WHT PLATE C CONCRETE

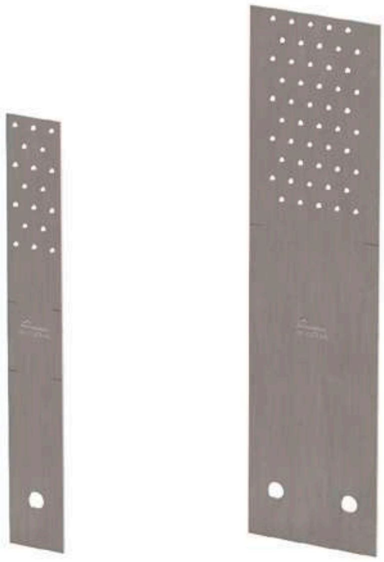
PLATES FOR TENSILE LOADS

CE
EN 14545

TWO VERSIONS
WHT PLATE 440, ideal for framed structures (platform frame); WHT PLATE 540, ideal for CLT panel structures (Cross Laminated Timber).

PLANAR JOINTS
Ideal for realizing distributed connections under tensile stress between the CLT (Cross Laminated Timber) panels and framed structures (platform frame) to and the concrete understructure.

QUALITY
The high tensile strength allows to optimize the number of plates installed, ensuring remarkable time saving.
Values calculated and certified according to CE marking.



CHARACTERISTICS

FOCUS	tensile joints on concrete
HEIGHT	440 | 540 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, SKR, VIN-FIX PRO, EPO-FIX PLUS

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

FIELDS OF USE
Timber-to-concrete shear joints for panels and timber struts
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels

TIMBER-TO-CONCRETE

Beside its natural function, it is ideal for solving situations where the transfer of tensile loads from timber to concrete is required.

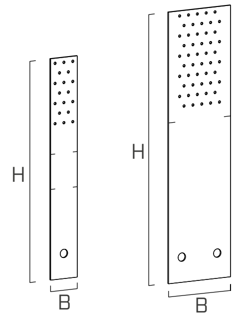
MULTIPURPOSE

Pre-calculated partial nailing can be used if there is a varying amount of stress or a levelling layer.

CODES AND DIMENSIONS

WHT PLATE C

CODE	B [mm]	H [mm]	holes [mm]	n_v Ø5 pcs	s [mm]		pcs
WHTPLATE440	60	440	Ø17	18	3	●	10
WHTPLATE540	140	540	Ø17	50	3	●	10



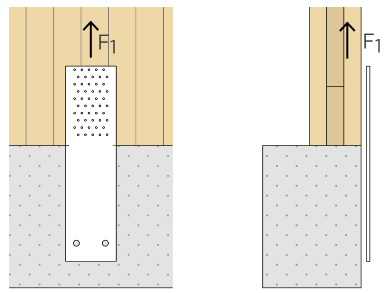
MATERIAL AND DURABILITY

WHT PLATE C: carbon steel DX51D+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

FIELD OF USE

- Timber-to-concrete joints
- OSB-to-concrete joints
- Timber-to-steel joints

EXTERNAL LOADS

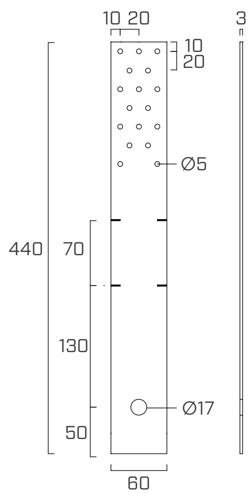


ADDITIONAL PRODUCTS - FASTENING

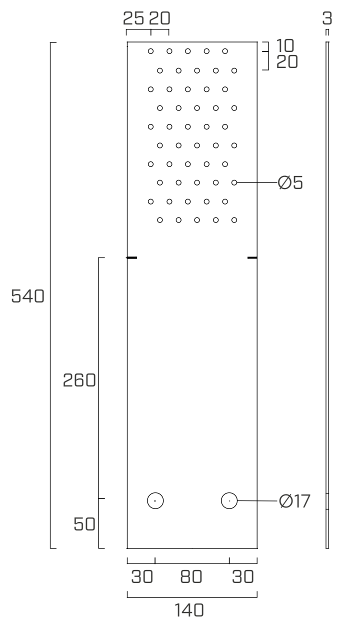
type	description	d [mm]	support	page
LBA	Anker nail	4		548
LBS	screw for plates	5		552
AB1	mechanical anchor	16		494
VIN-FIX PRO	chemical anchor	M16		511
EPO-FIX PLUS	chemical anchor	M16		517
KOS	bolt	M16		526

GEOMETRY

WHTPLATE440



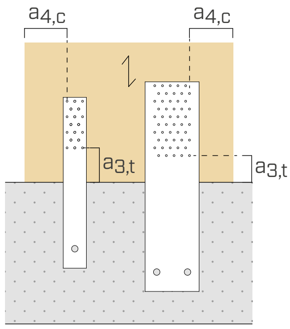
WHTPLATE540



INSTALLATION

TIMBER minimum distances			nails LBA Ø4	screws LBS Ø5
C/GL	$a_{4,c}$	[mm]	≥ 20	≥ 25
	$a_{3,t}$	[mm]	≥ 60	≥ 75
CLT	$a_{4,c}$	[mm]	≥ 12	≥ 12.5
	$a_{3,t}$	[mm]	≥ 40	≥ 30

- 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
- CLT: Minimum distances for Cross Laminated Timber according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA-11/0030 for screws



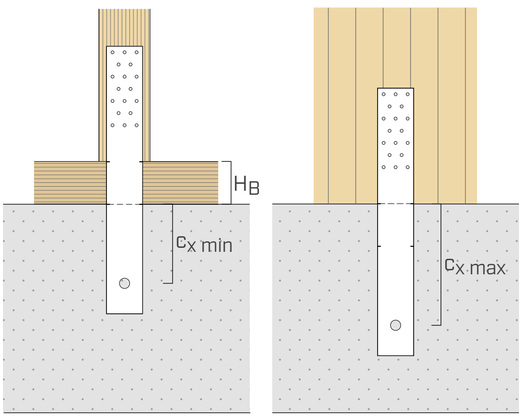
WHTPLATE440 INSTALLATION

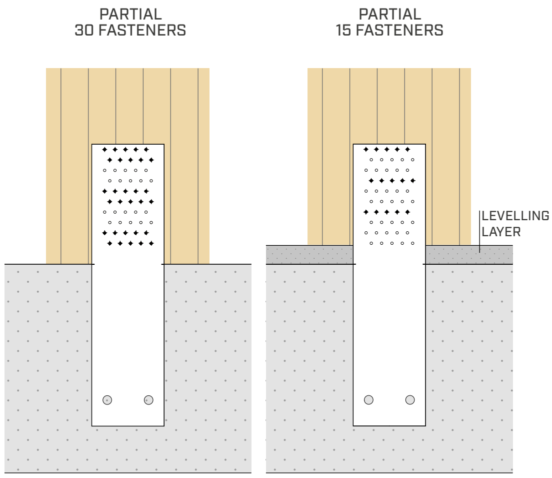
The WHT PLATE 440 can be used for different construction systems (CLT/frame) and ground connection systems (with/without **platform beam**, with/without levelling layer). Depending on the presence and dimension of H_B of the intermediate layer, in accordance with the minimum distances of the timber and concrete fasteners, the WHT PLATE 440 must be positioned in way that the anchor is at a distance from the concrete edge:

130 mm $\leq c_x \leq$ 200 mm.

WHTPLATE540 INSTALLATION

In the presence of design requirements such as varying stress values or the presence of a **levelling layer** between the wall and the support surface, it is possible to use pre-calculated and optimised **partial nailing** in order to influence the effective n_{ef} number of fastenings on timber. Alternative nailings are possible in accordance with the minimum distances for the connectors.

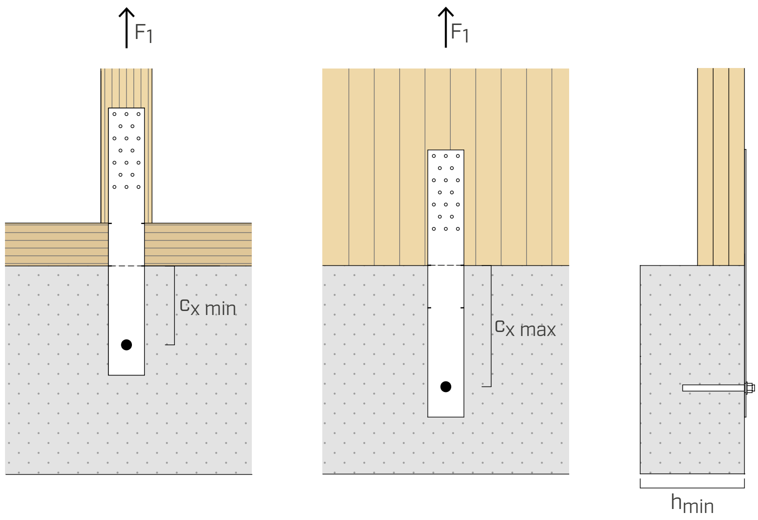




C_X [mm]	H_B [mm]
$c_{x\,min}$ = 130	70
$c_{x\,max}$ = 200	0

STATIC VALUES | TENSILE JOINT | TIMBER-TO-CONCRETE

WHTPLATE440



MINIMUM CONCRETE THICKNESS $h_{min} \geq 200$ mm

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	**holes fastening Ø5**			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	**Ø x L**	n_v				VIN-FIX PRO **Ø x L**		VIN-FIX PRO **Ø x L**		EPO-FIX PLUS **Ø x L**	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• $c_{2\ min}$ = 130 mm • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 190	**24,8**	M16 x 190	**17,6**	M16 x 190	**17,6**
	LBS screws	Ø5,0 x 60	18	**31,8**								
• $c_{2\ max}$ = 200 mm • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 190	**31,2**	M16 x 190	**25,1**	M16 x 190	**17,6**
	LBS screws	Ø5,0 x 60	15(1)	**27,5**								

MINIMUM CONCRETE THICKNESS $h_{min} \geq 150$ mm

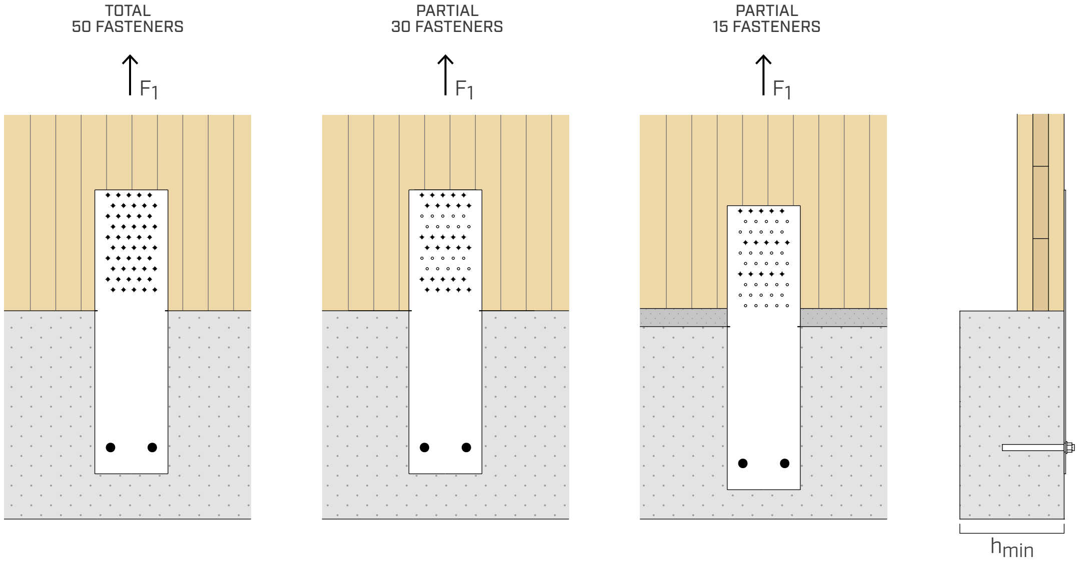
	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE					
configuration	**holes fastening Ø5**			$R_{1,k\ timber}$	$R_{1,k\ steel}$		$R_{1,d\ uncracked}$		$R_{1,d\ cracked}$		$R_{1,d\ seismic}$	
	type	**Ø x L**	n_v				EPO-FIX PLUS **Ø x L**		EPO-FIX PLUS **Ø x L**		EPO-FIX PLUS **Ø x L**	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• $c_{2\ min}$ = 130 mm • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 136	**20,2**	M16 x 136	**14,3**	M16 x 136	**14,3**
	LBS screws	Ø5,0 x 60	18	**31,8**								
• $c_{2\ max}$ = 200 mm • total fastening • 1 anchor M16	LBA nails	Ø4,0 x 60	18	**35,0**	**34,8**	γ_{M2}	M16 x 136	**28,8**	M16 x 136	**20,4**	M16 x 136	**17,6**
	LBS screws	Ø5,0 x 60	15 (1)	**27,5**								

NOTES:

(1) For the configuration in the table it is recommended not to install the screws of the lower row at a distance of $_{3,t}$ (stressed end) = 15d = 75 mm.

STATIC VALUES | TENSILE JOINT | TIMBER-TO-CONCRETE

WHTPLATE540



MINIMUM CONCRETE THICKNESS $h_{min} \geq 200$ mm

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE[3]					
configuration	holes fastening Ø5			$R_{1,k}$ timber	$R_{1,k}$ steel		$R_{1,d}$ uncracked		$R_{1,d}$ cracked		$R_{1,d}$ seismic	
	type	Ø x L	n_v				VIN-FIX PRO Ø x L		VIN-FIX PRO Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• **total fastening** • 2 anchors M16	LBA nails	Ø4,0 x 60	50	**83,5**	**70,6**	γ_{M2}	M16 x 190	**48,2**	M16 x 190	**34,2**	M16 x 190	**29,0**
	LBS screws	Ø5,0 x 60	50	**81,6**								
• **partial fastening**[2] 30 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	30	**70,8**								
	LBS screws	Ø5,0 x 60	30	**69,9**								
• **partial fastening**[2] 15 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	15	**35,4**								
	LBS screws	Ø5,0 x 60	15	**35,0**								

MINIMUM CONCRETE THICKNESS $h_{min} \geq 150$ mm

	$R_{1,K}$ TIMBER				$R_{1,K}$ STEEL		$R_{1,d}$ CONCRETE[3]					
configuration	holes fastening Ø5			$R_{1,k}$ timber	$R_{1,k}$ steel		$R_{1,d}$ uncracked		$R_{1,d}$ cracked		$R_{1,d}$ seismic	
	type	Ø x L	n_v				EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L		EPO-FIX PLUS Ø x L	
		[mm]	[pcs]	[kN]	[kN]	γ_{steel}	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
• **total fastening** • 2 anchors M16	LBA nails	Ø4,0 x 60	50	**83,5**	**70,6**	γ_{M2}	M16 x 136	**39,6**	M16 x 136	**28,0**	M16 x 136	**23,8**
	LBS screws	Ø5,0 x 60	50	**81,6**								
• **partial fastening**[2] 30 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	30	**70,8**								
	LBS screws	Ø5,0 x 60	30	**69,9**								
• **partial fastening**[2] 15 fasteners • 2 anchors M16	LBA nails	Ø4,0 x 60	15	**35,4**								
	LBS screws	Ø5,0 x 60	15	**35,0**								

NOTES:

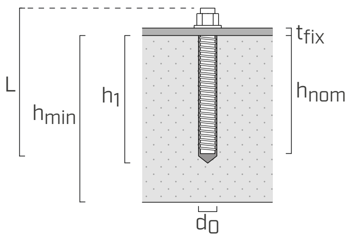
(2) In the case of configurations with partial nailing, the strength values in the table are valid for the installation of fasteners in timber in accordance with $a_1 > 10d$ ($n_{ef} = n$)

(3) The concrete strength values are valid if the assembly notches of the WHT-PLATE540 plate are positioned at the timber-to-concrete interface (c_x = 260 mm).

CHEMICAL ANCHORS INSTALLATION PARAMETERS[1]

anchor type		t_{fix}	$h_{nom} = h_{ef}$	h_1	d_0	h_{min}
type	**Ø x L** [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
EPO-FIX PLUS 5.8	M16 x min 136	3	114	120	18	**150**
VIN-FIX PRO EPO-FIX PLUS 5.8	M16 x 190	3	164	170		**200**

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534



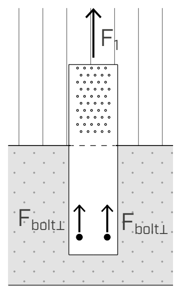
t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

DIMENSIONING OF ALTERNATIVE ANCHORS

Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchor and evaluable through the coefficients $k_{t\perp}$. The lateral shear load acting on the anchor can be obtained as follows:

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

$k_{t\perp}$	coefficient of eccentricity
F_1	tensile stress acting on the WHT PLATE



	$k_{t\perp}$
WHTPLATE440	1,00
WHTPLATE540	0,50

The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_{bolt\perp,d} \geq F_{bolt\perp,d}$.

NOTES FOR SEISMIC DESIGN

Particular attention has to be paid to the "capacity design" applied at different scale levels: the global structure and the connection system. Experimentally the ultimate strength of the LBA nail (and of the LBS screw) is notably larger than the characteristic strength evaluated according to EN 1995.
E.g. LBA nail Ø4 x 60 mm: $R_{v,k}$ =2,8 - 3,6 kN by experimental tests (variable according to the type of timber and plate thickness).

Experimental data derive from tests carried out within the Seismic-Rev research project and are reported in the scientific report: "Connection systems for timber buildings: experimental campaign to characterize stiffness, strength and ductility" (DICAM - Department of Civil, Environmental and Mechanical Engineering - UniTN).

NOTES:

[1] Valid for the strength values shown in the table.

GENERAL PRINCIPLES:

- Characteristic values according to EN 1995-1-1. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.

  The connection design strength value is 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.

- The timber strength values $R_{1,k\ timber}$ are calculated considering the effective number according to Table 8.1 (EN 1995-1-1)
- The calculation process used a timber characteristic density of $\rho_k = 350\ kg/m^3$ and C25/30 concrete with a thin reinforcing layer and minimum thickness indicated in the relative tables.
- Concrete design strength values are supplied for uncracked ($R_{1,d\ uncracked}$), cracked ($R_{1,d\ cracked}$) concrete and in case of seismic verification ($R_{1,d\ seismic}$) for use of chemical anchor with threaded rod in steel class 5.8.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2 elastic design according to EOTA TR045). For chemical anchors it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).
- 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), the anchor-to-concrete group can be verified using MyProject calculation software according to the design requirements.
- Dimensioning and verification of timber and concrete elements must be carried out separately.