NINO

CE
ETA-22/0089

UNIVERSAL ANGLE BRACKET FOR SHEAR AND TENSILE LOADS

VERSATILE
Available in three models to meet multiple fastening requirements for CLT or timber frame walls. ETA-certified strengths with resilient XYLOFON PLATE profile.

A CONDENSATION OF INNOVATION
The timber-to-timber configuration can be installed with LBA nails or LBS screws. The addition of the optional VGS full thread connectors provides the angle bracket with unimaginable strengths.

SURPRISING STRENGTHS
Excellent strength values for forces in all directions, with the possibility of use in timber-to-timber or timber-to-concrete configurations. On concrete, the additional washer provides surprising strengths.

CHARACTERISTICS

FOCUS	shear and tension fastening for timber frame and CLT
HEIGHT	from 77 to 197 mm
THICKNESS	2,5 | 3,0 mm
FASTENERS	LBA, LBS, VGS, SKR, VIN-FIX, HYB-FIX

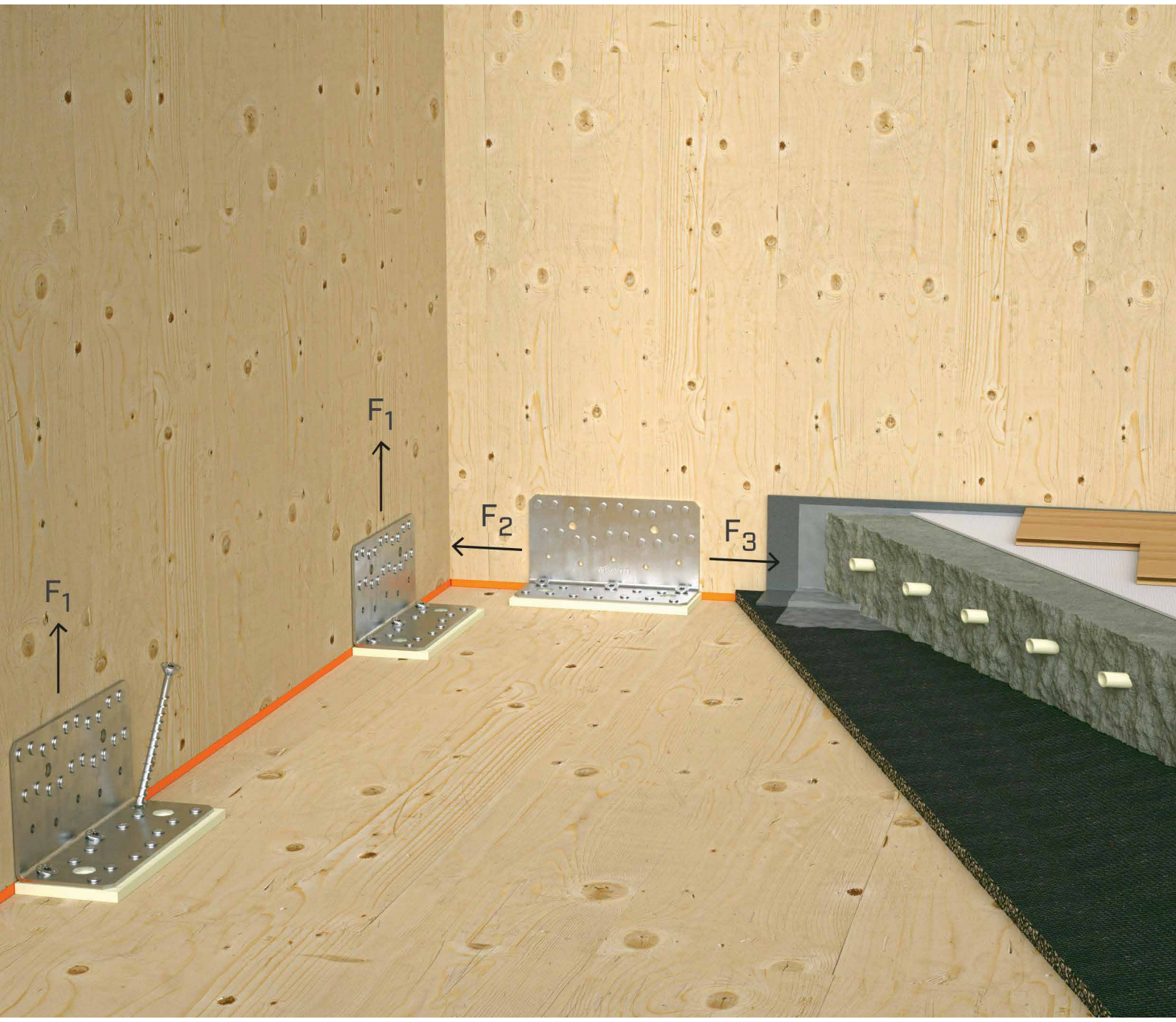
MATERIAL

Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE

Shear or tensile joints for timber-to-concrete and timber-to-timber:

- Solid timber and glulam
- CLT, LVL
- Framed structures (timber frame)
- Timber based panels



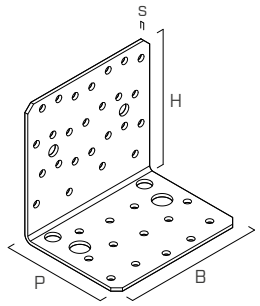
A SINGLE AND CONCEALED ANGLE BRACKET

A single type of angle bracket for shear and tensile forces. It can be integrated into the floor or false ceiling panels.

RAISED WALL

Partial nailing patterns allow installation on CLT walls with the presence of a root beam or concrete kerb up to 120 mm high.

CODES AND DIMENSIONS



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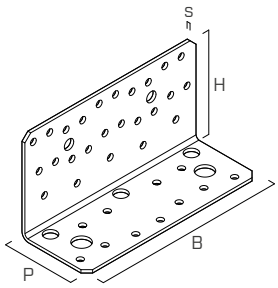

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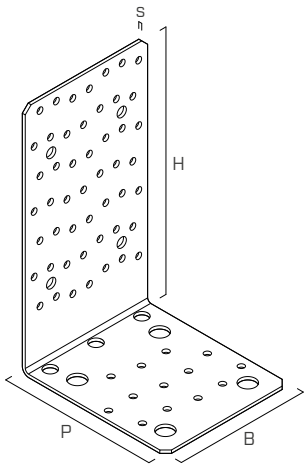
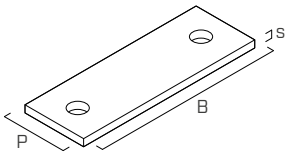


3

NINO

	CODE	B [mm]	P [mm]	H [mm]	s [mm]	n_V Ø5 pcs	n_H Ø5 pcs	n_H Ø10 pcs	n_H Ø13 pcs	n_V Ø8 pcs	pcs		
1	**NINO100100**	104	78	100	2,5	25	13	2	2	2	10	●	●
2	**NINO15080**	146	55	77	2,5	25	11	3	2	2	10	●	●
3	**NINO100200**	104	122	197	3	49	13	3	4	4	10	●	●



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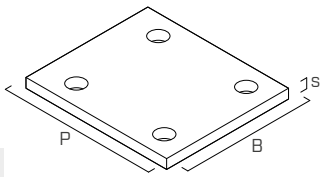


2

NINO WASHER

	CODE	NINO15080	NINO100200	B [mm]	P [mm]	s [mm]	n_H Ø14 pcs	pcs	
1	**NINOW15080**	●	-	146	50	6	2	10	●
2	**NINOW100200**	-	●	104	120	8	4	10	●

ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

	CODE	NINO100100	NINO15080	NINO100200	B [mm]	P [mm]	s [mm]	pcs	
1	**XYL3580105**	●	-	-	105	80	6	1	●
2	**XYL3555150**	-	●	-	150	55	6	1	●
3	**XYL35120105**	-	-	●	105	120	6	1	●

MATERIAL AND DURABILITY

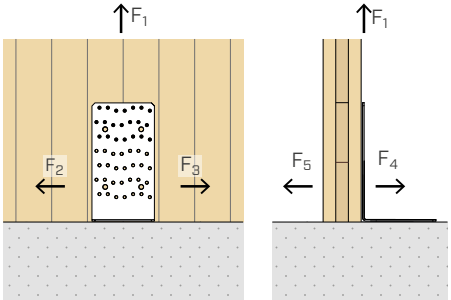
NINO: S250GD + Z275 steel.
NINO WASHER: S235 zinc plated carbon steel.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON PLATE: 35-shore polyurethane compound.

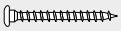
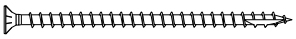
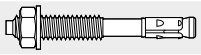
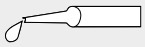
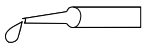
FIELD OF USE

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

EXTERNAL LOADS

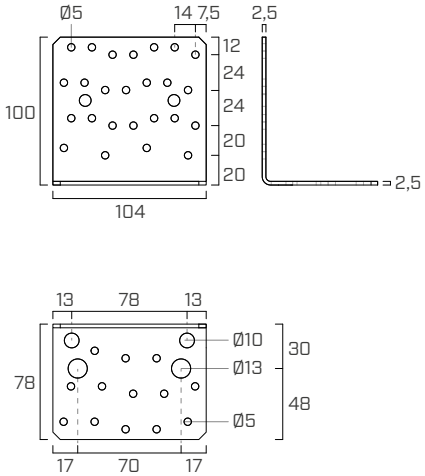


ADDITIONAL PRODUCTS - FASTENING

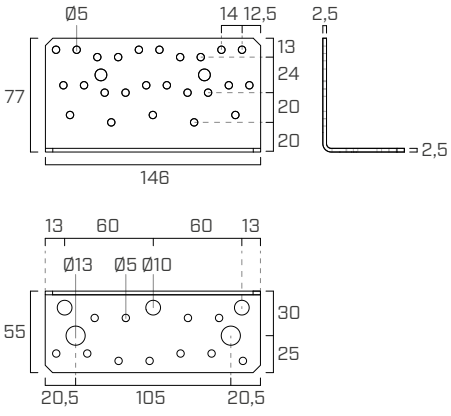
type	description		d [mm]	support
LBA	Anker nail		4	
LBS	screw for plates		5	
VGS	full thread screw		9	
AB1	mechanical anchor		12	
SKR	screw anchor		12	
VIN-FIX	chemical anchor		M12	
HYB-FIX	chemical anchor		M12	

GEOMETRY

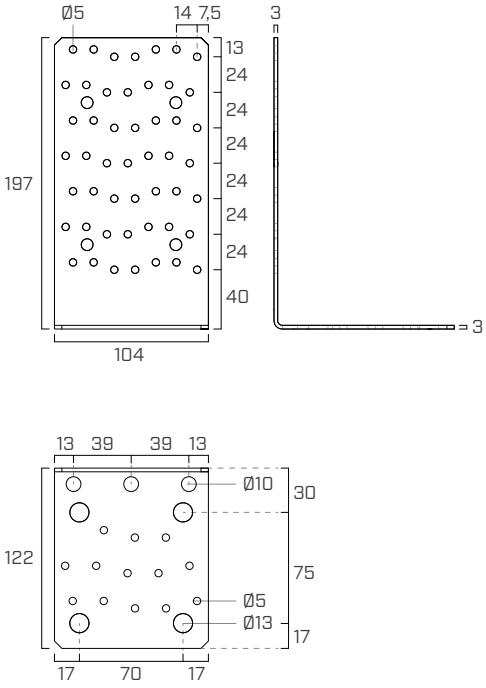
NINO100100



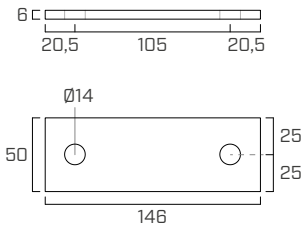
NINO15080



NINO100200



NINOW15080



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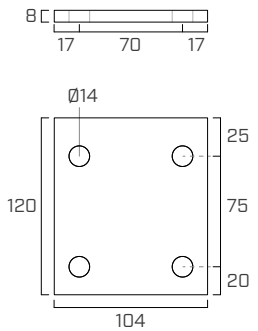
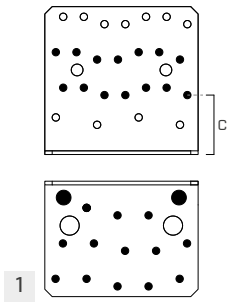
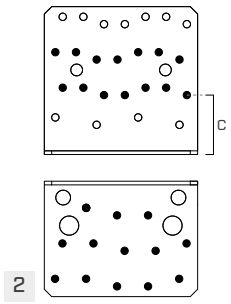


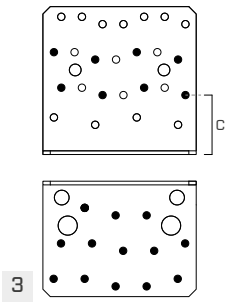
NINO100100 | TIMBER-TO-TIMBER FASTENING DIAGRAMS

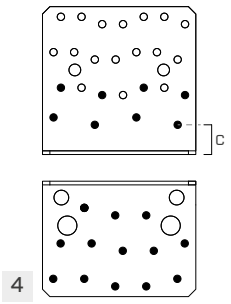
INSTALLATION ON CLT

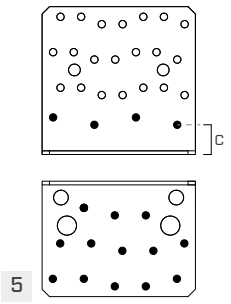




INSTALLATION ON TIMBER FRAME

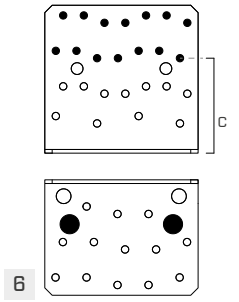


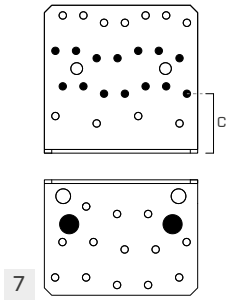




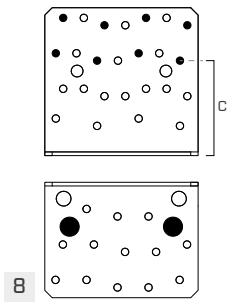
NINO100100 | TIMBER-TO-CONCRETE FASTENING DIAGRAMS

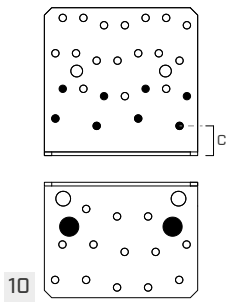
INSTALLATION ON CLT

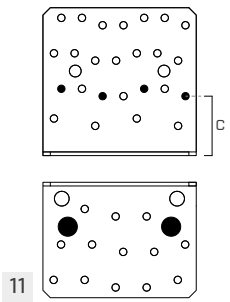


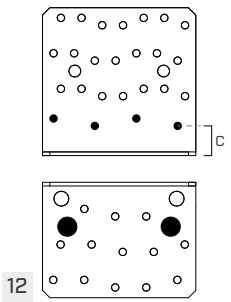


INSTALLATION ON TIMBER FRAME





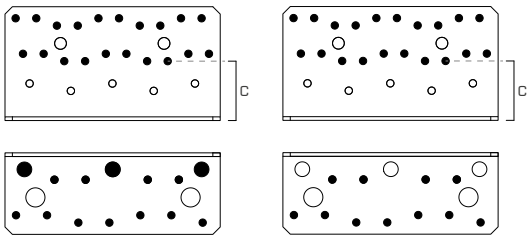




CODE	configuration	holes fastening Ø5		holes fastening Ø10	holes fastening Ø13	c	support	
		n_v	n_H	n_H	n_H			
		pcs	pcs	pcs	pcs	[mm]		
NINO100100	pattern 1	14	13	2	-	40	●	-
	pattern 2	14	13	-	-	40	●	-
	pattern 3	8	13	-	-	40	●	-
	pattern 4	8	13	-	-	20	●	-
	pattern 5	4	13	-	-	20	●	-
	pattern 6	14	-	-	2	64	-	●
	pattern 7	14	-	-	2	40	-	●
	pattern 8	8	-	-	2	64	-	●
	pattern 10	8	-	-	2	20	-	●
	pattern 11	4	-	-	2	40	-	●
	pattern 12	4	-	-	2	20	-	●

NINO15080 | TIMBER-TO-TIMBER FASTENING DIAGRAMS

INSTALLATION ON CLT



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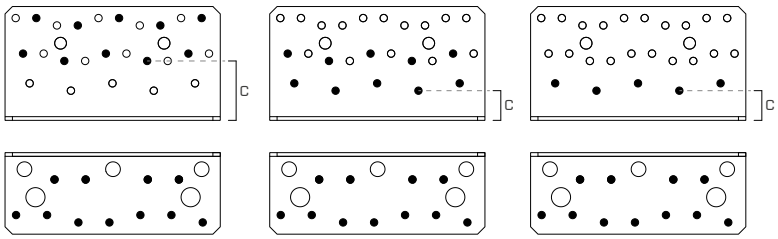
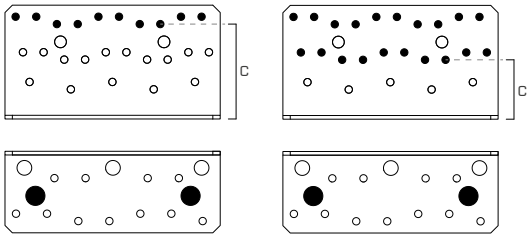
INSTALLATION ON TIMBER FRAME



3 4 5

NINO15080 | TIMBER-TO-CONCRETE FASTENING DIAGRAMS

INSTALLATION ON CLT



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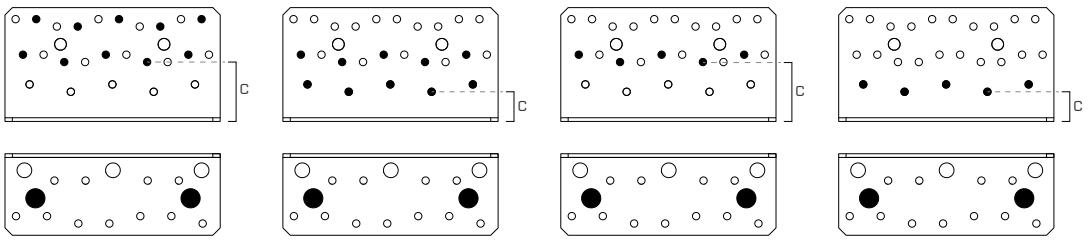
INSTALLATION ON TIMBER FRAME

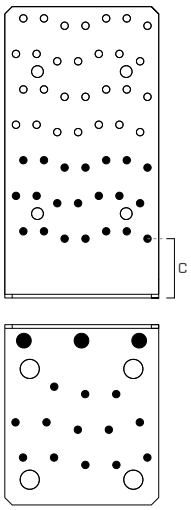


8 9 10 11

CODE	configuration	holes fastening Ø5		holes fastening Ø10	holes fastening Ø13	c	support	
		n_v	n_H	n_H	n_H			
		pcs	pcs	pcs	pcs	[mm]		
NINO15080	pattern 1	20	11	3	-	40	●	-
	pattern 2	20	11	-	-	40	●	-
	pattern 3	10	11	-	-	40	●	-
	pattern 4	10	11	-	-	20	●	-
	pattern 5	5	11	-	-	20	●	-
	pattern 6	10	-	-	2	64	-	●
	pattern 7	20	-	-	2	40	-	●
	pattern 8	10	-	-	2	40	-	●
	pattern 9	10	-	-	2	20	-	●
	pattern 10	5	-	-	2	40	-	●
	pattern 11	5	-	-	2	20	-	●

NINO100200 | TIMBER-TO-TIMBER FASTENING DIAGRAMS

INSTALLATION ON CLT



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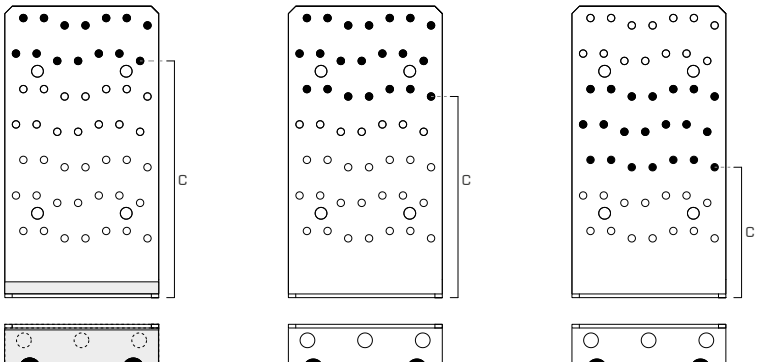
NINO100200 | TIMBER-TO-CONCRETE FASTENING DIAGRAMS

INSTALLATION ON CLT



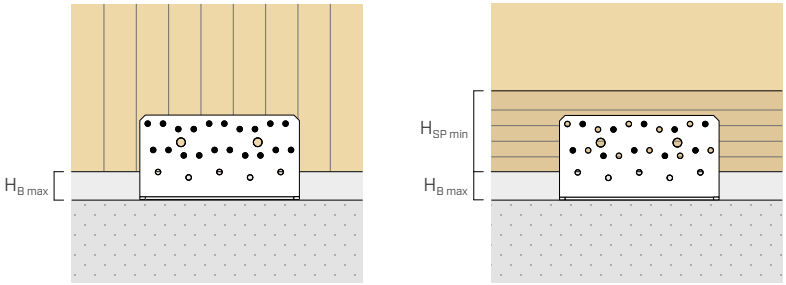
2 3 5

CODE	configuration	holes fastening Ø5		holes fastening Ø10	holes fastening Ø13		support	
		n_v	n_H	n_H	n_H	c		
		pcs	pcs	pcs	pcs	[mm]		
NINO100200	**pattern 1**	21	13	3	-	40	●	-
	pattern 2(*)	14	-	-	2	160	-	●
	pattern 3	21	-	-	2	136	-	●
	pattern 5	21	-	-	2	88	-	●

(*) Installation with washer NINOW100200.

INSTALLATION

MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER



NIN0100100

configuration	n_v holes Ø5	$H_{B\,max}$ [mm] CLT nails LBA Ø4	CLT screws LBS Ø5	C/GL nails LBA Ø4	C/GL screws LBS Ø5	$H_{SP\,min}$ [mm]
pattern 1	14	0	10	-	-	-
pattern 2	14	0	10	-	-	-
pattern 3	8	-	-	27	27	60
pattern 4	8	-	-	7	7	60
pattern 5	4	-	-	7	7	38
pattern 6	14	24	34	-	-	-
pattern 7	14	0	10	-	-	-
pattern 8	8	-	-	51	51	120
pattern 10	8	-	-	7	7	60
pattern 11	4	-	-	27	27	60
pattern 12	4	-	-	7	7	38

NIN015080

configuration	n_v holes Ø5	$H_{B\,max}$ [mm] CLT nails LBA Ø4	CLT screws LBS Ø5	C/GL nails LBA Ø4	C/GL screws LBS Ø5	$H_{SP\,min}$ [mm]
pattern 1	20	0	10	-	-	-
pattern 2	20	0	10	-	-	-
pattern 3	10	-	-	27	27	60
pattern 4	10	-	-	7	7	60
pattern 5	5	-	-	7	7	38
pattern 6	10	24	34	-	-	-
pattern 7	20	0	10	-	-	-
pattern 8	10	-	-	27	27	100
pattern 9	10	-	-	7	7	60
pattern 10	5	-	-	27	27	60
pattern 11	5	-	-	7	7	38

NIN0100200

configuration	n_v holes Ø5	$H_{B\,max}$ [mm] CLT nails LBA Ø4	CLT screws LBS Ø5
pattern 1	21	0	10
pattern 2	14	120	130
pattern 3	21	96	106
pattern 5	21	48	58

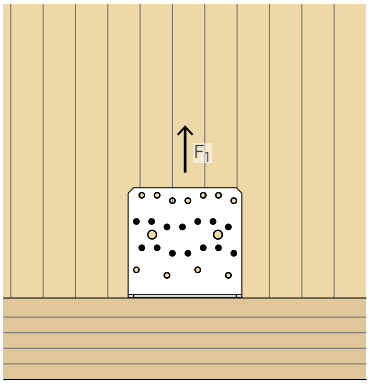
NOTES:

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:

- 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 consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420$ kg/m^3.
- The minimum platform thickness $H_{SP\,min}$ was determined by considering $a_{4,c} \geq 13$ mm and $a_{4,t} \geq 13$ mm with a minimum height of 38 mm in accordance with the requirements in ETA 22/0089.

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

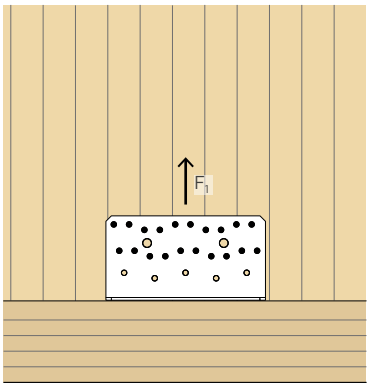
NINO100100



configuration	holes fastening Ø5				$R_{1,k\ timber}$	$K_{1,ser}$
	type	Ø x L [mm]	n_v pcs	n_H pcs	[kN]	[kN/mm]
pattern 1[(1)]	LBA nails	Ø4,0 x 60	14	13 + 2 VGS Ø9 x 140	20,0	$R_{1,k\ timber}/6$
	LBS screws	Ø5,0 x 50			20,0	
pattern 2	LBA nails	Ø4,0 x 60	14	13	5,9	$R_{1,k\ timber}/2$
	LBS screws	Ø5,0 x 50			6,8	

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

NINO15080



configuration	holes fastening Ø5				$R_{1,k\ timber}$	$K_{1,ser}$
	type	Ø x L [mm]	n_v pcs	n_H pcs	[kN]	[kN/mm]
pattern 1[(1)]	LBA nails	Ø4,0 x 60	20	11 + 3 VGS Ø9 x 140	39,5[(*)]	$R_{1,k\ timber}/6$
	LBS screws	Ø5,0 x 50			39,5[(*)]	
pattern 2	LBA nails	Ø4,0 x 60	20	11	4,0	$R_{1,k\ timber}/2$
	LBS screws	Ø5,0 x 50			6,0	

[(*)] In the case of installation coupled with an acoustic profile, the $R_{1,k\ timber}$ strength must be assumed to be 37,2 kN.

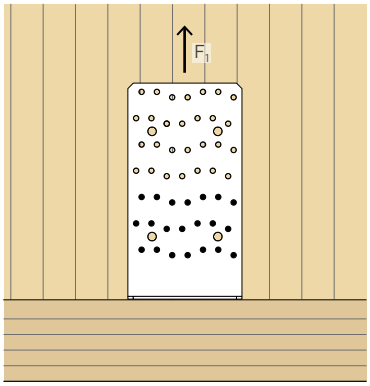
NOTES:

[(1)] The load-bearing capacity values listed are valid for installation with Ø9 VGS screws of length ≥ 140 mm. For screws of shorter length L, $R_{1,k\ timber}$ must be multiplied by a reduction factor of L/140.

- For angle bracket NINO100100, the strength values listed are also valid for installation with XYLOFON acoustic profile below the horizontal flange.

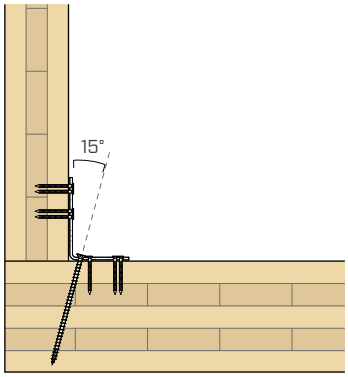
STRUCTURAL VALUES | TENSILE JOINT F_1 |TIMBER-TO-TIMBER

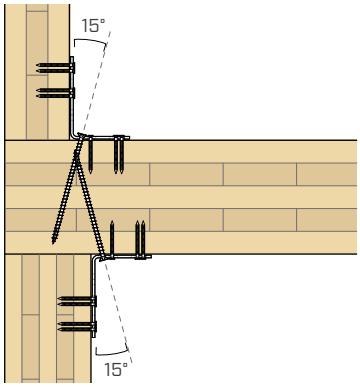
NINO100200



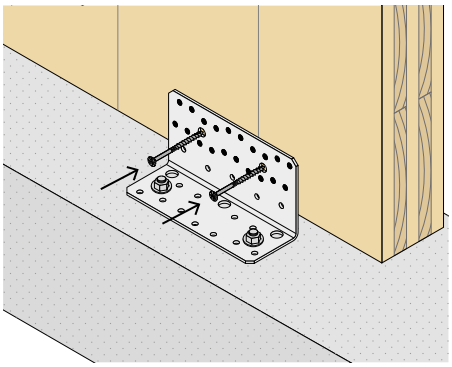
configuration	holes fastening Ø5				$R_{1,k\ timber}$	$K_{1,ser}$
	type	Ø x L	n_v	n_H		
		[mm]	pcs	pcs	[kN]	[kN/mm]
pattern 1(1)	LBA nails	Ø4,0 x 60	21	13 + 3 VGS Ø9 x 140	41,2	$R_{1,k\ timber}$/5
	LBS screws	Ø5,0 x 50			41,2	

INSTALLATION WITH INCLINED SCREWS | TIMBER-TO-TIMBER





WALL POSITIONING



Positioning of the walls using Ø6 or Ø8 screws to bring the panel closer to the angle bracket.

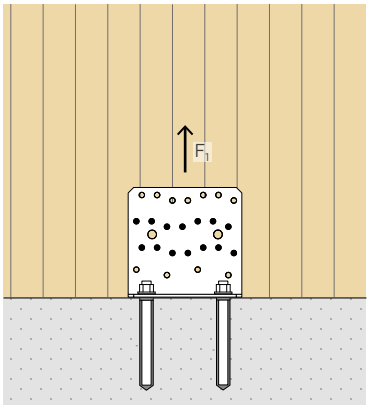
NOTES:

(1) The load-bearing capacity values listed are valid for installation with Ø9 VGS screws of length ≥ 140 mm. For screws of shorter length L, $R_{1,k\ timber}$ must be multiplied by a reduction factor of L/140.

- For NINO100200 angle bracket, the strength values listed are also valid for installation with XYLOFON acoustic profile.

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

NINO100100



TIMBER STRENGTH

configuration	TIMBER					CONCRETE		
	holes fastening Ø5			$R_{1,k\ timber}$	$K_{1,ser}$	holes fastening Ø13		$k_{t//}$
	type	Ø x L	n_v			Ø	n_H	
		[mm]	pcs	[kN]	[kN/mm]	[mm]	pcs	
pattern 6-7	LBA nails	Ø4,0 x 60	14	14,0	$R_{1,k\ timber}$/18	M12	2	1,21
	LBS screws	Ø5,0 x 50		14,0				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	holes fastening Ø13		$R_{1,d\ concrete}$
	type	Ø x L	pattern 6-7
		[mm]	[kN]
• **uncracked**	VIN-FIX 5.8[(1)]	M12 x 195	35,8
• **cracked**	VIN-FIX 5.8	M12 x 195	26,2
	HYB-FIX 5.8[(2)]	M12 x 195	38,8
• **seismic**	HYB-FIX 8.8	M12 x 195	15,5
		M12 x 245	20,1

CHEMICAL ANCHORS INSTALLATION PARAMETERS

anchor type		d_0	h_{ef}	h_{nom}	h_1	h_{min}
type	Ø x L					
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M12 x 195	14	170	170	175	200
HYB-FIX 8.8	M12 x 195		170	170	175	200
	M12 x 245		220	220	225	250

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
Concrete-side strength values were calculated assuming a t_{fix} thickness of 2 mm.

NOTES:

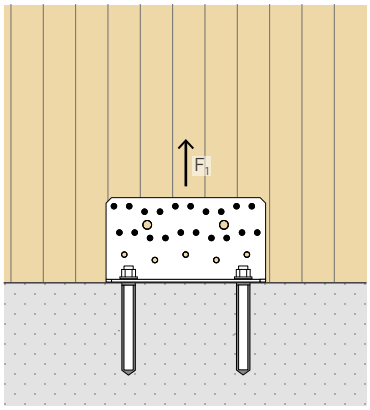
(1) VIN-FIX chemical anchor according to ETA 20/0363.
(2) HYB-FIX chemical anchor according to ETA 20/1285.

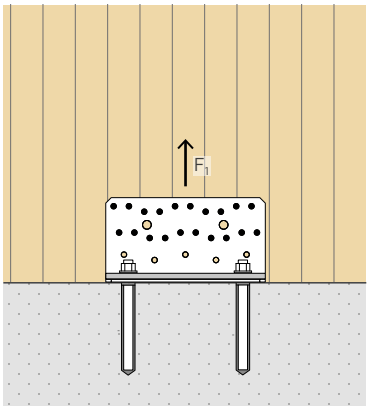
GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

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

NINO15080 | NINO15080 + NINOW15080





TIMBER STRENGTH

configuration	TIMBER							CONCRETE			
	holes fastening Ø5			no washer		washer		holes fastening Ø13		no washer	washer
	type	Ø x L	n_v	$R_{1,k\ timber}$	$K_{1,ser}$	$R_{1,k\ timber}$	$K_{1,ser}$	Ø	n_H	$k_{t//}$	$k_{t//}$
		[mm]	pcs	[kN]	[kN/mm]	[kN]	[kN/mm]	[mm]	pcs		
pattern 6	LBA nails	Ø4,0 x 60	10	14,7	$R_{1,k\ timber}/16$	24,9	$R_{1,k\ timber}/8$	M12	2	1,38	1,75
	LBS screws	Ø5,0 x 50		14,7		20,9					
pattern 7	LBA nails	Ø4,0 x 60	20	14,7		24,9					
	LBS screws	Ø5,0 x 50		14,7		24,9					

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	holes fastening Ø13		$R_{1,d\ concrete}$	
	type	Ø x L	no washer pattern 6-7	washer pattern 6-7
		[mm]	[kN]	[kN]
• **uncracked**	VIN-FIX 5.8[(1)]	M12 x 195	33,8	25,9
• **cracked**	VIN-FIX 5.8	M12 x 195	18,8	14,4
	HYB-FIX 5.8[(2)]	M12 x 195	36,2	27,7
• **seismic**	HYB-FIX 8.8	M12 x 195	14,3	10,9
		M12 x 245	18,6	13,9

CHEMICAL ANCHORS INSTALLATION PARAMETERS

anchor type		d_0	no washer				washer			
	[mm]	[mm]	h_{ef} [mm]	h_{nom} [mm]	h_1 [mm]	h_{min} [mm]	h_{ef} [mm]	h_{nom} [mm]	h_1 [mm]	h_{min} [mm]
VIN-FIX 5.8	M12 x 195	14	170	170	175	200	165	165	170	200
HYB-FIX 8.8	M12 x 195		170	170	175	200	165	165	170	200
	M12 x 245		220	220	225	250	210	210	215	240

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
The concrete-side strength values for installation with a washer were calculated assuming a t_{fix} thickness of 8 mm. For installation without washer, a t_{fix} value of 2 mm was assumed.

NOTES:

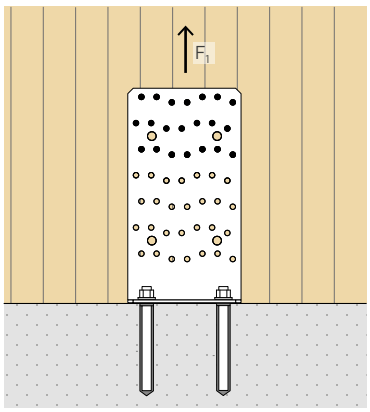
[(1)] VIN-FIX chemical anchor according to ETA 20/0363.
[(2)] HYB-FIX chemical anchor according to ETA 20/1285.

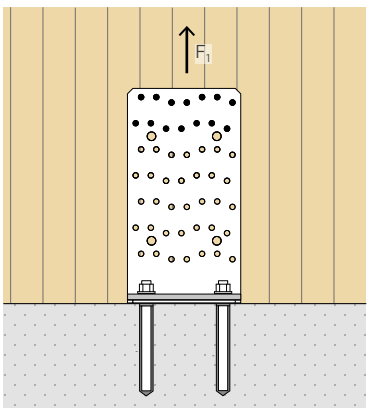
GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

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

NINO100200 | NINO100200 + NINOW100200





TIMBER STRENGTH

configuration	TIMBER							CONCRETE			
	holes fastening Ø5			no washer		washer		holes fastening Ø13		no washer	washer
	type	Ø x L	n_v	$R_{1,k\ timber}$	$K_{1,ser}$	$R_{1,k\ timber}$	$K_{1,ser}$	Ø	n_H	$k_{t//}$	$k_{t//}$
		[mm]	pcs	[kN]	[kN/mm]	[kN]	[kN/mm]	[mm]	pcs		
pattern 2	LBA nails	Ø4,0 x 60	14	-	$R_{1,k\ timber}/16$	34,7	$R_{1,k\ timber}/8$	M12	2	1,11	1,23
	LBS screws	Ø5,0 x 50		-		29,3					
pattern 3	LBA nails	Ø4,0 x 60	21	14,7		-					
	LBS screws	Ø5,0 x 50		14,7		-					
pattern 5	LBA nails	Ø4,0 x 60	21	14,7		-					
	LBS screws	Ø5,0 x 50		14,7		-					

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	holes fastening Ø13		$R_{1,d\ concrete}$	
	type	Ø x L	no washer pattern 3-5	washer pattern 2
		[mm]	[kN]	[kN]
• uncracked	VIN-FIX 5.8[(1)]	M12 x 195	39,0	34,2
	HYB-FIX 5.8[(2)]	M12 x 195	50,4	45,5
• cracked	VIN-FIX 5.8	M12 x 195	21,8	19,1
	HYB-FIX 5.8	M12 x 195	42,3	37,0
• seismic	HYB-FIX 8.8	M12 x 195	16,4	14,8
		M12 x 245	22,0	18,9

CHEMICAL ANCHORS INSTALLATION PARAMETERS

anchor type		d_0	no washer				washer			
	[mm]	[mm]	h_{ef} [mm]	h_{nom} [mm]	h_1 [mm]	h_{min} [mm]	h_{ef} [mm]	h_{nom} [mm]	h_1 [mm]	h_{min} [mm]
VIN-FIX 5.8	M12 x 195	14	170	170	175	200	165	165	170	200
HYB-FIX 5.8	M12 x 195		170	170	175	200	165	165	170	200
HYB-FIX 8.8	M12 x 195		170	170	175	200	165	165	170	200
	M12 x 245		220	220	225	250	210	210	215	240

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
The concrete-side strength values for installation with a washer were calculated assuming a t_{fix} thickness of 8 mm. For installation without washer, a t_{fix} value of 3 mm was assumed.

NOTES:

[(1)] VIN-FIX chemical anchor according to ETA 20/0363.
[(2)] HYB-FIX chemical anchor according to ETA 20/1285.

GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

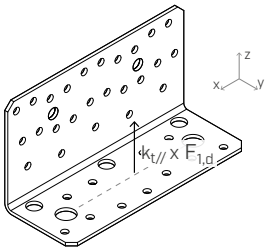
ANCHORS FOR CONCRETE STRESS VERIFICATION F_1

INSTALLATION WITH AND WITHOUT NINO 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 geometric parameters on the table (k_t).

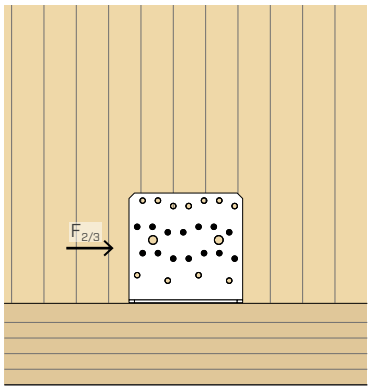
The anchor group must be verified for:

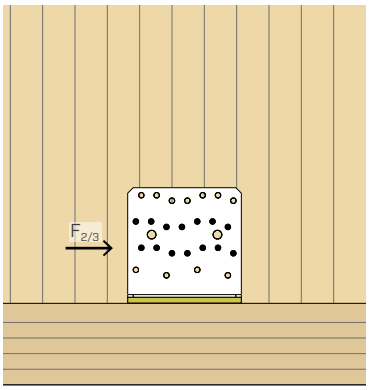
$N_{Sd,z} = k_{t//} \times F_{1,d}$



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

NIN0100100 | NIN0100100 + XYL3580105





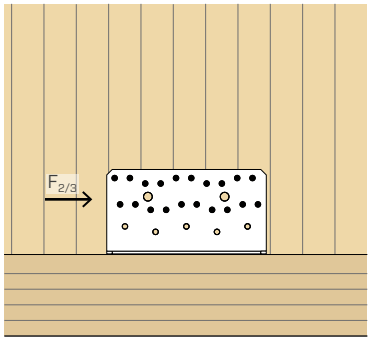
configuration	holes fastening Ø5				$R_{2/3,k\ timber}$		$K_{2/3,ser}$
	type	Ø x L	n_v	n_H	no XYLOFON	XYLOFON	
		[mm]	pcs	pcs	[kN]	[kN]	[kN/mm]
pattern 1	LBA nails	Ø4,0 x 60	14	13 + 2 VGS Ø9 x 140	38,1	34,6	$R_{2/3,k\ timber}/5$
	LBS screws	Ø5,0 x 50			18,5	16,9	
pattern 2	LBA nails	Ø4,0 x 60	14	13	17,2	9,4	
	LBS screws	Ø5,0 x 50			9,5	7,4	
pattern 3	LBA nails	Ø4,0 x 60	8	13	9,8	8,9	
	LBS screws	Ø5,0 x 50			9,1	7,4	
pattern 4	LBA nails	Ø4,0 x 60	8	13	11,3	9,4	
	LBS screws	Ø5,0 x 50			9,5	7,4	
pattern 5	LBA nails	Ø4,0 x 60	4	13	9,8	8,9	
	LBS screws	Ø5,0 x 50			9,0	7,4	

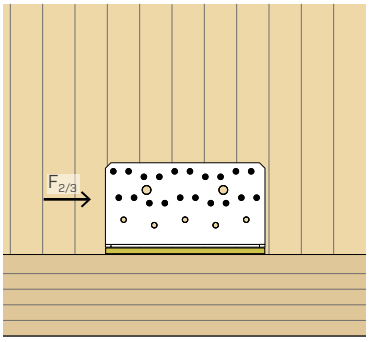
GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

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

NIN015080 | NIN015080+XYL3555150

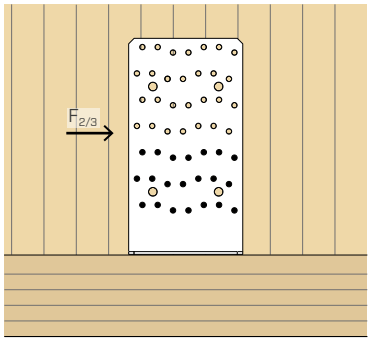


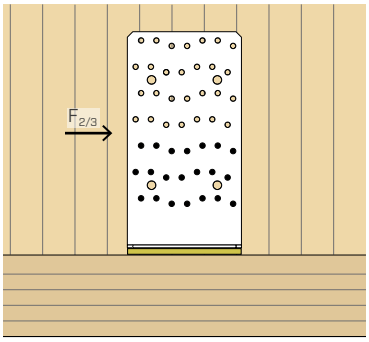


configuration	holes fastening Ø5				$R_{2/3,k\ timber}$		$K_{2/3,ser}$
	type	Ø x L	n_v	n_H	no XYLOFON	XYLOFON	
		[mm]	pcs	pcs	[kN]	[kN]	[kN/mm]
pattern 1	LBA nails	Ø4,0 x 60	20	11 + 3 VGS Ø9 x 140	38,1	34,6	$R_{2,3,k\ timber}/5$
	LBS screws	Ø5,0 x 50			27,6	25,5	
pattern 2	LBA nails	Ø4,0 x 60	20	11	15,5	13,0	
	LBS screws	Ø5,0 x 50			13,1	10,2	
pattern 3	LBA nails	Ø4,0 x 60	10	11	13,3	12,3	
	LBS screws	Ø5,0 x 50			12,3	10,1	
pattern 4	LBA nails	Ø4,0 x 60	10	11	15,5	13,0	
	LBS screws	Ø5,0 x 50			13,1	10,2	
pattern 5	LBA nails	Ø4,0 x 60	5	11	12,7	11,8	
	LBS screws	Ø5,0 x 50			11,2	10,0	

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

NIN0100200 | NIN0100200+XYL35120105





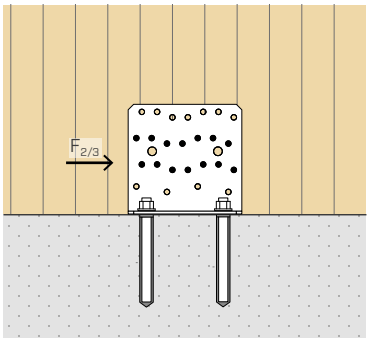
configuration	holes fastening Ø5				$R_{2/3,k\ timber}$		$K_{2/3,ser}$
	type	Ø x L	n_v	n_H	no XYLOFON	XYLOFON	
		[mm]	pcs	pcs	[kN]	[kN]	[kN/mm]
pattern 1	LBA nails	Ø4,0 x 60	21	13 + 3 VGS Ø9 x 140	26,7	18,7	$R_{2/3,k\ timber}/6$
	LBS screws	Ø5,0 x 50			18,7	17,2	

GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

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

NINO100100



TIMBER STRENGTH

configuration	TIMBER					CONCRETE		
	holes fastening Ø5			$R_{2/3,k\ timber}$	$K_{2/3,ser}$	holes fastening Ø13		
	type	Ø x L	n_v			Ø	n_H	e_y
		[mm]	pcs	[kN]	[kN/mm]	[mm]	pcs	[mm]
pattern 6	LBA nails	Ø4,0 x 60	14	18,1	$R_{2/3,k\ timber}/5$	M12	2	30
	LBS screws	Ø5,0 x 50		7,2				
pattern 7	LBA nails	Ø4,0 x 60	14	18,1				
	LBS screws	Ø5,0 x 50		9,8				
pattern 8	LBA nails	Ø4,0 x 60	8	5,8				
	LBS screws	Ø5,0 x 50		4,9				
pattern 10	LBA nails	Ø4,0 x 60	8	11,2				
	LBS screws	Ø5,0 x 50		9,4				
pattern 11	LBA nails	Ø4,0 x 60	4	9,3	$R_{2/3,k\ timber}/2$			
	LBS screws	Ø5,0 x 50		4,2				
pattern 12	LBA nails	Ø4,0 x 60	4	9,3				
	LBS screws	Ø5,0 x 50		6,3				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	holes fastening Ø14		$R_{2/3,d\ concrete}$
	type	Ø x L	
		[mm]	[kN]
• **uncracked**	VIN-FIX 5.8[(1)]	M12 x 140	30,3
	SKR-CE[(2)]	12 x 90	32,1
	AB1[(3)]	M12 x 100	30,7
• **cracked**	VIN-FIX 5.8	M12 x 140	26,9
	HYB-FIX 5.8[(4)]	M12 x 140	30,2
	SKR-CE	12 x 90	22,8
	AB1	M12 x 100	26,5
• **seismic**	HYB-FIX 8.8	M12 x 140	14,8
		M12 x 195	21,0
	SKR-CE	12 x 90	15,2
	AB1	M12 x 100	15,2

NOTES:

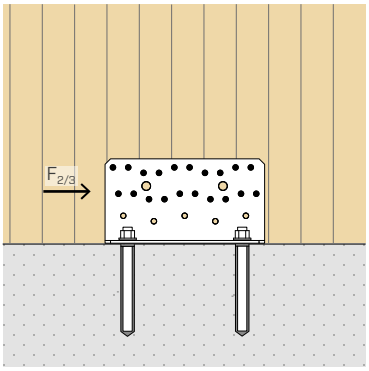
[(1)] VIN-FIX chemical anchor according to ETA 20/0363.
[(2)] SKR-CE screw anchor according to ETA 19/0100.
[(3)] AB1 mechanical anchor according to ETA 17/0481.
[(4)] HYB-FIX chemical anchor according to ETA 20/1285.

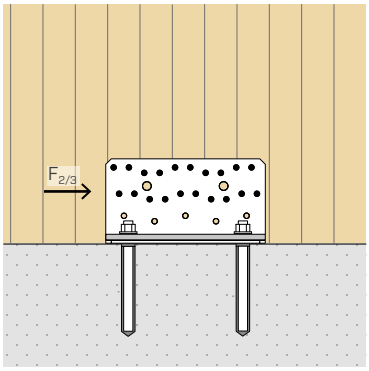
GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

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

NINO15080 | NINO15080 + NINOW15080





TIMBER STRENGTH

configuration	TIMBER					CONCRETE			
	holes fastening Ø5			no washer	washer	holes fastening Ø13			pattern 6
	type	Ø x L	n_v	$R_{2/3,k\ timber}$	$R_{2/3,k\ timber}$	Ø	n_H	e_y	e_z[1]
		[mm]	pcs	[kN]	[kN]	[mm]	pcs	[mm]	[mm]
pattern 6	LBA nails	Ø4,0 x 60	10	21,1	26,7	M12	2	30	66,5
	LBS screws	Ø5,0 x 50		7,9	7,9				
pattern 7	LBA nails	Ø4,0 x 60	20	21,3	21,3				
	LBS screws	Ø5,0 x 50		17,9	17,9				
pattern 8	LBA nails	Ø4,0 x 60	10	11,0	11,0				
	LBS screws	Ø5,0 x 50		9,3	9,3				
pattern 9	LBA nails	Ø4,0 x 60	10	15,7	15,7				
	LBS screws	Ø5,0 x 50		13,2	13,2				
pattern 10	LBA nails	Ø4,0 x 60	5	9,3	9,3				
	LBS screws	Ø5,0 x 50		6,0	6,0				
pattern 11	LBA nails	Ø4,0 x 60	5	10,0	10,0				
	LBS screws	Ø5,0 x 50		8,5	8,5				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$		
	type	Ø x L	no washer	washer pattern 6	washer pattern 7-8-9-10-11
		[mm]	[kN]	[kN]	[kN]
• **uncracked**	VIN-FIX 5.8[2]	M12 x 140	34,8	26,5	34,8
	VIN-FIX 8.8	M12 x 195	47,2	39,2	47,4
	SKR-CE[3]	12 x 90	37,6	15,6	37,6
	AB1[4]	M12 x 100	35,2	-	-
		M12 x 120	-	23,4	35,2
• **cracked**	VIN-FIX 5.8	M12 x 140	34,4	14,7	33,0
		M12 x 195	-	21,6	34,8
	HYB-FIX 8.8[5]	M12 x 140	47,2	28,5	47,4
	SKR-CE	12 x 90	29,8	7,5	29,8
	AB1	M12 x 100	34,3	-	-
		M12 x 120	-	14,4	34,2
• **seismic**	HYB-FIX 8.8	M12 x 140	18,4	8,8	17,8
		M12 x 195	26,2	13,0	26,1
	SKR-CE	12 x 90	17,5	-	8,8
	AB1	M12 x 120	17,5	-	8,8

NOTES:

[1] For patterns 7-8-9-10-11, eccentricity e_z is assumed to be zero, in accordance with ETA-22/0089.

[2] VIN-FIX chemical anchor according to ETA 20/0363.

[3] SKR-CE screw anchor according to ETA 19/0100.

[4] AB1 mechanical anchor according to ETA 17/0481.

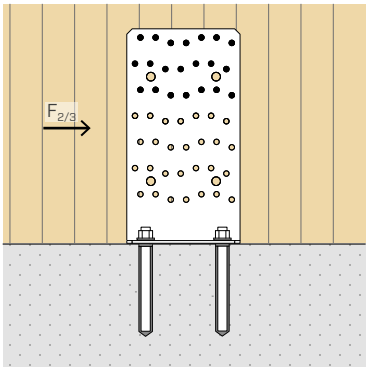
[5] HYB-FIX chemical anchor according to ETA 20/1285.

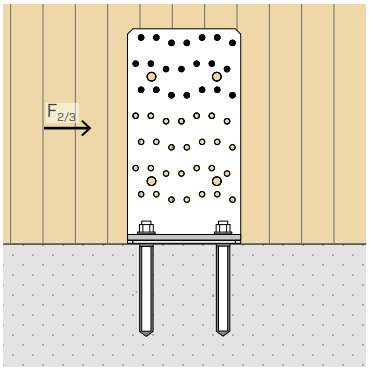
GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

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

NINO100200 | NINO100200 + NINOW100200





TIMBER STRENGTH

configuration	TIMBER					CONCRETE			
	holes fastening Ø5			no washer	washer	holes fastening Ø13			pattern 2
	type	Ø x L	n_v	$R_{2/3,k\ timber}$	$R_{2/3,k\ timber}$	Ø	n_H	e_y	e_z[1]
		[mm]	pcs	[kN]	[kN]	[mm]	pcs	[mm]	[mm]
pattern 2	LBA nails	Ø4,0 x 60	10	-	11,6	M12	3	30	174,5
	LBS screws	Ø5,0 x 50		-	3,5				
pattern 3	LBA nails	Ø4,0 x 60	10	10,7	-				
	LBS screws	Ø5,0 x 50		6,0	-				
pattern 5	LBA nails	Ø4,0 x 60	20	16,9	-				
	LBS screws	Ø5,0 x 50		8,3	-				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$	
	type	Ø x L	no washer pattern 3-5	washer pattern 2
		[mm]	[kN]	[kN]
• **uncracked**	VIN-FIX 5.8[2]	M12 x 195	30,3	11,4
	VIN-FIX 8.8	M12 x 195	41,2	12,5
	SKR-CE[3]	12 x 90	32,0	-
		12 x 110	-	4,8
	AB1[4]	M12 x 100	30,7	-
		M12 x 120	-	7,9
• **cracked**	VIN-FIX 8.8	M12 x 195	38,1	6,8
	VIN-FIX 8.8	M12 x 195	41,2	14,3
	SKR-CE	12 x 90	22,9	-
	AB1	M12 x 100	26,4	-
		M12 x 120	-	4,6
• **seismic**	HYB-FIX 8.8[5]	M12 x 140	14,8	-
		M12 x 195	21,0	5,0
	SKR-CE	12 x 90	7,6	-
	AB1	M12 x 100	7,7	-

NOTES:

[1] For patterns 3-5, eccentricity e_z is assumed to be zero.
[2] VIN-FIX chemical anchor according to ETA 20/0363.
[3] SKR-CE screw anchor according to ETA 19/0100.
[4] AB1 mechanical anchor according to ETA 17/0481.
[5] HYB-FIX chemical anchor according to ETA 20/1285.

GENERAL PRINCIPLES:

- For the general principles of calculation, see page 22.

CHEMICAL ANCHORS INSTALLATION PARAMETERS

NINO100100

anchor type		d_0	h_{ef}	h_{nom}	h_1	h_{min}
type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M12 x 140	14	120	120	125	200
HYB-FIX 5.8	M12 x 140	14	120	120	125	
HYB-FIX 8.8	M12 x 140	14	120	120	125	
	M12 x 195	14	170	170	175	
SKR-CE	12 x 90	10	64	88	110	
AB1	M12 x 100	12	70	80	85	

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
Concrete-side strength values were calculated assuming a t_{fix} thickness of 2 mm.

NINO15080

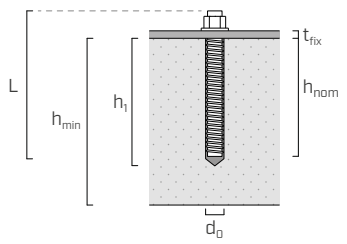
anchor type		d_0	no washer				washer			
			h_{ef}	h_{nom}	h_1	h_{min}	h_{ef}	h_{nom}	h_1	h_{min}
type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M12 x 140	14	120	120	125	200	115	115	120	200
	M12 x 195	14	170	170	175		170	170	175	
VIN-FIX 8.8	M12 x 195	14	170	170	175		170	170	175	
HYB-FIX 8.8	M12 x 140	14	120	120	125		115	115	120	
	M12 x 195	14	170	170	175		170	170	175	
SKR-CE	12 x 90	10	64	88	110		64	82	105	
AB1	M12 x 100	12	70	80	85		-	-	-	
	M12 x 120	12	-	-	-		70	80	85	

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
The concrete-side strength values for installation with a washer were calculated assuming a t_{fix} thickness of 8 mm. For installation without washer, a t_{fix} value of 2 mm was assumed.

NINO100200

anchor type		d_0	no washer				washer			
			h_{ef}	h_{nom}	h_1	h_{min}	h_{ef}	h_{nom}	h_1	h_{min}
type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M12 x 195	14	170	170	175	200	165	165	170	200
VIN-FIX 8.8	M12 x 195	14	170	170	175		165	165	170	
HYB-FIX 8.8	M12 x 140	14	120	120	125		115	115	120	
	M12 x 195	14	170	170	175		165	165	170	
SKR-CE	12 x 90	10	64	87	110		-	-	-	
	12 x 110	10	-	-	-		64	99	120	
AB1	M12 x 100	12	70	80	85		-	-	-	
	M12 x 120	12	-	-	-		70	80	85	

Pre-cut INA class 5.8 / 8.8 threaded rod, including nut and washer.
The concrete-side strength values for installation with a washer were calculated assuming a t_{fix} thickness of 11 mm. For installation without washer, a t_{fix} value of 3 mm was assumed.



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

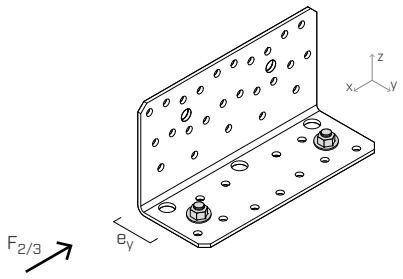
ANCHORS FOR CONCRETE STRESS VERIFICATION F2/3

INSTALLATION WITHOUT NINO 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 geometric parameters on the table (e).

The anchor group must be verified for:

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

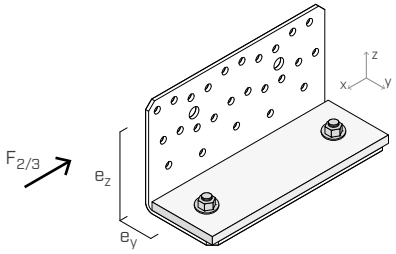


INSTALLATION WITH NINO WASHER

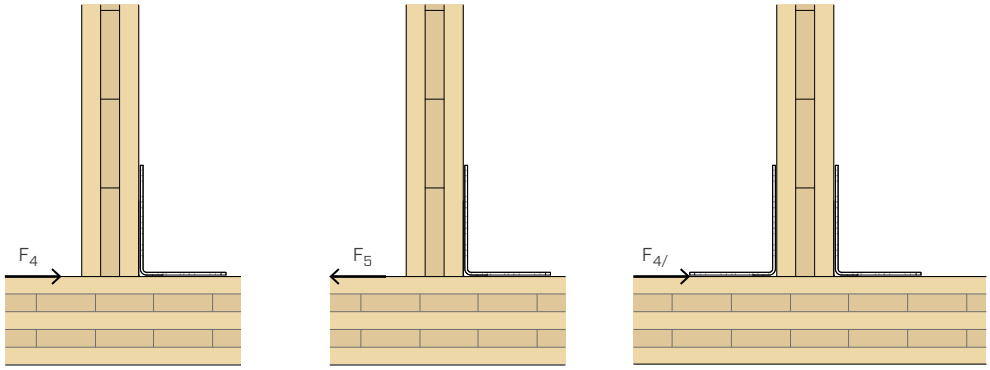
In the case of installation with NINO WASHER, the fastening elements to the concrete through anchors must be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).

The anchor group must be verified for:

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



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

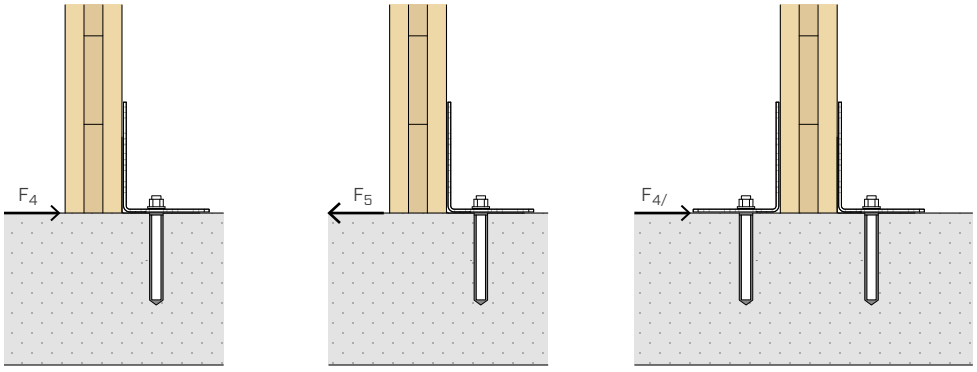


CODE	configuration	holes fastening Ø5				$R_{4,k\ timber}$	$R_{5,k\ timber}$	$R_{4/5,k\ timber}$
		type	Ø x L [mm]	n_v pcs	n_H pcs	[kN]	[kN]	[kN]
NINO100100	pattern 1	LBA nails	Ø4,0 x 60	14	13 + 2 VGS Ø9 x 140	23,2	1,8	25,0
		LBS screws	Ø5,0 x 50			22,0	1,8	23,8
	pattern 2	LBA nails	Ø4,0 x 60	14	13	23,2	1,8	25,0
		LBS screws	Ø5,0 x 50			22,0	1,8	23,8
	pattern 3	LBA nails	Ø4,0 x 60	8	13	7,4	1,8	9,2
		LBS screws	Ø5,0 x 50			7,4	1,8	9,2
	pattern 4	LBA nails	Ø4,0 x 60	8	13	23,2	3,4	26,6
		LBS screws	Ø5,0 x 50			22,0	3,4	25,4
	pattern 5	LBA nails	Ø4,0 x 60	4	13	9,2	3,4	12,6
		LBS screws	Ø5,0 x 50			9,2	3,4	12,6
NINO15080	pattern 1	LBA nails	Ø4,0 x 60	20	11 + 3 VGS Ø9 x 140	22,3	2,5	24,8
		LBS screws	Ø5,0 x 50			21,6	2,5	24,1
	pattern 2	LBA nails	Ø4,0 x 60	20	11	22,3	2,5	24,8
		LBS screws	Ø5,0 x 50			21,6	2,5	24,1
	pattern 3	LBA nails	Ø4,0 x 60	10	11	10,2	2,5	12,7
		LBS screws	Ø5,0 x 50			10,2	2,5	12,7
	pattern 4	LBA nails	Ø4,0 x 60	10	11	18,7	4,8	23,5
		LBS screws	Ø5,0 x 50			17,7	4,8	22,5
	pattern 5	LBA nails	Ø4,0 x 60	5	11	14,7	4,8	19,5
		LBS screws	Ø5,0 x 50			14,7	4,8	19,5
NINO100200	pattern 1	LBA nails	Ø4,0 x 60	21	13 + 3 VGS Ø9 x 140	19,1	2,6	21,7
		LBS screws	Ø5,0 x 50			19,1	2,6	21,7

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).
- Refer to ETA-22/0089 for $K_{4,ser}$ stiffness values in timber-to-timber and timber-to-concrete configuration.

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



CODE	configuration	holes fastening Ø5			$R_{4,k\ timber}$	$R_{5,k\ timber}$	$R_{4/5,k\ timber}$
		type	Ø x L	n_v			
			[mm]	pcs	[kN]	[kN]	[kN]
NINO100100	pattern 6	LBA nails	Ø4,0 x 60	14	6,2	1,1	7,4
		LBS screws	Ø5,0 x 50		6,2	1,1	7,4
	pattern 7	LBA nails	Ø4,0 x 60	14	23,2	1,8	25,0
		LBS screws	Ø5,0 x 50		22,0	1,8	23,8
	pattern 8	LBA nails	Ø4,0 x 60	8	3,8	1,1	5,0
		LBS screws	Ø5,0 x 50		3,8	1,1	5,0
	pattern 10	LBA nails	Ø4,0 x 60	8	14,4	3,4	17,8
		LBS screws	Ø5,0 x 50		13,6	3,4	17,0
	pattern 11	LBA nails	Ø4,0 x 60	4	6,3	1,8	8,1
		LBS screws	Ø5,0 x 50		5,9	1,8	7,7
	pattern 12	LBA nails	Ø4,0 x 60	4	9,2	3,4	12,6
		LBS screws	Ø5,0 x 50		9,2	3,4	12,6
NINO15080	pattern 6	LBA nails	Ø4,0 x 60	10	8,7	1,6	10,3
		LBS screws	Ø5,0 x 50		8,7	1,6	10,3
	pattern 7	LBA nails	Ø4,0 x 60	20	22,3	2,5	24,8
		LBS screws	Ø5,0 x 50		21,6	2,5	24,1
	pattern 8	LBA nails	Ø4,0 x 60	10	10,2	2,5	12,7
		LBS screws	Ø5,0 x 50		10,2	2,5	12,7
	pattern 9	LBA nails	Ø4,0 x 60	10	18,7	4,8	23,5
		LBS screws	Ø5,0 x 50		17,7	4,8	22,5
	pattern 10	LBA nails	Ø4,0 x 60	5	8,4	2,5	10,9
		LBS screws	Ø5,0 x 50		7,9	2,5	10,4
	pattern 11	LBA nails	Ø4,0 x 60	5	11,6	4,8	16,4
		LBS screws	Ø5,0 x 50		11,6	4,8	16,4
NINO100200	pattern 2	LBA nails	Ø4,0 x 60	14	2,1	0,7	2,8
		LBS screws	Ø5,0 x 50		2,1	0,7	2,8
	pattern 3	LBA nails	Ø4,0 x 60	21	2,6	0,8	3,4
		LBS screws	Ø5,0 x 50		2,6	0,8	3,4
	pattern 5	LBA nails	Ø4,0 x 60	21	4,9	1,2	6,1
		LBS screws	Ø5,0 x 50		4,9	1,2	6,1

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).
- Refer to ETA-22/0089 for $K_{4,ser}$ stiffness values in timber-to-timber and timber-to-concrete configuration.

GENERAL PRINCIPLES:

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

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

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

- The characteristic values of the load-bearing capacity $R_{k,timber}$ are determined for the combined timber-side and steel-side failure.
- 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

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2{,}66\ kN} ; \frac{F_{ax,short,Rk}}{1{,}28\ kN} \right\}$$

  - for screws

$$k_F = min \left\{ \frac{F_{v,short,Rk}}{2{,}25\ kN} ; \frac{F_{ax,short,Rk}}{2{,}63\ kN} \right\}$$

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

- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- For the calculation process a timber characteristic density ρ_k = 350 kg/m^3 has been considered. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

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

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

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- The anchors seismic design was carried out in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EN 1992-4, with α_{sus} = 0,6. For chemical anchors it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap} = 1).