ETA-Danmark A/S
Göteborg Plads 1
DK-2150 Nordhavn
Tel. +45 72 24 59 00
Fax +45 72 24 59 04
Internet www.etadanmark.dk

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 2025/11/19

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:	Simpson Strong-Tie 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 Int. Ltd For local branch refer to www.strongtie.eu
Manufacturing plant:	SIMPSON STRONG-TIE Manufacturing facilities
This European Technical Assessment	172 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	EAD 130186-00-0603 for Three-dimensional nailing plates
This version replaces:	The ETA with the same number and issued on 2021-12-09

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Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of 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 bases 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.

Posts OSP and OSPS are steel column made of a circular hollow tube with a plate welded at each end. These plates can be selected among 8 different available plates.

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.
A coloured top paint can be applied on post bases and holdowns.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter 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/m^3 to 420 kg/m^3.

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
- Cross Laminated timber according to EN 16351

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/m^3.

For timber or wood based material with a lower characteristic density than 350 kg/m^3 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/m^3.

For timber or wood based material with a higher characteristic density than 350 kg/m^3 the load-

carrying capacities shall be taken as that for 350 kg/m^3 unless detailed analyses are conducted.
The post bases down-load bearing capacities are given for timber which grain is parallel to the load axis unless other grain direction is stated.

The design of the connections shall be in accordance with Eurocode 5 or a similar national provision. 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 or coating ZM310 is applied, or when stainless steel with similar or better characteristic yield or ultimate strength is employed.

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 EN ISO 2081 or coated with ZM310, 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)	
Joint Strength - Characteristic load-carrying capacity	See Annex D
Joint Stiffness	No performance assessed
Joint ductility	No performance assessed
Resistance to seismic actions	See Annex D
Resistance to corrosion and deterioration	See section 3.6
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 Commission Delegated Regulation 2016/364
Resistance to fire	No performance assessed
3.3 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 3.4 – 3.7.

3.4 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 0 – 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 for all product except OSP have been calculated considering a ratio between the partial factor for timber connections and steel / concrete cross sections.

For steel yield strength:

k_{modi} = 1.18 $\left(EC5\text{: } k_{modi.y} = \frac{1.30}{1.10} = 1.18\right)$

For steel ultimate strength

k_{modi} = 1.04 $\left(EC5\text{: } k_{modi.u} = \frac{1.30}{1.25} = 1.04\right)$

For anchor bolt in concrete:

k_{modi} = 0,87 $\left(EC5\text{: } k_{modi.c} = \frac{1.30}{1.5} = 0.87\right)$

For k_{modi} > 1.18 / 1.04 / 0.87 the load-carrying capacities stated in Annex B and D are valid (on the safe side).
For k_{modi} <1.18 / 1.04 / 0.87 the load-carrying capacities stated in Annex B have to be multiplied by a factor

$$k_{safe} = \frac{k_{modi.y}}{1.18} \; or \; \frac{k_{modi.u}}{1.04} \; or \; \frac{k_{modi.c}}{0.87}$$

3.5 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 EAD 130186-00-0603. They should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

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, 4.0x60 or 4.0x75 in accordance with ETA-04/0013. It is allowed to use connector screws 5.0x35, 5.0x40, 5.0x50, 5.0x80, 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 plat 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.

3.6 Aspects related to the performance of the product

3.6.1 Corrosion protection in service class 1 and 2
In accordance with EAD 130186-00-0603 the hold downs shall have a zinc coating weight of min. Z275. The steel employed is S250GD (S350GD) with min. Z275 according to EN 10346 and G90 SS Grade 33 according to ASTM A-653.

3.6.2 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. Alternatively, ZM310 can be used as corrosion protection in service class 3 for Post Bases and Hold Downs (applicable for all steel thicknesses).

3.7 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 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, generally.
- 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 C16/20, unless other strength class 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.
- The timber section sizes shall be equal or superior to the horizontal plate in contact with

timber when contact is required (not appropriate for TPB).

- 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 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

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 provided for 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 prior to CE marking.

Issued in Copenhagen on 2025-11-19 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A: Revision History

Modifications and additions to the previous versions of ETA-07/0285 (and ETA-07/0314 merged in v4.0)	
Issue No.	Update
ETA-07/0285 1.0	First release
ETA-07/0314 1.0	First release
ETA-07/0285 2.0	Update of the dimensions C for post base type D/PPD.
	Update of the steel material of the tube for post bases PL, L and IL
	Update of the steel thickness of the tube of PPA post bases
	Add new post bases FPB, APB100/150, PBP60/50, CPB/CPS, PGS
	Update of coating for PPRB, PPRC, PBLR and APB7090/100
	Update of the steel material of the tube for PPRC and PBLR
	Update of the dimensions E2 and E3 for PPS230
	Add figures and ribbed bar diameter for PPSP post bases
	Update of the steel thickness of the tube of PBL post bases
	Add table 3 giving the factor to apply on characteristic values for use in service class 3
	Reduction of the resistance capacities for uplift load F_{R2} next to the revision of the nails capacities according to the update of the ETA-04/0013 (valid from 2008-08-13 to 2013-08-13). Reduction occurs for the post bases D/PPD, L, LS, LB, vario D/PB, vario DB/PB, U-shoe, PPUP, PBS, ABE. Reduction occurs also for lateral load H_{R1} for PPUP for the same reasons.
	Update of H_{R1} values for post base I next to mistakes
	Reduction of the resistance capacities next to the revision of the steel properties of the tube for download F_{R1} for the post bases PL, L, IL and lateral load H_R for PL and IL
	Update of H_{R2} values for post base vario IB next to mistakes
	Update of the resistance capacities table for download F_{R1} for PPR, PPRB and PPRC
	Add characteristic resistance capacities for new post bases FPB, APB100/150, PBP60/50, CPB, CPS and PGS.
ETA-07/0285 3.0	Insert list with names and alternative names
	Insert stainless steel
	Insert PLPP180
	Modification of hole size and hole position for PPRIX
	Add steel quality for PPSP70 and PPSP90
	Add post bases PPSR320
	Add post base CMS
	Modification the calculation for service class 3
	Delete the size 90x60 and 100x60 in table for force direction H_{R1} and H_{R2}
	Modification of values F1 for PJPS;PJPB, PJIS; PJIB,
	Modification of values F1 for PPSP70, PPSP90
	Add type PPSP320
	Add type CMS
	Modification of the hole-Ø in the bottom plates for types: PISB, PISBMAXI, PLB, PVDB, PVIB, PPB, PJPB, PJIB, PPMINI, APB7090, CPB From Ø11 to 11/12mm, or from Ø13 to 13/14mm, or from Ø17 to 17/18mm
	Rename the types
ETA-07/0314 3.0	Rename the index
	Add the new components of HD2P
	Add the characteristic capacities for the new components of HD2P
4.0	Merge of ETA-07/0314 and ETA-07/0385
	AKR – new values / nail pattern ; thickness 3,0mm added

	Add HD3B
	PPUP70/ PPUP90: modification of some sizes and the size of tube
	PPR, PPRB, APB : deletion of wood screwsØ12mm and anchor bolts
	PPD: modification of the values F_{R2}
	PL: modification of the values
	HD: modification of the hole diameter for the bolts (Ø of bolt + 2mm)
	HD: adding new sizes
	HD, BETA : modification the values to ($R_{1,k} = A_{gross}$ x 233N/mm²)
	Add possibility for installation of some Hold Downs on a timber floor
	Add the new components of HD2P
	Add the characteristic capacities for the new components of HD2P
5.0	Add PU /EMBU
	Modification of load values of PIS/PISB/PISMAXI/PISBMAXI
	Add CPT
	Add ABW
	Add APR110/150
	Add PBH75 / PBH120
	AKR: add new size 205; adding new nail pattern
	AH16050: adding new load application table
	PPD: Add no. + size of nails, add min. concrete type, add load table for “C20”
	APB100/150: adjust name table
	PPRC: update Zinc coating
	HD3B: include sizes into the drawing
	HE-anchor: adjust formula
6.0	Ensure overall consistency of the ETA, changing all drawings, notations, tables
	Replace all modified characteristic capacities by characteristic capacities
	Add ZM310 as an alternative coating
	Add new post bases TPB, PIBA110/160, PB3B, PB3C
	Add new hold-downs HTT22E, HTT31, HD2P-U379S80, MAH, SCMF
	Add steel posts OSP, OSPS
	Add stiffness of HTT, HTT22 ductility class and values for HTT4&5 with washer
	Add stiffness of AKR
	Merge capacity tables of PPD
	Change the geometry of plates of PPMini, update of the capacities
	Change the geometry of plates of PPA, PBL, PPSP130, PPUP, update of the capacities
	Update APB7090 capacities
7.0	Update AH capacities
	Bottom plate holes of PISB160&260 changed from 13 to 14 mm
	Add nail pattern for AKR245/L
	Switch char capacity to a single formula depending on kmod for APB7090 FPB PBS PPA PPS PPSDT PPSP
	Add SP9 / SPS9 as top part for OSP / OSPS
	Add PPSDT170IX as new version of PPS170IX
	Add PLO1
	Add PP18/24B and PP18/24S
	Add PBW
	some small modifications and corrections
	HD2P, and: additional option for modification of hole pattern and sizes.
	HTT – adjustment of formula for Zyklop

8.0	Add generally guideline for bolts with hold downs for pure tension connections
	Add additional length for PP18 > as PPxx/yy
	PLO1 – update of dimension table, add missing sizes
	Add PPC
	OSP, option for alternative hole diameter for SP6, SP7 and SP8
	Add additional option/nail pattern (no21) for KR
	Add additional fixing of AKR-range with anchors
	Add some additional explanation for some products
	To correct some typing errors
9.0	All - Minor typos and Table formatting etc. corrected
	Part II, chap. 1 Colored connectors added
	D5.1 APRN100/150 added
	D9 FPB – Capacity in Table D9-3 FPB x/2.5 corrected (typo)
	D40 PPxx/yy – Product names and capacities in Table D40-3 corrected
	D43 PPC – Capacities in Table D43-3 corrected
	D44 PBWS & PBWSL Post Base added
	D51 PPC deleted (duplicate of D43)
	D60 AH – Table D60-3 explanation text added
	D61 AKR – Capacities in Table D61-11/12/13/14 corrected
	D63 – HD240M12 and HD280M12 added in Table D63-4 (typo)
	D64 HD2P – Table D64-1+3 optional 3xØ6 holes added
	D68 HTT – value for steel failure added to formulas with washer for HTT4 & HTT5
	D68 HTT – Ductility class added for HTT22 and HTT22E
	D72 DTT2Z Hold Down added
10.0	All - Minor types and Table formatting etc. corrected
	additional zinc coating for some post bases: Fe/Zn10/A and Fe/Zn12/A
	additional option for timber screws instead of bolts (page 19)
	D3: additional Type APB: APB MINI
	D25: modification of sizes and capacities PPB
	D68: HTT22E, additional information about beginning of nailing (top or down) for the capacity
	D69: MAH, additional option for fixing on rigid support with an intermediate timber layer
	D71: additional Types SCMF
	D73: additional hold down HDCLT140

Table with the product names and alternative names

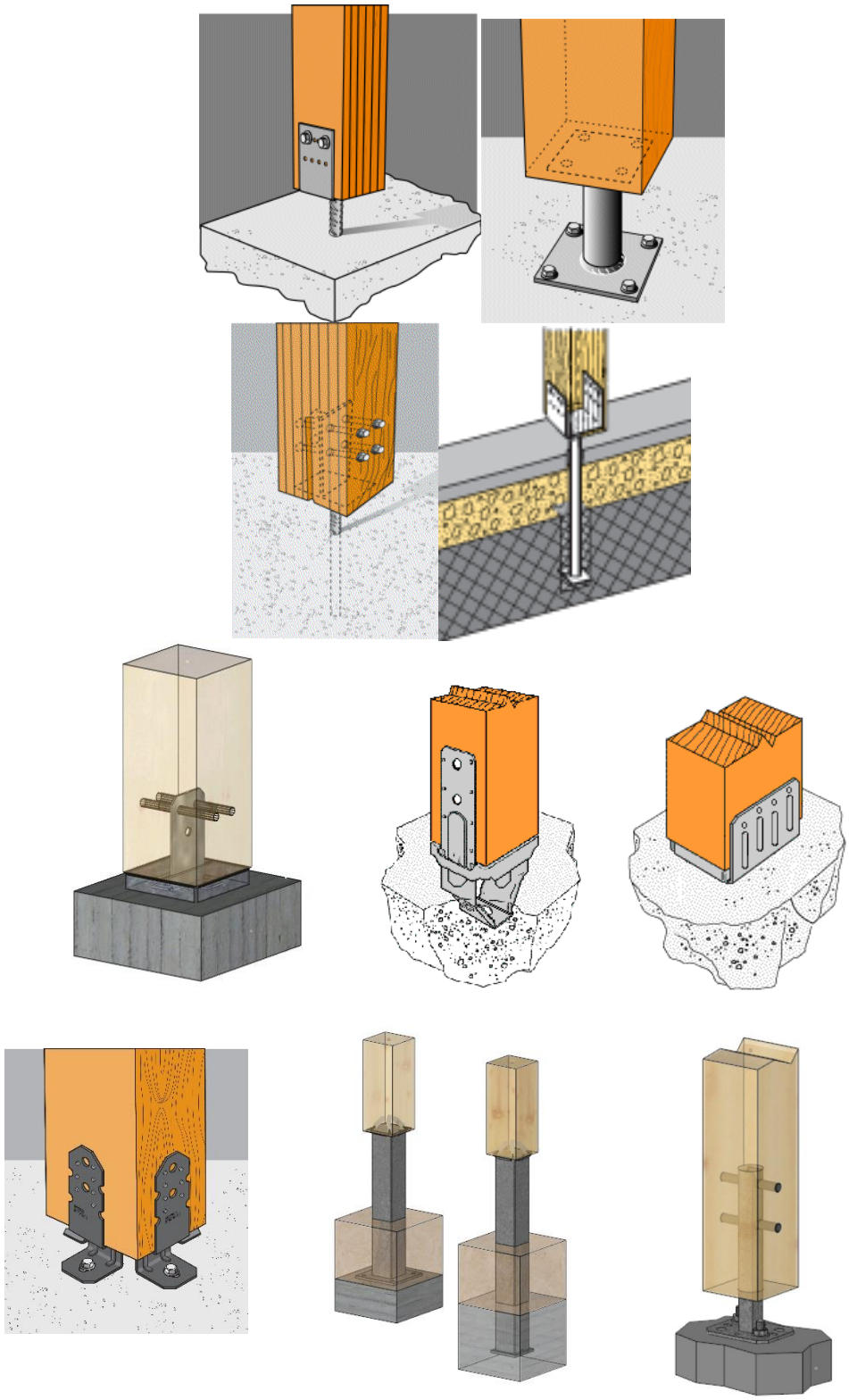
Alternative names are given for each product in annex D

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 add at the end of name following letter and/or combinations.

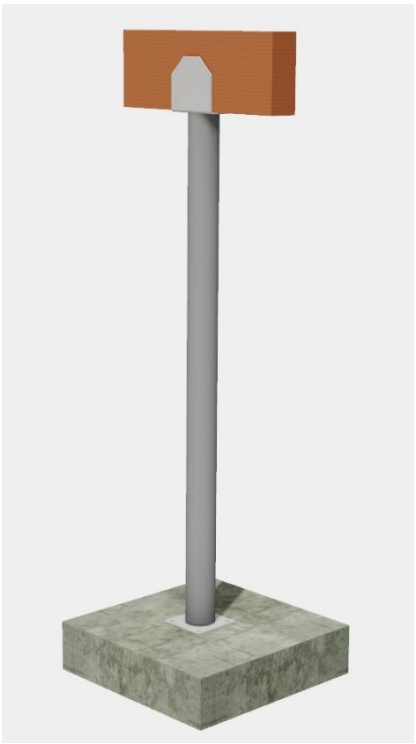
G	= galvanized
S or S2 or IX	= Stainless or Inox
HCR	= High Corrosion Resistant steel
Z	= ZM310 or other coating
-K	= Kit; incl. fasteners
-B	= without Barcode
-R	= Retail

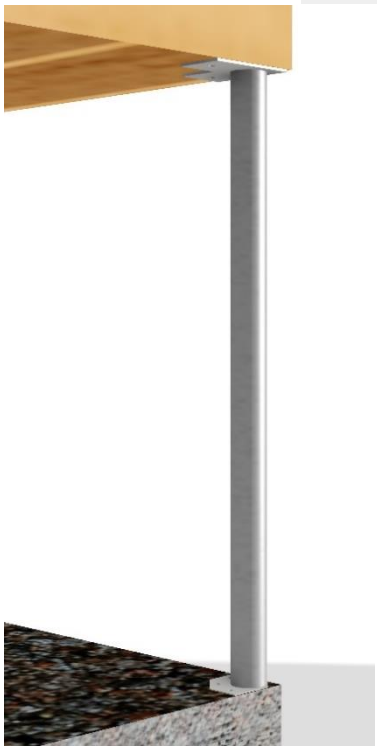
Annex B Typical Installation

B1 Typical installation post bases

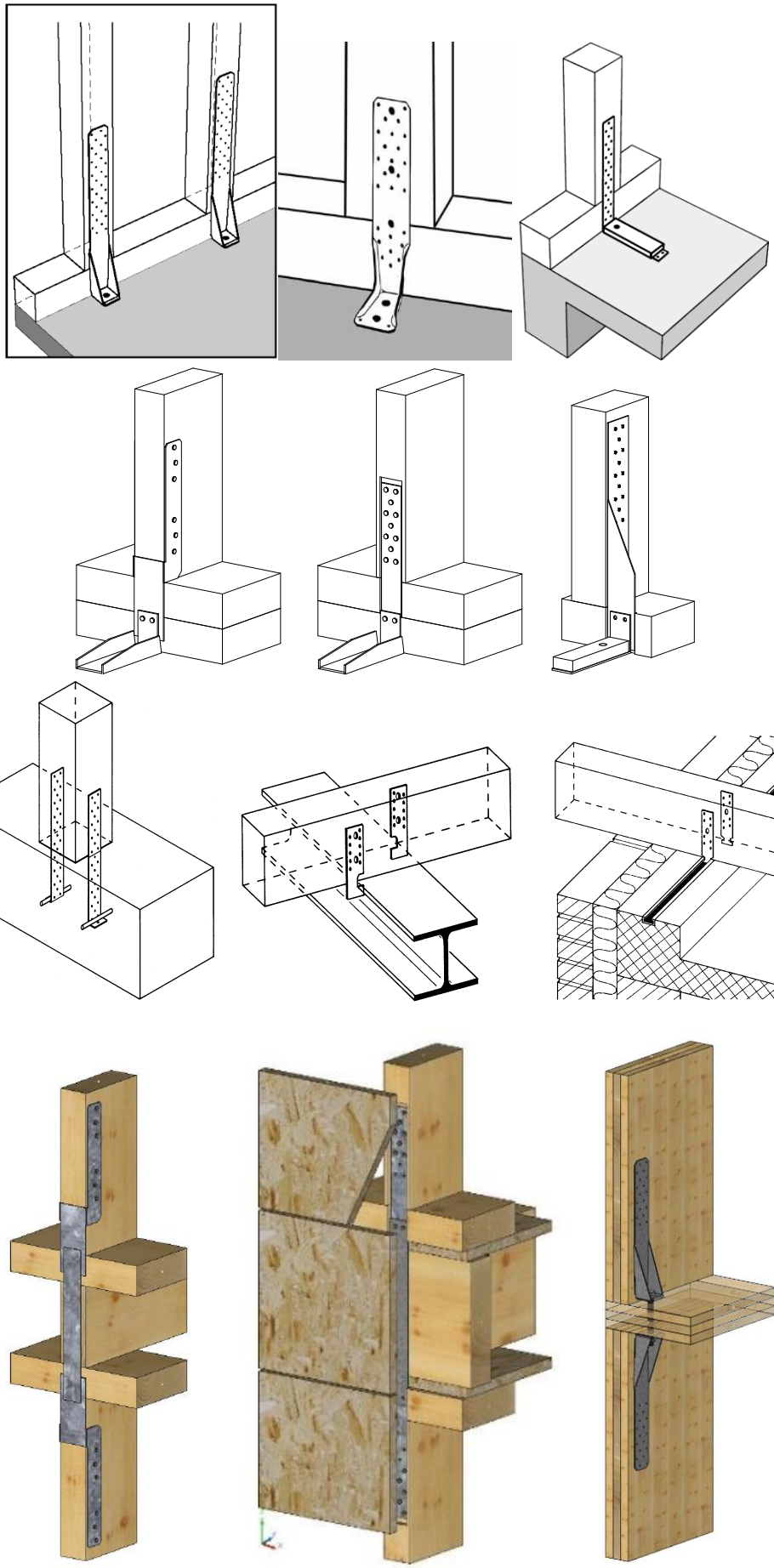


B2 Typical installation of steel column





B3 Typical installation hold down



Annex C Basis of design

C0 Symbols used in the ETA-07/0285

For the purpose of ETA-06/0270, the following symbols apply.

C1 Design Basis - general

The design value of load-bearing capacity R_d are calculated from characteristic capacity R_k as following:

$$R_d = \frac{R_k \times k_{mod}}{\gamma_m}$$

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

In some cases, R_k includes a k_{mod}^i factor, then the formula above is still valid.
For example:
Post-base CPT44Z characteristic capacity: $R_{1.k} = 49.7 / k_{mod}^{0.5}$
The associated design value is: $R_{1.d} = \frac{(49.7/k_{mod}^{0.5}) \times k_{mod}}{\gamma_m}$

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

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/m^3 and 350 is the characteristic density for timber class C24 in kg/m^3.

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

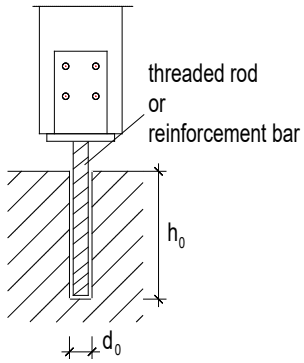
Concrete

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, 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 (acc. ETA-11/0360) or Simpson Strong-Tie ® AT-HP™ (accETA-14/0383(thread) ETA-11/0139 (rebar)). The design of the anchorage installation shall be performed in accordance with the latest versions of the equivalent European technical approval (ETA).

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

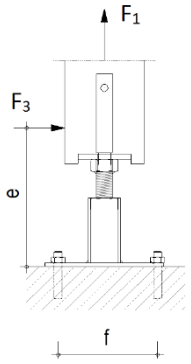
Unless otherwise indicated in the calculations the holes in the post bases have to be fully applied with the applicable fasteners. The fastener types for which the calculations have been made are stated at each post base.
The nail pattern shall be as described in Annex D. The fastener types for which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

Hold downs and post bases, which are only have to take a vertical tension load – or a constructive fixing- , can also be with a smaller diameter instead of d_{hole} -2mm. In this case have to be use an extra additional washer to make sure, that the tension load can take by the anchor / bolt.

Bolts can also be replaced by wood screws, provided that proof of load-bearing capacity is provided and the compressive strength of the wood is taken into account.

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:
$F_{axial,bolt} = F_3 \times e / f$

$F_{lateral,bolt} = F_3 / n$

For an uplift load:

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

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

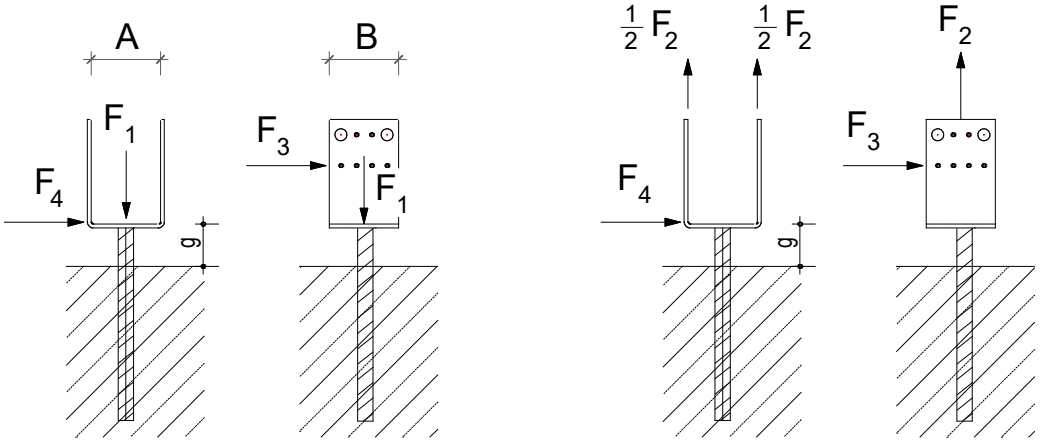


Figure C2a.Typical connection with notation for loads. The actual force directions are indicated for each post base

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
F_3 Load-carrying capacity for lateral load acting in the centre of the post in line with the lower row of holes
F_4 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, F_3 and F_4.
For combinations of loads, the following equation shall be fulfilled, unless otherwise indicated.

$$\sum_i \left(\frac{F_i}{R_i}\right) \leq 1.0$$

For horizontal loads F_3 and F_4 acting simultaneously the resulting horizontal load shall be calculated as

$$F_{3/4} = \sqrt{F_3^2 + F_4^2}$$

C2b Forces directions for hold downs

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

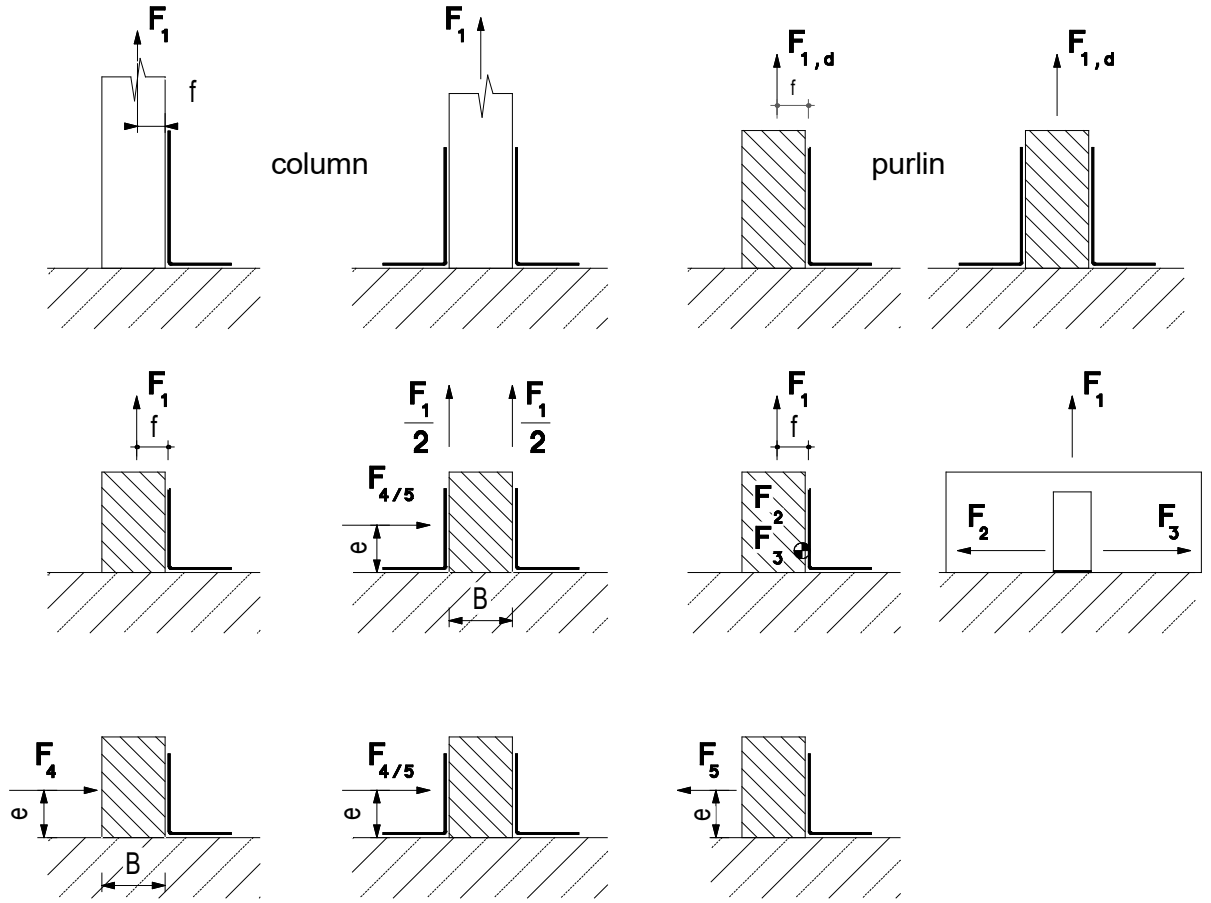


Figure C2b: Forces and their assumed positions. Top row for Hold Downs only subjected to a lifting force. Bottom rows for Hold Downs subjected to both eccentric lifting forces and lateral forces.

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:

$$\sum_{1-i}\left(\frac{F_{i,d}}{R_{i,d}}\right) \le 1{,}0$$

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

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. 6*d*, 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 / Stainless steel
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 / Impreg®+/Impreg®X4
Wood screw	10.0	-	Electroplated zinc / Impreg®+/Impreg®X4
Wood screw	12.0	-	Electroplated zinc / Impreg®+/Impreg®X4
Wood screw	16.0	-	Electroplated zinc / Impreg®+/Impreg®X4
Screw	6.0	≥60	Electroplated zinc
Screw	5.0	≥80	Electroplated zinc
Dowel	8.0	-	Electroplated zinc/ Hot-dip galvanized
Dowel	10.0	-	
Dowel	12.0	-	
Shear plate connector type C2 or C11	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		
Self-drilling screws such as JT2-3-5.5x25 or SD6-H15-5.5x22	5.5	25	See the manufacturer. Under service class 1&2 condition. it can be assumed the intended working life of these fasteners is 50 years according to EN1995-1-1 table 4.1

* According to an ETA

Annex D Product definition and capacities

Post Bases

D1: ABE

Product name	Alternative names
ABE	

Figure D1-1: Drawings

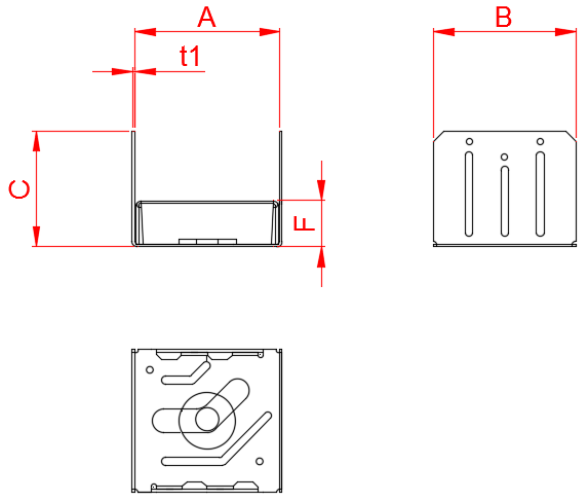


Table D1-1: Size specification

Model	Product dimensions [mm]					Holes			
	A	B	C	F	t_1	Qty	size	Qty	size
ABE44	90	89	71	28	1.5	6	Ø4	1	Ø14
ABE46	90	138	103	26.5	1.5	8	Ø4	1	Ø17
ABE66	140	138	79	26.5	1.5	8	Ø4	1	Ø17

Table D1-2: Material specification

Part	Material Grades	Coating specification
ABE	G90 SS Grade 33 according to ASTM A-653	Hot-dip galvanized according to EN ISO 1461:1999
	or stainless steel as described	

Table D1-3: Characteristic capacity

Model	Fastener				Characteristic capacities [kN]						
	On post		On concrete		$R_{1.k}$	$R_{2.k}$					
						Load duration					
	Qty	Type	Qty	Type		P	L	M	S	I	
ABE44	6	ARS3.1	1	Ø12	63.3	6.7					
	6	S3.75				7.1	7.8 / k_{mod}				
ABE46	8	CN3.7	1	Ø16	81.4	15.8					
	8	S4.0				11					
ABE66	8	CN3.7	1	Ø16	130.9	15.8					
	8	S4.0				11					

*Fasteners on timber post:
ARS3.1: Annular ring shank nail 3.1x35
CN3.7: Connector nail 3.7x50
S3.75: Smooth nail 3.75x75
S4.0: Smooth nail 4.0x90

D2: ABW

Product name	Alternative names
ABW44Z	
ABW44RZ	
ABW66Z	
ABW66RZ	

Figure D2-1: Drawings

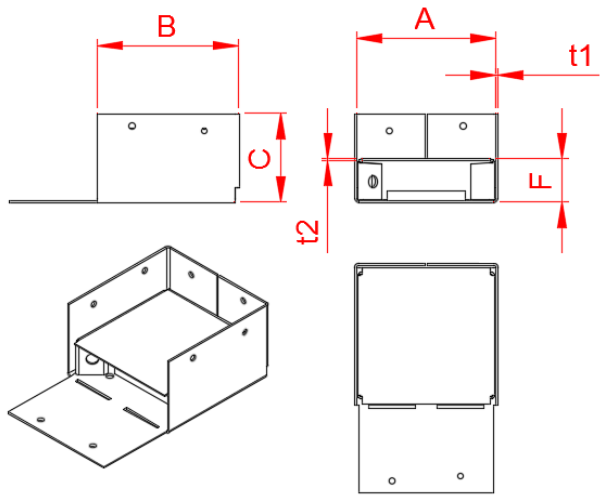


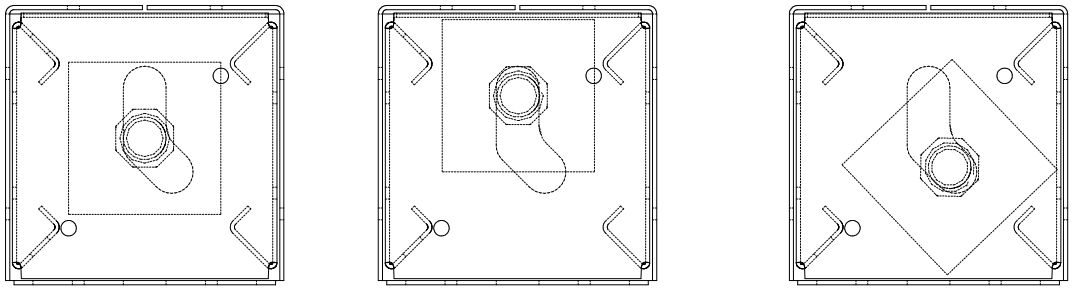
Table D2-1: Size specification

Model	Product dimensions [mm]							Holes			
								Top		Bottom	
	A	B	C	F	washer	t_1	t_2	Qty	size	Qty	size
ABW44Z	90.5	90.5	63.5	25.4	50x50x3.5	1.5	1.6	1	Ø5	1	Ø14
ABW44RZ	101.6	101.6	50	25.4	50x50x3.5	1.5	1.6	1	Ø5	1	Ø14
ABW66Z	139.7	139.7	76.2	25.4	76x76x6.0	1.8	2.7	1	Ø5	1	Ø14
ABW66RZ	152.4	152.4	71.4	25.4	76x76x6.0	1.8	2.7	1	Ø5	1	Ø14

Table D2-2: Material specification

Part	Material Grades	Coating specification
ABW	SS Grade 33 according to ASTM A653	G185 according to ASTM A653 Corresponding to ~40µm G90 for washer 50x50x3.5mm Corresponding to ~20µm

Figure D2-3: Anchor and washer position



The anchor and the washer can be set as in one of the three configuration shown above
After the timber post is set in place and the anchor bolt is tighten, the front flap has to be fold up.

Table D2-4: Characteristic capacity

					Characteristic capacities [kN]	
Model	Fasteners				$R_{1.k}$	$R_{2.k}$
	On post		On concrete			
	Qty	Type	Qty	Type		
ABW44Z	8	Ø3.75x75	1	Ø12	53.9	3.1
ABW44RZ	8	Ø3.75x75	1	Ø12	58.2	-/-
ABW66Z	12	Ø4x90	1	Ø12	105.9	7.4
ABW66RZ	12	Ø4x90	1	Ø12	110.4	min(6.6 ; 6.9/k_{mod})

For combined forces the following formula has to be checked: $\Sigma\ (F_{i.d} / R_{i.d}) \leq 1$
The bolt anchor shall have a minimum capacity of 1.0 x $F_{2.d}$.

D3: APB100-150 / APB MINI

Product name	Alternative names
APB100/150	
APB100/150Z	
APB MINI	
APB MINI Z	

Figure D3-1: Drawings

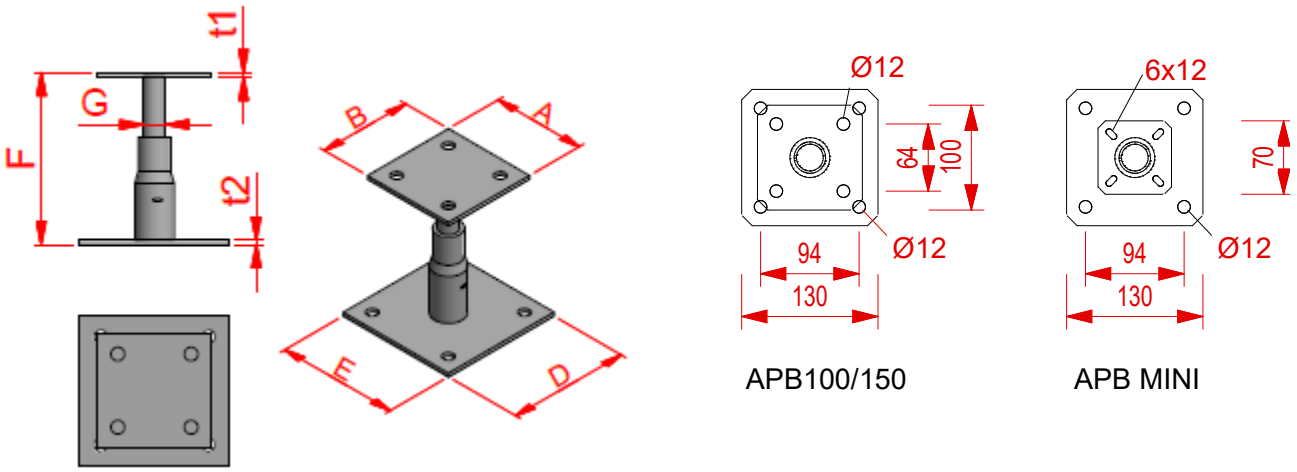


Table D3-1: Size specification

Model	Product dimensions [mm]							Holes			
								Top		Bottom	
	A	B	D	E	F	G	$t_1 = t_2$	Qty	size	Qty	size
APB100/150	100	100	130	130	100-150	20	4	4	Ø12	4	Ø12
ABP MINI	70	70	130	130	100-150	20	4	4	6x12	4	Ø12

Table D3-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A Type ….Z: Zinc Nickel galvanization plus top coating
Tube	S235 JRH according to EN 10219	
Threaded rod	Steel class 4.6 according to ISO 898	
	Or stainless steel as described	

Table D3-3: Characteristic capacity

					Characteristic capacities [kN]
Model	**Fasteners**				**$R_{1.k}$**
	On post		**On concrete**		
	Qty	**Type**	**Qty**	**Type**	
APB100/150	4	Ø10	4	Ø10	58.0 / $k_{mod}^{0.5}$
ABP MINI	4	Ø6	4	Ø10	

D4: APB7090/100

Product name	Alternative names
APB7090/100	

Figure D4-1: Drawings

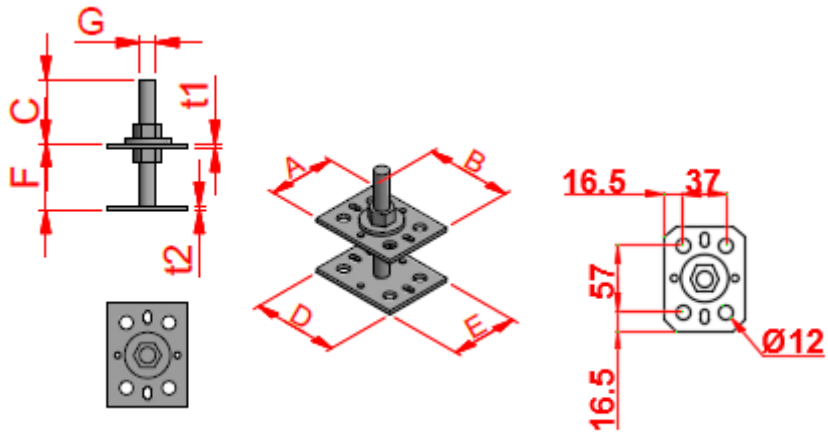


Table D4-1: Size specification

Model	Product dimensions [mm]								Holes							
									Top				Bottom			
	A	B	C	D	E	F	G	$t_1 = t_2$	Qty	size	Qty	size	Qty	size	Qty	size
APB7090/100	90	70	84-24	90	70	30-90	14	4	4	Ø11	4	Ø6	4	Ø11	4	Ø6

Table D4-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A Type ….Z: Zinc Nickel galvanization plus top coating
Threaded rod	Steel class 4.6 according to EN/ISO 898	
	Or stainless steel as described	

Table D4-3: Characteristic capacity

Model	Fasteners				Timber grain direction / load	Characteristic capacities [kN]
	On post		On concrete			$R_{1.k}$
	Qty	Type	Qty	Type		
APB7090/100	4	Ø10	4	Ø10	parallel	$21.7/k_{mod}^{0.75}$
					perpendicular	$\min(21.7/k_{mod}^{0.5}\ ;\ 16.3/k_{mod})$

D5: APR110/150

Product name	Alternative names
APR110/150	

Figure D5-1: Drawings

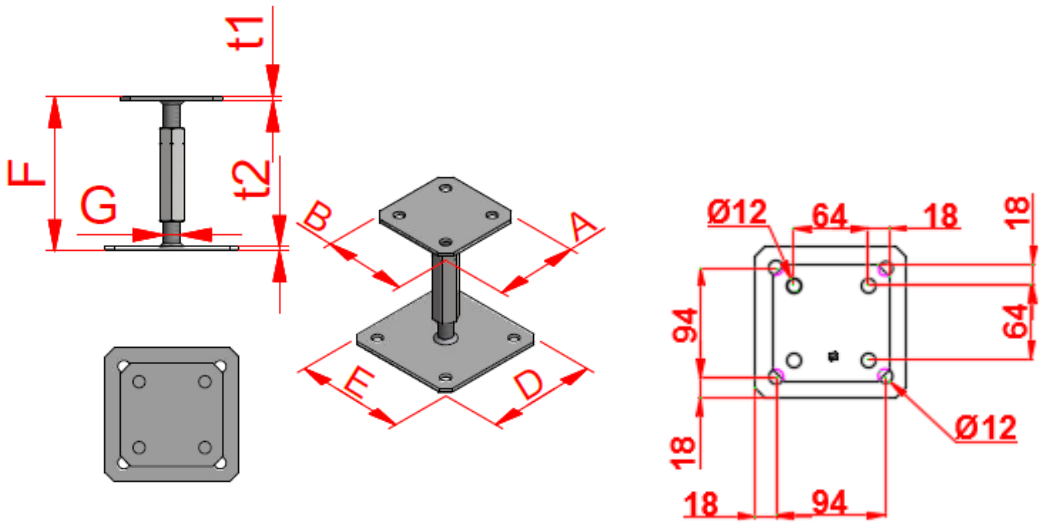


Table D5-1: Size specification

Model	Product dimensions [mm]							Holes			
								Top		Bottom	
	A	B	D	E	F	G	$t_1 = t_2$	Qty	size	Qty	size
APR110/150	100	100	130	130	110-150	16	4	4	Ø12	4	Ø12

Table D5-2: Material specification

Part	Material Grades	Coating specification
Plate	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc)
Tube	C15RPb according to EN10084	
Threaded Rod	steel class 4.6 according to ISO 898	
	Or Stainless steel as described	

Table D5-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On post		On concrete		
	Qty	Type	Qty	Type	$R_{1.k}$
APR110/150	4	Ø10	4	Ø10	36.7

D5.1: APRN100/150

Product name	Alternative names
APRN100/150	

Figure D5.1-1: Drawings

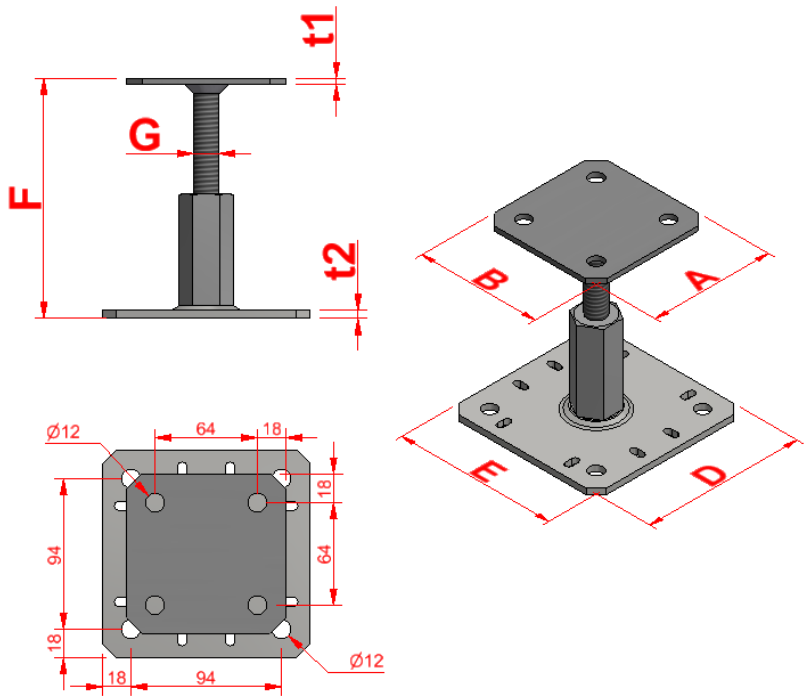


Table D5.1-1: Size specification

Model	Product dimensions [mm]								Holes					
									Top		Bottom			
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size	Qty	size
APRN100/150	100	100	130	130	100-150	16	4	5	4	Ø12	4	Ø12	8	Ø6x12

Table D5.1-2: Material specification

Part	Material Grades	Coating specification
Plate	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A Type ….Z: Zinc Nickel galvanization plus top coating
Nut	C15RPb according to EN10084	
Threaded Rod	steel class 4.6 according to ISO 898	
	Or Stainless steel as described	

Table D5.1-3: Characteristic capacity

					Characteristic capacitiy [kN]
	Fasteners				
	On post		On concrete		$R_{1.k}$
Model	Qty	Type	Qty	Type	
APRN100/150	4	Ø10	4	Ø10	46,1 / kmod^0.5

D6: CMR & CMS

Product name	Alternative names
CMR	
CMS	

Figure D6-1: Drawings

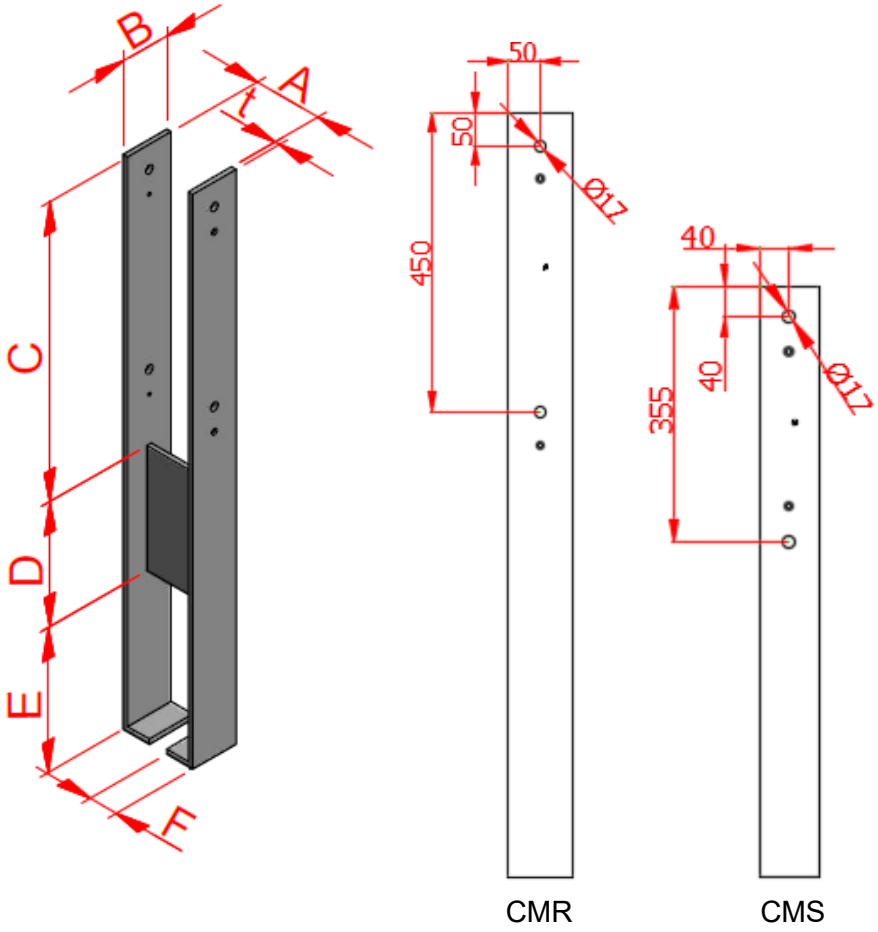


Table D6-1: Size specification

Model	Product dimensions [mm]							Holes			
								Top			
	A	B	C	D	E	F	t	Qty	size	Qty	size
CMR	115-165	100	625	250	300	60	10	4	Ø17	4	Ø6.5
CMS	80-140	80	470	150	200	40	8	4	Ø17	4	Ø6.5

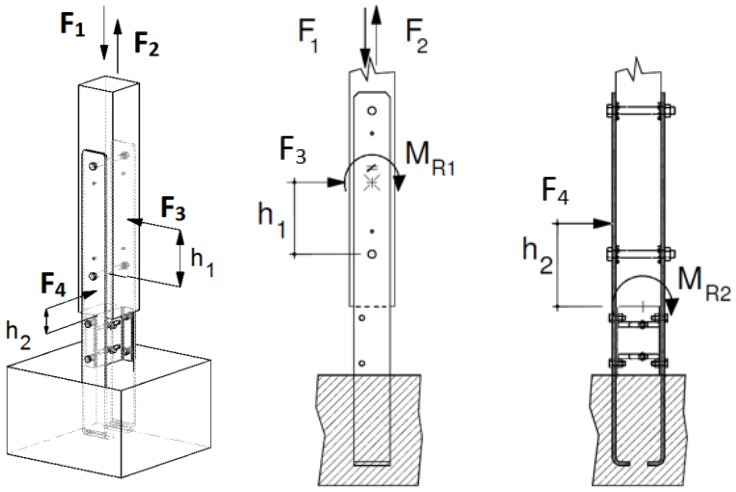
Table D6-2: Material specification

Part	Material Grades	Coating specification
CMR-CMS	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
	Or stainless steel as described	

Table D6-3: Characteristic capacity – for concrete C12/16

Model	Fasteners On post Qty	Fasteners On post Type	Timber size (mm)	Characteristic capacities [kN] $R_{1.k} = R_{2.k}$	$R_{3.k}$ for h_1 = 200 mm	$R_{4.k}$ for h_2 = 0 mm	$M_{r1.k}$	$M_{r2.k}$
CMR	2 + 4	bolt Ø16 + C2-75	115	117.2	min(99; 21.3/k_{mod})	min(33; 30.9/k_{mod})	min(19.8; 13.9/k_{mod})	6.7
			120					7
			125					7.3
			140					8.2
			150					8.8
			160					9.4
CMS	2 + 4	bolt Ø16 + C2-62	80	96.7	min(74; 15.0/k_{mod})	min(21.1; 19.8/k_{mod})	min(11.6; 7.1/k_{mod})	3.9
			100					4.8
			120					5.8
			140					6.8

The post-base shall be embedded in concrete in depth equal to dimension E.



For a load F_3 acting at the height h_1 > 200 mm for CMR (for CMS h_1 > 157mm) the load carrying capacity shall not be taken as higher than:

For CMR : $R_3(h) = R_3(200) * 200 / h_1$.
For CMS: $R_3(h) = R_3(157) * 157 / h_1$.

For a load F_4 acting at the height h_2 > 0 mm, the load carrying capacity shall not be taken higher than:

$R_4(h) = ½ R_4 * a / h_2$.

where:
a is 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 F_3 acting simultaneously it should be verified that $(F/R_{1/2})^2 + (F_3/R_3)^2 \leq 1$

For a vertical load F (either F_1 or F_2) and a horizontal load F_4 in the height h acting simultaneously it should be verified that $R_4(h) \leq M_{r2} / (h\,(1 - F / R_1))$

For combined loads the following check shall be made:

$$\left(\frac{F_{1/2.d}}{R_{1/2.d}}\right)^2 + \left(\frac{F_{3.d}}{R_{3.d}} + \frac{M_{1.d}}{M_{r1.d}}\right)^2 \leq 1$$

$$\left(\frac{F_{1/2.d}}{R_{1/2.d}} + \frac{M_{2.d}}{M_{r2.d}}\right)^2 + \left(\frac{F_{4.d}}{R_{4.d}}\right)^2 \leq 1$$

D7: CPB & CPS

Product name	Alternative names
CPB	CPB40
CPS	CPS40

Figure D7-1: Drawings

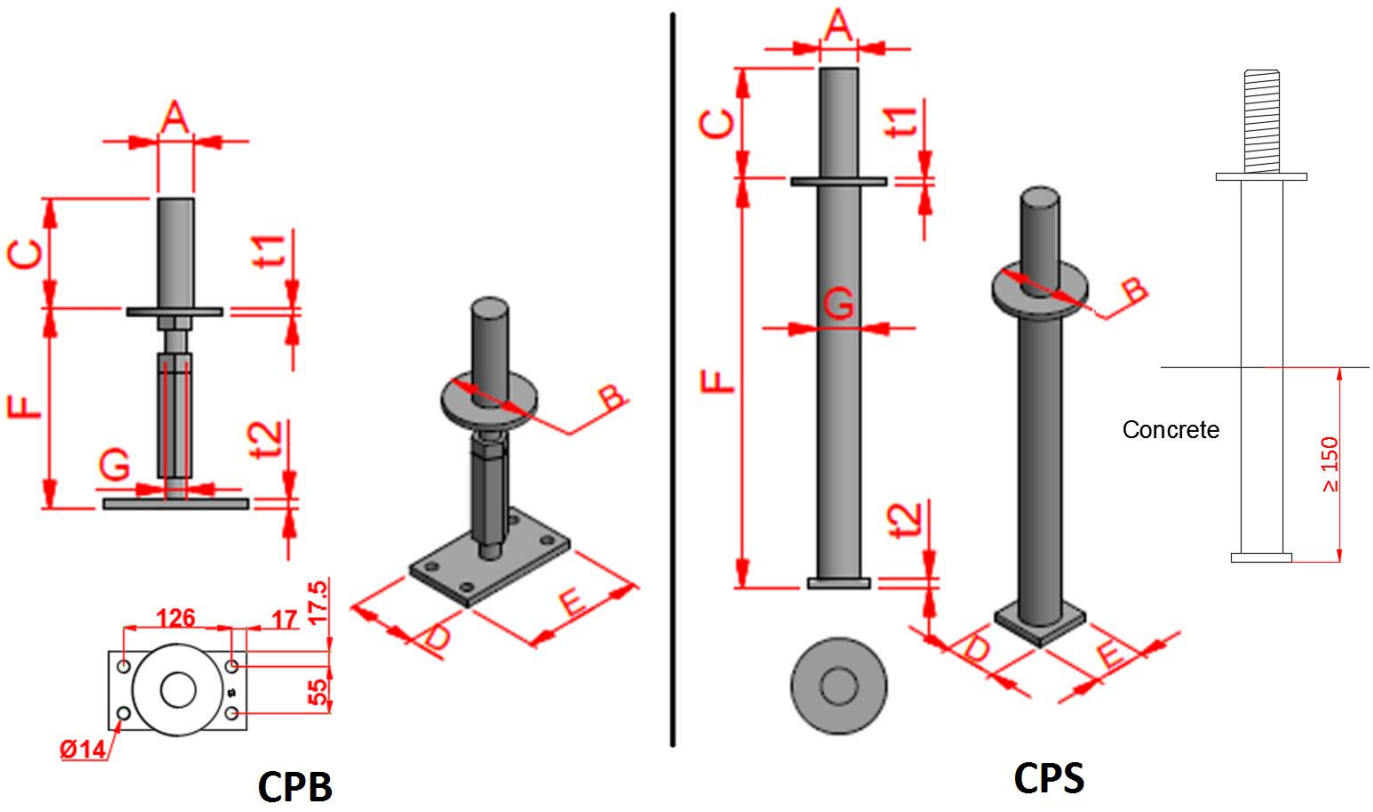


Table D7-1: Size specification

Model	Product dimensions [mm]									Holes Bottom	
	A	B	C	D	E	F	G	t_1	t_2	Qty	size
CPB	40	105	120	160	90	190-250	24	8	10	4	Ø14
CPS	40	105	120	70	70	450	48	8	10		

Table D7-2: Material specification

Part	Material Grades	Coating specification
Plates & tube	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Threaded rod	S355JO according to EN 10025	
	Or stainless steel as described	

The part with the length “C” is with a coarse thread, the hole for this thread in the timber column shall be made with Ø40mm.

Table D7-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]						
	On concrete		$R_{1.k}$	$R_{1.k}$ **	$R_{2.k}$	$R_{2.k}$ **	$R_{3.k} = R_{4.k}$		
							f		
	Qty	Type					190	250	
CPB	4	Ø12	$61/k_{mod}$	-	23.7	13.8	$1.7/k_{mod}$	$1.4/k_{mod}$	-
CPS	-	-	min(170.3; $118.7/k_{mod}$)	110.7	23.7	13.8	-	-	min(7.2 ; $5.2/k_{mod}$)

** In cases where the post base can be submitted to uplift AND download
f is the distance between concrete surface and post surface

For vertical load F_1 and horizontal load F_3 or F_4 acting simultaneously it shall be verified that:

$F_1 / R_{1.d} + F_{3/4} / R_{3/4.d} \leq 1$

D8: CPT

Product name	Alternative names
CPT44Z	
CPT66Z	
CPT88Z	

Figure D8-1: Drawings

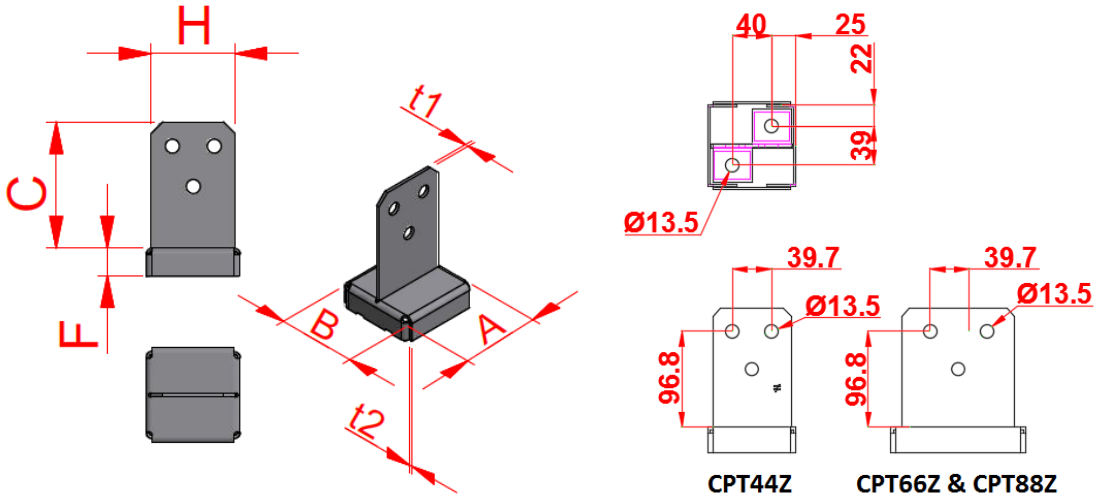


Table D8-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	C	F	H	washer	t_1	t_2	Qty	size	Qty	size
CPT44Z	88.9	88.9	145	25.4	79.4	35.7x28.6x3.5	3.5	2.7	3	Ø13.5	2	Ø13.5
CPT66Z	136.5	136.5	145	25.4	114	35.7x28.6x3.5	3.5	2.7	3	Ø13.5	2	Ø13.5
CPT88Z	184	184	145	25.4	114	35.7x28.6x3.5	3.5	2.7	3	Ø13.5	2	Ø13.5

Table D8-2: Material specification

Part	Material Grades	Coating specification
CPT	steel SS Grade 33 according to ASTM A653	G185 according to ASTM A653 Corresponding to ~40µm

Figure D8-2: Steel dowel pattern

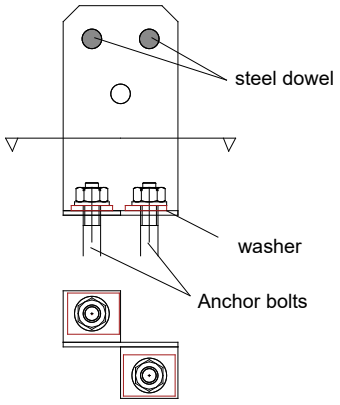


Table D8-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]			
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	Qty	Type				
CPT44Z	2	Ø13x70	2	Ø12	$49.7/k_{mod}^{0.5}$	$10.1/k_{mod}$	7.3	$\min(4.9; 3.5/k_{mod})$
CPT66Z	2	Ø13x121	2	Ø12	$76.3/k_{mod}^{0.5}$	$14.7/k_{mod}$	$\min(R_{2.k} \times 0.7; 9.1)$	$\min(6.9; 5.0/k_{mod})$
CPT88Z	2	Ø13x121	2	Ø12	$103.0/k_{mod}^{0.5}$	$14.7/k_{mod}$	$\min(R_{2.k} \times 0.7; 9.1)$	$\min(6.9; 5.0/k_{mod})$

For combined forces the following formula has to be checked: $\Sigma\ (F_i / R_{i.d}) \leq 1$

Model	Minimum anchor capacity per anchor		
	$F_{2.d}$	$F_{3.d}$	$F_{4.d}$
CPT44Z	$0.88 \times F_{2.d}$	$1.76 \times F_{3.d}$	$2 \times F_{3.d}$
CPT66Z			$1.1 \times F_{3.d}$
CPT88Z			

D9: FPB

Product name	Alternative names
FPB	

Figure D9-1: Drawings

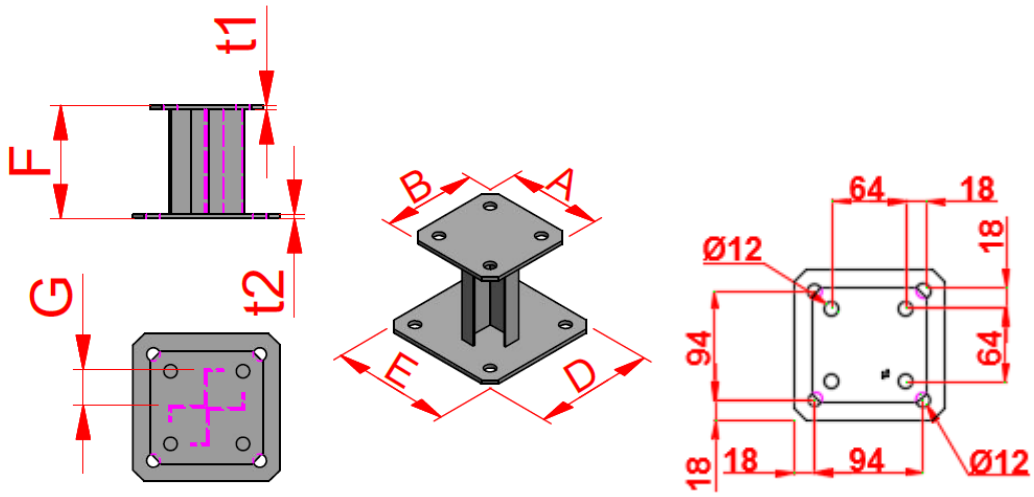


Table D9-1: Size specification

Model	Product dimensions [mm]							Holes			
								Top		Bottom	
	A	B	D	E	F	G	$t_1 = t_2$	Qty	size	Qty	size
FPB100/2 – FPB100/2IX	100	100	130	130	100	31	2	4	Ø12	4	Ø12
FPB150/2 – FPB150/2IX	100	100	130	130	150	31	2	4	Ø12	4	Ø12
FPB100/2.5 – FPB100/2.5IX	100	100	130	130	100	32	2,5	4	Ø12	4	Ø12
FPB150/2.5 – FPB150/2.5IX	100	100	130	130	150	32	2,5	4	Ø12	4	Ø12

Table D9-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Ribbed bar	B 550 BR+AC according to 10080	
	Or stainless steel 316L according to EN 10088	

Table D9-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On Post		On Concrete		$R_{1.k}$
	Qty	Type	Qty	Type	
FPB100/2 – FPB100/2IX	4	Ø10	4	Ø10	65.9 / k_{mod}
FPB150/2 – FPB150/2IX	4	Ø10	4	Ø10	
FPB100/2.5 – FPB100/2.5IX	4	Ø10	4	Ø10	Min(90.0/$k_{mod}^{0,4}$; 77,2/k_{mod})
FPB150/2.5 – FPB150/2.5IX	4	Ø10	4	Ø10	

Capacities are also valid when FPB is turned upside down.

D10: PB3B PB3C

Product name	Alternative names
PB3B	
PB3C	

Figure D10-1: Drawings

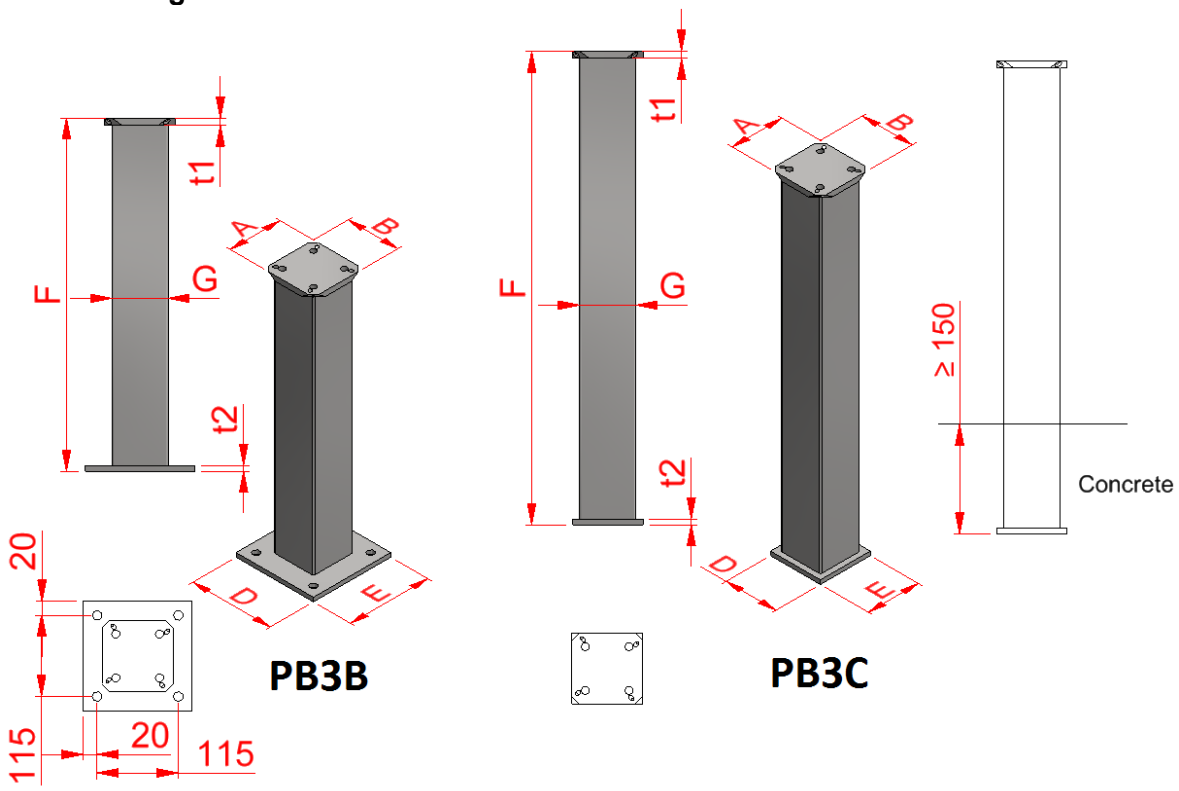


Table D10-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PB3B	100	100	155	155	500	80	8 (10)	8	4	Ø6.5	4	Ø14
PB3C	100	100	100	100	670	80	8 (10)	4	4	Ø6.5		

Table D10-2: Material specification

Part	Material Grades	Coating specification
Plates and tube	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461

Table D10-3: Characteristic capacity – for concrete C20/25

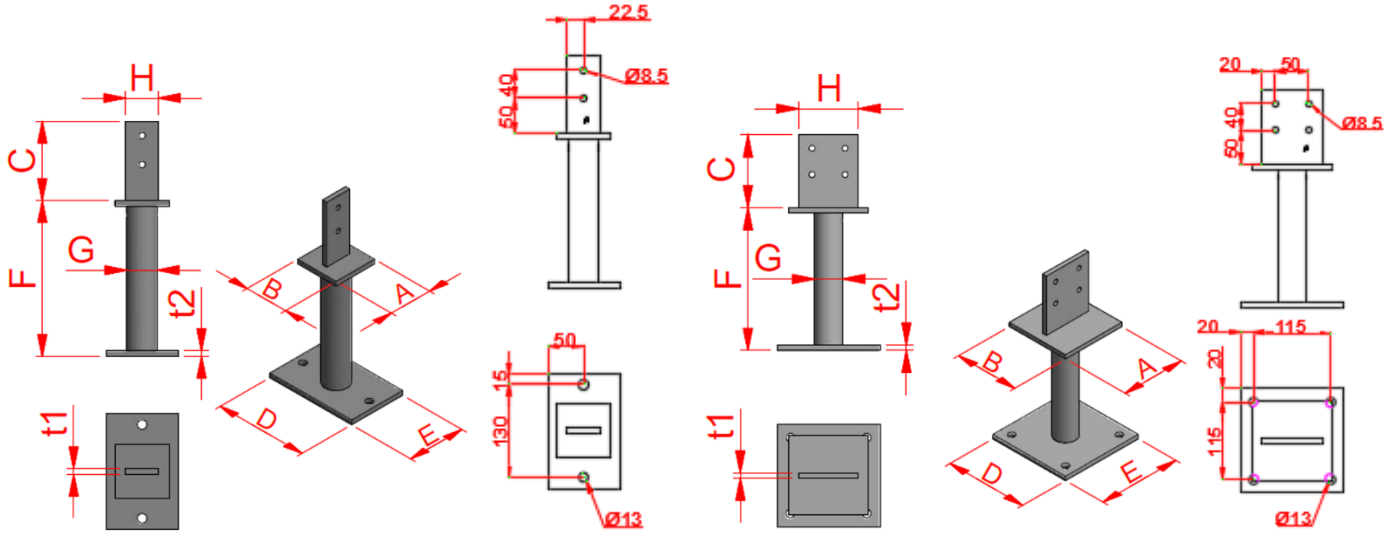
Model	Fasteners				Characteristic capacities [kN]		
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k} = R_{4.k}$
	Qty	Type	Qty	Type			
PB3B	4	Ø6	4	Ø12	202.6	2.83 x $R_{ax.sc.k}$	$R_{ax.sc.k}$
PB3C	4	Ø6			Min(202.6; 163/k_{mod})	2.83 x $R_{ax.sc.k}$	$R_{ax.sc.k}$

With $R_{ax.sc.k}$ = the axial capacitiy of screw for 45°.

D11: PBH

Product name	Alternative names
PBH75	
PBH120	

Figure D11-1: Drawings



PBH75 PBH120

Table D11-1: Size specification

Model	Product dimensions [mm]										Holes			
											Top		Bottom	
	A	B	C	D	E	F	G	H	t_1	t_2	Qty	size	Qty	size
PBH75	75	75	110	160	100	216	42	45	8	8	2	Ø8.5	2	Ø13
PBH120	120	120	110	155	155	216	42	90	8	8	4	Ø8,5	4	Ø13

Table D11-2: Material specification

Part	Material Grades	Coating specification
Plates and tube	S235JR according to EN 10025	Hot dip galvanized according to EN ISO 1461
	Or stainless steel as described	

Table D11-3: Characteristic capacity – for concrete C12/16

Model	Fasteners				Characteristic capacities [kN]				
	On post		On concrete		Timber size (mm)	$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	Qty	Type					
PBH75	2	Ø8	2	Ø12	80	min(105.5 ; 109.5 / k_{mod})	8.1	min(5.5 ; 5.4 / k_{mod})	min(5.8 ; 4.4 / k_{mod})
					100		9.5	min(6.5 ; 5.4 / k_{mod})	5 / $k_{mod}^{0,8}$
					120		10.4	min(7.1 ; 5.4 / k_{mod})	5.5 / $k_{mod}^{0,8}$
PBH120	4	Ø8	4	Ø12	80	109.5 / k_{mod}	20.7	5.4 / k_{mod}	5.5 / $k_{mod}^{0,8}$
					100				6 / $k_{mod}^{0,8}$
					120				6 / k_{mod}

D12: PBLR

Product name	Alternative names
PBLR	

Figure D12-1: Drawings

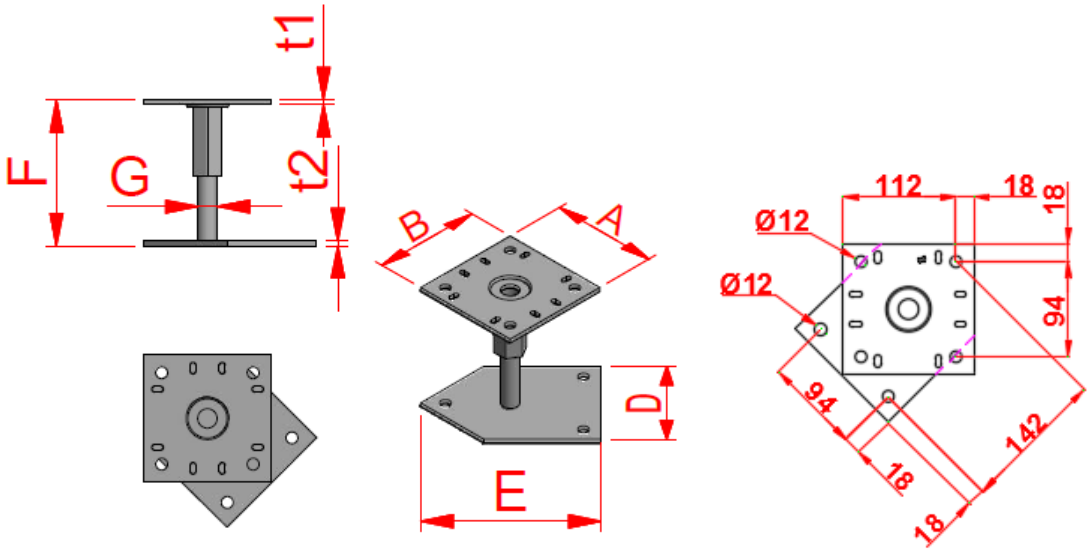


Table D12-1: Size specification

Model	Product dimensions [mm]								Holes					
									Top				Bottom	
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size	Qty	size
PBLR	130	130	130	171	110 - 150	20	5	5	4	Ø12	8	Ø6 x 12	3	Ø12

Table D12-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A Type ….Z: Zinc Nickel galvanization plus top coating
Nut	C15RPB according to EN 10084	
Rod	steel class 4.6 according to ISO 898	
	Or stainless steel as described	

Table D12-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On post		On concrete		$R_{1.k}$
	Qty	Type	Qty	Type	
PPLR	4 or 8	Ø10 or Ø6 at 45°	4	Ø10	51.1 / $k_{mod}^{0.5}$

D13: PBP60 - 50

Product name	Alternative names
PBP60/50	

Figure D13-1: Drawings

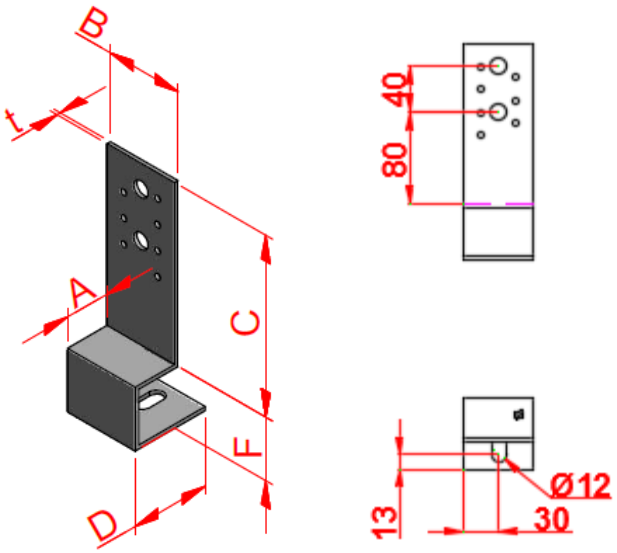


Table D13-1: Size specification

Model	Product dimensions [mm]						Holes					
							Top				Bottom	
	A	B	C	D	F	t	Qty	size	Qty	size	Qty	size
PBP60/50	35	60	140	62	49	3	2	Ø13	7	Ø5	1	Ø12 x 25

Table D13-2: Material specification

Part	Material Grades	Coating specification
PBP60/50	S235JR according to EN 10025	Sherardizing class C30 according to EN 13811 Or electroplated zinc Zn25/A according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc)
	Or stainless steel as described	

Table D13-3: Characteristic capacity

Model	No of post bases	Fasteners				Characteristic capacities [kN]	
		On post		On concrete		$R_{1.k}$	$R_{2.k}$
		Qty	Type	Qty	Type		
PBP60/50	2	4	Ø12	2	Ø10	$28/k_{mod}$	$8.3/k_{mod}$
	4	8	Ø12	4	Ø10	$63/k_{mod}$	

D14: PBS

Product name	Alternative names
PBS	

Figure D14-1: Drawings

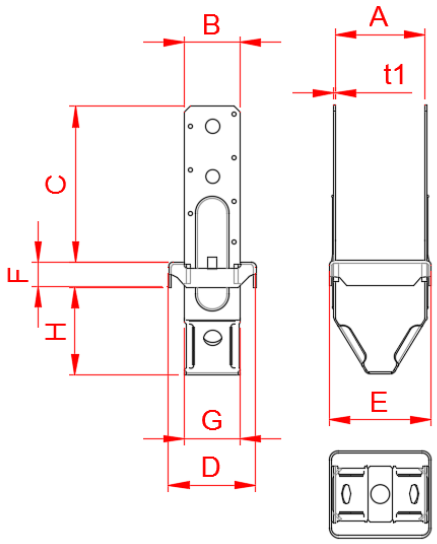


Table D14-1: Size specification

Model	Product dimensions [mm]									Holes					
										Top				Bottom	
	A	B	C	D	E	F	G	H	t_1	Qty	size	Qty	size	Qty	size
PBS44	90.5	57.2	159	89	90.5	25.4	57.2	84	2.5	4	Ø14.3	14	Ø14.3	3	Ø19.1
PBS46	90.5	57.2	159	138	90.5	25.4	57.2	84	2.5	4	Ø14.3	14	Ø14.3	3	Ø19.1
PBS66	139.5	57.5	165	136.5	139.5	25.4	57.2	120.7	2.5	4	Ø14.3	14	Ø14.3	3	Ø19.1

Table D14-2: Material specification

Part	Material Grades	Coating specification
PBS	G90 SS Grade 33 according to ASTM A-653	Hot-dip galvanized according to EN ISO 1461:1999
	Or stainless steel as described	

Table D14-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]	
	On post		$R_{1.k}$	$R_{2.k}$
	Qty	Type*		
PBS44	12	CN3.7	54.5/kmod^0.5	24
		S4		16
PBS46	12	CN3.7	57.5/kmod^0.5	24
		S4		16
PBS66	12	CN3.7	77.5/kmod^0.5	24
		S4		16

*Fasteners on timber post:
CN3.7: Connector nail 3.7x50
S4.0: Smooth nail 4.0x90

D15: PGS

Product name	Alternative names
PGS	PGS24/x

Figure D15-1: Drawings

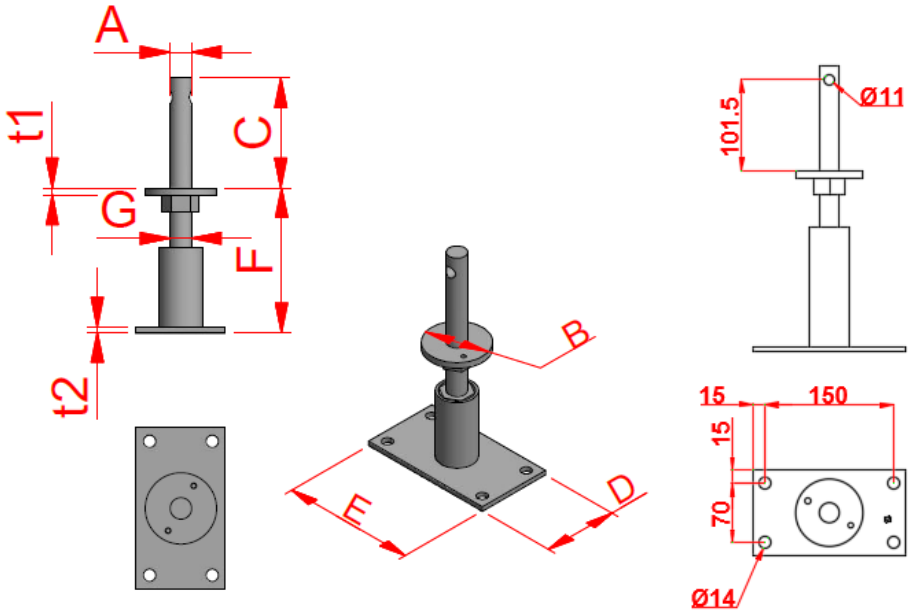


Table D15-1: Size specification

Model	Product dimensions [mm]									Holes					
										Top				Bottom	
	A	B	C	D	E	F	G	t_1	t_2	Qty	size	Qty	size	Qty	size
PGS24/130	24	80	125	100	180	100 - 195	24	8	6	1	Ø11	3	Ø6	4	Ø14
PGS24/180						180 - 245									
PGS24/230						230 - 295									
PGS24/280						280 - 345									

Table D15-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Tube	S235 JR according to EN 10219	
Threaded rod	S355 JO according to EN 10025	
	Or stainless steel as described	

Table D15-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]			
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	Qty	Type				
PGS24/130	1	Ø10x80	4	Ø12	min(96.1 ; 91.3/k_{mod})	5	2.9/k_{mod}	2.9/k_{mod}
		Ø10x100				5.6		
		Ø10x120				6.4		
		Ø10x140				7.2		
PGS24/180		Ø10x80				5		2.5/k_{mod}
		Ø10x100				5.6		
		Ø10x120				6.4		
		Ø10x140				7.2		
PGS24/230		Ø10x80				5		2.1/k_{mod}
		Ø10x100				5.6		
		Ø10x120				6.4		
		Ø10x140				7.2		
PGS24/280		Ø10x80				5		1.9/k_{mod}
		Ø10x100				5.6		
		Ø10x120				6.4		
		Ø10x140				7.2		

D16: PI

Product name	Alternative names
PI	PPI/26000; I

Figure D16-1: Drawings

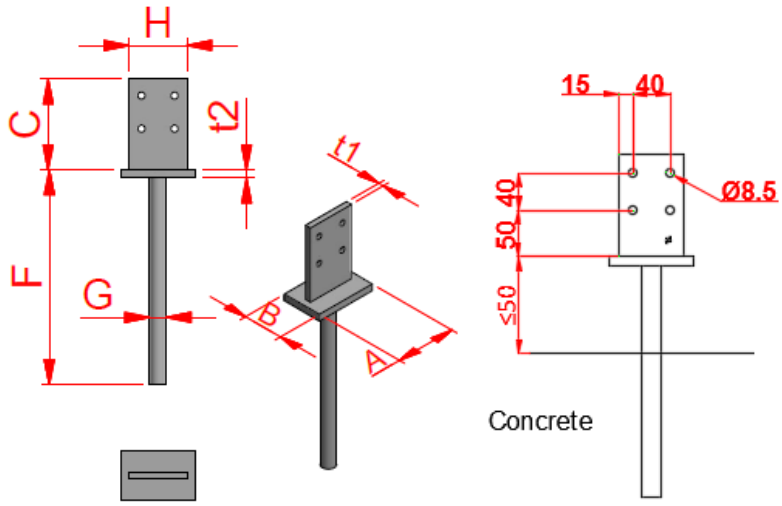


Table D16-1: Size specification

Model	Product dimensions [mm]								Holes	
									Top	
	A	B	C	F	G	H	t_1	t_2	Qty	size
PI	90	60	110	~260	20	70	8	10	4	Ø8,5

Table D16-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Ribbed bar	B 550 BR+AC according to 10080	
	Or stainless steel as described	

Table D16-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]					
	On post		$R_{1.k}$ Concrete			$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	C12/15	C16/20	C20/25			
PI	4	Ø8x60	36.9/k_{mod}	43.7/k_{mod}	min(90.0 ;54.5/k_{mod})	13.8	min(9.4 ; 7.9/k_{mod})	3.1
	4	Ø8x80				16	min(10.9 ; 7.9/k_{mod})	4.1
	4	Ø8x100				18.7	min(12.7 ; 7.9/k_{mod})	min(5.9 ; 5.3/k_{mod})
	4	Ø8x120				20.7	7.9/k_{mod}	min(7.9 ; 5.4/k_{mod})
	4	Ø8x140						min(9.4 ; 5.7/k_{mod})
	4	Ø8x160						6.3/k_{mod}

For vertical loads F_1 and horizontal loads F_4 acting simultaneously it shall be verified that:
$F_1 / R_{1.d} + F_4 / R_{4.d} \leq 1$.

D17: PIBA

Product name	Alternative names
PIBA110/160	

Figure D17-1: Drawings

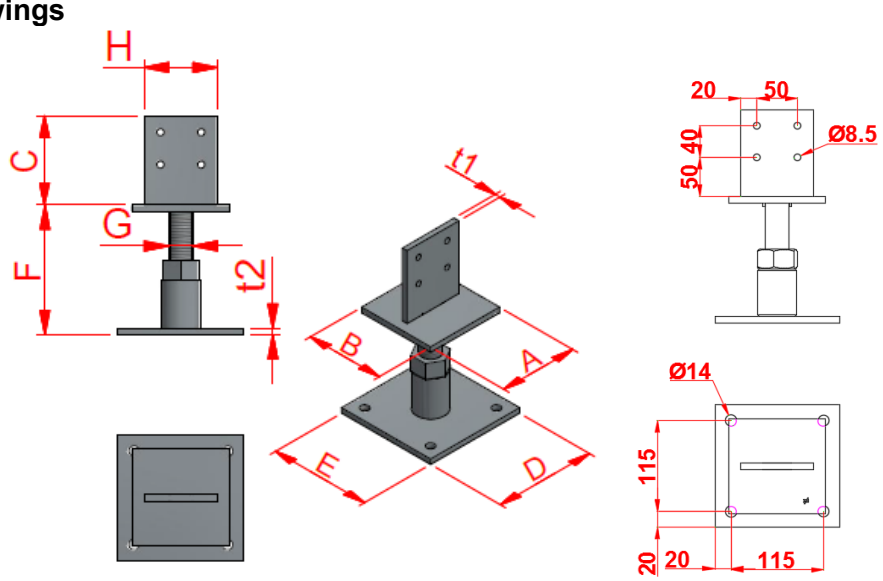


Table D17-1: Size specification

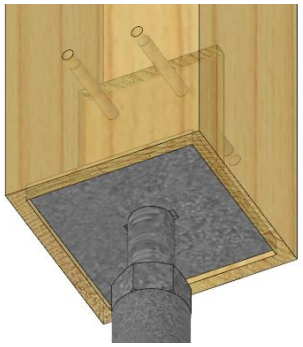
Model	Product dimensions [mm]										Holes			
											Top		Bottom	
	A	B	C	D	E	F	G	H	t_1	t_2	Qty	size	Qty	size
PIBA110/160	120	120	110	155	155	106-160	30	90	8	8	4	Ø8,5	4	Ø14

Table D17-2: Material specification

Part	Material Grades	Coating specification
Plate	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A Type ….Z: Zinc Nickel galvanization plus top coating
Tube	S235JRH according to EN 10219	
nut	M30, steel class 5 according to ISO4032	
Threaded rod	M30, steel class 4.8 according to DIN976	
	Or stainless steel as described	

Table D17-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]	
	On post		On concrete		$R_{1.k}$	$R_{2.k}$
	Qty	Type	Qty	Type		
PIBA110/150	2	Ø8	4	Ø12	$125/(k_{mod}{}^{0,5})$	20.7



The minimum size of the timber column may be 120x120mm. However the recommended minimum size of timber column would be of section 140x140mm with an extrusion into the bottom face of the member for the bottom plate, so a constructive wood preservation can be given.

D18: PIL

Product name	Alternative names
PIL	IL

Figure D18-1: Drawings

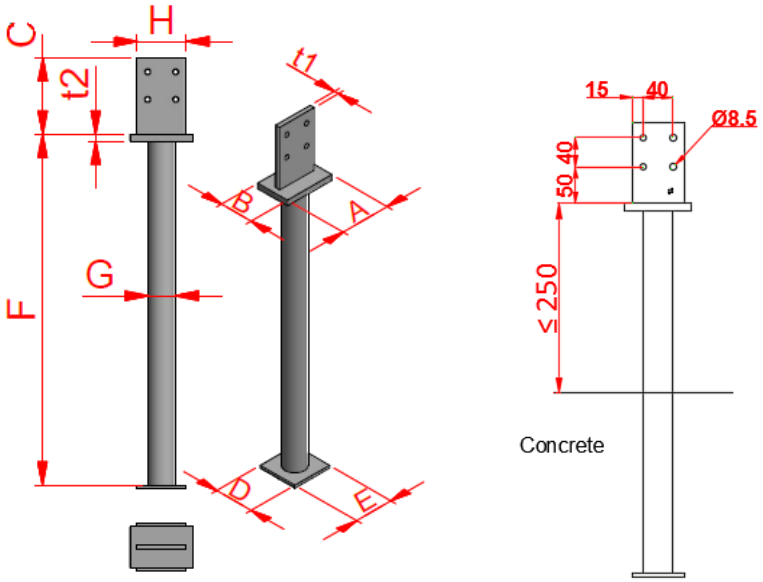


Table D18-1: Size specification

Model	Product dimensions [mm]										Holes	
											Top	
	A	B	C	D	E	F	G	H	t_1	t_2	Qty	size
PIL	90	60	110	70	70	510	38	70	10	5	4	Ø8.5

Table D18-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Tube Ø38x2	S220JR according to EN10025:2004	
	Or stainless steel as described	

Table D18-3: Characteristic capacity

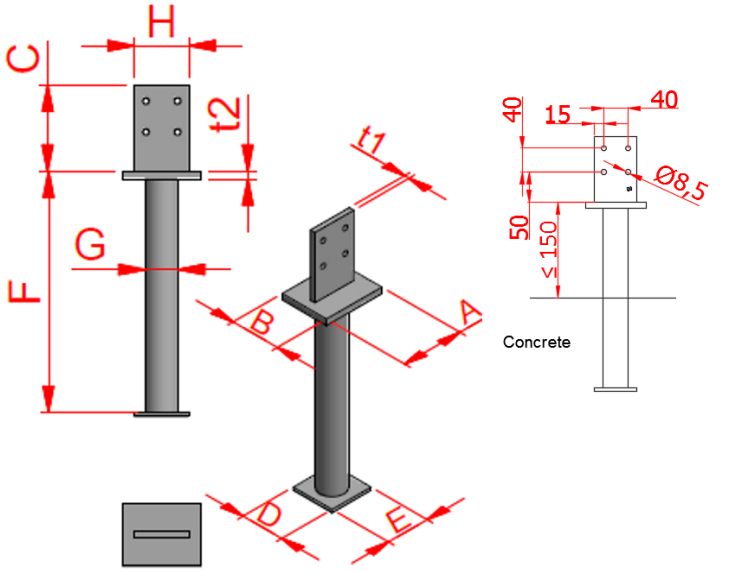
Model	Fasteners		Characteristic capacities [kN]			
	On post		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type				
PIL	4	Ø8x60	min(90 ; 57/k_{mod})	13.8	2.2/k_{mod}	1.8/k_{mod}
	4	Ø8x80		16		
	4	Ø8x100		18.7		2/k_{mod}
	4	Ø8x120		20.7		2.2/k_{mod}
	4	Ø8x140				2.4/k_{mod}
	4	Ø8x160				

For vertical loads F_1 and any horizontal loads $F_{3/4}$ acting simultaneously it shall be verified that:
$F_1 / R_{1.d} + F_{3/4} / R_{3/4.d} \leq 1$.

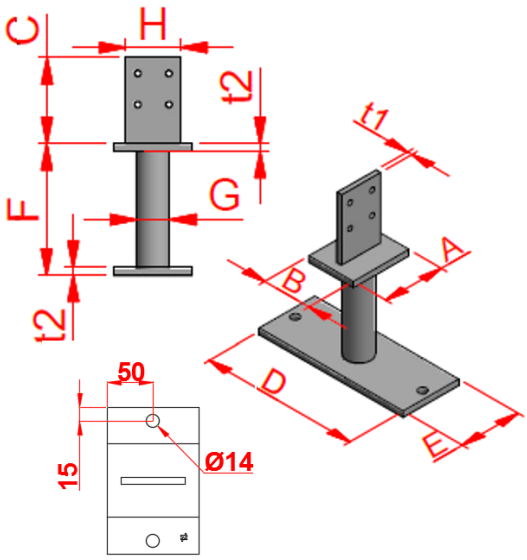
D19: PIS / PISB / PISMAXI / PISBMAXI

Product name	Alternative names
PIS70	IS
PISBxx	ISB
PISMaxi	IS Maxi
PISBMaxi	ISB Maxi

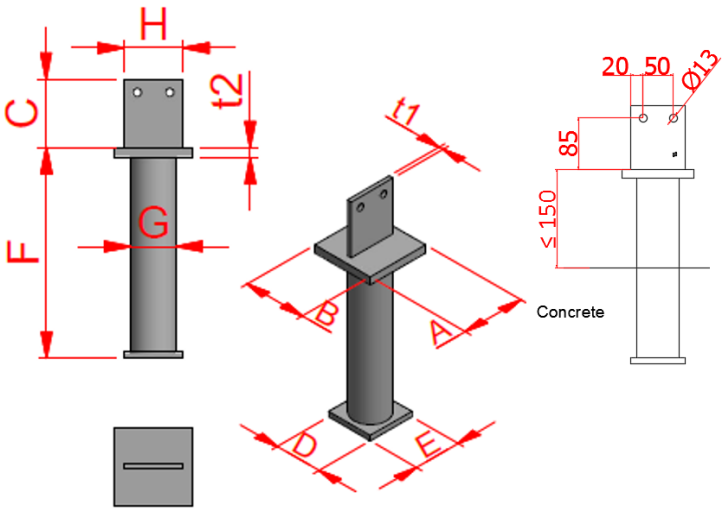
Figure D19-1: Drawings



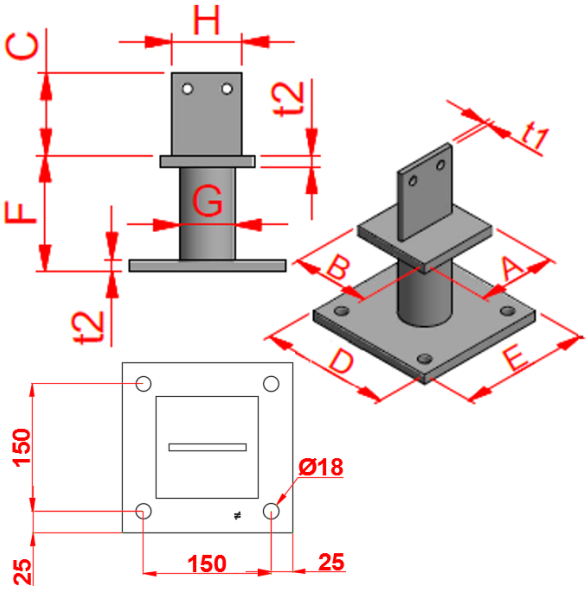
PIS70



PISBxx



PISMAXI



PISBMAXI

Table D19-1: Size specification

Model	Product dimensions [mm]										Holes			
											Top		Bottom	
	A	B	C	D	E	F	G	H	t_1	t_2	Qty	size	Qty	size
PIS70	100	80	110	70	70	313	42	70	8	10	4	Ø8.5		
PISB160	100	80	110	160	100	168	42	70	8	10	4	Ø8.5	2	Ø14
PISB260	100	80	110	260	100	168	42	70	8	10	4	Ø8.5	2	Ø14
PISMaxi	120	120	105	90	90	323	120	90	8	15	2	Ø13		
PISBMaxi	120	120	105	200	200	148	120	90	8	15	2	Ø13	4	Ø17

Table D19-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
tube	S235JR according to EN 10025	
	Or stainless steel as described	

Table D19-3: Characteristic capacity – for concrete C12/16

Model	Fasteners				Characteristic capacities [kN]			
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	Qty	Type				
PIS	4	Ø8x80	-	-	min(142.8 ; 110.8/k_{mod})	16	min(10.9 ; 6.3/k_{mod})	4.1
	4	Ø8x100	-	-		18.7	6.3/k_{mod}	min(5.9 ; 5.1 /k_{mod})
	4	Ø8x120	-	-		20.7		min(7 ; 5.5 /k_{mod})
PISB160 PISB260	4	Ø8x80	2	Ø12		16	min(10.9 ; 5.6/k_{mod})	4.1
	4	Ø8x100	2	Ø12		18.7	5.6/k_{mod}	min(5.9 ; 5.1 /k_{mod})
	4	Ø8x120	2	Ø12		20.7		min(7.9 ; 5.5 /k_{mod})
PISMaxi	2	Ø12x120	-	-	min(272.2 ; 187.9/k_{mod})	34.5	22.5	7.7
	2	Ø12x140	-	-		38.5	min(25.2 ; 24/k_{mod})	9.9
	2	Ø12x160	-	-		42.1	min(27.5 ; 24/k_{mod})	12.3
PISBMaxi	2	Ø12x120	4	Ø16	min(272.2 ; 256,9/k_{mod})	34.5	min(22.5 ; 14.1/k_{mod})	7.7
	2	Ø12x140	4	Ø16		38.5	min(25.2 ; 14.1/k_{mod})	9.9
	2	Ø12x160	4	Ø16		42.1	min(27.5 ; 14.1/k_{mod})	12.3

D24: PJPS / PJPB / PJIS / PJIB

Product name	Alternative names
PJPS	JPS
PJPB	JPB
PJIS	JIS
PJIB	JIB

Figure D24-1: Drawings

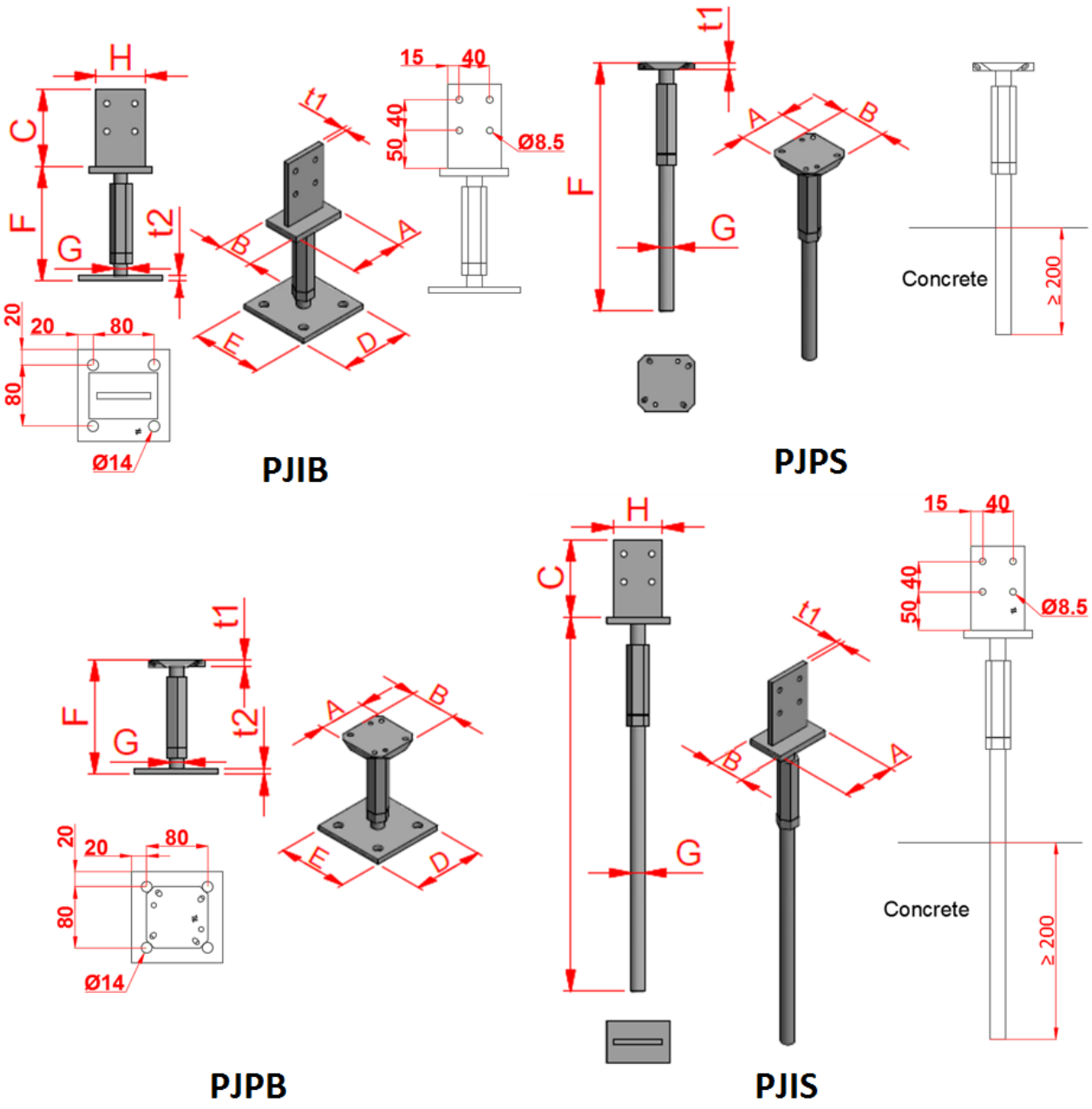


Table D24-1: Size specification

Model	Product dimensions [mm]									Holes			
										Top		Bottom	
	A	B	C	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PJPS	80	80				355 - 405	20	10 or 8		6	Ø6.5		
PJPB	80	80		120	120	163 - 213	20	10 or 8	8	6	Ø6.5	4	Ø13
PJIS	90	60	110			355 - 405	20	8		4	Ø8.5		
PJIB	90	60	110	120	120	163 - 213	20	8	8	4	Ø8.5	4	Ø13

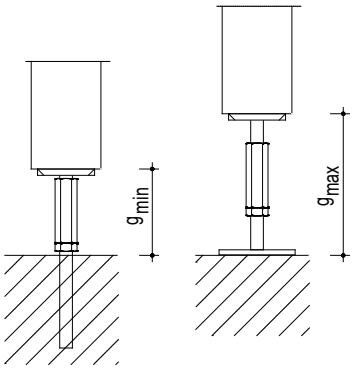
Table D24-2: Material specification

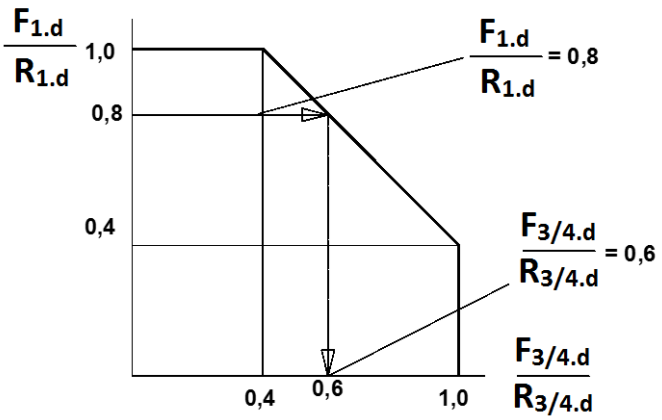
Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Threaded rod	S355 JO according to EN 10025	
	Or stainless steel as described	

Table D24-3: Characteristic capacity – for concrete C12/16

Model	Fasteners				Characteristic capacities [kN]					
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$ for g		$R_{4.k}$ for g	
	Qty	Type	Qty	Type			min	max	min	max
PJPS	4	Ø6x60			$54.5/k_{mod}$	7.6	min(2.7 ; $1.7/k_{mod}$)	min(2.7 ; $1.4/k_{mod}$)	min(2.7 ; $1.7/k_{mod}$)	min(2.7 ; $1.4/k_{mod}$)
PJPB	4	Ø6x60	4	Ø12						
PJIS	4	Ø8x80			min(90.7 ; $54.5/k_{mod}$)	16	$1.4/k_{mod}$	$1,1/k_{mod}$	min(2 ; $1.6/k_{mod}$)	min(1.7 ; $1.4/k_{mod}$)
	4	Ø8x100				18.7			min(2.3 ; $1.8/k_{mod}$)	min(2 ; $1.4/k_{mod}$)
	4	Ø8x120				20.7			min(2.6 ; $1.8/k_{mod}$)	min(2.1 ; $1.4/k_{mod}$)
PJIB	4	Ø8x80	4	Ø12		16			min(2 ; $1.6/k_{mod}$)	min(1.7 ; $1.4/k_{mod}$)
	4	Ø8x100				18.7			min(2.3 ; $1.8/k_{mod}$)	min(2 ; $1.4/k_{mod}$)
	4	Ø8x120				20.7			min(2.6 ; $1.8/k_{mod}$)	min(2.1 ; $1.4/k_{mod}$)

For vertical load F_1 and horizontal load $F_{3/4}$ acting simultaneously it shall be verified that the combination of loads fall below the lines shown in the diagram below.





For vertical load F_2 and any horizontal load $F_{3/4}$ acting simultaneously it shall be verified that:
$F_2 / R_{2.d} + F_{3/4} / R_{3/4.d} \leq 1$

D20: PL

Product name	Alternative names
PL	L

Figure D20-1: Drawings

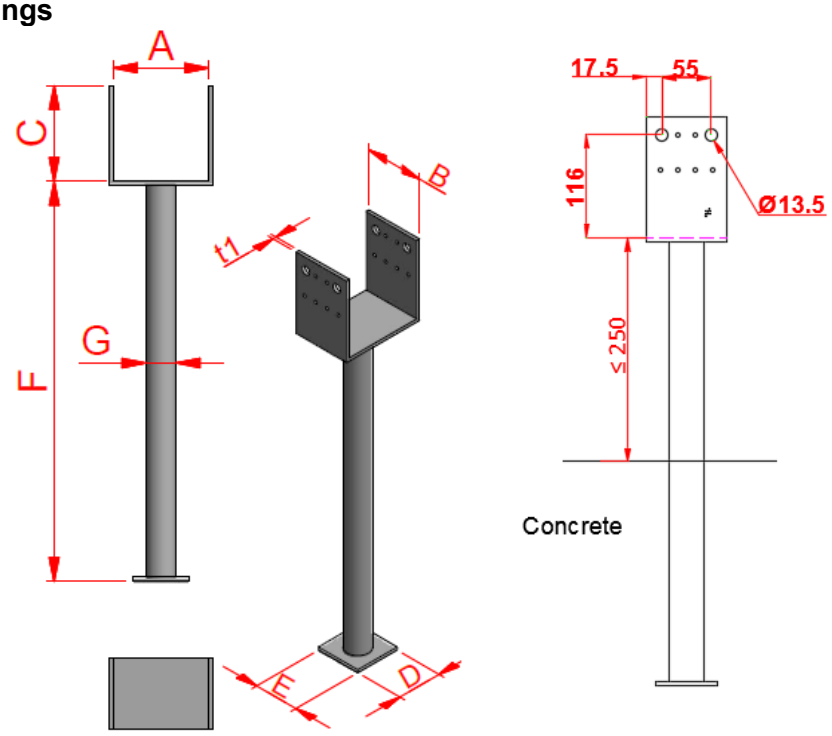


Table D20-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top			
	A	B	C	D	E	F	G	t_1	Qty	size	Qty	size
PL80/70G	80	70	126	70	70	500	38	5	8	Ø5	4	Ø13.5
PL100/70G	100	70	126	70	70	500	38	5	8	Ø5	4	Ø13.5
PL90/90G	90	90	141	70	70	500	38	5	12	Ø5	4	Ø13.5
PL100/90G	100	90	136	70	70	500	38	5	12	Ø5	4	Ø13.5
PL120/90G	120	90	126	70	70	500	38	5	12	Ø5	4	Ø13.5
PL140/90G	140	90	126	70	70	500	38	5	12	Ø5	4	Ø13.5

Table D20-2: Material specification

Part	Material Grades	Coating specification
Plate	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Tube Ø38x2	S220JR according to EN10025:2004	
	Or stainless steel as described	

Table D20-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]			
	On post		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type				
PL80/70G	8	Ø4x40	$57.1/k_{mod}$	min (18.4 ; $17.3/k_{mod}$)	$2.8/k_{mod}$	$3.5/k_{mod}$
PL100/70G	8	Ø4x40		min (18.4 ; $11.7/k_{mod}$)		
PL90/90G	12	Ø4x40		min (22.0 ; $18.0/k_{mod}$)		
PL100/90G	12	Ø4x40		min (22.0 ; $15.1/k_{mod}$)		
PL120/90G	12	Ø4x40		min (19.0 ; $11.4/k_{mod}$)		
PL140/90G	12	Ø4x40		$9.2/k_{mod}$		

For vertical loads F_1 and any horizontal loads $F_{3/4}$ acting simultaneously it shall be verified that:
$F_1 / R_{1.d} + F_{3/4} / R_{3/4.d} \leq 1$.

D21: PLPP180

Product name	Alternative names
PLPP180	

Figure D21-1: Drawings

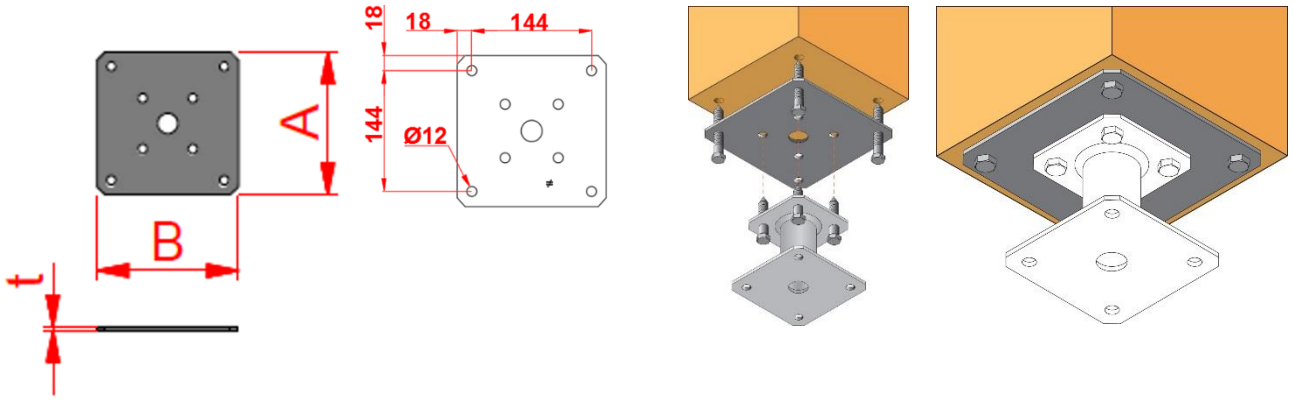


Table D21-1: Size specification

Model	Product dimensions [mm]			Holes			
				Top			
	A	B	t	Qty	size	Qty	size
PLPP180	180	180	4	8	Ø12	1	Ø25.5

Table D21-2: Material specification

Part	Material Grades	Coating specification
Plate	DD11 according to EN 10111	Hot-dip galvanized according to EN ISO 1461
	Or stainless steel as described	

Table D21-3: Characteristic capacity

The optional plate is compatible with the following post bases: PPA100, PPA150, FPB100, FPB150, APB100/150, and 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

D22: PLS & PLB

Product name	Alternative names
PLS	LS
PLB	LB

Figure D22-1: Drawings

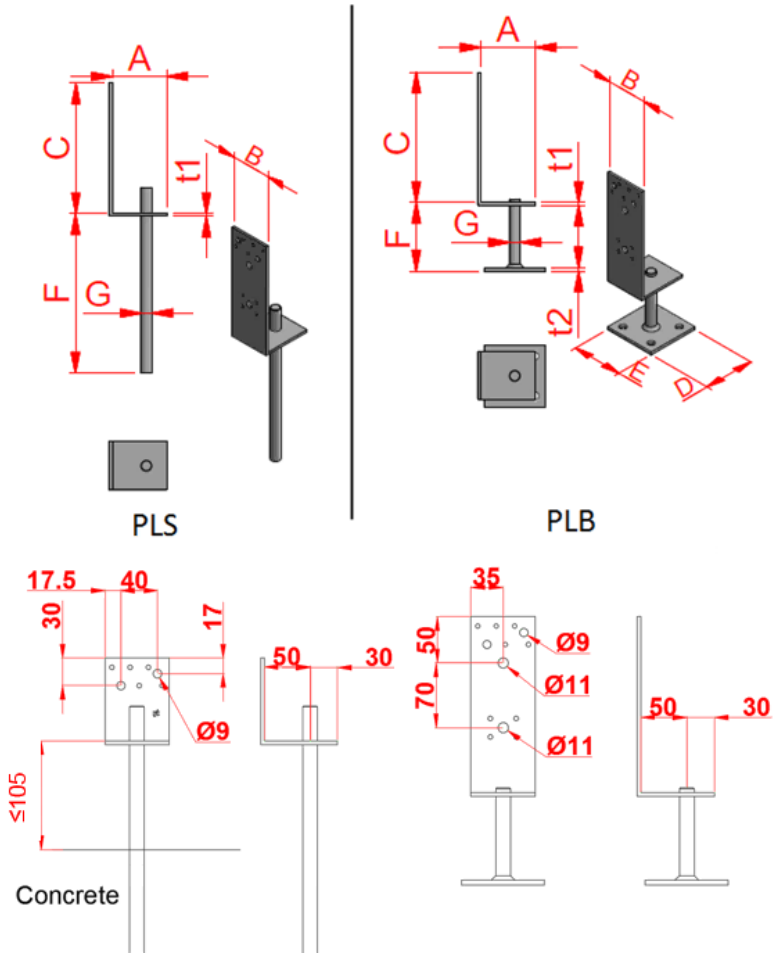


Table D22-1: Size specification

Model	Product dimensions [mm]									Holes					
										Top				Bottom	
	A	B	C	D	E	F	G	t_1	t_2	Qty	size	Qty	size	Qty	size
PLS60/65G	60	70	65			215 - 275	16	4		5	Ø5	2	Ø9		
PLS60/165G	60	70	165			215 - 275	16	4		7	Ø5	2	Ø11		
PLS80/90G	80	70	90			215 - 275	16	4		5	Ø5	2	Ø9		
PLS80/190G	80	70	190			215 - 275	16	4		9	Ø5	2	Ø11		
PLB60/65G	60	70	65	90	90	45 - 105	16	4	5	5	Ø5	2	Ø9	4	Ø12
PLB60/165G	60	70	165	90	90	45 - 105	16	4	5	9	Ø5	2	Ø11	4	Ø12
PLB80/90G	80	70	90	90	90	45 - 105	16	4	5	5	Ø5	2	Ø9	4	Ø12
PLB80/190G	80	70	190	90	90	45 - 105	16	4	5	9	Ø5	2	Ø11	4	Ø12

Table D22-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Threaded rod	Threaded rod: S355 JO according to EN 10025	
	Or stainless steel as described	

Table D22-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]		
			$R_{1.k}$		$R_{2.k}$
	On post		Load direction / timber grain		
	Qty	Type	Parallel	Perpendicular	
PLS60/65G	3	CNA4.0x40	min(50.8 ; 36.4/k_{mod})	min(20.1 ; 20.2/k_{mod})	min(5.4 ; 3.5/k_{mod})
PLB60/65G	2	CSA5.0x35			
PLS60/165G	2	CNA4.0x40			min(2.8 ; 3/k_{mod})
PLB60/165G	1	screw 8x60			
PLS80/90G	3	CNA4.0x40			2.3/k_{mod}
PLB80/90G	2	CSA5.0x35			
PLS80/190G	2	CNA4.0x40			min(2.8 ; 2.3/k_{mod})
PLB80/190G	1	screw 8x60			

D23: PP & PPL

Product name	Alternative names
PP	P
PPL	PL

Figure D23-1: Drawings

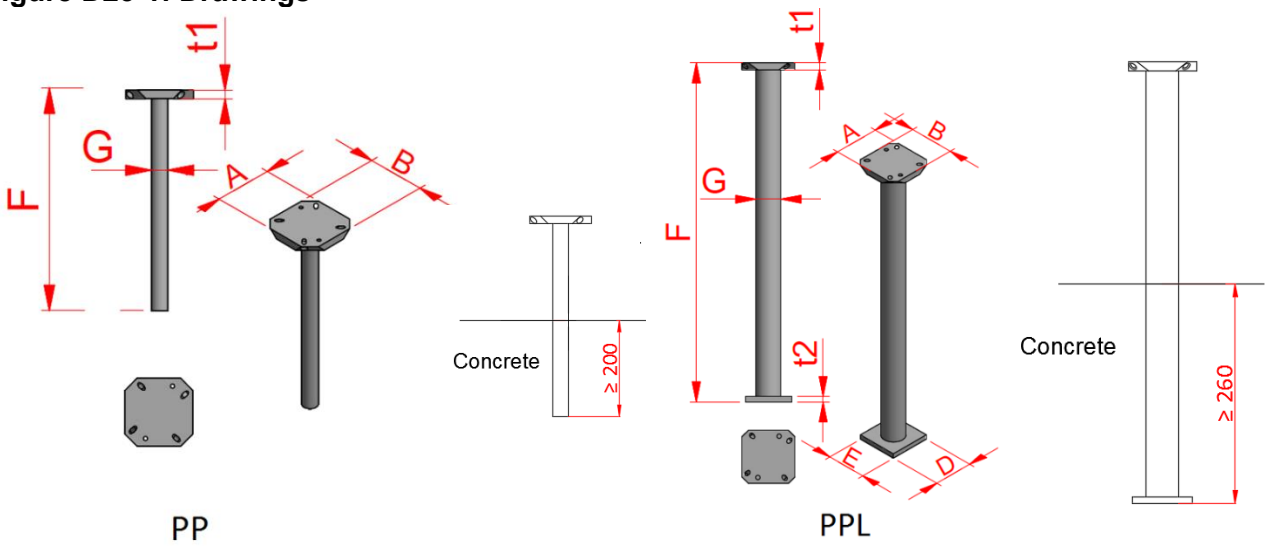


Table D23-1: Size specification

Model	Product dimensions [mm]								Holes	
									Top	
	A	B	D	E	F	G	t_1	t_2	Qty	size
PP	80	80			260	20	10 or 8		6	Ø6.5
PPL	80	80	70	70	510	38	10 or 8	5	6	Ø6.5

Table D23-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Ribbed bar	B 550 BR+AC according to EN 10080	
	Or stainless steel as described	

Table D23-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]		
	On post		$R_{1.k}$	$R_{2.k}$	$R_{3.k} = R_{4.k}$
	Qty	Type			
PP	4	screw 6x60	$31.6/k_{mod}$	7.6	2.7
PPL	4	screw 6x60	$57.1/k_{mod}$		$\min(2.7 ; 2.5/k_{mod})$

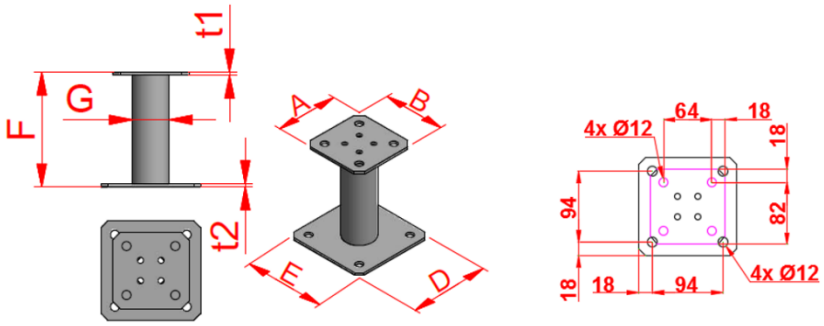
The capacities based on an axial capacity of the screws with $R_{ax.45.k}$ =2,7 kN.
For other screws, the capacities are to calculated respectively.

D24: PPA & PBL

Product name	Alternative names
PPA	
PBL	

Figure D24-1: Drawings

PPA



PBL

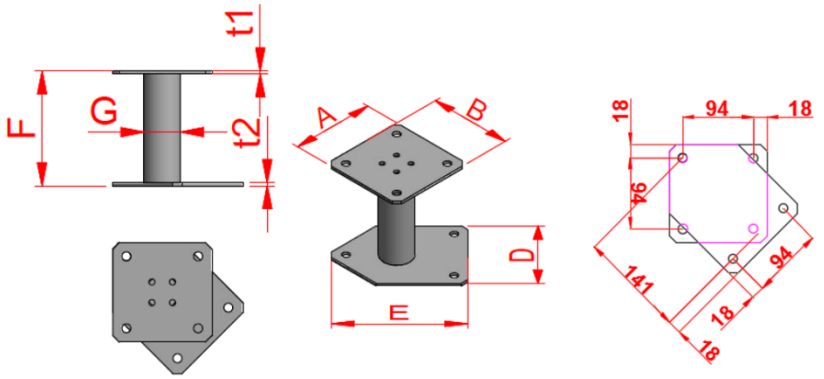


Table D24-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PPA100	100	100	130	130	100	48.3	4	4	4	Ø12	4	Ø12
PPA150	100	100	130	130	150	48.3	4	4	4	Ø12	4	Ø12
PBL100	130	130	130	180	100	48.3	4	4	4	Ø12	4	Ø12
PBL150	130	130	130	180	150	48.3	4	4	4	Ø12	4	Ø12

Table D24-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Tube	S235 JRH according to EN 10219-1	
	Or stainless steel as described	

Table D24-3: Characteristic capacity

Model	Characteristic capacities [kN]
	$R_{1.k}$
PPA & PBL	$78.5/k_{mod}\text{^}0.4$

Capacities are valid also when the connector is turned upside down.

D25: PPB & PPS80

Product name	Alternative names
PPB70	PB70
PPB75	PB75
PPB80	PB80; PB40605
PPS80	PS80

Figure D25-1: Drawings

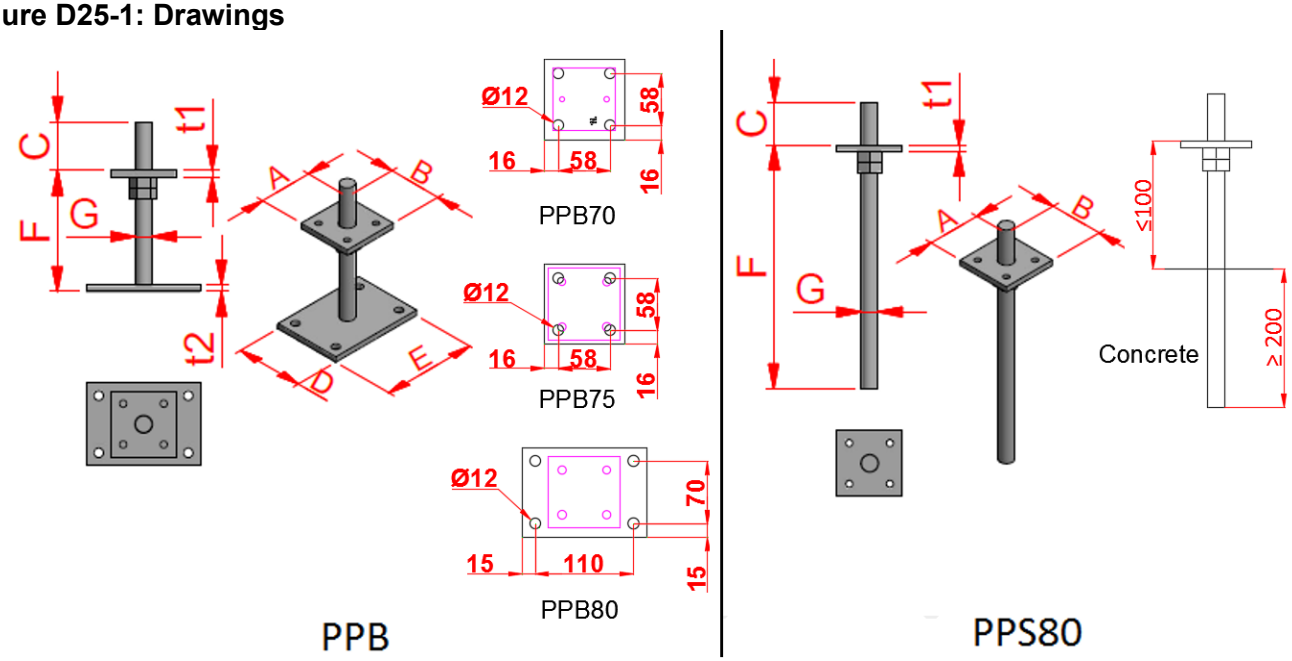


Table D25-1: Size specification

Model	Product dimensions [mm]									Holes			
										Top		Bottom	
	A	B	C	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PPB70	70	70	5 - 75	90	90	30 – 95*	16	6	5	2	Ø5.5	4	Ø12
PPB75	80	80	7 - 67	90	90	30 – 85*	20	8	5	4	Ø9	4	Ø12
PPB80	80	80	18 - 158	140	100	50 – 190*	20	8	8	4	Ø9	4	Ø12
PPS80	80	80	0 - 150			230 – 340*	20	8		4	Ø9		Ø12
PPB70NH	70	70	5 - 75	90	90	30 – 95*	16	6	5	-		4	Ø12
PPB75NH	80	80	7 - 67	90	90	30 – 85*	20	8	5	-		4	Ø12
PPB80NH	80	80	18 - 158	140	100	50 – 190*	20	8	8	-		4	Ø12
PPS80NH	80	80	0 - 150			230 – 340*	20	8		-			Ø12

* +/- 10mm

Table D25-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Threaded rod	S355 JO according to EN 10025	
	Or stainless steel as described	

Table D25-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]	
					$R_{1.k}$	
	On post		On concrete		Concrete	
	Qty	Type	Qty	Type	C16/20	C20/25
PPB	≤4	Ø8	4	Ø10	g≤100mm: min (88,3 ; 63,9/kmod) g>100mm: min (88,3 ; 57,9/kmod)	
PPS80	≤4	Ø8			$40/k_{mod}$	$49.5/k_{mod}$

D26: PPD

Product name	Alternative names
PPD	D

Figure D26-1: Drawings

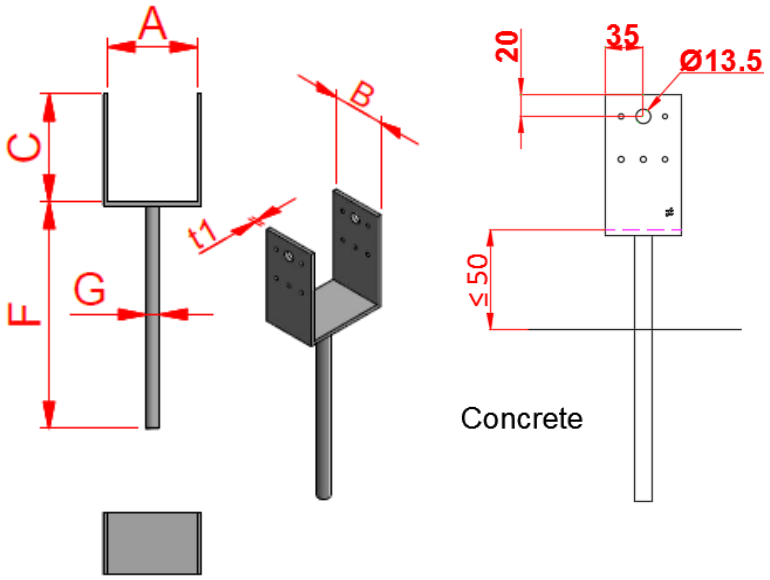


Table D26-1: Size specification

Model	Product dimensions [mm]						Holes			
							Top			
	A	B	C	F	G	t_1	Qty	size	Qty	size
PPD 48 x 40	48	40	121.5	255	16	5	8	Ø5	2	Ø13.5
PPD 50 x 40	50	40	120.5	255	16	5	8	Ø5	2	Ø13.5
PPD 73 x 40	73	40	121.5	255	16	5	8	Ø5	2	Ø13.5
PPD 100 x 40	100	40	120.5	255	16	5	8	Ø5	2	Ø13.5
PPD 98 x 60	98	60	122.5	255	16	5	10	Ø5	2	Ø13.5
PPD 70 x 70	70	70	126.5	255	16	5	10	Ø5	2	Ø13.5
PPD 73 x 70	73	70	125	255	16	5	10	Ø5	2	Ø13.5
PPD 75 x 70	75	70	124	255	16	5	10	Ø5	2	Ø13.5
PPD 80 x 70	80	70	121.5	255	16	5	10	Ø5	2	Ø13.5
PPD 90 x 70	90	70	126.5	255	16	5	10	Ø5	2	Ø13.5
PPD 100 x 70	100	70	121.5	255	16	5	10	Ø5	2	Ø13.5
PPD 90 x 90	90	90	136.5	255	20	5	12	Ø5	4	Ø13.5
PPD 100 x 90	100	90	131.5	255	20	5	12	Ø5	4	Ø13.5
PPD 115 x 90	115	90	124	255	20	5	12	Ø5	4	Ø13.5
PPD 120 x 90	120	90	121.5	255	20	5	12	Ø5	4	Ø13.5
PPD 123 x 90	123	90	120	255	20	5	12	Ø5	4	Ø13.5
PPD 125 x 90	125	90	119	255	20	5	12	Ø5	4	Ø13.5
PPD 140 x 90	140	90	121.5	255	20	5	12	Ø5	4	Ø13.5
PPD 148 x 90	148	90	117.5	255	20	5	12	Ø5	4	Ø13.5

Table D26-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Ribbed bar	B 550 BR+AC according to 10080	
	Or stainless steel as described	

Table D26-3: Characteristic capacity

Model	Fasteners		Characteristic capacities [kN]				
			$R_{1.k}$		$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	On Post		Concrete strength class				
	Qty	Type	C12/15	C20/25			
PPD 48 x 40	8	CNA 4.0x40	min(40.3 ; 28.0/k_{mod})	min(40.3 ; 40.9/k_{mod})	min(14.7 ; 13.0/k_{mod})	3.4/k_{mod}	min(8.3 ; 5.8/k_{mod})
PPD 50 x 40	8		min(42.0 ; 28.0/k_{mod})	40.9/k_{mod}	min(14.7 ; 12.2/k_{mod})	3.4/k_{mod}	min(8.3 ; 5.8/k_{mod})
PPD 73 x 40	8		min(50.8 ; 28.0/k_{mod})	38.6/k_{mod}	7.3/k_{mod}	3.4/k_{mod}	5.8/k_{mod}
PPD 100 x 40	8		min(47.9 ; 28.0/k_{mod})	min(47.9 ; 34.9/k_{mod})	5.0/k_{mod}	3.4/k_{mod}	5.8/k_{mod}
PPD 98 x 60	10		28.0/k_{mod}	min(73.7 ; 40.9/k_{mod})	7.6/k_{mod}	3.6/k_{mod}	5.8/k_{mod}
PPD 70 x 70	10		28.0/k_{mod}	min(63.5 ; 40.9/k_{mod})	min(18.4 ; 13.5/k_{mod})	3.6/k_{mod}	min(10.9 ; 5.8/k_{mod})
PPD 73 x 70	10		28.0/k_{mod}	min(69.7 ; 40.9/k_{mod})	min(18.4 ; 12.8/k_{mod})	3.5/k_{mod}	min(10.9 ; 5.8/k_{mod})
PPD 75 x 70	10		28.0/k_{mod}	min(74.0 ; 40.9/k_{mod})	min(18.4 ; 12.3/k_{mod})	3.6/k_{mod}	min(10.9 ; 5.8/k_{mod})
PPD 80 x 70	10		28.0/k_{mod}	min(81.9 ; 40.9/k_{mod})	min(18.4 ; 11.4/k_{mod})	3.7/k_{mod}	min(10.9 ; 5.8/k_{mod})
PPD 90 x 70	10		36.9/k_{mod}	min(94.8 ; 54.5/k_{mod})	min(18.4 ; 10.4/k_{mod})	5.5/k_{mod}	min(14.6 ; 10.8/k_{mod})
PPD 100 x 70	10		28.0/k_{mod}	40.9/k_{mod}	8.7/k_{mod}	3.7/k_{mod}	5.8/k_{mod}
PPD 90 x 90	12		36.9/k_{mod}	min(78.4; 54.5/k_{mod})	min(22.0 ; 13.4/k_{mod})	6.4/k_{mod}	min(18.7 ; 11.4/k_{mod})
PPD 100 x 90	12		36.9/k_{mod}	min(99.4 ; 54.5/k_{mod})	min(22.0 ; 11.7/k_{mod})	6.6/k_{mod}	min(18.7 ; 11.4/k_{mod})
PPD 115 x 90	12		36.9/k_{mod}	54.5/k_{mod}	9.9/k_{mod}	7.0/k_{mod}	11.4/k_{mod}
PPD 120 x 90	12		36.9/k_{mod}	54.5/k_{mod}	9.4/k_{mod}	7.2/k_{mod}	11.4/k_{mod}
PPD 123 x 90	12		36.9/k_{mod}	54.5/k_{mod}	9.1/k_{mod}	7.2/k_{mod}	11.4/k_{mod}
PPD 125 x 90	12		36.9/k_{mod}	54.5/k_{mod}	8.9/k_{mod}	7.3/k_{mod}	11.4/k_{mod}
PPD 140 x 90	12		36.9/k_{mod}	min(102.2 ; 54.5/k_{mod})	7.8/k_{mod}	7.2/k_{mod}	11.4/k_{mod}
PPD 148 x 90	12		36.9/k_{mod}	min(99.9 ; 54.5/k_{mod})	7.3/k_{mod}	7.3/k_{mod}	11.4/k_{mod}

For vertical loads F_1 and horizontal loads F_4 acting simultaneously it shall be verified that:
$F_1 / R_{1.d} + F_4 / R_{4.d} \leq 1$.
For vertical uplift F_2 and horizontal loads F_4 acting simultaneously it shall be verified that:
$(F_2 / R_{2.d})^2 + (F_4 / R_{4.d})^2 \leq 1$.

D27: PPMINI

Product name	Alternative names
PPMINI	

Figure D27-1: Drawings

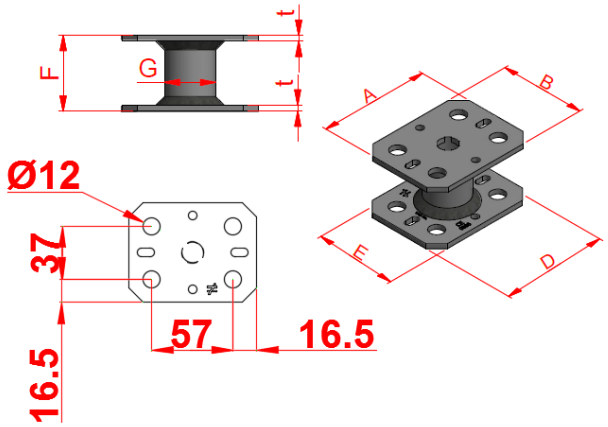


Table D27-1: Size specification

Model	Product dimensions [mm]							Holes							
								Top				Bottom			
	A	B	D	E	F	G	t	Qty	size	Qty	size	Qty	size	Qty	size
PPMINI50	90	70	90	70	50	34	4	4	Ø11	2	Ø6x12	4	Ø11	2	Ø6x12
PPMINI70	90	70	90	70	70	34	4	4	Ø11	2	Ø6x12	4	Ø11	2	Ø6x12
PPMINI80	90	70	90	70	80	34	4	4	Ø11	2	Ø6x12	4	Ø11	2	Ø6x12

Table D27-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Tube	S235 JRH according to EN 10219-1	
	Or stainless steel as described	

Table D27-3: Characteristic capacity

		Characteristic capacities [kN]
Model	Timber grain direction / load axis	$R_{1.k}$
PPMINI	parallel	58.6 / $k_{mod}^{0.37}$
	perpendicular	21.6

D28: PPR

Product name	Alternative names
PPR	

Figure D28-1: Drawings

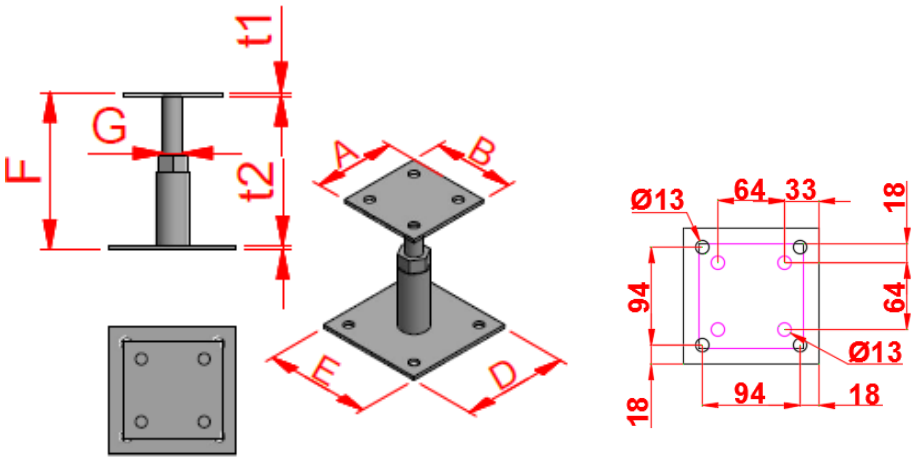


Table D28-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PPR	100	100	130	130	100 - 160	20	4	4	4	Ø13	4	Ø13

Table D28-2: Material specification

Part	Material Grades	Coating specification
Plates	P355 NB according to EN 10120	Hot-dip galvanized according to EN ISO 1461
Tube	P235TR1 according to EN 10216-1	
Threaded rod	steel class 4.6 according to ISO 898	
	Or stainless steel as described	

Table D28-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On post		On concrete		
	Qty	Type	Qty	Type	$R_{1.k}$
PPR	4	Ø12	4	Ø12	50.2 / $k_{mod}^{0.5}$

Capacities are also valid when the connector is turned upside down.

D29: PPRB

Product name	Alternative names
PPRB	

Figure D29-1: Drawings

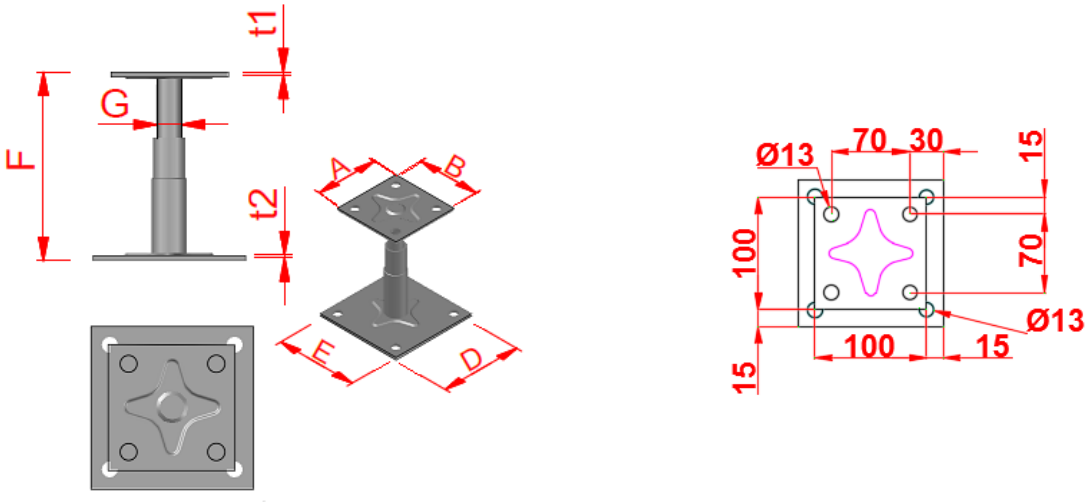


Table D29-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PPRB	100	100	130	130	100 - 160	20	4	4	4	Ø13	4	Ø13

Table D29-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Electroplated zinc Zn25/A according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc)
Tube	E235 according to EN 10305	
Threaded rod	steel class 4.6 according to ISO 898	
	Or stainless steel as described	

Table D29-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On post		On concrete		
	Qty	Type	Qty	Type	$R_{1.k}$
PPRB	4	Ø12	4	Ø12	42.7 / $k_{mod}^{0.5}$

Capacities are also valid when the connector is turned upside down.

D30: PPRC

Product name	Alternative names
PPRC	

Figure D30-1: Drawings

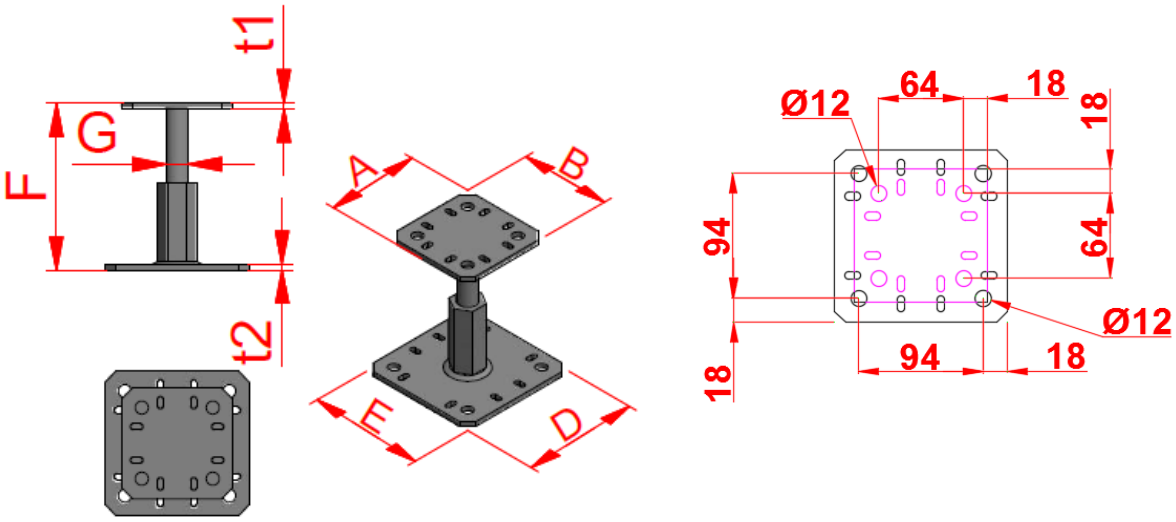


Table D30-1: Size specification

Model	Product dimensions [mm]								Holes							
									Top				Bottom			
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size	Qty	size	Qty	size
PPRC	10	100	13	13	100 - 150	20	5	5	8	Ø6x12	4	Ø12	8	Ø6x12	4	Ø12

Table D30-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A Type ….Z: Zinc Nickel galvanization plus top coating
Tube	C15RPB according to EN 10084	
Threaded rod	steel class 4.6 according to ISO 898	
	Or stainless steel as described	

Table D30-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On post		On concrete		$R_{1.k}$
	Qty	Type	Qty	Type	
PPRC	4 or 8	Ø10 or Ø6 at 45°	4	Ø10	51.1 / $k_{mod}^{0.5}$

D31: PPRIX

Product name	Alternative names
PPRIX	

Figure D31-1: Drawings

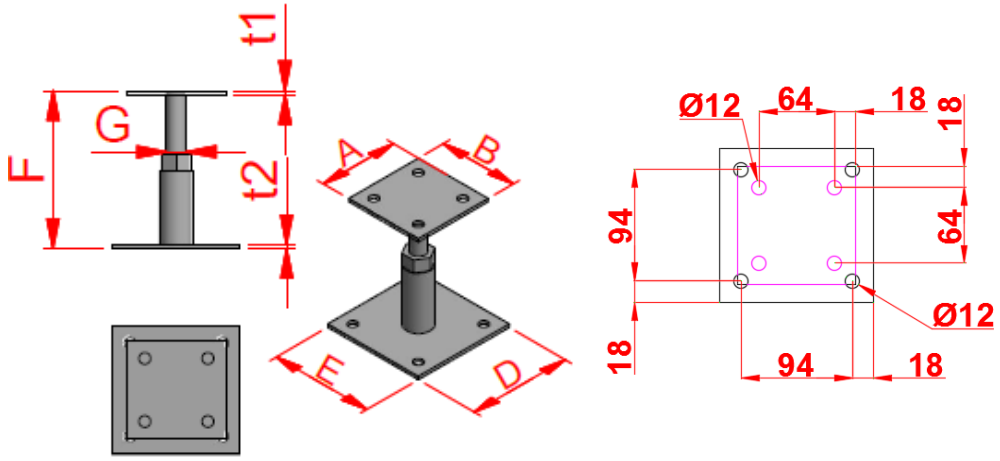


Table D31-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	D	E	F	G	t_1	t_2	Qty	size	Qty	size
PPRIX	100	100	130	130	100 - 160	20	4	4	4	Ø12	4	Ø12

Table D31-2: Material specification

Part	Material Grades	Coating specification
Plates	Stainless steel 316L according to EN 10088	-
Tube	B 550 BR+AC according to 10080	
Threaded rod	A4 (AISI 316L) according to ISO 350	

Table D31-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]
	On post		On concrete		
	Qty	Type	Qty	Type	$R_{1.k}$
PPRIX	4	Ø10	4	Ø10	36 / $k_{mod}^{0.5}$

Capacities are also valid when the connector is turned upside down.

D32: PPS & PPSDT

Product name	Alternative names
PPS	PPSIX (for stainless steel version)
PPSDT	PPSDTIX (for stainless steel version)

Figure D32-1: Drawings

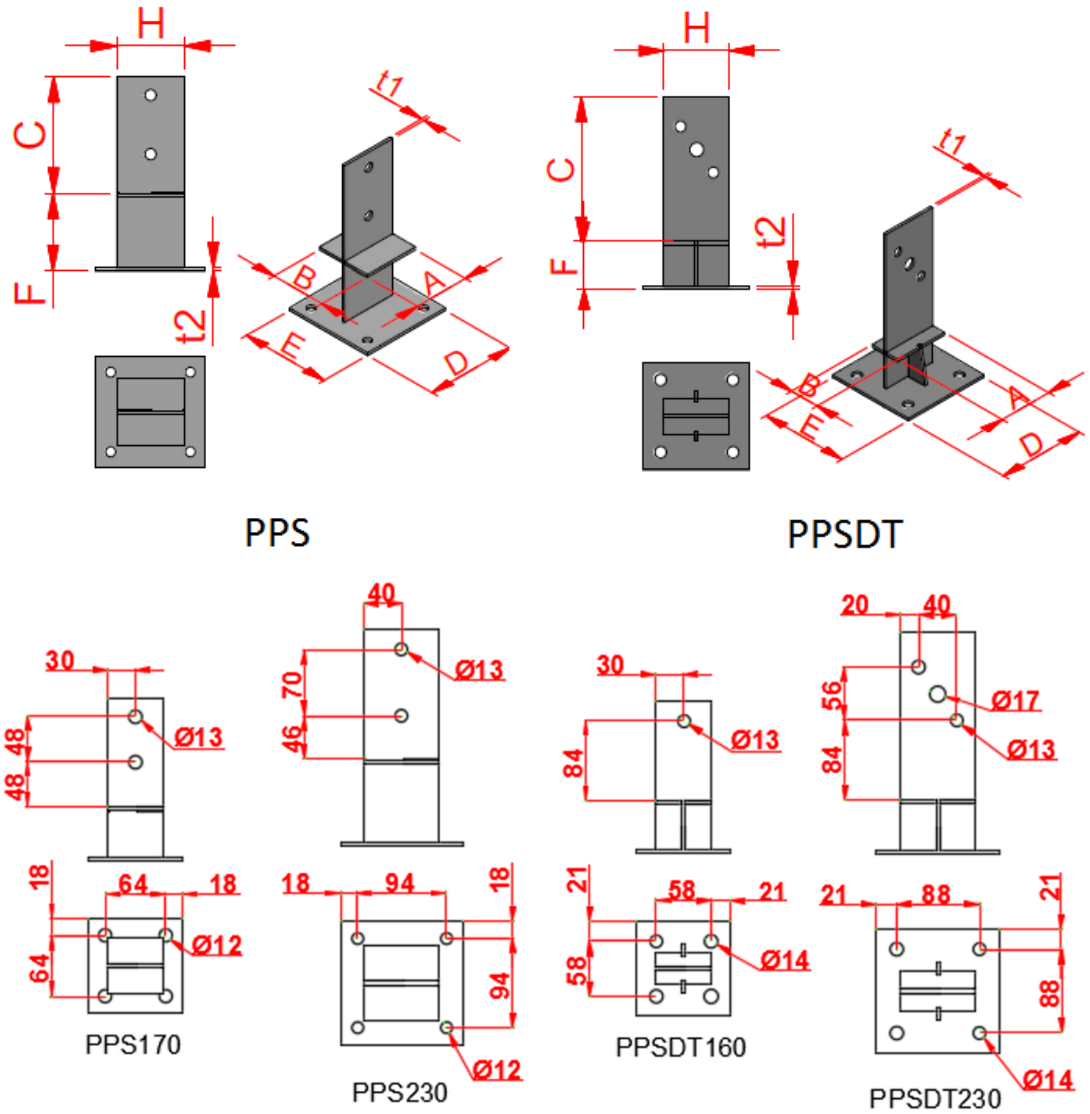


Table D32-1: Size specification

Model	Product dimensions [mm]								Holes					
									Top				Bottom	
	A	B	C	D	E	F	t_1	t_2	Qty	size	Qty	size	Qty	size
PPS170	80	80	114	100	100	56	4	4	2	Ø13			4	Ø12
PPS230	80	80	138	130	130	92	4	4	2	Ø13			4	Ø12
PPSDT160	34	60	104	100	100	56	4	4	1	Ø13			4	Ø14
PPSDT230	44	80	176	130	130	58	4	4	2	Ø13.5	1	Ø17	4	Ø14

Table D32-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Plates for PPS IX and PPSDT IX	stainless steel 1.4306 (Fy,k > 190 N/mm²)	--

Table D32-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]			
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	Qty	Type				
PPS170	2	STD12	4	Ø10	$25.9/k_{mod}$^0.5	16.3	$10.1/k_{mod}$	$1.2/k_{mod}$
PPS230	2	STD12	4	Ø10	$34.5/k_{mod}$^0.5	17.9	$13.3/k_{mod}$	$1.03/k_{mod}$
PPSDT160	1	STD12	4	Ø12	$40.5/k_{mod}$^0.5	8.4	5.5	$7.0/k_{mod}^{0.5}$
PPSDT230	2	STD12	4	Ø12	$53.5/k_{mod}$^0.5	23	$\min(15 ; 13.7/k_{mod})$	$9.3/k_{mod}^{0.5}$
PPS170 IX	2	STD12	4	Ø10	$23.3/k_{mod}$^0.5	16.3	$\min(21.3 ; 14.1/k_{mod})$	$0.98/k_{mod}$
PPSDT170IX	2	STD12	4	Ø10	$23.3/k_{mod}$^0.5	16.3	$\min(21.3 ; 14.1/k_{mod})$	$0.98/k_{mod}$
PPSDT230 IX	2	STD12	4	Ø12	$48.1/k_{mod}$^0.5	23	15	$8.5/k_{mod}^{0.5}$

To obtain full load-carrying capacities for lifting force and horizontal force the characteristic withdrawal capacity of the anchors should be minimum:

Model	Axial capacity [kN] of the anchor associated to full lifting capacity of post base
PPS170	20.2
PPS230	23.7
PPSDT160	13.4
PPSDT230	26.8
PPSDT170IX	25.6
PPS170 IX	25.6
PPSDT230 IX	28.5

D33: PPSP

Product name	Alternative names
PPSP	

Figure D33-1: Drawings

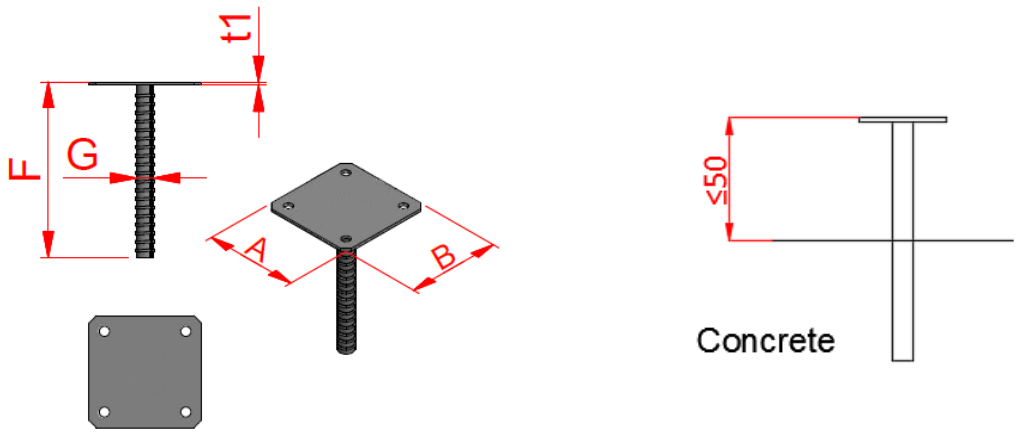


Table D33-1: Size specification

Model	Product dimensions [mm]				Holes	
					Top	
	A	B	G	t	Qty	size
PPSP70	70	70	16	4	4	Ø11
PPSP90	90	90	16	4	4	Ø11
PPSP100	100	100	20	4	4	Ø12
PPSP130	130	130	20	4	4	Ø12

Table D33-2: Material specification

Part	Material Grades	Coating specification
Plates type PPSP100; PPSP130	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Plates type PPSP70; PPSP90	DD11 acc to EN 10111	
Ribbed bar	B 550 BR+AC according to 10080	
	Or stainless steel as described	

Table D33-3: Characteristic capacity – for concrete C20/25

Model	Fasteners		Characteristic capacities [kN]
	On post		$R_{1.k}$
	Qty	Type	
PPSP70	4	Ø10	$\min(29.4/k_{mod}^{0.5}; 30.4/k_{mod})$
PPSP90	4	Ø10	$\min(31.2/k_{mod}^{0.5}; 30.4/k_{mod})$
PPSP100	4	Ø10	$\min(39.7/k_{mod}^{0.5}; 41.2/k_{mod})$
PPSP130	4	Ø10	$\min(39.7/k_{mod}^{0.5}; 41.2/k_{mod})$

D34: PPSR320

Product name	Alternative names
PPSR320	

Figure D34-1: Drawings

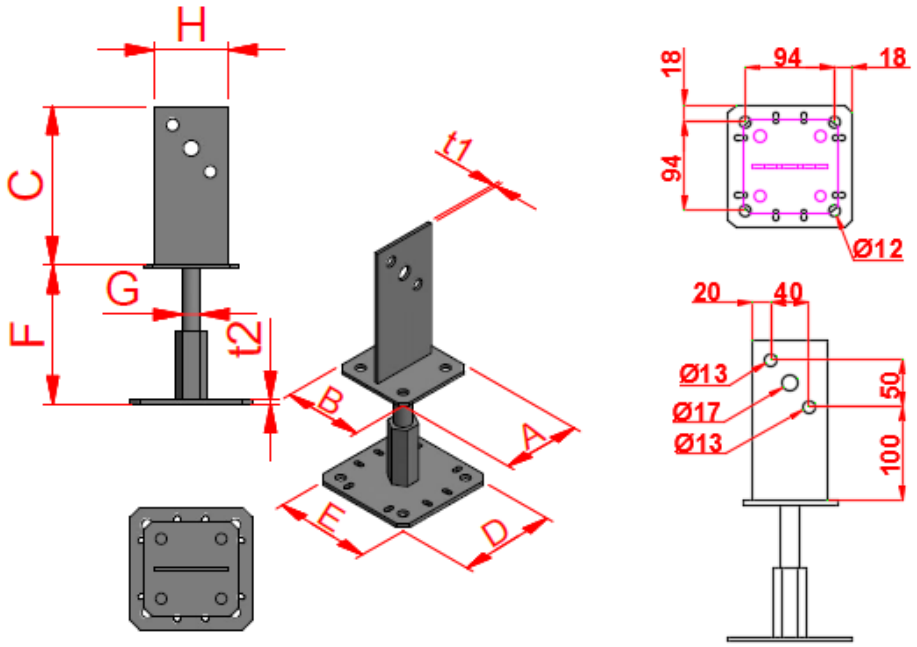


Table D34-1: Size specification

Model	Product dimensions [mm]										Holes							
											Top				Bottom			
	A	B	C	D	E	F	G	H	t_1	t_2	Qty	size	Qty	size	Qty	size	Qty	size
PPSR320	100	100	170	130	130	100 - 150	20	80	4	5	2	Ø13	1	Ø17	8	Ø6x12	4	Ø12

Table D34-2: Material specification

Part	Material Grades	Coating specification
Horizontal plates	S235JR according to EN 10025	Electroplate zinc Fe/Zn25/A according to EN ISO 2081 Or electroplate zinc Fe/Zn10/A (alkali zinc) Or electroplated zinc Fe/Zn12/A or Sherardizing class C30 according to EN 13811. Type ….Z: Zinc Nickel galvanization plus top coating
Nut	C15RPB according to EN 10084	
Threaded rod	Steel class 4.6 according to ISO 898	
Vertical plate	DD11 according to EN 10111	
	Or stainless steel as described	

Table D34-3: Characteristic capacity

					Characteristic capacities (kN)	
Model	Fasteners				$R_{1.k}$	$R_{2.k}$
	On post		On concrete			
	Qty	Type	Qty	Type		
PPSR320	1	Ø16	4	Ø10	51.1 / $k_{mod}^{0,5}$	min(29.5 ; 20.9 / k_{mod})
	2	Ø12				20.9 / k_{mod}

D35: PPUP

Product name	Alternative names
PPUP	

Figure D35-1: Drawings

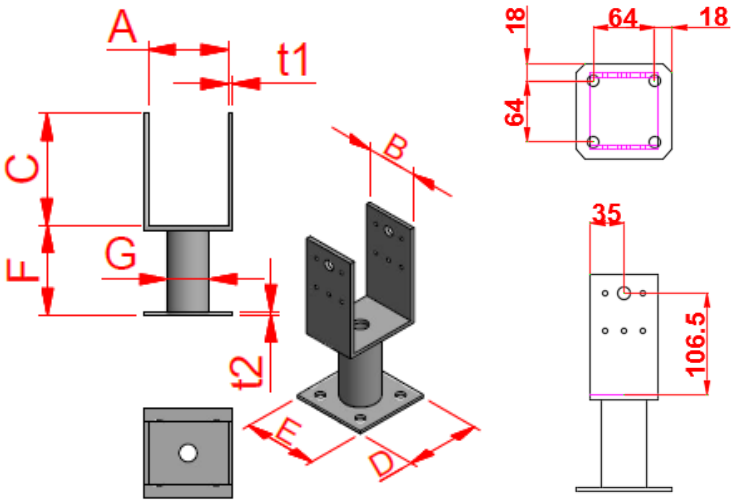


Table D35-1: Size specification

Model	Product dimensions [mm]									Holes					
										Top				Bottom	
	A	B	C	D	E	F	G	t_1	t_2	Qty	size	Qty	size	Qty	size
PPUP70	70	70	126.5	100	100	100	48.3	4	4	10	Ø5	2	Ø13.5	4	Ø12
PPUP90	90	70	121.5	100	100	100	48.3	4	4	10	Ø5	2	Ø13.5	4	Ø12

Table D35-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Tube	S235 JRH according to EN 10219-1	
	Or stainless steel as described	

Table D35-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]			
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type	Qty	Type				
PPUP70	10	CNA4,0x40	4	Ø10	92.2	17.8	10.7	8.2 / ($k_{mod}^{0.5}$)
PPUP90	10	CNA4,0x50	4	Ø10	min(121.5; 102.8/k_{mod})	21.9	min(13.1 ; 14.1/k_{mod})	10.6 / ($k_{mod}^{0.5}$)

To obtain full load-carrying capacities for lifting force and horizontal force, the characteristic withdrawal capacity of the anchors should be minimum: 14.9 kN for PPUP70 and 18.8 kN for PPUP90.

D36: PU / EMBU

Product name	Alternative names
PUxx	EMBU

xx: width of PU

Figure D36-1: Drawings

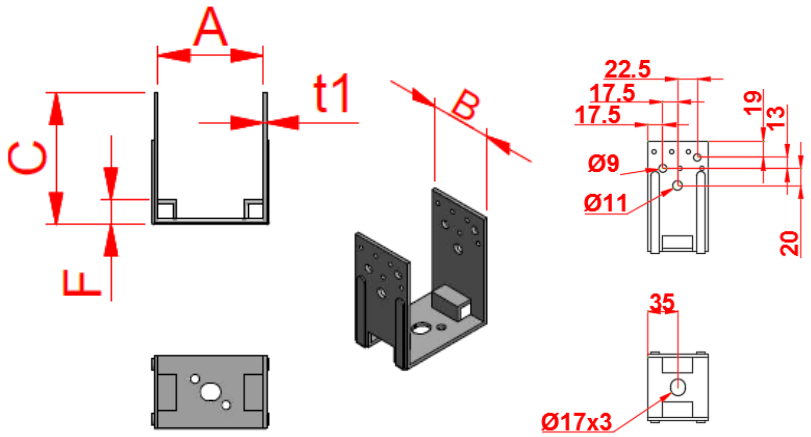


Table D36-1: Size specification

Model	Product dimensions [mm]					Holes									
						Top						Bottom			
	A	B	C	F	t	Qty	size	Qty	size	Qty	size	Qty			size
PU70-B	71	70	131	24	4	10	Ø5	4	Ø9	2	Ø11			1	Ø17x20
PU80-B	81	70	126	24	4	10	Ø5	4	Ø9	2	Ø11			1	Ø17x20
PU90-B	91	70	131	24	4	10	Ø5	4	Ø9	2	Ø11	2	Ø9	1	Ø17x20
PU100-B	101	70	126	24	4	10	Ø5	4	Ø9	2	Ø11	2	Ø9	1	Ø17x20
PU120-B	121	70	116	24	4	10	Ø5	4	Ø9	2	Ø11	2	Ø9	1	Ø17x20
PU140-B	141	70	106	24	4	10	Ø5	4	Ø9	2	Ø11	2	Ø9	1	Ø17x20

Table D36-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot dip galvanized according to EN ISO 1461
	Or stainless steel as described	

Table D36-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]	
	On post		On concrete		$R_{1.k}$	$R_{2.k}$
	Qty	Type	Qty	Type		
PU70-B	n	CNA4,0	1	Ø16	max(19.1 ; n x $R_{lat.k}$)	min(n x $R_{lat.k}$; 14.1/k_{mod})
PU80-B	n	CNA4,0	1	Ø16		min(n x $R_{lat.k}$; 11.7/k_{mod})
PU90-B	n	CNA4,0	1	Ø16		min(n x $R_{lat.k}$; 10.0/k_{mod})
PU100-B	n	CNA4,0	1	Ø16		min(n x $R_{lat.k}$; 8.76/k_{mod})
PU120-B	n	CNA4,0	1	Ø16		min(n x $R_{lat.k}$; 6.99/k_{mod})
PU140-B	n	CNA4,0	1	Ø16		min(n x $R_{lat.k}$; 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.

D37: PUA

Product name	Alternative names
PUAxx	U

Figure D37-1: Drawings

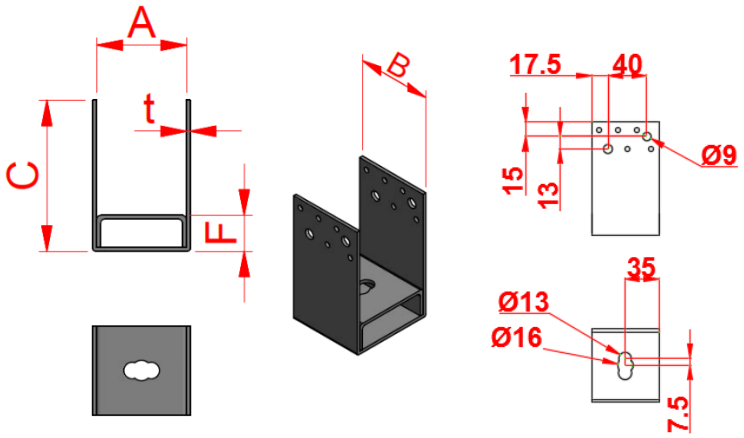


Table D37-1: Size specification

Model	Product dimensions [mm]					Holes					
						Top				Bottom	
	A	B	C	F	t	Qty	size	Qty	size	Qty	size
PUA45	46	70	127	30	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA50	51	70	125	28	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA60	61	70	120	23	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA70	71	70	115	28	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA80	81	70	110	23	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA90	91	70	115	28	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA100	101	70	110	23	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA120	121	70	110	23	3	10	Ø5	4	Ø9	1	Ø13x26-Ø16
PUA/B42	42	70		27	3					1	Ø13x26-Ø16
PUA/B47	47	70		25	3					1	Ø13x26-Ø16
PUA/B57	57	70		20	3					1	Ø13x26-Ø16
PUA/B67	67	70		25	3					1	Ø13x26-Ø16
PUA/B77	77	70		20	3					1	Ø13x26-Ø16
PUA/B87	87	70		25	3					1	Ø13x26-Ø16
PUA/B97	97	70		20	3					1	Ø13x26-Ø16
PUA/B117	117	70		20	3					1	Ø13x26-Ø16

PUA/BXX are item codes for U-shaped bottom plates

Table D37-2: Material specification

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

Table D37-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]	
	On post		On concrete		$R_{1.k}$	$R_{2.k}$
	Qty	Type	Qty	Type		
PUA45 + PUA/B42	10	Ø5	1	Ø12	min(29.6 ; 34.7/k_{mod})	min(18.1 ; 10.9/k_{mod})
PUA50 + PUA/B47	10	Ø5	1	Ø12		min(18.1 ; 9.8/k_{mod})
PUA60 + PUA/B57	10	Ø5	1	Ø12		7.6/k_{mod}
PUA70 + PUA/B67	10	Ø5	1	Ø12		6.2/k_{mod}
PUA80 + PUA/B77	10	Ø5	1	Ø12		5.2/k_{mod}
PUA90 + PUA/B87	10	Ø5	1	Ø12		4.5/k_{mod}
PUA100 + PUA/B97	10	Ø5	1	Ø12		4.0/k_{mod}
PUA120 + PUA/B117	10	Ø5	1	Ø12		3.2/k_{mod}

D38: PVD / PVDB / PVI / PVIB

Product name	Alternative names
PVD80	PB31950; VarioD80
PVD120	PB31948; Vario D120
PVDB80	PB31951; VarioDB80
PVDB120	PB31949; Vario DB120
PVI	Vario I
PVIB	Vario IB

Figure D38-1: Drawings

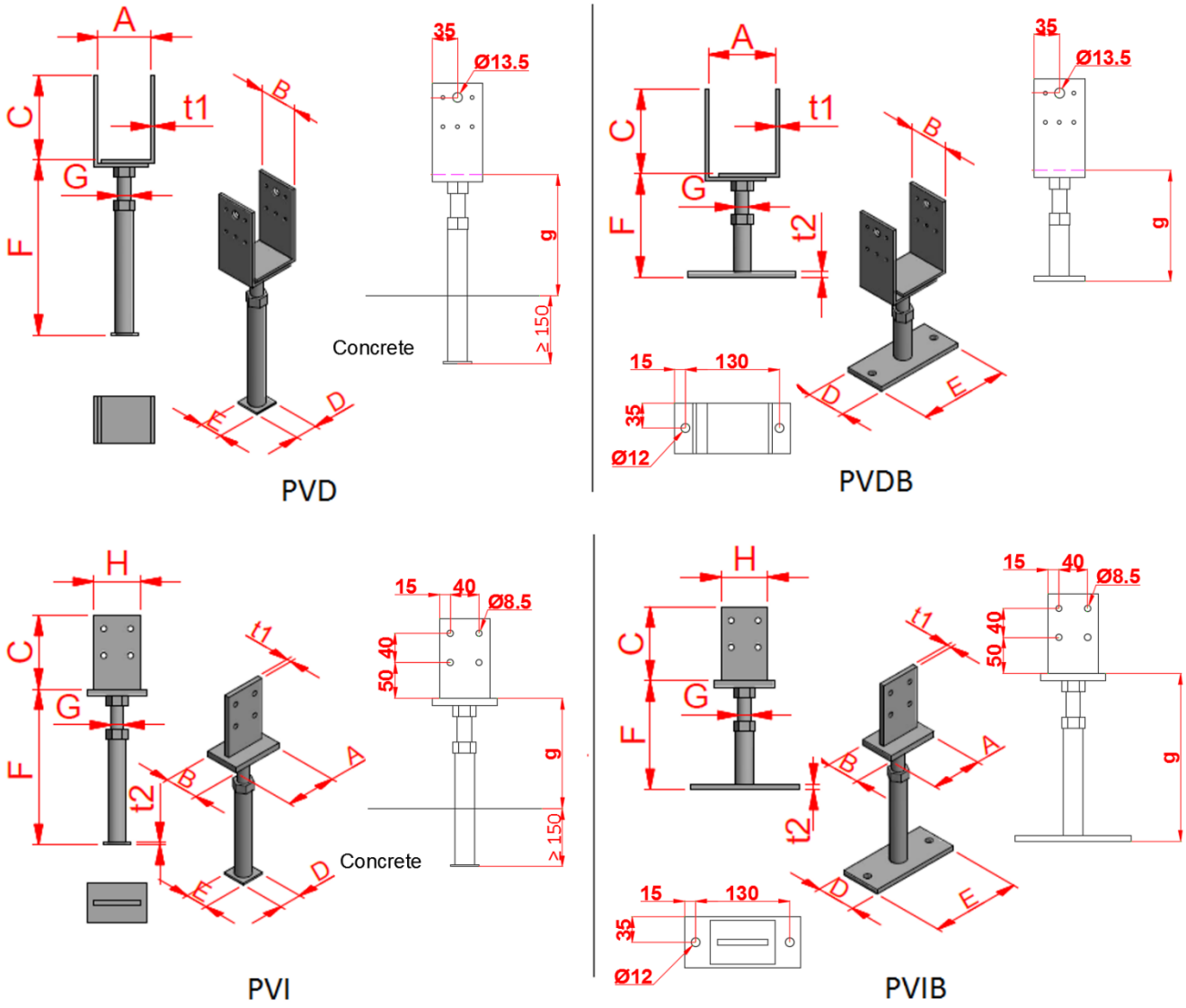


Table D38-1: Size specification

Model	Product dimensions [mm]										Holes					
											Top				Bottom	
	A	B	C	D	E	F	G	H	t_1	t_2	Qty	size	Qty	size	Qty	size
PVD80	80 - 120	70	120	40	40	249 - 302	20		5	4	10	Ø5	2	Ø13.5		
PVD120	120 - 160	70	120	40	40	249 - 302	20		5	4	10	Ø5	2	Ø13.5		
PVDB80	80 - 120	70	120	70	160	136 - 189	20		5	8	10	Ø5	2	Ø13.5	2	Ø12
PVDB120	120 - 160	70	120	70	160	136 - 189	20		5	8	10	Ø5	2	Ø13.5	2	Ø12
PVI	90	60	110	40	40	222 - 274	20	70	8	4	4	Ø8.5				
PVIB	90	60	110	70	160	109 - 161	20	70	8	8	4	Ø8.5			2	Ø12

Table D38-2: Material specification

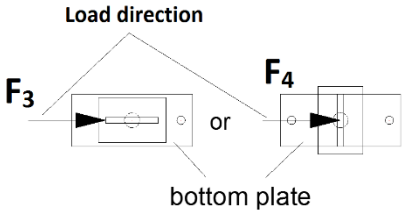
Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
Threaded rod	S355 JO according to EN 10025	
	Or stainless steel as described	

Table D38-3: Characteristic capacity

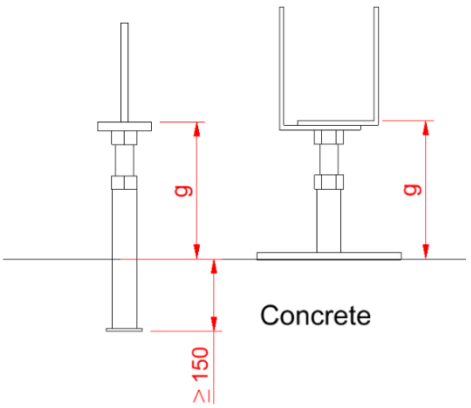
Model	Fasteners				Timber width [mm]	Characteristic capacities (kN)			
	On post		On concrete			$R_{1.k}$	$R_{2.k}$	$R_{3.k}$*	$R_{4.k}$*
	Qty	Type	Qty	Type					
PVD	10	CNA4,0x40			80	min(77.8 ; 49.0/k_{mod})	17.6	k_3 x 2.7/k_{mod}	k_4 x 6.5/k_{mod}
	10	CNA4,0x40			120		min(17.6 ; 11.6/k_{mod})		
	10	CNA4,0x40			160		min(15.2 ; 7.6/k_{mod})		
PVDB	10	CNA4,0x40	2	Ø10	80	min(77.8 ; 49.0/k_{mod})	17.6	k_3 x 1.4/k_{mod}	k_4 x 3.2/k_{mod}
	10	CNA4,0x40			120		min(17.6 ; 11.6/k_{mod})		
	10	CNA4,0x40			160		min(15.2 ; 7.6/k_{mod})		
PVI	4	Ø8x80			80	min(90.7 ; 49.0/k_{mod})	16.0	k_3 x 2.7/k_{mod}	k_4 x min(2.5 ; 2.2/k_{mod})
	4	Ø8x120			120		20.7		k_4 x min(3.8 ; 3.8/k_{mod})
	4	Ø8x160			160		20.7		k_4 x min(5.7 ; 4.7/k_{mod})
PVIB	4	Ø8x80	2	Ø10	80	min(90.7 ; 49.0/k_{mod})	16.0	k_3 x 2.6/k_{mod}	k_4 x min(1.9 ; 1.9/k_{mod})
	4	Ø8x120			120		20.7		k_4 x min(3.3 ; 2.7/k_{mod})
	4	Ø8x160			160		20.7		k_4 x min(3.5 ; 2.7/k_{mod})

Capacities depends on k factors, which depend on distance g. The following given modification factors shall be used.

For PVDB and PVIB, the horizontal load F_3 or F_4 shall always be in the direction of the longer side of the bottom plate.



PVD	g (mm)	48	73	98
	k_3	1	0.79	0.65
	k_4	1	0.61	0.44
PVDB	g (mm)	136	161	186
	k_3	1	0.88	0.84
	k_4	1	0.78	0.73
PVI	g (mm)	32	57	82
	k_3	1.15	1	0.85
	k_4	1.15	1	0.85
PVIB	g (mm)	120	145	170
	k_3	1.1	1	0.85
	k_4	1.1	1	0.85



D39: TPB

Product name	Alternative names
TPB195	

Figure D39-1: Drawings

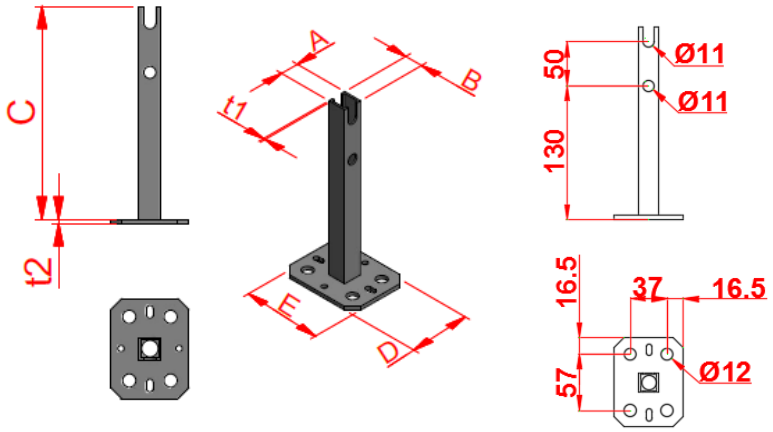


Table D39-1: Size specification

Model	Product dimensions [mm]							Holes					
								Top		Bottom			
	A	B	C	D	E	t_1	t_2	Qty	size	Qty	size	Qty	size
TPB195	20	20	191	70	90	2	4	2	Ø11	4	Ø6	4	Ø12

Table D39-2: Material specification

Part	Material Grades	Coating specification
Plate and tube	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
	Or stainless steel as described	

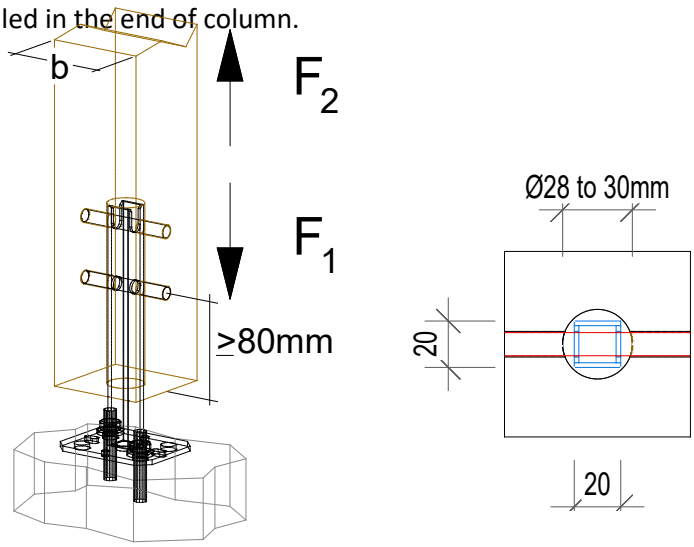
Table D39-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]	
	On post		On concrete		$R_{1.k}$	$R_{2.k}$
	Qty	Type	Qty	Type		
TPB195	2	Ø10x60	2	Ø10	15.5	7.8
	2	Ø10x70	2	Ø10	16.0	8.0
	2	Ø10x80	2	Ø10	17.0	8.5
	2	Ø10x90	2	Ø10	18.2	9.1
	2	Ø10x100	2	Ø10	19.7	9.8
	2	Ø10x120	2	Ø10	23.1	10.4
	2	Ø10x140	2	Ø10	26.0	10.4

Minimum size of the column: 60x60 mm

The anchoring has to be checked for uplift load. It shall be fixed with two anchor diagonally opposite.

A hole Ø28 or 30mm must be drilled in the end of column.



D40: PPxx/yyB, PPxx/yyS

Product name	Alternative names
PPxx/yyB	
PPxx/yyBZ	
PPxx/yyS	
PPxx/yySZ	

Figure D40-1: Drawings

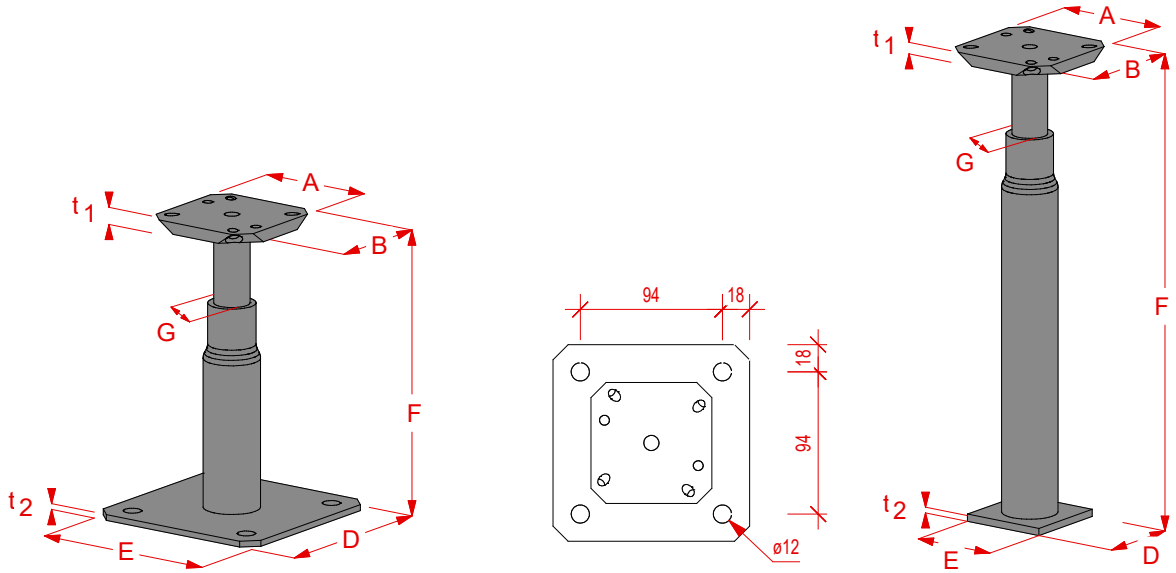


Table D40-1: Size specification

Model	Dimensions [mm]							Holes
	A	B	D	E	F	G	t_1 / t_2	Ø
PP13/19B	80	80	130	130	130-190	24	8/4	6,5 ; 12
PP18/24B	80	80	130	130	180-240	24	8/4	6,5 ; 12
PP23/29B	80	80	130	130	230-290	24	8/4	6,5 ; 12
PP28/34B	80	80	130	130	280-340	24	8/4	6,5 ; 12
PP13/19S	80	80	80*	80*	250-310	24	8/4	6,5
PP18/24S	80	80	80*	80*	300-360	24	8/4	6,5
PP23/29S	80	80	80*	80*	350-410	24	8/4	6,5
PP29/34S	80	80	80*	80*	410-470	24	8/4	6,5

t_1 can be also in t_1=10mm
*this size can be in range from 70x70 to 100x100mm (alternative size)

Table D40-2: Material specification

Part	Material Grades	Coating specification
Plates & tube	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461 or Type …Z: Zinc Nickel galvanization plus top coating
Threaded rod	S355JO according to EN 10025	
	Or stainless steel as described	

Table D40-3: Characteristic capacity

Model	Fasteners				Characteristic capacities [kN]		
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k} = R_{4.k}$
	Qty	Type	Qty	Type			
PP13/19B	4	Ø6	4	Ø10	min (100.5 /$k_{mod}^{0.6}$) ; 93 /k_{mod})	min (11.9 ; 10.3 /k_{mod})	min (3.0 ; 2.5 /k_{mod})
PP18/24B	4	Ø6	4	Ø10			min (3.0 ; 2.0 /k_{mod})
PP23/29B	4	Ø6	4	Ø10			min (3.0 ; 1.7 /k_{mod})
PP28/34B	4	Ø6	4	Ø10			min (2.8 ; 1.4 /k_{mod})
PP13/19S	4	Ø6	-	-	min (100.5 /$k_{mod}^{0.6}$) ; 93 /k_{mod})	min (11.9 ; 10.3 /k_{mod})	3.0
PP18/24S	4	Ø6	-	-			3.0
PP23/29S	4	Ø6	-	-			min (3.0 ; 3.2 /k_{mod})
PP28/34S	4	Ø6	-	-			min (3.0 ; 2.7 /k_{mod})

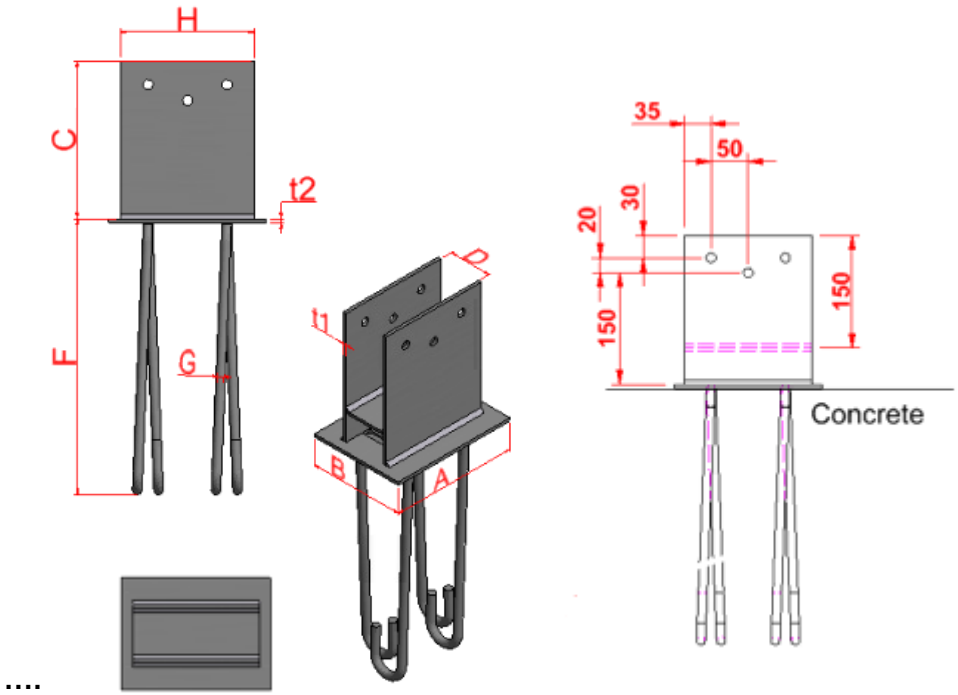
The capacities for $R_{2.k}$ and $R_{3.k}$/$R_{4.k}$ based on an axial capacity of the screws in the column with $R_{ax.45.k}$= 4,22 kN. For other axial capacities of the screws, the capacities should be modify accordantly except the values "xx/k_{mod} ".

The embedment length for model S in concrete shall be minimum 120 mm.

D41: PLO1

Product name	Alternative names
PLO1	

Figure D41-1: Drawings



....

PLO1

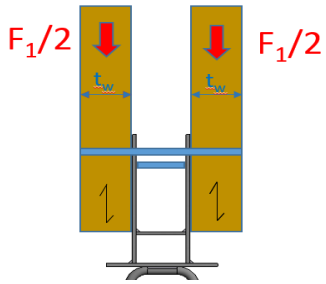
Table D41-1: Size specification

Model	Product dimensions [mm]									Holes	
										Top	
	A	B	C	D	F	G	H	t_1	t_2	Qty	size
PLO1	200	150	200	67,5	345	12	170	5	5	3	Ø13

Table D41-2: Material specification

Part	Material Grades	Coating specification
Plates	S235JR according to EN 10025:2004	Hot-dip galvanized according to EN ISO 1461:1999
Rebar	B500 or equivalent according to EN10080	
	Or stainless steel as described	

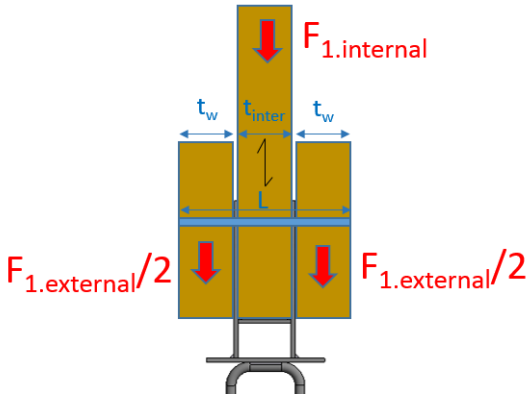
Table D41-3: Characteristic capacity, configuration 1



Capacities are valid for STD dowel or equivalent with $f_{ud.k} \geq 340$ N/mm²

Model	Fasteners		Characteristic capacities (kN)		
	On post		$R_{1.k} = R_{2.k}$	$R_{3.k}$	$R_{4.k}$
	Qty	Type			
PLO1	3	Ø12x180	37,8	min(17.8 ; 23.5/k_{mod})	17,1
		Ø12x200	43,3	min(21.2; 23.5/k_{mod})	
		Ø12x220	43,3	min(24.6; 23.5/k_{mod})	
		Ø12x240	43,3	min(28.1; 23.5/k_{mod})	

Table D41-4: Characteristic capacity, configuration 2



Capacities are valid for STD dowel or equivalent with $f_{ud.k} \geq 340$ N/mm²

Model	Fasteners		Characteristic capacities (kN)				
	On post		$R_{1.k} = R_{2.k}$		$R_{3.k}$**		$R_{4.k}$
	Qty	Type	Internal	External*	Internal	External	
PLO1	3	Ø12x180	43,4	24,7	23,1	23.5/k_{mod}	17,1
		Ø12x200		29,4			
		Ø12x220		34,2			
		Ø12x240		35			

* Transversal tension in timber shall be checked

** sum of the two must be lower than 23.5/k_{mod}

D42: PBW

Product name	Alternative names
PBWxxZ	
PBWxxG	

xx indicates the width “A” and can be any number between 45 and 100 mm (both values incl.).

Figure D42-1: Drawings

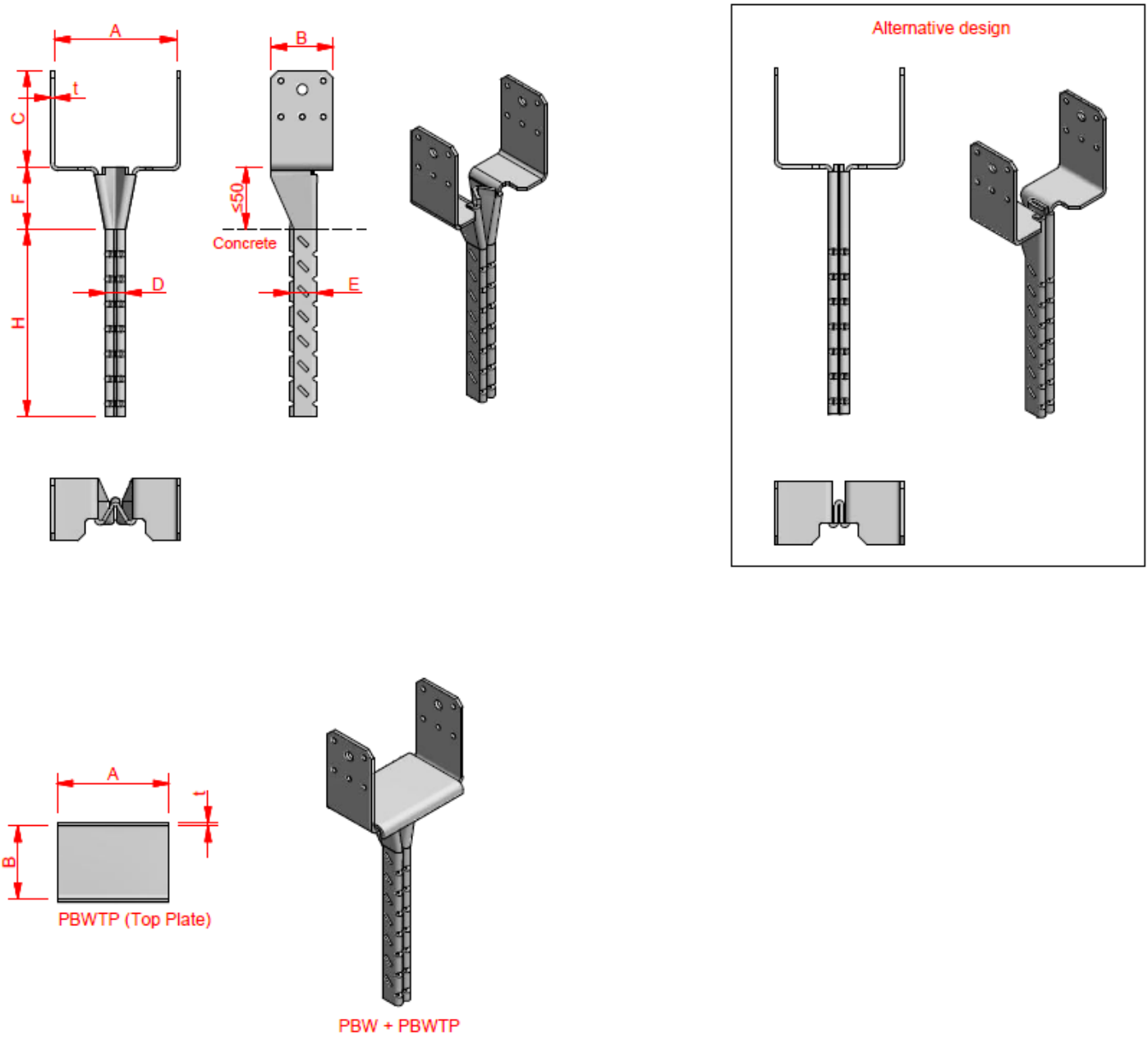


Table D42-1: Size specification

Model	Product dimensions [mm]								Holes	
	A	B	C	D	E	F	H	t	Ø5	Ø8,5
PBWxx	45-100	50	77	16	21	50	150	3,0	10	2
PBWTPxx	xx-8	58	-	-	-	-	-	3,0	0	0

xx indicates the width “A” and can be any number between 45 and 100 mm (both values incl.).

Table D42-2: Material specification

Part	Material Grades	Coating specification
PBWxxZ & PBWTPxxZ	S250 GD according to EN 10346	Pre-galvanized steel ZM310 according to EN10346
PBWxxG & PBWTPxxG	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461:1999

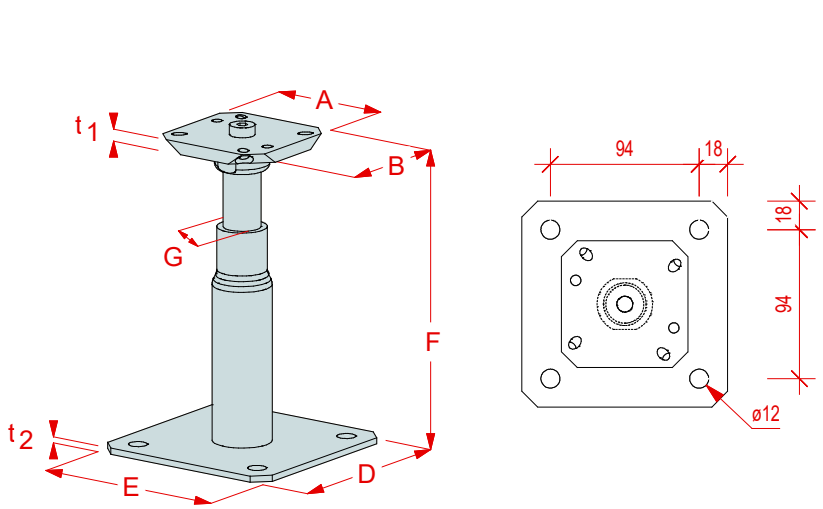
Table D42-3: Characteristic capacity

Model	Characteristic load carrying capacity (kN)				
	$R_{1,k}$			$R_{2,k}$	
	Fasteners	Concrete C12/15	Concrete C20/25	Fasteners	
PBWxx	10 x CSA5,0x40	22,0	22,0	4 x CSA5,0x40	$2,6/k_{mod}$
PBWxx + PBWTPxx	10 x CSA5,0x40	$35,0/k_{mod}$	$43,0/k_{mod}$	4 x CSA5,0x40	$2,6/k_{mod}$

D43: PPC

Product name	Alternative names
PPCxx/yyB	
PPCxx/yyBZ	

Figure D43-1: Drawings



PPCxx/yyB PPCxx/yyS

Table D43-1: Size specification

Model	Dimensions [mm]							Holes
	A	B	D	E	F	G	t_1 / t_2	Ø
PPC14/20B	80	80	130	130	140-200	24	8 / 4	6,5 ; 12
PPC19/25B	80	80	130	130	190-250	24	8 / 4	6,5 ; 12
PPC24/30B	80	80	130	130	240-300	24	8 / 4	6,5 ; 12
PPC29/35B	80	80	130	130	290-350	24	8 / 4	6,5 ; 12
PPC14/20S	80	80	80*	80*	260/320	24	8 / 4	6,5
PPC19/25S	80	80	80*	80*	310/370	24	8 / 4	6,5
PPC24/30S	80	80	80*	80*	360/420	24	8 / 4	6,5
PPC29/35S	80	80	80*	80*	410/470	24	8 / 4	6,5

*this size can be in range from 70x70 to 100x100mm (alternative size)
t_1 can be also in t_1=10mm

Table D43-2: Material specification

Part	Material Grades	Coating specification
Plates & tube	S235JR according to EN 10025	Type …G:Hot-dip galvanized according to EN ISO 1461 (e.g. PPC14/20BG) or Type …Z: Zinc Nickel galvanization plus top coating (e.g. PPC14/20BZ) or Type … B: Zinc Nickel galvanization plus black top coating (e.g. PPC14/20BB)
Threaded rod/Bolt	S355JO according to EN 10025/ 8.8	
	Or stainless steel as described	

Table D43-3: Characteristic capacity

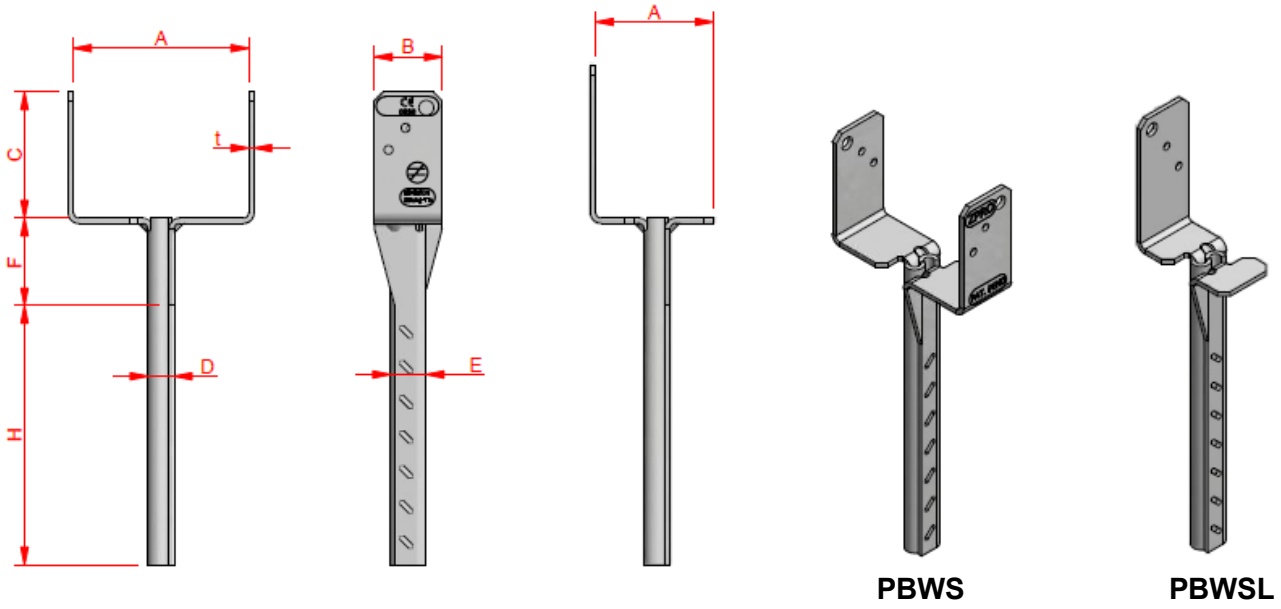
Model	Fasteners				Characteristic capacities [kN]		
	On post		On concrete		$R_{1.k}$	$R_{2.k}$	$R_{3.k} = R_{4.k}$
	Qty	Type	Qty	Type			
PPC14/20B	4	Ø6	4	Ø10	min (130 ; 93 /k_{mod})	min (11,9 ; 10,3 /k_{mod})	min (3,0 ; 2,4 /k_{mod})
PPC19/25B	4	Ø6	4	Ø10			min (3,0 ; 1,9 /k_{mod})
PPC24/30B	4	Ø6	4	Ø10			1,6 /k_{mod})
PPC29/35B	4	Ø6	4	Ø10			1,4 /k_{mod})
PPCxx/yyS	4	Ø6	-	-	min (130 ; 93 /k_{mod})	11,9	min (3,0 ; 2,6/k_{mod})

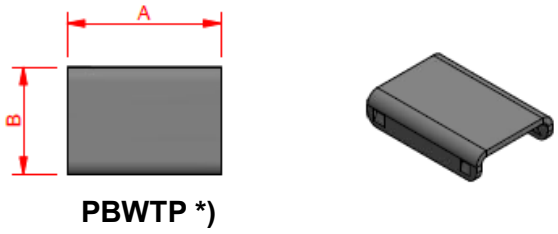
The capacities for $R_{2.k}$ and $R_{3.k}$/$R_{4.k}$ based on an axial capacity of the screws in the column with $R_{ax.45.k}$ =4,22 kN. For other axial capacities of the screws, the capacities should be modify accordantly except the values "xx/k_{mod} ".
The embedment length for PPCxx/yyS in concrete shall be minimum 120 mm.

D44: PBWS & PBWSL

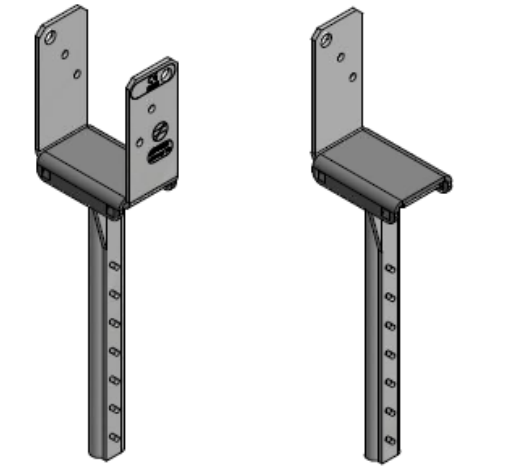
Product name	Alternative names
PBWSxxy	
PBWSLxxy	
PBWTPxxy	

Figure D42-1: Drawings





PBWTP *)



PBWS+PBWTP **PBWSL+PBWTP**

***) The geometry may differ a bit from drawing.**

Table D44-1: Size specification

Model	Product dimensions [mm]								Holes	
	A	B	C	D	E	F	H	t	Ø5	Ø8,5
PBWSxxY	45-120	38,6	72-99,5	16	21	50	148	3,0	4	2
PBWSLxxY	43-98	38,6	72-99,5	16	21	50	148	3,0	2	1
PBWTPxxY	xx-6	46	-	-	-	-	-	3,0	0	0

xx indicates the width “A” and can be any number between 45 and 120 mm (both values incl.).
y indicates the steel type/coating (Z = S250GD+ZM310 & S = Stainless Steel A4)

Table D44-2: Material specification

Model	Material Grades	Coating specification
PBWSxxZ PBWTPxxZ	S250GD according to EN 10346	Pre-galvanized steel with ZM310 coating according to EN10346
PBWSxxS PBWTPxxS	Stainless steel 1.4401/1.4404 (A4) to EN 10088	-

Table D44-3: Characteristic capacity

Model	Characteristic load carrying capacity (kN) *)		
	Fasteners	$R_{1,k}$	$R_{2,k}$
PBWS PBWSL	4 x CSA5,0x40 or 2 x SSH8x40	20,2	$2,1/k_{mod}$
PBWS/L + PBWTP	4 x CSA5,0x40 or 2 x SSH8x40	$34,1/k_{mod}$	$2,1/k_{mod}$

*) Minimum Concrete strength C12/15

Column

D50: OSP & OSPS

OSP Outdoor steel post

Product name	Alternative names			
	UK	France	DK	D
OSP				
OSPS				

The product OSP is composed of a tube with one welded plate SP at each end.
8 different plates SP with parameters described below are available.
The OSP characteristic capacity R_k to consider for one load direction is the minimum of the capacity given for each of the selected plates for this particular load direction. Failure modes associated to the tube, such as buckling or welding failure, are taken into account in each plate capacity in the following tables.
OSPS stands for OSP in the stainless steel version, the corresponding stainless steel plates are named SPS.

Figure D50-1: OSP Overview

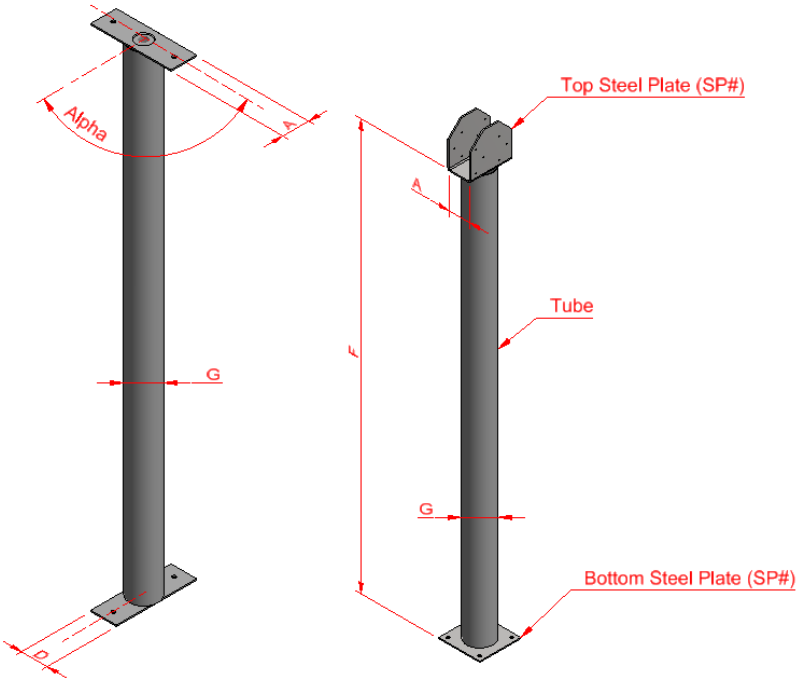
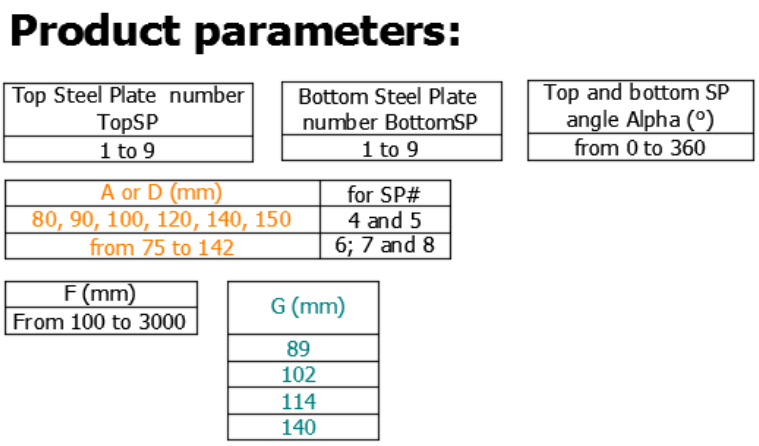
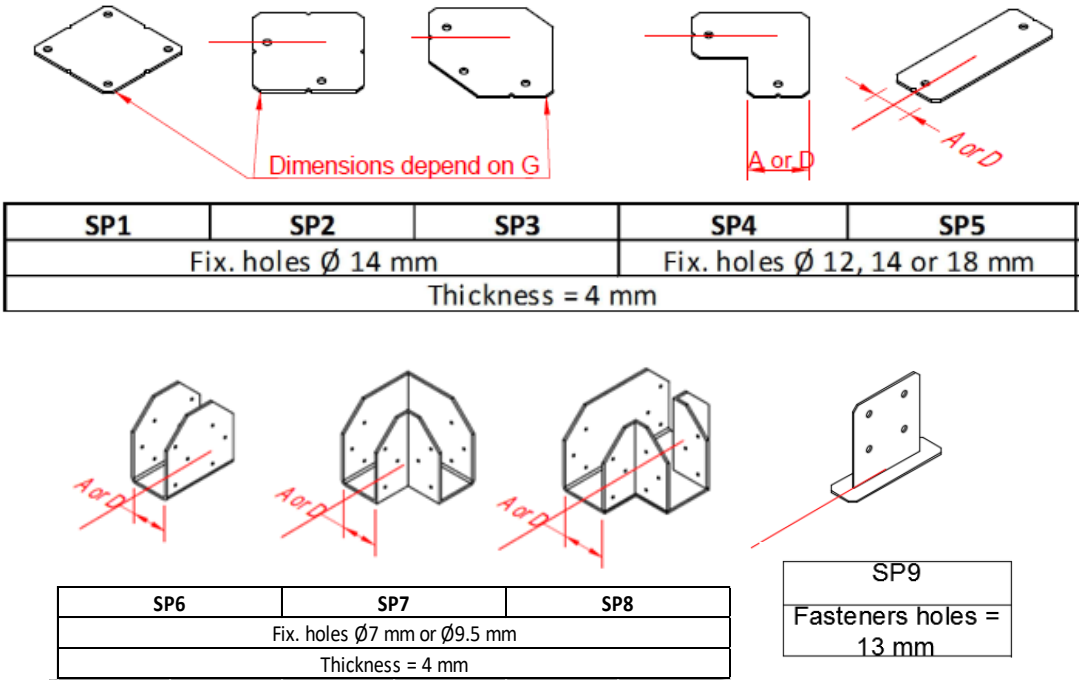


Figure D50-2: Overall size specification



The dimensions mentioned above are the necessary and sufficient parameters to determine all possible combinations. The compatibility between tube dimensions and plate dimensions are detailed for each plate further. The other dimensions that depend on these parameters are also specified in the further drawings.

Figure D50-3: Available SP and SPS Overview



for steel plate SP 6 and 8, the following rule shall be observed:

$\pi \frac{G}{4} < A < G + 40$ mm or $A - 40$ mm $< G < \frac{4A}{\pi}$

for steel plate SP 7, the following rule shall be observed:

$\pi \frac{G}{4} + 10 < A < G + 40$ mm or $A - 40$ mm $< G < \frac{4A}{\pi}$ -10

Other plate dimensions are given further in figures D50-4to D50-12

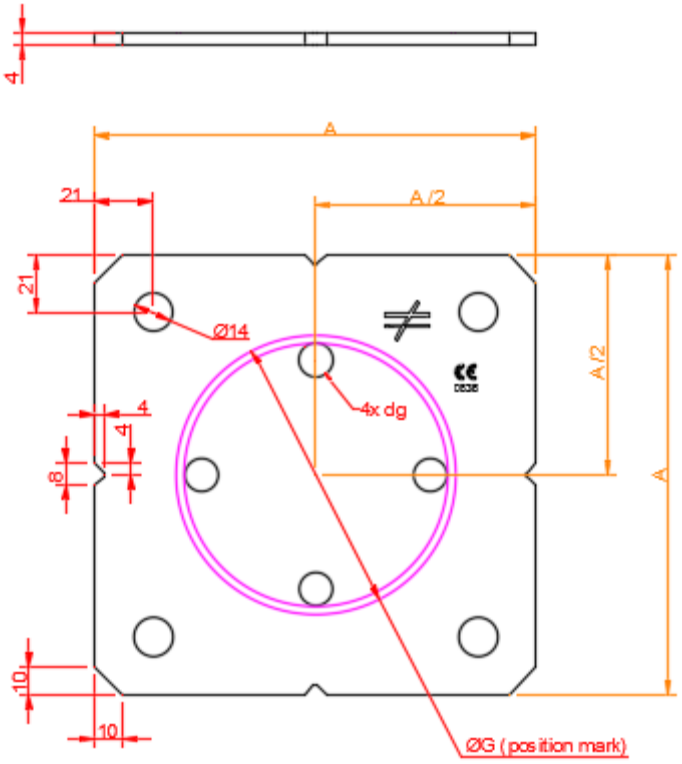
Table D50-1: Material specification OSP

Part	Material thickness	Material grades	Coating specification
Tube	3	S235JR according to EN10025:2004	hot dip galvanization according to EN ISO 1461 with optional painting
Plates	4	S235JR according to EN10025:2004	hot dip galvanization according to EN ISO 1461 with optional painting

Table D50-2: Material specification OSPS

Part	Material thickness	Material grades	Coating specification
Tube	3	Stainless steel 1.4401. 1.4404. 1.4521. 1.4301 or 1.4509 according to EN 10088-2:2014	
Plates	4	Stainless steel 1.4401. 1.4404. 1.4521. 1.4301 or 1.4509 according to EN 10088-2:2014	

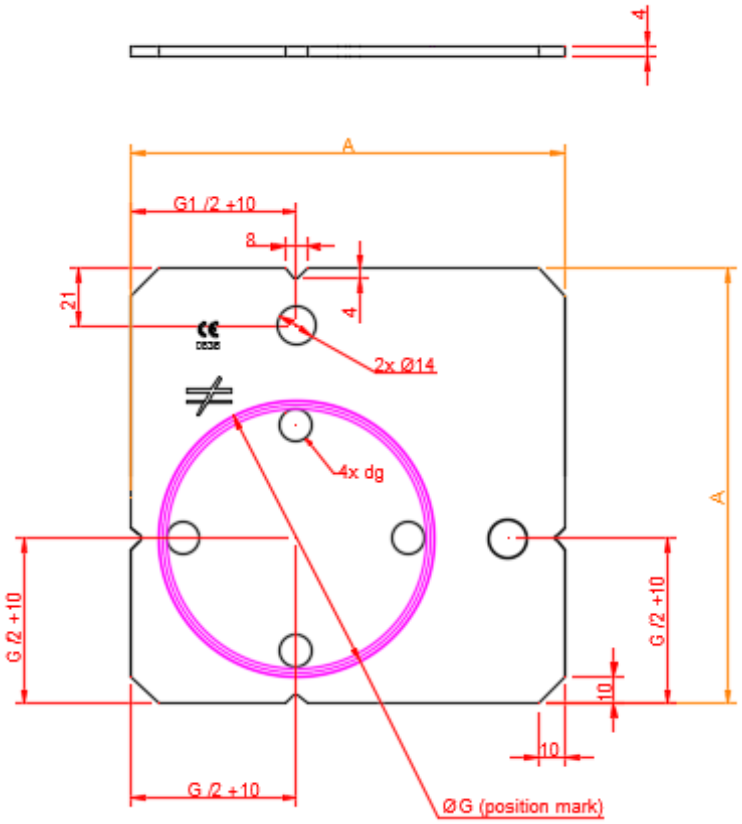
Figure D50-4: size specification SP1 or SPS1



Dimension A is linked to the tube diameter G:

Item	Product dimensions (mm)				Compatible with tube diam. G	d_g	Plate anchor holes
	A	B=A	C	t			
SP1/Ø89	150	150		4	88.9	12	4 Ø14
SP1/Ø102	160	160		4	101.6	12	4 Ø14
SP1/Ø114	180	180		4	114.3	18	4 Ø14
SP1/Ø140	200	200		4	139.7	20	4 Ø14

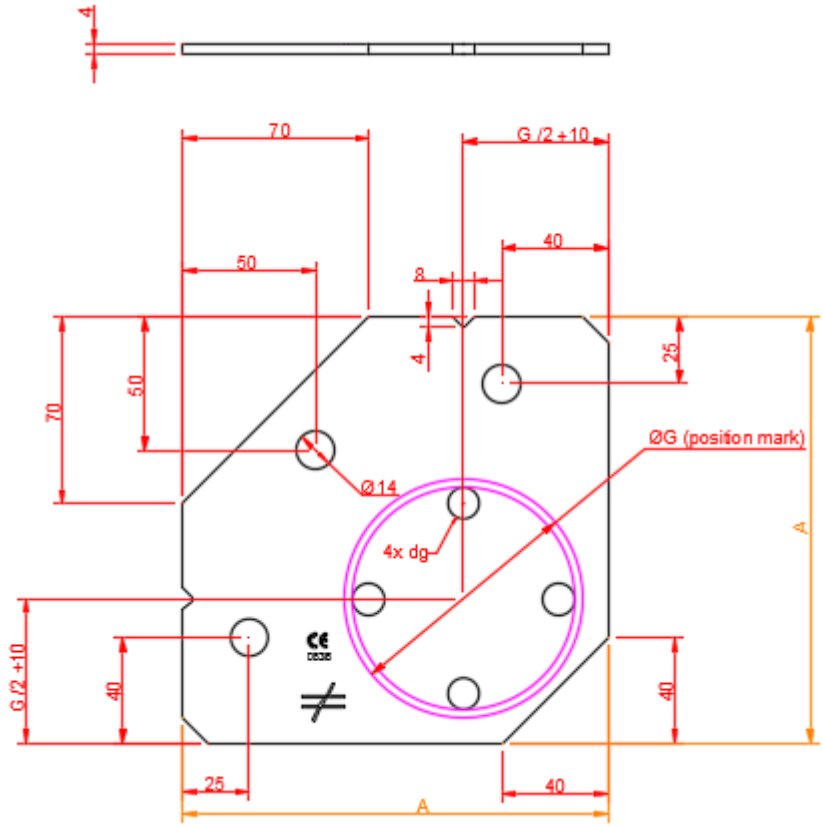
Figure D50-5: size specification SP2 or SPS2



Dimension A is linked to the tube diameter G:

Item	Product dimensions (mm)				Compatible with tube diam. G	d_g	Plate anchor holes
	A	B=A	C	t			
SP2/Ø89	150	150		4	88.9	12	2 Ø14
SP2/Ø102	160	160		4	101.6	12	2 Ø14
SP2/Ø114	180	180		4	114.3	18	2 Ø14
SP2/Ø140	200	200		4	139.7	20	2 Ø14

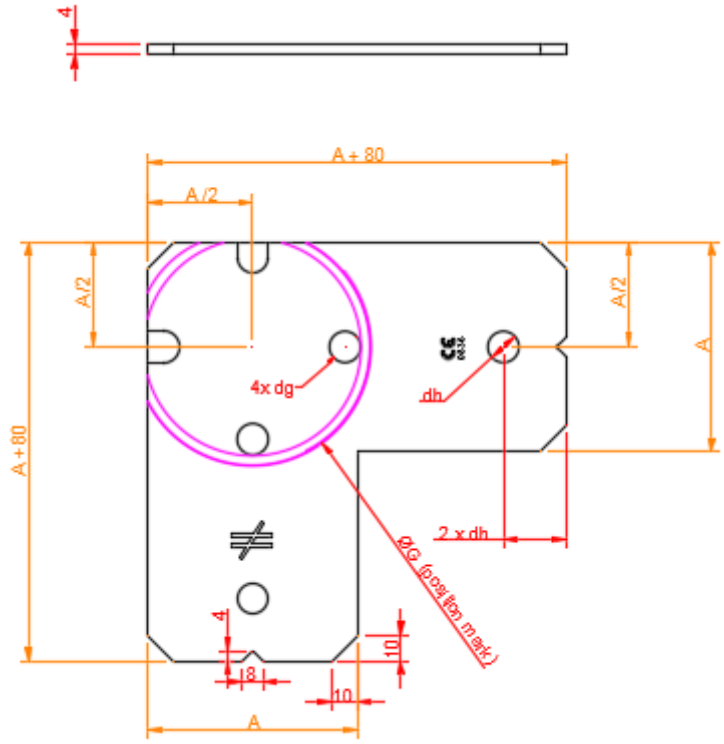
Figure D50-6: size specification SP3 or SPS3



Dimension A is linked to the tube diameter G:

Item	Product dimensions (mm)				Compatible with tube diam. G	d_g	Plate anchor holes
	A	B=A	C	t			
SP3/Ø89	160	160		4	88.9	12	3 Ø14
SP3/Ø102	180	180		4	101.6	12	3 Ø14
SP3/Ø114	180	180		4	114.3	18	3 Ø14
SP3/Ø140	200	200		4	139.7	20	3 Ø14

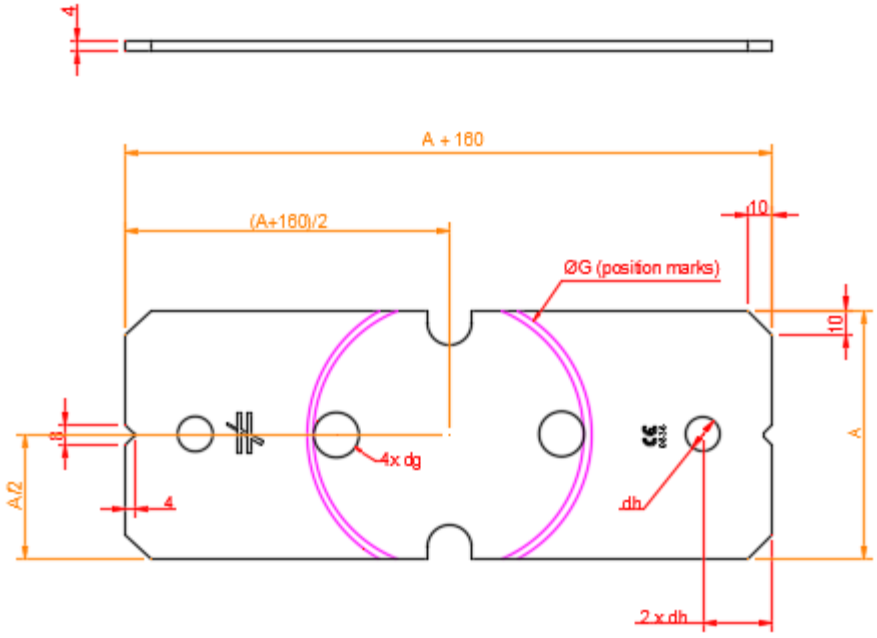
Figure D50-7: size specification SP4 or SPS4



Item	Product dimensions (mm)				Compatible with tube diam. G	Plate holes
	A	B	C	t		
SP4/ØG/80	80	160		4	88.9	2 Ø12
SP4/ØG/90	90	170		4	88.9 – 101.6	2 Ø12
SP4/ØG/100	100	180		4	88.9 – 101.6 – 114.3	2 Ø14
SP4/ØG/120	120	200		4	88.9 – 101.6 – 114.3 – 139.7	2 Ø14
SP4/ØG/140	140	220		4	114.3 – 139.7	2 Ø18
SP4/ØG/150	150	230		4	114.3 – 139.7	2 Ø18

G	d_g
88.9	12
101.6	12
114.3	18
139.7	20

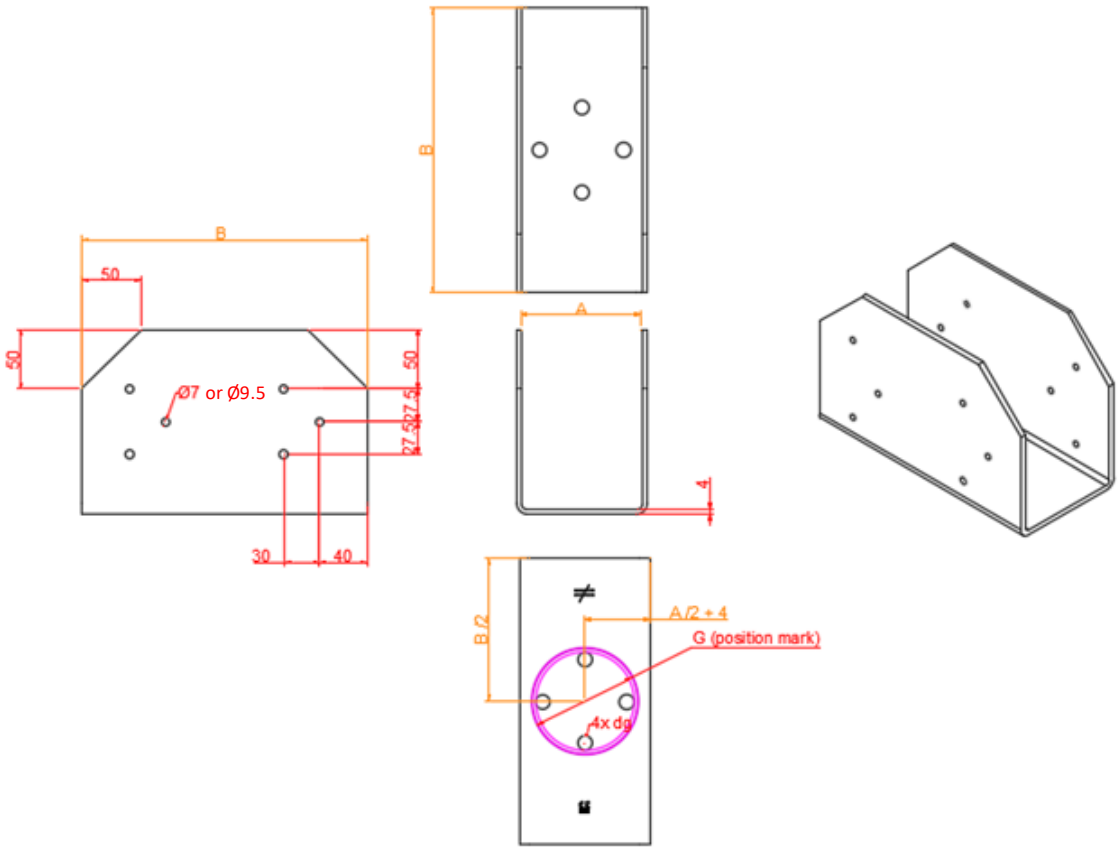
Figure D50-8: size specification SP5 or SPS5



Item	Product dimensions (mm)				Compatible with tube diam. G	Plate holes
	A	B	C	t		
SP5/ØG/80	80	240		4	88.9 – 101.6	2 Ø12
SP5/ØG/90	90	250		4	88.9 – 101.6 – 114.3	2 Ø12
SP5/ØG/100	100	260		4	88.9 – 101.6 – 114.3	2 Ø14
SP5/ØG/120	120	280		4	88.9 – 101.6 – 114.3 – 139.7	2 Ø14
SP5/ØG/140	140	300		4	114.3 – 139.7	2 Ø18
SP5/ØG/150	150	310		4	114.3 – 139.7	2 Ø18

G	d_g
88.9	12
101.6	12
114.3	18
139.7	20

Figure D50-9: size specification SP6 or SPS6

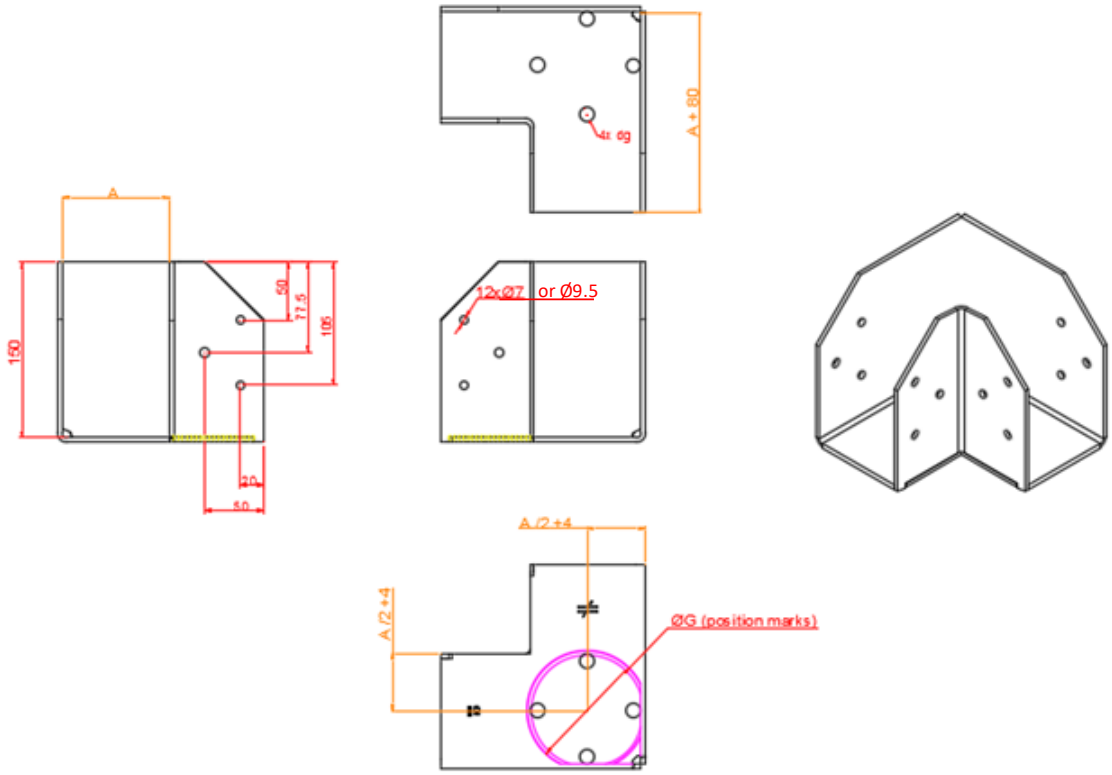


Item	Product dimensions (mm)				Compatible with tube diam. G	Plate holes for screws
	A	B	C	t		
SP6/ØG/A	from 75 to 90	230	195 – A/2	4	89 - 102	12 Ø7 or Ø9.5
SP6/ØG/A	from 91 to 115	255	207.5 - A/2	4	89 – 102 - 114	12 Ø7 or Ø9.5
SP6/ØG/A	from 116 to 142	282	221 - A/2	4	89 – 102 - 114 - 140	12 Ø7 or Ø9.5

G	d_g
88.9	12
101.6	12
114.3	18
139.7	20

Intermediate values for C are possible, as long as C > 150 mm.

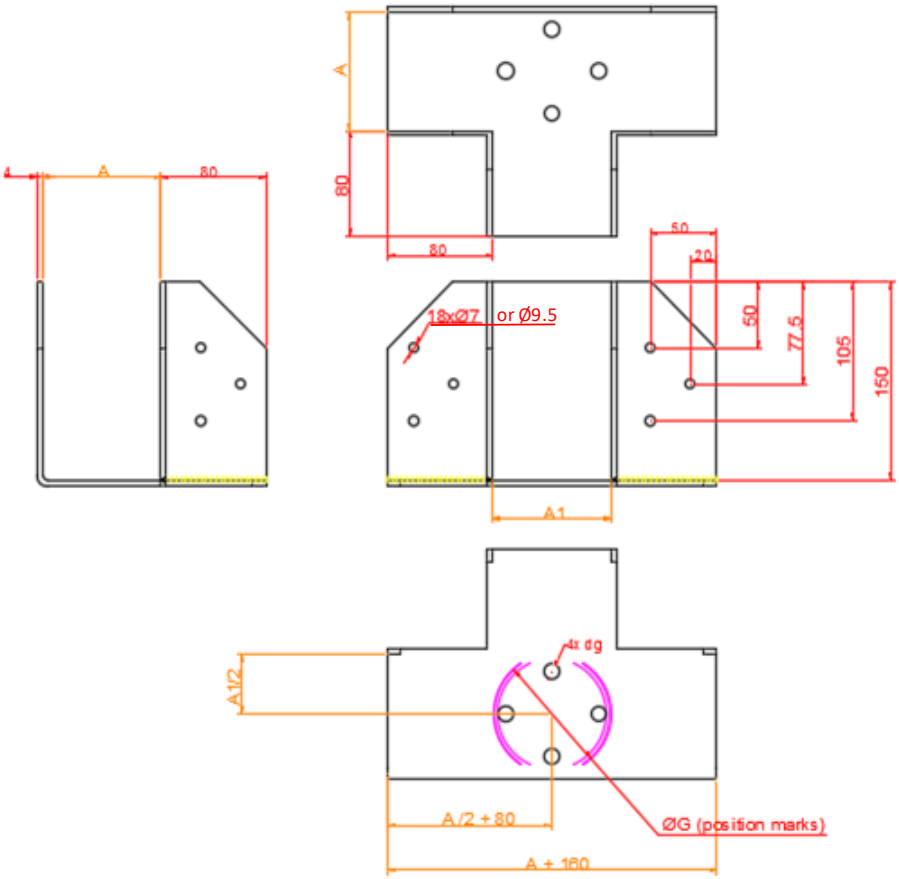
Figure D50-10: size specification SP7 or SPS7



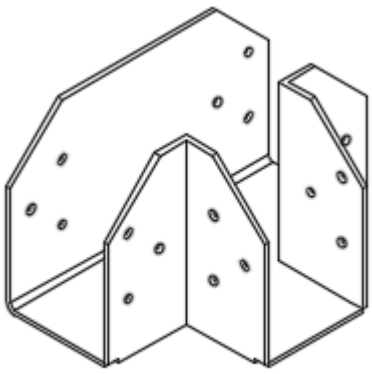
Item	Product dimensions (mm)				Compatible with tube diam. G	Plate holes for screws
	A	B	C	t		
SP7/ØG/A	from 75 to 142	A + 85	150	4	A – 40 mm < G < 4x A /π -10	12 Ø7 or Ø9.5

G	d_g
88.9	12
101.6	12
114.3	18
139.7	20

Figure D50-11: size specification SP8 or SPS8

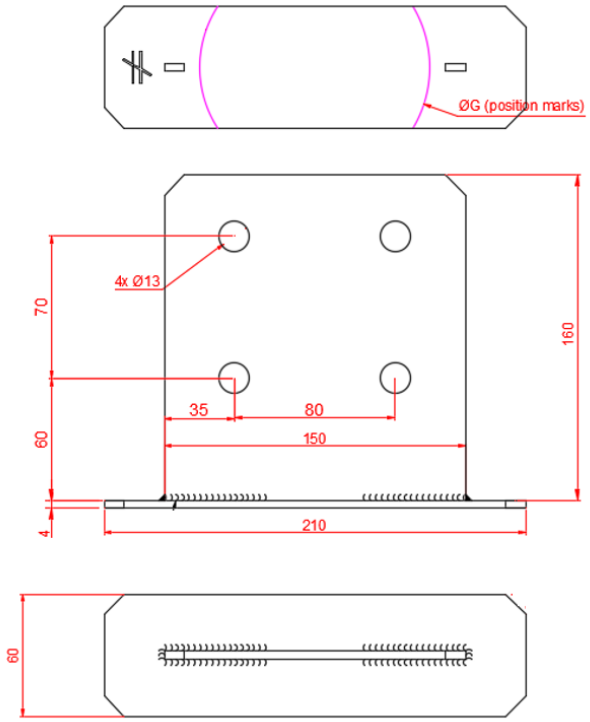


G	d_g
88.9	12
101.6	12
114.3	18
139.7	20



Item	Product dimensions (mm)				Compatible with tube diam. G	Plate holes for screws
	A	B	C	t		
SP8/ØG/A	from 75 to 142	A + 85	150	4	A – 40 mm < G < 4x A /π	18 Ø7 or Ø9.5

Figure D50-12: size specification SP9 or SPS9



Item	Product dimensions (mm)					Compatible with tube diam. G	Plate holes for dowels
	A	B	C	H	t		
SP9/ØG	210	60	160	150	4	88.9 – 101.6 – 114.3 – 139.7	Ø13

OSP characteristic capacities:

The OSP characteristic capacity R_k to consider for one load direction is the minimum of the capacity given for each of the selected plates for this particular load direction. Failure modes associated to the tube, such as buckling or welding failure, are taken into account in each plate capacity. Values are given for timber C24 minimum and concrete C20/25. For F1 on timber perpendicular to grain, when using GL24 timber, values can be multiplied by 1.16.

Table D50-3: SP1, SP2 and SP3 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]		Characteristic capacities on rigid support [kN]	
			$R_{1.k}$		$R_{1.k}$	$R_{2.k}$ *
	Qty	Type	Perpendicular to grain	Parallel to grain		
SP1/Ø89	4	Ø12	54.44/k_{mod}^0.38	155.76	116.91	14.88
SP1/Ø102	4	Ø12	63.63/k_{mod}^0.37	205.36	132.78	14.70
SP1/Ø114	4	Ø12	73.9/k_{mod}^0.37	239.52	144.16	13.22
SP1/Ø140	4	Ø12	93.33/k_{mod}^0.36	315.19	174.22	13.01
SP2/Ø89	2	Ø12	27.16/k_{mod}^0.12	-	93.95	10.71
SP2/Ø102	2	Ø12	32.09/k_{mod}^0.15	-	107.14	10.74
SP2/Ø114	2	Ø12	35.45/k_{mod}^0.16	-	115.92	10.11
SP2/Ø140	2	Ø12	44.89/k_{mod}^0.19	-	140.72	10.12
SP3/Ø89	3	Ø12	22.23/k_{mod}^0.14	-	71.54	7.94
SP3/Ø102	3	Ø12	26.56/k_{mod}^0.18	-	81.58	7.00
SP3/Ø114	3	Ø12	29.33/k_{mod}^0.19	-	90.68	9.15
SP3/Ø140	3	Ø12	37.58/k_{mod}^0.23	-	111.32	10.55

* The capacity of the anchors is not considered and shall be checked by the user.

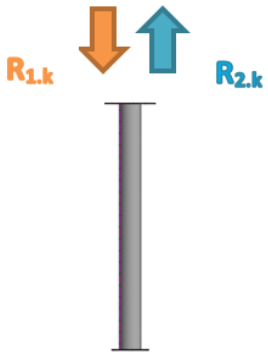
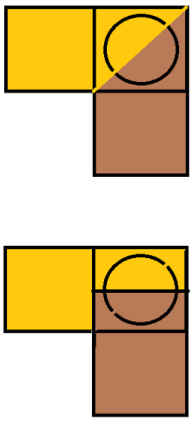


Table D50-4: SP4 Characteristic capacities

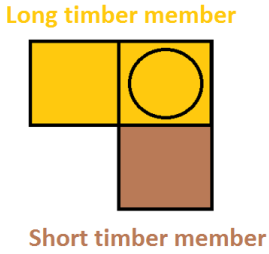
Model	Fasteners		Characteristic capacities on timber [kN]			Characteristic capacities on rigid support [kN]	
			$R_{1.k}$* perpendicular to grain, end support			$R_{1.k}$	$R_{2.k}$ **
	Qty	Type	Total	Short TM	Long TM		
SP4/Ø89/80	2	Ø10	51.2/k_{mod}^0.2	17.51/k_{mod}^0.2	33.69/k_{mod}^0.2	64.20	4.06
SP4/Ø89/90	2	Ø10	58.55/k_{mod}^0.19	18.23/k_{mod}^0.19	40.32/k_{mod}^0.19	73.90	4.14
SP4/Ø102/90	2	Ø10	59.19/k_{mod}^0.21	19.99/k_{mod}^0.21	39.19/k_{mod}^0.21	73.49	4.70
SP4/Ø89/100	2	Ø12	65.91/k_{mod}^0.18	19.33/k_{mod}^0.18	46.57/k_{mod}^0.18	82.25	4.51
SP4/Ø102/100	2	Ø12	67.01/k_{mod}^0.2	20.61/k_{mod}^0.2	46.4/k_{mod}^0.2	84.10	5.11
SP4/Ø114/100	2	Ø12	64.25/k_{mod}^0.21	22.22/k_{mod}^0.21	42.02/k_{mod}^0.21	79.16	5.90
SP4/Ø89/120	2	Ø12	80.62/k_{mod}^0.17	23.3/k_{mod}^0.17	57.31/k_{mod}^0.17	92.23	4.57
SP4/Ø102/120	2	Ø12	82.67/k_{mod}^0.19	23.16/k_{mod}^0.19	59.5/k_{mod}^0.19	100.86	5.07
SP4/Ø114/120	2	Ø12	81.66/k_{mod}^0.2	23.28/k_{mod}^0.2	58.37/k_{mod}^0.2	100.86	5.70
SP4/Ø140/120	2	Ø12	79.99/k_{mod}^0.24	27.5/k_{mod}^0.24	52.48/k_{mod}^0.24	96.15	7.57
SP4/Ø114/140	2	Ø16	98.26/k_{mod}^0.18	27.07/k_{mod}^0.18	71.19/k_{mod}^0.18	115.30	6.40
SP4/Ø140/140	2	Ø16	103.56/k_{mod}^0.13	29.33/k_{mod}^0.13	74.22/k_{mod}^0.13	121.48	8.40
SP4/Ø114/150	2	Ø16	106.56/k_{mod}^0.18	29.07/k_{mod}^0.18	77.49/k_{mod}^0.18	116.70	6.27
SP4/Ø140/150	2	Ø16	108.86/k_{mod}^0.2	28.76/k_{mod}^0.2	80.1/k_{mod}^0.2	131.78	8.01

* Load bearing capacity for each timber part is described below

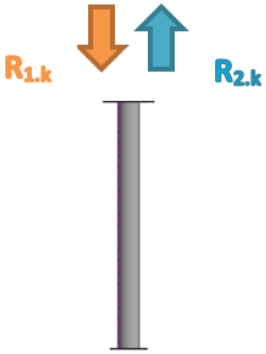
** The capacity of the anchors is not considered and shall be checked by the user.



Configuration 1



Configuration 2



If the plate is used to connect two timber parts as described in config 1, with equal contact area, then the load applied on each part shall not exceed the half of the total capacity in the table above. If the plate is used to connect two timber parts as described in config 2, with one longer timber member (short TM/long TM), then the load applied on each member shall not exceed the values given in the table for short and long TM.

Table D50-5: SP5 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]			Characteristic capacities on rigid support [kN]	
			$R_{1.k}$ perpendicular to grain		$R_{1.k}$ parallel to grain	$R_{1.k}$	$R_{2.k}$ *
	Qty	Type	End support	Intermediate support			
SP5/Ø89/80	2	Ø10	42.25/k_{mod}^0.24	51.2/k_{mod}^0.2	113.00	64.20	4.06
SP5/Ø102/80	2	Ø10	42.43/k_{mod}^0.27	51.36/k_{mod}^0.23	106.85/k_{mod}^0.27	61.80	4.68
SP5/Ø89/90	2	Ø10	48.48/k_{mod}^0.23	58.55/k_{mod}^0.19	113.00	73.90	4.14
SP5/Ø102/90	2	Ø10	49.13/k_{mod}^0.25	59.19/k_{mod}^0.21	129.00	73.49	4.70
SP5/Ø114/90	2	Ø10	47.25/k_{mod}^0.28	57.3/k_{mod}^0.23	115.59/k_{mod}^0.33	67.29	5.44
SP5/Ø89/100	2	Ø12	54.71/k_{mod}^0.22	65.91/k_{mod}^0.18	155.80	82.25	4.51
SP5/Ø102/100	2	Ø12	55.83/k_{mod}^0.24	67.01/k_{mod}^0.2	129.00	84.10	5.11
SP5/Ø114/100	2	Ø12	54.42/k_{mod}^0.26	65.59/k_{mod}^0.22	146.00	79.92	5.90
SP5/Ø89/120	2	Ø12	67.18/k_{mod}^0.21	80.62/k_{mod}^0.17	155.80	92.23	4.57
SP5/Ø102/120	2	Ø12	69.24/k_{mod}^0.22	82.67/k_{mod}^0.19	205.36	100.86	5.07
SP5/Ø114/120	2	Ø12	68.77/k_{mod}^0.23	82.19/k_{mod}^0.2	146.00	101.62	5.70
SP5/Ø140/120	2	Ø12	67.74/k_{mod}^0.28	81.13/k_{mod}^0.23	168.00	96.15	7.57
SP5/Ø114/140	2	Ø16	83.12/k_{mod}^0.22	98.79/k_{mod}^0.18	252.87	116.06	6.40
SP5/Ø140/140	2	Ø16	83.97/k_{mod}^0.25	99.62/k_{mod}^0.21	168.00	121.48	8.40
SP5/Ø114/150	2	Ø16	90.3/k_{mod}^0.21	107.1/k_{mod}^0.18	252.87	117.46	6.27
SP5/Ø140/150	2	Ø16	92.09/k_{mod}^0.24	108.86/k_{mod}^0.2	281.63/k_{mod}^0.21	131.78	8.01

* The capacity of the anchors is not considered and shall be checked by the user

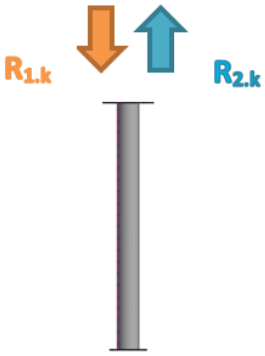


Table D50-6: SP6 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]		
			$R_{1.k}$* perpendicular to grain		$R_{2.k}$ perpendicular to grain
	Qty	Type	End support	Intermediate support	
SP6/Ø89/75	12	≥Ø6	48.17/k_{mod}^0.22	56.57/k_{mod}^0.19	12 x $R_{vk.screw}$**
SP6/Ø102/75	12	≥Ø6	49.68/k_{mod}^0.24	58.06/k_{mod}^0.21	
SP6/Ø89/80	12	≥Ø6	51.68/k_{mod}^0.22	60.63/k_{mod}^0.19	
SP6/Ø102/80	12	≥Ø6	53.42/k_{mod}^0.24	62.36/k_{mod}^0.21	
SP6/Ø89/90	12	≥Ø6	58.68/k_{mod}^0.21	68.76/k_{mod}^0.18	
SP6/Ø102/90	12	≥Ø6	60.89/k_{mod}^0.23	70.96/k_{mod}^0.2	
SP6/Ø114/90	12	≥Ø6	59.75/k_{mod}^0.26	69.8/k_{mod}^0.23	
SP6/Ø89/100	12	≥Ø6	65.69/k_{mod}^0.21	76.88/k_{mod}^0.18	
SP6/Ø102/100	12	≥Ø6	68.37/k_{mod}^0.23	79.56/k_{mod}^0.2	
SP6/Ø114/100	12	≥Ø6	67.69/k_{mod}^0.25	78.87/k_{mod}^0.22	
SP6/Ø89/115	12	≥Ø6	76.19/k_{mod}^0.21	89.07/k_{mod}^0.18	
SP6/Ø102/115	12	≥Ø6	79.59/k_{mod}^0.22	92.46/k_{mod}^0.19	
SP6/Ø114/115	12	≥Ø6	79.62/k_{mod}^0.24	92.47/k_{mod}^0.21	
SP6/Ø140/115	12	≥Ø6	80.74/k_{mod}^0.28	93.57/k_{mod}^0.25	
SP6/Ø89/120	12	≥Ø6	79.7/k_{mod}^0.21	93.13/k_{mod}^0.18	
SP6/Ø102/120	12	≥Ø6	83.33/k_{mod}^0.22	96.75/k_{mod}^0.19	
SP6/Ø114/120	12	≥Ø6	83.59/k_{mod}^0.24	97.01/k_{mod}^0.21	
SP6/Ø140/120	12	≥Ø6	85.18/k_{mod}^0.28	98.57/k_{mod}^0.24	
SP6/Ø114/140	12	≥Ø6	99.49/k_{mod}^0.23	115.15/k_{mod}^0.2	
SP6/Ø140/140	12	≥Ø6	102.96/k_{mod}^0.26	118.6/k_{mod}^0.23	

* For different width A than the ones given in the table, the user shall considered the minimum capacity between the two closest cases, dimension A can get up to 142 mm.
** Timber submitted to perpendicular tension shall be verified by the user, reinforcement with fully threaded screw is allowed.

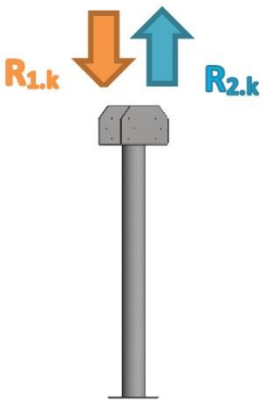
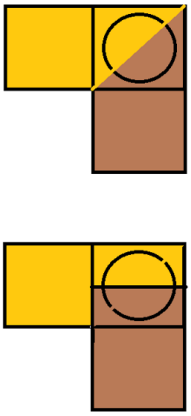


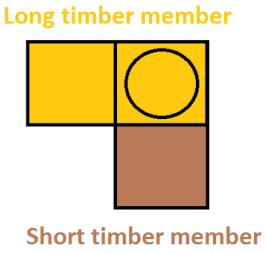
Table D50-7: SP7 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]			
			$R_{1.k}$* perpendicular to grain, end support			$R_{2.k}$ perpendicular to grain
	Qty	Type	Total	Short TM**	Long TM**	
SP7/Ø89/75	12	≥Ø6	56.57/k_{mod}^0.19	20.52/k_{mod}^0.19	36.05/k_{mod}^0.19	12 x Rvk.screw***
SP7/Ø89/80	12	≥Ø6	60.63/k_{mod}^0.19	21.21/k_{mod}^0.19	39.42/k_{mod}^0.19	
SP7/Ø89/90	12	≥Ø6	68.76/k_{mod}^0.18	22.32/k_{mod}^0.18	46.43/k_{mod}^0.18	
SP7/Ø102/90	12	≥Ø6	70.96/k_{mod}^0.2	24.11/k_{mod}^0.2	46.84/k_{mod}^0.2	
SP7/Ø89/100	12	≥Ø6	76.88/k_{mod}^0.18	23.84/k_{mod}^0.18	53.04/k_{mod}^0.18	
SP7/Ø102/100	12	≥Ø6	79.56/k_{mod}^0.2	25.12/k_{mod}^0.2	54.43/k_{mod}^0.2	
SP7/Ø114/100	12	≥Ø6	78.08/k_{mod}^0.22	27.04/k_{mod}^0.22	51.04/k_{mod}^0.22	
SP7/Ø89/115	12	≥Ø6	89.07/k_{mod}^0.18	27.44/k_{mod}^0.18	61.63/k_{mod}^0.18	
SP7/Ø102/115	12	≥Ø6	92.46/k_{mod}^0.19	27.3/k_{mod}^0.19	65.15/k_{mod}^0.19	
SP7/Ø114/115	12	≥Ø6	91.68/k_{mod}^0.21	28.28/k_{mod}^0.21	63.4/k_{mod}^0.21	
SP7/Ø140/115	12	≥Ø6	93.57/k_{mod}^0.25	32.7/k_{mod}^0.25	60.86/k_{mod}^0.25	
SP7/Ø89/120	12	≥Ø6	93.13/k_{mod}^0.18	28.64/k_{mod}^0.18	64.49/k_{mod}^0.18	
SP7/Ø102/120	12	≥Ø6	96.75/k_{mod}^0.19	28.5/k_{mod}^0.19	68.25/k_{mod}^0.19	
SP7/Ø114/120	12	≥Ø6	96.22/k_{mod}^0.21	28.52/k_{mod}^0.21	67.7/k_{mod}^0.21	
SP7/Ø140/120	12	≥Ø6	98.57/k_{mod}^0.24	33.19/k_{mod}^0.24	65.38/k_{mod}^0.24	
SP7/Ø114/140	12	≥Ø6	114.36/k_{mod}^0.2	33.13/k_{mod}^0.2	81.22/k_{mod}^0.2	
SP7/Ø140/140	12	≥Ø6	118.6/k_{mod}^0.23	34.27/k_{mod}^0.23	84.33/k_{mod}^0.23	

* For different width A than the ones given in the table, the user shall considered the minimum capacity between the two closest cases.
** Load bearing capacity for each timber part is described below.
*** The uplift load applied on each part shall not exceed the half of the table capacity. Timber submitted to perpendicular tension shall be verified by the user, reinforcement with fully threaded screw is allowed.



Configuration 1



Configuration 2

If the plate is used to connect two timber parts as described in config 1, with equal contact area, then the load applied on each part shall not exceed the half of the total capacity in the previous table. If the plate is used to connect two timber parts as described in config 2, with one longer timber member (short TM/long TM), then the load applied on each member shall not exceed the values for short and long TM given in the table.

Table D50-8: SP8 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]	
	Qty	Type	$R_{1.k}$* perpendicular to grain Intermediate support	$R_{2.k}$ perpendicular to grain
SP8/Ø89/75	18	≥Ø6	59.93/k_{mod}^0.25	18 x $R_{vk.screw}$**
SP8/Ø89/80	18	≥Ø6	61.7/k_{mod}^0.25	
SP8/Ø102/80	18	≥Ø6	67.37/k_{mod}^0.24	
SP8/Ø89/90	18	≥Ø6	64.39/k_{mod}^0.27	
SP8/Ø102/90	18	≥Ø6	70.76/k_{mod}^0.25	
SP8/Ø89/100	18	≥Ø6	68.37/k_{mod}^0.28	
SP8/Ø102/100	18	≥Ø6	73.05/k_{mod}^0.27	
SP8/Ø114/100	18	≥Ø6	80.13/k_{mod}^0.25	
SP8/Ø89/115	18	≥Ø6	78.63/k_{mod}^0.28	
SP8/Ø102/115	18	≥Ø6	78.63/k_{mod}^0.28	
SP8/Ø114/115	18	≥Ø6	82.53/k_{mod}^0.27	
SP8/Ø140/115	18	≥Ø6	98.84/k_{mod}^0.23	
SP8/Ø89/120	18	≥Ø6	82.05/k_{mod}^0.28	
SP8/Ø102/120	18	≥Ø6	82.05/k_{mod}^0.28	
SP8/Ø114/120	18	≥Ø6	82.78/k_{mod}^0.28	
SP8/Ø140/120	18	≥Ø6	99.78/k_{mod}^0.24	
SP8/Ø114/140	18	≥Ø6	95.73/k_{mod}^0.28	
SP8/Ø140/140	18	≥Ø6	100.79/k_{mod}^0.27	

* For different width A than the ones given in the table, the user shall consider the minimum capacity between the two closest cases.

**If the plate is used to connect three timber parts, then the load applied on each part shall not exceed the third of the table capacity. If two timber parts is connected, and one goes through the connector, then for this element SP6 capacity can be considered

*** Characteristic shear capacity of the screw, diameter ≥ 6 mm is recommended. If n timber parts are connected with one SP8, the uplift load applied on each part shall not exceed the 1/nth of the table capacity. Timber submitted to perpendicular tension shall be verified by the user, reinforcement with fully threaded screw is allowed.

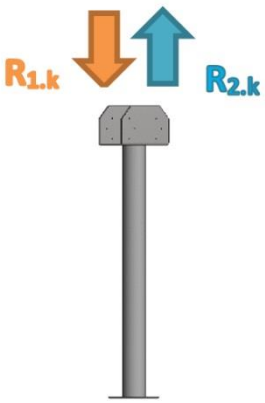


Table D50-10: SP9 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]					
			$R_{1.k} = R_{2.k}$ * perpendicular to grain					
			STD Dowel length [mm]					
	Qty	Type	80	100	120	140	160	180
SP9-G	4	STD12	42.6	45.9	50.2	55.1	60.4	66.0

*Capacities are valid for STD dowels or equivalent with $f_{u.k} \geq 340$ N/mm², this fastener shall not be used with SPS9

Model	Fasteners		Characteristic capacities on timber [kN]					
			$R_{1.k} = R_{2.k}$ * perpendicular to grain					
			STD Dowel length [mm]					
	Qty	Type	80	100	120	140	160	180
SP9-G	4	STDS12	49.9	52.1	55.6	59.8	64.6	69.7

*Capacities are valid for STDS dowels or equivalent with $f_{u.k} \geq 500$ N/mm², values are also valid with SPS9

OSPS characteristic capacities:

The OSPS characteristic capacity R_k to consider for one load direction is the minimum of the capacity given for each of the selected plates for this particular load direction. Failure modes associated to the tube, such as buckling or welding failure, are taken into account in each plate capacity. Values are given for timber C24 minimum and concrete C20/25. For F1 on timber perpendicular to grain, when using GL24 timber, values can be multiplied by 1.16.

Table D50-3: SPS1, SPS2 and SPS3 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]		Characteristic capacities on rigid support [kN]	
			$R_{1.k}$		$R_{1.k}$	$R_{2.k}$ *
	Qty	Type	perpendicular to grain	Parallel to grain		
SPS1/Ø89	4	Ø12	50.33/k_{mod}^0.37	121.8	108.23	12.03
SPS1/Ø102	4	Ø12	58.96/k_{mod}^0.37	157.75	122.88	11.88
SPS1/Ø114	4	Ø12	68.55/k_{mod}^0.36	191.72	133.57	10.69
SPS1/Ø140	4	Ø12	86.79/k_{mod}^0.35	254.7	161.36	10.52
SPS2/Ø89	2	Ø12	26.23/k_{mod}^0.13	-	91.38	8.66
SPS2/Ø102	2	Ø12	30.89/k_{mod}^0.16	-	103.96	8.68
SPS2/Ø114	2	Ø12	34.12/k_{mod}^0.17	-	112.6	8.17
SPS2/Ø140	2	Ø12	43.03/k_{mod}^0.19	-	136.34	8.18
SPS3/Ø89	3	Ø12	21.32/k_{mod}^0.16	-	69	6.42
SPS3/Ø102	3	Ø12	25.37/k_{mod}^0.19	-	78.46	5.66
SPS3/Ø114	3	Ø12	28.01/k_{mod}^0.2	-	87.36	7.40
SPS3/Ø140	3	Ø12	35.73/k_{mod}^0.23	-	106.93	8.53

* The capacity of the anchors is not considered and shall be checked by the user.

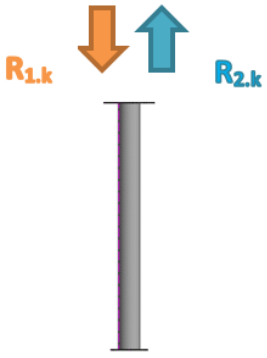
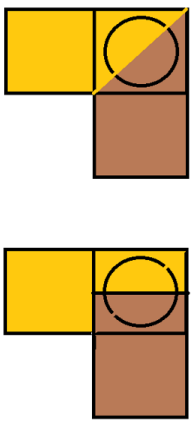


Table D50-4: SPS4 Characteristic capacities

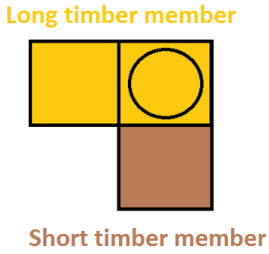
Model	Fasteners		Characteristic capacities on timber [kN]			Characteristic capacities on rigid support [kN]	
			$R_{1.k}$* perpendicular to grain, end support			$R_{1.k}$	$R_{2.k}$ **
	Qty	Type	Total	Short TM	Long TM		
SPS4/Ø89/80	2	Ø10	48.84/k_{mod}^0.21	16.63/k_{mod}^0.21	32.2/k_{mod}^0.21	59.71	3.28
SPS4/Ø89/90	2	Ø10	53.4/k_{mod}^0.26	15.75/k_{mod}^0.26	37.64/k_{mod}^0.26	69.00	3.35
SPS4/Ø102/90	2	Ø10	56.49/k_{mod}^0.21	19.13/k_{mod}^0.21	37.35/k_{mod}^0.21	68.14	3.80
SPS4/Ø89/100	2	Ø12	59.21/k_{mod}^0.25	15.63/k_{mod}^0.25	43.58/k_{mod}^0.25	76.89	3.65
SPS4/Ø102/100	2	Ø12	62.11/k_{mod}^0.25	18.47/k_{mod}^0.25	43.64/k_{mod}^0.25	78.35	4.13
SPS4/Ø114/100	2	Ø12	62.68/k_{mod}^0.18	21.88/k_{mod}^0.18	40.8/k_{mod}^0.18	73.44	4.77
SPS4/Ø89/120	2	Ø12	72.75/k_{mod}^0.24	18.87/k_{mod}^0.24	53.88/k_{mod}^0.24	85.02	3.70
SPS4/Ø102/120	2	Ø12	74.52/k_{mod}^0.25	18.77/k_{mod}^0.25	55.75/k_{mod}^0.25	94.06	4.10
SPS4/Ø114/120	2	Ø12	73.7/k_{mod}^0.26	19.13/k_{mod}^0.26	54.57/k_{mod}^0.26	94.27	4.61
SPS4/Ø140/120	2	Ø12	76.25/k_{mod}^0.23	26.51/k_{mod}^0.23	49.74/k_{mod}^0.23	88.69	6.12
SPS4/Ø114/140	2	Ø16	88.88/k_{mod}^0.24	21.97/k_{mod}^0.24	66.91/k_{mod}^0.24	107.29	5.18
SPS4/Ø140/140	2	Ø16	91.37/k_{mod}^0.27	24.78/k_{mod}^0.27	66.59/k_{mod}^0.27	113.16	6.79
SPS4/Ø114/150	2	Ø16	96.6/k_{mod}^0.24	23.61/k_{mod}^0.24	72.99/k_{mod}^0.24	107.79	5.07
SPS4/Ø140/150	2	Ø16	98.34/k_{mod}^0.26	23.37/k_{mod}^0.26	74.97/k_{mod}^0.26	122.91	6.48

* Load bearing capacity for each timber part is described below

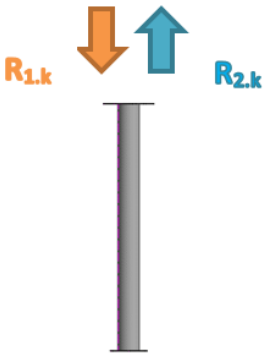
** The capacity of the anchors is not considered and shall be checked by the user.



Configuration 1



Configuration 2



If the plate is used to connect two timber parts as described in config 1, with equal contact area, then the load applied on each part shall not exceed the half of the total capacity in the table above. If the plate is used to connect two timber parts as described in config 2, with one longer timber member (short TM/long TM), then the load applied on each member shall not exceed the values for short and long TM given in table.

Table D50-5: SPS5 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]			Characteristic capacities on rigid support [kN]	
			$R_{1.k}$ perpendicular to grain		$R_{1.k}$ parallel to grain	$R_{1.k}$	$R_{2.k}$ *
	Qty	Type	End support	Intermediate support			
SPS5/Ø89/80	2	Ø10	40.1/k_{mod}^0.24	49.05/k_{mod}^0.2	106.91	59.71	3.28
SPS5/Ø102/80	2	Ø10	39.99/k_{mod}^0.27	48.92/k_{mod}^0.23	96.71/k_{mod}^0.33	56.81	3.78
SPS5/Ø89/90	2	Ø10	46.18/k_{mod}^0.23	56.25/k_{mod}^0.19	106.91	69.00	3.35
SPS5/Ø102/90	2	Ø10	46.53/k_{mod}^0.25	56.59/k_{mod}^0.21	122.18	68.14	3.80
SPS5/Ø114/90	2	Ø10	44.52/k_{mod}^0.28	54.57/k_{mod}^0.23	108.21/k_{mod}^0.32	61.81	4.40
SPS5/Ø89/100	2	Ø12	52.25/k_{mod}^0.22	63.44/k_{mod}^0.18	141.60	76.89	3.65
SPS5/Ø102/100	2	Ø12	53.07/k_{mod}^0.24	64.26/k_{mod}^0.2	122.18	78.35	4.13
SPS5/Ø114/100	2	Ø12	51.54/k_{mod}^0.26	62.71/k_{mod}^0.22	137.45	74.07	4.77
SPS5/Ø89/120	2	Ø12	64.4/k_{mod}^0.2	77.85/k_{mod}^0.17	141.60	85.02	3.70
SPS5/Ø102/120	2	Ø12	66.17/k_{mod}^0.22	79.6/k_{mod}^0.18	186.69	94.06	4.10
SPS5/Ø114/120	2	Ø12	65.57/k_{mod}^0.23	79/k_{mod}^0.19	137.45	94.90	4.61
SPS5/Ø140/120	2	Ø12	64/k_{mod}^0.27	77.4/k_{mod}^0.23	168.00	88.69	6.12
SPS5/Ø114/140	2	Ø16	79.62/k_{mod}^0.21	95.29/k_{mod}^0.18	229.88	107.92	5.18
SPS5/Ø140/140	2	Ø16	79.92/k_{mod}^0.24	95.58/k_{mod}^0.2	168.00	113.16	6.79
SPS5/Ø114/150	2	Ø16	86.64/k_{mod}^0.2	103.44/k_{mod}^0.17	229.88	108.42	5.07
SPS5/Ø140/150	2	Ø16	87.89/k_{mod}^0.23	104.67/k_{mod}^0.19	276.57/k_{mod}^0.16	122.91	6.48

* The capacity of the anchors is not considered and shall be checked by the user

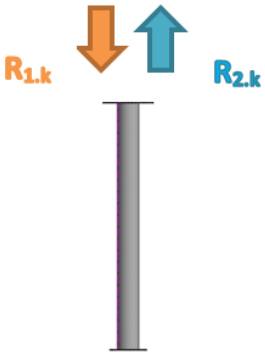


Table D50-6: SPS6 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]		
			$R_{1.k}$* perpendicular to grain		$R_{2.k}$ perpendicular to grain
	Qty	Type	End support	Intermediate support	
SPS6/Ø89/75	12	≥Ø6	45.75/k_{mod}^0.22	54.14/k_{mod}^0.19	12 x $R_{vk.screw}$**
SPS6/Ø102/75	12	≥Ø6	46.67/k_{mod}^0.26	55.05/k_{mod}^0.22	
SPS6/Ø89/80	12	≥Ø6	49.13/k_{mod}^0.22	58.08/k_{mod}^0.19	
SPS6/Ø102/80	12	≥Ø6	50.29/k_{mod}^0.25	59.23/k_{mod}^0.22	
SPS6/Ø89/90	12	≥Ø6	55.9/k_{mod}^0.22	65.98/k_{mod}^0.19	
SPS6/Ø102/90	12	≥Ø6	57.53/k_{mod}^0.24	67.59/k_{mod}^0.21	
SPS6/Ø114/90	12	≥Ø6	56.15/k_{mod}^0.27	66.2/k_{mod}^0.23	
SPS6/Ø89/100	12	≥Ø6	62.67/k_{mod}^0.21	73.87/k_{mod}^0.18	
SPS6/Ø102/100	12	≥Ø6	64.77/k_{mod}^0.23	75.96/k_{mod}^0.2	
SPS6/Ø114/100	12	≥Ø6	63.86/k_{mod}^0.26	75.03/k_{mod}^0.22	
SPS6/Ø89/115	12	≥Ø6	72.83/k_{mod}^0.21	85.71/k_{mod}^0.18	
SPS6/Ø102/115	12	≥Ø6	75.64/k_{mod}^0.23	88.51/k_{mod}^0.2	
SPS6/Ø114/115	12	≥Ø6	75.43/k_{mod}^0.24	88.29/k_{mod}^0.21	
SPS6/Ø140/115	12	≥Ø6	75.77/k_{mod}^0.29	88.6/k_{mod}^0.25	
SPS6/Ø89/120	12	≥Ø6	76.22/k_{mod}^0.21	89.65/k_{mod}^0.18	
SPS6/Ø102/120	12	≥Ø6	79.26/k_{mod}^0.22	92.69/k_{mod}^0.19	
SPS6/Ø114/120	12	≥Ø6	79.29/k_{mod}^0.24	92.7/k_{mod}^0.21	
SPS6/Ø140/120	12	≥Ø6	80.1/k_{mod}^0.28	93.49/k_{mod}^0.24	
SPS6/Ø114/140	12	≥Ø6	94.72/k_{mod}^0.23	110.38/k_{mod}^0.2	
SPS6/Ø140/140	12	≥Ø6	97.41/k_{mod}^0.26	113.05/k_{mod}^0.22	

* For different width A than the ones given in the table, the user shall considered the minimum capacity between the two closest cases, dimension A can get up to 142 mm.
** Timber submitted to perpendicular tension shall be verified by the user, reinforcement with fully threaded screw is allowed.

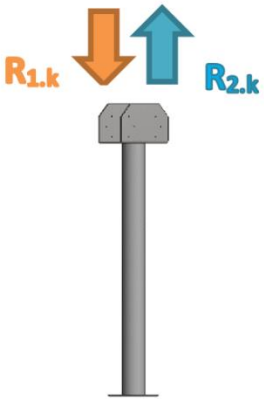
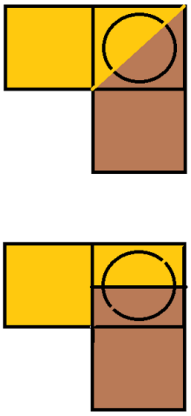


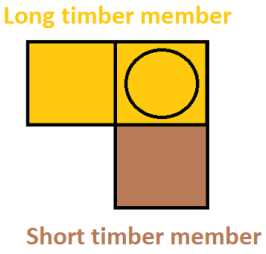
Table D50-7: SPS7 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]			
			$R_{1.k}$* perpendicular to grain, end support			$R_{2.k}$ perpendicular to grain
	Qty	Type	Total	Short TM**	Long TM**	
SPS7/Ø89/75	12	≥Ø6	54.14/k_{mod}^0.19	19.46/k_{mod}^0.19	34.67/k_{mod}^0.19	12 x Rvk.screw***
SPS7/Ø89/80	12	≥Ø6	58.08/k_{mod}^0.19	20.09/k_{mod}^0.19	37.99/k_{mod}^0.19	
SPS7/Ø89/90	12	≥Ø6	65.98/k_{mod}^0.19	21.09/k_{mod}^0.19	44.88/k_{mod}^0.19	
SPS7/Ø102/90	12	≥Ø6	67.59/k_{mod}^0.21	22.82/k_{mod}^0.21	44.77/k_{mod}^0.21	
SPS7/Ø89/100	12	≥Ø6	73.87/k_{mod}^0.18	22.48/k_{mod}^0.18	51.39/k_{mod}^0.18	
SPS7/Ø102/100	12	≥Ø6	75.96/k_{mod}^0.2	23.72/k_{mod}^0.2	52.24/k_{mod}^0.2	
SPS7/Ø114/100	12	≥Ø6	74.31/k_{mod}^0.22	25.67/k_{mod}^0.22	48.64/k_{mod}^0.22	
SPS7/Ø89/115	12	≥Ø6	85.71/k_{mod}^0.18	25.89/k_{mod}^0.18	59.81/k_{mod}^0.18	
SPS7/Ø102/115	12	≥Ø6	88.51/k_{mod}^0.2	25.71/k_{mod}^0.2	62.79/k_{mod}^0.2	
SPS7/Ø114/115	12	≥Ø6	87.57/k_{mod}^0.21	26.73/k_{mod}^0.21	60.83/k_{mod}^0.21	
SPS7/Ø140/115	12	≥Ø6	88.6/k_{mod}^0.25	31.17/k_{mod}^0.25	57.42/k_{mod}^0.25	
SPS7/Ø89/120	12	≥Ø6	89.65/k_{mod}^0.18	27.03/k_{mod}^0.18	62.62/k_{mod}^0.18	
SPS7/Ø102/120	12	≥Ø6	92.69/k_{mod}^0.19	26.85/k_{mod}^0.19	65.83/k_{mod}^0.19	
SPS7/Ø114/120	12	≥Ø6	91.98/k_{mod}^0.21	26.9/k_{mod}^0.21	65.08/k_{mod}^0.21	
SPS7/Ø140/120	12	≥Ø6	93.49/k_{mod}^0.24	31.6/k_{mod}^0.24	61.88/k_{mod}^0.24	
SPS7/Ø114/140	12	≥Ø6	109.66/k_{mod}^0.2	31.27/k_{mod}^0.2	78.39/k_{mod}^0.2	
SPS7/Ø140/140	12	≥Ø6	113.05/k_{mod}^0.22	32.43/k_{mod}^0.22	80.61/k_{mod}^0.22	

* For different width A than the ones given in the table, the user shall considered the minimum capacity between the two closest cases.
** Load bearing capacity for each timber part is described below.
*** The uplift load applied on each part shall not exceed the half of the table capacity. Timber submitted to perpendicular tension shall be verified by the user, reinforcement with fully threaded screw is allowed.



Configuration 1



Configuration 2

If the plate is used to connect two timber parts as described in config 1, with equal contact area, then the load applied on each part shall not exceed the half of the total capacity in the previous table. If the plate is used to connect two timber parts as described in config 2, with one longer timber member (short TM/long TM), then the load applied on each member shall not exceed the values for short and long TM given in the table.

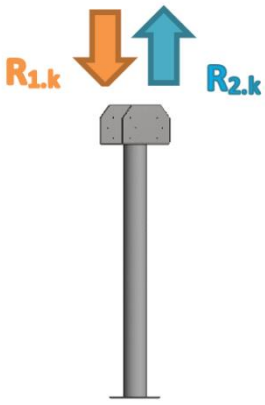
Table D50-8: SPS8 Characteristic capacities

Model	Fasteners		Characteristic capacities on timber [kN]	
	Qty	Type	$R_{1.k}$* perpendicular to grain Intermediate support	$R_{2.k}$ perpendicular to grain
SPS8/Ø89/75	18	≥Ø6	57.3/k_{mod}^0.23	18 x $R_{vk.screw}$**
SPS8/Ø89/80	18	≥Ø6	58.88/k_{mod}^0.24	
SPS8/Ø102/80	18	≥Ø6	64.56/k_{mod}^0.22	
SPS8/Ø89/90	18	≥Ø6	61.22/k_{mod}^0.26	
SPS8/Ø102/90	18	≥Ø6	67.6/k_{mod}^0.24	
SPS8/Ø89/100	18	≥Ø6	64.85/k_{mod}^0.27	
SPS8/Ø102/100	18	≥Ø6	69.53/k_{mod}^0.25	
SPS8/Ø114/100	18	≥Ø6	76.62/k_{mod}^0.23	
SPS8/Ø89/115	18	≥Ø6	74.58/k_{mod}^0.27	
SPS8/Ø102/115	18	≥Ø6	74.58/k_{mod}^0.27	
SPS8/Ø114/115	18	≥Ø6	78.48/k_{mod}^0.26	
SPS8/Ø140/115	18	≥Ø6	94.8/k_{mod}^0.22	
SPS8/Ø89/120	18	≥Ø6	77.82/k_{mod}^0.27	
SPS8/Ø102/120	18	≥Ø6	77.82/k_{mod}^0.27	
SPS8/Ø114/120	18	≥Ø6	78.55/k_{mod}^0.27	
SPS8/Ø140/120	18	≥Ø6	95.57/k_{mod}^0.22	
SPS8/Ø114/140	18	≥Ø6	90.79/k_{mod}^0.27	
SPS8/Ø140/140	18	≥Ø6	95.86/k_{mod}^0.26	

* For different width A than the ones given in the table, the user shall consider the minimum capacity between the two closest cases.

**If the plate is used to connect three timber parts, then the load applied on each part shall not exceed the third of the table capacity. If two timber parts is connected, and one goes through the connector, then for this element SP6 capacity can be considered

*** Characteristic shear capacity of the screw, diameter ≥ 6 mm is recommended. If n timber parts are connected with one SP8, the uplift load applied on each part shall not exceed the 1/nth of the table capacity. Timber submitted to perpendicular tension shall be verified by the user, reinforcement with fully threaded screw is allowed.



Hold Downs

D60: AH

Product name	Alternative names
AH	

Figure D60-1: Drawings

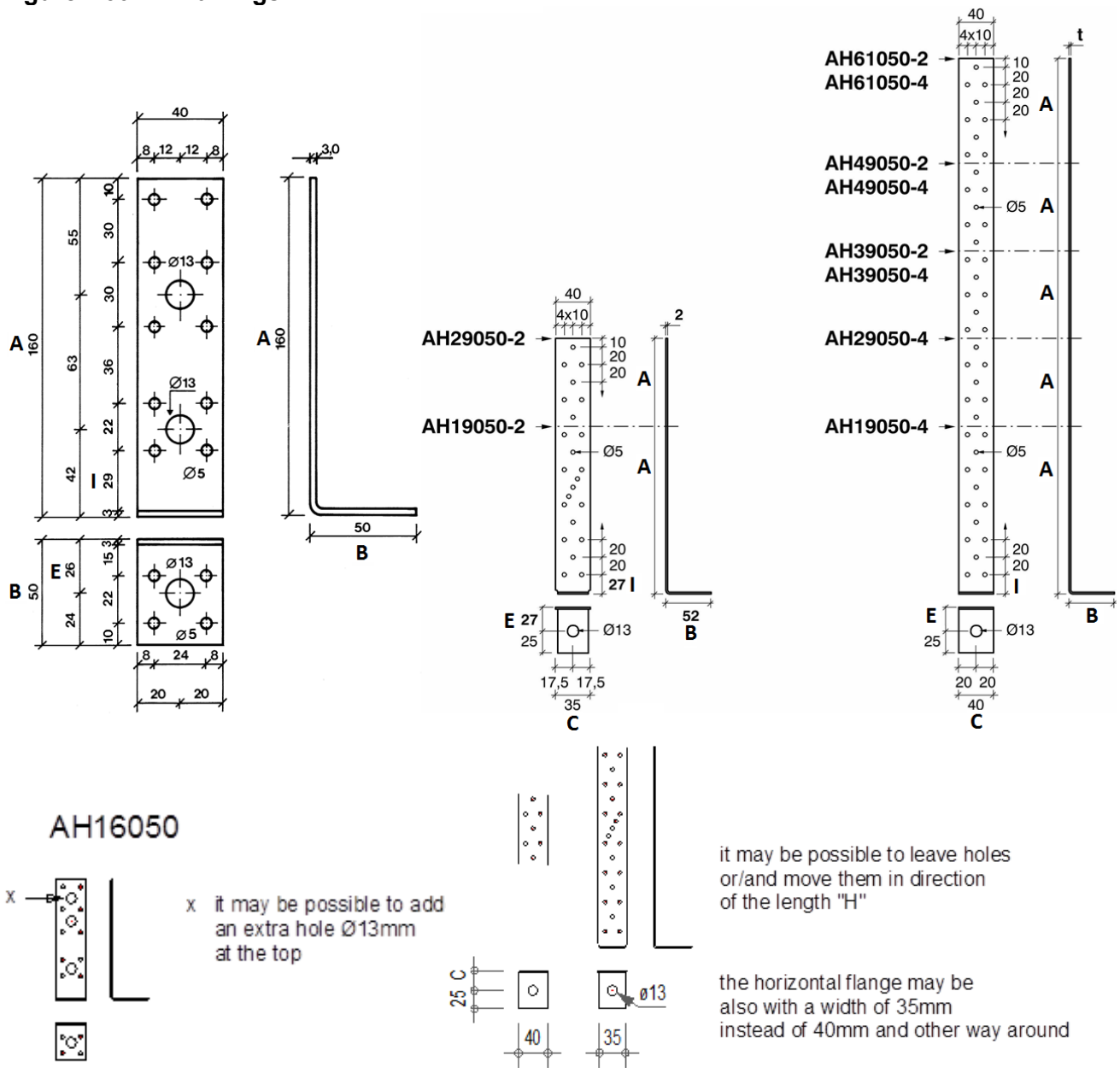


Table D60-1: Size specification

Model	Product dimensions [mm]							Holes							
								Top				Bottom			
	A	B	C	t (washer)	E	I	t	Qty	size	Qty	size	Qty	size	Qty	size
AH16050	160	50	40		18	32	3	10	Ø5	3	Ø13	4	Ø5	1	Ø13
AH19050-2	192	52	40	10	25	20	2	16	Ø5					1	Ø13
AH29050-2	292	52	40	10	25	20	2	23	Ø5					1	Ø13
AH39050-2	392	52	40	10	27	22	2	27	Ø5					1	Ø13
AH49050-2	492	52	40	10	27	22	2	36	Ø5					1	Ø13
AH61050-2	612	52	40	10	27	22	2	45	Ø5					1	Ø13
AH19050-4	194	54	40	10	29	24	4	12	Ø5					1	Ø13
AH29050-4	294	54	40	10	29	24	4	18	Ø5					1	Ø13
AH39050-4	394	54	40	10	29	24	4	27	Ø5					1	Ø13
AH49050-4	494	54	40	10	29	24	4	36	Ø5					1	Ø13
AH61050-4	614	54	40	10	29	24	4	45	Ø					1	Ø13

Table D60-2: Material specification

Part	Material Grades	Coating specification
Strap	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
Washer	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
	Or stainless steel as described	

Figure D60-2: Nail pattern

	Minimum	Maximum
AH16050	2	Purlin = 10 column = 6, the 4 lower holes cannot 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 D60-3: Characteristic capacity

	Characteristic capacities [kN]	
Model	**$R_{1.k}$ on rigid support**	**$R_{1.k}$ on rigid support with an intermediate timber layer**
AH16050	min(n_{eff} x $R_{lat.k}$; 15.3 / k_{mod})	min(n_{eff} x $R_{lat.k}$; 15.3 / k_{mod})
AH19050-2	min(n_{eff} x $R_{lat.k}$; 15.23 / k_{mod})	$min\left\{\begin{array}{c}\frac{0.037}{k_{mod}} \times \frac{d_a^3 \times N_{Rk.s}}{d_N^2 \times \pi} + 6.41\ kN \\ \left[\left(\frac{0.05}{3 \times R_{ax.k.nail}}\right)^2 + \left(\frac{1}{R_{lat.k.nail} \times n}\right)^2\right]^{-0.5} \\ 12.57/k_{mod}\end{array}\right\}$
AH29050-2		
AH39050-2		
AH49050-2		
AH61050-2		
AH19050-4	min(n_{eff} x $R_{lat.k}$; 19.77 / k_{mod})	$min\left\{\begin{array}{c}\frac{0.037}{k_{mod}} \times \frac{d_a^3 \times N_{Rk.s}}{d_N^2 \times \pi} + 6.41\ kN \\ \left[\left(\frac{0.05}{3 \times R_{ax.k.nail}}\right)^2 + \left(\frac{1}{R_{lat.k.nail} \times n}\right)^2\right]^{-0.5} \\ 24.52/k_{mod}\end{array}\right\}$
AH29050-4		
AH39050-4		
AH49050-4		
AH61050-4		

Bolt factor/ Bolt forces	$k_{b.ax}$ = 2.33	$F_{b.ax}$ = F_1 + 4.92 kN
	$k_{b.lat}$ = 0.79	$k_{b.lat}$ = 0.9

The washer to use is: US40/50/10

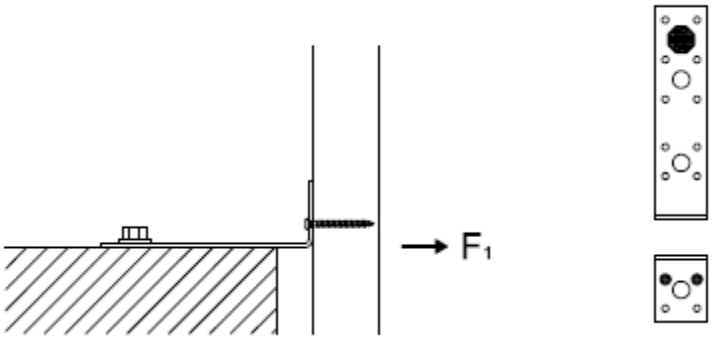
Where:

$R_{ax,k,nail}$	axial characteristic capacity of one fastener
$R_{lat,k,nail}$	lateral characteristic capacity of one fastener
n_{eff} = n	the effective number of nail
d_a	thread diameter of the anchor
d_N	nominal diameter of the anchor, or smaller cross section diameter of the anchor
N_{Rks}	characteristic steel axial resistance

Table D60-4: Characteristic capacity (F_1 – Downward)

		Characteristic capacity [kN]
Model	**Fastener Specification**	**$R_{1.k}$**
AH16050	2 pcs CSA5,0x40 / 1 pcs Concrete Screw/Bolt	3.3

It is assumed that the connection cannot rotate.



AH16050

For a timber to timber connection (column or beam)
The connection is possible between the vertical flap and a beam or a column.

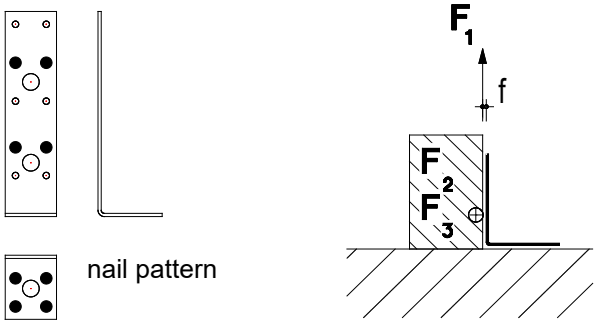


Table D60-5: Characteristic capacity – 1 angle bracket per connection

			Characteristic capacities [kN] - 1 Angle bracket	
Model	**Fasteners**		**$R_{1.k}$**	**$R_{2.k} = R_{3.k}$**
	Qty	**Type**		
AH16050	8	CNA4.0x40	1.0	2.0
	8	CNA4.0x60	min(1.6 ; 1.2/k_{mod})	2.6

By using one angle bracket, it is assumed f ~ 0 mm.

Table D60-5: Characteristic capacity – 2 angle brackets per connection

			Characteristic capacities [kN] - 2 Angle brackets		
Model	**Fasteners per angle bracket**		**$R_{1.k}$**	**$R_{2.k} = R_{3.k}$**	**$R_{4.k} = R_{4.k}$**
	Qty	**Type**			
AH16050	8	CNA4.0x40	min(2.7 ; 2.7/k_{mod})	4.0	min(2.1 ; 2.1/k_{mod})
	8	CNA4.0x60	max(2.68/k_{mod} ; 4.48 - 1.0 /k_{mod})	5.2	max(2.6 ; 2.1/k_{mod})

D61: AKR

Product name	Alternative names
AKR	

Figure D61-1: Drawings

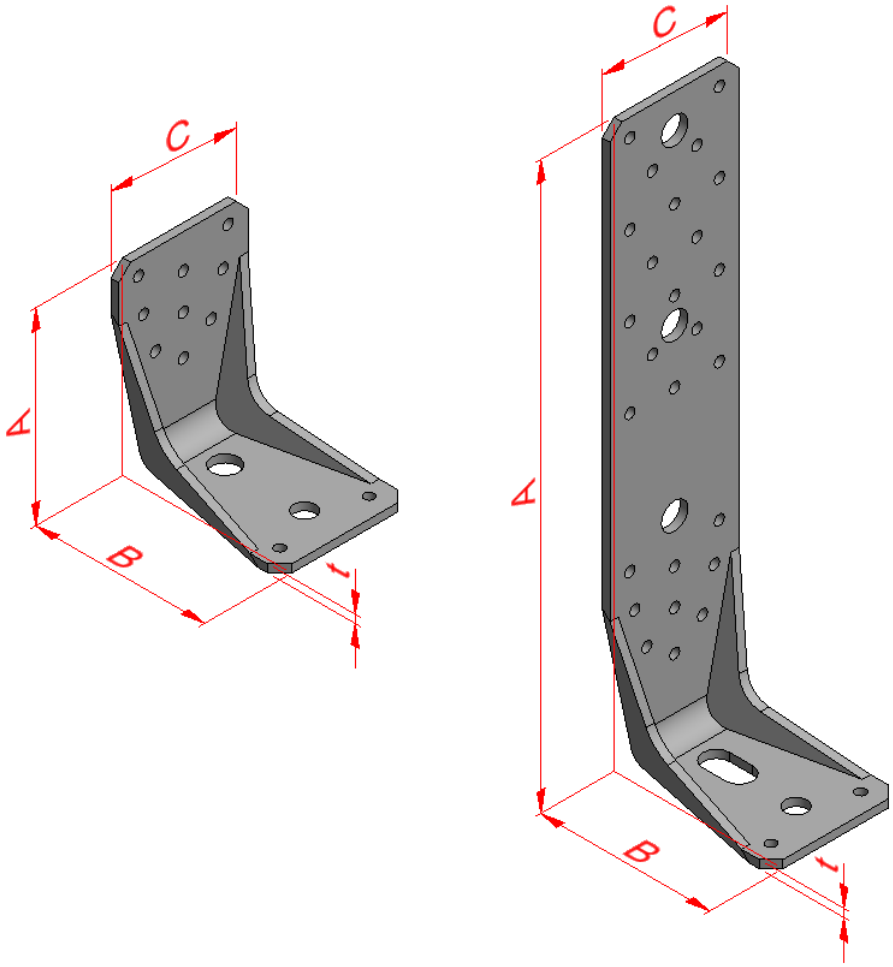


Table D61-1: Size specification

Model	Product dimensions [mm]				Holes									
					Top, flange A				Bottom, flange B					
	A	B	C	t	Qty	size	Qty	size	Qty	size	Qty	size	Qty	size
AKR95G	95	85	65	4	9	Ø5.2			1	Ø13.5	1	Ø11	2	Ø5.2
AKR95x3				3										
AKR95S				3										
AKR95LG				4					1	Ø13.5x25				
AKR95x3L				3										
AKR95LS				3										
AKR135G	135	85	65	4	14	Ø5.2	1	Ø13.5	1	Ø13.5	1	Ø11	2	Ø5.2
AKR135x3				3										
AKR135S				3										
AKR135LG				4					1	Ø13.5x25				
AKR135x3L				3										
AKR135LS				3										
AKR165G	165	85	65	4	15	Ø5.2	1	Ø13.5	1	Ø13.5	1	Ø11	2	Ø5.2
AKR165x3				3										
AKR165S				3										
AKR165LG				4					1	Ø13.5x25				
AKR165x3L				3										
AKR165LS				3										
AKR205G	205	85	65	4	20	Ø5.2	2	Ø13.5	1	Ø13.5	1	Ø11	2	Ø5.2
AKR205x3				3										
AKR205S				3										
AKR205LG				4					1	Ø13.5x25				
AKR205x3L				3										
AKR205LS				3										
AKR245G	245	85	65	4	22	Ø5.2	2	Ø13.5	1	Ø13.5	1	Ø11	2	Ø5.2
AKR245x3				3										
AKR245S				3										
AKR245LG				4					1	Ø13.5x25				
AKR245x3L				3										
AKR245LS				3										
AKR285G	285	85	65	4	26	Ø5.2	3	Ø13.5	1	Ø13.5	1	Ø11	2	Ø5.2
AKR285x3				3										
AKR285S				3										
AKR285LG				4					1	Ø13.5x25				
AKR285x3L				3										
AKR285LS				3										

The letter “L” in the model name stands for **long oblong hole.** which is on the short flange**.**

Table D61-2: Material specification

Part	Material Grades	Coating specification
4 mm thick plates	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
3 mm thick plates	S250 GD according to EN 10326	Pre-galvanized steel min Z275 according to EN10326
	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 patterns are respectively n°11 and n°20.

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

The nail patterns 13 and 18 are only for force direction F_1.

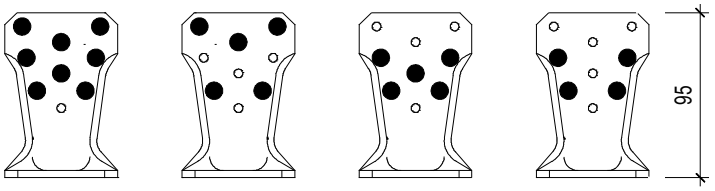
The nail pattern “partial/column” are for connection to a beam and also to a column.

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:

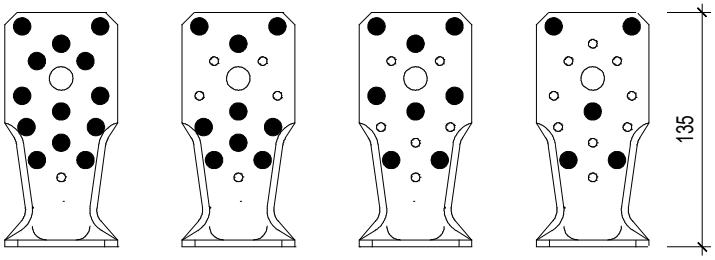
Figure D61-2: Nail pattern

AKR95/ ..L

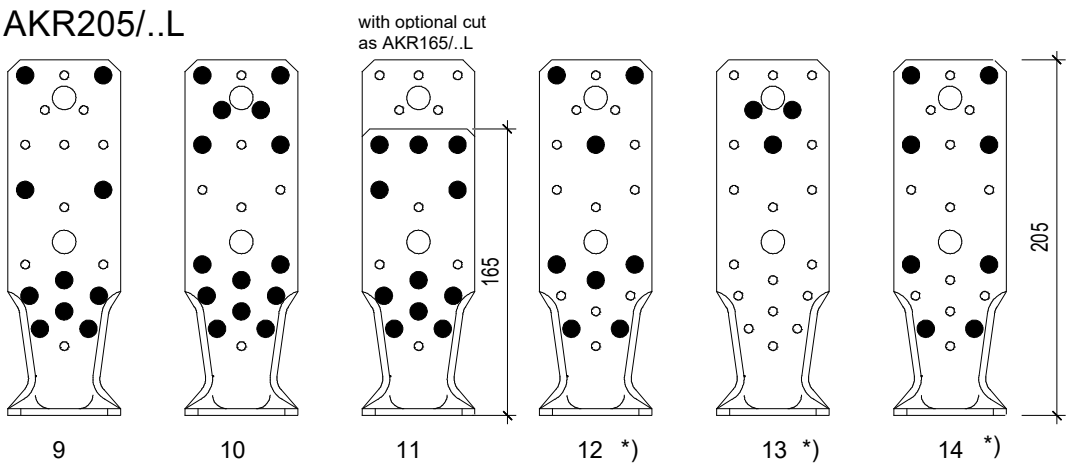


*) = connection to column possible

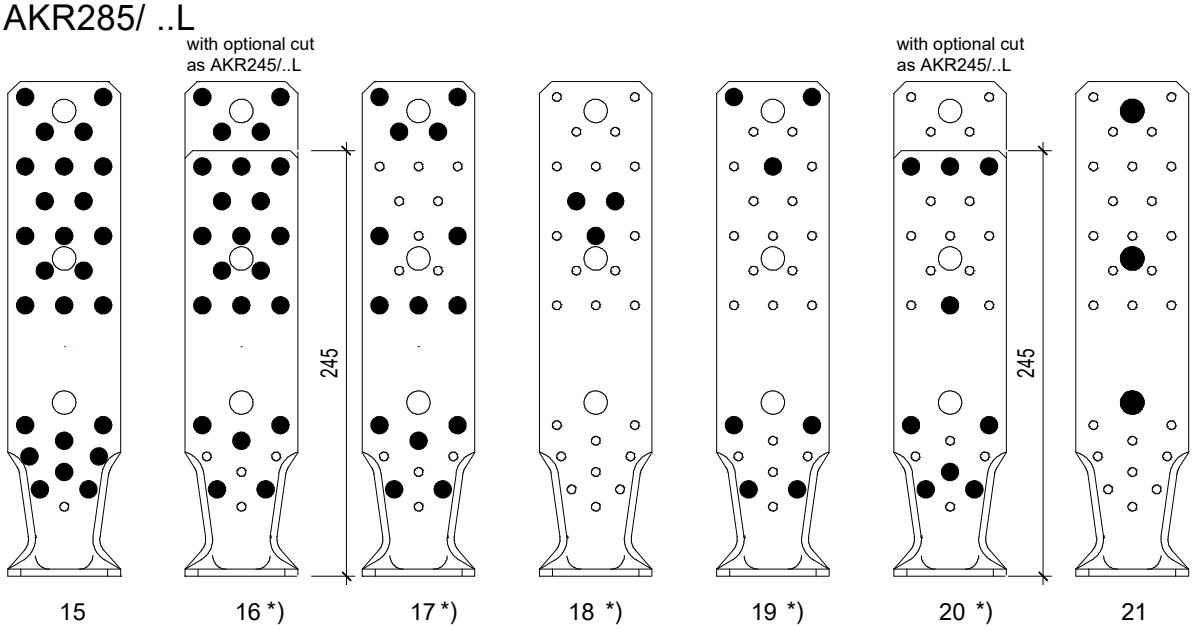
AKR135/..L



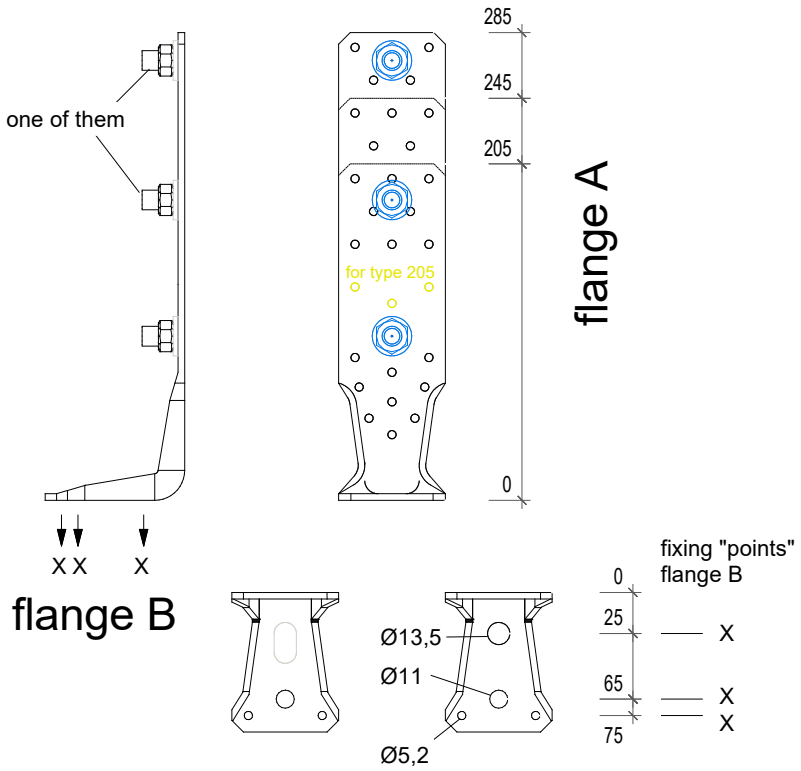
AKR205/..L



AKR285/ ..L



Nailing pattern 22:



For the fixing in flange B can be choice different fastener, e.g. bolts/screws in the holes placed 25mm or 65mm, or nails/screw Ø4/5mm in the holes placed at e=75mm.
For the type with oblong hole, the values can be determine by interpolation.
For force direction $F_{6,}$ only a constructive fixing in flange B is necessary.

Table D61-3: Characteristic capacities for load direction F_1 for one AKR

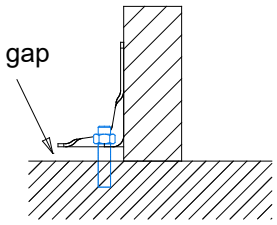
Model	Nail pattern n°	n	Characteristic capacities $R_{1,k}$ [kN]					
			CNA4.0x40		CNA4.0x50		CNA4.0x60	
			$R_{bend.nail.k}$	$R_{1.nail.k}$	$R_{bend.nail.k}$	$R_{1.nail.k}$	$R_{bend.nail.k}$	$R_{1.nail.k}$
AKR95	1	8	6.60	8.78	8.80	11.32	11.00	13.24
AKR95	2	5	2.99	5.75	3.98	7.39	4.98	8.59
AKR95	3	5	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 D61-4					
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
AKR245	16	18	1.97	19.52	2.62	25.20	3.28	29.50
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 D61-4					
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 D61-4					
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
AKR245-L	16	18	1.33	14.75	1.77	19.30	2.21	23.19
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

For an AKR with a thickness of 4.0mm: $R_{1,k} = \min\begin{cases} R_{1,nail,k} \\ \dfrac{21{,}43kN}{k_{\mathrm{mod}}} + R_{bend,nail,k} \end{cases}$

For an AKR with a thickness of 3.0mm: $R_{1,k} = \min\begin{cases} R_{1,nail,k} \\ \dfrac{12{,}52kN}{k_{\mathrm{mod}}} + R_{bend,nail,k} \end{cases}$ with $R_{1.nail.k}$ and $R_{bend.nail.k}$ 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.

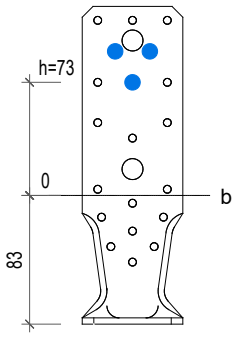
Table D61-4: Characteristic capacities for load direction F_1 for nail pattern 13 and 18 for one AKR**:**

	Characteristic capacity governed by nails: n=3 nails [kN]					
	$R_{1.nail.k}$					
Nails	type AKR			type AKR…L		
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

	Characteristic capacity governed by steel [kN]
	$R_{F.1.i.k}$ [kN]
AKR205	4.89
AKR285	4.02
AKR205L	3.30
AKR285L	2.72

$R_{F1.i.k}$ is based on the bending

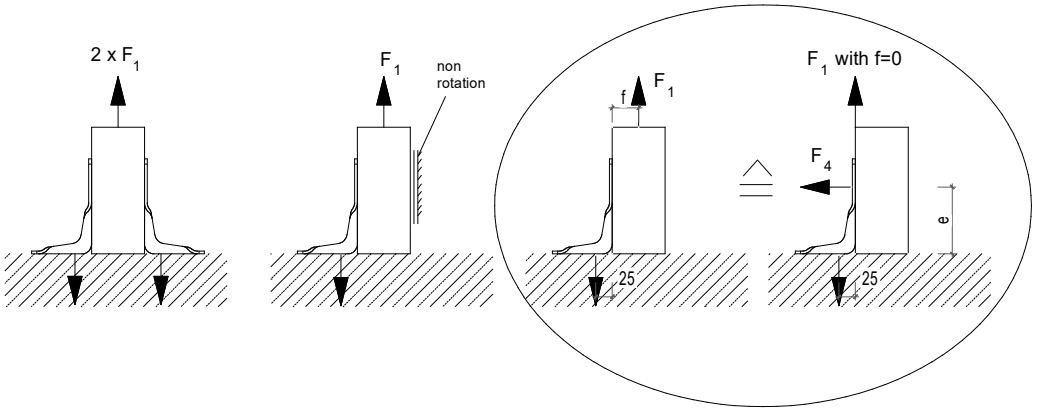


h = distance of the lowermost nail to line b

With i = h

$R_{1.k}$= min($R_{1.nail.k}$;$R_{F.1.i.k}$/k_{mod})

The capacity $R_{1.nail.i.k}$ shall be calculated as design capacity with the current k_{mod}. The capacity $R_{F1.i.k}$ shall be calculated with k_{mod}= 1.0 for all load durations.



$F_4 = F_1 \times (f+25mm) / e$

Table D61-5: Characteristic capacities for load direction $F_{2/3}$ for one AKR

Type	Nail pattern n°	n	Characteristic capacity $R_{2/3.k}$ [kN]		
			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
AKR245	16	18	2.9	3.8	4.6
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	9	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
AKR245-L	16	18	2.1	2.8	3.4
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 $F_{2.d}$ x 0.2 and a lateral force of $F_{2.d}$ / n_{AKR} .with n_{AKR} = number of AKR

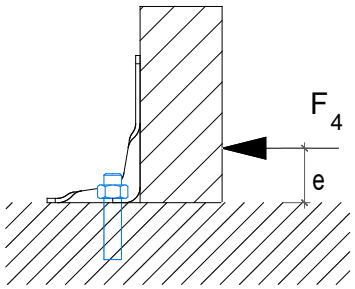
Characteristic capacities for load direction F_4 (only for types without oblong hole) for one AKR

for AKR with a thickness of 4.0mm:

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

for AKR with a thickness of 3.0mm:

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



e is the eccentricity in [mm] ; e ≥ 25mm

Negative values may not be considered.

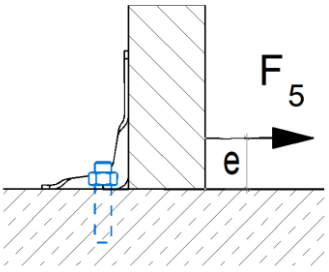
The bolt shall have a capacity to sustain an axial force of $F_{4.d}$ x 1.5 and a lateral force of $F_{4.d}$ x 1.0.

Table D61-6: Characteristic capacities for load direction F_5 (only for types without long hole) for one AKR

Type	Nail pattern n°	n	e < 71		e > 71	
			X_1	$e_{max\ force}$	X_1	$e_{max\ force}$
AKR95	1	8	402		378	
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	131-e	382	e - 10
AKR205	12	8	244		256	
AKR205	13	3	n/a		n/a	
AKR205	14	8	210		363	
AKR285	15	25	402		378	
AKR245	16	18	244		256	
AKR285	16	22	244		256	
AKR285	17	14	244		256	
AKR285	18	3	n/a		n/a	
AKR285	19	7	210		196	
AKR285/AKR245	20	9	274		271	

n = number of nails according to the nail pattern

$$R_{5,k} = \min\begin{cases} \dfrac{X_1 \times R_{ax,k}}{e_{\max,force}} \\ \dfrac{536kNmm}{e \times k_{mod}} \\ \dfrac{51kNmm}{(e-71mm) \times k_{mod}} \end{cases}$$



With:

$R_{ax.k}$ the axial characteristic capacity of the used nail in [kN]

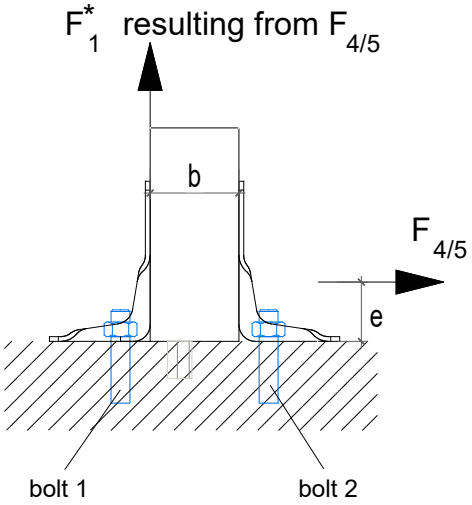
e eccentricity in [mm]

Negative values may not be considered.

The bolt shall have a min. capacity R_d to sustain an axial force of $F_{5.d}$ x 1.0 and a lateral force of $F_{5.d}$ x 1.0.

Table D61-7: Characteristic capacities for load direction $F_{4/5}$ (only for types without long hole) for a pair of AKR

		Characteristic capacity [kN]
Thickness of AKR [mm]	**Nail pattern n°**	**$R_{4/5.k}$**
4	all	$26.5/k_{mod}$
3	all	$15.75/k_{mod}$



The size b shall be a minimum of 60 mm.

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 inserted in [mm]

The bolt 1 shall have a capacity to sustain an axial force of $F^{*}_{1.d}$ x 1.0.
The bolt 2 shall have a capacity to sustain an axial force of $F_{4/5d}$ x 0.5 and a lateral force of $F_{4/5.d}$ x 1.0.

Table D61-8: Stiffness to F_1 and F_2 loads

The stiffness K_{ser} of AKR and AKR-L submitted to F_1 and F_2 loads. is given in the two following tables for different sizes of CNA nails. Intermediate values can be determined by interpolation.

Type	Nail pattern n°	Nail quantity	K_{ser} [kN/mm] for one AKR and load direction **F1** and CNA4.0x…			K_{ser} [kN/mm] for one AKR and load direction **F2** and CNA4.0x…		
			40	50	60	40	50	60
AKR95	1	8	1.21	1.57	1.83	0.35	0.43	0.48
AKR95	2	5	0.80	1.02	1.19	0.25	0.30	0.35
AKR95	3	5	0.71	0.92	1.09	0.22	0.28	0.30
AKR95	4	4	0.57	0.74	0.87	0.21	0.26	0.29
AKR135	5	13	2.20	2.81	3.24	0.55	0.69	0.77
AKR135	6	9	1.47	1.88	2.18	0.41	0.51	0.58
AKR135	7	8	1.42	1.81	2.07	0.39	0.48	0.54
AKR135	8	5	0.87	1.11	1.28	0.26	0.33	0.39
AKR205	9	10	1.31	1.71	2.03	0.46	0.58	0.65
AKR205	10	14	2.31	2.96	3.43	0.54	0.69	0.82
AKR205	11	11	2.02	2.57	2.93	0.48	0.62	0.72
AKR205	12	8	0.99	1.29	1.54	0.33	0.43	0.50
AKR205	13	3	0.37	0.48	0.58	n/a		
AKR205	14	8	1.18	1.53	1.79	0.39	0.48	0.55
AKR285	15	25	3.13	4.08	4.70	0.61	0.80	0.97
AKR245	16	18	2,70	3,48	4,08	0,39	0,52	0,63
AKR285	16	22	2.88	3.75	4.15	0.40	0.53	0.65
AKR285	17	14	1.93	2.51	2.96	0.39	0.50	0.61
AKR285	18	3	0.41	0.54	0.63	n/a		
AKR285	19	7	0.72	0.95	1.15	0.30	0.40	0.47
AKR285	20	9	0.99	1.29	1.56	0.40	0.51	0.61
AKR95-L	1	8	0.92	1.20	1.44	0.30	0.39	0.44
AKR95-L	2	5	0.61	0.80	0.95	0.21	0.28	0.32
AKR95-L	3	5	0.53	0.70	0.84	0.19	0.25	0.29
AKR95-L	4	4	0.43	0.56	0.67	0.18	0.24	0.26
AKR135-L	5	13	1.72	2.24	2.65	0.50	0.64	0.72
AKR135-L	6	9	1.13	1.48	1.76	0.36	0.46	0.53
AKR135-L	7	8	1.13	1.46	1.72	0.33	0.43	0.50
AKR135-L	8	5	0.69	0.89	1.05	0.22	0.29	0.33
AKR205-L	9	10	0.97	1.27	1.54	0.37	0.48	0.57
AKR205-L	10	14	1.79	2.34	2.78	0.43	0.55	0.66
AKR205-L	11	11	1.63	2.11	2.47	0.40	0.51	0.61
AKR205-L	12	8	0.72	0.95	1.15	0.26	0.35	0.41
AKR205-L	13	3	0.27	0.36	0.43	n/a		
AKR205-L	14	8	0.89	1.16	1.40	0.32	0.41	0.48
AKR285-L	15	25	2.28	3.00	3.65	0.46	0.61	0.75
AKR245-L	16	18	2,04	2,67	3,21	0,29	0,39	0,47
AKR285-L	16	22	2.11	2.78	3.38	0.29	0.39	0.48
AKR285-L	17	14	1.43	1.88	2.27	0.29	0.37	0.47
AKR285-L	18	3	0.31	0.40	0.49	n/a		
AKR285-L	19	7	0.51	0.68	0.83	0.24	0.30	0.37
AKR285-L	20	9	0.71	0.93	1.14	0.30	0.40	0.48

The slip modulus of the anchorage at the bottom of the bracket shall also be considered together with the *Kser* of the connector AKR.

Table D61-9 Characteristic capacity CLT timber beam to CLT timber beam – 1 Angle Bracket AKR285X3L – Nailing pattern 21

CLT to rigid support connection				1 angle bracket per connection			
Item	Nailing Pattern	Fasteners				Characteristic capacities [kN] - CLT	
		Header		Joist		$R_{1,k}$	$R_{2,k}$
		Qty	Type	Qty	Type	SS-H Ø12x80	SS-H Ø12x80
AKR285X3L	Nailing pattern 21	1	Bolt Ø12	3	SS-H	13,3	-

CLT density was considered as C24 - ρ_k = 350 kg/m³

Table D61-10 AKR285X3L slip modulus k_{ser}

Configuration	Nailling pattern	R_1 load direction	R_2 load direction
		k_{ser} [kN/mm]	k_{ser} [kN/mm]
		SS-H Ø12x80	SS-H Ø12x80
CLT to rigid support (with SS-H screws)	21	1,89	--

These slip modulus are given for 1 angle bracket. In case of 2 brackets, values can be obtained by multiplying the above by 2.

Characteristic Capacities for nailing pattern 22:

The values $R_{i,k}$ for one AKR per connection, with prevention of rotation (so that the connected timber elements are prevented against rotation), are stated in the tables below.

The fixing in flange B has to consider for pure shear or axial forces. For force direction F_6, it has to fix constructive.

Table D61-11: Characteristic capacities for load direction F_1 and nailing pattern 22 for one AKR

Characteristic capacities $R_{1.k}$ [kN] AKR, t=4,0 mm

Overlapping of the AKR [mm]	e [mm]		
X1	25	65	75
5	21,4 / k_{mod}	10,8 / k_{mod}	9,3 / k_{mod}
20	21,4 / k_{mod}	8,9 / k_{mod}	7,7 / k_{mod}
40	16,9 / k_{mod}	6,5 / k_{mod}	5,6 / k_{mod}
60	10,5 / k_{mod}	4,0 / k_{mod}	3,5 / k_{mod}

R_1 is limited by the axial capacity of fastener in flange B.

Characteristic capacities $R_{1.k}$ [kN] AKR, t=3,0 mm

Overlapping of the AKR [mm]	e [mm]		
X1	25	65	75
5	12,5 / k_{mod}	6,1 / k_{mod}	5,2 / k_{mod}
20	12,5 / k_{mod}	5,0 / k_{mod}	4,4 / k_{mod}
40	9,5 / k_{mod}	3,6 / k_{mod}	3,2 / k_{mod}
60	5,9 / k_{mod}	2,3 / k_{mod}	2,0 / k_{mod}

R_1 is limited by the axial capacity of fastener in flange B.

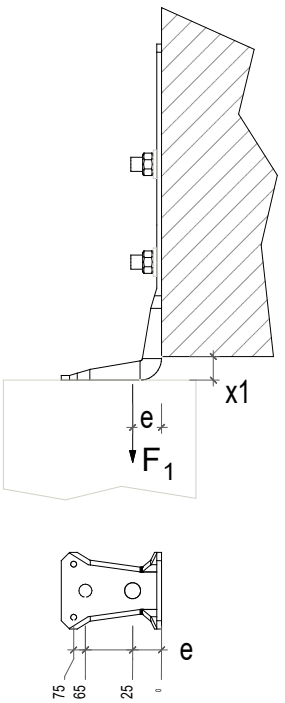


Table D61-12: Characteristic capacities for load direction $F_{2/3}$ and nailing pattern 22 for one AKR

Thickness of AKR [mm]	for e = ... [mm]		
	25	65	75
	Characteristic capacity $R_{2/3.k}$ [kN]		
3	1,0 / k_{mod}	0,4 / k_{mod}	0,4 / k_{mod}
4	1,8 / k_{mod}	0,7 / k_{mod}	0,6 / k_{mod}

Table D61-13: Characteristic capacities for load direction F_4 and nailing pattern 22 for one AKR

Thickness of AKR [mm]	X1 [mm]			
	5	20	40	60
	Characteristic capacity R_4 [kN]			
3	5,4 / k_{mod}	4,5 / k_{mod}	3,24 / k_{mod}	2,0 / k_{mod}
4	5,4 / k_{mod}	4,5 / k_{mod}	3,24 / k_{mod}	2,0 / k_{mod}

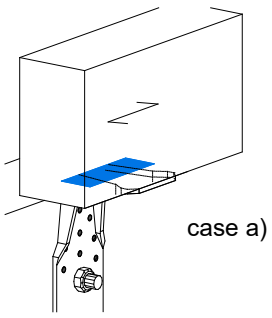
Table D61-14: Characteristic capacities for load direction F_5 and nailing pattern 22 for one AKR

Thickness of AKR [mm]	Characteristic capacity R_5 [kN]
3	0,61 / k_{mod}
4	

Table D61-15: Characteristic capacities for load direction F_6 and nailing pattern 22 for one AKR

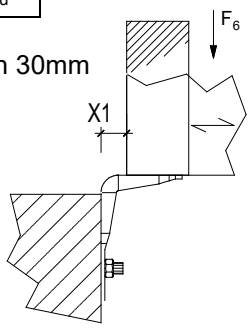
Case a	X1 [mm]		
Thickness of AKR [mm]	18	40	60
	Characteristic capacity $R_{6.k}$ [kN]		
4	2,3 / k_{mod}	1,2 / k_{mod}	0,8 / k_{mod}
3	1,4 / k_{mod}	0,7 / k_{mod}	0,5 / k_{mod}

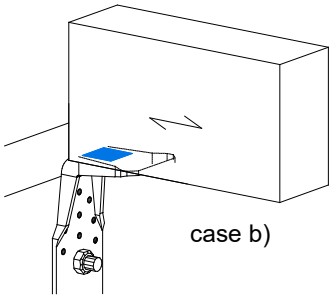
Case b	X1 [mm]		
Thickness of AKR [mm]	18	40	60
	Characteristic capacity $R_{6.k}$ [kN]		
4	1,8 / k_{mod}	1,1 / k_{mod}	0,8 / k_{mod}
3	1,2 / k_{mod}	0,7 / k_{mod}	0,5 / k_{mod}



Case a) the pressure area is increased on both sides with 30mm

Case b) the pressure area is limited by the width of AKR





D62: BETA

Product name	Alternative names
BETA	

Figure D62-1: Drawings

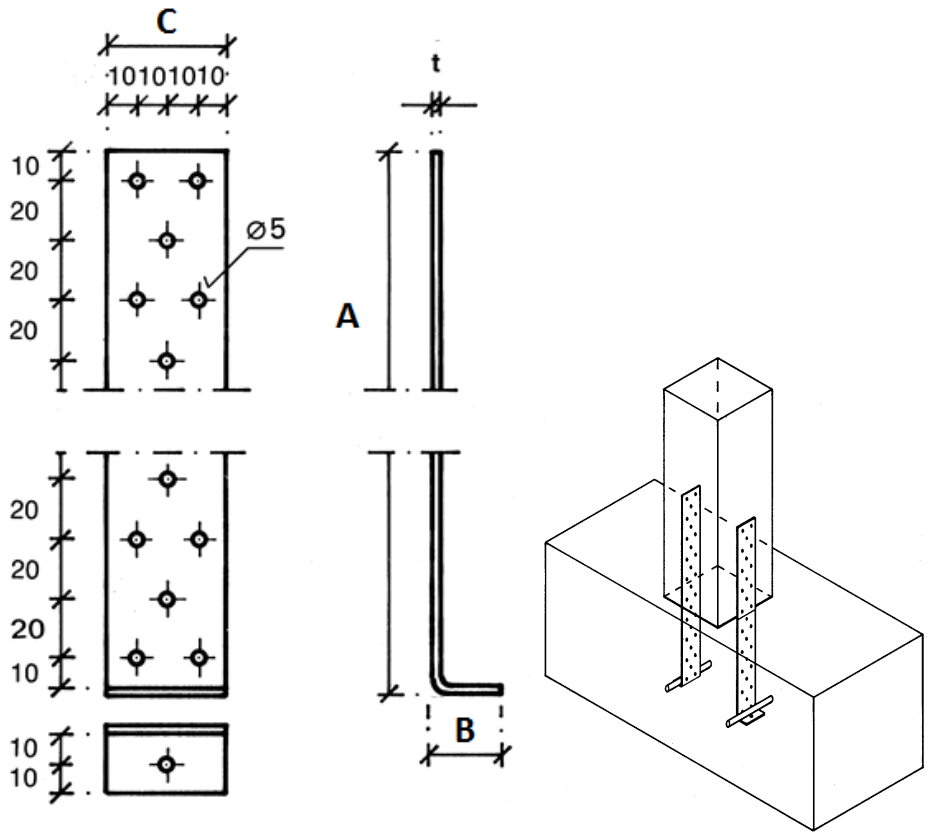


Table D62-1: Size specification

Model	Product dimensions [mm]				Holes			
					Top		Bottom	
	A	B	C	t	Qty	size	Qty	size
BETA2/200	200	22	40	2	15	Ø5	1	Ø5
BETA2/300	300	22	40	2	22.5	Ø5	1	Ø5
BETA2/400	400	22	40	2	30	Ø5	1	Ø5
BETA2/500	500	22	40	2	37.5	Ø5	1	Ø5
BETA2/600	600	22	40	2	45	Ø5	1	Ø5
BETA4/200	200	24	40	4	15	Ø5	1	Ø5
BETA4/300	300	24	40	4	22.5	Ø5	1	Ø5
BETA4/400	400	24	40	4	30	Ø5	1	Ø5
BETA4/500	500	24	40	4	37.5	Ø5	1	Ø5
BETA4/600	600	24	40	4	45	Ø5	1	Ø5

Other lengths for the vertical flange are allowed.

Table D62-2: Material specification

Part	Material Grades	Coating specification
Plates	S250GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
	Or stainless steel as described	

Table D62-3: Characteristic capacity

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

$$R_{1,k} = \min \begin{cases} A_{st} \times 0{,}37 \times f_{c,k}{}^{2/3} / k_{\mathrm{mod}} \\ n_{ef} \times R_{lat,k} \\ 223 \times A_{gross} / k_{\mathrm{mod}} \end{cases}$$

$f_{c.k}$ = 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

$$A_{st} = \begin{cases} A_{st.0}\ (see\ table\ below) & for\ lc = 100\ mm \\ A_{st.0}\ /100\ mm\ \times\ l_c & for\ lc > 100\ mm \end{cases}$$

Model	A_{gross} (mm²)	$A_{st.0}$ (mm²)
BETA2/200	80	8400
BETA2/300	80	8400
BETA2/400	80	8400
BETA2/500	80	8400
BETA2/600	80	8400
BETA4/200	160	8800
BETA4/300	160	8800
BETA4/400	160	8800
BETA4/500	160	8800
BETA4/600	160	8800

The capacity of a model with a different length can be determine as the cross section area (A_{gross}) is the same as the ones in the table above.

D63: HD tension tie

Product name	Alternative names
HDxx	

Figure D63-1: Drawings

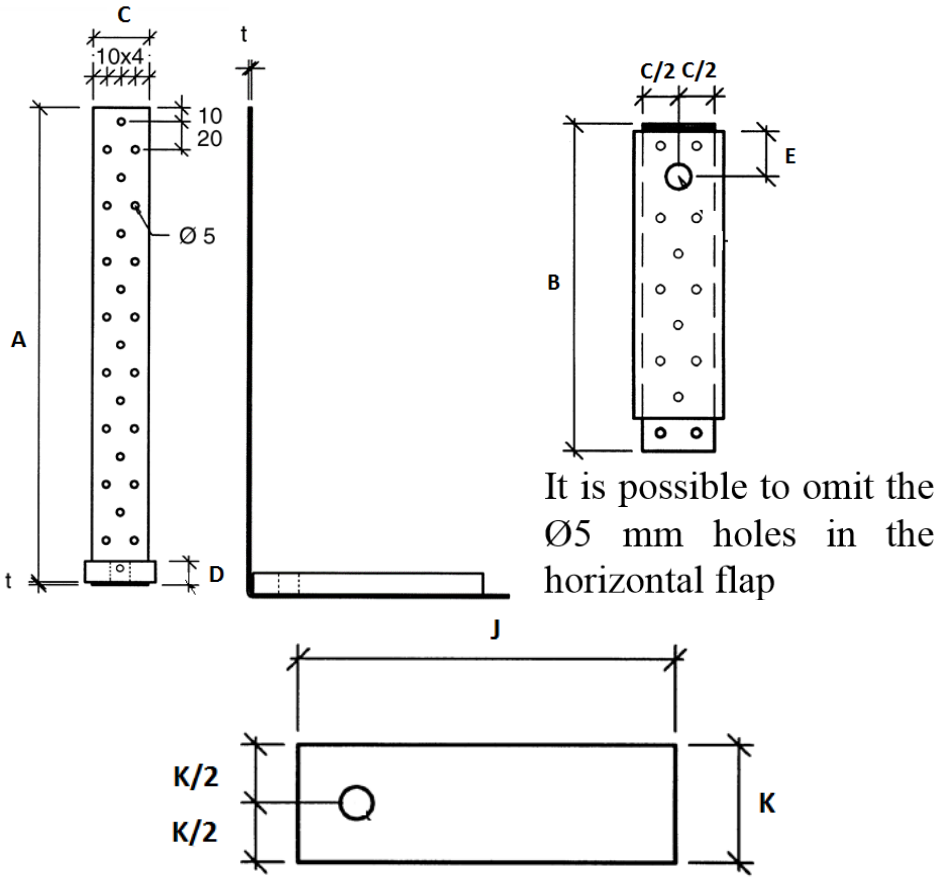


Table D63-1: Size specification

Model	Product dimensions [mm]						Washer dimensions [mm]		Holes			
									Top		Bottom*	
	A	B	C	D	E	t	J	K	Qty	size	Qty	minimum size
HD140M12G	140	90	60	12	28	2	90	50	17	Ø5	1	Ø13.5 +1/-0.5
HD240M12G	240	122	40	15	28	2	110	60	11	Ø5	1	Ø13.5 +1/-0.5
HD280M12G	280	122	40	15	28	2	110	60	11	Ø5	1	Ø13.5 +1/-0.5
HD340M12G	340	182	40	15	27	2	160	50	24	Ø5	1	Ø13.5 +1/-0.5
HD400M16G	400	123	40	15	28	3	110	60	29	Ø5	1	Ø17.5 +1/-0.5
HD420M16G	420	222	60	20	37	2	200	60	50	Ø5	1	Ø17.5 +1/-0.5
HD420M20G	420	102	60	20	37	2	85	60	50	Ø5	1	Ø21.5 +1/-0.5
HD480M20G	480	123	60	20	37.5	2.5	115	70	57	Ø5	1	Ø21.5 +1/-0.5

* refers to the hole diameter in the washer. 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 (A) and other width (C) are allowed. If the associated cross section area A_{gross} is the same as one of the models in the table above, then the capacity is also the same.

The hole pattern (distances and hole diameter) can be changed as long as the net cross section is not reduced or considered as written below.

Table D63-2: Material specification

Part	Material Grades	Coating specification
Strap	S250GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
Washer	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
	Or stainless steel as described	

Table D63-3: Nail pattern

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

Table D63-4: Characteristic capacity

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

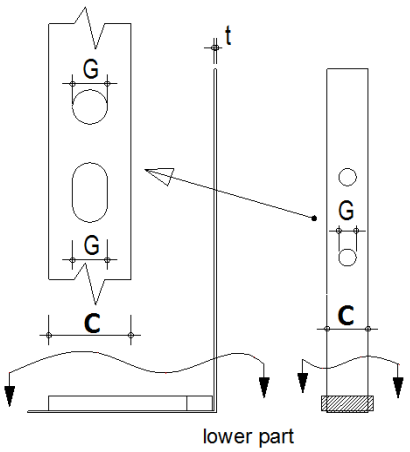
$$R_{1.k} = \min \begin{Bmatrix} \frac{W_{pl} \times 277}{E \times k_{mod}} \\ A_{gross} \times 223/k_{mod} \\ n_{ef} \times R_{lat.k} \end{Bmatrix}$$

A_{gross} = gross cross sectional area of the vertical flap in mm² = $B \times t_1$ 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
E = distance of the bolt hole to the vertical flange – as given in table D63-1

Model	A gross [mm²]	k_r	W_{pl} [mm³]
HD140M12	120	0.71	1296
HD240M12	80	0.76	2590
HD280M12	80	0.76	2590
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

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:

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

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 D64-3 (HD2P)

D64: HD2P

HD2P is a connector product family in which each model is based on the combination of two components connected together with self-drilling screws, one upper part and one lower part taken from the following list and an optional washer.

Product name	Type	Alternative names
HDULx	Upper part	
HDURx	Upper part	
HDUSx	Upper part	
HDUFx	Upper part	
HDBUx	Lower part	
HDBWx	Lower part	
HD2P60G *	Combination	
HD2PL40G **	Combination	
HD2P-U379S80***	Combination	

*from components HDUF400 and HDBU220
**from components HDUF250 and HDBU163
***from components HDUS348-80-C and HDBU379-84-16-C

Figure D64-1: Drawings

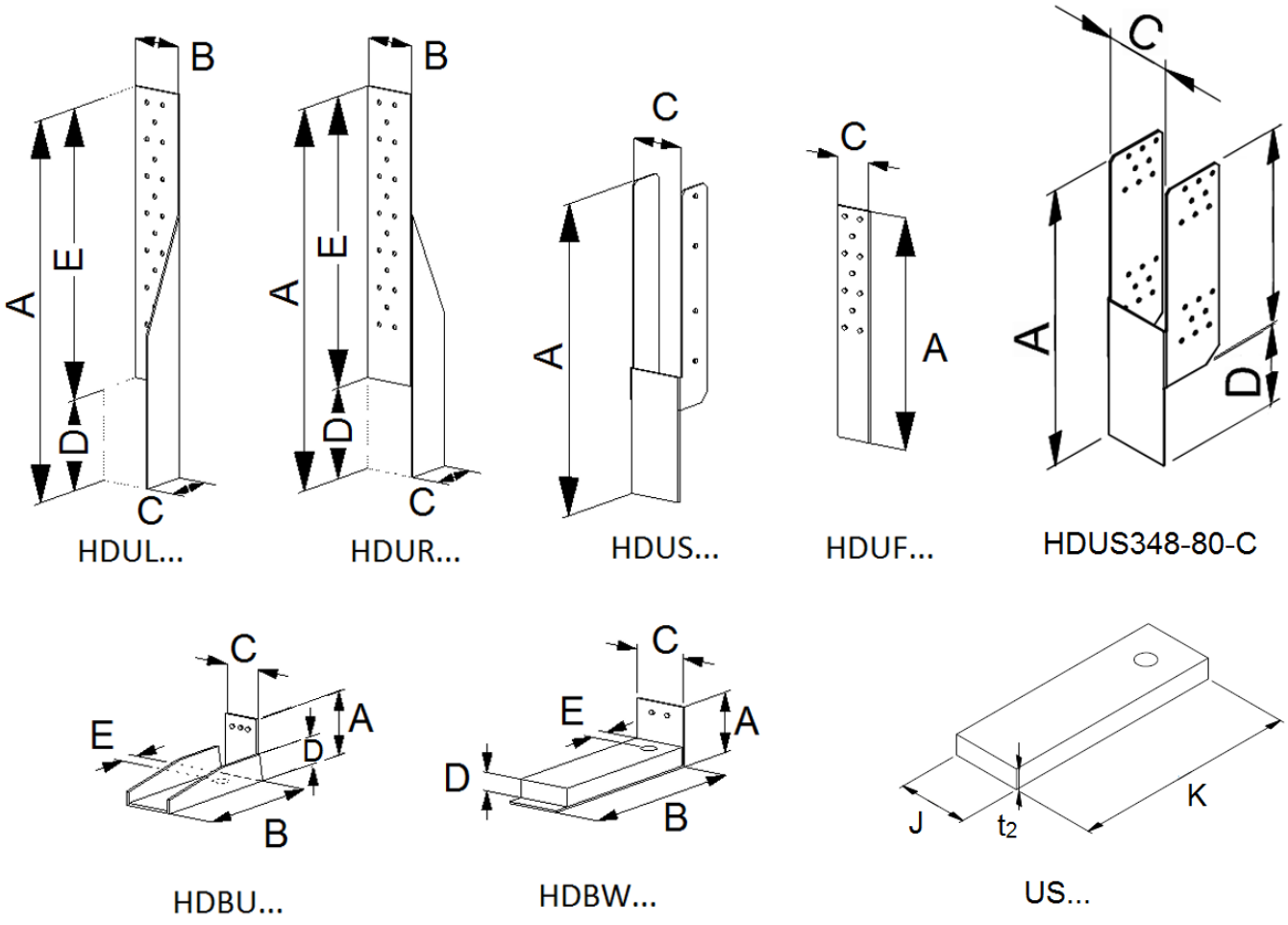


Table D64-1: Size specification

Model	Product dimensions [mm]									Holes			
	A	B	C	D	E	t_1	t_2	J	K	Qty	size	Qty	size
HDUF250G	250		40			2				11	Ø5		
HDUF400G	400		60			2				40	Ø5		
HDUS336G	336	44.5	61	100	236	2				12	Ø5		
HDUS348-80G	348	78.5	81 [6]	100	248	2				32	Ø5		
HDUL380G	380	55	52.5 - 55.0	65	315	2				20	Ø5		
HDUR380G	380	55	52.5 - 55.0	65	315	2				20	Ø5		
HDUL465G	465	55	52.5 - 55.0	150	315	2				20	Ø5		
HDUR465G	465	55	52.5 - 55.0	150	315	2				20	Ø5		
HDUL xx G	≥ 300	55	52.5 - 55.0	≥ 65	A - D	2					Ø5		
HDUR xx G	≥ 300	55	52.5 - 55.0	≥ 65	A - D	2					Ø5		
HDUF40XG	≥ 250		≥ 40			2					Ø5		
HDUF60XG	≥ 250		60			2					Ø5		
HDBU163G [1]	65	163	40	30	50	3	10	40	50	2 [7]	Ø6	1	Ø13
HDBU220G [1] [2]	65	220	54	45	55	4	10 / 8	40 / 50	50	5	Ø6	1	Ø18
HDBU379G [1] [2]	65	379	40	45	114	4	10 / 8	40 / 50	50	2 [7]	Ø6	1	Ø18
HDBU379-84-16G [5]	65	379	74	75	55	4	15	70	90	6	Ø6	1	Ø18
HDBW60G	82	65	50	15	27	2	15	50	60	2 [7]	Ø6	1	Ø14
HDBW160G	65	182	50	15	27	2	15	50	160	2 [7]	Ø6	1	Ø13.5 (+1; -0.5) [3]
HDBW200G	65	222	60	20	37	2	20	60	200	5	Ø6	1	Ø17.5 (+1; -0.5) [4]

Together with: [1] US40/50/10G ; [2] US50/50/8G; [3] 12.5 to 14 mm; [4] 16.5 to 18 mm ; [5] washer70x90x15mm with Ø18mm; [6] optional up to 141mm, [7] optional 3 holes

For HDBUx and HDBWx (bottom parts), the size A can be modified.

For HDUFxx the hole pattern (distances and hole diameter) can be changed as long as the net cross section is not reduced.

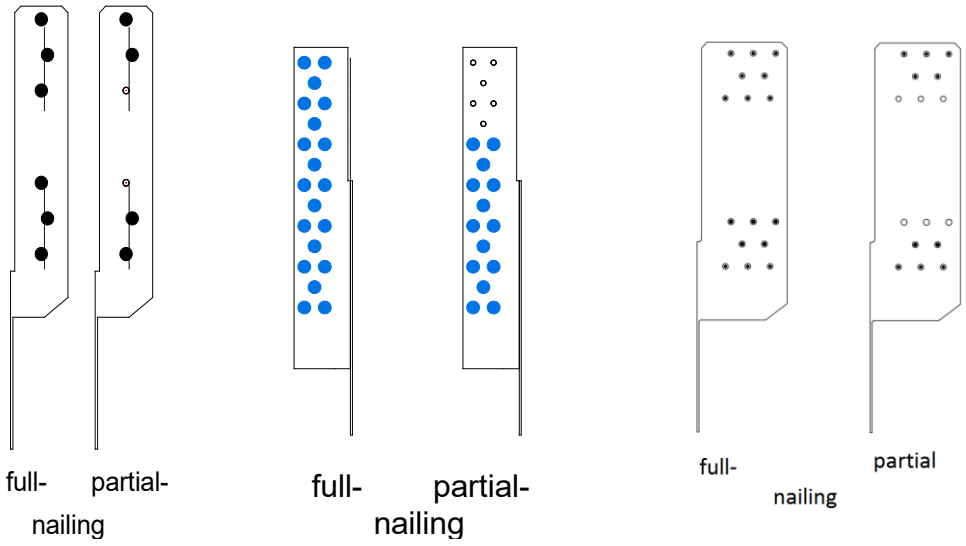
Combinations		upper parts									
		HDUF250	HDUF400	HDUS336	HDUS348-80G	HDUL380	HDUR380	HDUL465	HDUR465	HDUF40X	HDUF60X
lower parts	HDBU163G	o	o	o	o	o	o	o	o	o	
	HDBU220G		o		o	o	o	o	o		
	HDBU379G	o	o	o	o	o	o	o	o		o
	HDBU379-84-16G				o						
	HDBW60G	o	o	o	o	o	o	o	o	o	
	HDBW160G	o	o	o	o	o	o	o	o	o	
	HDBW200G		o	o	o	o	o	o	o		o

The free cells show non logical or not possible combinations.

Table D64-2: Material specification

Part	Material Grades	Coating specification
Plates	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
Washer	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 for HDUS and HDUL/R



Model	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
HDUS348-80G	2x6 nails on extreme rows. Then nail holes shall be filled symmetrically starting from top and bottom rows	full nailing 2x16 nails

Table D64-3: Characteristic capacity

The capacity of a combination of an upper and lower part is given by the lower capacity between the two parts given in the following tables.
Also the capacity of the anchor shall be checked by using the following formula:

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

With:
$R_{bolt.k}$ = characteristic withdrawal capacity of the (anchor)-bolt in kN
k_r = factor to calculate the force in the bolt, given in the following tables
$F_{1.d}$ = Design load applied to the connector.

Table of capacities of upper parts:

Model	Characteristic capacities (kN) $R_{1.k}$	
HDUF250G HDUF40XG	$\min\begin{Bmatrix} n_{ef} \times R_{lat.k} \\ 17.8\ kN/k_{mod} \end{Bmatrix}$	
HDUF400G HDUF60XG	$\min\begin{Bmatrix} n_{ef} \times R_{lat.k} \\ 26.7\ kN/k_{mod} \end{Bmatrix}$	
HDUS336G	$\min\begin{Bmatrix} C \times n_{ef\ per\ side} \times R_{lat.k} \\ 23.1\ kN/k_{mod} \end{Bmatrix}$ with C = 1.95	when full contact between top holdown part and timber
	$\min\begin{Bmatrix} D \times R_{lat.k} \\ 17.95\ kN/k_{mod} \end{Bmatrix}$ with D = $\begin{cases} 10.47\ for\ full\ nailing \\ 7.41\ for\ partial\ nailing \end{cases}$	when no full contact between top holdown part and timber
HDUS348-80G	$\min\begin{Bmatrix} n_{tot} \times 0{,}691 \times R_{lat.k} \\ 42\ kN/k_{mod} \end{Bmatrix}$	use nail holes symetrically starting from top and bottom rows
HDUL380G HDUR380G HDUL465G HDUR465G HDUL xx G HDUR xx G	$\min\begin{Bmatrix} C \times R_{lat.k} \\ 21.4 \times R_{ax.k} \end{Bmatrix}$ with C = $\begin{cases} 11.7\ for\ full\ nailing \\ 8.1\ for\ partial\ nailing \end{cases}$	

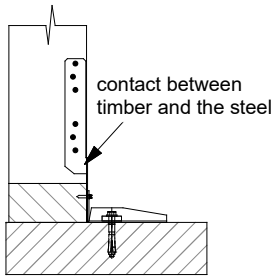


Table of capacities of lower parts:

Model	Characteristic capacity (kN)		Bolt factor k_r	max. n_{cs}
	$R_{1,k}$	$R_{5,k}$		
BDBU163G	$min\begin{Bmatrix} \frac{R_{s,k}}{k_{mod}} \\ V_{s,k} \times n_{sc}/k_{mod} \end{Bmatrix}$	13,7	1,55	3
HDBU220G		34,6	1,4	3
HDBU379G		16,7	1,46	3
HDBW60G		19,8	2	3
HDBW160G		21,2	1,24	3
HDBW200G		23,4	1,23	3
HDBU379-84-16G	$min\begin{Bmatrix} \frac{R_{s,k}}{k_{mod}} \\ n_{sc} \times \left(\frac{1}{V_{s,k}} + \frac{0{,}035}{N_{s,k}}\right)^{-1} / k_{mod} \end{Bmatrix}$	45,95	1,17	6

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

n_{tot} = total number of nails

$V_{s.k}$ = characteristic Capacity of self-tapping screws (for EJOT JT2-3-5.5*25 or alternatively H-3-5.5x25 $V_{s.k}$= 6.4 kN)

$N_{s.k}$ = characteristic Capacity of self-tapping screws (for EJOT JT2-3-5.5*25 or alternatively H-3-5.5x25 $N_{s.k}$= 3.4 kN)

n_{sc} = number of self-drilling screws

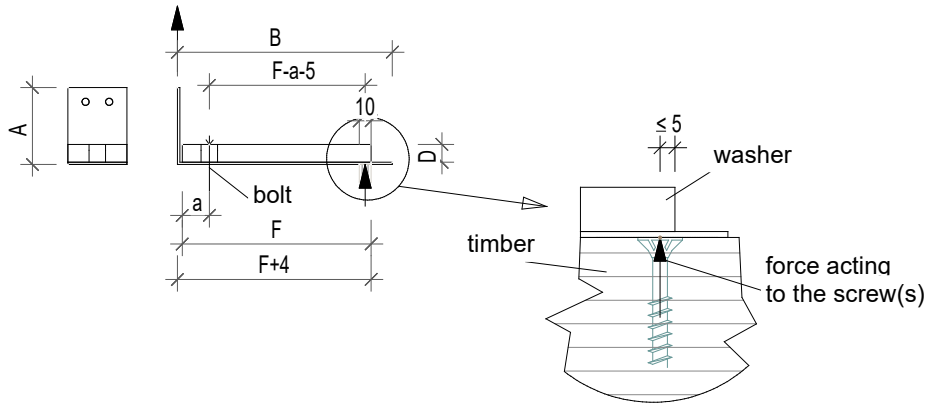
$R_{ax.k}$ = characteristic axial capacity of one nail in kN

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

$R_{s.k}$ = capacity given in the table

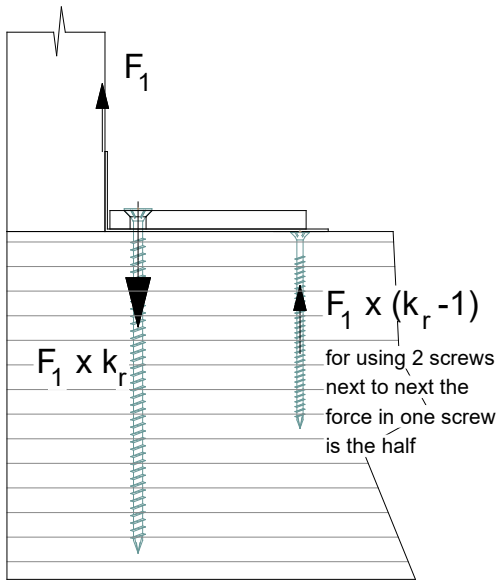
The different γ_m for the screws are included in the formulas

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.

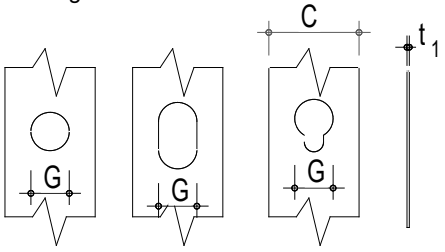
A connection to the timber can also be occurring with a HDUFxx next

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:

$$R_{1,k} = \min \begin{cases} n_{ef} \times R_{lat,k} \\ \dfrac{A_{net} \times 295\, N/mm^2}{k_{\mathrm{mod}}} \end{cases}$$

With A_{net}= (C-G) x 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:



D65: HD3B

Product name	Alternative names
HD3B	

Figure D65-1: Drawings

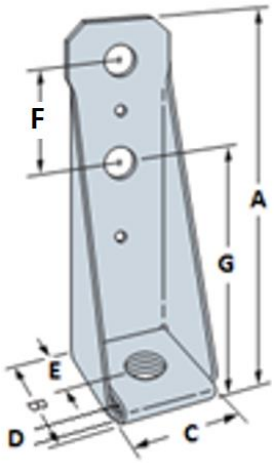


Table D65-1: Size specification

Model	Product dimensions [mm]								Holes					
									Top				Bottom	
	A	B	C	D	E	F	G	t	Qty	size	Qty	size	Qty	size
HD3B	220	56	59	11	33	45	123	2.7	2	Ø17.5	2	Ø4	1	Ø17.5

Table D65-2: Material specification

Part	Material Grades	Coating specification
Plate	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 D65-3: Characteristic capacity

						Characteristic capacities [kN]
		Fasteners				
		On stud		On support		
Model	Type of stud	Qty	Type	Qty	Type	$R_{1.k}$
HD3B	Steel	2	Ø16	1	Ø16	39.89
	Timber	2	Ø16	1	Ø16	15.59

For a timber with a size < 100x100mm: the capacity of the bolts in the timber are to be checked:
n x $F_{v.RK}$; with n= number of bolts
It must be checked. that the anchor fulfils the following formula: $\frac{F_{1,d}}{R_{anchor,d}} \leq 1$

D66: HD5A

Product name	Alternative names
HD5A	

Figure D66-1: Drawings

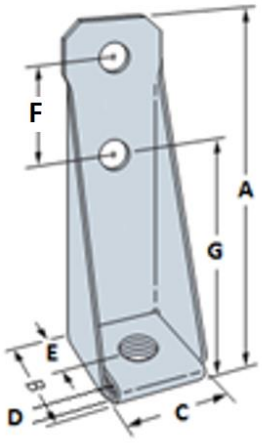


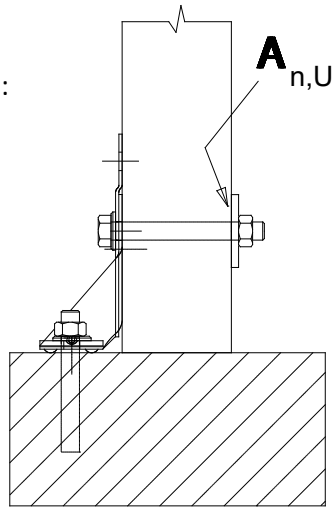
Table D66-1: Size specification

Model	Product dimensions [mm]								Holes			
									Top		Bottom	
	A	B	C	D	E	F	G	t	Qty	size	Qty	size
HD5A	239	90.4	68.9	13	56	77	133	2.8	2	Ø21	1	Ø22

Table D66-2: Material specification

Part	Material Grades	Coating specification
Plate	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 D66-3: Characteristic capacity



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

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

$A_{n.u}$ = net area of the washer (on the backside of connected timber)
$f_{c.90.k}$ = characteristic compressive strength perpendicular to timber
$R_{anchor.d}$ = 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:

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

D67: HE

Product name	Alternative names
HE	

Figure D67-1: Drawings

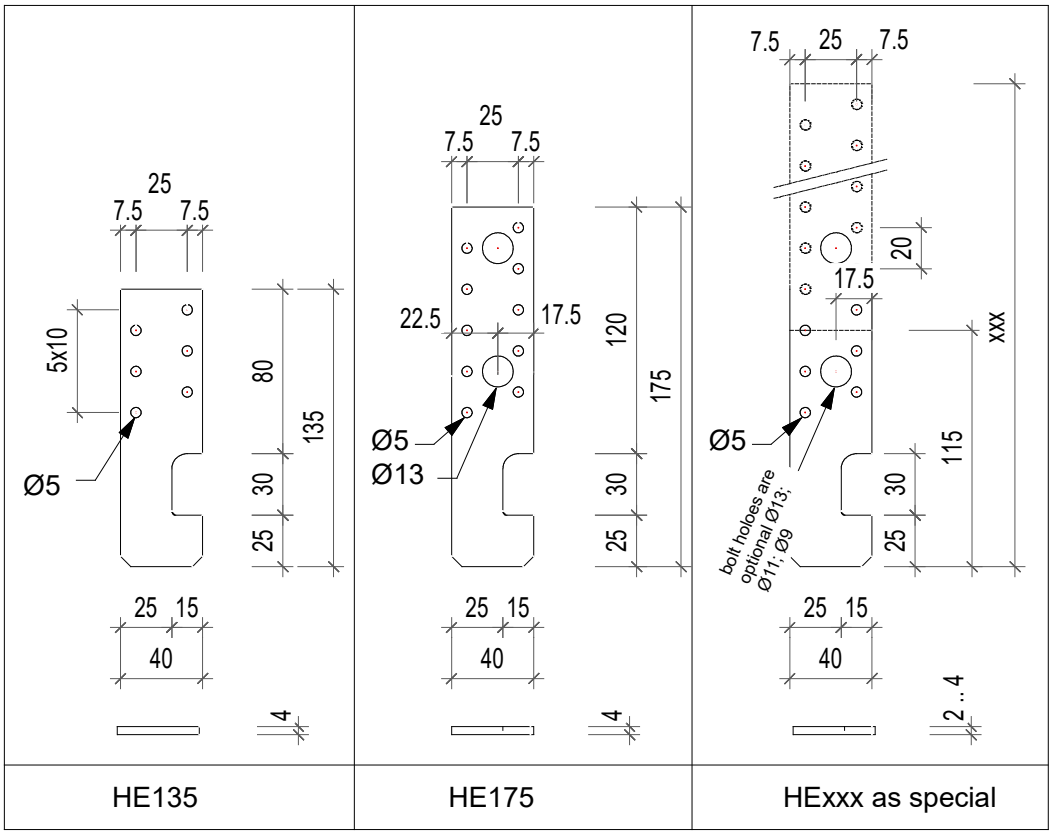


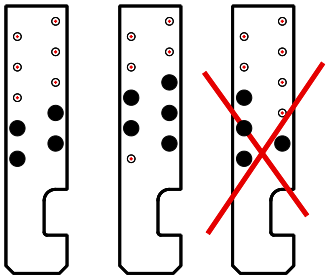
Table D67-1: Size specification
n/a

Table D67-2: Material specification

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

Nail pattern:

Model	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 D67-3: Characteristic capacity

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

$$R_{1,k} = min\begin{cases} C\ x\ R_{lat,k} \\ 8{,}5\ kN/k_{mod}\ x\ (t/4\ mm) \end{cases}$$

$R_{lat.k}$ 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 67-4

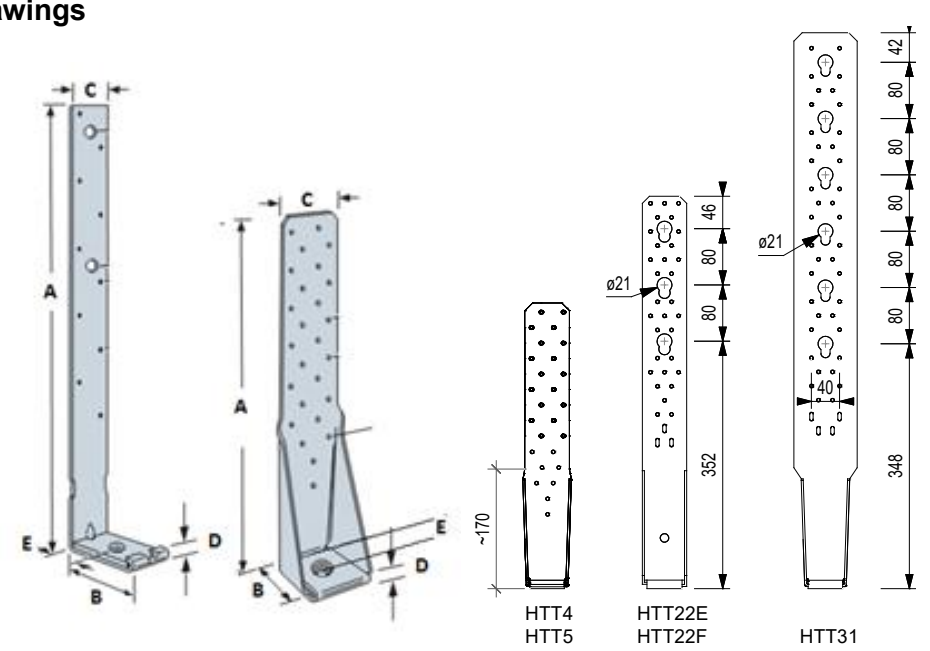
No of nails	I_p [mm^2]	C factor
3	800	3,0
4	1944	3,8
5	2230	4,4
6	2688	4,7
7	4557	6,1
8	5450	6,6
9	8278	8,0
10	9813	8,6

Tabel 67-5

No of bolts	I_p [mm^2]	C factor
2 M12	1800	1,9

D68: HTT & LTT

Figure D68-1: Drawings



LTT **HTT**

Table D68-1: Size specification

Model	Product dimensions [mm]						Holes							
							Top						Bottom	
	A	B	C	D	E	t	Qty	size	Qty	size	Qty	size	Qty	size
LTT20B	502	70	51	7	35	2.7	10	Ø5	2	Ø14			1	Ø21
HTT4	309	62	64	12	33	2.8	18	Ø4.7					1	Ø17.5
HTT5	403	62	64	12	33	2.8	26	Ø4.7					1	Ø17.5
HTT16	403	62	64	12	33	2.8	18	Ø4.7					1	Ø18
HTT22	569	62	64	12	33	2.8	32	Ø4.7					1	Ø18
HTT22E & HTT22F	558	60	63	12	33	3	31	Ø5	3	Ø21	3	Ø5x12	1	Ø18
HTT31	790	60	90	12	33	3	41	Ø5	6	Ø21	4	Ø5x12	1	Ø25

Table D68-2: Material specification

Part	Material Grades	Coating specification
HTT4 HTT5 HTT16 HTT22 & LTT20B	G90 galvanized steel SS Grade 33 according to ASTM A-653	
	Or stainless steel as described	
HTT22F	S250GD according to EN 10346	Z275 according to EN 10346
	Or stainless steel as described	
HTT22E	S350GD according to EN 10346	Z275 according to EN 10346
	Or stainless steel as described	
HTT31	S350GD according to EN 10346	Z275 according to EN 10346

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

Model	Minimum	Maximum
LTT20B	2	10
HTT4	4	18
HTT5	4	26
HTT16	4	18
HTT22	4	32
HTT22E & HTT22F	10	34
HTT31		45 CSA5,0x80 / 6 ZYK + 4 CSA5,0x80

Table D68-3: Characteristic capacity

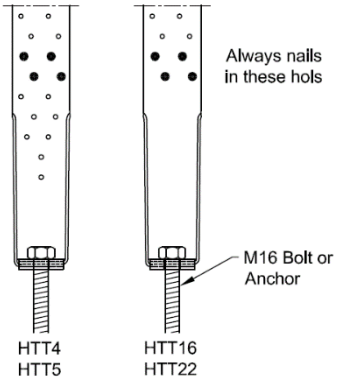
HTT4/5/16/22

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

HTT4 & HTT5 &
HTT16 & HTT22

without Washer:

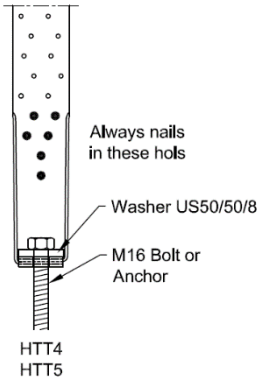
$$R_{1,k} = min\begin{cases}(n-3{,}5)\times R_{lat,k}\\ 25{,}2\times R_{ax,k}\\ 43{,}0/k_{mod}\end{cases}$$



HTT4 & HTT5

with Washer:

$$R_{1,k} = min\begin{cases}(n-3{,}5)\times R_{lat,k}\\ 32{,}3\times R_{ax,k}\\ 43{,}0/k_{mod}\end{cases}$$



$R_{lat,k}$ = 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: $\frac{F_{1,d}}{R_{anchor,d}} \le 1$

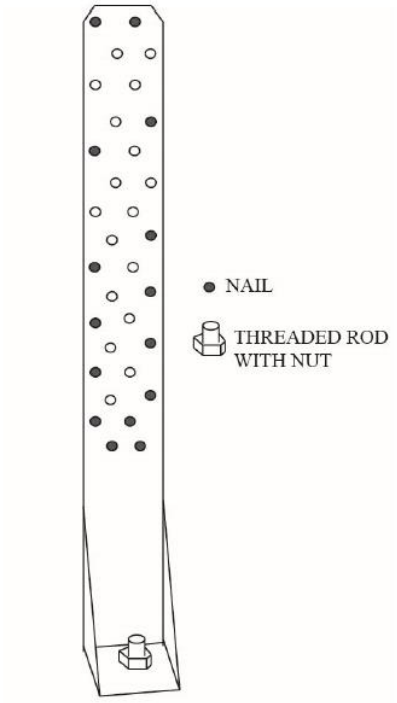
The values are also applicable for a connection with a gap between the short flanges of the HTT and the bearing support.

Table D68-4 Ductility class for CLT panel to CLT panel – 1 Hold Down

CLT to CLT connection				1 angle bracket per connection		
Item	Nailing Pattern	Fasteners				Ductility class for uplift load F1
		Header		Joist		
		Qty	Type	Qty	Type	
HTT22	See below	1	M16 Bolt	15	CNA4,0x60	DCM

DCM = Medium ductility class (mean ratio $4 < D_{u,80\%} / D_y < 6$)

The anchor or fastener in the support shall be designed with sufficient overstrength to ensure the development of cyclic yielding in the dissipation zones as disclosed in 8.6 (4) in EN 1998-1:2004.



HTT22 | Simpson Strong Tie®

For the CLT floor, use a cover plate as shown below. The cover plate is not necessary for the steel base.

Table D68-5 Ductility class for CLT panel to rigid support – 1 Hold Down

CLT to rigid support				1 angle bracket per connection		
Item	Nailing Pattern	Fasteners				Ductility class for uplift load F1
		Header		Joist		
		Qty	Type	Qty	Type	
HTT22	See above	1	M16 Bolt	15	CNA4,0x60	DCH

DCH = High ductility class (mean ratio $D_{u,80\%}$ / D_y > 6)

The anchor or fastener in the support shall be designed with sufficient overstrength to ensure the development of cyclic yielding in the dissipation zones as disclosed in 8.6 (4) in EN 1998-1:2004.

LTT20B

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

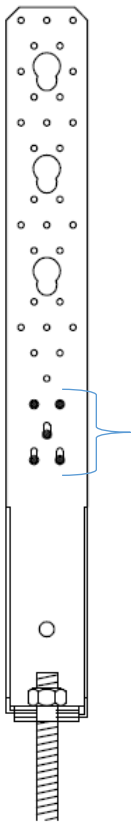
$$R_{1,k} = \min \begin{cases} n \times R_{lat,k} \\ 2{,}85kN / k_{\mathrm{mod}} \end{cases}$$

$R_{lat,k}$ = 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:

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

HTT22F & HTT22E



The capacity of the **HTT22F** in kN is:

$$R_{1,k} = min\begin{cases} (n-3.5)\times R_{lat,k} \\ k_2 \times R_{ax,k} \\ {}^{47.2}/_{k_{mod}}\ for\ CNA\ or\ CSA\ and\ {}^{37.4}/_{k_{mod}}\ for\ fasteners\ in\ big\ holes \end{cases}$$

The capacity of the **HTT22E** in kN is:

$$R_{1,k} = min\begin{cases} (n-3.5)\times R_{lat,k} \\ k_2 \times R_{ax,k} \\ {}^{57.5}/_{k_{mod}}\ for\ CNA\ or\ CSA\ (*)and\ {}^{47.6}/_{k_{mod}}\ for\ fasteners\ in\ big\ holes \end{cases}$$

With:

n the number of fasteners in the hold down
$R_{lat,k}$ the lateral capacity of the fasteners above the lowest 5 holes.
$R_{ax,k}$ the axial capacity of the fasteners in the lowest 5 holes (3 oblong + 2 round).

(*) for beginning with nailing/screwing by the lowermost holes
for the beginning with nailing/screwing by the topmost holes,
the value for fastener in big holes is vailable

$$k_2 = \begin{cases} 53.5 \text{ if CNA4.0x35 or 40} \\ 43.2 \text{ if CNA4.0x50 or 60 or CSA screws from 35 to 80mm long} \end{cases}$$

Always insert fasteners in, at least the 3 oblong holes and the first row of round holes (a total of 5 fasteners).

Stiffness of the connection in kN/mm can be determined using the equation:

$$k_{ser} = a \times (n-3) + b$$

With *n*, the number of nails in the timber
a and b as shown in the table below:

Type of fastener	HTT22F		HTT22E	
	a	*b*	*a*	*b*
CNA4.0x35	0.117	1.437	0.117	1.437
CNA4.0x40	0.121	1.633	0.122	1.623
CNA4.0x50	0.131	2.026	0.134	1.995
CNA4.0x60	0.140	2.419	0.145	2.367
CSA5.0x35	0.154	1.892	0.190	2.340
CSA5.0x40	0.150	2.023	0.186	2.501
CSA5.0x50	0.144	2.242	0.179	2.772
CSA5.0x80	0.127	2.899	0.157	3.585

If an extra US50/50/8G-B is used, capacity doesn't change but k_{ser} shall be multiplied by 1.3 for both HTT22E & HTT22F.

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

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

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

The stiffness K_{ser} of HTT5/16/22, submitted to vertical load, is given in the two following tables with n = numbers of CNA nails.

Table D68-6: K_{ser} of HTT4/5/16/22 without additional washer

Number of nails	K_{ser} [kN/mm] for nails CNA4,0x …			
	35	40	50	60
≥5	0,31 + (n-5)x0,2	0,33 + (n-5)x0,22	0,40 + (n-5)x0,27	0,43 + (n-5)x0,29

Table D68-7: K_{ser} of HTT4/5/16/22 with additional washer

Number of nails	K_{ser} [kN/mm] for nails CNA4,0x …			
	35	40	50	60
≥15	3,04 + (n-15)x0,265	3,34 + (n-15)x0,29	4,03 + (n-15)x0,35	4,29 + (n-15)x0,374

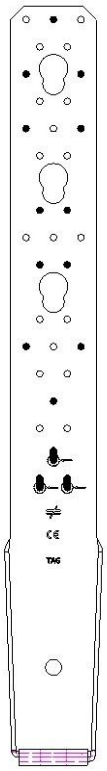
The slip modulus of the anchor shall also be considered together with the K_{ser} of the connector HTT.

Table D68-8 Ductility class for CLT panel to rigid support – 1 Hold Down

CLT to rigid support				1 angle bracket per connection		
Item	Nailing Pattern	Fasteners				Ductility class for uplift load F1
		Header		Joist		
		Qty	Type	Qty	Type	
HTT22E	See below	1	M16 Bolt	15	CNA4,0x60	DCM

DCM = Medium ductility class (mean ratio $4 < D_{u,80\%} / D_y < 6$)

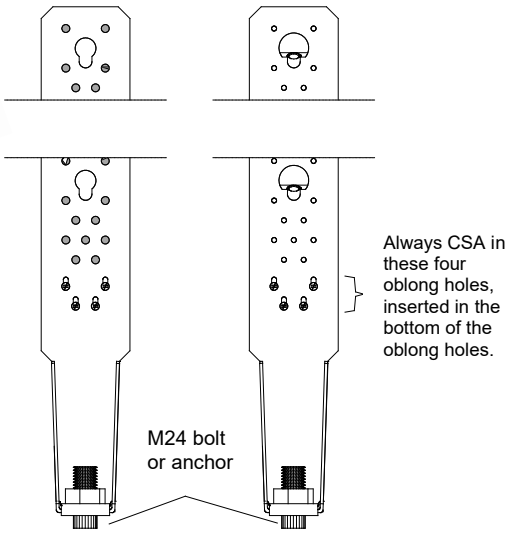
The anchor or fastener in the support shall be designed with sufficient overstrength to ensure the development of cyclic yielding in the dissipation zones as disclosed in 8.6 (4) in EN 1998-1:2004.



HTT31

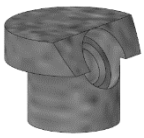
For connection with fastener:

$$R_{1.k} = \min \begin{cases} (n-4) \times R_{lat.k} \\ 26.8 \times R_{ax.k} \\ 85.1 / k_{\mathrm{mod}} \end{cases}$$



For connection with Zyklop™:

$$R_{1.k} = min \begin{cases} n_z \times R_{ZYK.k} \\ n_{ef} \times R_{ax.screw} \times 0.86 \\ 26.8 \times R_{ax.k} \\ 78.3 / k_{mod} \end{cases}$$



HTT31

With:

n = the number of fastener including the 4 CSA screws in the lowest 4 oblong holes

n_z = number of ZYKT69 or ZYK10

n_{ef} = eff. number of ZYKT69 or ZYK10 acc. to the ETA-20/1071

$R_{lat,k}$ = the lateral capacity of one fastener installed above the lowest 4 oblong holes

$R_{ax,k}$ = the axial capacity of one fastener installed in the lowest 4 oblong holes

$R_{k.ZYK}$ = the lateral capacity of the ZYKLOP connector (ZYKT69 or ZYK10) or alternative the lateral capacity of a bolt M20 steel-timber.

$R_{ax.screw}$ = the axial capacity of the screw inside the ZYKLOP connector

The relevant values for the Zyklop™ are given in ETA-20/1071.

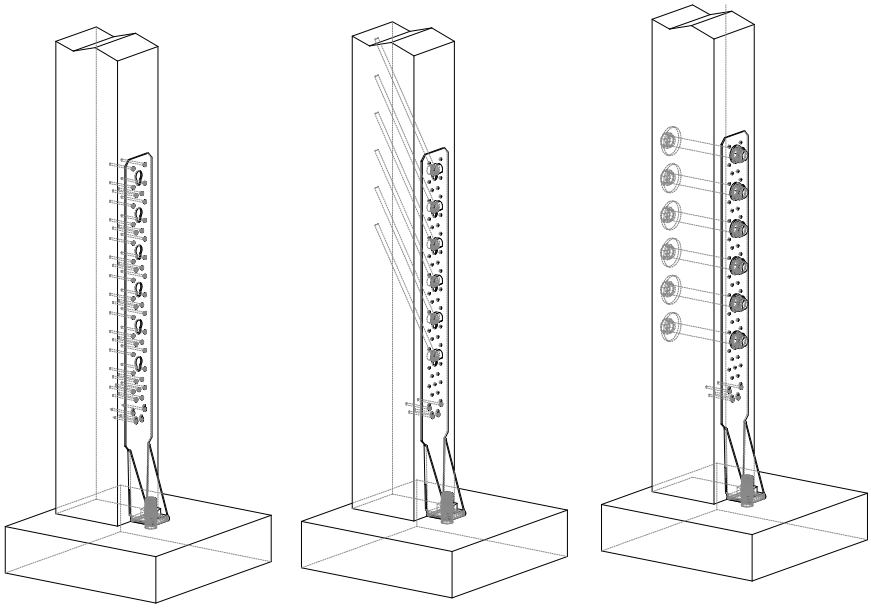
Stiffness of the connection with HTT31 :

Table D68-9: K_{ser} of HTT31

Model	Fasteners		Stiffness** (kN/mm)
	Qty	Type	
HTT31	6 *	ZYKT69	17,1
HTT31	6 *	Bolt Ø20	
HTT31	45	CSA5,0x80	24,3

* with additional 4 CSA5,0x80 in the lowest 4 oblong holes

** for a lower number of fasteners the k_{ser} –value shall be reduced according to the number of fasteners.

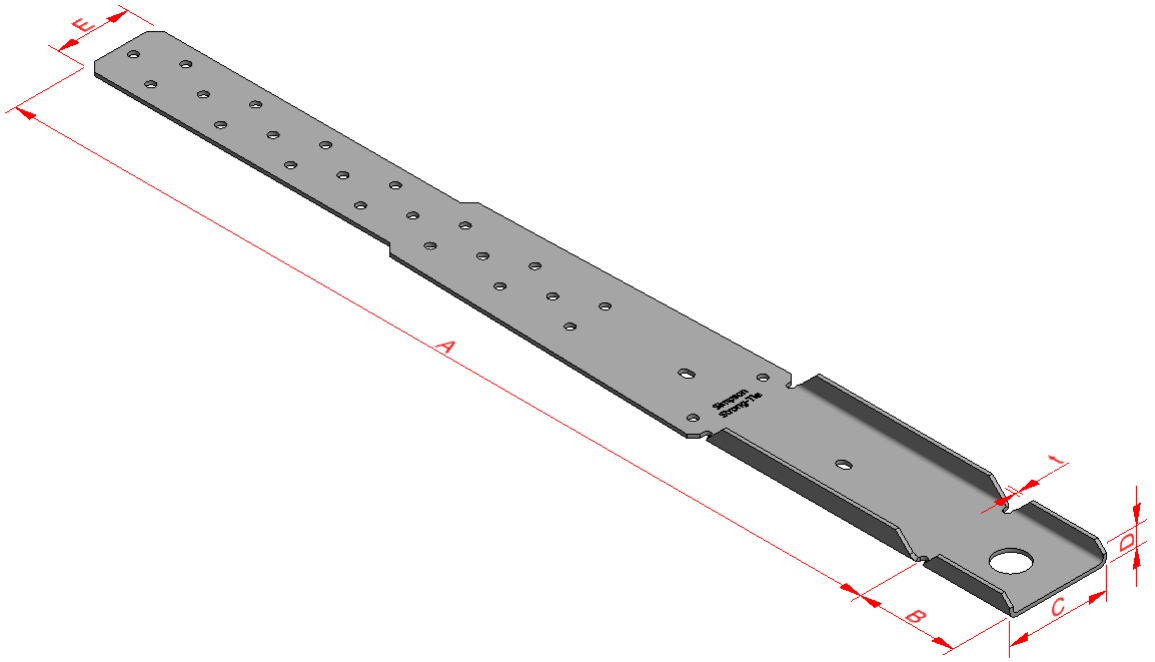


HTT31

D69: MAH

Product name	Alternative names
MAH	-

Table D69-1: Size specification

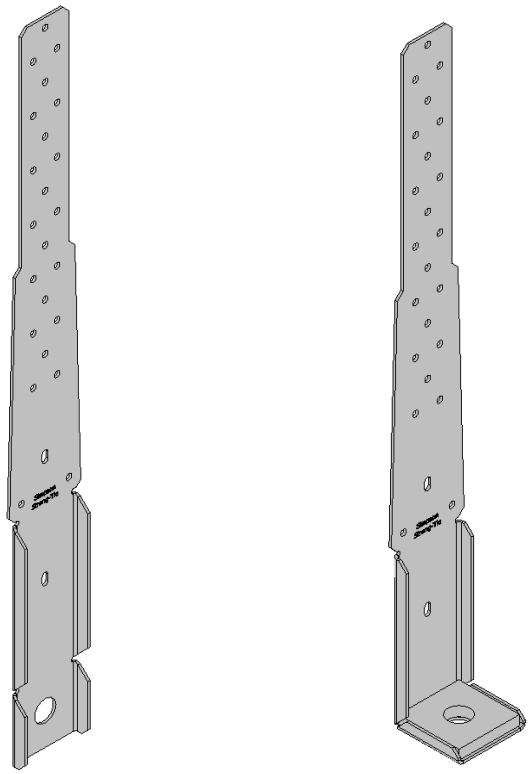


Model	Product dimensions [mm]						Holes			
							Top		Bottom	
	A	B	C	D	E	t	Qty	size	Qty	size
MAH485	484	53	55	12.2	40	2	23	Ø5	1	Ø18

Table D69-2: Material specification

Part	Material Grades	Coating specification
MAH485	S250 GD according to EN 10346	Pre-galvanized steel min Z275 according to EN10346
US50/50/8G	S235JR according to EN 10025	Hot-dip galvanized according to EN ISO 1461
	Or stainless steel as described	-

Table D69-3: Characteristic capacity



Model	Characteristic capacities [kN]	
	$R_{1.k}$	
	Flat	Folded*
MAH485	min(n_{eff} x $R_{lat.k}$; 18.7 / k_{mod})	min(n_{eff} x $R_{lat.k}$; 24.6 / k_{mod})

*US50/50/8G is compulsory

Note:

- Values can be calculated with CNA4.0 nails and CSA5.0 screws
- The principle is to start nailing at the bottom and go up regularly
- If extra strap is added the maximum number of nails on the part where there is only strap is equal to the number of nails that go through strap + MAH

The anchor must be able to take a load: "$F_{anchor.Rk} \geq 1.96 \times F_k$

Stiffness:

Note: the minimum number of fastener is 7 and the maximum is 21. No data are given with extra strap.

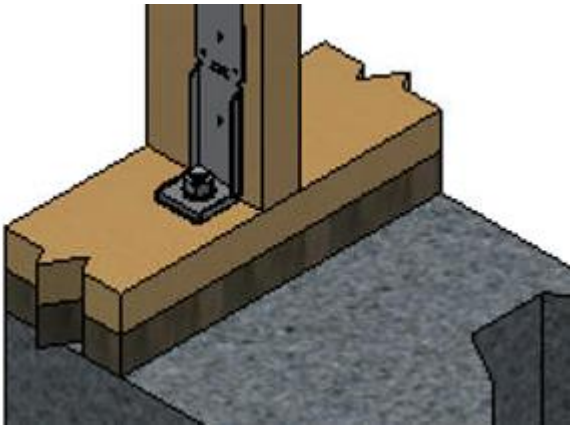
$k_{ser} = a \times n + b$

with n. the number of fasteners

k_{ser} is the stiffness in kN/mm

Fastener	Flat configuration		Folded configuration	
	a	b	a	b
CNA4.0x35	0,160	1,805	0,205	2,319
CNA4.0x40	0,161	1,824	0,207	2,343
CNA4.0x50	0,165	1,862	0,214	2,417
CNA4.0x75	0,173	1,957	0,231	2,620
CSA5.0x50	0,223	2,524	0,286	3,242

Table D69-4: Characteristic capacity with an intermediate timber layer



Model	Fasteners				Characteristic capacities [kN] - 1 angle per connection		
					$R_{1.k}$ on rigid support with an intermediate timber layer		
	On post		On timber layer				
	Qty	Type	Qty	Type	CNA4.0x35	CNA4.0x50	CNA4.0x60
MAH485/2	21	Ø5	1	Ø16	$\min \begin{cases} 25{,}24 \\ 15{,}79/kmod \end{cases}$	15,79 / k_{mod}	15,79 / k_{mod}

Equations valid for an anchor with: $N_{Rk,s}$ > 60 kN (refer to the values in the Anchor ETA)

Bolt factor/Bolt forces	$F_{b.ax} = F_1 + 8.35\ kN$
	$k_{b.lat} = 0.87$

The anchor capacity shall be checked using load factor, it is assumed that the anchor work with no lever arm for an intermediate timber layer under 90 mm.

D70: PROFA

Product name	Alternative names
PROFA	

Figure D7-1: Drawings

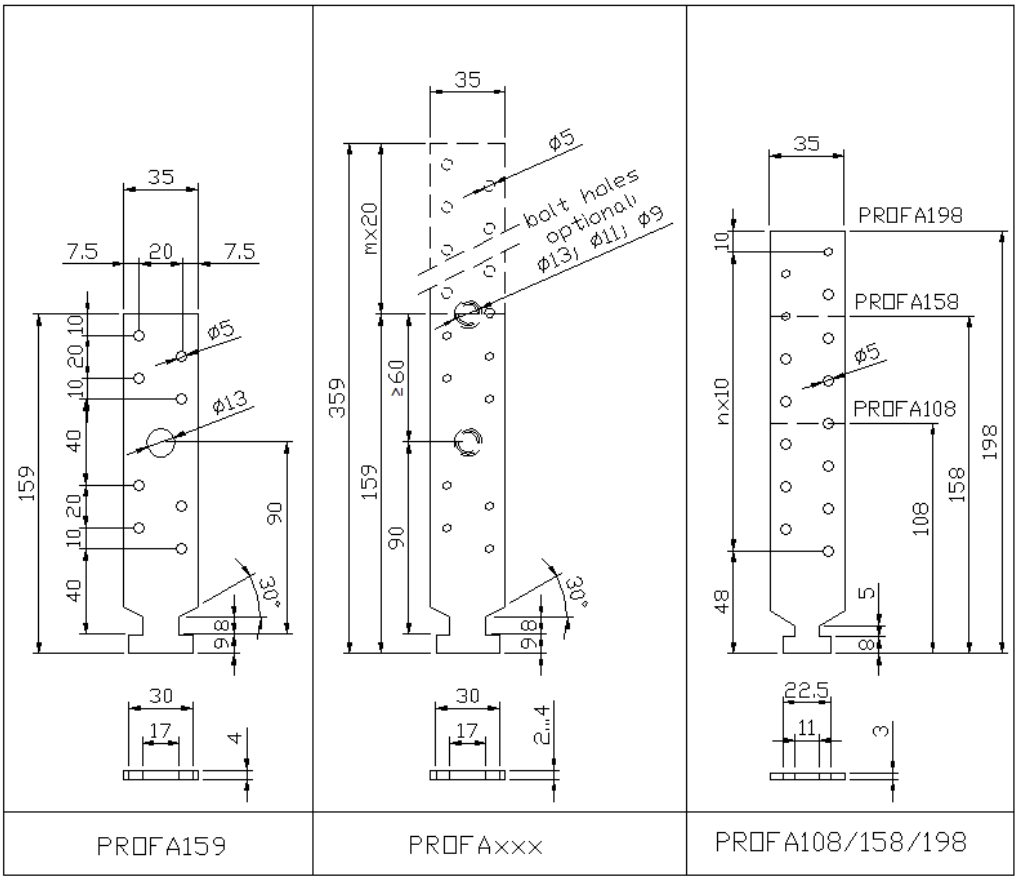
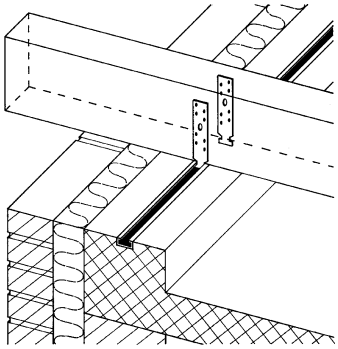


Table D70-1: Size specification
n/a

Table D70-2: Material specification



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

Table D70-3: Nail pattern

Model	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.

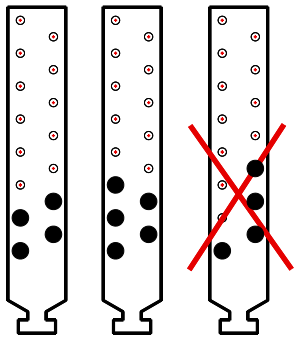


Table D70-4: Characteristic capacity

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

For PROFA 108/158/198 (thickness = 3.0 mm)

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

For PROFA 159 to PROFA 359 (thickness = 4.0mm)

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

For PROFA 159 to PROFA 359 (thickness = 3.0mm)

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

For PROFA 159 to PROFA 359 (thickness = 2.0mm in steel 1.4529)

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

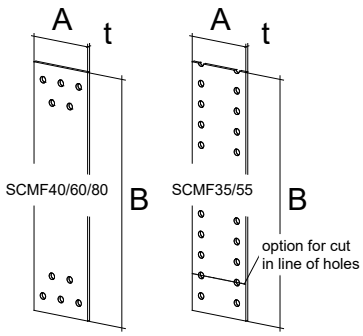
n = number of the nails / connector screws; the nails will be used side by side.
$R_{lat.k}$ = characteristic lateral capacity of the fasteners / bolt M12
k_{mod} = load-duration factor

D71: SCMF

The plate SCMF is made to be used with HDUxx components from the HD2P product family.
Self-drilling screws are used to connect SCMF to HDUxx at each end.

Product name	Alternative names
SCMF	

Figure D71-1: Drawings



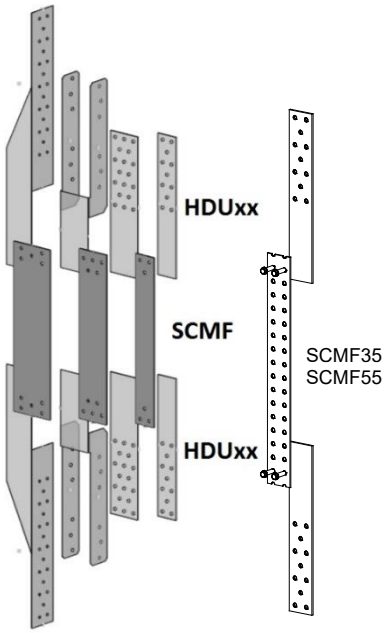


Table D71-1: Size specification

Model	Product dimensions [mm]			Holes	
	A	B	t	Qty	size
SCMF40/B	40	>100	2	6*	Ø6
SCMF60/B	60	>100	2	10*	Ø6
SCMF80/B	80	>100	2	10*	Ø6
SCMF35/B	35	>100	2	n	Ø6
SCMF55/B	55	>100	2	n	Ø6

* or less number

Table D71-2: Material specification

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

Table D71-3: Characteristic capacity

			Characteristic capacities (kN)	
Model	Fasteners		$R_{1.k}$	$R_{s.k}$
	Qty	Type		
SCMF40	2x3	Self-drilling screw ϕ5,5	$\min\begin{cases} R_{s.k} / k_{\mathrm{mod}} \\ V_{R.k} \times n_{sc} / k_{\mathrm{mod}} \end{cases}$	16.6
SCMF60	2x5			24.9
SCMF80	2x5			36.8
SCMF35	2x2			12,8
SCMF55	2x2			12,8
SCMF55	2x4			25,2

The capacity of the connector that includes SCMF and the two HDU components is equal to the minimum capacity of the three parts. The capacity of SCMF itself is given above.
$V_{R.k}$ = characteristic Capacity of self-tapping screws (for EJOT JT2-3-5.5*25 or alternatively H-3-5.5x25 $V_{R.k}$ = 6.4 kN)
n_{sc} = number of self-drilling screws
$R_{s.k}$ = steel cross section capacity given in the table

D72: DTT2Z

Product name	Alternative names
DTT2Z	

Figure D72-1: Drawing

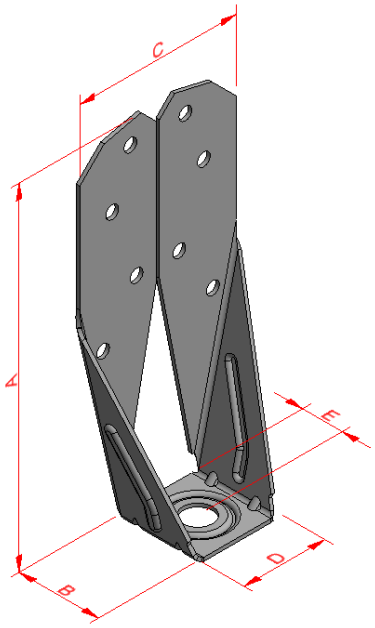


Table D72-1: Size specification

Model	Dimensions [mm]						Holes	
	A	B	C	D	E	Thickness	Flange A	Flange B
DTT2Z	176	41	82	41	21	1,9	8 x Ø6,7	1 x Ø15,5

Table D72-2: Material specification

Part	Material Grades	Coating specification
DTT2Z	~S250 GD according to EN 10346	Pre-galvanized steel min G185 (~40 µm Zinc pr. side)
	Or stainless steel as described	-

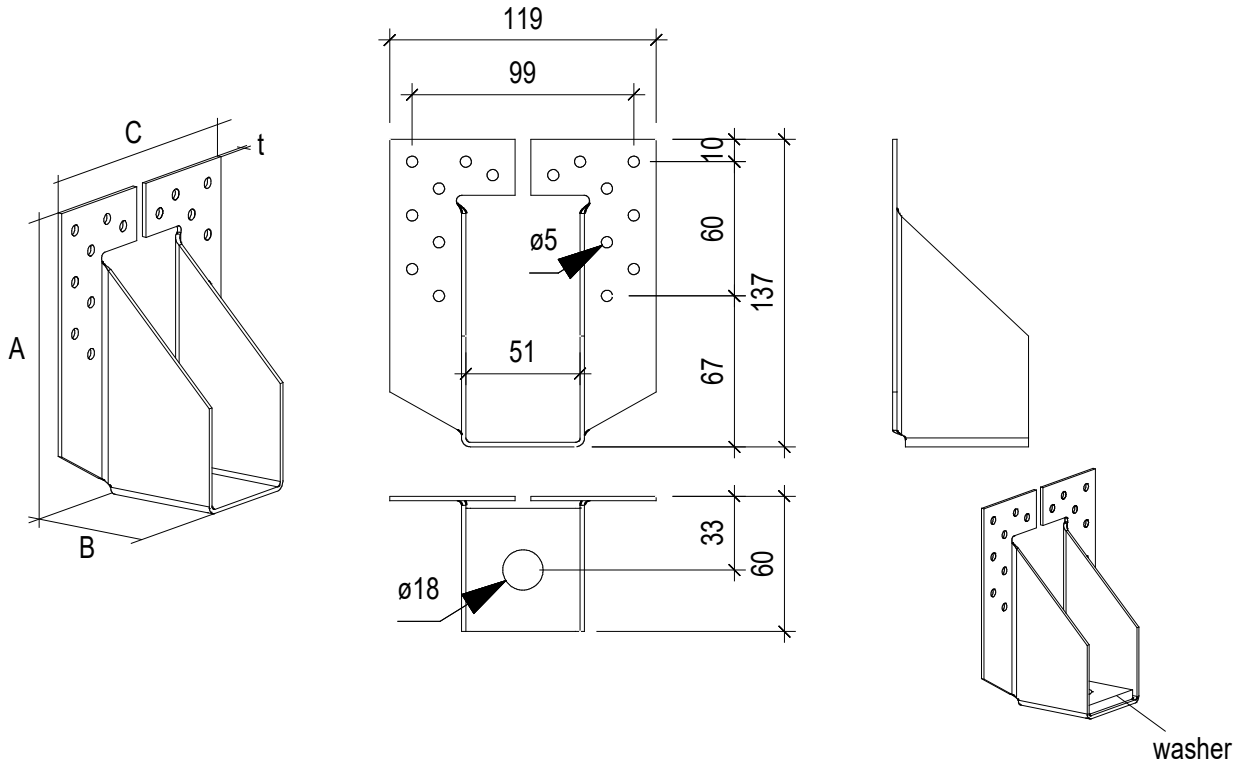
Table D72-3: Characteristic capacity

Model	Characteristic load carrying capacity (kN)	
	Fasteners	$R_{1,k}$
DTT2Z	8 x SDS25112 or 8 x SSH6x40	12,3

D73: HDCLT140

Product name	alternative names
HDCLT140	

Figure D73-1 : Drawing



type	dimension [mm] A	B	C	t
HDCLT140	137	60	119	2

+ washer : US50/50/8

Table D73-2: Material specification

Part	Material Grades	Coating specification
HTT140	S250GD+Z275 according to EN 10346	~20µm 55µm
washer	S235 according to EN 10025	
	Or stainless steel as described	

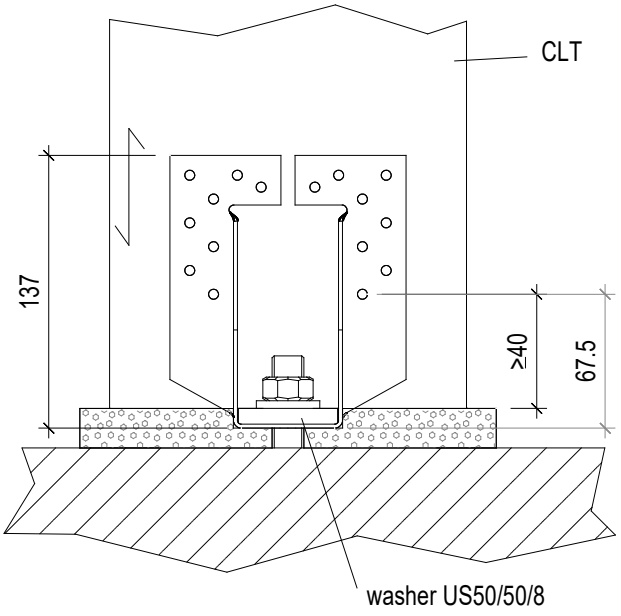
Table D73-3: Characteristic capacity

	$R_{1.k}$ [kN]				
	CNA			CSA	
	4x40	4x50	4x60	5x40	5x50
HDCLT140	7.6	10.1	12.6	min(22.1 ; 24.2/kmod)	min(26.1 ; 24.2/kmod)

	K_{ser} [kN/mm]				
	CNA			CSA	
	4x40	4x50	4x60	5x40	5x50
HDCLT140	1.2	1.5	1.9	4.4	5.2

The anchor shall be have a capacity of minimum $F_{1.d}$, the calculation need to be made seperately.

Connetion to CLT

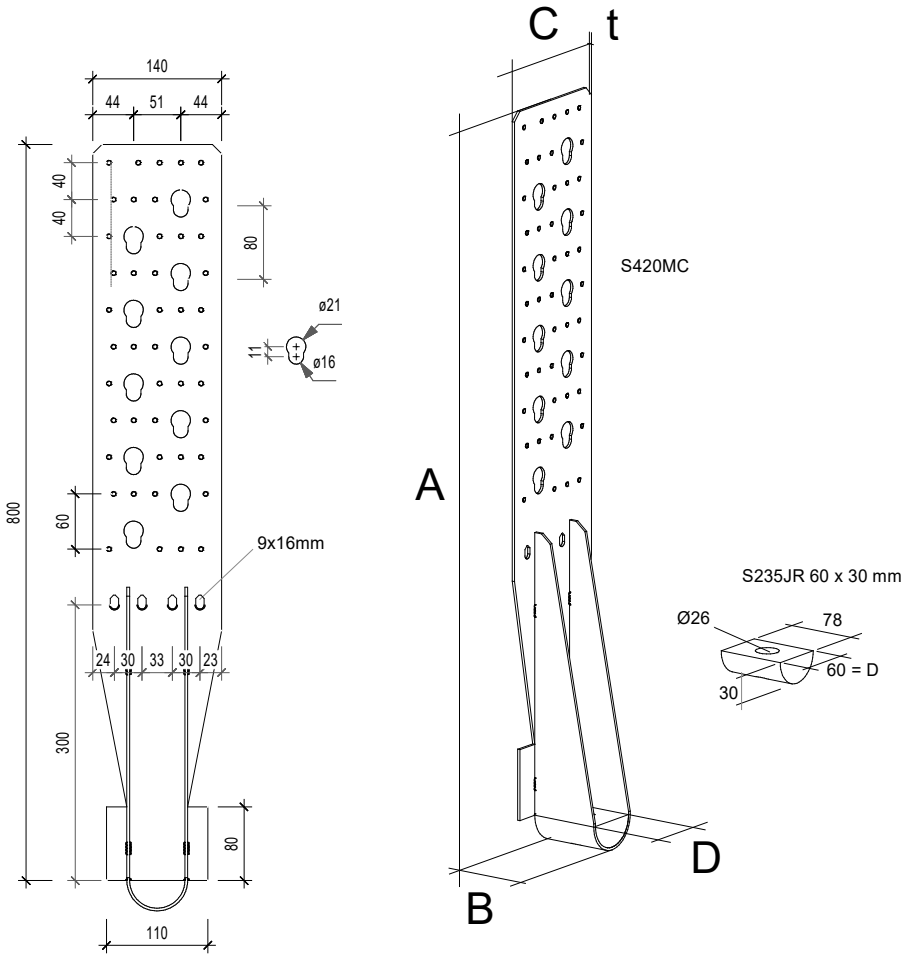


For connection to solid timber, the distance of the lowermost faster shall be have a distance accoring to the EN1995.

D74: HTT140

Product name	alternative names
HTT140	

Figure D74-1 : Drawing



	Dimension [mm]					holes		
Type	A	B	C	D	t	keyhole Ø21/16mm	Ø5mm	oblong 9x16mm
HTT140	800	83	140	60	3	10	45	4

Table D74-2: Material specification

Part	Material Grades	Coating specification
HTT140	S420MC according to DIN EN 10149-2	zinc coating Fe/Zn12A
Washer ½ Ø60	S235JR according to EN 10025	
	Or stainless steel as described	

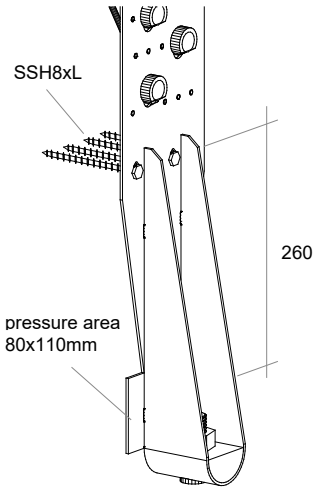
Table D74-3: Characteristic capacity

Type	fastener	Characteristic capacity [kN] $R_{1.k}$
HTTXL	n x ZYKT69 ** with SST-A8x300 + 4 SSH8xL	min.: n_{ef} x $R_{lat.ZYKT.k}$ * 140 /k_{mod}
	n x CSA + 4 SSH8xL	min.: n x $R_{lat.CSA.k}$ 140 /k_{mod}

* acc. to ETA-20/1071 with n_{ef} = n
** can be replaced by ZYK41

The anchor up to Ø24mm must have a load capacity of at least $F_{1.d}$. The calculation must be performed separately.
Anchor with Ø < 24mm: an extra washer is to place on the ½ Ø60 washer.

The eccentricity, based on the lever arm of the bolt axis and the surface of the column/timber element is fixed with the 4 SSH screws in the 9x16 mm oblong holes.
The load-bearing capacity of the screw group must be at least n_{ef} x $R_{ax.SSH.d} \geq F_{1.d} \times 0{,}165$.
SSH8.0x120 meet the requirement.



The lower part 80 x 110 mm must be placed in contact with the column/timber element.

When fastening with an intermediate layer between the HTT140 and the column/timber element, the intermediate layer must have a compressive strength of at least $f_{c.90.d}$ of C24 wood.

Application notes:
The support must be able to absorb the offset moment.
The splitting tension in the area of the SSH screws must be checked this is achieved with the SSH8.0x120 for wood min. C24 b ≥ 140 and h≤ 320.

The connection to other wood-based materials, in particular CLT, can be made in the same way. Where applicable, the regulations governing the approval of CLT must be observed.