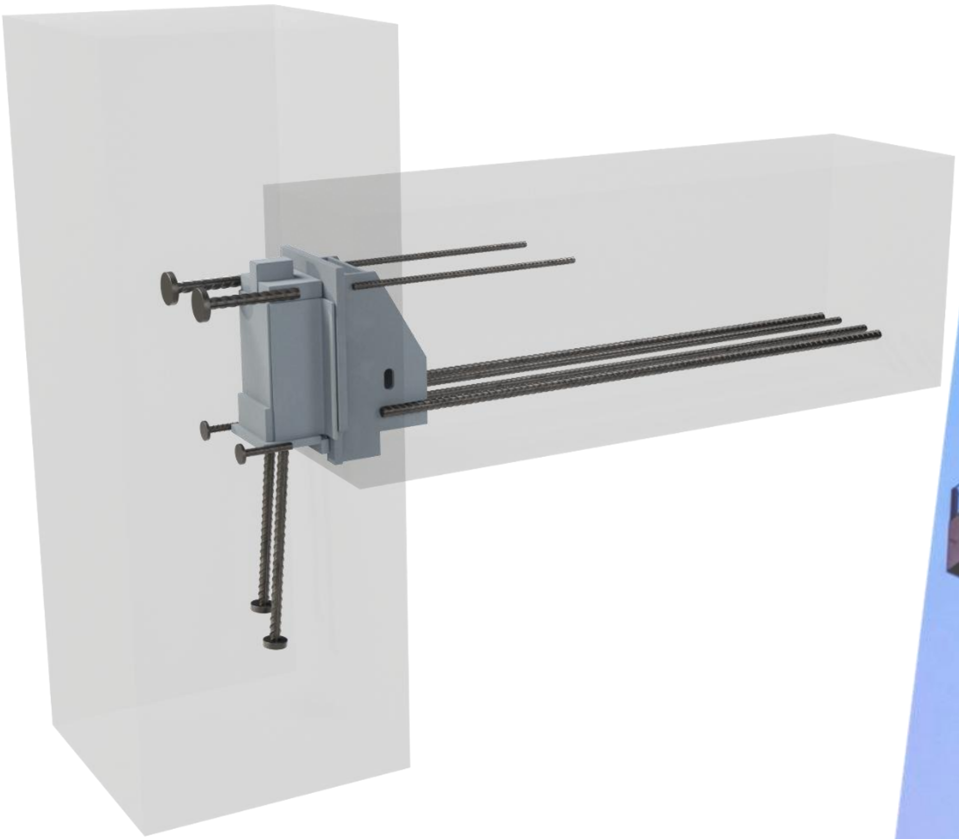
RSTEEL®



PINCOR® Hidden Corbel

Technical manual

Version: **25.02.2026**

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1. DESCRIPTION OF THE SYSTEM

Hidden corbels are fastening components that are used to create hidden connections for precast beams to precast columns. The corbels can also be used to create connections for steel box beams to precast columns when the detailing of the end of the steel box beam is compatible with the detailing of the hidden corbel.

The corbels transfer beam forces to columns, both during erection as well as in service. **In relation to bending moment, the corbels are pinned connections at the ends of the beams.** The corbels can transfer torsion from the end of the beam to the column, which provides the possibility to install hollow core slabs to one side of the beam without additional temporary work support. The corbels have built-in restraints against the opening of the joint and are capable of transferring horizontal loads. This can be taken advantage of in robust design.

The hidden corbels are formed from three parts: the column part, the beam part and the interconnecting Lock part. The erection pack plate allows the end of the beam to be vertically adjusted. The gap between the column face and the end of the beam is left ungrouted. **The corbels cannot be used for transferring bending moments from the end of the beam.**

2. MATERIALS AND DIMENSIONS

Table 1. Materials and standards for the individual parts of the PINCOR®

Part	Material	Standard
Plates	S355J2	EN 10025
Rebars	B500B	EN 10080 (SFS 1300)

Hidden corbel part dimensions (column part, beam part, Lock part) and related figures are given below.

Table 2. PINCOR®-Column part dimensions

Dimensions [mm]	"-200/t1"	"-200/t3"	"-400"	"-600"	"-800"	"-1100"	Tolerances
h	521	506	585	710	835	1035.5	-
h*	137.5	122.5	197.5	247.5	297.5	372.5	±0.5
w	184	184	204	224	225	246	-
w*	84	84	104	124	125	146	±0.5
l	215	215	225	235	248	258	-
t	30	30	30	30	30	30	-
Rebar lower	2×Ø12	2×Ø12	2×Ø16	2×Ø20	2×Ø25	2×Ø32	-
l_1	307	307	311	386	461	586	±5
w_1	40	40	50	60	60	70	-
Rebar upper	2×Ø16	2×Ø16	2×Ø20	2×Ø20	2×Ø25	2×Ø25	-
l_2	130	130	130	130	132	130	±5
w_2	102	102	126	146	152	173	-
Rebar middle	2×Ø12	2×Ø12	2×Ø12	2×Ø12	2×Ø12	2×Ø12	-
l_3	60	60	60	60	60	60	±5
w_3	124	124	144	164	165	186	-
Weight [kg]	7.0	6.8	10.2	13.5	18.6	28.7	-
Color code	Deep Orange (RAL 2011)	Signal Violet (RAL 4008)	Traffic Red (RAL 3020)	Light Grey (RAL 7035)	Sulfur Yellow (RAL 1016)	Signal Green (RAL 6032)	

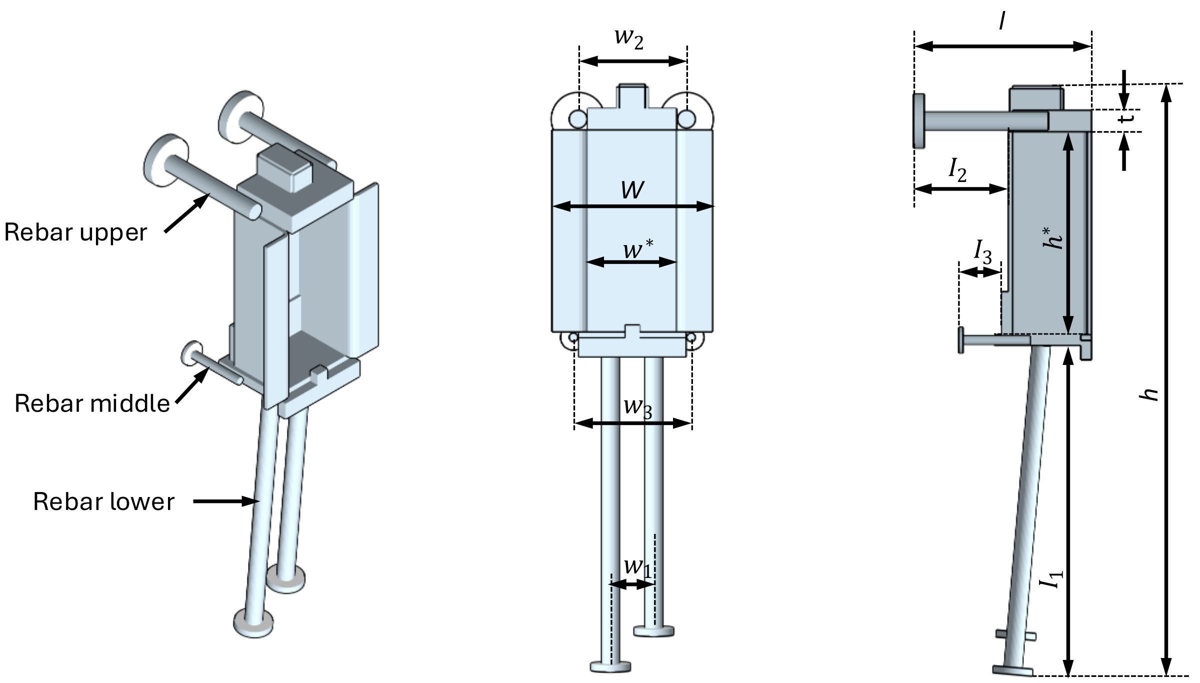


Figure 1. PINCOR®-Column part dimension markings

Table 3. PINCOR®-Lock part dimensions

Dimensions [mm]	"-200/t1"	"-200/t3"	"-400"	"-600"	"-800"	"-1100"	Tolerances
h	180	165	240	290	340	415	-
h*	100	80	165	215	265	340	±0.5
w	100	100	120	140	142	164	-
w*	80	80	100	120	120	140	±0.5
l	135	140	147	161	175	195	-
t	16	16	20	25	30	35	-
t_p (nom.)	20	20	20	20	20	20	-
Weight [kg]	4.9	4.8	8.8	14.6	20.2	31.8	-
Color code	Deep Orange (RAL 2011)	Signal Violet (RAL 4008)	Traffic Red (RAL 3020)	Light Grey (RAL 7035)	Sulfur Yellow (RAL 1016)	Signal Greeen (RAL 6032)	

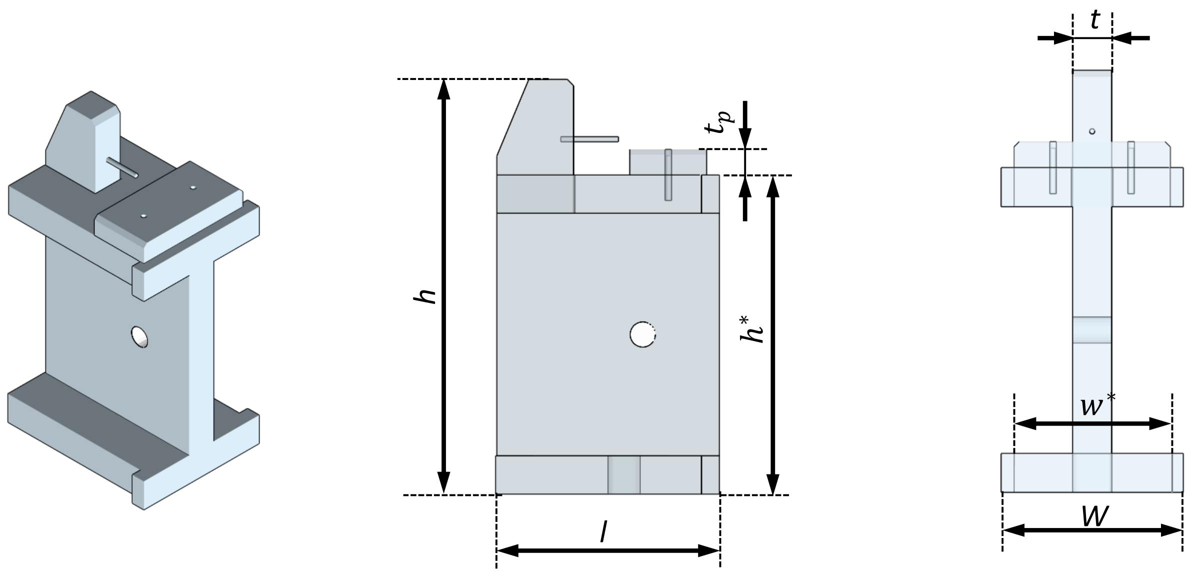


Figure 2. PINCOR®-Lock part dimension markings

Table 4. PINCOR®-Beam part dimensions

Dimensions [mm]	"-200/t1"	"-200/t3"	"-400"	"-600"	"-800"	"-1100"	Tolerances
h	247	200	312	362	412	495	-
h*	155	135	220	270	320	395	±0.5
w	200	200	220	240	243	266	-
w*	84	84	104	124	125	146	±0.5
l	751	946	873	1222	1371	1491	-
t	10	15	12	16	20	25	-
Rebar lower	2×Ø16	3×Ø16	4×Ø16	2×Ø20+2×Ø16	4×Ø20	4×Ø25	-
l_1	625	815	720	1040	1135	1245	±5
h_1	84	84	84	84	84	82.5	-
w_1	143	143	165	187	190	222	-
Rebar upper	2Ø12	2Ø12	2Ø12	2Ø12	2Ø12	2Ø12	-
l_2	390	390	390	390	390	390	±5
h_2	204	162	269	319	369	444	-
w_2	138	138	158	178	181	208	-
Weight [kg]	10.7	12.2	17.9	28	38.5	58.5	-
Color code	Deep Orange (RAL 2011)	Signal Violet (RAL 4008)	Traffic Red (RAL 3020)	Light Grey (RAL 7035)	Sulfur Yellow (RAL 1016)	Signal Green (RAL 6032)	

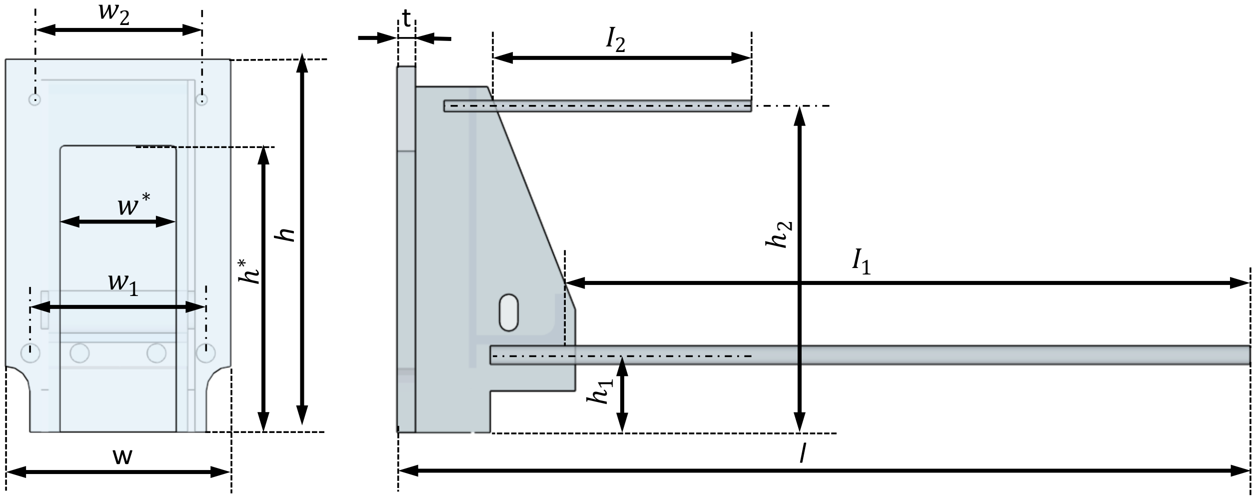
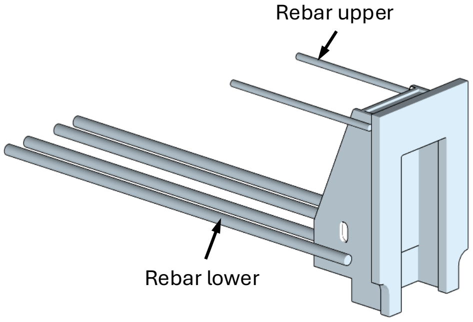


Figure 3. PINCOR®-Beam part dimension markings



3. MANUFACTURING AND TOLERANCES

3.1. Manufacturing method

Plates:	Thermal or mechanical cutting
Rebars:	Mechanical cutting
Welding:	MAG welding, manual or robotic
Welding class:	B (EN ISO 5817)
Execution class:	EXC3 (EN 1090-2)

The product shall be produced clean and dry. Light surface rusting may be present at delivery of the product. The product is to be stored in dry conditions. The product may be installed with light surface rusting, and in accordance with general requirements for reinforcement bars.

3.2. Surface treatment

Corbel parts have no surface treatment. Upon request, they can be supplied hot dip galvanized in accordance with EN ISO 1461.

Surfaces of corbel parts (including the Lock part), that remain visible after concreting and grouting, can be painted.

3.3. Manufacturing tolerances

Production tolerance values for the components are listed in the corresponding tables, which specify the dimensions of each element. As a general rule:

- Tolerance for rebar lengths is ±5 mm
- Tolerance for steel plate dimensions is ±0.5 mm

3.4. Quality control

R-Group Baltic OÜ internal manufacturing and quality control in accordance with EN 1090-2. External quality control provided to R-Group Baltic OÜ by Kiwa Inspecta OÜ.

3.5. Markings

Marking includes R-Group Baltic OÜ identifier marking (production order number, product name with the size info, manufacturing date).

4. RESISTANCES

The hidden corbel connection transfers beam end vertical shear and torsion as well as beam axial force and lateral shear. The hidden corbel must not be used for transfer of bending moment from the beam end.

The minimum concrete grade of the column and the beam is C40/50, and maximum aggregate size is 16 mm.

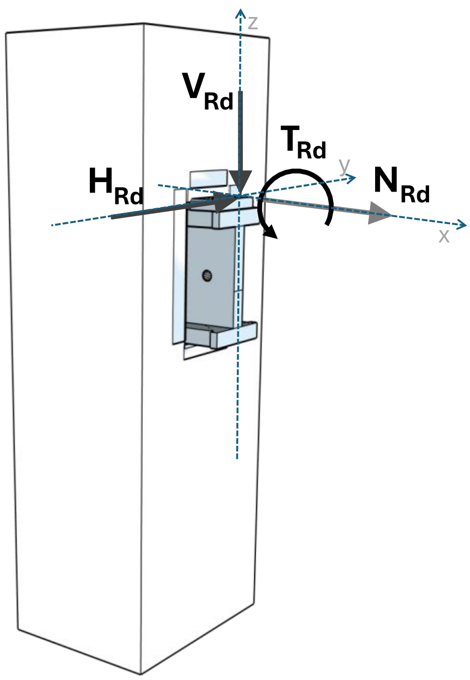
When PINCOR® is used accidentally with concrete grades lower than C40/50, the design resistances of the connection must be reduced with appropriate factors according to Table 5.

Table 5. Resistance reduction factors for usage of lower concrete grades

Concrete grade	Reduction factor for all sizes
C35/45	0.875
C32/40	0.80
C30/37	0.75

Table 6. PINCOR®-200/t1 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	200	0	0	0	-
max.N_{Rd}	0	40	0	0	-
V_{Rd} + N_{Rd}	≤200	≤40	0	0	0.67 * $\lvert V_{Rd}\rvert$ + $\lvert N_{Rd}\rvert$ / 2 ≤ 135
max.V_{Rd} + max.T_{Rd}	200	0	5	0	-
max.V_{Rd} + max.H_{Rd}	200	0	0	60	-
max.V_{Rd} + T_{Rd} + H_{Rd}	200	0	≤5	≤60	$\lvert T_{Rd}\rvert$ / 0.084 + $\lvert H_{Rd}\rvert$ ≤ 60
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	175	35	5	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	175	35	0	60	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	175	35	≤5	≤60	$\lvert T_{Rd}\rvert$ / 0.084 + $\lvert H_{Rd}\rvert$ ≤ 60



V_{Rd} : Beam end vertical shear in [kN]
M_{Rd} : Beam end vertical moment in [kN·m]
N_{Rd} : Beam end axial tension in [kN]
T_{Rd} : Beam end torsion in [kN·m]
H_{Rd} : Beam end lateral shear in [kN]

Table 7. PINCOR®-200/t3 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	200	0	0	0	-
max.N_{Rd}	0	40	0	0	-
V_{Rd} + N_{Rd}	≤200	≤40	0	0	$0.77 * \lvert V_{Rd}\rvert + \lvert N_{Rd}\rvert / 2 \leq 154$
max.V_{Rd} + max.T_{Rd}	200	0	5	0	-
max.V_{Rd} + max.H_{Rd}	200	0	0	78	-
max.V_{Rd} + T_{Rd} + H_{Rd}	200	0	≤5	≤78	$\lvert T_{Rd}\rvert / 0.064 + \lvert H_{Rd}\rvert \leq 78$
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	177	35	5	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	177	35	0	78	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	177	35	≤5	≤78	$\lvert T_{Rd}\rvert / 0.064 + \lvert H_{Rd}\rvert \leq 78$

V_{Rd} : Beam end vertical shear in [kN]
M_{Rd} : Beam end vertical moment in [kN·m]
N_{Rd} : Beam end axial tension in [kN]
T_{Rd} : Beam end torsion in [kN·m]
H_{Rd} : Beam end lateral shear in [kN]

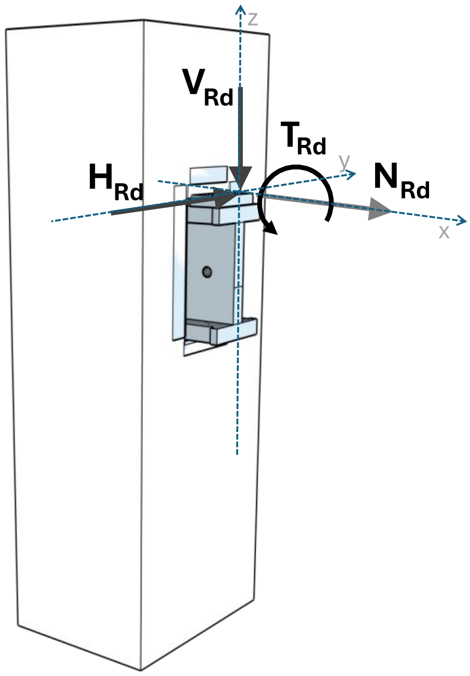


Table 8. PINCOR®-400 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	400	0	0	0	-
max.N_{Rd}	0	80	0	0	-
V_{Rd} + N_{Rd}	≤400	≤80	0	0	0.51 * $\|V_{Rd}\|$ + $\|N_{Rd}\|$ / 2 ≤ 204
max.V_{Rd} + max.T_{Rd}	400	0	10	0	-
max.V_{Rd} + max.H_{Rd}	400	0	0	69	-
max.V_{Rd} + T_{Rd} + H_{Rd}	400	0	≤10	≤69	$\|T_{Rd}\|$ / 0.145 + $\|H_{Rd}\|$ ≤ 69
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	330	66	10	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	330	66	0	69	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	330	66	≤10	≤69	$\|T_{Rd}\|$ / 0.145 + $\|H_{Rd}\|$ ≤ 69

V_{Rd} : Beam end vertical shear in [kN]
M_{Rd} : Beam end vertical moment in [kN·m]
N_{Rd} : Beam end axial tension in [kN]
T_{Rd} : Beam end torsion in [kN·m]
H_{Rd} : Beam end lateral shear in [kN]

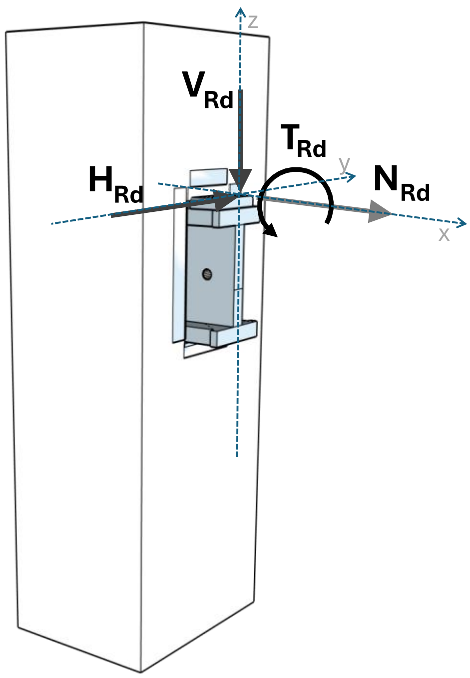


Table 9. PINCOR®-600 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	600	0	0	0	-
max.N_{Rd}	0	120	0	0	-
V_{Rd} + N_{Rd}	≤600	≤120	0	0	$0.44 * \lvert V_{Rd}\rvert + \lvert N_{Rd}\rvert / 2 \leq 265$
max.V_{Rd} + max.T_{Rd}	600	0	20	0	-
max.V_{Rd} + max.H_{Rd}	600	0	0	106	-
max.V_{Rd} + T_{Rd} + H_{Rd}	600	0	≤20	≤106	$\lvert T_{Rd}\rvert / 0.190 + \lvert H_{Rd}\rvert \leq 106$
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	490	98	20	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	490	98	0	106	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	490	98	≤20	≤106	$\lvert T_{Rd}\rvert / 0.190 + \lvert H_{Rd}\rvert \leq 106$

V_{Rd} : Beam end vertical shear in [kN]
M_{Rd} : Beam end vertical moment in [kN·m]
N_{Rd} : Beam end axial tension in [kN]
T_{Rd} : Beam end torsion in [kN·m]
H_{Rd} : Beam end lateral shear in [kN]

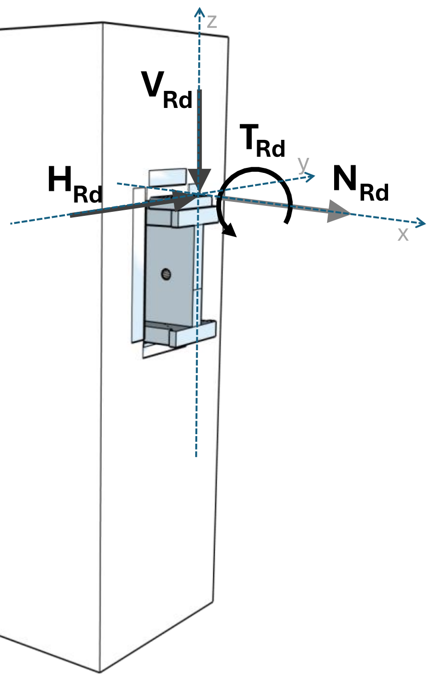


Table 10. PINCOR®-800 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	800	0	0	0	-
max.N_{Rd}	0	160	0	0	-
V_{Rd} + N_{Rd}	≤800	≤160	0	0	$0.39 * \lvert V_{Rd}\rvert + \lvert N_{Rd}\rvert / 2 \leq 315$
max.V_{Rd} + max.T_{Rd}	800	0	30	0	-
max.V_{Rd} + max.H_{Rd}	800	0	0	128	-
max.V_{Rd} + T_{Rd} + H_{Rd}	800	0	≤30	≤128	$\lvert T_{Rd}\rvert / 0.235 + \lvert H_{Rd}\rvert \leq 128$
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	640	128	30	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	640	128	0	128	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	640	128	≤30	≤128	$\lvert T_{Rd}\rvert / 0.235 + \lvert H_{Rd}\rvert \leq 128$

V_{Rd} : Beam end vertical shear in [kN]
M_{Rd} : Beam end vertical moment in [kN·m]
N_{Rd} : Beam end axial tension in [kN]
T_{Rd} : Beam end torsion in [kN·m]
H_{Rd} : Beam end lateral shear in [kN]

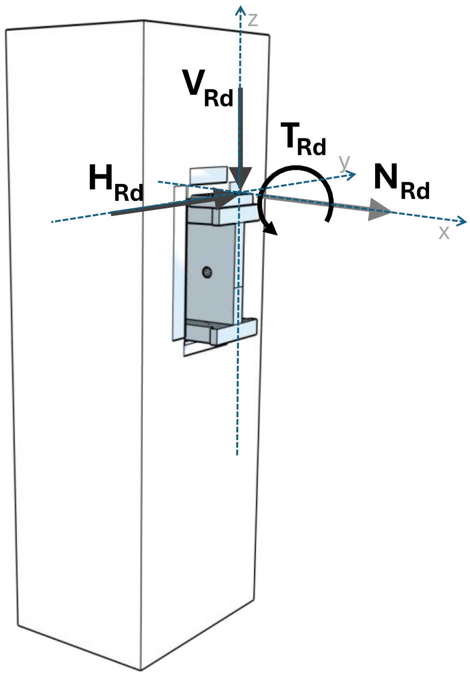
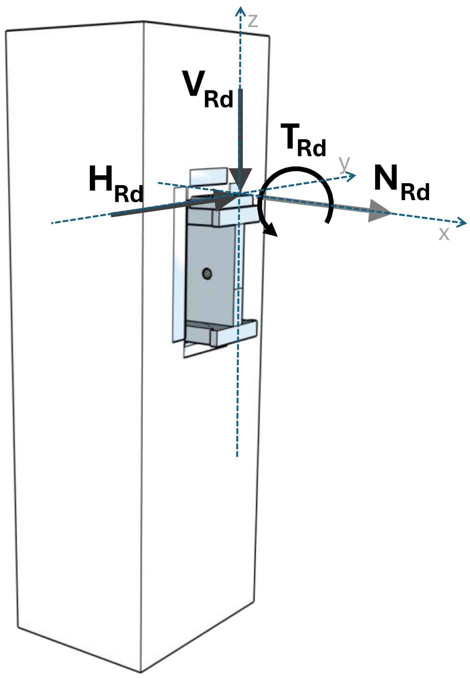


Table 11. PINCOR®-1100 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	1100	0	0	0	-
max.N_{Rd}	0	220	0	0	-
V_{Rd} + N_{Rd}	≤1100	≤220	0	0	$0.34 * \lvert V_{Rd}\rvert + \lvert N_{Rd}\rvert / 2 \le 370$
max.V_{Rd} + max.T_{Rd}	1100	0	50	0	-
max.V_{Rd} + max.H_{Rd}	1100	0	0	164	-
max.V_{Rd} + T_{Rd} + H_{Rd}	1100	0	≤50	≤164	$\lvert T_{Rd}\rvert / 0.305 + \lvert H_{Rd}\rvert \le 164$
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	840	168	50	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	840	168	0	164	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	840	168	≤50	≤164	$\lvert T_{Rd}\rvert / 0.305 + \lvert H_{Rd}\rvert \le 164$

V_{Rd} : Beam end vertical shear in [kN]
M_{Rd} : Beam end vertical moment in [kN·m]
N_{Rd} : Beam end axial tension in [kN]
T_{Rd} : Beam end torsion in [kN·m]
H_{Rd} : Beam end lateral shear in [kN]



The minimum concrete grade of the column and the beam is C40/50.

The column part of the hidden corbel is designed to transfer compression stress applied to the top of the column shoe down to below the column part. Maximum transferred compression stress is calculated based on the design compression stress of C40/50 concrete (0.85 * 40 / 1.35 = 25.2 MPa).

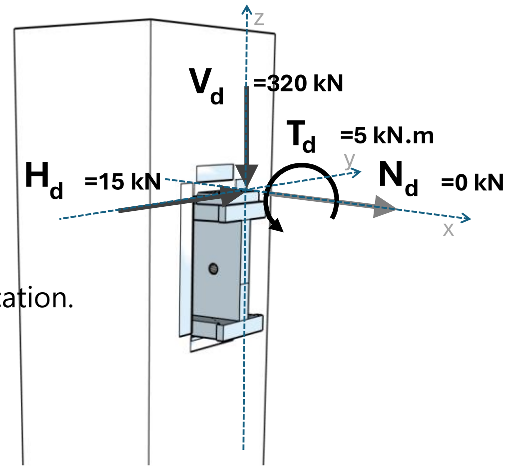
Reduced partial factors, as well as manufacturing tolerances, have been considered for determining the length of the reinforcement of the beam part.

The length of the reinforcement has been determined on the basis of the bar diameter. Anchorage coefficients, α_6 = 2.0, α_2 = calculated on the basis of 40 mm of concrete cover to the bottom layer of reinforcement and 75 mm thickness for the upper reinforcement, others $\alpha_1 \ldots \alpha_5$ =1.0.

4.1.1. Example designs

Example 1

A 400 mm × 600 mm column and a 300 mm × 600 mm beam will be assembled using an PINCOR® connector. The concrete grade for the precast elements is C40/50. The loads acting on the connection are:



Shear force, V_d = 320 kN

Torsional moment, T_d = 5 kN·m

Horizontal force, H_d = 15 kN

Find the proper PINCOR® connector size to use for this application.

Solution:

Shear force on the connection will be 320 kN. Proper PINCOR® size might be PINCOR® 400.

Minimum element size check according to Table 12 → Sizes are ok.

Table 12. Minimum column size and beam size [mm]

PINCOR®	Column min. width (Bx)	Column min. depth (By)	Beam min. width of the web	Beam min. height
"-200/t1"	280	280	280	280
"-200/t3"	280	280	280	240
"-400"	300	300	300	350
"-600"	340	340	340	400
"-800"	380	380	380	450
"-1100"	380	380	380	530

PINCOR® 400 resistance given on Table 8.

According to loads, "max.V_{Rd} + T_{Rd} + H_{Rd}" load type must be checked.

Table 8. PINCOR®-400 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	400	0	0	0	-
max.N_{Rd}	0	80	0	0	-
V_{Rd} + N_{Rd}	≤400	≤80	0	0	$0.51 * \|V_{Rd}\| + \|N_{Rd}\| / 2 \leq 204$
max.V_{Rd} + max.T_{Rd}	400	0	10	0	-
max.V_{Rd} + max.H_{Rd}	400	0	0	69	-
max.V_{Rd} + T_{Rd} + H_{Rd}	400	0	≤10	≤69	$\|T_{Rd}\| / 0.145 + \|H_{Rd}\| \leq 69$
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	330	66	10	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	330	66	0	69	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	330	66	≤10	≤69	$\|T_{Rd}\| / 0.145 + \|H_{Rd}\| \leq 69$

$V_d = 320 < V_{Rd} = 400 \rightarrow$ OK

$T_d = 5 < T_{Rd} = 10 \rightarrow$ OK

$H_d = 15 < H_{Rd} = 69 \rightarrow$ OK

$$|T_{Rd}| / 0.145 + |H_{Rd}| \leq 69$$

$$|5| / 0.145 + |15| \leq 69$$

$49.48 \leq 69 \rightarrow$ OK

Example 2

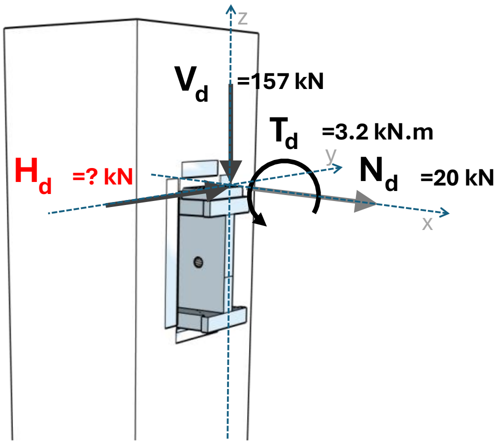
A 300 mm × 400 mm column and a 300 mm × 400 mm beam will be assembled using an PINCOR® connector. The concrete grade for the precast elements is C40/50. The loads acting on the connection are:

Shear force, V_d = 157 kN

Torsional moment, T_d = 3.2 kN·m

Axial force, N_d = 20 kN

Lateral shear force, H_d = unknown



Find the following:

- The proper PINCOR® connector size to use for this application.
- Maximum lateral shear force can be applied to connection.

Solution:

The shear force on the connection will be 157 kN. Proper PINCOR® size might be PINCOR® 200.

Minimum element size check according to Table 12 → Sizes are ok. PINCOR® 200/t1 or PINCOR® 200/t3 can be used in the connection.

Table 12. Minimum column size and beam size [mm]

PINCOR®	Column min. width (Bx)	Column min. depth (By)	Beam min. width of the web	Beam min. height
"-200/t1"	280	280	280	280
"-200/t3"	280	280	280	240
"-400"	300	300	300	350
"-600"	340	340	340	400
"-800"	380	380	380	450
"-1100"	380	380	380	530

PINCOR® 200 resistance given on Table 6 and Table 7.

According to loads, "max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}" load type must be checked for both PINCOR® 200/t1 & t3 types.

- **For PINCOR® 200/t1:**

Table 6. PINCOR®-200/t1 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	200	0	0	0	-
max.N_{Rd}	0	40	0	0	-
V_{Rd} + N_{Rd}	≤200	≤40	0	0	0.67 * $\lvert V_{Rd}\rvert$ + $\lvert N_{Rd}\rvert$ / 2 ≤ 135
max.V_{Rd} + max.T_{Rd}	200	0	5	0	-
max.V_{Rd} + max.H_{Rd}	200	0	0	60	-
max.V_{Rd} + T_{Rd} + H_{Rd}	200	0	≤5	≤60	$\lvert T_{Rd}\rvert$ / 0.084 + $\lvert H_{Rd}\rvert$ ≤ 60
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	175	35	5	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	175	35	0	60	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	175	35	≤5	≤60	$\lvert T_{Rd}\rvert$ / 0.084 + $\lvert H_{Rd}\rvert$ ≤ 60

V_d = 157 < V_{Rd} = 175 → OK

T_d = 3.2 < T_{Rd}=5 → OK

N_d = 20 < N_{Rd}=35 → OK

H_d = unknown < H_{Rd} = 60

$\lvert T_{Rd}\rvert$ / 0.084 + $\lvert H_{Rd}\rvert$ ≤ 60 → $\lvert 3.2\rvert$ / 0.084 + $\lvert H_d\rvert$ ≤ 60

$\lvert H_d\rvert$ ≤ 21.9 (maximum lateral shear force can be applied to connection)

- **For PINCOR® 200/t3:**

Table 7. PINCOR®-200/t3 hidden corbel EC:n (EN 1992, EN 1993) design resistances

Loading type	V_{Rd} [kN]	N_{Rd} [kN]	T_{Rd} [kN·m]	H_{Rd} [kN]	Condition must be satisfied!
max.V_{Rd}	200	0	0	0	-
max.N_{Rd}	0	40	0	0	-
V_{Rd} + N_{Rd}	≤200	≤40	0	0	0.77 * $\|V_{Rd}\|$ + $\|N_{Rd}\|$ / 2 ≤ 154
max.V_{Rd} + max.T_{Rd}	200	0	5	0	-
max.V_{Rd} + max.H_{Rd}	200	0	0	78	-
max.V_{Rd} + T_{Rd} + H_{Rd}	200	0	≤5	≤78	$\|T_{Rd}\|$ / 0.064 + $\|H_{Rd}\|$ ≤ 78
max.V_{Rd} + max.N_{Rd} + max.T_{Rd}	177	35	5	0	-
max.V_{Rd} + max.N_{Rd} + max.H_{Rd}	177	35	0	78	-
max.V_{Rd} + max.N_{Rd} + T_{Rd} + H_{Rd}	177	35	≤5	≤78	$\|T_{Rd}\|$ / 0.064 + $\|H_{Rd}\|$ ≤ 78

V_d = 157 < V_{Rd} = 177 → OK

T_d = 3.2 < T_{Rd}=5 → OK

N_d = 20 < N_{Rd}=35 → OK

H_d = unknown < H_{Rd} = 78

$|T_{Rd}|$ / 0.064 + $|H_{Rd}|$ ≤ 60 → $|3.2|$ / 0.064 + $|H_d|$ ≤ 78

$|H_d|$ ≤ 28 (maximum lateral shear force can be applied to connection)

PINCOR® 200/t3 is selected.

5. USER INSTRUCTIONS

5.1. Limits of Use

The design resistances of the hidden corbels have been calculated for static loads. For case specific dynamic effects, increased load factors are to be adopted in accordance with EN 1990 + A1 + AC section 4.1.5. The corbel is not designed for fatigue effects.

The corbel must not be used for the transfer of bending moment from the beam end. At the beam end connection, the structures must allow vertical rotation of the beam end.

5.2. Design Guidance

The design resistances of the hidden corbels, calculated in accordance with EC (EN 1992, 1993), are presented in Section 4, "Resistance". Additional reinforcement for these design resistances is presented in Section 5.5, "Reinforcement instructions".

The hidden corbel is primarily intended to transfer in the final as-built condition vertical shear (V_{Rd}) from the end beam to the column. The hidden corbel must not be used to transfer bending moment (M_{Rd}). Torsion design resistance (T_{Rd}) provided by the hidden corbel can be taken advantage of, particularly in the construction phase. Axial tension design resistance (N_{Rd}), as well as lateral shear design resistance (H_{Rd}) can be taken advantage of, particularly for robustness design.

5.3. Minimum structural dimensions

Minimum structural dimensions for the hidden corbels are presented for corbel parts installed at the centreline of the column and beam, and which satisfy also R120 fire class requirements.

The presented minimum structural dimensions take into account the design resistances (see Section 4, "Resistance") as well as the associate additional reinforcement (see Section 5.4, "Reinforcement instructions").

Table 12. Minimum column size and beam size [mm]

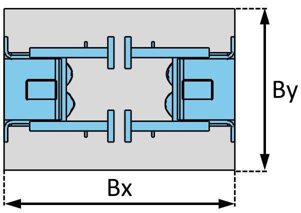
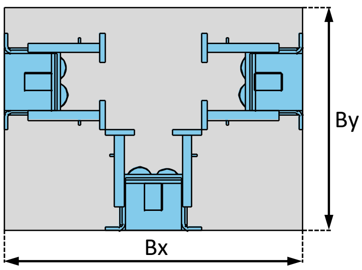
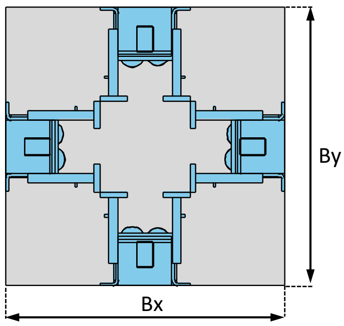
PINCOR®	Column min. width (Bx)	Column min. depth (By)	Beam min. width of the web	Beam min. height
"-200/t1"	280	280	280	280
"-200/t3"	280	280	280	240
"-400"	300	300	300	350
"-600"	340	340	340	400
"-800"	380	380	380	450
"-1100"	380	380	380	530

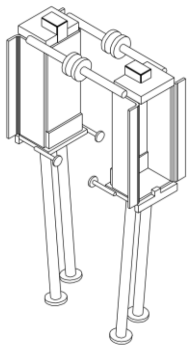
5.4. Multiple PINCOR® Usage

Depending on the structural requirements, a single column may include more than one PINCOR® section.

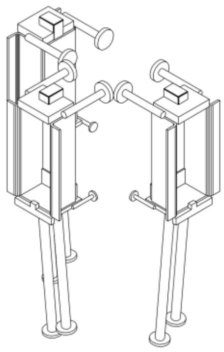
Table 13 shows the minimum column dimensions required for using multiple PINCOR® sections in rectangular columns, without any modification to the PINCOR® section itself. If the column dimensions are smaller than the values in the table, or if you plan to use circular columns, please contact our technical team for guidance on the PINCOR® arrangement.

Table 13. Multiple PINCOR® usage

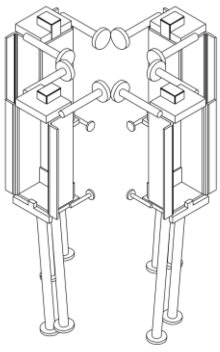
Double		Triple		Quadruple	
					
Bx	**By**	**Bx**	**By**	**Bx**	**By**
455	280	595	440	595	595
455	280	595	440	595	595
475	300	640	470	640	640
495	340	680	510	680	680
525	380	725	555	725	725
545	380	765	575	765	765



Double

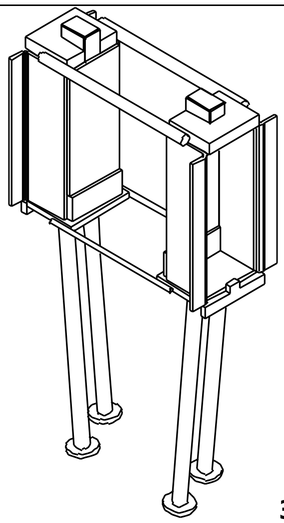


Triple

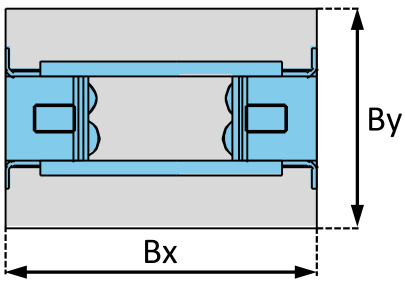


Quadruple

The most common configuration is the two-sided application. If column width (Bx) is smaller than the values in Table 13, two sided PINCOR® usage is suggested. For all possible multiple PINCOR® uses outside the column sizes listed in the Table 13, please contact the technical department at technical@rsteel.eu.



3d

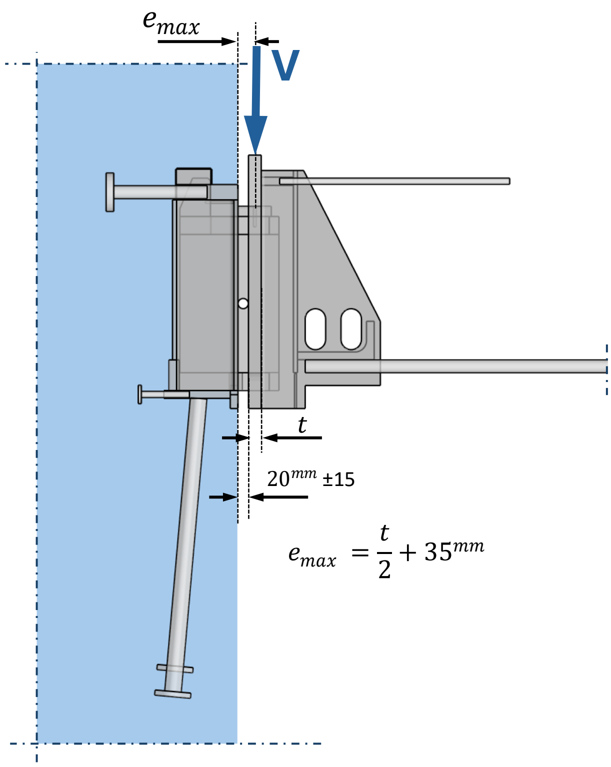


Plan

The installation of PINCOR® is carried out by placing the beam component onto the lock component, which is already inserted into the column section. In this arrangement, the shear force from the beam is transferred to the column surface with an eccentricity. In Table 14, maximum eccentricity values are provided.

Table 14. Shear force eccentricity values

PINCOR®	t [mm]	e_{max} [mm]
"-200/t1"	10	40
"-200/t3"	15	42.5
"-400"	12	41
"-600"	16	43
"-800"	20	45
"-1100"	25	47.5



5.5. Reinforcement instructions

The general reinforcement of the column is designed according to the cross section of the column and the applied forces. Additional local reinforcement, presented here, is to be provided for the purpose of transferring local loads from the corbel to the column.

Additional shear links (shear link bundles) are to be provided to transfer loads from the beam to the reinforcement of the column, as well as to ensure good performance of the hidden corbel. Additional reinforcement is to be placed both at the top as well as at the bottom of the column part of the corbel. The presented additional reinforcement allows transfer of loads according to the presented design resistances (see Section 4," Resistance"). For two shear link spaces below the bottom horizontal bearing plate of the column part, shear links are to be provided with maximum spacing of 300mm.

The sizing of the presented additional shear links for the column part is dependent on the column main reinforcement bars being spaced (center-to-center) less than or equal to 400mm. This positioning limit of the main reinforcement bars must be taken into account for the design of wide columns or walls, such that the required main reinforcement is located with a spacing <400mm at the column parts.

The general reinforcement of the beam is designed according to the cross section of the beam and the applied forces. Additional local reinforcement, presented here, is to be provided for the purpose of transferring local loads from the corbel to the beam. The beam reinforcement is anchored with vertical and horizontal stirrups at the end of the beam.

Additional shear links (shear link bundles) are to be provided to transfer loads from the reinforcement of the beam to the corbel, as well as to ensure good performance of the hidden corbel. Additional reinforcement is to be placed next to the end plate of the beam part of the corbel. The presented additional reinforcement allows transfer of loads according to the presented design resistances (see Section 4, "Resistance"). The presented additional reinforcement has been calculated on the basis of the minimum beam size (see Section 5.3, "Minimum structural dimensions").

The amount of additional shear links can be reduced, if the design forces are significantly smaller than the presented design resistances (see Section 4, "Resistance"), for example if the hidden corbel does not need to be designed for transfer of torsion. If needed, please contact RSTEEL for more information.

Table 15. Additional reinforcement required for the hidden corbels (B500B link quantities)

PINCOR®	Column additional links above the corbel	Column additional links below the corbel	Beam additional links
"-200/t1"	4×Ø8 (eg. 3+1)	4×Ø8 (eg. 3+1)	3×Ø8
"-200/t3"	5×Ø8 (eg. 3+2)	5×Ø8 (eg. 3+2)	4×Ø8 (eg. 3+1)
"-400"	6×Ø8 (eg. 3+3)	6×Ø8 (eg. 3+3)	3×Ø10
"-600"	7×Ø8 (eg. 3+3+1)	7×Ø8 (eg. 3+3+1)	4×Ø10 (eg. 3+1)
"-800"	7×Ø10 (eg. 3+3+1)	7×Ø10 (eg. 3+3+1)	5×Ø10 (eg. 3+2)
"-1100"	7×Ø10 (eg. 3+3+1)	7×Ø10 (eg. 3+3+1)	7×Ø10 (eg. 3+3+1)

NOTE. Max. 3 no. links to be assembled in a bundle. Free space between bundles min. 25 mm (concrete maximum aggregate size 16 mm). Below figure represents PINCOR® 600 additional reinforcement.

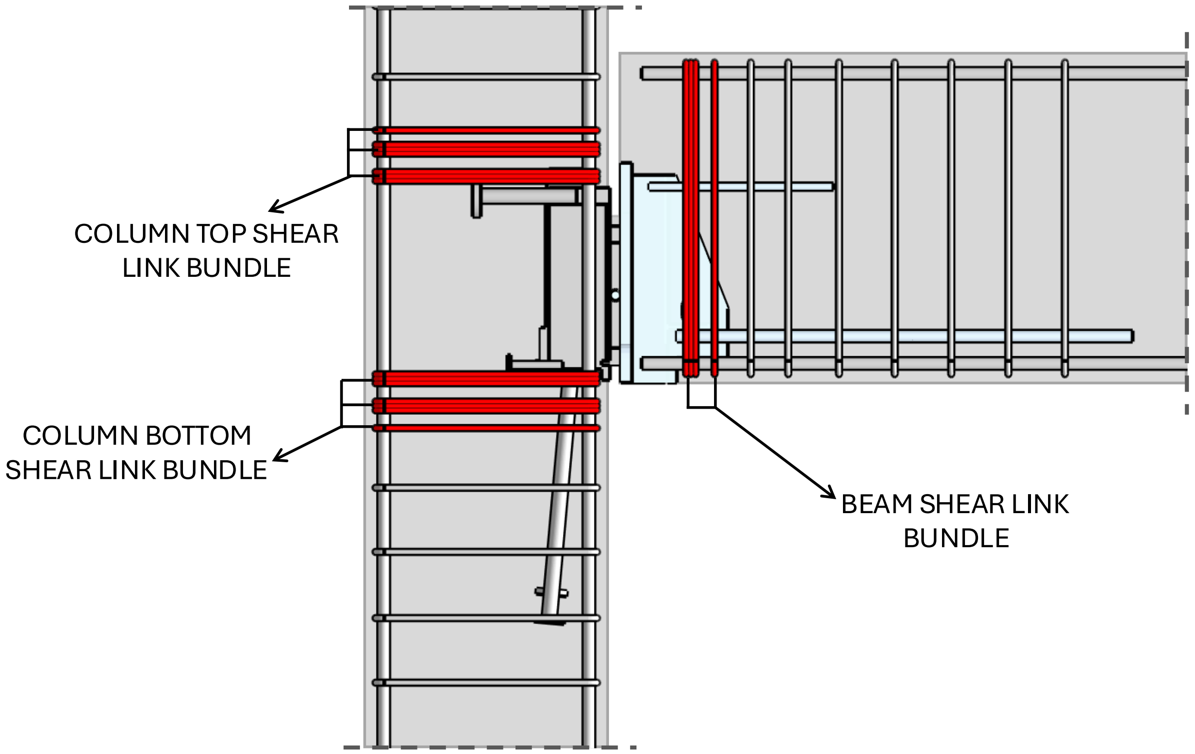


Figure 4. Additional reinforcement required for the hidden corbels

5.6. Positioning of beam tendons and additional hole provisions

Tendons can be placed around the beam part of the hidden corbel as shown in the image below. PL4 plate is provided to the bottom of the beam part internal vertical plate (at the rear of the space provided of insertion of the Lock part), through which holes can be drilled for installing the tendons. Tendons installed through the space provided for insertion of the Lock part are to be cut at the face of the internal vertical plate so that they do not interfere with the installation of the beam on site.

Hole provisions and positions for links to beam ledges: dimensions a, b, and c.

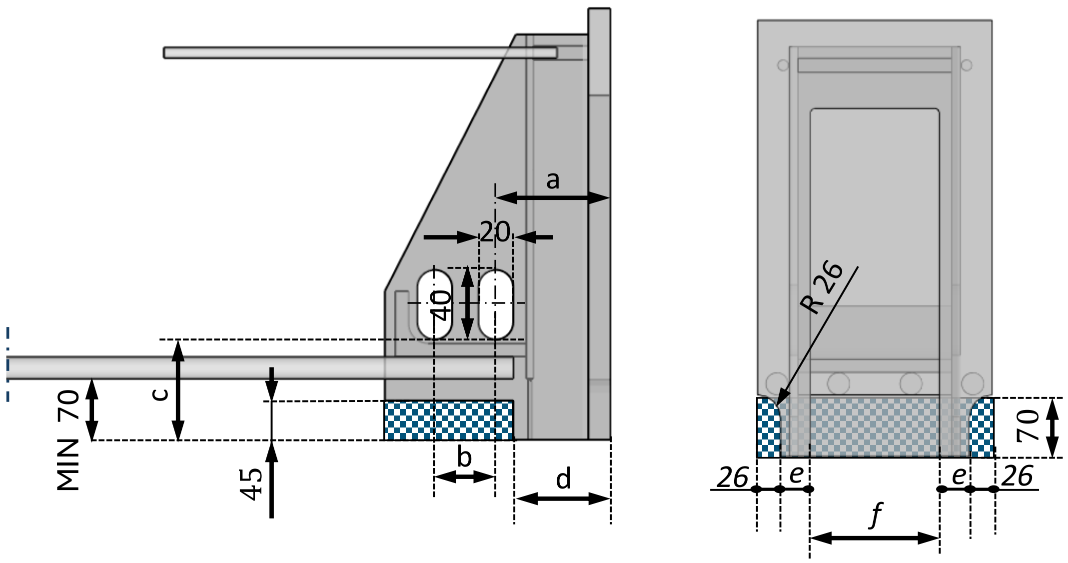


Figure 5. Hole provisions and positions for links to beam ledges: dimensions a, b, and c

Table 16. Hole provisions and positions for links to beam ledges: dimensions a, b, and c

Dimensions [mm]							
PINCOR®	**Holes**	**a**	**b**	**c**	**d**	**e**	**f**
"-200/t1"	1no. D20x40	98	-	110	91	32	84
"-200/t3"	1no. D20	103	-	110	96	32	84
"-400"	1no. D20x40	100	-	120	93	32	104
"-600"	1no. D20x40	117	-	120	97	32	124
"-800"	2no. D20x40	121	70	125	101	33	125
"-1100"	2no. D20x40	131	70	125	111	34	146

6. INSTALLATION

6.1. Tolerances

Table 17. Installation tolerances [mm]

PINCOR®	Along the axis of the beam	Vertical	Rotation about the axis of the beam
"-200/t1"	±15	-20...20*	±1 degs
"-200/t3"	±15	-20...20*	±1 degs
"-400"	±15	-20...20*	±1 degs
"-600"	±15	-20...20*	±1 degs
"-800"	±15	-20...20*	±1 degs
"-1100"	±15	-20...20*	±1 degs

*NOTE. Adjustment is dependent on the thickness of the Lock part erection pack plate. The nominal thickness of the Lock part erection pack plate is 20 mm. Available standard thicknesses are 5, 10, 15, 20, 25, 30, 35, 40 mm. Other intermediate thicknesses are according to special order.

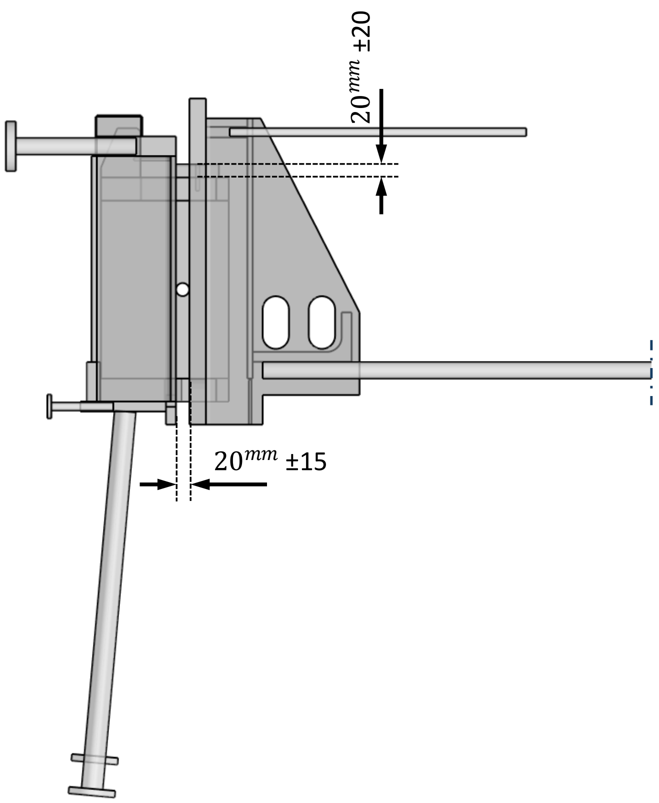


Figure 6. Installation tolerances

Table 18. Installation tolerances of the beam part and column part within the mould, relative to the base point, in the plane of the installation surface

PINCOR®	Position	Inclination	Inclination measured as horizontal offset dimension of top of part relative to bottom of part
"-200/t1"	±5 mm	±0,5 degs	±2 mm
"-200/t3"	±5 mm	±0,5 degs	±2 mm
"-400"	±5 mm	±0,5 degs	±2 mm
"-600"	±5 mm	±0,5 degs	±2 mm
"-800"	±5 mm	±0,5 degs	±2.5 mm
"-1100"	±5 mm	±0,5 degs	±3 mm

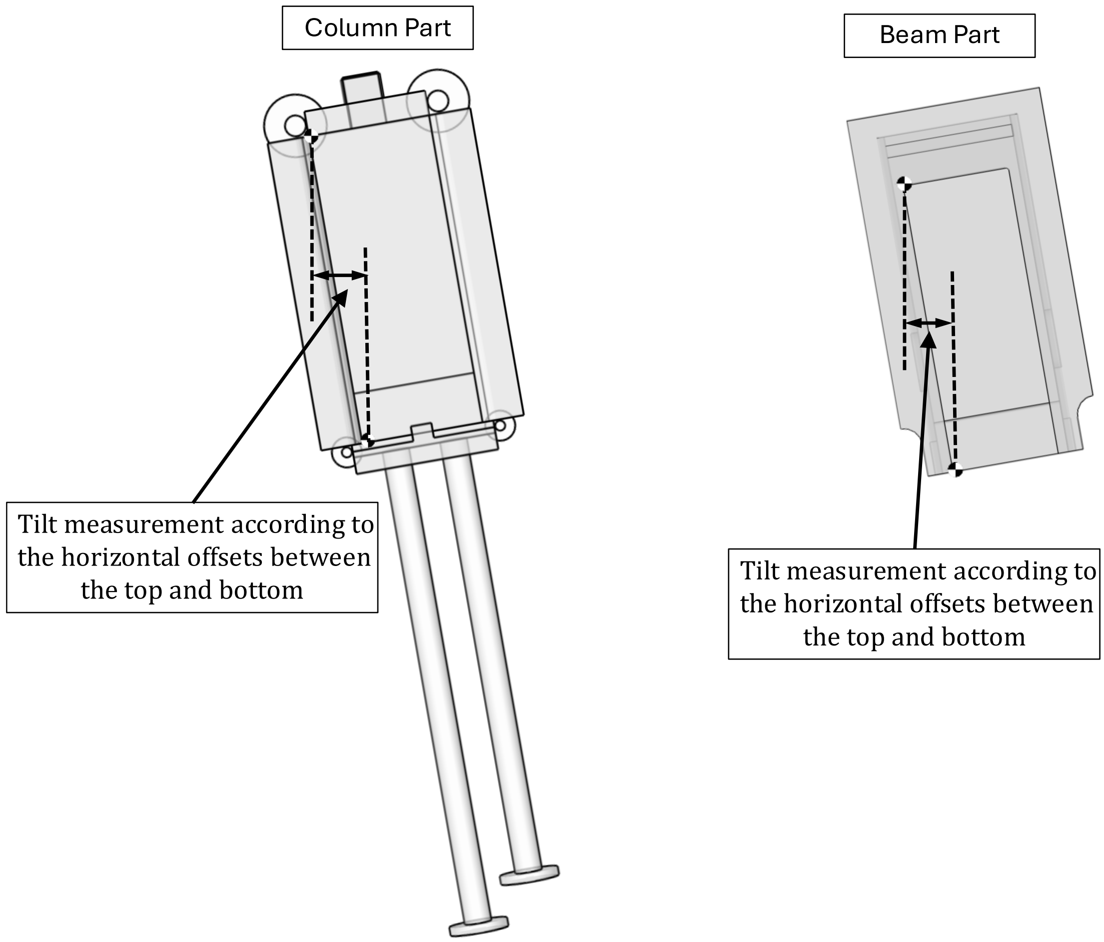


Figure 7. Tilt measurement according to the horizontal offset between the top and bottom

Installed inclinations that are greater than the stated tolerances can be corrected by adjustment of the Lock part erection pack plate, and local grinding of the flanges of the Lock part. For additional instructions, contact RSTEEL.

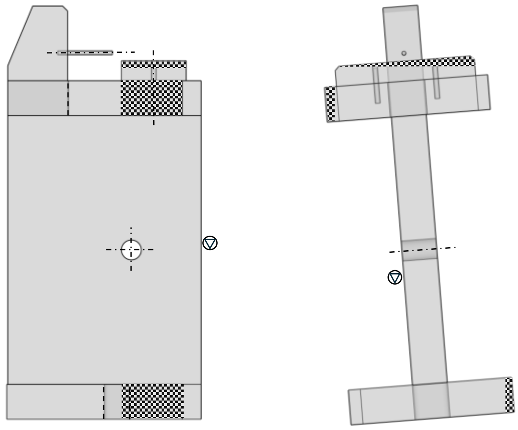


Figure 8. Adjustment of the Lock part erection pack plate, and local grinding of the flanges of the Lock part

6.2. Manufacturing of the pre-cast elements

Good quality casting around the column parts and beam parts will ensure that they function properly with the surrounding concrete of the column and beam. To ensure proper function, concrete must be cast in layers and using vibration so that it is cast without voids around the column parts and beam parts.

The column part of the corbel is installed to the bottom or to the side of the mould. The column can be cast either on its side or vertically. When cast vertically, it is especially important to ensure that the concrete is cast carefully in the area immediately below the bottom horizontal plate of each column part, to ensure good casting without voids. The column part is positioned in the mould with the help of the positioning reference.

The beam part of the corbel is installed to the bottom of the mould of the beam and is secured to the end of the mould. The concrete shelves of the beam (if applicable) next to the beam part as well as the area below the bottom horizontal plate of the beam part is cast first, followed by the remaining area around the beam part noting especially that the area above the bottom horizontal plate must be checked for good casting without voids. The beam part is positioned in the mould with the help of the positioning reference.

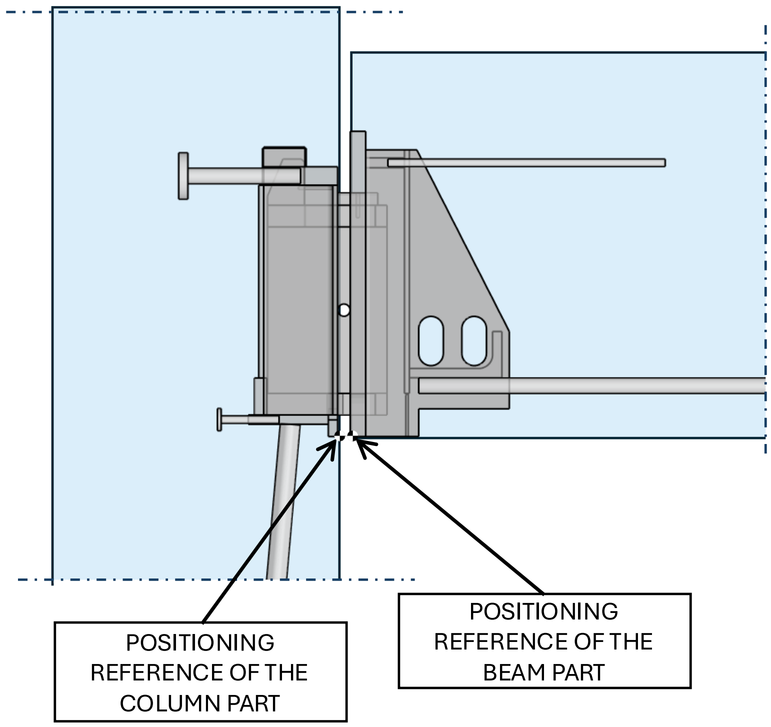


Figure 9. Beam and column part positioning

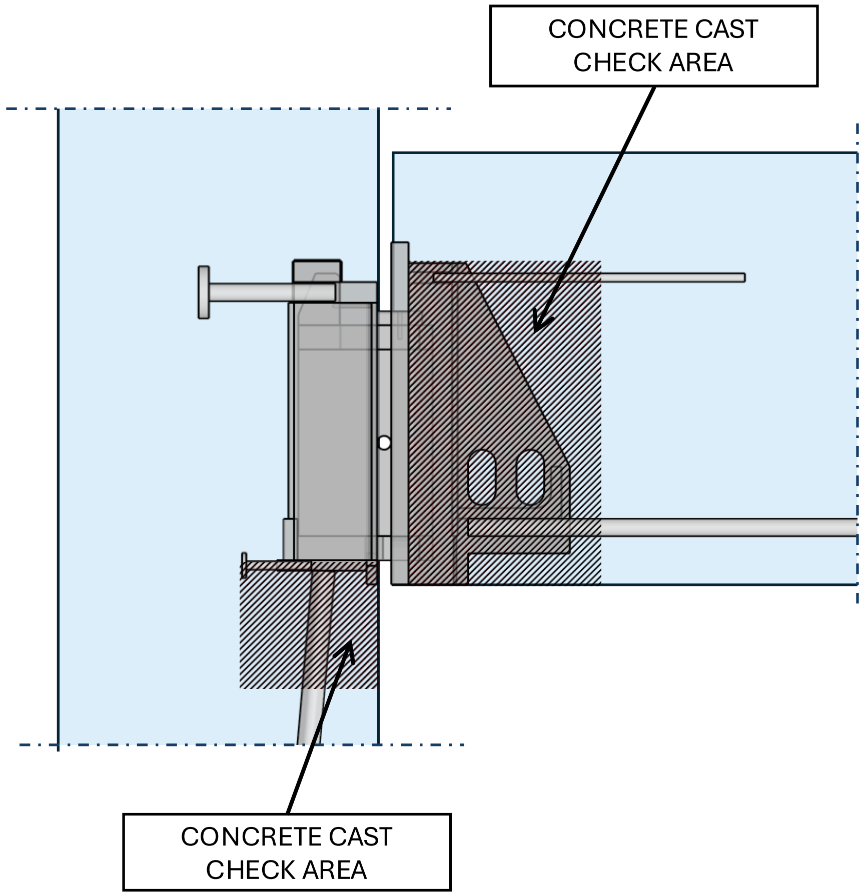


Figure 10. Concrete cast check area

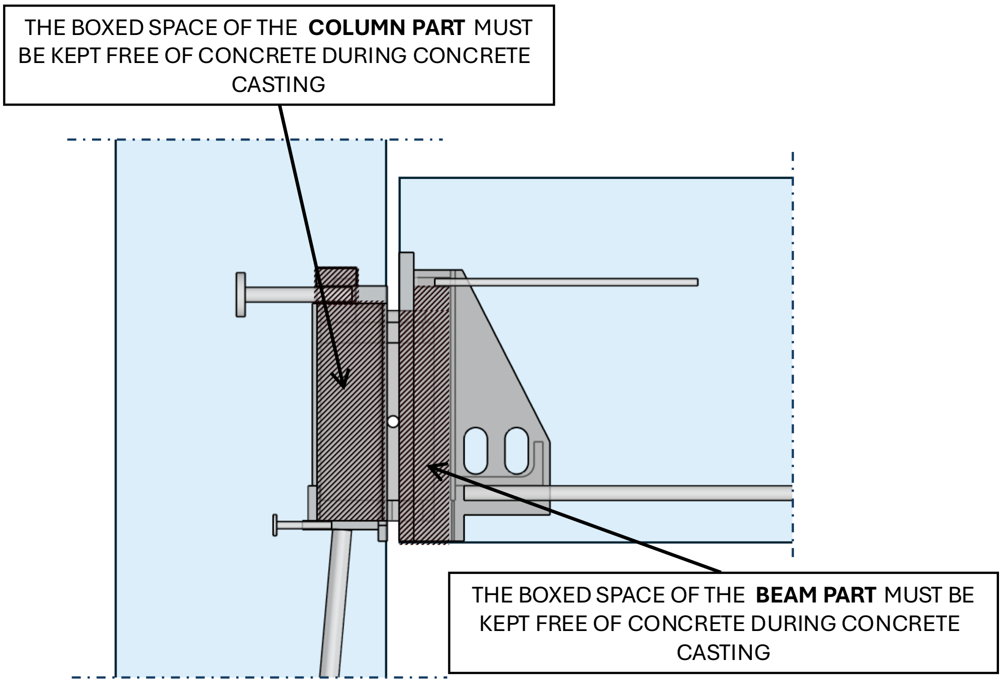


Figure 11. Recess areas on beam and column parts

Checklist prior to casting:

- ✓ The correct part, size and type has been installed in the mould
- ✓ The positioning of the part is correct
- ✓ The parts are tied to the reinforcement and mould
- ✓ Additional reinforcements are in position
- ✓ Tendons (if applicable) are in position
- ✓ Casting mould parts are in position

Checklist after casting:

- ✓ The part has remained in the correct position, and has not moved or rotated
- ✓ Casting has been successful around the part, especially below the column part and behind the beam part
- ✓ Casting mould parts are removed and the parts are clean i.e. no concrete or cement

6.3. Installation of the pre-cast elements

Installation is to be carried out in accordance with the approved installation design plan.

The column is to be installed in the correct position, vertical and level, noting especially locating of the corbels to within the erection tolerances.

The Lock part of the corbel is installed at site into the column part, preferably after installation of the column. The Lock parts of PINCOR®-600 to PINCOR®-1100 are provided with D20 holes to assist with lifting. The Lock part is in position when the bottom of the Lock part is in firm contact with the back plate of the column part. The Lock part is locked in place with the help of the in-built tooth and recess arrangement, as well as with locking rods. Columns must not be lifted, moved, nor supported using the Lock part. The installed level must be verified, and the thickness of the erection pack plate chosen as required. The locking rods (2no.) of the erection pack plate are to be installed before the installation of the erection pack plate.

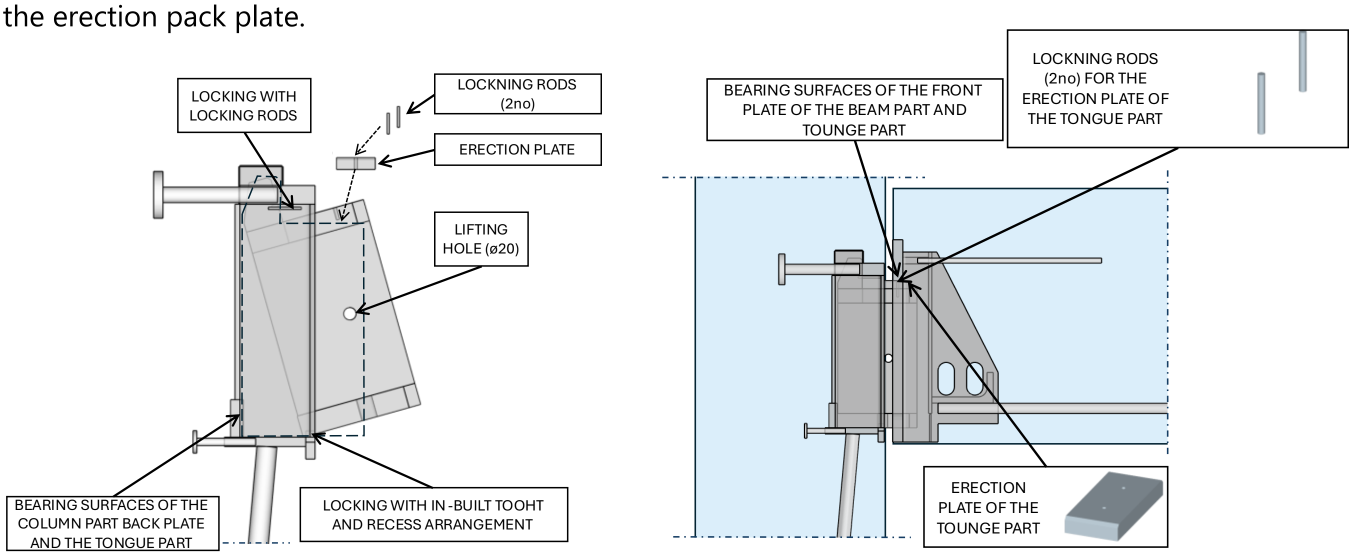


Figure 12. Installation of precast elements

NOTE. The lifting holes are only provided for PINCOR®-600... PINCOR®-1100

The beam is to be lowered carefully down onto the Lock part, in such a way that the Lock part is located entirely inside the space provided of insertion of the Lock part as well as without damaging any parts of the hidden corbel. The beam is in position when the bearing surface of the Lock part is in firm contact with the bearing surface of the front place of the beam part, after which the lifting lines to the beam can be disconnected. The nominal free space between the beam and the column is 20 mm (min. 5 mm...max. 35 mm). NOTE. The free space between the beam and the column must not be grouted up to allow for movements from vertical rotation of the end of the beam.

The connection is to be completed following the instructions of the designer, for example:

- ✓ If required, visible surfaces are to be painted.
- ✓ If required, mineral/stone wool or polyurethane foam is installed to the free space between the beam and the column, above the top of the Lock part, to prevent joint grout from getting into the free space that is to be kept clear to allow for movements. Once installed, the slab element joints can be grouted, and the surface concrete layer can be cast.
- ✓ If required, firestop material is applied to seal (from the bottom) the space that is provided for insertion of the Lock part, the sides and bottom (up to the Lock part) of the free space that is to be kept clear to allow for movements, as well as any other areas of the vertical joint that are directly exposed to fire.

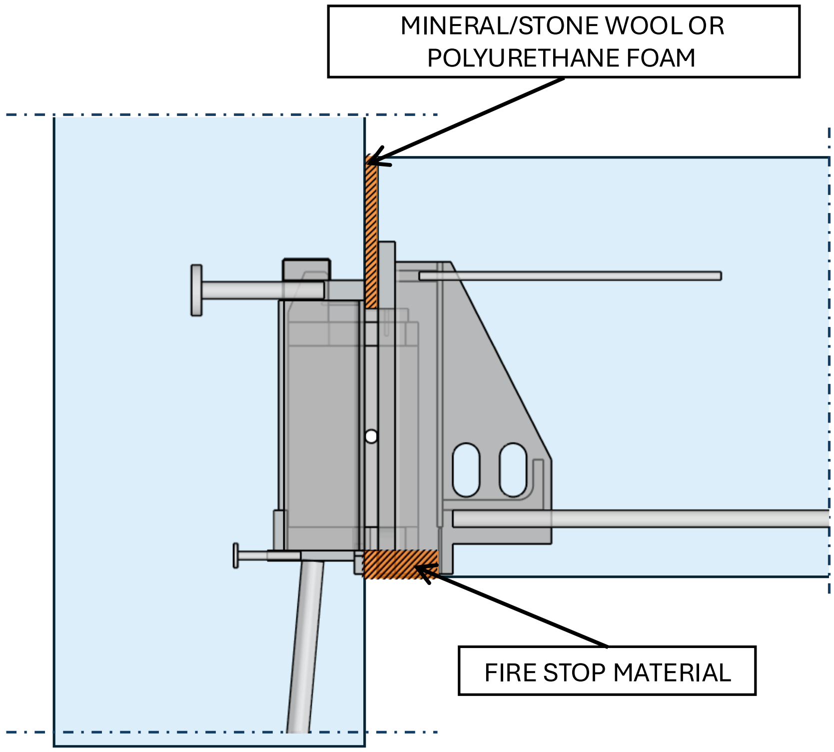


Figure 13. Fire protection

NOTES

TECHNICAL MANUAL REVISIONS

01.10.2025 (FA)

- First published version

25.02.2026 (FA)

- Minor text changed.

SUPPORT MATERIAL

DESIGN TOOLS

RSTEEL® Design Tool was created to facilitate the work of designers and offer the best and most transparent design process on the market. The free and fully cloud-based software guarantees seamless workflow within the design organization, as well as continuous support and updates.

rsteel-design.com

DESIGN COMPONENTS

We have created design components for Tekla as well as Revit and AutoCAD. More products will be created, and existing products will receive steady updates and fixes when needed.

warehouse.tekla.com/#/organization/u7be79e90-ace8-46ca-a26c-849a5dc4c283

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SALES AND TECHNICAL SUPPORT

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DOCUMENTATION

All our products have been tested and have all necessary approvals and markings. You can find all related information on each products page.

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