WKR

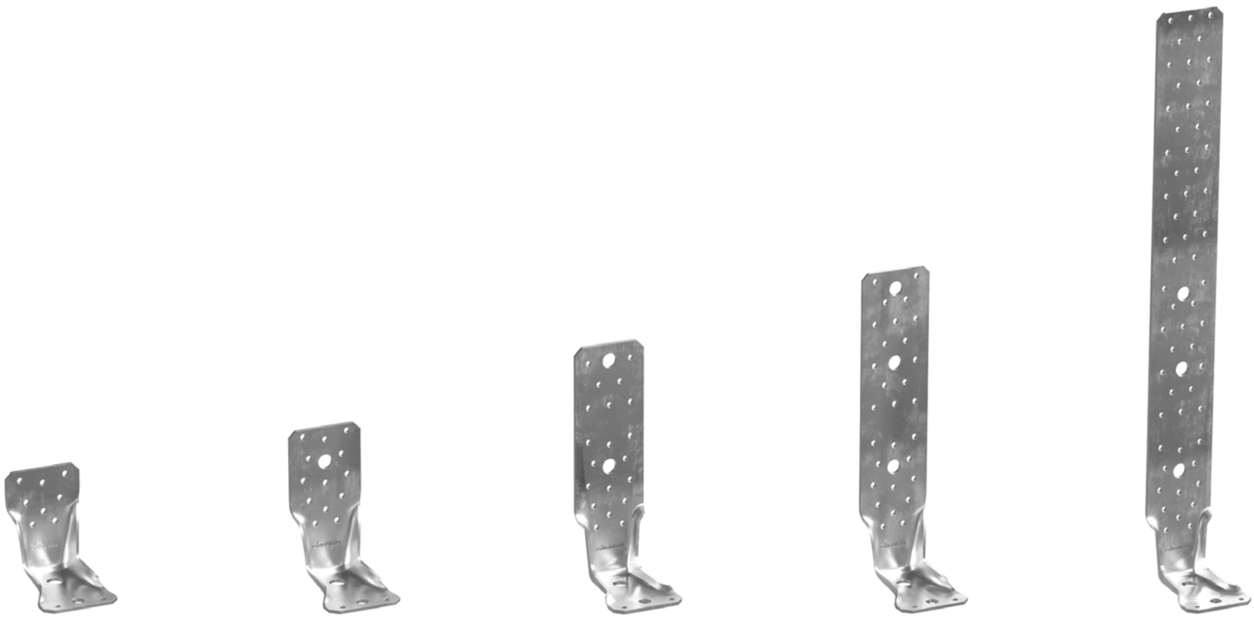
CE
ETA-22/0089

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 mortar, root beam or concrete curb.

TIMBER-TO-TIMBER CONFIGURATION
Exceptional strength values also for installation in timber-to-timber configuration. Possibility of installation with through-rod 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.



CHARACTERISTICS

FOCUS	tension fastening for timber frame and CLT
HEIGHT	from 95 to 530 mm
THICKNESS	3,0 | 3,5 mm
FASTENERS	LBA, LBS, VGS, HUS, HBS PLATE, SKR, VIN-FIX, HYB-FIX

MATERIAL

Bright zinc plated carbon steel, three dimensional perforated plate.

FIELD OF USE

Timber-to-concrete and timber to-timber joints
- solid timber and glulam
- CLT, LVL
- framed structures (timber frame)
- timber based panels

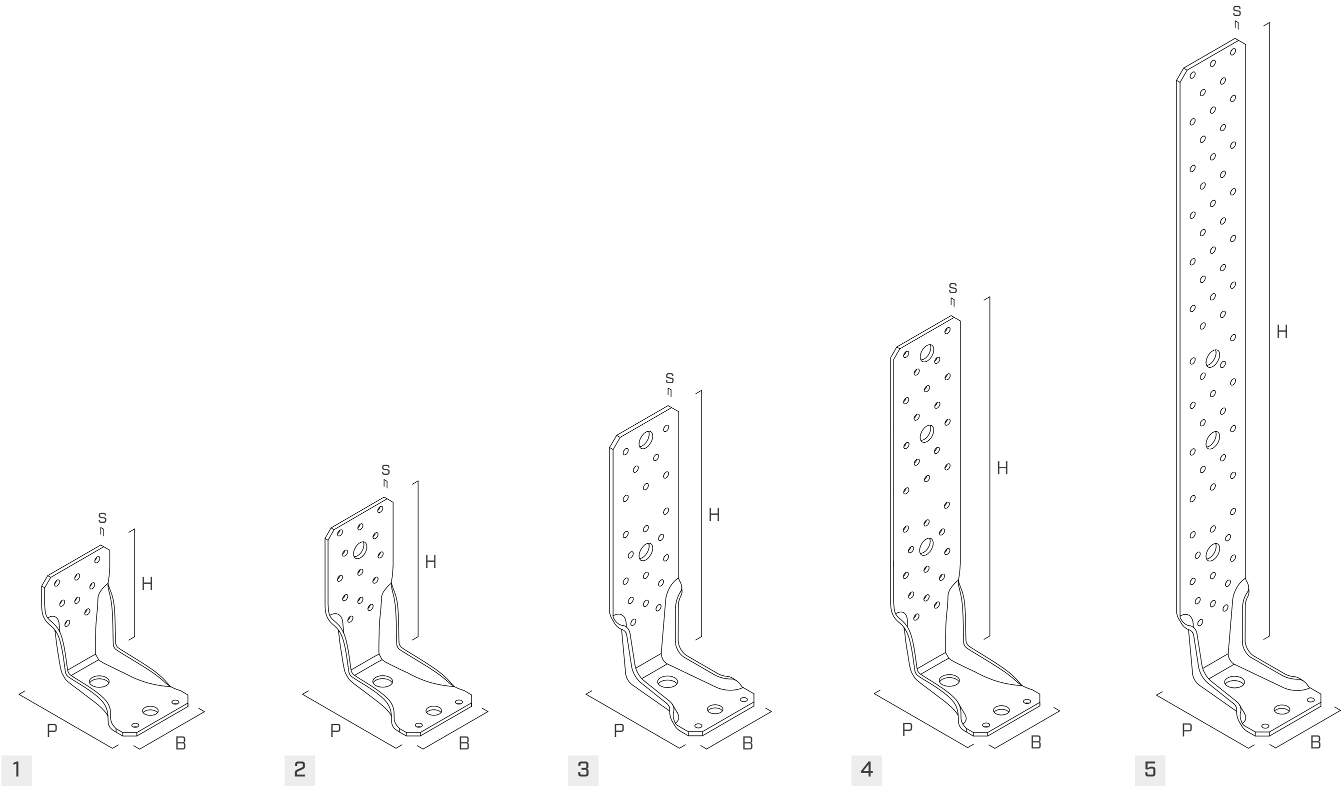
RAISED WALL

Partial nailing patterns allow installation on timber frame or CLT walls with the presence of concrete curbs 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	P	H	s	n_V Ø5	n_H Ø14	n_H Ø11	n_V Ø13,5	pcs		
		[mm]	[mm]	[mm]	[mm]	pcs	pcs	pcs	pcs			
1	**WKR9530**	65	85	95	3	8	1	1	-	25	●	●
2	**WKR13535**	65	85	135	3,5	13	1	1	1	25	●	●
3	**WKR21535**	65	85	215	3,5	20	1	1	2	25	●	●
4	**WKR28535**	65	85	287	3,5	29	1	1	3	25	●	●
5	**WKR53035**	65	85	530	3,5	59	1	1	3	10	●	●

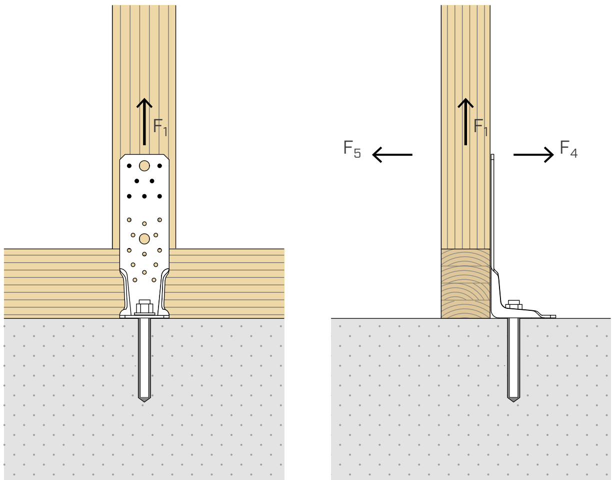
MATERIAL AND DURABILITY

WKR9530: S250 + Z275 steel.
WKR13535 | WKR21535 | WKR28535 | WKR53035:
S235 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1)

FIELD OF USE

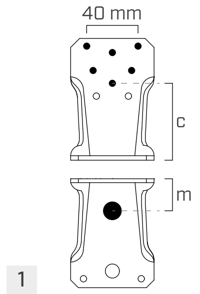
- Timber-to-timber joints
- Timber to concrete joints
- Timber-to-steel joints

EXTERNAL LOADS

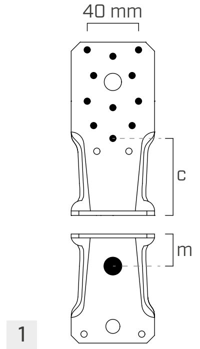


TIMBER-TO-CONCRETE FASTENING DIAGRAMS

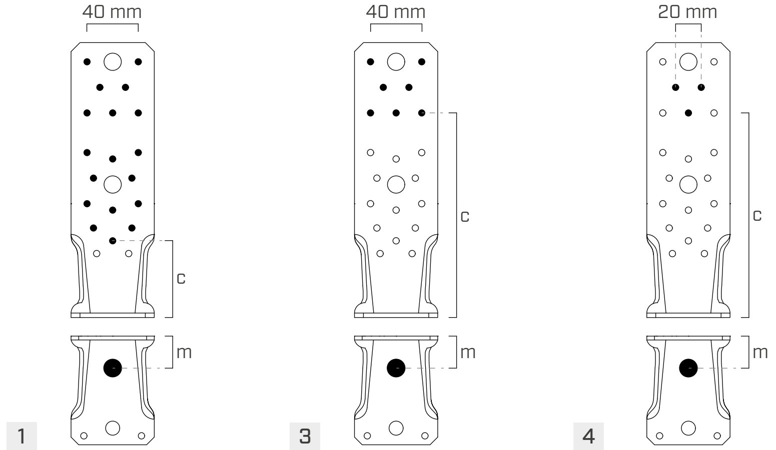
WKR9530



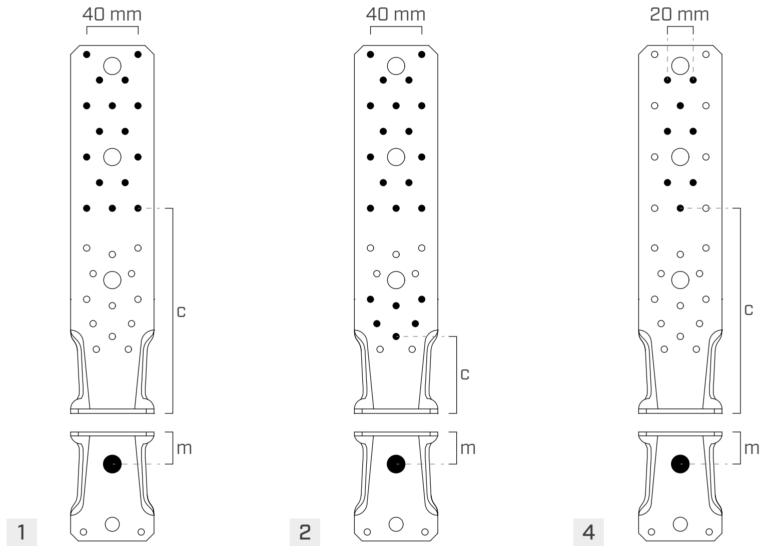
WKR13535



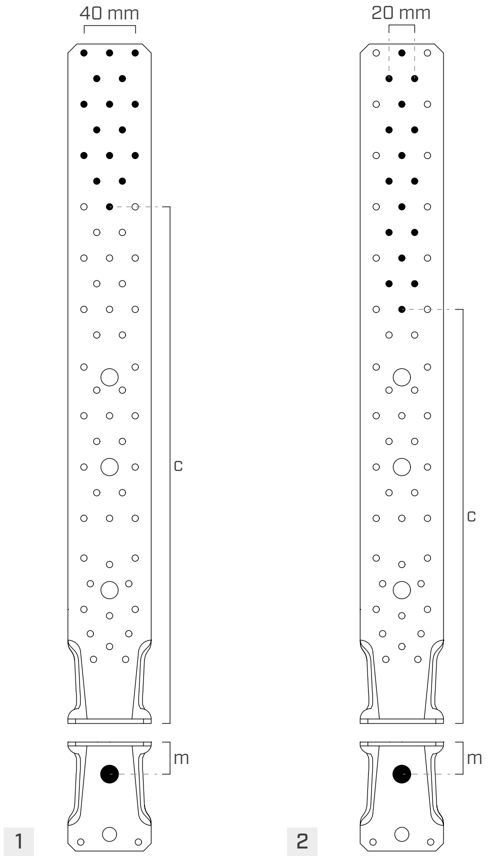
WKR21535



WKR28535

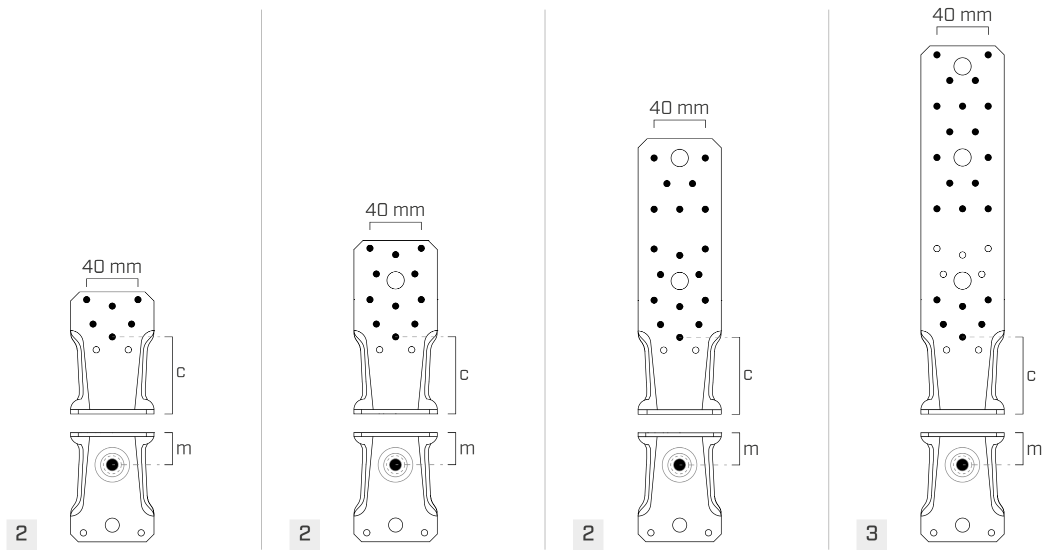


WKR53035



TIMBER-TO-TIMBER FASTENING DIAGRAMS

WKR9530 WKR13535 WKR21535 WKR28535

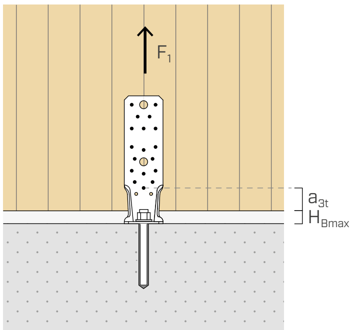


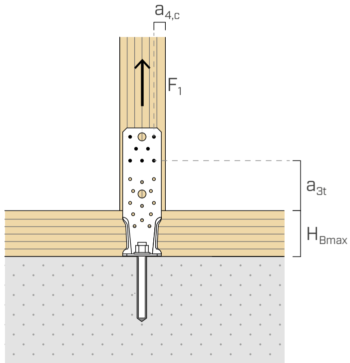
CODE	configuration	holes fastening Ø5 n_v pcs	c [mm]	m [mm]	support	
WKR9530	pattern 1	6	60		●	-
	pattern 2	6	60		-	●
WKR13535	pattern 1	11	60		●	-
	pattern 2	11	60		-	●
WKR21535	pattern 1	18	60		●	-
	pattern 2	18	60		-	●
	pattern 3	7	160	25	●	-
	pattern 4	3	160		●	-
WKR28535	pattern 1	16	160		●	-
	pattern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

ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support
LBA	Anker nail		4	
LBS	screw for plates		5	
VGS	full thread screw		11-13	
HUS	turned washer		11-13	
HBSPLATE	pan head screw		10-12	
AB1	mechanical anchor		12	
SKR	screw anchor		M12	
VIN-FIX	chemical anchor		M12	
HYB-FIX	chemical anchor		M12	

INSTALLATION





MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER

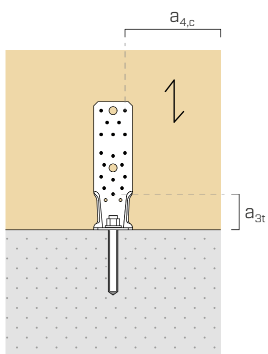
CODE	configuration	$H_{B\ max}$ [mm]			
		CLT		C/GL	
		nails	screws	nails	screws
		LBA Ø4	LBS Ø5	LBA Ø4	LBS Ø5
WKR9530	**pattern 1-2**	20	30	-	-
WKR13535	**pattern 1-2**	20	30	-	-
WKR21535	**pattern 1-2**	20	30	-	-
	pattern 3-4	120	130	100	85
WKR28535	**pattern 1-4**	120	130	100	85
	pattern 2-3	20	30	-	-
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

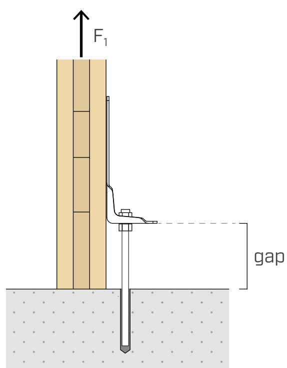
TIMBER minimum distances			**nails** LBA Ø4	**screws** LBS Ø5
C/GL	$a_{4,c}$	[mm]	≥ 20	≥ 25
	$a_{3,t}$	[mm]	≥ 60	≥ 75
CLT	$a_{4,c}$	[mm]	≥ 12	≥ 12,5
	$a_{3,t}$	[mm]	≥ 40	≥ 30

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995-1-1 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 1995-1-1 (Annex K) for nails and ETA 11/0030 for screws.

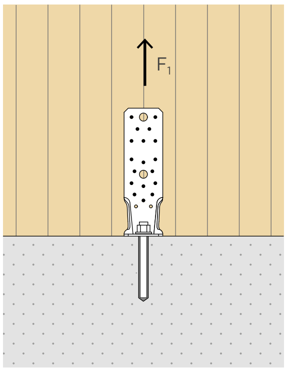


INSTALLATION WITH GAP

In the presence of F_1 tensile forces, installation of the angle bracket raised above the bearing surface is possible. This allows, for example, to install the angle bracket even in the presence of an intermediate H_B layer (bedding mortar, root beam or concrete curb) greater than $H_{B\ max}$. It is recommended to install a lock nut below the horizontal flange, to prevent that excessive tightening of the nut may stress the connection.



STRUCTURAL VALUES | TENSILE JOINT F_1 | TIMBER-TO-CONCRETE



TIMBER STRENGTH

CODE	configuration	holes fastening Ø5 type	Ø x L [mm]	n_v [pcs]	$R_{1,k\ timber}$ (1) [kN]	$K_{1,ser}$ [kN/mm]
WKR9530	pattern 1	LBA nails	Ø4,0 x 60	6	15,0	
		screws LBS	Ø5,0 x 50		13,3	
WKR13535	pattern 1	LBA nails	Ø4,0 x 60	11	28,3	
		screws LBS	Ø5,0 x 50		24,6	
WKR21535	pattern 1	LBA nails	Ø4,0 x 60	18	47,0	
		screws LBS	Ø5,0 x 50		40,3	
	pattern 3	LBA nails	Ø4,0 x 60	7	18,7	
		screws LBS	Ø5,0 x 50		15,8	
	pattern 4	LBA nails	Ø4,0 x 60	3	8,0	$R_{1,k\ timber}/4$
		screws LBS	Ø5,0 x 50		6,8	
WKR28535	pattern 1	LBA nails	Ø4,0 x 60	16	37,3	
		screws LBS	Ø5,0 x 50		36,0	
	pattern 2	LBA nails	Ø4,0 x 60	22	57.6	
		screws LBS	Ø5,0 x 50		49,3	
	pattern 4	LBA nails	Ø4,0 x 60	8	21,3	
		screws LBS	Ø5,0 x 50		18,0	
WKR53035	pattern 1-2	LBA nails	Ø4,0 x 60	16	42,6	
		screws LBS	Ø5,0 x 50		36,0	

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

- For installation 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.

STRENGTH ON STEEL SIDE

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 in the table 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	holes fastening Ø14 type	Ø x L [mm]	$R_{1,d\ concrete}$ no gap pattern 1 [kN]	no gap pattern 2 [kN]	no gap pattern 3 [kN]	no gap pattern 4 [kN]	gap pattern 1 [kN]	gap pattern 2 [kN]
WKR9530 WKR13535	• **uncracked**	VIN-FIX 5.8(1)	M12 x 195	26,6	-	-	-	28,0	-
		SKR-CE	12 x 90	10,5	-	-	-	-	-
		AB1(2)	M12 x 100	17,4	-	-	-	-	-
	• **cracked**	VIN-FIX 5.8	M12 x 195	19,5	-	-	-	20,5	-
		HYB-FIX 5.8(3)	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	-
WKR21535	• **uncracked**	VIN-FIX 5.8	M12 x 195	25,4	-	19,3	19,3	28,0	-
		SKR-CE	12 x 90	10,1	-	7,6	7,6	-	-
		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	-
WKR28535	• **uncracked**	VIN-FIX 5.8	M12 x 195	19,3	25,4	-	19,3	-	28,0
		SKR-CE	12 x 90	7,6	10,1	-	7,6	-	-
		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
WKR53035	• **uncracked**	VIN-FIX 5.8	M12 x 195	19,3	19,3	-	-	-	-
		SKR-CE	12 x 90	7,6	7,6	-	-	-	-
		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	-	-	-	-

NOTES:

(1) Chemical anchor VIN- FIX according to ETA 20/0363.

(2) Mechanical anchor AB1 according to ETA 17/0481.

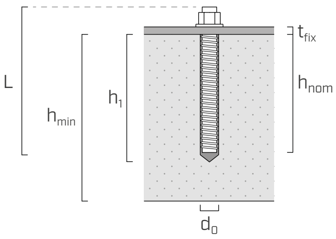
(3) Chemical anchor HYB- FIX according to ETA 20/1285.

- 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[1]

anchor type		h_{ef}	h_{nom}	h_1	d_0	h_{min}
type	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		200
HYB-FIX 8.8	M12 x 195	170	170	175	14	200
	M12 x 245	210	210	215		250
SKR-CE	12 x 90	64	87	110	10	200
AB1	M12 x 100	70	80	85	14	200

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
For more information, see the data sheet available at www.rothoblaas.com.
Concrete-side strength values were calculated assuming a t_{fix} thickness of 3 mm for all angle brackets.



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

DIMENSIONING OF ALTERNATIVE ANCHORS

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:

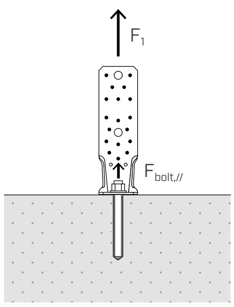
$$F_{bolt//,d} = k_{t//} \cdot F_{1,d}$$

$k_{t//}$ 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

CODE	configuration	$k_{t//}$
WKR9530	pattern 1-2	1,05
WKR13535	pattern 1-2	1,05
WKR21535	pattern 1-2	1,10
	pattern 3-4	1,45
WKR28535	pattern 2-3	1,10
	pattern 1-4	1,45
WKR53035	pattern 1-2	1,45



INSTALLATION WITH GAP

CODE	configuration	$k_{t//}$
WKR9530	pattern 1	1,00
WKR13535	pattern 1	
WKR21535	pattern 1	
WKR28535	pattern 2	

NOTES:

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

CALCULATION EXAMPLES: DETERMINING RESISTANCE R_{1d}

TIMBER-TO-CONCRETE | INSTALLATION WITH GAP

PROJECT DATA
Service class = 1
Load duration = instantaneous

CONNECTOR
WKR13535
Configuration = Pattern 1 with gap
Fixing on timber: nails LBA 4 x 60 mm

ANCHOR CHOICE
Uncracked concrete
VIN-FIX anchor M12 x 195 (5.8 steel class)

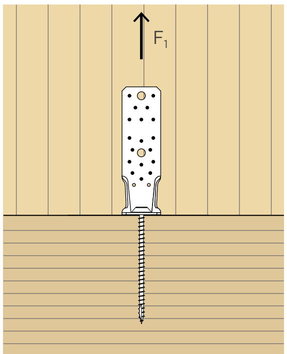
$$R_{1,d} = min \begin{cases} \dfrac{R_{1,k\,timber} \cdot k_{mod}}{\gamma_M} & = 23{,}95\,[kN] \\ \dfrac{R_{1,k,bolt,head}}{\gamma_{M2}} & = 15{,}2\,[kN] \\ R_{1,d\,concrete} & = 28{,}0\,[kN] \end{cases}$$

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

$R_{1,d}$ = 15,2 kN

STRUCTURAL VALUES | TENSILE JOINT F_1 |TIMBER-TO-TIMBER



TIMBER STRENGTH

CODE	configuration	holes fastening Ø5			$R_{1,k\,timber}$ (1)	$K_{1,ser}$
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN/mm]
WKR9530	pattern 2	LBA nails	Ø4,0 x 60	6	15,0	$R_{1,k\,timber}/4$
		screws LBS	Ø5,0 x 50		13,3	
WKR13535	pattern 2	LBA nails	Ø4,0 x 60	11	28,3	
		screws LBS	Ø5,0 x 50		24,6	
WKR21535	pattern 2	LBA nails	Ø4,0 x 60	18	47,0	
		LBS screws	Ø5,0 x 50		40,3	
WKR28535	pattern 3	LBA nails	Ø4,0 x 60	22	57.6	
		LBS screws	Ø5,0 x 50		49,3	

NOTES:

(1) Installation with nails and screws of shorter length than proposed in the table is possible. In this case, the bearing capacity values $R_{1,k\,timber}$ 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

STRENGTH ON STEEL SIDE

connector	WKR	$R_{1,k\ screw,head}$ (*) [kN]	γ_{steel}
VGS Ø11 + HUS 10	WKR9530 / WKR13535 / WKR21535 / WKR285135	$R_{tens,k}$	γ_{M2}
VGS Ø13 + HUS 12			
HBS PLATE Ø10	WKR9530	20,0	
	WKR13535 / WKR21535 / WKR285135	21,0	
HBS PLATE Ø12	WKR9530	27,0	
	WKR13535 / WKR21535 / WKR285135	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	$k_{t//}$	holes fastening Ø14 type(1)	$R_{1,k,screw,ax}$ (2) [kN]
WKR9530	pattern 2	1,05	HBSP Ø10 x 180 HBSP Ø10 x 140 HBSP Ø12 x 200 HBSP Ø12 x 140 VGS Ø11 x 200 + HUS10 VGS Ø11 x 150 + HUS10 VGS Ø13 x 200 + HUS12 VGS Ø13 x 150 + HUS12	18,9 13,9 24,2 16,7 26,4 19,5 31,2 23,0
WKR13535	pattern 2	1,05		
WKR21535	pattern 2	1,10		
WKR28535	pattern 3	1,10		

CALCULATION EXAMPLES: DETERMINING RESISTANCE R_{1d}

TIMBER-TO-TIMBER

PROJECT DATA
Service class = 1
Load duration = instantaneous

CONNECTOR
WKR9530
Configuration = Pattern 2
Fixing on timber: nails LBA 4 x 60 mm

SCREW SELECTION
HBS PLATE = 10 x 140 mm
Pre-drilling hole = no

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

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

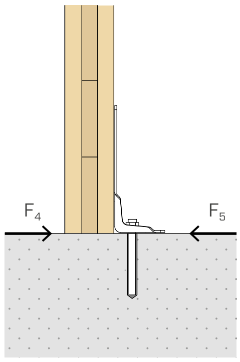
$R_{1,d}$ = 11,2 kN

NOTES:

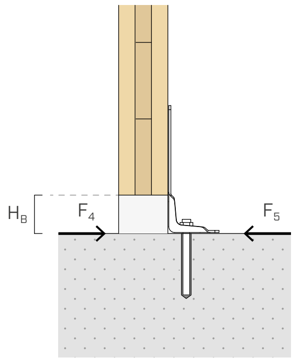
(1) If there are design requirements such as F_1 stresses of different amounts, or depending on the thickness of the floor slab, it is possible to use Ø11 and Ø13 VGS screws with HUS10 and HUS12 washers and Ø10 and Ø12 HBS PLATE screws of different lengths than those proposed in the table (see the "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

(2) The $R_{1,k,screw,ax}$ values can be consulted in the "Screws and connectors for timber" catalogue.

STRUCTURAL VALUES | SHEAR JOINT F_4-F_5 | TIMBER-TO-CONCRETE



$H_B = 0$



$0 < H_B \leq H_{Bmax}$

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

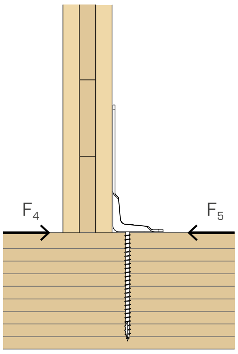
- In the case of $F_{5,Ed}$ stress, it is required to verify for the simultaneous shear action on the $F_{v,Ed}$ anchor and the additional extraction component $F_{ax,Ed}$:

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

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-concrete configuration.

STRUCTURAL VALUES | SHEAR JOINT F_4-F_5 | TIMBER-TO-TIMBER



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

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

- 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.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-22/0089. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments. The connection design strength values are obtained from the values on the table as follows:

  - timber-to-concrete installation

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

  - timber-to- timber installation

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

- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- For the calculation process a timber characteristic density ρ_k = 350 kg/m^3 has been considered. 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 hypotheses 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 1992-4, 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 "Screws and connectors for timber" catalogue.