

3



03

ANGLE BRACKETS

ANGLE BRACKETS

ANGLE BRACKETS TOP 80 / TOP 120

Advantages

- No bothersome centre rib during processing
- Optimised hole pattern
- Full nail fitting always possible
- High stability due to special, discreet corrugation
- Type 80 as an alternative to the "size 90 bracket"
- GREENLINE = resource-saving manufacturing



Introduction to statics **from page 110** / Products & statics **from page 120**

ANGLE BRACKET 110/170 S

Advantages

- Universal use for higher loads
- 9 bolt holes Ø 13 mm
- Perfectly suited to take loads F_2 and F_3



Introduction to statics **from page 110** / Products & statics **from page 132**

ANGLE BRACKET TOP KR 90E (EXTRA)

Advantages

- 40 % lighter in comparison to 90 x 90 x 65 x 2.5 mm
- High stability due to raised edge on both sides
- Versatile in use
- Alternative to different brackets such as 70 x 70 x 55 mm and 90 x 90 x 65 mm (for use under consideration of the necessary loads)
- Very good for loads due to the outer rib F_2/F_3 and F_1 suitable



Introduction to statics **from page 110** / Products & statics **from page 124**

ANGLE BRACKETS KR

Advantages

- For connections between timber/timber; timber/concrete
For use on timber/masonry etc.
- Due to the ribs in the bending radius, KR angle brackets are very sturdy, economical and affordable in use for extreme loads
- By making use of the Greenline series, you receive products with resource-saving manufacturing. This gives you an ecologically and economic advantage



Introduction to statics **from page 110** / Products & statics **from page 134**

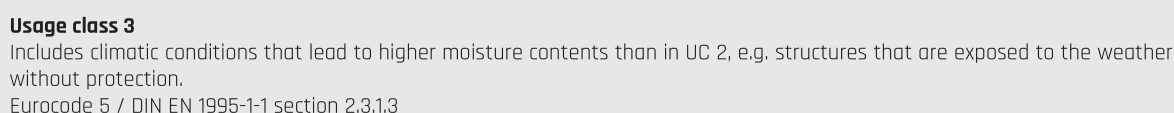
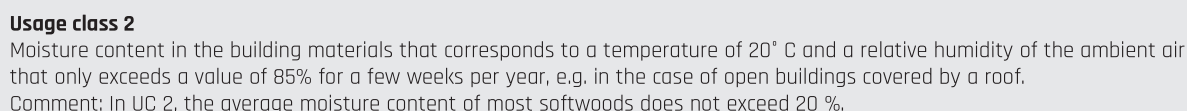
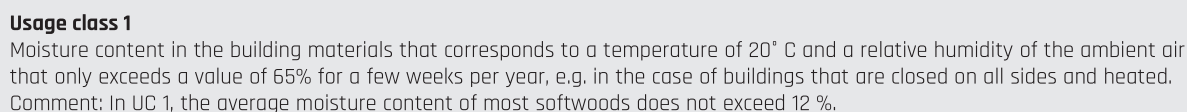
ANGLE BRACKETS

ASSORTMENT

						Height [mm]	Length [mm]	Width [mm]	Basics Statik & Diagramme from page	Products & Statik from page	Products Made of V4A from page
ANGLE BRACKET TOP 80/120						80-120	60	55	110	120	
ANGLE BRACKET 70X70X2.0					 	70	70	55	110	122	293
ANGLE BRACKET 70X70 GREENLINE						70	70	55	110	122	
ANGLE BRACKET TOP KR90E						95	85	65	110	124	
ANGLE BRACKET 90X90X2.5					 	90	90	65	110	128	293
ANGLE BRACKET 90X90 GREENLINE						90	90	65	110	126	
ANGLE BRACKET 100X100X3.0					 	100	100	90	110	130	293
ANGLE BRACKET 100X100 GREENLINE						105	105	90	110	130	
STRUT CONNECTOR 135 DEGREES						90-100	90-100	65-90		132	
ANGLE BRACKET TYPE 110/170L						170	110	95	110	132	
ANGLE BRACKET KR 3 MM						95-285	88	65	110	134	
ANGLE BRACKET KR 4 MM						95-285	88	65	110	134	
ANGLE BRACKET TYPE 50/80						90	50	50-80	110	138	
ANGLE BRACKET TYPE 110						90	50	110	110	138	
ANGLE BRACKET TYPE 55/80						80	60	55	110	140	
ANGLE BRACKET TYPE 60/100						100	60	60	110	140	
CONSOLE ANGLE						120-200	54	60	110	142	
ANGLE BRACKET TYPE 40/45						50-90	50-90	40-45	110	144	
ANGLE BRACKET TYPE 40/90					 	90	90	40	110	146	294
ANGLE BRACKET TYPE 40/120						120	95	40	110	146	
ANGLE BRACKET TYPE 692						65	65	90	110	146	

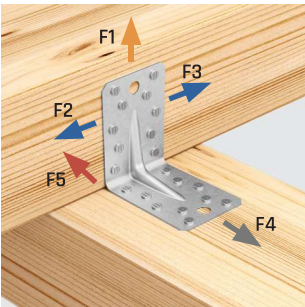
ASSORTMENT

	CE symbol
	Steel with indication of the steel quality and galvanisation
	Stainless steel with material number
	Timber/timber connection
	Timber/concrete-connection

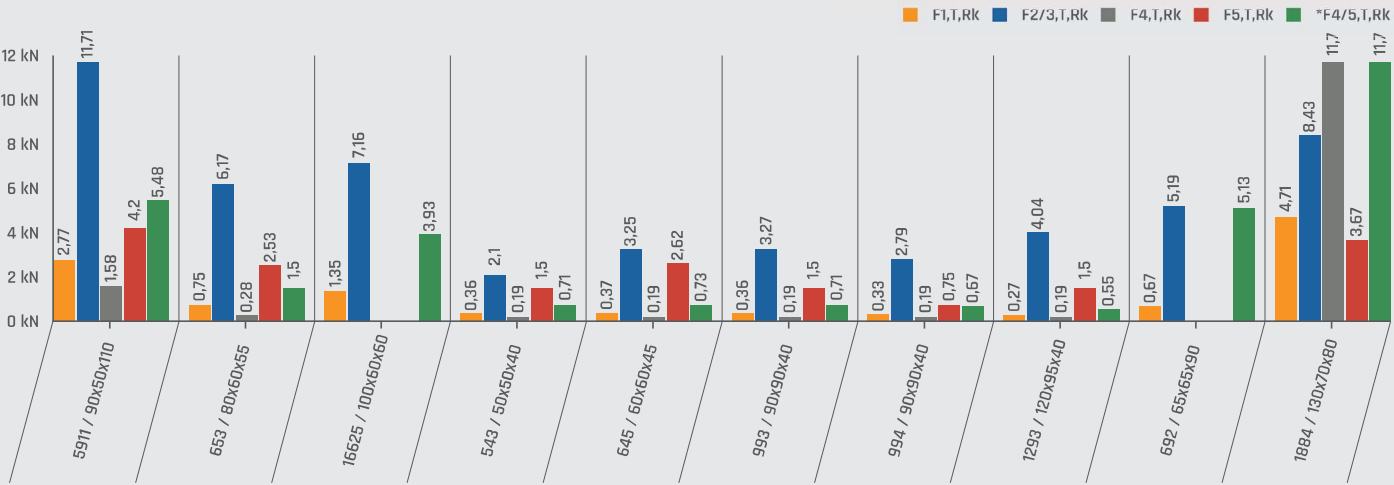
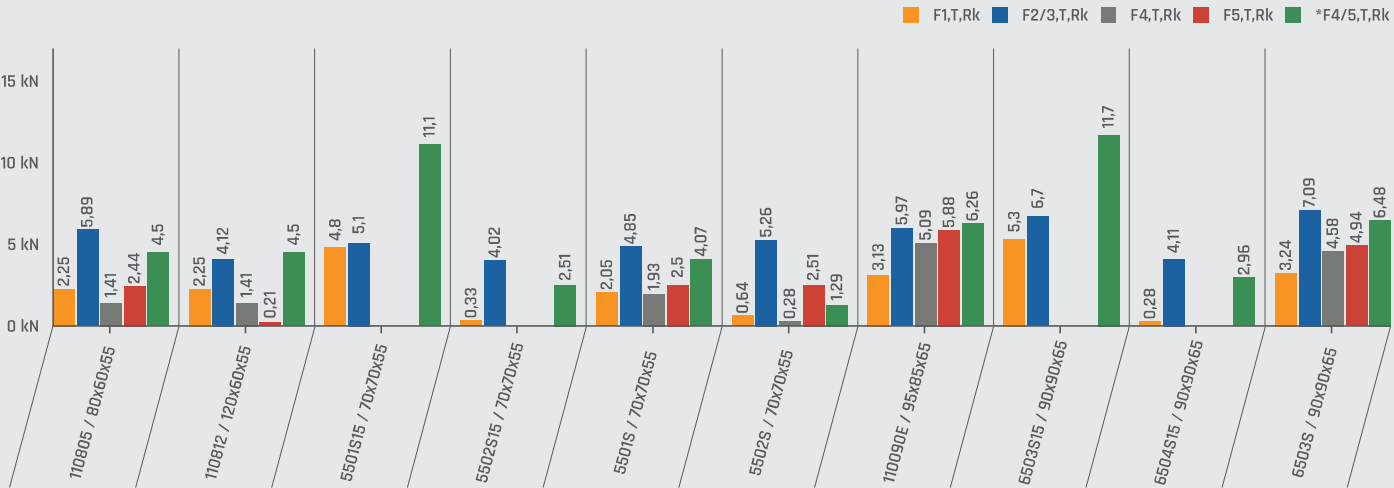


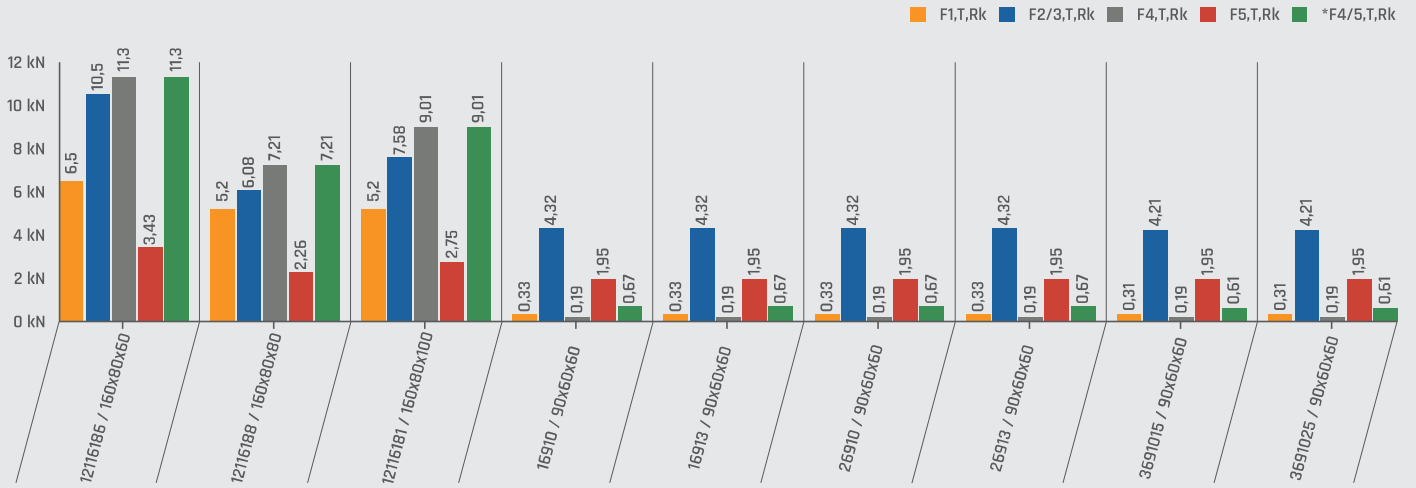
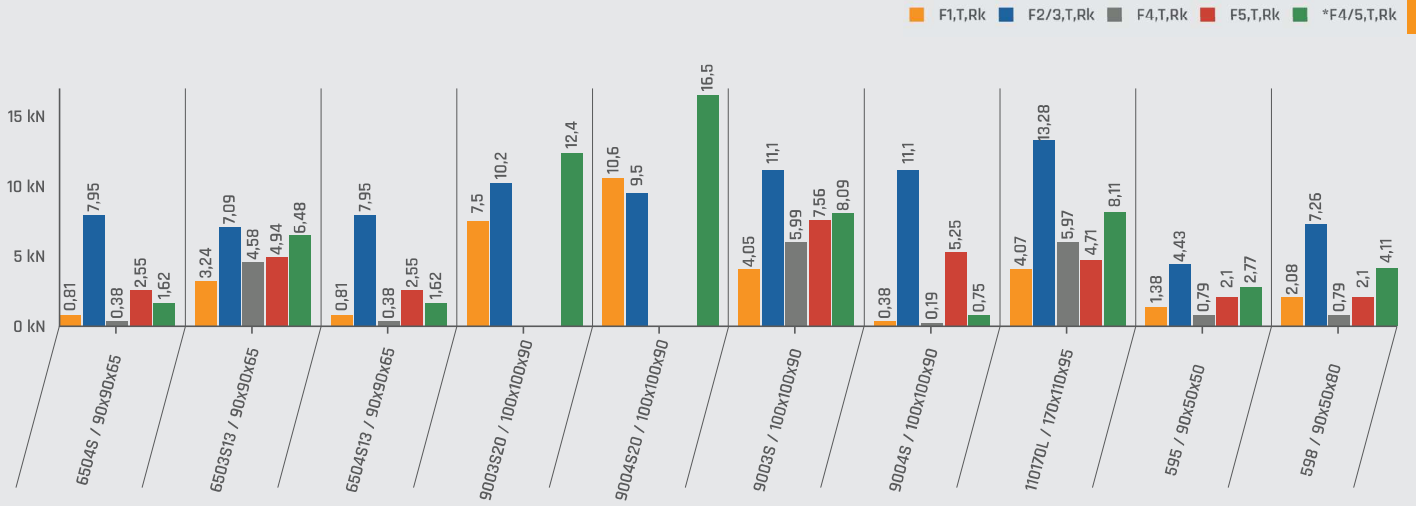
ANGLE BRACKETS

STATICS DIAGRAM



3





ANGLE BRACKETS

TECHNICAL FEATURES

3

Geometry

H	Height (mm)
L	Length (mm)
B	Width (mm)
S	Material thickness (mm)

Tables

n_a	Number of connecting elements
NB	Nail pattern
Full	Maximum number of connecting elements
Partial	Minimum number of connecting elements

Timber connecting element

$\emptyset_{[mm]}$	Diameter of connecting element
$L_{[mm]}$	Length of connecting element
	Grain direction in the wood component

Connecting element concrete/ steel

Bo	Dowels/bolts
----	--------------

Load directions

F_1 	Force at a right angle to the connector level, lifting force
F_2 	Force in rod direction
F_3 	Force in rod direction
F_4 	Force in direction of the angle bracket
F_5 	Force away from the angle bracket



CE symbol



Steel with indication of the steel quality and galvanisation



Stainless steel with material number



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

Design

$F_{1,Ed}$	Design load for load direction 1 in kN
$F_{2/3,Ed}$	Design load for load direction 2 or 3 in kN
$F_{4,Ed}$	Design load for load direction 4 in kN
$F_{5,Ed}$	Design load for load direction 5 in kN
$F_{4/5,Ed}$	Design load for load direction 4 or 5 in kN
$F_{1,Rk}$	Characteristic value of the load capacity in load direction 1 for one or for two angle brackets in kN
$F_{2/3,Rk}$	Characteristic value of the load capacity in load direction 2 or 3 for one or for two angle brackets in kN
$F_{4,Rk}$	Characteristic value of the load capacity in load direction 4 for one angle bracket in kN
$F_{5,Rk}$	Characteristic value of the load capacity in load direction 5 for one angle bracket in kN
$F_{4/5,Rk}$	Characteristic value of the load capacity in load direction 4 or 5 for two angle brackets in kN
$F_{1,Rd}$	Design value of the load capacity in load direction 1 for one or for two angle brackets in kN
$F_{2/3,Rd}$	Design value of the load capacity in load direction 2 or 3 for one or for two angle brackets in kN
$F_{4,Rd}$	Characteristic value of the load capacity in load direction 4 for one angle bracket in kN
$F_{5,Rd}$	Characteristic value of the load capacity in load direction 5 for one angle bracket in kN
$F_{4/5,Rd}$	Characteristic value of the load capacity in load direction 4 or 5 for two angle brackets in kN
$F_{i,Ed}$	Design value of load capacity for one or two angle brackets for the respective load direction "i" (i = 1 to 5) in kN
$F_{i,Rk,T}$	Characteristic value of the load-bearing capacity of the sheet steel-timber connection with GH threaded/anchor nails for the 'i' (i = 1 to 5) in kN respective load direction 'i' (i = 1 to 5) in kN
$F_{i,Rk,S}$	Characteristic value for steel load capacity of the bracket (table value „S“ oder $F_{Rk,S}$ bzw. $F_{Rd,S}$) for the respective load direction "i" (i = 1 to 5) in kN
k_{mod}	Modification factor for load impact duration and usage class
$\gamma_{M,T}$	Partial safety factor for timber (for Germany: 1.3)
$\gamma_{M,S}$	Partial safety factor for steel for cross-section stresses (for Germany: 1.0)

Dowel design

$k_{t,ax}$	Coefficient for calculating the axial load-bearing capacity per bolt, for connecting the bracket to concrete or steel components for the respective Load direction "i" (i = 1 to 5)
$k_{t,v}$	Coefficient for calculating the shear load-bearing capacity per bolt, for connecting the bracket to concrete or steel components for the respective Load direction "i" (i = 1 to 5)
$F_{i,Ed}$	Design load on one or two angle brackets for the respective load direction "i" (i = 1 to 5) in kN
$F_{i,Rd}$	Design value of load capacity on one or two angle brackets for the respective load direction "i" (i = 1 to 5) in kN
$F_{i,Ed,B}$	Design value for one bolt or one anchor for the respective load direction "i" (i = 1 to 5) in kN
$F_{i,Rd,B}$	Design value of the load-bearing capacity of the entire connection to concrete or steel with bolts or anchors for the respective Load direction 'i' (i = 1 to 5) in kN (calculation must be carried out separately and is based on the respective approval and standard of the bolts or anchors)

ANGLE BRACKETS

APPLICATIONS

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Application:

Timber/timber; timber/concrete, steel connections

Materials:

350
GD
Z275

250
GD
Z275

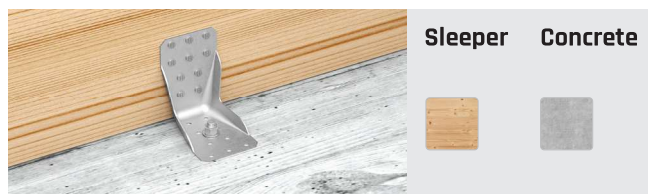
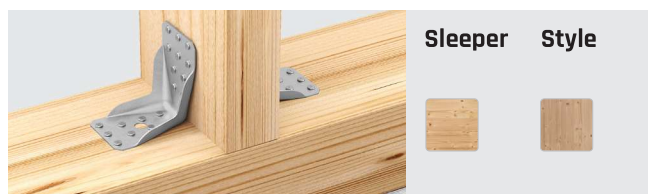
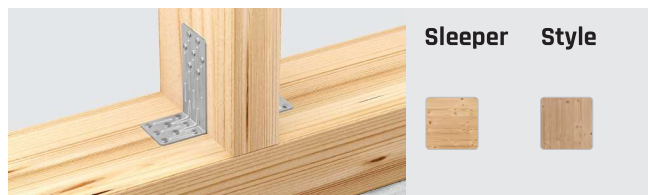
235
JR
feuerverzinkt

A4
1.4571

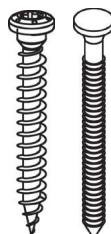
Material thicknesses:

1.5 / 2.0 / 2.5 / 3.0 / 4.0 / 6.0 / 8.0 mm

More on request.



For use in usage classes



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

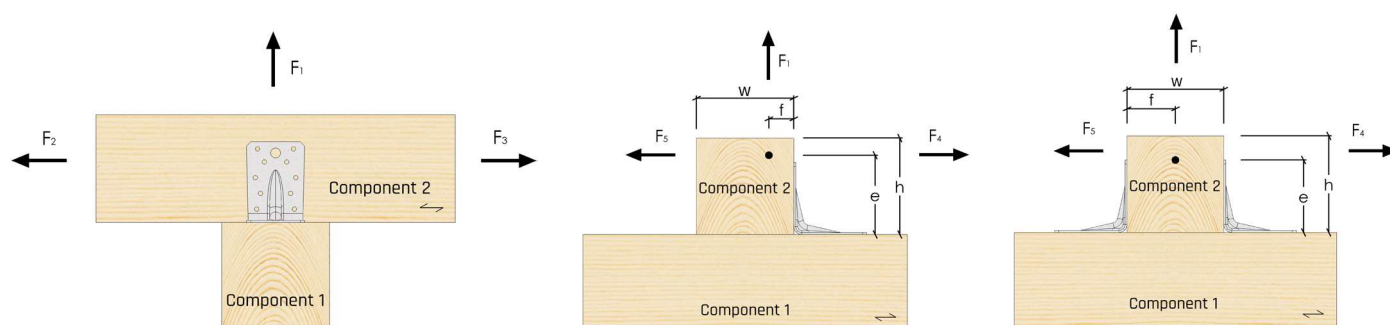
Bolt, dowel or concrete anchor M10, M12

Connecting elements from page 274

ANGLE BRACKETS

LOAD DIRECTIONS

3



Load F_1 :

For the load-bearing capacity of a bracket, the load is applied at spacing f from the contact surface between the bracket and the timber beam is applied (Figure 2). If it is assumed that the timber component is prevented from rotating or if two console angles are arranged, then the eccentricity is $f = 0$.

Load $F_{2/3}$

Calculation of the load-bearing capacity of one or two angle brackets that are loaded with a force in the direction of the axis of component 2 (Fig. 1).

Load $F_4 / F_5 / F_{4/5}$

In all three cases, the load is applied at a distance e from the contact surface between component 1 and component 2 (Figure 2). The load cases are considered as a combination of two base load cases.

The first base load case is the lateral load with forces $n F_4$, F_5 or $F_{4/5}$ with $e = 0$.

For the arrangement with an angle bracket, the rotation of component 2 is taken into account.

For the arrangement with two angle brackets, the rotation of component 2 is prevented and the load on the beam due to the moment is calculated as the lifting force $F_1 = F_{4/5} \times e/w$, w is thereby the width of component 2

Nail patterns

Partial and full nail fitting or partial and full screw fitting
See nail pattern for the product

Connection over intermediate layers

The characteristic load capacities for the connection with angle brackets indicated in the tables also apply to an intermediate layer between the angle bracket and timber component. The following conditions must be met:

- The intermediate layer must be connected to the timber component without being able to be moved.
- The insert depth of the profiled area of the nail or the thread length of the screw in the timber component must be the same or greater.
- For this, a correspondingly long connecting element must be used.
- The characteristic perforation strength $f_{h,k}$ of the connecting element in the intermediate layer must be the same or greater.

Determination of load capacity

The load capacity of connections with angle brackets $F_{i,Rd}$ for the respective load direction "i" ($i = 1$ to 5) corresponds to the smallest value of:

- The load capacity of the steel sheet-timber connection with GH threaded/anchor nails $F_{i,Rd,T}$
- Steel load capacity of the bracket $F_{i,Rd,S}'$
- Load-bearing capacity of the connection to concrete or steel with bolts or anchors under consideration of the coefficient $k_{t,ax}$ or $k_{t,v}$, see section 4.

$$F_{i,Rd} = \min \left\{ \frac{k_{mod} \cdot F_{i,Rk,T}}{\gamma_{M,T}}; \frac{F_{i,Rk,S}}{\gamma_{M,S}}; F_{i,Rd,B} \right\}$$

The increased load capacity values of the GH threaded/anchor nails according to ETA-13/0523 apply.
The values of EN14592 apply to angle brackets made of stainless steel.

Connection timber- concrete/ steel

The design load of the respective load direction "i" (i = 1 to 5) $F_{i,Ed,B}$ for one bolt or for one anchor is calculated as follows:

$$F_{i,Ed,B} = k_{i,t,ax} \times F_{i,Ed} \quad \text{for axial stress on the bolt or anchor}$$

$$F_{i,Ed,B} = k_{i,t,v} \times F_{i,Ed} \quad \text{for lateral stress on the bolt or anchor}$$

Load in one direction

In case of sole impact of load components F_1 , $F_{2/3}$, F_4 or F_5 or $F_{4/5}$ the proof of interaction must be provided in the following form:

$$\frac{F_{i,Ed}}{F_{i,Rd}} \leq 1$$

Load in several directions

In case of simultaneous impact of load components F_1 , $F_{2/3}$, F_4 or F_5 and $F_{4/5}$ the proof of interaction must be provided as follows:
For a bracket, the loads F_4 and F_5 never take effect at the same time.

For one bracket:

$$\left(\frac{F_{1,Ed}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2/3,Ed}}{F_{2/3,Rd}}\right)^2 + \left(\frac{F_{4,Ed}}{F_{4,Rd}}\right)^2 + \left(\frac{F_{5,Ed}}{F_{5,Rd}}\right)^2 \leq 1$$

For two brackets:

$$\left(\frac{F_{1,Ed}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2/3,Ed}}{F_{2/3,Rd}}\right)^2 + \left(\frac{F_{4/5,Ed}}{F_{4/5,Rd}}\right)^2 \leq 1$$

General information

The load capacities apply to timbers with a characteristic raw density of 350 kg/m³.

Curvatures of the timber components and joist edges in the area of the angle brackets are not permitted - the wood must be sharp-edged in the area of the bracket.

There must be proof that no gaps occur in the timber component for all load directions according to EN 1995 or an equivalent national standard.

Minimum spacing according to EN 1995-1-1

[mm]		Force parallel to the grain	Force at a right angle to the grain	Force under the bracket a to the grain
		(a = 0°)	(a = 90°)	(a any)
a ₁	in grain direction	28	14	(14+14 x cos a)
a ₂	Right angle to the grain direction	14	14	14
a _{3,t}	End grain with stress	60	40	(40 + 20 x cos a)
a _{3,e}	End grain without stress	40	40	40
a _{4,t}	Loaded edge	20	28	(20 + 8 x sin a)
a _{4,e}	Unloaded edge	20	20	20

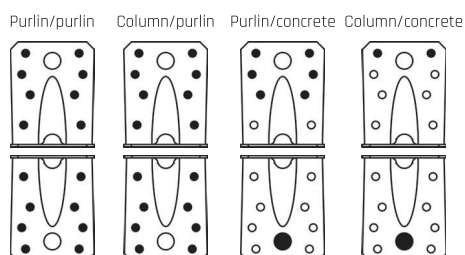
Nails Ø 4 mm, without pilot drilling, in nail plates, p_k ≤ 420 kg/m³

ANGLE BRACKETS

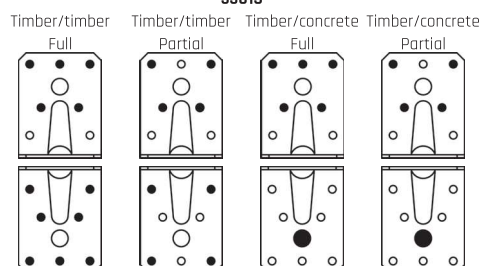
HOLE PATTERNS

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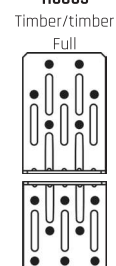
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5501S15



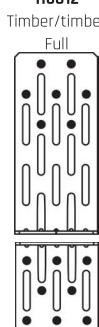
TYPE 55/70 2.0 with rib
5501S



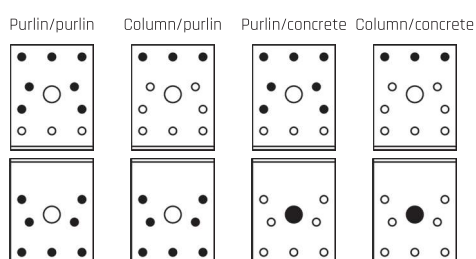
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110805



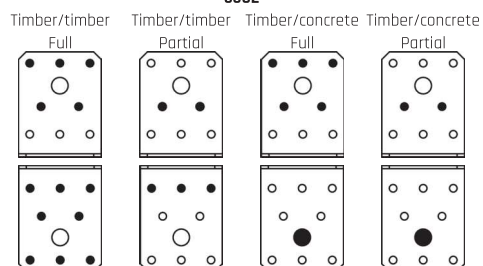
TOP 120
110812



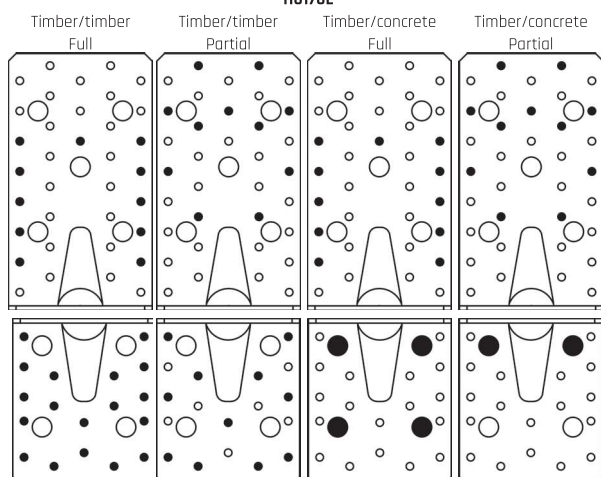
TYPE 55/70S 1.5 GREENLINE without rib
5502S15



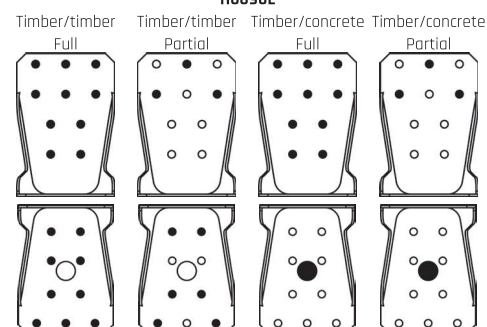
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5502



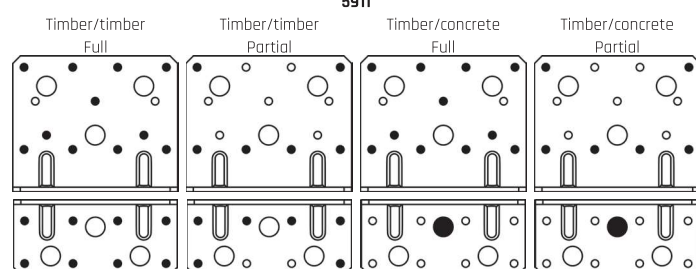
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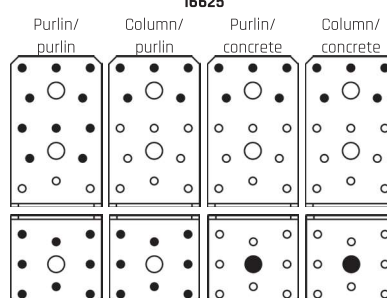
TOP KR 90 E (EXTRA)
110090E



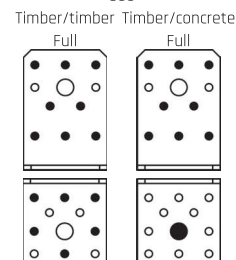
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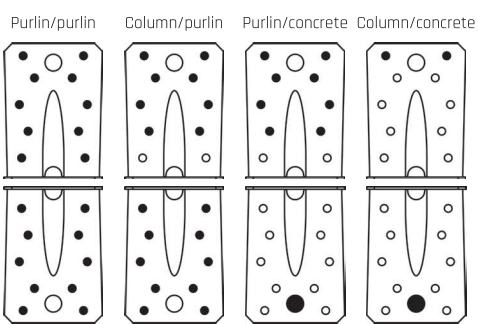
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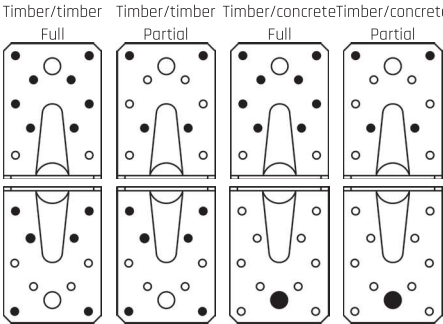
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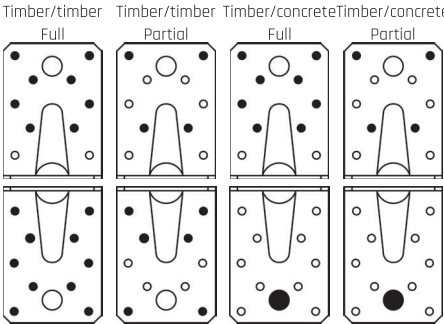
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6503S15



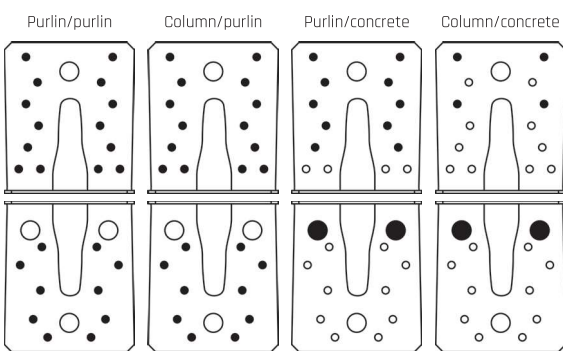
TYPE 65/90 2.5 with rib
6503S



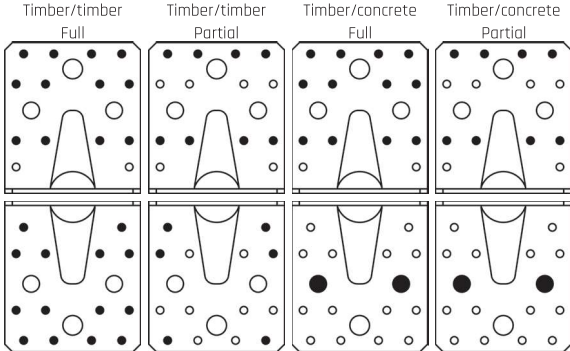
TYPE 65/90S13 with rib / hole Ø 13mm
6503S13



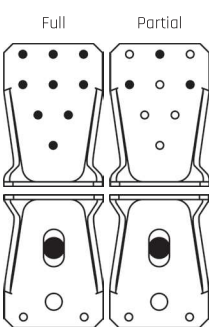
TYPE 90/100S 1.5 GREENLINE with rib
9003S20



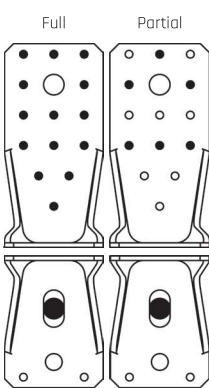
TYPE 90/100S 3.0 with rib
9003S



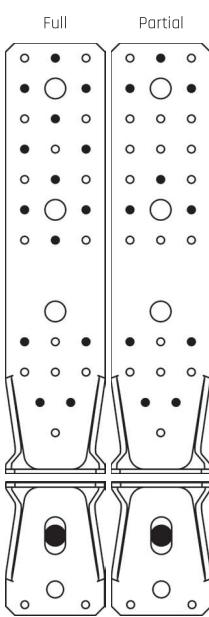
KR slotted hole 95 mm
1100953L / 110953L



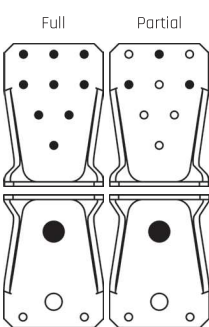
KR slotted hole 135 mm
1101353L / 110135L



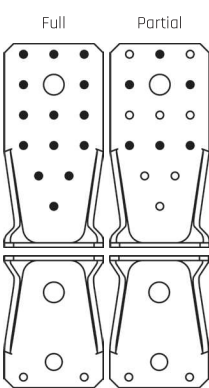
KR slotted hole 285 mm
1102853L / 110285L



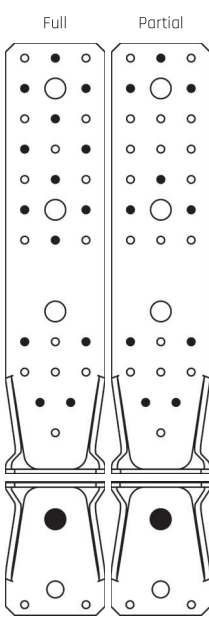
KR round hole 95 mm
1100953 / 110095



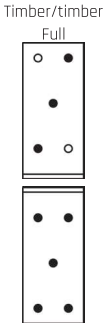
KR round hole 135 mm
1101353 / 110135



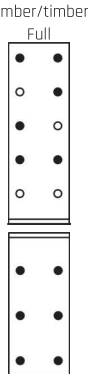
KR round hole 285 mm
1102853 / 110285



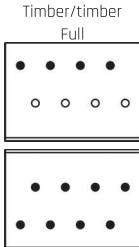
TYPE 40/90
994



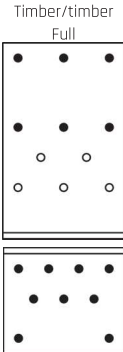
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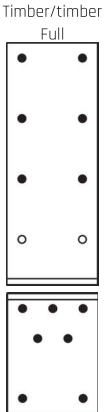
TYPE 692
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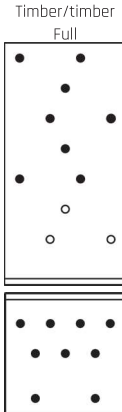
Extra thick
1884



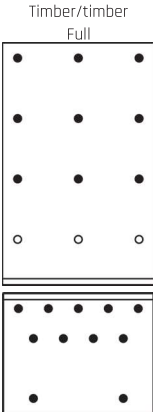
Extra thick
12116186

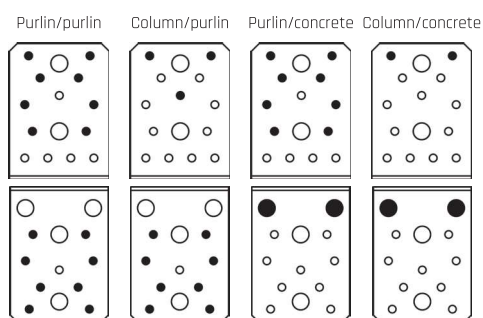
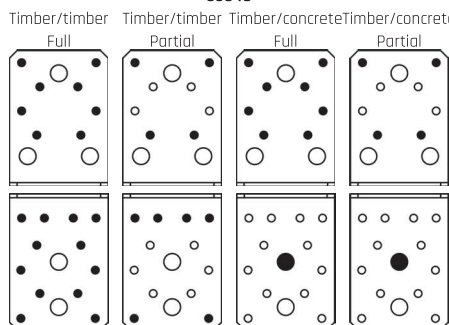
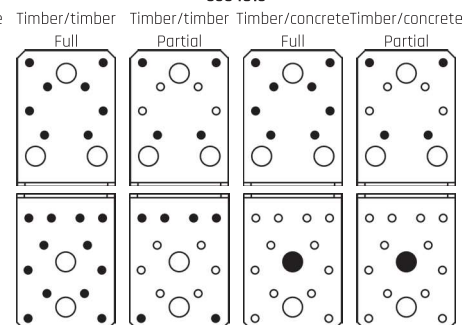
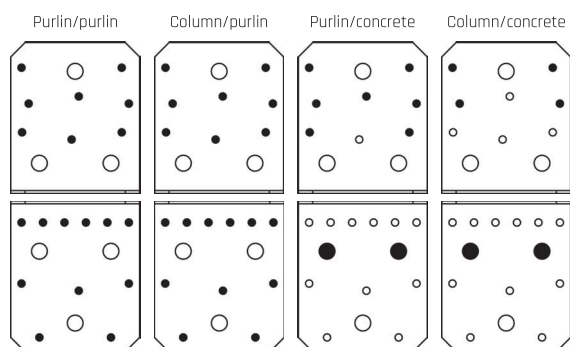
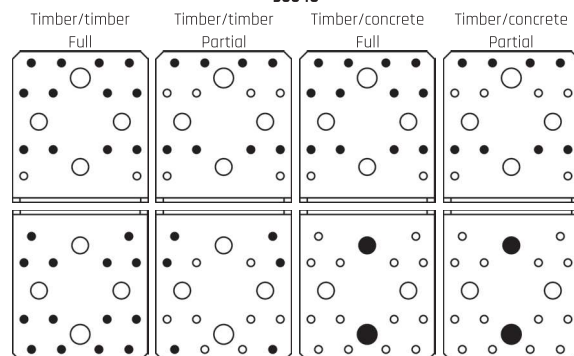
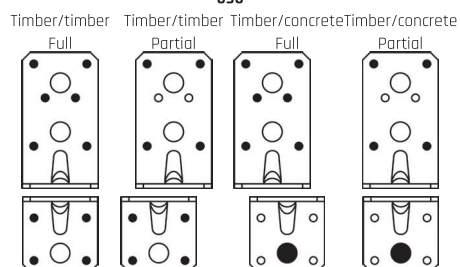
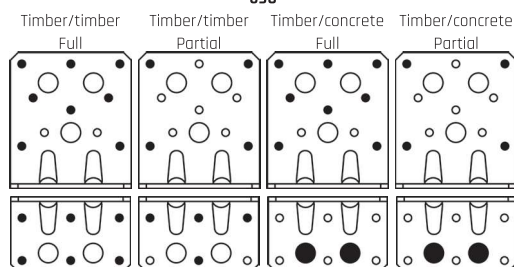
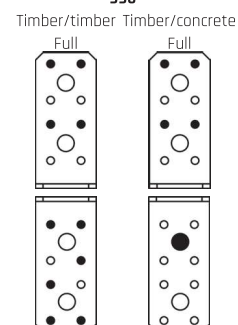
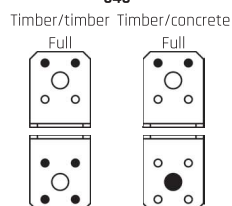
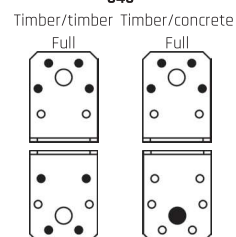
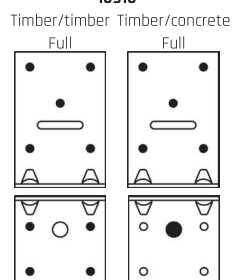
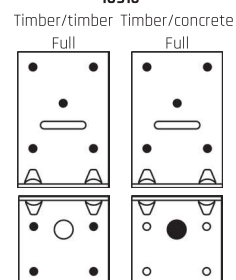
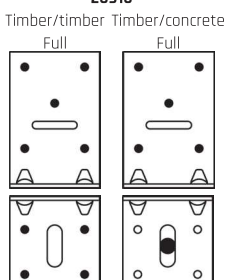
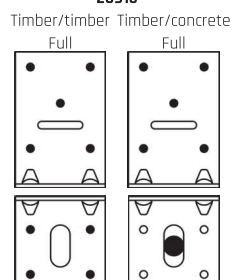
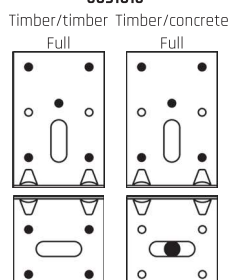
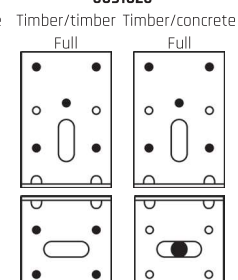


Extra thick
12116188



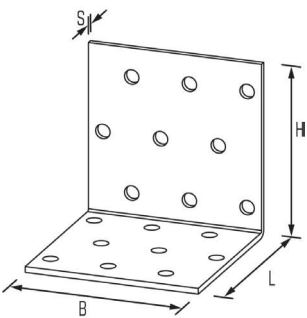
Extra thick
12116181



TYPE 65/90S 1.5 GREENLINE without rib
6504S15

TYPE 65/90 2.5 without rib
6504S

TYPE 65/90S13 without rib / hole Ø 13mm
6504S13

TYPE 90/100S 1.5 GREENLINE without rib
9004S20

TYPE 90/100S 3.0 without rib
9004S

TYPE 50
595

TYPE 80
598

TYPE 40
993

TYPE 40
543

TYPE 45
645

TYPE RL
16910

TYPE RL
16913

TYPE LL
26910

TYPE LL
26913

TYPE LLG
3691015

TYPE LLG
3691025


NAIL PLATE BRACKET

2,0 MM

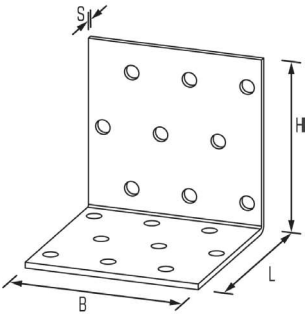


3

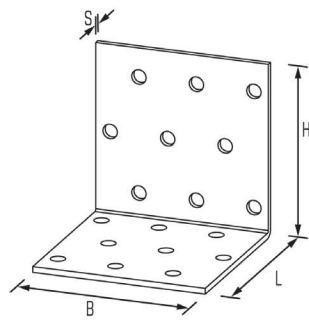
Art. No.	Dimensions [mm]							nN	EAN	Weight	Pallet	PU		
	H	x	L	x	W(B)	x	T(S)							
								Ø 5	4019346	kg				
10499	40	x	40	x	20	x	2,0	4	120019	0.022	14000	200	■	
10500	40	x	40	x	40	x	2,0	8	120026	0.044	14000	200	■	
10501	40	x	40	x	60	x	2,0	12	120057	0.066	10500	150	■	
10521	50	x	50	x	40	x	2,0	8	120033	0.055	14000	200	■	
10502	60	x	60	x	40	x	2,0	12	120040	0.066	10500	150	■	
10503	60	x	60	x	50	x	2,0	12	120163	0.082	7000	100	■	
10504	60	x	60	x	60	x	2,0	18	120064	0.100	7000	100	■	
10518	60	x	60	x	80	x	2,0	24	120279	0.133	4000	100	■	
10519	80	x	80	x	60	x	2,0	24	120286	0.133	4800	100	■	
10527	80	x	80	x	80	x	2,0	32	120293	0.177	4050	50	■	

NAIL PLATE BRACKET

2,5 MM



Art. No.	Dimensions [mm]							nN	EAN	Weight	Pallet	PU		
	H	x	L	x	W(B)	x	T(S)							
								Ø 5	4019346	kg				
10522	40	x	40	x	60	x	2,5	12	120095	0.082	10500	150	■	
10523	50	x	50	x	40	x	2,5	8	120170	0.069	14000	200	■	
10524	60	x	60	x	40	x	2,5	12	120071	0.082	10500	150	■	
10525	60	x	60	x	50	x	2,5	12	120088	0.103	7000	100	■	
10526	60	x	60	x	60	x	2,5	18	120101	0.124	7000	100	■	
10505	60	x	60	x	80	x	2,5	24	120149	0.165	4000	100	■	
10506	60	x	60	x	100	x	2,5	30	120187	0.206	4000	100	■	
10507	80	x	80	x	60	x	2,5	24	120118	0.165	4800	100	■	
10508	80	x	80	x	80	x	2,5	32	120125	0.220	4050	50	■	
10509	80	x	80	x	100	x	2,5	40	120194	0.275	2550	50	■	
10513	90	x	90	x	40	x	2,5	16	120156	0.124	5100	100	■	
10510	100	x	100	x	60	x	2,5	30	120200	0.206	2400	50	■	
10511	100	x	100	x	80	x	2,5	40	120217	0.275	2550	50	■	
10512	100	x	100	x	100	x	2,5	50	120132	0.343	2550	50	■	



NAIL PLATE BRACKET

UNEQUAL-LEGGED

Art. No.	Dimensions [mm]							nN Ø 5	EAN 4019346	Weight kg	Pallet	PU	 
	H	x	L	x	W(B)	x	T(S)						
10514	60	x	40	x	60	x	2,5	15	120309	0.103	5100	150	■
10515	80	x	60	x	60	x	2,5	21	120316	0.144	4800	100	■
10516	100	x	60	x	60	x	2,5	24	120323	0.165	4800	50	■
10517	200	x	100	x	100	x	2,5	100	120330	0.515	1275	25	■

3



Equal-legged and unequal-legged nail plate brackets are used in various connections. Whether its for roofing or interior fitting, landscaping or for simple cross or beam connection.

Nail plate brackets come in almost every size. Further dimensions can be produced at short notice.