

Installation of BOLDA® Column Shoe

Precast factory – Casting of BOLDA® Column Shoe

Identification of the product

BOLDA® Column Shoes are available in standard models (30, 36, 39, 45 and 52) analogous to M-thread sizes of the PPM® High-Strength Anchor Bolts or COPRA® Anchoring Couplers. The model of column shoe can be identified by the name in the label on the product and also according to the color of the product. Color codes are shown in the table hereafter. Color codes of recess boxes are corresponding to the color codes of BOLDA® Column Shoes.

BOLDA® Column Shoe with corresponding recess box.

Column Shoe	Anchor Bolt	Corner recess	Middle recess	Color code
BOLDA 30	PPM 30 / COPRA 30	BOLDA 30 CBOX	BOLDA 30 MBOX	Black
BOLDA 36	PPM 36 / COPRA 36	BOLDA 36 CBOX	BOLDA 36 MBOX	Red
BOLDA 39	PPM 39 / COPRA 39	BOLDA 39 CBOX	BOLDA 39 MBOX	Brown
BOLDA 45	PPM 45 / COPRA 45	BOLDA 45 CBOX	BOLDA 45 MBOX	Violet
BOLDA 52	PPM 52 / COPRA 52	BOLDA 52 CBOX	BOLDA 52 MBOX	White

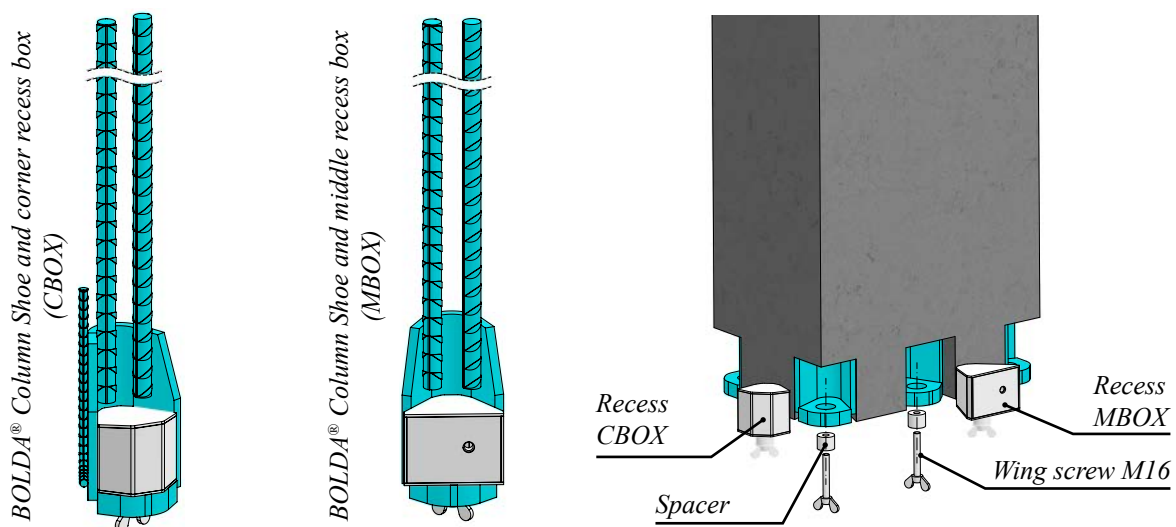
Installation of the column shoes

BOLDA® Column Shoes are placed into the reinforcement of the column and fixed through their base plates to the end plate of the mold with recess boxes. Installation tolerance of column shoe in crosswise direction of the column is ± 2 mm. Supplementary reinforcement must be placed at the area of column base, according to drawings (Technical Manual Annex A). After casting the column, boxes are removed from shoes and voids are checked that they are clean from concrete.

Recess boxes are fixing accessories used to form pockets in concrete column for anchor bolts. There are separate recess boxes available for all types of column shoes and depending on the column shoe position in column's cross-section:

- CBOX is used with column shoes fixed in corner of the column
- MBOX is used with column shoes fixed in middle of the column

Recess boxes enable the shoes to be fastened and positioned to the end plate of the mold. The wing screw M16, which comes with a spacer equal to the size of the column shoe's bolt hole, is used for fixing. With the help of the spacer, the shoe can be fixed to the correct place in the end plate. Environmental friendly formers are very durable and re-usable. It is recommended to maintain them to achieve long operating life.

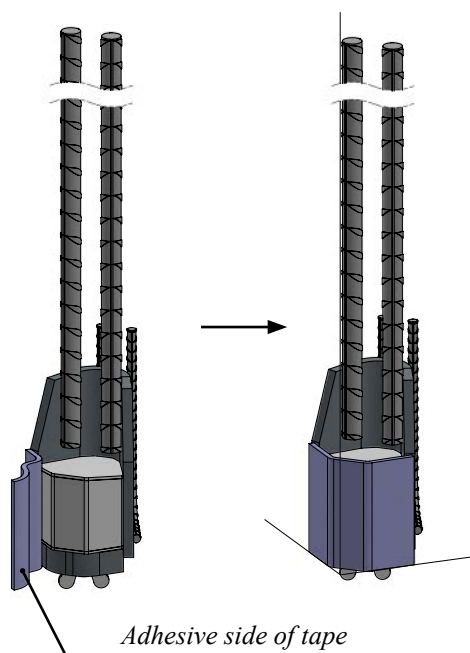


Recess boxes for corner and middle position of BOLDA® Column Shoe.

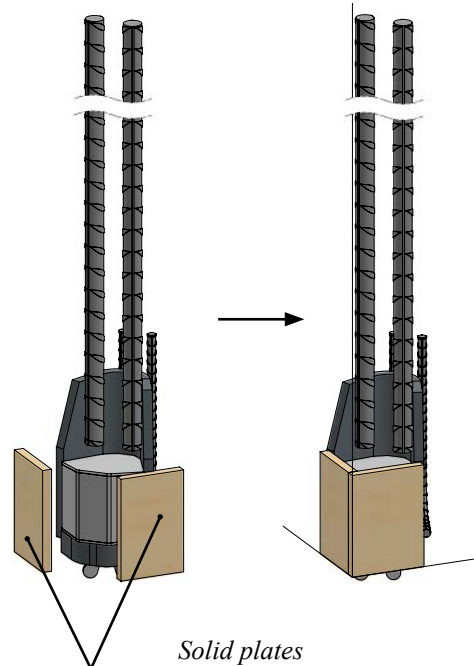
To ensure higher values of concrete cover thicknesses of the main anchor bars in accordance with chapter 1.2.3 of the technical manual, follow these instructions for increased values Δ_c of concrete cover:

- If $\Delta_c < 5\text{mm}$, there is no special request for recess boxes; instructions are same as for standard concrete cover of column shoes. The gap is too small to be filled up with concrete. However if the gap is filled or partially filled, the concrete shell can be easily crushed after removing mold.
- If $5\text{ mm} \leq \Delta_c \leq 10\text{mm}$, self-adhesive foam tape or equivalent can be used to prevent the fill up of the gap. Foam tape of corresponding thickness Δ_c is fixed on two sides of the recess box.
- If $\Delta_c > 10\text{mm}$, to prevent the concrete to fill up the gap, it is recommended to use some kind of solid plate – e.g. plywood or hardened polystyrene of corresponding thickness Δ_c . These plates can be fixed to the surface of the mold.

Use of self-adhesive foam tape to prevent the gap from filling up with concrete.

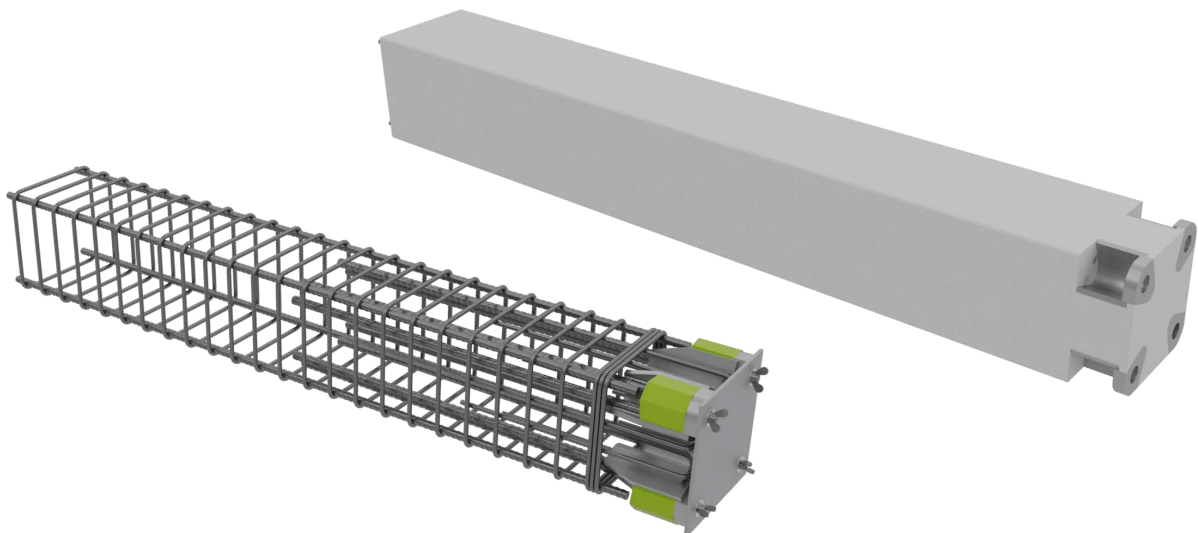


Use of solid plates to prevent the gap from filling up with concrete.



Ensure thicker concrete cover if using self-adhesive foam tape or solid plates

BOLDA® Column Shoes before and after casting.



Construction site – Assembling the connection

Identification of the product

BOLDA® Column Shoes are available in standard models (30, 36, 39, 45 and 52) analogous to PPM® High-Strength Anchor Bolts or COPRA® Anchoring Coupler M-thread sizes. The model of column shoe can be identified by the name in the label on the product and also according to the color of the product. Color codes are shown in the table hereafter.

BOLDA® Column Shoe color identification.

Column Shoe	Color code	Anchor Bolt	Installation template
BOLDA 30	Black	PPM 30 / COPRA 30	PPL 30
BOLDA 36	Red	PPM 36 / COPRA 36	PPL 36
BOLDA 39	Brown	PPM 39 / COPRA 39	PPL 39
BOLDA 45	Violet	PPM 45 / COPRA 45	PPL 45
BOLDA 52	White	PPM 52 / COPRA 52	PPL 52

Erection of precast column

1. To level precast concrete column

Before erecting the column, upper nuts and washers are removed from anchor bolts. Lower leveling nuts and washers are adjusted at the correct level. The column is erected directly on the pre-leveled washers and nuts.

In alternative method shim plates are placed between anchor bolts and adjusted at the proper level. Lower leveling nuts must be leveled at least 5 mm under the top level of shims to secure that column will rest first on the shims. This method is recommended for heavier columns for easier and faster alignment of the column.

2. To align precast concrete column

Upper nuts and washers are screwed on the bolts and column is aligned in the vertical position by leveling nuts. It is practical to use long builder's spirit level, optical or laser level or two theodolites from different directions to ensure verticality. Adequate torque can be achieved typically by 10-15 impacts of a slog ring spanner (DIN 7444), combination spanner or open ended slogging spanner (DIN 133) and 1.5 kg sledgehammer.



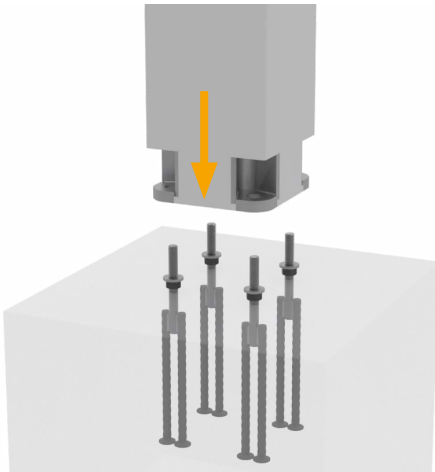
3. To grout joint and recesses

Before loading the column by any other structures e.g. beams or columns, the joint underneath the column and bolt recesses must be grouted by following instructions of the grout supplier. The grout must be non-shrink grade and strength according to plans. To avoid air being trapped in the joint, it is recommended to pour grout from one side of the column only. Grouting formwork is made so that adequate concrete cover for column shoes and anchor bolts is achieved.

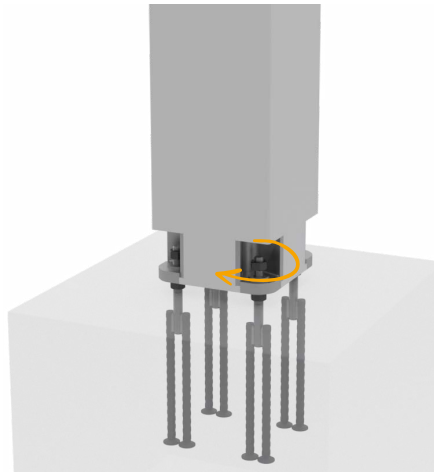
After grout has reached sufficient strength, the connection is finalized and joining structures may be erected on the column.

Erection of a precast concrete column step by step

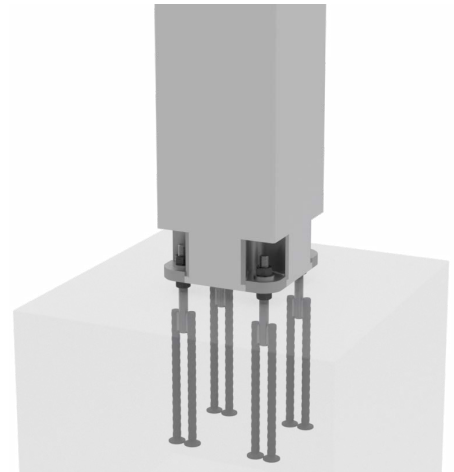
The column is installed directly on the pre-leveled washers and nuts.



The upper nuts and washers are screwed onto the bolts.



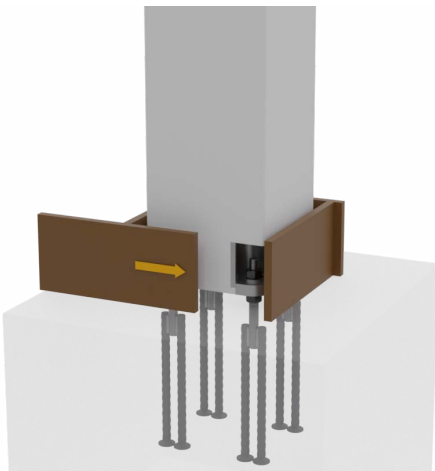
After the nuts are tightened, the crane can be released.



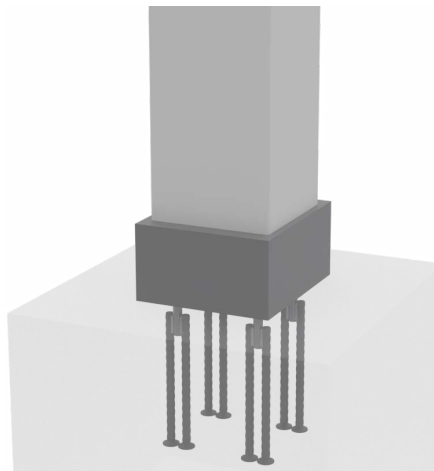
NOTE!

The open joint must be grouted, and the grout has to reach its designed strength before the column is loaded by other structures.

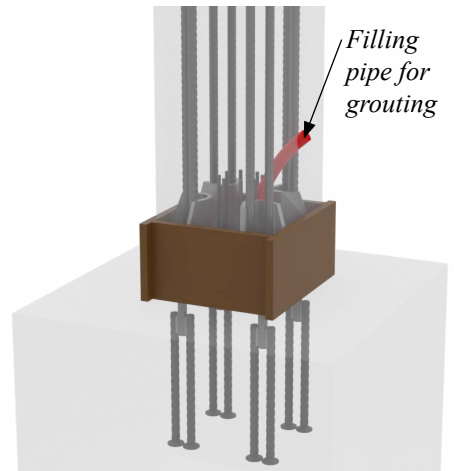
Formwork for grouting the joint and recesses.



Finalized connection after grouting has hardened.



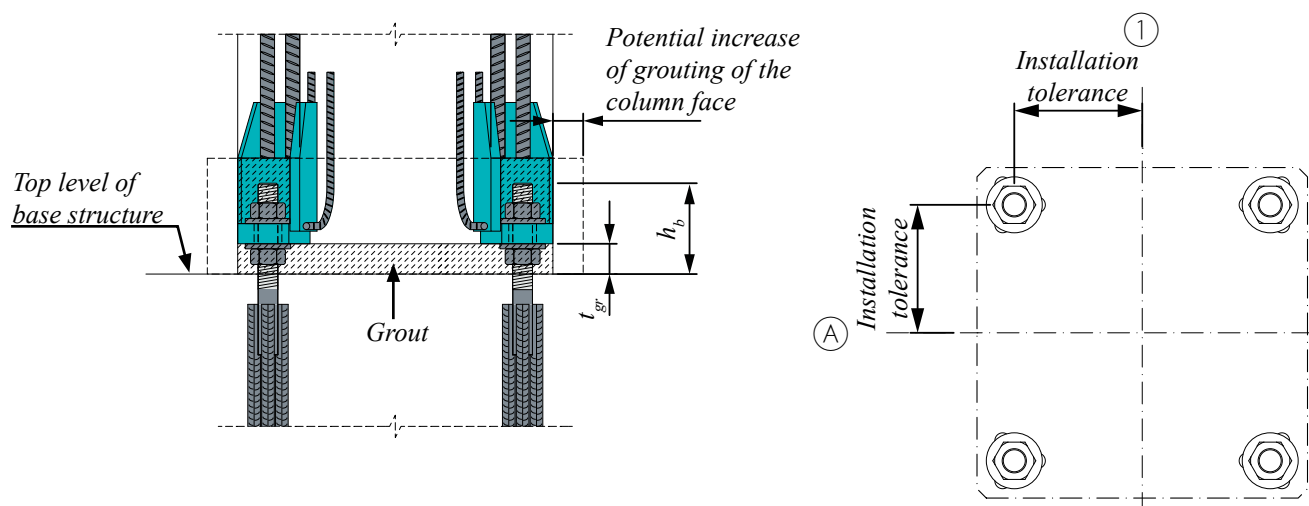
Alternative where grouting is aligned with column face.



Filling pipe for grouting

In column to foundation connections wider grouting can be provided to ensure higher concrete cover if it is required. It is recommended to increase the cover in aggressive environment.

Installation tolerances and the anchor bolt's protrusion from the surface of concrete when BOLDA® Column Shoes are used.



Column Shoe	BOLDA 30	BOLDA 36	BOLDA 39	BOLDA 45	BOLDA 52
Anchor Bolt	PPM 30	PPM 36	PPM 39	PPM 45	PPM 52
Thickness of grouting t_{gr} [mm]	50	55	60	65	70
Protrusion of bolt h_b [mm] ¹⁾	135	160	175	190	220
Installation tolerance for the bolt [mm]	±3	±4	±4	±4	±5

¹⁾ Anchor bolt protrusions h_b are guideline values and they are valid for grout thicknesses and corresponding BOLDA® Column Shoe in the table.