

ANGLE BRACKET FOR TENSILE LOADS

NEW VERSION

The classic Rothoblaas hold-down in an optimised version. Reducing the number of fasteners and modifying steel thickness has led to more efficient fastening without sacrificing performance.

COMPLETE RANGE

Available in 5 sizes to meet all static or seismic performance requirements, for CLT, LVL or timber frame walls.

FREEDOM OF FASTENING

They can be fastened with LBA nails, LBS screws or LBS HARDWOOD in different lengths. Capacity design is made possible by the wide choice of fastenings and partial nailing.

TIMBER FRAME

The new NARROW PATTERN nailing allow installation on frame walls with reduced studs widths (60 mm).

SERVICE CLASS

SC1 SC2

MATERIAL

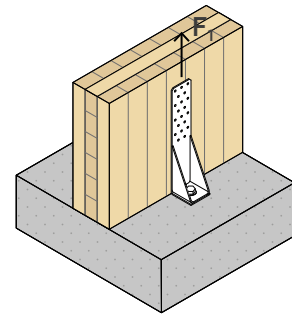
S355
Fe/Zn12c

WHT: S355 + Fe/Zn12c carbon steel

S275
Fe/Zn12c

WHT WASHER: S275 + Fe/Zn12c carbon steel

EXTERNAL LOADS

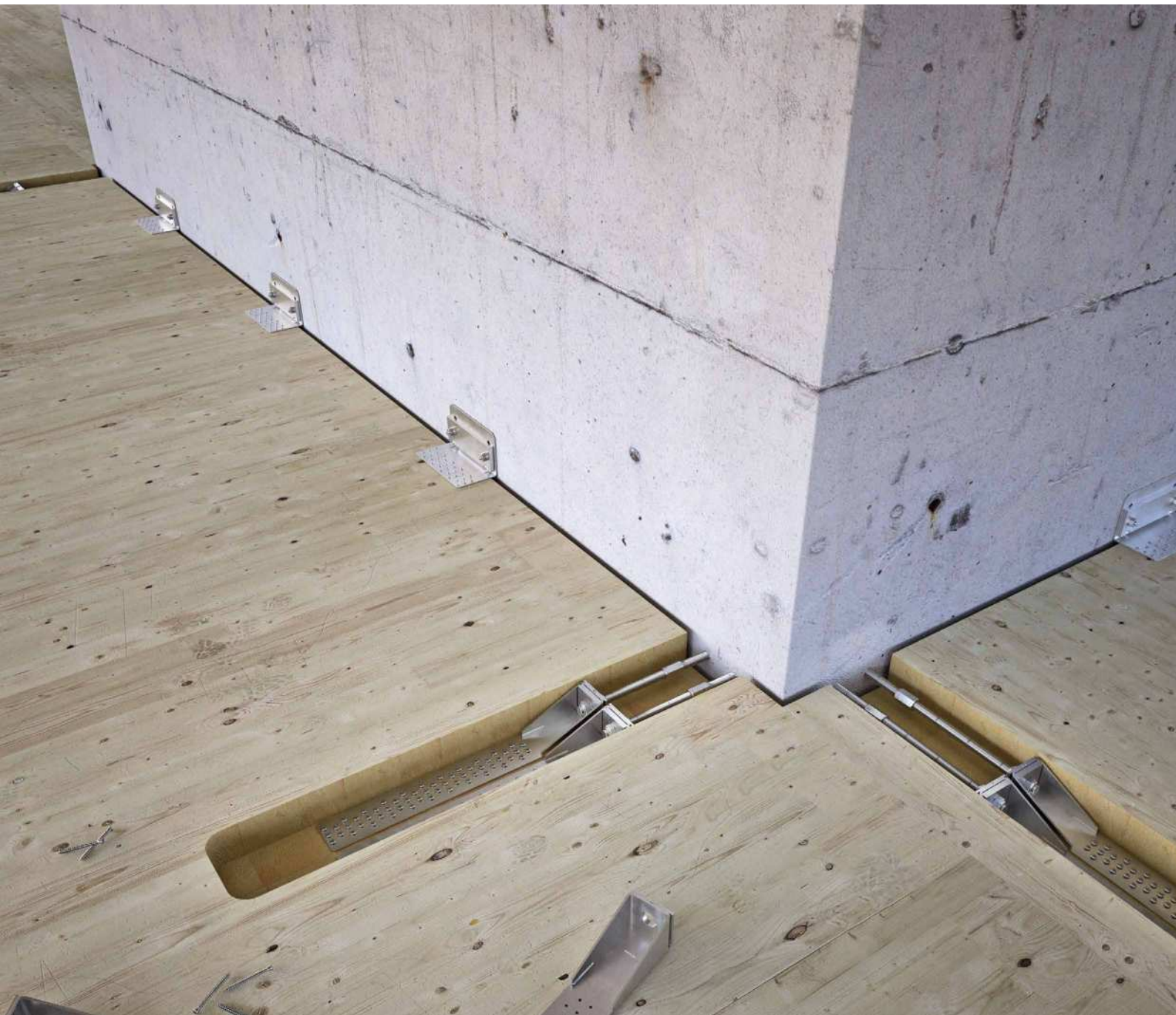


FIELDS OF USE

Tensile joints for timber walls.
Suitable for walls subject to high stress.
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



HYBRID STRUCTURES

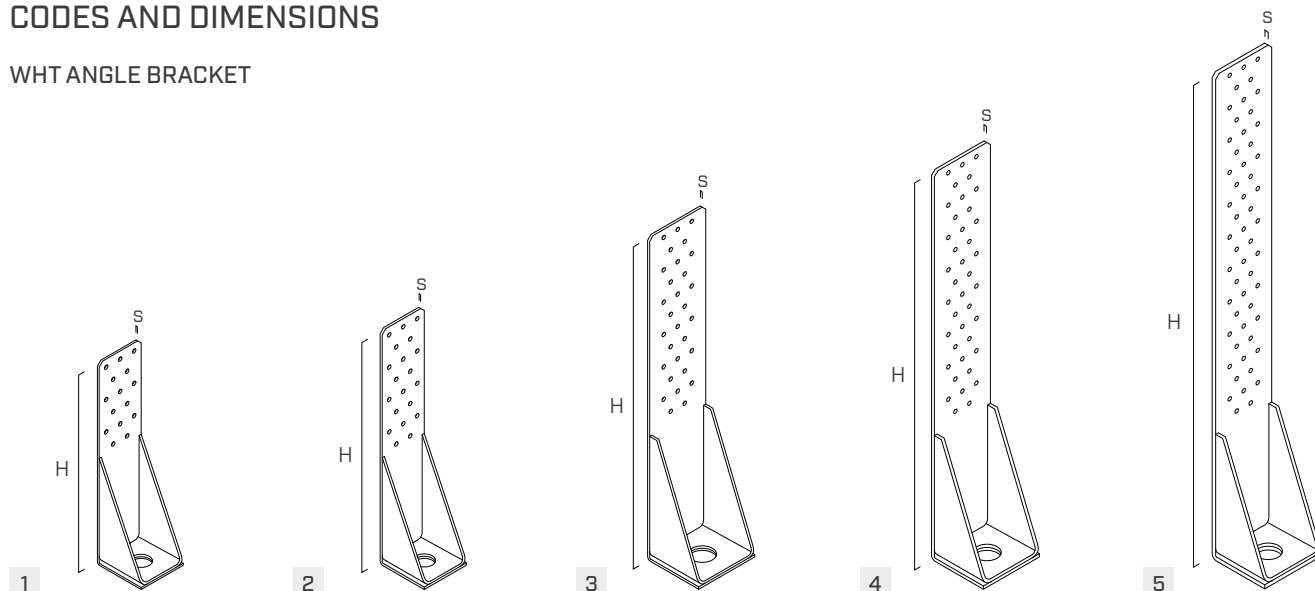
Ideal for tensile connections between timber floors and bracing core in hybrid timber-to-concrete buildings.

RAISED INSTALLATION

The certification with a gap between angle bracket and support allows special requirements such as reinforced concrete kerbs to be supported.

CODES AND DIMENSIONS

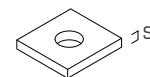
WHT ANGLE BRACKET



CODE	H [mm]	s [mm]	$n_v \text{ } \varnothing 5$ [pcs]	hole [mm]	H [in]	s [in]	$n_v \text{ } \varnothing .20$ [pcs]	hole [in]	pcs
1 WHT15	250	2,5	15	Ø23	10	0.10	15	Ø0.91	20
2 WHT20	290	3	20	Ø23	11 7/16	0.12	20	Ø0.91	20
3 WHT30	400	3	30	Ø29	15 3/4	0.12	30	Ø1.14	10
4 WHT40	480	4	40	Ø29	19	0.16	40	Ø1.14	10
5 WHT55	600	5	55	Ø29	23 5/8	0.20	55	Ø1.14	1

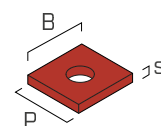
WHTW WASHER

CODE	hole [mm]	Ø [mm]	s [mm]	hole [in]	s [in]	WHT15	WHT20	WHT30	WHT40	WHT55	pcs
1 WHTW6016	Ø18	M16	6	Ø0.71	0.24	●	●	-	-	-	1
2 WHTW6020	Ø22	M20	6	Ø0.87	0.24	●	●	-	-	-	1
3 WHTW8020	Ø22	M20	10	Ø0.87	0.39	-	-	●	●	-	1
4 WHTW8024	Ø26	M24	10	Ø1.02	0.39	-	-	●	●	-	1
5 WHTW8024L	Ø26	M24	12	Ø1.02	0.47	-	-	-	-	●	1



ACOUSTIC PROFILE | XYLOFON WASHER

CODE		hole	P	B	s	hole	P	B	s	pcs
		[mm]	[mm]	[mm]	[mm]	[in]	[in]	[in]	[in]	
XYLW806060	WHT15	Ø23	60	60	6	Ø0.91	2 3/8	2 3/8	0.24	10
	WHT20									
XYLW808080	WHT30	Ø27	80	80	6	Ø1.06	3 1/8	3 1/8	0.24	10
	WHT40									
	WHT55									

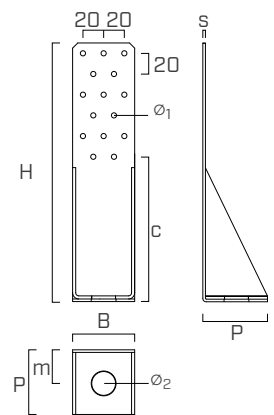


FASTENERS

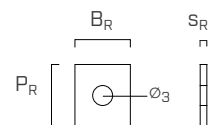
type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
LBS HARDWOOD	round head screw on hardwoods		5	
VIN-FIX	vinyl ester chemical anchor		M16-M20-M24	
HYB-FIX	hybrid chemical anchor		M16-M20-M24	
EPO-FIX	epoxy chemical anchor		M16-M20-M24	
KOS	hexagonal head bolt		M16-M20-M24	

GEOMETRY

WHT		WHT15	WHT20	WHT30	WHT40	WHT55
Height	H [mm]	250	290	400	480	600
Base	B [mm]	60	60	80	80	80
Depth	P [mm]	62,5	63	73	74	75
Vertical flange thickness	s [mm]	2,5	3	3	4	5
Hole position in timber	c [mm]	140	140	170	170	170
Hole position in concrete	m [mm]	32,5	33	38	39	40
Flange holes	Ø ₁ [mm]	5	5	5	5	5
Base hole	Ø ₂ [mm]	23	23	29	29	29



WHTW WASHER		WHTW6016	WHTW6020	WHTW8020	WHTW8024	WHTW8024L
Base	B _R [mm]	50	50	70	70	70
Depth	P _R [mm]	56	56	66	66	66
Thickness	s _R [mm]	6	6	10	10	12
Washer hole	Ø ₃ [mm]	18	22	22	26	26

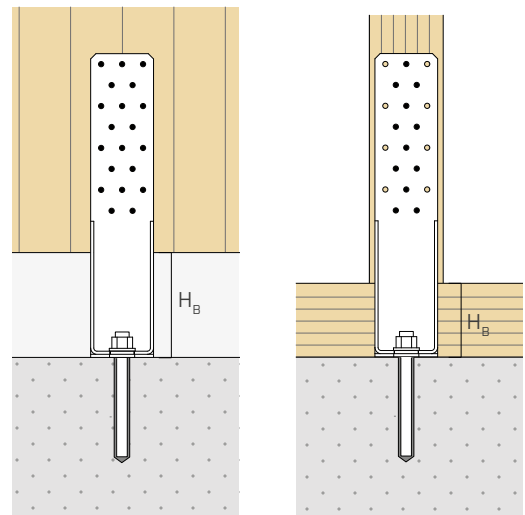


INSTALLATION

MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER

CODE	H _{B max} [mm]			
	CLT		C/GL	
	nails LBA Ø4	screws LBS Ø5	nails LBA Ø4	screws LBS Ø5
WHT15	100	110	80	65
WHT20	100	110	80	65
WHT30	130	140	110	95
WHT40	130	140	110	95
WHT55	130	140	110	95

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.

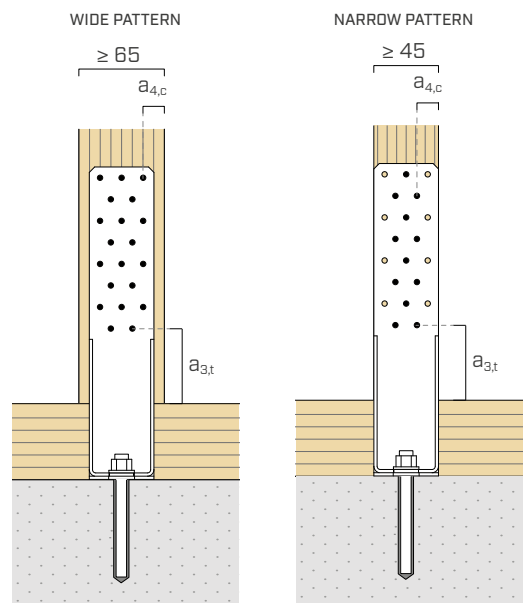


MINIMUM DISTANCES

TIMBER minimum distances		nails LBA Ø4	screws LBS Ø5
C/GL	a _{4,c} [mm]	≥ 12,5 ^(*)	≥ 12,5 ^(*)
	a _{3,t} [mm]	≥ 60	≥ 75
CLT	a _{4,c} [mm]	≥ 12	≥ 13
	a _{3,t} [mm]	≥ 40	≥ 30
LVL	a _{4,c} [mm]	≥ 12,5 ^(*)	≥ 12,5 ^(*)
	a _{3,t} [mm]	≥ 80	≥ 100

^(*) In case of installation on reduced-width studs (12.5 mm ≤ a_{4,c} < 5d) in C/GL or LVL, the resistance R_{1,k timber} must be calculated with reference to ETA-23/0813-Annex B.

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995:2014 according to ETA considering a timber density ρ_k ≤ 420 kg/m³.
- CLT minimum distances for Cross Laminated Timber according to ÖNORM EN 1995:2014 (Annex K) for nails and ETA-11/0030 for screws.
- LVL: minimum distances for LVL (edge face) in accordance with EN 1995:2014 and ETA-23/0813 considering a characteristic density of timber elements ρ_k ≤ 500 kg/m³.

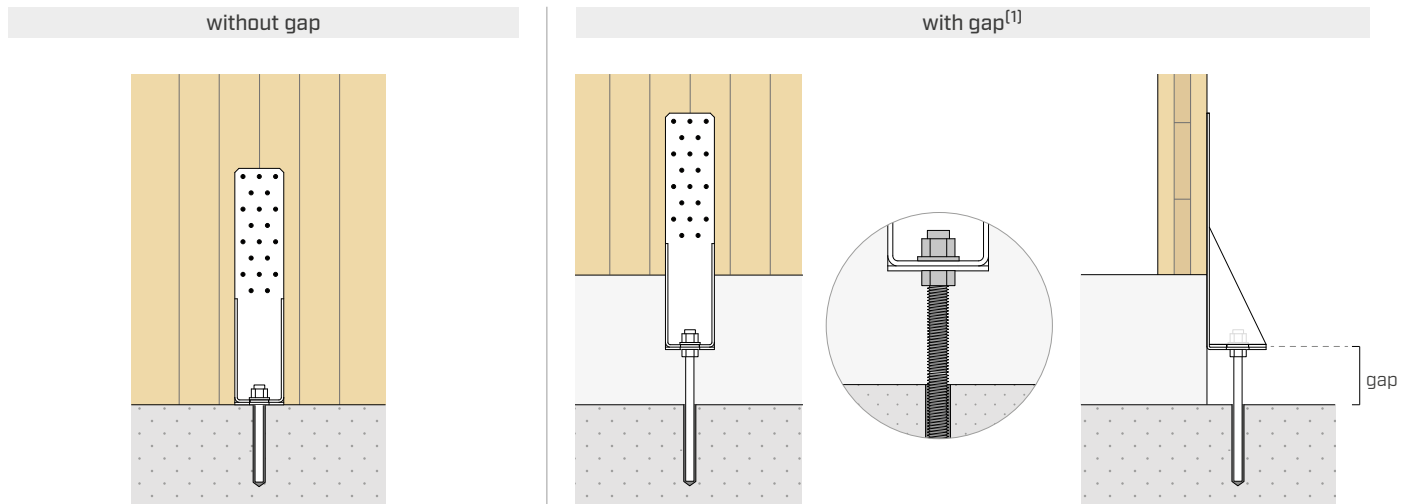


INSTALLATION

INSTALLATION WITH GAP

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 layer H_B (bedding grout, base plate or concrete kerb) greater than $H_{B \max}$ or to manage site tolerances such as the anchor hole being located away from the wall or studs.

In case of installation with gap, it is recommended to install a lock nut below the horizontal flange, to prevent that excessive tightening of the nut may stress the connection.

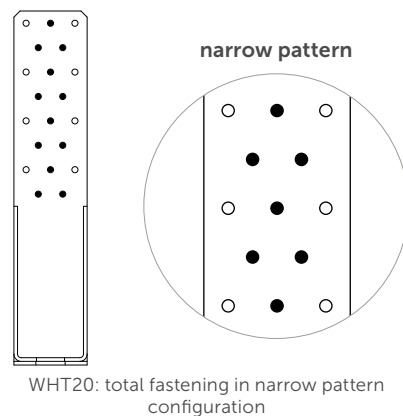
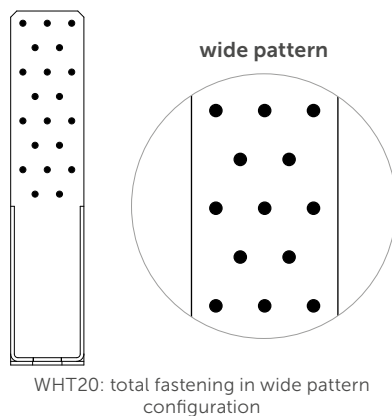


⁽¹⁾ The gap height does not affect the resistance $R_{1,k}$ of the angle bracket.

FASTENING PATTERNS

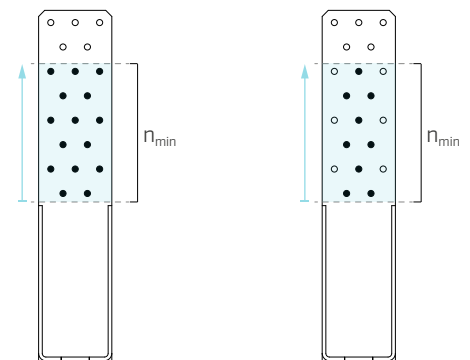
It is possible to install the angle bracket in two specific patterns:

- **wide pattern:** installation of connectors on all columns of the vertical flange;
- **narrow pattern:** installation with narrow nailing, leaving the outermost columns free.

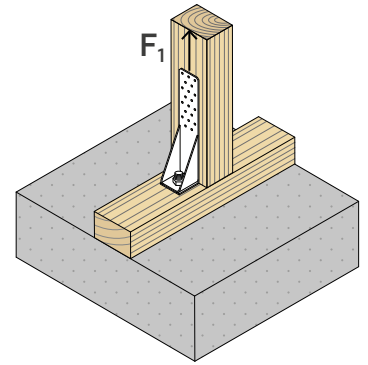
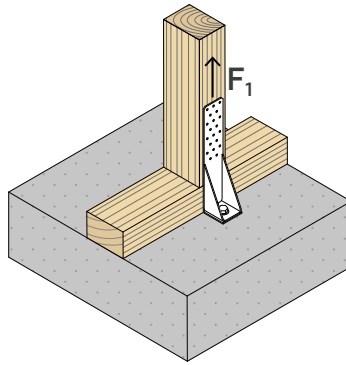
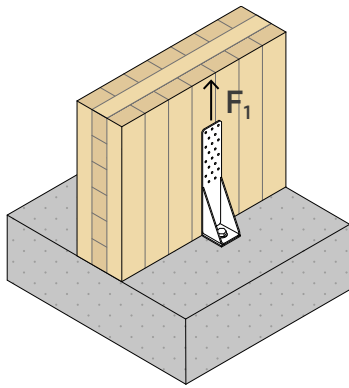


Full or partial fastening patterns can both be adopted. In the case of installation with partial fastening, the number of connectors can be varied, guaranteeing the minimum quantity $n_{\min}$ shown in the table below. The connectors must be installed starting from the bottom holes.

CODE	$n_{\min}$ [pcs.]	
	wide pattern	narrow pattern
WHT15	10	6
WHT20	15	9
WHT30	20	12
WHT40	25	15
WHT55	30	18



WHT20: partial fastening in wide pattern and narrow pattern respectively, with installation of the minimum number of connectors $n_{\min}$.



STRENGTH ON TIMBER SIDE | WIDE PATTERN | total fastening

CODE	TIMBER				STEEL				
	type	fastening holes Ø5 Ø x L [mm]	n_V [pcs]	$R_{1,k}$ timber [kN]	no washer $R_{1,k}$ steel [kN]	washer $R_{1,k}$ steel [kN]	γ_{steel}	no washer $K_{1,ser}$ [N/mm]	washer $K_{1,ser}$ [N/mm]
WHT15	LBA	Ø4 x 60	15	36,8	30,0	40,0	γ_{M0}	5000	5880
	LBS	Ø5 x 70		35,6					
	LBSH	Ø5 x 50		35,3					
WHT20	LBA	Ø4 x 60	20	48,1	40,0	50,0	γ_{M0}	6667	7980
	LBS	Ø5 x 70		48,3					
	LBSH	Ø5 x 50		47,9					
WHT30	LBA	Ø4 x 60	30	76,4	-	70,0	γ_{M0}	-	11667
	LBS	Ø5 x 70		73,7					
	LBSH	Ø5 x 50		73,1					
WHT40	LBA	Ø4 x 60	40	101,9	-	90,0	γ_{M0}	-	15000
	LBS	Ø5 x 70		96,5					
	LBSH	Ø5 x 50		95,8					
WHT55	LBA	Ø4 x 60	55	141,5	-	120,0	γ_{M0}	-	20000
	LBS	Ø5 x 70		132,1					
	LBSH	Ø5 x 50		131,0					

STRENGTH ON TIMBER SIDE | NARROW PATTERN | total fastening

CODE	TIMBER				STEEL			
	type	fastening holes Ø5 Ø x L [mm]	n_V [pcs]	$R_{1,k}$ timber [kN]	no washer $R_{1,k}$ steel [kN]	washer $R_{1,k}$ steel [kN]	γ_{steel}	$K_{1,ser}$ [N/mm]
WHT15	LBA	Ø4 x 60	9	22,6	30,0	-	γ_{M0}	3360
	LBS	Ø5 x 70		20,3				
	LBSH	Ø5 x 50		20,2				
WHT20	LBA	Ø4 x 60	12	28,3	40,0	-	γ_{M0}	4620
	LBS	Ø5 x 70		27,9				
	LBSH	Ø5 x 50		27,7				
WHT30	LBA	Ø4 x 60	18	45,3	-	70,0	γ_{M0}	7140
	LBS	Ø5 x 70		43,2				
	LBSH	Ø5 x 50		42,8				
WHT40	LBA	Ø4 x 60	24	59,4	-	90,0	γ_{M0}	9240
	LBS	Ø5 x 70		55,9				
	LBSH	Ø5 x 50		55,4				
WHT55	LBA	Ø4 x 60	33	84,9	-	120,0	γ_{M0}	13020
	LBS	Ø5 x 70		78,7				
	LBSH	Ø5 x 50		78,1				

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | F₁

STRENGTH ON TIMBER SIDE | PARTIAL FASTENING

For partial fastening patterns, the values of $R_{1,k \text{ timber}}$ are obtained by multiplying the characteristic strength of the individual connector $R_{v,k}$ by the relative n_{eq} shown in the table below, where n represents the total number of nails expected to be installed.

CODE	wide pattern n_{eq}		narrow pattern n_{eq}	
	LBA	LBS / LBSH	LBA	LBS / LBSH
WHT15	n-2	n-1	n-1	n-1
WHT20	n-3	n-1	n-2	n-1
WHT30	n-3	n-1	n-2	n-1
WHT40	n-4	n-2	n-3	n-2
WHT55	n-5	n-3	n-3	n-2

For of $R_{v,k}$ values of the connectors, refer to the catalogue "TIMBER SCREWS AND DECK FASTENING" at www.rothoblaas.com.

USE OF ALTERNATIVE FASTENINGS

It is possible to use nails or screws of a shorter length than those proposed.

In this case, the bearing capacity values $R_{1,k \text{ timber}}$ must be multiplied by a reductive factor k_F :

connector length [mm]	k_F		
	LBA Ø4	LBS Ø5	LBSH Ø5
40	0,74	0,79	0,83
50	0,91	0,89	1,00
60	1,00	0,94	1,08
70	-	1,00	1,14
75	1,13	-	-
100	1,30	-	-

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.

The values shown in the table have been determined taking into account the contribution of the coefficient $k_{t//}$ in the calculations.

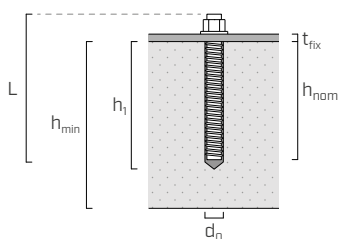
CODE	configuration on concrete	fastening holes Ø14		$R_{1,d \text{ concrete}}$	
		type	Ø x L [mm]	no gap [kN]	gap [kN]
WHT15 WHT20 no washer	uncracked	VIN-FIX 5.8	M16 x 195	34,0	37,1
			M16 x 245	44,7	48,8
			M20 x 245	55,9	61,0
	cracked	HYB-FIX 5.8	M16 x 195	45,1	49,2
			M16 x 245	59,3	64,6
	seismic	EPO-FIX 8.8	M20 x 245	40,3	44,0
WHT15 WHT20	uncracked	VIN-FIX 5.8	M16 x 245	42,6	46,5
			M20 x 245	53,2	58,0
	cracked	HYB-FIX 8.8	M16 x 195	43,7	47,6
			M16 x 245	47,6	51,9
	seismic	EPO-FIX 8.8	M20 x 245	38,3	41,8
			M20 x 330	55,7	60,7
WHT30 WHT40	uncracked	VIN-FIX 5.8	M20 x 245	53,2	58,0
			M20 x 330	73,3	79,9
			HYB-FIX 8.8	91,5	99,7
	cracked	HYB-FIX 5.8	M20 x 245	64,0	69,8
			VIN-FIX 5.8	89,6	97,7
			EPO-FIX 5.8	107,3	117,0
WHT55	uncracked	EPO-FIX 8.8	M24 x 330	64,6	70,4
			M24 x 495	103,4	112,7
	cracked	EPO-FIX 5.8	M24 x 330	153,2	167,0
			M24 x 495	107,3	117,0
	seismic	EPO-FIX 8.8	M24 x 330	143,4	156,3
			M24 x 495	64,6	70,4

ANCHORS INSTALLATION PARAMETERS

type of rod Ø x L [mm]		WHT type	type of washer	t _{fix} [mm]	h _{nom} =h _{ef} [mm]	h ₁ [mm]	d ₀ [mm]	h _{min} [mm]
M16	195	WHT15 / WHT20	WHTW6016	11	160	165	18	200
	245	WHT15 / WHT20	WHTW6016	11	200	205	18	250
M20	245	WHT15 / WHT20	WHTW6020	11	200	205	22	250
	330			11	290	295	22	350
	245	WHT30	WHTW8020	16	200	205	22	250
	330			16	280	285	22	350
	245	WHT40	WHTW8020	16	195	200	22	250
	330			16	275	280	22	350
M24	330	WHT30	WHTW8024	16	280	285	28	350
	330	WHT40 / WHT55	WHTW8024	18	275	280	28	350
	330	WHT55	WHTW8024	21	275	280	28	350
	495	WHT55	WHTW8024L	21	440	445	28	350

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_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchoring depth
h₁ minimum hole depth
d₀ hole diameter in the concrete support
h_{min} concrete minimum thickness

ANCHORS VERIFICATION FOR STRESS LOADING F₁

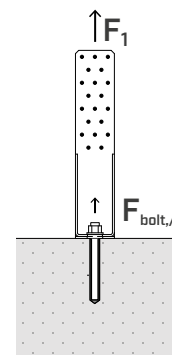
Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the k_{t//} coefficients. The axial load acting on the anchor can be obtained as follows:

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

k_{t//} coefficient of eccentricity

F_{1,d} axial load on the WHT 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} ≥ F_{bolt//,d}.



	INSTALLATION WITH GAP	INSTALLATION WITHOUT GAP
CODE	k _{t//}	k _{t//}
WHT15	1,00	1,09
WHT20	1,00	1,09
WHT30	1,00	1,09
WHT40	1,00	1,09
WHT55	1,00	1,09

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-23/0813.
- Design values can be obtained from values in the table as follows:

TOTAL FASTENING

$$R_d = \min \left\{ \frac{k_{t//} \cdot R_{k, \text{timber}} \cdot k_{mod}}{Y_M}, \frac{R_{k, \text{steel}}}{Y_{M0}}, \frac{R_{d, \text{concrete}}}{Y_{M0}} \right\}$$

PARTIAL FASTENING

$$R_d = \min \left\{ \frac{n_{eq} \cdot R_{k, \text{timber}} \cdot k_{mod}}{Y_M}, \frac{R_{k, \text{steel}}}{Y_{M0}}, \frac{R_{d, \text{concrete}}}{Y_{M0}} \right\}$$

The coefficients k_{mod}, Y_M and Y_{M0} should be taken according to the current regulations used for the calculation.

- The value of K_{1,ser} for fastenings other than those proposed can be calculated as follows:

$$K_{1,ser} = \min \left\{ \frac{n_{eq} \cdot R_{k, \text{timber}}}{6}, \frac{R_{k, \text{steel}}}{6} \right\}$$

- The calculation process used a timber characteristic density of ρ_k = 350 kg/m³ and a C25/30 concrete strength class with a thin reinforcing layer, where there is no spacing and edge-distance and minimum thickness indicated in the installation parameters tables 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.

- Concrete design strength values are supplied for uncracked (R_{1,d uncracked}), cracked (R_{1,d cracked}) concrete and in case of seismic verification (R_{1,d seismic}) for use of chemical anchor with threaded rod in steel class 5.8 and 8.8.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) and elastic design according to EN 1992:2018.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- 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.

INTELLECTUAL PROPERTY

- WHT hold-downs are protected by the following Registered Community Designs: RCD 015032190-0019 | RCD 015032190-0020 | RCD 015032190-0021 | RCD 015032190-0022 | RCD 015032190-0023.