WBR | WBO | WVS | WHO

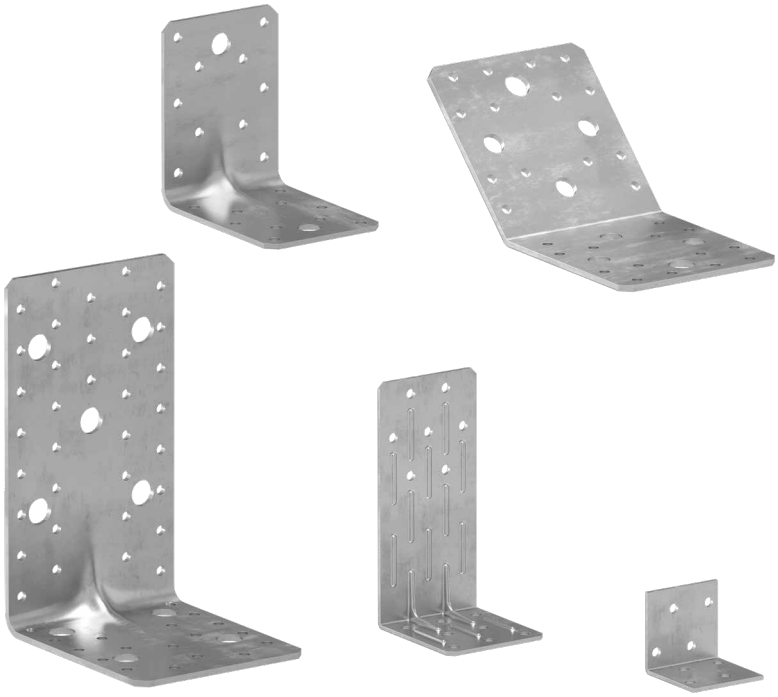
STANDARD ANGLE BRACKETS

CE
ETA

COMPLETE RANGE
Simple and effective angle brackets available in a full range of sizes to meet all structural and non-structural needs.

TIMBER AND CONCRETE
Due to the quantity and arrangement of the fastening holes, they can be used for both timber to timber, and timber to concrete connections.

CERTIFICATION
Suitability of use is guaranteed by the CE marking according to ETA.



SERVICE CLASS

SC1 SC2 — **WBR, WBO, WVS, WHO**

SC1 SC2 SC3 — **WBR A2**

MATERIAL

DX51D Z275 — **WBR**: DX51D + Z275 carbon steel

A2 AISI 304 — **WBR A2, WHO A2, LBV A2**: A2 AISI 304 stainless steel

S250 Z275 — **WBO - WVS - WHO**: S250GD +Z275 carbon steel

FIELD OF USE

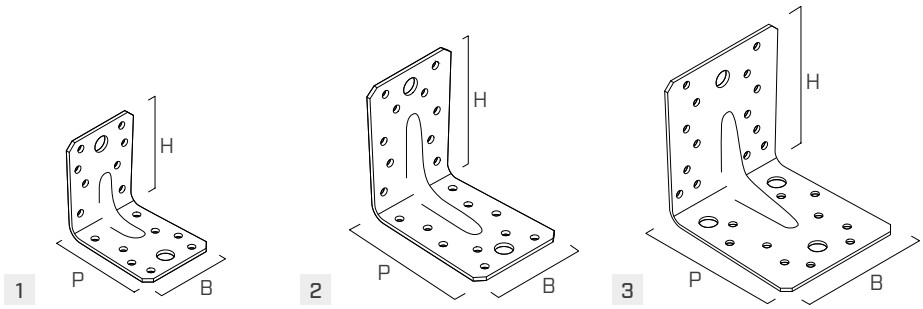
Structural or non-structural applications for fastening any timber element.
Suitable for small structures, furniture and small joinery connections.

Can be applied to:
- solid timber and glulam
- LVL
- other timber-based materials

CODES AND DIMENSIONS

WBR 70-90-100

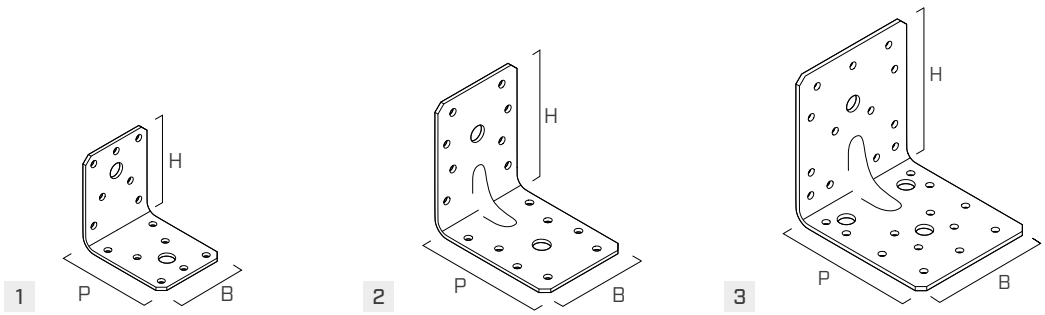
DX51D Z275



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n Ø11 [pcs]			pcs.
1	**WBR07015**	55	70	70	1,5	16	2	●	●	100
2	**WBR09015**	65	90	90	1,5	20	2	●	●	100
3	**WBR10020**	90	105	105	2,0	24	4	●	●	50

WBR A2 70-90-100

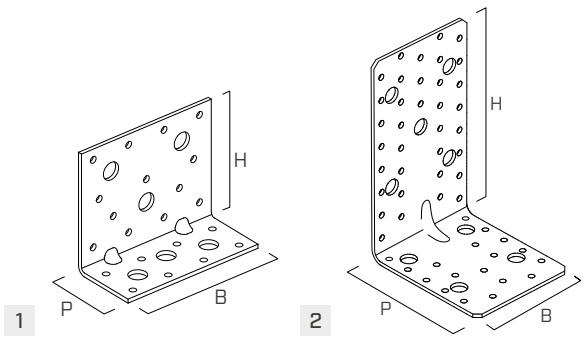
A2 AISI 304



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n Ø11 [pcs]			pcs.
1	**AI7055**	55	70	70	2,0	14	2	●	●	100
2	**AI9065**	65	90	90	2,5	16	2	●	●	100
3	**AI10090**	90	105	105	2,5	26	4	●	●	50

WBR 90110-170

DX51D Z275

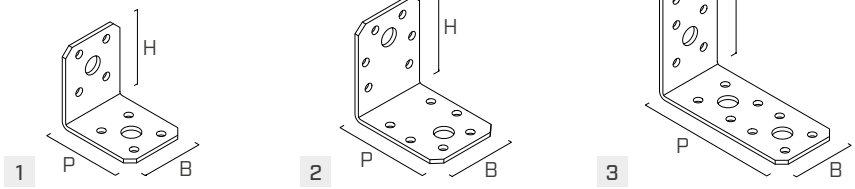


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n Ø13 [pcs]			pcs.
1	**WBR90110**	110	50	90	3,0	21	6	●	●	50
2	**WBR170**	95	114	174	3,0	53	9	●	●	25

CODES AND DIMENSIONS

WBO 50 - 60 - 90

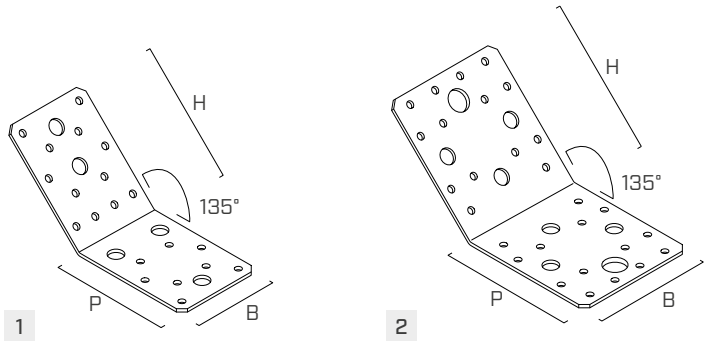
S250 Z275



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n Ø11 [pcs]			pcs.
1	**WBO5040**	40	50	50	2,5	8	2	●	●	150
2	**WBO6045**	45	60	60	2,5	12	2	●	●	50
3	**WBO9040**	40	90	90	3,0	16	4	●	●	100

WBO 135°

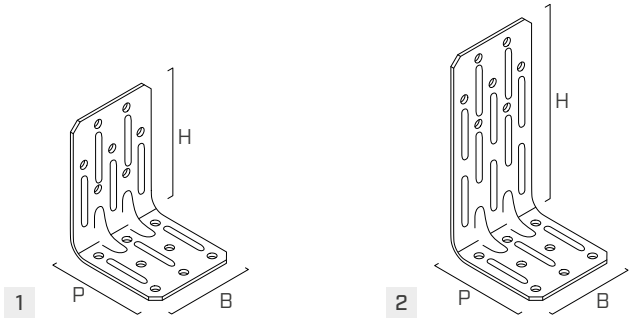
S250 Z275



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n Ø11 [pcs]	n Ø13 [pcs]			pcs.
1	**WBO13509**	65	90	90	2,5	20	5	-	●	●	100
2	**WBO13510**	90	100	100	3,0	28	6	2	●	●	40

WVS 80 - 120

S250 Z275

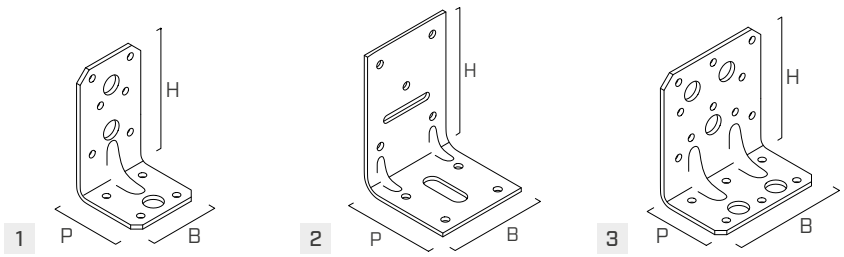


	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]			pcs.
1	**WVS8060**	55	60	80	2,0	15	●	-	100
2	**WVS12060**	55	60	120	2,0	15	●	-	100

CODES AND DIMENSIONS

WVS 90

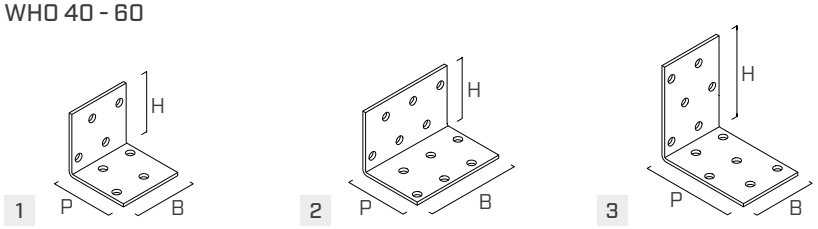
S250 Z275



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n Ø13 [pcs]	n $Ø_V$ [pcs]	n $Ø_H$ [pcs]			pcs.
1	**WVS9050**	50	50	90	3,0	10	3	-	-	●	●	100
2	**WVS9060**	60	60	90	2,5	9	-	1 - Ø5 x 30	1 - Ø10 x 30	●	-	100
3	**WVS9080**	80	50	90	3,0	16	5	-	-	●	●	100

WHO 40 - 60

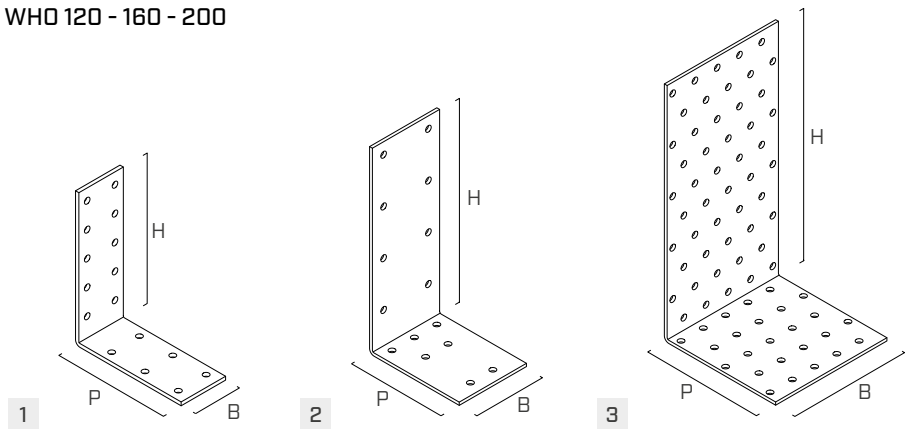
S250 Z275



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n_V Ø5 [pcs]	n_H Ø5 [pcs]			pcs.
1	**WHO4040**	40	40	40	2,0	8	4	4	●	-	200
2	**WHO4060**	60	40	40	2,0	12	6	6	●	-	150
3	**WHO6040**	40	60	60	2,0	12	6	6	●	-	150

WHO 120 - 160 - 200

S250 Z275



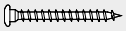
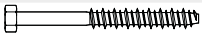
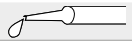
	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø5 [pcs]	n_V Ø5 [pcs]	n_H Ø5 [pcs]			pcs.
1	**WHO12040**	40	95	120	3,0	16	10	6	●	-	100
2	**WHO16060**	60	80	160	4,0	15	8	7	●	-	50
3	**WHO200100**	100	100	200	2,5	75	50	25	●	-	25

WHO A2 | AISI304 - LBV A2 | AISI304

A2 AISI 304

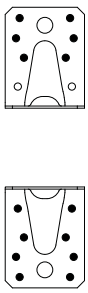
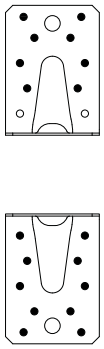
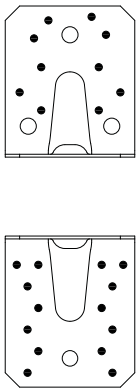
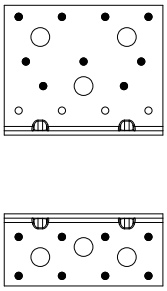
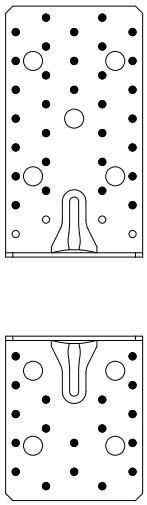
	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n Ø4,5 [pcs]	pcs.
1	**WHOI1540**	15	40	40	1,75	4	50
2	**LBVI15100**	15	100	-	1,75	4	50

ADDITIONAL PRODUCTS - FASTENING

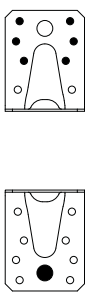
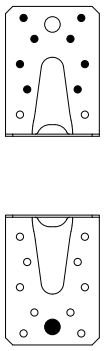
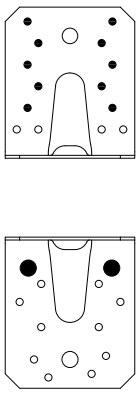
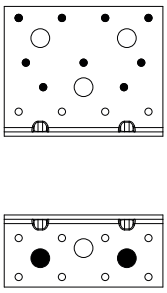
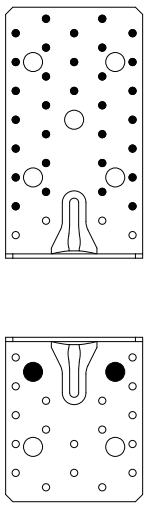
type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
SKR	screw-in anchor		10-12	
VIN-FIX	vinyl ester chemical anchor		M10 - M12	

FASTENING PATTERNS

TIMBER-TO-TIMBER

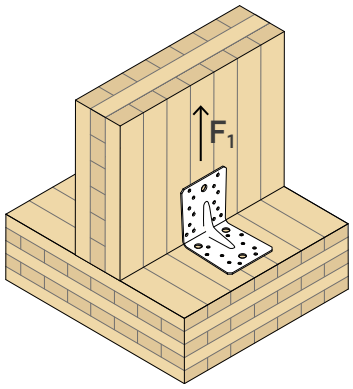
WBR07015	WBR09015	WBR10020	WBR90110	WBR170
				
pattern 1	**pattern 1**	**pattern 1**	**pattern 1**	**pattern 1**

TIMBER-TO-CONCRETE

WBR07015	WBR09015	WBR10020	WBR90110	WBR170
				
pattern 2	**pattern 2**	**pattern 2**	**pattern 2**	**pattern 2**

STRUCTURAL VALUES | TIMBER-TO-TIMBER | F_1

WBR07015 | WBR09015 | WBR10020 | WBR90110 | WBR170

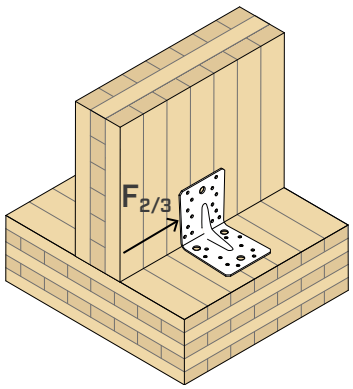


TIMBER STRENGTH

CODE	configuration on timber	fastening holes Ø5				$R_{1,k\ timber}$	$R_{1,k\ steel}$
		type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	[kN]	[kN]
WBR07015	**pattern 1**	LBA	Ø4 x 60	6	8	**2,0**	-
		LBS	Ø5 x 60			**5,0**	-
WBR09015	**pattern 1**	LBA	Ø4 x 60	8	10	**2,1**	-
		LBS	Ø5 x 60			**5,4**	-
WBR10020	**pattern 1**	LBA	Ø4 x 60	10	14	**4,1**	-
		LBS	Ø5 x 60			**11,0**	-
WBR90110	**pattern 1**	LBA	Ø4 x 60	9	8	**2,5**	**3,4**
WBR170	**pattern 1**	LBA	Ø4 x 60	31	18	**1,7**	**3,7**

STRUCTURAL VALUES | TIMBER-TO-TIMBER | $F_{2/3}$

WBR07015 | WBR09015 | WBR10020 | WBR90110 | WBR170



TIMBER STRENGTH

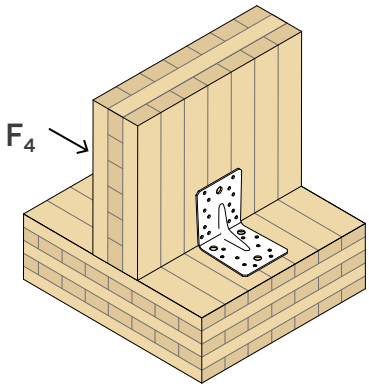
CODE	configuration on timber	fastening holes Ø5				$R_{2/3,k\ timber}$
		type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	[kN]
WBR07015	**pattern 1**	LBA	Ø4 x 60	6	8	**5,6**
		LBS	Ø5 x 60			**5,9**
WBR09015	**pattern 1**	LBA	Ø4 x 60	8	10	**6,8**
		LBS	Ø5 x 60			**7,1**
WBR10020	**pattern 1**	LBA	Ø4 x 60	10	14	**9,3**
		LBS	Ø5 x 60			**10,1**
WBR90110	**pattern 1**	LBA	Ø4 x 60	9	8	**7,1**
WBR170	**pattern 1**	LBA	Ø4 x 60	31	18	**11,0**

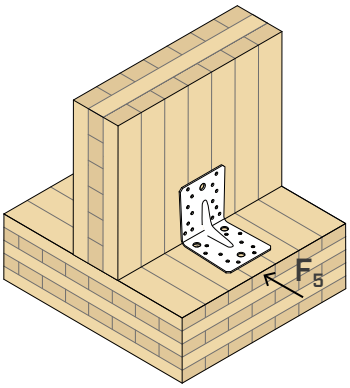
GENERAL PRINCIPLES

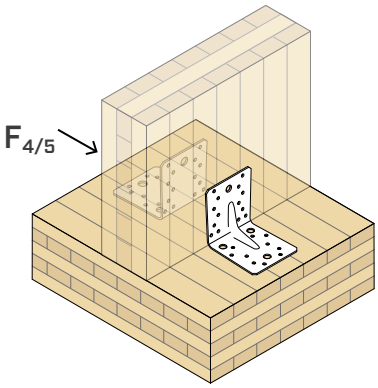
For the GENERAL PRINCIPLES of calculation, see page 11.

STRUCTURAL VALUES | TIMBER-TO-TIMBER | F_4 | $F_{4/5}$

WBR07015 | WBR09015 | WBR10020







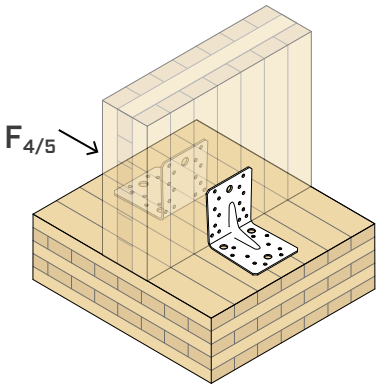
TIMBER STRENGTH

CODE	configuration on timber	fastening holes Ø5				$R_{4,k\ timber}$	$R_{5,k\ steel}$	$R_{4/5,k\ timber}$ (*)
		type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	[kN]	[kN]	[kN]
WBR07015	**pattern 1**	LBA LBS	Ø4 x 60 Ø5 x 60	6	8	**6,3** **6,3**	**1,1** **1,1**	**7,4** **7,4**
WBR09015	**pattern 1**	LBA LBS	Ø4 x 60 Ø5 x 60	8	10	**6,6** **6,6**	**1,2** **1,2**	**7,7** **7,7**
WBR10020	**pattern 1**	LBA LBS	Ø4 x 60 Ø5 x 60	10	14	**11,1** **11,1**	**2,2** **2,2**	**13,3** **13,3**

(*) 2 angle brackets per joint.

STRUCTURAL VALUES | TIMBER-TO-TIMBER | $F_{4/5}$

WBR90110 | WBR170



TIMBER STRENGTH

CODE	configuration on timber	fastening holes Ø5				$R_{4/5,k}$ (*)	
		type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	$R_{4/5,k\ timber}$ [kN]	$R_{4/5,k\ steel}$ [kN]
WBR90110	**pattern 1**	LBA	Ø4 x 60	9	8	**10,4**	**10,9**
WBR170	**pattern 1**	LBA	Ø4 x 60	31	18	**12,4**	**9,2**

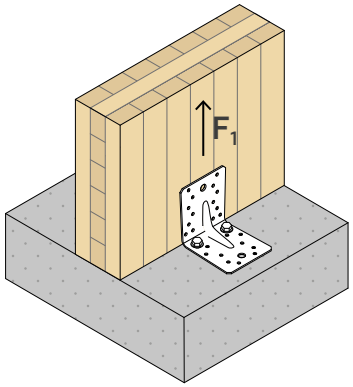
(*) 2 angle brackets per joint.

NOTES

- The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | F_1

WBR10020



TIMBER STRENGTH

CODE	TIMBER				STEEL
	fastening holes Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$
	type	Ø x L [mm]	n_V [pcs]	[kN]	[kN]
WBR10020	LBA	Ø4 x 60	10	**26,6**	**8,6**
	LBS	Ø5 x 60		**24,1**	**8,6**

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	fastening holes Ø11			$R_{1,d\ concrete}$	$k_{t//}$
	type	Ø x L [mm]	n_H [pcs]	[kN]	
uncracked	VIN-FIX 5.8	M10 x 140	2	**21,2**	1,15
	SKR	M10 x 80		**11,7**	
cracked	VIN-FIX 5.8	M10 x 140		**11,8**	
	SKR	M10 x 80		**8,0**	

CHEMICAL ANCHORS INSTALLATION PARAMETERS

anchor type		d_0	h_{ef}	h_{nom}	h_1	h_{min}
	Ø x L	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M10 x 140	12	115	115	120	200
SKR	M10 x 80	8	56	70	85	150

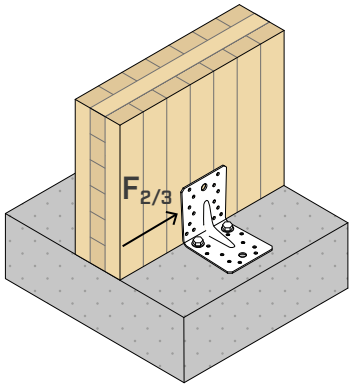
INA precut threaded rod complete with nut and washer: see INA data sheet at www.rothoblaas.com

GENERAL PRINCIPLES

For the GENERAL PRINCIPLES of calculation, see page 11.

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_{2/3}$

WBR10020



TIMBER STRENGTH

CODE	type	fastening holes Ø5 Ø x L [mm]	n_V [pcs]	$R_{2/3,k\ timber}$ [kN]
WBR10020	LBA	Ø4 x 60	10	**8,6**
	LBS	Ø5 x 60		**7,8**

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	type	fastening holes Ø11 Ø x L [mm]	n_H [pcs]	$R_{2/3,d\ concrete}$ [kN]	e_y [mm]
uncracked	VIN-FIX 5.8	M10 x 140	2	**27,1**	21,5
	SKR	M10 x 80		**16,1**	
cracked	VIN-FIX 5.8	M10 x 140		**27,1**	
	SKR	M10 x 80		**11,2**	

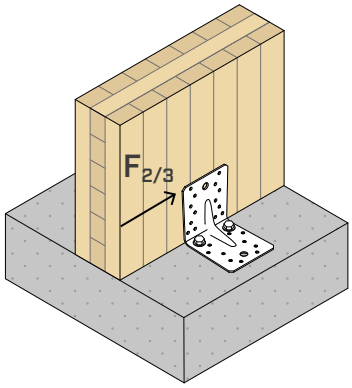
CHEMICAL ANCHORS INSTALLATION PARAMETERS

anchor type	Ø x L	d_0 [mm]	h_{ef} [mm]	h_{nom} [mm]	h_1 [mm]	h_{min} [mm]
VIN-FIX 5.8	M10 x 140	12	115	115	120	200
SKR	M10 x 80	8	56	70	85	150

INA precut threaded rod complete with nut and washer: see INA data sheet at www.rothoblaas.com

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_{2/3}$

WBR90110 | WBR170



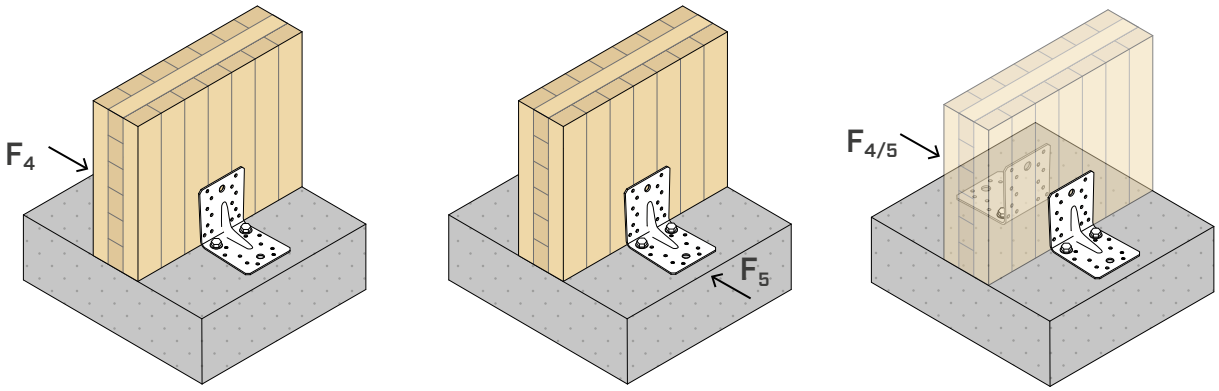
TIMBER STRENGTH

CODE	configuration on timber	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	fastening holes Ø11 n_H [pcs]	$R_{2/3,k}$ $R_{2/3,k\ timber}$ [kN]	$R_{2/3,k}$ $Bolt_{2/3}$ [1] [kN]
WBR90110	**pattern 2**	LBA	Ø4 x 60	9	2	**7,1**	**0,71**
WBR170	**pattern 2**	LBA	Ø4 x 60	31	2	**11,0**	**0,65**

[1] Timber-to-concrete characteristic values are calculated by distributing part of the moment given by eccentricity on the nails. Other static diagrams can be calculated by the designer.

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | F_4 | F_5 | $F_{4/5}$

WBR07015 | WBR09015 | WBR10020



TIMBER STRENGTH

CODE	configuration on timber	fastening holes Ø5			$R_{4,k\ timber}$	$R_{5,k\ steel}$	$R_{4/5,k\ timber}$ (*)
		type	Ø x L [mm]	n_V [pcs]	[kN]	[kN]	[kN]
WBR07015	**pattern 2**	LBA	Ø4 x 60	6	**6,3**	**1,1**	**7,4**
		LBS	Ø5 x 60		**6,3**	**1,1**	**7,4**
WBR09015	**pattern 2**	LBA	Ø4 x 60	8	**6,6**	**1,2**	**7,7**
		LBS	Ø5 x 60		**6,6**	**1,2**	**7,7**
WBR10020	**pattern 2**	LBA	Ø4 x 60	10	**11,1**	**2,2**	**13,3**
		LBS	Ø5 x 60		**11,1**	**2,2**	**13,3**

The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

(*) 2 angle brackets per joint.

GENERAL PRINCIPLES

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA. 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:

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

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

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

  - for nails

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2,83\ kN} ; \frac{F_{ax,short,Rk}}{1,39\ kN} \right\}$$

  - for screws

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2,41\ kN} ; \frac{F_{ax,short,Rk}}{3,28\ kN} \right\}$$

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

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

- 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 process used a timber characteristic density of ρ_k = 350 kg/m^3 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.
- 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).
- 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;
  - SKR screw-in anchor according to ETA-24/0024.