TITAN N

ETA 11/0496

ANGLE BRACKET FOR SHEAR AND TENSILE FORCES

HIGH HOLES
Ideal for CLT, it is easy to install thanks to the raised holes. Values also certified with partial fastening for presence of bedding mortar or root beam.

80 kN SHEAR
Exceptional shear strengths. Up to 82,6 kN on concrete (with TCW washer). Up to 46,7 kN on timber.

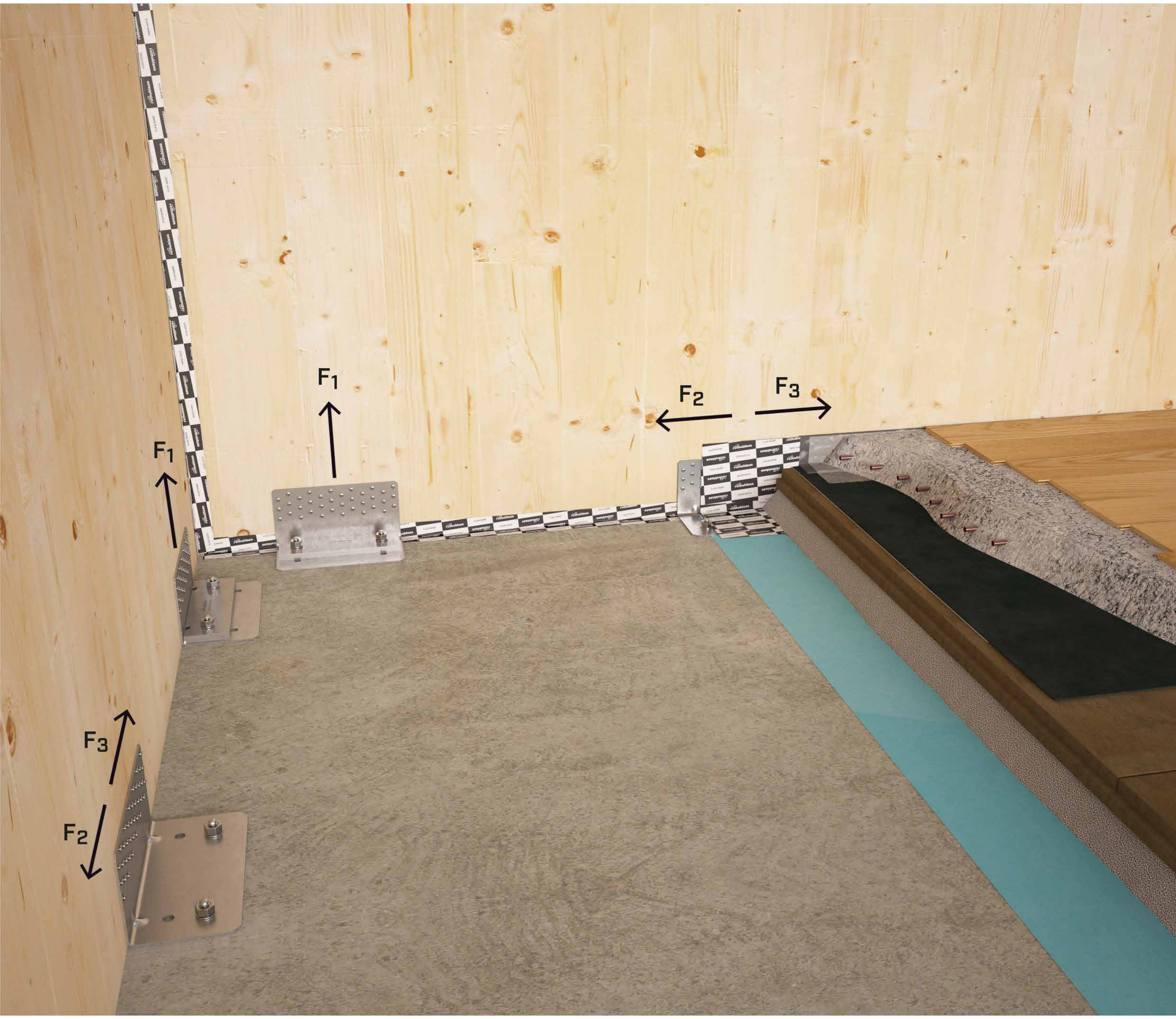
70 kN TENSILE
On concrete, TCN angle brackets with TCW washers provide excellent tensile strength. $R_{1,k}$ up to 69,8 kN characteristic values.

CHARACTERISTICS

FOCUS	shear and tensile joints
HEIGHT	120 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, VIN-FIX, HYB-FIX, SKR, AB1

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Shear and tensile joints for timber-to-concrete and timber-to-timber applications
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels



CONCEALED HOLD DOWN

Ideal on timber-to-concrete both as a hold down at the ends of the walls and as shear angle bracket along the walls. It can be integrated into the floor panels.

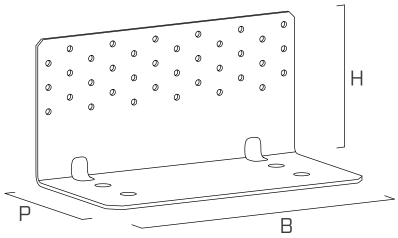
ALL DIRECTIONS

Certified shear ($F_{2,3}$), tensile (F_1) and tilting ($F_{4,5}$) strengths. Values certified also for partial fastenings and with interposed acoustic profiles.

CODES AND DIMENSIONS

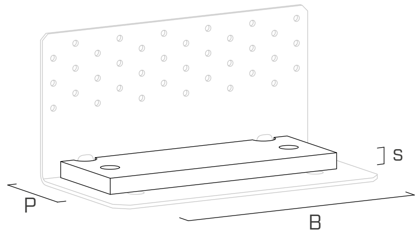
TITAN N - TCN | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm]	P [mm]	H [mm]	holes [mm]	n_V Ø5 [pcs]	s [mm]		pcs
TCN200	200	103	120	Ø13	30	3	●	10
TCN240	240	123	120	Ø17	36	3	●	10



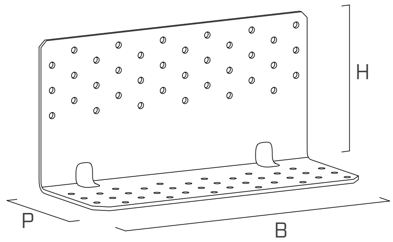
TITAN WASHER - TCW | CONCRETE-TO-TIMBER JOINTS

CODE	TCN200	TCN240	B [mm]	P [mm]	s [mm]	holes [mm]		pcs
TCW200	●	-	190	72	12	Ø14	●	1
TCW240	-	●	230	73	12	Ø18	●	1



TITAN N - TTN | TIMBER-TO-TIMBER JOINTS

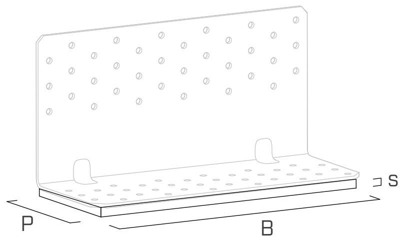
CODE	B [mm]	P [mm]	H [mm]	n_H Ø5 [mm]	n_V Ø5 [mm]	s [mm]		pcs
TTN240	240	93	120	36	36	3	●	10



ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

CODE	type	B	P [mm]	s [mm]		pcs
XYL35120240	xylofon plate	240 mm	120	6	●	10
ALADIN95	soft	50 m(*)	95	5	●	10
ALADIN115	extra soft	50 m(*)	115	7	●	10

(*) To be cut on site



MATERIAL AND DURABILITY

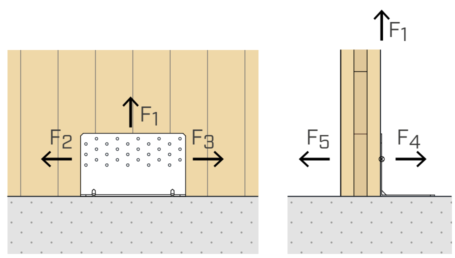
TITAN N: carbon steel DX51D+Z275.
TITAN WASHER: S235 bright zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON PLATE: 35-shore polyurethane compound.
ALADIN STRIPE: compact EPDM.

FIELD OF USE

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

EXTERNAL LOADS



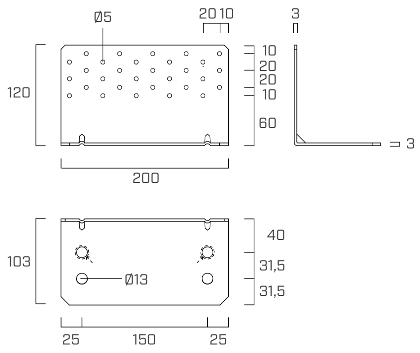
ADDITIONAL PRODUCTS - FASTENING

type	description		d [mm]	support
LBA	Anker nail		4	
LBS	screw for plates		5	
AB1	mechanical anchor		12 - 16	
SKR	screw anchor		12 - 16	
VIN-FIX(*)	chemical anchor		M12 - M16	
HYB-FIX	chemical anchor		M12 - M16	

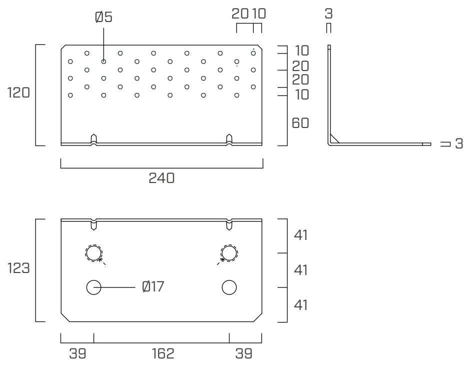
(*) For more information, see the data sheet available at www.rothoblaas.com

GEOMETRY

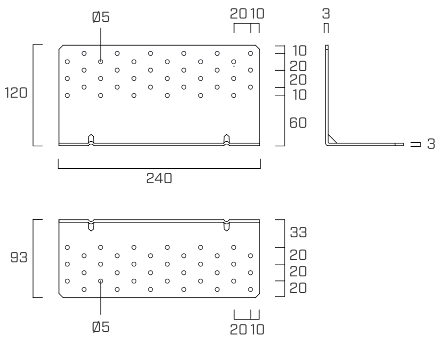
TCN200



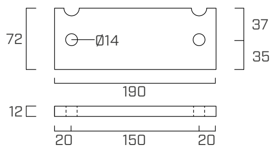
TCN240



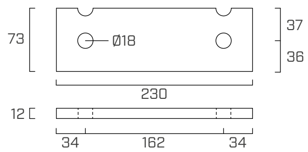
TTN240



TCW200



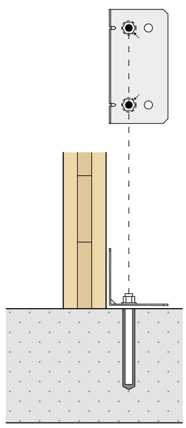
TCW240



INSTALLATION ON CONCRETE

To fix **TITAN TCN** angle bracket to the concrete foundation, **2 anchors** must be used, according to one of the following installation configurations, according to the acting stress.

IDEAL INSTALLATION

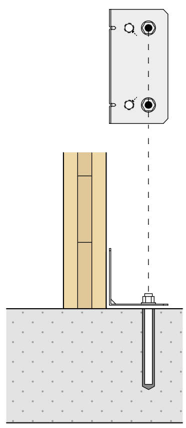


2 anchors positioned in the INTERNAL HOLES (**IN**) (identified by a mark on the product)

Reduced stress on the anchor (minimum e_y and k_t eccentricity)

Optimized connection strength

ALTERNATIVE INSTALLATION

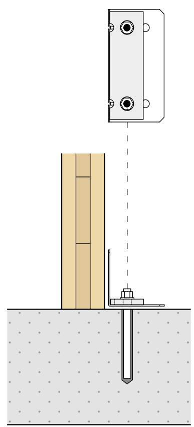


2 anchors placed in the EXTERNAL HOLES (**OUT**) (e.g. interaction between the anchor and the concrete support reinforcement)

Maximum stress on the anchor (maximum e_y and k_t eccentricity)

Reduced connection strength

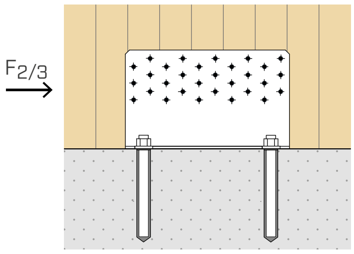
INSTALLATION WITH WASHER



The WASHER TCW must be fastened by means of 2 anchors positioned in the INTERNAL HOLES (**IN**)

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

TCN200



TIMBER STRENGTH

configuration on timber [1]	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø13		IN[2]	OUT[3]
	type	Ø x L [mm]	n_V [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{y,OUT}$ [mm]
• full pattern	LBA nails	Ø4,0 x 60	30	**22,1**	M12	2	**38,5**	**70,0**
	screws LBS	Ø5,0 x 50		**26,5**				
• pattern 4	LBA nails	Ø4,0 x 60	25	**17,4**				
	screws LBS	Ø5,0 x 50		**20,4**				
• pattern 3	LBA nails	Ø4,0 x 60	20	**13,7**				
	screws LBS	Ø5,0 x 50		**16,0**				
• pattern 2	LBA nails	Ø4,0 x 60	15	**9,6**				
	screws LBS	Ø5,0 x 50		**11,2**				
• pattern 1	LBA nails	Ø4,0 x 60	10	**6,4**				
	screws LBS	Ø5,0 x 50		**7,5**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$	
	type	Ø x L [mm]	IN[2] [kN]	OUT[3] [kN]
• uncracked	VIN-FIX 5.8	M12 x 140	**35,5**	**29,1**
	VIN-FIX 8.8	M12 x 140	**48,1**	**39,1**
	SKR-CE	12 x 90	**38,3**	**31,3**
	AB1	M12 x 100	**35,4**	**28,9**
• cracked	VIN-FIX 5.8	M12 x 140	**35,2**	**29,1**
	VIN-FIX 8.8	M12 x 140	**39,8**	**32,6**
	SKR-CE	12 x 90	**34,6**	**28,4**
	AB1	M12 x 100	**35,4**	**28,9**
• seismic	HYB-FIX 8.8	M12 x 195	**29,0**	**23,8**
	SKR-CE	12 x 90	**8,8**	**7,2**
	AB1	M12 x 100	**10,6**	**8,7**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN200	VIN-FIX 5.8 / 8.8	M12 x 140	3	121	121	130	14	**200**
	HYB-FIX 8.8	M12 x 195	3	176	176	185	14	**210**
	SKR-CE	12 x 90	3	64	87	110	10	**200**
	AB1	M12 x 100	3	70	80	85	12	

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

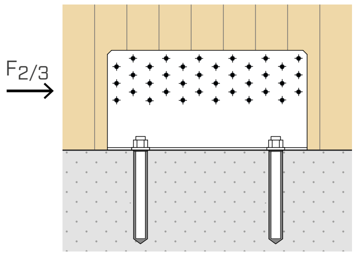
t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

NOTES:

(1) Partial fastening pattern on page 7.
(2) Installation of the anchors in the two internal holes (IN).
(3) Installation of the anchors in external holes (OUT).

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

TCN240



TIMBER STRENGTH

configuration on timber [(1)]	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø17		IN[(2)]	OUT[(3)]
	type	Ø x L [mm]	n_V [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{y,OUT}$ [mm]
• full pattern	LBA nails	Ø4,0 x 60	36	**30,3**	M16	2	**39,5**	**80,5**
	screws LBS	Ø5,0 x 50		**36,3**				
• pattern 4	LBA nails	Ø4,0 x 60	30	**24,0**				
	screws LBS	Ø5,0 x 50		**28,2**				
• pattern 3	LBA nails	Ø4,0 x 60	24	**18,8**				
	screws LBS	Ø5,0 x 50		**22,1**				
• pattern 2	LBA nails	Ø4,0 x 60	18	**13,3**				
	screws LBS	Ø5,0 x 50		**15,6**				
• pattern 1	LBA nails	Ø4,0 x 60	12	**8,9**				
	screws LBS	Ø5,0 x 50		**10,4**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø17		$R_{2/3,d\ concrete}$	
	type	Ø x L [mm]	IN[(2)] [kN]	OUT[(3)] [kN]
• uncracked	VIN-FIX 5.8	M16 x 160	**67,2**	**52,9**
	VIN-FIX 8.8	M16 x 160	**90,1**	**70,9**
	SKR-CE	16 x 130	**67,4**	**53,1**
	AB1	M16 x 145	**67,4**	**53,1**
• cracked	VIN-FIX 5.8 / 8.8	M16 x 160	**55,0**	**43,2**
	SKR-CE	16 x 130	**55,0**	**43,2**
	AB1	M16 x 145	**55,0**	**43,2**
• seismic	HYB-FIX 8.8	M16 x 195	**35,2**	**27,7**
	SKR-CE	16 x 130	**19,9**	**15,8**
	AB1	M16 x 145	**19,9**	**15,8**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN240	VIN-FIX 5.8 / 8.8	M16 x 160	3	134	134	140	18	**200**
	HYB-FIX 8.8	M16 x 195	3	164	164	170	18	
	SKR-CE	16 x 130	3	85	127	150	14	
	AB1	M16 x 145	3	85	97	105	16	

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

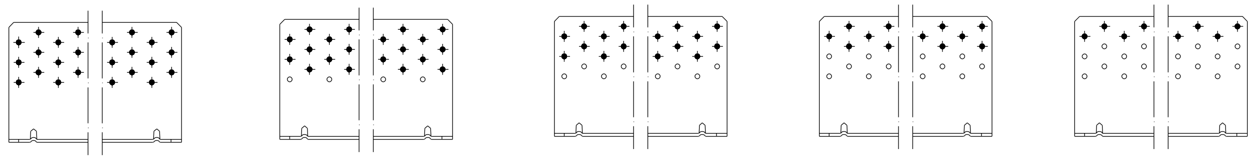
t_{fix} fastened plate thickness
h_{nom} nominal anchoring depth
h_{ef} effective anchor depth
h_1 minimum hole depth
d_0 hole diameter in the concrete support
h_{min} concrete minimum thickness

GENERAL PRINCIPLES:

For the general principles of calculation, see page 17.

TCN200 - TCN240 | PARTIAL FASTENING PATTERNS FOR STRESS $F_{2/3}$

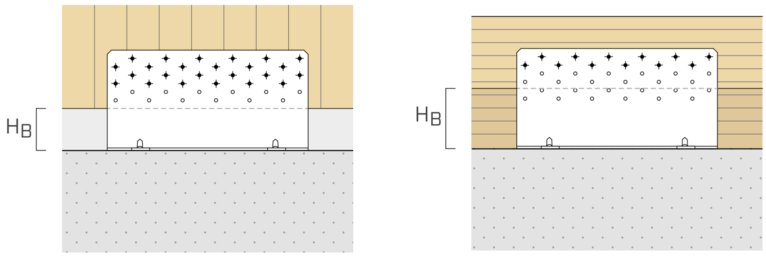
In the presence of design requirements such as $F_{2/3}$ stresses of different value or the presence of an intermediate H_B layer (levelling mortar, sill or ground) between the wall and the supporting surface, partial fastening patterns can be adopted:



FULL PATTERN | PATTERN 4 | PATTERN 3 | PATTERN 2 | PATTERN 1

Pattern 2 also applies in case of F_4, F_5 and $F_{4/5}$ stresses.

MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER



configuration on timber	n_v holes Ø5 [pcs]		CLT $H_{B\,max}$ [mm]		C/GL $H_{B\,max}$ [mm]	
	TCN200	TCN240	nails LBA Ø4	screws LBS Ø5	nails LBA Ø4	screws LBS Ø5
• full pattern	*30*	*36*	20	30	32	10
• pattern 4	*25*	*30*	30	40	42	20
• pattern 3	*20*	*24*	40	50	52	30
• pattern 2	*15*	*18*	50	60	62	40
• pattern 1	*10*	*12*	60	70	72	50

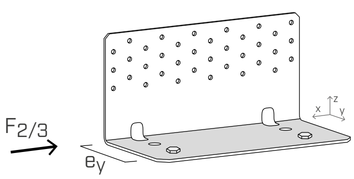
The height of the H_B intermediate layer (levelling mortar, sill or timber platform beam) is determined by taking into account the following regulatory requirements for fastenings on timber:
- CLT: minimum distances according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA 11/0030 for screws.
- C/GL: minimum distances for solid timber or glulam with horizontal fibres consistent with EN 1995-1-1 according to ETA considering a timber density of $\rho_k \leq 420$ kg/m^3.

TCN200 - TCN240 | VERIFICATION OF ANCHORS FOR CONCRETE FOR $F_{2/3}$ STRESS

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).
E_y calculation eccentricities vary depending on the type of installation selected: 2 internal anchors (IN) or 2 external anchors (OUT).

The anchor group must be verified for:

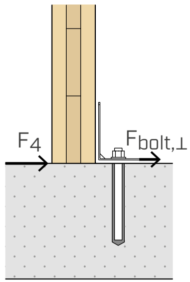
$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN/OUT}$



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

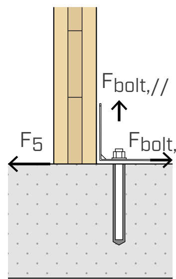
TCN200 - TCN240

F_4		TIMBER: holes fastening Ø5 type	ØxL [mm]	n_v [pcs]	$R_{4,k\ timber}$ [kN]	STEEL: $R_{4,k\ steel}$ [kN]	γ_{steel}	CONCRETE: holes fastening Ø [mm]	n_H [pcs]	IN[1] $k_{t\perp}$	$k_{t//}$
TCN200	• full nailing	LBA nails	Ø4,0 x 60	30	**20,9**	**22,4**	γ_{M0}	M12	2	0,5	-
		screws LBS	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	15	**20,7**	**24,3**	γ_{M0}				
		screws LBS	Ø5,0 x 50								
TCN240	• full nailing	LBA nails	Ø4,0 x 60	36	**24,1**	**26,9**	γ_{M0}	M16	2	0,5	-
		screws LBS	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	18	**23,9**	**29,1**	γ_{M0}				
		screws LBS	Ø5,0 x 50								



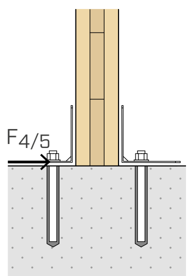
The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{4,d}$

F_5		TIMBER: holes fastening Ø5 type	ØxL [mm]	n_v [pcs]	$R_{5,k\ timber}$ [kN]	STEEL: $R_{5,k\ steel}$ [kN]	γ_{steel}	CONCRETE: holes fastening Ø [mm]	n_H [pcs]	IN[1] $k_{t\perp}$	$k_{t//}$
TCN200	• full pattern	LBA nails	Ø4,0 x 60	30	**6,6**	**2,7**	γ_{M0}	M12	2	0,5	0,47
		screws LBS	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	15	**3,6**	**1,6**	γ_{M0}			0,5	0,83
		screws LBS	Ø5,0 x 50								
TCN240	• full pattern	LBA nails	Ø4,0 x 60	36	**8,0**	**3,3**	γ_{M0}	M16	2	0,5	0,48
		screws LBS	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	18	**4,3**	**1,9**	γ_{M0}			0,5	0,83
		screws LBS	Ø5,0 x 50								



The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{5,d}$; $N_{Sd,z} = 2 \times k_{t//} \times F_{5,d}$

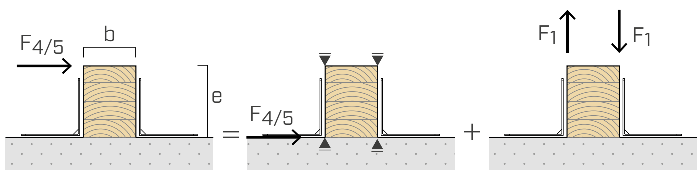
$F_{4/5}$ TWO ANGLE BRACKETS		TIMBER: holes fastening Ø5 type	ØxL [mm]	n_v [pcs]	$R_{4/5,k\ timber}$ [kN]	STEEL: $R_{4/5,k\ steel}$ [kN]	γ_{steel}	CONCRETE: holes fastening Ø [mm]	n_H [pcs]	IN[1] $k_{t\perp}$	$k_{t//}$
TCN200	• full pattern	LBA nails	Ø4,0 x 60	30 + 30	**25,6**	**14,9**	γ_{M0}	M12	2 + 2	0,41	0,08
		screws LBS	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	15 + 15	**22,4**	**20,9**	γ_{M0}			0,46	0,06
		screws LBS	Ø5,0 x 50								
TCN240	• full pattern	LBA nails	Ø4,0 x 60	36 + 36	**27,8**	**24,7**	γ_{M0}	M16	2 + 2	0,43	0,06
		screws LBS	Ø5,0 x 50								
	• pattern 2	LBA nails	Ø4,0 x 60	18 + 18	**25,2**	**30,6**	γ_{M0}			0,48	0,04
		screws LBS	Ø5,0 x 50								



The group of 2 anchors must be verified for: $V_{Sd,y} = 2 \times k_{t\perp} \times F_{4/5,d}$; $N_{Sd,z} = 2 \times k_{t//} \times F_{4/5,d}$

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). For joints with 2 angle brackets, in case the stress $F_{4/5,d}$ is applied with eccentricity e≠0, the verification for combined loads is required considering the contribution of the additional tensile component:

$$\Delta F_{1,d} = F_{4/5,d} \cdot \frac{e}{b}$$



NOTES:

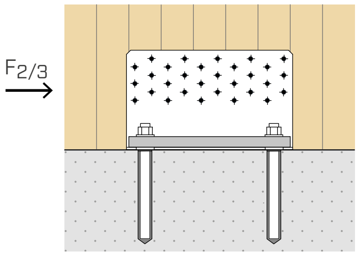
(1) Installation of the anchors in the two internal holes (IN).

GENERAL PRINCIPLES:

For the general principles of calculation, see page 17.

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

TCN200 + TCW200



TIMBER STRENGTH

configuration on timber	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø13		IN(1)	
	type	Ø x L [mm]	n_v [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{z,IN}$ [mm]
TCN200 + TCW200	LBA nails	Ø4,0 x 60	30	**56,7**	M12	2	**38,5**	**83,5**
	screws LBS	Ø5,0 x 50		**66,4**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$
	type	Ø x L [mm]	IN(1) [kN]
• uncracked	VIN-FIX 5.8	M12 x 140	**27,4**
	HYB-FIX 8.8	M12 x 195	**41,5**
	SKR-CE	12 x 110	**17,4**
	AB1	M12 x 120	**26,1**
• cracked	VIN-FIX 5.8	M12 x 140	**21,1**
	HYB-FIX 8.8	M12 x 195	**41,8**
	AB1	M12 x 120	**17,3**
• seismic	HYB-FIX 8.8	M12 x 195	**14,0**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN200 + TCW200	VIN-FIX 5.8	M12 x 140	15	111	111	120	14	200
	HYB-FIX 8.8	M12 x 195	15	166	166	175	14	
	SKR-CE	12 x 110	15	64	95	115	10	
	AB1	M12 x 120	15	70	80	85	12	

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

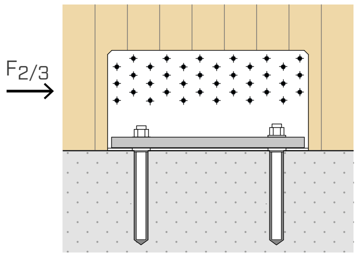
- t_{fix} fastened plate thickness
- h_{nom} nominal anchoring depth
- h_{ef} effective anchor depth
- h_1 minimum hole depth
- d_0 hole diameter in the concrete support
- h_{min} concrete minimum thickness

NOTES:

(1) Installation of the anchors in the two internal holes (IN).

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

TCN240 + TCW240



TIMBER STRENGTH

	TIMBER				CONCRETE			
configuration on timber	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø17		IN(1)	
	type	Ø x L [mm]	n_v [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{z,IN}$ [mm]
TCN240 + TCW240	LBA nails	Ø4,0 x 60	36	**70,5**	M16	2	**39,5**	**83,5**
	screws LBS	Ø5,0 x 50		**82,6**				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø17		$R_{2/3,d\ concrete}$ IN(1)
	type	Ø x L [mm]	[kN]
• uncracked	VIN-FIX 5.8	M16 x 195	**57,5**
	HYB-FIX 8.8	M16 x 195	**80,4**
	SKR-CE	16 x 130	**32,1**
	AB1	M16 x 145	**39,5**
• cracked	VIN-FIX 5.8	M16 x 195	**32,2**
	HYB-FIX 8.8	M16 x 245	**80,4**
	AB1	M16 x 145	**28,4**
• seismic	HYB-FIX 8.8	M16 x 245	**23,9**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN240 + TCW240	VIN-FIX 5.8	M16 x 195	15	160	160	165	18	**200**
	HYB-FIX 8.8	M16 x 195	15	160	160	165	18	**200**
		M16 x 245	15	210	210	215		**250**
	SKR-CE	16 x 130	15	85	115	145	14	**200**
	AB1	M16 x 145	15	85	97	105	16	

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

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

GENERAL PRINCIPLES:

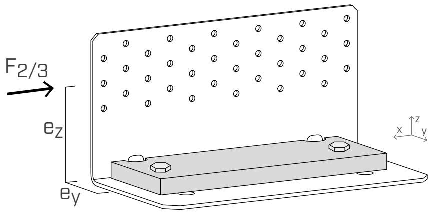
For the general principles of calculation, see page 17.

TCW200 - TCW240 | VERIFICATION OF ANCHORS FOR CONCRETE FOR $F_{2/3}$ STRESS

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).
The calculation eccentricities e_y and e_z refer to installation with WASHER TCW of 2 internal anchors (IN).

The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN}$
$M_{Sd,y} = F_{2/3,d} \times e_{z,IN}$



TCW200 - TCW240 | CONNECTION STIFFNESS FOR STRESS $F_{2/3}$

EVALUTATION OF SLIP MODULUS $K_{2/3,ser}$

- $K_{2/3,ser}$ experimental average value for TITAN joint on CLT (Cross Laminated Timber) according to ETA 11/0496

type	fastening type Ø x L [mm]	n_v [pcs]	$K_{2/3,ser}$ [mm]
TCN200 + TCW200	LBS nails Ø5,0 x 50	30	**9600**
TCN240 + TCW240	LBS nails Ø5,0 x 50	36	**10000**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint screws* GL24h/C24

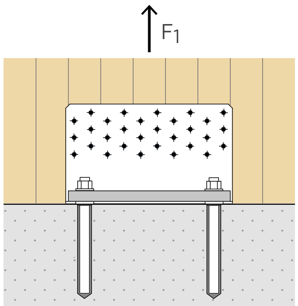
Screws (nails without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 §7.1)

type	fastening type Ø x L [mm]	n_v [pcs]	K_{ser} [mm]
TCN200 + TCW200	LBS nails Ø5,0 x 50	30	**31192**
TCN240 + TCW240	LBS nails Ø5,0 x 50	36	**37431**

* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

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

TCN200 + TCW200



TIMBER STRENGTH

	TIMBER				STEEL		CONCRETE		
configuration on timber	holes fastening Ø5			$R_{1,k\ timber}$	$R_{1,k\ steel}$		holes fastening Ø13		IN(1)
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_H [pcs]	$k_{t//}$ [mm]
TCN200 + TCW200	LBA nails	Ø4,0 x 60	30	**57,9**	**45,7**	γ_{M0}	M12	2	**1,09**
	screws LBS	Ø5,0 x 50		**68,1**					

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	holes fastening Ø13		$R_{1,d\ concrete}$ IN(1)
	type	Ø x L [mm]	[kN]
• uncracked	VIN-FIX 5.8	M12 x 195	**21,3**
	HYB-FIX 8.8	M12 x 195	**40,8**
• cracked	VIN-FIX 5.8	M12 x 195	**16,0**
	HYB-FIX 5.8	M12 x 195	**23,0**
	HYB-FIX 8.8	M12 x 245	**30,6**
• seismic	HYB-FIX 8.8	M12 x 245	**11,8**

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN200 + TCW200	VIN-FIX 5.8	M12 x 195	15	160	160	165	14	**200**
	HYB-FIX 5.8 / 8.8	M12 x 195	15	160	160	165	14	
	HYB-FIX 8.8	M12 x 245	15	210	210	215	14	**250**

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

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

NOTES:

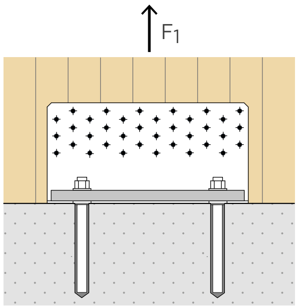
(1) Installation of the anchors in the two internal holes (IN).

GENERAL PRINCIPLES:

For the general principles of calculation, see page 17.

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

TCN240 + TCW240



TIMBER STRENGTH

	TIMBER				STEEL		CONCRETE		
configuration on timber	**holes fastening Ø5**			**$R_{1,k\ timber}$**	**$R_{1,k\ steel}$**		**holes fastening Ø17**		**IN (1)**
	type	**Ø x L** [mm]	**n_v** [pcs]	[kN]	[kN]	γ_{steel}	**Ø** [mm]	**n_H** [pcs]	**$k_{t//}$** [mm]
TCN240 + TCW240	LBA nails	Ø4,0 x 60	36	**69,5**	**68,9**	γ_{M0}	M16	2	**1,08**
	screws LBS	Ø5,0 x 50		**81,7**					

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions on concrete for anchors installed in internal holes (IN) with WASHER.

configuration on concrete	**holes fastening Ø17**		**$R_{1,d\ concrete}$**
	type	**Ø x L** [mm]	**IN (1)** [kN]
• uncracked	VIN-FIX 5.8	M16 x 195	**27,4**
	HYB-FIX 8.8	M16 x 195	**45,7**
• cracked	VIN-FIX 5.8	M16 x 195	**15,3**
	HYB-FIX 5.8	M16 x 195	**31,2**
	HYB-FIX 8.8	M16 x 245	**42,2**
• seismic	HYB-FIX 8.8	M16 x 245	**14,9**
		M16 x 330	**21,1**

installation	**anchor type**		**t_{fix}**	**h_{ef}**	**h_{nom}**	**h_1**	**d_0**	**h_{min}**
	type	**Ø x L** [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCN240 + TCW200	VIN-FIX 5.8	M16 x 195	15	160	160	165	18	**200**
	HYB-FIX 5.8	M16 x 195	15	160	160	165	18	
	HYB-FIX 8.8	M16 X 195	15	160	160	165	18	**200**
		M16 x 245	15	210	210	215	18	**250**
		M16 x 330	15	295	295	300	18	**350**

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

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

NOTES:

(1) Installation of the anchors in the two internal holes (IN).

GENERAL PRINCIPLES:

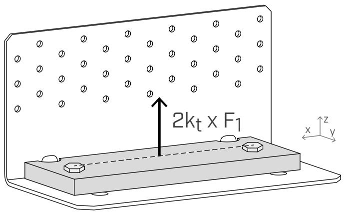
For the general principles of calculation, see page 17.

TCW200 - TCW240 | VERIFICATION OF ANCHORS FOR CONCRETE FOR F_1 STRESS

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (k_t).
2 internal anchors (IN) must be provided for installation on concrete with WASHER TCW.

The anchor group must be verified for:

$N_{Sd,z} = 2 \times k_{t//} \times F_{1,d}$



TCW200 - TCW240 | CONNECTION STIFFNESS FOR STRESS F_1

EVALUTATION OF SLIP MODULUS $K_{1,ser}$

- $K_{1,ser}$ experimental average value for TITAN joint on C24 CLT (Cross Laminated Timber) panels

type	fastening type Ø x L [mm]	n_v [pcs]	$K_{1,ser}$ [N/mm]
TCN200 + TCW200	-	-	-
TCN240 + TCW240	LBA nails Ø4,0 x 60	36	**28455**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint nails* GL24h/C24

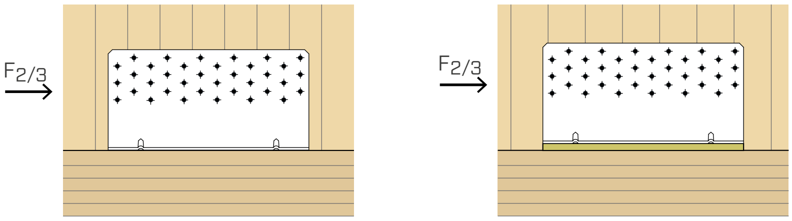
Nails (without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

type	fastening type Ø x L [mm]	n_v [pcs]	K_{ser} [N/mm]
TCN200 + (TCW200)	LBA nails Ø4,0 x 60	30	**26093**
TCN240 (+ TCW240)	LBA nails Ø4,0 x 60	36	**31311**

* For steel-to-timber connections the reference standard indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3))

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

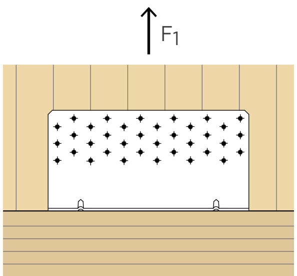
TTN240



configuration on timber[1]	TIMBER type	holes fastening Ø5 Ø x L [mm]	n_V [pcs]	n_H [pcs]	profile[2] s [mm]	$R_{2/3,k\ timber}$ [kN]
TTN240	LBA nails	Ø4,0 x 60	36	36	-	**37,9**
	screws LBS	Ø5,0 x 50				**46,7**
TTN240 + XYLOFON	LBA nails	Ø4,0 x 60	36	36	6	**24,8**
	screws LBS	Ø5,0 x 50				**22,8**
TTN240 + ALADIN STRIPE SOFT	LBA nails	Ø4,0 x 60	36	36	5	**28,9**
	screws LBS	Ø5,0 x 50				**27,5**
TTN240 + ALADIN STRIPE EXTRA SOFT	LBA nails	Ø4,0 x 60	36	36	7	**27,5**
	screws LBS	Ø5,0 x 50				**25,8**

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

TTN240



	TIMBER type	holes fastening Ø5 Ø x L [mm]	n_V [pcs]	n_H [pcs]	$R_{1,k\ timber}$ [kN]
TTN240	LBA nails	Ø4,0 x 60	36	36	**7,4**
	screws LBS	Ø5,0 x 50			**16,2**

NOTES:

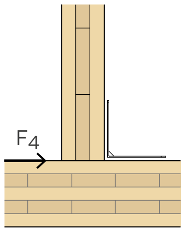
[1] The TTN240 angle bracket can be installed in combination with different resilient acoustic profiles inserted below the horizontal flange in full pattern configuration. The strength values in the table are given in ETA-11/0496 and calculated according to *"Blaß, H.J. und Laskewitz, B. (2000); Load-Carrying Capacity of Joints with Dowel-Type fasteners and Interlayers."*, conservatively disregarding the stiffness of the profile.

[2] Profile thickness: in the case of ALADIN profile, the calculation took into account the reduced thickness, due to the corrugated section and the consequent crushing induced by the nail head during insertion.

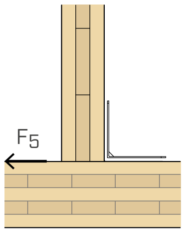
STRUCTURAL VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-TIMBER

TTN240

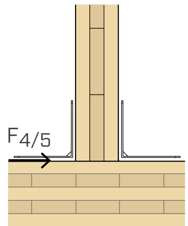
F_4		TIMBER				STEEL	
		holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$	
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
TTN240	• full pattern	LBA nails	Ø4,0 x 60	36 + 36	23,8	31,1	γ_{M0}
		screws LBS	Ø5,0 x 50				



F_5		TIMBER				STEEL	
		holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$	
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
TTN240	• full pattern	LBA nails	Ø4,0 x 60	36 + 36	7,3	3,4	γ_{M0}
		screws LBS	Ø5,0 x 50				

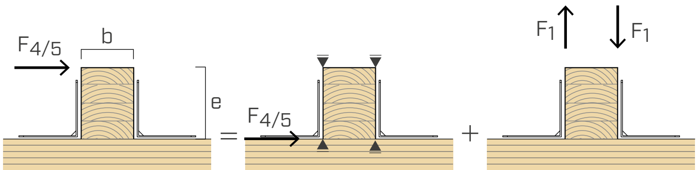


$F_{4/5}$ TWO ANGLE BRACKETS		TIMBER				STEEL	
		holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$	
		type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
TTN240	• full pattern	LBA nails	Ø4,0 x 60	72 + 72	26,7	31,6	γ_{M0}
		screws LBS	Ø5,0 x 50				



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). For joints with 2 angle brackets, in case the stress $F_{4/5,d}$ is applied with eccentricity e≠0, the verification for combined loads is required considering the contribution of the additional tensile component:

$$\Delta F_{1,d} = F_{4/5,d} \cdot \frac{e}{b}$$



GENERAL PRINCIPLES:

For the general principles of calculation, see page 17.

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0496. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments (see Chapter 6 ANCORS FOR CONCRETE). The connection design strength values are obtained from the values on the table as follows:

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

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

- 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:

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

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

- 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.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045. For chemical anchors subjected to shear stress it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).