WKR

DESIGN REGISTERED

ETA-22/0089

TENSILE ANGLE BRACKET FOR BUILDINGS

TIMBER FRAME AND CLT
Ideal for timber frame and CLT because of the optimized nailing patterns. Certified configurations with the presence of bedding grout, base plate or concrete kerb.

TIMBER-TO-TIMBER CONFIGURATION
Exceptional strength values also for installation in timber-to-timber configuration. Possibility of installation with passing bolts or with VGS screws or HBS PLATE.

CERTIFICATION WITH GAP
Certification with raised installation opens up numerous application possibilities for solving non-standard connections or managing tolerances in innovative ways.

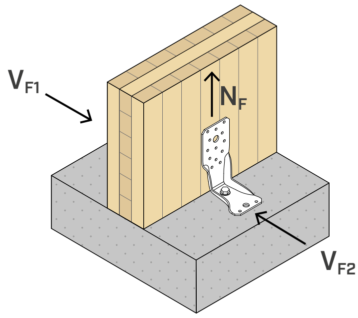
SERVICE CONDITIONS DRY

MATERIAL

S250 Z275 **WKR9530**: carbon steel S250GD+Z275

S235 Fe/Zn12c **WKR13535 | WKR21535 | WKR28535 | WKR53035:**
S235 + Fe/Zn12c carbon steel

EXTERNAL LOADS



CANADIAN DESIGN VALUES
USA, EU and more design values available online.

FIELDS OF USE
Tension joints with small to medium stress.
Also optimised for fastening frame walls.
Timber-to-timber, timber-to-concrete and timber-to-steel configurations.

Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels

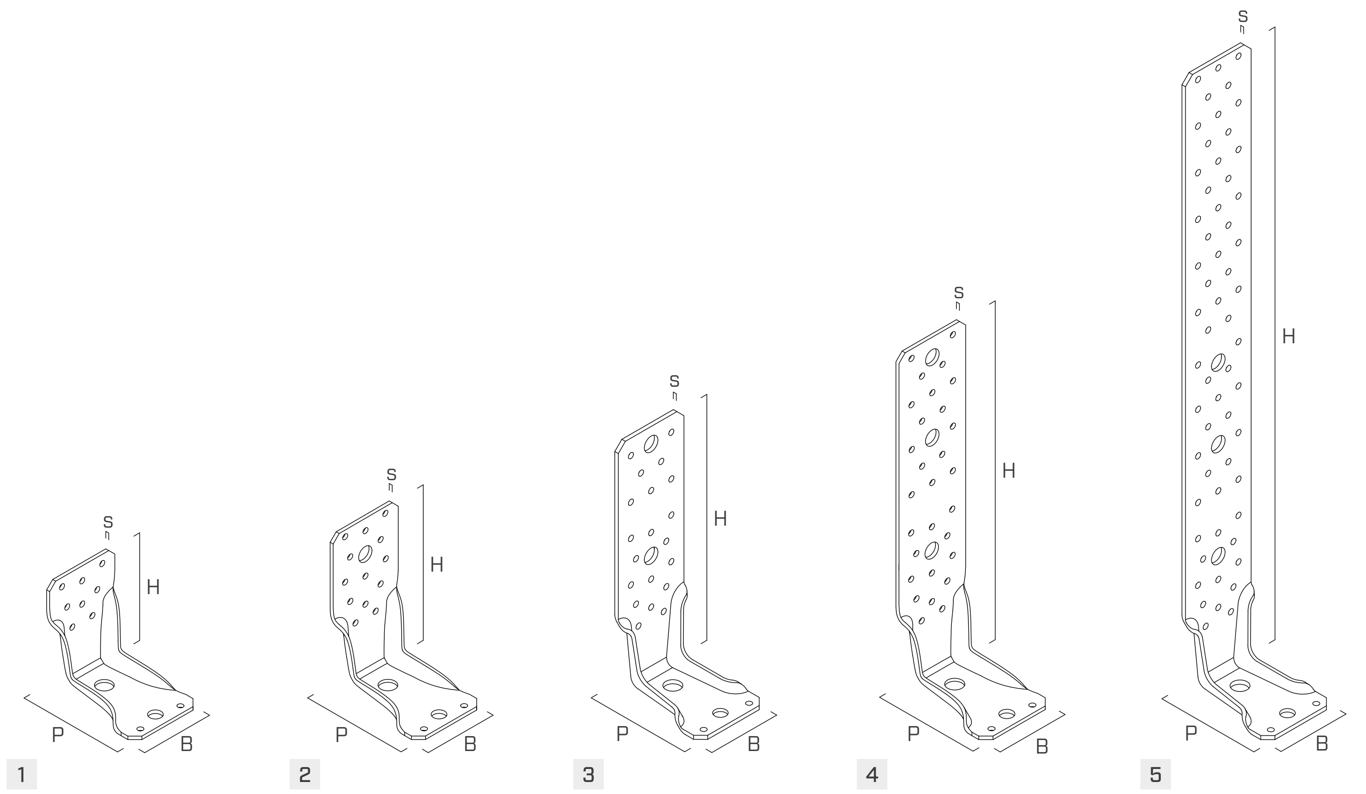
RAISED WALL

Partial nailing patterns allow installation on timber frame or CLT walls in the presence of concrete kerb up to 370 mm high.

PREFABRICATION

On prefabricated timber frame walls, it is possible to pre-install the anchor in the concrete and the angle bracket on the wall. With a MUT 6334 joint nut and threaded rod, it is possible to complete the connection on site, managing all installation tolerances as best as possible.

CODES AND DIMENSIONS



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	*B [in]*	*P [in]*	*H [in]*	*s [in]*	n_V Ø5 *n_V Ø0.20* [pcs]	n_H Ø14 *n_H Ø0.56* [pcs]	n_H Ø11 *n_H Ø0.44* [pcs]	n_V Ø13,5 *n_V Ø0.53* [pcs]			pcs
1	**WKR9530**	65	85	95	3	*2 9/16*	*3 3/8*	*3 3/4*	*0.12*	8	1	1	-	●	●	25
2	**WKR13535**	65	85	135	3,5	*2 9/16*	*3 3/8*	*5 5/16*	*0.14*	13	1	1	1	●	●	25
3	**WKR21535**	65	85	215	3,5	*2 9/16*	*3 3/8*	*8 7/16*	*0.14*	20	1	1	2	●	●	25
4	**WKR28535**	65	85	287	3,5	*2 9/16*	*3 3/8*	*11 5/16*	*0.14*	29	1	1	3	●	●	25
5	**WKR53035**	65	85	530	3,5	*2 9/16*	*3 3/8*	*20 7/8*	*0.14*	59	1	1	3	●	●	10

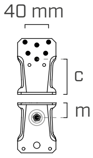
FASTENERS

type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
VGS	fully threaded countersunk screw		11-13	
HUS	turned washer		11-13	
HBS PLATE	pan head screw		10-12	
AB1	CE1 expansion anchor		12	
SKR	screw-in anchor		M12	
VIN-FIX	vinyl ester chemical anchor		M12	
HYB-FIX	hybrid chemical anchor		M12	
EPO-FIX	epoxy chemical anchor		M12	
ULS13373	washer		M12	

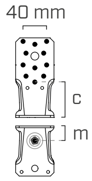
FASTENING PATTERNS

TIMBER-TO-TIMBER

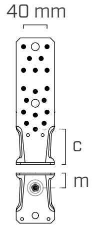
WKR9530	WKR13535	WKR21535	WKR28535



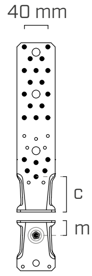
pattern 2



pattern 2



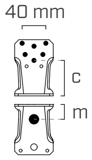
pattern 2



pattern 3

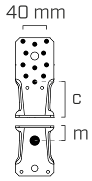
TIMBER-TO-CONCRETE

WKR9530



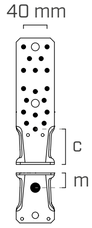
pattern 1

WKR13535

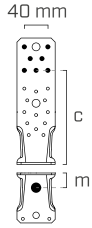


pattern 1

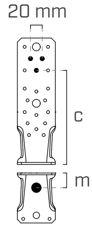
WKR21535



pattern 1

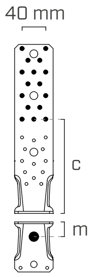


pattern 3

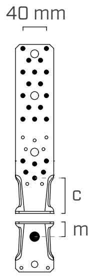


pattern 4

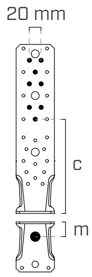
WKR28535



pattern 1

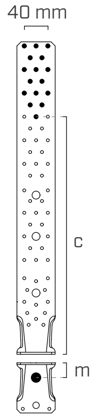


pattern 2

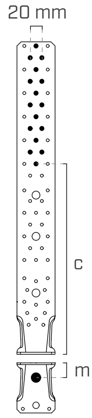


pattern 4

WKR53035



pattern 1

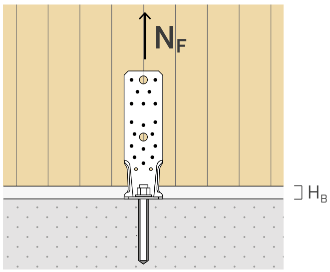


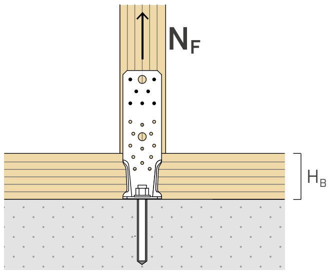
pattern 2

CODE	configuration	fastening holes Ø5 n_V [pcs]	c [mm]	m [mm]	support (timber)	support (concrete)
WKR9530	pattern 1	6	60	25	-	●
	pattern 2	6	60		●	-
WKR13535	pattern 1	11	60		-	●
	pattern 2	11	60		●	-
WKR21535	pattern 1	18	60		-	●
	pattern 2	18	60		●	-
	pattern 3	7	160		-	●
	pattern 4	3	160		-	●
WKR28535	pattern 1	16	160		-	●
	pattern 2	22	60		-	●
	pattern 3	22	60		●	-
	pattern 4	8	160		-	●
WKR53035	pattern 1	16	400		-	●
	pattern 2	16	320		-	●

INSTALLATION

MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER





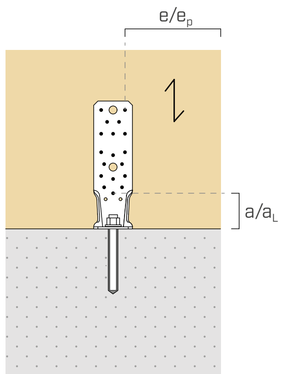
CODE	configuration	$H_{B\ max}$ [mm] nails LBA Ø4 spruce-pine-fir and northern species	douglas fir-larch, hem-fir, and western red cedar	screws LBS Ø5 not pre-drilled $G \leq 0.44$	$0.44 < G \leq 0.5$	pre-drilled any G
WKR9530	pattern 1 pattern 2	12	0	-	-	0
WKR13535	pattern 1 pattern 2	12	0	-	-	0
WKR21535	pattern 1 pattern 2	12	0	-	-	0
	pattern 3 pattern 4	112	100	85	50	100
WKR28535	pattern 1	112	100	85	50	100
	pattern 4	12	0	-	-	0
	pattern 2	12	0	-	-	0
	pattern 3	112	100	85	50	100
WKR53035	pattern 1	352	340	325	290	340
	pattern 2	272	260	245	210	260

- The height of the H_B intermediate layer (levelling mortar, sill or timber platform beam) is determined by taking into account the regulatory requirements for fastenings on timber, shown in the minimum distance table.
- Zero values represent that the wall can be installed without a gap

MINIMUM DISTANCES

TIMBER minimum distances			nails LBA Ø4 spruce-pine-fir and northern species	douglas fir-larch, hem-fir and western red cedar
timber	e	[mm]	≥ 16	≥ 20
	a	[mm]	≥ 48	≥ 60

TIMBER minimum distances			screws LBS Ø5 not pre-drilled $G \leq 0.44$	$0.44 < G \leq 0.5$	pre-drilled any G
timber	e_p	[mm]	≥ 25	≥ 35	≥ 15
	a_L	[mm]	≥ 75[‡]	≥ 110	≥ 60[†]



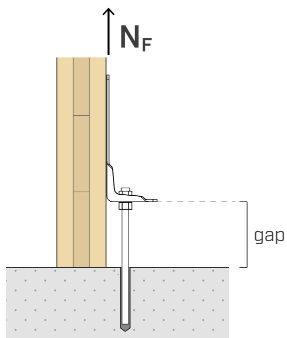
G = mean relative density
[†] For Douglas Fir-Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
[‡] For Western Red Cedar, this minimum spacing shall be increased by 50%.

Timber: minimum distances for Cross laminated timber according to section 12.9 placemen t of nails and spikes for LBA nails and section 12.12 placement of self tapping screws for LBS screws in CSA O86 2024.

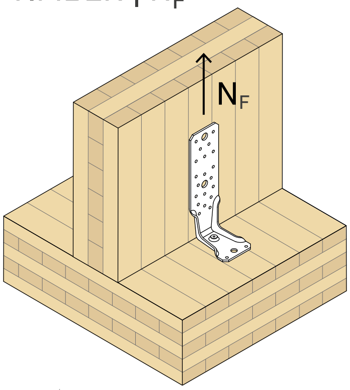
e edge distance perpendicular to grain
e_p unloaded edge distance
a end distance parallel to grain
a_L loaded end distance

INSTALLATION WITH GAP

In the presence of N_F tensile forces, installation of the angle bracket raised above the bearing surface is possible. This makes it possible, for example, to install the angle bracket even with an intermediate H_B layer (bedding grout, base plate or concrete kerb) greater than $H_{B\ max}$. It is advisable to add a lock nut under the horizontal flange to prevent any tension in the connection caused by over-tightening the nut.



STRUCTURAL VALUES | TIMBER-TO-TIMBER | N_F



TIMBER STRENGTH

CODE	configuration	fastening holes Ø5			STEEL-CLT N_r (1)(2) factored lateral resistance (K_D=1.15)			K_{ser} (3)
		type	Ø x L [mm]	n_V [pcs]	E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	[N/mm]
WKR9530	**pattern 2**	LBA	Ø4 x 60	6	7,1	7,7	**8,3**	**3750**
		LBS	Ø5 x 50		7,5	8,4	**9,2**	**3325**
WKR13535	**pattern 2**	LBA	Ø4 x 60	11	12,9	14,2	**15,3**	**7075**
		LBS	Ø5 x 50		13,8	15,4	**16,9**	**6150**
WKR21535	**pattern 2**	LBA	Ø4 x 60	18	21,1	23,2	**25,1**	**11750**
		LBS	Ø5 x 50		22,6	25,2	**27,7**	**10075**
WKR28535	**pattern 3**	LBA	Ø4 x 60	22	25,8	28,4	**30,6**	**14400**
		LBS	Ø5 x 50		27,6	30,8	**33,9**	**12325**

STRENGTH ON STEEL SIDE

connector	WKR	$R_{punching, screw}$ (*) [kN]
VGS Ø11 + HUS 10	WKR9530 / WKR13535 / WKR21535 / WKR28535	**Prt**
VGS Ø13 + HUS 12		
HBS PLATE Ø10	WKR9530	**16**
	WKR13535 / WKR21535 / WKR28535	**16,8**
HBS PLATE Ø12	WKR9530	**21,6**
	WKR13535 / WKR21535 / WKR28535	**23,2**

(*) The values $R_{punching, screw}$ in the table refer to a punching shear failure of the connector in the horizontal flange.

STRENGTH ON ANCHOR SYSTEM SIDE

Strength values of some of the possible fastening solutions.

CODE	configuration	$k_{t//}$	fastening holes Ø14 type (4)	P_{rw} (*)(5) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]
WKR9530	**pattern 2**	1,05	HBS PLATE Ø10x140	**7,03**	**8,13**	**9,20**
			HBS PLATE Ø10x180	**9,84**	**11,38**	**12,88**
WKR13535	**pattern 2**	1,05	HBS PLATE Ø12x140	**8,43**	**9,76**	**11,04**
			HBS PLATE Ø12x200	**12,65**	**14,63**	**16,56**
WKR21535	**pattern 2**	1,10	VGS Ø11x150 + HUS10	**9,97**	**11,54**	**13,05**
			VGS Ø11x200 + HUS10	**13,84**	**16,01**	**18,11**
WKR28535	**pattern 3**	1,10	VGS Ø13x150 + HUS12	**11,60**	**13,42**	**15,18**
			VGS Ø13x200 + HUS12	**16,17**	**18,71**	**21,16**

(*) Final values of P_{rw} should take into acount the contribution of kt// coefficient in the calculation, see the example on page 11.

NOTES

(1) Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2024. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

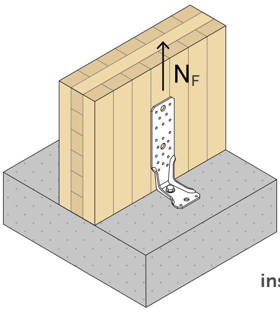
(2) Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

(3) The slip modulus of the shear connection, K_{ser}, is measured through testing on European wood species with a density of 350 kg/m^3.

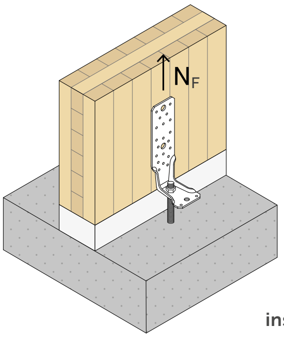
(4) If there are design requirements such as N_F stresses of different amounts, or depending on the thickness of the floor slab, it is possible to use Ø11 and Ø13 VGS screws with HUS10 and HUS12 washers and Ø10 and Ø12 HBS PLATE screws of different lengths than those proposed in the table (see the "TIMBER SCREWS AND DECK FASTENING" catalogue).

(5) The P_{rw} values can be consulted in the "TIMBER SCREWS AND DECK FASTENING".

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | N_F



installation without gap



installation with gap

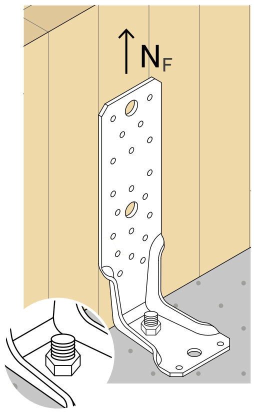
TIMBER STRENGTH

					STEEL - CLT			
		fastening holes Ø5			factored lateral resistance N_r (1) (2) (K_D=1.15)			
CODE	configuration	type	Ø x L [mm]	n_V [pcs]	E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	K_{ser} (3) [N/mm]
WKR9530	pattern 1	LBA	Ø4 x 60	6	7,1	7,7	8,3	3750
		LBS	Ø5 x 50		7,5	8,4	9,2	3325
WKR13535	pattern 1	LBA	Ø4 x 60	11	12,9	14,2	15,3	7075
		LBS	Ø5 x 50		13,8	15,4	16,9	6150
WKR21535	pattern 1	LBA	Ø4 x 60	18	21,1	23,2	25,1	11750
		LBS	Ø5 x 50		22,6	25,2	27,7	10075
	pattern 3	LBA	Ø4 x 60	7	8,2	9,0	9,8	4675
		LBS	Ø5 x 50		8,8	9,8	10,8	3950
	pattern 4	LBA	Ø4 x 60	3	3,5	3,9	4,2	2000
		LBS	Ø5 x 50		3,8	4,2	4,6	1700
WKR28535	pattern 1	LBA	Ø4 x 60	16	18,7	20,7	22,3	9325
		LBS	Ø5 x 50		20,1	22,4	24,6	9000
	pattern 2	LBA	Ø4 x 60	22	25,8	28,4	30,6	14400
		LBS	Ø5 x 50		27,6	30,8	33,9	12325
	pattern 4	LBA	Ø4 x 60	8	9,4	10,3	11,1	5325
		LBS	Ø5 x 50		10,1	11,2	12,3	4500
WKR53035	pattern 1-2	LBA	Ø4 x 60	16	18,7	20,7	22,3	10650
		LBS	Ø5 x 50		20,1	22,4	24,6	9000

STRENGTH ON STEEL SIDE WITHOUT WASHER

CODE	configuration	$R_{punching, bolt}$ (*) no gap [kN]	gap [kN]
WKR9530	pattern 1	20,8	6,64
WKR13535	pattern 1		15,2
WKR21535	pattern 1		15,2
	pattern 3-4		-
WKR28535	pattern 1-4		-
	pattern 2		15,2
WKR53035	pattern 1-2		-

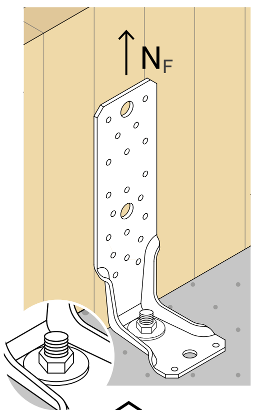
(*) The values $R_{punching, bolt}$ refer to a punching shear failure of the connector in the horizontal flange.



STRENGTH ON STEEL SIDE WITH WASHER ULS13373

CODE	configuration	$R_{punching, bolt}$ (*) no gap [kN]	gap [kN]
WKR9530	pattern 1	20,8	12,8
WKR13535	pattern 1	29,6	28
WKR21535	pattern 1		28
	pattern 3-4		-
WKR28535	pattern 1-4		-
	pattern 2		28
WKR53035	pattern 1-2		-

(*) The values $R_{punching, bolt}$ refer to a punching shear failure of the connector in the horizontal flange.



CONCRETE STRENGTH

Strength values of some of the possible fastening solutions. For additional solutions, different from those indicated in the table, it is possible to use the My Project software available at www.rothoblaas.com.

CODE	configuration on concrete	fastening holes Ø14		concrete resistance $R_{concrete}$ (*)(6)				concrete resistance $R_{concrete}$ (*)(6)	
				no gap				gap	
		type	Ø x L	pattern 1	pattern 2	pattern 3	pattern 4	pattern 1	pattern 2
			[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
WKR9530 WKR13535	uncracked	VIN-FIX 5.8	M12 x 195	**19,8**	-	-	-	**20,8**	-
		SKR	12 x 90	**10,1**	-	-	-	-	-
		AB1	M12 x 115	**14,2**	-	-	-	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**10,9**	-	-	-	**11,5**	-
		HYB-FIX 5.8	M12 x 195	**19,4**	-	-	-	**20,4**	-
		AB1	M12 x 115	**10,2**	-	-	-	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**11,7**	-	-	-	**12,2**	-
			M12 x 245	**14,4**	-	-	-	**15,1**	-
		EPO-FIX 8.8	M12 x 195	**12,4**	-	-	-	**13,0**	-
WKR21535	uncracked	VIN-FIX 5.8	M12 x 195	**18,9**	-	**14,3**	**14,3**	**20,8**	-
		SKR	12 x 90	**9,6**	-	**7,3**	**7,3**	-	-
		AB1	M12 x 115	**13,6**	-	**10,3**	**10,3**	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**10,4**	-	**7,9**	**7,9**	**11,5**	-
		HYB-FIX 5.8	M12 x 195	**18,5**	-	**14,1**	**14,1**	**20,4**	-
		AB1	M12 x 115	**9,7**	-	**7,4**	**7,4**	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**11,1**	-	**8,4**	**8,4**	**12,2**	-
			M12 x 245	**13,7**	-	**10,4**	**10,4**	**15,1**	-
		EPO-FIX 8.8	M12 x 195	**11,8**	-	**9,0**	**9,0**	**13,0**	-
WKR28535	uncracked	VIN-FIX 5.8	M12 x 195	**14,3**	**18,9**	-	**14,3**	-	**20,8**
		SKR	12 x 90	**7,3**	**9,6**	-	**7,3**	-	-
		AB1	M12 x 115	**10,3**	**13,6**	-	**10,3**	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**7,9**	**10,4**	-	**7,9**	-	**11,5**
		HYB-FIX 5.8	M12 x 195	**14,1**	**18,5**	-	**14,1**	-	**20,4**
		AB1	M12 x 115	**7,4**	**9,7**	-	**7,4**	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**8,4**	**11,1**	-	**8,4**	-	**12,2**
			M12 x 245	**10,4**	**13,7**	-	**10,4**	-	**15,1**
		EPO-FIX 8.8	M12 x 195	**9,0**	**11,8**	-	**9,0**	-	**13,0**
WKR53035	uncracked	VIN-FIX 5.8	M12 x 195	**14,3**	**14,3**	-	-	-	-
		SKR	12 x 90	**7,3**	**7,3**	-	-	-	-
		AB1	M12 x 115	**10,3**	**10,3**	-	-	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**7,9**	**7,9**	-	-	-	-
		HYB-FIX 5.8	M12 x 195	**14,1**	**14,1**	-	-	-	-
		AB1	M12 x 115	**7,4**	**7,4**	-	-	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**8,4**	**8,4**	-	-	-	-
			M12 x 245	**10,4**	**10,4**	-	-	-	-
		EPO-FIX 8.8	M12 x 195	**9,0**	**9,0**	-	-	-	-

(*) The concrete resistance values ($R_{concrete}$) are dertmined taking into acount the contribution of kt// coefficient in the calculation.

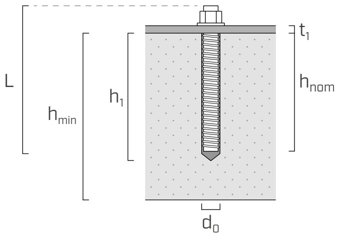
NOTES

- The gap installation must be carried out with only chemical anchors and pre-cut INA threaded rod or MGS to be cut to size.

ANCHORS INSTALLATION PARAMETERS

anchor type		h_{ef}	h_{nom}	h_1	d_0	h_{min}
	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M12 x 195	170	170	175	14	200
HYB-FIX 5.8	M12 x 195	170	170	175	14	200
HYB-FIX 8.8	M12 x 195	170	170	175	14	200
	M12 x 245	210	210	215	14	250
EPO-FIX 8.8	M12 x 195	170	170	175	14	200
SKR	12 x 90	64	87	110	10	200
AB1	M12 x 115	70	85	105	14	200

Precut INA threaded rod, with nut and washer.
MGS threaded rod class 8.8 to be cut to size: for more information, see the "PLATES AND CONNECTORS FOR TIMBER" catalogue, available in the "Catalogues" section of the website www.rothoblaas.com.



t_1	thickness of plate
h_{nom}	nominal eembedment depth
h_{eff}	effective anchor embedment depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

ANCHORS VERIFICATION FOR STRESS LOADING N_F

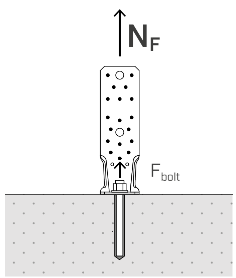
Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the $k_{t//}$ coefficients. The axial load acting on the anchor can be obtained as follows:

$$F_{bolt} = k_{t//} \cdot N_r$$

$k_{t//}$ coefficient of eccentricity
N_r axial load on the WKR angle bracket

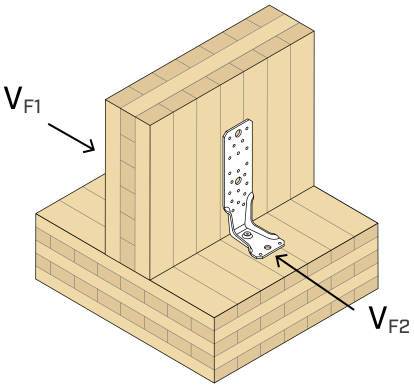
The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: min ($R_{punching,\ bolt}$, $R_{concrete}$) ≥ F_{bolt}.

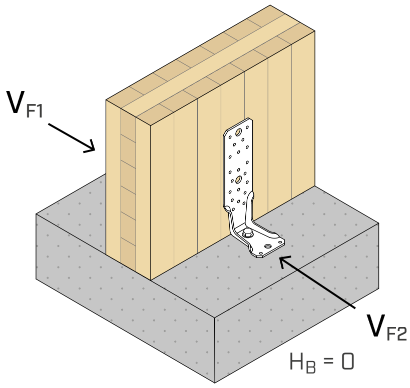
	INSTALLATION WITHOUT GAP		INSTALLATION WITH GAP	
CODE	**configuration**	$k_{t//}$	**configuration**	$k_{t//}$
WKR9530	**pattern 1-2**	1,05	**pattern 2**	1,00
WKR13535	**pattern 1-2**	1,05	**pattern 2**	
WKR21535	**pattern 1-2**	1,10	**pattern 2**	
	pattern 3-4	1,45		
WKR28535	**pattern 2-3**	1,10	**pattern 3**	
	pattern 1-4	1,45		
WKR53035	**pattern 1-2**	1,45	-	-

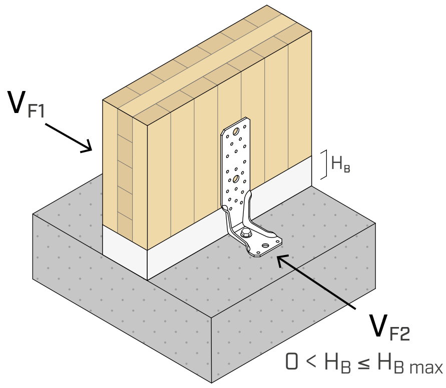


NOTES
(1) Valid for the strength values shown in the table.

STRUCTURAL VALUES | F_4 | F_5







TIMBER-TO-TIMBER

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	factored lateral resistance V_{r1} (7) (K_D=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	factored lateral resistance V_{r2} (7) [kN]	l_{BL} (8) [mm]
WKR9530	pattern 2	LBA	Ø4 x 60	6	7,1	7,7	8,3	1,5	70,0
		LBS	Ø5 x 50		7,5	8,4	9,2	3,4	
WKR13535	pattern 2	LBA	Ø4 x 60	11	12,6	14,2	15,3	3,1	
		LBS	Ø5 x 50		13,6	15,4	16,9	3,6	
WKR21535	pattern 2	LBA	Ø4 x 60	18	13,1	16,7	19,8	3,1	
		LBS	Ø5 x 50		15,2	20,5	25,4	3,6	
WKR28535	pattern 3	LBA	Ø4 x 60	22	13,4	17,2	20,5	3,1	
		LBS	Ø5 x 50		14,4	19,1	23,3	3,6	

TIMBER-TO-CONCRETE

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	$H_B = 0$: factored resistance V_{r1} (7) (KD=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	factored resistance V_{r2} (7) [kN]	$0 < H_B \le H_{B\,max}$: factored resistance V_{r1} (7) (KD=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	factored resistance V_{r2} (7) [kN]	l_{BL} (8) [mm]
WKR9530	pattern 1	LBA	Ø4 x 60	6	7,1	7,7	8,3	1,5	7,1	7,7	8,3	1,5	70,0
		LBS	Ø5 x 50		7,5	8,4	9,2	3,1	7,5	8,4	9,2	3,1	
WKR13535	pattern 1	LBA	Ø4 x 60	11	12,0	14,2	15,3	3,1	12,9	14,2	15,3	3,1	70,0
		LBS	Ø5 x 50		12,1	15,3	16,9	3,3	13,0	15,4	16,9	3,3	
WKR21535	pattern 1	LBA	Ø4 x 60	18	12,5	16,0	19,0	2,6	14,6	19,7	24,4	2,6	70,0
		LBS	Ø5 x 50		12,6	16,2	19,3	3,3	14,7	19,9	24,7	3,3	
WKR28535	pattern 1	LBA	Ø4 x 60	16	8,0	10,3	12,4	0,5	18,7	20,7	22,3	0,5	160,0
		LBS	Ø5 x 50		8,1	10,5	12,6	0,5	20,1	22,4	24,6	0,5	
	pattern 2	LBA	Ø4 x 60	22	12,8	16,5	19,6	3,1	13,8	18,2	22,2	3,1	70,0
		LBS	Ø5 x 50		12,9	16,7	20,0	3,3	13,9	18,4	22,6	3,3	
WKR53035	pattern 1	LBA	Ø4 x 60	16	8,0	10,3	12,4	0,2	18,7	20,7	22,3	0,2	423,0
		LBS	Ø5 x 50		8,1	10,5	12,6	0,2	20,1	22,4	24,6	0,2	
	pattern 2	LBA	Ø4 x 60	16	8,0	10,3	12,4	0,2	18,7	20,7	22,3	0,2	343,0
		LBS	Ø5 x 50		8,1	10,5	12,6	0,2	20,1	22,4	24,6	0,2	

NOTES

(7) In the case of V_{F2} stress, it is required to verify for the simultaneous shear action on the N_F anchor and the additional extraction component N_{ax}.

$$N_{ax} = \frac{V_{F2} \cdot l_{BL}}{25\ mm}$$

(8) l_{BL} = distance between the last row of at least two connectors and the bearing surface

- The V_{r1} timber resistance is limited by the lateral N_r resistance of the base connector.
- The slip modulus of the shear connection, K_{ser}, is measured through testing on European wood species with a density of 350 kg/m³.

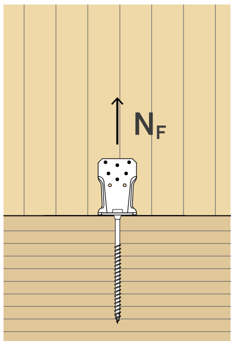
CALCULATION EXAMPLES | DETERMINING RESISTANCE R_{design}

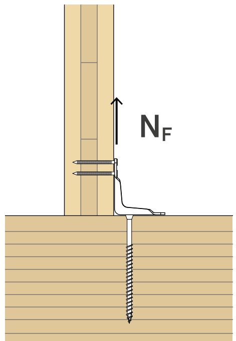
TIMBER-TO-TIMBER

Project data	
Service condition	Dry service condition
Load duration	Short
Timber	CLT (G = 0.42)

Connector	WKR9530
Configuration	pattern 2
Fastening on timber	nails LBA Ø4 x 60 mm

Screw selection	
HBS PLATE	Ø10 x 140 mm
Pre-drilling hole	without pre-drilled hole





CSA O86; 2024

$K_{t//}$ = 1,05
N_r = 7,7 kN
$R_{punching,\ screw}$ = 16 kN
P_{rw} = 8,13 kN

$$R_{design} = min \begin{cases} N_r & = \mathbf{7{,}7}\ [kN] \\ R_{punching,\ screw} & = \mathbf{16{,}0}\ [kN] \\ \dfrac{P_{rw}}{K_{t//}} & = \mathbf{7{,}7}\ [kN] \end{cases}$$

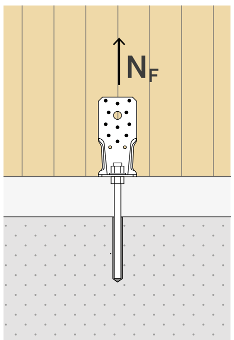
R_{design} = **7,7** kN ✓

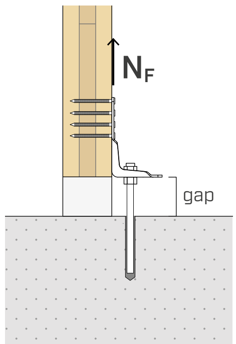
TIMBER-TO-CONCRETE | INSTALLATION WITH GAP

Project data	
Service condition	Dry service condition
Load duration	Short
Timber	CLT (G = 0.42)

Connector	WKR13535
Configuration	pattern 1 with gap
Fastening on timber	nails LBA Ø4 x 60 mm

Anchor choice	
VIN-FIX anchor	M12 x 195 (5.8 steel class)
Uncracked concrete	





EN 1995:2014

N_r = 14,2 kN
$R_{punching,\ bolt}$ = 15,2 kN
$P_{concrete}$ = 20,8 kN

$$R_{design} = min \begin{cases} N_r & = \mathbf{14{,}2}\ [kN] \\ R_{punching,\ bolt} & = \mathbf{15{,}2}\ [kN] \\ R_{concrete} & = \mathbf{20{,}8}\ [kN] \end{cases}$$

R_{design} = **14,2** kN ✓

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-22/0089.
- Design values can be obtained from values in the table as follows:

  TIMBER-TO-CONCRETE INSTALLATION

$$R_{design} = min \begin{cases} N_r \\ R_{punching,\ bolt} \\ R_{concrete} \end{cases}$$

  TIMBER-TO-TIMBER INSTALLATION

$$R_{design} = min \begin{cases} N_r \\ R_{punching,\ screw} \\ \dfrac{P_{rw}}{K_{t//}} \end{cases}$$

- The lateral resistance of LBS screws and LBA nails is determined according to CSA O86:2024, section 12.12 (self-tapping screws) and section 12.9 (nails and spikes), respectively.
- The specified bending yield strength for LBA with a 4 mm diameter is fyb = 645 MPa, and for LBS with a 5 mm diameter is fyb = 1075 MPa.
- G is the mean relative density according to Table A.12 in CSA O86:2025. Typical wood species considered include Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- For applications on CLT (Cross Laminated Timber) it is recommended to use nails/screws of adequate length to ensure that the fixing depth involves a sufficient timber thickness to prevent fragile failure for group effects.
- The gap height does not affect the angle bracket resistance N_r.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle failures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- The calculation of the concrete anchors is performed following CSA A23.3:2024, Annex D.
- The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is taken from European Technical Assessment test reports.
- The bond strength of HYB-FIX and EPO-FIX for seismic design is calculated by multiplying τ_{cr} by 0.8, according to Section D.6.5.2 in CSA A23.3:2024.
- The calculation process uses C25/30 concrete without considering edge effects.
- Fastening elements to concrete using anchors not listed in the table must be verified according to the load applied to the anchors.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchors-to-concrete must be recalculated according to the design requirements.
- For proper installation of screws, it is recommended to refer to the "TIMBER SCREWS AND DECK FASTENING" catalogue.
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363;
  - HYB-FIX chemical anchor according to ETA-20/1285;
  - EPO-FIX chemical anchor according to ETA-23/0419;
  - SKR screw-in anchor according to ETA-24/0024;
  - AB1 mechanical anchor according to ETA-17/0481 (M12).

NOTES

(1) Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2020. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

(2) Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

(3) The slip modulus of the shear connection, Kser, is measured through testing on European wood species with a density of 350 kg/m^3.

(4) If there are design requirements such as N_F stresses of different amounts, or depending on the thickness of the floor slab, it is possible to use Ø11 and Ø13 VGS screws with HUS10 and HUS12 washers and Ø10 and Ø12 HBS PLATE screws of different lengths than those proposed in the table (see the " TIMBER SCREWS AND DECK FASTENING" catalogue).

(5) The P_{rw} values can be consulted in the "TIMBER SCREWS AND DECK FASTENING" catalogue.

(6) The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is based on ETA certifications for VIN-FIX, HYB-FIX, and EPO-FIX chemical anchors.

(7) In the case of V_{F2} stress, it is required to verify for the simultaneous shear action on the N_F anchor and the additional extraction component N_{ax}

$$N_{ax} = \frac{V_{F2} \cdot l_{BL}}{25\ mm}$$

(8) l_{BL} = distance between the last row of at least two connectors and the bearing surface

- If there are design requirements such as the presence of an intermediate H_B layer (levelling mortar, sill or platform) greater than H_{Bmax}, the installatio of the angle bracket raised above the bearing surface (gap installation) is allowed.

INTELLECTUAL PROPERTY

- A WKR model is protected by the Registered Community Design RCD 015032190-0024.