

HALFEN HBT REBEND CONNECTION

TECHNICAL PRODUCT INFORMATION



HALFEN HBT REBEND CONNECTION

HBT 13.1-E

CONCRETE

NEW!

- quality marked by RAL institute
- type tested to EUROCODE 2

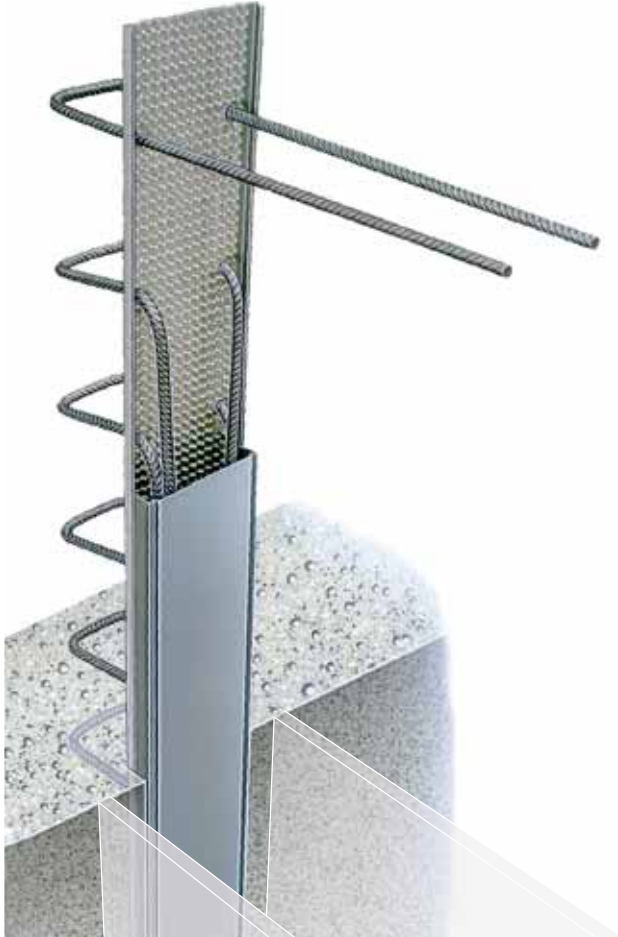


HALFEN
YOUR BEST CONNECTIONS

HALFEN HBT REBEND CONNECTION

System Description

HBT – solution for reinforcement starter bars



HBT technical specifications

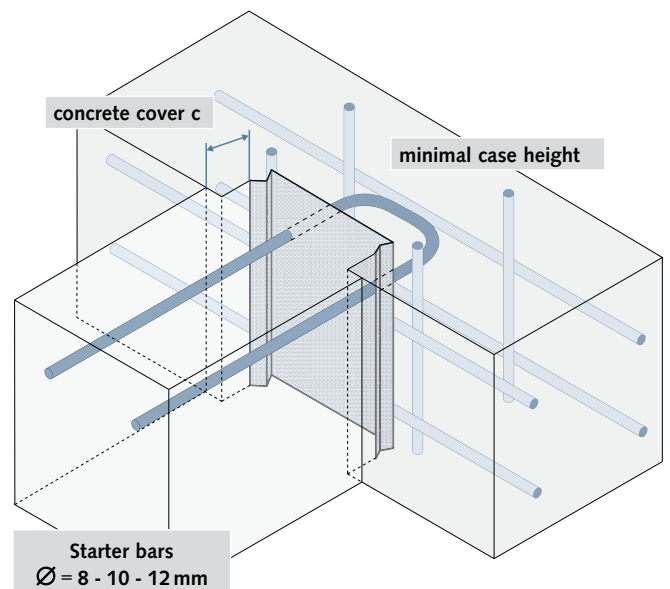
- standard element lengths: 1.25 m and 0.80 m, further lengths on request
- 7 case sizes starting from 6 cm width for connecting various building components
- 13 different stirrup types available for one- and two-row connections
- rebar diameter \varnothing : 8 - 10 - 12 mm
- stirrups
 - a) B500B
 - b) B500B NR stainless steel (available on request)
- bending roll diameter at rebend location
$$d_{BR} = 6 \times \varnothing$$

Product advantages

HALFEN HBT Rebend connections are type tested. They comply with the requirements stipulated by the German Concrete Association (DBV, Deutscher Beton Verein) in its publication on rebending reinforcement bars and recess cases from January 2011. The over-lap lengths are calculated according to Eurocode 2.

An approval certificate is therefore not required for the rebend connection.

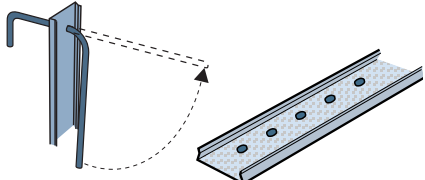
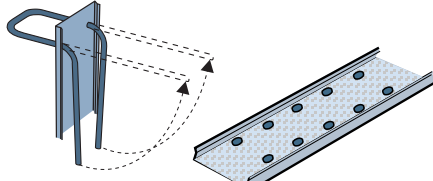
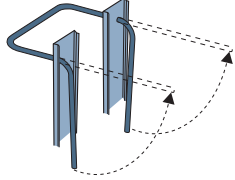
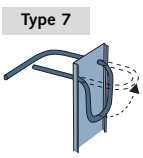
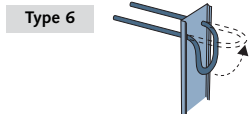
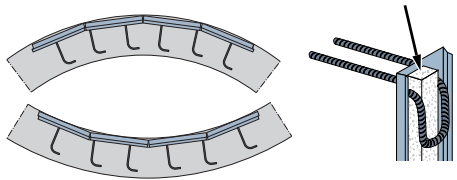
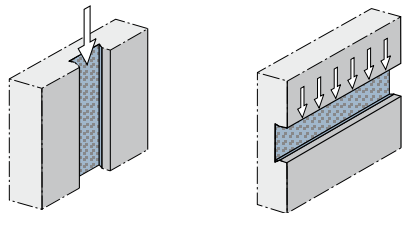

- case and cover are made of pre-galvanized steel to prevent corrosion
- no plastic components remain in the concrete
- the specially shaped profile prevents fresh concrete entering the case
- case is simply nailed or glued to the formwork
- strong steel case and cover retain their shape during concrete pour
- the pre-punched cover is simple and quick to remove after the concrete has cured
- the steel casing has a profiled back providing optimal bond and shear transfer to the concrete
- minimal required concrete cover is ensured with minimal height case sides (see "c" in drawing below)



The required concrete cover c for all steel parts remaining in the concrete has to be met. The minimal required tolerance Δc for the metal box (housing) may be reduced by 5 mm.

HALFEN HBT REBEND CONNECTION

Contents

| | | |
|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| | Application examples / Type overview | 4-5 |
|  | Standard element single row: HBT 55 and 85 | 6 |
|  | Standard element double row: HBT 120 and 150 Standard element double row: HBT 190 and 220 Minimal element lengths for HBT Standard short element for single or double row, L=800 mm | 7 8 8 9 |
| Type 4  | Product Range: Profile variants, stirrup types Maximal over-lap length $l_{ü,max}$ | 10 |
| Type 7  | | 11 |
| Type 6  | Standard element HBT 80 as precast connection (structural connection) | 12 |
|  | Adapting the HBT to curved formwork, 'HBT-Strip' securing strip | 13 |
|  | Static values, notes on calculations Applications according to 'Rebending reinforcement' guidelines Table values according to type tests; Basics according to 'Rebend' guidelines Assembly instructions Corbel calculations/calculation basics | 14 15 16-19 19 20-21 |
|  | Order forms Specifications for tender Addresses, technical assistance | 22 23 back of catalogue |



Digital technical drawings for HBT-Elements can be found in the HALFEN Reinforcement systems CAD-library. Free download available under www.halfen.com.

Available in the following file formats:

- CAD - DWG
- CAD - DXF

A free DVD is also available. Call us or send an e-mail.

Addresses, telephone- and fax numbers can be found on the back cover of this catalogue.

HALFEN HBT REBEND CONNECTION

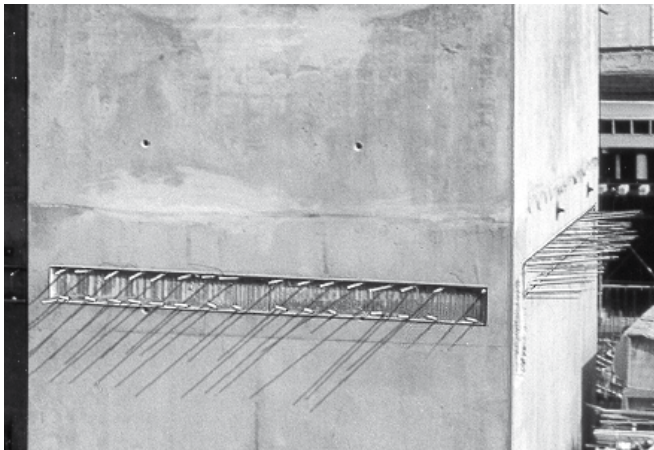
Application examples



The RAL Quality Mark guarantees compliance with the technical product requirements and the related services regarding:

- specification, quality management, logistics, competent technical advice, high-quality technical documentation and software, fulfilment of the guaranteed benefits and guaranteeing the neutrality of tender documents

Biannual monitoring provided by DNV GL guarantees that the recommended requirements of the quality control association for anchor and reinforcement technology (Gütegemeinschaft Verankerungs und Bewehrungstechnik e.V) are maintained.



Connection; wall – floor/ceiling slab



Connection; grandstand in stadium – supporting element



Connection; wall – stair landing



Connection; column – wall

The HALFEN HBT Rebend connection allows easy and efficient connection of concrete components at different phases of construction. Walls, ceilings and stairs can be subsequently cast and securely fixed using HALFEN HBT Rebend connections.

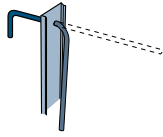
Perfect connections for numerous applications with 57 possible combinations of rebar types and profile widths. HALFEN HBT Rebend connection elements are available with reinforcement bars in diameters of 8, 10 and 12 mm.

Available as a standard product for the most common installation situations with single- and double-row connections in element lengths of 0.8 m and 1.25 m.

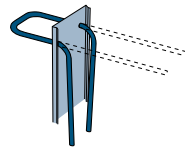
HALFEN HBT REBEND CONNECTION

Type Overview/Application examples

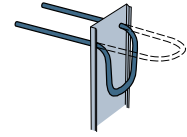
Type 1



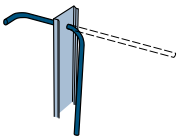
Type 5



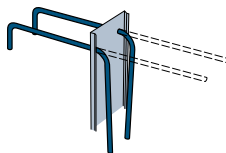
Type 6



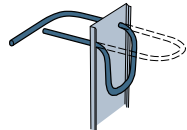
Type 2



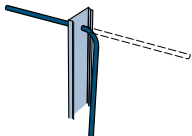
Type 11



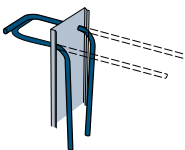
Type 7



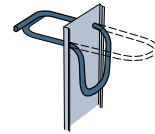
Type 3



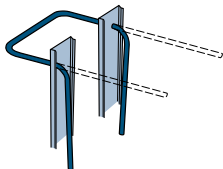
Type 22



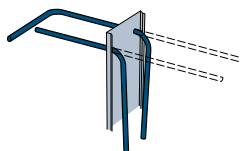
Type 8



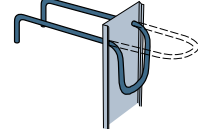
Type 4



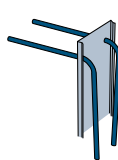
Type 23



Type 9

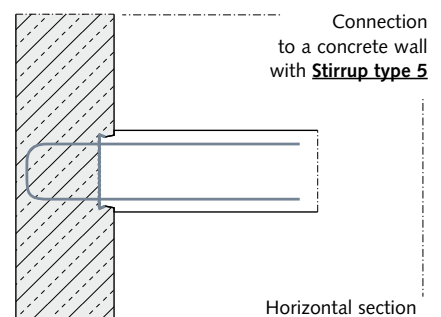
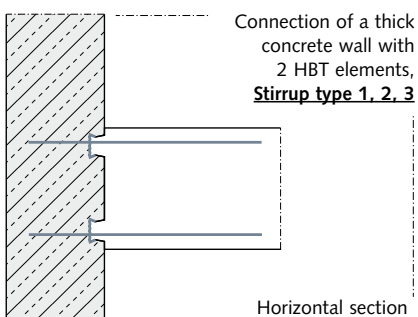
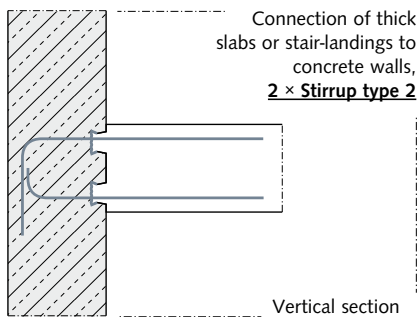
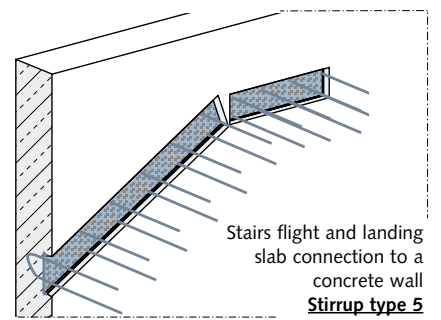
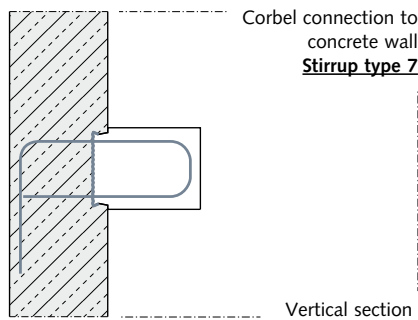
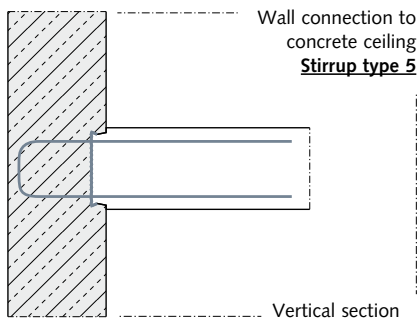


Type 33



Standard type

Mixed type

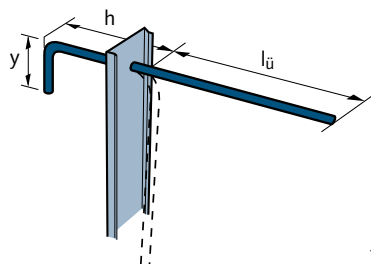


HALFEN HBT REBEND CONNECTION

Standard Elements, Single-row

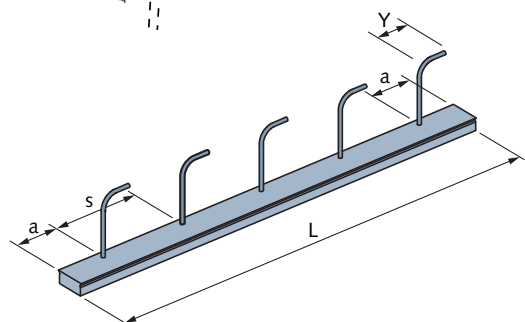
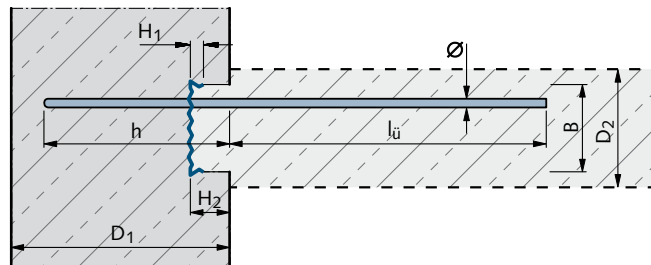
HBT 55 and HBT 85

Type 1



• bending roll diameter in bend location
 $d_{BR} = 6 \times \varnothing$

• material:
 Steel rebar
 B500B, B500B NR

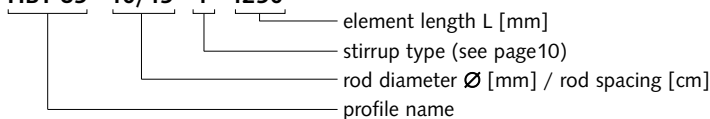


| HBT Type 1 – System layout | | | |
|---------------------------------|----------------------|------------------|---------------------|
| element length L | rebar spacing s [cm] | number of rebars | end distance a [cm] |
| standard element L = 1250 mm | 10 | 12 | 7.5 |
| | 15 | 8 | 10.0 |
| | 20 | 6 | 12.5 |
| | 25 | 5 | 12.5 |

| HBT Type 1 – Standard element with element length 1250 mm | | | | | | | | | | | | |
|-----------------------------------------------------------|---------------------------------------|-----------|---------------------------|------------|------------|-----------------------|------------|-----------------|-------------------|------------------------------|-----|---------------------|
| item | | order no. | dimension of starter bars | | | for element thickness | | case dimensions | | | | element-weight [kg] |
| profile | rod \varnothing / spacing s [mm/cm] | 0054.010- | $l_{\ddot{u}}^*$ [mm] | h^* [mm] | y^* [mm] | D_1 [cm] | D_2 [cm] | width B [mm] | height H_1 [mm] | height with cover H_2 [mm] | | |
| HBT 55 | 8/15 | 00001 | 320 | 170 | 75 | ≥ 19 | ≥ 6 | 58 | 12 | 24 | 2.7 | |
| | 8/20 | 00002 | | | | | | | | | 2.3 | |
| | 8/25 | 00003 | | | | | | | | | 2.1 | |
| | 10/15 | 00004 | 390 | | 95 | | | | | 30 | 4.1 | |
| | 10/20 | 00005 | | | | | | | | | 3.4 | |
| | 10/25 | 00006 | | | | | | | | | 3.0 | |
| profile | | 0054.020- | | | | | | | | | | |
| HBT 85 | 10/10 | 00007 | 390 | 170 | 95 | ≥ 19 | ≥ 9 | 86 | 12 | 30 | 6.0 | |
| | 10/15 | 00001 | | | | | | | | | 4.4 | |
| | 10/20 | 00002 | | | | | | | | | 3.7 | |
| | 10/25 | 00003 | | | | | | | | | 3.3 | |
| | 12/10 | 00008 | 460 | | 110 | | | | | 36 | 9.0 | |
| | 12/15 | 00004 | | | | | | | | | 6.4 | |
| | 12/20 | 00005 | | | | | | | | | 5.2 | |
| | 12/25 | 00006 | | | | | | | | | 4.5 | |

* Other sizes are also available

Order example: HBT 85 - 10/15 - 1 - 1250



Notes:

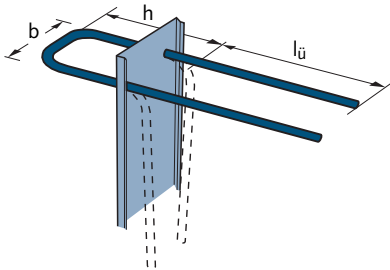
- other HBT 120 element lengths on request (compare tables on page 8 and page 11)
- according to DIN 1045-1:2008-08, section 12.6, the required anchorage and over-lap lengths for individual tensile forces in each reinforcing rod must be observed
- the anchorage and over-lap lengths required by DIN 1045-1:2008-08 may be reduced by 20%, otherwise, according to the data sheet 'Rebending rebar', the reinforcement may only be utilized to 80% of calculated values
- calculation notes for anchoring length → page 20

HALFEN HBT REBEND CONNECTION

Standard Elements, Double-row

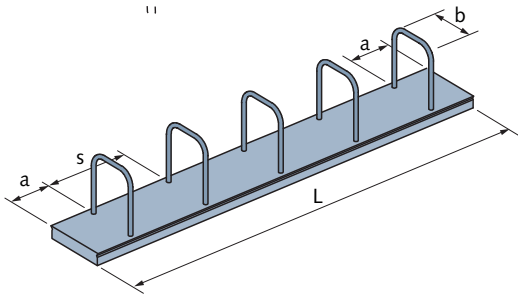
HBT 120 and HBT 150

Type 5 Double-row connection, standard rebar

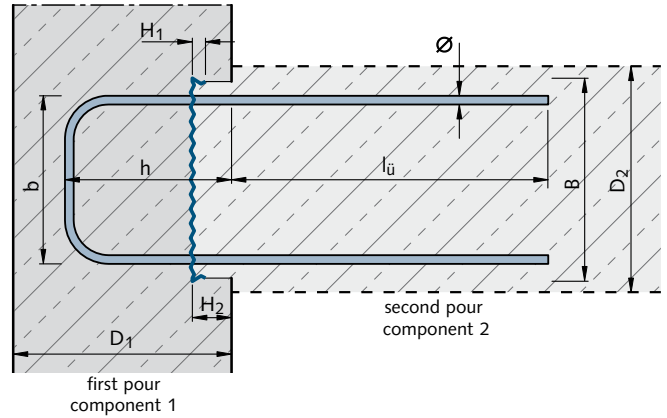


- bending roll diameter in bend location
 $d_{BR} = 6 \times \varnothing$

- material:
Steel rebar
B500B, B500B NR



System:



HBT Type 5 – Stirrup position

| element length L | stirrup spacings [cm] | no. of stirrups | end distance a [cm] |
|---------------------------------|-----------------------|-----------------|---------------------|
| standard element L = 1250 mm | 10 | 12 | 7.5 |
| | 15 | 8 | 10.0 |
| | 20 | 6 | 12.5 |
| | 25 | 5 | 12.5 |

HBT Type 5 – Standard element with element length 1250 mm (table continues on page 8)

| item | | order no. | dimensions of starter bars | | | for element thickness | | case dimensions | | | element-weight [kg] | |
|---------|----------------------------------------|-----------|----------------------------|------------|--------|-----------------------|------------|-----------------|-------------------|------------------------------|---------------------|------|
| profile | rod \varnothing / spacings s [mm/cm] | | $l_{\ddot{u}}^*$ [mm] | h^* [mm] | b [mm] | D_1 [cm] | D_2 [cm] | width B [mm] | height H_1 [mm] | height with cover H_2 [mm] | | |
| HBT 120 | 8/15 | 00001 | 320 | 170 | 88 | ≥ 19 | ≥ 13 | 122 | 12 | 24 | 4.9 | |
| | 8/20 | 00002 | | | | | | | | | 4.1 | |
| | 8/25 | 00003 | | | | | | | | | 3.7 | |
| | 10/15 | 00004 | 390 | | 90 | | | | | 92 | 30 | 7.5 |
| | 10/20 | 00005 | | | | | | | | | | 6.1 |
| | 10/25 | 00006 | | | | | | | | | | 5.4 |
| | 12/15 | 00007 | 390 | | 460 | | | | | 36 | 10.1 | 10.1 |
| | 12/20 | 00008 | 8.5 | | | | | | | | | |
| | 12/25 | 00009 | 7.6 | | | | | | | | | |
| profile | | 0054.050- | | | | | | | | | | |
| HBT 150 | 8/15 | 00001 | 320 | 170 | 116 | ≥ 19 | ≥ 16 | 150 | 12 | 24 | 5.3 | |
| | 8/20 | 00002 | | | | | | | | | 4.4 | |
| | 8/25 | 00003 | | | | | | | | | 4.0 | |
| | 10/10 | 00010 | 360 | | 118 | | | | | 30 | 10.8 | |
| | 10/15 | 00004 | 7.9 | | | | | | | | | |
| | 10/20 | 00005 | 6.4 | | | | | | | | | |
| | 10/25 | 00006 | 310 | | 120 | | | | | 36 | 5.6 | |
| | 12/10 | 00011 | | | | | | | | | 16.2 | |
| | 12/15 | 00007 | | | | | | | | | 11.5 | |
| | 12/20 | 00008 | 460 | | 9.1 | | | | | 7.9 | 9.1 | |
| | 12/25 | 00009 | | | | | | | | | 7.9 | |

*Other sizes are also available

Notes:

- other element lengths on request, further available rebar types → table on page 11
- according to DIN 1045-1:2008-08, section 12.6, the required anchorage and over-lap lengths for individual tensile forces in each reinforcing rod must be observed
- the anchorage and over-lap lengths required by DIN 1045-1:2008-08 may be reduced by 20%, otherwise, according to the data sheet 'Rebending rebar', the reinforcement may only be utilized to 80% of calculated values
- calculation notes for anchor lengths → page 20

HALFEN HBT REBEND CONNECTION

Standard Elements, Double Row; Minimal Element Lengths for HBT

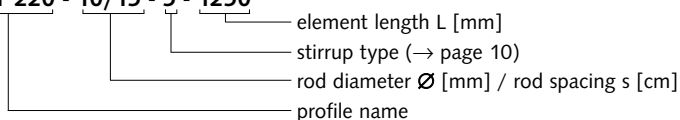
HBT 190 and HBT 220

HBT Type 5 – Standard element with element length 1250 mm (table continued from page 7)

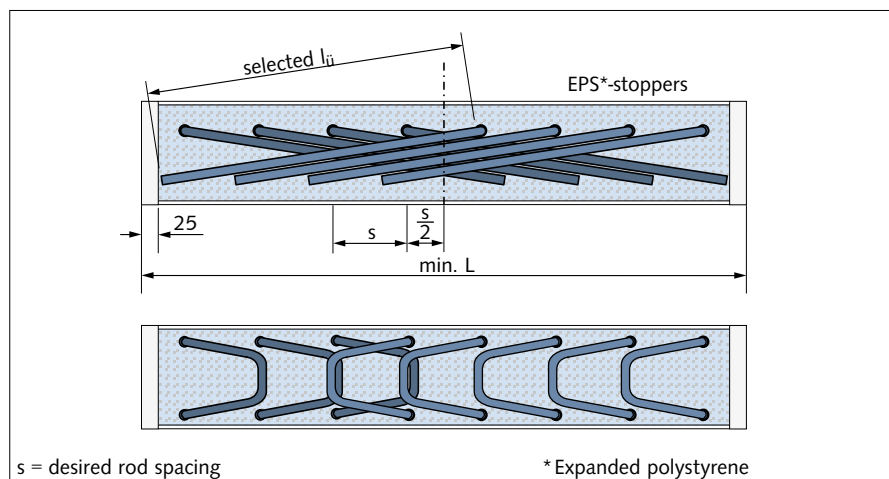
| item name | | order no. | dimension of starter bars | | | for element thickness | | case dimensions | | | element-weight [kg] |
|-----------|---------------------------------------|-----------|---------------------------|------------|--------|-----------------------|------------|-----------------|-------------------|------------------------------|---------------------|
| profile | rod \varnothing / spacing s [mm/cm] | 0054.060- | $l_{\bar{u}}^*$ [mm] | h^* [mm] | b [mm] | D_1 [cm] | D_2 [cm] | width B [mm] | height H_1 [mm] | height with cover H_2 [mm] | |
| HBT 190 | 8/15 | 00001 | 320 | 170 | 152 | ≥ 19 | ≥ 19 | 186 | 12 | 24 | 5.8 |
| | 8/20 | 00002 | | | | | | | | | 4.9 |
| | 8/25 | 00003 | | | | | | | | | 4.5 |
| | 10/10 | 00010 | 390 | | 154 | | | | | 30 | 11.5 |
| | 10/15 | 00004 | | | | | | | | | 8.5 |
| | 10/20 | 00005 | | | | | | | | | 6.9 |
| | 10/25 | 00006 | 460 | | 156 | | | | | 36 | 6.2 |
| | 12/10 | 00011 | | | | | | | | | 17.0 |
| | 12/15 | 00007 | | | | | | | | | 12.1 |
| | 12/20 | 00008 | | | | | | | | | 9.7 |
| 12/25 | 00009 | 8.5 | | | | | | | | | |
| profile | | 0054.070- | | | | | | | | | |
| HBT 220 | 8/15 | 00001 | 320 | 170 | 188 | ≥ 19 | ≥ 23 | 222 | 12 | 24 | 6.2 |
| | 8/20 | 00002 | | | | | | | | | 5.3 |
| | 8/25 | 00003 | | | | | | | | | 4.9 |
| | 10/10 | 00010 | 390 | | 190 | | | | | 30 | 12.1 |
| | 10/15 | 00004 | | | | | | | | | 9.0 |
| | 10/20 | 00005 | | | | | | | | | 7.4 |
| | 10/25 | 00006 | 460 | | 192 | | | | | 36 | 6.6 |
| | 12/10 | 00011 | | | | | | | | | 17.7 |
| | 12/15 | 00007 | | | | | | | | | 12.7 |
| | 12/20 | 00008 | | | | | | | | | 10.2 |
| | 12/25 | 00009 | | | | | | | | | 9.0 |

*Other sizes are also available. Please see notes on page 7.

Order example: **HBT 220 - 10/15 - 5 - 1250**



Minimal element lengths for rebend connection HBT, position of reinforcement in the metal case



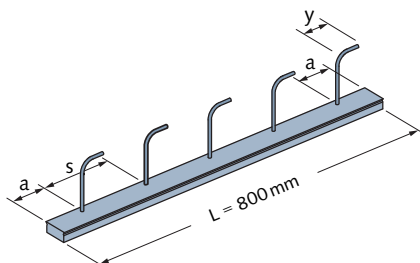
| Minimal element lengths for $l_{\bar{u}}$ standard | | | | |
|----------------------------------------------------|--------|----------------------|------------------|-----------------|
| \varnothing [mm] | s [cm] | $l_{\bar{u}}$ ① [mm] | min. length [mm] | no. of stirrups |
| 8 | 10 | 320 | 650 | 6 |
| 8 | 15 | 320 | 600 | 4 |
| 8 | 20 | 320 | 650 | 4 |
| 10 | 10 | 390 | 800 | 8 |
| 10 | 15 | 390 | 750 | 4 |
| 10 | 20 | 390 | 700 | 4 |
| 12 | 10 | 460 | 950 | 8 |
| 12 | 15 | 460 | 900 | 6 |
| 12 | 20 | 460 | 850 | 4 |

① Max. $l_{\bar{u}}$ - observe dimension for each profile (see page 11)

HALFEN HBT REBEND CONNECTION

Standard Elements as Short Element, L = 800 mm

HBT 55 and 85

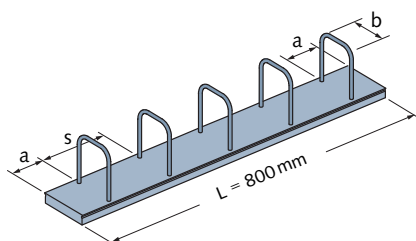


1-row

Type 1

system drawing → see page 6

HBT 120, 150, 190 and 220



2-row

Type 5

system drawing → see page 7

Stirrup position, short elements

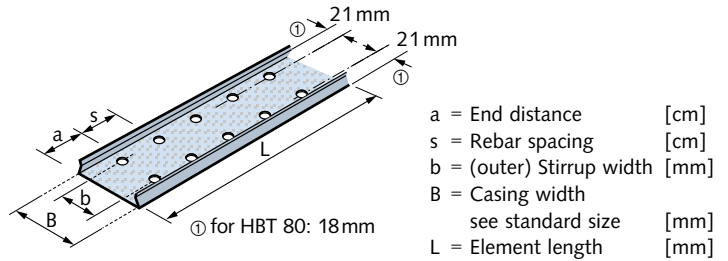
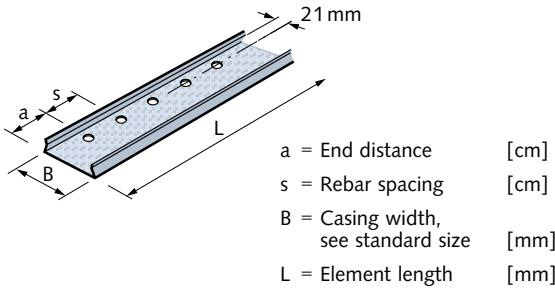
| HBT Type 1 and 5 – stirrup position | | | |
|-------------------------------------|------------------------|----------------|---------------------|
| element length L | stirrup-spacing s [cm] | no. of stirrup | end distance a [cm] |
| short-element L = 800mm | 10 | 8 | 5.0 |
| | 15 | 6 | 2.5 |
| | 20 | 4 | 10.0 |
| | 25 | 4 | 2.5 |

| Short element, element length 800 mm | | | | | | | | | | | |
|--------------------------------------|--------------------------------|-----------|---------------------------|-----------|--------------|------------------------|------------------------|--------------------|----------------------------------|---------------------------------------------|----------------------------|
| item name | | order no. | dimension of starter bars | | | for element thickness | | case dimensions | | | |
| profile | rod Ø/ spacing s [mm/cm] | 0054. ... | l _ü [mm] | h [mm] | y, b [mm] | D ₁ [cm] | D ₂ [cm] | width B [mm] | height H ₁ [mm] | height with cover H ₂ [mm] | element- weight [kg] |
| HBT 55 | 8/15 | 010-00101 | 320 | 170 | 75 | ≥ 19 | ≥ 6 | 58 | 12 | 24 | 1.9 |
| | 8/20 | 010-00102 | | | | | | | | | 1.5 |
| | 8/25 | 010-00103 | | | | | | | | | 1.5 |
| | 10/15 | 010-00104 | 390 | 95 | ≥ 19 | ≥ 6 | 58 | 12 | 30 | 3.0 | |
| | 10/20 | 010-00105 | | | | | | | | 2.2 | |
| | 10/25 | 010-00106 | | | | | | | | 2.2 | |
| HBT 85 | 10/10 | 020-00101 | 390 | 170 | 95 | ≥ 19 | ≥ 9 | 86 | 12 | 30 | 3.9 |
| | 10/15 | 020-00102 | | | | | | | | | 3.1 |
| | 10/20 | 020-00103 | | | | | | | | | 2.3 |
| | 10/25 | 020-00104 | | | | | | | | | 2.3 |
| HBT 120 | 8/15 | 040-00101 | 320 | 170 | 88 | ≥ 19 | ≥ 13 | 122 | 12 | 24 | 3.5 |
| | 8/20 | 040-00102 | | | | | | | | | 2.7 |
| | 8/25 | 040-00103 | | | | | | | | | 2.7 |
| | 10/15 | 040-00104 | 390 | 90 | ≥ 19 | ≥ 13 | 122 | 12 | 30 | 5.5 | |
| | 10/20 | 040-00105 | | | | | | | | 4.0 | |
| | 10/25 | 040-00106 | | | | | | | | 4.0 | |
| HBT 150 | 8/15 | 050-00101 | 320 | 170 | 116 | ≥ 19 | ≥ 16 | 150 | 12 | 24 | 3.7 |
| | 8/20 | 050-00102 | | | | | | | | | 2.9 |
| | 8/25 | 050-00103 | | | | | | | | | 2.9 |
| | 10/10 | 050-00104 | 360 | 170 | 118 | ≥ 19 | ≥ 16 | 150 | 12 | 30 | 6.8 |
| | 10/15 | 050-00105 | | | | | | | | | 5.6 |
| | 10/20 | 050-00106 | | | | | | | | | 4.2 |
| | 10/25 | 050-00107 | | | | | | | | | 4.2 |
| HBT 190 | 8/15 | 060-00101 | 320 | 170 | 152 | ≥ 19 | ≥ 19 | 186 | 12 | 24 | 4.1 |
| | 8/20 | 060-00102 | | | | | | | | | 3.2 |
| | 8/25 | 060-00103 | | | | | | | | | 3.2 |
| | 10/10 | 060-00104 | 390 | 170 | 154 | ≥ 19 | ≥ 19 | 186 | 12 | 30 | 7.5 |
| | 10/15 | 060-00105 | | | | | | | | | 5.9 |
| | 10/20 | 060-00106 | | | | | | | | | 4.4 |
| | 10/25 | 060-00107 | | | | | | | | | 4.4 |
| HBT 220 | 8/15 | 070-00101 | 320 | 170 | 188 | ≥ 19 | ≥ 23 | 222 | 12 | 24 | 4.4 |
| | 8/20 | 070-00102 | | | | | | | | | 3.5 |
| | 8/25 | 070-00103 | | | | | | | | | 3.5 |
| | 10/10 | 070-00104 | 390 | 170 | 190 | ≥ 19 | ≥ 23 | 222 | 12 | 30 | 7.7 |
| | 10/15 | 070-00105 | | | | | | | | | 6.2 |
| | 10/20 | 070-00106 | | | | | | | | | 4.6 |
| | 10/25 | 070-00107 | | | | | | | | | 4.6 |

HALFEN HBT REBEND CONNECTION

Product Range: Profile Variants, Stirrup Types

Single- and double-row layouts



1-row

for profile HBT 55, 85 and 120

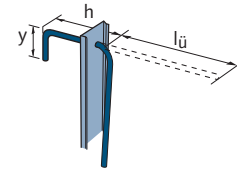
2-row

for profile HBT 80, 120, 150, 190 and 220

Stirrup types

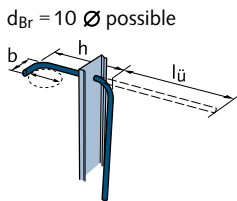
Type 1

min $h = 120$ mm

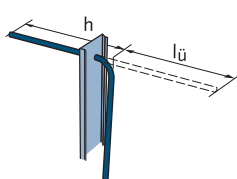


Type 2

min $h = 120$ mm



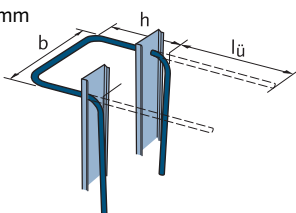
Type 3



$l_{\ddot{u}} \geq 60$ mm

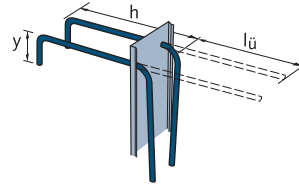
Type 4

min $h = 120$ mm

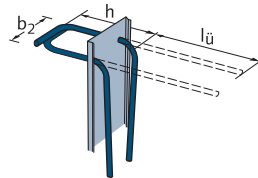


| Type 4 | b [mm] |
|--------|-----------|
| HBT 55 | 200...500 |
| HBT 85 | 250...500 |

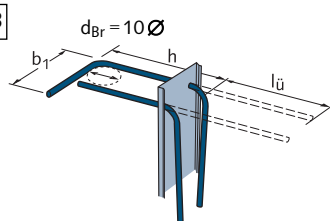
Type 11



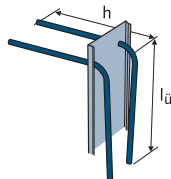
Type 22



Type 23

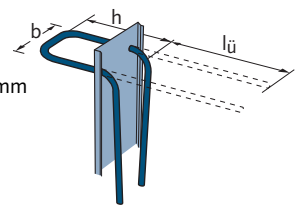


Type 33



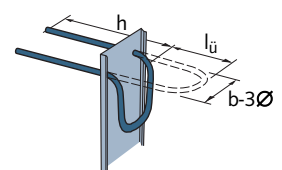
Type 5

min $h = 120$ mm



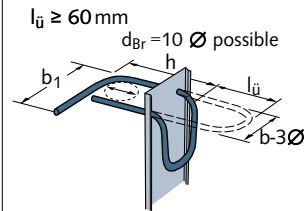
Type 6

$l_{\ddot{u}} \geq 60$ mm



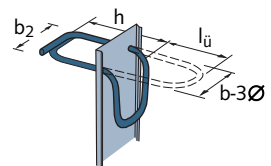
Type 7

$l_{\ddot{u}} \geq 60$ mm



Type 8

$l_{\ddot{u}} \geq 60$ mm

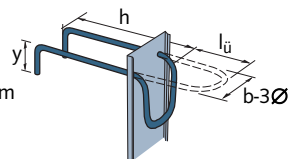


Type 7 and 8

| rod \varnothing | min h [mm] |
|-------------------|--------------|
| 8 | 135 |
| 10 | 155 |
| 12 | 170 |

Type 9

$l_{\ddot{u}} \geq 60$ mm
min $h = 140$ mm



It may be possible to use HALFEN HBS-05 or a HALFEN HLB Loop Box® if a connection using HBT is not viable.

Product information can be found at www.halfen.com.

For technical support contact HALFEN GmbH, Engineering Support, reinforcement technology. Addresses can be found at the back of this catalogue.

HALFEN HBT REBEND CONNECTION

Product Range: Maximum Possible Over-lap Lengths $l_{ü,max}$

HBT 55, 85, 80 and 120

| $l_{ü,max}$ [mm] | | | $l_{ü,max}$ [mm] for stirrup type (see page 10) | | |
|------------------|------------------------|--------------------|-------------------------------------------------|-------------------|------------|
| item name | | | | | |
| profile | rod \varnothing [mm] | rod-spacing s [cm] | 1, 2, 3, 4 | 5, 11, 22, 23, 33 | 6, 7, 8, 9 |
| HBT 55 | 8 | 10 | 210 | — | — |
| | | 15 | 510 | — | — |
| | | 20 | 600 | — | — |
| | | 25 | 600 | — | — |
| | 10 | 10 | 200 | — | — |
| | | 15 | 390 | — | — |
| | | 20 | 510 | — | — |
| | | 25 | 510 | — | — |
| HBT 85 | 10 | 10 | 430 | — | — |
| | | 15 | 510 | — | — |
| | | 20 | 600 | — | — |
| | | 25 | 600 | — | — |
| | 12 | 10 | 430 | — | — |
| | | 15 | 510 | — | — |
| | | 20 | 600 | — | — |
| | | 25 | 600 | — | — |
| HBT 80 | 8 | 10 | — | 170 | 70 |
| | | 15 | — | 360 | 125 |
| | | 20 | — | 450 | 175 |
| | | 25 | — | 500 | 225 |
| | 10 | 10 | — | 160 | 60 |
| | | 15 | — | 320 | 120 |
| | | 20 | — | 400 | 170 |
| | | 25 | — | 450 | 220 |
| HBT 120 | 8 | 10 | — | 290 | 115 |
| | | 15 | — | 510 | 175 |
| | | 20 | — | 600 | 235 |
| | | 25 | — | 600 | 290 |
| | 10 | 10 | 600 | 240 | 80 |
| | | 15 | 600 | 510 | 130 |
| | | 20 | — | 600 | 180 |
| | | 25 | — | 600 | 230 |
| | 12 | 10 | 600 | 215 | 70 |
| | | 15 | 600 | 390 | 120 |
| | | 20 | — | 440 | 170 |
| | | 25 | — | 490 | 220 |

HBT 150, 190 and 220

| $l_{ü,max}$ [mm] | | | $l_{ü,max}$ [mm] for stirrup type (see page 10) | |
|------------------|------------------------|--------------------|-------------------------------------------------|------------|
| item name | | | | |
| profile | rod \varnothing [mm] | rod-spacing s [cm] | 5, 11, 22, 23, 33 | 6, 7, 8, 9 |
| HBT 150* | 8 | 10 | 360 | 100 |
| | | 15 | 510 | 150 |
| | | 20 | 600 | 210 |
| | | 25 | 600 | 260 |
| | 10 | 10 | 360 | 85 |
| | | 15 | 510 | 135 |
| | | 20 | 600 | 185 |
| | | 25 | 600 | 235 |
| | 12 | 10 | 310 | 90 |
| | | 15 | 480 | 150 |
| | | 20 | 530 | 200 |
| | | 25 | 580 | 250 |
| HBT 190* | 8 | 10 | 500 | 100 |
| | | 15 | 510 | 150 |
| | | 20 | 600 | 210 |
| | | 25 | 600 | 260 |
| | 10 | 10 | 500 | 110 |
| | | 15 | 510 | 170 |
| | | 20 | 600 | 220 |
| | | 25 | 600 | 280 |
| 12 | 10 | 430 | 90 | |
| | 15 | 510 | 140 | |
| | 20 | 600 | 190 | |
| | 25 | 600 | 240 | |
| HBT 220* | 8 | 10 | 600 | 100 |
| | | 15 | 600 | 150 |
| | | 20 | 600 | 210 |
| | | 25 | 600 | 260 |
| | 10 | 10 | 600 | 110 |
| | | 15 | 600 | 170 |
| | | 20 | 600 | 220 |
| | | 25 | 600 | 280 |
| | 12 | 10 | 600 | 90 |
| | | 15 | 600 | 140 |
| | | 20 | 600 | 190 |
| | | 25 | 600 | 240 |

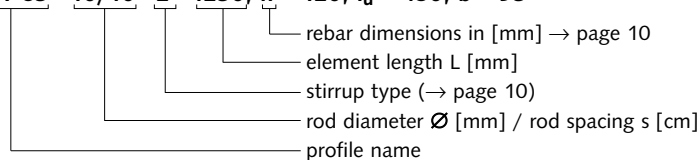
* larger $l_{ü}$ available on request

Note:

Maximal over-lap only applies to element length 1250 mm.

Maximum over-lap for other element lengths are supplied on request.

Order example: **HBT 85 - 10/10 - 2 - 1250, h = 120, $l_{ü} = 430$, b = 95**



HALFEN HBT REBEND CONNECTION

Static Values, Calculation Values

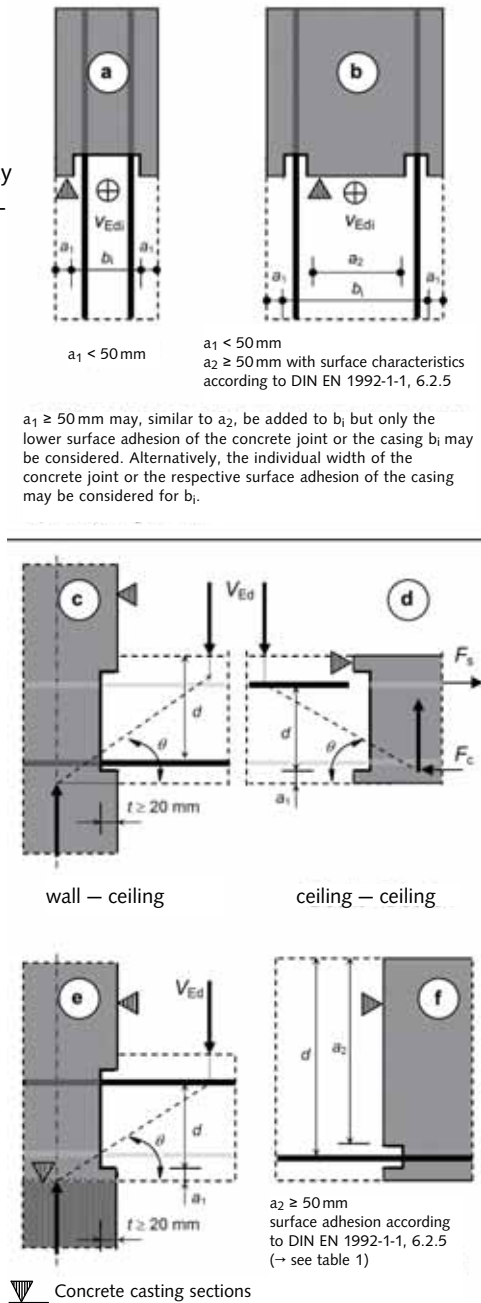
Shear load, standard cases (in accordance with 'Rebending rebar' data sheet issued by the DBV)

Source:

Data sheet 'Rebending of reinforcing steel and requirements on protective boxes according to Eurocode 2' issued by the (DBV) Deutschen Beton- und Bautechnik-Verein e.V. (German Society for Concrete and Construction Technology), January 2011

figure 8:
Calculating limits of load capacity – cross-section values

Explanations of the standard cases see page 15.



The type test for HALFEN HBT Rebend connectors can be found at www.halfen.com

According to DIN EN 1992-1-1, section 6.2.5 the HBT-Profile is classified as having a smooth surface. According to the type test, in its main application, case (C), the HBT-Profiles mostly achieve the same results for $V_{Rd,c}$ as achieved by serrated profiles.

The type test for HBT Connections was based on the guidelines 'Rebending rebar' issued by the DBV and on **DIN EN 1992-1-1**.

Excerpts for shear load capacity as defined in the type test can be found in the tables on pages 16 through to page 19.

Load capacity values have not changed in comparison to the previous type test according to DIN 1045-1:2008-8.

- Case (a) → page 19
- Case (b) → type test HBT
- Case (c) → page 16, 17
- Case (d) → type test HBT
- Case (e) → page 18
- Case (f) → type test HBT
- Corbel → page 19

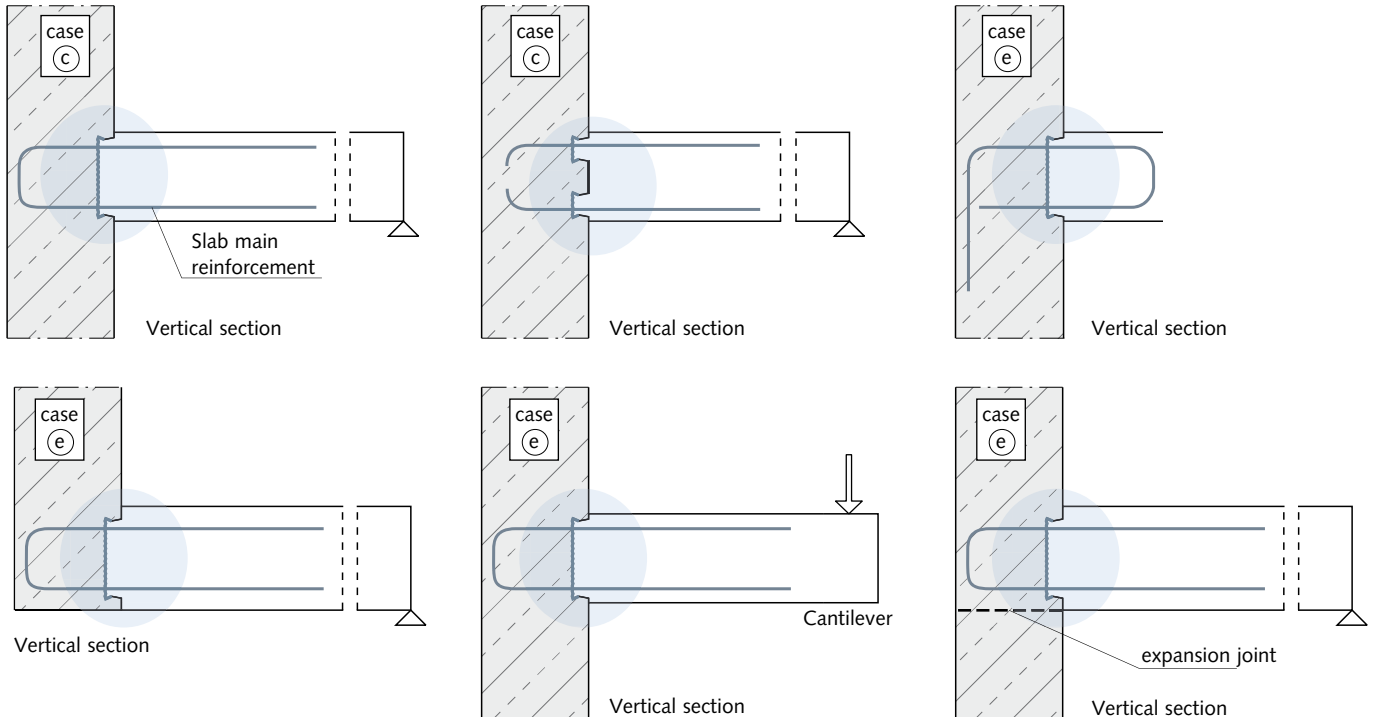
Calculation of the required anchoring and over-lap length is according to DIN EN 1992-1-1, taking into account that the base value for anchoring length l_b can be calculated using the reduced calculation value for steel stress. This generally results in a reduction of about 20% in anchoring and over-lap lengths.

$$f_{yd,red} = 0.8 \cdot \frac{f_{yk}}{\gamma_s}$$

HALFEN HBT REBEND CONNECTION

Applications according to data sheet 'Rebending rebar'

Case classification in accordance with the 'Rebending rebar' data sheet



Case (a) (b)

The rebend rebar acts as connecting reinforcement in the joint. The shear force is transmitted parallel to the connection.

Case a is only for type HBT with double-row rebar. The side surfaces are only considered as supporting if these are > 5 cm, taking surfaces adhesion into account.

Case (c)

Case c is assumed with pin-jointed, linear-loads. The rebend rebar serves as longitudinal reinforcement for the connected building component, whereby, the lower row overlaps the bending reinforcement of the slab; the top row represents the structural reinforcement of the slab. If not placed in the connected component then shear force capacity in the connection is limited to $V_{Rd,c}$.

By adding shear reinforcement, HALFEN HDB-S Shear rails for example (see HDB catalogue), the load capacity may be increased to $V_{Rd,s} \leq 0.3 V_{Rd,max}$. If the distance from the component edge to the lower edge of the profile is less than $a_1 < 5$ cm, then the connection as in case e must be selected.

Case (e)

If the upper row is assumed to be load bearing then a fixed end beam as in case e must be calculated.

These cases generally include applications such as stair-landing slabs and corbels.

According to DIN EN 1992-1-1, 8.3 (NA.5) [R1] the reinforcement in rebend connections when subjected to predominantly static loads up to the load bearing limit may be subjected to maximum 80% of the allowable value of the calculated stress-strain factor for rebar as in DIN EN 1992-1-1, figure 3.8 [R1] (see also figure 6). According to DIN EN 1992-1-1, 8.4.3, eq. (8.3) [R1] the reinforcement anchorage length may also be calculated with the reduced design value for steel stress, $\sigma_{s,d} \leq f_{yd,red} = 0.8 \times f_{yk}/\gamma_s$.

Data sheet 'rebending rebar'
Section 3.1 (3)

If subjected to a combination of shear forces along the joint and transverse forces at right-angles to the joint simultaneously, these verification may be carried out separately.

Data sheet 'rebending rebar'
Section 5.3 (7)

HALFEN HBT REBEND CONNECTION

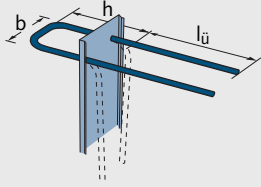
Tables According to the Type-test (Eurocode 2)

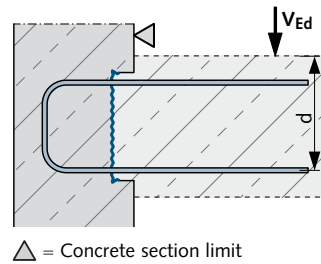
Shear load, standard case 'c' (according to 'Rebending rebar' data sheet issued by the DBV) without shear reinforcement

Example: 'Rebending rebar' data sheet figure 8, case C

$\sigma_{cp} = 0$

d: see illustration

| Type 5 double-row connection, h = 170 mm | \varnothing [mm] | $l_{\bar{u}}^*$ [mm] |
|-----------------------------------------------------------------------------------|--------------------|----------------------|
|  | 8 | 320 |
| | 10 | 390 |
| | 12 | 460 |



Shear force stress max. V_{Ed} [kN/m] ($\leq 0.3 V_{Rd,max}$) for HBT 80, 120*, 150, 190 and 220

Observe the specifications in the type tests

| rod \varnothing / spacing s [mm/cm] | d = 100 mm | d = 120 mm | d = 140 mm | d = 160 mm | d = 180 mm | d = 200 mm | d = 220 mm | d = 240 mm | d = 260 mm | d = 280 mm |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| concrete quality C20/25 | | | | | | | | | | |
| 8/25 | 44.3 | 48.2 | 51.8 | 55.3 | 58.9 | 62.4 | 62.9 | 62.9 | 62.9 | 62.9 |
| 8/20 | 44.3 | 48.2 | 51.8 | 55.3 | 58.9 | 62.4 | 64.6 | 66.7 | 68.8 | 70.9 |
| 8/15 | 44.3 | 48.2 | 51.8 | 55.3 | 58.9 | 62.4 | 64.6 | 66.7 | 68.8 | 70.9 |
| 10/25 | 44.3 | 53.1 | 58.5 | 62.1 | 65.6 | 69.1 | 71.3 | 73.5 | 75.6 | 77.7 |
| 10/20 | 44.3 | 53.1 | 58.5 | 62.1 | 65.6 | 69.1 | 71.3 | 73.5 | 75.6 | 77.7 |
| 10/15 | 44.3 | 53.1 | 58.5 | 62.1 | 65.6 | 69.1 | 71.3 | 73.5 | 75.6 | 77.7 |
| 12/25 | - | 53.1 | 62.0 | 68.8 | 72.3 | 75.9 | 78.1 | 80.2 | 82.3 | 84.4 |
| 12/20 | - | 53.1 | 62.0 | 68.8 | 72.3 | 75.9 | 78.1 | 80.2 | 82.3 | 84.4 |
| 12/15 | - | 55.8 | 62.0 | 68.8 | 72.3 | 75.9 | 78.1 | 80.2 | 82.3 | 84.4 |
| concrete quality C25/30 | | | | | | | | | | |
| 8/25 | 49.5 | 55.1 | 59.0 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 |
| 8/20 | 49.5 | 55.1 | 59.0 | 63.0 | 66.9 | 70.9 | 73.3 | 75.7 | 78.1 | 78.7 |
| 8/15 | 49.5 | 55.1 | 59.0 | 63.0 | 66.9 | 70.9 | 73.3 | 75.7 | 78.1 | 80.4 |
| 10/25 | 49.5 | 59.4 | 66.8 | 70.8 | 74.8 | 78.7 | 81.2 | 83.6 | 85.9 | 88.3 |
| 10/20 | 49.5 | 59.4 | 66.8 | 70.8 | 74.8 | 78.7 | 81.2 | 83.6 | 85.9 | 88.3 |
| 10/15 | 49.5 | 59.4 | 66.8 | 70.8 | 74.8 | 78.7 | 81.2 | 83.6 | 85.9 | 88.3 |
| 12/25 | - | 59.4 | 69.3 | 78.6 | 82.6 | 86.6 | 89.0 | 91.4 | 93.8 | 96.1 |
| 12/20 | - | 59.4 | 69.3 | 78.6 | 82.6 | 86.6 | 89.0 | 91.4 | 93.8 | 96.1 |
| 12/15 | - | 60.1 | 69.3 | 78.6 | 82.6 | 86.6 | 89.0 | 91.4 | 93.8 | 96.1 |
| concrete quality C30/37 | | | | | | | | | | |
| 8/25 | 54.2 | 61.4 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 | 62.9 |
| 8/20 | 54.2 | 61.4 | 65.7 | 70.1 | 74.4 | 78.7 | 78.7 | 78.7 | 78.7 | 78.7 |
| 8/15 | 54.2 | 61.4 | 65.7 | 70.1 | 74.4 | 78.7 | 81.4 | 84.0 | 86.6 | 89.2 |
| 10/25 | 54.2 | 65.1 | 74.6 | 78.9 | 83.2 | 87.6 | 90.2 | 92.9 | 95.5 | 98.0 |
| 10/20 | 54.2 | 65.1 | 74.6 | 78.9 | 83.2 | 87.6 | 90.2 | 92.9 | 95.5 | 98.0 |
| 10/15 | 54.2 | 65.1 | 74.6 | 78.9 | 83.2 | 87.6 | 90.2 | 92.9 | 95.5 | 98.0 |
| 12/25 | - | 65.1 | 75.9 | 86.8 | 92.1 | 96.4 | 99.1 | 101.7 | 104.3 | 106.8 |
| 12/20 | - | 65.1 | 75.9 | 86.8 | 92.1 | 96.4 | 99.1 | 101.7 | 104.3 | 106.8 |
| 12/15 | - | 65.1 | 75.9 | 86.8 | 92.1 | 96.4 | 99.1 | 101.7 | 104.3 | 106.8 |

Note:

- refer to type test for values for rebar spacing of 10 cm
- *because of its dense reinforcement sufficient over-lap is not always possible with the HBT 120 (page 7). The values for load capacity should be adjusted accordingly

HALFEN HBT REBEND CONNECTION

Tables According to the Type-test (Eurocode 2)

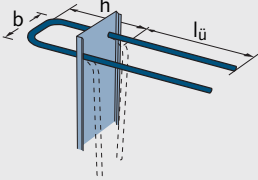
Shear load, standard case 'c' (according to 'Rebending rebar' data sheet issued by the DBV) with shear reinforcement

Example: 'Rebending rebar' data sheet figure 8, case (C)

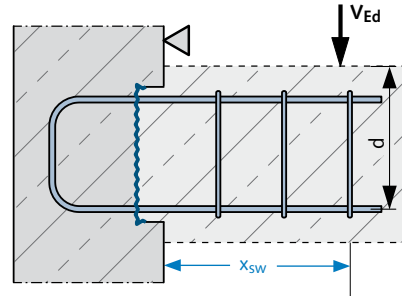
$\sigma_{cp} = 0$

d: see illustration

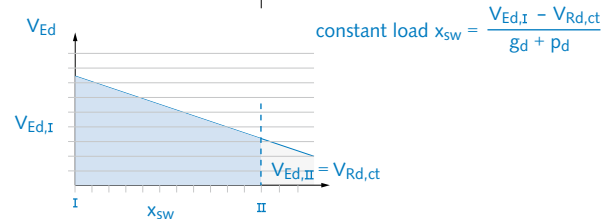
(HALFEN HDB-S or rebar)

| Type 5 double row connection, h = 170 mm | Ø [mm] | l _ü * [mm] |
|-----------------------------------------------------------------------------------|--------|-----------------------|
|  | 8 | 320 |
| | 10 | 390 |
| | 12 | 460 |

$$a_{sw} = \frac{V_{Ed}}{f_{yd} \cdot z} \quad z = \min \begin{cases} 0.9 \cdot d \\ d - c_{v,I} - 30 \text{ mm} \end{cases}$$



△ = Concrete section limit



Shear force stress max. V_{Ed} [kN/m] ($\leq 0.3 \cdot V_{Rd,max}$) for HBT 80, 120*, 150, 190 and 220

Observe the specifications in the type tests.

| rod Ø / spacing s [mm/cm] | d = 100 mm | d = 120 mm | d = 140 mm | d = 160 mm | d = 180 mm | d = 200 mm | d = 220 mm | d = 240 mm | d = 260 mm | d = 280 mm |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| concrete quality C20/25 | | | | | | | | | | |
| 8/25 | 63.8 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 |
| 8/20 | 63.8 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 |
| 8/15 | 63.8 | 89.3 | 114.8 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 |
| 10/25 | 63.8 | 87.5 | 87.5 | 87.5 | 87.5 | 87.5 | 87.5 | 87.5 | 87.5 | 87.5 |
| 10/20 | 63.8 | 89.3 | 109.4 | 109.4 | 109.4 | 109.4 | 109.4 | 109.4 | 109.4 | 109.4 |
| 10/15 | 63.8 | 89.3 | 114.8 | 140.3 | 145.8 | 145.8 | 145.8 | 145.8 | 145.8 | 145.8 |
| 12/25 | - | 89.3 | 100.5 | 100.5 | 100.5 | 100.5 | 100.5 | 100.5 | 100.5 | 100.5 |
| 12/20 | - | 89.3 | 114.8 | 125.6 | 125.6 | 125.6 | 125.6 | 125.6 | 125.6 | 125.6 |
| 12/15 | - | 89.3 | 114.8 | 140.3 | 165.8 | 167.5 | 167.5 | 167.5 | 167.5 | 167.5 |
| concrete quality C25/30 | | | | | | | | | | |
| 8/25 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 |
| 8/20 | 79.7 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 |
| 8/15 | 79.7 | 111.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 |
| 10/25 | 79.7 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 |
| 10/20 | 79.7 | 111.6 | 126.9 | 126.9 | 126.9 | 126.9 | 126.9 | 126.9 | 126.9 | 126.9 |
| 10/15 | 79.7 | 111.6 | 143.4 | 169.2 | 169.2 | 169.2 | 169.2 | 169.2 | 169.2 | 169.2 |
| 12/25 | - | 111.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 |
| 12/20 | - | 111.6 | 143.4 | 145.8 | 145.8 | 145.8 | 145.8 | 145.8 | 145.8 | 145.8 |
| 12/15 | - | 111.6 | 143.4 | 175.3 | 194.4 | 194.4 | 194.4 | 194.4 | 194.4 | 194.4 |
| concrete quality C30/37 | | | | | | | | | | |
| 8/25 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 | 69.9 |
| 8/20 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 |
| 8/15 | 95.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 | 116.6 |
| 10/25 | 95.6 | 109.3 | 109.3 | 109.3 | 109.3 | 109.3 | 109.3 | 109.3 | 109.3 | 109.3 |
| 10/20 | 95.6 | 133.9 | 136.6 | 136.6 | 136.6 | 136.6 | 136.6 | 136.6 | 136.6 | 136.6 |
| 10/15 | 95.6 | 133.9 | 172.1 | 182.1 | 182.1 | 182.1 | 182.1 | 182.1 | 182.1 | 182.1 |
| 12/25 | - | 131.7 | 131.7 | 131.7 | 131.7 | 131.7 | 131.7 | 131.7 | 131.7 | 131.7 |
| 12/20 | - | 133.9 | 164.6 | 164.6 | 164.6 | 164.6 | 164.6 | 164.6 | 164.6 | 164.6 |
| 12/15 | - | 133.9 | 172.1 | 210.4 | 219.5 | 219.5 | 219.5 | 219.5 | 219.5 | 219.5 |

Note:

- refer to type test for values for rebar spacing of 10 cm
- *because of its dense reinforcement sufficient over-lap is not always possible with the HBT 120 (page 7). The values for load capacity should be adjusted accordingly.

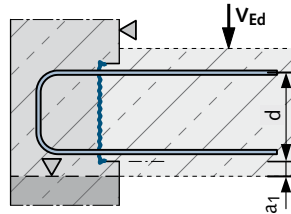
HALFEN HBT REBEND CONNECTION

Values in Tables are According to the Type-test (Eurocode 2)

Shear force, Standard case 'e' (in accordance with 'Rebending rebar' data sheet)

Example: 'Rebending rebar' data sheet
figure 8, case (e)
 $\sigma_{cp} = 0$

No shear force reinforcement



Δ = Concrete section limit

| Type 5 double row connection, h = 170 mm | \varnothing [mm] | $l_{ü}^*$ [mm] |
|------------------------------------------|--------------------|----------------|
| | 8 | 320 |
| | 10 | 390 |
| | 12 | 460 |

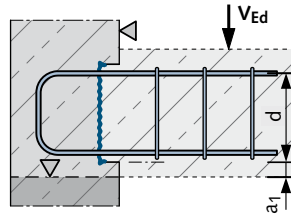
Shear force stress $V_{Rd,c}$ [kN/m] ($\leq 0.3 \cdot V_{Rd,max}$) for HBT 120*; 150, 190 and 220 Observe the specifications in the type tests

| profile | HBT 120 ① | | | HBT 150 | | | HBT 190 | | | HBT 220 | | |
|----------------------------------------|-----------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|
| | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 |
| rod \varnothing [mm]/ spacing s [cm] | | | | | | | | | | | | |
| 8/25 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 8/20 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 8/15 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 10/25 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 10/20 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 10/15 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 12/25 | 17.9 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 12/20 | 18.1 | 20.0 | 21.9 | 22.8 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |
| 12/15 | 19.9 | 21.4 | 22.8 | 23.4 | 25.5 | 28.0 | 29.2 | 32.7 | 35.8 | 35.5 | 39.7 | 43.5 |

* Because of its dense reinforcement sufficient over-lap is not always possible with the HBT 120 (Page 7). Refer to the type test for HBT 80 and values for rebar spacing of 10 cm.

Example: 'Rebending rebar' data sheet
figure 8, case (e)
 $\sigma_{cp} = 0$

With shear force reinforcement (HALFEN HDB-S or rebar)



Δ = Concrete section limit

| Type 5 double-row connection, h = 170 mm | \varnothing [mm] | $l_{ü}^*$ [mm] |
|------------------------------------------|--------------------|----------------|
| | 8 | 320 |
| | 10 | 390 |
| | 12 | 460 |

$$a_{sw} = \frac{V_{Ed}}{f_{yd} \cdot z} \quad z = \min \begin{cases} 0.9 \cdot d \\ d - c_{v,l} - 30 \text{ mm} \end{cases}$$

Shear force stress $V_{Rd,s}$ [kN/m] ($\leq 0.3 \cdot V_{Rd,max}$) for HBT 120*; 150, 190 and 220 Observe the specifications in the type tests

| profile | HBT 120 ① | | | HBT 150 | | | HBT 190 | | | HBT 220 | | |
|----------------------------------------|-----------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|
| | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 |
| rod \varnothing [mm]/ spacing s [cm] | | | | | | | | | | | | |
| 8/25 | 48.7 | 56.5 | 63.8 | 48.7 | 56.5 | 63.8 | 48.7 | 56.5 | 63.8 | 48.7 | 56.5 | 63.8 |
| 8/20 | 60.8 | 70.6 | 79.7 | 60.8 | 70.6 | 79.7 | 60.8 | 70.6 | 79.7 | 60.8 | 70.6 | 79.7 |
| 8/15 | 77.8 | 94.1 | 106.3 | 81.1 | 94.1 | 106.3 | 81.1 | 94.1 | 106.3 | 81.1 | 94.1 | 106.3 |
| 10/25 | 58.3 | 67.7 | 76.4 | 58.3 | 67.7 | 76.4 | 58.3 | 67.7 | 76.4 | 58.3 | 67.7 | 76.4 |
| 10/20 | 72.9 | 84.6 | 95.5 | 72.9 | 84.6 | 95.5 | 72.9 | 84.6 | 95.5 | 72.9 | 84.6 | 95.5 |
| 10/15 | 77.8 | 97.2 | 116.7 | 97.2 | 112.8 | 127.4 | 97.2 | 112.8 | 127.4 | 97.2 | 112.8 | 127.4 |
| 12/25 | 67.0 | 77.7 | 87.8 | 67.0 | 77.7 | 87.8 | 67.0 | 77.7 | 87.8 | 67.0 | 77.7 | 87.8 |
| 12/20 | 77.8 | 97.2 | 109.7 | 83.7 | 97.2 | 109.7 | 83.7 | 97.2 | 109.7 | 83.7 | 97.2 | 109.7 |
| 12/15 | 77.8 | 97.2 | 116.7 | 111.7 | 129.6 | 146.3 | 111.7 | 129.6 | 146.3 | 111.7 | 129.6 | 146.3 |

* Because of its dense reinforcement sufficient over-lap is not always possible with the HBT 120 (Page 7). Refer to the type test for HBT 80 and values for rebar spacing of 10 cm.

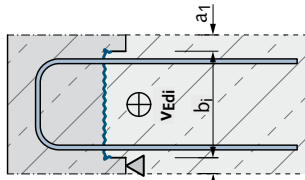
HALFEN HBT REBEND CONNECTION

Values in Tables are According to the Type-test (Eurocode 2) / Assembly instructions

Shear force, Case 'a' (in accordance with 'Rebending rebar' data sheet issued by the DBV)

Example: 'Rebending rebar' data sheet figure 8, case (a)

$a_1 \leq 5 \text{ cm}, \sigma_n = 0$



Δ = Concrete section limit

| Type 5 double-row connection, h = 170 mm | \varnothing [mm] | $l_{ü}^*$ [mm] |
|------------------------------------------|--------------------|----------------|
| | 8 | 320 |
| | 10 | 390 |
| | 12 | 460 |

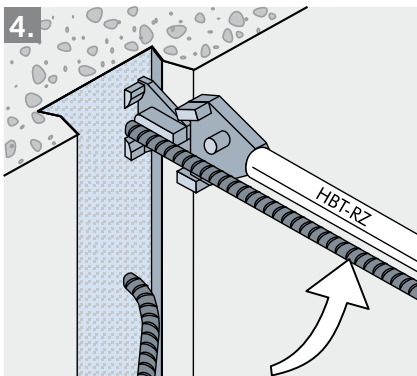
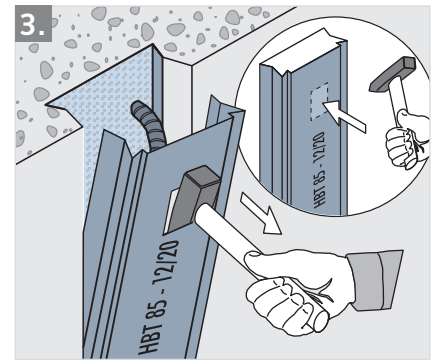
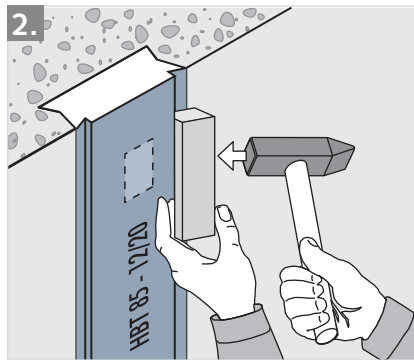
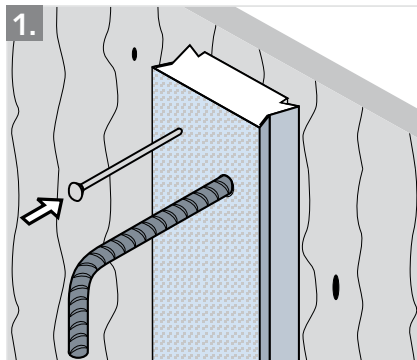
Shear force stress max. V_{Edi} [kN/m] ($\leq V_{Rdi,max}$) for HBT 120*; 150; 190 and 220

Observe the specifications in the type tests

| profile concrete quality rod \varnothing [mm]/ spacing s [cm] | HBT 120 ① | | | HBT 150 | | | HBT 190 | | | HBT 220 | | |
|--------------------------------------------------------------------------|-----------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|
| | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 | C20/25 | C25/30 | C30/37 |
| 8/25 | 91.1 | 105.7 | 119.3 | 95.9 | 111.2 | 125.6 | 102.1 | 118.4 | 133.7 | 108.2 | 125.6 | 141.8 |
| 8/20 | 108.6 | 126.0 | 142.3 | 113.4 | 131.6 | 148.6 | 119.6 | 138.8 | 156.7 | 125.8 | 145.9 | 164.8 |
| 8/15 | 137.8 | 159.9 | 180.5 | 142.6 | 165.5 | 186.8 | 148.8 | 172.6 | 194.9 | 155.0 | 179.8 | 203.1 |
| 10/25 | 105.0 | 121.8 | 137.6 | 109.8 | 127.4 | 143.9 | 116.0 | 134.6 | 152.0 | 122.2 | 141.8 | 160.1 |
| 10/20 | 126.0 | 146.2 | 165.1 | 130.8 | 151.8 | 171.4 | 137.0 | 158.9 | 179.5 | 143.2 | 166.1 | 187.6 |
| 10/15 | 138.3 | 172.8 | 207.4 | 165.8 | 192.4 | 217.2 | 172.0 | 199.6 | 225.3 | 178.2 | 206.7 | 233.5 |
| 12/25 | 117.5 | 136.3 | 153.9 | 122.3 | 141.9 | 160.2 | 128.5 | 149.1 | 168.3 | 134.6 | 156.2 | 176.4 |
| 12/20 | 138.3 | 164.3 | 185.5 | 146.4 | 169.9 | 191.8 | 152.6 | 177.0 | 199.9 | 158.8 | 184.2 | 208.0 |
| 12/15 | 138.3 | 172.8 | 207.4 | 170.0 | 212.5 | 244.5 | 192.8 | 223.7 | 252.6 | 199.0 | 230.9 | 260.7 |

* Because of its dense reinforcement sufficient over-lap is not always possible with the HBT 120 (Page 7). Refer to the type test for HBT 80 and values for rebar spacing of 10 cm.

Assembly instructions



1. Nail the HBT-Element to the timber formwork in the specified position. When using steel formwork use suitable fixings, for example, magnetic fixing plates.
2. After the concrete has cured strike the formwork; place a wood block in the long groove in the cover and tap lightly with a hammer until the cover loosens.
3. Use a hammer claw to punch in the perforated hole in the cover; hook the hammer in the hole and pull the lid out.
4. Place the HALFEN Rebend gripper under the rebar and pull handle evenly with both hands until the rebar is in the desired position. The bar must be rebent straight without any kinks. Proceed in a similar manner to rebent all rods of the HBT-Element one-by-one. The contoured back of the HBT-Element casing remains in the concrete.

Note: Detailed assembly instructions can be found at www.halfen.com.

HALFEN HBT REBEND CONNECTION

Corbel Calculation/Calculation Basics

Calculating corbels with HBT type 7

Structural boundary conditions

Geometrical parameters: $0.2 \leq \frac{a_c}{h_c} \leq 1.0$

Anchoring length in the corbel:

$$l_{b,min} \geq \max \left\{ 0.3 \cdot \frac{\phi}{4} \cdot \frac{\sigma_{sd}}{f_{bd}}; 10 \phi \right\}$$

The minimal anchor length may generally be reduced when directly supported by (2/3) $l_{b,min} \geq 6.7 \phi$.

Over-lap in the wall: The over-lap l_o in the wall must be dimensioned for full load of the rebar.

Structural notes: The distance between the side edge of the panel and the outermost reinforcement stirrup in the HBT-connection should not exceed 5 cm. The side edges of the panel must be secured with reinforcement stirrups.

Force in tension beam: $Z_{Ed} = F_{Ed} \cdot \frac{a_c}{z_0} + H_{Ed} \cdot \frac{a_H + z_0}{z_0}$

with $\cot \theta = \frac{a_c}{z_0} \geq 1.0$

$$z_0 = d \cdot \left(1 - 0.4 \cdot \frac{F_{Ed}}{0.3 \cdot V_{Rd,max}} \right)$$

$$H_{Ed} \geq 0.2 \cdot F_{Ed}$$

Required reinforcement for tension:

$$a_{s,req} = \frac{Z_{Ed}}{0.8 \cdot f_{yk} / \gamma_s} \cdot \frac{l_{bd,req}}{l_{bd,actual}}$$

with $\frac{l_{bd,req}}{l_{bd,actual}} \geq 1.0$

Maximal allowable shear load:

$$V_{Ed} \leq 0.3 \cdot V_{Rd,max}$$

$$V_{Rd,max} = b_w \cdot z \cdot v_1 \cdot f_{cd} \cdot \frac{1}{\cot \theta + \tan \theta}$$

$$\text{with } v_1 = 0.75 \cdot \left(1.1 - \frac{f_{ck}}{500} \right) \leq 0.75$$

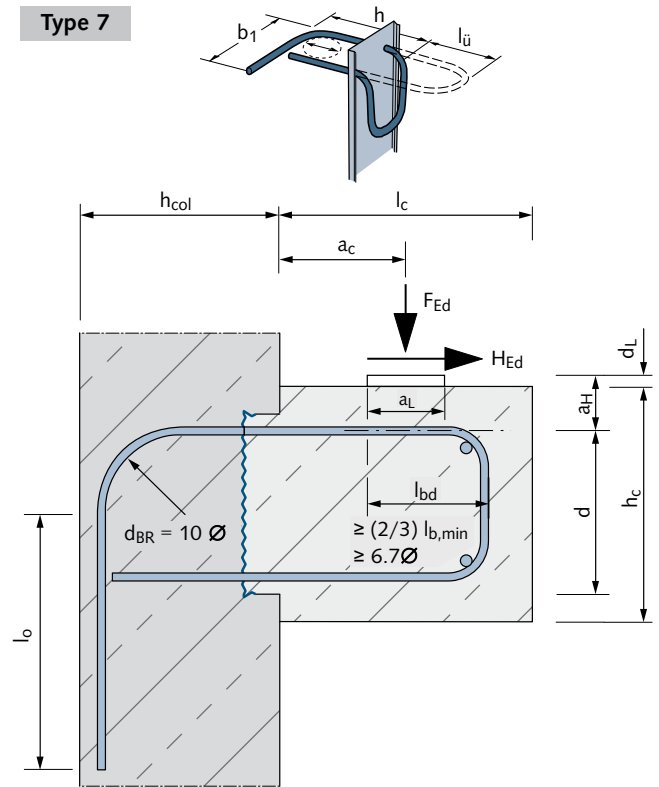
Verifying the HBT over-lap lengths:

$$l_{o,actual} = b_1 - 6 \cdot \phi \geq l_{o,req}$$

Note: The bearing stress under the load distribution plate and the joint load-bearing capacity in the wall must be verified according to DIN EN 1992-1-1 or according to pub. 532 of the *Deutscher Ausschuss für Stahlbeton** (DAfStb). Observe the specifications in the type tests.

*German Committee for Structural Concrete

Type 7



Calculation basics according to the DBV data sheet "rebending reinforcement bars"

Shear force parallel to concrete joint

Total load capacity: DIN EN 1992-1-1, eq. 6.25 without $\mu \cdot \sigma_n$

$$V_{Rdi} = c \cdot f_{ctd} + V_{Rdi,s} \leq V_{Rdi,max}$$

c_j = factor according to DIN EN 1992-1-1, 6.2.5

$$f_{ctd} = 0.85 \cdot f_{ctk;0,05} / \gamma_c \text{ with } \gamma_c = 1.5$$

Reinforcement load capacity

$$V_{Rdi,s} = \rho \cdot f_{yd,red} \cdot (1.2 \cdot \mu \cdot \sin \alpha + \cos \alpha)$$

with $\rho = \frac{A_s}{A_i}$ (A_s = anchored reinforcement cross-section)

$$f_{yd,red} = 0.80 \cdot \frac{f_{yk}}{\gamma_s}$$

Maximal acceptable shear force: DIN EN 1992-1-1, 6.2.5

$$V_{Rdi,max} = 0.5 \cdot v \cdot f_{cd}$$

v = factor according to DIN EN 1992-1-1, 6.2.5

HALFEN HBT REBEND CONNECTION

Calculation Basics

Calculation basics, extracts from the DBV "rebending reinforcement" data sheet

| DIN EN 1992-1-1. 6.2.5 | | | |
|------------------------|-------------------|-----|-----|
| Joint surface | c | μ | v |
| serrated | 0.5 | 0.9 | 0.7 |
| rough | 0.4 ¹⁾ | 0.7 | 0.5 |
| smooth | 0.2 ¹⁾ | 0.6 | 0.2 |
| very smooth | 0 | 0.5 | 0 |

1) if $\sigma_n \leq 0$ then $c_j = 0$ applies

Further notes

Anchoring length:

$$l_{bd}(80\%) = 0.8 \cdot \frac{\varnothing}{4} \cdot \frac{f_{yd}}{f_{bd}} \cdot \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \frac{A_{s,req}}{A_{s,actual}} \geq l_{b,min}$$

$$l_{o(80\%)} = l_{bd(80\%)} \cdot \alpha_6 \geq l_{o,min} \quad \text{according to DIN EN 1992-1-1}$$

Shear force perpendicular to the concrete joint

Acceptable shear load with no shear reinforcement:

DIN EN 1992-1-1, eq. 6.2 reduction using roughness coefficient.

$$V_{Rd,c} = \frac{c}{0.5} \cdot \left(0.15 / \gamma_c \cdot k \cdot (100 \cdot \rho_l \cdot f_{ck})^{1/3} + 0.12 \cdot \sigma_{cp} \right) \cdot b_w \cdot d$$

c = factor according to DIN EN 1992-1-1, 6.2.5

$$k = 1 + \sqrt{\frac{200}{d[\text{mm}]}} \leq 2.0$$

In eq. 6.2, the longitudinal reinforcement considered in tension in the static system, given sufficient anchorage, may be used in the calculation. Reducing the amount of reinforcement because the longitudinal reinforcement is not fully utilized with 80% of characteristic strength is not necessary.

Acceptable shear force **with** shear force reinforcement:

DIN EN 1992-1-1, eq. 6.8

$$V_{Rd,s} = \frac{A_{sw}}{s} \cdot f_{ywd} \cdot z \cdot \cot \theta$$

$$\text{with } z \approx 0.9 \cdot d \text{ or } z \leq d - c_{v,l} - 30 \text{ mm}$$

Maximal acceptable shear force **with** shear force reinforcement:

DIN EN 1992-1-1, eq. 6.9 for 90° - stirrup reinforcement, limited in rebend area to 30%

$$V_{Ed} \leq 0.30 \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} \cdot \frac{1}{\cot \theta + \tan \theta}$$

$$\text{with } v_1 = 0.75 \cdot \left(1.1 - \frac{f_{ck}}{500} \right) \leq 0.75$$

Limits for compression struts:

DIN EN 1992-1-1, eq. 6.7aDE but limited to $\theta \leq 45^\circ$ for $l_e = 0.5 \cdot \cot \theta \cdot d$ both sides of the joint

$$1.0 \leq \cot \theta \leq \frac{1.2 + 1.4 \cdot \sigma_{cd} / f_{cd}}{1 - V_{Rd,cc} / V_{Ed}} \leq 3.0$$

with eq. 6.7bDE according to DIN EN 1992-1-1

$$V_{Rd,cc} = c \cdot 0.48 \cdot f_{ck}^{1/3} \cdot (1 - 1.2 \cdot \sigma_{cd} / f_{cd}) \cdot b_w \cdot z$$

c = factor according to DIN EN 1992-1-1, 6.2.5

Table below:

over-lap length l_o according to DIN EN 1992-1-1

for good bonding properties the following applies:

$$f_{bd} = 2.3 \text{ N/mm}^2 \text{ for C20/25}$$

$$f_{bd} = 2.7 \text{ N/mm}^2 \text{ for C25/30}$$

$$f_{bd} = 3.0 \text{ N/mm}^2 \text{ for C30/37}$$

$$\alpha_1 = 1.0 \text{ for straight rebar ends}$$

$$\alpha_2 = 1.0$$

$$\alpha_3 = 1.0$$

$$\alpha_6 = 1.0 \text{ according to table 8.3DE, DIN EN 1992-1-1}$$

$$\alpha_6 = 1.4 \text{ for } \varnothing 12/10$$

| reinforcement density in cm ² /m | | | | over-lap length for C20/25 | | |
|---------------------------------------------|--------|-------|------|----------------------------|---------------------------|-----------------------------------------------|
| ∅ [mm] | s [cm] | 100% | 80% | l _o (100%) [mm] | l _o (80%) [mm] | selected l _o as standard size [mm] |
| 8 | 10 | 5.03 | 4.02 | 375 | 300 | 320 |
| | 15 | 3.35 | 2.68 | | | |
| | 20 | 2.51 | 2.01 | | | |
| | 25 | 2.01 | 1.61 | | | |
| 10 | 10 | 7.85 | 6.28 | 468 | 375 | 390 |
| | 15 | 5.24 | 4.19 | | | |
| | 20 | 3.93 | 3.14 | | | |
| | 25 | 3.14 | 2.51 | | | |
| 12 | 10 | 11.31 | 9.05 | 787 | 629 | 460 |
| | 15 | 7.54 | 6.03 | | | |
| | 20 | 5.65 | 4.52 | | | |
| | 25 | 4.52 | 3.62 | | | |

Technical support

Engineering services and technical support for your individual projects. Contact information can be found at the back of this catalogue.

HALFEN HBT REBEND CONNECTION

Tender Text Examples

HALFEN Rebend connection, type HBT 85-10/20-1-1250

HALFEN HBT Rebend connection with single-row rebend reinforcement in a galvanized steel case to form a reinforced connection, type-tested according to DIN 1045-1:2008-08 and DIN EN 1992-1; with approved surface properties for the case according to the DBV "rebending reinforcement" data sheet; marked and RAL-GZ 658/2 approved by the Association of anchoring and reinforcement technology.

Type HBT 85 – 10/20 – 1 – 1250

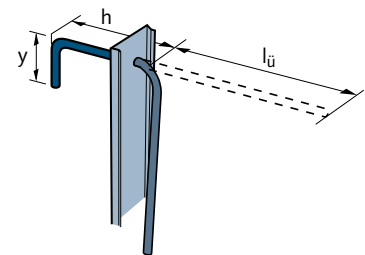
with

85 = type identifier for case width 86 mm, with single-row of rebar,
10/20 = rebar steel B500B, rod diameter 10 mm, rod spacing 200 mm,
1 = standard rebar type 1,
1250 = case length [mm],
in standard rod dimensions

rod length 1 $h = 170$ mm,

rod length 2 $l_{\ddot{u}} = 390$ mm,

hook length $y = 95$ mm,



or equivalent; deliver and install according to manufacturer's instructions.

HALFEN Rebend connection, type HBT 150-12/15-5-1250

HALFEN HBT Rebend connection with double-row rebend reinforcement in a galvanized steel case to form a reinforced connection, type-tested according to DIN 1045-1:2008-08 and DIN EN 1992-1; with approved surface properties for the case according to the DBV "rebending reinforcement" data sheet; marked and RAL-GZ 658/2 approved by the Association of anchoring and reinforcement technology.

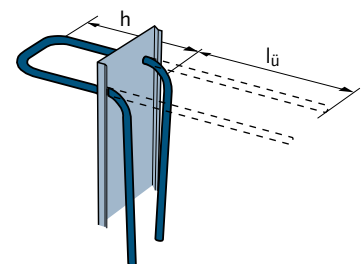
Type HBT 150 – 12/15 – 5 – 1250

with

150 = type identifier for case width of 150 mm, with double-row of rebar,
12/15 = rebar steel B500B, rod diameter 12 mm, rod spacing 150 mm,
5 = standard rebar type 5,
1250 = case length [mm],
in standard rod dimensions

rod length 1 $h = 170$ mm,

rod length 2 $l_{\ddot{u}} = 460$ mm,



or equivalent; deliver and install according to manufacturer's instructions.

HALFEN Rebend connection, stainless steel A4

Apply the text as above but replace "B500B" with "stainless reinforcement steel B500B NR according to Building Authority Approval".

Further tender text examples can be found at www.halfen.com.

CONTACT HALFEN WORLDWIDE

HALFEN is represented by subsidiaries in the following 14 countries, please contact us:

| | | | |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------|
| Austria | HALFEN Gesellschaft m.b.H. Leonard-Bernstein-Str. 10 1220 Wien | Phone: +43-1-259 6770 E-Mail: office@halfen.at Internet: www.halfen.at | Fax: +43-1-259-677099 |
| Belgium / Luxembourg | HALFEN N.V. Borkelstraat 131 2900 Schoten | Phone: +32-3-658 07 20 E-Mail: info@halfen.be Internet: www.halfen.be | Fax: +32-3-658 15 33 |
| China | HALFEN Construction Accessories Distribution Co.Ltd. Room 601 Tower D, Vantone Centre No. A6 Chao Yang Men Wai Street Chaoyang District Beijing · P.R. China 100020 | Phone: +86-10 5907 3200 E-Mail: info@halfen.cn Internet: www.halfen.cn | Fax: +86-10 5907 3218 |
| Czech Republic | HALFEN-DEHA s.r.o. Business Center Safrankova Šafránkova 1238/1 155 00 Praha 5 | Phone: +420-311-690 060 E-Mail: info@halfen-deha.cz Internet: www.halfen-deha.cz | Fax: +420-235-314 308 |
| France | HALFEN S.A.S. 18, rue Goubet 75019 Paris | Phone: +33-1-445231 00 E-Mail: halfen@halfen.fr Internet: www.halfen.fr | Fax: +33-1-445231 52 |
| Germany | HALFEN Vertriebsgesellschaft mbH Katzbergstrasse 3 40764 Langenfeld | Phone: +49-2173-970-0 E-Mail: info@halfen.de Internet: www.halfen.de | Fax: +49-2173-970 225 |
| Italy | HALFEN S.r.l. Soc. Unipersonale Via F.lli Bronzetti N° 28 24124 Bergamo | Phone: +39-035-0760711 E-Mail: info@halfen.it Internet: www.halfen.it | Fax: +39-035-0760799 |
| Netherlands | HALFEN b.v. Oostermaat 3 7623 CS Borne | Phone: +31-742-6714 49 E-Mail: info@halfen.nl Internet: www.halfen.nl | Fax: +31-742 6726 59 |
| Norway | HALFEN AS Postboks 2080 4095 Stavanger | Phone: +47-51 82 34 00 E-Mail: post@halfen.no Internet: www.halfen.no | Fax: +47-51 82 34 01 |
| Poland | HALFEN Sp. z o.o. Ul. Obornicka 287 60-691 Poznan | Phone: +48-61-622 14 14 E-Mail: info@halfen.pl Internet: www.halfen.pl | Fax: +48-61-622 14 15 |
| Sweden | Halfen AB Box 150 435 23 Mölnlycke | Phone: +46-31-98 58 00 E-Mail: info@halfen.se Internet: www.halfen.se | Fax: +46-31-98 58 01 |
| Switzerland | HALFEN Swiss AG Hertistrasse 25 8304 Wallisellen | Phone: +41-44-849 78 78 E-Mail: mail@halfen.ch Internet: www.halfen.ch | Fax: +41-44-849 78 79 |
| United Kingdom / Ireland | HALFEN Ltd. Humphrys Road · Woodside Estate Dunstable LU5 4TP | Phone: +44-1582-47 03 00 E-Mail: info@halfen.co.uk Internet: www.halfen.co.uk | Fax: +44-1582-47 03 04 |
| United States of America | HALFEN USA Inc. 8521 FM 1976 P.O. Box 547 Converse, TX 78109 | Phone: +1 800.423.91 40 E-Mail: info@halfenusa.com Internet: www.halfenusa.com | Fax: +1 877.683.4910 |
| For countries not listed HALFEN International | HALFEN International GmbH Liebigstr. 14 40764 Langenfeld / Germany | Phone: +49-2173-970-0 E-Mail: info@halfen.com Internet: www.halfen.com | Fax: +49-2173-970-849 |

Furthermore HALFEN is represented with sales offices and distributors worldwide. Please contact us: www.halfen.com

NOTES REGARDING THIS CATALOGUE

Technical and design changes reserved. The information in this publication is based on state-of-the-art technology at the time of publication. We reserve the right to make technical and design changes at any time. HALFEN GmbH shall not accept liability for the accuracy of the information in this publication or for any printing errors.

The Quality Management System of Halfen GmbH is certified for the locations in Germany, France, the Netherlands, Austria, Poland, Switzerland and the Czech Republic according to **DIN EN ISO 9001:2008**, Certificate No. QS-281 HH.

