate. Recommended Ø5 mm guide hole (of minimum length 50 mm) for VGS screws of length L > 300 mm.

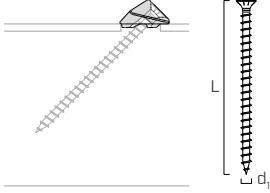
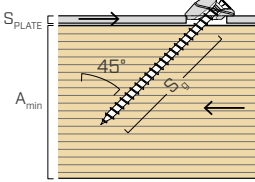
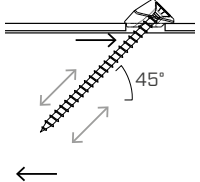


HELPS WITH INSTALLATION

The JIG VGU template makes it easy to prepare 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.

geometry			SLIDING ⁽¹⁾⁽²⁾								steel tension
											
VGS/VGS EVO						factored lateral resistance $N_r^{(4)}$				factored tension resistance $T_{rs}^{(5)}$	
VGU VGU EVO	d_1 [mm] [in]	L [mm] [in]	S_{PLATE} [mm] [in]	S_g [mm]	$A_{min}^{(3)}$ [mm]	G					
						0.35	0.42	0.49	0.55	[kN]	
VGU945 VGUEVO945	9 0.36	100 4	3,2 1/8	70	70	2,97	3,44	3,89	4,26	12,61	
		120 4 3/4		90	85	3,82	4,42	5,00	5,48		
		140 5 1/2		110	100	4,67	5,40	6,11	6,70		
		160 6 1/4		130	115	5,51	6,38	7,22	7,92		
		180 7 1/8		150	125	6,36	7,36	8,33	9,14		
		200 8		170	140	7,21	8,34	9,44	10,35		
		220 8 5/8		190	155	8,06	9,33	10,55	11,57		
		240 9 1/2		210	170	8,91	10,31	11,66	12,79		
		260 10 1/4		230	185	9,76	11,29	12,77	14,01		
		280 11		250	200	10,61	12,27	13,88	15,23		
		300 11 3/4		270	210	11,45	13,25	14,99	16,45		
		320 12 5/8		290	225	12,30	14,23	16,10	17,66		
		340 13 3/8		310	240	13,15	15,22	17,21	18,88		
		360 14 1/4		330	255	14,00	16,20	18,32	20,10		
		380 15		350	270	14,85	17,18	19,43	21,32		
		400 15 3/4		370	285	15,70	18,16	20,54	22,54		
		440 17 1/4		410	310	17,39	20,12	22,76	24,97		
		480 19		450	340	19,09	22,09	24,98	27,41		
		520 20 1/2		490	370	20,79	24,05	27,20	29,85		
		560 22		530	395	22,48	26,01	29,42	32,28		
		600 23 5/8		570	425	24,18	27,98	31,64	34,72		
		100 4	12,7 1/2	55	60	2,33	2,70	3,05	3,35		
		120 4 3/4		75	75	3,18	3,68	4,16	4,57		
		140 5 1/2		95	90	4,03	4,66	5,27	5,79		
		160 6 1/4		115	105	4,88	5,64	6,38	7,00		
		180 7 1/8		135	115	5,73	6,63	7,49	8,22		
		200 8		155	130	6,58	7,61	8,60	9,44		
		220 8 5/8		175	145	7,42	8,59	9,71	10,66		
		240 9 1/2		195	160	8,27	9,57	10,82	11,88		
		260 10 1/4		215	175	9,12	10,55	11,93	13,10		
		280 11		235	190	9,97	11,53	13,04	14,31		
		300 11 3/4		255	200	10,82	12,52	14,15	15,53		
		320 12 5/8		275	215	11,67	13,50	15,27	16,75		
		340 13 3/8		295	230	12,51	14,48	16,38	17,97		
		360 14 1/4		315	245	13,36	15,46	17,49	19,19		
		380 15		335	260	14,21	16,44	18,60	20,40		
		400 15 3/4		355	270	15,06	17,42	19,71	21,62		
		440 17 1/4		395	300	16,76	19,39	21,93	24,06		
		480 19		435	330	18,45	21,35	24,15	26,50		
		520 20 1/2		475	355	20,15	23,31	26,37	28,93		
		560 22		515	385	21,85	25,28	28,59	31,37		
		600 23 5/8		555	415	23,54	27,24	30,81	33,80		

			SLIDING ⁽¹⁾⁽²⁾								
geometry			steel-to-timber							steel tension	
											
VGS/VGS EVO						factored lateral resistance N _r ⁽⁴⁾				factored tension resistance T _{rs} ⁽⁵⁾	
VGU VGU EVO	d ₁ [mm] [in]	L [mm] [in]	S _{PLATE} [mm] [in]	S _g [mm]	A _{min} ⁽³⁾ [mm]	G					
						0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	[kN]	
VGU1145 VGUEVO1145	11 0.44	80 3 1/8	4,8 3/16	40	50	2,07	2,40	2,71	2,98	16,38	
		100 4		60	65	3,11	3,60	4,07	4,47		
		125 4 15/16		85	85	4,41	5,10	5,77	6,33		
		150 6		110	100	5,70	6,60	7,47	8,19		
		175 6 7/8		135	120	7,00	8,10	9,16	10,05		
		200 8		160	135	8,30	9,60	10,86	11,91		
		225 8 7/8		185	155	9,59	11,10	12,56	13,78		
		250 10		210	170	10,89	12,60	14,25	15,64		
		275 10 7/8		235	190	12,18	14,10	15,95	17,50		
		300 11 3/4		260	205	13,48	15,60	17,65	19,36		
		325 12 3/4		285	225	14,78	17,10	19,34	21,22		
		350 13 3/4		310	240	16,07	18,60	21,04	23,08		
		375 14 3/4		335	260	17,37	20,10	22,74	24,94		
		400 15 3/4		360	275	18,67	21,60	24,43	26,81		
		425 16 3/4		385	295	19,96	23,10	26,13	28,67		
		450 17 3/4		410	315	21,26	24,60	27,83	30,53		
		475 18 11/16		435	330	22,55	26,10	29,53	32,39		
		500 19 3/4		460	350	23,85	27,60	31,22	34,25		
		525 20 11/16		485	365	25,15	29,10	32,92	36,11		
		550 21 5/8		510	385	26,44	30,60	34,62	37,98		
		575 22 5/8		535	400	27,74	32,10	36,31	39,84		
		600 23 5/8		560	420	29,03	33,59	38,01	41,70		
		80 3 1/8	14,3 9/16	25	40	1,30	1,50	1,70	1,86		
		100 4		45	55	2,33	2,70	3,05	3,35		
		125 4 15/16		70	70	3,63	4,20	4,75	5,21		
		150 6		95	90	4,93	5,70	6,45	7,07		
		175 6 7/8		120	110	6,22	7,20	8,14	8,94		
		200 8		145	125	7,52	8,70	9,84	10,80		
		225 8 7/8		170	145	8,81	10,20	11,54	12,66		
		250 10		195	160	10,11	11,70	13,24	14,52		
		275 10 7/8		220	180	11,41	13,20	14,93	16,38		
		300 11 3/4		245	195	12,70	14,70	16,63	18,24		
		325 12 3/4		270	215	14,00	16,20	18,33	20,10		
		350 13 3/4		295	230	15,30	17,70	20,02	21,97		
		375 14 3/4		320	250	16,59	19,20	21,72	23,83		
		400 15 3/4		345	265	17,89	20,70	23,42	25,69		
		425 16 3/4		370	285	19,18	22,20	25,11	27,55		
		450 17 3/4		395	300	20,48	23,70	26,81	29,41		
		475 18 11/16		420	320	21,78	25,20	28,51	31,27		
		500 19 3/4		445	335	23,07	26,70	30,20	33,14		
		525 20 11/16		470	355	24,37	28,20	31,90	35,00		
		550 21 5/8		495	375	25,66	29,70	33,60	36,86		
		575 22 5/8		520	390	26,96	31,20	35,29	38,72		
		600 23 5/8		545	410	28,26	32,70	36,99	40,58		

geometry			SLIDING ⁽¹⁾⁽²⁾				steel tension			
										
VGS/VGS EVO			factored lateral resistance $N_r^{(4)}$				factored tension resistance $T_{rs}^{(5)}$			
VGU VGU EVO	d_1 [mm] [in]	L [mm] [in]	S_{plate} [mm] [in]	S_g [mm]	$A_{min}^{(3)}$ [mm]	G				
						0.35	0.42	0.49	0.55	
						[kN]	[kN]	[kN]	[kN]	[kN]
VGU1345 VGUEVO1345	13 0.52	80	4,8 3/16	35	50	2,15	2,49	2,81	3,08	22,60
		100		55	65	3,37	3,91	4,41	4,84	
		150		105	100	6,44	7,46	8,42	9,24	
		200		155	135	9,50	11,01	12,43	13,63	
		250		205	170	12,56	14,56	16,44	18,03	
		300		255	205	15,63	18,11	20,45	22,43	
		350		305	240	18,69	21,66	24,46	26,83	
		400		355	275	21,76	25,21	28,47	31,23	
		450		405	310	24,82	28,76	32,48	35,62	
		500		455	345	27,89	32,31	36,48	40,02	
		550		505	380	30,95	35,86	40,49	44,42	
		600		555	415	34,01	39,41	44,50	48,82	
		80	14,3 9/16	20	40	1,23	1,42	1,60	1,76	
		100		40	50	2,45	2,84	3,21	3,52	
		150		90	90	5,52	6,39	7,22	7,92	
		200		140	125	8,58	9,94	11,23	12,31	
		250		190	160	11,64	13,49	15,24	16,71	
		300		240	195	14,71	17,04	19,24	21,11	
		350		290	230	17,77	20,59	23,25	25,51	
		400		340	265	20,84	24,14	27,26	29,91	
		450		390	300	23,90	27,69	31,27	34,30	
		500		440	335	26,97	31,24	35,28	38,70	
		550		490	370	30,03	34,79	39,29	43,10	
		600		540	405	33,09	38,34	43,30	47,50	

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 listed values are based on standard long term load duration factor ($K_D = 1.0$), dry service condition factor ($K_{SF} = 1.0$), and treatment factor ($K_T = 1.0$).
- The factored thread withdrawal resistance were evaluated considering a penetration length of S_g , as shown in the table. For intermediate values of S_g it is possible to linearly interpolate.
- The steel thread is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u , equal to 58 ksi (400 MPa).
- VGS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA-O86 2024 Table A12. Most common wood species are assumed such as Northern species ($G = 0.35$), Spruce-Pine-Fir ($G = 0.42$), Douglas Fir ($G = 0.49$), and Southern Pine ($G = 0.55$).
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Check VGS INSTALLATION INSTRUCTIONS on Rothoblaas's website or inside the product box for the complete installation indications.

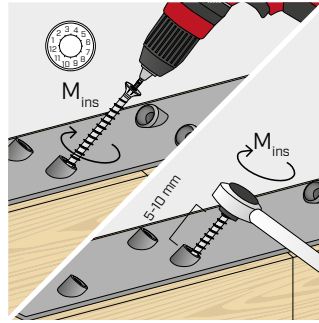
NOTES

- (1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, (in millimeters), minus the tip length, L_{tip} . The length of the tip is equal to the nominal diameter of the respective fasteners, d_1 , as specified in Table 2C of the ELC-4645 report. Factor for fastener axis-to-grain angle, J_a , and the factor for dowel bearing effect for laterally loaded connections, J_w , varies according to connection geometry.
- (2) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.
- (3) The fixable thickness (A) is calculated as the sum of the projected lengths of S_g and L_{tip} , plus an additional 15 mm.
- (4) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane. For fully threaded screws, the head pull-through resistance is not relevant to the connection capacity; instead, thread withdrawal governs.
- (5) Factored lateral resistance values (N_r) must be compared to the factored tension resistance of the screw (T_{rs}), with the lower value determining the governing resistance.

INSTALLATION INSTRUCTIONS

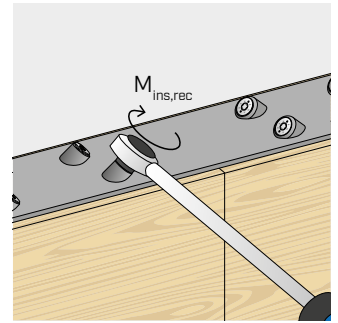


The use of pulse screw guns/impact wrenches is not permitted.

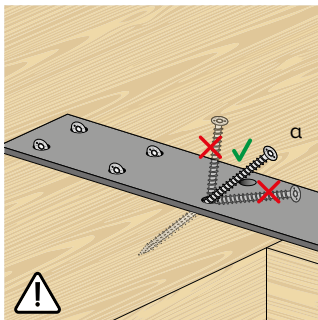


Ensure correct tightening. We recommend the use of torque-controlled screwdrivers, e.g. with **TORQUE LIMITER**. Alternatively, tighten with a torque wrench.

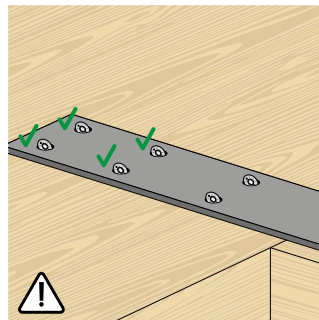
VGS	d ₁ [mm]	M _{ins,rec} [Nm]
Ø9	9	20
Ø11 L < 400 mm	11	30
Ø11 L ≥ 400 mm	11	40
Ø13	13	50



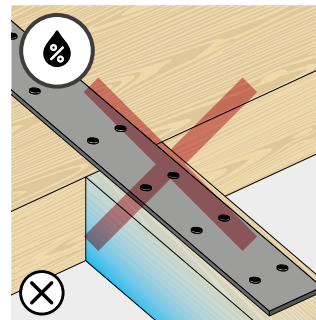
After installation, the fasteners can be inspected using a torque wrench.



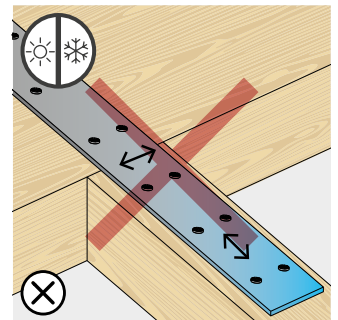
Avoid bending.



The installation of multiple screws must be performed to guarantee that loads are distributed evenly to all fasteners.

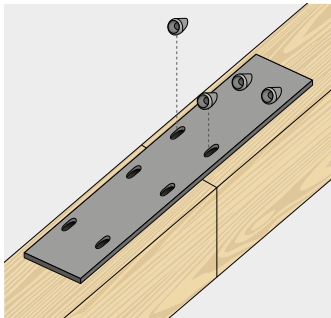


Shrinkage or swelling of timber elements due to changes in moisture content must be avoided.

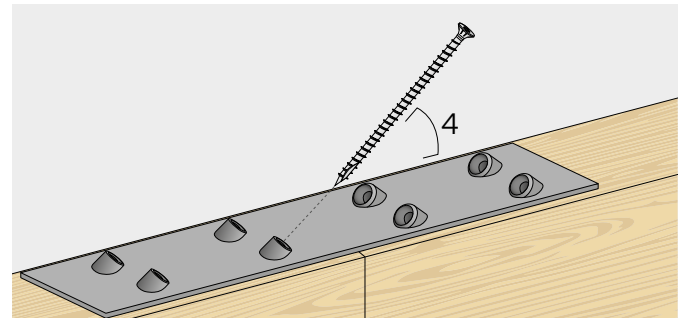
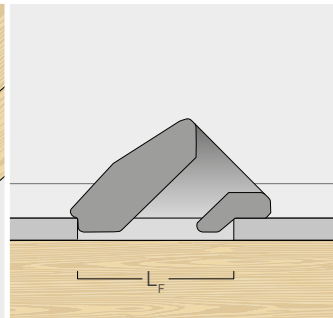


Avoid dimensional changes in the metal, e.g. due to large temperature fluctuations.

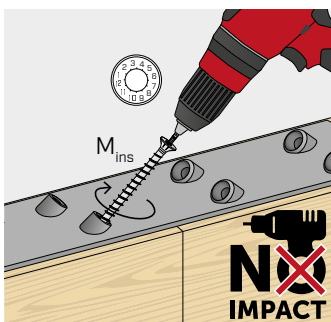
INSTALLATION WITHOUT PRE-DRILL



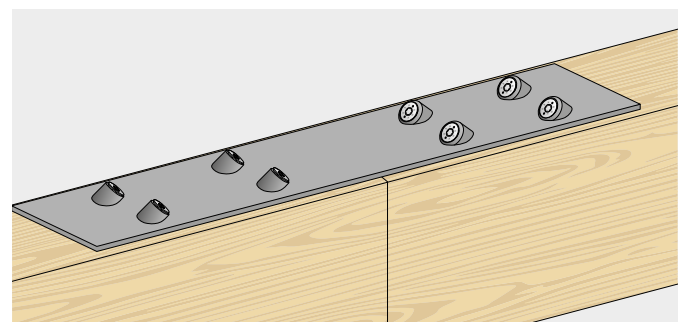
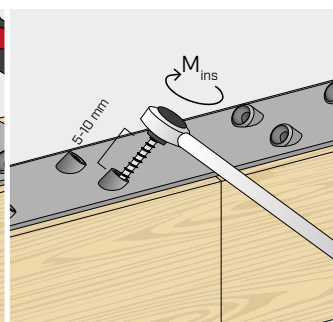
Place the steel plate on the wood and set the VGU washers in the slots provided.



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

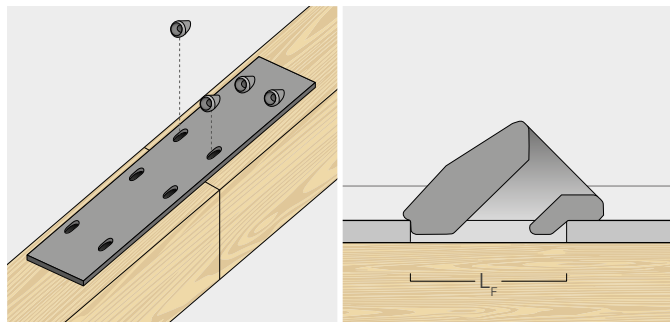


Screw in, ensuring correct tightening.

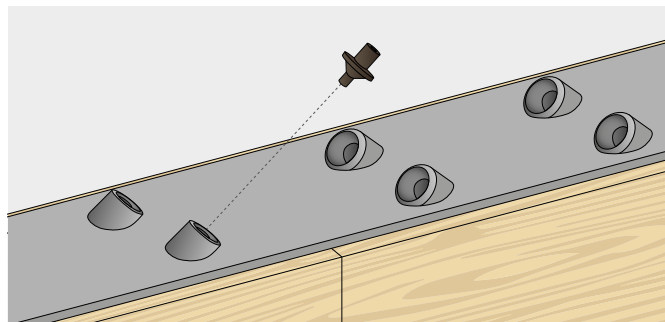


Perform the operation for all washers. The assembly must be performed so as to guarantee that the stress is evenly distributed among all the installed VGU washers.

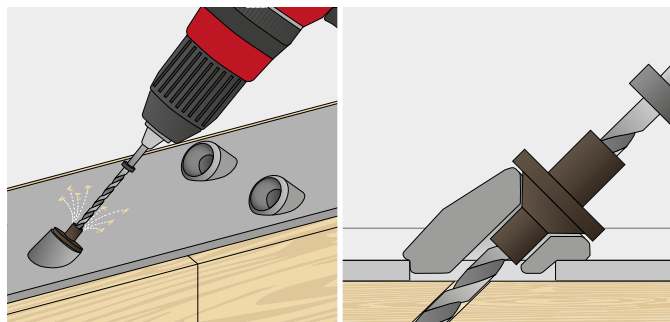
INSTALLATION WITH THE AID OF A PRE-DRILL TEMPLATE



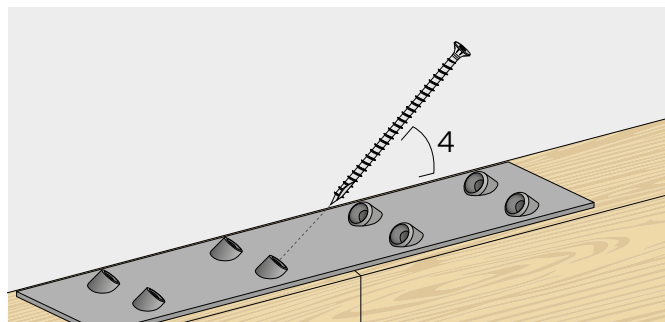
Place the steel plate on the wood and set the VGU washers in the slots provided.



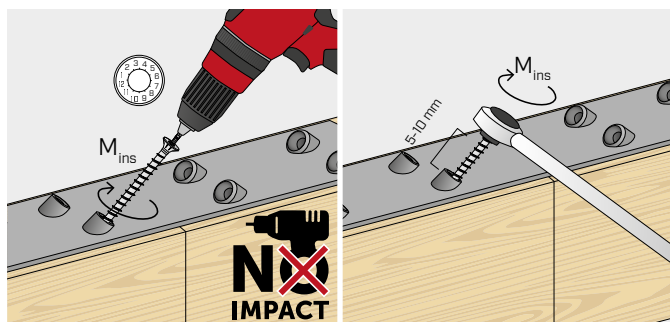
Use the VGU JIG template of the correct diameter by positioning it in the VGU washer



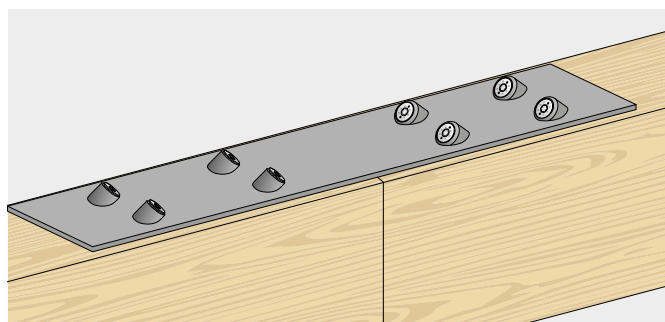
Using the pre-drill template, prepare a pre-drill/guide hole (at least 50 mm length) using an appropriate tip



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



Screw in, ensuring correct tightening.



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

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