5

05 SHEARING ANGLES SHEARING/TENSILE PLATES

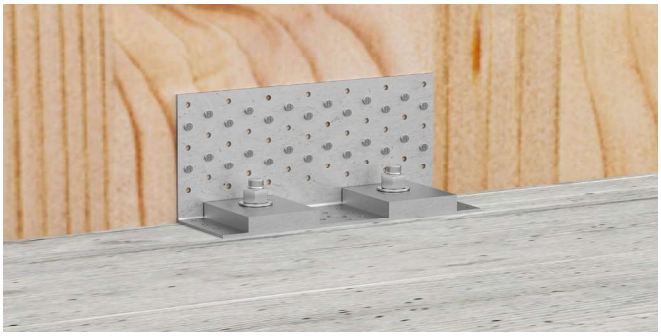
SHEARING ANGLES SHEARING/TENSILE

SHEARING ANGLES

The shearing angles "shearing 80" and "shearing 120" were developed to take shearing and tensile loads in timber frames and solid timber construction.

Advantages:

- Connection timber/concrete
- Efficient and quick assembly with GH threaded nails
- Expandable by modular system
- Hole pattern is optimised for board plywood and softwood
- Hole spacing is also optimised for any height compensation
- Various nail patterns are possible, including under consideration of the grain course and edge spacing
- Assembly via intermediate layer, which can and cannot move



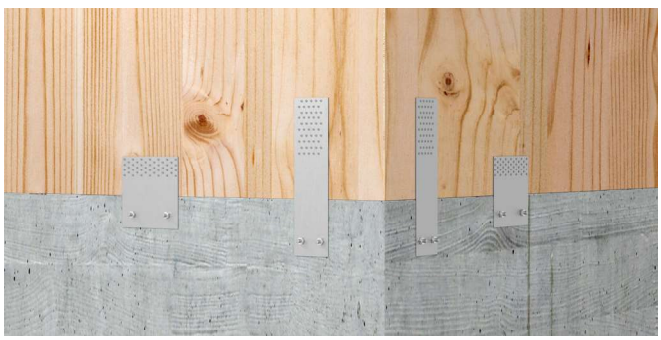
Products **from page 194**

SHEARING AND TENSILE PLATES

Tensile plates were developed to transfer the tensile forces from timber frames and solid timber walls into the baseplate.

Advantages:

- Connection timber/concrete
- Economic and quick assembly
- Hole pattern is optimised for board plywood and softwood
- Various nail patterns are possible, including under consideration of the grain course and edge spacing
- Assembly via intermediate layer, which can and cannot move



Basics of statics **from page 196**
Products & statics **from page 202**

SHEARING/TENSILE PLATES - SHEARING ANGLES

ASSORTMENT

							Basics Statics from page	Products & Statics from page
SHEARING ANGLES			250 GD Z275	NKL 2				194
SHEARING ANGLES & PULL TABS IN THE MODULAR SYSTEM			250 GD Z275	NKL 2				194
SHEARING PLATES		CE	250 GD Z275	NKL 2			196	202
TENSION PLATES		CE	250 GD Z275	NKL 2			196	202

5

CE symbol

Steel with indication of the steel quality and zinc coating

Timber/timber connection

Timber/concrete-connection

NKL 1 **Usage class 1**
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 65% for a few weeks per year, e.g. in the case of buildings that are closed on all sides and heated.
Comment: In UC 1, the average moisture content of most softwoods does not exceed 12 %.

NKL 2 **Usage class 2**
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 85% for a few weeks per year, e.g. in the case of open buildings covered by a roof.
Comment: In UC 2, the average moisture content of most softwoods does not exceed 20 %.

NKL 3 **Usage class 3**
Includes climatic conditions that lead to higher moisture contents than in UC 2, e.g. structures that are exposed to the weather without protection. Eurocode 5 / DIN EN 1995-1-1 section 2.3.1.3

SHEARING AND TENSILE PLATES

TECHNICAL FEATURES

Geometry

H	Height (mm)
L	Length (mm)
W(B)	Width (mm)
T(S)	Material thickness (mm)
Ø [mm]	Diameter

Tables

$F_{z,rk}$	Max. load capacity in load direction [kN]
n	Number of holes Ø5.0
n_{Bo}	Number of holes for dowels/bolts with Ø 17.0[mm]
n_{erf}	Necessary number of nails/screws
$F_{Stahl,Rk}$	Characteristic steel load capacity [kN]
NH	Softwood C24
BSP	Board plywood VH 24
⟷	Grain course

Timber connecting element

GH threaded holes ETA-13/0523 Ø4.0xL [mm]
GH wood connector screw ETA-13/0523 Ø5 [mm]
Dowels/bolts

Load directions

$F_{z,rk}$ ↑	Tensile PL 440 + PL 540; lifting load, load direction F1
$F_{z,rk}$ ↔	Shearing PL140; PL220; PL 260 shearing load, load direction $F_{2/3}$

Design

$F_{timber,Rk}$	Characteristic value of load capacity "timber"
$F_{steel,Rk}$	Characteristic value of load capacity "Steel"
k_{mod}	Modification coefficient according to EN 1995-1-1
γM	Partial safety factor for connections in wood construction (DE: γ_M=1.3
γM2	Partial safety factor for stress of structural steel connections on perforated soffit (DE: γ_{M2}=1.25)

Axis/edge spacing

$a_{4,t}$	Minimum spacing from stressed edge, vertical
$a_{3,t}$	to the grain direction
e_{Bo}	Minimum spacing from stressed end grain, parallel
a_{Bo}	to the grain direction
ΔH	Possible height compensation between the lower edge of the timber and Concrete top edge

Steel with indication of the steel quality and zinc coating

Timber/timber connection

Timber/concrete-connection

Usage class 1
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 65% for a few weeks per year, e.g. in the case of buildings that are closed on all sides and heated.
Comment: In UC 1, the average moisture content of most softwoods does not exceed 12 %.

Usage class 2
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 85% for a few weeks per year, e.g. in the case of open buildings covered by a roof.
Comment: In UC 2, the average moisture content of most softwoods does not exceed 20 %.

Usage class 3
Includes climatic conditions that lead to higher moisture contents than in UC 2, e.g. structures that are exposed to the weather without protection. Eurocode 5 / DIN EN 1995-1-1 section 2.3.1.3

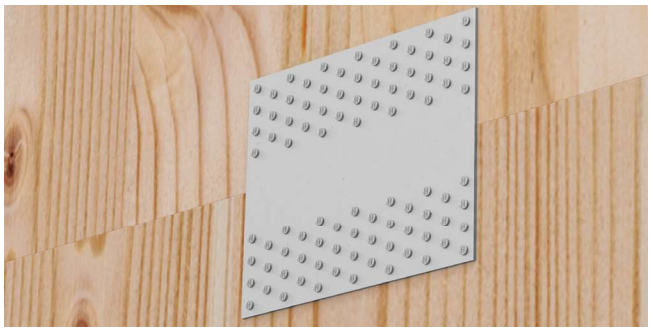
SHEARING AND TENSILE

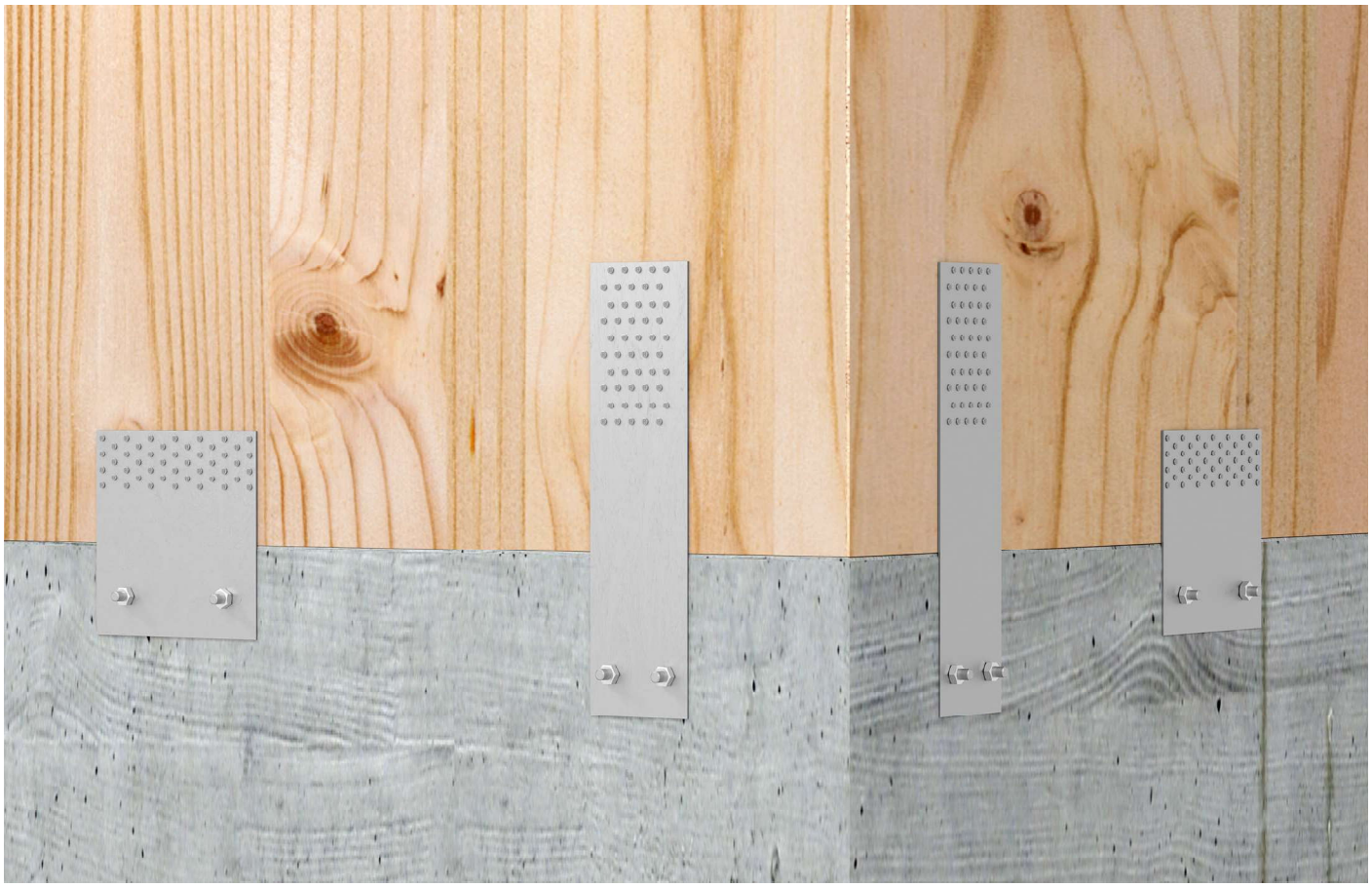
APPLICATIONS

Application:
GH shearing plates for the introduction of shear forces of timber frame and solid wood walls.
GH tension plates for the introduction of tensile forces of timber frame and solid wood walls

Materials:
250 GD Z275

Material thickness:
3.0 mm



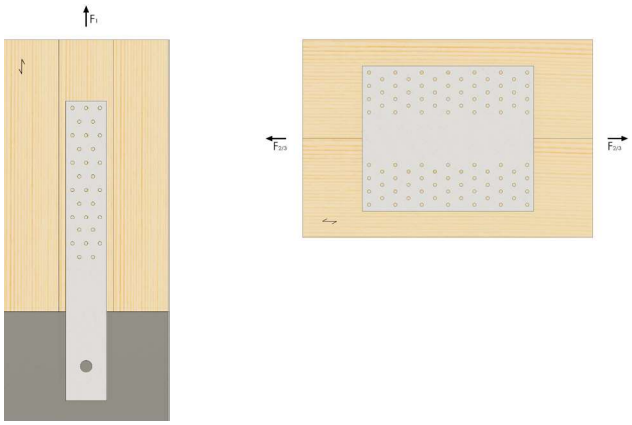


Connecting element
GH threaded nails 4.0 x 35 / 40 / 50 / 60 / 75 / 100 mm
GH screws 5.0 x 25 / 35 / 40 / 50 / 60 / 70 mm
Bolt, dowel or concrete anchor M16

Connecting elements from page 274

SHEARING AND TENSILE PLATES

LOAD DIRECTIONS



Minimum and edge spacing

			GH threaded nails Ø 4.0 x L [mm]	
[mm]		Reduktion*	min. for NH / BSP	Selected NH / BSP
a_1	10d / 12d	0,7	28	40
a_2	5d	0,7	14	20
			min. for HN	selected for HN
$a_{3,t}$	15d	-	60	60
$a_{4,t}$	7d / 10d	-	28	30
			min. for BSP	Selected for BSP
$a_{3,t}$	12d	-	48	50

* Reduction of the connecting element spacing according to EN 1995-1-1:2010, section 8.3.1.4 (1)

Connection to timber

Partial nail fitting or partial screw fitting
Full nail fitting or full screw fitting
Nail patterns for NH = softwood C24 and BSP= board plywoodz VH 24

Load capacities of individual connecting elements

In addition to the listed load-bearing capacity of the individual fastening elements in shearing, a possible block shear failure was taken into account in the load-bearing capacities, see DIN EN 1995-1-1, Annex A.

Connection over intermediate layers

The specified load-bearing capacities also apply to intermediate layers if the following requirements are met:
Intermediate layer:
- OSB boards type OSB/3 and OSB/4 according to EN 13986 (EN 300) or approval
- Synthetic resin-bonded chipboard in accordance with EN 13986 (EN 312) or approval
- Solid wood panels according to EN 13986 (EN 13353) or approval
- Plywood according to EN 13986 (EN 636) or approval
- Plasterboards according to approval
- Fibreboards according to EN 13986 (EN 622-2 and 622-3) minimum raw density 650 kg/m^3

The value of the characteristic bearing strength of the intermediate layer must at least fulfil the value for solid softwood of strength class C24.
The compressive strength of the intermediate layer when loaded at right angles to the connecting surface (for wood-based panels, compressive strength perpendicular to the board plane) must be at least equal to the value of the compressive strength perpendicular to the grain for solid softwood of strength class C24.

Connection of the intermediate layer
The intermediate layer must be force-fit to the timber component (non-moving intermediate layer).
In other cases and generally in the case of movable intermediate layers, the load-bearing capacity of the connecting element should be determined individually for the respective connection.

Connecting element for intermediate layers
The length must be selected so that the profiled length (insert depth) behind the intermediate layer corresponds at least to the length specified in the statics tables.

Connection to concrete

The load-bearing capacity for fixing in concrete must be verified separately in accordance with the requirements of the selected anchor, bolt, screw with Ø16mm.
Edge spacing in the concrete component must be selected and verified in accordance with the selected connecting elements in the concrete and the associated approval/ETA.

Design / proof

Combined stress
For GH screws under combined stress of pulling out and shearing, the following condition must be met:

$$\left(\frac{F_{ax,Ed}}{F_{ax,Rd}}\right)^2 + \left(\frac{F_{v,Ed}}{F_{v,Rd}}\right)^2 \leq 1$$

Load capacities of steel sheet
In the statics tables, the following proof of load capacity has been considered for the steel plate:
Tensile and shearing load capacity of steel, perforated soffit

Design values
To determine the design value of the respective connector, the decisive design value from the connection is determined.

Design value of "timber" failure

$$F_{Holz,Rd} = k_{mod} \cdot \frac{F_{Holz,Rk}}{\gamma_M}$$

Design value of "steel" failure

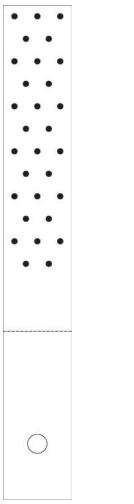
$$F_{Stahl,Rd} = \frac{F_{Stahl,Rk}}{\gamma_{M2}}$$

Design tablen

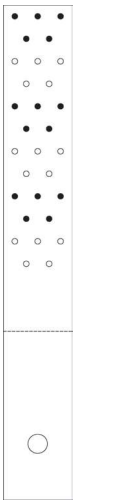
Load capacities in timber in kN
For the connections, the assumption is made that the interconnected components are held against twisting and that eccentric load situations are therefore excluded.
The number of nails must be used under consideration of the specified nail/screw patterns.

Nail/screw patterns for pull tabs

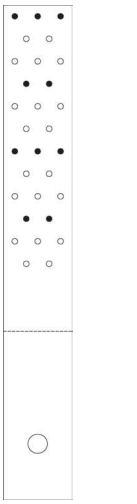
1: Full nail fitting
n = 30
11260440



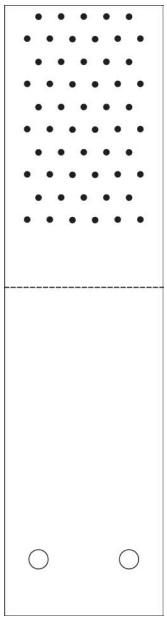
2: Partial nail fitting
n = 15
11260440



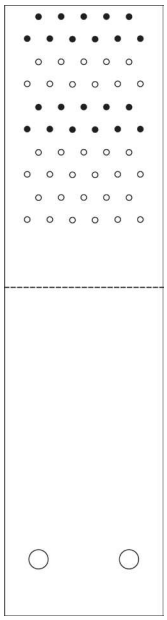
3: Partial nail fitting
n = 10
11260440



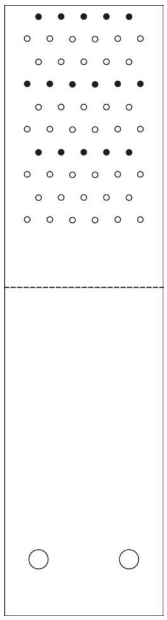
1: Full nail fitting
n = 55
112140540



2: Partial nail fitting
n = 22
112140540

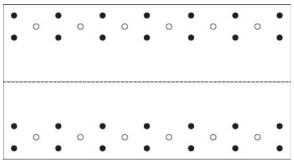


3: Partial nail fitting
n = 16
112140540

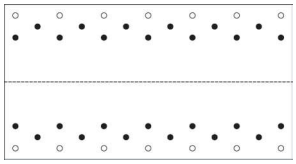


Nail/screw patterns for shearing plates

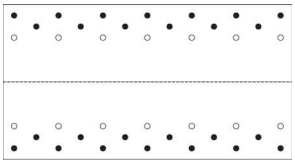
1: Partial nail fitting
Sleeper/plate (NH/BSH) or board plywood (BSP)
Side surface grain direction
112140260



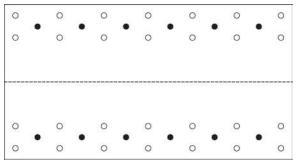
2: Partial nail fitting
Board plywood (BSP)
Side surface grain direction
112140260



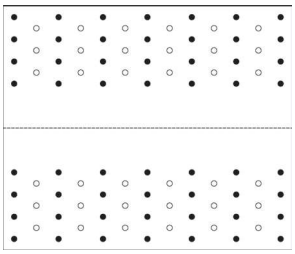
3: Partial nail fitting
Board plywood (BSP)
Side surface grain direction
112140260



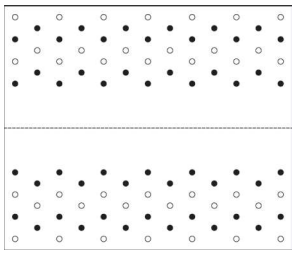
4: Partial nail fitting
Board plywood (BSP)
Narrow surface grain direction
112140260



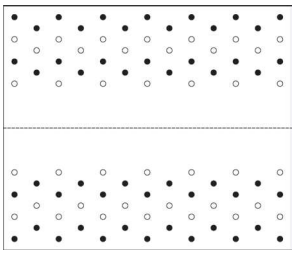
Sleeper (NH/BSH) or board plywood
Side surface
112220260



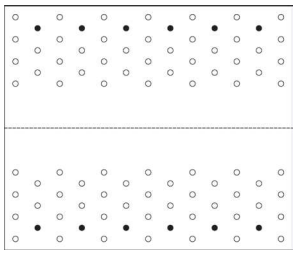
Board plywood (BSP)
Side surface
112220260



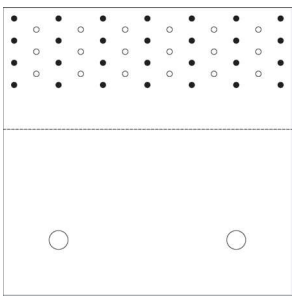
Board plywood (BSP)
Side surface grain direction vertical
112220260



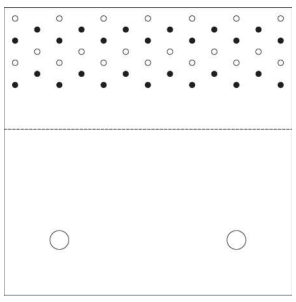
Board plywood (BSP)
Narrow surface grain direction
112220260



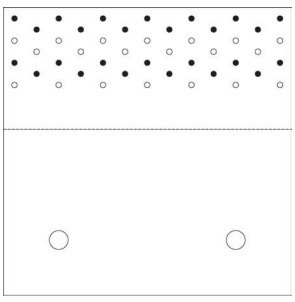
Sleeper (NH/BSH) or board plywood
Side surface grain direction
112260260



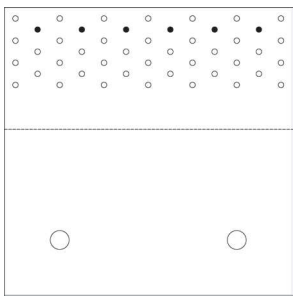
Board plywood (BSP)
Side surface grain direction
112260260



Board plywood (BSP)
Side surface
112260260



Board plywood (BSP)
Narrow surface grain direction
112260260



TECHNICAL ADVICE ON TIMBER CONNECTORS AND WOOD CONSTRUCTION SCREWS!

TIPP

Our technology team will offer you extensive advice on our timber connectors and wood construction screws.

Whether you are a trader, user or construction engineer, if you require technical information about timber connectors and wood construction screws or have technical questions about structural or building physics problems, please contact our

technical hotline: +49 7023 743323-40
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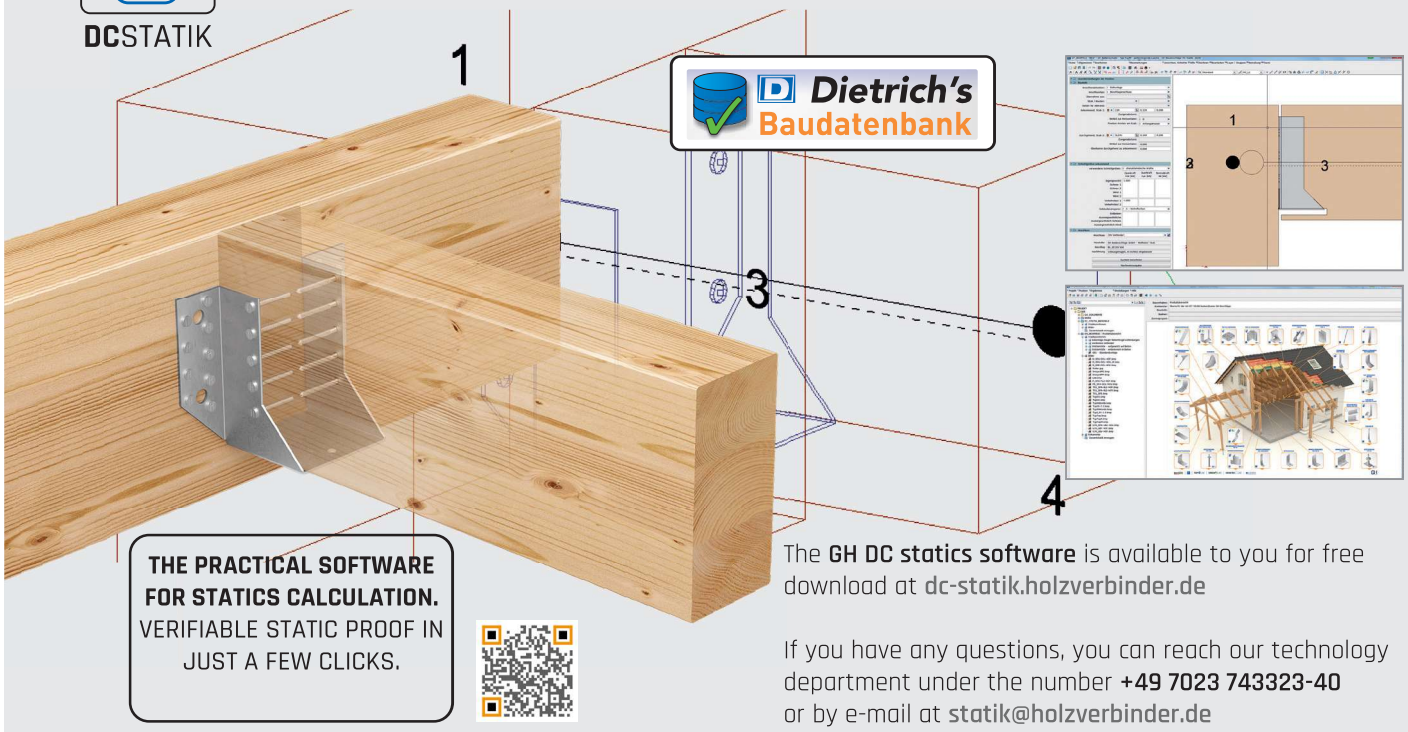
EXTENSIVE DESIGN OF OUR GH WOOD CONNECTORS* **WITH THE GH D STATICS**



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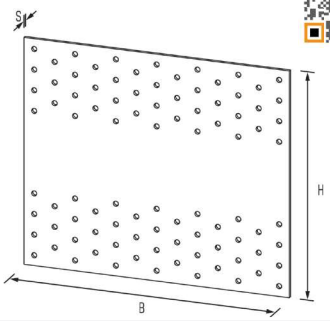
*Joist hanger timber/timber, integral connector, UV connector timber/timber, OV connector, stanchion



TOPLINE KONSTRULINE EN 14545

NKL 2 250 GD Z275

SHEARING PLATES

TYPE PL

Art. No.	Dimensions [mm]					nN	nBo	EAN	Weight	Pallet	PU		
	H	x	W(B)	x	T(S)	Ø 5	Ø 17	4019346	kg				
112140260	140	x	260	x	3,0	40	-	032879	0.804	480	10	■	
112220260	220	x	260	x	3,0	96	-	032886	1.263	480	10	■	

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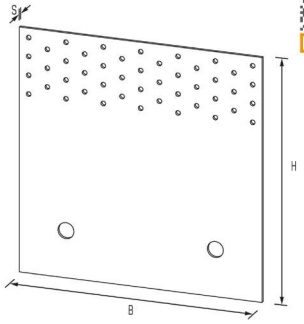


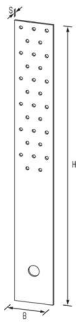
TOPLINE KONSTRULINE EN 14545

NKL 2 250 GD Z275

SHEARING PLATES

TYPE PL 260

Art. No.	Dimensions [mm]					nN	nBo	EAN	Weight	Pallet	PU		
	H	x	W(B)	x	T(S)	Ø 5	Ø 17	4019346	kg				
112260260	260	x	260	x	3,0	46	2	032893	1.493	480	10		■



TOPLINE KONSTRULINE EN 14545

NKL 2 250 GD Z275

TENSILE PLATES

TYPE PL

Art. No.	Dimensions [mm]					nN	nBo	EAN	Weight	Pallet	PU		
	H	x	W(B)	x	T(S)	Ø 5	Ø 17	4019346	kg				
11260440	440	x	60	x	3,0	30	1	032787	0.519	540	10		■
112140540	540	x	140	x	3,0	55	2	032794	1.740	160	10		■

SHEARING PLATES TYPE PL

Timber / Timber

Art. No.	Load case $F_{2/3}$					Nail pattern	1		2		3		4*		5**	
	H	W(B)	T(S)	Ø5	Ø17	VM	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$
112140260	140	260	3	40	-	4.0x50	21,90	28	20,50	26	18,90	26	9,10	12(14)	12,50	12
						4.0x60	23,30	28	21,80	26	20,20	26	9,70	12(14)	13,30	12
						4.0x75	24,80	28	32,20	26	21,50	26	10,30	12(14)	14,10	12
112220260	220	260	3	96	-	4.0x50	30,40	56	31,90	48	30,00	52	6,10	24(28)*	13,30	24
						4.0x60	32,40	56	34,10	48	32,10	52	6,50	24(28)*	14,20	24
						4.0x75	34,40	56	36,20	48	34,00	52	6,90	24(28)*	15,10	24

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SHEARING PLATES TYPE PL 260

Timber / Concrete

Art. No.	Load case $F_{2/3}$					Nail pattern	1		2		3		4*	
	H	W(B)	T(S)	Ø5	Ø17	VM	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$
112260260	260	260	3	46	2	4.0x50	30,40	28	31,90	26	30,00	26	6,10	6-7
						4.0x60	32,40	14	34,10	13	32,10	13	6,50	6-7
						4.0x75	34,40	14	36,20	13	34,00	13	6,90	6-7

* The connecting elements must be arranged in the narrow face of the cross laminated timber in such a way that they are not located in the end grain.

** Connections with differing connection patterns, for combinations of connection pattern 4 with one of the connection patterns 1 to 3 – e.g. narrow surface BSP (nail pattern 4) with side surface PSB (nail pattern 1-3).

TENSILE PLATES TYPE PL

Timber / Concrete

Art. No.	Load case F_1					Nail pattern	1		2		3		
	H	W(B)	T(S)	Ø5	Ø17	VM	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{z,rk}$	$n_{erf.}$	$F_{steel,Rk}$
11260440	440	60	3	30	1	4.0x50	31,60	30	31,60	15	22,10	10	35,30
						4.0x60	38,30	30	35,50	15	23,60	10	35,30
						4.0x75	48,40	30	37,70	15	25,10	10	35,30
112140540	540	140	3	55	2	4.0x50	63,20	55	48,70	22	35,40	16	70,60
						4.0x60	76,60	55	52,00	22	37,80	16	70,60
						4.0x75	96,80	55	55,30	22	40,20	16	70,60