WKR

TENSILE ANGLE BRACKET FOR BUILDINGS

DESIGN REGISTERED

ETA-22/0089

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.

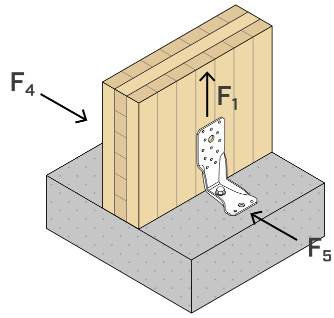
SERVICE CLASS SC1 SC2

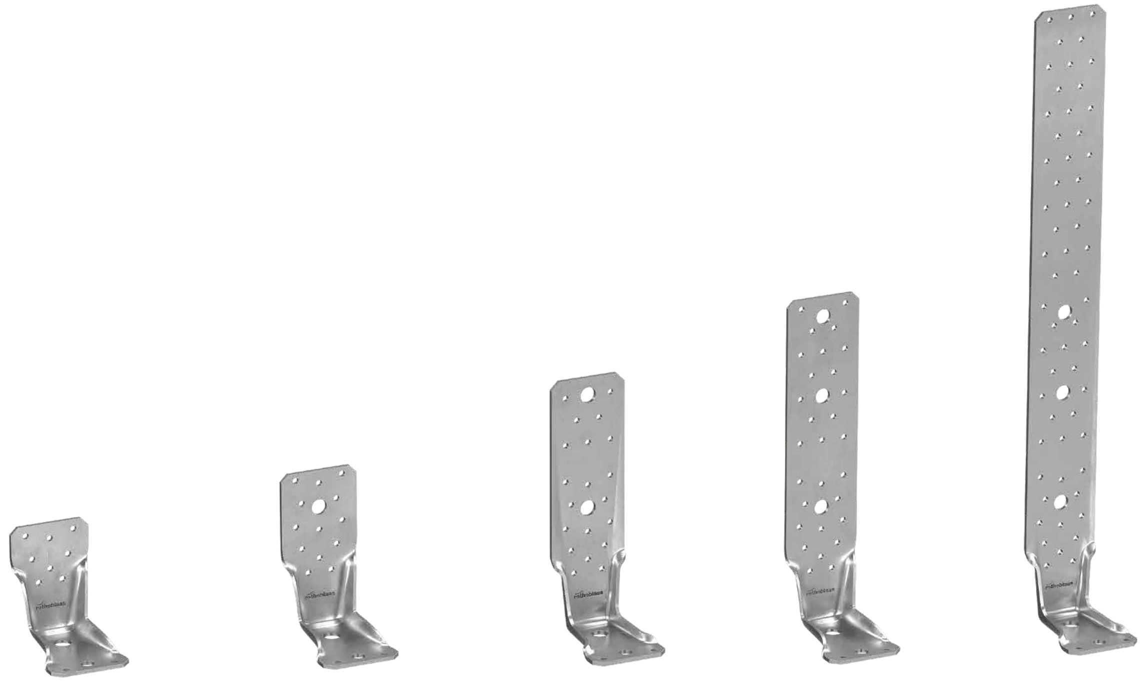
MATERIAL

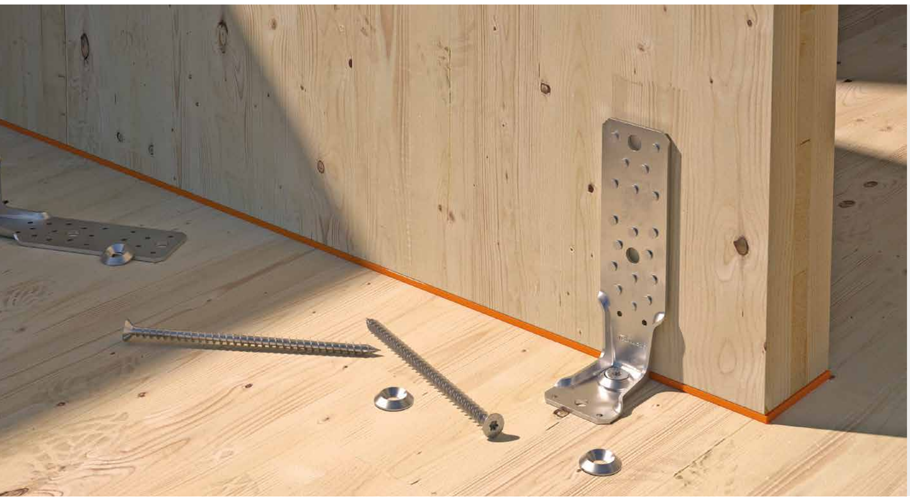
S250 Z275 — **WKR9530**: carbon steel S250GD+Z275

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

EXTERNAL LOADS







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

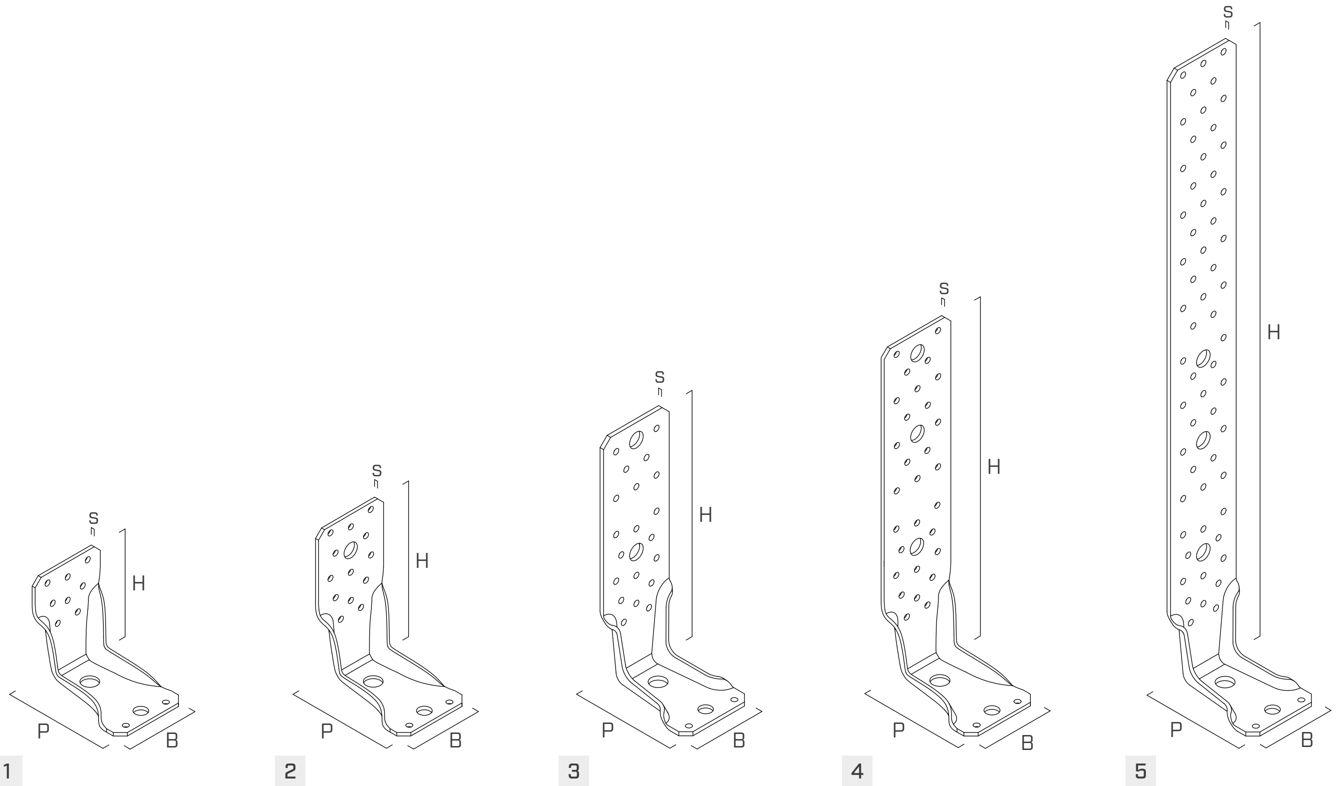
RAISED WALL

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]	timber	concrete	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

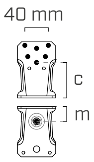
FASTENERS

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

FASTENING PATTERNS

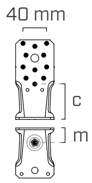
TIMBER-TO-TIMBER

WKR9530



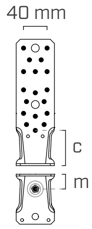
pattern 2

WKR13535



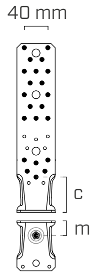
pattern 2

WKR21535



pattern 2

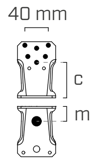
WKR28535



pattern 3

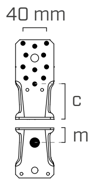
TIMBER-TO-CONCRETE

WKR9530



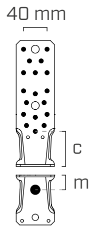
pattern 1

WKR13535

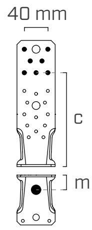


pattern 1

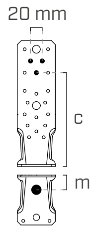
WKR21535



pattern 1

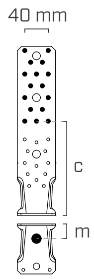


pattern 3

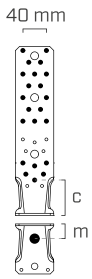


pattern 4

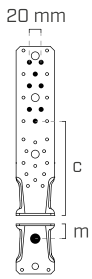
WKR28535



pattern 1

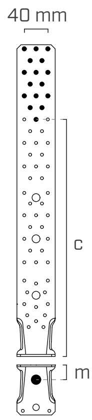


pattern 2

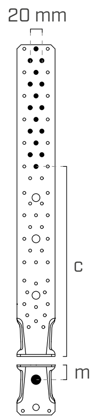


pattern 4

WKR53035



pattern 1

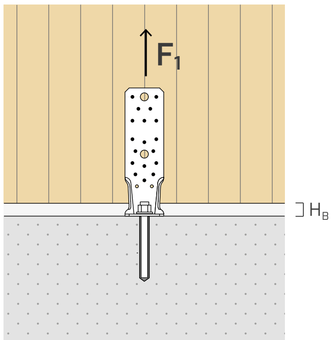


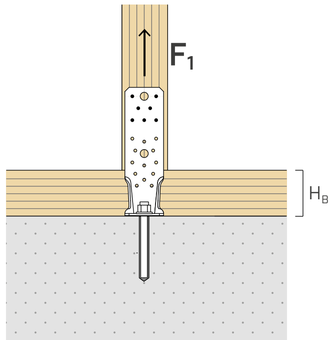
pattern 2

CODE	configuration	fastening holes Ø5			support	
		n_V [pcs]	c [mm]	m [mm]	timber	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





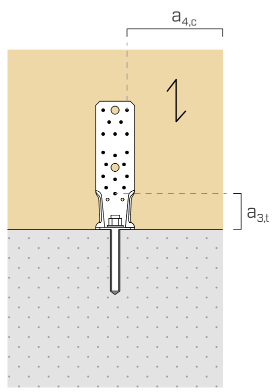
CODE	configuration	$H_{B\,max}$ [mm]			
		CLT		C/GL	
		nails LBA Ø4	screws LBS Ø5	nails LBA Ø4	screws LBS Ø5
WKR9530	**pattern 1** **pattern 2**	20	30	-	-
WKR13535	**pattern 1** **pattern 2**	20	30	-	-
WKR21535	**pattern 1** **pattern 2**	20	30	-	-
	pattern 3 **pattern 4**	120	130	100	85
WKR28535	**pattern 1** **pattern 4**	120	130	100	85
	pattern 2 **pattern 3**	20	30	-	-
WKR53035	**pattern 1**	360	370	340	325
	pattern 2	280	270	260	245

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.

MINIMUM DISTANCES

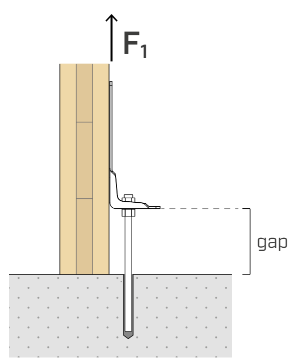
TIMBER			nails LBA Ø4	screws LBS Ø5
C/GL	$a_{4,c}$	[mm]	≥ 12,5	≥ 12,5
	$a_{3,t}$	[mm]	≥ 60	≥ 75
CLT	$a_{4,c}$	[mm]	≥ 12	≥ 12,5
	$a_{3,t}$	[mm]	≥ 40	≥ 30

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995:2014 according to ETA considering a timber density $\rho_k \leq 420$ kg/m^3.
- CLT minimum distances for Cross Laminated Timber according to ÖNORM EN 1995:2014 (Annex K) for nails and ETA-11/0030 for screws.

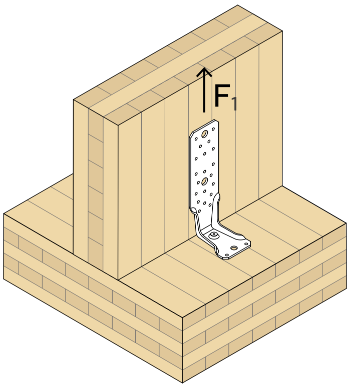


INSTALLATION WITH GAP

In the presence of F_1 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 | F_1



TIMBER STRENGTH

CODE	configuration	fastening holes Ø5			$R_{1,k\ timber}$ (1)	$K_{1,ser}$
		type	Ø x L [mm]	n_V [pcs]	[kN]	[kN/mm]
WKR9530	pattern 2	LBA	Ø4 x 60	6	15,0	$R_{1,k\ timber}/4$
		LBS	Ø5 x 50		13,3	
WKR13535	pattern 2	LBA	Ø4 x 60	11	28,3	
		LBS	Ø5 x 50		24,6	
WKR21535	pattern 2	LBA	Ø4 x 60	18	47,0	
		LBS	Ø5 x 50		40,3	
WKR28535	pattern 3	LBA	Ø4 x 60	22	57,6	
		LBS	Ø5 x 50		49,3	

STRENGTH ON STEEL SIDE

connector	WKR	$R_{1,k\ screw,head}$ (*) [kN]	γ_{steel}
VGS Ø11 + HUS 10	WKR9530 / WKR13535 / WKR21535 / WKR28535	$R_{tens,k}$	γ_{M2}
VGS Ø13 + HUS 12			
HBS PLATE Ø10	WKR9530	20,0	
	WKR13535 / WKR21535 / WKR28535	21,0	
HBS PLATE Ø12	WKR9530	27,0	
	WKR13535 / WKR21535 / WKR28535	29,0	

(*) The values 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(2)	$R_{1,k,screw,ax}$ (3) [kN]
WKR9530	pattern 2	1,05	HBS PLATE Ø10x140	13,9
			HBS PLATE Ø10x180	18,9
WKR13535	pattern 2	1,05	HBS PLATE Ø12x140	16,7
			HBS PLATE Ø12x200	24,2
WKR21535	pattern 2	1,10	VGS Ø11x150 + HUS10	19,5
			VGS Ø11x200 + HUS10	26,4
WKR28535	pattern 3	1,10	VGS Ø13x150 + HUS12	23,0
			VGS Ø13x200 + HUS12	31,2

NOTES

(1) Installation with nails and screws of shorter length than proposed in the table is possible. In this case, the bearing capacity values $R_{1,k\ timber}$ must be multiplied by the following reductive factor k_F:

- for nails

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2,66\ kN} ; \frac{F_{ax,short,Rk}}{1,28\ kN} \right\}$$

- for screws

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2,25\ kN} ; \frac{F_{ax,short,Rk}}{2,63\ kN} \right\}$$

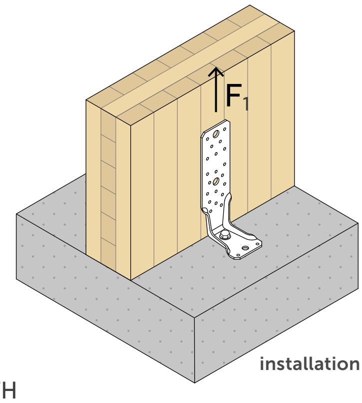
$F_{v,short,Rk}$ = characteristic shear strength of the nail or screw

$F_{ax,short,Rk}$ = characteristic withdrawal strength of the nail or screw

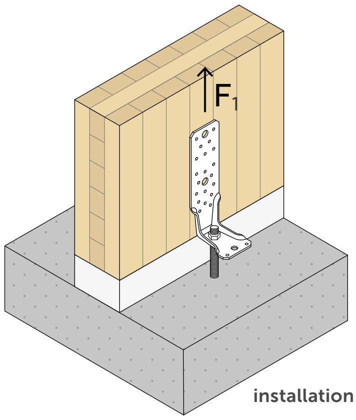
(2) If there are design requirements such as F_1 stresses of different amounts, or depending on the thickness of the floor slab, it is possible to use Ø11 and Ø13 VGS screws with HUS10 and HUS12 washers and Ø10 and Ø12 HBS PLATE screws of different lengths than those proposed in the table (see the " TIMBER SCREWS AND DECK FASTENING" catalogue).

(3) The $R_{1,k,screw,ax}$ values can be consulted in the "TIMBER SCREWS AND DECK FASTENING".

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | F_1



installation without gap



installation with gap

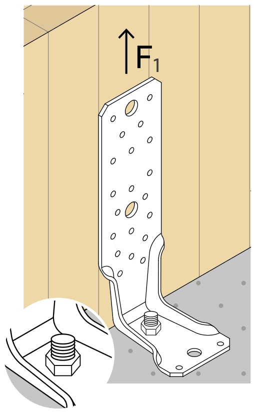
TIMBER STRENGTH

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	$R_{1,k\ timber}$ (1) [kN]	$K_{1,ser}$ [kN/mm]
WKR9530	**pattern 1**	LBA	Ø4 x 60	6	**15,0**	**$R_{1,k\ timber}$ /4**
		LBS	Ø5 x 50		**13,3**	
WKR13535	**pattern 1**	LBA	Ø4 x 60	11	**28,3**	
		LBS	Ø5 x 50		**24,6**	
WKR21535	**pattern 1**	LBA	Ø4 x 60	18	**47,0**	
		LBS	Ø5 x 50		**40,3**	
	pattern 3	LBA	Ø4 x 60	7	**18,7**	
		LBS	Ø5 x 50		**15,8**	
	pattern 4	LBA	Ø4 x 60	3	**8,0**	
		LBS	Ø5 x 50		**6,8**	
WKR28535	**pattern 1**	LBA	Ø4 x 60	16	**37,3**	
		LBS	Ø5 x 50		**36,0**	
	pattern 2	LBA	Ø4 x 60	22	**57,6**	
		LBS	Ø5 x 50		**49,3**	
	pattern 4	LBA	Ø4 x 60	8	**21,3**	
		LBS	Ø5 x 50		**18,0**	
WKR53035	**pattern 1-2**	LBA	Ø4 x 60	16	**42,6**	
		LBS	Ø5 x 50		**36,0**	

STRENGTH ON STEEL SIDE WITHOUT WASHER

CODE	configuration	$R_{1,k,bolt,head}$ (*) no gap [kN]	gap [kN]	γ_{steel}
WKR9530	**pattern 1**	**26**	**8,3**	γ_{M2}
WKR13535	**pattern 1**		**19**	
WKR21535	**pattern 1**		**19**	
	pattern 3-4		**-**	
WKR28535	**pattern 1-4**		**-**	
	pattern 2		**19**	
WKR53035	**pattern 1-2**		**-**	

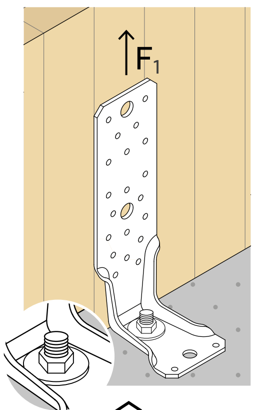
(*) The values $R_{1k,bolt,head}$ refer to a punching shear failure of the connector in the horizontal flange.



STRENGTH ON STEEL SIDE WITH WASHER ULS13373

CODE	configuration	$R_{1,k,bolt,head}$ (*) no gap [kN]	gap [kN]	γ_{steel}
WKR9530	**pattern 1**	**26**	**16**	γ_{M2}
WKR13535	**pattern 1**	**37**	**35**	
WKR21535	**pattern 1**		**35**	
	pattern 3-4		**-**	
WKR28535	**pattern 1-4**		**-**	
	pattern 2		**35**	
WKR53035	**pattern 1-2**		**-**	

(*) The values $R_{1k,bolt,head}$ 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		$R_{1,d\ concrete}$ no gap				$R_{1,d\ concrete}$ 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	**26,6**	-	-	-	**28,0**	-
		SKR	12 x 90	**10,1**	-	-	-	-	-
		AB1	M12 x 100	**17,4**	-	-	-	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**19,5**	-	-	-	**20,5**	-
		HYB-FIX 5.8	M12 x 195	**26,7**	-	-	-	**28,0**	-
		AB1	M12 x 100	**10,2**	-	-	-	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**14,6**	-	-	-	**15,4**	-
			M12 x 245	**18,1**	-	-	-	**19,0**	-
		EPO-FIX 8.8	M12 x 195	**23,6**	-	-	-	**24,8**	-
WKR21535	**uncracked**	VIN-FIX 5.8	M12 x 195	**25,4**	-	**19,3**	**19,3**	**28,0**	-
		SKR	12 x 90	**9,6**	-	**7,3**	**9,6**	-	-
		AB1	M12 x 100	**16,6**	-	**12,6**	**12,6**	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**18,6**	-	**14,1**	**14,1**	**20,5**	-
		HYB-FIX 5.8	M12 x 195	**25,5**	-	**19,3**	**19,3**	**28,0**	-
		AB1	M12 x 100	**9,7**	-	**7,4**	**7,4**	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**14,0**	-	**10,6**	**10,6**	**15,4**	-
			M12 x 245	**17,3**	-	**13,1**	**13,1**	**19,0**	-
		EPO-FIX 8.8	M12 x 195	**22,5**	-	**17,1**	**17,1**	**24,8**	-
WKR28535	**uncracked**	VIN-FIX 5.8	M12 x 195	**19,3**	**25,4**	-	**19,3**	-	**28,0**
		SKR	12 x 90	**7,3**	**9,6**	-	**9,6**	-	-
		AB1	M12 x 100	**12,6**	**16,6**	-	**12,6**	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**14,1**	**18,6**	-	**14,1**	-	**20,5**
		HYB-FIX 5.8	M12 x 195	**19,3**	**25,5**	-	**19,3**	-	**28,0**
		AB1	M12 x 100	**7,4**	**9,7**	-	**7,4**	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**10,6**	**14,0**	-	**10,6**	-	**15,4**
			M12 x 245	**13,1**	**17,3**	-	**13,1**	-	**19,0**
		EPO-FIX 8.8	M12 x 195	**17,1**	**22,5**	-	**17,1**	-	**24,8**
WKR53035	**uncracked**	VIN-FIX 5.8	M12 x 195	**19,3**	**19,3**	-	-	-	-
		SKR	12 x 90	**7,3**	**9,6**	-	-	-	-
		AB1	M12 x 100	**12,6**	**12,6**	-	-	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**14,1**	**14,1**	-	-	-	-
		HYB-FIX 5.8	M12 x 195	**19,3**	**19,3**	-	-	-	-
		AB1	M12 x 100	**7,4**	**7,4**	-	-	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**10,6**	**10,6**	-	-	-	-
			M12 x 245	**13,1**	**13,1**	-	-	-	-
		EPO-FIX 8.8	M12 x 195	**17,1**	**17,1**	-	-	-	-

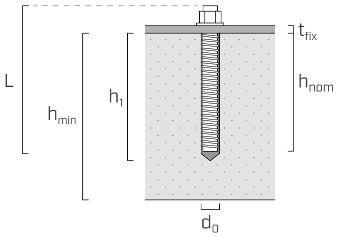
NOTES

- 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 100	70	80	85	14	200

Precut INA threaded rod, with nut and washer: see page <?>.
MGS threaded rod class 8.8 to be cut to size: see page <?>.



t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchoring depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

ANCHORS VERIFICATION FOR STRESS LOADING F_1

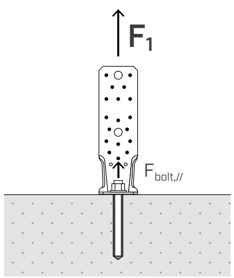
Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the $k_{t//}$ coefficients. The axial load acting on the anchor can be obtained as follows:

$$F_{bolt//,d} = k_{t//} \cdot F_{1,d}$$

$k_{t//}$ coefficient of eccentricity
$F_{1,d}$ axial load on the WKR angle bracket

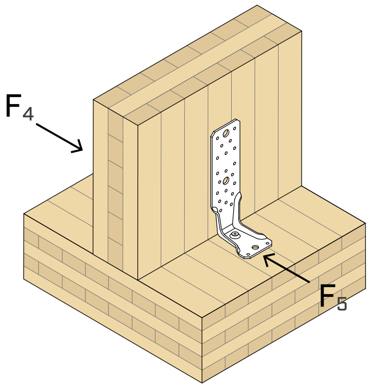
The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_{bolt//,d} \geq F_{bolt//,d}$.

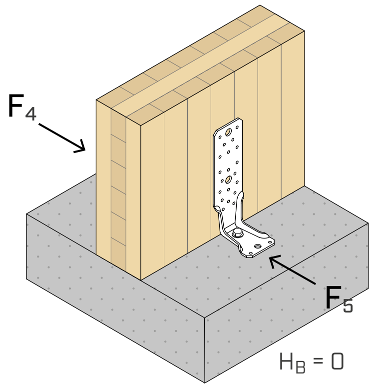
	INSTALLATION WITHOUT GAP		INSTALLATION WITH GAP	
CODE	**configuration**	$k_{t//}$	**configuration**	$k_{t//}$
WKR9530	**pattern 1-2**	1,05	**pattern 2**	1,00
WKR13535	**pattern 1-2**	1,05	**pattern 2**	
WKR21535	**pattern 1-2**	1,10	**pattern 2**	
	pattern 3-4	1,45		
WKR28535	**pattern 2-3**	1,10	**pattern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

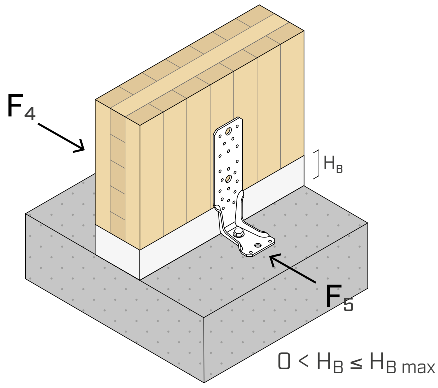


NOTES
(1) Valid for the strength values shown in the table.

STRUCTURAL VALUES | F_4 | F_5







TIMBER-TO-TIMBER

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	$R_{4,k\ timber}$ (1) [kN]	$R_{5,k\ timber}$ (1) [kN]	l_{BL} (2) [mm]
WKR9530	**pattern 2**	LBA	Ø4 x 60	6	**14,7**	**2,6**	70,0
		LBS	Ø5 x 50		**14,1**	**3,4**	
WKR13535	**pattern 2**	LBA	Ø4 x 60	11	**18,3**	**2,6**	
		LBS	Ø5 x 50		**17,2**	**3,6**	
WKR21535	**pattern 2**	LBA	Ø4 x 60	18	**23,0**	**2,6**	
		LBS	Ø5 x 50		**21,1**	**3,6**	
WKR28535	**pattern 3**	LBA	Ø4 x 60	22	**25,6**	**2,6**	
		LBS	Ø5 x 50		**23,4**	**3,6**	

TIMBER-TO-CONCRETE

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	$H_B = 0$ $R_{4,k\ timber}$ (1) [kN]	$H_B = 0$ $R_{5,k\ timber}$ (1) [kN]	$0 < H_B \le H_{B\ max}$ $R_{4,k\ timber}$ (1) [kN]	$0 < H_B \le H_{B\ max}$ $R_{5,k\ timber}$ (1) [kN]	l_{BL} (2) [mm]
WKR9530	**pattern 1**	LBA	Ø4 x 60	6	**14,7**	**2,6**	**11,3**	**2,6**	70,0
		LBS	Ø5 x 50		**14,1**	**3,4**	**10,7**	**3,4**	
WKR13535	**pattern 1**	LBA	Ø4 x 60	11	**18,3**	**2,6**	**14,9**	**2,6**	70,0
		LBS	Ø5 x 50		**17,2**	**3,6**	**13,8**	**3,6**	
WKR21535	**pattern 1**	LBA	Ø4 x 60	18	**23,0**	**2,6**	**19,6**	**2,6**	70,0
		LBS	Ø5 x 50		**21,1**	**3,6**	**17,7**	**3,6**	
WKR28535	**pattern 1**	LBA	Ø4 x 60	16	**21,7**	**1,0**	**13,0**	**0,9**	160,0
		LBS	Ø5 x 50		**20,0**	**1,0**	**11,3**	**0,9**	
	pattern 2	LBA	Ø4 x 60	22	**25,6**	**2,6**	**22,3**	**2,6**	70,0
		LBS	Ø5 x 50		**23,4**	**3,6**	**20,0**	**3,6**	
WKR53035	**pattern 1**	LBA	Ø4 x 60	16	**21,7**	**0,3**	**11,5**	**0,3**	343,0
		LBS	Ø5 x 50		**20,0**	**0,3**	**9,8**	**0,3**	
	pattern 2	LBA	Ø4 x 60	16	**21,7**	**0,3**	**11,5**	**0,3**	423,0
		LBS	Ø5 x 50		**20,0**	**0,3**	**9,8**	**0,3**	

NOTES

(1) Installation with nails and screws of shorter length than proposed in the table is possible. In this case, the bearing capacity values $R_{4,k\ timber}$ and $R_{5,k\ timber}$ must be multiplied by the following reductive factor k_F:

- for nails

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2{,}66\ kN} ; \frac{F_{ax,short,Rk}}{1{,}28\ kN} \right\}$$

- for screws

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2{,}25\ kN} ; \frac{F_{ax,short,Rk}}{2{,}63\ kN} \right\}$$

$F_{v,short,Rk}$ = characteristic shear strength of the nail or screw

$F_{ax,short,Rk}$ = characteristic withdrawal strength of the nail or screw

(1) In the case of $F_{5,Ed}$ stress, it is required to verify for the simultaneous shear action on the $F_{v,Ed}$ anchor and the additional extraction component $F_{ax,Ed}$:

$$F_{ax,Ed} = \frac{F_{5,Ed} \cdot l_{BL}}{25\ mm}$$

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

- The $R_{4,k\ timber}$ resistance is limited by the lateral $R_{v,k}$ resistance of the base connector.
- Refer to ETA-22/0089 for $K_{4,ser}$ stiffness values in timber-to-timber configuration.

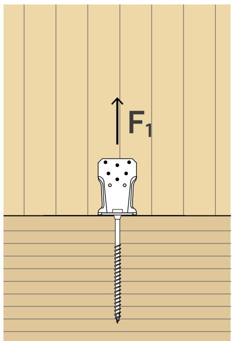
CALCULATION EXAMPLES | DETERMINING RESISTANCE R_{1d}

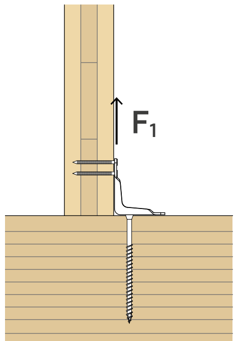
TIMBER-TO-TIMBER

Project data	
Service class	SC1
Load duration	instantaneous

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





EN 1995:2014

k_{mod} = 1,1
γ_M = 1,3
γ_{M2} = 1,25
$k_{t//}$ = 1,05
$R_{1,k,\ timber}$ = 15,0 kN
$R_{1,k,screw,head}$ = 20,0 kN
$R_{1,k,\ screw,ax}$ = 13,9 kN

$$R_{1,d} = min \begin{cases} \dfrac{R_{1,k\ timber} \cdot k_{mod}}{\gamma_M} & = \mathbf{12{,}7}\ [kN] \\ \dfrac{R_{1,k,screw,head}}{\gamma_{M2}} & = \mathbf{16{,}0}\ [kN] \\ \dfrac{R_{1,k,screw,ax}}{k_{t//}} \cdot \dfrac{k_{mod}}{\gamma_M} & = \mathbf{11{,}2}\ [kN] \end{cases}$$

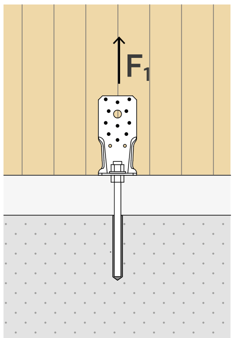
$R_{1,d}$ = **11,2** kN ✓

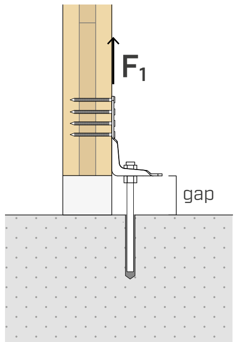
TIMBER-TO-CONCRETE | INSTALLATION WITH GAP

Project data	
Service class	SC1
Load duration	instantaneous

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

k_{mod} = 1,1
γ_M = 1,3
γ_{M2} = 1,25
$R_{1,k\ timber}$ = 28,3 kN
$R_{1,k,bolt,head}$ = 19,0 kN
$R_{1,d\ concrete}$ = 28,0 kN

$$R_{1,d} = min \begin{cases} \dfrac{R_{1,k\ timber} \cdot k_{mod}}{\gamma_M} & = \mathbf{23{,}95}\ [kN] \\ \dfrac{R_{1,k,bolt,head}}{\gamma_{M2}} & = \mathbf{15{,}2}\ [kN] \\ R_{1,d\ concrete} & = \mathbf{28{,}0}\ [kN] \end{cases}$$

$R_{1,d}$ = **15,2** kN ✓

GENERAL PRINCIPLES

- Characteristic values comply with the EN1995:2014 standard in accordance with ETA-22/0089.
- Design values can be obtained from values in the table as follows:

TIMBER-TO-CONCRETE INSTALLATION

$$R_d = min \begin{cases} \frac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{k\ bolt,\ head}}{\gamma_{M2}} \\ R_{d,\ concrete} \end{cases}$$

TIMBER-TO-TIMBER INSTALLATION

$$R_d = min \begin{cases} \frac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{k,screw,ax}}{k_{t//}} \cdot \frac{k_{mod}}{\gamma_M} \\ \frac{R_{k,screw,head}}{\gamma_{M2}} \end{cases}$$

The coefficients k_{mod}, γ_M and γ_{M2} should be taken according to the current regulations used for the calculation.

- The use of nails is allowed in accordance with EN 14592, in this case the bearing capacity values $R_{1,k\ timber}$ must be multiplied by the following reductive factor K_{rid}:

$$k_{rid} = min \left\{ \frac{F_{v,EN\ 14592,Rk}}{2,66\ kN} ; \frac{F_{ax,EN\ 14592,Rk}}{1,28\ kN} \right\}$$

- 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.
- A timber density of ρ_k = 350 kg/m^3 was considered for the calculation process. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ 350\ kg/m^3 \ \leq \rho_k \leq \ 420\ kg/m^3$$

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ LVL\ with\ \ \rho_k \leq \ 500\ kg/m^3$$

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used.
- The strength values are valid for the calculation hypothesis defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- The anchors seismic design was carried out in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EN 1992:2018, with α_{sus} = 0,6. For chemical anchors it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap} = 1).
- 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) Installation with nails and screws of a shorter length than proposed in the table is possible by multiplying the load-bearing capacity values $R_{1,k\ timber}$ by the following reductive factor k_F:

- for nails

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2,66\ kN} ; \frac{F_{ax,short,Rk}}{1,28\ kN} \right\}$$

- for screws

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2,25\ kN} ; \frac{F_{ax,short,Rk}}{2,63\ kN} \right\}$$

$F_{v,short,Rk}$ = characteristic shear strength of the nail or screw

$F_{ax,short,Rk}$ = characteristic withdrawal strength of the nail or screw

- In the presence of an H_B intermediate layer (levelling mortar, sill or platform) with nails on CLT and $a_{3,t}$ < 60 mm, the $R_{1,k\ timber}$ values in the table must be multiplied by a 0,93 coefficient.
- If there are design requirements such as the presence of an intermediate H_B layer (levelling mortar, sill or platform) greater than $H_{B\ max}$, the installation 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.