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Authorised and notified according
to Article 29 of the Regulation (EU)
No 305/2011 of the European
Parliament and of the Council of 9
March 2011

MEMBER OF EOTA



European Technical Assessment ETA-07/0285 of 03/12/2015

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:

Hold Downs
Post Bases

Product family to which the above construction product belongs:

Three-dimensional nailing plate (timber to timber and timber to concrete/steel hold downs and post bases)

Manufacturer:

SIMPSON STRONG-TIE A/S
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Manufacturing plant:

Simpson Strong-Tie A/S	Simpson Strong-Tie 5151	Simpson Strong-Tie 2600	Simpson Strong-Tie ZAC des Quatre Chemins 85400 Sainte Gemme La Plaine France	Simpson Strong-Tie Winchester Road Cardinal Point Tamworth Staffordshire B78 3HG United Kingdom
Hedegaardsvej 4-11, Boulstrup 8300 Odder Denmark	S. Airport Way Stockton CA 95206 USA	International Street Columbus, OH 43228 USA		

This European Technical Assessment contains:

128 pages including 4 annexes which form an integral part of the document

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:

Guideline for European Technical Approval (ETAG) No. 015 Three Dimensional Nailing Plates, April 2013, used as European Assessment Document (EAD).

This version replaces:

The ETA with the same number and issued on 2013-04-30 and expiry on 2018-04-30

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product

The hold downs are one or more pieces, non-welded hold downs. They are intended for timber to timber, timber to concrete or timber to steel connections fastened by a range of nails, screws or bolts.

Post base ABE, PBS and U-shoe are manufactured by pressing of galvanized steel plates. PBP60/50 is manufactured by pressing of raw steel. All other post bases are welded steel connectors.

The upper part e.g. a plate, a U-shaped plate or a vertical plate for embedment into the timber is fastened to the timber member with nails, screws, bolts or dowels.

The lower part of the post base is either a bar, a threaded rod, a tube or a plate for embedment into the support of concrete or a steel plate to be fastened by anchor bolts to the concrete support.

Steel quality, dimensions of the post bases, hole positions and corrosion protection are shown in Annex D.

The post bases and hold downs can also be produced from stainless steel type 1.4401 or type 1.4404 according to EN 10088-2 or a stainless steel with a minimum characteristic yield stress of 235 N/mm² or a minimum ultimate tensile strength of 330 N/mm². Dimensions, hole positions, steel type and typical installations are shown in Annex B and D.

2 Specification of the intended use in accordance with the applicable EAD

The intended use of the post bases and the hold downs is to support timber structures or wood-based structural members to their support, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled. Each connection shall be made with one post base.

The static and kinematic behaviour of the timber members or the supports shall be as described in Annex D.

The wood members can be of solid timber, glued laminated timber and similar glued members, or wood-based structural members with a characteristic density

from 290 kg/m³ to 420 kg/m³.

This requirement to the material of the wood members can be fulfilled by using the following materials:

- Solid timber classified to C14-C40 according to EN 338 / EN 14081
- Glued members of timber classified to C14-C40 according to EN 338 / EN 14081 when structural adhesives are used.
- Glued laminated timber classified to GL24c or better according to EN 1194 / EN 14080.
- Solid Wood Panels, SWP according to EN 13353.
- Laminated Veneer Lumber LVL according to EN 14374
- Plywood according to EN 636
- Oriented Strand Board, OSB according to EN 300

Annex C states formulas for the characteristic load-carrying capacity of the post bases and the hold down connections, which depend on the characteristic density of the timber employed.

For some of the connectors Annex D states the load-carrying capacities of the post bases and the hold down connections for a characteristic density of 350 kg/m³.

For timber or wood based material with a lower characteristic density than 350 kg/m³ the load-carrying capacities shall be reduced by the k_{dens} factor:

$$k_{dens} = \left(\frac{\rho_k}{350} \right)$$

Where ρ_k is the characteristic density of the timber in kg/m³.

For timber or wood based material with a higher characteristic density than 350 kg/m³ the load-carrying capacities shall be taken as that for 350 kg/m³ unless detailed analyses are conducted.

The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code. The wood members shall have a thickness which is larger than the penetration depth of the nails into the members.

The hold downs are primarily for use in timber structures subject to the dry, internal conditions defined by service class 1 and 2 of Eurocode 5 and for connections subject to static or quasi-static loading.

The hold downs can also be used in outdoor timber structures, service class 3, when a corrosion protection in accordance with Eurocode 5 is applied, or when stainless steel with similar or better characteristic yield or ultimate strength is employed.

The post bases with a zinc coating Z275 according to EN 10346 or G90 according to ASTM A-653 are intended for use in service class 1 and 2 according to EN 1995 (Eurocode 5).

Post bases which are hot dipped galvanized according to EN ISO 1461:1999 with a zinc coating thickness of approximately 55 µm or made from stainless steel according to EN 10088:2005 or sherardized according to EN 13811:2003 or electroplated zinc according to EN 1403 and 12329:2000 allowing a use in external conditions are intended for use in service class 1,2 and 3 according to EN 1995 (Eurocode 5).

The hold downs may also be used for connections between a timber member and a support made from concrete blocks or similar.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the connectors of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability*) (BWR1)	
Characteristic load-carrying capacity	See Annex D
Stiffness	No performance assessed
Ductility in cyclic testing	No performance assessed
3.2 Safety in case of fire (BWR2)	
Reaction to fire	The post bases are made from steel classified as Euroclass A1 in accordance with EN 13501-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.3 Hygiene, health and the environment (BWR3)	
Influence on air quality	The product does not contain/release dangerous substances specified in TR 034, dated March 2012**)
3.7 Sustainable use of natural resources (BWR7)	No Performance Determined
3.8 General aspects related to the performance of the product	The post bases have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3
Identification	See Annex A

*) See additional information in section 3.9 – 3.12.

**) In addition to the specific clauses relating to dangerous substances contained in this European technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.9 Safety principles and partial factors

The characteristic load-carrying capacities have been calculated considering different ratios between the partial factors for timber connections and steel cross sections.

According to clause 6.3.5 of EN 1990 (Eurocode – Basis of structural design) the characteristic resistance for structural members that comprise more than one material acting in association should be calculated as

$$R_d = \frac{1}{\gamma_{M,1}} R \left\{ \eta_1 X_{k,1}; \eta_i X_{k,i(i>1)} \frac{\gamma_{m,1}}{\gamma_{m,i}}; a_d \right\}$$

where $\gamma_{M,1}$ is the global partial factor for material 1 (in this case wood), $\gamma_{m,1}$ is the partial factor on the material and $\gamma_{m,i}$ are material partial factors for the other materials, i.e. the calculations are made with material parameters modified by multiplication by

$$k_{modi} = \gamma_{m,1} / \gamma_{m,i}$$

The characteristic load-carrying capacities have been calculated considering a ratio between the partial factor for timber connections and steel / concrete cross sections

$$k_{modi} = 1,18 \quad \text{for steel yield strength}$$

$$(EC5: k_{modi,y} = \frac{1,30}{1,10} = 1,18)$$

$$k_{modi} = 1,0 \quad \text{for steel ultimate strength}$$

$$(EC5: k_{modi,u} = \frac{1,30}{1,25} \approx 1,0)$$

$$k_{modi} = 0,87 \quad \text{for anchor bolt in concrete}$$

$$(EC5: k_{modi,c} = \frac{1,30}{1,50} = 0,87)$$

For $k_{modi} > 1,18 / 1,0 / 0,87$ the load-carrying capacities stated in Annex B and D are valid (on the safe side).

For $k_{modi} < 1,18 / 1,0 / 0,87$ the load-carrying capacities stated in Annex B have to be multiplied by a factor

$$k_{safe} = \frac{k_{modi,y}}{1,18} \text{ or } \frac{k_{modi,u}}{1,0} \text{ or } \frac{k_{modi,c}}{0,87}$$

3.10 Mechanical resistance and stability

See annex D for characteristic load-carrying capacity in the different force directions F_1 to F_5 .

The characteristic capacities of the post bases and the hold downs are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. They should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

No performance has been determined in relation to ductility of a joint under cyclic testing. The contribution to the performance of structures in seismic zones, therefore, has not been assessed.

No performance has been determined in relation to the joint's stiffness properties - to be used for the analysis of the serviceability limit state.

Fastener

Connector nails and screws in accordance with ETA-04/0013

The load-carrying capacities of the post bases and the hold downs have been determined based on the use of connector nails 4,0x35, 4,0x40, 4,0x50 or 4,0x60 in accordance with ETA-04/0013. It is allowed to use connector screws 5,0x35, 5,0x40 or 5,0x50 or connector nails 4,2x35, 4,2x50 or 4,2x60 in accordance with ETA-04/0013 with the same or better performance as the 4,0 mm connector nails and still achieve the same load-carrying capacity of the connection.

The capacity of a post base connection and a hold down connection with 4,0x50 connector nails in accordance with ETA-04/0013 can be calculated by linear interpolation between the capacities for 4,0x40 and 4,0x60 connector nails.

Threaded nails in accordance with EN 14592

The design model also allows the use of threaded nails in accordance with EN 14592 with a diameter in the range 4,0 – 4,2 mm and a minimum length of 35 mm, assuming a thick steel plate when calculating the lateral nail load-carrying capacity. If no calculations are made a reduction factor equal to the ratio between the characteristic withdrawal capacity of the actual used threaded nail and the characteristic withdrawal capacity of the corresponding connector nail according to table B1 in ETA-04/0013 is applicable for all load-carrying capacities of the connection.

Other fasteners

Further, for most hold downs, anchor bolts are assumed as fasteners to a reinforced concrete structure. For such hold downs it is stated at the tables with load-carrying capacities (Annex B) which characteristic capacities have been assumed for the bolt connection. Bolts to a steel structure with at least the same capacities can also be used.

Stainless steel

For the post bases and the hold downs produced from stainless steel type 1.4401 or type 1.4404 according to EN 10088-4:2005 or a stainless steel with a minimum characteristic 0.2% yield stress of 240 N/mm², a minimum 1.0% yield stress of 270 N/mm² and a minimum ultimate tensile strength of 530 N/mm² the characteristic load carrying capacities can be considered as the same as those published in this document subject to the use of stainless CNA connector nails or CSA connector screws covered by the ETA-04/0013 or stainless threaded nails or screws in accordance to the standard EN 14592 respecting the rules given in the paragraph "fasteners" above.

3.11 Aspects related to the performance of the product

3.11.1 Corrosion protection in service class 1 and 2

In accordance with ETAG 015 the hold downs shall have a zinc coating weight of min. Z275. The steel employed is S250 GD with min. Z275 according to EN 10346 and G90 SS Grade 33 according to ASTM A-653.

3.11.2 Corrosion protection in service class 3

In accordance with Eurocode 5 the hold downs with a thickness of up to 3 mm shall be made from stainless steel. Hold downs with a thickness from 3 to 5 mm can be made from stainless steel or have a zinc coating of min. Fe/Zn 25c/Z350 according to ISO 2081/EN 10147. The nails or screws shall be produced from stainless steel or have a zinc coating of min. Fe/Zn 25c.

This requirement is fulfilled by post bases with a corrosion protection hot-dip galvanized of approximately 55 µm according to EN ISO 1461:1999 or stainless steel according to EN10088:2005 or electroplated zinc coating according to EN12329:2000 allowing a use of the product in external conditions or sherardizing according to EN 13811:2003.

3.12 General aspects related to the fitness for use of the product

The post bases and the hold downs are manufactured in accordance with the provisions of the European Technical Assessment using the automated manufacturing process as identified during the inspection of the plant by notified inspection body and laid down in the technical documentation.

The execution of the connection shall be in accordance with the manufacturers installation guide.

Hold downs

A hold down connection is deemed fit for use provided:

- The forces shall act on the timber members as described in Annex C.
- The timber member shall be free from wane under the nails in the vertical flap.
- The support shall be restrained against rotation.
- Nail or screw types and sizes shall be those mentioned in the tables of Annex D.
- The nails or screws shall be inserted without pre-drilling of the holes.
- There shall be nails or screws in the holes as prescribed in Annex D.
- There shall be no gap between the hold down connector and the timber member or the support, unless otherwise described
- The bolts shall have a diameter not less than the hole diameter minus 2 mm.
- The bolts shall have washers as specified in Annex C

Post bases

The stated type of fasteners for each post base has to be applied in applicable holes in the post base.

The installation instructions provided by the manufacturer stipulate:

- The primary structural member – the post member shown in typical installation page 16 or a beam member - to which the post bases are fixed shall be:
 - Restrained against rotation
 - Capable to transfer the force to the post bases as assumed.
 - Free from wane in areas in contact with the post base.
- The secondary structural member – the concrete support - to which the post bases are fixed shall be:
 - Made from concrete of at least strength class C15, unless otherwise is indicated in annex C of this ETA.
- To ensure sufficient capacity the designer has to take into account splitting of the timber.
- The timber member shall be free from wane.
- There shall be no gap between the timber and the horizontal contact area.
- Otherwise the gap between the timber member and the post base may not exceed 3 mm.
- There are no specific requirements relating to preparation of the timber members.

4 Attestation and verification of constancy of performance (AVCP)

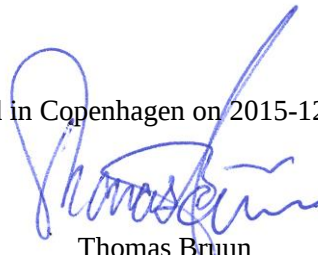
4.1 AVCP system

According to the decision 97/638/EC of the European Commission¹, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark

Issued in Copenhagen on 2015-12-03 by



Thomas Bruun
Managing Director, ETA-Danmark

Annex A: Revision History

<i>Modifications and additions to the previous ETA-07/0285 valid from 2013-04-30 to 2018-04-30</i>	
Pages	Update
1-5	Renamed the index
D33	Added PU /EMBU
D6	Load values
D34	Added CPT
D35	Added ABW
D36	Added APR110/150
D37	Added PBH75 / PBH120
D63	AKR: added new size 205; added new nail pattern
D64-4	AH16050: added new load application table
D1	PPD: Add no. + size of nails, add min. concrete type, add load table for “C20”
D18	APB100/150: adjust name table
Tab. D19-2	PPRC: update Zinc coating
Fig. D61-1	HD3B: include sizes into the drawing
Tab. D68-3	HE-anchor: adjust formula

Table with the product names and alternative names / Hold downs

Alternative names are given by the products in annex D

The annexed "x" in the name of products is for the different size of products, the range is given in the Annex A.

It may be possible to added at the end of name following letter and/or combinations.

- G = galvanized
- S or S2 or IX = Stainless or Inox
- HCR = high corrosion resistant steel
- K = Kit; incl. fasteners
- B = without Barcode
- R = retail

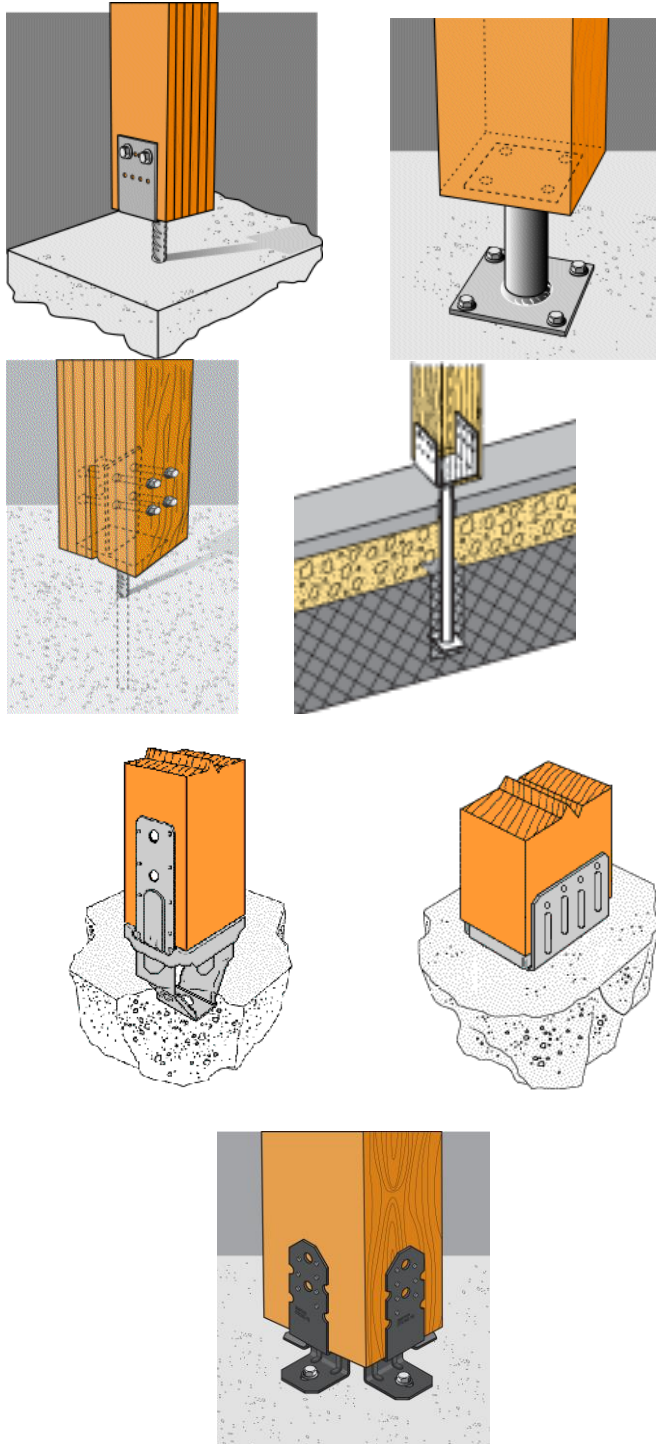
Table with the product names and alternative names / post bases

Product Name	alternative names				
	UK	France	Denmark	Germany	old name
PPD					D
PI		PPI/26000			I
PP					P
PPL					PL
PL					L
PIL					IL
PIS					IS
PISB	PBH				ISB
PISMAXI					IS MAXI
PISBMAXI					ISB MAXI
PLS					LS
PLB					LB
PVD		PB31950 PB31948			Vario D
PVDB		PB31951 PB31949			Vario DB
PVI					Vario I
PVIB					Vario IB
PPB					PB
PPS					PS
PJPS					JPS
PJPB					JPB
PJIS					JIS
PJIB					JIB
PUA					U-Shoe
PPA					
FPB					
PLPP180					
PPR					
PPRIX					
PPRB					
APB100/150					
PPRC	-	-	-	-	-
PBLR	-	-	-	-	-
PPUP					
PPS					
PPSDT					
PPSP					
PPSR320					
PPMINI					
APB7090					
PBP					
PBS					
ABE					
CPB					
CPS					

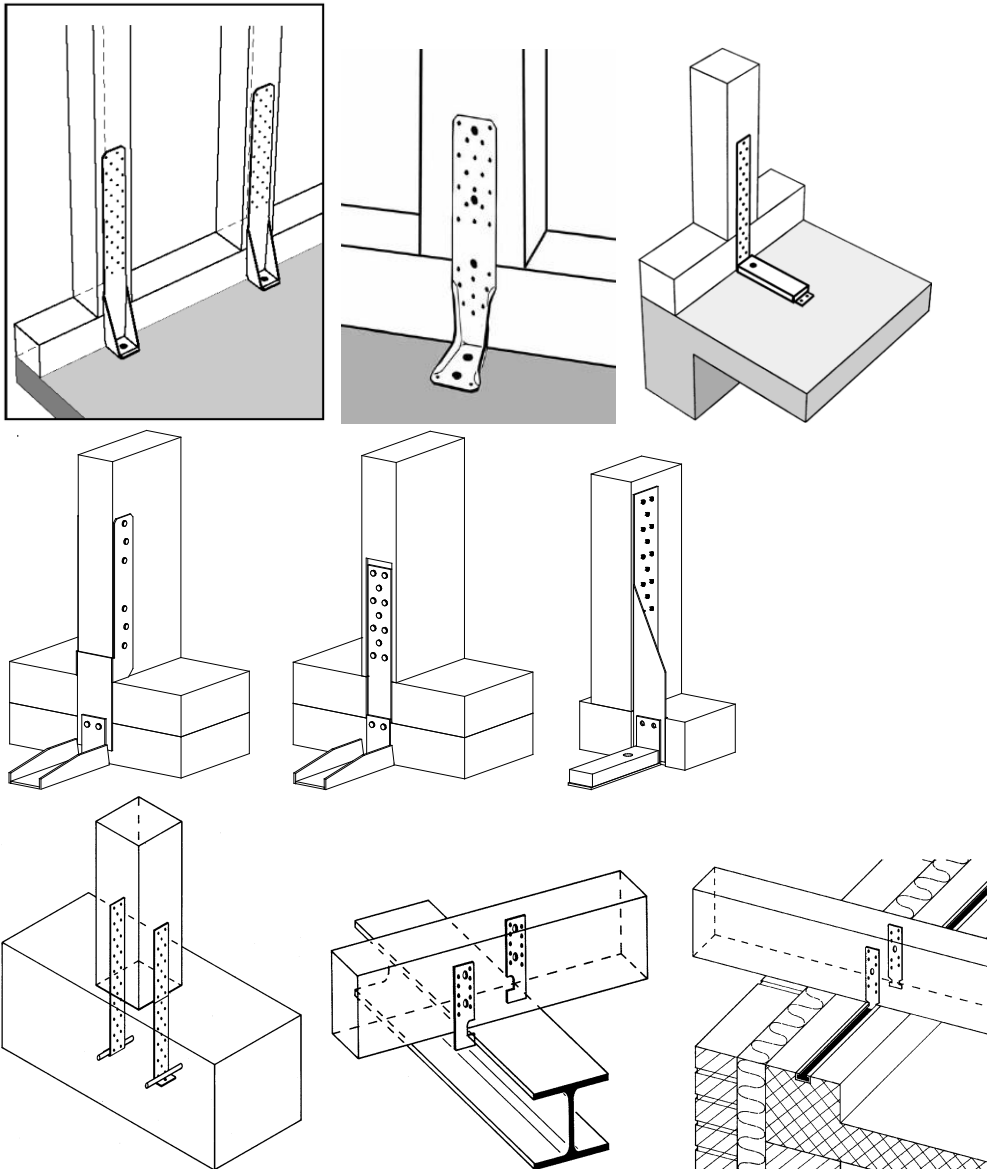
Product Name	alternative names				
	UK	France	Denmark	Germany	old name
PGS					
PBL					
CMR					
CMS					
PU		EMBU			
CPT					
ABW					
APR					
It may be possible to add the following letter and/or combinations at the end of the name. G = galvanized S or S2 or IX = Stainless or Inox HCR = high corrosion resistant steel -K = Kit; incl. fasteners -B = without Barcode -R = retail					

Annex B Typical Installation

B1 Typical installation post bases



B2 Typical installation hold down



Annex C

Characteristic load-carrying capacity

C1 Design Basis - general

The design values F_d are calculated from the modified characteristic capacities $F_{R,k}$ for service class 1 and 2 and the indicated load-duration classes as:

$$F_d = \frac{F_{R,k}}{\gamma_M}$$

with the material partial coefficient γ_M for wood.

Modified characteristic capacity means, that the characteristic load-carrying capacities have been modified by the factor k_{mod} as given in **Table 1**.

The design values F_d are calculated from characteristic capacities $F_{R,k}$ as:

$$R_d = \frac{k_{mod} R_k}{\gamma_M}$$

with the material partial coefficient γ_M for wood and the load-duration factor k_{mod} is given in table 1 or 2, correspondent the service class

Table 1 Factor k_{mod} for service class 1 and 2

Load duration class and k_{mod} factors for service class 1 and 2				
P	L	M	S	I
Permanent	Long term	Medium term	Short term	Instantaneous
0,6	0,7	0,8	0,9	1,1

Table 2 Factor k_{mod} for service class 3

Load duration class and k_{mod} factors for service class 3				
P	L	M	S	I
Permanent	Long term	Medium term	Short term	Instantaneous
0,5	0,55	0,65	0,7	0.9

For Service class 3 the characteristic capacities may be calculated from values given in tables by interpolation analog to the k_{mod} factors, or using the formulas with the relevant k_{mod} .

Density

The load-carrying capacities of the post base and the hold downs connections are stated for a timber strength class C24 with a characteristic density of 350 kg/m³ unless otherwise indicated.

The load-carrying capacity of the connections for a lower characteristic density should be determined under the assumption that the load-carrying capacity is proportional to the density. In consequence, the value should be reduced using the factor k_{dens} as defined below:

$$k_{dens} = \left(\frac{\rho_k}{350} \right)$$

where ρ_k is the characteristic density of the timber in kg/m³ and 350 is the characteristic density for timber class C24 in kg/m³.

The load-carrying capacity for a larger characteristic density shall be taken as equal to the one published in this document unless a special investigation is made

Concrete

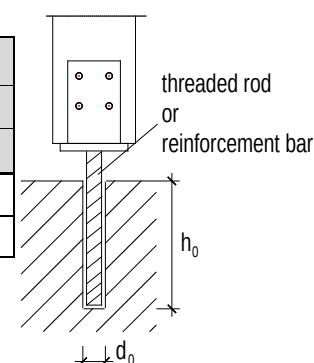
The load-carrying capacities of the post base connections are stated for a concrete class C15 unless otherwise indicated.

Installation with bonded anchorage

The post bases of types: **PJIS, PLS, PJPS, PPS** may be installed in reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum as a post-installed-anchorage with injection system Simpson Strong-Tie® SET-XP Epoxy Adhesive Injection System (acc. ETA-11/0360) or Simpson Strong-Tie® AT-HP™ (acc. ETA-11/0150 or ETA-11/0151). The design of the anchorage installation shall be performed in accordance with the latest versions of the equivalent European technical approval (ETA).

The post bases of types: **PI, PP, PPD** may be installed in reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum as a post-installed-anchorage with injection system Simpson Strong-Tie® SET-XP Epoxy Adhesive Injection System. The design of the anchorage installation shall be performed in accordance with the latest version of the European technical approval ETA-11/0360.

Injection Mortar System	Drill hole diameter d_0			
	Threaded rod		Reinforcement bar	
	M16	M20	Ø16	Ø20
SET-XP	18 mm	24 mm	20 mm	25 mm
AT-HP	18 mm	22 mm	-/-	-/-



Wane

Where force is carried by contact compression no wane may occur.

Where the lateral force is acting toward a Hold Down connector the force is carried by contact compression so for this case no wane may occur in the surface of the timber under the vertical flap. Additionally, no wane may occur under the nails.

Fastening

Unless otherwise indicated in the calculations the holes in the post bases have to be fully applied with the applicable fasteners. The fastener types for which the calculations have been made are stated at each post base.

The nail pattern shall be as described in Annex D. The fastener types for which the calculations have been made are stated at the relevant post bases and hold downs.

The thickness of the beam shall be a minimum of the embedment depth of the nails or screws.

Assumed characteristic capacities of anchor bolts

The capacity of the anchor bolts are to be checked.

The calculations to use corresponding to the forces are outlined below:

For a lateral load: the axial force for the bolt:

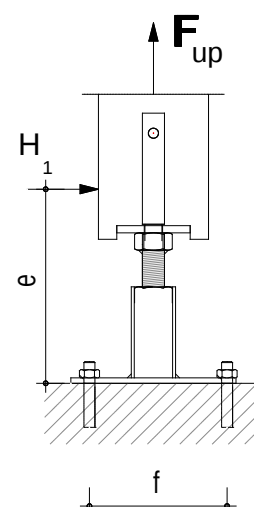
$$F_{\text{axial,bolt}} = H_1 \times e / f$$

$$F_{\text{lateral,bolt}} = H_1 / n$$

For an uplift load:

$$F_{\text{axial,bolt}} = F_{\text{up}} / n$$

With n = number of bolts.



The above method should be used to check anchor bolt capacities unless otherwise stated alongside the product details.

C2 Definition of force directions

C2a Force directions for post bases

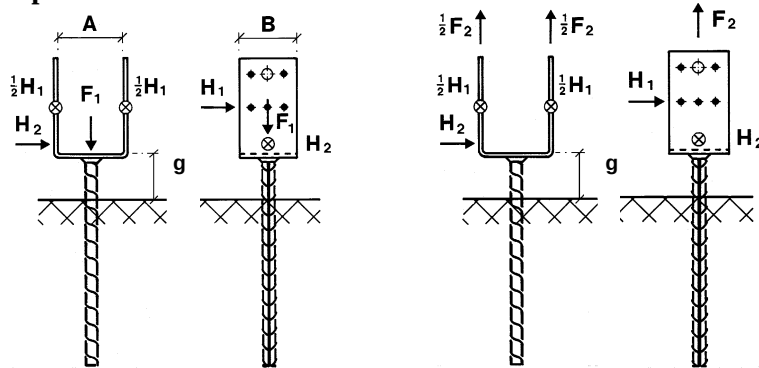


Figure C2a. Typical connection with notation for loads. The actual force directions are indicated at each post base. The capacities in the tables are stated in kN and kNm.

Gap

The gap (g) is the distance from the top side of the concrete to the top side of the top plate. The gap is stated for each post base in the following.

Acting forces

Unless otherwise indicated in the tables with load-carrying capacities, the forces are assumed to act as described below:

- F_1 Load-carrying capacity for downward load acting along the central axis of the joint
- F_2 Load-carrying capacity for upward load acting along the central axis of the joint
- H_1 Load-carrying capacity for lateral load acting in the centre of the post in line with the lower row of holes
- H_2 Load-carrying capacity for axial load acting in the centre of the compression zone at the bottom of the timber member

$M_{1/2}$ are described by types CMR and CMS

Combined forces

In the following tables the load-carrying capacities are given for the individual loads: F_1 , F_2 , H_1 and H_2 .

For combinations of loads it is – unless otherwise indicated – sufficient to verify that the individual loads can be taken.

For horizontal loads H_1 and H_2 acting simultaneously the resulting horizontal load shall be calculated as

$$H = \sqrt{H_1^2 + H_2^2}$$

C2b Forces directions for hold downs

The characteristic load-carrying capacities are determined for the following force directions.

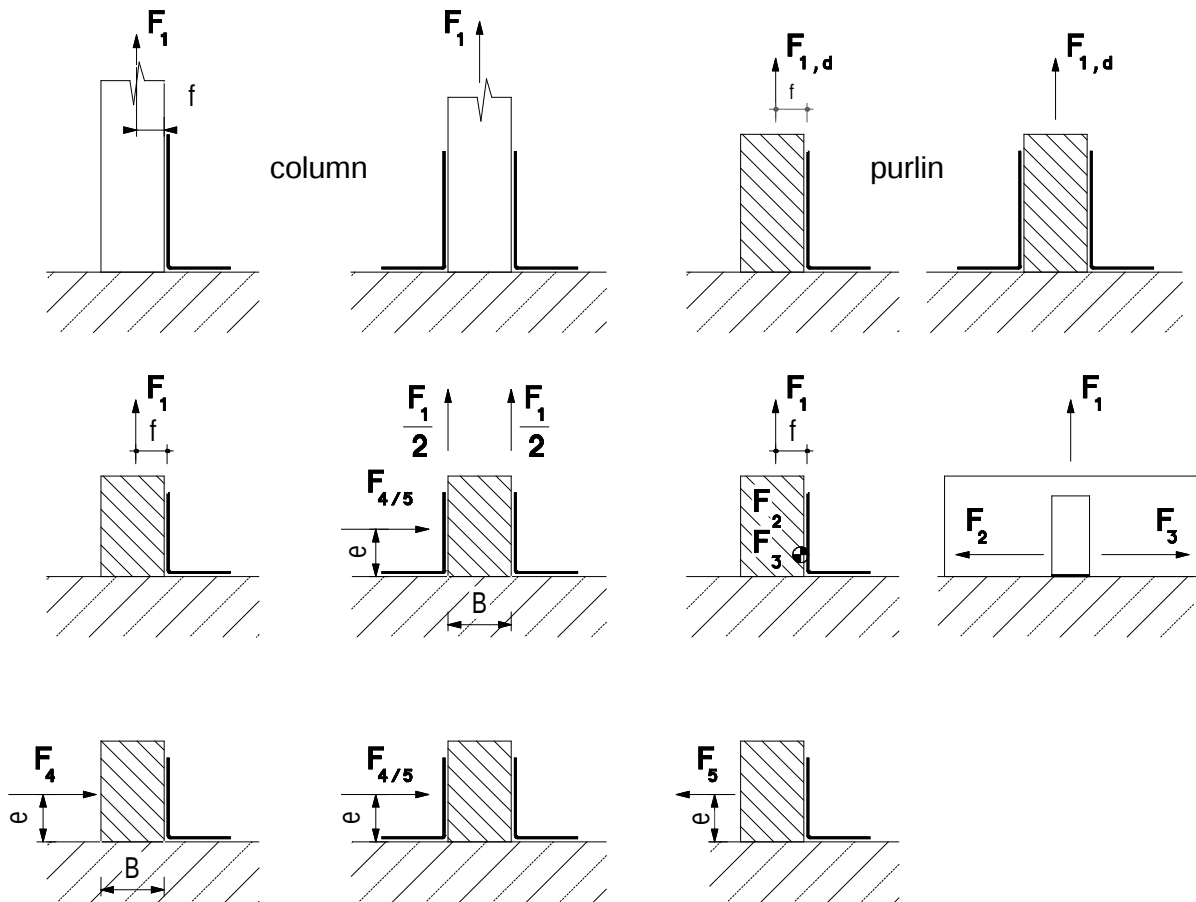


Figure C2b: Forces and their assumed positions. Top row for Hold Downs only subjected to a lifting force. Bottom rows for Hold Downs subjected to both eccentric lifting forces and lateral forces.

Two hold downs

- F_1 Lifting force acting along the central axis of the joint
- F_2 and F_3 Lateral force acting in the joint between the purlin and beam in the purlin direction
- F_4 and F_5 Lateral force acting in the beam direction along the axis of the joint but elevated e above the beam

One hold down per connection

- F_1 Lifting force acting in the central axis of the hold down but in a distance f from the vertical flap of the hold down
If the purlin is prevented from rotation the load-carrying capacity will be half that of a connection with two hold downs
- F_2 and F_3 Lateral force acting in the joint between the purlin and the beam in the purlin direction
- F_4 Lateral force acting in the beam direction perpendicular to the vertical flap elevated e above the beam directed towards the hold downs vertical flap
- F_5 Lateral force acting in the beam direction perpendicular to the vertical flap elevated e above the beam directed away from the hold downs vertical flap

Combined forces

For practical purposes the strength verification is always carried out for design forces and design capacities. If the forces are combined the following inequalities shall be fulfilled:

$$\sum_{1-i} \left(\frac{F_{i,d}}{R_{i,d}} \right) \leq 1,0 \quad \text{For the hold down AKR shall be fulfilled: } \left(\frac{F_{1,d}}{R_{1,d}} + \frac{F_{4/5,d}}{R_{4/5,d}} \right)^2 + \left(\frac{F_{2/3,d}}{R_{2/3,d}} \right) \leq 1,0$$

The capacity can be limited by the capacity of the anchor bolt. This has to be investigated separately, see below.

Additional conditions

The nail pattern shall be as described in Annex D. The fastener types for which the calculations have been made are stated at the relevant hold downs.

The thickness of the beam shall be according to Eurocode 5, t_{pen} shall be min. $6d$, where d is the diameter of the nail or screw.

C3 Fasteners

Nail, screw and bolt type	Nail, screw and bolt size (mm)		Finish and corrosion protection
	Diameter	Length	
Connector nail According to ETA-04/0013	3,7; 4,0; 4,2	35 to 100	Electroplated zinc
Annular ring shank nail according to EN 14592	3,1 4,0	35 35 to 100	Electroplated zinc
Smooth shank nail	3.75	75	Hot dipped galvanized
Smooth shank nail	4.0	90	Hot dipped galvanized
Lag screw	8; 10; 12; 16		Electroplated zinc
Wood screw	5,0	-	Electroplated zinc
Wood screw	10,0	-	Electroplated zinc
Wood screw	12,0	-	Electroplated zinc
Wood screw	16,0	-	Electroplated zinc
Screw, SPAX-S	6,0	≥60	Electroplated zinc
Screw, SPAX SCRB/9558	5,0	80	Electroplated zinc
Dowel	8,0	-	Electroplated zinc/ Hot-dip galvanized
Dowel	10,0	-	
Dowel	12,0	-	
Shear plate connector type C2	62 75		Hot-dip galvanized
Bolt M12	12	-	Concerning corrosion protection see the specifications of the manufacturer
Bolt M16	16		
Anchor bolt M10	10		
Anchor bolt M12	12	-	
Anchor bolt M16	16	-	
Concrete screws *	8 – 20		
Ejot Saphier JT2-3-5,5x25	5,5		See the manufacturer

* according to a technical approval

Annex D Product definition and capacities

Post Bases

D1: PPD

Product Name	alternative names			
	UK	France	DK	D
PPD _{xx}				D

xx = size of PPD

Figure D1-1: Drawings

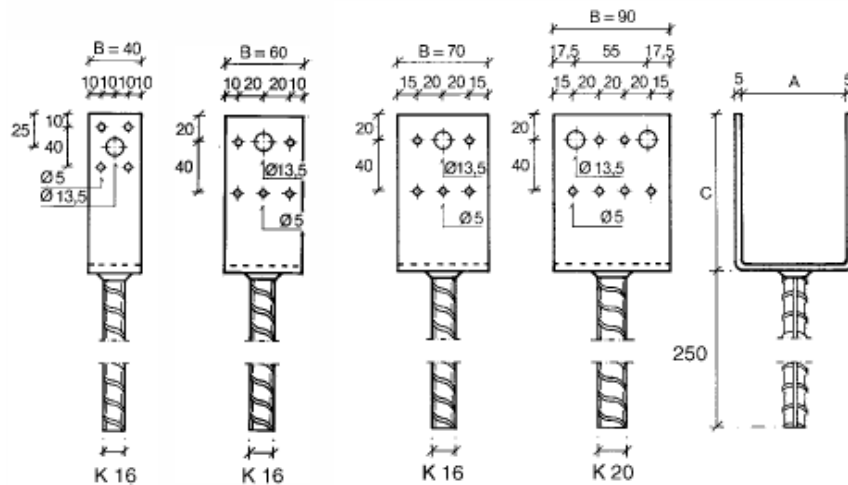


Table D1-1: Size specification

Type	Dimensions [mm]				
	A	B	C	Ribbed bar Ø	No. of nails / flap
PPD 48 x 40	48	40	126.5	16	4
PPD 50 x 40	50	40	125.5	16	4
PPD 73 x 40	73	40	126.5	16	4
PPD 100 x 40	100	40	125.5	16	4
PPD 98 x 60	98	60	127.5	16	5
PPD 70 x 70	70	70	131.5	16	5
PPD 73 x 70	73	70	130.0	16	5
PPD 75 x 70	75	70	129.0	16	5
PPD 80 x 70	80	70	126.5	16	5
PPD 90 x 70	90	70	131.5	16	5
PPD 100 x 70	100	70	126.5	16	5
PPD 90 x 90	90	90	141.5	20	6
PPD 100 x 90	100	90	136.5	20	6
PPD 115 x 90	115	90	129.0	20	6
PPD 120 x 90	120	90	126.5	20	6
PPD 123 x 90	123	90	125.0	20	6
PPD 125 x 90	125	90	124.0	20	6
PPD 140 x 90	140	90	126.5	20	6
PPD 148 x 90	148	90	122.5	20	6

Table D1-2: Material specification

Material thickness	Material Grades	Coating specification
5	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Ribbed bar	B 550 BR+AC according to 10080:2006	
	Or stainless steel as described	

Table D1-3: Characteristic capacity – for concrete C20 [full nailing with CNA4,0x40] $k_{\text{modi}}=1,18$

Size of PPD	load direction [for concrete C20]							
	F ₁ characterist capacity (kN)		F ₂ characterist capacity (kN)		H _{R1} characterist capacity (kN)		H _{R2} characterist capacity (kN)	
	min. of		min. of		min. of		min. of	
	timber	steel ¹⁾	timber	steel ¹⁾	timber	steel ¹⁾	timber	steel ¹⁾
48 x 40	40,3	40,9	14,7	13,0		3,4	8,3	5,8
50 x 40		40,9	14,7	12,2		3,4	8,3	5,8
73 x 40		38,6		7,3		3,4		5,8
100 x 40	47,9	34,9		5,0		3,4		5,8
98 x 60	73,7	40,9		7,6		3,6		5,8
73 x 70	69,7	40,9	18,4	12,8		3,5	10,9	5,8
70 x 70	63,5	40,9	18,4	13,5		3,6	10,9	5,8
75 x 70	74,0	40,9	18,4	12,3		3,6	10,9	5,8
80 x 70	81,9	40,9	18,4	11,4		3,7	10,9	5,8
100 x 70		40,9		8,7		3,7		5,8
90 x 90	78,4	54,5	22,0	13,4		6,4	18,7	11,4
90x70	94,8	54,5	18,4	10,4		5,5	14,6	10,8
100 x 90	99,4	54,5	22,0	11,7		6,6	18,7	11,4
100x70	91,7	54,5		9,1		5,5		10,8
115 x 90		54,5		9,9		7,0		11,4
120 x 90		54,5		9,4		7,2		11,4
123 x 90		54,5		9,1		7,2		11,4
125 x 90		54,5		8,9		7,3		11,4
140 x 90	102,2	54,5		7,8		7,2		11,4
148 x 90	99,9	54,5		7,3		7,3		11,4

¹⁾ for steel $k_{\text{mod}} = 1,0$ shall be used for all load durations

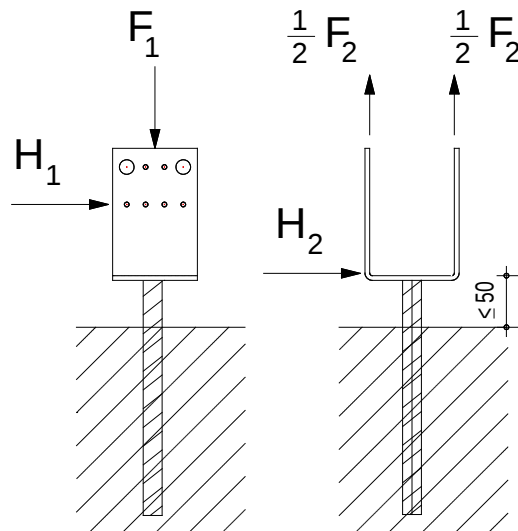
Table D1-4: Characteristic capacity – for concrete C20 [full nailing with CNA4,0x40] $k_{modi}=1,18$

Size of PPD [mm]	load direction - for concrete C20 [full nailing with CNA4,0x40]							
	F1		F2		HR1		HR2	
	characteristic capacity		characteristic capacity		characteristic capacity		characteristic capacity	
	min. of		min. of		min. of		min. of	
	timber	steel ¹⁾	timber	steel ¹⁾	timber	steel ¹⁾	timber	steel ¹⁾
48 x 40	40.3	40.9	14.7	13.0	-	3.4	8.3	5.8
50 x 40	-	40.9	14.7	12.2	-	3.4	8.3	5.8
73 x 40	-	38.6	-	7.3	-	3.4	-	5.8
100 x 40	47.9	34.9	-	5.0	-	3.4	-	5.8
98 x 60	73.7	40.9	-	7.6	-	3.6	-	5.8
73 x 70	69.7	40.9	18.4	12.8	-	3.5	10.9	5.8
70 x 70	63.5	40.9	18.4	13.5	-	3.6	10.9	5.8
75 x 70	74.0	40.9	18.4	12.3	-	3.6	10.9	5.8
80 x 70	81.9	40.9	18.4	11.4	-	3.7	10.9	5.8
90x70	94.8	54.5	18.4	10.4	-	5.5	14.6	10.8
100 x 70	-	40.9	-	8.7	-	3.7	-	5.8
90 x 90	78.4	54.5	22.0	13.4	-	6.4	18.7	11.4
100 x 90	99.4	54.5	22.0	11.7	-	6.6	18.7	11.4
115 x 90	-	54.5	-	9.9	-	7.0	-	11.4
120 x 90	-	54.5	-	9.4	-	7.2	-	11.4
123 x 90	-	54.5	-	9.1	-	7.2	-	11.4
125 x 90	-	54.5	-	8.9	-	7.3	-	11.4
140 x 90	102.2	54.5	-	7.8	-	7.2	-	11.4
148 x 90	99.9	54.5	-	7.3	-	7.3	-	11.4

1) for steel $k_{mod} = 1,0$ shall be used for all load durations

For vertical loads F_1 and horizontal loads H_2 acting simultaneously it shall be verified that:
 $F_1 / F_{R1} + H_2 / H_{R2} \leq 1$.

For vertical uplift F_2 and horizontal loads H_2 acting simultaneously it shall be verified that:
 $(F_2 / F_{R2})^2 + (H_2 / H_{R2})^2 \leq 1$.

Figure D1-2: Application

D2: PI

Product Name	alternative names			
	UK	France	DK	D
PI		PPI/26000		I

Figure D2-1: Drawings

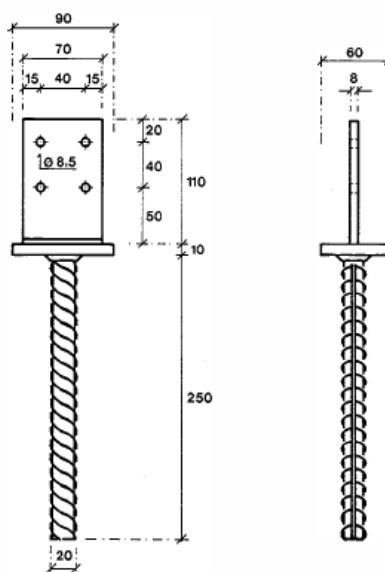


Table D2-1: Size specification

n/a

Table D2-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Ribbed bar	B 550 BR+AC according to 10080:2006	
	Or stainless steel as described	

Table D2-3: Characteristic capacity $k_{modi}=1,18$

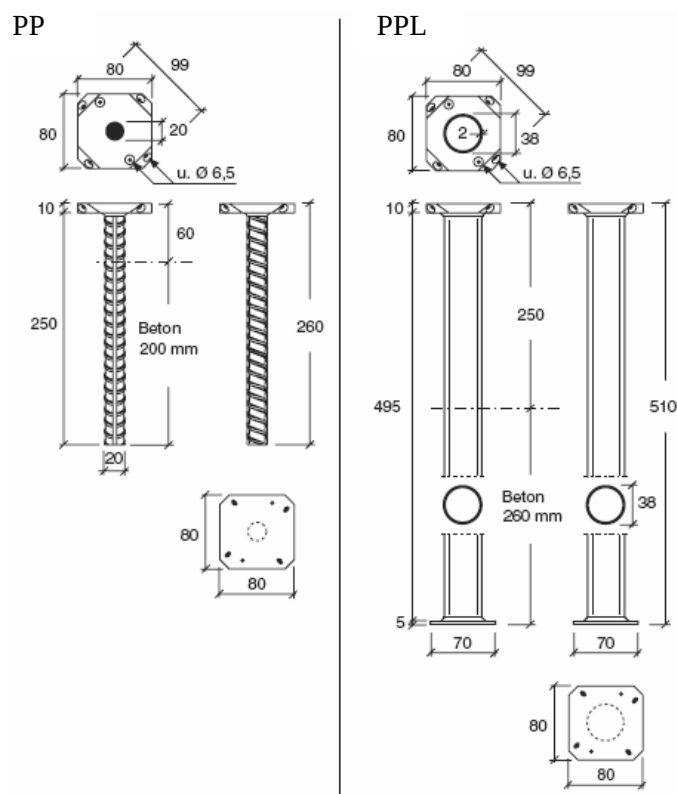
Load Direction	Timber depth, t [mm]	Concrete	Load duration class (kN)				
			P	L	M	S	I
F_{R1}		C12 C15 C20	36,9 43,7 54,5				
F_{R2}	60 80 100 ≥ 120		13,8 k_{mod} 16,0 k_{mod} 18,7 k_{mod} 20,7 k_{mod}				
H_{R1}	60 80 100 ≥ 120		5,6 6,5 7,6 7,9	6,6 7,6 7,9 7,9	7,5 7,9 7,9 7,9	7,9 7,9 7,9 7,9	7,9 7,9 7,9 7,9
H_{R2}	60 80 100 120 140 160		1,9 2,4 3,6 4,7 5,6 6,3	2,2 2,8 4,2 5,4 5,7 6,3	2,5 3,3 4,7 5,4 5,7 6,3	2,8 3,7 5,3 5,4 5,7 6,3	3,4 4,5 5,3 5,4 5,7 6,3

For vertical loads F_1 and horizontal loads H_2 acting simultaneously it shall be verified that:

$$F_1 / F_{R1} + H_2 / H_{R2} \leq 1.$$

D3: PP / PPL

Product Name	alternative names			
	UK	France	DK	D
PP				P
PPL				PL

Figure D3-1: Drawings**Table D3-1: Size specification**

n/a

Table D3-2: Material specification

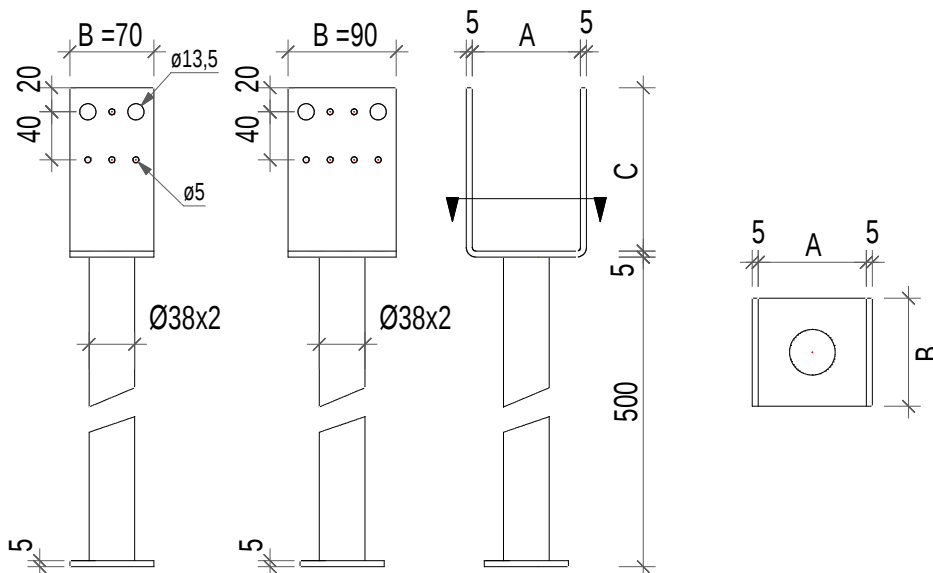
Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Ribbed bar	B 550 BR+AC according to 10080:2006	
	Or stainless steel as described	

Table D3-3: Characteristic capacity $k_{mod}=1,18$

Type	Load Direction	Load duration class (kN)				
		P	L	M	S	I
PP	F_{R1}	31,6				
	F_{R2}	7,6 k_{mod}				
	H_R	2,7 k_{mod}				
PPL	F_{R1}	57.1				
	F_{R2}	7,6 k_{mod}				
	H_R	1.6	1.9	2.1	2.4	2.5

D4: PL

Product Name	alternative names			
	UK	France	DK	D
PL				L

Figure D4-1: Drawings**Table D4-1: Size specification**

Type	Dimensions [mm]		
	A	B	C
PL80/70G	80	70	126
PL100/70G	100	70	126
PL90/90G	90	90	141
PL100/90G	100	90	136
PL120/90G	120	90	126
PL140/90G	140	90	126

Table D4-2: Material specification

Material thickness	Material Grades	Coating specification
5	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Tube Ø38x2,0	S220JR according to EN10025:2004	
	Or stainless steel as described	

Table D4-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load direction	type	characteristic capacity (kN)	
		min. of	
		timber	steel ¹⁾
F ₁	all		57,1
F ₂	PL80/70	18,4	17,3
	PL80/70	18,4	11,7
	PL90/90	22,0	18,0
	PL100/90	22,0	15,1
	PL120/90	19,0	11,4
	PL140/90		9,2
H ₁	all		2,8
H ₂	all		3,5

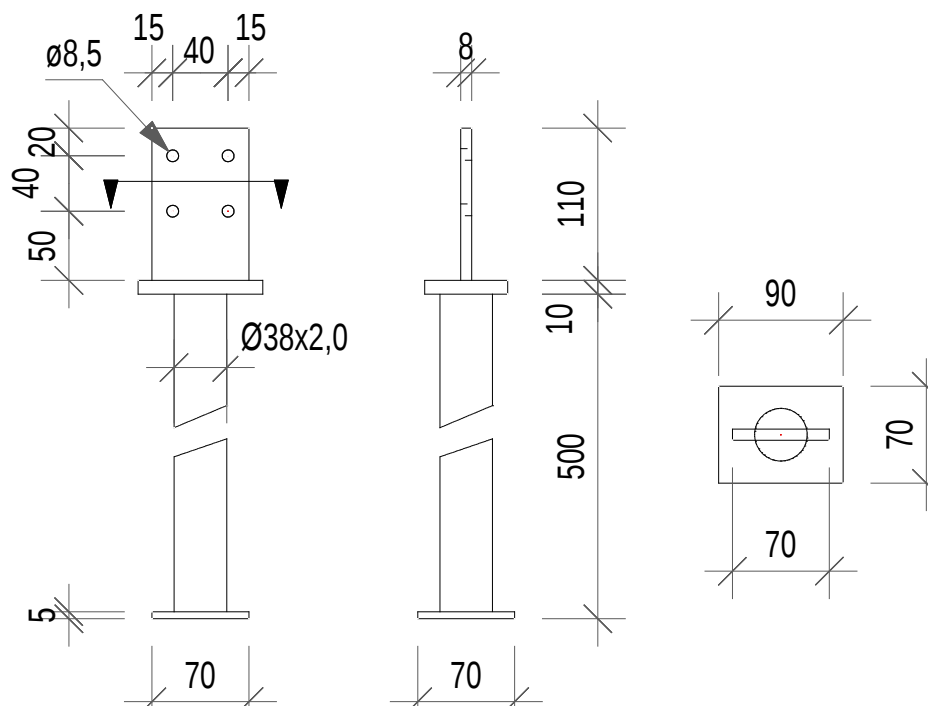
¹⁾ for steel $k_{\text{mod}} = 1,0$ shall be used for all load durations

For vertical loads F and any horizontal loads H acting simultaneously it shall be verified that:

$$F_1 / F_R + H / H_R \leq 1.$$

D5: PIL

Product Name	alternative names			
	UK	France	DK	D
PIL				IL

Figure D5-1: Drawings**Table D5-1: Size specification**

n/a

Table D5-2: Material specification

Material thickness	Material Grades	Coating specification
5, 8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Tube $\varnothing 38 \times 2,0$	S220JR according to EN10025:2004	
	Or stainless steel as described	

Table D5-3: Characteristic capacity $k_{mod}=1,18$

Load Direction	Timber thickness, t [mm]	Load duration class (kN)				
		P	L	M	S	I
F_{R1}		54	57			
F_{R2}	60	13,8 k_{mod}				
	80	16,0 k_{mod}				
	100	18,7 k_{mod}				
	≥ 120	20,7 k_{mod}				
H_{R1}		2.2				
H_{R2}	60	1.8				
	80	1.8				
	100	2.0				
	120	2.2				
	140	2.4				
	160	2.4				

For vertical loads F and any horizontal loads H acting simultaneously it shall be verified that:
 $F_1 / F_R + H / H_R \leq 1$.

D6: PIS / PISB / PISMAXI / PISBMAXI

Product Name	alternative names			
	UK	France	DK	D
PIS70				IS
PISBxx				ISB
PIS Maxi				IS Maxi
PISB Maxi				ISB Maxi

xx = size of PISB

Figure D6-1: Drawings

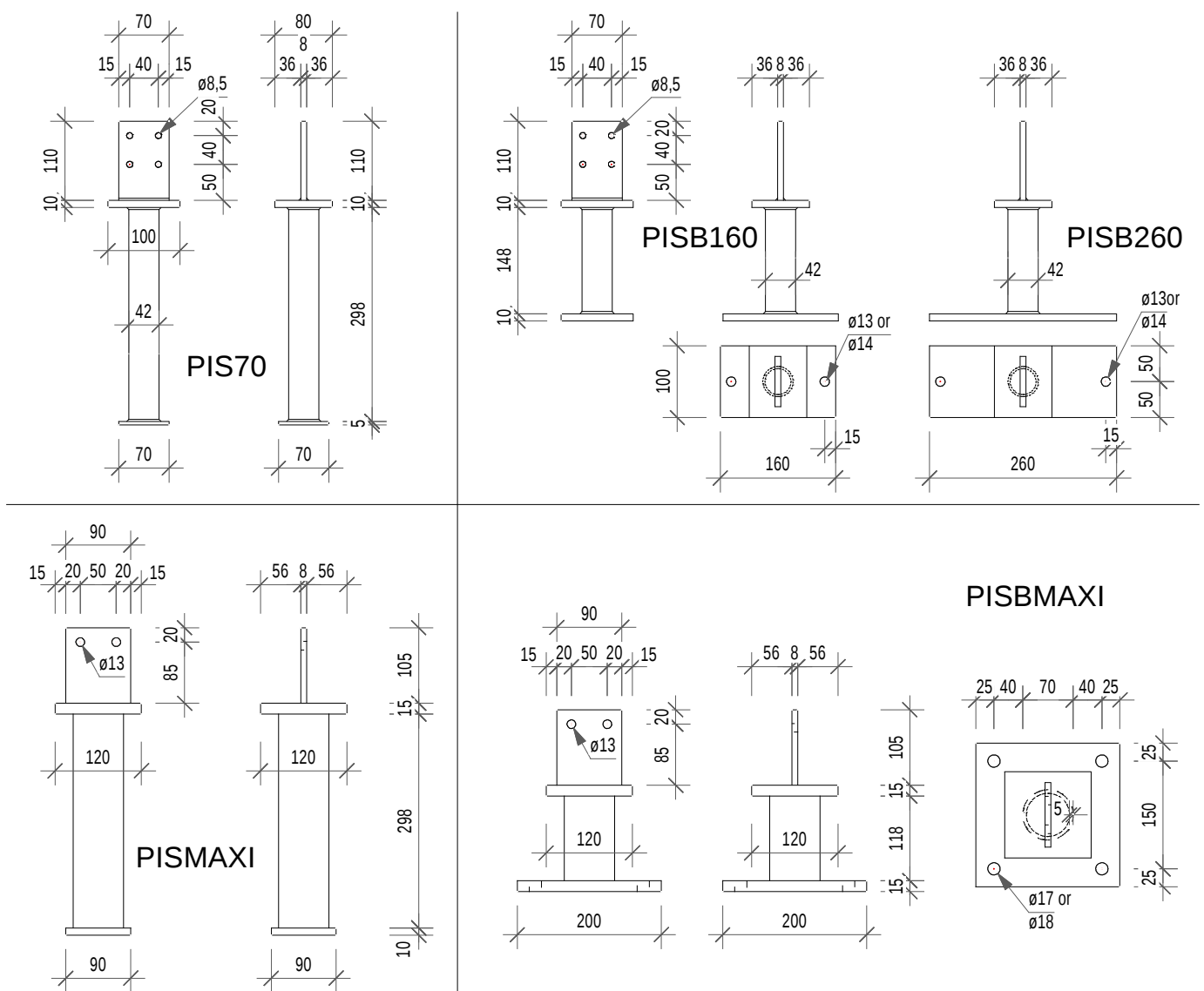


Table D6-1: Size specification

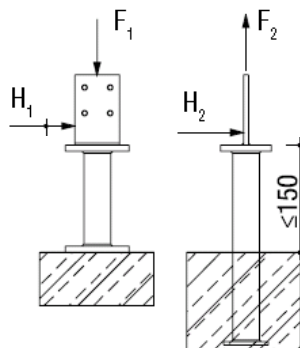
See drawing

Table D6-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10, 15	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
tube	S235JR according to EN 10025:2004	
	Or stainless steel as described	

Table D6-3: Characteristic capacity – for concrete C12 $k_{modi}=1,18$

Load direction	Width of timber b [mm]	PIS70 characteristic capacity [kN]		PISBxx characteristic capacity [kN]		Width of timber b [mm]	PISMAXI characteristic capacity [kN]		PISBMAXI characteristic capacity [kN]			
		min. of		min. of			min. of		min. of			
		timber	steel ¹⁾	timber	steel ¹⁾		timber	steel ¹⁾	timber	steel ¹⁾		
F ₁	all	142.8	110.8	142.8	110.8	all	272.2	187.9	272.2	256.9		
F ₂	80	16.0	-	16.0	-	120	34.5	-	34.5	-		
	100	18.7		18.7		140	38.5		38.5			
	120	20.7		20.7		160	42.1		42.1			
H ₁	80	10.9	6.3	10.9	5.6	120	22.5	-	22.5	-		
	100	-		-		140	25.2		24		25.2	14.1
	120	-		-		160	27.5				27.5	
H ₂	80	4.1	-	4.1	-	120	7.7	-	7.7	-		
	100	5.9	5.1	5.9	5.1	140	9.9		9.9			
	120	7.0	5.5	7.9	5.5	160	12.3		12.3			

1) for steel $k_{mod} = 1,0$ shall be used for all load durations**Figure D6-2: Application**

D7: PLS and PLB

Product Name	alternative names			
	UK	France	DK	D
PLS				LS
PLB				LB

Figure D7-1: Drawings

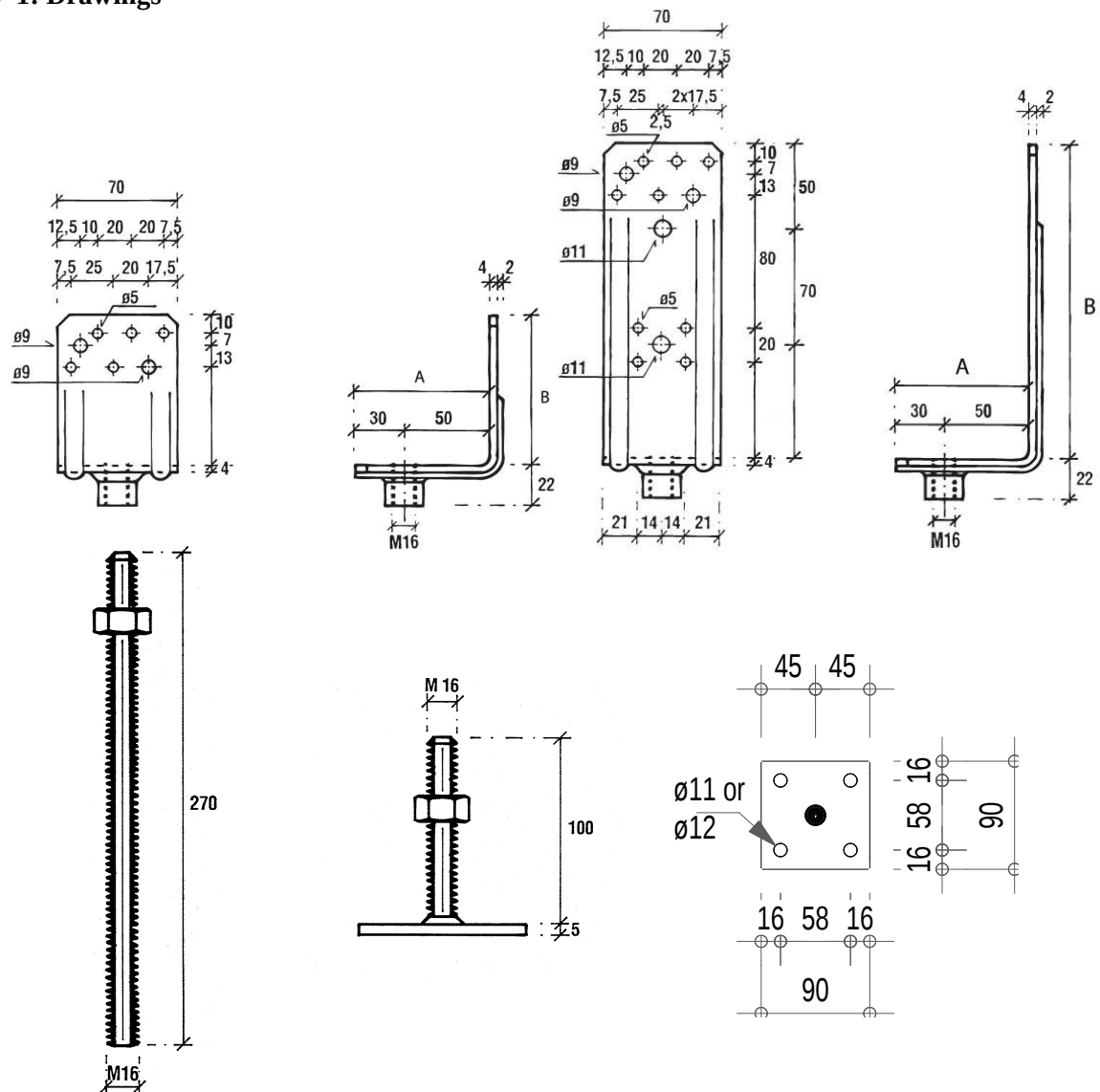


Table D7-1: Size specification

Type	Dimensions [mm]		Upper part
	A	B	
PLS60/65G	60	65	S
PLS60/165G	60	165	S
PLS80/90G	80	90	S
PLS80/190G	80	190	S
PLB60/65G	60	65	B
PLB60/165G	60	165	B
PLB80/90G	80	90	B
PLB80/190G	80	190	B

Table D7-2: Material specification

Material thickness	Material Grades	Coating specification
4, 5	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Threaded rod	Threaded rod: S355 JO according to EN 10025:2004	
	Or stainless steel as described	

Table D7-3: Characteristic capacity $k_{modi}=1,18$

Load direction	size of PLS / PLB	PLB und PLS		
		connection to:	characteristic capacity [kN] min. of	
			timber	steel ¹⁾
F ₁ down	all	column	50,8	36,4
		beam	20,1	20,2
F ₂ uplift		with fastener:	to column or beam	
	60x65	3 CNA4,0x40 or 2 CSA5,0x35	5,4	3,5
	60x165	2 CNA4,0x40 or 1 screw 8x60	2,8	3,0
	80x90	3 CNA4,0x40 or 2 CSA5,0x35	-	2,3
	80x190	2 CNA4,0x40 or 1 screw 8x60	2,8	2,3

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations

D8: PVD, PVDB, PVI, PVIB

Product Name	alternative names			
	UK	France	DK	D
PVD80		PB31950		Vario D80
PVD120		PB31948		Vario D120
PVDB80		PB31951		Vario DB80
PVDB120		PB31949		Vario DB120
PVI				Vario I
PVIB				Vario IB

Figure D8-1: Drawings

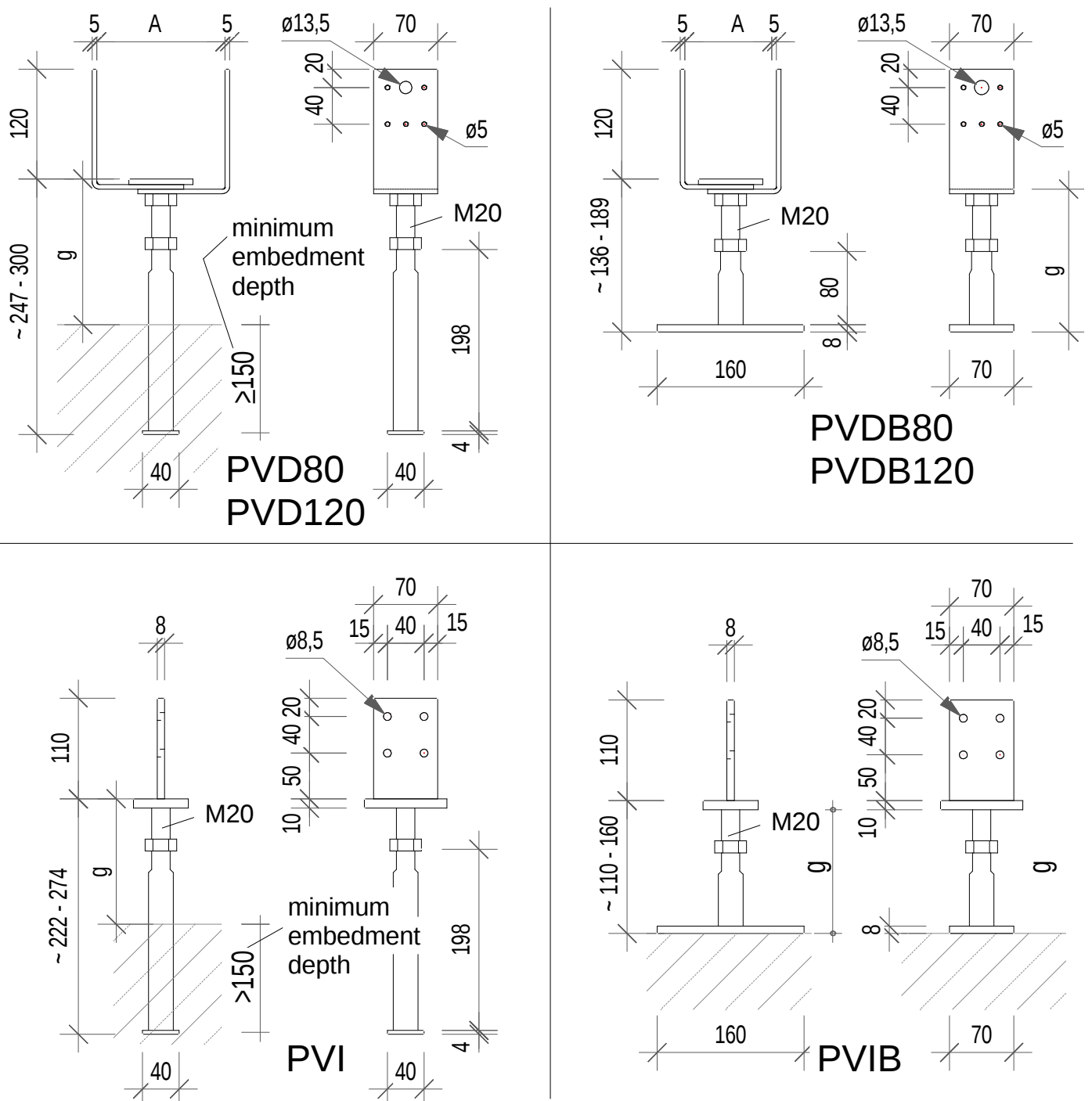


Table D8-1: Size specification

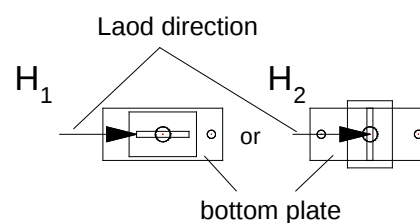
Type	Dimensions [mm]		
	A min	A max	No. of holes Ø5
PVD 80	80	120	5 / flap
PVD 120	120	160	5 / flap
PVDB80	80	120	5 / flap
PVDB120	120	160	5 / flap

Table D8-2: Material specification

Material thickness	Material Grades	Coating specification
4, 5, 8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Threaded rod	S355 JO according to EN 10025:2004	
	Or stainless steel as described	

Table D8-3: Characteristic capacity – for concrete C12 [full nailing with CNA4,0x40] $k_{modi}=1,18$

Load direction	width of timber b [mm]	PVD		PVBD	
		characteristic capacity [kN]			
		min. of		min. of	
		timber	steel ¹⁾	timber	steel ¹⁾
F ₁		77,8	49,0	77,8	49,0
F ₂	80	17,6		17,6	
	120	17,6	11,6	17,6	11,6
	160	15,2	7,6	15,2	7,6
		at g =		at g =	
H ₁	≥80	48mm	2,7	136mm	1,4
		73mm	2,1	161mm	1,2
		98mm	1,7	186mm	1,1
H ₂	≥80	48mm	6,5	136mm	3,2
		73mm	3,9	161mm	2,7
		98mm	2,8	186mm	2,3

**PVDB and PVIB**

The horizontal load H₁ or H₂ shall always be in the direction of the longer side of the bottom plate.

Load direction	width of timber b [mm]	PVI		PVIB	
		characteristic capacity [kN]			
		min. of		min. of	
		timber	steel ¹⁾	timber	steel ¹⁾
F ₁		90,7	49,0	90,7	49,0
F ₂	80	16,0		16,0	
	120	20,7		20,7	
	160	20,7		20,7	
		at g = 57mm		at g = 145mm	
H ₁			2,7		2,6
H ₂	80	2,5	2,2	1,9	1,9
	120	3,8	3,8	3,3	2,7
	160	5,7	4,7	3,5	2,7

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations

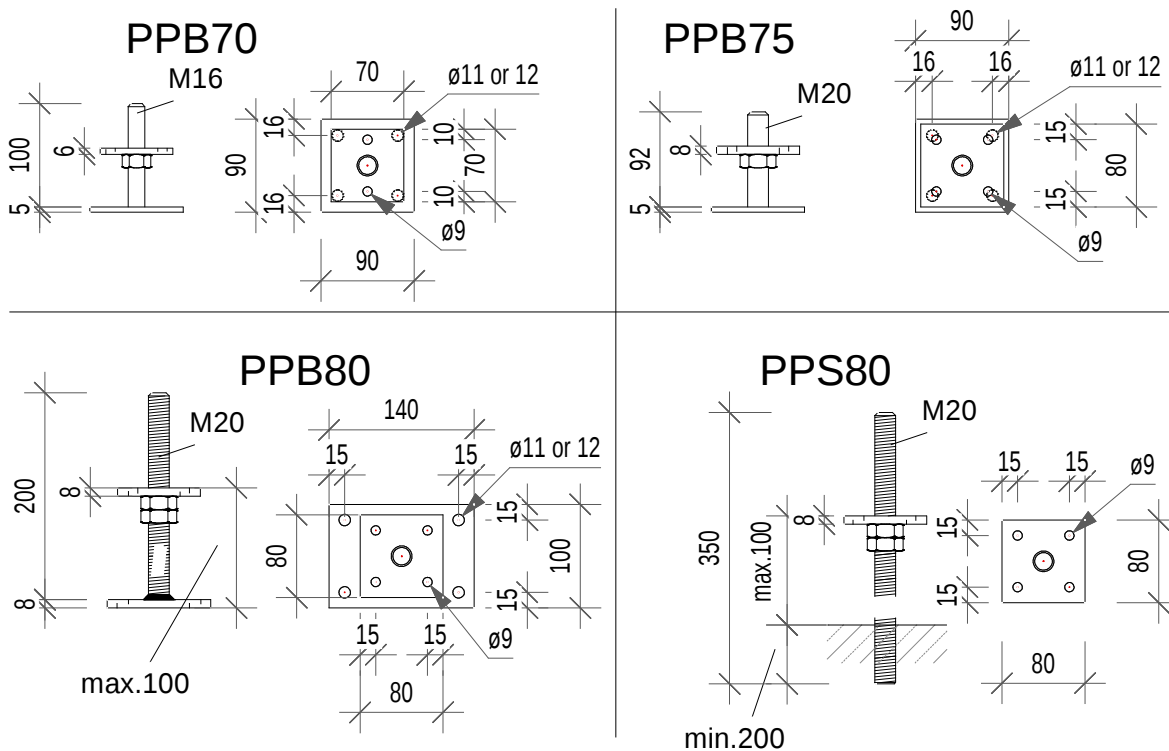
Capacities have been determined for a specific distance g. For other cases, please apply the given modification factors given in this table

Modification factors for differing size g			
PVI		PVIB	
g	factor	g	factor
32	1,15	120	1,1
57	1,0	145	1,0
82	0,85	170	0,85

Basis for table
before

D9: PPB and PPS

Product Name	alternative names			
	UK	France	DK	D
PPB70				PB70
PPB75				PB75
PPB80		PB40605		PB80
PPS80				PS80

Figure D9-1: Drawings**Table D9-1: Size specification**

n/a

Table D9-2: Material specification

Material thickness	Material Grades	Coating specification
6, 8	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Threaded rod	S355 JO according to EN 10025:2004	
	Or stainless steel as described	

Table D9-3: Characteristic capacity

$k_{\text{modi}}=1,18$

Load direction	type	characteristic capacity [kN]	
		min. of timber	steel ¹⁾
F ₁	PPS		40,0 ²⁾
	PPB	88,3	49,5 ³⁾
			63,9

¹⁾ for steel $k_{\text{mod}} = 1,0$ shall be used for all load durations

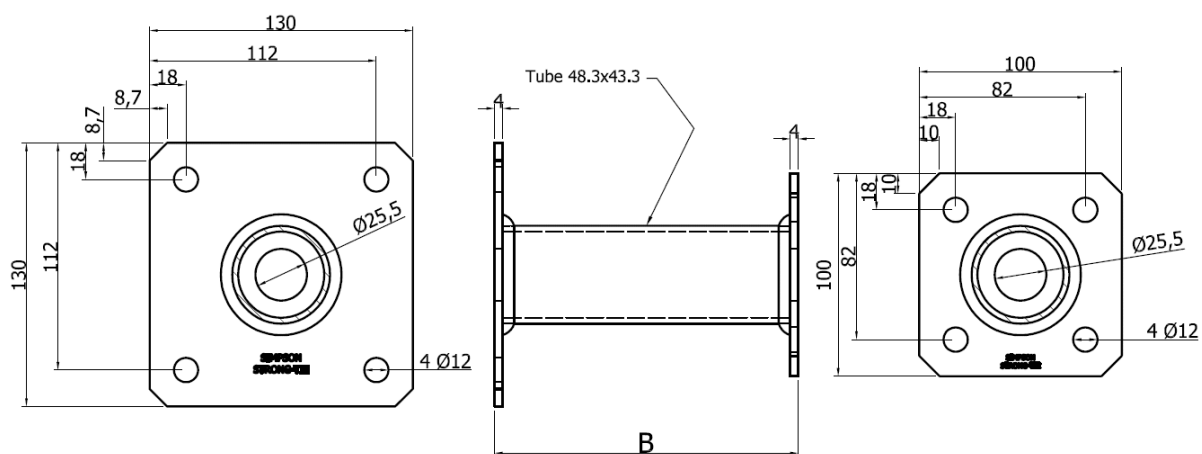
²⁾ with C15 concrete

³⁾ with C20 concrete

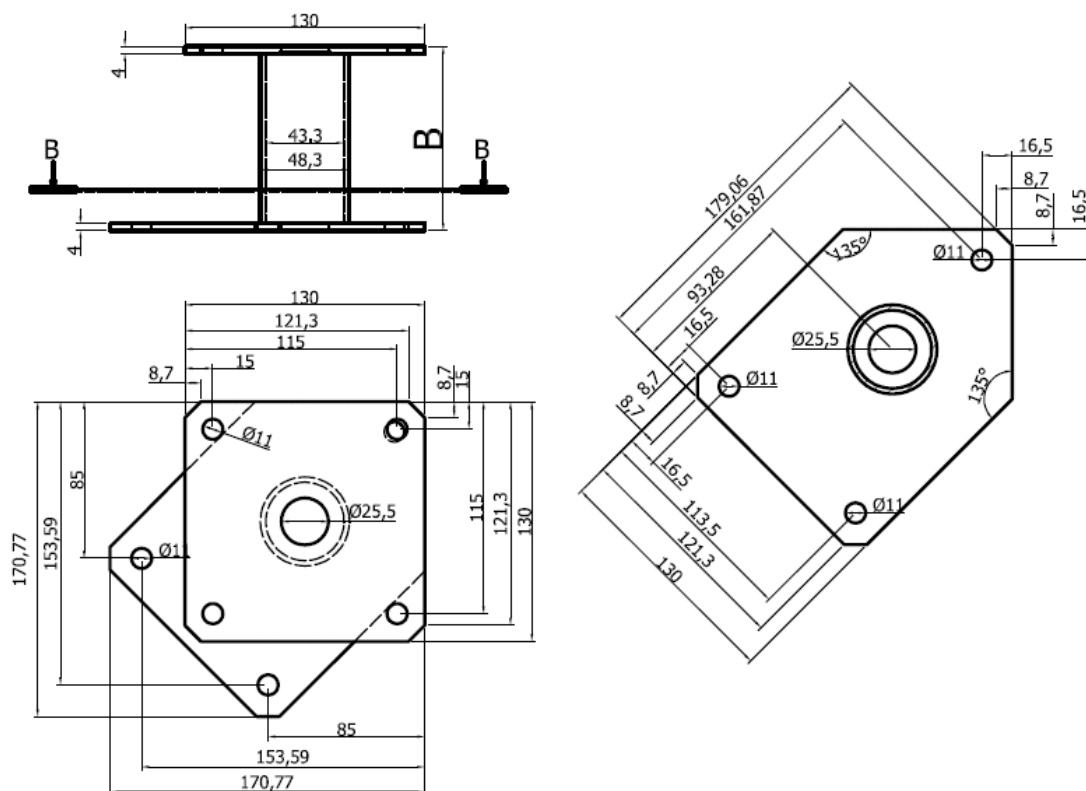
D10: PPA / PBL

Product Name	alternative names			
	UK	France	DK	D
PPA				
PBL				

Figure D10-1: Drawings



PPA



PBL

Table D10-1: Size specification

Type	Dimension [mm]
	B
PPA100	100
PPA150	150
PBL100	100
PBL150	150

Table D10-2: Material specification

Material thickness	Material Grades	Coating specification
4	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
tube	S235 JRH according to EN 10219-1:2006	
	Or stainless steel as described	

Table D10-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PPA100 / PBL 100 PPA150 / PBL 150	55,9	61,7	67,3	72,9	83,7

The capacities for post base PPA are valid also for the case, where the connector is turned upside down.

D11: PJPS / PJPB / PJIS / PJIB

Product Name	alternative names			
	UK	France	DK	D
PJPS				JPS
PJPB				JPB
PJIS				JIS
PJIB				JIB

Figure D11-1: Drawings

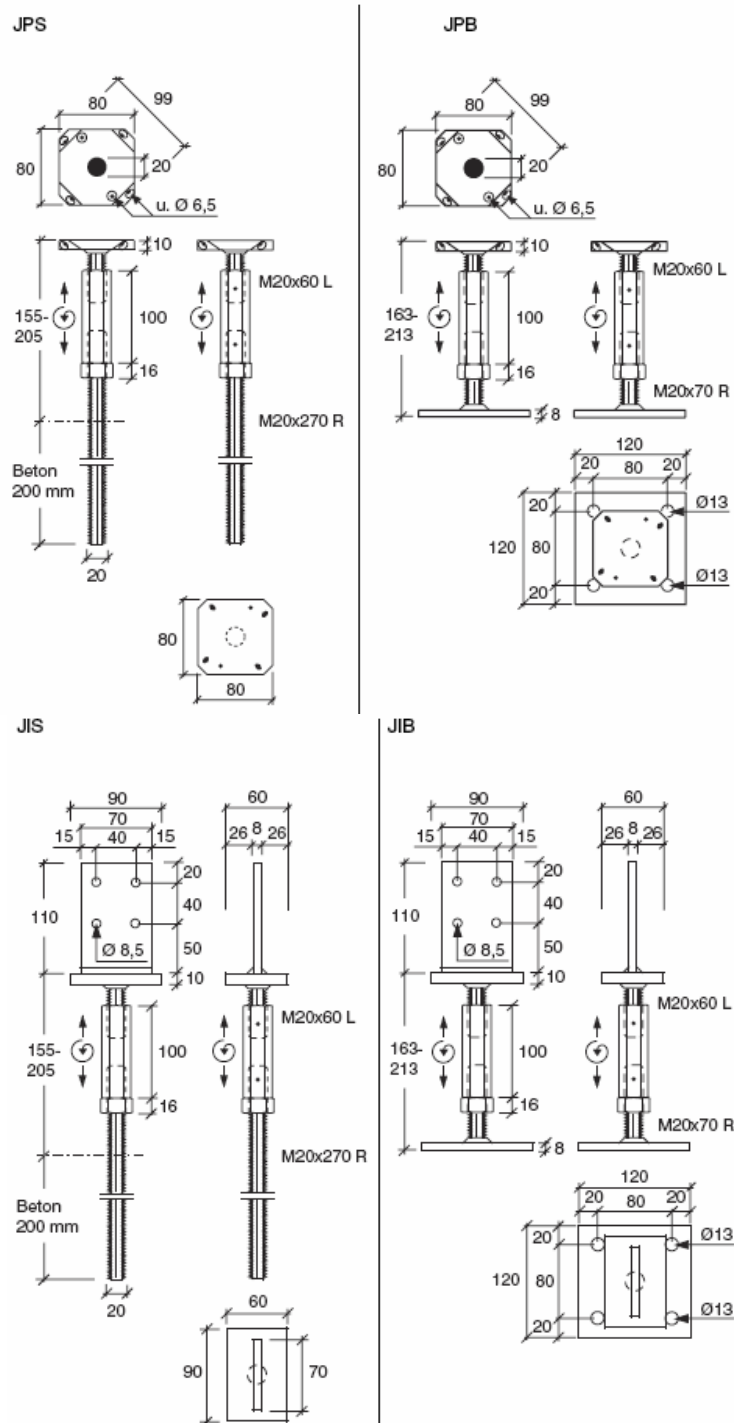


Table D11-1: Size specification

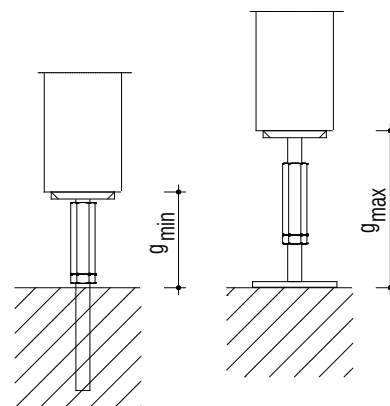
n/a

Table D11-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Threaded rod	S355 JO according to EN 10025:2004	
	Or stainless steel as described	

Table D11-3: Characteristic capacity – for concrete C12 $k_{modi}=1,18$

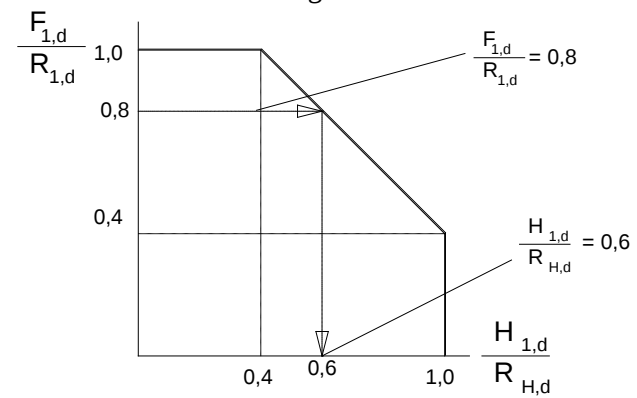
Load direction	width of timber b [mm]	PJIS and PJIB characteristic capacity (kN)	
		min. of timber	steel ¹⁾
F_1		90,7	54,5
F_2	80	16,0	
	100	18,7	
	120	20,7	
H_1	bei g_{min}		1,4
	bei g_{max}		1,1
H_2 bei g_{min}	80	2,0	1,6
	100	2,3	1,8
	120	2,6	1,8
H_2 bei g_{max}	80	1,7	1,4
	100	2,0	1,4
	120	2,1	1,4

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations

Load direction	Type	PJPS und PJPB characteristic capacity (kN)	
		min. of timber	steel ¹⁾
F_1	PJPB		54,5
	PJPS		
F_2	PJPB	7,6	
	PJPS		
H	PJPB und PJPS	2,7	1,7
	g_{min} g_{max}		1,4

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durationsFor types PJPS and PJPB are no difference for H_1 and H_2 .For vertical load F_1 and horizontal load H acting simultaneously it shall be verified that the combination of loads fall below

the lines shown in the diagram.

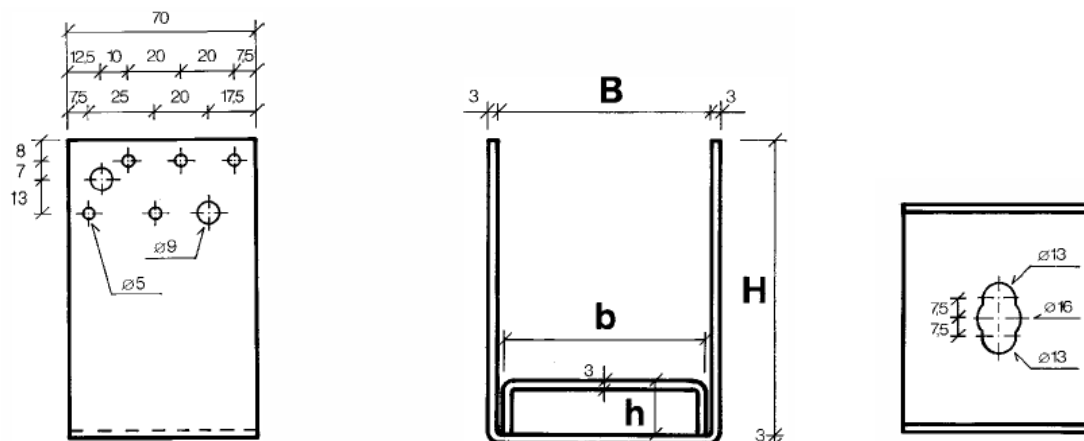


For vertical load F_2 and any horizontal load H acting simultaneously it shall be verified that:
 $F_2 / F_{R2} + H / H_R \leq 1$

D12: PUA

Product Name	alternative names			
	UK	France	DK	D
PUAxx				U-Anker

xx = width of the PUA

Figure D12-1: Drawings*The inside part is named PUA/Bxx***Table D12-1: Size specification**

type	size [mm]			inside part	size [mm]	
	B	H	Ø		b	h
PUA45	46	127	5; 9	PUA/B42	42	27
PUA50	51	125	5; 9	PUA/B47	47	25
PUA60	61	120	5; 9	PUA/B57	57	20
PUA70	71	115	5; 9	PUA/B67	67	25
PUA80	81	110	5; 9	PUA/B77	77	20
PUA90	91	115	5; 9	PUA/B87	87	25
PUA100	101	110	5; 9	PUA/B97	97	20
PUA120	121	110	5; 9	PUA/B117	117	20

Table D12-2: Material specification

Material thickness	Material Grades	Coating specification
3	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
	Or stainless steel as described	

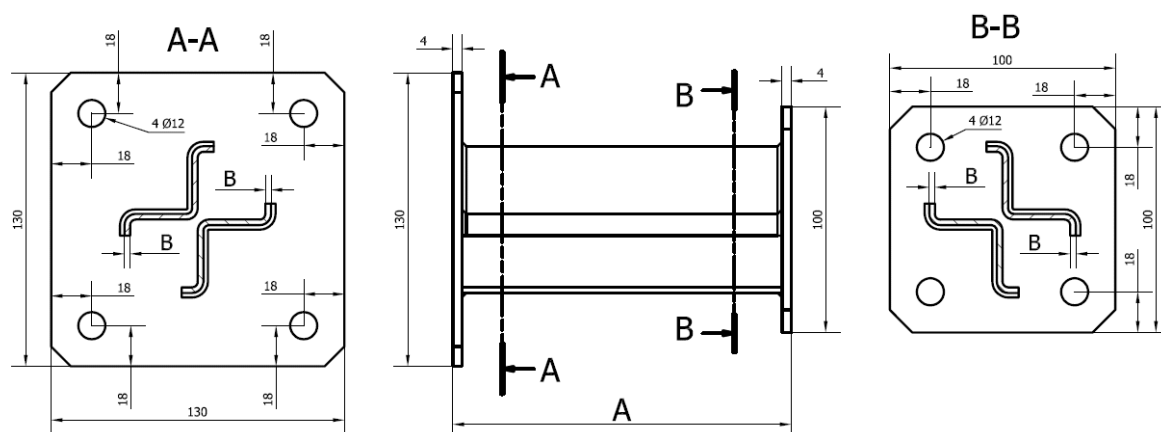
Table D12-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load direction	Type	PUA with PUA/B characteristic capacity (kN)	
		min. of timber	steel ¹⁾
F ₁	alle	29,6	34,7
F ₂	PUA45-B	18,1	10,9
	PUA50-B	18,1	9,8
	PUA60-B		7,6
	PUA70-B		6,2
	PUA80-B		5,2
	PUA90-B		4,5
	PUA100-B		4,0
	PUA120-B		3,2

¹⁾ for steel $k_{\text{mod}} = 1,0$ shall be used for all load durations

D13: FPB

Product Name	alternative names			
	UK	France	DK	D
FPB				

Figure D13-1: Drawings

Fasteners to timber: wood screw Ø10.
Fastener to concrete: anchor bolt M10.

Table D13-1: Size specification

Type	Dimensions [mm]	
	A	B
FPB100/2 – FPB100/2IX	100	2
FPB150/2 – FPB150/2IX	150	
FPB100/2.5 – FPB100/2.5IX	100	2.5
FPB150/2.5 – FPB150/2.5IX	150	

Table D13-2: Material specification

Material thickness	Material Grades	Coating specification
2; 2,5; 4,0	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Ribbed bar	B 550 BR+AC according to 10080:2006	
	Or stainless steel 316L according to EN 10088:2005	

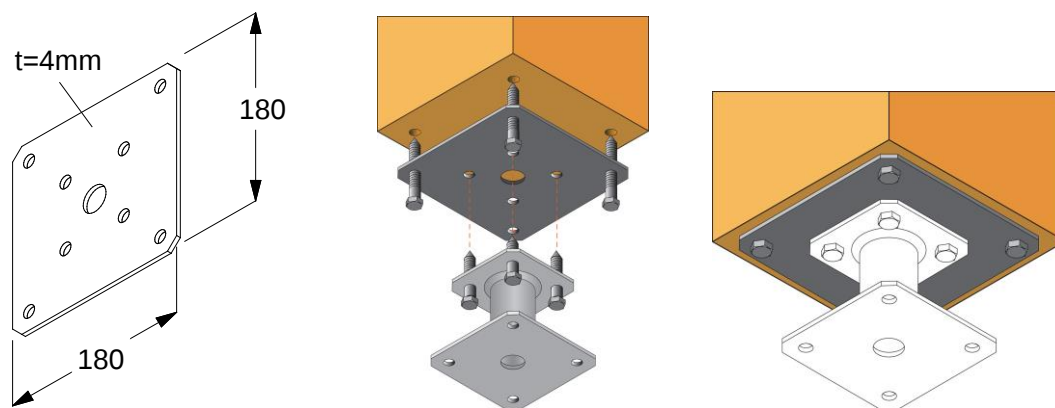
Table D13-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	FPB100/2 – FPB100/2IX	65.9				
	FPB150/2 – FPB150/2IX					
	FPB100/2.5 – FPB100/2.5IX	66.3	72.8	77.2		
	FPB150/2.5 – FPB150/2.5IX					

The capacities for post base FPB are valid also for the case, where the connector is turned upside down.

D14: PLPP180

Product Name	alternative names			
	UK	France	DK	D
PLPP180				

Figure D14-1: Drawings**Table D14-1: Size specification**

n/a

Table D14-2: Material specification

Material thickness	Material Grades	Coating specification
4	DD11 according to EN 10111:1998	Hot-dip galvanized according to EN ISO 1461:1999
	Or stainless steel as described	

Table D14-3: Characteristic capacity

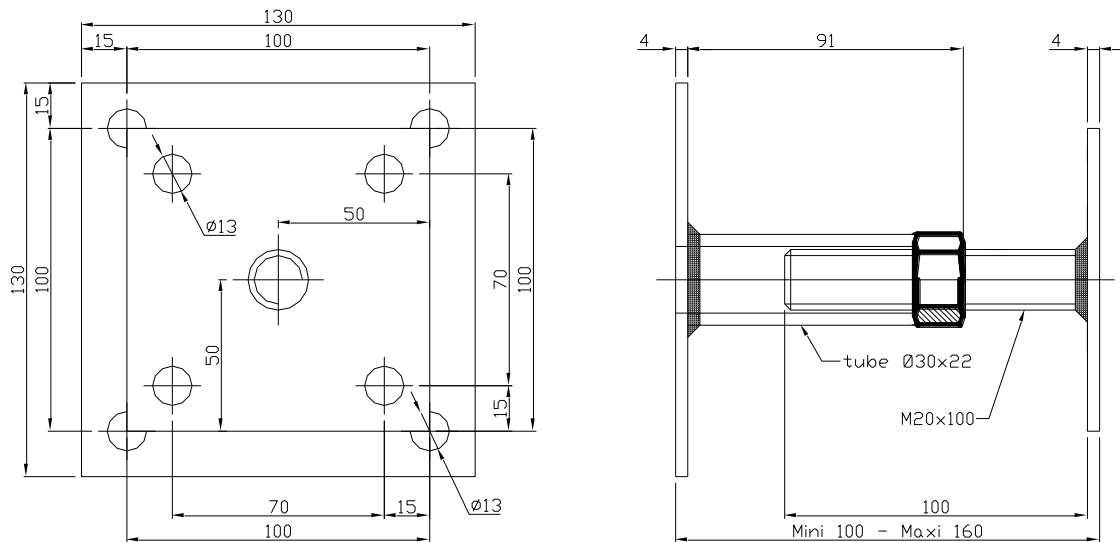
n/a

The optional plate is compatible with the following post bases: PPA100, PPA150, FPB100, FPB150, APB100/150, PPRC. The use of this optional plate doesn't change the performance of the post bases.

It must be used with 8 wood screws as shown on the drawing above

D15: PPR

Product Name	alternative names			
	UK	France	DK	D
PPR				

Figure D15-1: Drawings

Fasteners to timber: wood screw Ø10; Fastener to concrete: anchor bolt M10

Table D15-1: Size specification

n/a

Table D15-2: Material specification

Material thickness	Material Grades	Coating specification
4	P355 NB according to EN 10120:1997	Hot-dip galvanized according to EN ISO 1461:1999
tube	P235TR1 according to EN 10216-1:2002	
Threaded rod	steel class 4.6 according to ISO 898:1999	
	Or stainless steel as described	

Table D15-3: Characteristic capacity

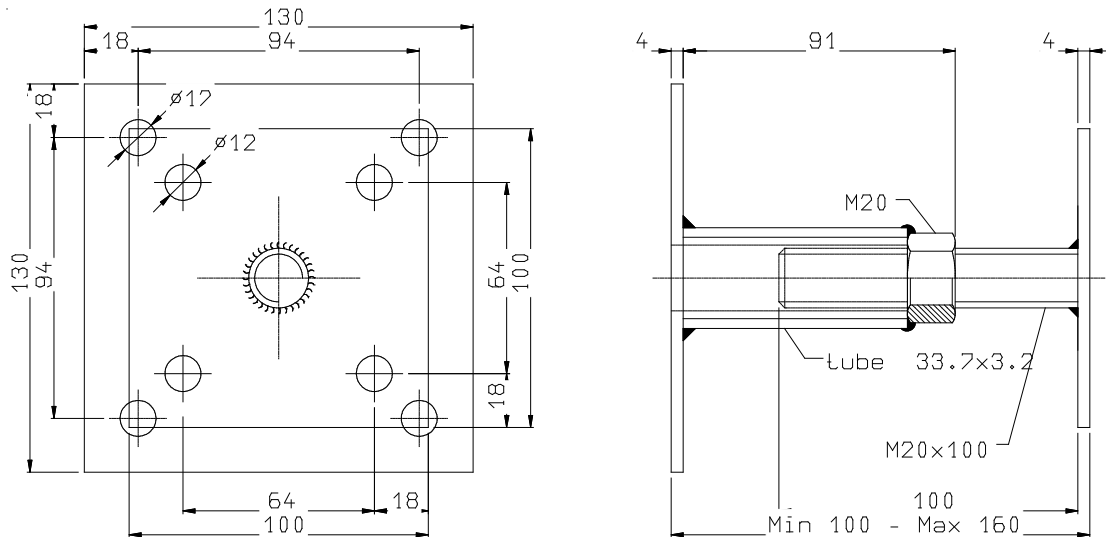
$k_{modi}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PPR,	39	42	46	48	53

The capacities are valid also for the case, where the connector is turned upside down.

D16: PPRIX

Product Name	alternative names			
	UK	France	DK	D
PPRIX				

Figure D16-1: Drawings

Fasteners to timber: wood screw Ø10; Fastener to concrete: anchor bolt M10

Table D16-1: Size specification

n/a

Table D16-2: Material specification

Material thickness	Material Grades	Coating specification
4	Stainless steel 316L according to EN 10088:2005	N/A
tube	B 550 BR+AC according to 10080:2006	
Threaded rod	A4 (AISI 316L) according to ISO 350	

Table D16-3: Characteristic capacity

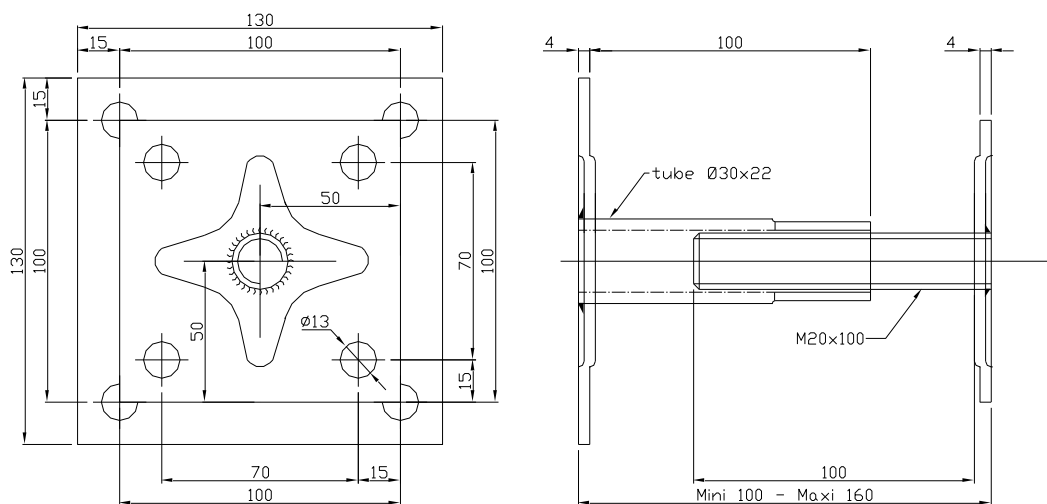
$k_{modi}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PPR,	28	30	32	34	38

The capacities are valid also for the case, where the connector is turned upside down.

D17: PPRB

Product Name	alternative names			
	UK	France	DK	D
PPRB				

Figure D17-1: Drawings**Table D17-1: Size specification**

n/a

Table D17-2: Material specification

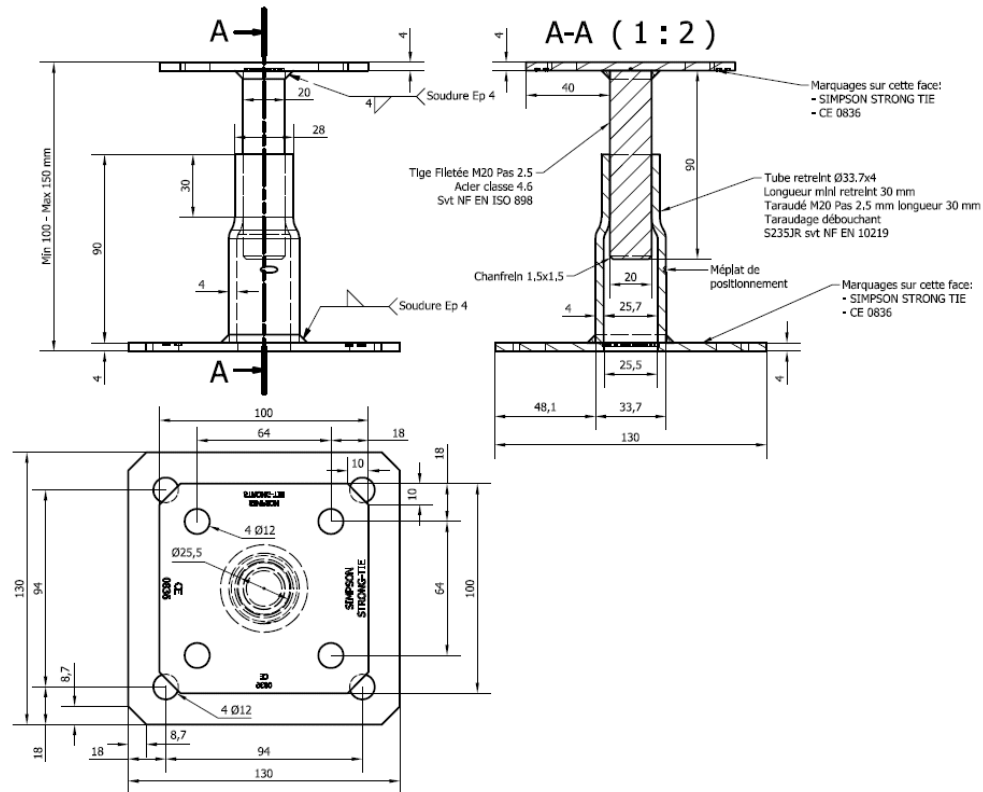
Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Electroplated zinc Zn25/A according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc)
tube	E235 according to EN 10305:2003	
Threaded rod	steel class 4.6 according to ISO 898:1999	
	Or stainless steel as described	

Table D17-3: Characteristic capacity $k_{modi}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PPRB	33	36	38	40	45

D18: APB100/150

Product Name	alternative names			
	UK	France	DK	D
APB100/150				

Figure D18-1: Drawings

Fasteners to timber: wood screw Ø10; Fastener to concrete: anchor bolt M10

Table D18-1: Size specification

n/a

Table D18-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Electroplated zinc Zn25/A according to EN ISO 2081
tube	S235 JRH according to EN 10219:2006	
Threaded rod	steel class 4.6 according to ISO 898:1999	Or electroplated zinc Zn10/A (alkali zinc)
	Or stainless steel as described	

Table D18-3: Characteristic capacity

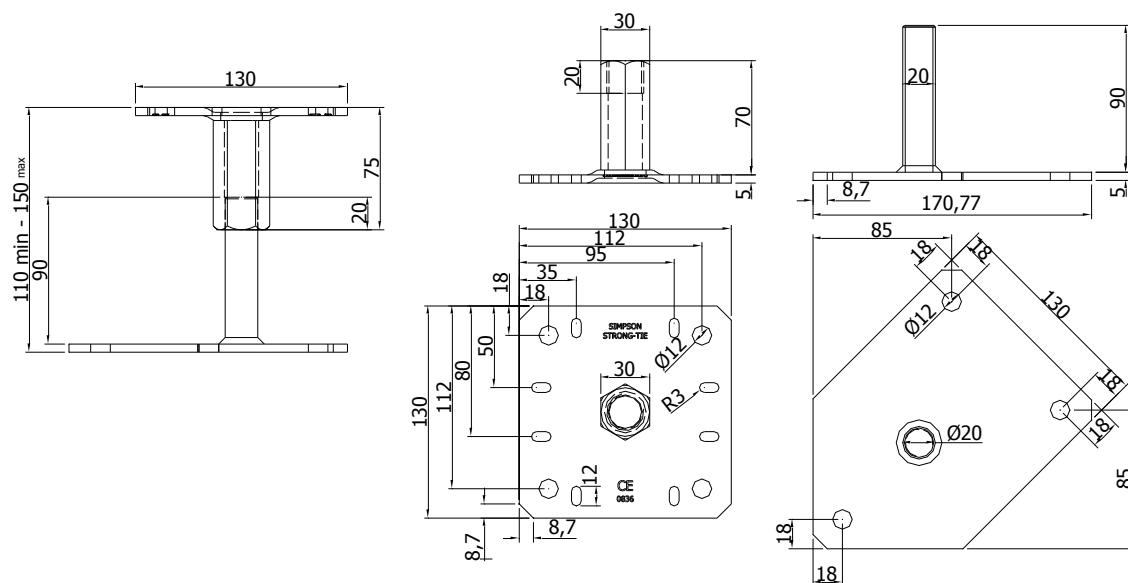
$k_{modi}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	APB100/150	45	49.1	52.7	55.9	61.9

D20: PBLR

Product Name	alternative names			
	UK	France	DK	D
PPLR				

Figure D3-1: Drawings



Fasteners to timber: wood screw Ø10; SPAX-S 5,0x80 at 45°; Fastener to concrete: anchor bolt M10

Table D20-1: Size specification

n/a

Table D20-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Electroplated zinc Zn25/A according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc)
tube	C15RPB according to EN 10084:1999	
Threaded rod	steel class 4.6 according to ISO 898:1999	
	Or stainless steel as described	

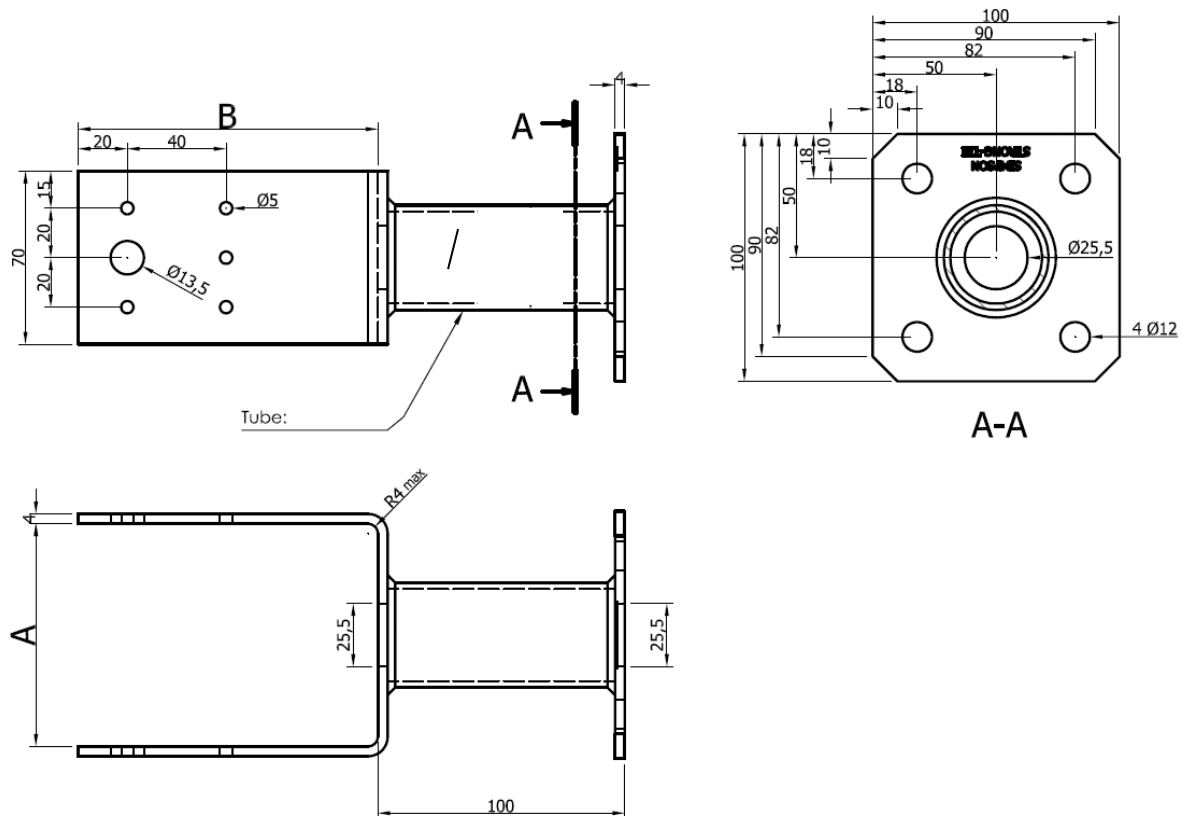
Table D20-3: Characteristic capacity

 $k_{\text{modi}}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PBLR	40	43	46	49	54

D21: PPUP

Product Name	alternative names			
	UK	France	DK	D
PPUP				

Figure D21-1: Drawings**Table D21-1: Size specification**

Type	Dimension [mm]		tube
	A	B	
PPUP70	70	126,5	$\varnothing 48,3 \times 2,5$
PPUP90	90	121,5	$\varnothing 48,3 \times 2,5$

Table D21-2: Material specification

Material thickness	Material Grades	Coating specification
4	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
tube	S235 JRH according to EN 10219-1:2006	
	Or stainless steel as described	

Table D21-3: Characteristic capacity $k_{mod}=1,18$

Type	Load Direction	Load duration class (kN)				
		P	L	M	S	I
PPUP 70	F_{R1}	55	65	74	83	101
	F_{R2}	$17.8 k_{mod}$				
	H_{R1}	$10.6 k_{mod}$				
	H_{R2}	6,4	6,9	7,4	7,8	8,6
PPUP 90	F_{R1}	73	85	97	103	134
	F_{R2}	$21.4 k_{mod}$				
	H_{R1}	8.6	10	11.4	12.9	14.1
	H_{R2}	8,2	8,9	9,5	10,1	11,1

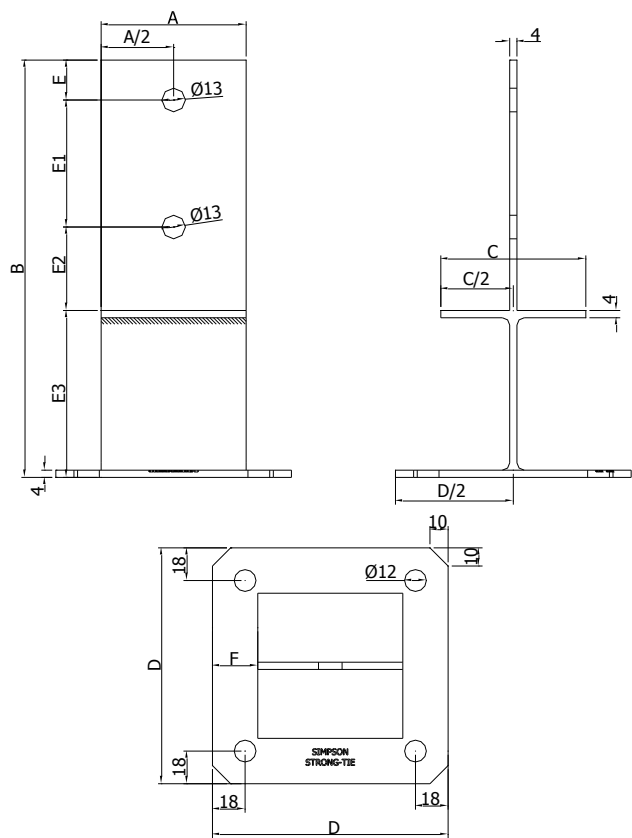
 k_{mod} : load duration factor

To obtain full load-carrying capacities for lifting force and horizontal force the characteristic withdrawal capacity of the anchors should be minimum: 15,4 kN for PPUP70 and 19,2 kN for PPUP90.

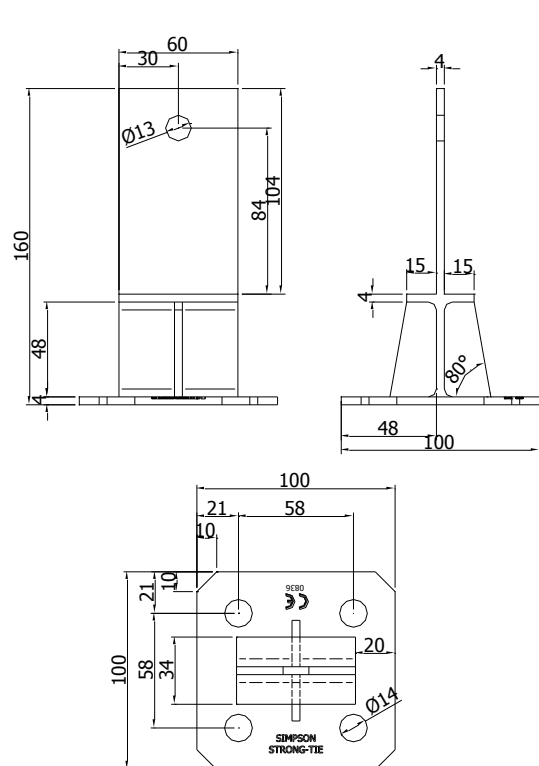
D22: PPS and PPSDT

Product Name	alternative names			
	UK	France	DK	D
PPS				
PPSDT				

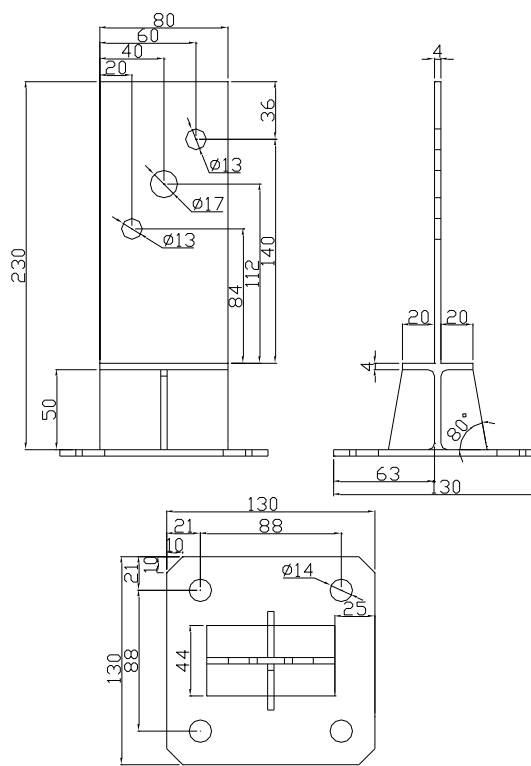
Figure D22-1: Drawings



PPS



PPSDT160



PPSDT230

Table D22-1: Size specification

Type	Dimensions [mm]								
	A	B	C	D	E	E1	E2	E3	F
PPS170	60	170	60	100	18	48	48	56	20
PPS230	80	230	80	130	22	70	46	92	25

Table D22-2: Material specification

Material thickness	Material Grades	Coating specification
4	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
	Or stainless steel as described	

Table D22-3: Characteristic capacity $k_{mod}=1,18$

Type	Load Direction	Load duration class (kN)				
		P	L	M	S	I
PPS 170	F_{R1}	20,1	21,7	23,2	24,6	27,2
	F_{R2}	16,4 k_{mod}				
	H_{R1}	10,1				
	H_{R2}	1,2				
PPS 230	F_{R1}	26,8	28,9	30,9	32,8	36,2
	F_{R2}	18,0 k_{mod}				
	H_{R1}	13,3				
	H_{R2}	1,03				
PPSDT 160	F_{R1}	31	34	36	38	43
	F_{R2}	8,45 k_{mod}				
	H_{R1}	9,3				
	H_{R2}	5,4	5,9	6,3	6,7	7,4
PPSDT 230	F_{R1}	41	45	48	51	56
	F_{R2}	23,0 k_{mod}				
	H_{R1}	15,2				
	H_{R2}	7,2	7,7	8,4	8,9	9,9

 k_{mod} : load duration factor

To obtain full load-carrying capacities for lifting force and horizontal force the characteristic withdrawal capacity of the anchors should be minimum: 20,2 kN for PPS170, 23,7 kN for PPS230, 13,4 for PSDT160 and 26,8 kN for PSDT230.

D23: PPSP

Product Name	alternative names			
	UK	France	DK	D
PPSP				

Figure D23-1: Drawings

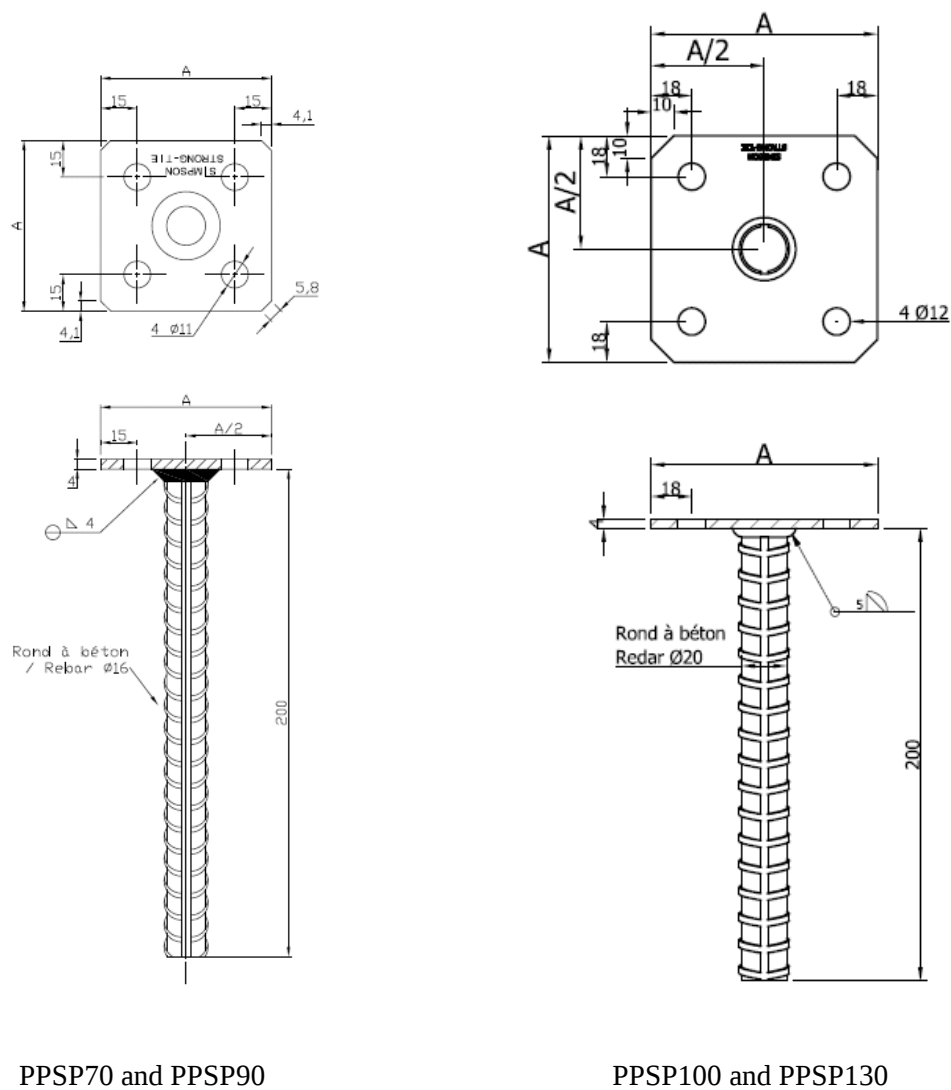


Table D23-1: Size specification

Type	Dimensions [mm]	
	A	Ø ribbed bar
PPSP70	70	16
PPSP90	90	16
PPSP100	100	20
PPSP130	130	20

Table D23-2: Material specification

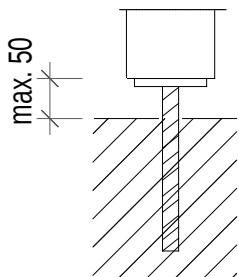
Material thickness	Material Grades	Coating specification
4 types PPSP100; PPSP130	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
4 Types PPSP70; PPSP90	DD11 acc to EN 10111:2008	
Ribbed bar	B 550 BR+AC according to 10080:2006	
	Or stainless steel as described	

Table D23-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load Direction	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PPSP 70	22,7	24,5	26,3	28,0	30,4
	PPSP 90	24,2	26,1	27,9	29,7	30,4
	PPSP 100	33	36	38	41	41
	PPSP 130	33	36	38	41	41

Fasteners to timber: wood screw Ø10.

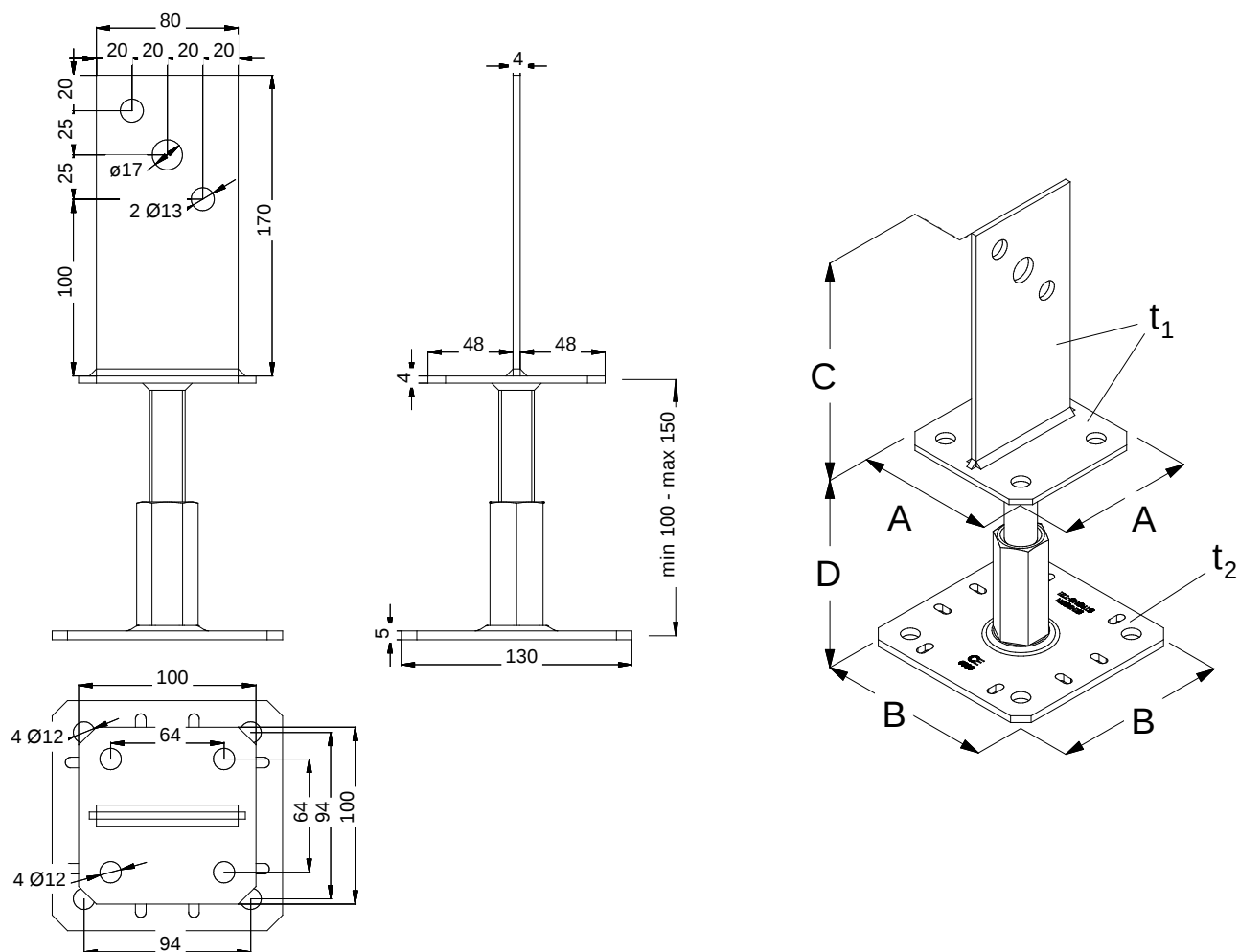
The characteristic compressive strength of the concrete shall be at least 20 MPa.



D24: PPSR320

Product Name	alternative names			
	UK	France	DK	D
PPSR320				

Figure D24-1: Drawings



Fasteners to timber: bolt or dowel Ø16 or bolts or dowel Ø12.
Fastener to concrete: anchor bolt M10.

Table D24-1: Size specification

	size [mm]						
	A	B	C	D	t ₁	t ₂	Ø
PPSR320	100	130	170	100-150	4	5	12,0 13,0 17,0

Table D24-2: Material specification

Material thickness	Material Grades	Coating specification
4; 5	S235JR according to EN 10025:2004	Electroplated Zinc Zn12/C according to ISO 2081:2009 and EN 1403 or Sherardizing class C30 according to EN 13811:2003.
tube	C15RPB according to EN 10084:1999	
Threaded rod	Steel class 4.6 according to ISO 898:1999	
Concealed plate	DD11 according to EN 10111:2008	
	Or stainless steel as described	

Table D24-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load Direction	Load duration class (kN)				
	P	L	M	S	I
F_{R1}	48,8				
F_{R2}	20,8				

D25: PPMINI

Product Name	alternative names			
	UK	France	DK	D
PPMINI				

Figure D25-1: Drawings

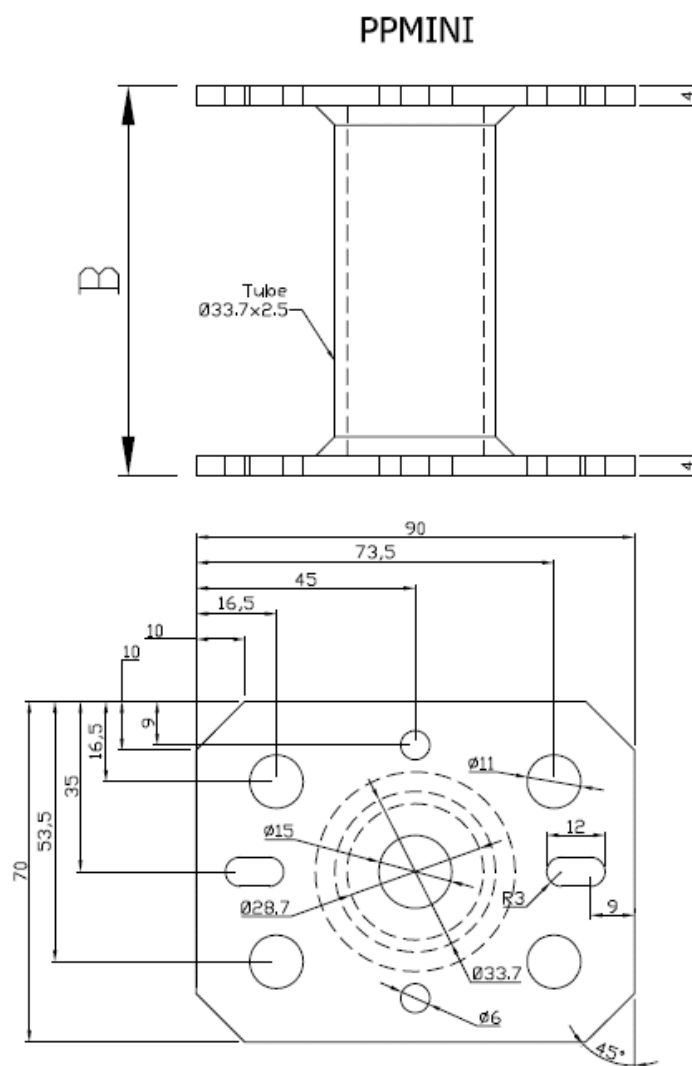


Table D25-1: Size specification

Type	Dimension [mm]
	B
PPMINI50	50
PPMINI70	70
PPMINI80	80

Table D25-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Tube	S235 JRH according to EN 10219-1:2006	
	Or stainless steel as described	

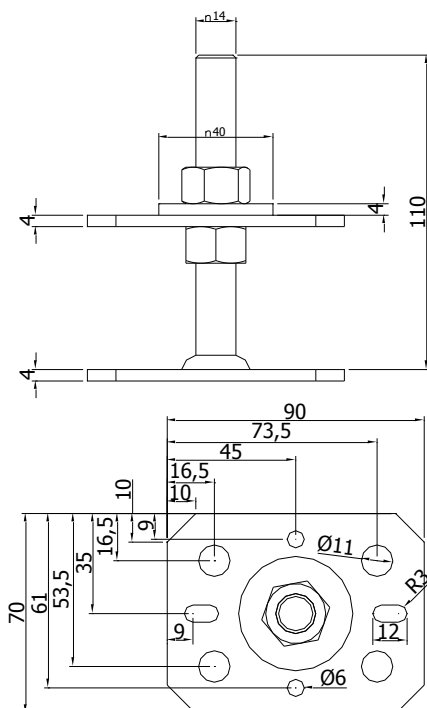
Table D25-3: Characteristic capacity $k_{\text{modi}}=1,18$

Load Duration	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	PPMINI	44	48	52	56	63

For PPMINI the capacities are valid also for the case, where the connector is turned upside down.

D26: APB7090/100

Product Name	alternative names			
	UK	France	DK	D
APB7090/100				

Figure D26-1: Drawings**Table D26-1: Size specification**

n/a

Table D26-2: Material specification

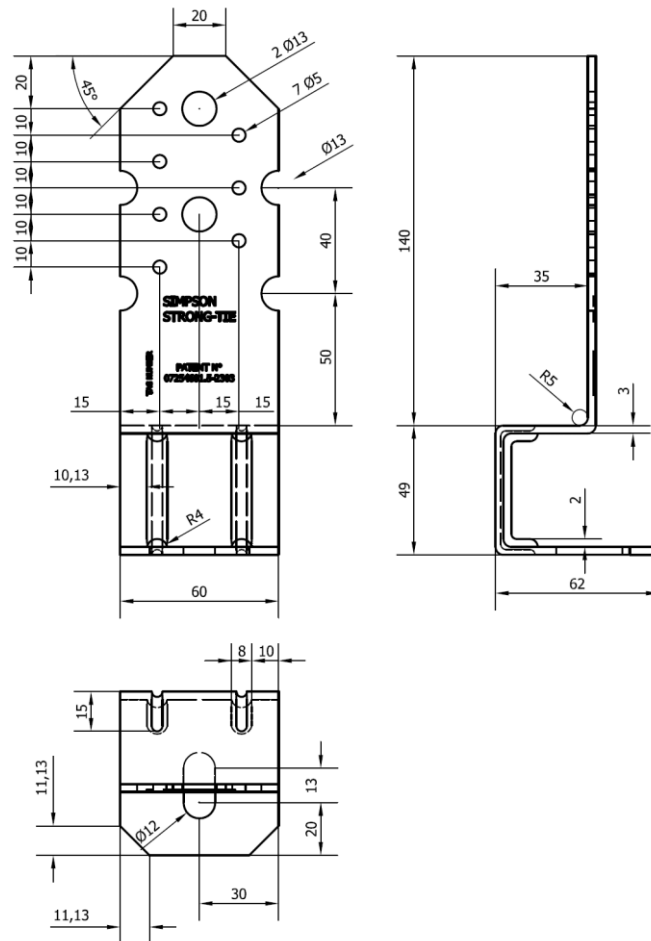
Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Electroplated zinc Zn 12/c according to EN ISO 2081 or sherardizing class C30 according to EN 13811:2003
Threaded rod	Steel class 4.6 according to EN/ISO 898:1999	
	Or stainless steel as described	

Table D26-3: Characteristic capacity $k_{modi}=1,18$

Load Duration	Type	Load duration class (kN)				
		P	L	M	S	I
F_{R1}	APB column APB beam	24	25	25	25	25
		10,2	9,8	9,5	8,4	8,4

D27: PBP60/50

Product Name	alternative names			
	UK	France	DK	D
PBP60/50				

Figure D27-1: Drawings**Table D27-1: Size specification**

n/a

Table D27-2: Material specification

Material thickness	Material Grades	Coating specification
3	S235JR according to EN 10025:2004	Sherardizing class C30 according to EN 13811:2003 Or electroplated zinc Zn25/A according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc)
	Or stainless steel as described	

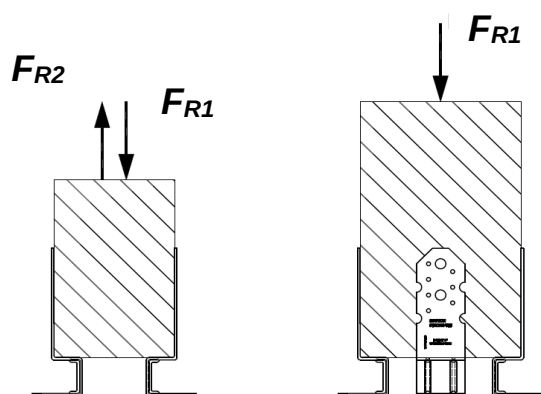


Table D27-3: Characteristic capacity

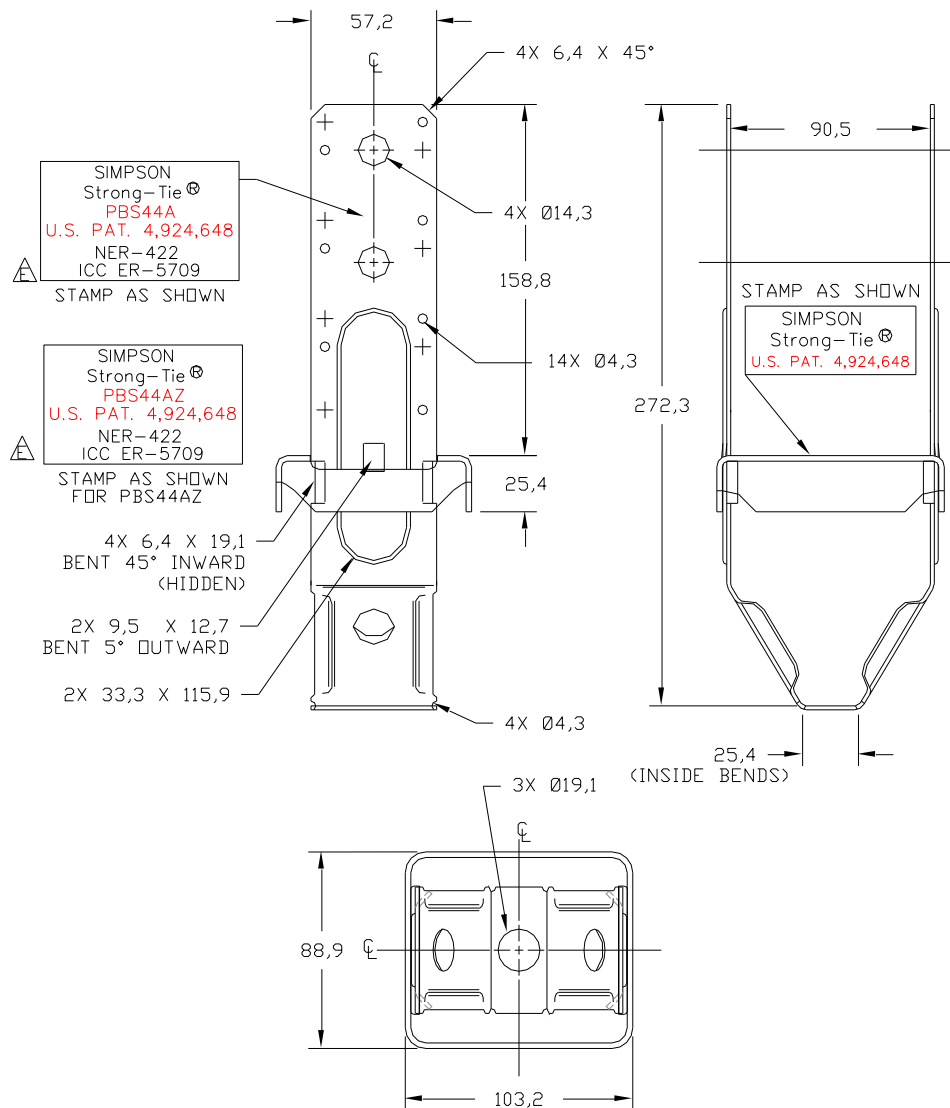
$k_{\text{modi}}=1,18$

Load Direction	Type	No. of post bases	Load duration class (kN)				
			P	L	M	S	I
F_{R1}	PBP60/50	2	28				
		4	63				
F_{R2}	PBP60/50	2	8.3				

D28: PBS

Product Name	alternative names			
	UK	France	DK	D
PBS				

Figure D28-1: Drawings



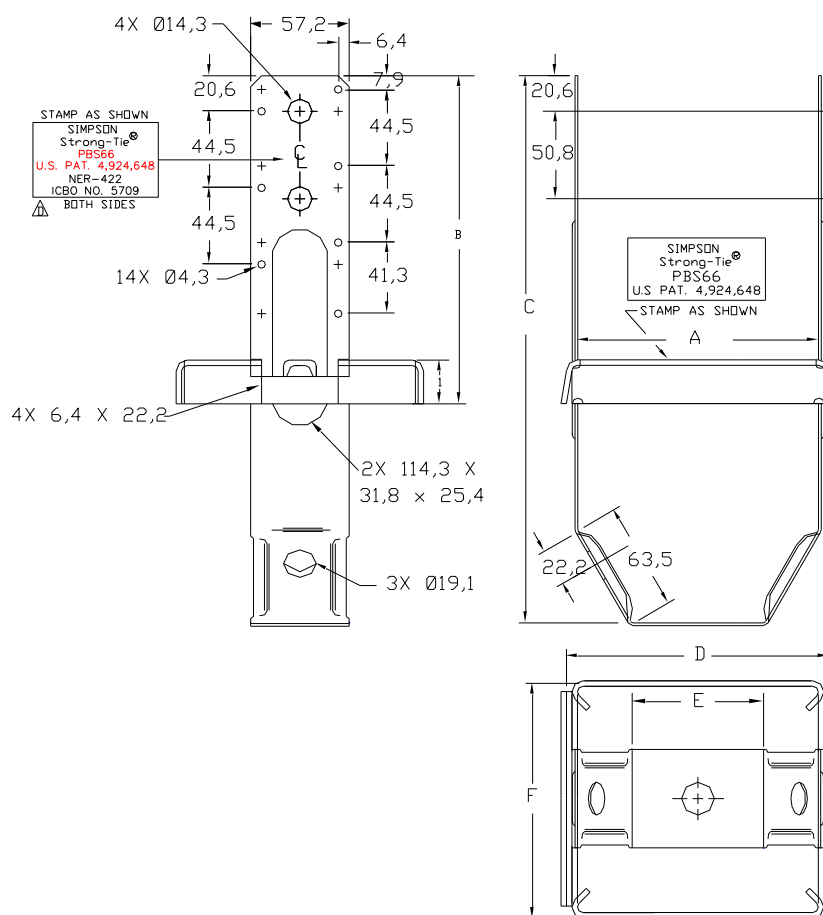


Table D28-1: Size specification

Type	Dimension [mm]					
	A	B	C	D	E	F
PBS46	90,5	187,3	270,7	101,6	25,4	138,1
PBS66	139,7	190,5	311,2	152,4	76,2	136,5

Table D28-2: Material specification

Material thickness	Material Grades	Coating specification
2,5 mm	G90 SS Grade 33 according to ASTM A-653	Galvanized
	Or stainless steel as described	

Table D28-3: Characteristic capacity $k_{\text{mod}}=1,18$

			Load duration class (kN)				
Type	Load Direction	Nails ¹⁾	P	L	M	S	I
PBS 44	F_{R1}		42	46	49	52	57
	F_{R2}	CN 3,7 S 4,0	24 k_{mod} 16 k_{mod}				
PBS 46	F_{R1}		45	48	51	55	60
	F_{R2}	CN 3,7 S 4,0	24 k_{mod} 25 16 k_{mod} 16				
PBS 66	F_{R1}		60	65	69	73	81
	F_{R2}	CN 3,7 S 4,0	24 k_{mod} 25 16 k_{mod} 16				

- 1) Fastener to timber: ARS 3,1: Annular ring shank nail 3,1 x 35
 CN 3,7: Connector nail 3,7 x 50
 S 3,75: Smooth nail 3,75 x 75
 S 4,0: Smooth nail 4,0 x90

- 2) k_{mod} : load duration factor

D29: ABE

Product Name	alternative names			
	UK	France	DK	D
ABE				

Figure D29-1: Drawings

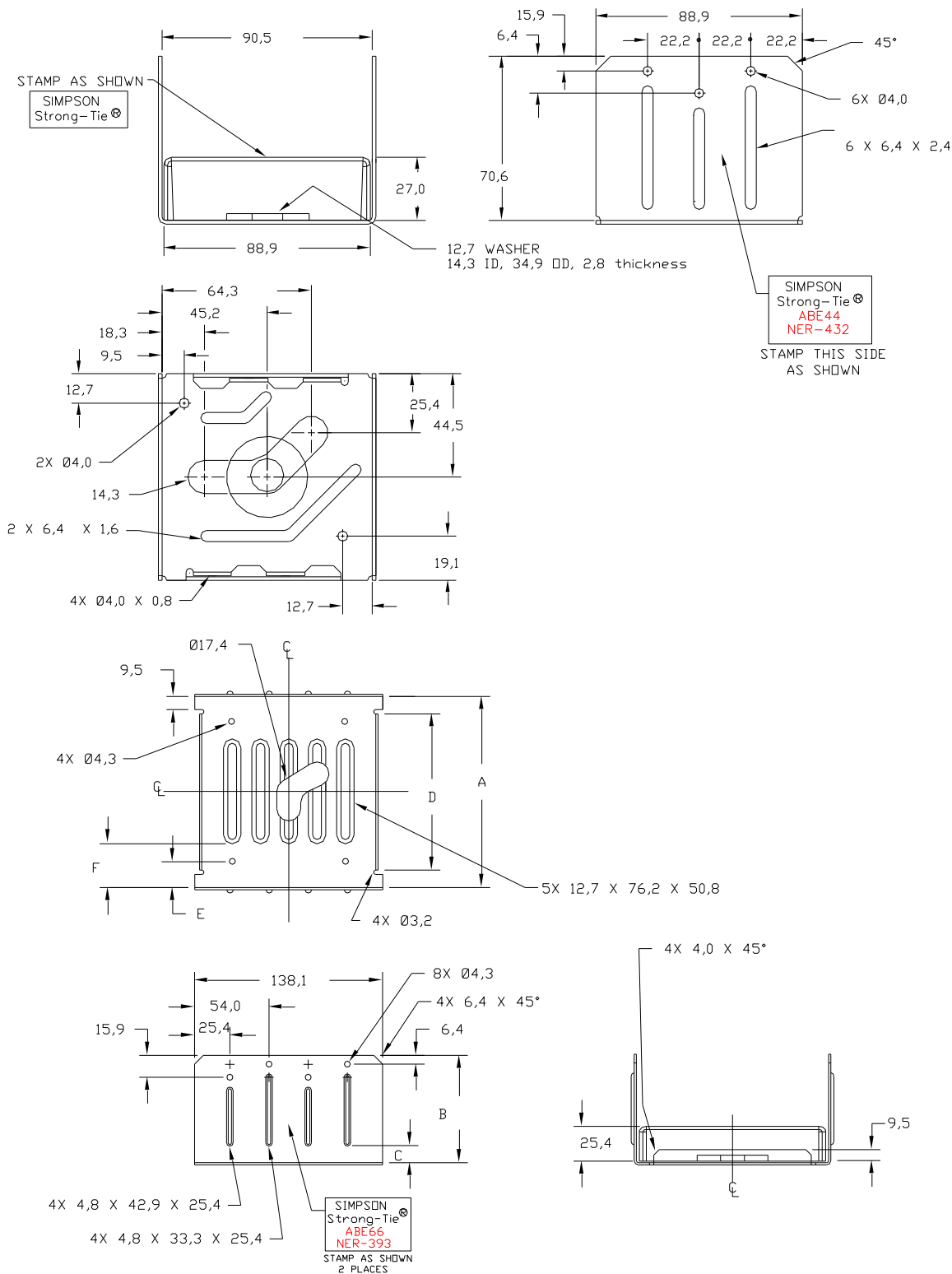


Table D29-1: Size specification

Type	Dimension [mm]					
	A	B	C	D	E	F
ABE44	90,5	70,6	15,9	63	13	18
ABE46	90,5	103,2	38,1	65,1	6,4	20,6
ABE66	139,7	79,4	15,9	114,3	19,1	31,8

Table D29-2: Material specification

Material thickness	Material Grades	Coating specification
1,5 to 2,6	G90 SS Grade 33 according to ASTM A-653	Galvanized
	Or stainless steel as described	

Table D29-3: Characteristic capacity $k_{mod}=1,18$

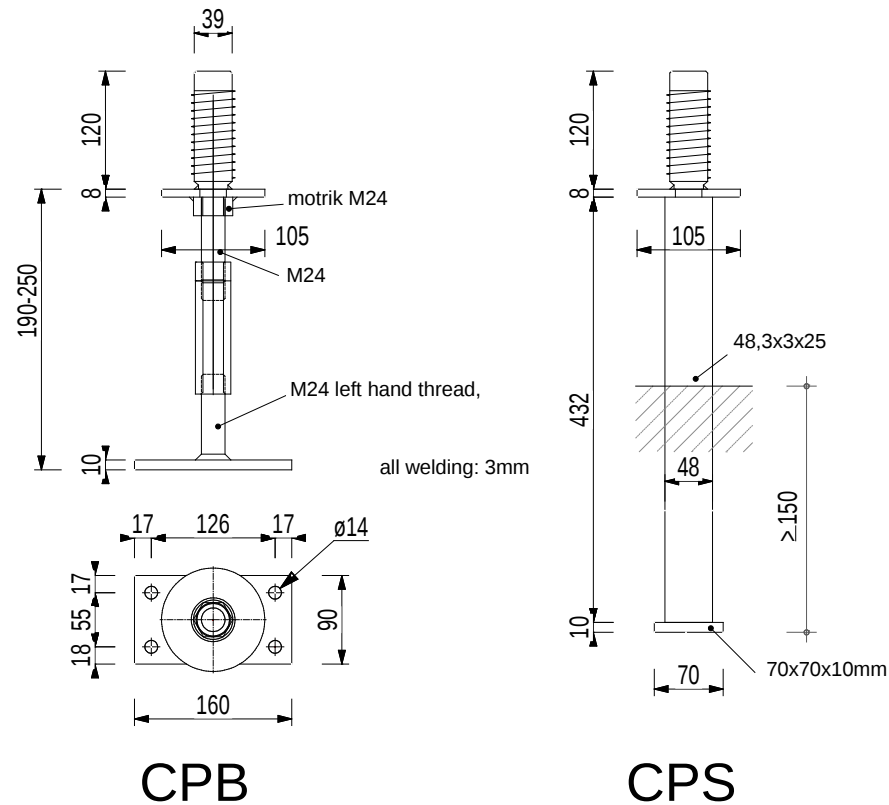
			Load duration class				
Type	Load Direction	Nails ¹⁾	P	L	M	S	I
ABE 44	F_{R1}		38	45	51	58	70
	F_{R2}	ARS 3,1 S 3,75	4,3	7,8	6,7 k_{mod} 7,8	7,8	7,8
ABE 46	F_{R1}		49	57	66	74	90
	F_{R2}	CN 3,7 S 4,0			15.8 k_{mod} 11 k_{mod}		
ABE 66	F_{R1}		79	92	105	118	144
	F_{R2}	CN 3,7 S 4,0			15.8 k_{mod} 11 k_{mod}		

- ¹⁾ Fastener to timber: ARS 3,1: Annular ring shank nail 3,1 x 35
 CN 3,7: Connector nail 3,7 x 50
 S 3,75: Smooth nail 3,75 x 75
 S 4,0: Smooth nail 4,0 x90

- ²⁾ k_{mod} : load duration factor

D30: CPB and CPS

Product Name	alternative names			
	UK	France	DK	D
CPB				CPB40
CPS				CPS40

Figure D30-1: Drawings**Table D30-1: Size specification**

n/a

Table D30-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Tube	S235 JR according to EN 10219:2004	
Threaded rod	S355 JO according to EN 10025:2004	
	Or stainless steel as described	

Table D30-3: Characteristic capacity

$k_{modi}=1,18$ for steel and $k_{modi}= 0,87$ for concrete have been used

Load direction	timber size [mm]	CPB characteristic capacity (kN) min. of	
		timber	steel ¹⁾
F ₁	≥ 120		61,0
F ₂		23,7	
F ₂ **		13,8	
	h =		
H ₁ H ₂	190		1,7
	250		1,4

Load direction	timber size [mm]	CPS characteristic capacity (kN) min. of	
		timber	steel ¹⁾
F ₁	b ≥ 120	170,3	118,7
F ₂		23,7	
F ₁ **		110,7	
F ₂ **		13,8	
H ₁ H ₂		7,2	5,2

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations

** in case where download AND uplift is possible

For vertical load F₁ and horizontal load H₁ or H₂ acting simultaneously it shall be verified that:

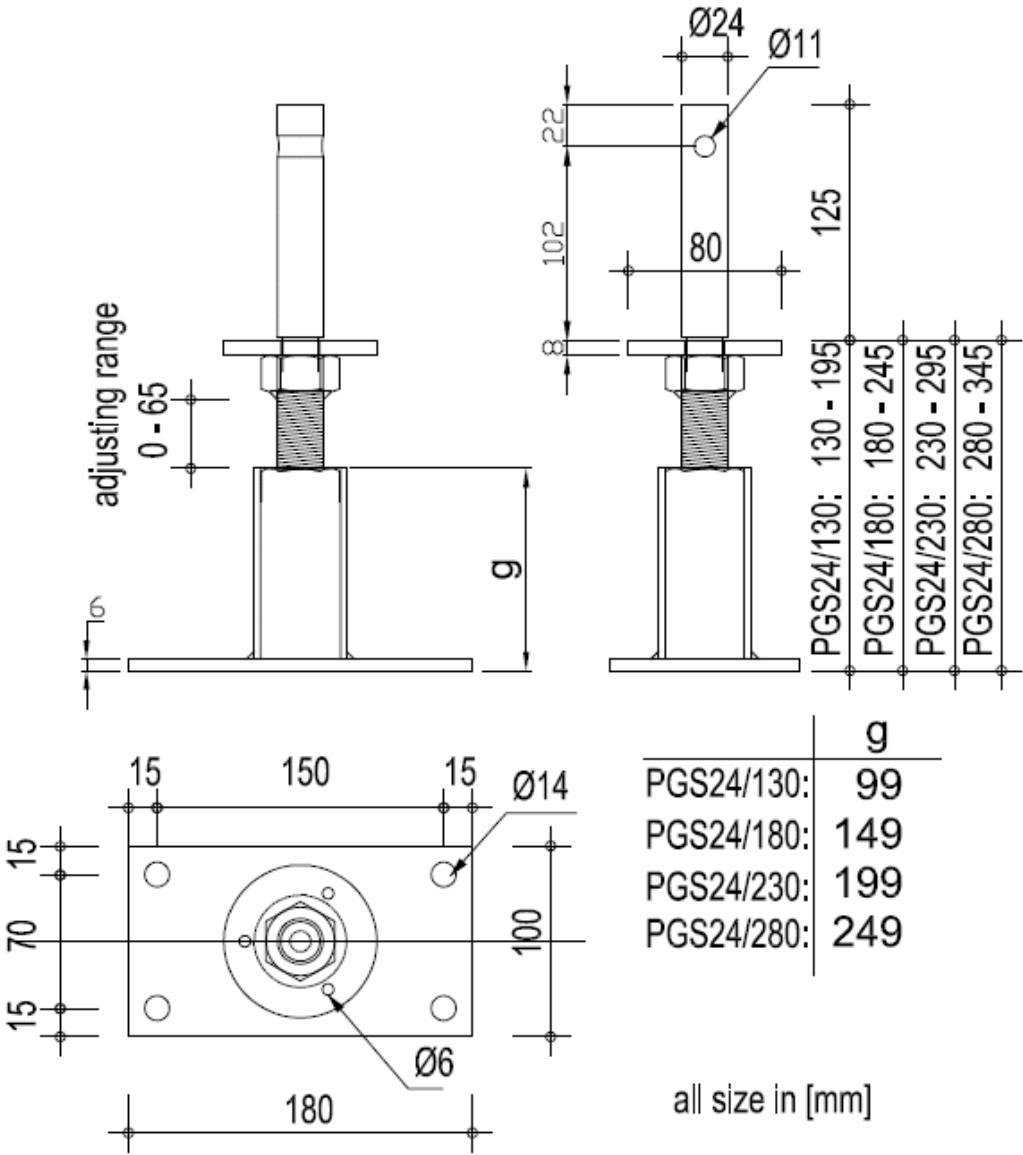
$$F_1 / F_{R,1} + H_i / H_{R,i} \leq 1$$

D31: PGS

Product Name	alternative names			
	UK	France	DK	D
PGS				PGS24/x

x = size

Figure D31-1: Drawings



Muster

Table D31-1: Size specification
n/a

Table D31-2: Material specification

Material thickness	Material Grades	Coating specification
8, 10	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Tube	S235 JR according to EN 10219:2004	
Threaded rod	S355 JO according to EN 10025:2004	
	Or stainless steel as described	

Table D31-3: Characteristic capacity $k_{modi}=1,18$

Load direction	timber size [mm]	PGS characteristic capacity [kN] min. of	
		timber	steel ¹⁾
F ₁	100x100	96,1	91,3
F ₂	b=80	5,0	
	b=100	5,6	
	b=120	6,4	
	b=140	7,2	
	for timber size min. 100mm x100mm		
H ₁	all		2,9
H ₂	24/130		2,9
	24/180		2,5
	24/230		2,1
	24/280		1,9

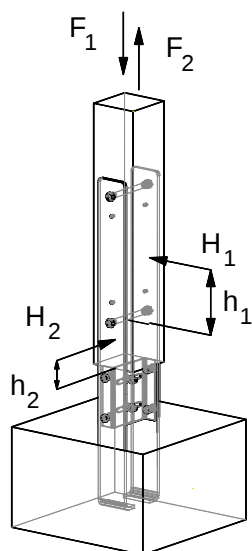
¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations

Table D32-3: Characteristic capacity – for concrete C12 $k_{modi}=1,18$ $k_{modi} = 1,18$ **CMR**

Force direction	Timber size b [mm]	Characteristic Capacity $R_{i,k}$ [kN] bzw. [kNm]	
		min. of	
		timber	Steel ¹⁾
$F_1 = F_2$	≥ 115	117,2	
H_1 for $h_1=200\text{mm}$	≥ 115	99,0	21,3
H_2 for $h_2=0\text{mm}$	≥ 115	33,0	30,9
M_1	≥ 115	19,8	13,9
M_2	115	6,7	
	120	7,0	
	125	7,3	
	140	8,2	
	150	8,8	
	160	9,4	

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations $k_{modi} = 1,18$ **CMS**

Force direction	Timber size b [mm]	Characteristic Capacity $R_{i,k}$ [kN] bzw. [kNm]	
		min. of	
		timber	Steel ¹⁾
$F_1 = F_2$	≥ 80	96,9	
H_1	≥ 80	74,0	15,0
H_2	≥ 80	21,1	19,8
M_1	≥ 80	11,6	7,1
M_2	80	3,9	
	100	4,8	
	120	5,8	
	140	6,8	

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations

For a load H_1 acting in the height for CMR $h_1 > 200$ mm (for CMS $h_1 > 157$ mm) the load carrying capacity should not be taken as higher than:

For CMR : $H_{R1}(h) = H_{R1}(200) 200 / h_1$. for CMS: $H_{R1}(h) = H_{R1}(157) 157 / h_1$.

For a load H_2 acting in the height $h_2 > 0$ mm, the load carrying capacity should not be taken as higher than:

$$H_{R2}(h) = \frac{1}{2} F_{R2} a / h_2.$$

where:

a The inner distance between the vertical steel plates e.g. the column depth.

For a vertical load F (either F_1 or F_2) and a horizontal load H_1 acting simultaneously it should be verified that $(F/F_{R1})^2 + (H_1/H_{R1})^2 \leq 1$

For a vertical load F (either F_1 or F_2) and a horizontal load H_2 in the height h acting simultaneously it should be verified that $H_{R2}(h) \leq M_{R2} / (h (1 - F / F_{R1}))$

For combined loads the following check shall be made:

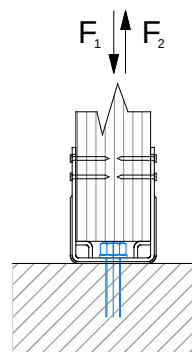
$$\left(\frac{F_{1/2,d}}{R_{1/2,d}} \right)^2 + \left(\frac{H_{1,d}}{R_{H1,d}} + \frac{M_{1,d}}{R_{M1,d}} \right)^2 \leq 1$$

$$\left(\frac{F_{1/2,d}}{R_{1/2,d}} + \frac{M_{2,d}}{R_{M2,d}} \right)^2 + \left(\frac{H_{2,d}}{R_{H2,d}} \right)^2 \leq 1$$

Table D33-3: Characteristic capacity

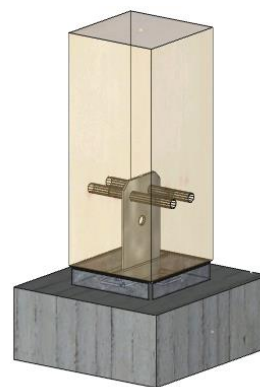
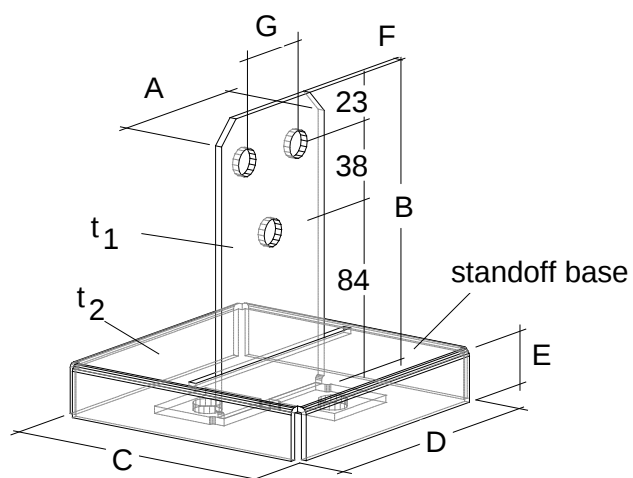
load direction	type	PU characteristic capacity [kN] min. of	
F ₁	all	$\max \begin{cases} 19,1 \\ n \times R_{lat.k} \end{cases}$	
F ₂	PU70-B	n x R _{lat.k}	14,12/k _{mod}
	PU80-B		11,73/k _{mod}
	PU90-B		10,03/k _{mod}
	PU100-B		8,76/k _{mod}
	PU120-B		6,99/k _{mod}
	PU140-B		5,82/k _{mod}

n = total number of nails. If the number of nails on each side is different, n is twice the number of nails in the side where the number is the minimum



D34: CPT

Product Name	alternative names			
	UK	France	DK	D
CPT44Z				
CPT66Z				
CPT88Z				

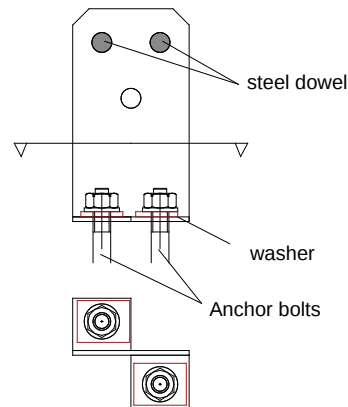
Figure D34-1: Drawings**Table D34-1: Size specification**

Type	Dimensions [mm]									
	A	B	C	D	E	F	G	holes □	t ₁	t ₂
CPT44Z	79,4	145	88,9	88,9	25,4	3,5	39,7	13,5	3,5	2,7
CPT66Z	114	145	136,5	136,5	25,4	3,5	57,1	13,5	3,5	2,7
CPT88Z	114	145	184	184	25,4	3,5	57,1	13,5	3,5	2,7

to use with the washer CPTZ-03, 35,7x28,6x3,5 with Ø13,5mm

Table D34-2: Material specification

Material thickness	Material Grades	Coating specification
3,5mm	steel SS Grade 33 according to ASTM A653	G185 according to ASTM A653
Standoff base: 2,7mm		Corresponding to ~40µm

Figure D34-2: Steel dowel pattern**Table D34-3: Characteristic capacity**Characteristic capacities $R_{i,k}$ [kN]

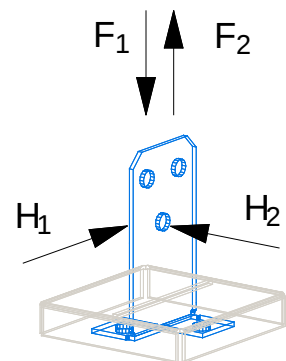
Types	Characteristic capacities [kN] :				steel dowels to use	
	$R_{1,k}$	$R_{2,k}$	$R_{H1,k}$	$R_{H2,k}$	No.	size [mm]
	download	uplift	lateral	lateral		
CPT44Z	$49.7/k_{mod}^{0.5}$	$10.1 / k_{mod}$	7.3	$\min(4.9, 3.5/k_{mod})$	2	Ø13x70
CPT66Z	$76.3/ k_{mod}^{0.5}$	$14.7/k_{mod}$	$\min(R_{2,k} \times 0.7, 9.1)$	$\min(6.9, 5.0/k_{mod})$	2	Ø13x121
CPT88Z	$103.0/ k_{mod}^{0.5}$	$14.7/k_{mod}$	$\min(R_{2,k} \times 0.7, 9.1)$	$\min(6.9, 5.0/k_{mod})$	2	Ø13x121

The design load has to be calculate always as:

$$R_{i,d} = R_{i,k} \times k_{mod} / \gamma_M$$

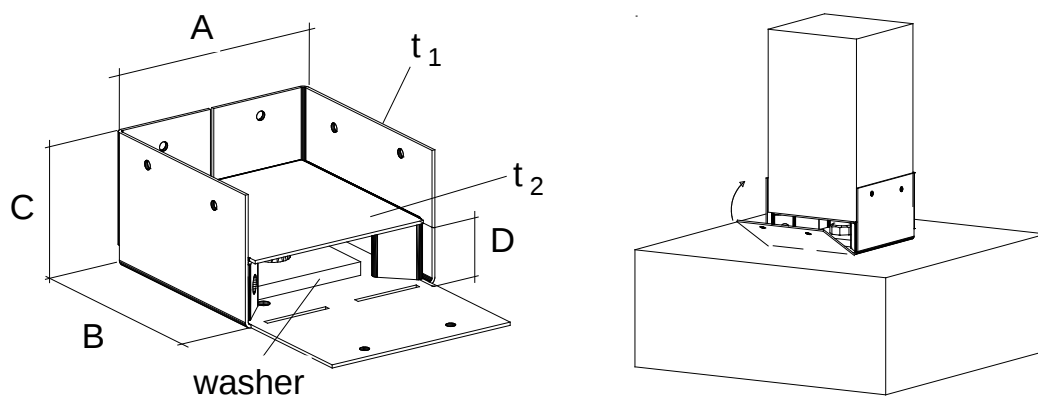
For combined forces have to be checked: $\square (F_{i,d} / R_{i,d}) \leq 1$ For $F_{i,d}$ is to insert also $H_{i,d}$.

The timbersize have to be minimum the size of the standoff base.

**The anchorage has to be checked as following:**For force direction F_2 : the anchorage of each of the both anchors has to be a capacity of minimum $0.88 \times F_{2,d}$ For force direction H_1 : the anchorage of each of the both anchors has to be a capacity of minimum $1.76 \times H_{1,d}$ For force direction H_2 type CPT44 :the anchorage of each of the both anchors has to be a capacity of minimum $2.0 \times H_{2,d}$ For force direction H_2 type CPT66 and 88 :the anchorage of each of the both anchors has to be a capacity of minimum $1.1 \times H_{2,d}$

D35: ABW

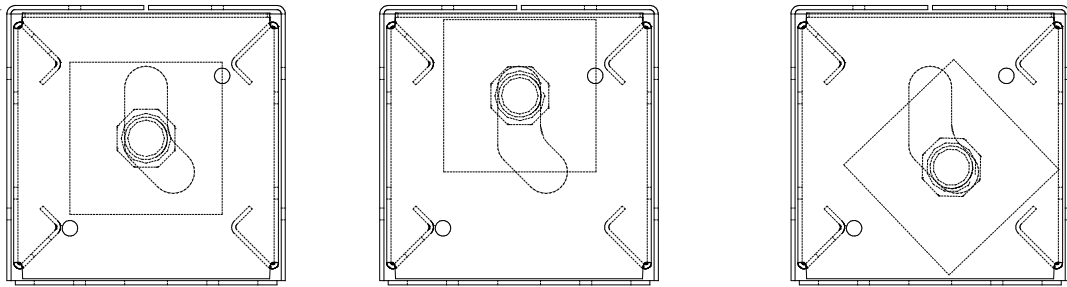
Product Name	alternative names			
	UK	France	DK	D
ABW44Z				
ABW44RZ				
ABW66Z				
ABW66RZ				

Figure D35-1: Drawings**Table D35-1: Size specification**

References	Dimensions [mm]						
	A	B	C	D	washer	t ₁	t ₂
ABW44Z	90,5	90,5	63,5	25,4	50x50x3,5	1,5	1,6
ABW44RZ	101,6	101,6	50	25,4	50x50x3,5	1,5	1,6
ABW66Z	139,7	139,7	76,2	25,4	76x76x6,0	1,8	2,7
ABW66RZ	152,4	152,4	71,4	25,4	76x76x6,0	1,8	2,7

Table D35-2: Material specification

Material thickness	Material Grades	Coating specification
1,5 / 1,8 mm	SS Grade 33 according to ASTM A653	G185 according to ASTM A653 Corresponding to ~40µm
Standoff base: 1,6 / 2,7 mm		G90 for washer 50x50x3,5mm Corresponding to ~20µm

Figure D35-2:

The washer is to place as shown before, preferable as shown left.

The Front-flat has to be turn up after the placing of the timber and screw tightly the bolt.

Table D35-3: Characteristic capacity

Characteristic capacities $R_{i,k}$ [kN]

Types	Characteristic capacities [kN] :					
	$R_{1,k}$	$R_{2,k}$	nails to use		bolt to use	
	download	uplift	no	size [mm]	no	size [mm]
ABW44Z	53,9	3,1	8	3,75x75	1	Ø12
ABW44RZ	58,2	-/-	8	3,75x75	1	Ø12
ABW66Z	105,9	7,4	12	4,0x90	1	Ø12
ABW66RZ	110,4	$\min(6.6; 6.9/k_{mod})$	12	4,0x90	1	Ø12

The design load has to be calculate always as:

$$R_{i,d} = R_{i,k} \times k_{mod} / \gamma_M$$

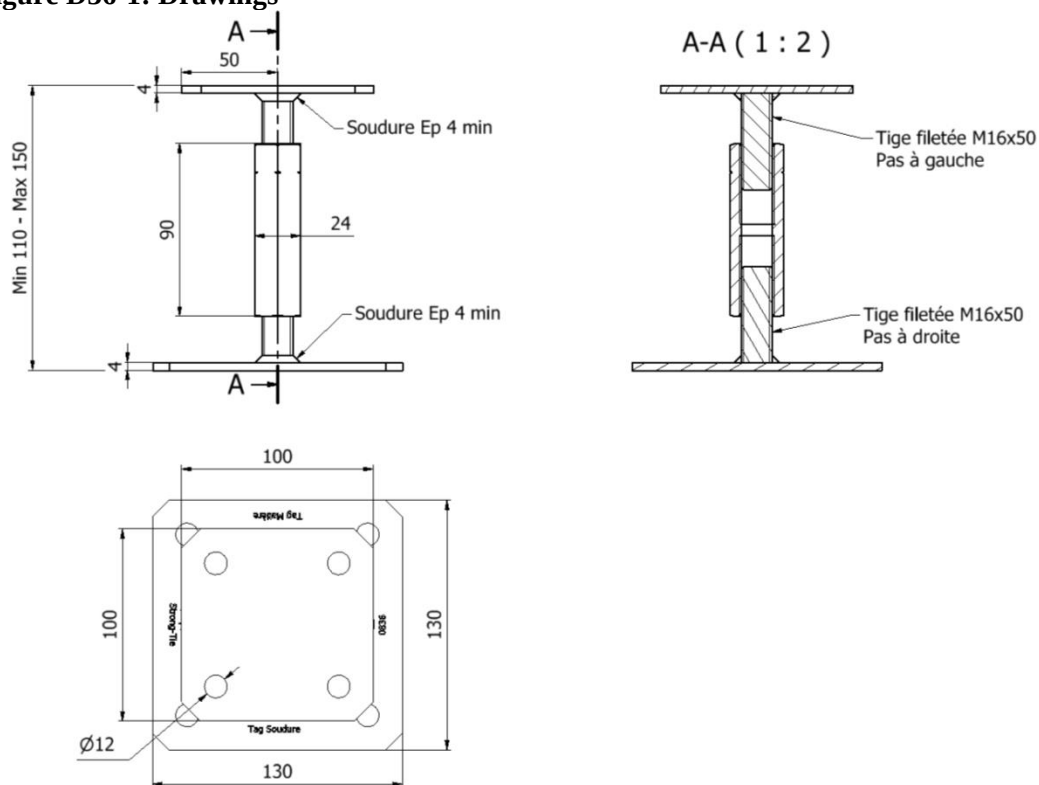
For combined forces have to be checked: $\sum (F_{i,d} / R_{i,d}) \leq 1$

The anchorage has to be checked as following:

For force direction F_2 : the anchorage of each of the both anchors has to be a capacity of minimum $1.0 \times F_{2,d}$

D36: APR110/150

Product Name	Alternative names			
	UK	France	Dk	D
APR110/150				

Figure D36-1: Drawings

Fasteners to timber: wood screw Ø10; Fasteners to concrete: anchor bolt M10

Table D36-1: Size specification

See drawing

Table D36-2: Material specification

Component	Material Grades	Coating specification
Plate	S235JR according to EN 10025:2004	Electroplated zinc Zn25/A according to EN ISO 2081:2009 Or Electroplated zinc Zn10/A (alkali zinc)
Tube	C15RPb according to EN10084:1999	
Threaded rod	steel class 4.6 according to ISO 898:1999	
	Or Stainless steel as described	

Table D36-3: Characteristic capacity

Load Direction	Type	Value (kN) - C24 - Download
F1 - Down	APR110/150	36.7

D37: PBH75 / PBH120

Product Name	alternative names			
	UK	France	DK	D
PBH75				
PBH120				

Figure D37-1: Drawings

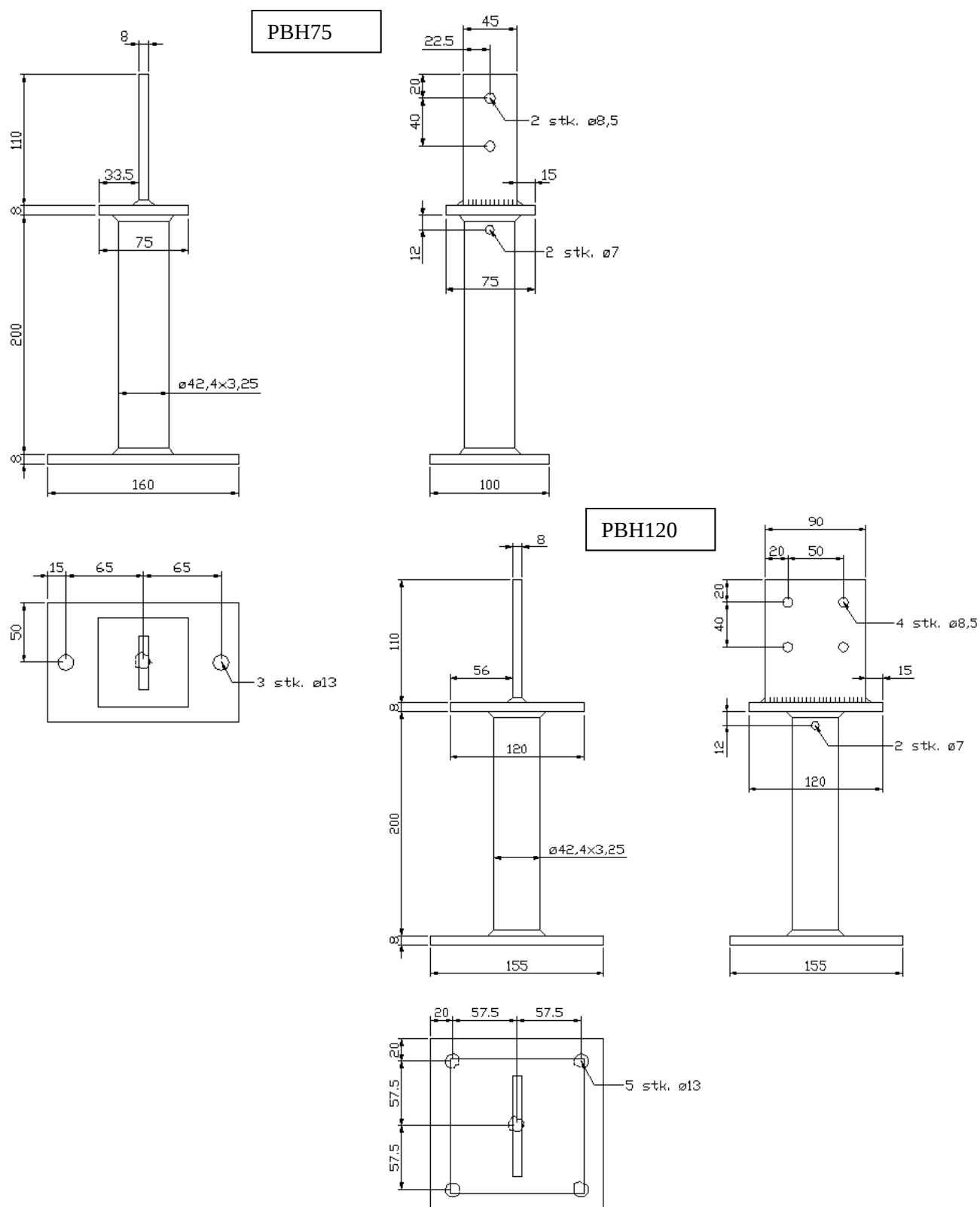


Table D37-1: Size specification

See drawing

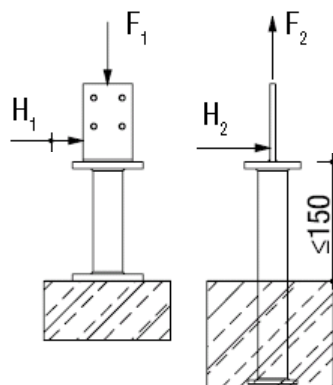
Table D37-2: Material specification

Material thickness	Material Grades	Coating specification
8	S235JR according to EN 10025:2008	Hot dip galvanized according to EN1461:2009
tube		
	Or stainless steel as described	

Table D37-3: Characteristic capacity - for concrete C12 $k_{mod}=1,18$

Load direction	Width of timber [mm]	PBH75		Width of timber [mm]	PBH120	
		characteristic capacity [kN] min. of			characteristic capacity [kN] min. of	
		timber ¹⁾	steel ²⁾		timber ¹⁾	steel ²⁾
F ₁	all	105.5	109.5	all	-	109.5
F ₂	80	8.1	-	120	20.7	-
	100	9.5		140		
	120	10.4		160		
H ₁	80	5.5	5.4	120	-	5.4
	100	6.5		140		
	120	7.1		160		
H ₂	80	5.8	4.4	120	5.5/kmod^0.8	-
	100	5.0/kmod^0.8	-	140	6.0/kmod^0.8	
	120	5.5/kmod^0.8	-	160	6.0/kmod	

1) Characteristic Capacities are based on C24 timber

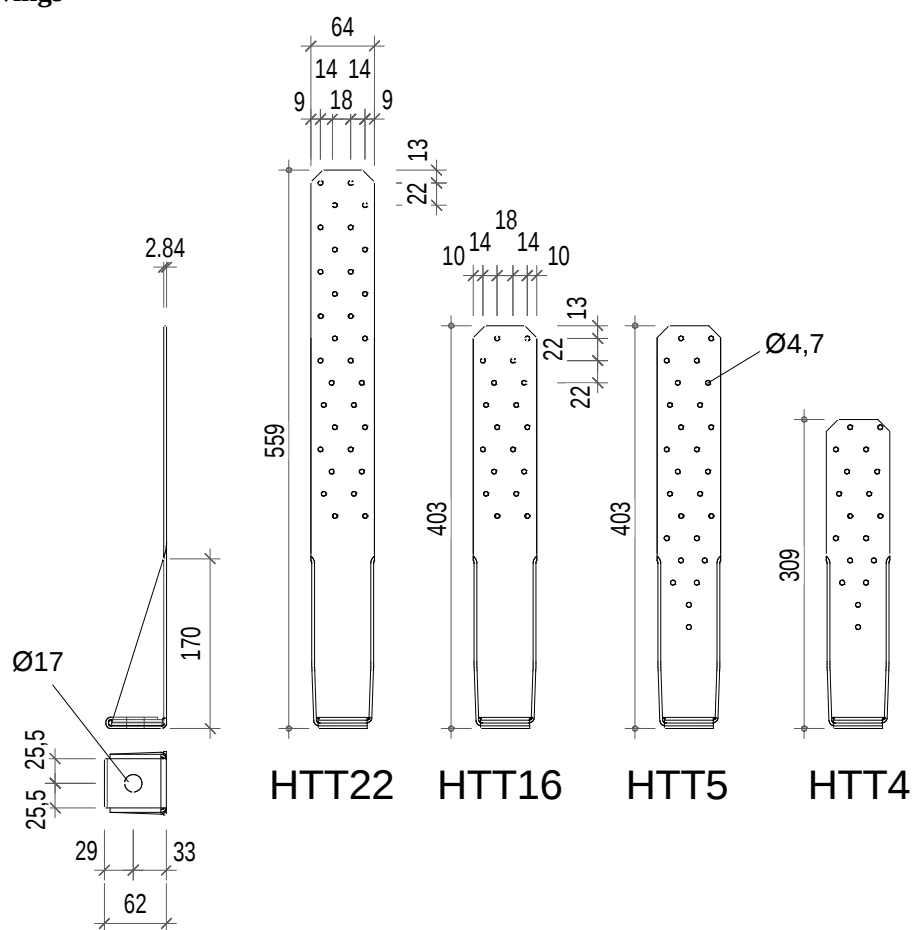
2) for steel $k_{mod} = 1,0$ shall be used for all load durations**Figure D37-2: Application**

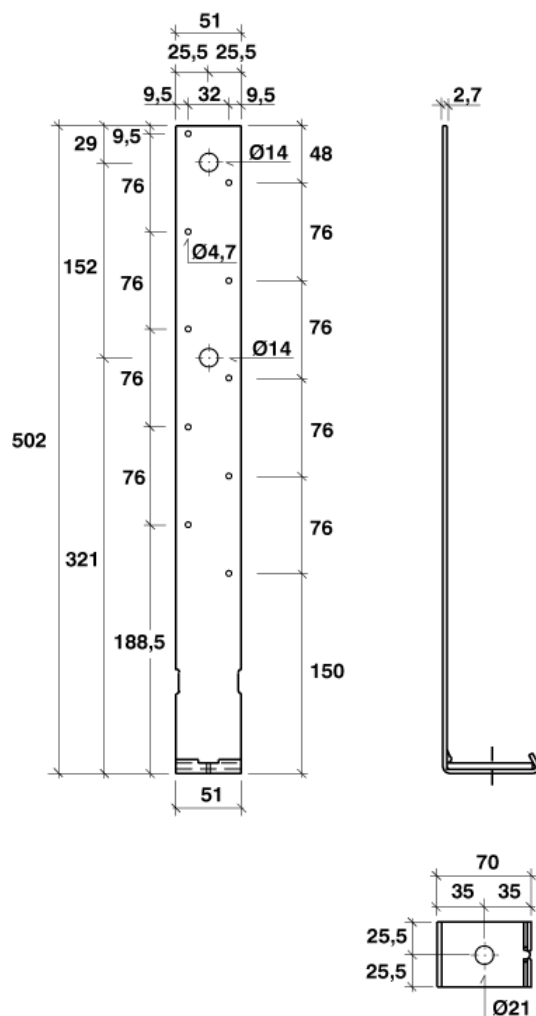
Hold Downs

D60: HTT and LTT

Product Name	alternative names			
	UK	France	DK	D
HTTx				
LTT20B				

Figure D60-1: Drawings





LTT20B

Table D60-1: Size specification

n/a

Table D60-2: Material specification

Material thickness	Material Grades	Coating specification
2,7 ; 2,84	G90 galvanized steel SS Grade 33 according to ASTM A-653	
	corresponding to S235 JR according to EN 10025	
	Or stainless steel as described	

The nails in the vertical flap have to be arranged equally left and right about the centre-line.

	Minimum	Maximum
LTT20B	2	10
HTT4	4	18
HTT5	4	26
HTT16	4	18
HTT22	4	32

Table D60-3: Characteristic capacity**HTT4/5/16/22**

The characteristic load-carrying capacity of one Hold Down HTT4/5/16/22 is calculated as:

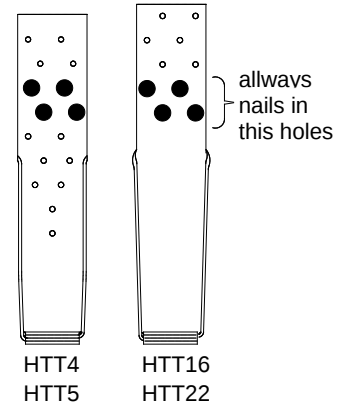
$$R_{1,k} = \min \begin{cases} (n - 3,5) \times R_{lat,k} \\ 25,2 \times R_{ax,k} \\ \frac{43,0}{k_{mod}} \end{cases}$$

$R_{lat,k}$ = characteristic lateral load-carrying capacity of one nail

$R_{ax,k}$ = characteristic withdrawal capacity of one nail

k_{mod} = load duration factor

n = number of nails



It must be checked, that the anchor fulfils the following formula:

$$\frac{F_{1,d}}{R_{anchor,d}} \leq 1$$

The values are also applicable for a connection with a gap between the short flange of the HTT and the bearing support.

LTT20B

The characteristic load-carrying capacity of one Hold Down LTT 20B is calculated as:

$$R_{1,k} = \min \begin{cases} n \times R_{lat,k} \\ 2,85kN / k_{mod} \end{cases}$$

$R_{lat,k}$ = characteristic lateral load-carrying capacity of one nail

k_{mod} = load duration factor

n = number of nails

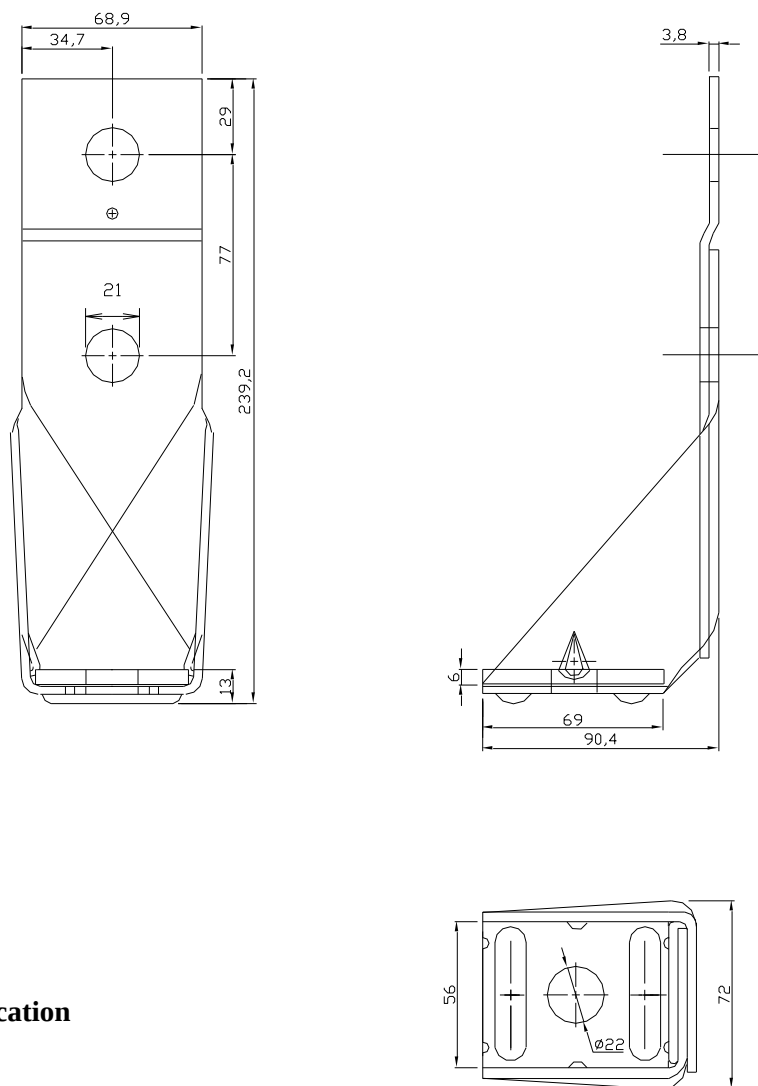
$R_{anchor,d}$ = Tensile design capacity of the anchor bolt in the concrete

It must be checked, that the anchor fulfils the following formula:

$$\frac{1,5 \times F_{1,d}}{R_{anchor,d}} \leq 1$$

D61: HD5A

Product Name	alternative names			
	UK	France	DK	D
HD5A				

Figure D61-1: Drawings**Table D60-1: Size specification**

n/a

Table D61-2: Material specification

Material thickness	Material Grades	Coating specification
2,7 ; 2,84	G90 galvanized steel SS Grade 33 according to ASTM A-653	
	corresponding to S235 JR according to EN 10025	
	Or stainless steel as described	

Table D61-3: Characteristic capacity

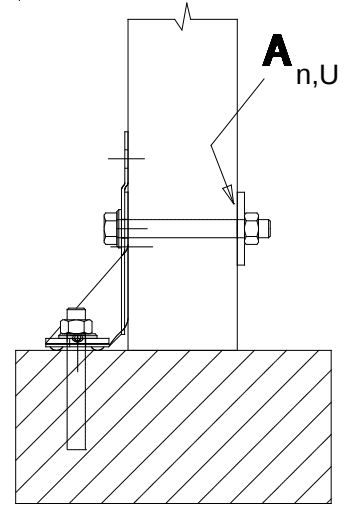
The characteristic load-carrying capacity of one Hold Down HD5A is calculated as:

$$R_{1,k} = \min \begin{cases} 8,2kN/k_{\text{mod}} \\ 4,15 \times A_{n,U} \times f_{c,90,k} \end{cases}$$

$A_{n,u}$ = net area of the washer (on the backside of connected timber)
 $f_{c,90,k}$ = characteristic compressive strength perpendicular to timber
 $R_{\text{anchor},d}$ = Tensile design capacity of the anchor bolt in the concrete
 k_{mod} = load duration factor

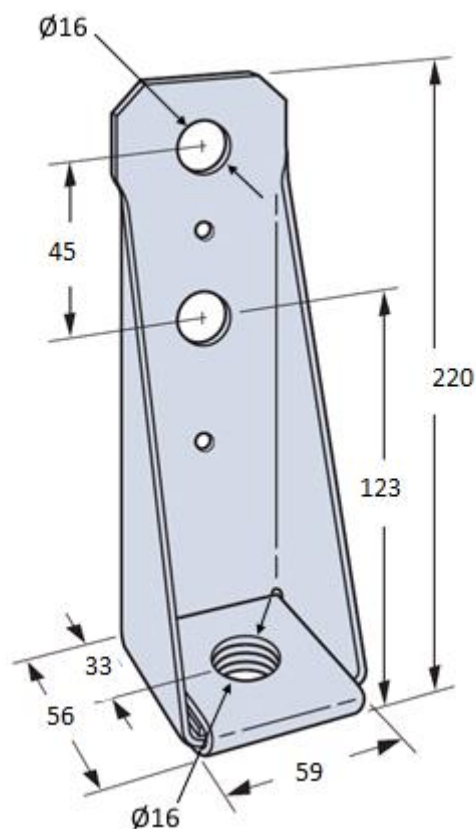
It must be checked, that the anchor fulfils the following formula:

$$\frac{F_{1,d}}{R_{\text{anchor},d}} \leq 1$$



D62: HD3B

Product Name	alternative names			
	UK	France	DK	D
HD3B				

Figure D61-1: Drawings**Table D62-1: Size specification**

See drawing

Table D61-2: Material specification

Material thickness	Material Grades	Coating specification
2,7 ; 2,84	G90 galvanized steel SS Grade 33 according to ASTM A-653	
	corresponding to S235 JR according to EN 10025	
	Or stainless steel as described	

Table D61-3: Characteristic capacity

Model	Post	Number and Ø post	Ø on header	Characteristic values (kN) uplift
HD3B	Steel	2 Ø16	Ø16	39.89
	Timber	2 Ø16	Ø16	15.59

For a timber with a size < 100x100mm: the capacity of the bolts in the timber are to be checked:

$n \times F_{v,RK}$; with n = number of bolts

It must be checked, that the anchor fulfils the following formula:

$$\frac{F_{1,d}}{R_{anchor,d}} \leq 1$$

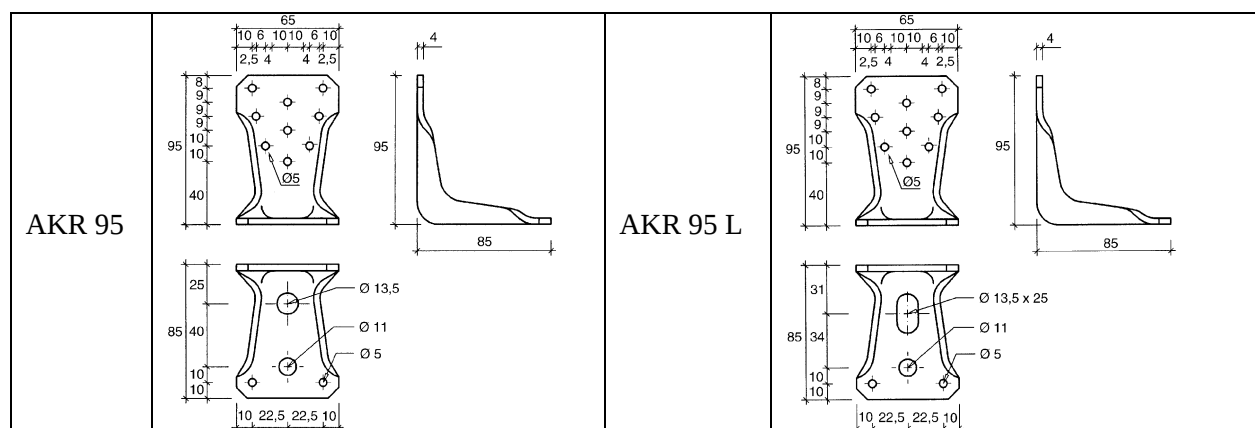
D63: AKR

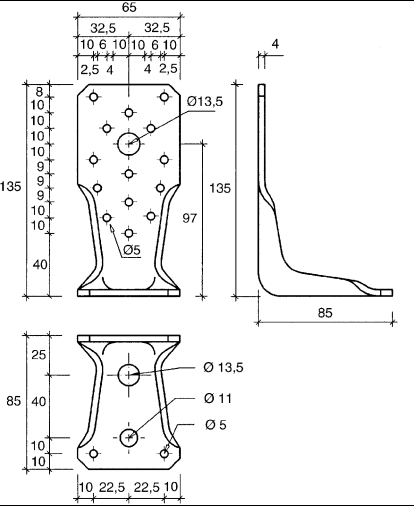
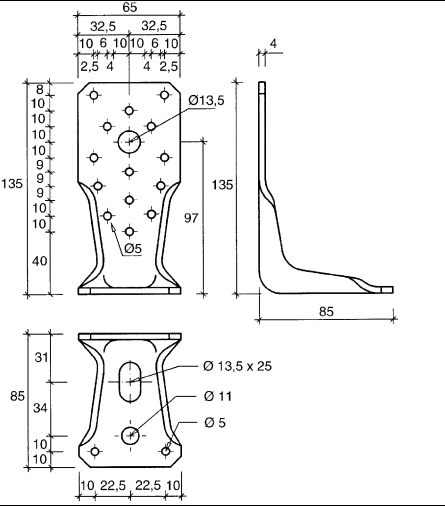
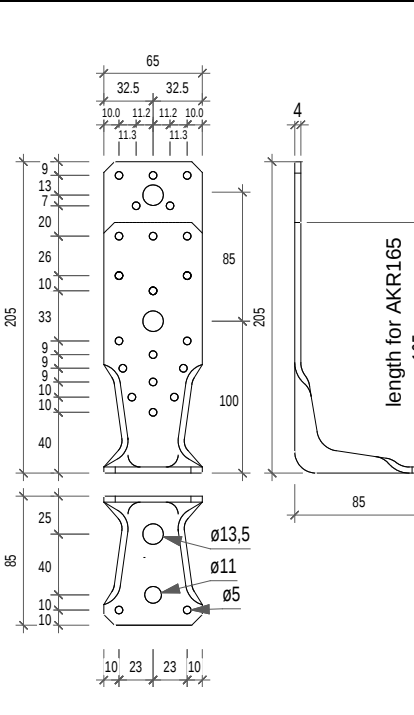
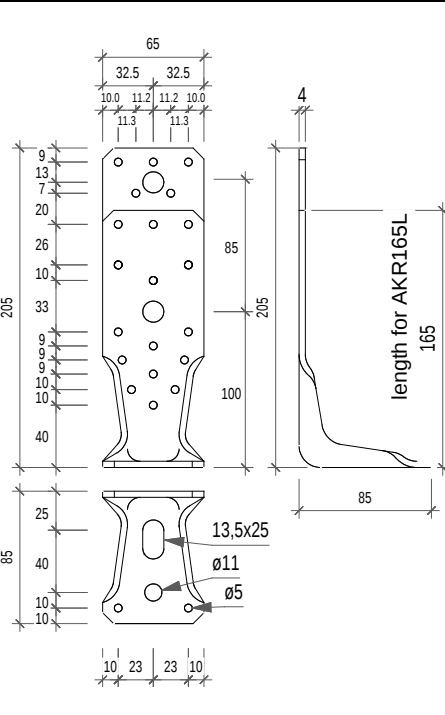
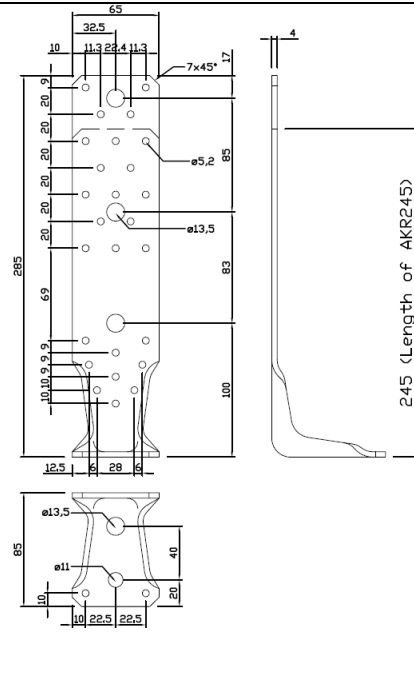
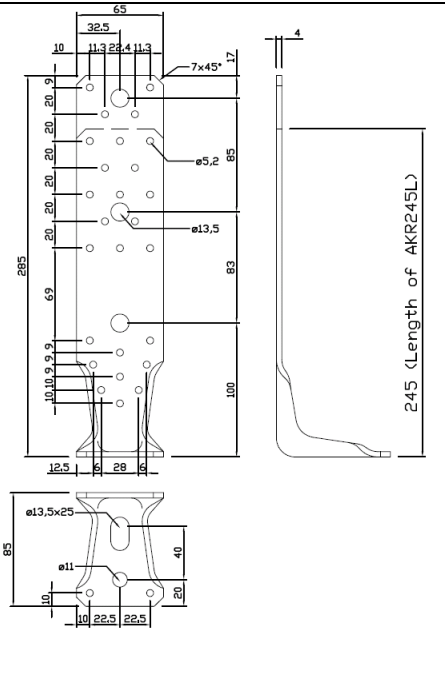
Product Name	alternative names			
	UK	France	DK	D
AKR...				

.... with following numbers and letters as shown in the table below

S235JR	S250GD	stainless steel	
4,0mm	3,0mm	3,0mm	
AKR95G	AKR95x3	AKR95S	
AKR95LG	AKR95x3L	AKR95LS	
AKR135G	AKR135x3	AKR135S	
AKR135LG	AKR135x3L	AKR135LS	
AKR165G	AKR165x3	AKR165S	as a option of AKR205
AKR165LG	AKR165x3L	AKR165LS	
AKR205G	AKR205x3	AKR205S	
AKR205LG	AKR205x3L	AKR205LS	
AKR245G	AKR245x3	AKR245S	as a option of AKR285
AKR245LG	AKR245x3L	AKR245LS	
AKR285G	AKR285x3	AKR285S	
AKR285LG	AKR285x3L	AKR285LS	

The letter “L” in the name shows, that a **long hole** is in the short flange.

Figure D63-1: Drawings

AKR135	 Technical drawing of AKR135 showing front, side, and bottom views with dimensions. Front view: 65mm width, 135mm height, 4mm thickness, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes. Side view: 85mm width, 135mm height, 4mm thickness. Bottom view: 65mm width, 85mm height, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes.	AKR135 L	 Technical drawing of AKR135 L showing front, side, and bottom views with dimensions. Front view: 65mm width, 135mm height, 4mm thickness, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes. Side view: 85mm width, 135mm height, 4mm thickness. Bottom view: 65mm width, 85mm height, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes.
AKR205/ AKR165	 Technical drawing of AKR205/ AKR165 showing front, side, and bottom views with dimensions. Front view: 65mm width, 205mm height, 4mm thickness, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes. Side view: 85mm width, 205mm height, 4mm thickness. Bottom view: 65mm width, 85mm height, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes.	AKR205L/ AKR165L	 Technical drawing of AKR205L/ AKR165L showing front, side, and bottom views with dimensions. Front view: 65mm width, 205mm height, 4mm thickness, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes. Side view: 85mm width, 205mm height, 4mm thickness. Bottom view: 65mm width, 85mm height, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes.
AKR285/ AKR245	 Technical drawing of AKR285/ AKR245 showing front, side, and bottom views with dimensions. Front view: 65mm width, 285mm height, 4mm thickness, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes. Side view: 85mm width, 285mm height, 4mm thickness. Bottom view: 65mm width, 85mm height, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes.	AKR285L/ AKR245L	 Technical drawing of AKR285L/ AKR245L showing front, side, and bottom views with dimensions. Front view: 65mm width, 285mm height, 4mm thickness, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes. Side view: 85mm width, 285mm height, 4mm thickness. Bottom view: 65mm width, 85mm height, 10mm top flange, 10mm side flange, 10mm bottom flange, 10mm central hole, 10mm side holes, 10mm bottom holes.

The thickness may also be 3,0 mm. See material specification.

Table D63-1: Size specification

n/a

Table D63-2: Material specification

Material thickness	Material Grades	Coating specification
4	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
3	S250 GD according to EN 10326:2004	Pre-galvanized steel min Z275 according to EN10326:2004
3	Or stainless steel as described	

The types 165 and 245 are respectively options of the AKR205 and 285 and can only be cut at the factory (with chamfer). The corresponding nail pattern are given respectively in no 11 and no 20.

A nail pattern of a small AKR can be used for a larger AKR also, with using the capacity for the nail pattern of the smaller one.

The nail patterns 15 and 16 are only for force direction F_1 .

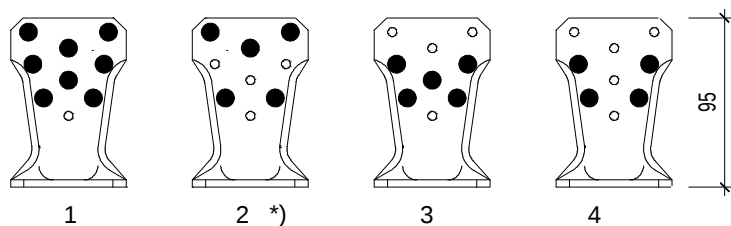
The nail pattern “partial/column” are for connection to beam and also for column.

The nail pattern “column” are also possible for a connection to a beam.

For connection to a column, nail pattern with nails in the lower part as shown below or with less nails are only to be considered :

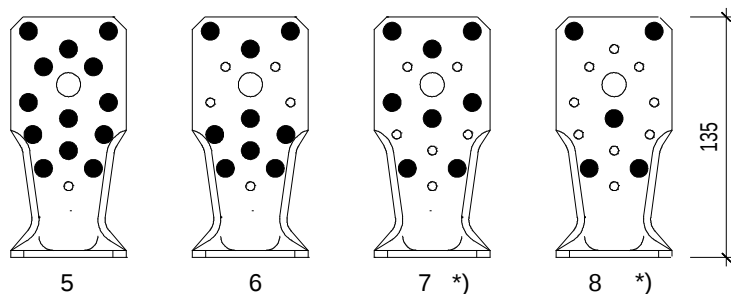
Figure D63-2: Nail pattern

AKR95/..L

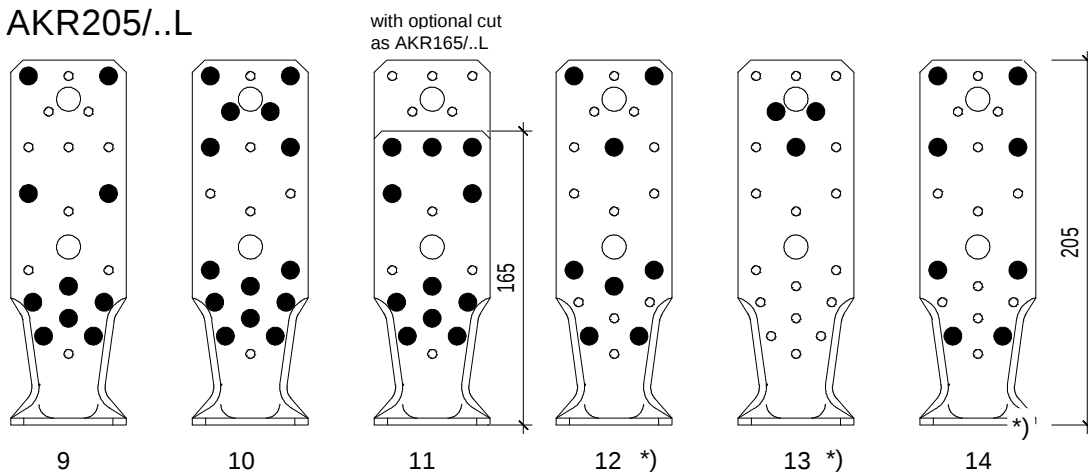


*) = connection to column possible

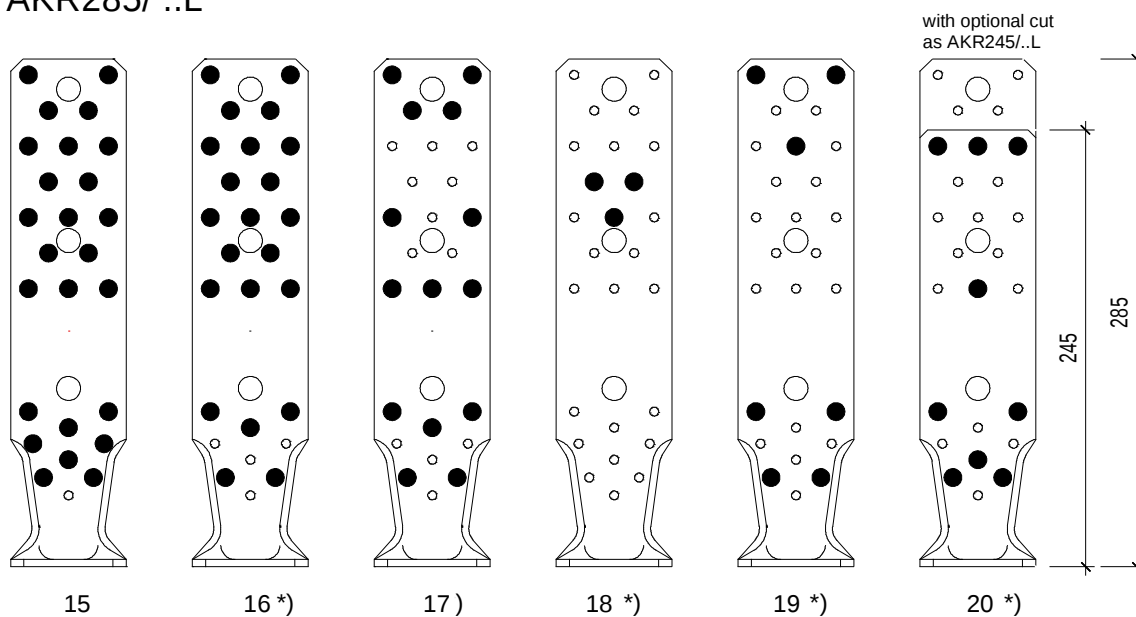
AKR135/..L



AKR205/..L



AKR285/..L



Characteristic capacities**Table D63-3: Load direction F_1 for one AKR [kN]**

Type	nail pattern	n	CNA4,0x40		CNA4,0x50		CNA4,0x60	
			R _{bend,nail,k}	R _{1,nail,k}	R _{bend,nail,k}	R _{1,nail,k}	R _{bend,nail,k}	R _{1,nail,k}
AKR95	1	8	6,60	8,78	8,80	11,32	11,00	13,24
AKR95	2	5	2,99	5,75	3,98	7,39	4,98	8,59
AKR95	3	5	6,31	5,15	8,41	6,67	10,52	7,86
AKR95	4	4	5,06	4,13	6,75	5,35	8,44	6,30
AKR135	5	13	4,34	15,89	5,79	20,34	7,24	23,46
AKR135	6	9	4,34	10,60	5,79	13,60	7,24	15,77
AKR135	7	8	1,97	10,24	2,62	13,06	3,28	14,97
AKR135	8	5	1,97	6,28	2,62	8,02	3,28	9,22
AKR205	9	10	4,34	9,50	5,79	12,36	7,24	14,67
AKR205	10	14	4,34	16,71	5,79	21,43	7,24	24,80
AKR205/AKR165	11	11	4,34	14,61	5,79	18,57	7,24	21,16
AKR205	12	8	1,97	7,15	2,62	9,32	3,28	11,12
AKR205	13	3	See Table D63-4					
AKR205	14	8	0,80	8,54	1,07	11,04	1,34	12,95
AKR285	15	25	4,34	22,62	5,79	29,49	7,24	35,16
AKR285	16	22	1,97	20,83	2,62	27,09	3,28	32,17
AKR285	17	14	1,97	13,97	2,62	18,12	3,28	21,40
AKR285	18	3	See Table D63-4					
AKR285	19	7	1,22	5,22	1,63	6,86	2,04	8,29
AKR285/AKR245	20	9	1,57	7,14	2,09	9,35	2,61	11,27
AKR95L	1	8	4,46	6,65	5,95	8,70	7,43	10,44
AKR95L	2	5	2,02	4,41	2,69	5,76	3,36	6,88
AKR95L	3	5	4,26	3,85	5,68	5,05	7,11	6,09
AKR95L	4	4	3,42	3,09	4,56	4,05	5,70	4,88
AKR135L	5	13	2,93	12,44	3,91	16,17	4,89	19,18
AKR135L	6	9	2,93	8,19	3,91	10,68	4,89	12,72
AKR135L	7	8	1,33	8,15	1,77	10,57	2,21	12,46
AKR135L	8	5	1,33	4,97	1,77	6,44	2,21	7,62
AKR205L	9	10	2,93	6,98	3,91	9,18	4,89	11,14
AKR205L	10	14	2,93	12,98	3,91	16,89	4,89	20,10
AKR205L/AKR165L	11	11	2,93	11,81	3,91	15,25	4,89	17,88
AKR205L	12	8	1,33	5,20	1,77	6,85	2,21	8,34
AKR205L	13	3	See Table D63-4					
AKR205L	14	8	0,54	6,43	0,72	8,42	0,91	10,14
AKR285L	15	25	2,93	16,48	3,91	21,71	4,89	26,43
AKR285L	16	22	1,33	15,29	1,77	20,12	2,21	24,43
AKR285L	17	14	1,33	10,36	1,77	13,60	2,21	16,45
AKR285L	18	3	See Table D63-4					
AKR285L	19	7	0,83	3,71	1,10	4,91	1,38	6,03
AKR285L/AKR245L	20	9	1,06	5,11	1,41	6,75	1,76	8,27

n = number of nails according to the nail pattern

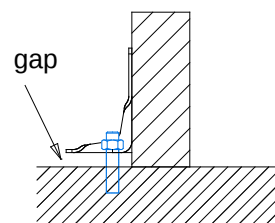
$$\text{For an AKR with a thickness of 4,0mm: } R_{1,k} = \min \left\{ \frac{R_{1,nail,k}}{k_{mod}} + R_{bend,nail,k} \right\}$$

$$\text{For an AKR with a thickness of 3,0mm: } R_{1,k} = \min \left\{ \frac{R_{1,nail,k}}{k_{mod}} + R_{bend,nail,k} \right\} \quad \text{with } R_{1,nail,k} \text{ and } R_{bend,nail,k} \text{ are given in the table}$$

before.

The force shall act in the middle of the beam/column, or the eccentricity may be overcome by clamping or an extra calculated force F_4 shall be considered.

The values are also applicable for a connection with a gap between the short flange of the AKR and the bearing, for F_1 load direction only.



The bolt shall have a capacity to sustain an axial force of $F_{1,d}$.

Instead of bolts also timber screws with washers can be applied to the bottom leg for a pure uplift force connection.

Table D63-4: Load direction F_1 for nail pattern 13 an 18:

	characteristic capacity limit by the nails: $R_{1,nail,k}$ [kN] ; n=3 nails					
	type AKR			type AKR...L		
nails	h=73	113	153	73	113	153
CNA4,0x40	3,35	3,83	4,17	2,55	3,04	3,44
CNA4,0x50	4,32	4,88	5,28	3,33	3,94	4,42
CNA4,0x60	5,04	5,60	5,97	3,99	4,65	5,15

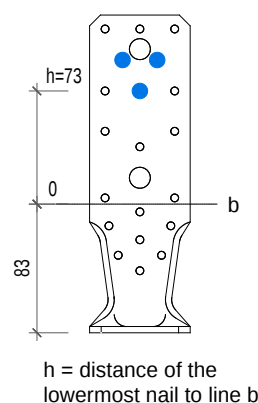
h = place of the lowermost nail above the line "b". Nail pattern 13: h=73mm, nail pattern 18: h=113mm

	$R_{F,1,i,k}$ [kN]
AKR205	4,89
AKR285	4,02
AKR205L	3,30
AKR285L	2,72

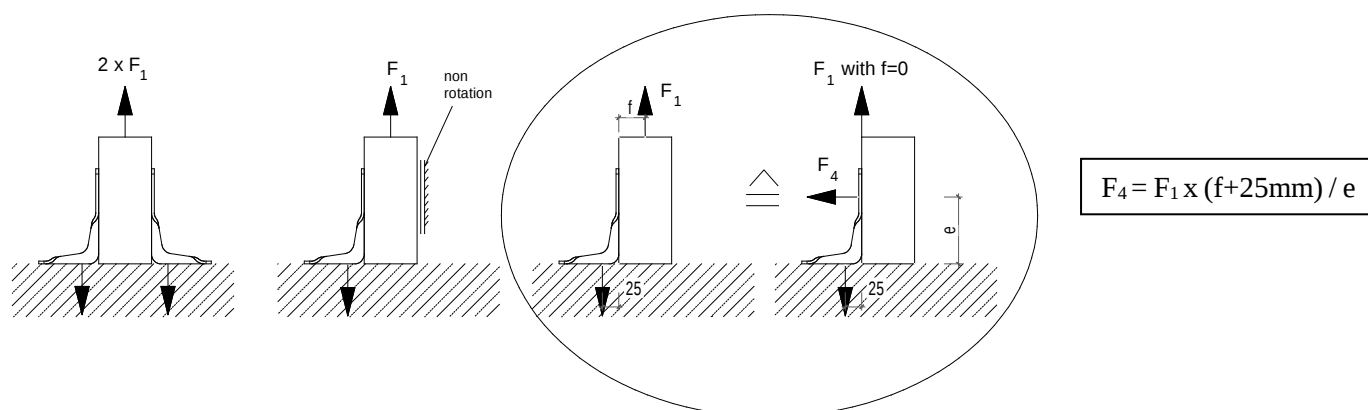
$R_{F,1,i,k}$ is based on the bending

With $i = h$

$$R_{1,k} = \min(R_{1,nail,k}; R_{F,1,i,k})$$



The capacity $R_{1,nail,i,k}$ shall be calculated as design capacity with the current k_{mod} , the capacity $R_{F,1,i,k}$ shall be calculated with $k_{mod} = 1,0$ for all load durations.

**Table D63-5: Load direction $F_{2/3}$: $R_{2/3}$ [kN] for one AKR**

Type	nail patter n	n	for CNA 4,0x40	for CNA 4,0x50	for CNA 4,0x60
AKR95	1	8	2,5	3,1	3,5
AKR95	2	5	1,8	2,2	2,5
AKR95	3	5	1,6	2,0	2,2
AKR95	4	4	1,5	1,9	2,1
AKR135	5	13	4,0	5,0	5,6
AKR135	6	9	3,0	3,7	4,2
AKR135	7	8	2,8	3,5	3,9
AKR135	8	5	1,9	2,4	2,8
AKR205	9	10	3,3	4,2	4,7
AKR205	10	14	3,9	5,0	5,9
AKR205/AKR165	11	11	3,5	4,5	5,2
AKR205	12	8	2,4	3,1	3,6
AKR205	13	3	n/a	n/a	n/a
AKR205	14	8	2,8	3,5	4,0
AKR285	15	25	4,4	5,8	7,0
AKR285	16	22	2,9	3,8	4,7
AKR285	17	14	2,8	3,6	4,4
AKR285	18	3	n/a	n/a	n/a
AKR285	19	7	2,2	2,9	3,4
AKR285/AKR245	20	8	2,9	3,7	4,4
AKR95L	1	8	2,2	2,8	3,2
AKR95L	2	5	1,5	2,0	2,3
AKR95L	3	5	1,4	1,8	2,1
AKR95L	4	4	1,3	1,7	1,9
AKR135L	5	13	3,6	4,6	5,2
AKR135L	6	9	2,6	3,3	3,8
AKR135L	7	8	2,4	3,1	3,6
AKR135L	8	5	1,6	2,1	2,4
AKR205L	9	10	2,7	3,5	4,1

AKR205L	10	14	3,1	4,0	4,8
AKR205L/AKR165L	11	11	2,9	3,7	4,4
AKR205L	12	8	1,9	2,5	3,0
AKR205L	13	3	n/a	n/a	n/a
AKR205L	14	8	2,3	3,0	3,5
AKR285L	15	25	3,3	4,4	5,4
AKR285L	16	22	2,1	2,8	3,5
AKR285L	17	14	2,1	2,7	3,4
AKR285L	18	3	n/a	n/a	n/a
AKR285L	19	7	1,7	2,2	2,7
AKR285L/AKR245L	20	9	2,2	2,9	3,5

n = number of nails according to the nail pattern

The connected beam shall be free of twisting, so that no rotation occurs.

For a connection to a column with this load direction, it is recommended to use 2 pieces of AKR.

The bolt shall have a min. capacity R_d to sustain an axial force of $F_{2,d} \times 0,2$ and a lateral force of $F_{2,d} / n_{AKR}$.
with n_{AKR} = number of AKR

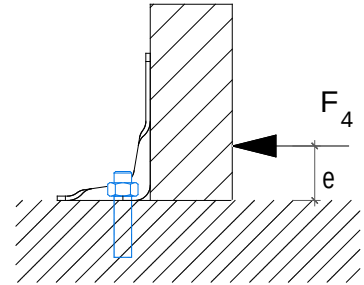
Load direction F_4 (only for types without long hole)

for AKR with a thickness of 4,0mm:

$$R_{4,k} = \min \left\{ \begin{array}{l} \frac{10,6kN \times 50mm}{e \times k_{mod}} \\ \frac{51kNmm}{(e - 71mm) \times k_{mod}} \end{array} \right.$$

for AKR with a thickness of 3,0mm:

$$R_{4,k} = \min \left\{ \begin{array}{l} \frac{6,3kN \times 50mm}{e \times k_{mod}} \\ \frac{28,7kNmm}{(e - 71mm) \times k_{mod}} \end{array} \right.$$



Negative values may not be considered, e shall be inserted in [mm]

The bolt shall have a capacity to sustain an axial force of $F_{4,d} \times 1,5$, and a lateral force of $F_{4,d} \times 1,0$.

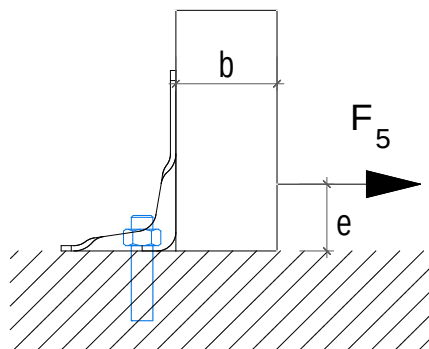
Table D63-6: Load direction F_5 (only for types without long hole)

Type	nail pattern	n	e < 71		e > 71	
			X_1	$e_{\max \text{ force}}$	X_1	$e_{\max \text{ force}}$
AKR95	1	8	402	131-e	378	e - 10
AKR95	2	5	244		256	
AKR95	3	5	319		215	
AKR95	4	4	257		172	
AKR135	5	13	419		742	
AKR135	6	9	357		480	
AKR135	7	8	247		500	
AKR135	8	5	197		301	
AKR205	9	10	354		382	
AKR205	10	14	402		378	
AKR205/AKR165	11	11	354		382	
AKR205	12	8	244		256	
AKR205	13	3				
AKR205	14	8	210		363	
AKR285	15	25	402		378	
AKR285	16	22	244		256	
AKR285	17	14	244		256	
AKR285	18	3				
AKR285	19	7	210		196	
AKR285/AKR245	20	9	274		271	

n = number of nails according to the nail pattern

$$R_{5,k} = \min \left\{ \begin{array}{l} \frac{X_1 \times R_{ax,k}}{e_{\max, force}} \\ \frac{536 \text{ kNmm}}{e \times k_{\text{mod}}} \\ \frac{51 \text{ kNmm}}{(e - 71 \text{ mm}) \times k_{\text{mod}}} \end{array} \right.$$

with $R_{ax,k}$ [kN] = the axial characteristic capacity of the used nail
 sizes “e” shall be inserted in [mm]



Negative values may not be considered.

The bolt shall have a min. capacity R_d to sustain an axial force of $F_{5,d} \times 1,0$ and a lateral force of $F_{5,d} \times 1,0$.

Table D63-7: Load direction $F_{4/5}$ (only for types without long hole)

Type	nail pattern	Characteristic capacity $R_{4/5,k}$ [kN]
all with a thickness of 4,0mm	all	26,5/ k_{mod}
all with a thickness of 3,0mm	all	15,75/ k_{mod}

The size b shall be a minimum of 60mm.

The “left” AKR shall be checked additionally for a tension force:

$$F_{1,d}^* = \frac{F_{4/5,d} \times (e - 16,5mm)}{b + 83mm}$$

Sizes “e” and “b” shall be insert in [mm]

The bolt 1 shall have a capacity to sustain an axial force of $F_{1,d}^* \times 1,0$.

The bolt 2 shall have a capacity to sustain an axial force of $F_{4/5,d} \times 0,5$, and a lateral force of $F_{4/5,d} \times 1,0$.

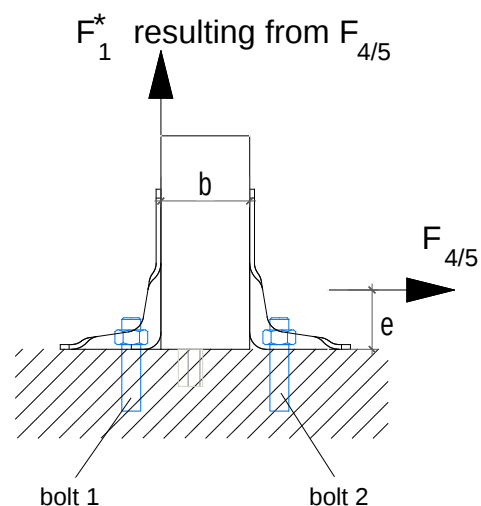


Table D64-1: Size specification

Type	H mm	L mm	t mm	A mm	C mm
AH16050	160	50	3		
AH19050-2	192	52	2		
AH29050-2	292	52	2		
AH39050-2	392	52	2	22	27
AH49050-2	492	52	2	22	27
AH61050-2	612	52	2	22	27
AH19050-4	194	54	4	24	29
AH29050-4	294	54	4	24	29
AH39050-4	394	54	4	24	29
AH49050-4	494	54	4	24	29
AH61050-4	614	54	4	24	29

Other lengths (H) are possible, for the same cross section the same capacity is given.

Table D64-2: Material specification

Material thickness	Material Grades	Coating specification
2 ; 3 ; 4	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
Washer: 10,0	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
	Or stainless steel as described	

Figure D64-2: Nail pattern

	Minimum	Maximum
AH16050	2	Purlin = 10 column = 6, the 4 lower holes can not be used
types 190xx and up	2	Purlin: use all holes other than the lower 2 holes Column: use all holes other than the lower 3 holes

Table D64-3: Characteristic capacityLoad direction $F_{1,k}$

type	characteristic capacity (kN)	
	timber	min. of steel ¹⁾
AH16050	n x $R_{lat,k}$	15,0
AH19050/2		
AH29050/2		
AH39050/2		
AH49050/2		
AH61050/2		
AH19050/4		
AH29050/4		
AH39050/4		
AH49050/4		
AH61050/4		

¹⁾ for steel $k_{mod} = 1,0$ shall be used for all load durations
 $R_{lat,k}$ = lateral characteristic capacity of the nail

The washer to use is: US40/50/10.

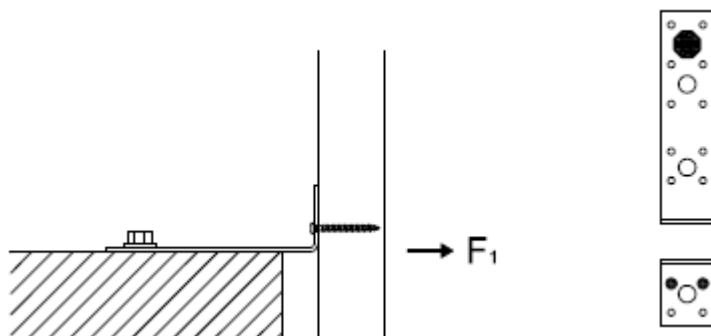
It must be checked, that the anchor fulfils the following formula:

$$\frac{3 \times F_{1,d}}{R_{anchor,d}} \leq 1$$

Table D64-4: Characteristic capacity (F_1 – downward)

Fastener Specification	Characteristic capacity of Connector (kN)
2 pcs CSA5,0x40 / 1 pcs Concrete Screw/Bolt	3.3

It is assumed that the connection cannot rotate.



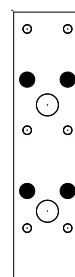
AH16050

For a connection between timber to timber members (column or beam)

The connection is possible with a beam or a column at the vertical flap.

Table 64-5 With connector nails 4,0x40

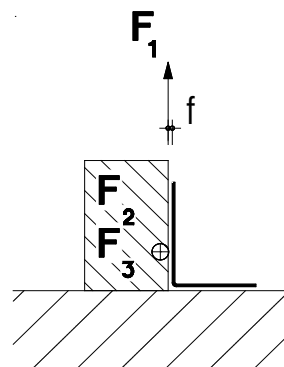
angle bracket AH16050 with connector nails 4,0x40						
load duration	k_{mod}	1 Angle Bracket		2 Angle Bracket		
		$R_{1,k}$	$R_{2,k}$ $R_{3,k}$	$R_{1,k}$	$R_{2,k}$ $R_{3,k}$	$R_{4,k}$ $R_{5,k}$
P	0,6	0,6	1,2	1,6	2,4	1,3
L	0,7	0,7	1,4	1,9	2,8	1,5
M	0,8	0,8	1,6	2,2	3,2	1,7
S	0,9	0,9	1,8	2,4	3,6	1,9
I	1,1	1,1	2,2	2,7	4,4	2,1



nail pattern

Table 64-6 With connector nails 4,0x60

angle bracket AH16050 with connector nails 4,0x60						
load duration	k_{mod}	1 Angle Bracket		2 Angle Bracket		
		$R_{1,k}$	$R_{2,k}$ $R_{3,k}$	$R_{1,k}$	$R_{2,k}$ $R_{3,k}$	$R_{4,k}$ $R_{5,k}$
P	0,6	1,0	1,6	2,7	3,1	2,1
L	0,7	1,1	1,8	2,7	3,6	2,1
M	0,8	1,2	2,1	2,7	4,2	2,1
S	0,9	1,2	2,3	3,0	4,7	2,3
I	1,1	1,2	2,9	3,9	5,7	2,9

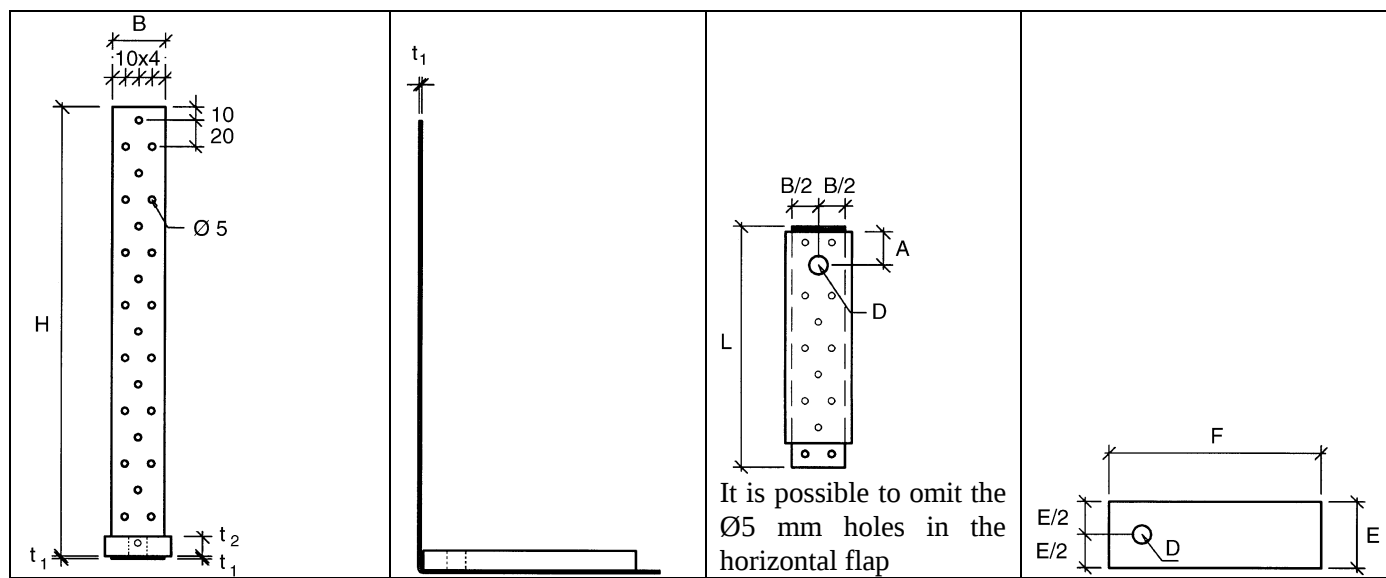


For using the capacity of use with one angle bracket it is assumed, the distance f will be ~ 0 mm

D65: HD Tension Tie

Product Name	alternative names			
	UK	France	DK	D
HDxx				

xx = size and size of bolt

Figure D65-1: Drawings**Table D65-1: Size specification**

Type	H	L	B	t ₁	t ₂	A	D*	E	F
HD340M12	340	182	40	2,0	15	25	12,5 to 14	50	160
HD400M16	400	123	40	3,0	15	25	16,5 to 18	60	110
HD420M16	420	222	60	2,0	20	35	16,5 to 18	60	200
HD420M20	420	102	60	2,0	20	35	20,5 to 22	60	85
HD480M20	480	123	60	2,5	20	35	20,5 to 22	70	115
HD140M12	140	90	60	2,0	12	25	14	50	90

* D refers to the hole diameter in the washer. Intermediate values are possible. The hole in the sheet-metal part below the washer can be up to +2 mm larger than the hole in the washer

Other lengths (H) and other width (B) are possible, for the same cross section the same capacity is given.

Table D65-2: Material specification

Material thickness	Material Grades	Coating specification
2 ; 3	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
Washer 15; 20	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
	Or stainless steel as described	

Figure D64-2: Nail pattern

	Minimum	Maximum
All types	2	All holes can be used by considering the minimum distance of the nails to the end of timber

Table D65-3: Characteristic capacity

The characteristic load-carrying capacity in N of one Tension Tie is calculated as:

$$R_{1,k} = \min \left\{ \begin{array}{l} \frac{W_{pl} \times 277}{A \times k_{mod}} \\ A_{gross} \times 223 / k_{mod} \\ n_{ef} \times R_{lat,k} \end{array} \right.$$

A_{gross} =	gross cross sectional area of the vertical flap in $mm^2 = B t_1$, see table below
$R_{lat,k}$ =	characteristic lateral Load-carrying capacity of one connector nail
$n_{ef} = n^{k_{ef}}$	effective number of nails with k_{ef} by EC 5 , table 8.1
k_r =	reduction factor, see table below
k_{mod} =	load-duration factor
W_{pl} =	the plastic section modulus of the lower part; see table below
A =	distance of the bolt hole to the vertical flange – as given in table D65-1

typ	A_{gross} [mm ²]	k_r	W_{pl} [mm ³]
HD340M12	80	0.84	2025
HD400M16	120	0.76	2363
HD420M16	120	0.82	4200
HD420M20	120	0.56	3800
HD480M20	150	0.68	4800
HD140M12	120	0.71	1296

It must be checked, that the anchor fulfils the following formula:

$$\frac{F_{1,d}}{R_{anchor,d} \times k_r} \leq 1$$

A connection to the timber can also be occurring as shown next:

Larger holes are possible for bolts or other fastener instead of a nail pattern.

For this cases the value $R_{1,k}$ shall be calculate as:

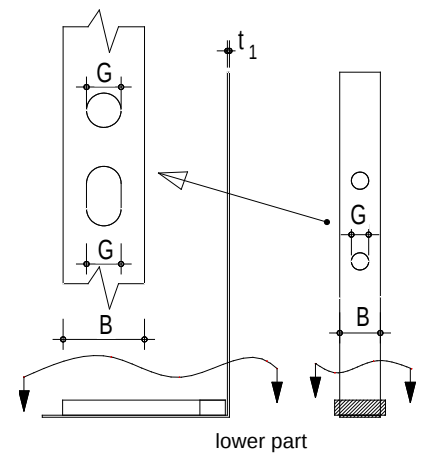
$$R_{1,k} = A_{net} \times 295 N/mm^2 \quad \text{with} \quad A_{net} = (B - G) \times t_1$$

For $R_{lat,k}$ shall be use the characteristic lateral load-carrying capacity of the used fastener.

The lower part shall be as described before by using the W_{pl} from the table before.

Installation on a timber floor:

For the pressure area it may be possible to use screws for the pressure. In this case the calculation for the screws may be done separately according to the following system : see after table D66-3 (HD2P)



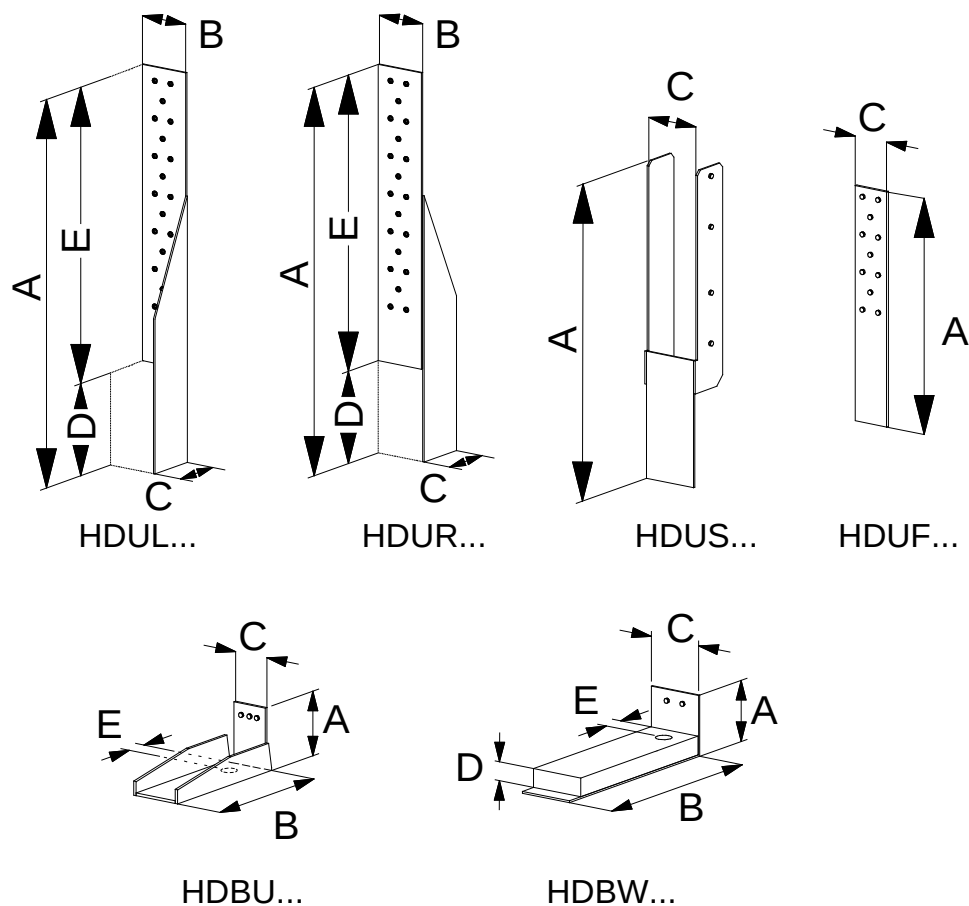
D66: HD2P based on components

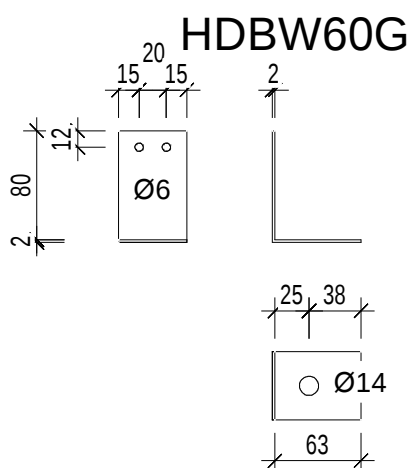
Product Name	alternative names			
	UK	France	DK	D
HDUL _x				
HDUR _x				
HDUS _x				
HDUF _x				
HDBU _x				
HDBW _x				
HD2P60G *				
HD2PL40G **				

* from components HDUF400 and HDBU220

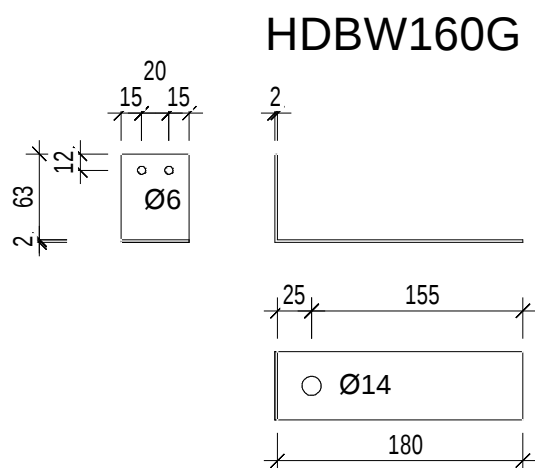
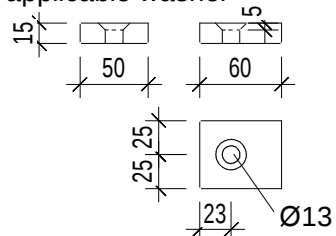
** from components HDUF250 and HDBU163

Figure D66-1: Drawings

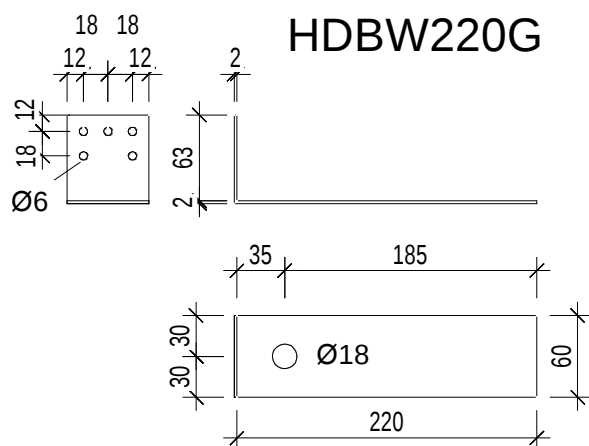
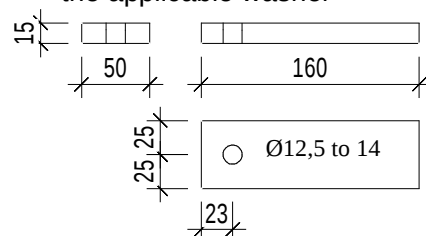




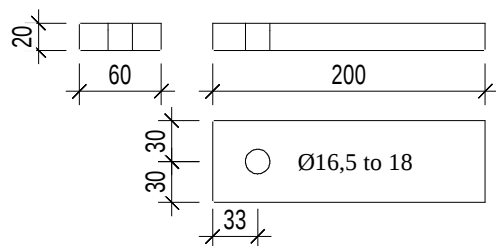
the applicable washer

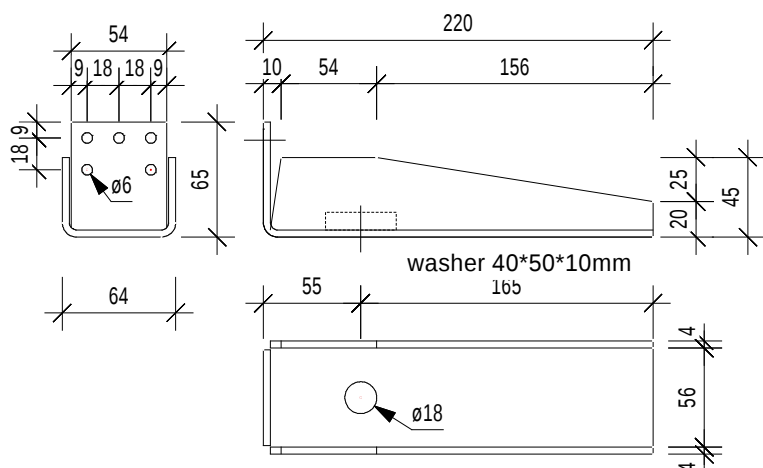


the applicable washer

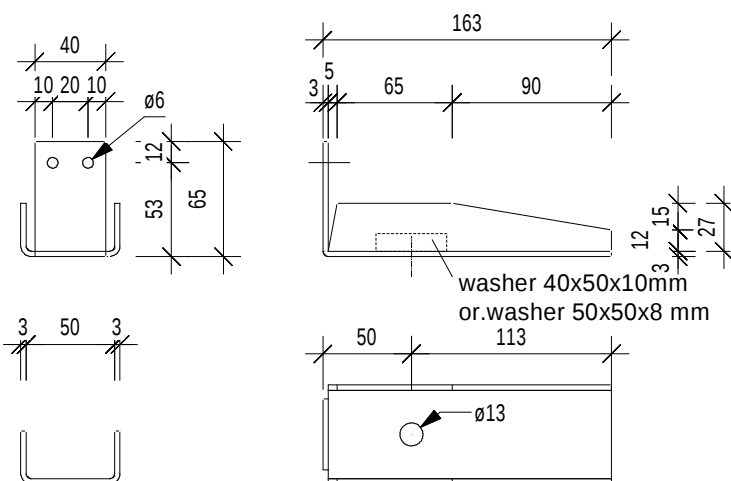


the applicable washer

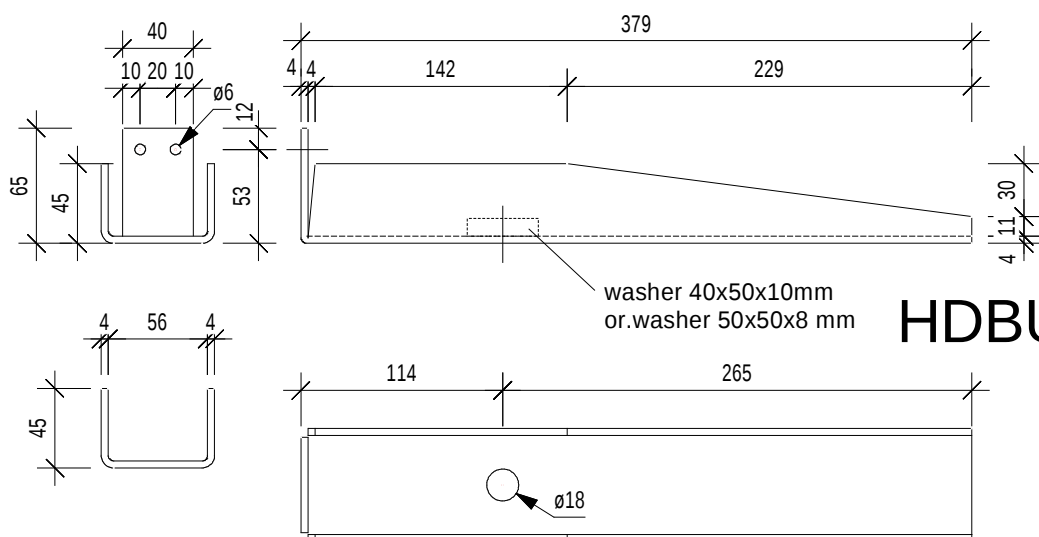




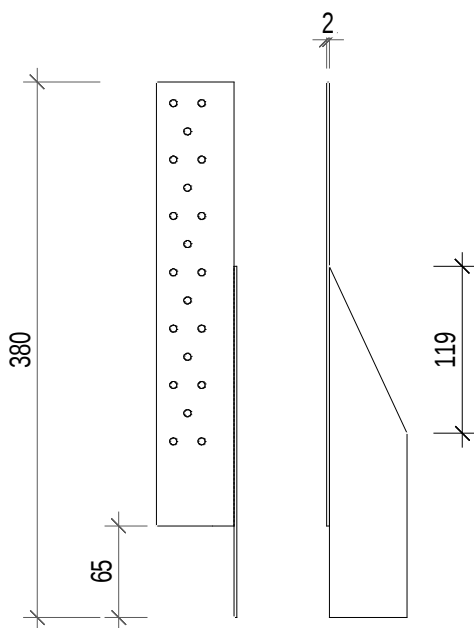
HDBU220



HDBU163

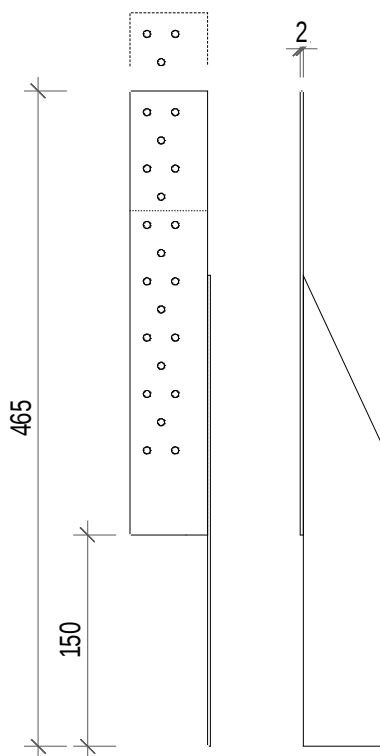


HDBU379



HDUL380

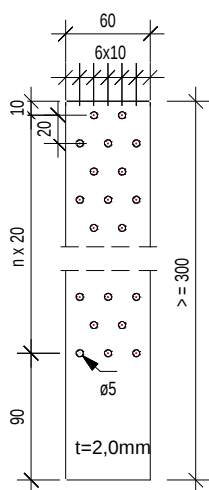
HDUR380 mirror-image



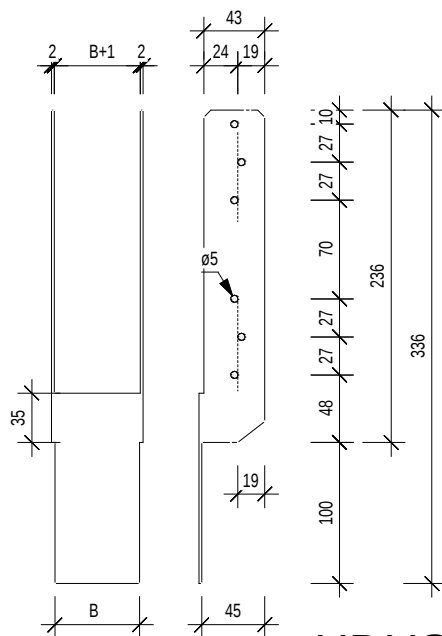
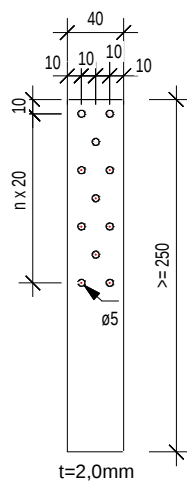
HDUL465

HDUR465 mirror-image

HDULxx and HDURxx are analogous



HDUF...



HDUS...

Table D66-1: Size specification

	thickness	size [mm]					
		A	B	C	D	E	Ø
HDUF250G	2,0	250		40			5
HDUF400G	2,0	400		60			5
HDUS336G	2,0	336	>40				5
HDUL380G	2,0	380	55	52,5 - 55,0	65	315	5
HDUR380G	2,0	380	55	52,5 - 55,0	65	315	5
HDUL465G	2,0	465	55	52,5 - 55,0	150	315	5
HDUR465G	2,0	465	55	52,5 - 55,0	150	315	5
HDUL xx G	2,0	≥ 300	55	52,5 - 55,0	≥ 65	A - D	5
HDUR xx G	2,0	≥ 300	55	52,5 - 55,0	≥ 65	A - D	5
HDUF40XG	2,0	≥ 250		≥ 40			5
HDUF60XG	2,0	≥ 250		60			5
HDBU163G	3,0	65	163	40		50	13 ¹⁾
HDBU220G	4,0	65	220	54		55	18 ^{1) 2)}
HDBU379G	4,0	65	379	40		114	18 ^{1) 2)}
HDBW60G	2,0 + 15,0	82	65	50	15	27	13,0
HDBW160G	2,0 + 15,0	65	182	50	15	27	12,5 ³⁾
HDBW200G	2,0 + 20,0	65	222	60	20	37	16,5 ⁴⁾

Together with: ¹⁾ US40/50/10G ; ²⁾ US50/50/8G; ³⁾ up to 14 mm; ⁴⁾ up to 18 mm
 For HDBUx and HDBWx (bottom parts) are possible to modify the size A

The connection between the upper and lower part governed by the self tapping screws EJOT JT2-3-5,5x25 or with equivalent screws.

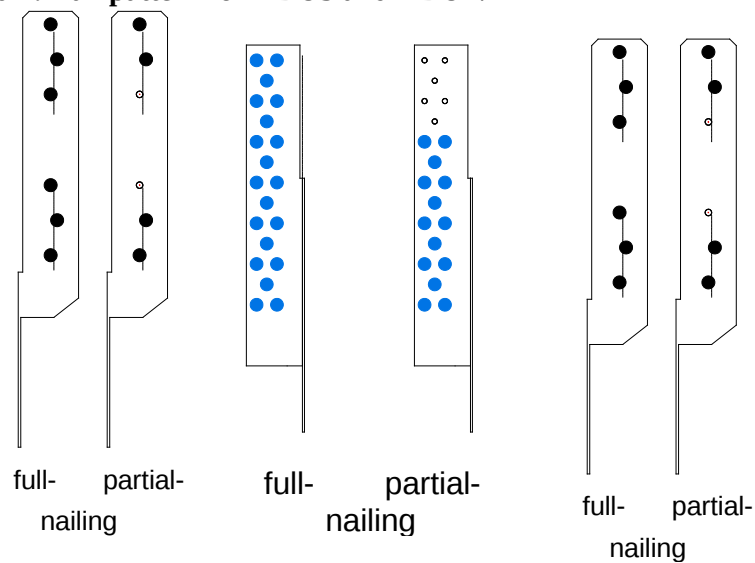
combinations		upper parts								
		HDUF250	HDUF400	HDUS336	HDUR380	HDUR380	HDUL465	HDUR465	HDUF40X	HDUF60X
lower parts	HDBU163G	O	O	O	O	O	O	O	O	
	HDBU220G		O		O	O	O	O		O
	HDBU379G	O	O	O	O	O	O	O	O	O
	HDBW60G	O	O	O	O	O	O	O	O	
	HDBW160G	O	O	O	O	O	O	O	O	
	HDBW200G		O	O	O	O	O	O		O

The free cells show non logical or non possible combinations.

Table D66-2: Material specification

Material thickness	Material Grades	Coating specification
2 ; 3	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
Washer 15; 20	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
	Or stainless steel as described	

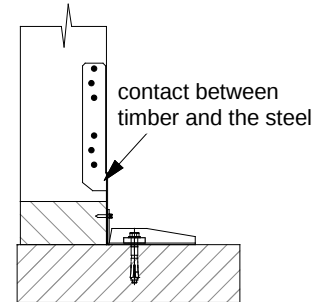
Figure D66-2: Nail pattern for HDUS and HDUL/R



	Minimum	Maximum
HDUF	2	All holes can be used by considering the minimum distance of the nails to the end of the timber
HDUS	Partial nailing 2x4 nails	full nailing , 2x6 nails
HDUL/R	Partial nailing 14 nails	full nailing , 20 nails

Table D66-3: Characteristic capacity

Model	$R_{1,k}$ [kN]
HDUF250G	$\min \begin{cases} n_{ef} \times R_{lat,k} \\ 17,8kN / k_{mod} \end{cases}$
HDUF40XG	
HDUF400G	$\min \begin{cases} n_{ef} \times R_{lat,k} \\ 26,7kN / k_{mod} \end{cases}$
HDUF60XG	
HDUS336G	$\min \begin{cases} C \times n_{per-side} \times R_{lat,k} \\ 23,1kN / k_{mod} \end{cases}$ or $\min \begin{cases} D \times R_{lat,k} \\ 17,95kN / k_{mod} \end{cases}$ using the formula with "C", for contact between the hold down and the timber C=1,95 using the formula with "D" for no contact between the hold down and the timber Fullnailing: D=10,47 partial nailing: D= 7,41
HDUL380G	$\min \begin{cases} C \times R_{lat,k} \\ 21,4 \times R_{ax,k} \end{cases}$ full nailing: C=11,7 partial nailing: C= 8,1
HDUR380G	
HDUL465G	
HDUR465G	
HDULxxG	
HDURxxG	



Model	$R_{1,k}$ [kN]	$R_{s,k}$ [kN]	factor k_r	max n_s
HDBU163G with ¹⁾	$\min \begin{cases} R_{s,k} / k_{mod} \\ V_{R,k} \times n_{sc} / k_{mod} \end{cases}$	13,7	1,55	2
HDBU220G with ^{1) 2)}		34,6	1,40	3
HDBU379G with ^{1) 2)}		16,7	1,46	2
HDBW60G		19,8	2,00	2
HDBW160G		21,2	1,24	2
HDBW200G		23,4	1,23	3

It is imperative:

$$R_{1,d} = \frac{R_{1,k} \times k_{mod}}{\gamma} \quad \text{with } \gamma \text{ for timber.}$$

It shall be to check:

$$R_{bolt,d} \geq F_{1,d} \times k_r$$

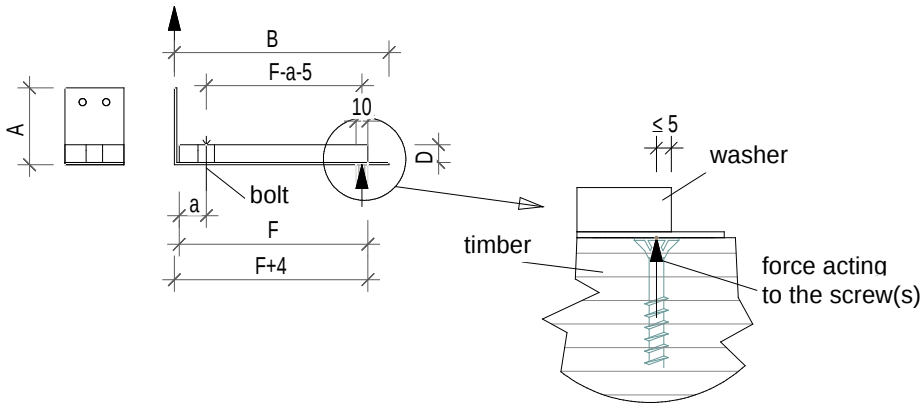
With:

- n_{ef} = n^{kef} effective number of nails with k_{ef} by EC 5 , table 8.1
- $n_{per-side}$ = number of nails on each side
- $V_{R,k}$ = characteristic Capacity of self-tapping screws (for EJOT JT2-3-5,5*25 $V_{R,k}$ = 6,4 kN)
- n_{sc} = number of self-tapping screws
- $R_{ax,k}$ = characteristic axial capacity of one nail in kN
- $R_{bolt,k}$ = characteristic withdrawal capacity of the (anchor)-bolt in kN
- $R_{lat,k}$ = characteristic lateral load-carrying capacity of one nail in kN
- k_r = factor to calculate the force in the bolt
- $R_{s,k}$ = capacity given in the table

The capacity of a combination of an upper and lower part is given by the lower capacity of both parts.

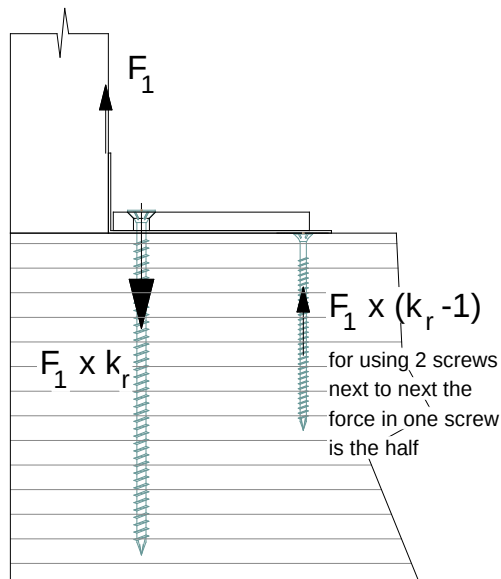
Installation on a timber floor:

For the pressure area it may be possible to use screws for the pressure. In this case the calculation for the screws may be done separately according the following system:



The force for the screws at the end of the washer may be calculated with the given lever arms.
The screws may be placed with a distance of 5 mm from the end of the washer.

The force axial to the screw is: $F_{ax,d} = F_{1,d} \times (k_r - 1)$ as compression



The distances between the screws and to the edges are to be considered, as given in an approval or according EN1995 or a national standard.

A connection to the timber can also be occurring with a HDUFxx next

Larger holes are possible for bolts or other fasteners instead of a nail.
For this cases the value $R_{1,k}$ shall be calculate as:

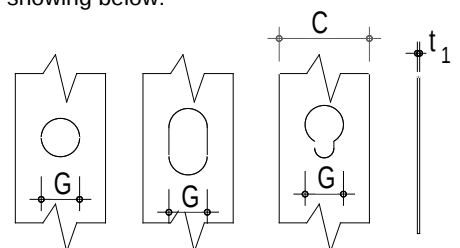
$$R_{1,k} = \min \left\{ \begin{array}{l} n_{ef} \times R_{lat,k} \\ \frac{A_{net} \times 295 \text{ N/mm}^2}{k_{mod}} \end{array} \right.$$

With $A_{net} = (C - G) \times t_1$

$R_{lat,k}$ is the characteristic lateral load-carrying capacity of the used fastener.

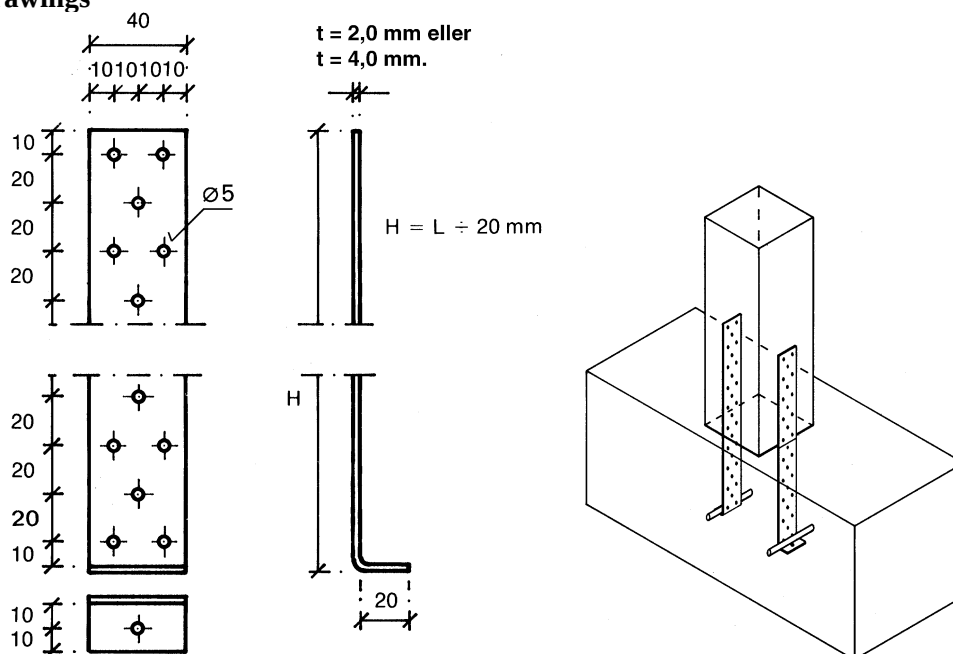
The length of the HDUF may be selected as required for the used fastener.

HDUF: the hole pattern may be modified as showing below:



D67: BETA

Product Name	alternative names			
	UK	France	DK	D
BETA				

Figure D67-1: Drawings**Table D67-1: Size specification**

Type	L mm	t mm
BETA2/200	200	2,0
BETA2/300	300	2,0
BETA2/400	400	2,0
BETA2/500	500	2,0
BETA2/600	600	2,0
BETA4/600	200	4,0
BETA4/600	300	4,0
BETA4/600	400	4,0
BETA4/600	500	4,0
BETA4/600	600	4,0

Other lengths of the vertical flange are possible, for the same cross section the same capacity is given.

Table D67-2: Material specification

Material thickness	Material Grades	Coating specification
2 ; 4	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
	Or stainless steel as described	

Table D67-3: Characteristic capacity

The characteristic load-carrying capacity of one Concrete anchor strap is calculated as:

$$R_{l,k} = \min \left\{ \begin{array}{l} A_{st} \times 0,37 \times f_{c,k}^{2/3} / k_{mod} \\ n_{ef} \times R_{lat,k} \\ 223 \times A_{gross} / k_{mod} \end{array} \right.$$

$f_{c,k}$ = characteristic compression strength of the concrete according to EN 1992-1-1

$n_{ef} = n^{k_{ef}}$ effective number of nails with k_{ef} by EC 5 , table 8.1

$R_{lat,k}$ = characteristic lateral capacity of the connector nails

A_{gross} = gross area of the vertical flap in mm²

k_{mod} = load-duration factor

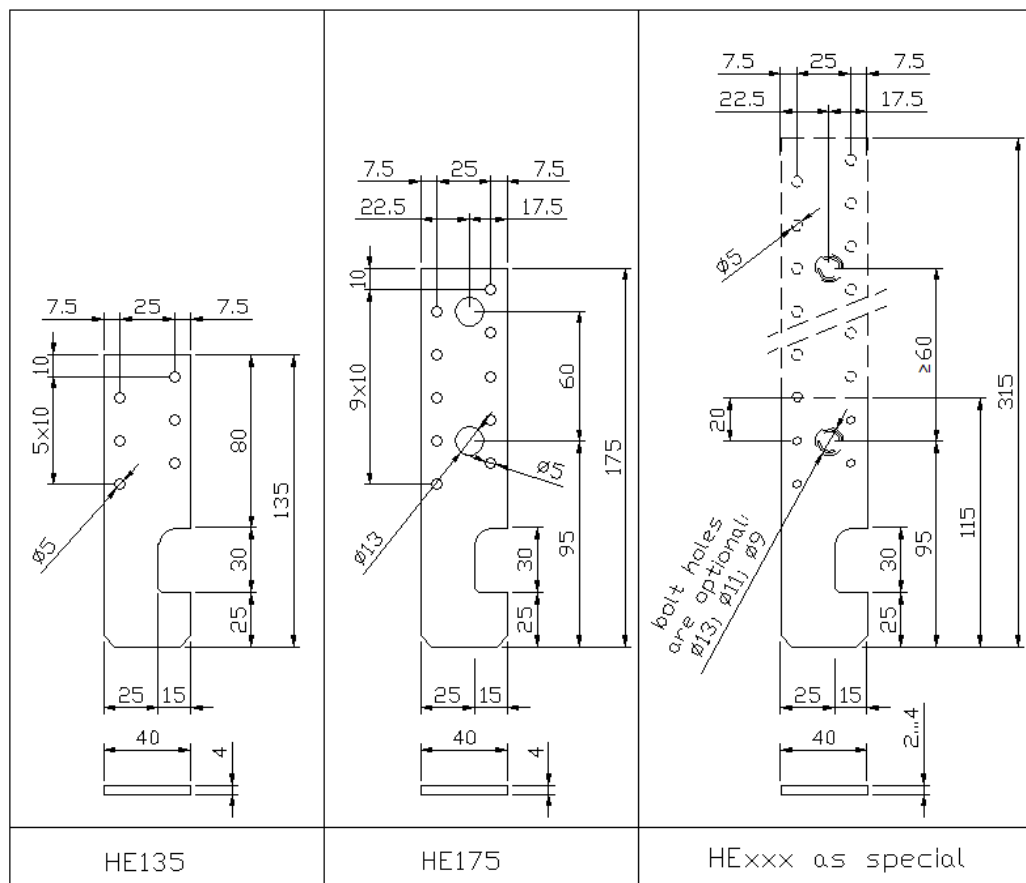
l_c = embedment length in concrete in mm

A_{st} = embedding face with a minimum l_c of 100mm, for a larger l_c it will be changed by: $A_{st} = A_{st(table)} / 100\text{mm} \times l_c$

Type	A_{gross} [mm ²]	A_{st} [mm ²]
BETA2/200	80	8400
BETA2/300	80	8400
BETA2/400	80	8400
BETA2/500	80	8400
BETA2/600	80	8400
BETA4/600	160	8800
BETA4/600	160	8800
BETA4/600	160	8800
BETA4/600	160	8800
BETA4/600	160	8800

D68: HE Anchor

Product Name	alternative names			
	UK	France	DK	D
HE				

Figure D68-1: Drawings**Table D68-1: Size specification**

n/a

Table D68-2: Material specification

Material thickness	Material Grades	Coating specification
2 ; 4	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
	Or stainless steel as described	

Nail pattern:

	Minimum	Maximum
HE135	3	6
HE175	3	10
HE XXX	3	22

The size for type HE xxx may be in a range from 115 mm to 315 mm in steps of 20mm

The nails shall be placed alternating in height.

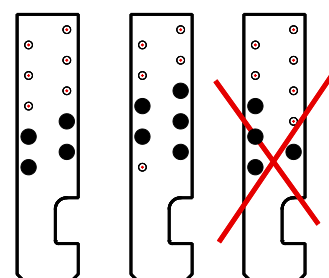


Table D68-3: Characteristic capacity

The characteristic load-carrying capacity of one HE Anchor is calculated as:

$$R_{1,k} = \min \left\{ \begin{array}{l} C \times R_{lat,k} \\ 8,5kN / k_{mod} \times (t / 4mm) \end{array} \right.$$

$R_{lat,k}$ = characteristic lateral capacity of the connector nails / bolt M12

C = the factor from the following table

k_{mod} = load-duration factor

t = thickness of HE anchor [mm]

Table 68-4

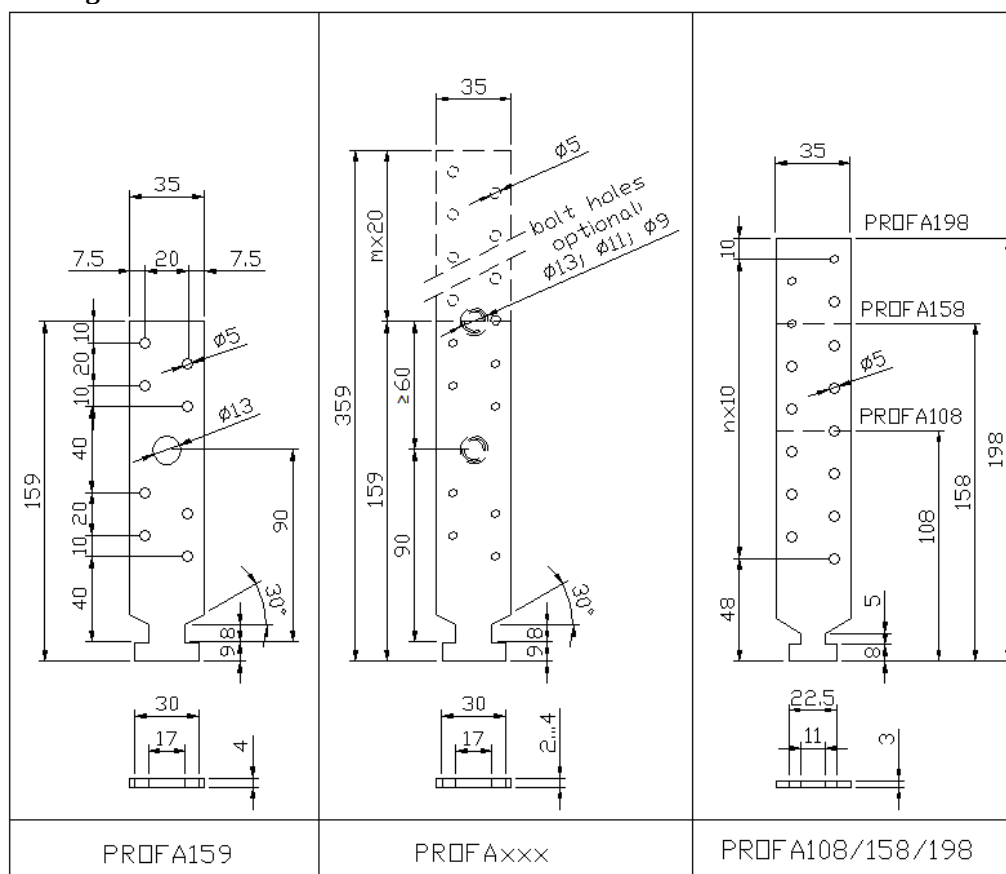
no of nails	I_p [mm ²]	factor "C"
3	800	3.0
4	1944	3.8
5	2230	4.4
6	2688	4.7
7	4557	6.1
8	5450	6.6
9	8278	8.0
10	9813	8.6

Table 68-5

no of bolt	I_p [mm ²]	faktor "C"
2 M12	1800	1,9

D69: PROFA

Product Name	alternative names			
	UK	France	DK	D
PROFA				

Figure D69-1: Drawings**Table D69-1: Size specification**

n/a

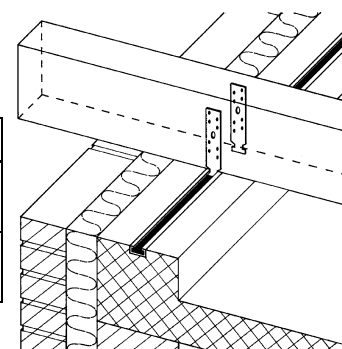
Table D69-2: Material specification

Material thickness	Material Grades	Coating specification
2 ; 4	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
	Or stainless steel as described	

Nail pattern:

	Minimum	Maximum
PROFA108	2	6
PROFA158	2	10
PROFA198	2	14
PROFA159	2	8
PROFA XXX	2	28

The size for type PROFA xxx may be in a range from 159 mm to 359 mm in steps of 20mm



The nails shall be placed alternating in height.

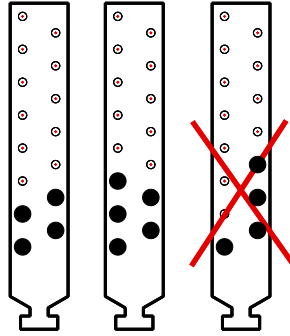


Table D69-3: Characteristic capacity

The characteristic load-carrying capacity of one Profile Anchor is calculated as:

For PROFA 108/158/198 (thickness = 3,0 mm)

$$R_{1,k} = \min \begin{cases} n \times R_{lat,k} \\ 6,3kN / k_{mod} \end{cases}$$

For PROFA 159 to PROFA 359 (thickness = 4,0mm)

$$R_{1,k} = \min \begin{cases} n \times R_{lat,k} \\ 9,4kN / k_{mod} \end{cases}$$

For PROFA 159 to PROFA 359 (thickness = 3,0mm)

$$R_{1,k} = \min \begin{cases} n \times R_{lat,k} \\ 7,1kN / k_{mod} \end{cases}$$

For PROFA 159 to PROFA 359 (thickness = 2,0mm in steel 1.4529)

$$R_{1,k} = \min \begin{cases} n \times R_{lat,k} \\ 5,65kN / k_{mod} \end{cases}$$

n = number of the nails / connector screws; the nails will be used side by side.

$R_{lat,k}$ = characteristic lateral capacity of the connector nail / bolt M12

k_{mod} = load-duration factor