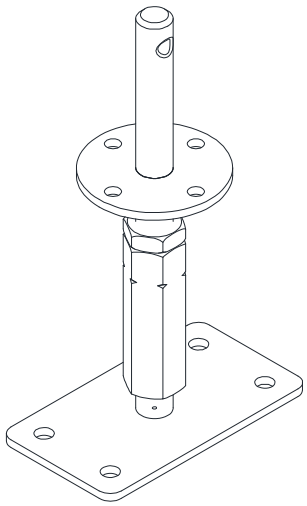
Design example, Post support joint D aBv 19613201

Post, joint



Post NH C24 14/14

Planned distance of the end-grain end from the floor: a ≈ 200 mm

Service class 2 (Post under roof and protected from the weather, water spray)

Combinations of actions

1 Combination of self-weight and snow, k_{mod} = 0.9

Compressive force $F_{1,c,Ed}$ = 31.2 kN

2 Combination of self-weight and wind, k_{mod} = 1.0

Tensile force $F_{1,t,Ed}$ = 2.47 kN Horizontal force $F_{2/3}$ and $F_{4/5}$ = 0.78 kN

If correct arrangement of the post support is not checked in the place of installation, the horizontal load should be assumed to be n the most unfavourable constellation.

Properties and requirements of the post support from table

Column base		Fasteners	Post		Maximum spacings		
Type	Art.No.		min w	min h	max a	$e_{2/3}$	$e_{4/5}$
			mm	mm	mm	mm	mm
D aBv	19613201	4 screws ∅10x120	120	120	236	236	236

Specified fasteners

• 4 screws ∅10x120 to EN 14592 with thread length $l_{ef} \geq 100$ mm

→ e.g. GH timber screw HS+ ∅10x200 with l_{ef} = 100 mm

or hex head wood screws to DIN 571 ∅10x180 with $l_{ef} = 0.6 \cdot 180 = 108$ mm

The screws are to be screwed into predrilled holes.

Specified minimum cross-section of the post

b/h =14/14 > min b/h = 12/12 ✓

Maximum spacings

a = 200 mm < max a = 236 mm ✓

Load-carrying capacities of the post support from the table and strength verifications

Columne base		$F_{1,c}$ - compression			$F_{1,t}$ - tension			$F_{2/3}$			$F_{4/5}$		
Type	Art.No.	Timber	Steel		Timber	Steel		Timber	Steel		Timber	Steel	
		$F_{1,c,Rk,Holz}$	$F_{1,c,Rk,Stahl}$	$\gamma_{M,Stahl}$	$F_{1,t,Rk,Holz}$	$F_{1,t,Rk,Stahl}$	$\gamma_{M,Stahl}$	$F_{2/3,Rk,Holz}$	$F_{2/3,Rk,Stahl}$	$\gamma_{M,Stahl}$	$F_{4/5,Rk,Holz}$	$F_{4/5,Rk,Stahl}$	$\gamma_{M,Stahl}$
D aBv	19613201 [b]	129	59,2 [1] 44,3	1,00 1,10	16,3 [d]	6,66	1,00	8,36 [5]	1,66	1,25	8,36 [5]	1,66	1,25

Design value of the load-carrying capacities for action combination 1

[b] The thickness of the baseplate is 6 mm → the reduction factors [1] and [5] are to be taken into consideration!

$F_{1,c,Rd}$ = min {$k_{mod} \cdot F_{1,c,Rk,timber} / \gamma_{M,timber}$; $F_{1,c,Rk,steel} / \gamma_{M,Stahl}$} = min {0.9 · 129 / 1.3 ; 0.67 · 59.2 / 1.0 ; 44.3 / 1.1}
= 39.7 kN

Verification of the load-carrying capacity for action combination 1

$F_{1,c,Ed} / F_{1,c,Rd}$ = 31.2 / 39.7 = 0.79 ✓

Design value of the load-carrying capacities for action combination 2

[d] An increase in resistance (load-carrying capacity) of the timber joint does not affect the overall resistance here, as the overall resistance is limited by the steel's resistance.

$F_{1,t,Rd}$ = min {$k_{mod} \cdot F_{1,t,Rk,Timber} / \gamma_{M,Timber}$; $F_{1,t,Rk,Steel} / \gamma_{M,steel}$} = min {1.0 · 16.3 / 1.3 ; 6.66 / 1.0} = 6.66 kN

$F_{2/3,Rd}$ = $F_{4/5,Rd}$= min {$k_{mod} \cdot F_{2/3,Rk,\ timber} / \gamma_{M,timber}$; $F_{2/3,Rk,steel} / \gamma_{M,steel}$} = min {1.0 · 0.84 · 8.36 / 1.3 ; 1.66 / 1.25}
= 1.33 kN

Verification of the load-carrying capacity for action combination 2

$F_{1,t,Ed} / F_{1,t,Rd} + F_{2/3,Ed} / F_{2/3,Rd}$ = 2.47 / 6.66 + 0.78 / 1.33 = 0.96 ✓

Loading of the anchor bolts

4 anchor bolts ∅12 mm

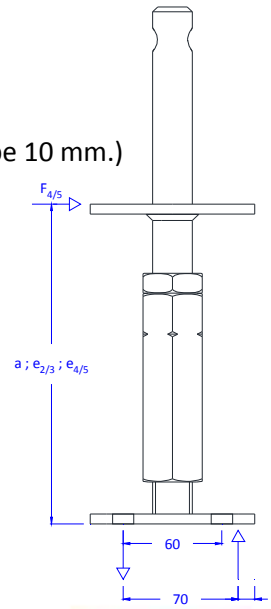
Action combination 1

No loading of the anchor bolts, as the compressive force is transferred through the footplate and into the substrate.

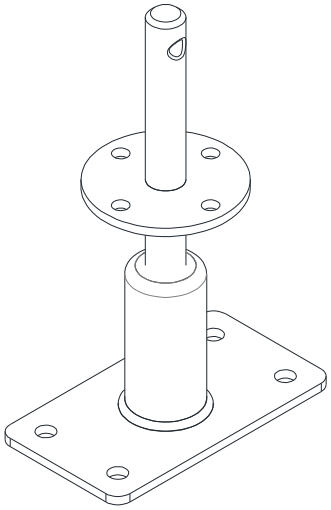
Action combination 2

If correct arrangement of the post support is not checked in the place of installation, the load of the anchor bolt should be determined using the most unfavourable constellation. Further, it is recommended that the anchor bolt load then be determined with the maximum spacing $e_{2/3}$ or $e_{4/5}$.

- Tensile load on the anchor bolts due to load $F_{1,t,Ed}$ and eccentric load $F_{4/5,Ed}$
  $F_{ax,Bo,Ed} = F_{1,t,Ed} / 4 + F_{4/5,Ed} / 2 \cdot e_{4/5} / 70$ mm = 2.47 / 4 + 0.78 / 2 · 236 / 70 = 1.93 kN
  (The distance between the rotation point and the member edge was assumed to be 10 mm.)
- Lateral load of the anchor bolt due to load $F_{4/5,Ed}$
  $F_{lat,Bo,Ed} = F_{4/5,Ed} / 4$ = 0.78 / 4 = 0.20 kN



Design example, Post support joint D aBv 19823130



Post, joint

Post NH C24 14/14

Planned distance of the end-grain end from the floor: a ≈ 200 mm

Service class 3 (weathering of the post possible)

Combinations of actions

1 Combination of self-weight and snow, k_{mod} = 0.7

Compressive force $F_{1,c,Ed}$ = 43.2 kN

2 Combination of self-weight and wind, k_{mod} = 0.8

Tensile force $F_{1,t,Ed}$ = 1.18 kN Horizontal force $F_{2/3}$ and $F_{4/5}$ = 0.98 kN

If correct arrangement of the post support is not checked in the place of installation, the horizontal load should be assumed to be n the most unfavourable constellation.

Properties and requirements of the post support from table

Column base		Fasteners	Post		Maximum spacings		
Type	Art.No.		min w	min h	max a	$e_{2/3}$	$e_{4/5}$
			mm	mm	mm	mm	mm
D aBv	19823130	4 screws ∅10x120 (Load case $F_{1,t}$: +1 dowel ∅10)	120	120	210	210	210

Specified fasteners

- 4 screws ∅10x120 to EN 14592 with thread length $l_{ef} \geq 100$ mm

  Hot-dip galvanised hex head wood screws to DIN 571 ∅10x180 with $l_{ef} = 0.6 \cdot 180 = 108$ mm
- 1 dowel ∅10x140 S235 hot-dip galvanised for loading by load $F_{1,t}$

Hot-dip galvanised fasteners are required due to service class 3.

The screws are to be screwed into predrilled holes.

Specified minimum cross-section of the post

b/h =14/14 > min b/h = 12/12 ✓

Maximum spacings

a = 200 mm < max a = 210 mm ✓

Load-carrying capacities of the post support from the table and strength verifications

Column base		$F_{1,c}$ - compression			$F_{1,t}$ - tension			$F_{2/3}$			$F_{4/5}$		
Type	Art.-No.	Timber	Steel		Timber	Steel		Timber	Steel		Timber	Steel	
		$F_{1,c,Rk,Holz}$	$F_{1,c,Rk,Stahl}$	$\gamma_{M,Stahl}$	$F_{1,t,Rk,Holz}$	$F_{1,t,Rk,Stahl}$	$\gamma_{M,Stahl}$	$F_{2/3,Rk,Holz}$	$F_{2/3,Rk,Stahl}$	$\gamma_{M,Stahl}$	$F_{4/5,Rk,Holz}$	$F_{4/5,Rk,Stahl}$	$\gamma_{M,Stahl}$
D aBv	19823130[b)]	129	95,5	1,25	6,36[c)]	6,66[c)]	1,00	7,67[5)]	2,01	1,00	7,67[5)]	1,55	1,00

Design value of the load-carrying capacities for action combination 1

[b)] The thickness of the baseplate is 6 mm → the reduction factor [5)] must be taken into consideration!

$F_{1,c,Rd}$ = min {k_{mod} · $F_{1,c,Rk,timber}$ / $\gamma_{M,timber}$; $F_{1,c,Rk,steel}$ / $\gamma_{M,steel}$} = min {0.7 · 129 / 1.3 ; 95.5 / 1.25} = 69.5 kN

Verification of the load-carrying capacity for action combination 1

$F_{1,c,Ed}$ / $F_{1,c,Rd}$ = 43.2 / 69.5 = 0.62 ✓

Design value of the load-carrying capacities for action combination 2

$F_{1,t,Rd}$ = min {k_{mod} · $F_{1,t,Rk,\ timber}$ / $\gamma_{M,timber}$; $F_{1,t,Rk,steel}$ / $\gamma_{M,steel}$} = min {0.8 · 6.36 / 1.3 ; 6.66 / 1.0} = 3.91 kN

$F_{2/3,Rd}$ = $F_{4/5,Rd}$= min {k_{mod} · $F_{2/3,Rk,\ timber}$ / $\gamma_{M,timber}$; $F_{2/3,Rk,steel}$ / $\gamma_{M,steel}$} = min {0.8 · 0.84 · 7.67 / 1.3 ; 1.55 / 1.0}
= 1.55 kN

The more unfavourable of the two load cases $F_{2/3}$ and $F_{4/5}$ is used for the resistance analysis.

Verification of the load-carrying capacity for action combination 2

$F_{1,t,Ed}$ / $F_{1,t,Rd}$ + $F_{2/3,Ed}$ / $F_{2/3,Rd}$ = 1.18 / 3.91 + 0.98 / 1.55 = 0.93 ✓

Loading of the anchor bolts

4 anchor bolts ∅12 mm

Action combination 1

No loading of the anchor bolts, as the compressive force is transferred through the footplate and into the substrate.

Action combination 2

If correct arrangement of the post support is not checked in the place of installation, the load of the anchor bolt should be determined using the most unfavourable constellation. Further, it is recommended that the anchor bolt load then be determined with the maximum spacing $e_{2/3}$ or $e_{4/5}$.

- Tensile load on the anchor bolts due to load $F_{1,t,Ed}$ and eccentric load $F_{4/5,Ed}$
  $F_{ax,Bo,Ed}$ = $F_{1,t,Ed}$ / 4 + $F_{4/5,Ed}$ / 2 · $e_{4/5}$ / 70 mm = 1.18 / 4 + 0.98 / 2 · 210 / 70 = 1.77 kN
  (The distance between the rotation point and the member edge was assumed to be 10 mm.)
- Lateral load of the anchor bolt due to load $F_{4/5,Ed}$
  $F_{lat,Bo,Ed}$ = $F_{4/5,Ed}$ / 4 = 0.98 / 4 = 0.25 kN