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

MEMBER OF EOTA

# European Technical Assessment ETA-07/0285 of 2019/05/23

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<br>For local branch refer to www.strongtie.eu |
| **Manufacturing plant:** | SIMPSON STRONG-TIE Manufacturing facilities |
| **This European Technical** | 150 pages including 4 annexes which form an integral part of the document |
| **This European Technical Assessment is issued in accordance with Regulation (EU)** | Guideline for European Technical Approval (ETAG) No. 015 Three Dimensional Nailing Plates, April 2013, used as European Assessment Document (EAD). |
| **This version replaces:** | The ETA with the same number and issued on 2018-06-12 |

**INDEX**

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

# II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

## 1 Technical description of product and intended use

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

Post 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.

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

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

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

The wood members can be of solid timber, glued laminated timber and similar glued members, or wood-based structural members with a characteristic density from 290 kg/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 $\rho_k$ 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)** | |
| Characteristic load-carrying capacity | See Annex D |
| Stiffness | No performance assessed |
| Ductility in cyclic testing | No performance assessed |
| **3.2 Safety in case of fire (BWR2)** | |
| Reaction to fire | The post bases are made from steel classified as Euroclass A1 in accordance with EN 13501-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC |
| **3.7 Sustainable use of natural resources (BWR7)** | No Performance Determined |
| **3.8 General aspects related to the performance of the product** | The post bases have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3 |
| Identification | See Annex A |

*) See additional information in section 3.9 – 3.12.

### 3.9 Safety principles and partial factors

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

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

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

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

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

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

$k_{modi}$ = 1.18 for steel yield strength

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

$k_{modi}$ = 1.04 for steel ultimate strength

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

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

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

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

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

### 3.10 Mechanical resistance and stability

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

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

**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.

### 3.11 Aspects related to the performance of the product

*3.11.1 Corrosion protection in service class 1 and 2*
In accordance with ETAG 015 the hold downs shall have a zinc coating weight of min. Z275. The steel employed is S250GD (S350GD) with min. Z275 according to EN 10346 and G90 SS Grade 33 according to ASTM A-653.

*3.11.2 Corrosion protection in service class 3*
In accordance with Eurocode 5 the hold downs with a thickness of up to 3 mm shall be made from stainless steel. Hold downs with a thickness from 3 to 5 mm can be made from stainless steel or have a zinc coating of min. Fe/Zn 25c/Z350 according to ISO 2081/EN 10147. The nails or screws shall be produced from stainless steel or have a zinc coating of min. Fe/Zn 25c.
This requirement is fulfilled by post bases with a corrosion protection hot-dip galvanized of approximately 55 µm according to EN ISO 1461:1999 or stainless steel according to EN10088:2005 or electroplated zinc coating according to EN12329:2000 allowing a use of the product in external conditions or sherardizing according to EN 13811:2003. Alternatively, ZM310 can be used as corrosion protection in service class 3 for Post Bases and Hold Downs (applicable for all steel thicknesses).

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

The post bases and the hold downs are manufactured in accordance with the provisions of the European Technical Assessment using the automated manufacturing process laid down in the technical documentation.

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

Hold downs
A hold down connection is deemed fit for use provided:

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

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

The installation instructions provided by the manufacturer stipulate:

- The primary structural member – the post member shown in typical installation page 16 or a beam member - to which the post bases are fixed shall be:
  - Restrained against rotation
  - Capable to transfer the force to the post bases as assumed.
  - Free from wane in areas in contact with the post base.
- The secondary structural member – the concrete support - to which the post bases are fixed shall be:
  - Made from concrete of at least strength class 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 Attestation and verification of constancy of performance (AVCP)

## 4.1 AVCP system

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

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

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

Issued in Copenhagen on 2019-05-23 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:<br>PISB, PISBMAXI, PLB, PVDB, PVIB, PPB, PJPB, PJIB, PPMINI, APB7090, CPB<br>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 |

## Table with the product names and alternative names

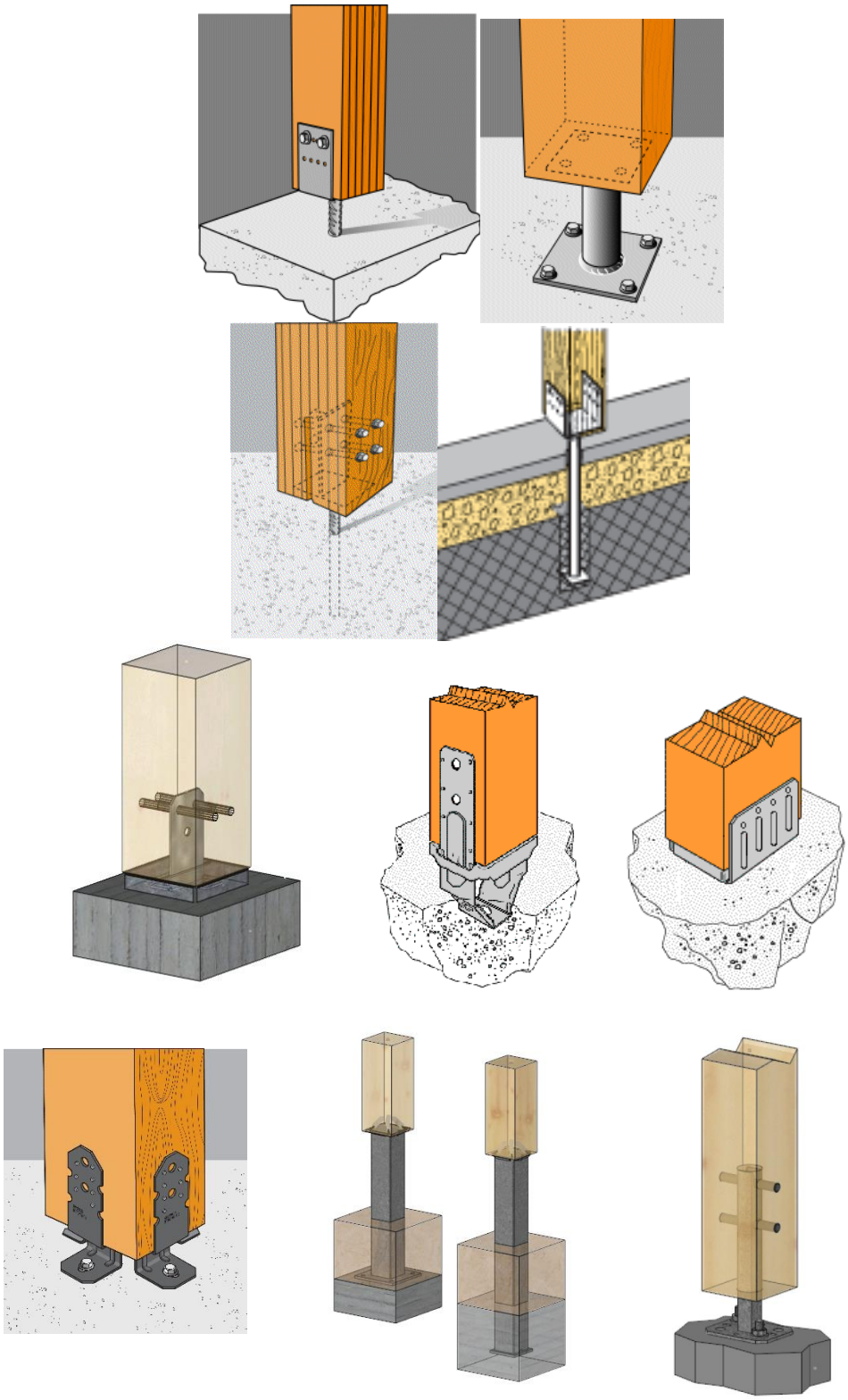
Alternative names are given for each product in annex D

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.

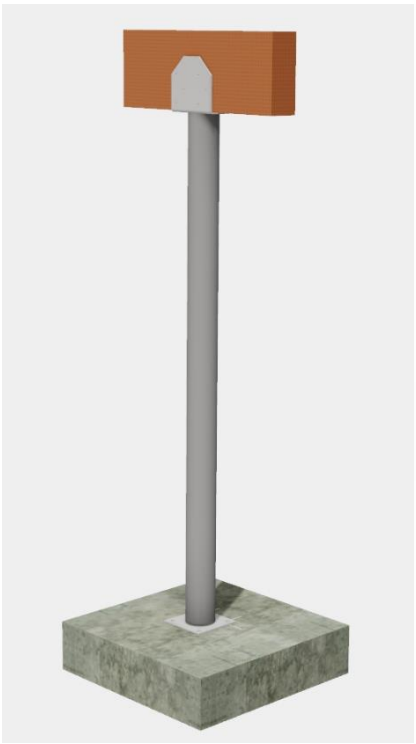
| | |
|---|---|
| G | = galvanized |
| S or S2 or IX | = Stainless or Inox |
| HCR | = High Corrosion Resistant steel |
| Z | = ZM310 or other coating |
| -K | = Kit; incl. fasteners |
| -B | = without Barcode |
| -R | = Retail |

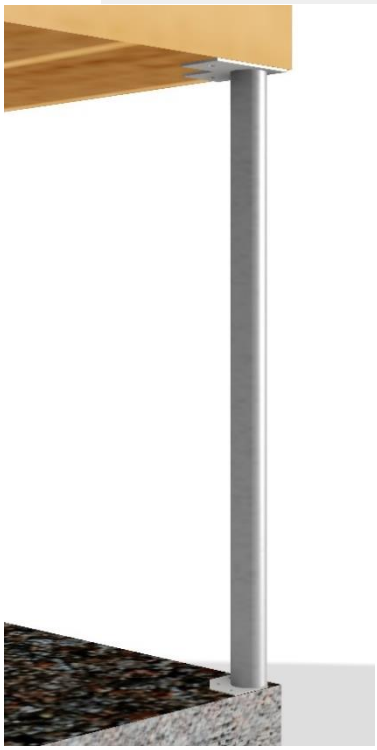
# Annex B Typical Installation

## B1 Typical installation post bases

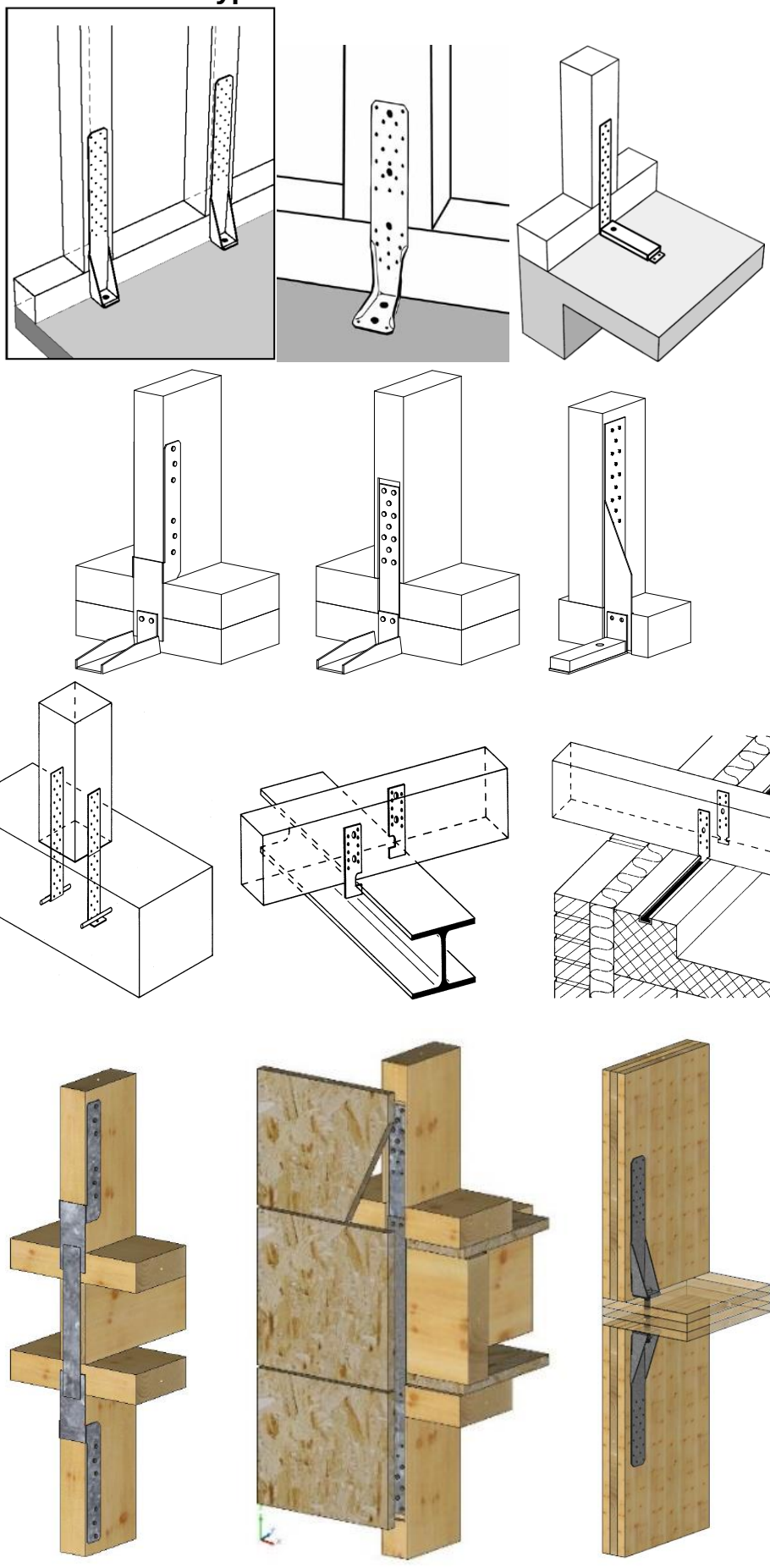


## B2 Typical installation of steel column





## 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 $\gamma_M$ 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 $\rho_k$ 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

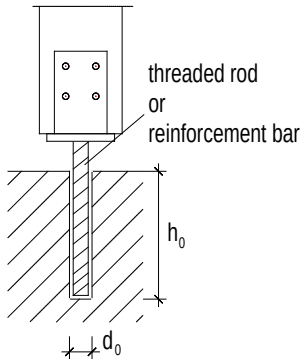
**Concrete**

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 | -/- | -/- |

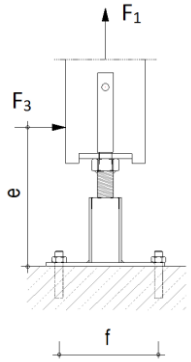



**Wane**
Where force is carried by contact compression no wane may occur.
Where the lateral force is acting toward a Hold Down connector the force is carried by contact compression so for this case no wane may occur in the surface of the timber under the vertical flap. Additionally, no wane may occur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

**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

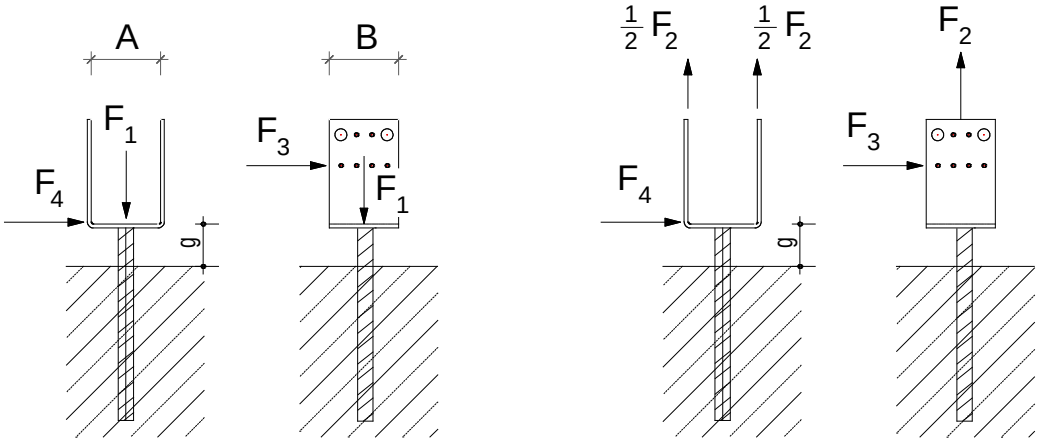



Figure C2a.Typical connection with notation for loads. The actual force directions are indicated for each post base

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.

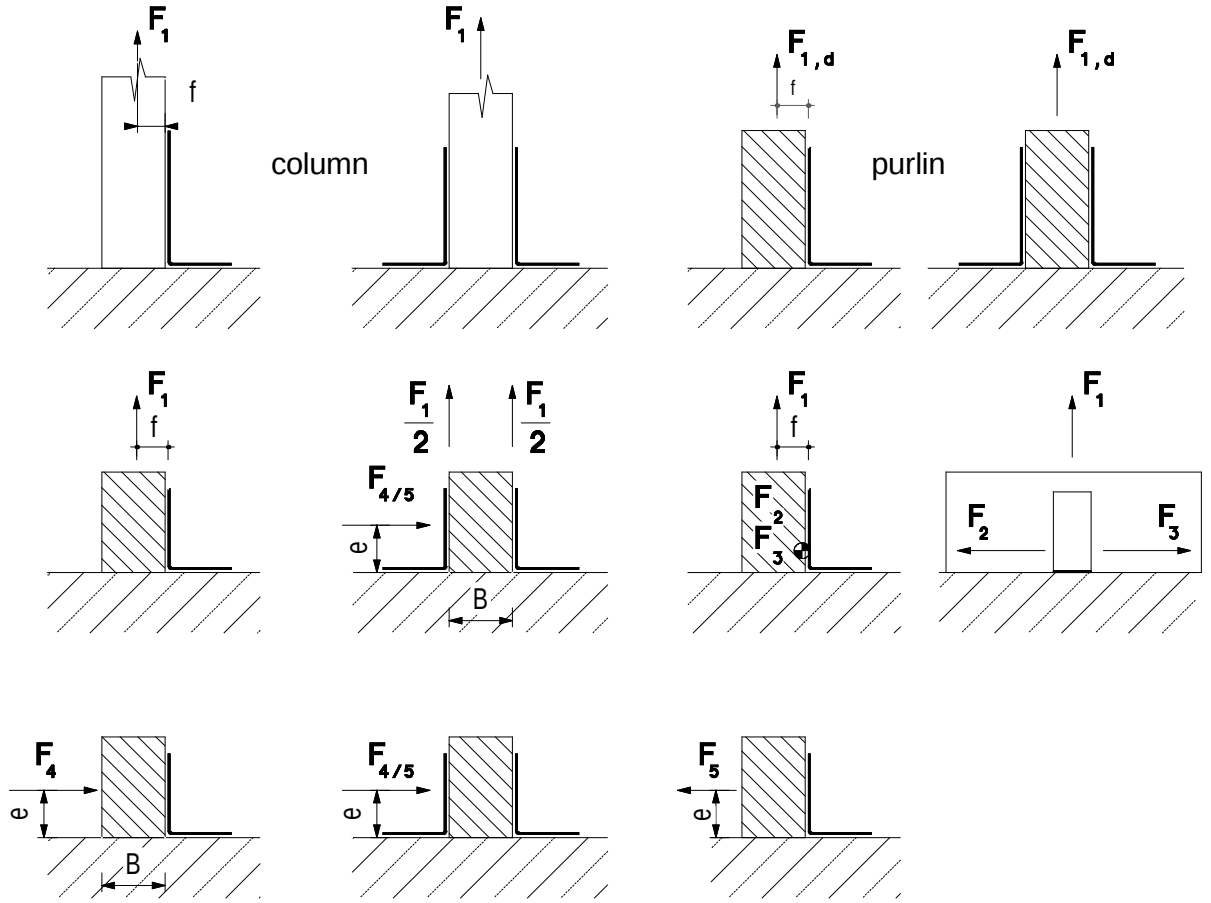



Figure C2b: Forces and their assumed positions. Top row for Hold Downs only subjected to a lifting force. Bottom rows for Hold Downs subjected to both eccentric lifting forces and lateral forces.

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<br>4.0 | 35<br>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<br>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.<br>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**

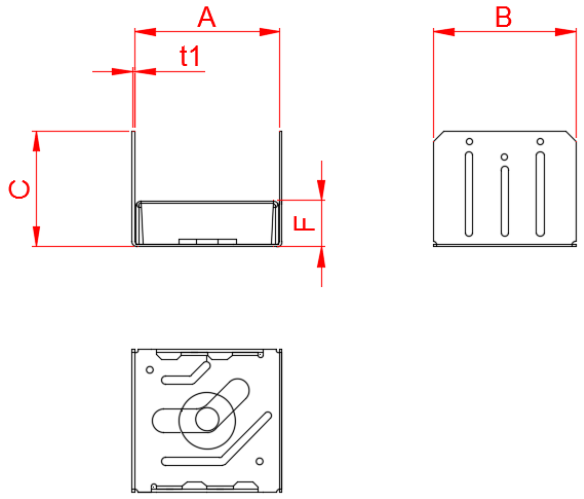



**Table D1-1: Size specification**

| 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**

| | | | | | | Characteristic capacities [kN] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fastener | | | | | $R_{2.k}$ | | | | |
| | On post | | On concrete | | | Load duration | | | | |
| Model | Qty | Type | Qty | Type | $R_{1.k}$ | 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**

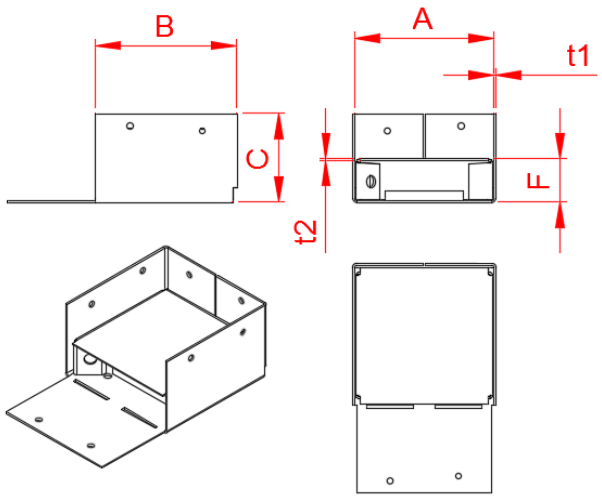


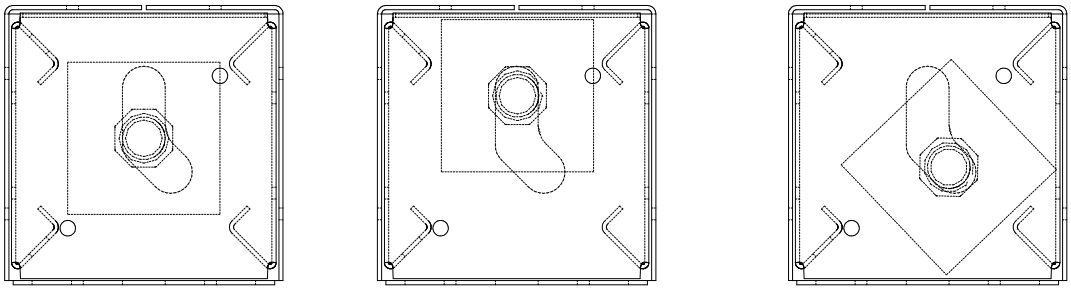

**Table D2-1: Size specification**

| 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<br>according to ASTM A653 | G185<br>according to ASTM A653<br>Corresponding to ~40µm<br>G90 for washer 50x50x3.5mm<br>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] | |
|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ |
| | On post | | On concrete | | | |
| Model | 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

| Product name | Alternative names |
|---|---|
| APB100/150 | |
| APB100/150Z | |

**Figure D3-1: Drawings**

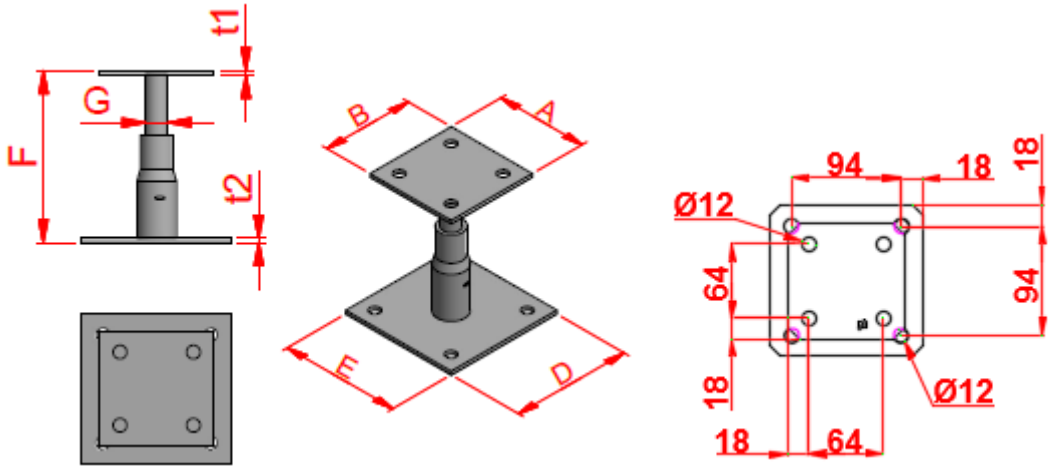



**Table D3-1: Size specification**

| 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 |

**Table D3-2: Material specification**

| Part | Material Grades | Coating specification |
|---|---|---|
| Plates | S235JR according to EN 10025 | Electroplated zinc Zn25/A according to EN ISO 2081<br>Or electroplated zinc Zn10/A (alkali zinc)<br>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] |
|---|---|---|---|---|---|
| | Fasteners | | | | |
| | On post | | On concrete | | $R_{1.k}$ |
| Model | Qty | Type | Qty | Type | |
| APB100/150 | 4 | Ø10 | 4 | Ø10 | 58.0 / $k_{mod}^{0.5}$ |

## D4: APB7090/100

| Product name | Alternative names |
|---|---|
| APB7090/100 | |

**Figure D4-1: Drawings**

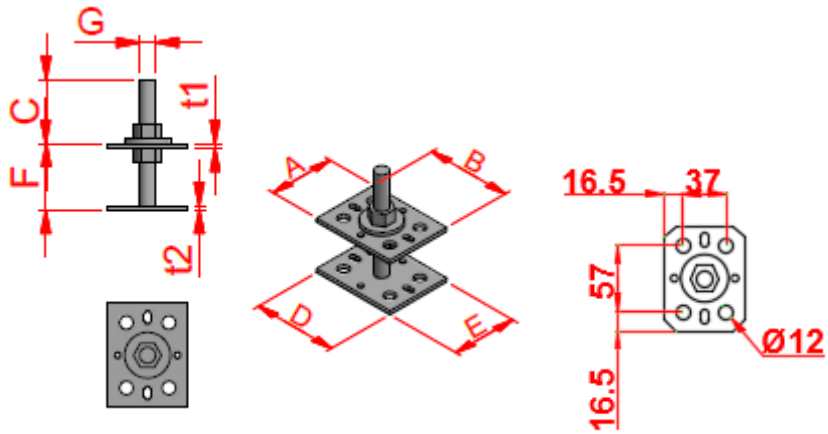



**Table D4-1: Size specification**

| 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 | Electroplated zinc Zn 12/c according to EN ISO 2081 or sherardizing class C30 according to EN 13811 |
| 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**

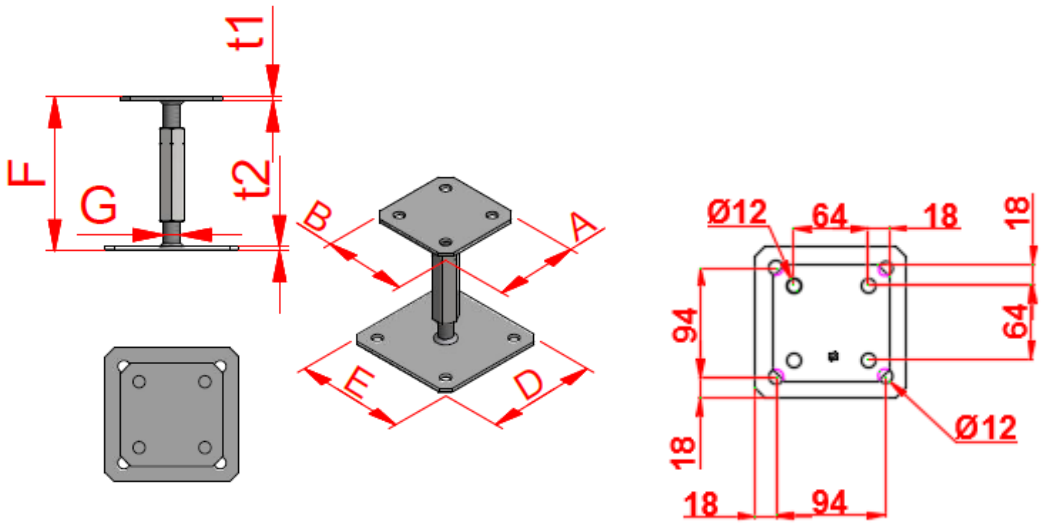



**Table D5-1: Size specification**

| 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 | Electroplated zinc Zn25/A according to EN ISO 2081 Or Electroplated zinc 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**

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

## D6: CMR & CMS

| Product name | Alternative names |
|---|---|
| CMR | |
| CMS | |

**Figure D6-1: Drawings**

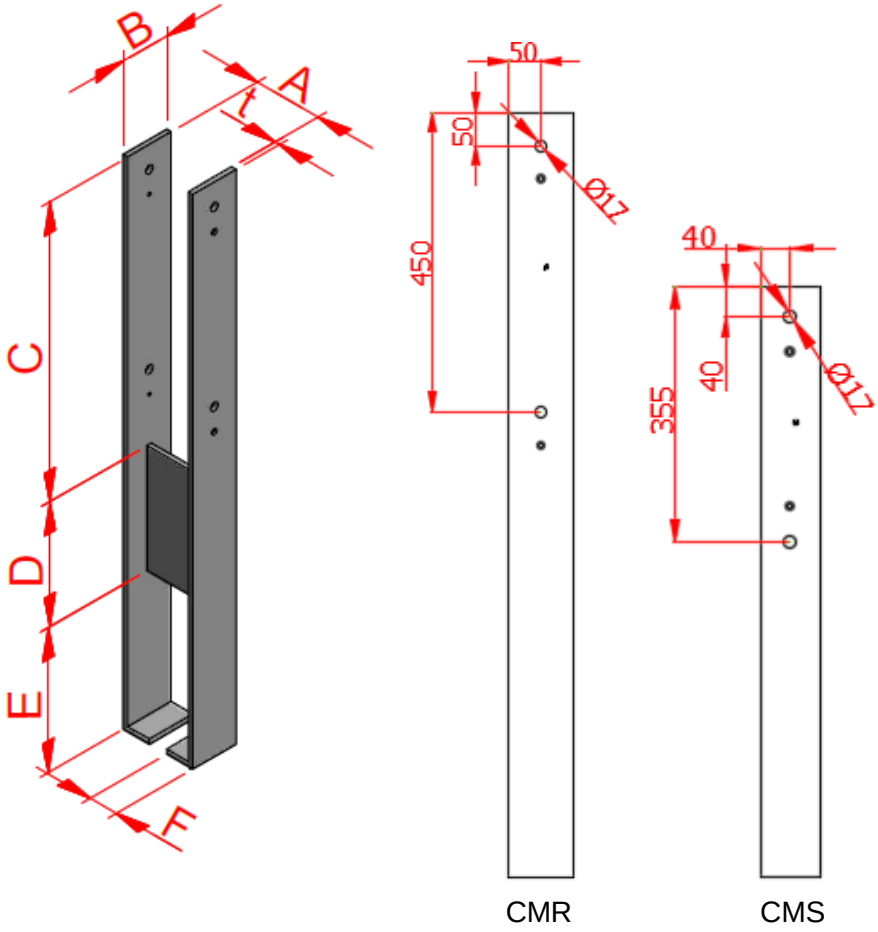



**Table D6-1: Size specification**

| Model | Product dimensions [mm] | | | | | | | Holes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Top | | | |
| | A | B | C | D | E | F | t | Qty | size | Qty | size |
| CMR | 115-165 | 100 | 625 | 200 | 325 | 60 | 10 | 4 | Ø17 | 4 | Ø6.5 |
| CMS | 80-140 | 80 | 470 | 150 | 200 | 40 | 8 | 4 | Ø17 | 4 | Ø6.5 |

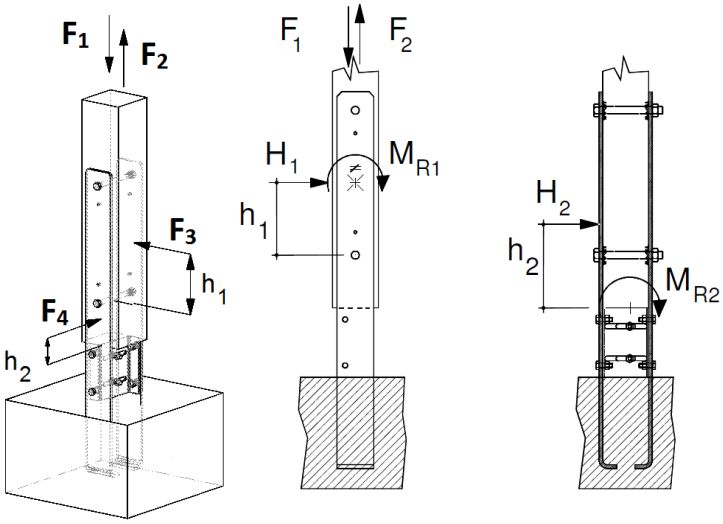
**Table D6-2: Material specification**

| 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**

| | | | | Characteristic capacities [kN] | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | Fasteners On post Qty | Fasteners On post Type | Timber size (mm) | $R_{1.k}$ = $R_{2.k}$ | $R_{3.k}$ 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**

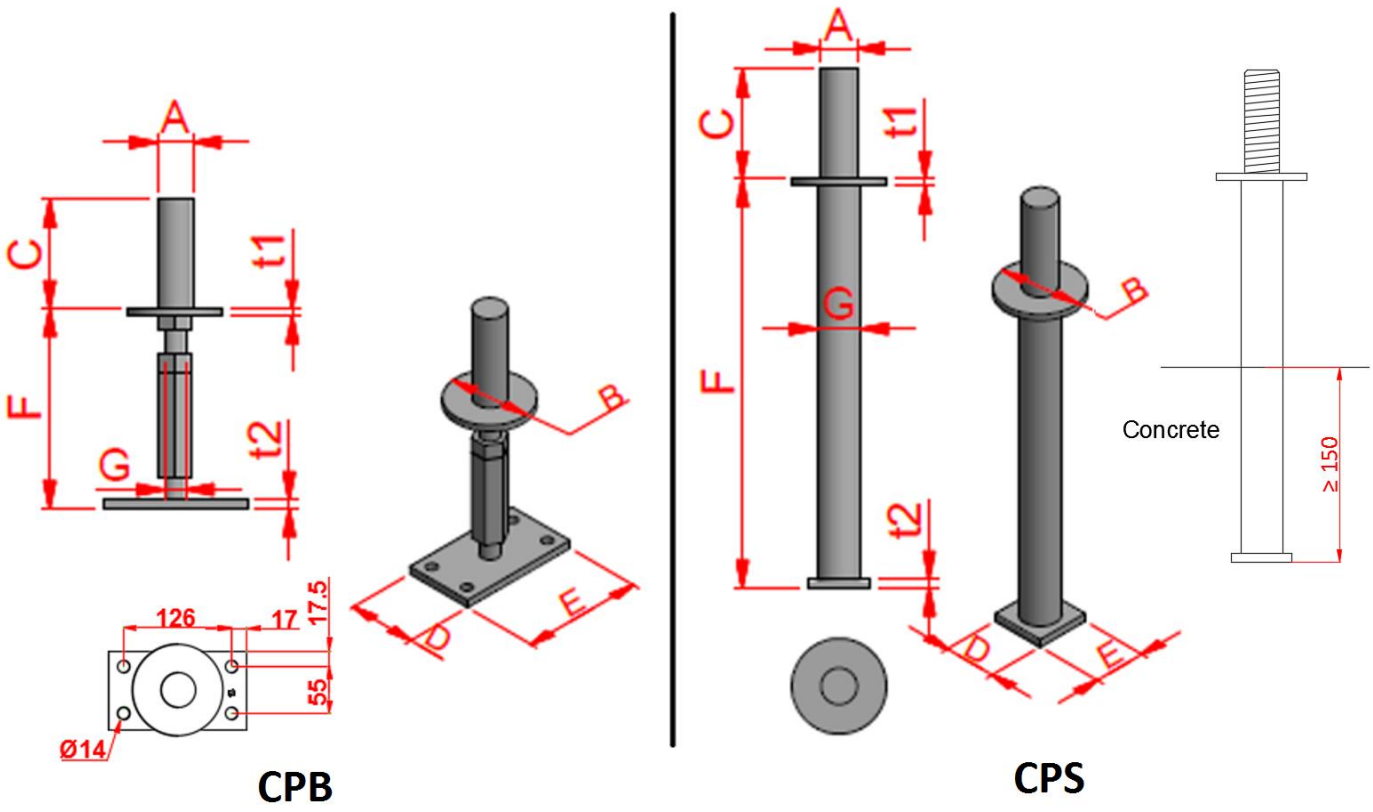



**Table D7-1: Size specification**

| Model | Product dimensions [mm] | | | | | | | | | Holes | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Bottom | |
| | A | B | C | D | E | F | G | $t_1$ | $t_2$ | Qty | size |
| CPB | 39 | 126 | 120 | 160 | 90 | 190-250 | 24 | 8 | 10 | 4 | Ø14 |
| CPS | 39 | 126 | 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**

| | | | Characteristic capacities [kN] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ | $R_{1.k}$ ** | $R_{2.k}$ | $R_{2.k}$ ** | $R_{3.k} = R_{4.k}$ | | |
| | On concrete | | | | | | f | | |
| Model | Qty | Type | | | | | 190 | 250 | |
| CPB | 4 | Ø12 | $61/k_{mod}$ | | 23.7 | 13.8 | 1.7 | 1.4 | |
| 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**

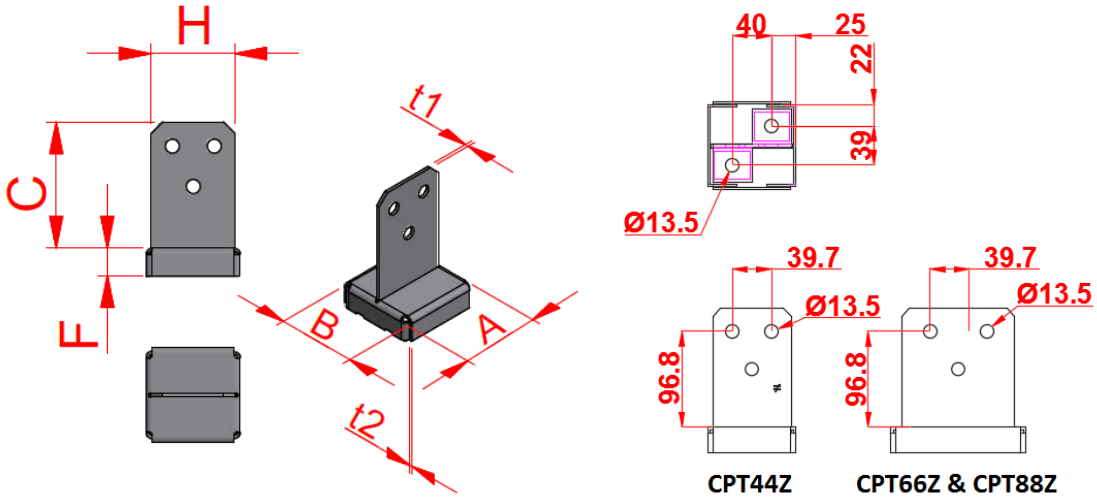



**Table D8-1: Size specification**

| 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**

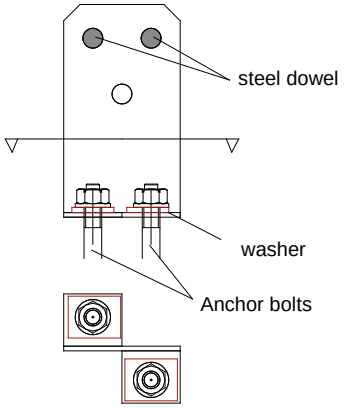


**Table D8-3: Characteristic capacity**

| | | | | | Characteristic capacities [kN] | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | On concrete | | | | | |
| Model | 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 | $103.0/k_{mod}^{0.5}$ | $14.7/k_{mod}$ | $\min(R_{2.k} \times 0.7; 9.1)$ | $\min(6.9; 5.0/k_{mod})$ |

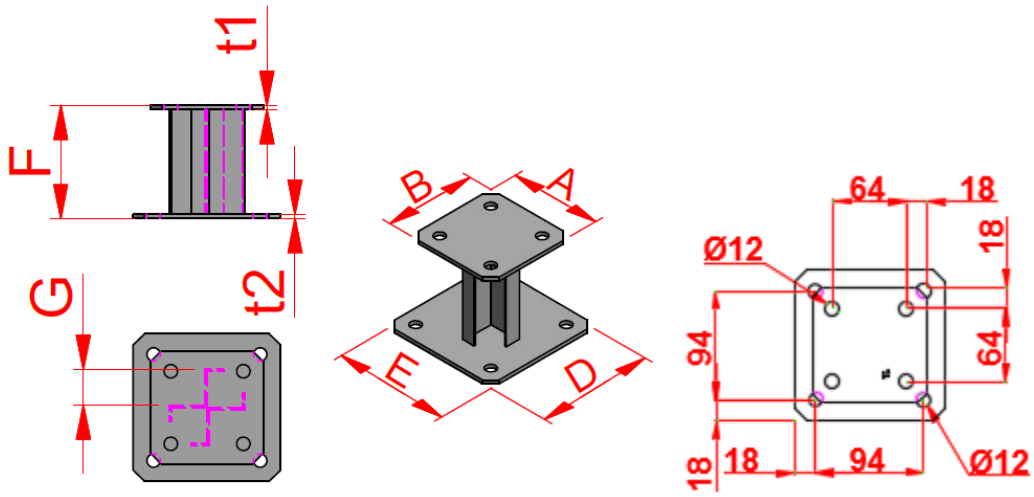
For combined forces the following formula has to be checked: $\Sigma\ (F_i / R_{i.d}) \leq 1$

| | Minimum anchor capacity per anchor | | |
|---|---|---|---|
| Model | $F_{2.d}$ | $F_{3.d}$ | $F_{4.d}$ |
| 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 | | $R_{1.k}$ | | Load duration | | | | |
| | 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/$k_{mod}^{0.4}$ ; 72.2/kmod) | | | | |
| 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**

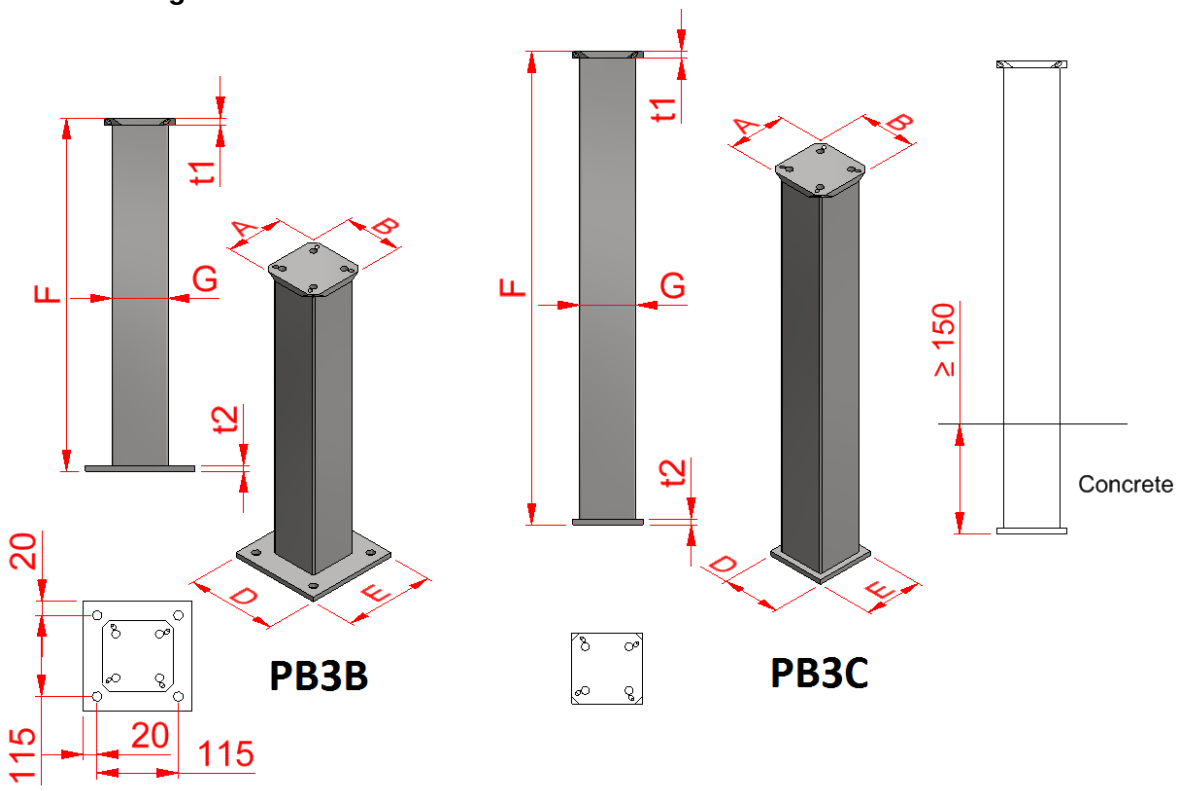



**Table D10-1: Size specification**

| 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 | 8 | 4 | Ø6.5 | 4 | Ø14 |
| PB3C | 100 | 100 | 100 | 100 | 670 | 80 | 8 | 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**

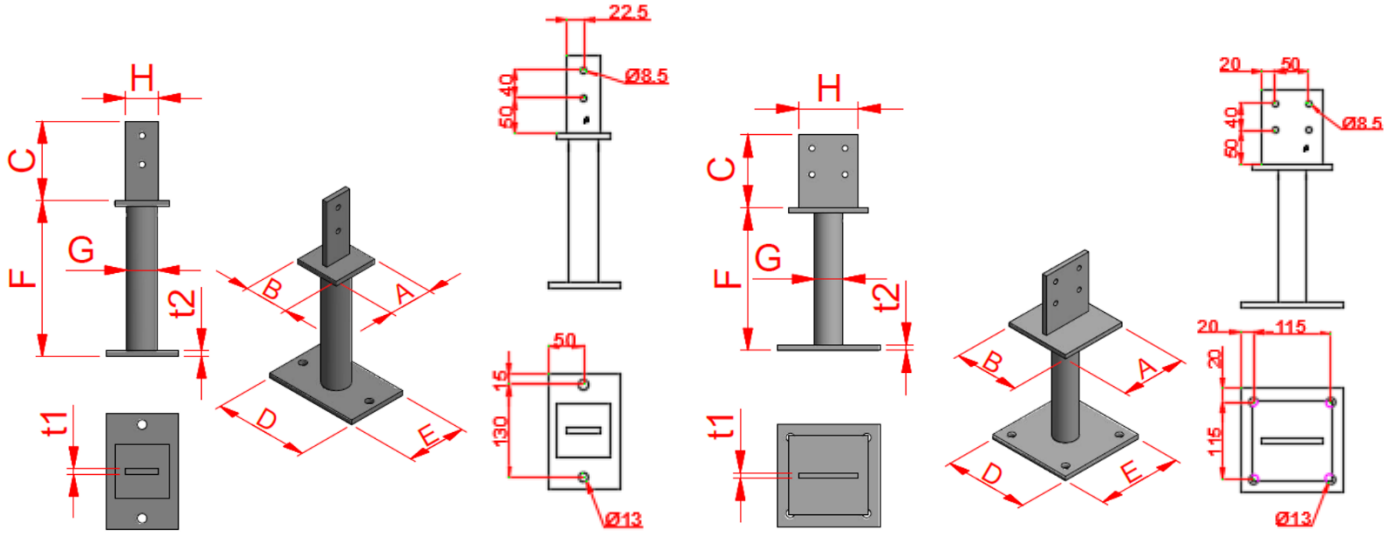
| | | | | | Characteristic capacities [kN] | | |
|---|---|---|---|---|---|---|---|
| | Fasteners | | | | | | |
| | On post | | On concrete | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ = $R_{4.k}$ |
| Model | Qty | Type | Qty | Type | | | |
| PB3B | 4 | Ø6 | 4 | Ø12 | 202.6 | 2.83 x $R_{ax.sc.k}$ | $R_{ax.sc.k}$ |
| 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

| | | | | | | Characteristic capacities [kN] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | Timber size (mm) | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | On concrete | | | | | | |
| Model | 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**

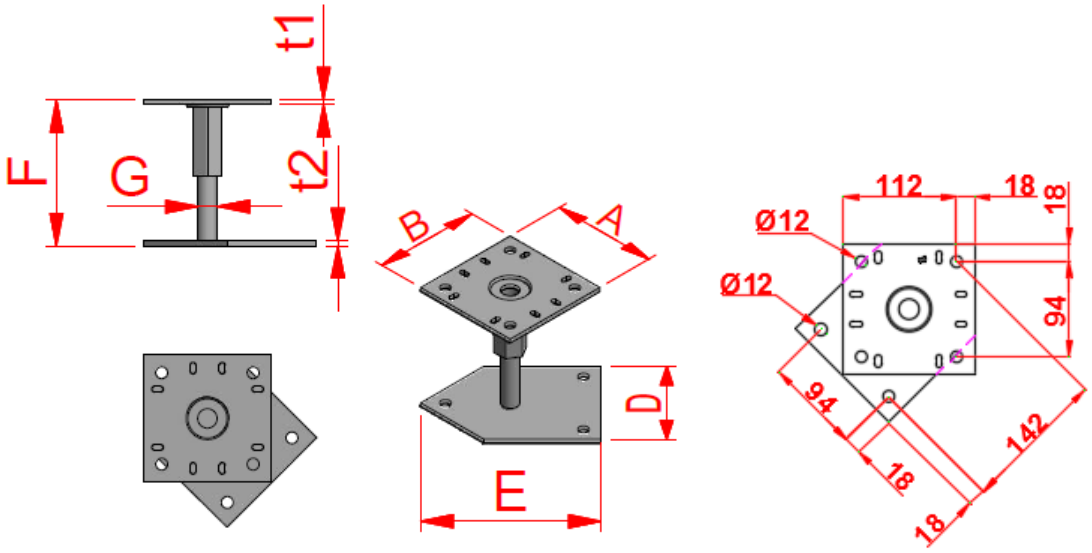



**Table D12-1: Size specification**

| 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 | Electroplated zinc Zn25/A according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc) |
| 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**

| | | | | | Characteristic capacities [kN] |
|---|---|---|---|---|---|
| | Fasteners | | | | |
| | On post | | On concrete | | $R_{1.k}$ |
| Model | 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**

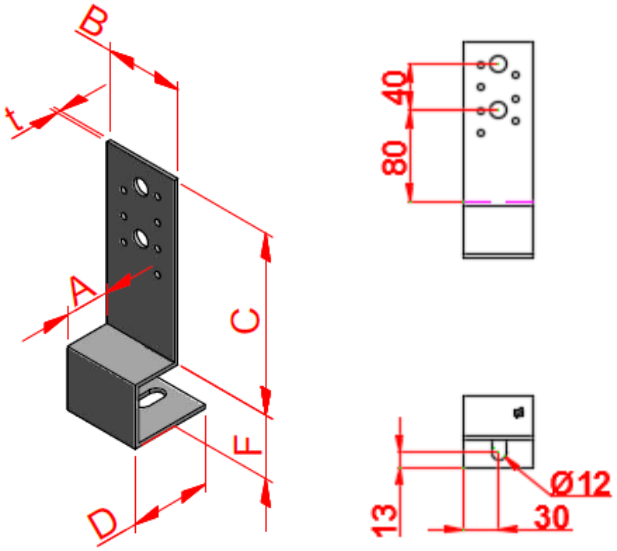



**Table D13-1: Size specification**

| 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<br>Or electroplated zinc Zn25/A<br>according to EN ISO 2081<br>Or electroplated zinc Zn10/A (alkali zinc) |
| | Or stainless steel as described | |

**Table D13-3: Characteristic capacity**

| Model | Nb 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**

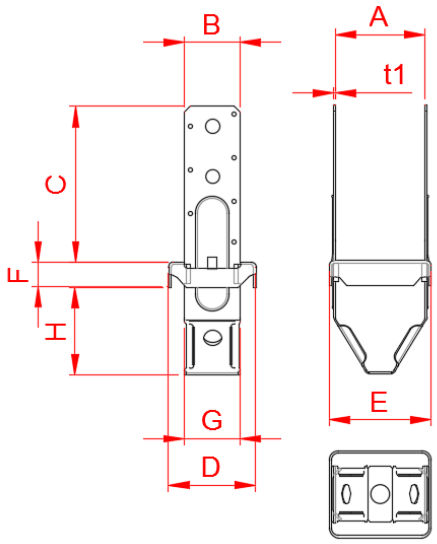



**Table D14-1: Size specification**

| 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**

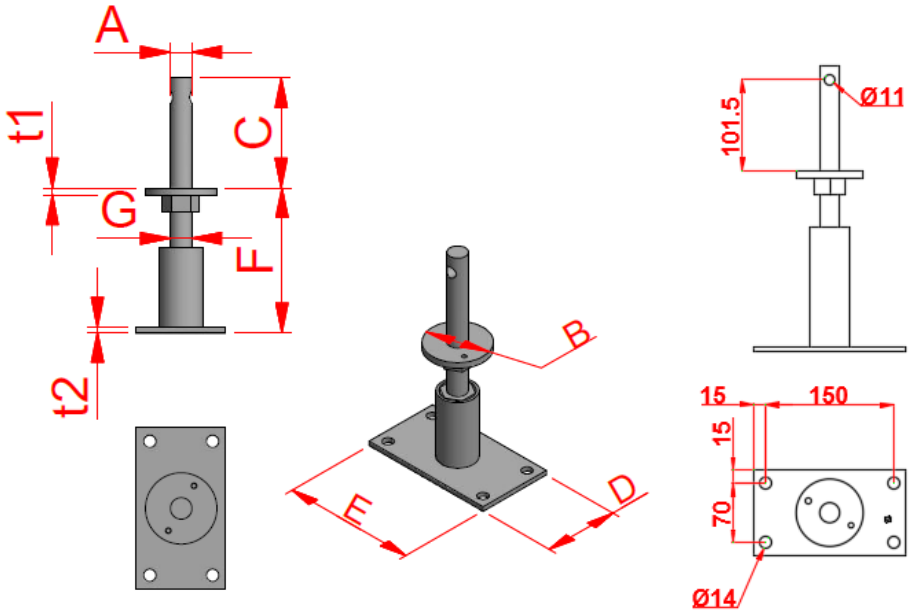



**Table D15-1: Size specification**

| 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**

| | | | | | Characteristic capacities [kN] | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | On concrete | | | | | |
| Model | 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**

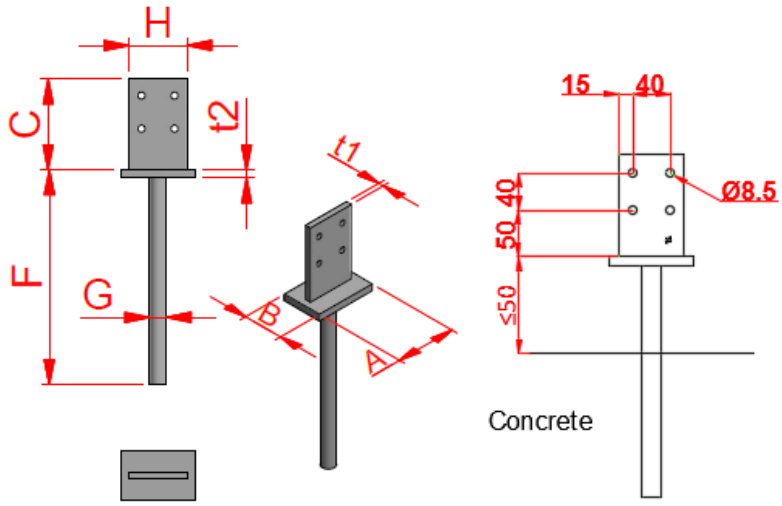



**Table D16-1: Size specification**

| Model | Product dimensions [mm] | | | | | | | | Holes | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Top | |
| | A | B | C | F | G | H | $t_1$ | $t_2$ | Qty | size |
| PI | 90 | 60 | 110 | 250 | 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**

| | | | Characteristic capacities [kN] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ | | | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | Concrete | | | | | |
| Model | Qty | Type | C12/15 | C16/20 | C20/25 | | | |
| PI | 4 | Ø8x60 | $36.9/k_{mod}$ | $43.7/k_{mod}$ | $54.5/k_{mod}$ | 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**

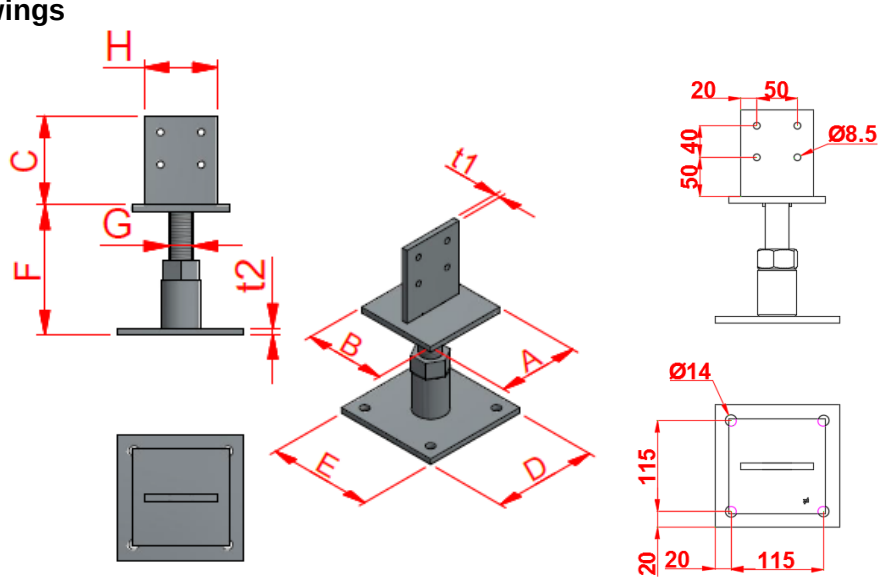



**Table D17-1: Size specification**

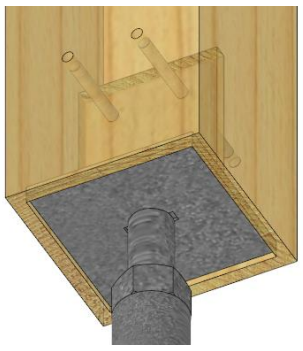
| Model | Product dimensions [mm] | | | | | | | | | | Holes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Top | | Bottom | |
| | A | B | C | D | E | F | G | H | $t_1$ | $t_2$ | Qty | size | Qty | size |
| PIBA110/160 | 120 | 120 | 110 | 155 | 155 | 106-160 | 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<br><br>Or electroplate zinc Fe/Zn10/A (alkali zinc) |
| 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**

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

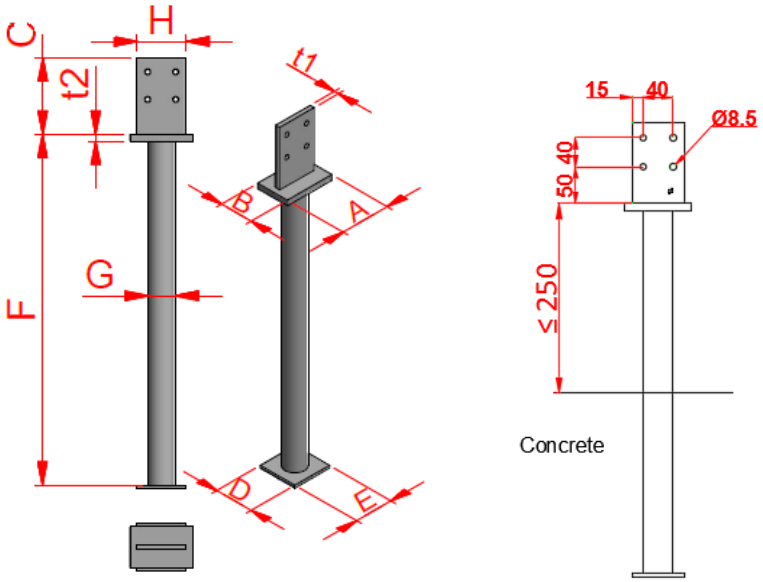


The minimum size of the timber column may be 120x120mm. However the recommended minimum size of timber column would be of section 140x140mm with an extrusion into the bottom face of the member for the bottom plate, so a constructive wood preservation can be given.

## 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

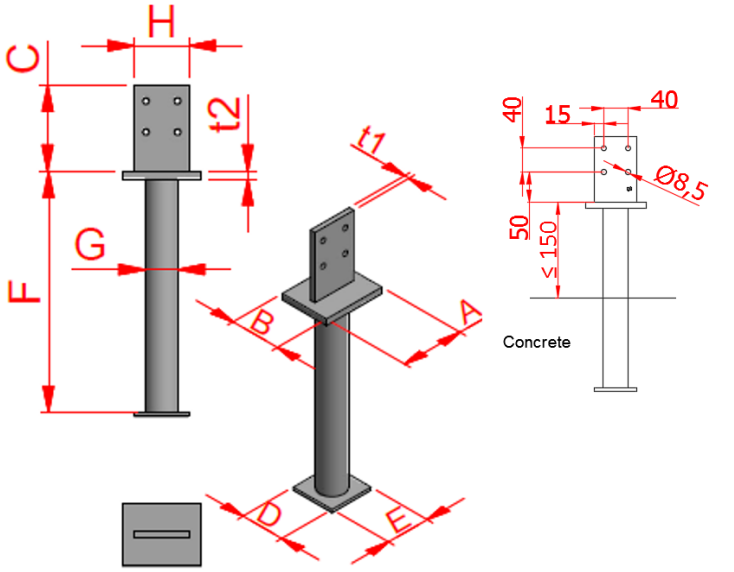
| Model | Fasteners On post Qty | Fasteners On post Type | Characteristic capacities [kN] $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
|---|---|---|---|---|---|---|
| PIL | 4 | Ø8x60 | min(90 ; 57/$k_{mod}$ ) | 13.8 | 2.2/$k_{mod}$ | 1.8/$k_{mod}$ |
| | 4 | Ø8x80 | | 16 | | |
| | 4 | Ø8x100 | | 18.7 | | 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:
$F_1 / R_{1.d} + F_{3/4} / R_{3/4.d} \leq 1$.

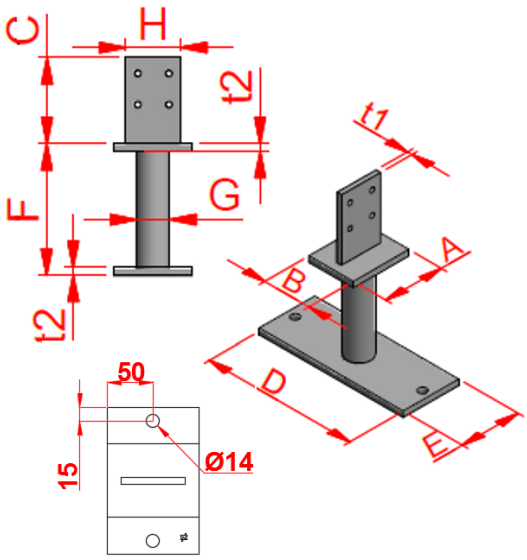
## D19: PIS / PISB / PISMAXI / PISBMAXI

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

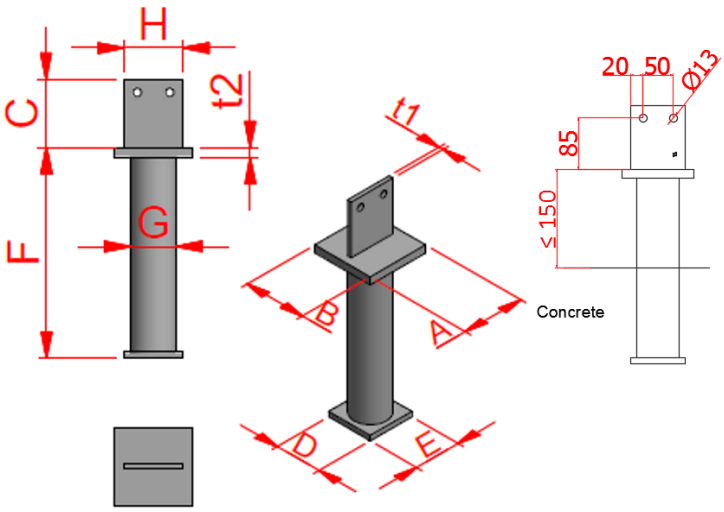
**Figure D19-1: Drawings**



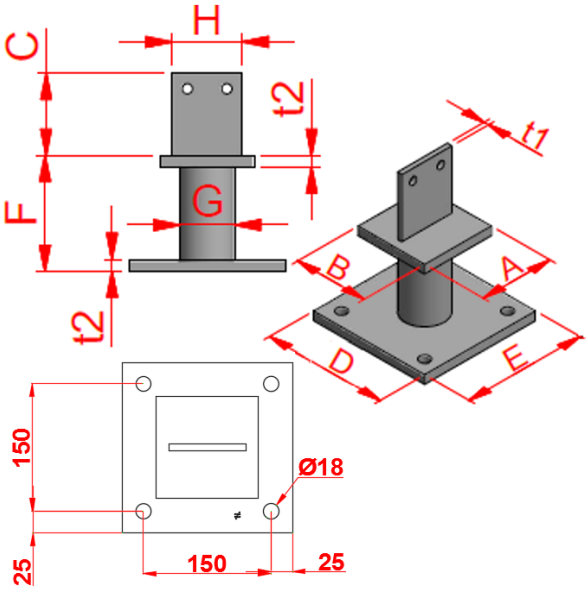

PIS70




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**

| | | | | | Characteristic capacities [kN] | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | On concrete | | | | | |
| Model | 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 | 22.5 | 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**

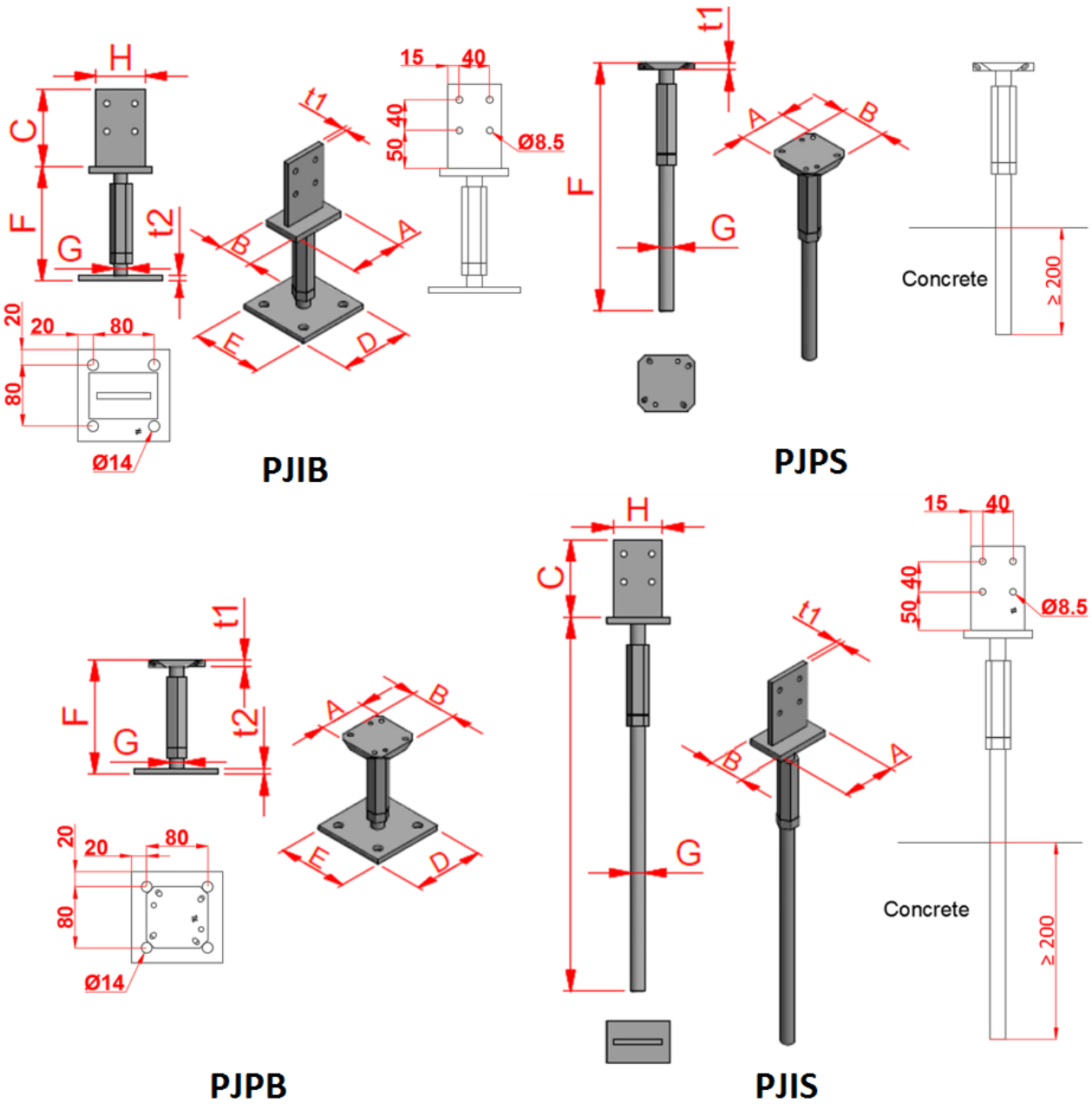


**Table D24-1: Size specification**

| 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 |

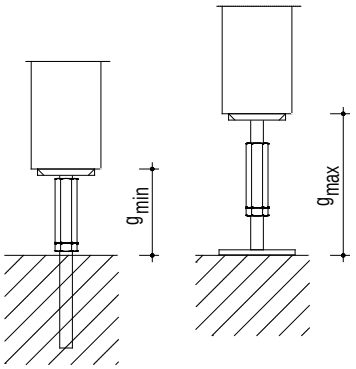
**Table D24-2: Material specification**

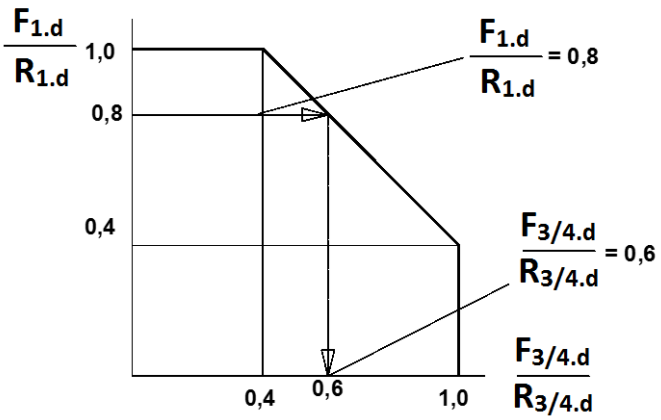
| Part | Material Grades | Coating specification |
|---|---|---|
| Plates | S235JR according to EN 10025 | Hot-dip galvanized according to EN ISO 1461 |
| Threaded rod | S355 JO according to EN 10025 | |
| | Or stainless steel as described | |

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

| | | | | | Characteristic capacities [kN] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | | $R_{4.k}$ | |
| | On post | | On concrete | | | | for g | | for g | |
| Model | 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**

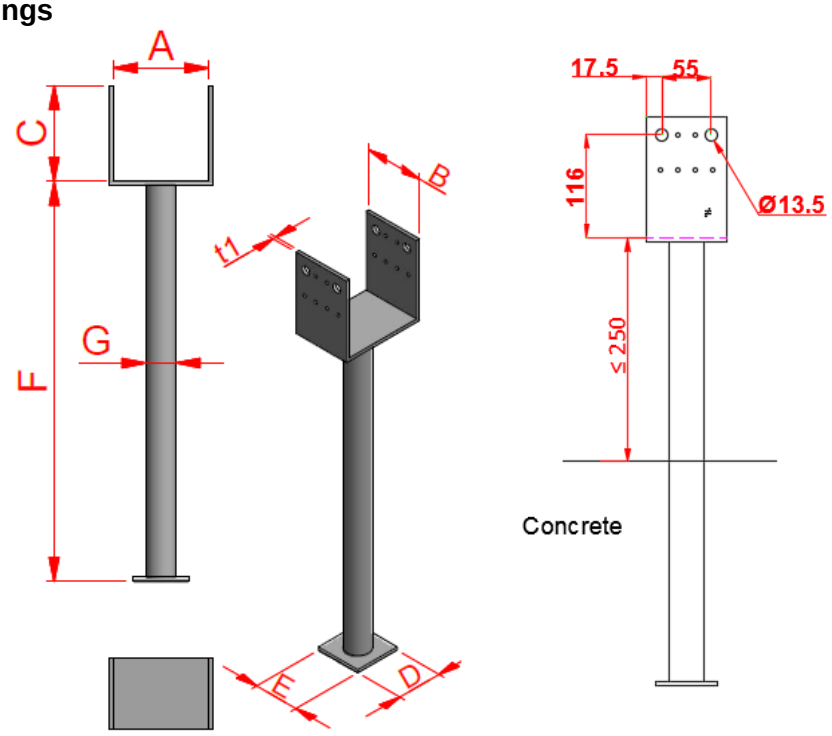



**Table D20-1: Size specification**

| 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**

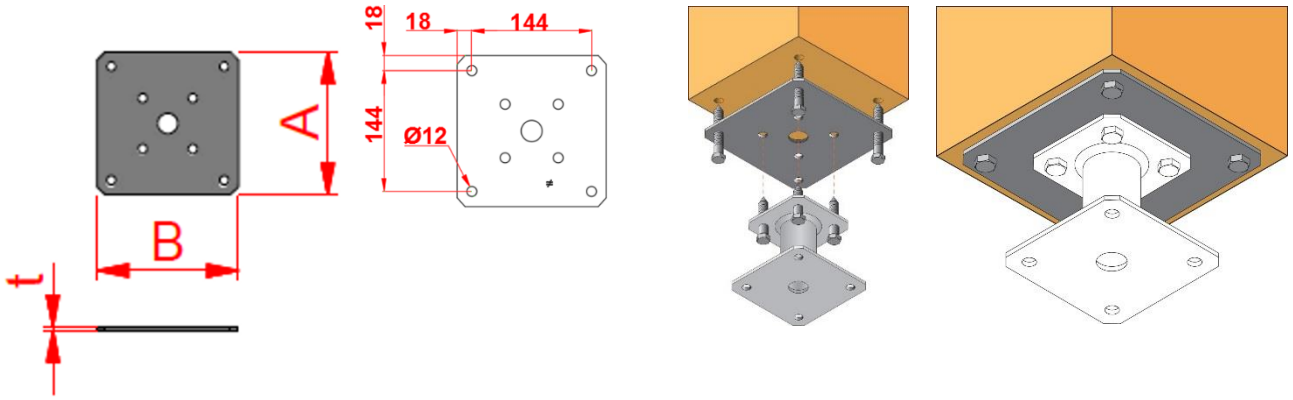
| | | | Characteristic capacities [kN] | | | |
|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | | | | |
| Model | Qty | Type | | | | |
| PL80/70G | 8 | Ø4x40 | $57.1/k_{mod}$ | min (18.4 ; $17.3/k_{mod}$ ) | $2.8/k_{mod}$ | $3.5/k_{mod}$ |
| 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**

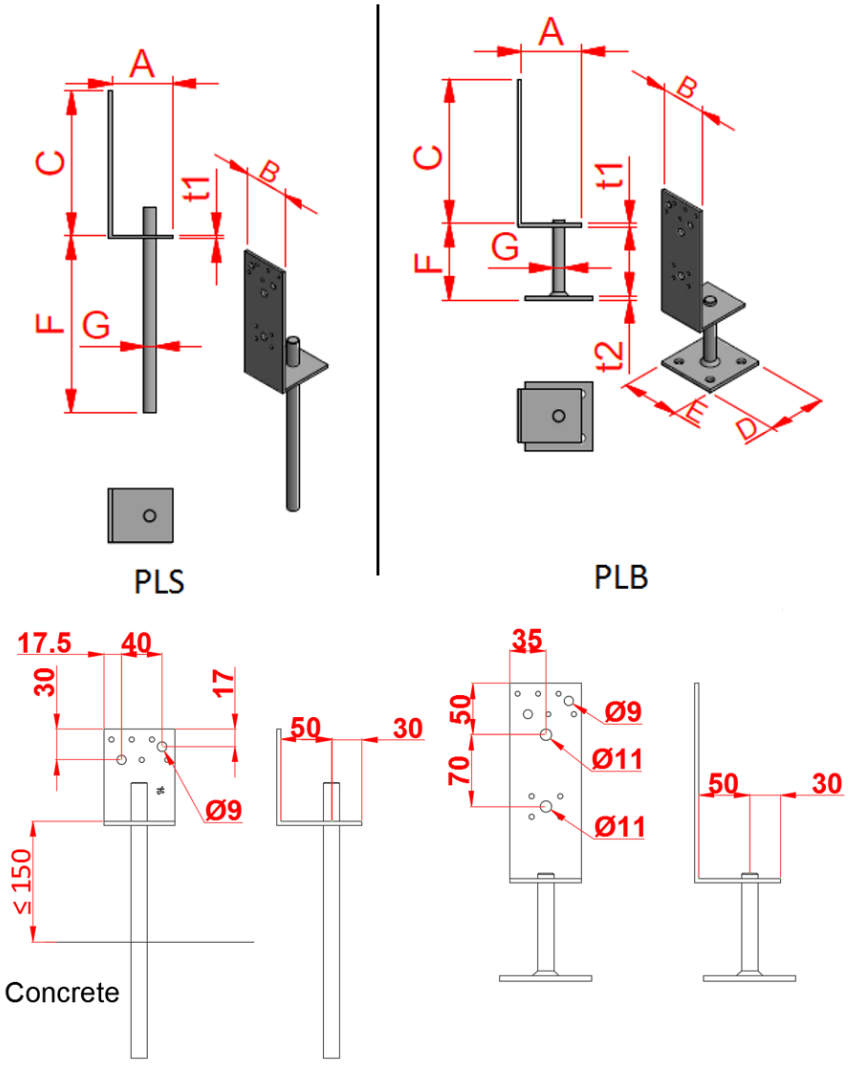



**Table D22-1: Size specification**

| 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**

| | | | Characteristic capacities [kN] | | |
|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ | | $R_{2.k}$ |
| | On post | | Load direction / timber grain | | |
| Model | 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**

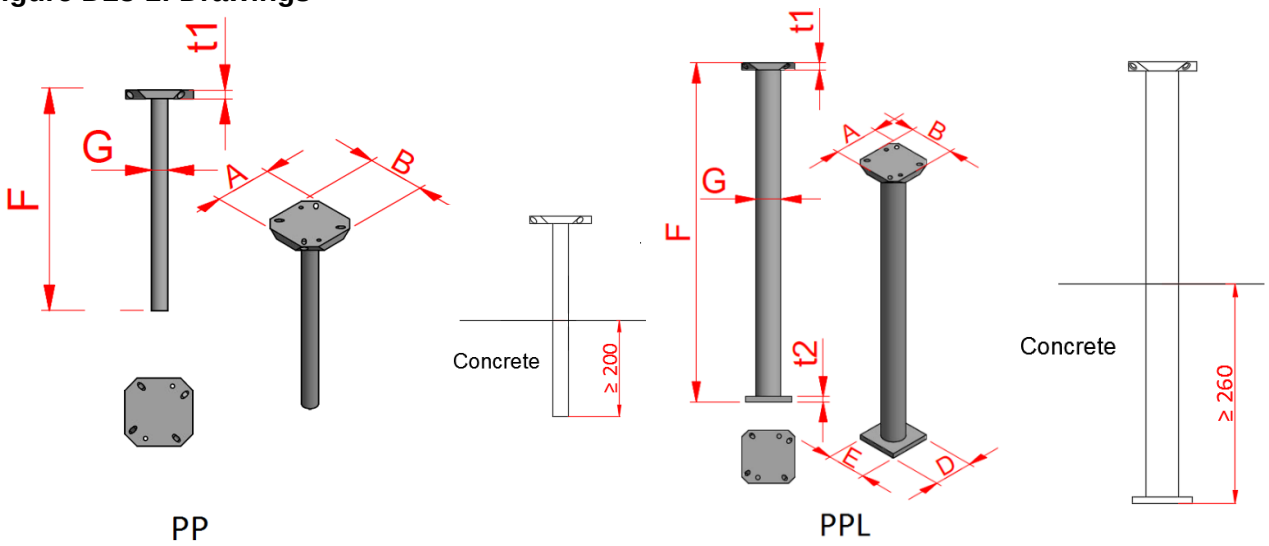



**Table D23-1: Size specification**

| 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**

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

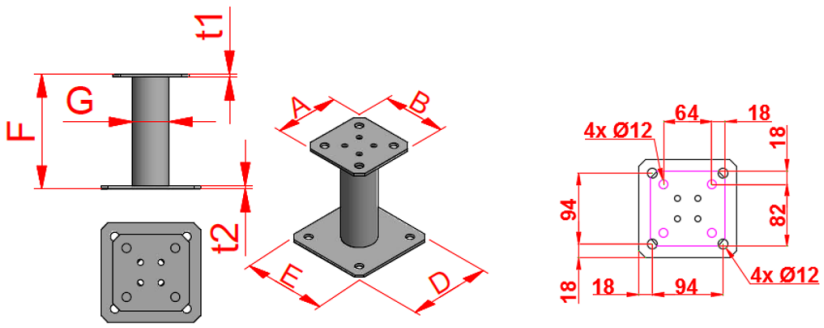
The capacities based on an axial capacity of the screws with $R_{ax.45.k}$ =2,7 kN.
For other screws, the capacities are to calculated respectively.

## D24: PPA & PBL

| Product name | Alternative names |
|---|---|
| PPA | |
| PBL | |

**Figure D24-1: Drawings**

**PPA**




**PBL**

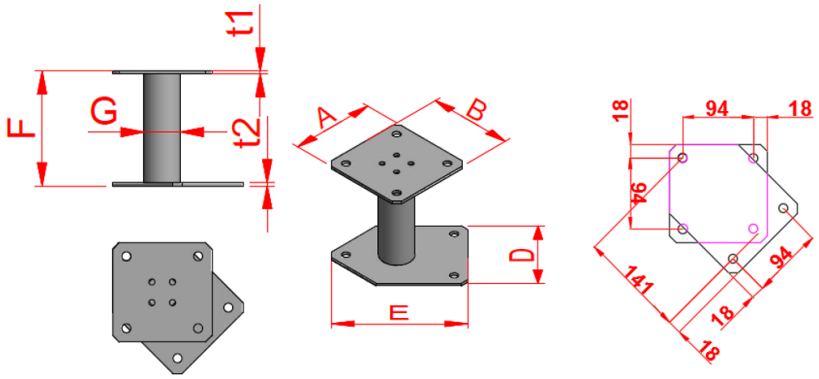



**Table D24-1: Size specification**

| 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

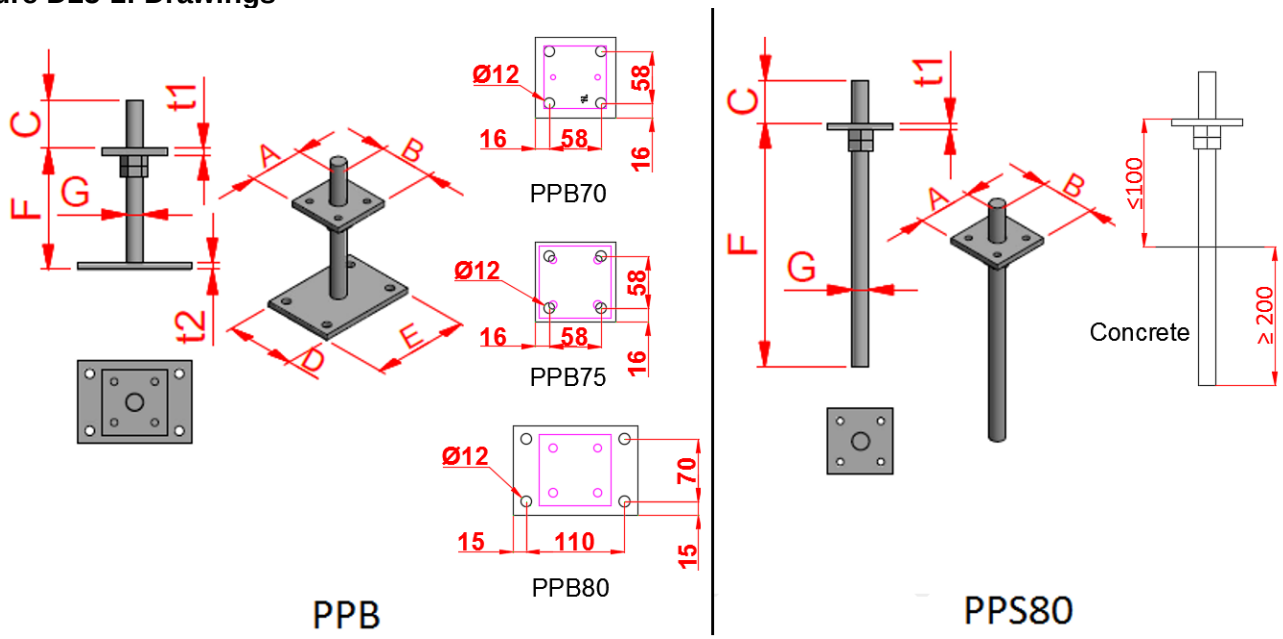
| Model | Characteristic capacities [kN] | | | | |
|---|---|---|---|---|---|
| | $R_{1.k}$ | | | | |
| | | | | | |
| PPA & PBL | $78.5/k_{mod}{}^{0.4}$ | | | | |

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 - 100 | 16 | 6 | 5 | 2 | Ø5.5 | 4 | Ø12 |
| PPB75 | 80 | 80 | 7 - 67 | 90 | 90 | 30 - 90 | 20 | 8 | 5 | 4 | Ø9 | 4 | Ø12 |
| PPB80 | 80 | 80 | 8 - 158 | 140 | 100 | 50 - 200 | 20 | 8 | 8 | 4 | Ø9 | 4 | Ø12 |
| PPS80 | 80 | 80 | 0 - 170 | | | 230 - 350 | 20 | 8 | | 4 | Ø9 | | Ø12 |

### 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 | min( 88.3 ; 63.9/$k_{mod}$ ) | |
| PPS80 | 4 | Ø8 | | | 40/$k_{mod}$ | 49.5/$k_{mod}$ |

## D26: PPD

| Product name | Alternative names |
|---|---|
| PPD | D |

**Figure D26-1: Drawings**

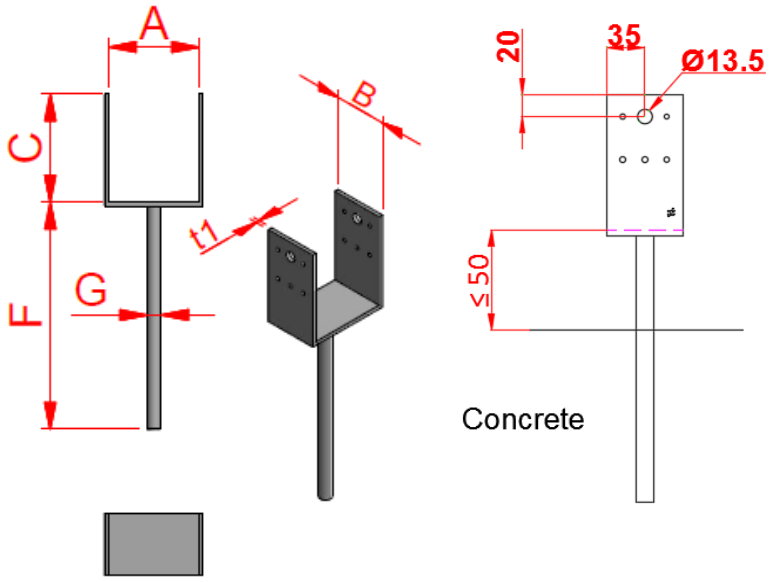



**Table D26-1: Size specification**

| 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**

| | | | Characteristic capacities [kN] | | | | |
|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ | | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On Post | | Concrete strength class | | | | |
| Model | 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**

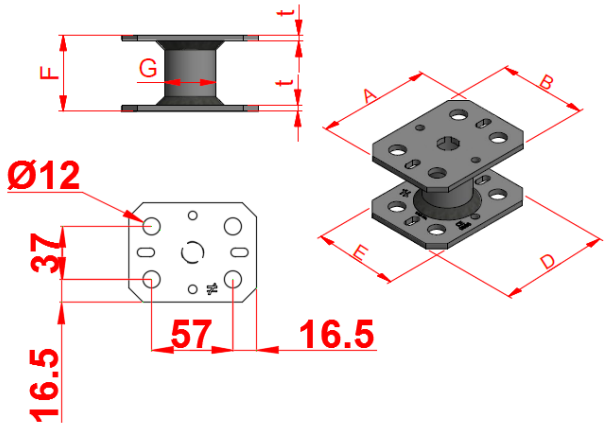



**Table D27-1: Size specification**

| 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**

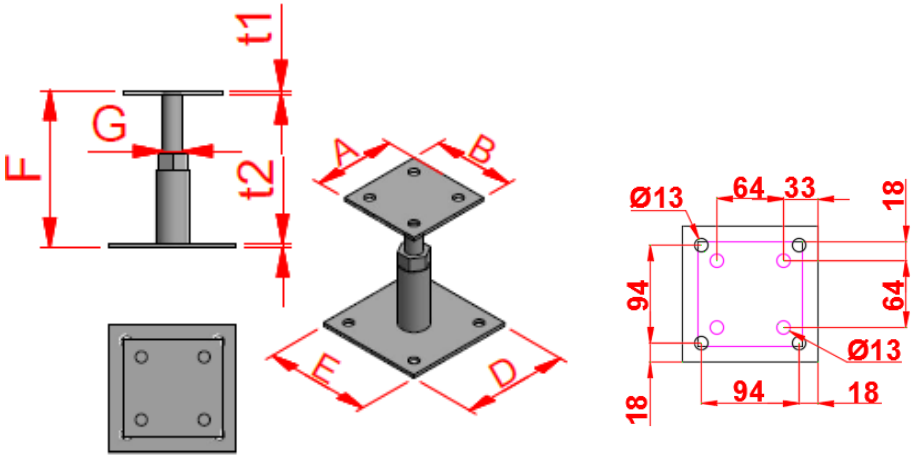



**Table D28-1: Size specification**

| 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**

| | | | | | Characteristic capacities [kN] |
|---|---|---|---|---|---|
| | Fasteners | | | | |
| | On post | | On concrete | | $R_{1.k}$ |
| Model | Qty | Type | Qty | Type | |
| 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**

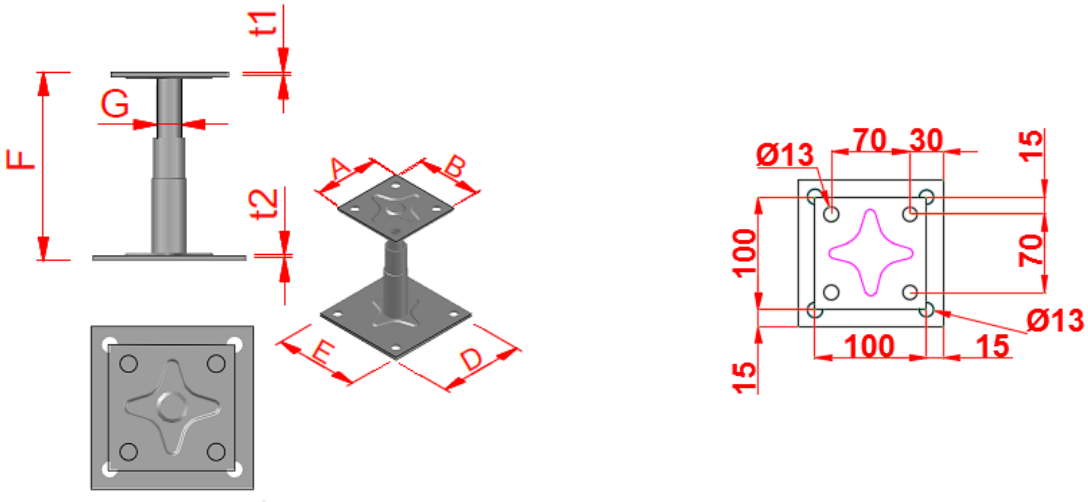



**Table D29-1: Size specification**

| 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**

| | | | | | Characteristic capacities [kN] |
|---|---|---|---|---|---|
| | Fasteners | | | | |
| | On post | | On concrete | | $R_{1.k}$ |
| Model | Qty | Type | Qty | Type | |
| 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**

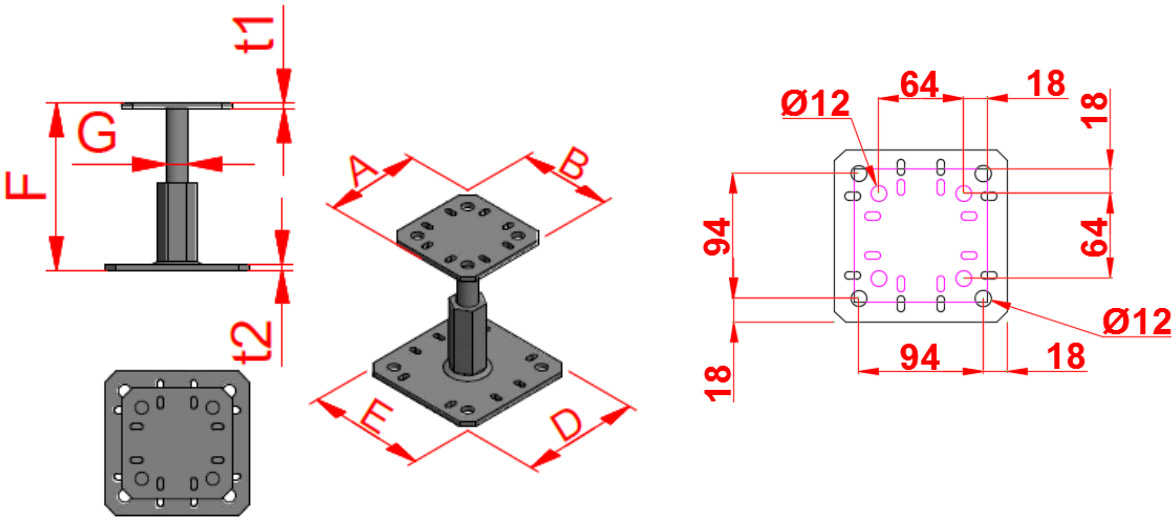



**Table D30-1: Size specification**

| 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 | Electroplated zinc Zn12/C according to EN ISO 2081 Or electroplated zinc Zn10/A (alkali zinc) |
| 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**

| | | | | | Characteristic capacities [kN] |
|---|---|---|---|---|---|
| | Fasteners | | | | |
| | On post | | On concrete | | $R_{1.k}$ |
| Model | 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**

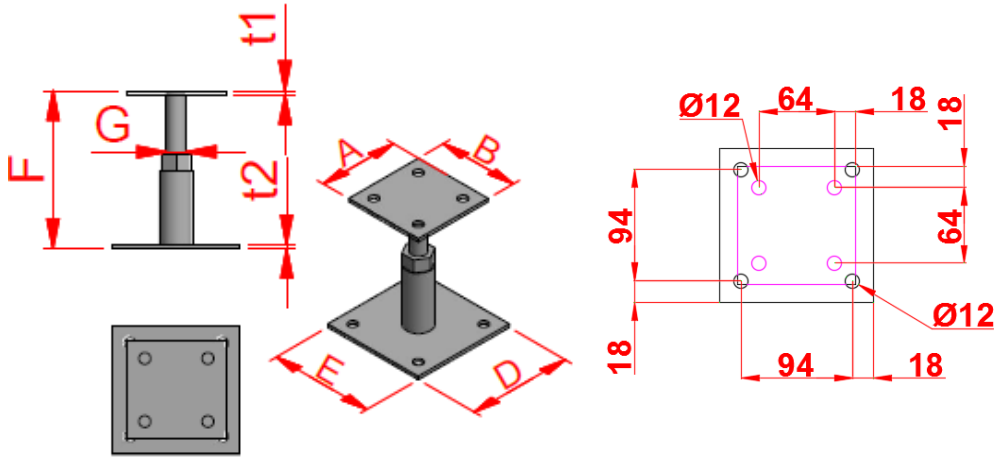



**Table D31-1: Size specification**

| 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**

| | | | | | Characteristic capacities [kN] |
|---|---|---|---|---|---|
| | Fasteners | | | | |
| | On post | | On concrete | | $R_{1.k}$ |
| Model | Qty | Type | Qty | Type | |
| 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**

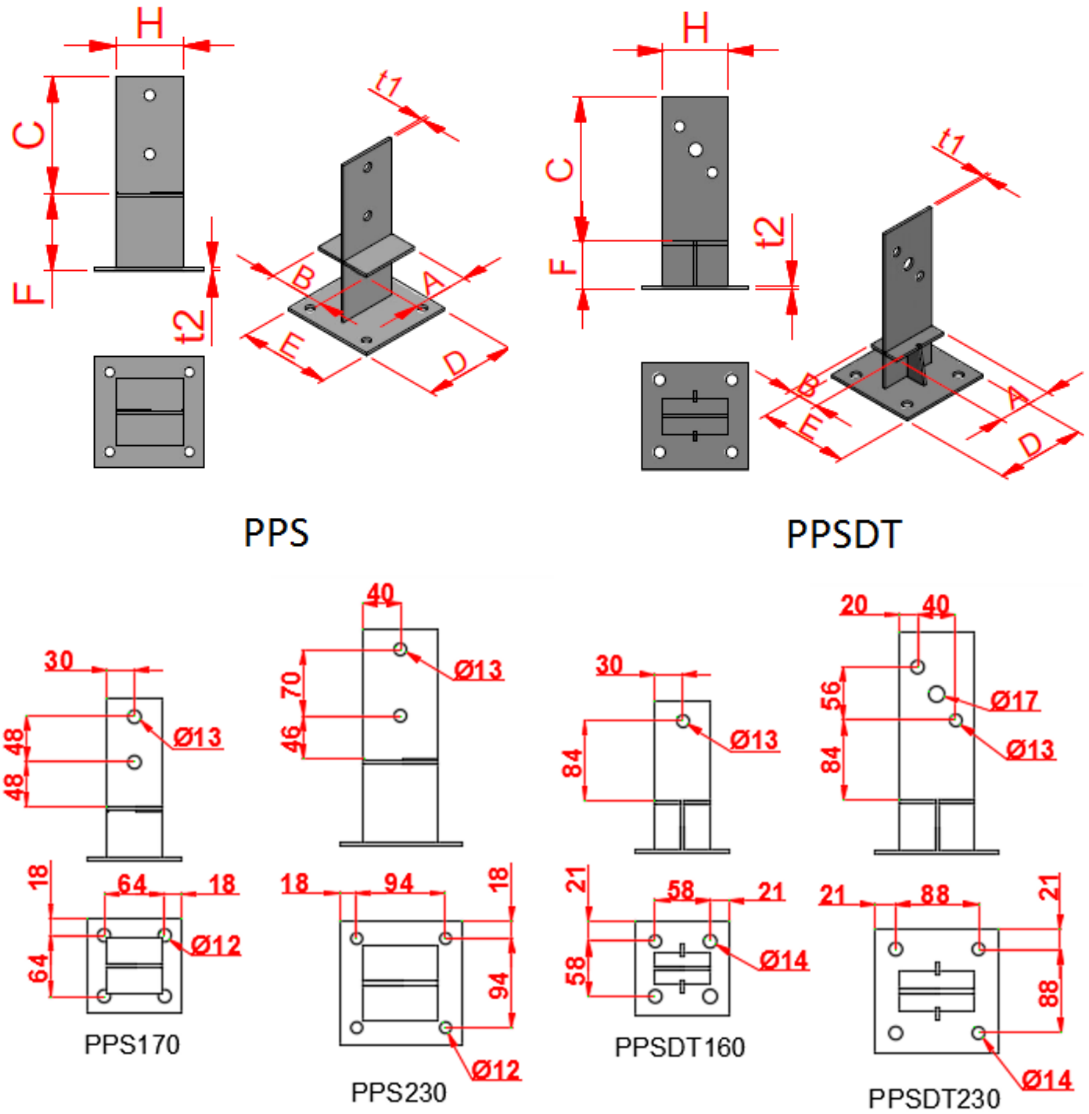



**Table D32-1: Size specification**

| 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 |
| | Or stainless steel as described | |

**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 postbase |
|---|---|
| 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**

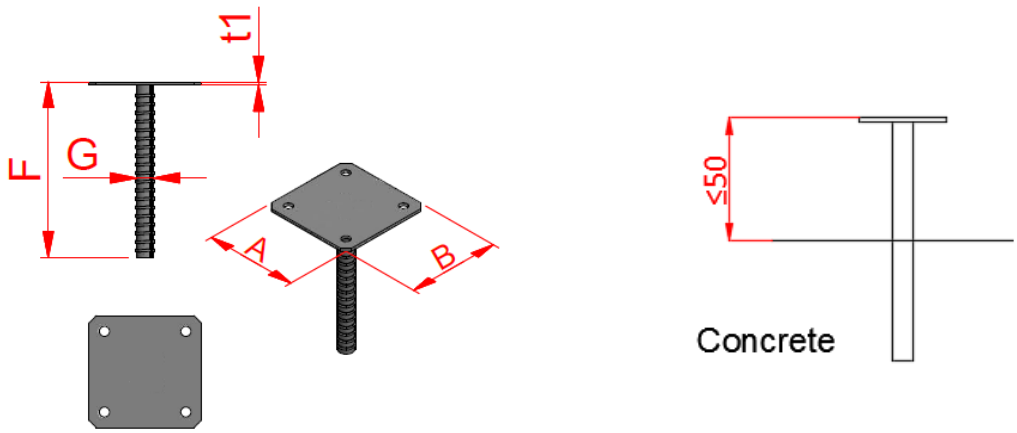



**Table D33-1: Size specification**

| 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**

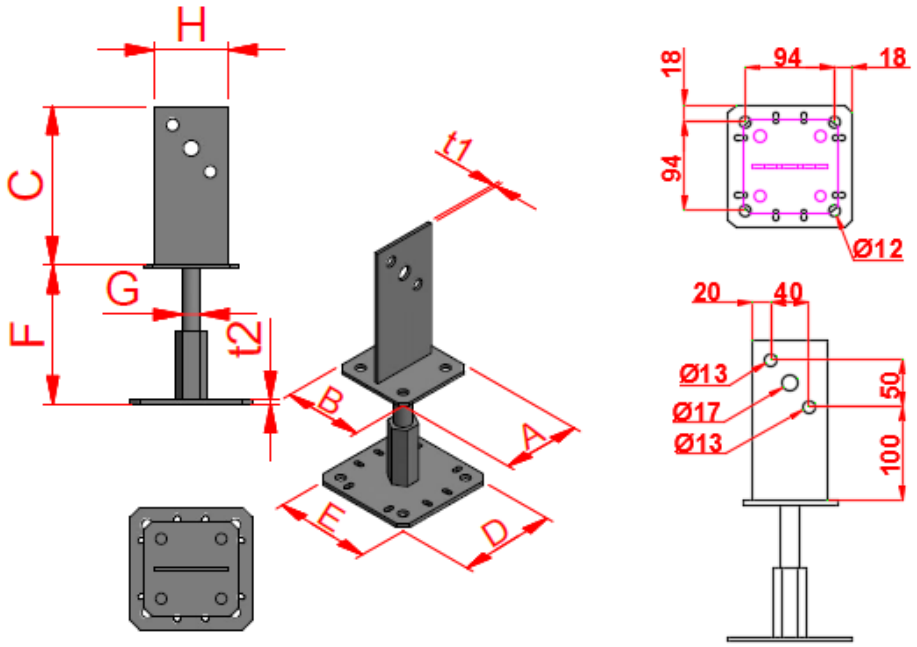



**Table D34-1: Size specification**

| 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 | Electroplated Zinc Zn12/C according to ISO 2081 and EN1403 or Sherardizing class C30 according to EN 13811. |
| 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 | |

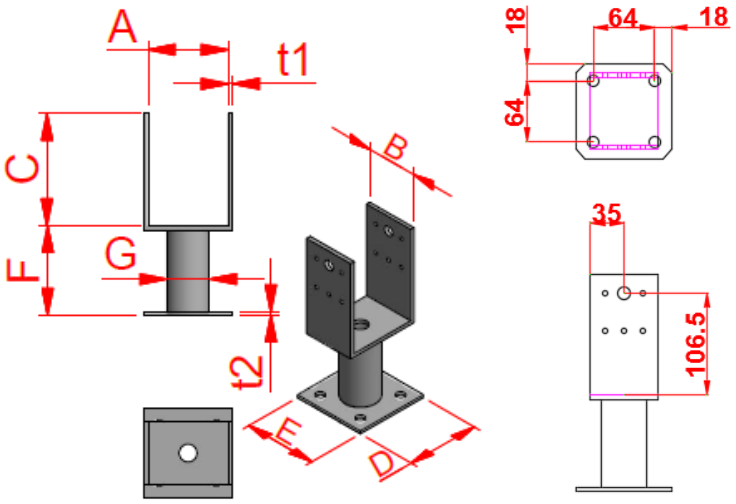
**Table D34-3: Characteristic capacity**

| | | | | | Characteristic capacities (kN) | |
|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ |
| | On post | | On concrete | | | |
| Model | 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

| | | | | | Characteristic capacities [kN] | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$ | $R_{4.k}$ |
| | On post | | On concrete | | | | | |
| Model | 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 / ($k_{mod}^{0.5}$) |

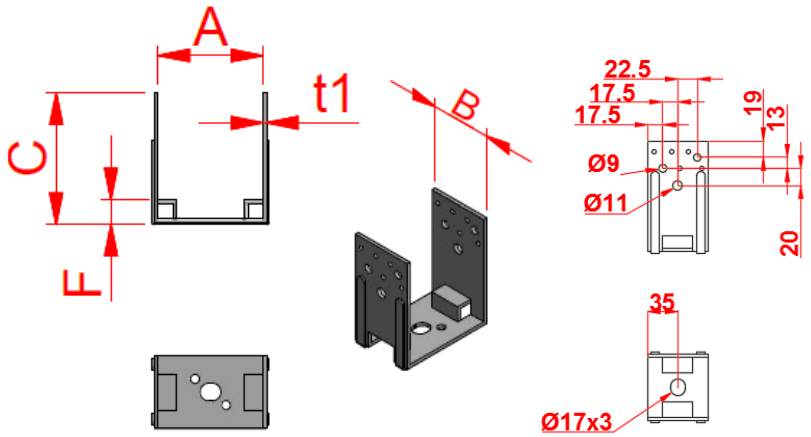
To obtain full load-carrying capacities for lifting force and horizontal force, the characteristic withdrawal capacity of the anchors should be minimum: 14.9 kN for PPUP70 and 18.8 kN for PPUP90.

## 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 | $t_1$ | Qty | size | Qty | size | Qty | | | size |
| PU70-B | 71 | 70 | 131 | 24 | 4 | 10 | Ø5 | 4 | Ø9 | | | 1 | Ø17x20 |
| PU80-B | 81 | 70 | 126 | 24 | 4 | 10 | Ø5 | 4 | Ø9 | | | 1 | Ø17x20 |
| PU90-B | 91 | 70 | 131 | 24 | 4 | 10 | Ø5 | 4 | Ø9 | 2 | Ø9 | 1 | Ø17x20 |
| PU100-B | 101 | 70 | 126 | 24 | 4 | 10 | Ø5 | 4 | Ø9 | 2 | Ø9 | 1 | Ø17x20 |
| PU120-B | 121 | 70 | 116 | 24 | 4 | 10 | Ø5 | 4 | Ø9 | 2 | Ø9 | 1 | Ø17x20 |
| PU140-B | 141 | 70 | 106 | 24 | 4 | 10 | Ø5 | 4 | Ø9 | 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

| | | | | | Characteristic capacities [kN] | |
|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ |
| | On post | | On concrete | | | |
| Model | 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**

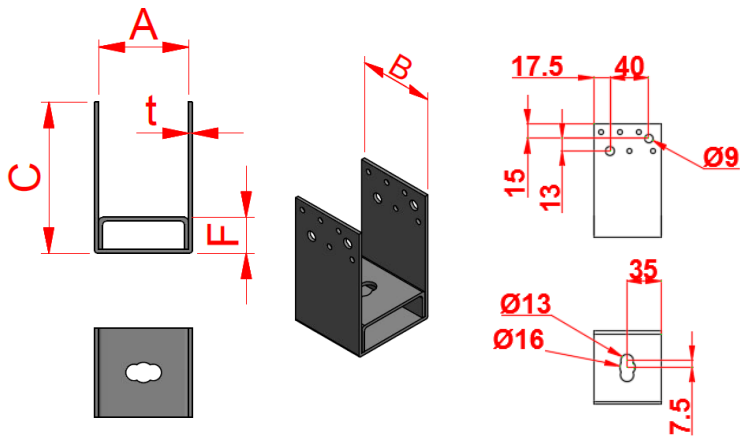



**Table D37-1: Size specification**

| 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

| | | | | | Characteristic capacities [kN] | |
|---|---|---|---|---|---|---|
| | Fasteners | | | | | |
| | On post | | On concrete | | $R_{1.k}$ | $R_{2.k}$ |
| Model | 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**

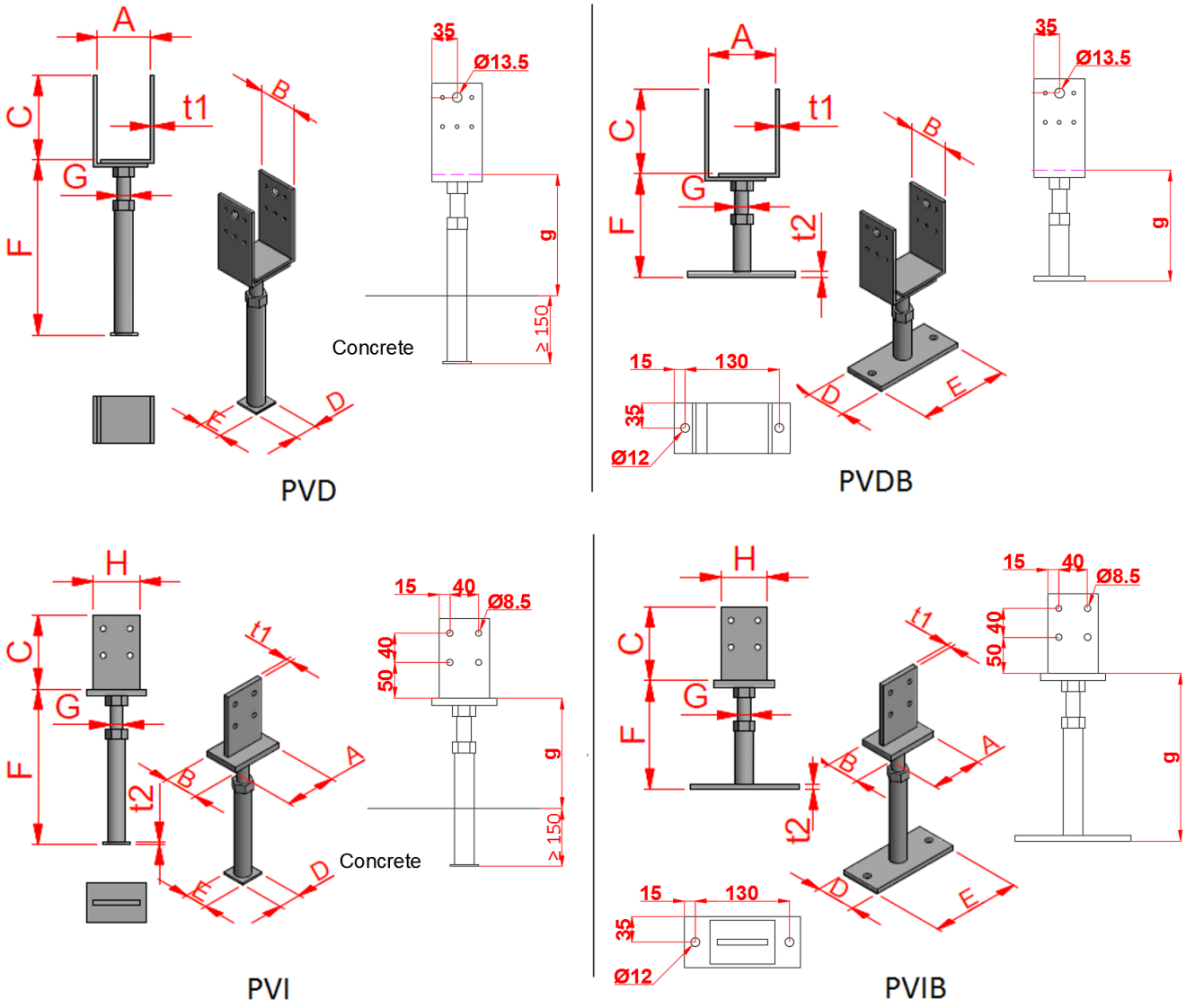


**Table D38-1: Size specification**

| 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 | 60 | 90 | 110 | 40 | 40 | 222 - 274 | 20 | 70 | 8 | 4 | 4 | Ø8.5 | | | | |
| PVIB | 60 | 90 | 110 | 70 | 160 | 109 - 161 | 20 | 70 | 8 | 8 | 4 | Ø8.5 | | | 2 | Ø12 |

**Table D38-2: Material specification**

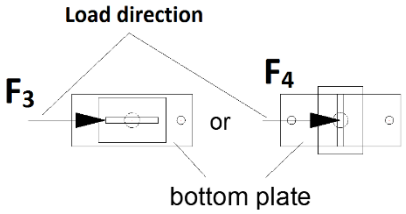
| Part | Material Grades | Coating specification |
|---|---|---|
| Plates | S235JR according to EN 10025 | Hot-dip galvanized according to EN ISO 1461 |
| Threaded rod | S355 JO according to EN 10025 | |
| | Or stainless steel as described | |

**Table D38-3: Characteristic capacity**

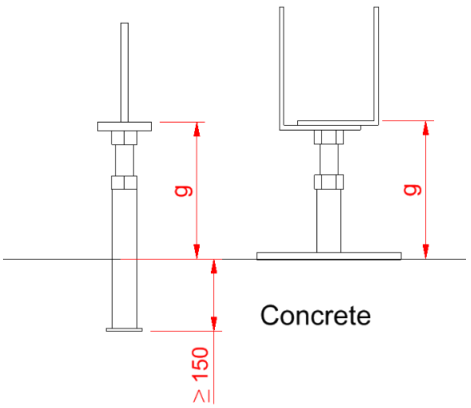
| | | | | | | Characteristic capacities (kN) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Fasteners | | | | Timber width [mm] | $R_{1.k}$ | $R_{2.k}$ | $R_{3.k}$* | $R_{4.k}$* |
| | On post | | On concrete | | | | | | |
| Model | Qty | Type | Qty | Type | | | | | |
| PVD | 10 | CNA4,0x40 | | | 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**

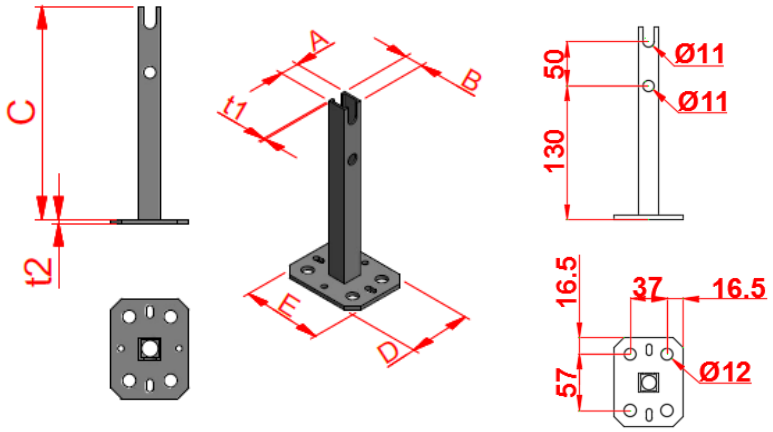



**Table D39-1: Size specification**

| 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 | |

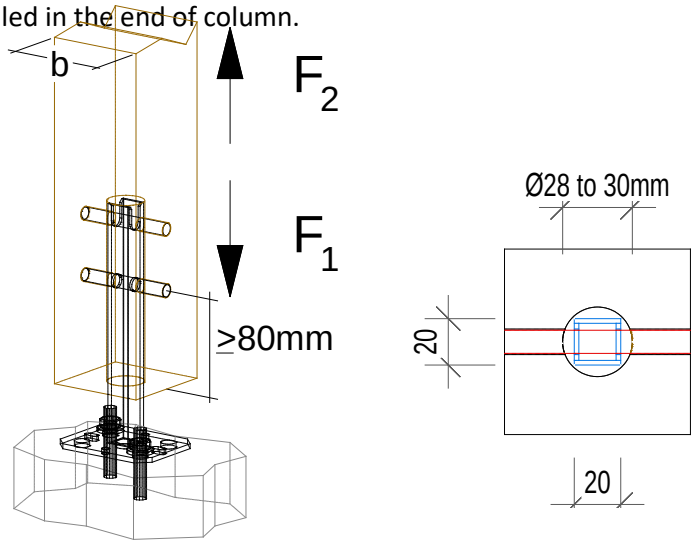
**Table D39-3: Characteristic capacity**

| | | | | | Characteristic capacities [kN] | |
|---|---|---|---|---|---|---|
| | Fasteners | | | | $R_{1.k}$ | $R_{2.k}$ |
| | On post | | On concrete | | | |
| Model | 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.

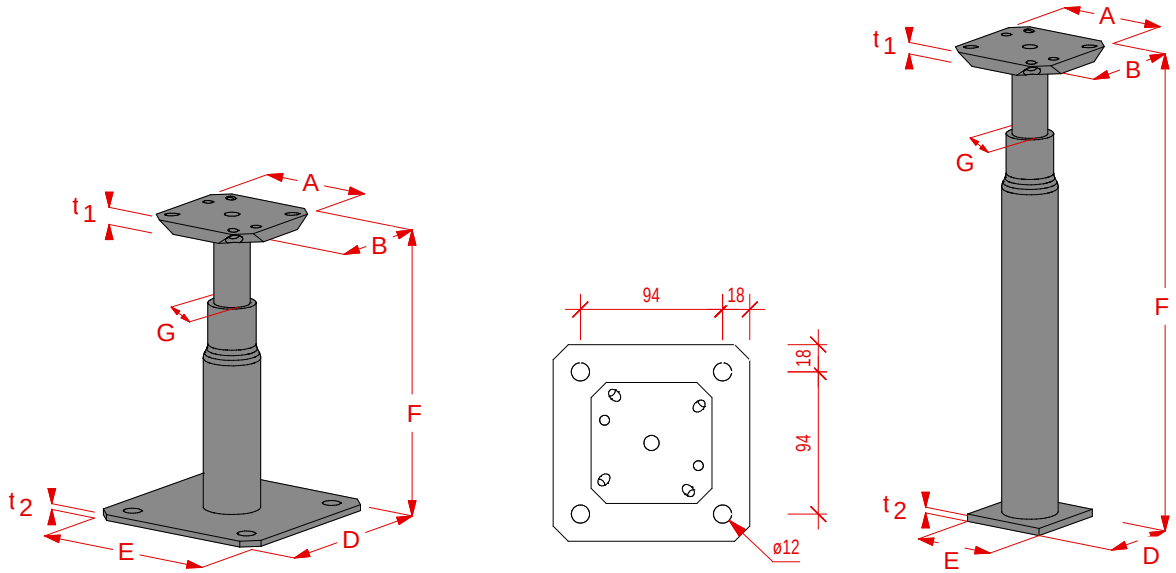
A hole Ø28 or 30mm must be drilled in the end of column.



## D40: PP18

| Product name | Alternative names |
|---|---|
| PP18/24B | |
| PP18/24B**Z** | |
| PP18/24S | |
| PP18/24S**Z** | |

**Figure D40-1: Drawings**




PP18/24B PP18/24S

**Table D40-1: Size specification**

| Model | Product dimensions [mm] | | | | | | | | Holes | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Top | Bottom |
| | A | B | D | E | F | G | t1 | t2 | Ø | Ø |
| PP18/24B | 80 | 80 | 130 | 130 | 180-240 | 24 | 8(10) | 4 | 6,5 | 12 |
| PP18/24S | 80 | 80 | 80* | 80* | 300-360 | 24 | 8(10) | 4 | 6,5 | |

*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**

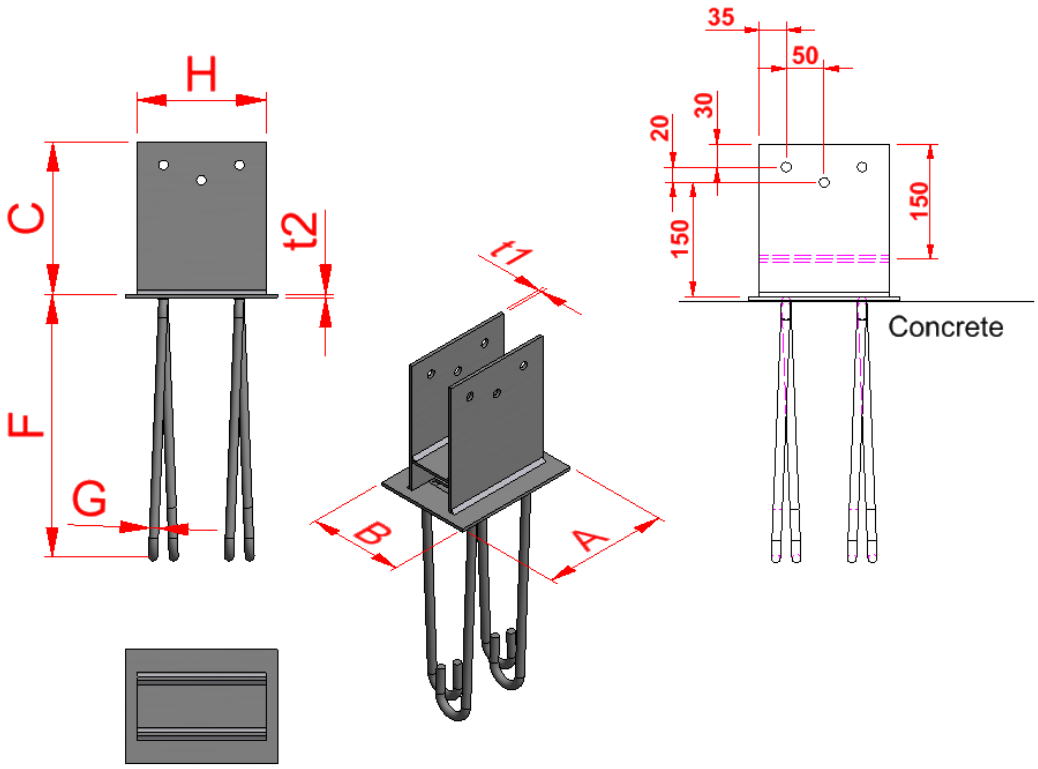
| | | | | | Characteristic capacities [kN] | | |
|---|---|---|---|---|---|---|---|
| **Model** | **Fasteners** | | | | **$R_{1.k}$** | **$R_{2.k}$** | **$R_{3.k} = R_{4.k}$** |
| | **On post** | | **On concrete** | | | | |
| | **Qty** | **Type** | **Qty** | **Type** | | | |
| PP18/24B | 4 | Ø6 | 4 | Ø10 | min (100.5/$k_{mod}^{0.6}$; 93 /kmod) | min (2.83x$R_{ax.45}$; 10.3/$k_{mod}$) | min (0.71x $R_{ax.45}$ ; 2.0/$k_{mod}$) |
| PP18/24S | 4 | Ø6 | | | min (100.5/$k_{mod}^{0.6}$; 93 /kmod) | min (2.83x$R_{ax.45}$; 10.3/$k_{mod}$) | 0.71x $R_{ax.45}$ |

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 $R_{ax.45.k}$
The embedment length for PP18/24S in concrete shall be minimum 120mm.

## D41: PLO1

| Product name | Alternative names |
|---|---|
| PLO1 | |

**Figure D41-1: Drawings**




PLO1

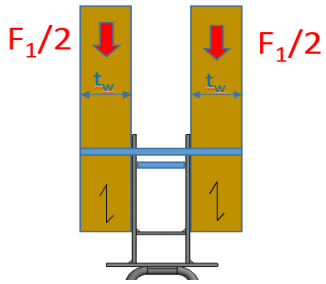
**Table D41-1: Size specification**

| Model | Product dimensions [mm] | | | | | | | Holes | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Top | |
| | A | B | C | F | G | $t_1$ | $t_2$ | Qty | size |
| PLO1 | 200 | 150 | 200 | 345 | 12 | 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 | |

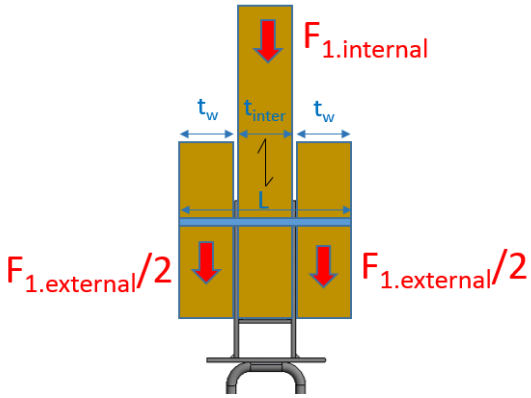
**Table D41-3: Characteristic capacity, configuration 1**




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**

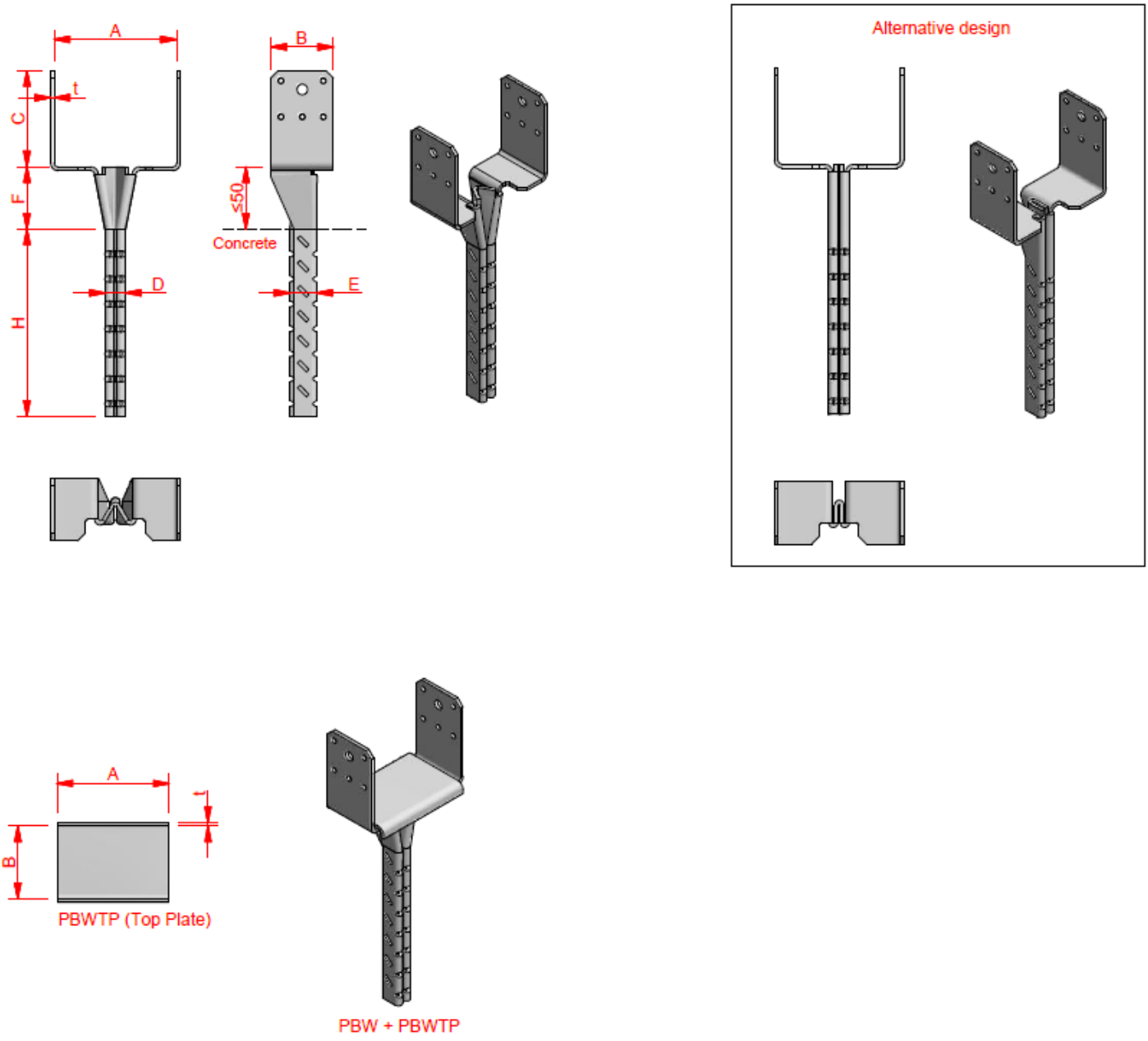


**Table D42-1: Size specification**

| 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 | $2,6/k_{mod}$ |

## 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

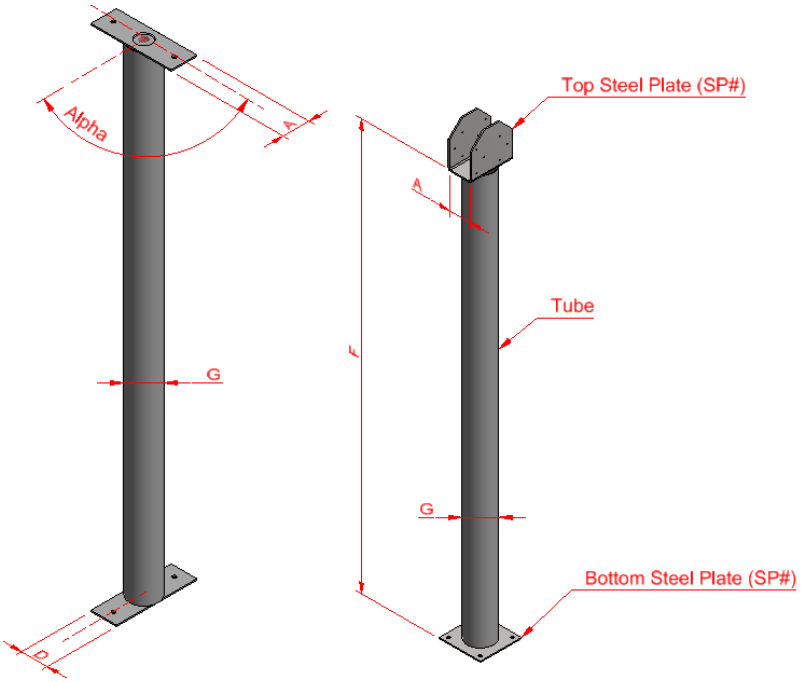


Figure D50-2: Overall size specification

**Product parameters:**

| Top Steel Plate number TopSP |
|---|
| 1 to 9 |

| Bottom Steel Plate number BottomSP |
|---|
| 1 to 9 |

| Top and bottom SP angle Alpha (°) |
|---|
| from 0 to 360 |

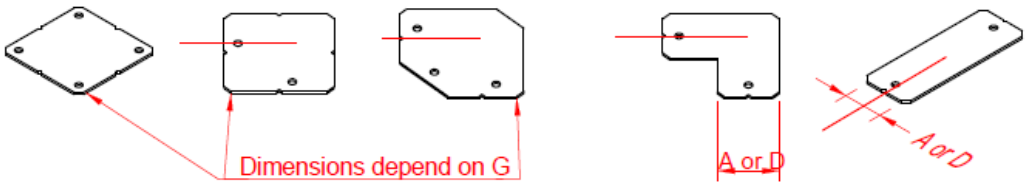
| A or D (mm) | for SP# |
|---|---|
| 80, 90, 100, 120, 140, 150 | 4 and 5 |
| from 75 to 142 | 6; 7 and 8 |

| F (mm) |
|---|
| From 100 to 3000 |

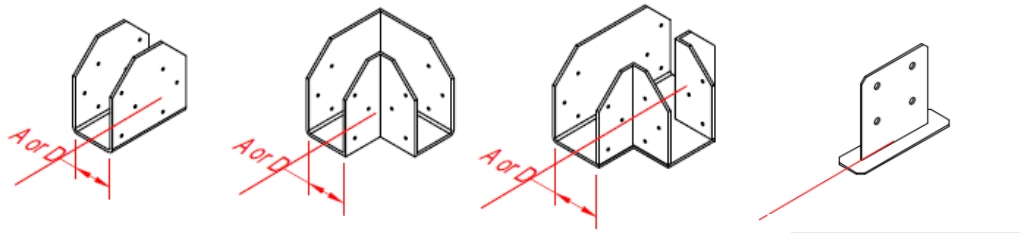
| G (mm) |
|---|
| 89 |
| 102 |
| 114 |
| 140 |

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




| SP1 | SP2 | SP3 | SP4 | SP5 |
|---|---|---|---|---|
| Fix. holes Ø 14 mm | | | Fix. holes Ø 12, 14 or 18 mm | |
| Thickness = 4 mm | | | | |




| SP6 | SP7 | SP8 |
|---|---|---|
| Fix. holes Ø 7 mm | | |
| Thickness = 4 mm | | |

| SP9 |
|---|
| Fasteners holes = 13 mm |

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

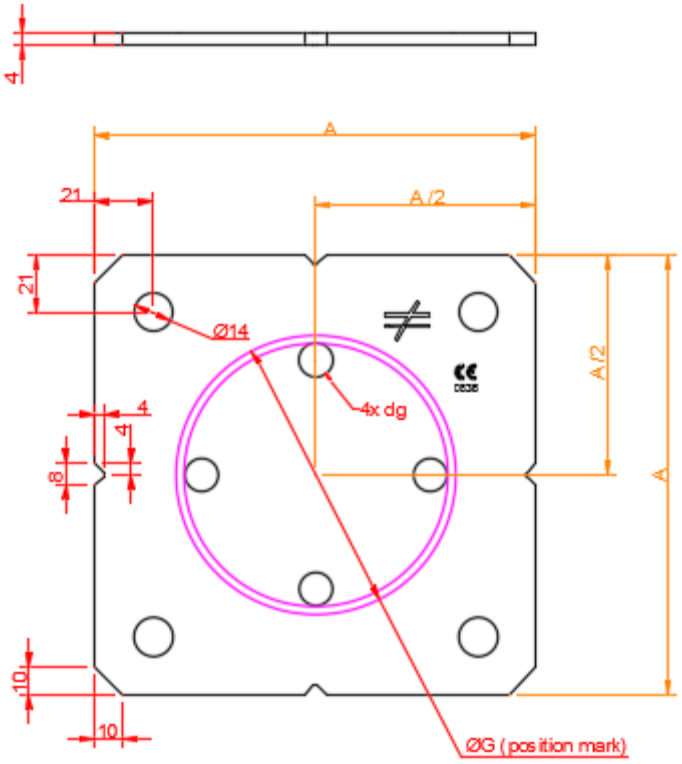
Table D50-1: Material specification OSP

| 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 | |

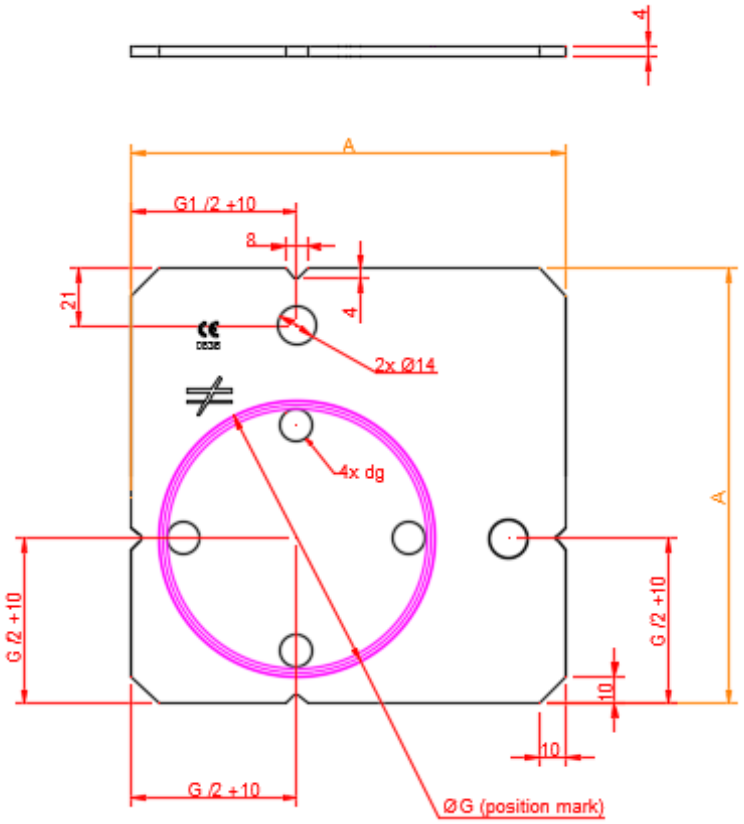
Figure D50-4: size specification SP1 or SPS1




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 |

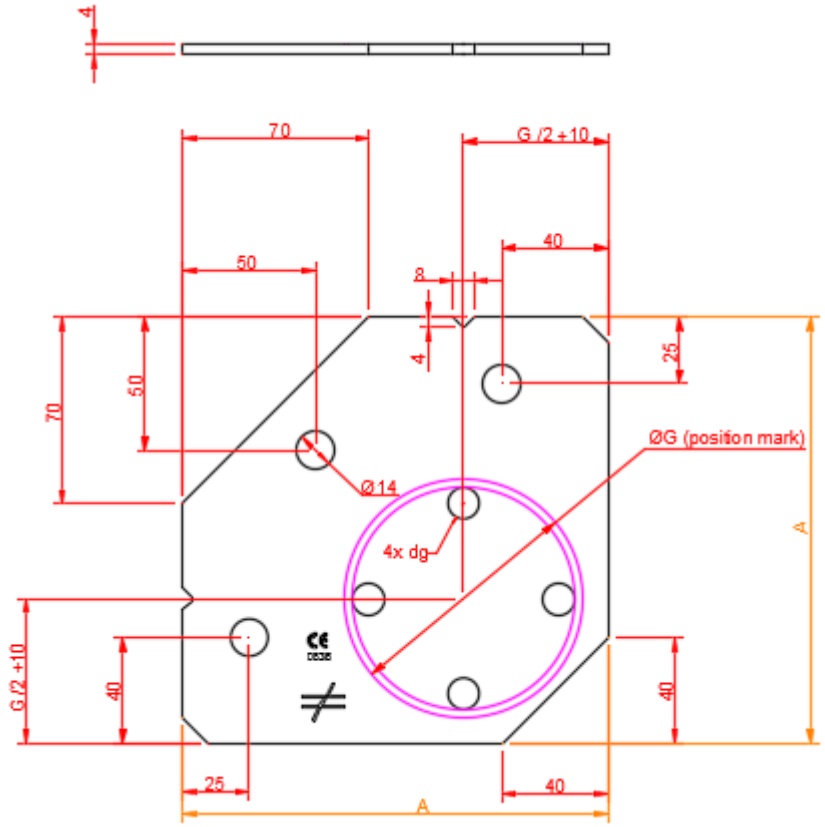
Figure D50-5: size specification SP2 or SPS2




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 |

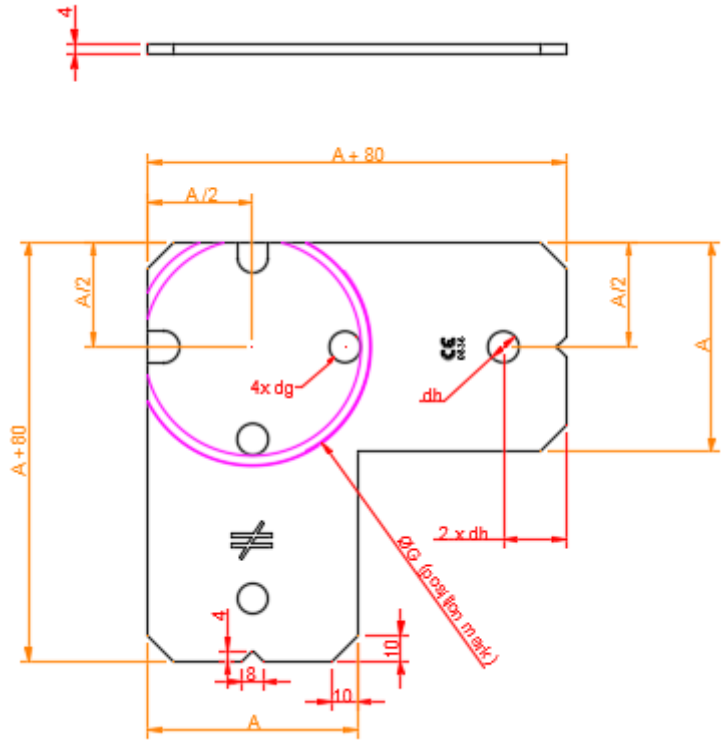
Figure D50-6: size specification SP3 or SPS3




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 |

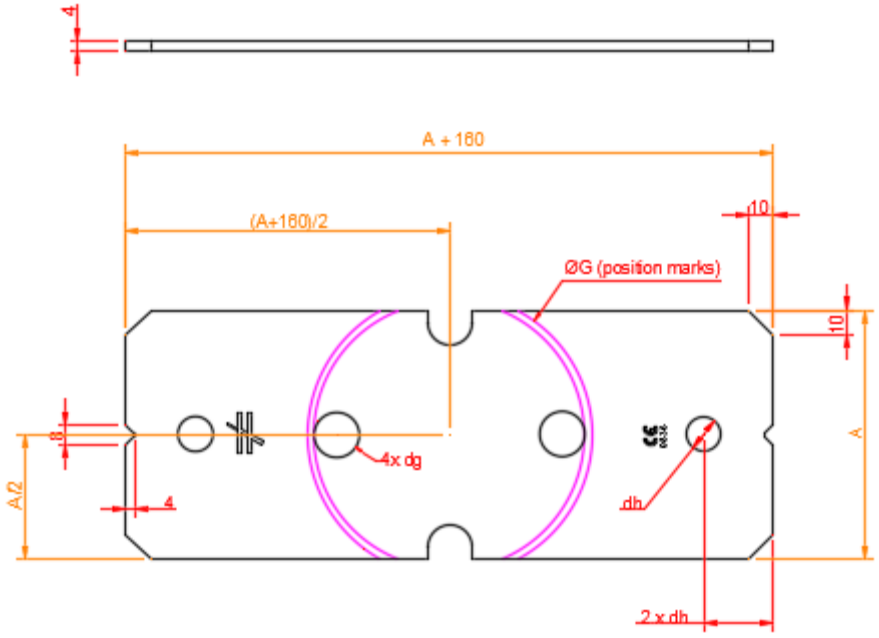
Figure D50-7: size specification SP4 or SPS4




| 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 |

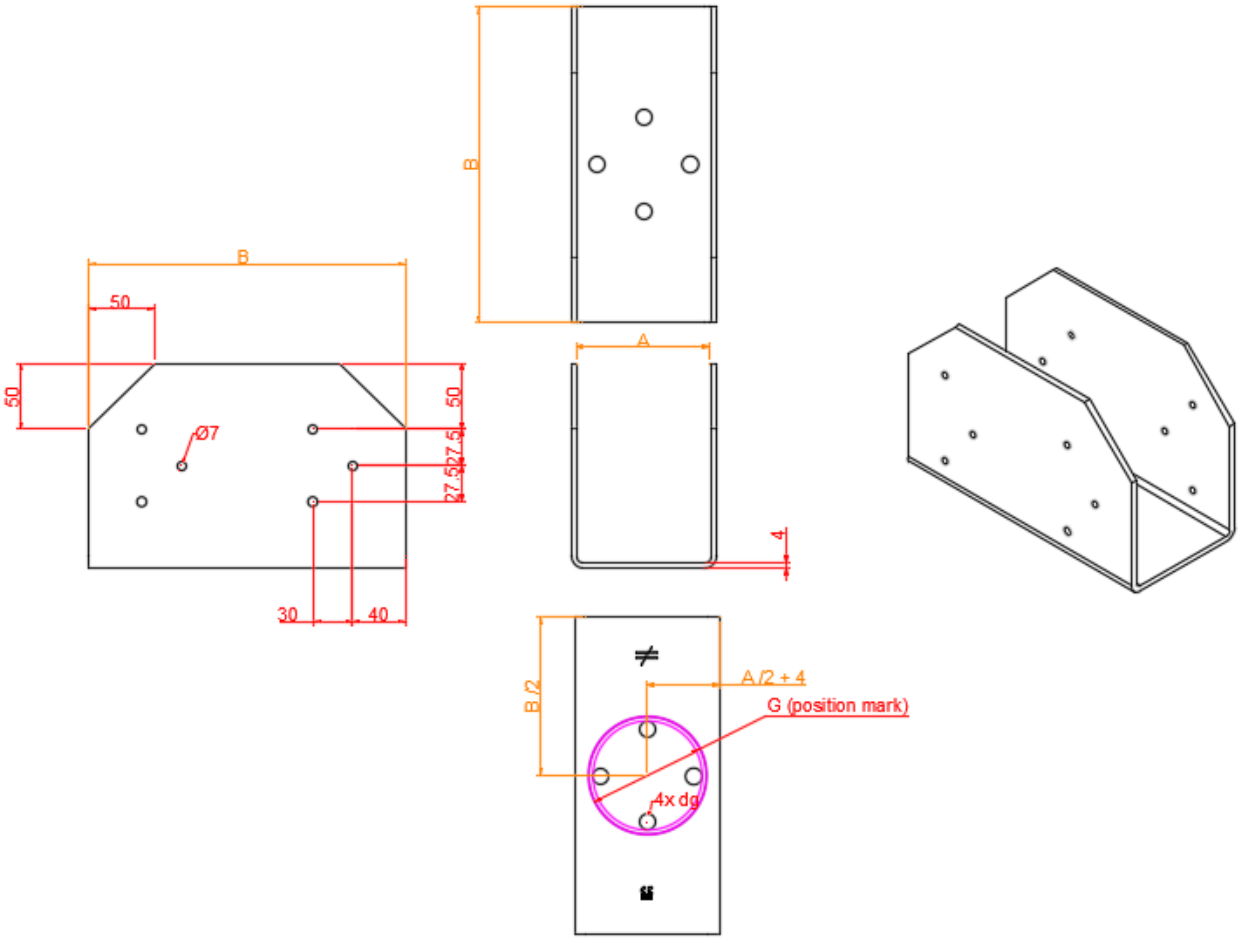
Figure D50-8: size specification SP5 or SPS5




| 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

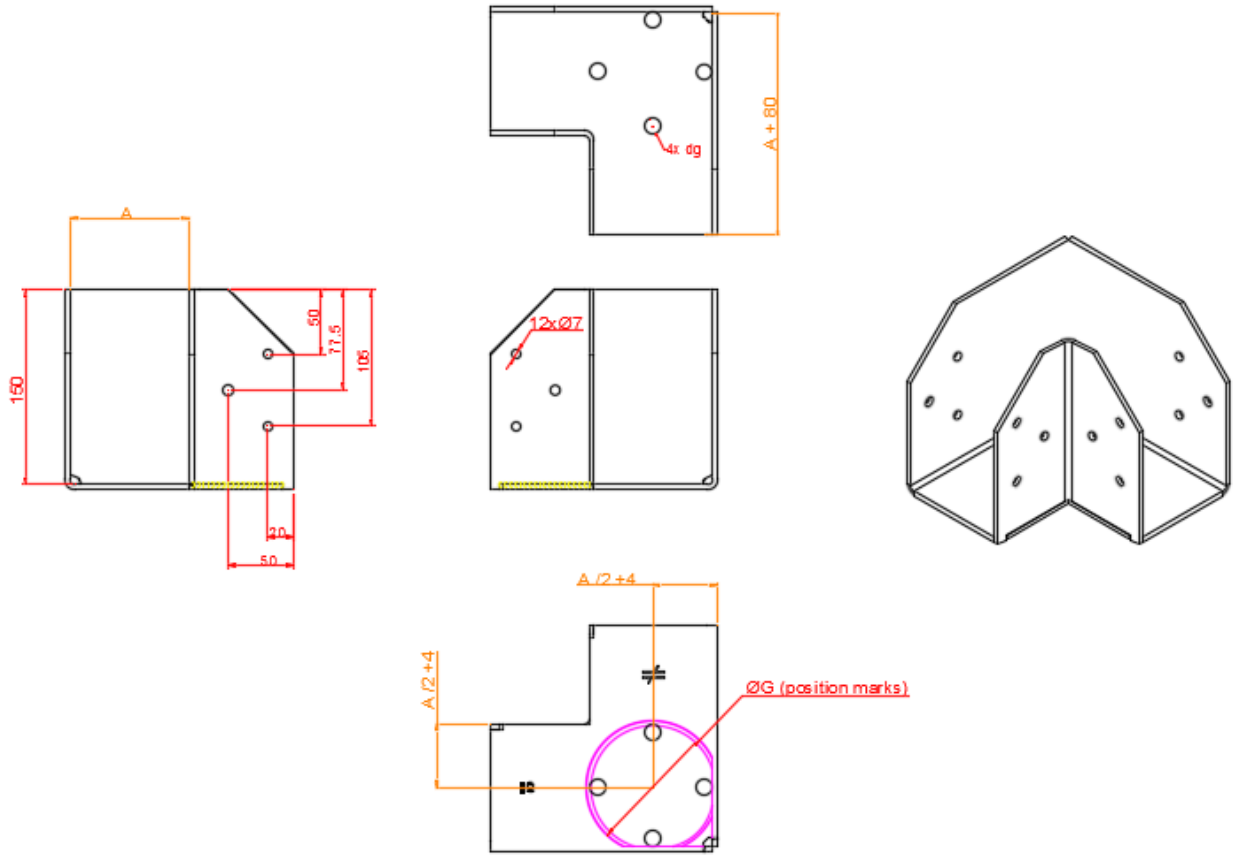



| Item | Product dimensions (mm) | | | | Compatible with tube diam. G | Plate holes for screws |
|---|---|---|---|---|---|---|
| | A | B | C | t | | |
| SP6/ØG/A | from 75 to 90 | 230 | 195 – A/2 | 4 | 89 - 102 | 12 Ø7 |
| SP6/ØG/A | from 91 to 115 | 255 | 207.5 - A/2 | 4 | 89 – 102 - 114 | 12 Ø7 |
|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

| 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.

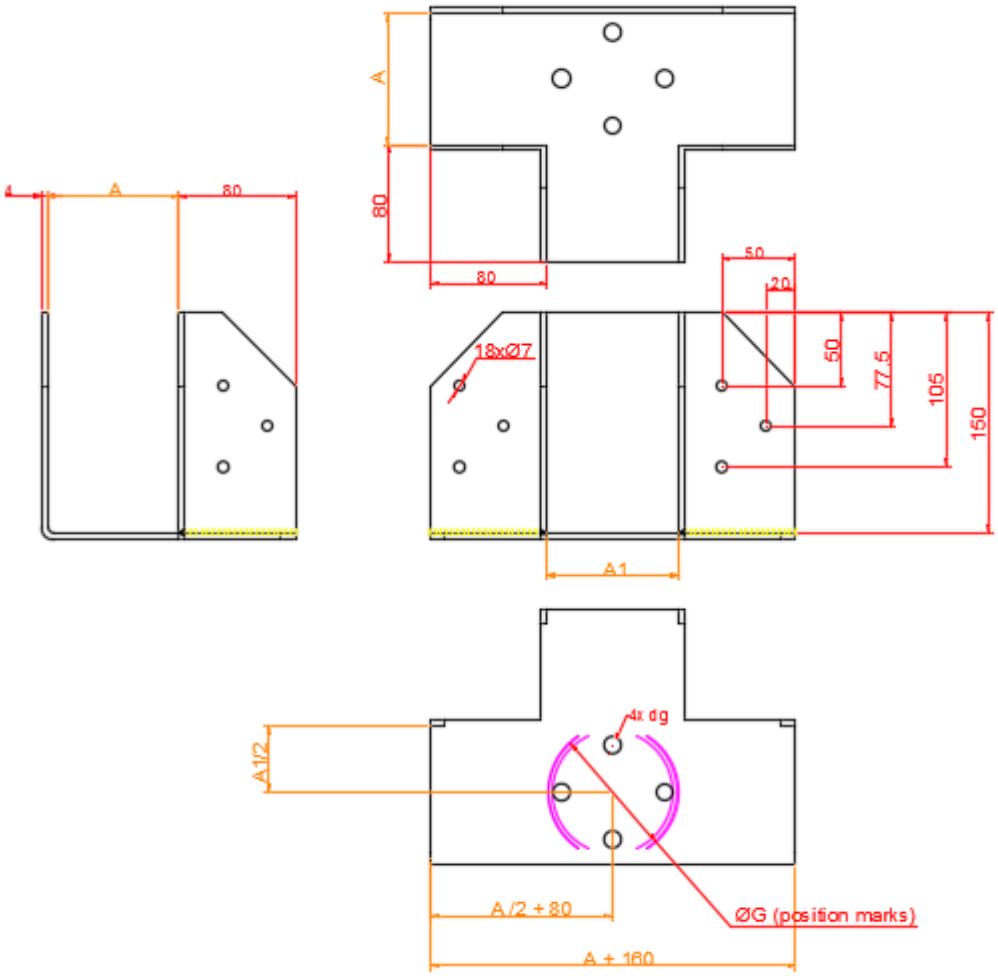
Figure D50-10: size specification SP7 or SPS7



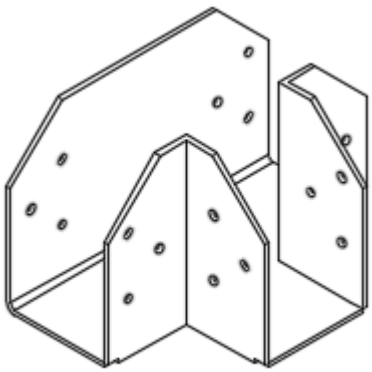

| Item | Product dimensions (mm) | | | | Compatible with tube diam. G | Plate holes for screws |
|---|---|---|---|---|---|---|
| | A | B | C | t | | |
| SP7/ØG/A | from 75 to 142 | A + 85 | 150 | 4 | A – 40 mm < G < 4x A /π -10 | 12 Ø7 |

| G | $d_g$ |
|---|---|
| 88.9 | 12 |
| 101.6 | 12 |
| 114.3 | 18 |
| 139.7 | 20 |

Figure D50-11: size specification SP8 or SPS8

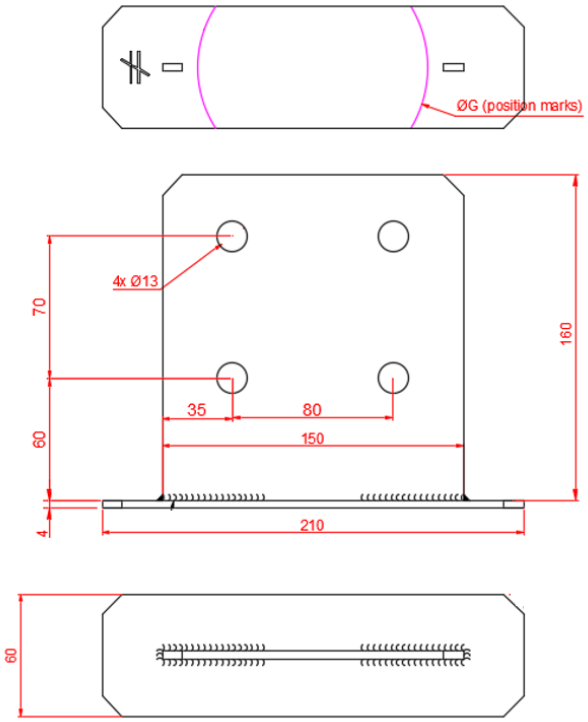



| G | $d_g$ |
|---|---|
| 88.9 | 12 |
| 101.6 | 12 |
| 114.3 | 18 |
| 139.7 | 20 |



| 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 |

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

| | | | Characteristic capacities on timber [kN] | | Characteristic capacities on rigid support [kN] | |
|---|---|---|---|---|---|---|
| | | | $R_{1.k}$ | | | |
| Model | Fasteners Qty | Fasteners Type | perpendicular to grain | Parallel to grain | $R_{1.k}$ | $R_{2.k}$ * |
| 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.

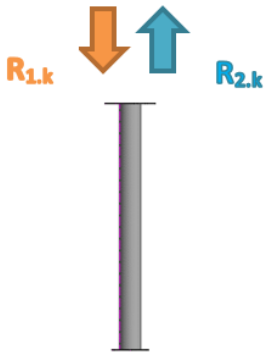
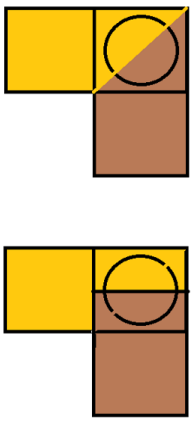


Table D50-4: SP4 Characteristic capacities

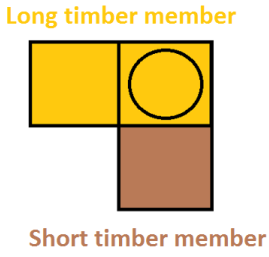
| | | | Characteristic capacities on timber [kN] | | | Characteristic capacities on rigid support [kN] | |
|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$* perpendicular to grain, end support | | | | |
| Model | Qty | Type | Total | Short TM | Long TM | $R_{1.k}$ | $R_{2.k}$ ** |
| SP4/Ø89/80 | 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

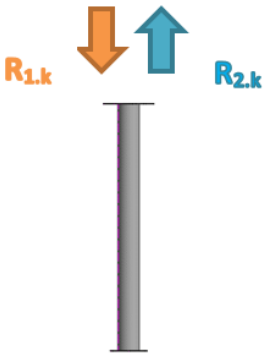
** The capacity of the anchors is not considered and shall be checked by the user.



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

| | | | Characteristic capacities on timber [kN] | | | Characteristic capacities on rigid support [kN] | |
|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ perpendicular to grain | | $R_{1.k}$ parallel to grain | | |
| Model | Qty | Type | End support | Intermediate support | | $R_{1.k}$ | $R_{2.k}$ * |
| 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

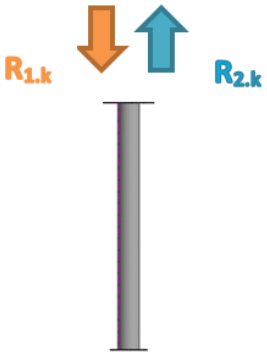


Table D50-6: SP6 Characteristic capacities

| | | | Characteristic capacities on timber [kN] | | |
|---|---|---|---|---|---|
| | | | $R_{1.k}$* perpendicular to grain | | |
| | Fasteners | | | | $R_{2.k}$ perpendicular to grain |
| Model | 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.

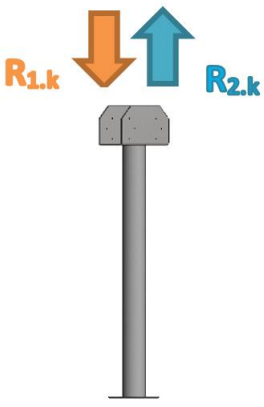


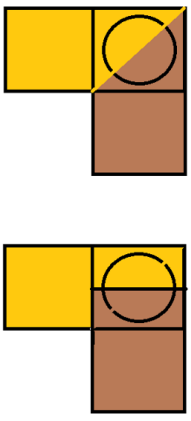
Table D50-7: SP7 Characteristic capacities

| | | | Characteristic capacities on timber [kN] | | | |
|---|---|---|---|---|---|---|
| | | | $R_{1.k}$* perpendicular to grain, end support | | | $R_{2.k}$ perpendicular to grain |
| Model | Fasteners Qty | Fasteners 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 | |

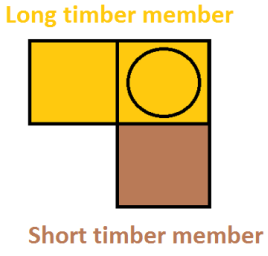
* For different width A than the ones given in the table, the user shall considered the minimum capacity between the two closest cases.


** 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

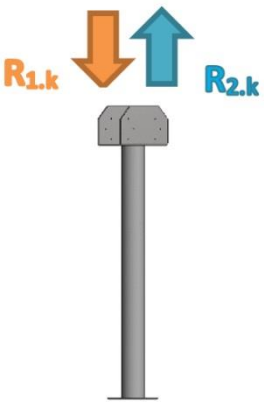
If the plate is used to connect two timber parts as described in config 1, with equal contact area, then the load applied on each part shall not exceed the half of the total capacity in the previous table. If the plate is used to connect two timber parts as described in config 2, with one longer timber 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

| | | | Characteristic capacities on timber [kN] | |
|---|---|---|---|---|
| Model | Fasteners | | $R_{1.k}$* perpendicular to grain Intermediate support | $R_{2.k}$ perpendicular to grain |
| | Qty | Type | | |
| 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/n$^{th}$ 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

| | | | Characteristic capacities on timber [kN] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k} = R_{2.k}$ * perpendicular to grain | | | | | |
| | Fasteners | | STD Dowel length [mm] | | | | | |
| Model | 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

| | | | Characteristic capacities on timber [kN] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k} = R_{2.k}$ * perpendicular to grain | | | | | |
| | Fasteners | | STD Dowel length [mm] | | | | | |
| Model | 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 $_{mod}$es 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

| | | | Characteristic capacities on timber [kN] | | Characteristic capacities on rigid support [kN] | |
|---|---|---|---|---|---|---|
| | | | $R_{1.k}$ | | | |
| Model | Fasteners Qty | Fasteners Type | perpendicular to grain | Parallel to grain | $R_{1.k}$ | $R_{2.k}$ * |
| 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.

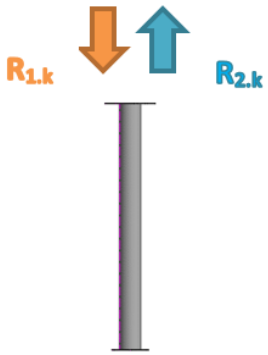
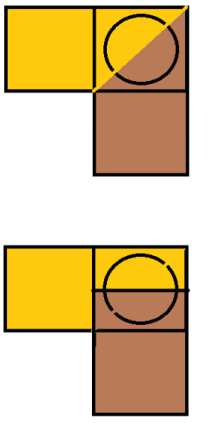


Table D50-4: SPS4 Characteristic capacities

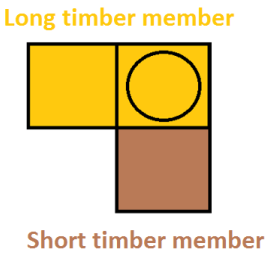
| | | | Characteristic capacities on timber [kN] | | | Characteristic capacities on rigid support [kN] | |
|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$* perpendicular to grain, end support | | | | |
| Model | Qty | Type | Total | Short TM | Long TM | $R_{1.k}$ | $R_{2.k}$ ** |
| SPS4/Ø89/80 | 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

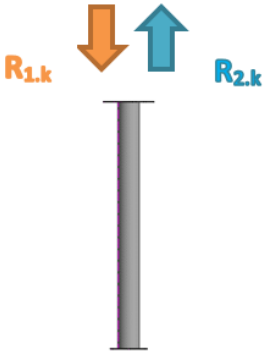
** The capacity of the anchors is not considered and shall be checked by the user.



**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

| | | | Characteristic capacities on timber [kN] | | | Characteristic capacities on rigid support [kN] | |
|---|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ perpendicular to grain | | $R_{1.k}$ parallel to grain | | |
| Model | Qty | Type | End support | Intermediate support | | $R_{1.k}$ | $R_{2.k}$ * |
| 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

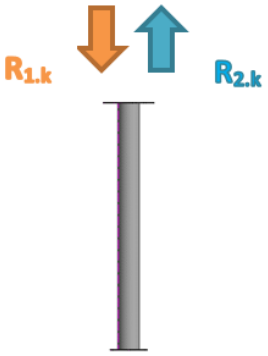


Table D50-6: SPS6 Characteristic capacities

| | | | Characteristic capacities on timber [kN] | | |
|---|---|---|---|---|---|
| | | | $R_{1.k}$* perpendicular to grain | | $R_{2.k}$ perpendicular to grain |
| | Fasteners | | | Intermediate support | |
| Model | Qty | Type | End 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.

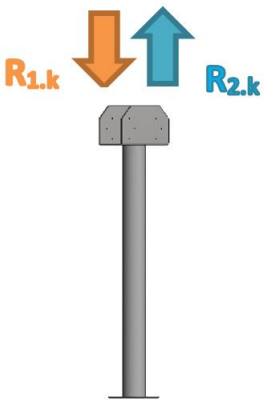


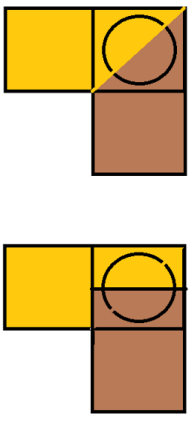
Table D50-7: SPS7 Characteristic capacities

| | | | Characteristic capacities on timber [kN] | | | |
|---|---|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$* perpendicular to grain, end support | | | $R_{2.k}$ perpendicular to grain |
| Model | 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 | |

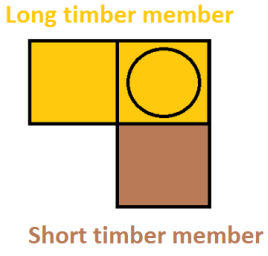
* For different width A than the ones given in the table, the user shall considered the minimum capacity between the two closest cases.


** 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

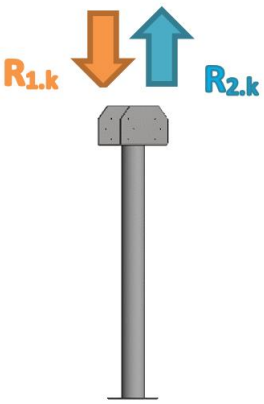
If the plate is used to connect two timber parts as described in config 1, with equal contact area, then the load applied on each part shall not exceed the half of the total capacity in the previous table. If the plate is used to connect two timber parts as described in config 2, with one longer timber 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

| | | | Characteristic capacities on timber [kN] | |
|---|---|---|---|---|
| Model | Fasteners | | $R_{1.k}$* perpendicular to grain Intermediate support | $R_{2.k}$ perpendicular to grain |
| | Qty | Type | | |
| 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/$n^{th}$ 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**

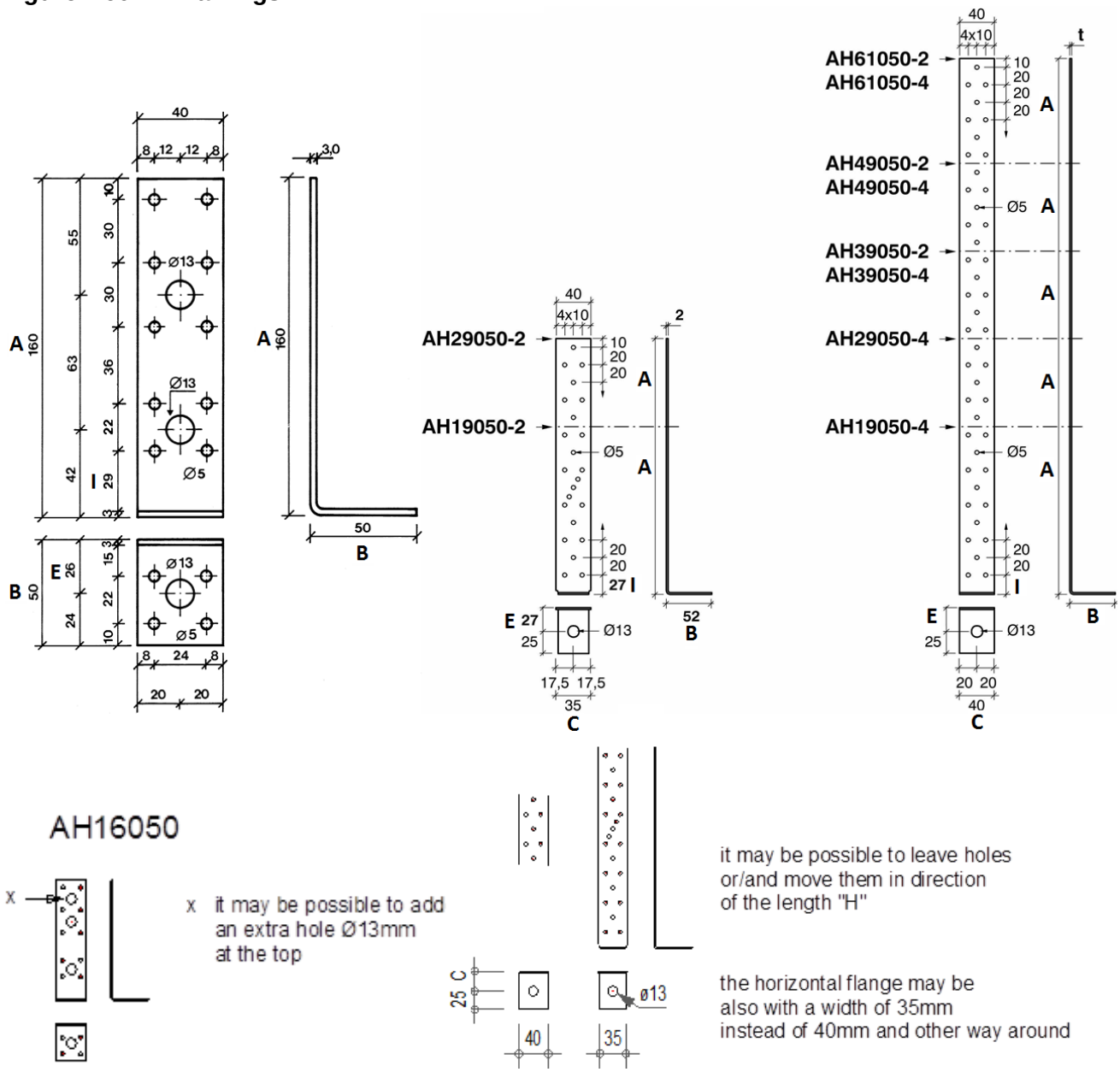


**Table D60-1: Size specification**

| 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<br>column = 6, the 4 lower holes cannot be used |
| types 190xx and up | 2 | Purlin: use all holes other than the lower 2 holes<br>Column: use all holes other than the lower 3 holes |

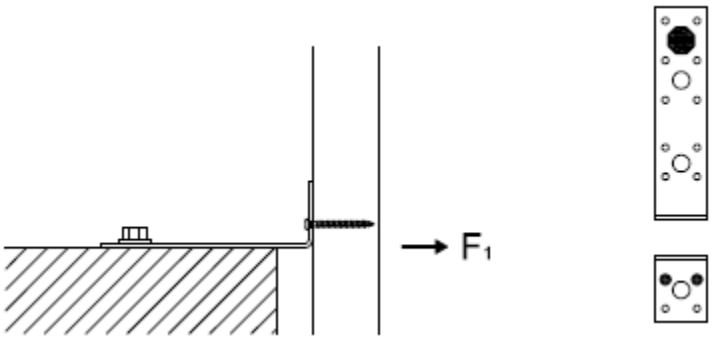
**Table D60-3: Characteristic capacity**

| | 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 / $k_{mod}$ ) | $\min\left\{\frac{0.037}{k_{mod}} \times \frac{d_a^3 \times N_{Rk,s}}{d_N^2 \times \pi} + 6.41\ kN ; \left[\left(\frac{0.05}{3 \times R_{ax,k,nail}}\right)^2 + \left(\frac{1}{R_{lat,k,nail} \times n}\right)^2\right]^{-0.5} ; 12.57/k_{mod}\right\}$ |
| AH29050-2 | | |
| AH39050-2 | | |
| AH49050-2 | | |
| AH61050-2 | | |
| AH19050-4 | min( $n_{eff}$ x $R_{lat.k}$ ; 19.77 / $k_{mod}$ ) | $\min\left\{\frac{0.037}{k_{mod}} \times \frac{d_a^3 \times N_{Rk,s}}{d_N^2 \times \pi} + 6.41\ kN ; \left[\left(\frac{0.05}{3 \times R_{ax,k,nail}}\right)^2 + \left(\frac{1}{R_{lat,k,nail} \times n}\right)^2\right]^{-0.5} ; 24.52/k_{mod}\right\}$ |
| AH29050-4 | | |
| AH39050-4 | | |
| AH49050-4 | | |
| AH61050-4 | | |
| bolt factor/ Bolt forces | $k_{b.ax}$ = 2.33 | $F_{b.ax}$ = F1 + 4.92 kN |
| | $k_{b.lat}$ = 0.79 | $k_{b.lat}$ = 0.9 |

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

| | Characteristic capacity [kN] |
|---|---|
| **Fastener Specification** | **$R_{1.k}$** |
| 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.

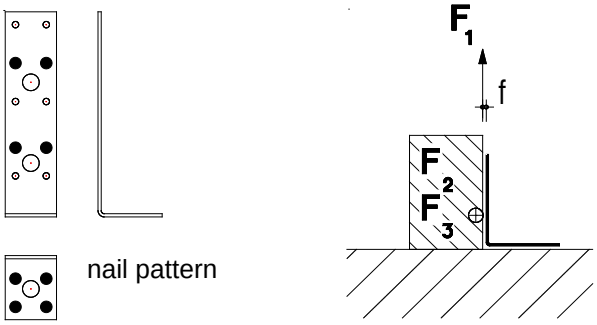



**Table D60-5: Characteristic capacity – 1 angle bracket per connection**

| | | | Characteristic capacities [kN] - 1 Angle bracket | |
|---|---|---|---|---|
| | Fasteners | | $R_{1.k}$ | $R_{2.k}$ = $R_{3.k}$ |
| Model | 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 | | |
|---|---|---|---|---|---|
| | Fasteners per angle bracket | | $R_{1.k}$ | $R_{2.k} = R_{3.k}$ | $R_{4.k} = R_{4.k}$ |
| Model | 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**

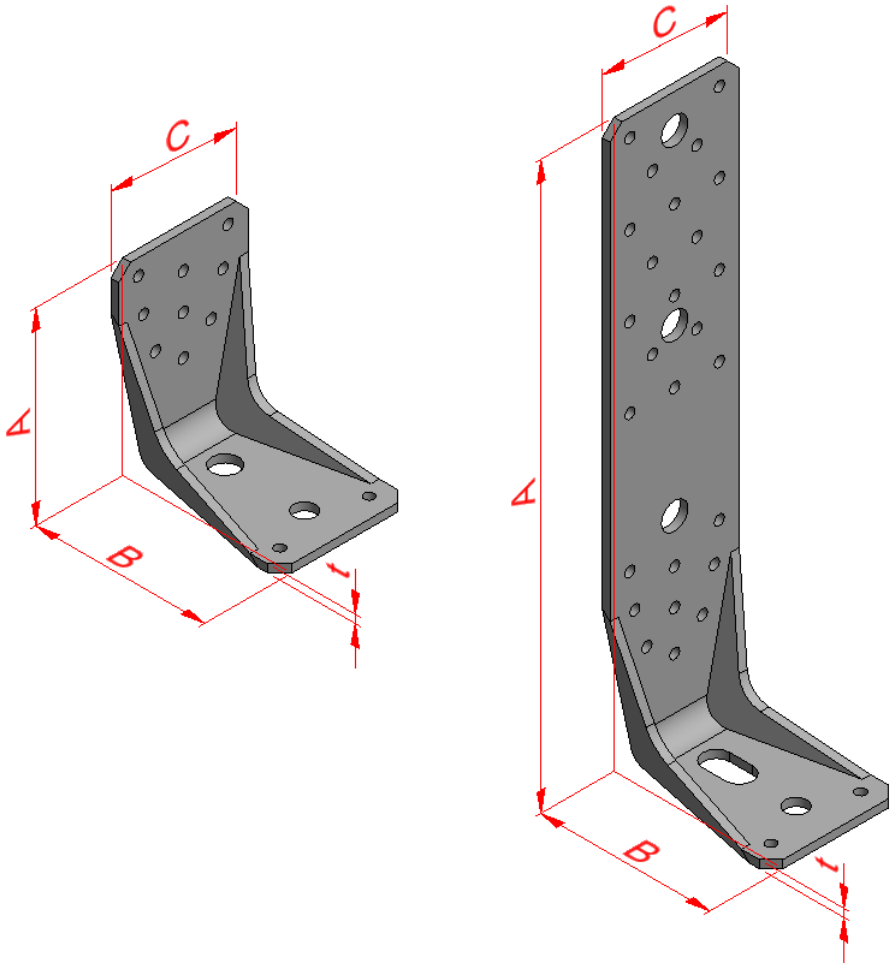


**Table D61-1: Size specification**

| 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. with using the capacity for the nail pattern of the smaller one.

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

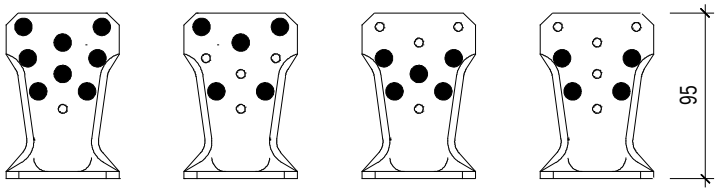
The nail pattern “partial/column” are for connection to a beam and also to a column.

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**

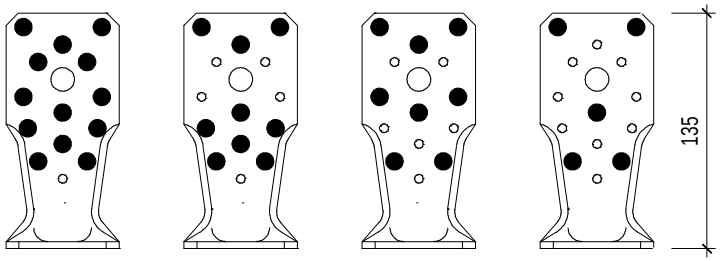
AKR95/ ..L




1 2 *) 3 4

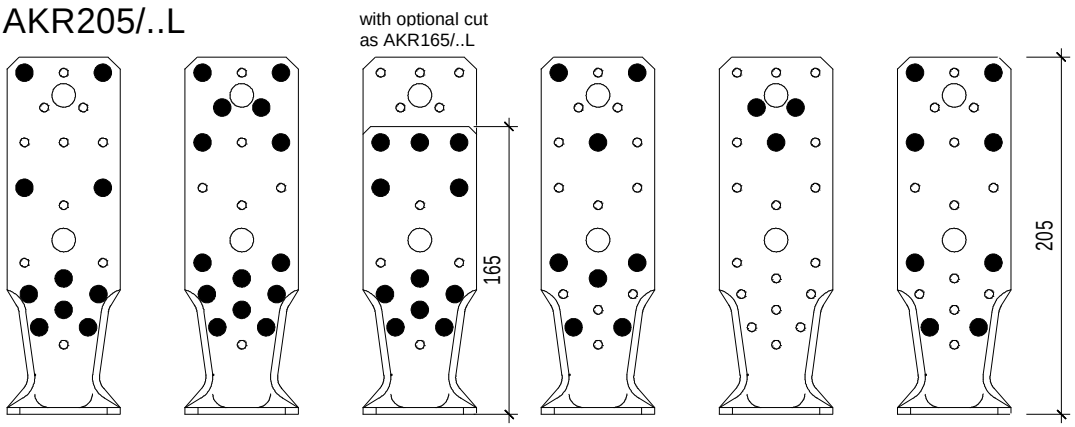
*) = connection to column possible

AKR135/..L



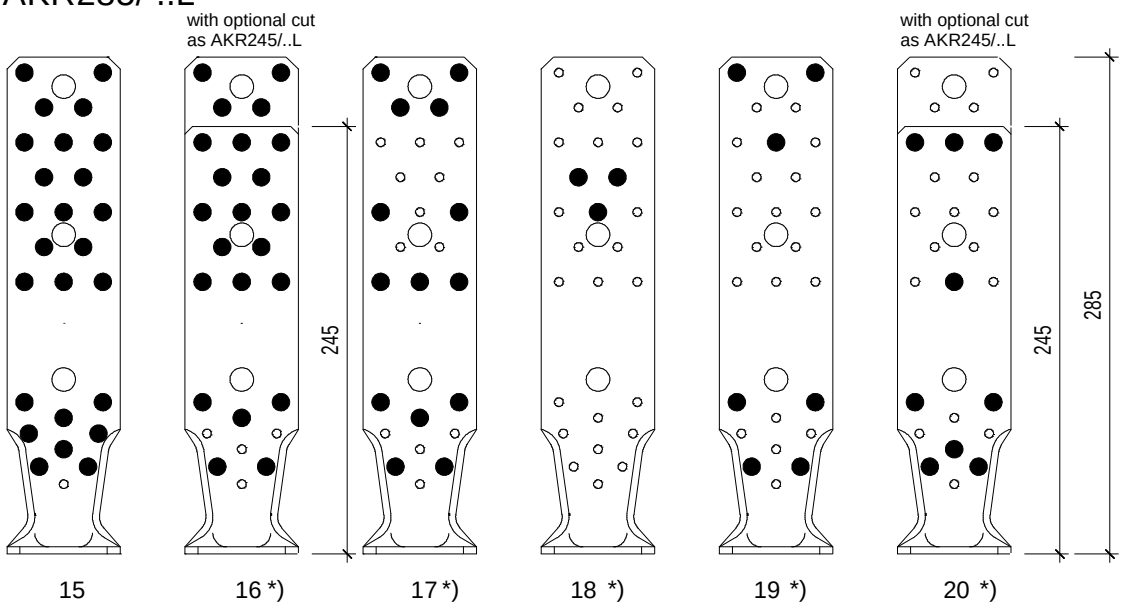

5 6 7 *) 8 *)

AKR205/..L




9 10 11 12 *) 13 *) 14 *)

AKR285/ ..L




15 16 *) 17 *) 18 *) 19 *) 20 *)

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

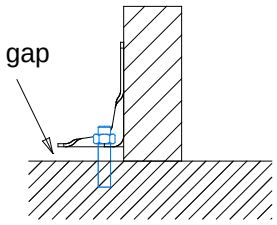
| Model | Nail pattern n° | n | Characteristic capacities [kN] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | CNA4.0x40 | | CNA4.0x50 | | CNA4.0x60 | |
| | | | $R_{bend.nail.k}$ | $R_{1.nail.k}$ | $R_{bend.nail.k}$ | $R_{1.nail.k}$ | $R_{bend.nail.k}$ | $R_{1.nail.k}$ |
| AKR95 | 1 | 8 | 6.60 | 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.

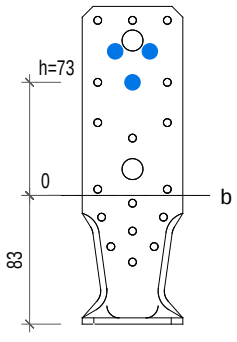
**Table D61-4: Characteristic capacities for load direction $F_1$** for nail pattern 13 and 18. for one AKR**:**

| | **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

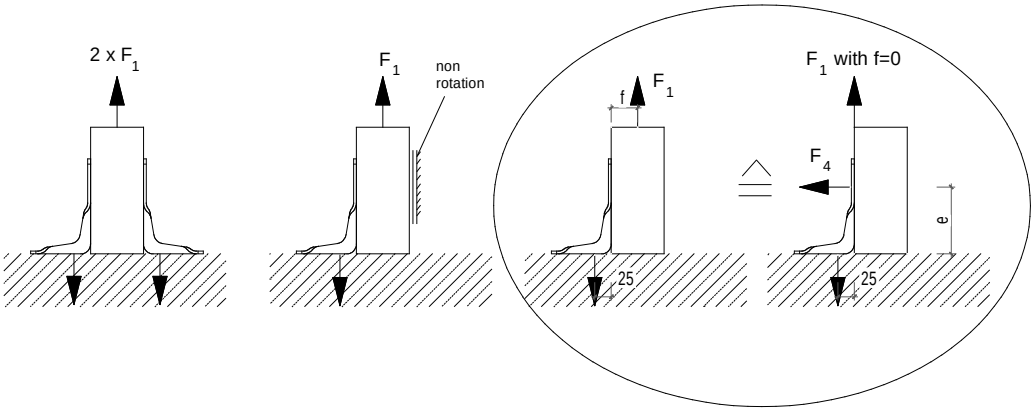



h = distance of the lowermost nail to line b

With i = h

**$R_{1.k}$= min($R_{1.nail.k}$;$R_{F.1.i.k}$ )**

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

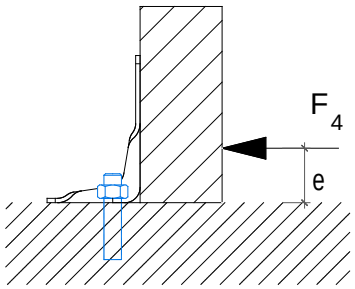
**Characteristic capacities for load direction $F_4$** (only for types without oblong hole) for one AKR

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:

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




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

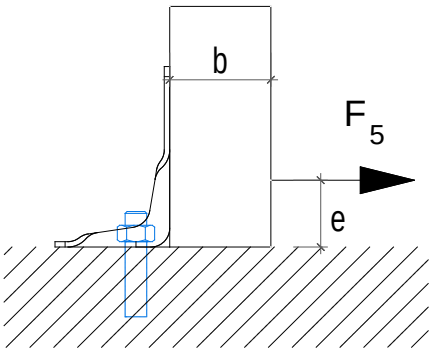
The bolt shall have a capacity to sustain an axial force of $F_{4.d}$ x 1.5 . and a lateral force of $F_{4.d}$ x 1.0.

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

| Type | Nail pattern n° | n | Characteristic capacity $R_{5.k}$ [kN] | | | |
|---|---|---|---|---|---|---|
| | | | 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 | | | | |
| 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 | | | | |
| AKR285 | 19 | 7 | 210 | | 196 | |
| AKR285/AKR245 | 20 | 9 | 274 | | 271 | |

n = number of nails according to the nail pattern

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



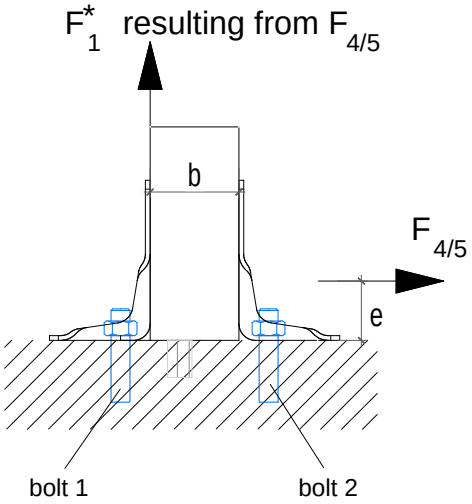

with $R_{ax.k}$ [kN] = the axial characteristic capacity of the used nail
sizes “e” shall be inserted in [mm]

Negative values may not be considered.

The bolt shall have a min. capacity $R_d$ to sustain an axial force of $F_{5.d}$ 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] |
|---|---|---|
| **Type** | **Nail pattern n°** | **$R_{4/5.k}$** |
| all with a thickness of 4.0mm | all | $26.5/k_{mod}$ |
| all with a thickness of 3.0mm | all | $15.75/k_{mod}$ |




The size b shall be a minimum of 60mm.

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

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

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

The bolt 1 shall have a capacity to sustain an axial force of $F^{*}_{1.d}$ 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.

## D62: BETA

| Product name | Alternative names |
|---|---|
| BETA | |

**Figure D62-1: Drawings**

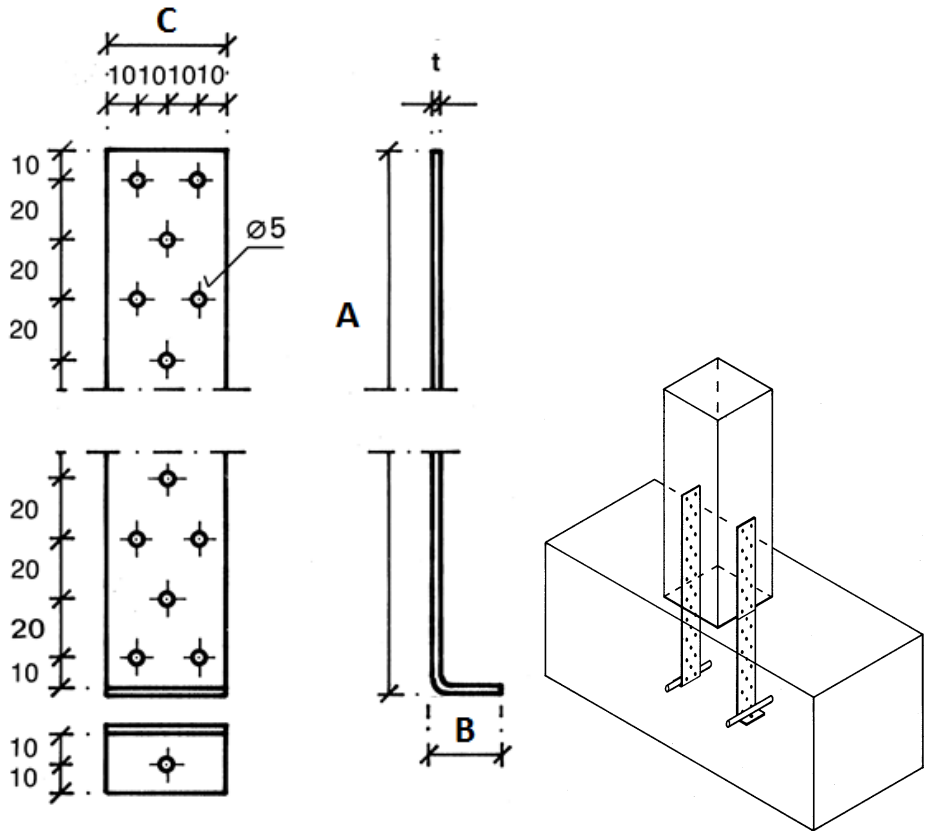



**Table D62-1: Size specification**

| 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**

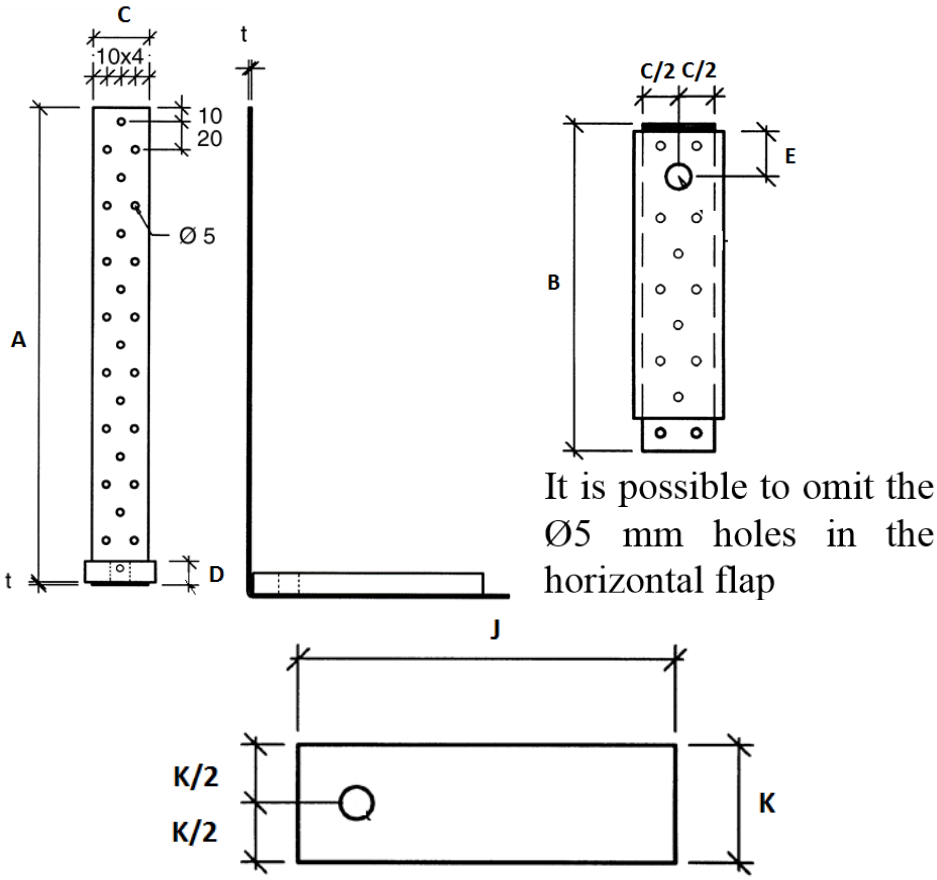



**Table D63-1: Size specification**

| 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 model 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

| | 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:

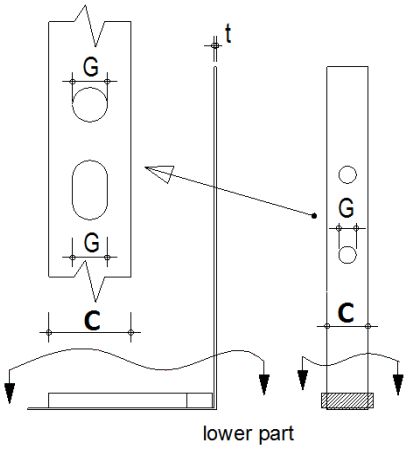
$$R_{1.k} = \min \left\{ \begin{array}{c} \frac{W_{pl} \times 277}{E \times k_{mod}} \\ A_{gross} \times 223/k_{mod} \\ n_{ef} \times R_{lat.k} \end{array} \right\}$$

$A_{gross}$ = gross cross sectional area of the vertical flap in 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

| type | A gross [mm²] | $k_r$ | $W_{pl}$ [mm³] |
|---|---|---|---|
| HD340M12 | 80 | 0.84 | 2025 |
| HD400M16 | 120 | 0.76 | 2363 |
| HD420M16 | 120 | 0.82 | 4200 |
| HD420M20 | 120 | 0.56 | 3800 |
| HD480M20 | 150 | 0.68 | 4800 |
| HD140M12 | 120 | 0.71 | 1296 |

It must be checked that the anchor fulfils the following formula: $\frac{F_{1,d}}{R_{anchor,d} \times k_r} \leq 1$

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




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

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

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

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**

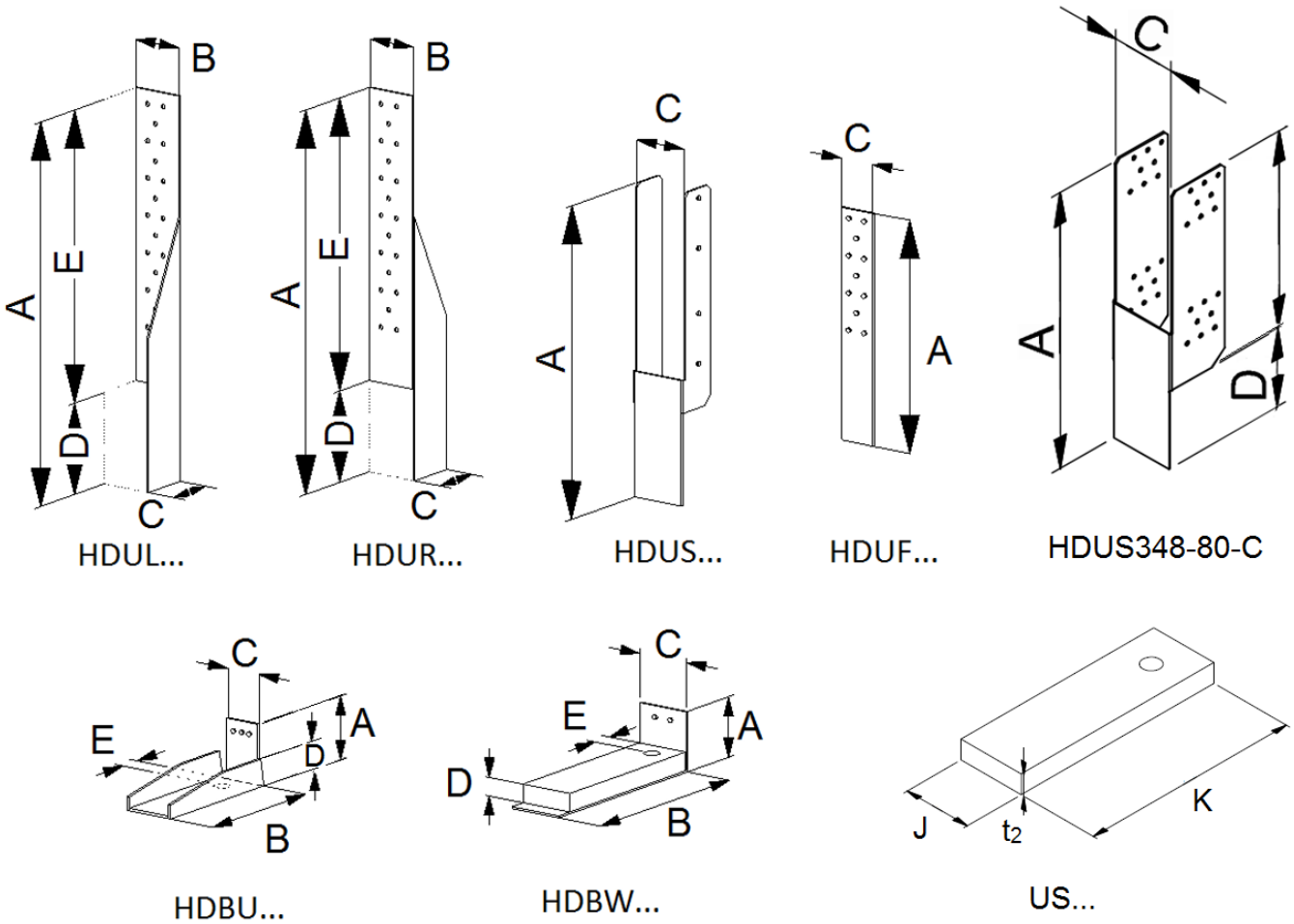


**Table D64-1: Size specification**

| 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 | 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 | 5 | 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 | Ø6 | 1 | Ø14 |
| HDBW160G | 65 | 182 | 50 | 15 | 27 | 2 | 15 | 50 | 160 | 2 | 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

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.

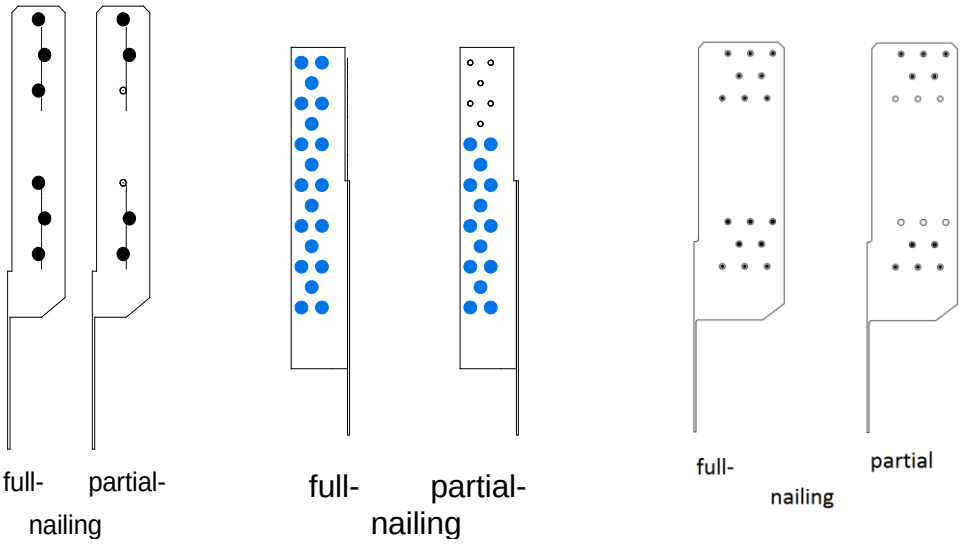
| Combinations | | upper parts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HDUF250 | HDUF400 | HDUS336 | HDUS348-80G | HDUL380 | HDUR380 | HDUL465 | HDUR465 | HDUF40X | HDUF60X |
| lower parts | HDBU163G | o | o | o | o | o | o | o | o | o | |
| | HDBU220G | | o | | o | 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**




| | 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<br>HDUF40XG | $\min\begin{Bmatrix} n_{ef} \times R_{lat.k} \\ 17.8\ kN/k_{mod} \end{Bmatrix}$ | |
| HDUF400G<br>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<br>HDUR380G<br>HDUL465G<br>HDUR465G<br>HDUL xx G<br>HDUR xx G | $\min\begin{Bmatrix} C \times R_{lat.k} \\ 21.4 \times R_{ax.k} \end{Bmatrix}$ with C = $\begin{cases} 11.7\ for\ full\ nailing \\ 8.1\ for\ partial\ nailing \end{cases}$ | |

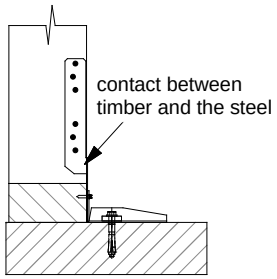



Table of capacities of lower parts:

| Model | Characteristic capacities (kN) $R_{1.k}$ | $R_{s.k}$ | Bolt factor $k_r$ | max $n_{sc}$ |
|---|---|---|---|---|
| HDBU163G | $\min\begin{Bmatrix} R_{s.k} / k_{mod} \\ V_{s.k} \times n_{sc} / k_{mod} \end{Bmatrix}$ | 13.7 | 1.55 | 2 |
| HDBU220G | | 34.6 | 1.4 | 3 |
| HDBU379G | | 16.7 | 1.46 | 2 |
| HDBW60G | | 19.8 | 2 | 2 |
| HDBW160G | | 21.2 | 1.24 | 2 |
| HDBW200G | | 23.4 | 1.23 | 3 |
| HDBU379-84-16G | $\min\begin{Bmatrix} R_{s.k} / k_{mod} \\ n_{sc} \times \left(\frac{1}{V_{s.k}} + \frac{0.035}{N_{s.k}}\right)^{-1} / k_{mod} \end{Bmatrix}$ | 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 $V_{s.k}$= 6.4 kN)

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

$n_{sc}$ = number of self-drilling screws

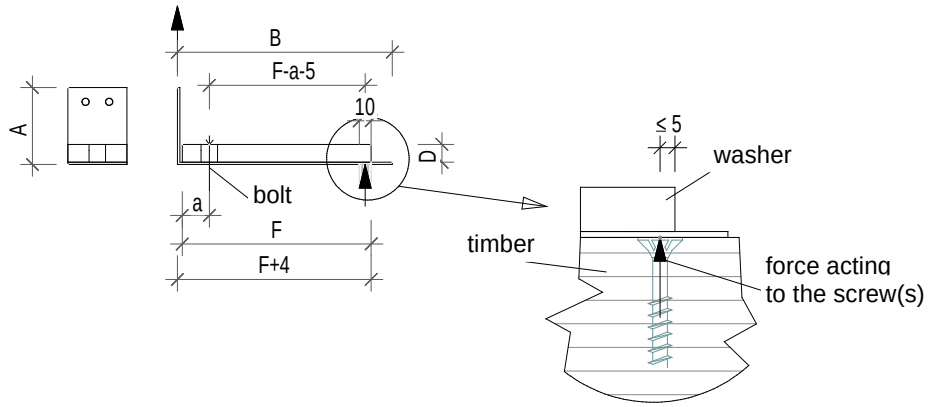
$R_{ax.k}$ = characteristic axial capacity of one nail in kN

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

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

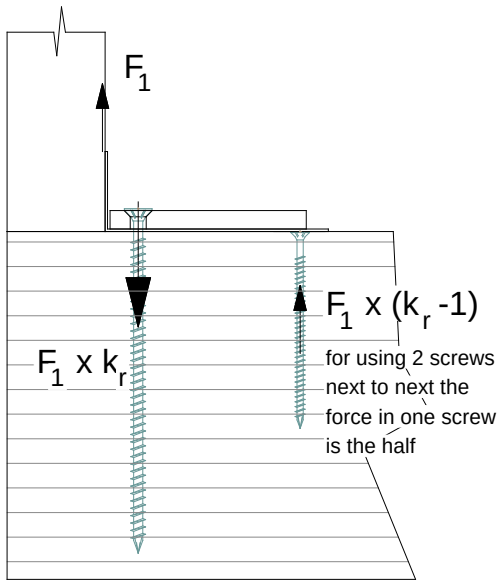
The different $\gamma_m$ for the screws are included in the formulas

**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.

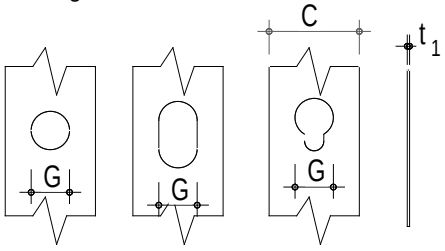
**A connection to the timber can also be occurring with a HDUFxx** next

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**

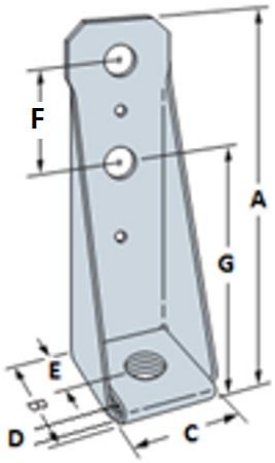



**Table D65-1: Size specification**

| 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<br>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**

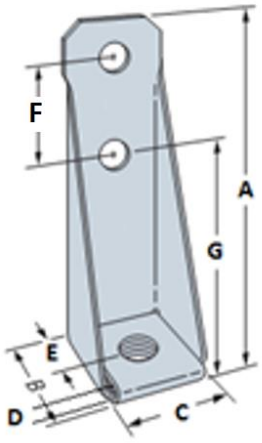


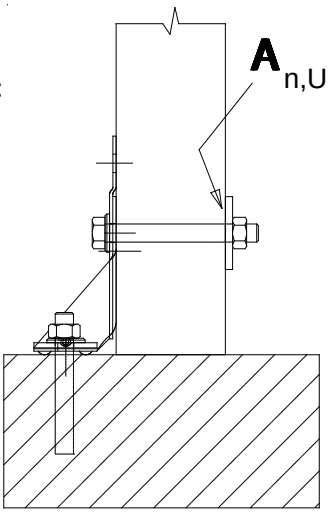

**Table D66-1: Size specification**

| 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<br>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**

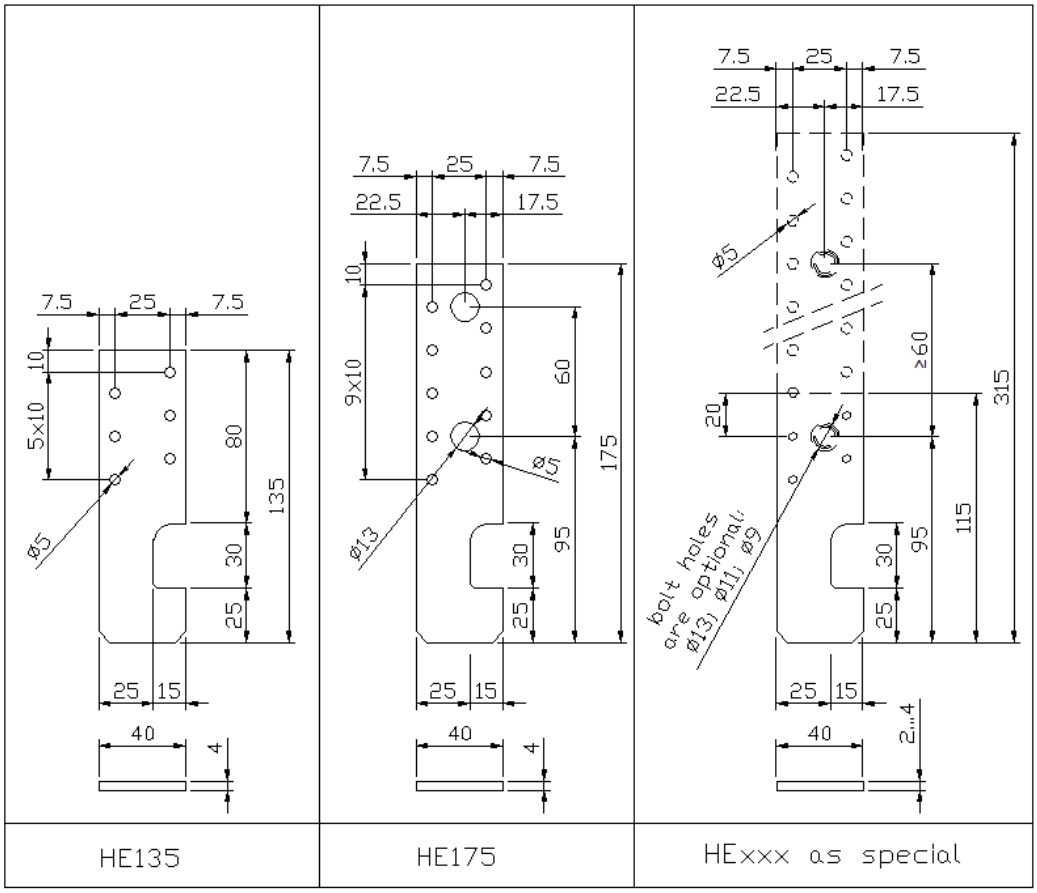



**Table D67-1: Size specification**

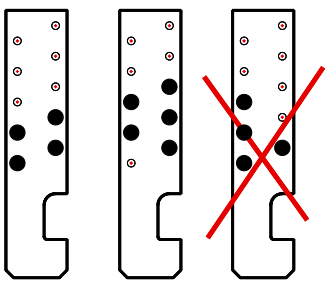
n/a

**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**:

| | 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:

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

$R_{lat.k}$ = 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**

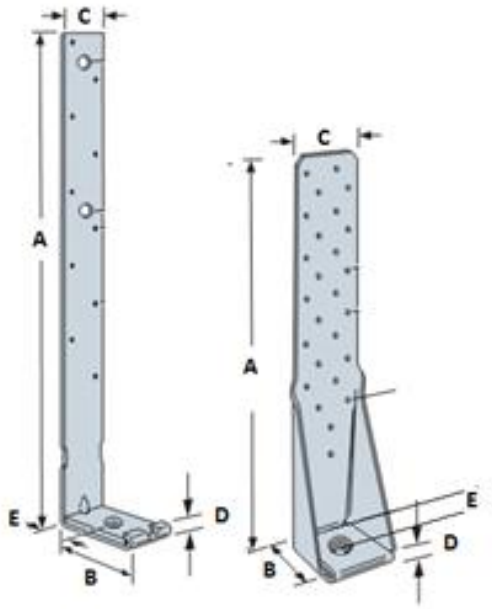
| no of nails | $l_p$ [mm²] | factor "C" |
|---|---|---|
| 3 | 800 | 3.0 |
| 4 | 1944 | 3.8 |
| 5 | 2230 | 4.4 |
| 6 | 2688 | 4.7 |
| 7 | 4557 | 6.1 |
| 8 | 5450 | 6.6 |
| 9 | 8278 | 8.0 |
| 10 | 9813 | 8.6 |

**Table 67-5**

| no of bolt | $l_p$ [mm²] | faktor "C" |
|---|---|---|
| 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<br>HTT5<br>HTT16<br>HTT22 &<br>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 |

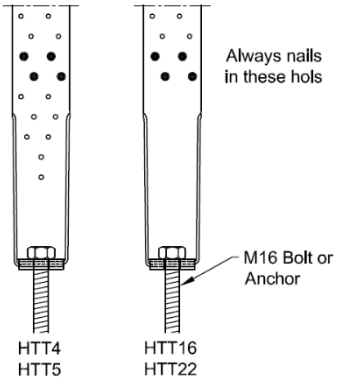
### Table D68-3: Characteristic capacity

### HTT4/5/16/22

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

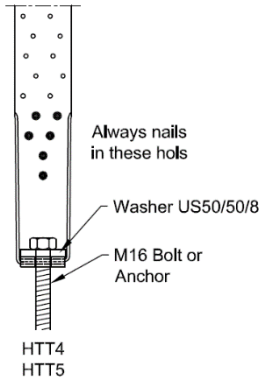
HTT4 & HTT5 &
HTT16 & HTT22
without Washer:

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




HTT4 & HTT5
with Washer:

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




HTT5 installed on 1,2 mm Light Gauge Steel with FPHSD34S1214R
Light Gauge Steel Framing Screws (fully Screwed = 26 pcs.) with Washer: $R_{1,k}$ = 43,7 kN

$R_{lat,k}$ = characteristic lateral load-carrying capacity of one nail
$R_{ax,k}$ = characteristic withdrawal capacity of one nail
$k_{mod}$ = load duration factor

n = number of nails

It must be checked, that the anchor fulfils the following formula: $\frac{F_{1,d}}{R_{anchor,d}} \leq 1$

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

**LTT20B**

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

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

$R_{lat,k}$ = 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 nails in the hold down

$R_{lat,k}$ the lateral capacity of the nails
$R_{ax,k}$ the axial capacity of the nails

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

When used with fasteners in big holes, at least the 3 oblongs and the first row of round hole must be filled with 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:

| | **HTT22F** | | **HTT22E** | |
|---|---|---|---|---|
| Type of fastener | *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:

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

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 D68-4: $K_{ser}$ 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 D68-5: $K_{ser}$ 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.

The connection of CLT panel to a rigid support with an HTT22 with CNA4.0x60 offers a mean ratio $D_{u,80\%} / D_y > 6$ ($D_{u,80\%} / D_y$ ratio disclosed in EN12512), therefore this connection has a high capacity to dissipate energy according to EN 1998-1:2004 §8 and is suitable for dissipative zone of DCH class building.

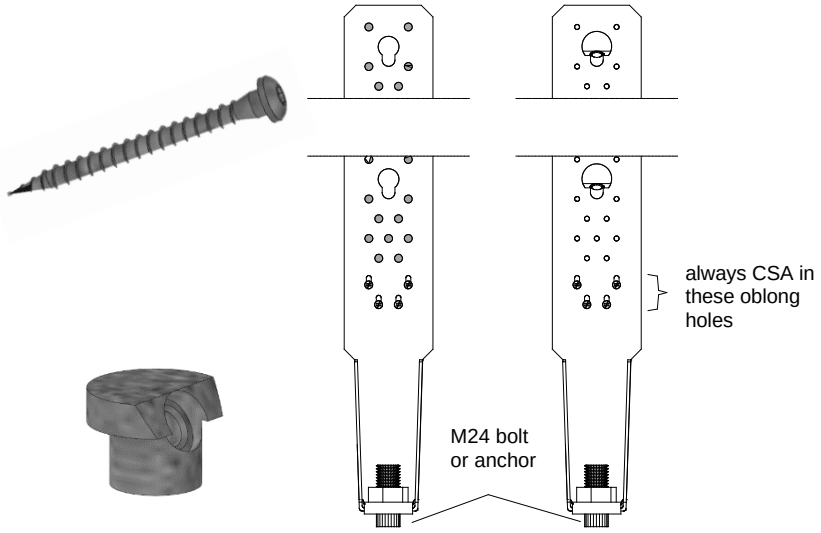
The connection of CLT panel to a CLT support with an HTT22 with CNA4.0x60 offers a mean ratio $4 < D_{u,80\%} / D_y < 6$, therefore this connection has a medium capacity to dissipate energy according to EN 1998-1:2004 §8 and is suitable

for dissipative zone of DCM class building. 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:

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




HTT31

For connection with Zyklop™:

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



With:

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

$n_z$ = number of ZYKT69 or ZYK10

$n_{ef}$ = eff. number of ZYKT69 or ZYK10 acc. to the ETA-07/0137

$R_{lat,k}$ = the lateral capacity of one fastener

$R_{ax,k}$ = the axial capacity of one fastener

$R_{k.ZYK}$ = 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-07/0317.

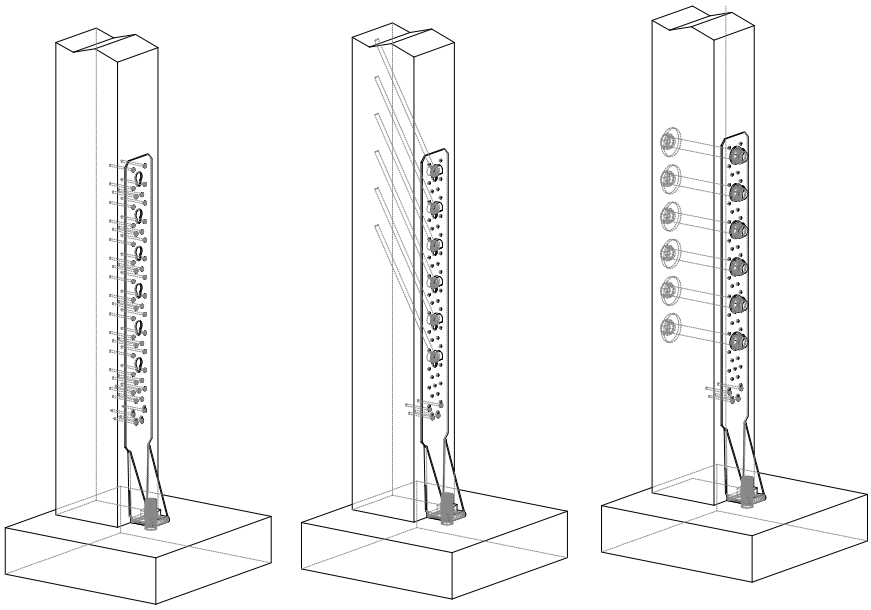
Stiffness of the connection with HTT31 :

**Table D60-6: $K_{ser}$ 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 oblong holes

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

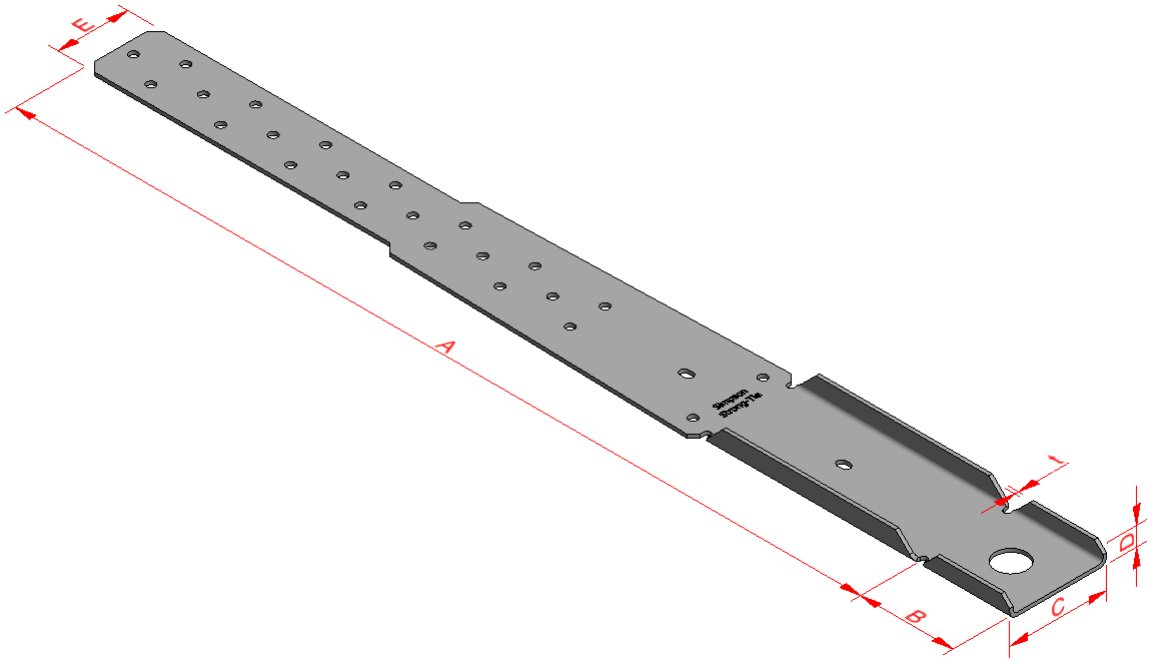


HTT31

## D69: MAH

| Product name | Alternative names |
|---|---|
| MAH | - |

**Table D69-1: Size specification**

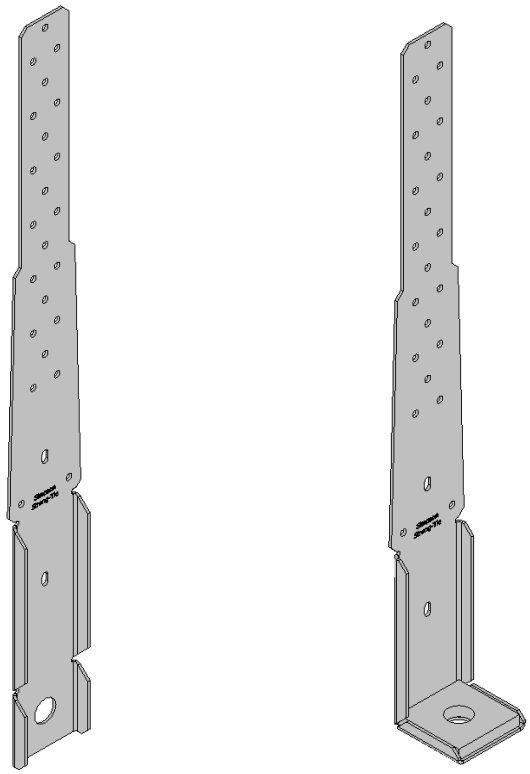



| Model | Product dimensions [mm] | | | | | | Holes | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Top | | Bottom | |
| | A | B | C | D | E | t | Qty | size | Qty | size |
| MAH485 | 484 | 53 | 55 | 12.2 | 40 | 2 | 23 | Ø5 | 1 | Ø18 |

**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 nails
- 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

:

| | 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 |

## D70: PROFA

| Product name | Alternative names |
|---|---|
| PROFA | |

**Figure D7-1: Drawings**

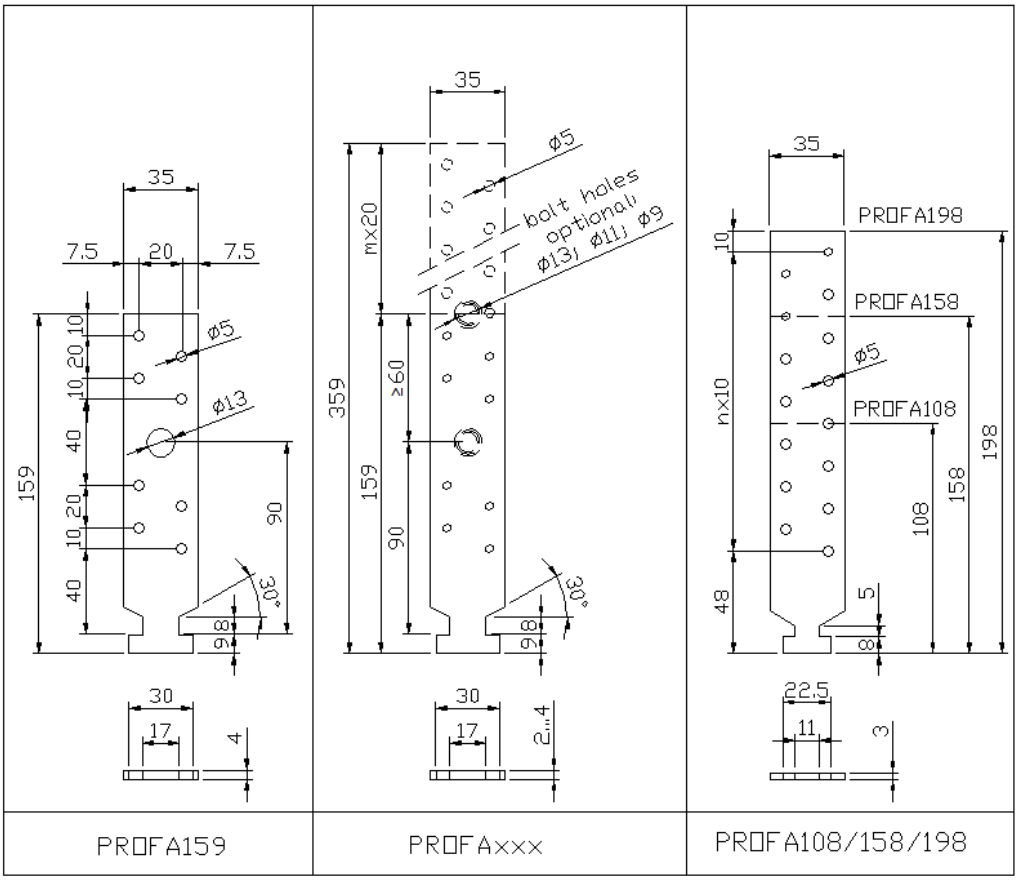
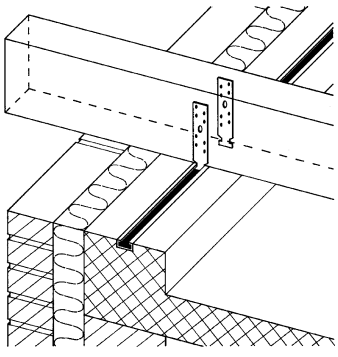



**Table D70-1: Size specification**
n/a

**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.

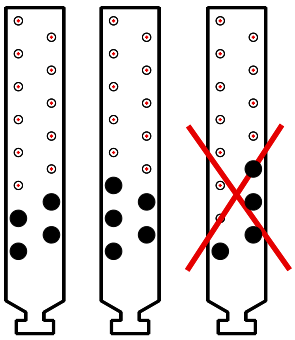


**Table D70-4: Characteristic capacity**

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

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

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

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

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

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

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

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

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

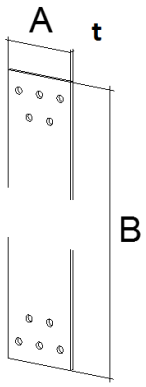
n = number of the nails / connector screws; the nails will be used side by side.
$R_{lat.k}$ = characteristic lateral capacity of the fasteners / bolt M12
$k_{mod}$ = load-duration factor

## 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**



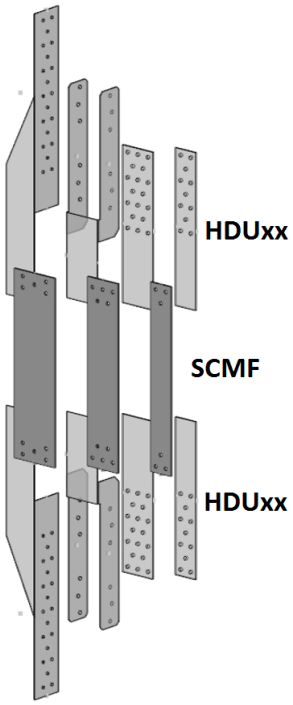




**Table D71-1: Size specification**

| 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 |

**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**

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 below.

| | | | 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 |

$V_{R.k}$ = characteristic Capacity of self-tapping screws (for EJOT JT2-3-5.5*25 $V_{R.k}$ = 6.4 kN)
$n_{sc}$ = number of self-drilling screws
$R_{s.k}$ = steel cross section capacity given in the table