TITAN S

ANGLE BRACKET FOR SHEAR AND TENSILE FORCES

HOLES FOR HBS PLATE
Fastening with HBS PLATE Ø8 screws using a screwdriver makes installation easy and fast and allows you to work safely and comfortably. The angle bracket can be easily disassembled by removing the screws.

85 kN SHEAR
Exceptional shear strengths. Up to 85,9 kN on concrete (with TCW washer). Up to 60,0 kN on timber.

75 kN TENSILE
On concrete, the TCS angle bracket with TCW washer provides excellent tensile strength. $R_{1,k}$ up to 75,9 kN characteristic values.

USA, Canada and more design values available online.

CE
ETA-11/0496

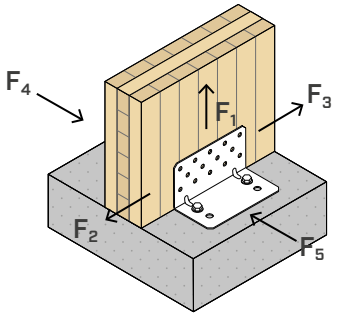
SERVICE CLASS SC1 SC2

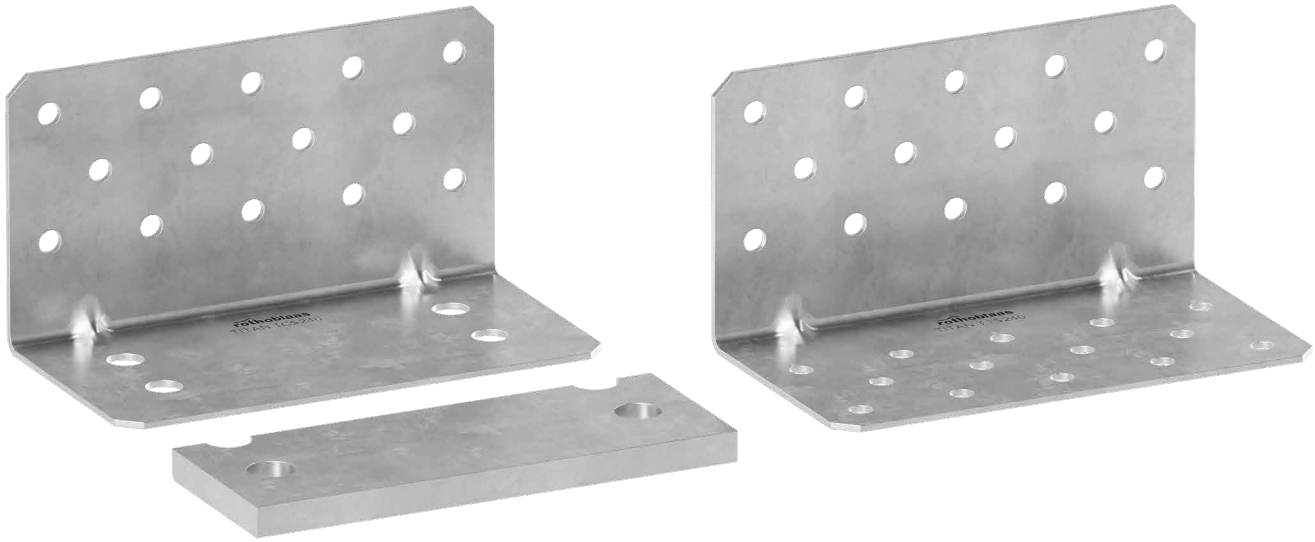
MATERIAL

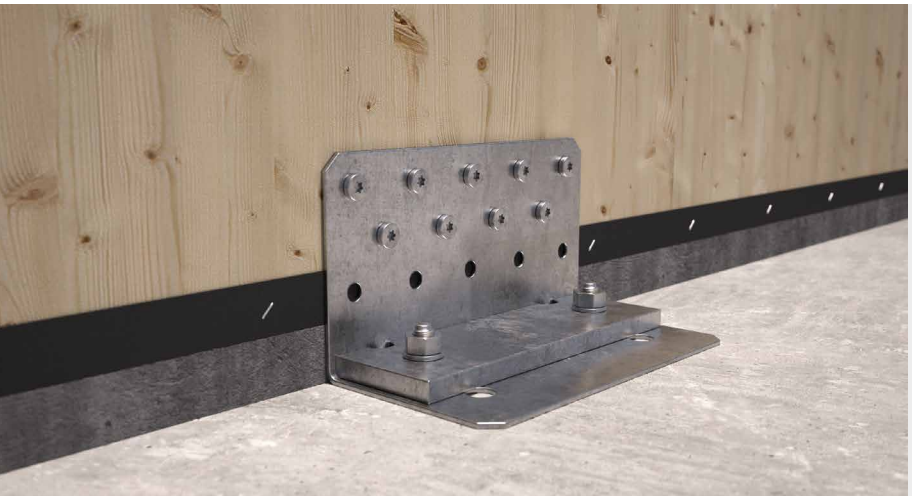
DX51D Z275 **TITAN S:** DX51D + Z275 carbon steel.

S235 Fe/Zn12c **TITAN WASHER:** S235 + Fe/Zn12c carbon steel

EXTERNAL LOADS







FIELDS OF USE

Shear and tension 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
- CLT and LVL panels

EASY INSTALLATION

The angle brackets fastening using a reduced number of HBS PLATE Ø8 screws makes installation faster and easier.

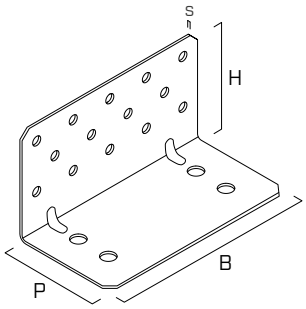
ALL DIRECTIONS

Exceptional strength values in all directions allow use even in special or non-standard situations.

CODES AND DIMENSIONS

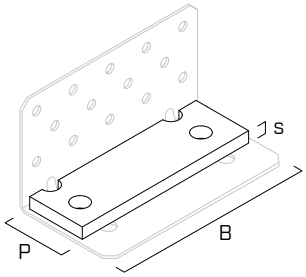
TITAN S - TCS | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm] *[in]*	P [mm] *[in]*	H [mm] *[in]*	holes [mm] *[in]*	n_V Ø11 *n_V Ø0.44* [pcs]	s [mm] *[in]*		pcs
TCS240	240 *9 1/2*	123 *4 13/16*	130 *5 1/8*	4 x Ø17 *4 x Ø0.67*	14	3 *0.12*	●	10



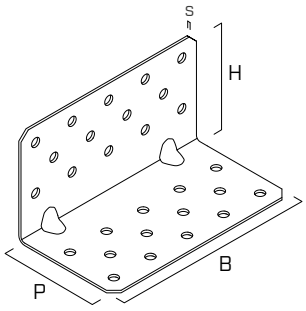
TITAN WASHER - TCW240 | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm] *[in]*	P [mm] *[in]*	s [mm] *[in]*	holes [mm] *[in]*		pcs
TCW240	230 *9 1/16*	73 *2 7/8*	12 *0.47*	Ø18 *Ø0.71*	●	1



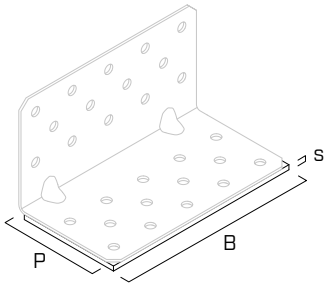
TITAN S - TTS | TIMBER-TO-TIMBER JOINTS

CODE	B [mm] *[in]*	P [mm] *[in]*	H [mm] *[in]*	n_H Ø11 *n_H Ø0.44* [pcs]	n_V Ø11 *n_V Ø0.44* [pcs]	s [mm] *[in]*		pcs
TTS240	240 *9 1/2*	130 *5 1/8*	130 *5 1/8*	14	14	3 *0.12*	●	10



ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

CODE	type	B [mm] *[in]*	P [mm] *[in]*	s [mm] *[in]*		pcs
XYL35120240	XYLOFON PLATE	240 *9 1/2*	120 *4 3/4*	6 *0.24*	●	10

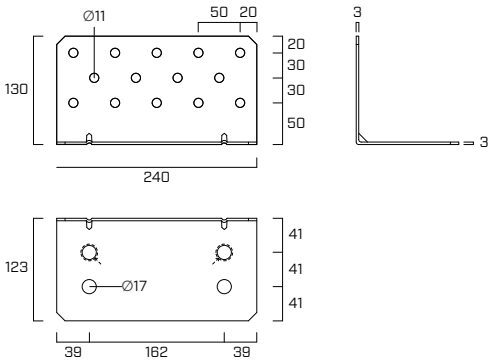


FASTENERS

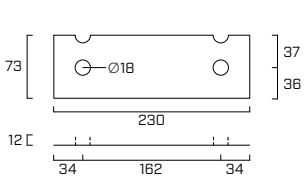
type	description		d [mm]	support	page
HBS PLATE	pan head screw		8		573
HBS PLATE EVO	C4 EVO pan head screw		8		573
AB1	CE1 expansion anchor		16		536
SKR	screw-in anchor		16		528
VIN-FIX	vinyl ester chemical anchor		M16		545
HYB-FIX	hybrid chemical anchor		M16		552
EPO-FIX	epoxy chemical anchor		M16		557

GEOMETRY

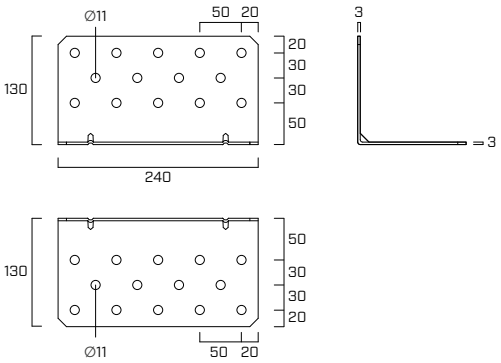
TCS240



TCW240



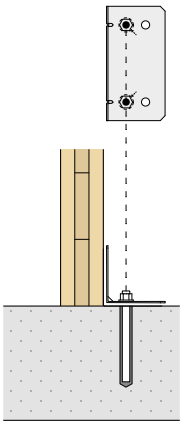
TTS240



INSTALLATION ON CONCRETE

To fix **TITAN TCS** 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



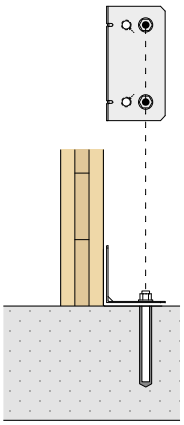
2 anchors positioned in the INTERNAL HOLES (**IN**) (identified by a mark on the product)

$e=e_{y,IN}$

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

optimized connection strength

alternative installation



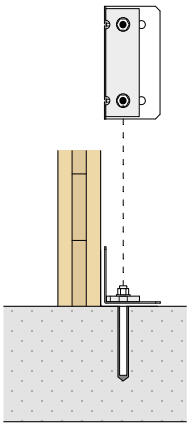
2 anchors placed in the EXTERNAL HOLES (**OUT**) (e.g. in case of clash between the anchor and the concrete support reinforcement)

$e=e_{y,OUT}$

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

reduced connection strength

installation with washer

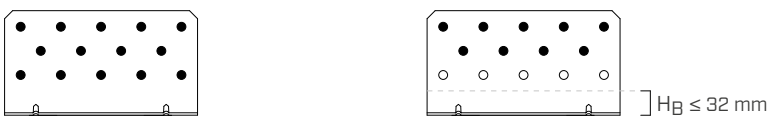


The WASHER TCW must be fastened by means of 2 anchors positioned in the INTERNAL HOLES (**IN**)

$e=e_{y,IN}$

TCS240 | PARTIAL FASTENING PATTERNS

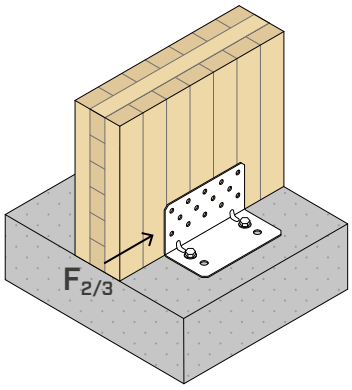
In the presence of design requirements such as stresses of different value or the presence of an intermediate H_B layer (levelling grout, sill or ground) between the wall and the supporting surface, a partial fastening pattern can be adopted.



full pattern

partial pattern

STRUCTURAL VALUES | **TCS240** | TIMBER-TO-CONCRETE | $F_{2/3}$



TIMBER STRENGTH

configuration on timber	fastening holes Ø11			$R_{2/3,k\ timber}$	$K_{2/3,ser}$
	type	Ø x L [mm]	n_V [pcs]	[kN]	[N/mm]
full pattern	HBS PLATE	Ø8 x 80	14	**70,3**	**8200**
partial pattern	HBS PLATE	Ø8 x 80	9	**36,1**	**7000**

CONCRETE STRENGTH

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

configuration on concrete	fastening holes Ø17			$R_{2/3,d\ concrete}$			
	type	Ø x L [mm]	n_H [pcs]	IN(1) [kN]	OUT(2) [kN]	$e_{y,IN}$ [mm]	$e_{y,OUT}$ [mm]
uncracked	VIN-FIX 5.8	M16 x 160	2	**67,2**	**52,9**	**39,5**	**80,5**
	VIN-FIX 8.8	M16 x 160		**90.1**	**70,9**		
	SKR	16 x 130		**65,0**	**51,2**		
	AB1	M16 x 145		**79,0**	**62,4**		
cracked	VIN-FIX 5.8/8.8	M16 x 160		**55,0**	**43.2**		
	SKR	16 x 130		**45,3**	**35,7**		
	AB1	M16 x 145		**67,0**	**53,1**		
seismic	HYB-FIX 8.8	M16 x 195		**35,2**	**27,7**		
	EPO-FIX 8.8	M16 x 195		**47,1**	**37,2**		

ANCHORS INSTALLATION PARAMETERS

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]
TCS240	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	
	EPO-FIX 8.8	M16 x 195	3	164	164	170	18	
	SKR	16 x 130	3	85	127	150	14	
	AB1	M16 x 145	3	85	97	105	16	

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

Precut INA threaded rod, with nut and washer: see page 562.
MGS threaded rod class 8.8 to be cut to size: see page 174.

NOTES

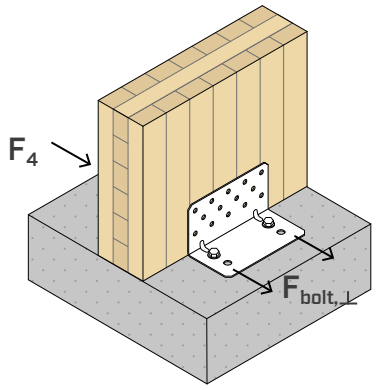
(1) Installation of the anchors in the two internal holes (IN).

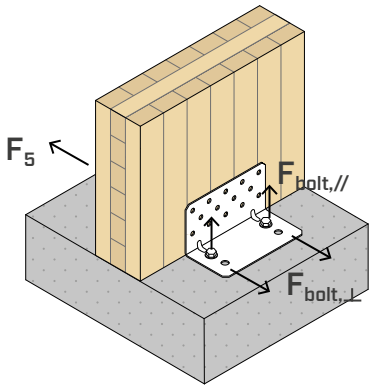
(2) Installation of the anchors in external holes (OUT).

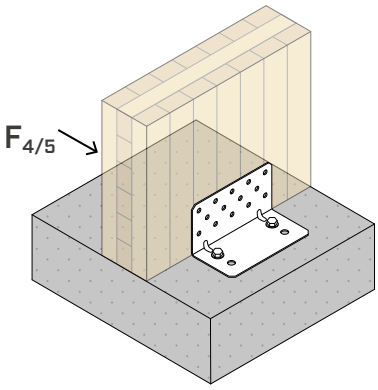
For the GENERAL PRINCIPLES of calculation, see page 241.

For the anchors verification refer to page 241.

STRUCTURAL VALUES | **TCS240** | TIMBER-TO-CONCRETE | F_4 | F_5 | $F_{4/5}$







	TIMBER				STEEL		CONCRETE			
	fastening holes Ø11			$R_{4,k\ timber}$	$R_{4,k\ steel}$		fastening holes		IN[1]	
F_4	type	Ø x L	n_V				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCS240	HBS PLATE	Ø8 x 80	14	**21,1**	**18,1**	γ_{M0}	M16	2	0,5	-

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

	TIMBER				STEEL		CONCRETE			
	fastening holes Ø11			$R_{5,k\ timber}$	$R_{5,k\ steel}$		fastening holes		IN[1]	
F_5	type	Ø x L	n_V				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCS240	HBS PLATE	Ø8 x 80	14	**17,1**	**4,3**	γ_{M0}	M16	2	0,5	0,36

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

	TIMBER				STEEL		CONCRETE			
$F_{4/5}$	fastening holes Ø11			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$		fastening holes		IN[1]	
TWO ANGLE BRACKETS	type	Ø x L	n_V				Ø	n_H	$k_{t\perp}$	$k_{t//}$
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[pcs]		
TCS240	HBS PLATE	Ø8 x 80	14 + 14	**27,4**	**18,8**	γ_{M0}	M16	2 + 2	0,39	0,08

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

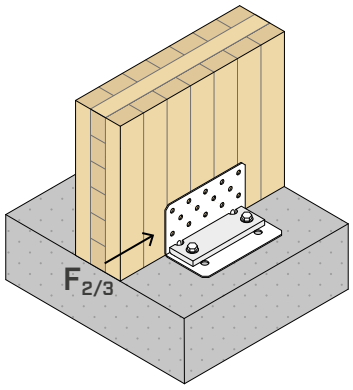
NOTES

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

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

For the GENERAL PRINCIPLES of calculation, see page 241.

STRUCTURAL VALUES | **TCS240 + TCN240** | TIMBER-TO-CONCRETE | $F_{2/3}$



TIMBER STRENGTH

configuration on timber	fastening holes Ø11			$R_{2/3,k\ timber}$	$K_{2/3,ser}$
	type	Ø x L [mm]	n_V [pcs]	[kN]	[N/mm]
TCS240 + TCW240	HBS PLATE	Ø8 x 80	14	**85.9**	**9000**

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	fastening holes Ø17			$R_{2/3,d\ concrete}$		
	type	Ø x L [mm]	n_H [pcs]	IN[(1)] [kN]	$e_{y,IN}$ [mm]	$e_{z,IN}$ [mm]
uncracked	VIN-FIX 8.8	M16 x 195	2	**60,9**	**39,5**	**78,5**
	HYB-FIX 8.8	M16 x 195		**81,4**		
	SKR	16 x 130		**32,7**		
	AB1	M16 x 145		**42,5**		
cracked	VIN-FIX 5.8/8.8	M16 x 195		**33,6**		
	HYB-FIX 8.8	M16 x 195		**72,0**		
	AB1	M16 x 145		**30,3**		
seismic	HYB-FIX 8.8	M16 x 245		**24,7**		
	EPO-FIX 8.8	M16 x 245		**31,2**		

ANCHORS INSTALLATION PARAMETERS

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]
TCS240 + TCW240	VIN-FIX 5.8/8.8	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	18	250
	EPO-FIX 8.8	M16 x 245	15	210	210	215	18	250
	SKR	16 x 130	15	85	115	145	14	200
	AB1	M16 x 145	15	85	97	105	16	200

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

Precut INA threaded rod, with nut and washer: see page 562.
MGS threaded rod class 8.8 to be cut to size: see page 174.

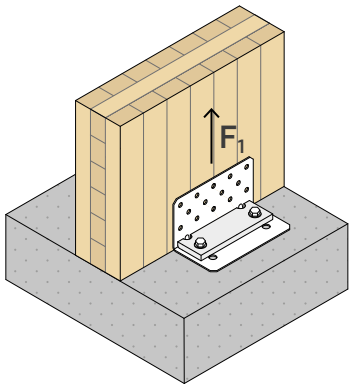
NOTES

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

For the GENERAL PRINCIPLES of calculation, see page 241.

For the anchors verification refer to page 241.

STRUCTURAL VALUES | **TCS240 + TCW240** | TIMBER-TO-CONCRETE | F_1



TIMBER STRENGTH

configuration on timber		TIMBER				STEEL		
		fastening holes Ø11			$R_{1,k\ timber}$	$R_{1,k\ steel}$		K_{ser}
		type	Ø x L [mm]	n_V [pcs]	[kN]	[kN]	γ_{steel}	[N/mm]
TCS240 + TCW240	full pattern	HBS PLATE	Ø8 x 80	14	-(3)	**75,9**	γ_{M0}	**11500**
	partial pattern(1)	HBS PLATE	Ø8 x 80	9	**33,9**	**75,9**		-

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	fastening holes Ø17			$R_{1,d\ concrete}$	
	type	Ø x L [mm]	n_H [pcs]	IN(2) [kN]	$k_{t//}$
uncracked	VIN-FIX 5.8/8.8	M16 x 195		**27,4**	
	HYB-FIX 5.8/8.8	M16 x 195		**45,7**	
cracked	VIN-FIX 5.8/8.8	M16 x 195		**15,3**	
	HYB-FIX 5.8/8.8	M16 x 195		**31,2**	
	HYB-FIX 5.8/8.8	M16 x 245	2	**42,2**	**1,08**
seismic	HYB-FIX 8.8	M16 x 245		**14,9**	
		M16 x 330		**21,1**	
	EPO-FIX 8.8	M16 x 245		**19,8**	
		M16 x 330		**28,1**	

ANCHORS INSTALLATION PARAMETERS

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]
TCS240 + TCW240	VIN-FIX 5.8/8.8	M16 x 195	15	160	160	165	18	200
	HYB-FIX 5.8/8.8	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
	EPO-FIX 8.8	M16 x 245	15	210	210	215	18	250
		M16 x 330	15	295	295	300	18	350

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

Precut INA threaded rod, with nut and washer: see page 562.
MGS threaded rod class 8.8 to be cut to size: see page 174.

NOTES

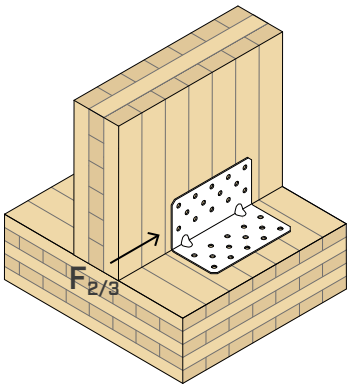
(1) In case of design requirements such as F_1 stress of different value or presence of an H_B intermediate layer between the wall and the supporting surface, partial fastening with $H_B \leq 32$ mm can be adopted for application on CLT panel.

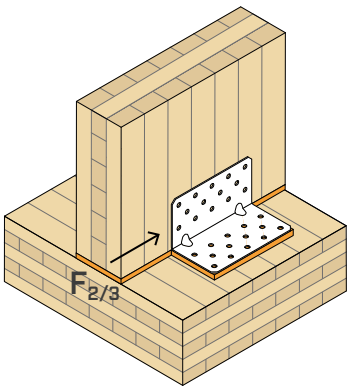
(2) Installation of the anchors in the two internal holes (IN).

(3) The experimental failure mode is steel-side, so no timber-side failure is considered.

For the GENERAL PRINCIPLES of calculation, see page 241.
For the anchors verification refer to page 241.

STRUCTURAL VALUES | **TTS240** | TIMBER-TO-TIMBER | $F_{2/3}$

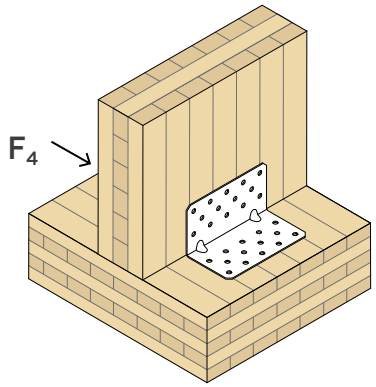


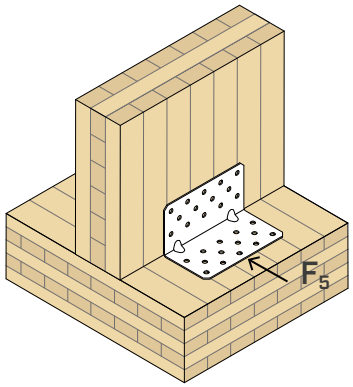


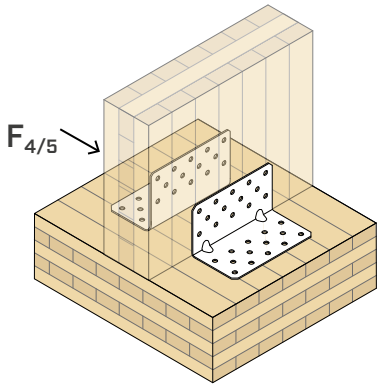
TIMBER STRENGTH

configuration on timber	fastening holes Ø11 type	Ø x L [mm]	n_V [pcs]	n_H [pcs]	profile s [mm]	$R_{2/3,k\ timber}$ [kN]	$K_{2/3,ser}$ [N/mm]
TTS240	HBS PLATE	Ø8 x 80	14	14	-	**60,0**	**5600**
TTS240 + XYLOFON	HBS PLATE	Ø8 x 80	14	14	6	**35,7**	**6000**

STRUCTURAL VALUES | **TTS240** | TIMBER-TO-TIMBER | F_4 | F_5 | $F_{4/5}$







	TIMBER				STEEL	
F_4	fastening holes Ø11 type	Ø x L [mm]	n [pcs]	$R_{4,k\ timber}$ [kN]	$R_{4,k\ steel}$ [kN]	γ_{steel}
TTS240	HBS PLATE	Ø8 x 80	14 + 14	**20,7**	**20,9**	γ_{M0}

	TIMBER				STEEL	
F_5	fastening holes Ø11 type	Ø x L [mm]	n [pcs]	$R_{5,k\ timber}$ [kN]	$R_{5,k\ steel}$ [kN]	γ_{steel}
TTS240	HBS PLATE	Ø8 x 80	14 + 14	**16,8**	**4,2**	γ_{M0}

	TIMBER				STEEL	
$F_{4/5}$ TWO ANGLE BRACKETS	fastening holes Ø11 type	Ø x L [mm]	n_V [pcs]	$R_{4/5,k\ timber}$ [kN]	$R_{4/5,k\ steel}$ [kN]	γ_{steel}
TTS240	HBS PLATE	Ø8 x 80	28 + 28	**25,2**	**23,4**	γ_{M0}

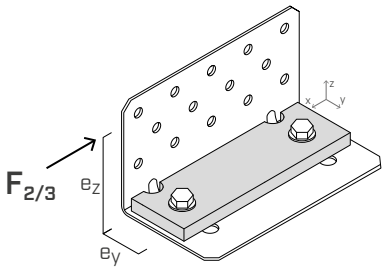
NOTES

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

For the GENERAL PRINCIPLES of calculation, see page 241.

TCW240 | ANCHORS VERIFICATION FOR STRESS LOADING $F_{2/3}$ WITH WASHER

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

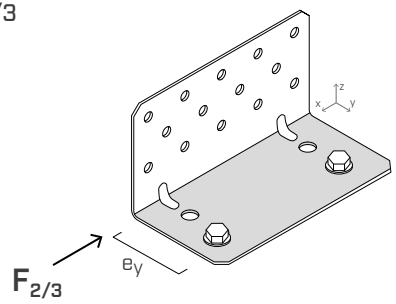


The anchor group must be verified for:

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

TCS240 | ANCHORS VERIFICATION FOR STRESS LOADING $F_{2/3}$

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

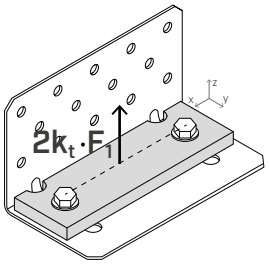


The anchor group must be verified for:

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

TCS240 - TCW240 | ANCHORS VERIFICATION FOR STRESS LOADING F_1 WITH WASHER

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



The anchor group must be verified for:

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

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0496.
- Design values can be obtained from characteristic values as follows:

$$R_d = min \begin{cases} \frac{R_{k,\,timber} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{k,\,steel}}{\gamma_{M0}} \\ R_{d,\,concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{M0} 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 failures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- A timber density of ρ_k = 350 kg/m^3 was considered for the calculation process. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

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

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

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used. The strength values are valid for the calculation hypothesis defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) and elastic design according to EN 1992:2018. 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).
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363;
  - HYB-FIX chemical anchor according to ETA-20/1285;
  - EPO-FIX chemical anchor according to ETA-23/0419;
  - SKR screw-in anchor according to ETA-24/0024;
  - AB1 mechanical anchor according to ETA-99/0010 (M16).

UK CONSTRUCTION PRODUCT EVALUATION

- UKTA-0836-22/6373.