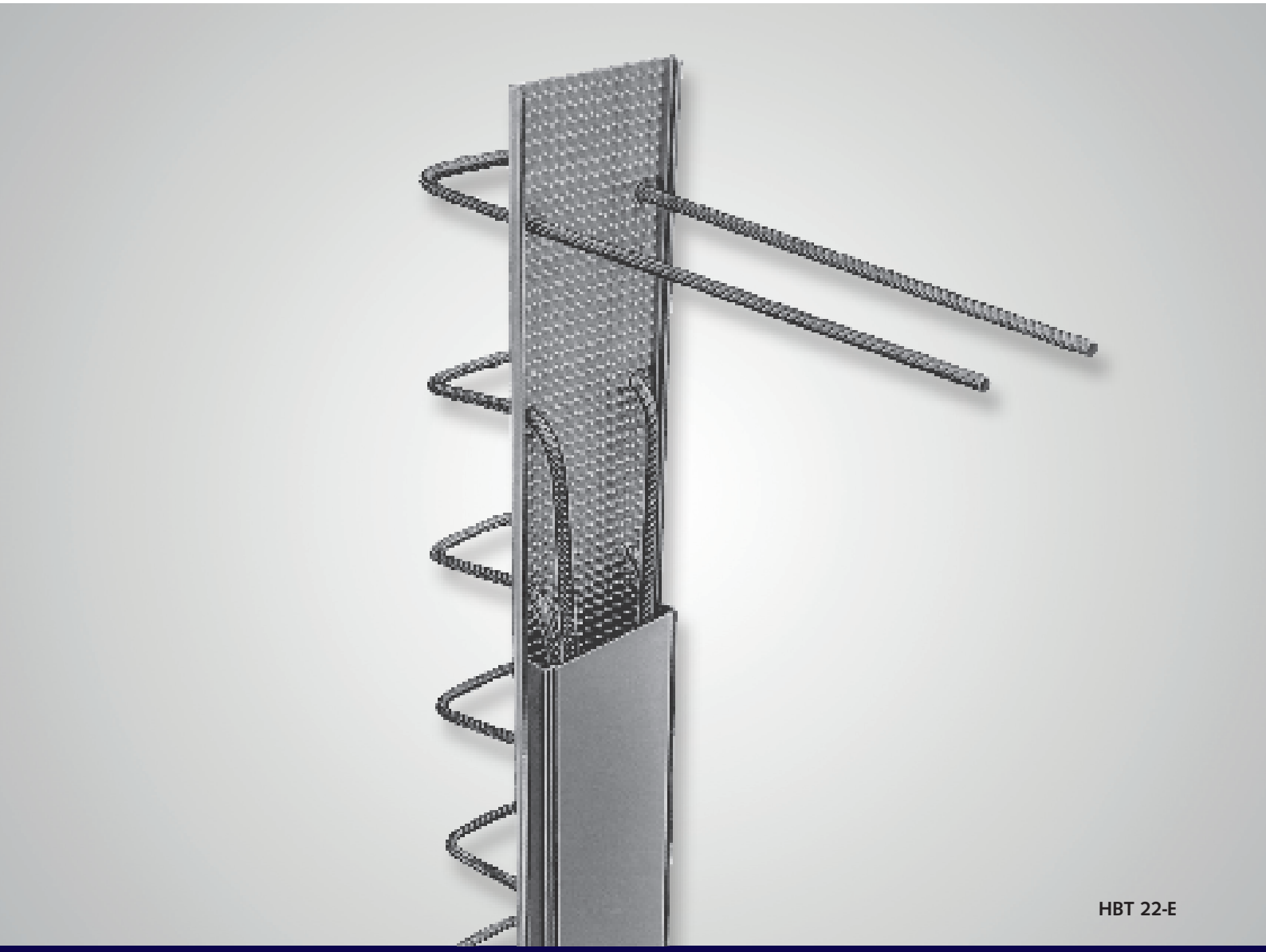
Leviat®

HALFEN

HALFEN HBT REBEND CONNECTIONS
Technical Product Information

- DIBt Approval Z-21.8-2035
- Type tested acc. to approval and EUROCODE 2



HBT 22-E

Leviat®

We imagine, model and make engineered products and innovative construction solutions that help turn architectural visions into reality and enable our construction partners to build better, safer, stronger and faster.

Leviat is a world leader in connecting, fixing, lifting and anchoring technology.

From the build of new schools, hospitals, homes and infrastructure, to the repair and maintenance of heritage structures, our engineering skills are making a difference around the world.

We provide technical design assistance at every stage of a project, from initial planning to installation and beyond.

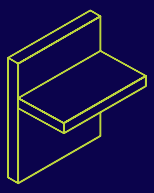
Our technical support services range from simple product selection through to the development of a fully customised project-specific design solution.

Every promise we make locally, has the commitment and dedication of our global team behind it. We employ almost 3,000 people at 60 locations across North America, Europe and Asia-Pacific, providing an agile and responsive service worldwide.

>3,000
People

60+
Locations

~20
Countries

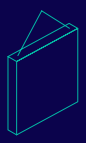


Structural Connections

Systems to form robust, efficient connections, and continuity of concrete reinforcement as necessary, between walls, slabs, columns, beams and balconies, providing structural integrity as well as enhanced thermal and acoustic performance.

- Insulated balcony connectors
- Reinforcing bar couplers
- Concrete Connections
- Reinforcement continuity systems
- Punching shear reinforcement
- Shear load connectors
- Floor Joint Systems
- Precast / Reinforced Columns
- Infrastructure Products
- Precast Connections
- Acoustic dowels and bearings
- Prestress

Other areas of expertise:

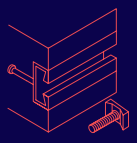


Lifting & Bracing

Systems for the safe and efficient transportation, lifting and temporary bracing of cast concrete elements and tilt-up panels before permanent structural connections are made.

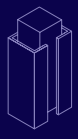
Façade Support & Restraint

Systems for the safe and thermally-efficient fixing of the external building envelope, including brick and natural stone, insulated sandwich panels, curtain walling and suspended concrete façades, and also the repair and strengthening of existing masonry installations.



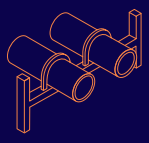
Anchoring & Fixing

Systems for fixing secondary fixtures to concrete, including anchor channels, bolts and inserts; also tension rod systems for roofs and canopies.



Formwork & Site Accessories

Non-structural accessories that complement our engineered solutions and help keep your construction environment operating safely and efficiently, including moulds for casting standard and special concrete elements and construction essentials such as reinforcing bar spacers.



Industrial Technology

Mounting channels, pipe clamps and other versatile framing systems that provide safe fixing in a wide range of industrial applications.

Leviat product ranges:

Ancon | Aschwanden | Connolly | Halfen | Helifix | Isedio | Meadow Burke | Modersohn | Moment | Plaka | Scaldex | Thermomass

HALFEN HBT Rebend connections – the connection solution

HALFEN HBT Rebend connections allow simple and effective connection of reinforced concrete elements, which are cast in different phases of a construction project. Sufficient bond is ensured with all types of subsequently cast concrete slabs and elements, from floor slabs, walls and stair elements.

The HALFEN HBT Rebend connection has a DIBt* General Building Authority Approval. With this simplified, approval conform design concept, using only two basic load cases, the HBT achieves higher shear resistance values than previously.

*DIBt Deutsches Institut für Bautechnik = German Institute of Construction Engineering

Safe

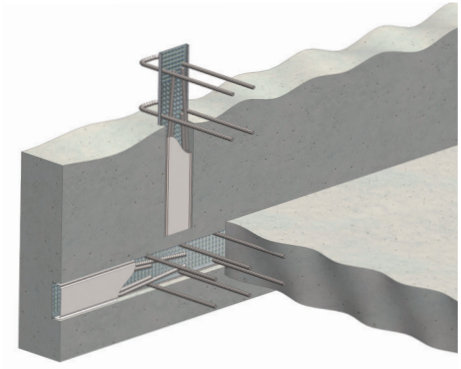
- more reliable design with General Building Authority approval based on real-world load capacity tests
- type tested load capacity tables
- more reliable design and execution with factory production and third party monitoring

Simple

- simplified calculation method — only two basic load cases
  - shear load longitudinal to joint
  - shear load transverse to joint
- both longitudinal and transverse shear load using standard type profiles
- if required, verification of combined longitudinal and transverse shear load in the concrete joint is possible
- one standard type is suitable for structural connections including static relevent connections — no risk of different types causing mix-ups on-site or in the precast plant
- reduced casing depth — ideal for thin elements or precast concrete elements with minimal concrete cover

Versatile

Optimal connections for a multitude of applications with 57 possible combinations of rebar and box widths. A standardized product range with box lengths of 0.8 m and 1.25 m are available for the most common applications.



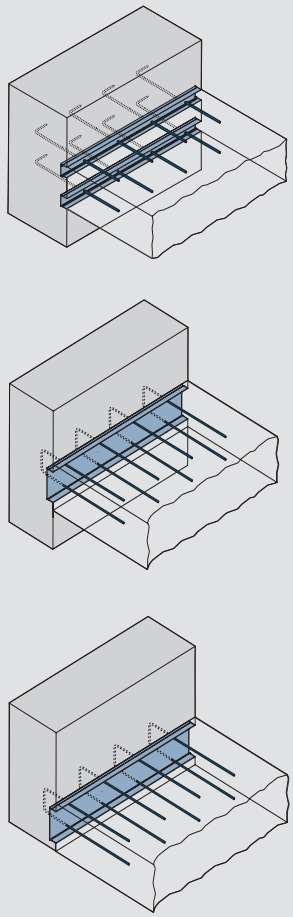
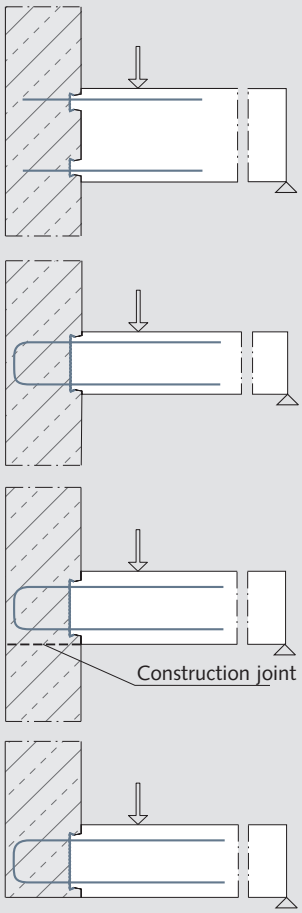
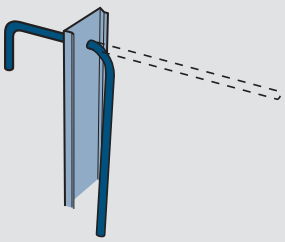
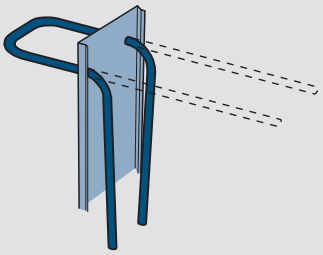
Low installation height

The HBT Casing has a particularly small depth, this allows installation in the required concrete cover of component 1. No time-consuming re-design of the structural reinforcement is necessary.

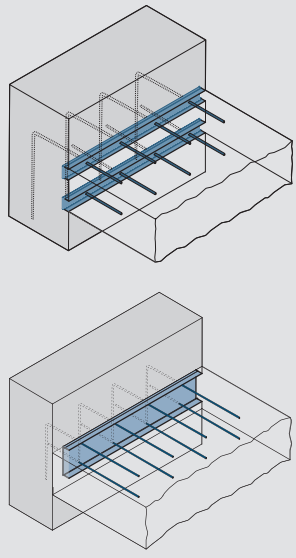
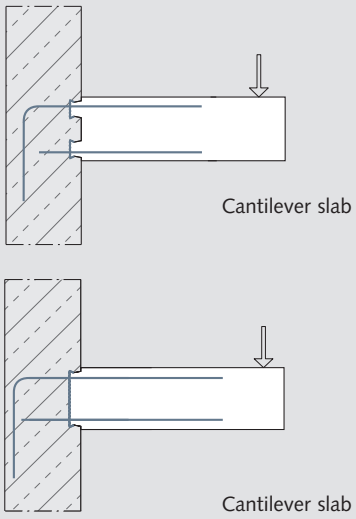
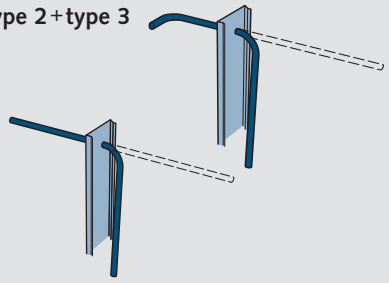
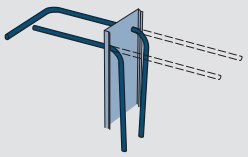
CONTENT

HALFEN HBT REBEND CONNECTIONS
Type Overview/Application Examples

Shear load transverse to the joint, slab – wall

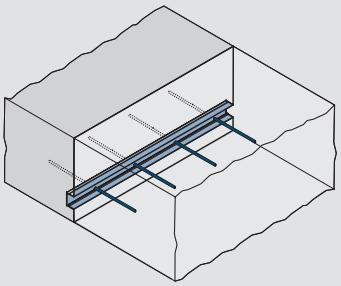
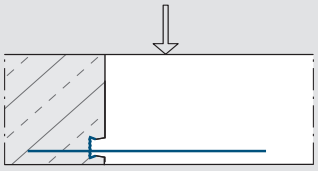
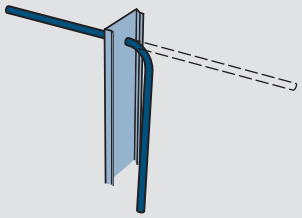
Application	Vertical section	Rebar type
		2 × Type 1  Type 5 

Shear load transverse to the joint, (cantilever) slab – wall

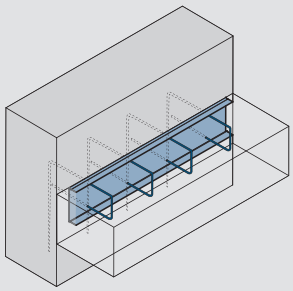
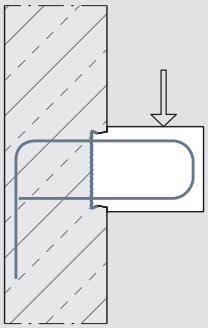
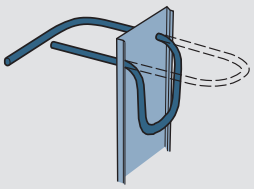
Application	Vertical section	Rebar type
		Type 2 + type 3  Type 23 

HALFEN HBT REBEND CONNECTIONS
Type Overview/Application Examples

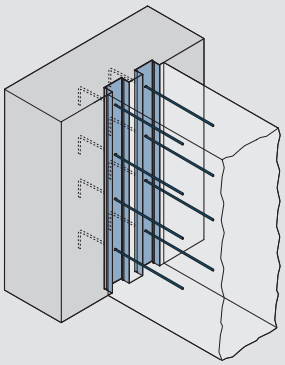
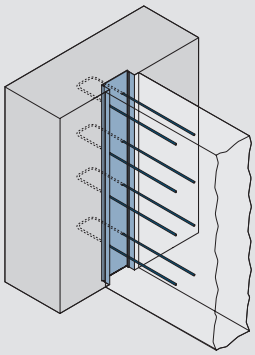
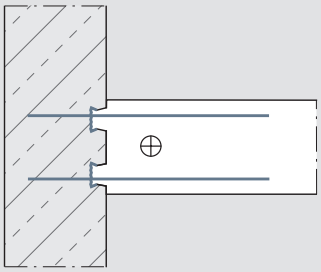
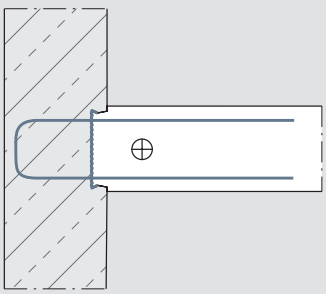
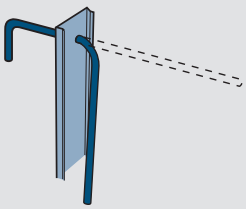
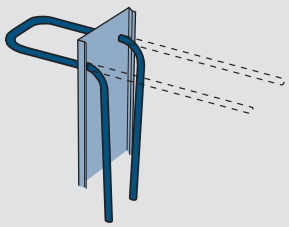
Shear load tranverse to the joint, slab – slab connection

Application	Vertical section	Rebar type
		Type 3 

Shear load transverse to the joint, corbel – wall

Application	Vertical section	Rebar type
		Type 7 

Shear load longitudinal to the joint, wall – wall and slab – wall

Application	Horizontal section	Rebar type
 	 	2 × Type 1  Type 5 

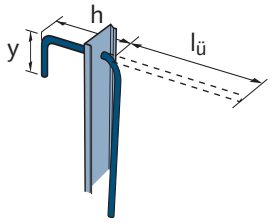
HALFEN HBT REBEND CONNECTIONS
Type overview

Single and double-row element connections

The rebar are delivered bent and secured in a robust profiled casing with a removable cover. The HBT Rebend connections are available in different widths. The rebend connections are cast into concrete elements. After striking the formwork, the casing covers are removed and the rebar straightened.

Depending on the application, a single-row or double-row HBT Rebend element is required and selected. The single-row version has a regular spacing of holes penetrated by a single row of reinforcement bars. The double-row version has two rows of reinforcement bars designed for the required application.

Type 1



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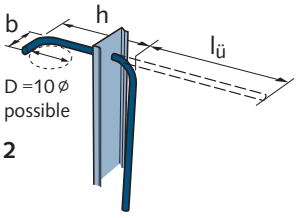

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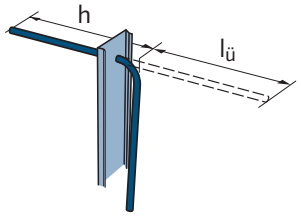

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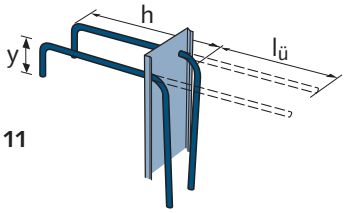

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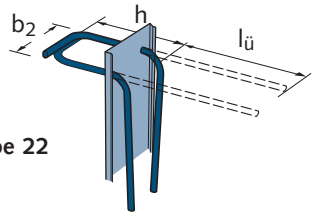

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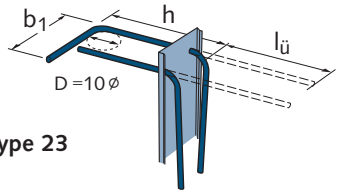

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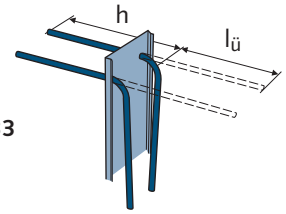

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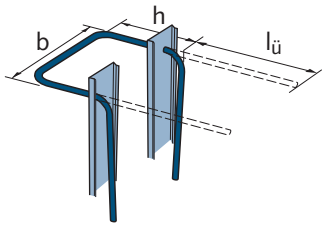

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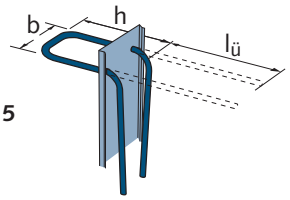

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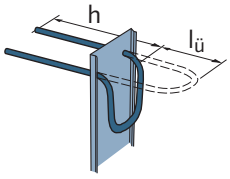
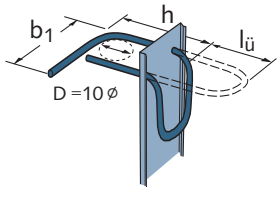


Type 7



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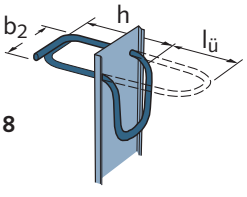

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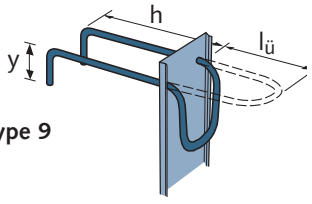
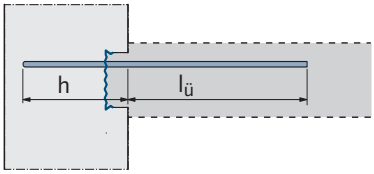
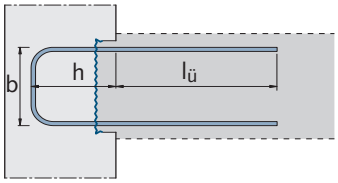


Single-row connection



Double-row connection

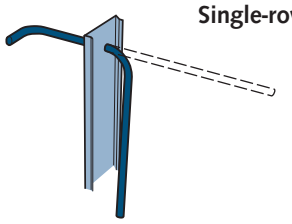


HALFEN HBT REBEND CONNECTIONS
Order examples

Order examples

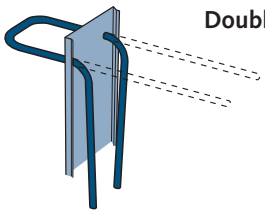
We offer a wide range of standard HBT Rebend connections for the most common applications. We also have a wide range of HBTs with profile widths of 58 - 222 mm and with rebar diameters of 8, 10 or 12 mm in B500B reinforcement steel.

Rebar dimensions and element lengths are freely definable, limited only by geometric specifications and limits in production. Please contact our support team for stainless-steel HBT versions. Contact information can be found at the back of this catalogue.



Single-row: HBT 85 - 10/10 - 2 - 1250, h = 120, $l_{ü}$ = 430, b= 95, 10∅

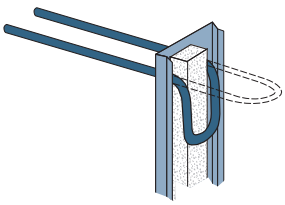
- bend diameter
- rebar dimensions [mm]
- element length L [mm]
- rebar type
- bar diameter ∅ [mm] / bar spacing s [cm]
- profile indentifier



Double-row: HBT 120 - 10/15 - 5 - 1250, h = 170, $l_{ü}$ = 390

- rebar dimensions [mm]
- element length L [mm]
- rebar type
- bar diameter ∅ [mm] / bar spacing s [cm]
- profile indentifier

HBT Connection with foam strip filler
"HBT Strip"

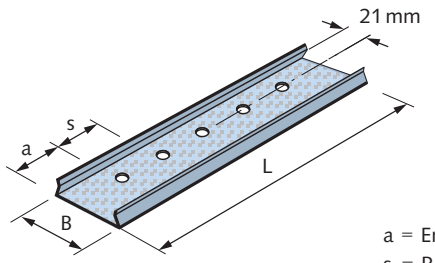


Double-row: HBT- S 220 - 12/20 - 6 - 750, h = 300, $l_{ü}$ = 190, 4 stirrups

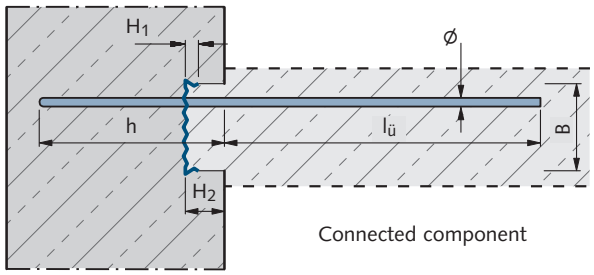
- rebar dimensions [mm]
- element length L [mm]
- rebar type
- bar diameter ∅ [mm] / bar spacing s [cm]
- profile indentifier
- S for "HBT Strip"

HALFEN HBT REBEND CONNECTIONS
Single-row elements

Casing dimensions



a = End spacing
s = Rebar spacing
B = Casing width
L = Element length

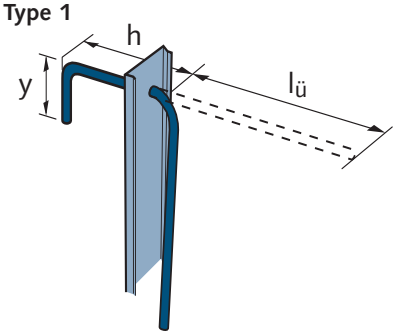


Casing dimensions [mm]				
Casing type	rebar ø [mm]	width B	height H_1	height H_2
HBT 55	8	58	12	24
	10			30
HBT 85	10	86		30
	12			36
HBT 120	10	122		30
	12			36

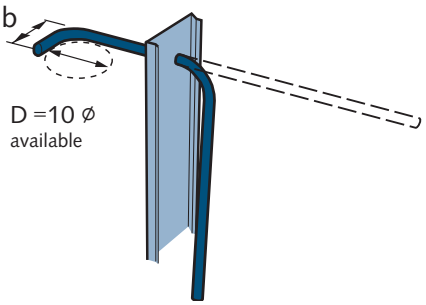
Rebar layout			
element length L	rebar spacing s [cm]	number of rebar	end spacing a [cm]
standard element L = 1250 mm	10	12	7.5
	15	8	10.0
	20	6	12.5
	25	5	12.5
short element L = 800 mm	10	8	5.0
	15	6	2.5
	20	4	10.0
	25	4	2.5
Other element lengths on request			

Rebar types

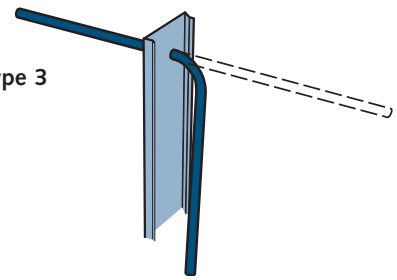
Type 1



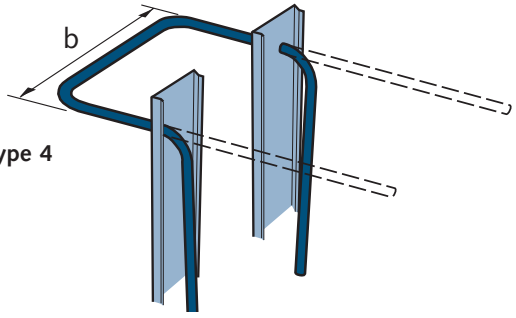
Type 2



Type 3

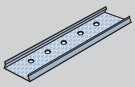
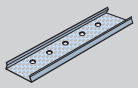
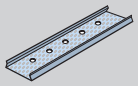


Type 4



HALFEN HBT REBEND CONNECTIONS
Single-row elements

Rebar dimensions [mm]

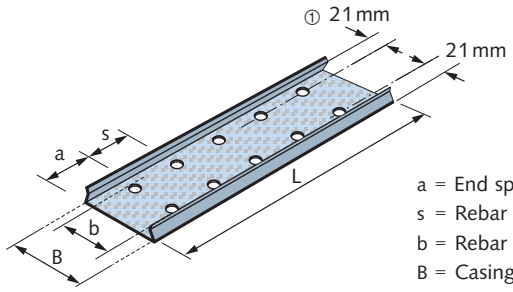
Casing type	Rebar-Ø	Rebar spacing	Standard Type 1			Types 1, 2, 3, 4			only Type 4
			L = 1250 mm				L = 1250 mm	L ≥ 800 mm	
	[mm]	[cm]	h	$l_ü$	y	h_{min}	$l_{ü,max}$	$l_{ü,max}$	b [mm]
HBT 55 	8	10	170*	210	75	120	210	210	200...500
		15		320*			510	430	
		20					600	455	
		25						480	
	10	10	170*	200	95	120	200	200	
		15		390*			390	390	
		20					510	450	
		25						475	
HBT 85 	10	10	170*	390*	95	120	430	400	250...500
		15					510	425	
		20					600	450	
		25						475	
	12	10	170*	430	110	120	430	395	
		15		460*			510	420	
		20					600	445	
		25						470	
HBT 120 	10	10	170*	390*	95	120	600	400	on request
		15						425	
		20						450	
		25						475	
	12	10	170*	460*	110	120	600	395	
		15						420	
		20						445	
		25						470	

* Standard dimensions according to the type test

Load-bearing capacities must be reduced for elements where the $l_ü$ lengths are smaller than the standard lengths.
This can be done linearly using $l_ü$ /req $l_ü$* V_{Rd}.
To ensure safety, the standard length according to the type test [values marked with*] may be used for value req $l_ü$.
Alternatively, the exact value for req $l_ü$ can be found in the type statics tables – the values are determined according to the boundary conditions, concrete quality and static effective depth.

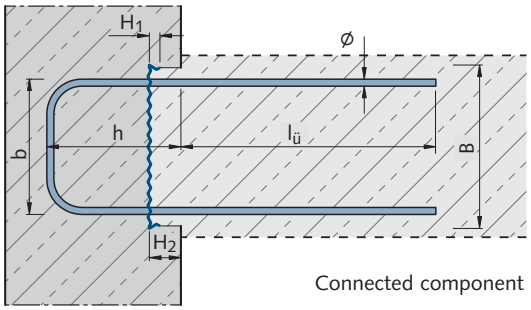
HALFEN HBT REBEND CONNECTIONS
Double-Row elements

Casing dimensions



① for HBT 80: 18 mm

a = End spacing
s = Rebar spacing
b = Rebar width
B = Casing width
L = Casing length



Component 1

Connected component

Casing dimensions [mm]

Casing size	rebar Ø [mm]	width B	height H_1	height H_2	b
HBT 80	8	86	12	24	58
	10			30	60
HBT 120	8	122		24	88
	10			30	90
	12			36	92
HBT 150	8	150		24	116
	10			30	118
	12			36	120
HBT 190	8	186		24	152
	10			30	154
	12			36	156
HBT 220	8	222		24	188
	10			30	190
	12			36	192

Rebar layout

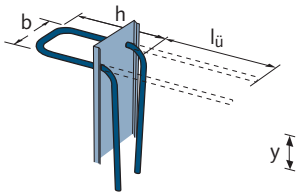
casing length L	rebar spacing s [cm]	number of rebar	end spacing a [cm]
standard casing L = 1250 mm	10	12	7.5
	15	8	10.0
	20	6	12.5
	25	5	12.5
short casing L = 800 mm	10	8	5.0
	15	6	2.5
	20	4	10.0
	25	4	2.5

Other casing lengths on request

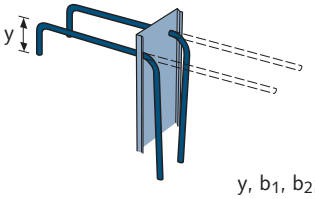
Reinforcement bar types

Straight rebar

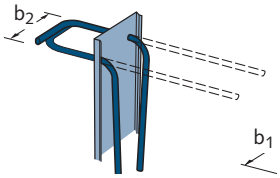
Type 5



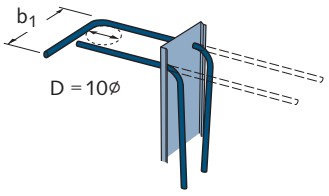
Type 11



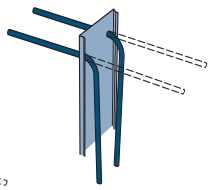
Type 22



Type 23



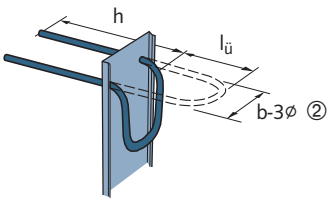
Type 33



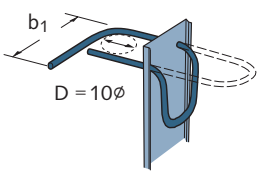
y, b_1, b_2; are freely definable

Stirrups

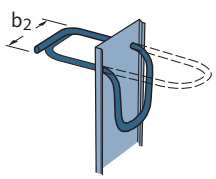
Type 6



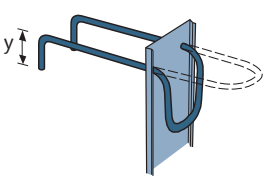
Type 7



Type 8



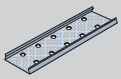
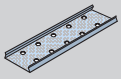
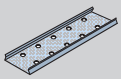
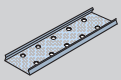
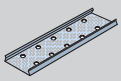
Type 9



② Reduced rebar width at stirrup end due to minimal space in the case (see page 20)

HALFEN HBT REBEND CONNECTIONS
Double-Row elements

Rebar dimensions [mm]

Casing type	Rebar ø	Rebar spacing	Standard Type 5		Types 5, 11, 22, 23 ④, 33			Types 6, 7, 8, 9			
			L = 1250 mm		h_{min}	L = 1250 mm	L ≥ 800 mm	Type 6	Type 7 ③, 8	Type 9	L ≥ 600 mm
	[mm]	[cm]	h	$l_ü$		$l_{ü,max}$	$l_{ü,max}$	h_{min}	h_{min}	h_{min}	$60 \le l_ü \le l_{ü,max}$
HBT 80 ③ 	8	10	170*	170	120	170	170	120	135	140	70
		15		320*		360	360				125
		20				450	450				175
		25				500	480				225
	10	10	170*	160	120	160	160	120	155	140	60
		15		320		320	320				120
		20		390*		400	400				170
		25				450	450				220
HBT 120 	8	10	170*	290	120	290	290	120	135	140	115
		15		320*		510	430				175
		20				600	455				235
		25					480				290
	10	10	170*	240	120	240	240	120	155	140	80
		15		390*		510	425				130
		20				600	450				180
		25					475				230
	12	10	170*	215	120	215	215	120	170	140	70
		15		390		390	390				120
		20		440		440	440				170
		25		460*		490	470				220
HBT 150 	8	10	170*	320*	120	360	360	120	135	140	100
		15				510	430				150
		20				600	455				210
		25					480				260
	10	10	170*	360	120	360	360	120	155	140	85
		15		390*		510	425				135
		20				600	450				185
		25					475				235
	12	10	170*	310	120	310	310	120	170	140	90
		15		460*		480	420				150
		20				530	445				200
		25				580	470				250
HBT 190 	8	10	170*	320*	120	500	405	120	135	140	100
		15				510	430				150
		20				600	455				210
		25					480				260
	10	10	170*	390*	120	500	400	120	155	140	110
		15				510	425				170
		20				600	450				220
		25					475				280
	12	10	170*	430	120	430	395	120	170	140	90
		15		460*		510	420				140
		20				600	445				190
		25					470				240
HBT 220 	8	10	170*	320*	120	600	405	120	135	140	100
		15					430				150
		20					455				210
		25					480				260
	10	10	170*	390*	120	600	400	120	155	140	110
		15					425				170
		20					450				220
		25					475				280
	12	10	170*	460*	120	600	395	120	170	140	90
		15					420				140
		20					445				190
		25					470				240

* Standard dimensions according to the type test. See note on page 9. ③ Rebar type 7 is not available for HBT 80
④ Because of the required bending roll diameter (D = 10 x bar diam.); h_{min} for type 23 is equal to h_{min} of type 7

HALFEN HBT REBEND CONNECTIONS
Calculation Basis according to Approval no. Z-21.8-2035

General information

The concept for the Approval is based on the calculation and the structural application as applied in the following standards and guidelines: DIN EN 1992-1-1 with DIN EN 1992-1-1/NA (National Annex) and the DBV*-guidelines "Rebending of reinforcing steel and requirements of protective boxes/casings according to Eurocode 2". Generally two different shear load cases are evaluated: shear load transverse and longitudinal to the concrete joint.

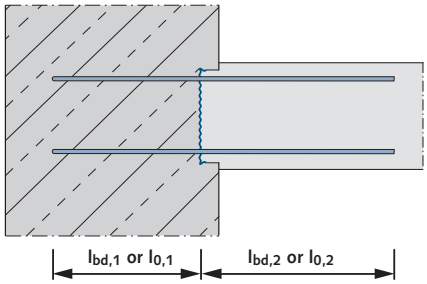
According to the Approval, due to the product characteristics the shear loads transverse to the joint in the HBT Rebend connections can be classed as "indented" and shear loads longitudinal to the joint can be classified as "rough".

Material:
- stirrup (8, 10 and 12 mm) in reinforcement steel B500B, rust free steel B500 NR on request)
- casing in galvanized sheet steel with a specially designed profile
- sturdy cover made of galvanized sheet steel with pre-punched opening for easy removal of the cover after striking the formwork

The maximum load bearing capacity of the rebend connection must be limited to 80% of the design yield strength of the rebar; the following applies for tensile strength:

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

Existing anchorage lengths and lap lengths must be taken into consideration for the calculation. These can be calculated from the back surface of the casing. Verification of the anchorage lengths and lap lengths is according to Eurocode 2, taking the bonding characteristics into account.



Anchorage and lap length requirements for the reinforcement

*DBV Deutschen Beton- und Bautechnik-Verein E.V = German Concrete and Construction Technology Association

Calculation according to Approval no. Z-21.8-2035

The load capacities in the type test were compiled with great care and for nearly all possible boundary conditions for both direct and indirect support in component 1 and for relevant combinations with good and medium bond. The designer/planner is responsible for determining the support type of component 1 as a direct or indirect support.

The shear force bearing capacities have been calculated and independently tested for almost all possible applications. This avoids time-consuming additional verifications.

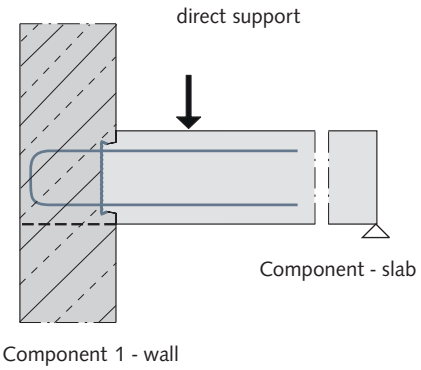
The resistance loads for the most common boundary conditions (direct support of component 1 with good bond) are included in this technical product information.
See tables on page 15.

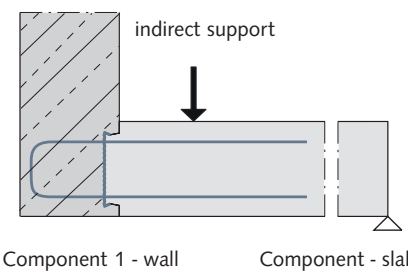
There are two basic application cases:
– shear load transverse to the connection
– shear load longitudinal to the connection

More detailed complete resistance tables can be found in the type test.

Always observe the general guidelines in the type test.

Examples of direct and indirect support:





HALFEN HBT REBEND CONNECTIONS
Calculation Basis according to Approval no. Z-21.8-2035

Shear load transverse to the concrete joint

The HBT Rebend connection provides linear support for a jointed slab connection for load case "shear stress transverse to the concrete connection". A double-row or two single-row elements types can be used for connection. The static effective depth d [mm] must be determined before using the load capacity tables. This depends on the tension zone location. As standard, the rebend connections are installed centrally and the boxes width is selected to suit wall/floor slab thickness.

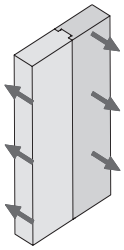
Other configurations are possible. The correct determination of the static effective depth is critical when calculating and selecting the correct HBT.

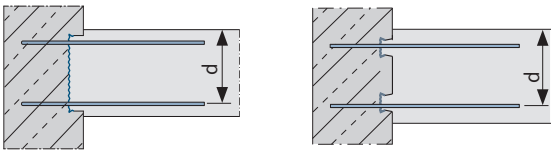
If the tension zone is at the bottom of the component then the upper reinforcement forms the connection to the structural reinforcement and the lower reinforcement the connection to the lower tension reinforcement in the slab.

Verification of the anchorage and lap lengths must be in accordance with DIN EN 1992-1-1.

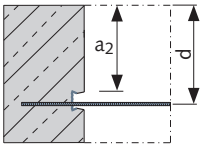
The design of the anchorage at end supports with shear force transverse to the joint without shear reinforcement is according to DIN EN 1992-1-1, 9.2.1.3 with a_L = d, for connections with shear reinforcement the design is according to DIN EN 1992-1-1, see equation (9.3).

Additional tension loads at right angle to the joint must be ruled out, otherwise separate verification and calculation of the load-bearing capacity is required.



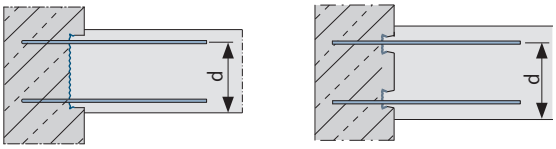


Tension zone at lower edge of component



Tension zone at lower edge of component, single row elements

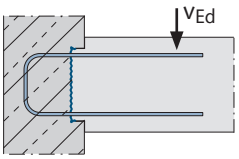
a_2 must be designed as interlocked in accordance with EN 1992-1-1, if lever arm **d** is calculated to the edge of the building component.



Tension zone at upper edge of component

Shear resistance tranverse to the joint without shear reinforcement

The decisive resistance $V_{Rd,c}$ for verification is calculated according to DIN EN 1992-1-1, section 6.2.2. This value depends on the static effective depth d and the ratio of longitudinal reinforcement in the tension zone. Assuming the same reinforcement, the resulting v_{Ed} values may be linearly interpolated over the static effective depth d.

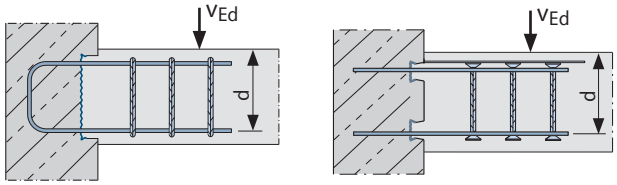


HALFEN HBT REBEND CONNECTIONS
Calculation Basis according to Approval no. Z-21.8-2035

Shear resistance transverse to the joint with shear reinforcement

The maximal resistance for verification is 30% of the shear load resistance $V_{Rd,max}$ calculated in accordance with DIN EN 1992-1-1, section 6.2.3:

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



An additional load in the longitudinal reinforcement caused by shear forces must be verified assuming a compression strut angle of 45° (cot θ = 1.0). The installation dimension of the longitudinal reinforcement is assumed to be $c_{v,l}$ = 26 mm. This means for additional perpendicular shear reinforcement of ⌀6 mm results in a concrete cover of c_{nom} =20 mm.

Alternatively, HDB-S shear elements can de used as reinforcement.

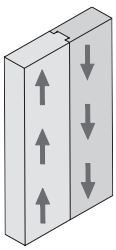
Please refer to the following documents when designing with HALFEN HDB-S shear bars as reinforcement elements,
- HDB product information catalogue
- approval Z-15.1-249

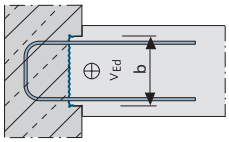
Shear load longitudinal to the concrete joint

Static verification is according to DIN EN 1992-1-1, Section 6.2.5, and DIN EN 1992-1-1/NA (National Annex), whereby the following additional provisions are to be observed.

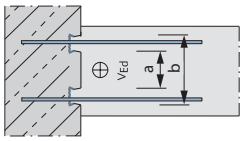
Factors to used to calculate the shear load resistance v_{Rdi}:

c = 0.4
μ = 0.7
v = 0.5





Width **b** for longitudinal load in the joint with double-row elements



Width **b** for longitudinal load in the joint with two single-row elements

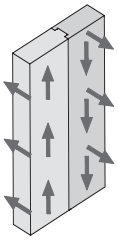
To be on the safe side the width B of the element is used to determine the transmissible shear force parallel to the joint when using double-layer HBT. The box widths are added together when using two single-layer elements. If the joint area **a_1** (required: $a_1 \geq 5$ cm) between two single-layered elements is also used for shear force transfer, it must be rough or indented in accordance with DIN EN 1992-1-1. Likewise, edge zones may be assumed to be load bearing if larger than 5 cm and the surface is rough or indented.

The resulting values for v_{Rd} determined in the type test may be linearly interpolated, for the same reinforcement, if the conditions above for width b have been met.

The concrete cover of the re-bend connections for longitudinal shear load along the joint must be designed according to DIN EN 1992-1-1, which also requires, $c_{nom} \geq$ max (3⌀, 30 mm, aggregate diameter d_g).

Combined shear load, transverse and longitudinal to the concrete joint

If the connection is subjected to combined shear load (longitudinal and transverse to the concrete joint), each load direction can be verified separately.



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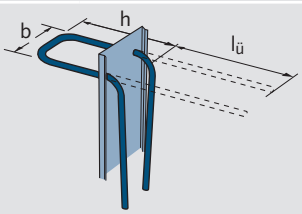
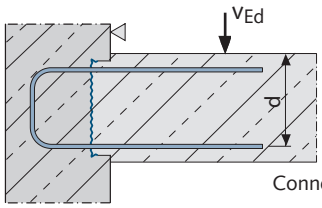
HALFEN HBT REBEND CONNECTIONS
Selected resistance values according to the type test

Shear load capacity transverse to the joint — no shear reinforcement

Shear load resistances transverse to the joint v_{Rd} [kN/m], without shear reinforcement in the slab, good bond, direct support in component 1.

A double-layer or two single-layer types can be used for a connection. The static effective depth d [mm] must be determined before using the resistance load tables.

Type 5 double-row connection h= 170 mm	Rebar ⌀ [mm]	$l_{ü}$ [mm]
	8	320
	10	**390**
	12	460



Assumptions:
$\sigma_{cp} = 0$
d: see illustration

△ = Casting section end

Shear load resistance v_{Rd} [kN/m]

Rebar ⌀/ spacing s [mm/cm]	d [mm]									
	100 mm	120 mm	140 mm	160 mm	180 mm	200 mm	220 mm	240 mm	260 mm	280 mm
Concrete grade C20/25										
8/25	44.3	53.1	62.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0
8/20	44.3	53.1	62.0	70.8	78.8	78.8	78.8	78.8	78.8	78.8
8/15	44.3	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	105.0
8/10	–	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
10/25	44.3	53.1	62.0	70.8	78.8	78.8	78.8	78.8	78.8	78.8
10/20	44.3	53.1	62.0	70.8	79.7	88.5	94.0	98.5	98.2	98.5
10/15	44.3	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
10/10	–	56.6	62.7	70.8	79.7	88.5	94.0	99.4	104.7	109.8
12/25	–	53.1	62.0	70.8	79.7	88.5	90.5	90.5	90.5	90.5
12/20	–	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
12/15	–	55.8	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
12/10	–	63.9	70.8	77.4	83.7	89.8	94.0	99.4	104.7	109.8
Concrete grade C25/30										
8/25	49.5	59.4	63.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0
8/20	49.5	59.4	69.3	78.8	78.8	78.8	78.8	78.8	78.8	78.8
8/15	49.5	59.4	69.3	79.2	89.1	99.0	105.0	105.0	105.0	105.0
8/10	–	59.4	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
10/25	49.5	59.4	69.3	79.2	89.1	91.5	91.5	91.5	91.5	91.5
10/20	49.5	59.4	69.3	79.2	89.1	99.0	105.1	111.1	114.3	114.3
10/15	49.5	59.4	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
10/10	–	60.9	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
12/25	–	59.4	69.3	79.2	89.1	99.0	105.1	105.1	105.1	105.1
12/20	–	59.4	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
12/15	–	60.1	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
12/10	–	68.8	76.3	83.4	90.2	99.0	105.1	111.1	117.0	122.8
Concrete grade C30/37										
8/25	54.2	63.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0
8/20	54.2	65.1	75.9	78.8	78.8	78.8	78.8	78.8	78.8	78.8
8/15	54.2	65.1	75.9	86.8	97.6	105.0	105.0	105.0	105.0	105.0
8/10	–	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
10/25	54.2	65.1	75.9	86.8	97.6	98.4	98.4	98.4	98.4	98.4
10/20	54.2	65.1	75.9	86.8	97.6	108.4	115.1	121.7	123.1	123.1
10/15	54.2	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
10/10	–	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
12/25	–	65.1	75.9	86.8	97.6	108.4	115.1	118.6	118.6	118.6
12/20	–	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
12/15	–	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
12/10	–	73.1	81.0	88.6	97.6	108.4	115.1	121.7	128.2	134.5

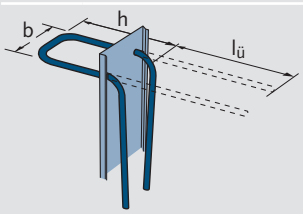
Notes: See the type test for load capacities for further boundry conditions and for medium bond.
Standard dimensions according to page 9 and11.

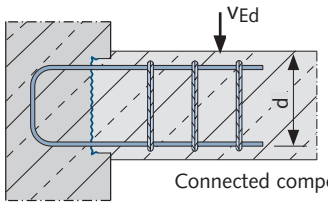
HALFEN HBT REBEND CONNECTIONS
Selected resistance values according to the type test

Shear load capacity transverse to the joint — with shear reinforcement

Shear load resistances transverse to the joint v_{Rd} [kN/m], with shear reinforcement in the slab, good bond, direct support in component 1.

A double-layer or two single-layer types can be used for a connection. The static effective depth d [mm] must be determined before using the resistance load tables.

Type 5 double-row connection h= 170 mm	Rebar ⌀ [mm]	$l_{ü}$ [mm]
	8	320
	10	**390**
	12	460



Assumptions:
$\sigma_{cp} = 0$
d: see illustration (HALFEN HDB-S or stirrups)

△ = Casting section end

Shear load resistance v_{Rd} [kN/m]

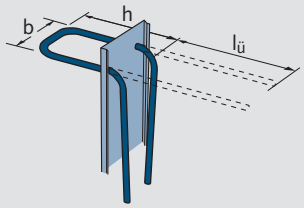
Rebar ⌀/ spacing s [mm/cm]	d [mm]									
	100 mm	120 mm	140 mm	160 mm	180 mm	200 mm	220 mm	240 mm	260 mm	280 mm
Concrete grade C20/25										
8/25	61.2	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9
8/20	61.2	87.7	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
8/15	61.2	87.7	112.2	116.6	116.6	116.6	116.6	116.6	116.6	116.6
8/10	–	87.7	112.2	137.7	163.2	174.8	174.8	174.8	136.5	136.5
10/25	61.2	87.7	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
10/20	61.2	87.7	112.2	136.6	136.6	136.6	136.6	136.6	136.6	136.6
10/15	61.2	87.7	112.2	137.7	163.2	182.1	182.1	182.1	182.1	182.1
10/10	–	87.7	112.2	137.7	163.2	188.7	214.2	239.7	265.2	273.2
12/25	–	87.7	112.2	137.7	157.4	157.4	157.4	157.4	157.4	157.4
12/20	–	87.7	112.2	137.7	163.2	188.7	196.7	196.7	196.7	196.7
12/15	–	87.7	112.2	137.7	163.2	188.7	214.2	239.7	262.3	262.3
12/10	–	87.7	112.2	137.7	163.2	188.7	214.2	239.7	262.2	290.7
Concrete grade 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	76.5	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
8/15	76.5	108.4	116.6	116.6	116.6	116.6	116.6	116.6	116.6	116.6
8/10	–	108.4	140.3	172.1	174.8	174.8	174.8	174.8	174.8	174.8
10/25	76.5	108.4	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
10/20	76.5	108.4	136.6	136.6	136.6	136.6	136.6	136.6	136.6	136.6
10/15	76.5	108.4	140.3	172.1	182.1	182.1	182.1	182.1	182.1	182.1
10/10	–	108.4	140.3	172.1	204.0	235.9	267.8	273.2	273.2	273.2
12/25		108.4	140.3	157.4	157.4	157.4	157.4	157.4	157.4	157.4
12/20	–	108.4	140.3	172.1	196.7	196.7	196.7	196.7	196.7	196.7
12/15	–	108.4	140.3	172.1	204.0	235.9	262.3	262.3	262.3	262.3
12/10	–	108.4	140.3	172.1	204.0	235.9	267.8	299.6	331.5	359.7
Concrete grade 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	91.8	116.6	116.6	116.6	116.6	116.6	116.6	116.6	116.6	116.6
8/10	–	130.01	163.3	174.8	174.8	174.8	174.8	174.8	174.8	174.8
10/25	91.8	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
10/20	91.8	130.1	136.6	136.6	136.6	136.6	136.6	136.6	136.6	136.6
10/15	91.8	130.1	163.3	182.1	182.1	182.1	182.1	182.1	182.1	182.1
10/10	–	130.1	163.3	206.6	244.8	273.2	273.2	273.2	273.2	273.2
12/25	–	130.1	157.4	157.4	157.4	157.4	157.4	157.4	157.4	157.4
12/20	–	130.1	163.3	196.7	196.7	196.7	196.7	196.7	196.7	196.7
12/15	–	130.1	163.3	206.6	244.8	262.3	262.3	262.3	262.3	262.3
12/10	–	130.1	163.3	206.6	244.8	283.1	321.3	359.6	393.4	393.4

Notes: Standard dimensions according to page 9 and 11.
See the type test for load capacities for further boundry conditions and for medium bond.

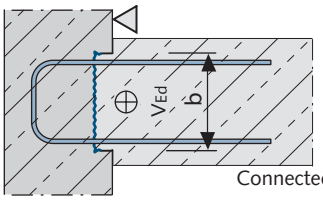
HALFEN HBT REBEND CONNECTIONS
Selected resistance values according to the type test

Shear load capacity longitudinal to the joint

Shear load resistances longitudinal to the joint v_{Rd} [kN/m], good bond.

Type 5 double-row connection h= 170 mm	Rebar ⌀ [mm]	$l_ü$ [mm]
	8	320
	10	**390**
	12	460

A double-layer or two single-layer types can be used for a connection. Width b [mm] must be determined before using the resistance load tables.



Connected component

Component 1

△ = Casting section end

Shear load resistance v_{Rd} [kN/m]

Rebar ⌀/ spacing s [mm/cm]	b [mm]															
	86	122	150	186	222	200	220	240	260	280	300	320	340	360	380	400
Concrete grade C20/25																
8/25	111.9	124.5	134.4	147.0	159.6	151.9	158.9	165.9	172.9	180.0	187.0	194.0	201.0	208.0	215.0	222.0
8/20	132.4	145.0	154.8	167.4	180.1	172.3	179.4	186.4	193.4	200.4	207.4	214.4	221.4	228.5	235.5	242.5
8/15	166.4	179.1	188.9	201.5	214.1	206.4	213.4	220.4	227.4	234.5	241.5	248.5	255.5	262.5	269.5	276.6
8/10	–	247.2	257.0	269.6	282.3	274.5	281.6	288.6	295.6	302.6	309.6	316.6	323.6	330.7	337.7	344.7
10/25	128.2	140.8	150.6	163.2	175.9	168.1	175.2	182.2	189.2	196.2	203.2	210.2	217.2	224.3	231.3	238.3
10/20	152.7	165.3	175.1	187.7	200.4	192.6	199.7	206.7	213.7	220.7	227.7	234.7	241.7	248.8	255.8	262.8
10/15	193.5	206.1	215.9	228.6	241.2	233.5	240.5	247.5	254.5	261.5	268.5	275.6	282.6	289.6	296.6	303.6
10/10	–	287.8	297.6	310.2	322.9	315.1	322.2	329.2	336.2	343.2	350.2	357.2	364.2	371.3	378.3	385.3
12/25	–	155.3	165.2	177.8	190.4	182.7	189.7	196.7	203.7	210.8	217.8	224.8	231.8	238.8	245.8	252.8
12/20	–	183.5	193.3	205.9	218.6	210.8	217.9	224.9	231.9	238.9	245.9	252.9	259.9	267.0	274.0	281.0
12/15	–	230.4	240.2	252.8	265.5	257.7	264.8	271.8	278.8	285.8	292.8	299.8	306.8	313.9	320.9	327.9
12/10	–	324.2	334.0	346.6	359.3	351.5	358.5	365.6	372.6	379.6	386.6	393.6	400.6	407.7	414.7	421.7
Concrete grade C25/30																
8/25	129.9	144.5	155.9	170.6	185.2	176.3	184.4	192.5	200.7	208.8	217.0	225.1	233.2	241.4	249.5	257.7
8/20	153.6	168.2	179.6	194.3	208.9	200.0	208.1	216.3	224.4	232.5	240.7	248.8	257.0	265.1	273.2	281.4
8/15	193.1	207.8	219.2	233.8	248.5	239.5	247.7	255.8	263.9	272.1	280.2	288.4	296.5	304.6	312.8	320.9
8/10	–	286.8	298.2	312.9	327.5	318.6	326.7	334.9	343.0	351.1	359.3	367.4	375.5	383.7	391.8	400.0
10/25	148.7	163.4	174.8	189.4	204.1	195.1	203.2	211.4	219.5	227.7	235.8	243.9	252.1	260.2	268.4	276.5
10/20	177.1	191.8	203.2	217.8	232.5	223.5	231.7	239.8	248.0	256.1	264.2	272.4	280.5	288.7	296.8	304.9
10/15	224.5	239.2	250.6	265.2	279.9	270.9	279.1	287.2	295.3	303.5	311.6	319.8	327.9	336.0	344.2	352.3
10/10	–	333.9	345.3	360.0	374.6	365.7	373.8	382.0	390.1	398.2	406.4	414.5	422.7	430.8	438.9	447.1
12/25	–	180.3	191.7	206.3	221.0	212.0	220.1	228.3	236.4	244.6	252.7	260.8	269.0	277.1	285.3	293.4
12/20	–	212.9	224.3	239.0	253.6	244.7	252.8	260.9	269.1	277.2	285.4	293.5	301.6	309.8	317.9	326.1
12/15	–	267.3	278.7	293.4	308.0	299.1	307.2	315.4	323.5	331.6	339.8	347.9	356.1	364.2	372.3	380.5
12/10	–	376.2	387.6	402.2	416.9	407.9	416.1	424.2	432.3	440.5	448.6	456.8	464.9	473.0	481.2	489.3
Concrete grade C30/37																
8/25	146.7	163.2	176.1	192.6	209.2	199.0	208.2	217.4	226.6	235.8	245.0	254.2	263.4	272.6	281.8	291.0
8/20	173.4	190.0	202.9	219.4	235.9	225.8	235.0	244.2	253.4	262.6	271.8	281.0	290.2	299.4	308.6	317.7
8/15	218.1	234.6	247.5	264.0	280.6	270.5	279.7	288.9	298.0	307.2	316.4	325.6	334.8	344.0	353.2	362.4
8/10	–	323.9	336.8	353.3	369.9	359.7	368.9	378.1	387.3	396.5	405.7	414.9	424.1	433.3	442.5	451.7
10/25	167.9	184.5	197.3	213.9	230.4	220.3	229.5	238.7	247.9	257.1	266.3	275.5	284.7	293.9	303.1	312.2
10/20	200.0	216.6	229.5	246.0	262.5	252.4	261.6	270.8	280.0	289.2	298.4	307.6	316.8	326.0	335.2	344.3
10/15	253.5	270.1	283.0	299.5	316.0	305.9	315.1	324.3	333.5	342.7	351.9	361.1	370.3	379.5	388.7	397.8
10/10	–	377.1	390.0	406.5	423.1	412.9	422.1	431.3	440.5	449.7	458.9	468.1	477.3	486.5	495.7	504.9
12/25	–	203.6	216.4	233.0	249.5	239.4	248.6	257.8	267.0	276.2	285.4	294.6	303.7	312.9	322.1	331.3
12/20	–	240.4	253.3	269.8	286.4	276.3	285.5	294.7	303.9	313.0	322.2	331.4	340.6	349.8	359.0	368.2
12/15	–	301.9	314.8	331.3	347.8	337.7	346.9	356.1	365.3	374.5	383.7	392.9	402.1	411.3	420.5	429.6
12/10	–	424.8	437.7	454.2	470.8	460.6	469.8	479.0	488.2	497.4	506.6	515.8	525.0	534.2	543.4	552.6

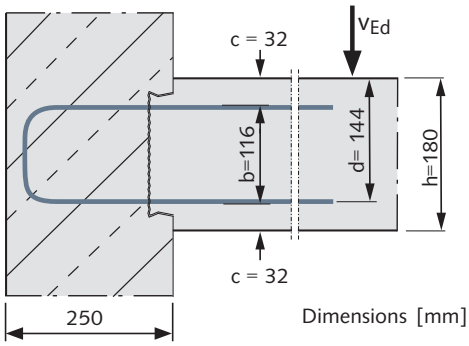
Notes: Standard dimensions according to page 9 and 11.
See the type test for load capacities for further boundry conditions and for medium bond.

HALFEN HBT REBEND CONNECTIONS
Application example

Example calculation for connection of a reinforced concrete slab

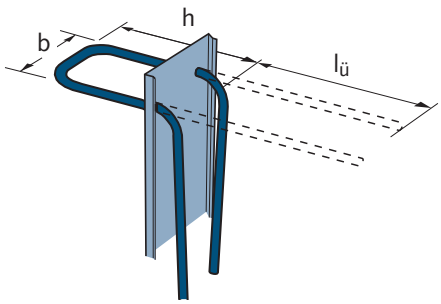
Boundary conditions

- Concrete: C20/25
- Stirrup Type 5, rebar ⌀8mm
- v_{Ed} = 113.0 kN/m
- Direct support; good bond, with shear load reinforcement



Example: Central installation of the HBT

Type 5



1. Select a casing

HBT 150, ⌀8mm Reinforcement stirrups]

2. Calculating the effective depth d [mm]

b = 116 mm: from table on page 10

c = (h - b)/2 = (180 mm-116 mm)/2 = 32 mm
casing installation at centre of slab

d = h - c - Rebar ⌀/2

d = 180 mm - 32 mm - 8 mm/2 = 144 mm

Extract from the table on page 10

Casing dimensions [mm]

Casing size	rebar ⌀ [mm]	width B	height H_1	height H_2	b
HBT 120	10	122		30	90
	12			36	92
HBT 150	8			24	116
	10	150	12	30	118
	12			36	120
HBT 190	8			24	152
	10	186		30	154

3. Calculating v_{Rd} [kN/m]

Intermediate values for d can be linearly interpolated

113.0 kN/m: from the table on page 16

v_{Rd} = 113.1 kN/m > v_{Ed} = 113.0 kN/m

Application verified for d=144 mm and ⌀8/15 reinforcement

Extract from the table on page 16

Shear load resistance v_{Rd} [kN/m]

144 mm

Rebar ⌀/ spacing s [mm/cm]	d [mm] 100 mm	120 mm	140 mm	160 mm	180 mm	200 mm
8/25	61.2	69.9	69.9	69.9	69.9	69.9
8/20	61.2	87.7	87.4	87.4	87.4	87.4
8/15	61.2	87.7	112.2	116.6	116.6	116.6
8/10	–	87.7	112.2	137.7	163.2	174.8
10/25	61.2	87.7	109.3	109.3	109.3	109.3
10/20	61.2	87.7	112.2	136.6	136.6	136.6
10/15	61.2	87.7	112.2	137.7	163.2	182.1
10/10	–	87.7	112.2	137.7	163.2	188.7
12/25	–	87.7	112.2	137.7	157.4	157.4
12/20	–	87.7	112.2	137.7	163.2	188.7

113,1 kN/m

4. Verifying the anchorage length

see table on page 11

*Standard dimension according to the type test.

→ no reduction of v_{Rd} required.

Extract from the table on page 11

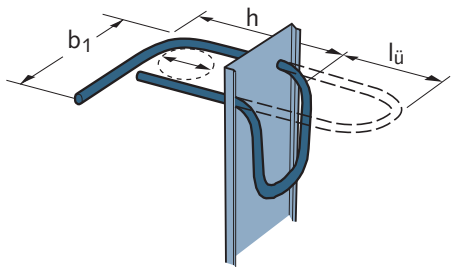
Rebar dimensions [mm]

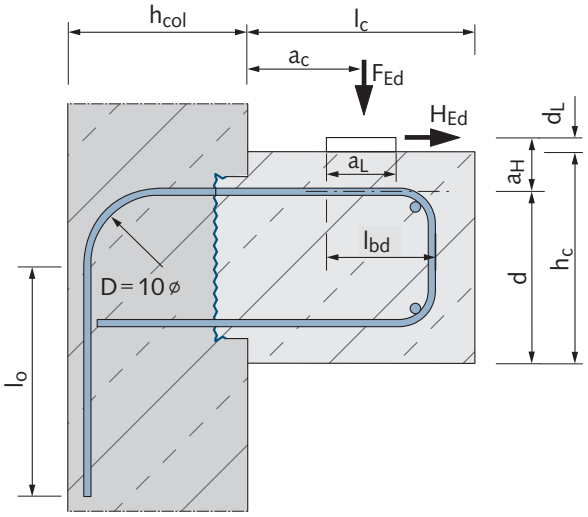
Casing type	Rebar ⌀ [mm]	Rebar spacing [cm]	Standard Type 5 L = 1250 mm h	Standard Type 5 L = 1250 mm $l_ü$	Types 5, 11, 22, 23 h_{min}	Types 5, 11, 22, 23 L = 1250 $l_{ü,max}$
		20		440		440
		25		460*		490
HBT 150		10				360
	8	15	170*	320*	120	510
		20				600
		25				
		10		360		360
		15				510

HALFEN HBT REBEND CONNECTIONS
Application example

Calculating a reinforced concrete corbel with HBT Type 7

Type 7





Structural boundary conditions

Geometric assumptions: $0.2 \leq \frac{a_c}{h_c} \leq 1.0$

Shear load capacity of the corbel:

$$F_{Ed} \leq V_{Rd,max} = 0.5 \cdot \nu \cdot b_c \cdot z \cdot \frac{f_{ck}}{\gamma_c}$$

where $\nu = 0.7 - \frac{f_{ck}}{200\ N/mm^2} \geq 0.5$

$z = 0.9 \cdot d$

Tensile load in the corbel:

$$Z_{Ed} = F_{Ed} \cdot \frac{a_c}{z_o} + H_{Ed} \cdot \frac{a_H + z_o}{z_o}$$

where $z_o = d \cdot \left(1 - 0.4 \cdot \frac{F_{Ed}}{V_{Rd,max}}\right)$; $H_{Ed} \geq 0.2 \cdot F_{Ed}$

and $\frac{a_c}{z_o} \geq 0.4$

Required reinforcement for tension

$$a_{s,rqd} = \frac{Z_{Ed}}{0.8 \cdot f_{yd}}$$

In addition to the corbel calculation above, the rebend connection has to be verified according to the specifications in approval no. Z-21.8-2035 (see page 10 f).

The compressive stresses under the load application plate and the wall's joint load bearing capacity must be verified in accordance with DIN EN 1992-1-1 resp. publication no. 532 issued by the German Committee for Structural Concrete (DAfStb).

The spacing between the sides of the corbel and the outermost rebars in the HBT Connection should not exceed 5 cm. The free side-edge of the corbel must be strengthened using stirrups.

In addition, verification of the lap length in component 1 and the anchorage length in the corbel is required in accordance with DIN EN 1992-1-1. The geometric boundary conditions for values $l_{0,vorh}$ and l_{bd} are provided in the figure above. The value $l_{b,rqd}$ may be verified using 80% of the steel yield strength.

Concrete strength class C30/37 c_{nom} = 35 mm

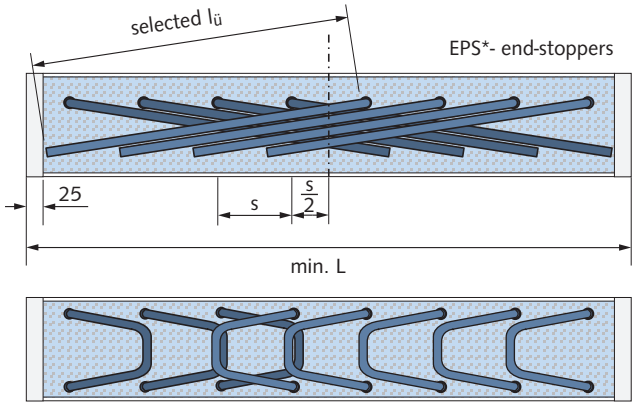
	reinforcement ø/s	h_c = 160 mm	190 mm	230 mm	250 mm
		max F_{Ed} for profile type [kN/m]			
		HBT 120	HBT 150	HBT 190	HBT 220
L_c = 200 mm	8/25	51.7	61.7	61.4	61.3
$l_ü$ = 165 mm	8/20	64.2	76.9	77.1	77.0
a_c = 100 mm	8/15	64.5	–	–	–
	10/25	63.7	76.4	91.8	96.7
	10/20	64.0	80.1	101.5	110.1
	10/15	–	–	101.5	110.1
L_c = 220 mm	8/25	53.4	61.5	61.2	61.1
$l_ü$ = 185 mm	8/20	64.4	77.3	77.0	76.8
a_c = 110 mm	10/25	63.9	79.1	95.4	96.5
	10/20	–	79.9	101.3	110.0
	12/25	63.3	79.4	100.8	109.6
	12/20	–	79.4	100.8	109.6
L_c = 240 mm	8/25	53.3	61.4	61.1	60.9
$l_ü$ = 205 mm	8/20	64.3	77.1	76.8	76.7
a_c = 120 mm	10/25	63.8	79.8	96.5	96.3
	10/20	–	–	101.2	109.8
	12/25	63.2	79.3	100.6	109.5
L_c = 260 mm	8/25	50.1	60.5	60.9	60.7
$l_ü$ = 225 mm	8/20	62.2	–	–	–
a_c = 130 mm	10/25	63.7	79.7	96.3	96.2
	12/25	–	79.1	100.5	109.3
L_c = 280 mm	8/25	47.3	57.2	60.8	60.6
$l_ü$ = 245 mm	10/25	–	–	96.2	96.0
a_c = 140 mm	12/25	–	79.0	–	–

H_{Ed} = 0,2 · F_{Ed}; h = 170 mm, b_1 = 400 mm load-plate a_L = 50 mm, d_L = 10 mm

These values are for pre-dimensioning; final values must be verified. Further dimensions and resistance values are available on request. Generally, significantly better resistance values are possible when using the HALFEN HSC Stud connector.

HALFEN HBT REBEND CONNECTIONS
Layout of the reinforcement in the casing

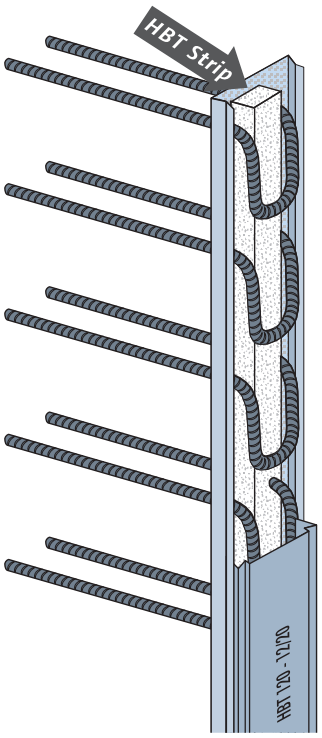
Minimum casings lengths for the rebend connections — layout of the reinforcement bars in the casing



* Expanded polystyrene

Minimum casing lengths for $l_ü$ standard				
rebar ⌀ [mm]	rebar spacing s [mm]	$l_ü$ [mm]	minimum casing length L [mm]	number of rebar
8	100	320	650	6
8	150	320	600	4
8	200	320	650	4
8	250	320	800	4
10	100	390	800	8
10	150	390	750	4
10	200	390	700	4
10	250	390	800	4
12	100	460	950	8
12	150	460	900	6
12	200	460	850	4
12	250	460	800	4

HBT Strip — the perfect solution for precast elements



The precast industry always puts an emphasis on achieving the minimal values for concrete cover and overall component dimensions. This places high demands on dimensional accuracy in manufacture of rebend connection elements.

The HBT-Connection with 'HBT Strip' (HBT-S) fulfils these requirements perfectly. Available for all double-row HBT connections with rebar types 6, 7, 8 and 9, in profile widths HBT - S 80, 120, 150, 190, 220.

- rebars are secured during transport
- compliance with required lap and anchorage lengths
- recommended for loop connections and corbel connections
- HBT Strip is easily removed after striking the formwork

Order example:

HBT - S - 80 - 10/15 - 6 - 1250

- 1250 — casing length L [mm]
- 6 — rebar type (see page 8)
- 10/15 — rebar diameter ⌀ [mm]/rebar spacing s [cm]
- S — profile indentifier - S for 'HBT-Strip'

See page 22 for installation; the HBT Strip must be removed after all connecting rebars have been rebent.

Always check the position of the rebar in the casing before installation as vibration during transport may have caused the rebar to move.

An additional/separate order of HBT Strips is recommended. This helps to ensure the position of the rebar in the casing is maintained.

HALFEN HBT REBEND CONNECTIONS
Application examples

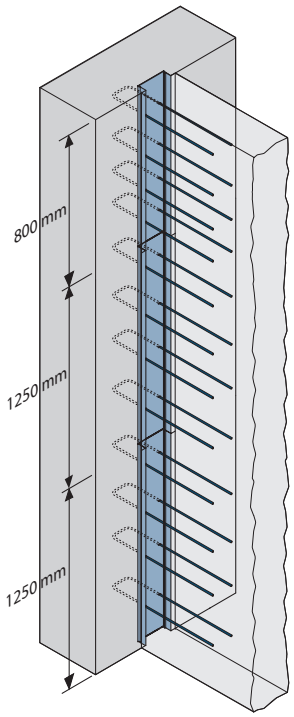
Application of short units

Various lengths — efficient installation times

Combining 1250 mm standard units and 800 mm units helps to avoid unnecessary modification of the HBT Units.

Standard combinations					
HBT Element	clear floor height [m]				
	2.40	2.50	2.85	3.30	3.75
	combinations				
short element L = 800 mm	3	–	2	1	–
standard element L = 1250 mm	–	2	1	2	3

In numerous applications, further on-site modification of the HBT Casing is not required. This avoids the risk of damage to the rebar in the casing. The designer/engineer can plan more efficiently and on-site preparation time for installation of the HBT Units is reduced.

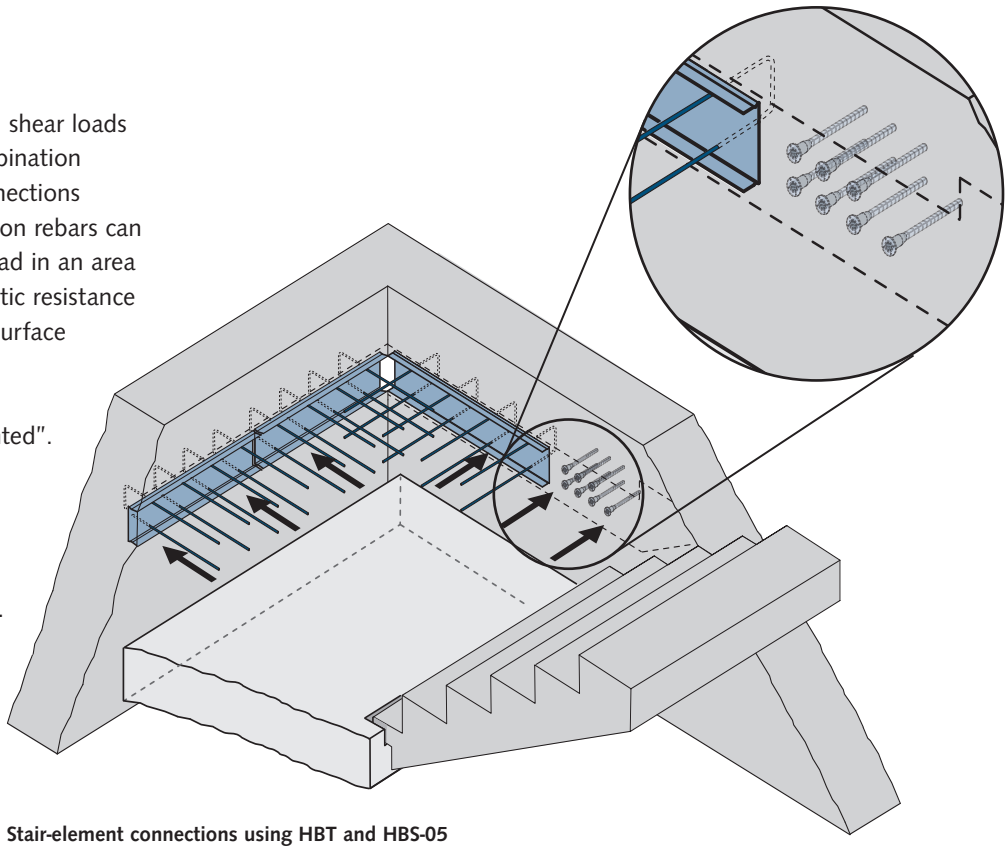


Wall connection using two 1250 mm HBT Elements and a 800 mm HBT Element to obtain a 3.30 m wall height

In combination with HBS-05

Combined strength!

In applications with concentrated shear loads HBT Rebend connections in combination with HALFEN HBS-05 Screw connections is also possible. HBS-05 Connection rebars can be used if the calculated shear load in an area exceeds the allowable characteristic resistance values for the HBT Profiles. The surface characteristics in the area of the HBS-05 Screw connections must be designed as “rough” or “indented”. Verification of shear load transfer is according to DIN EN 1992-1-1, 6.2.5. The result is a **cost effective** solution and **efficient** installation.

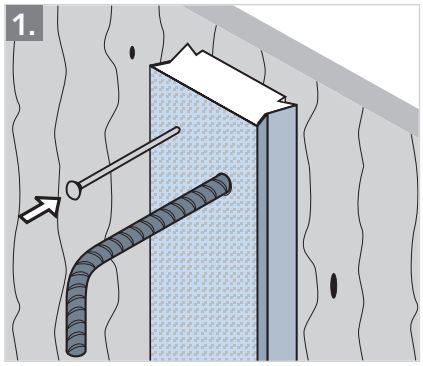


Stair-element connections using HBT and HBS-05

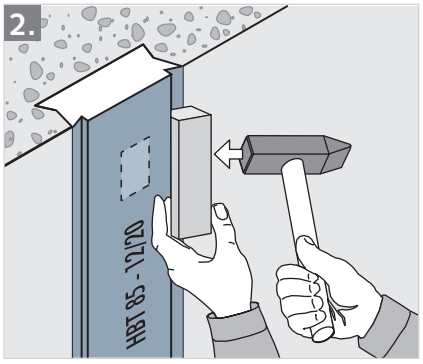
HALFEN HBT REBEND CONNECTIONS
Installation instructions

Assembly instructions

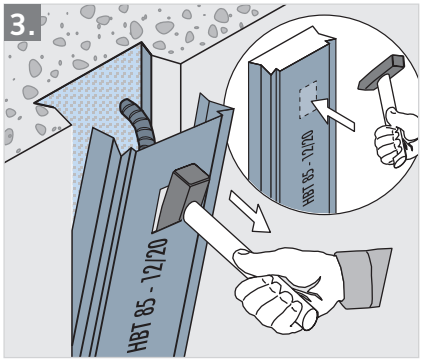
Simple to use, installation of the single row and the double row elements follow the same procedure.



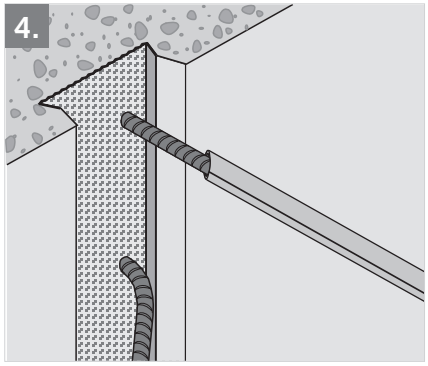
1. Nail the HBT Element to the timber formwork in the specified position.
Use suitable methods for fixing elements to metal formwork, for example magnets.
Check the rebar lengths that protrude from the case after installation.



2. After the concrete has cured, strike the formwork.
Use a wood block placed in the long groove in the side of the cover. Hit the block with a hammer to loosen the cover.



3. Use a claw-hammer to punch-in the marked perforated tab in the cover.
Hook the claw-hammer in the resulting hole and pull the lid out.

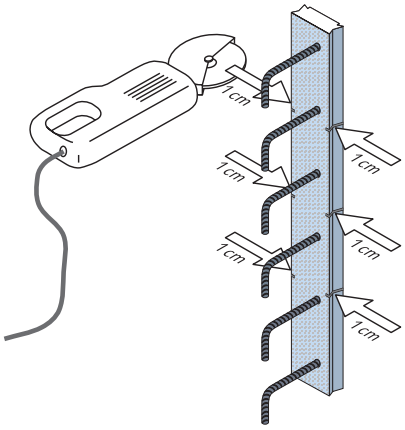


4. Use a suitable width pipe to straighten the rebar. Pull the pipe evenly upwards, until the rebar is straightened to the desired position without kinking.
Reposition in between pulls.
Repeat for all HBT element bars.
The profiled steel casing remains in the concrete.

Consider the environment:
The steel cover is recyclable scrap metal, please dispose of in a responsible manner.

HALFEN HBT REBEND CONNECTIONS
Installation instructions

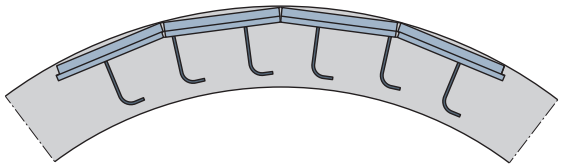
HBT Element adapted to curved formwork



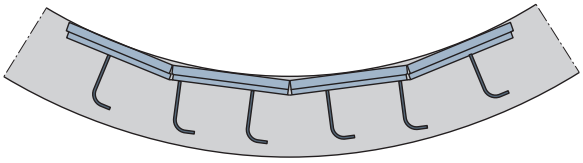
Adapting the HBT Casing

Using an angle-grinder cut approximately 1 cm deep incisions into both sides of the case at regular intervals. This lessens the rigidity of the protective casing and allows fixing to formwork when making curved concrete elements. To achieve a better fit to smaller curvature (< 3.00 m), up to seven incisions per side are possible.
After fixing the HBT Casing to the formwork cover, incisions and gaps with suitable adhesive tape to prevent concrete seeping into the casing.

Caution when working with an angle-grinder!
The reinforcing steel bars in the HBT Casing must not be damaged.



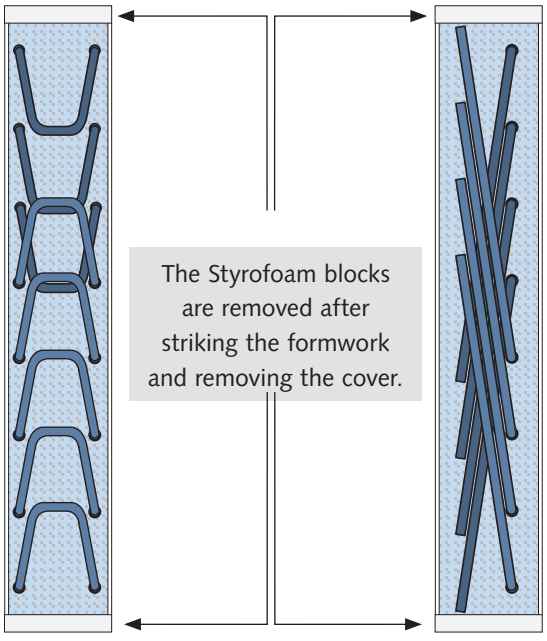
HBT Casing fitted to a convex curvature
Outer radius ≥ ca. 3.00 m; smaller radius is achieved with more incisions.



HBT Casing fitted to a concave curvature
Inner radius ≥ ca. 3.00 m. A smaller radius is achieved with more incisions.

Sealing the HBT casing

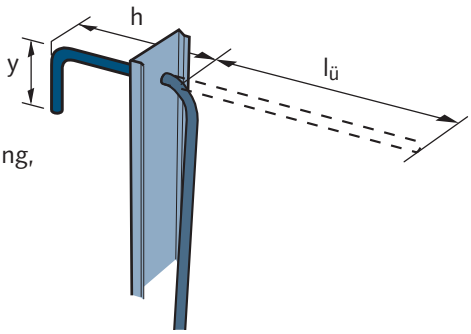
Special Styrofoam blocks placed at the short ends of the casing serve to seal the box in the concrete pour for the 1st component to prevent concrete ingress. The casings are additionally secured down the centre with reinforced adhesive tape. Remove the tape to take off the cover. The Styrofoam blocks can then be removed.



HALFEN HBT REBEND CONNECTIONS
Tender Texts

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

HALFEN HBT Rebend connection with single-row rebend reinforcement in a galvanized sheet-metal casing to form a reinforced connection, with General Building Authority Approval no. Z-21.8-2035,

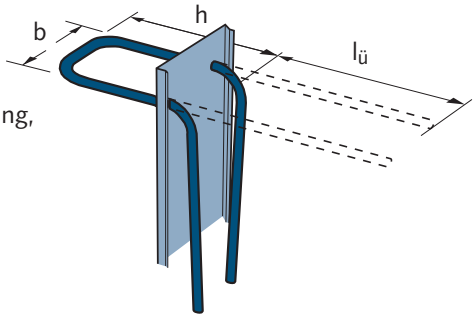


Type HBT 85 – 10/20 – 1 – 1250
with
85 = type identifier for a casing width of 85 mm with a single-row of rebar,
10/20 = reinforcement steel B500B with 10 mm bar diameter and 200 mm bar spacing,
1 = standard rebar type 1,
1250 = element length [mm],
in standard rebar dimensions
rebar length 1 h = 170 mm,
rebar length 2 $l_ü$ = 390 mm,
bend length y = 95 mm,

or equivalent; deliver and install according to the 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 sheet-metal casing to form a reinforced connection, with General Building Authority Approval no. Z-21.8-2035,



Type HBT 150 – 12/15 – 5 – 1250
with
150 = type identifier for a casing width of 150 mm with a double-row of rebar,
12/15 = reinforcement steel B500B with 12 mm bar diameter and 150 mm bar spacing,
5 = standard rebar type 5,
1250 = element length [mm],
in standard rebar dimensions
rebar length 1 h = 170 mm,
rebar length 2 $l_ü$ = 460 mm,

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

HALFEN Rebend connection, with stainless steel reinforcement bars

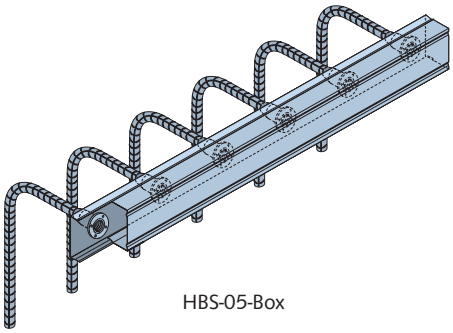
The texts above can be adapted to order stainless-steel reinforcing rebend connections by replacing the designation "B500B" to " B500 NR stainless reinforcing steel acc. to the building authority approval".

Further tender texts can be found at www.halfen.com.

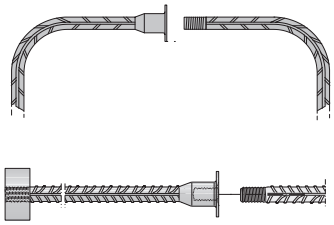
HALFEN HBT REBEND CONNECTIONS
Other HALFEN Reinforcement Products

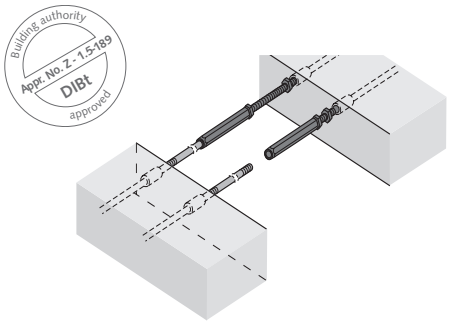
HALFEN HBS-05 Threaded couplers

The HALFEN HBS-05 Threaded couplers allow rebar continuity joints with simple screw and socket rebar. Their versatility allows nearly every type of reinforcement joint. HALFEN HBS-05 fulfils German and international certification criterion. Extensive certification and test reports prove their suitability also under extreme conditions.



HBS-05-Box

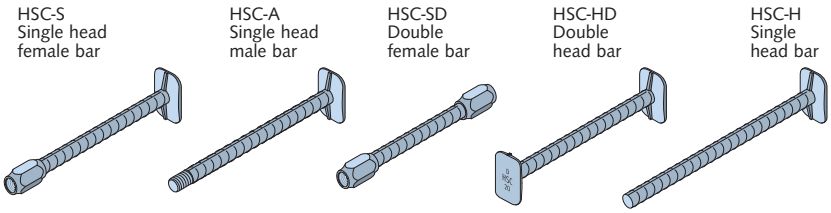


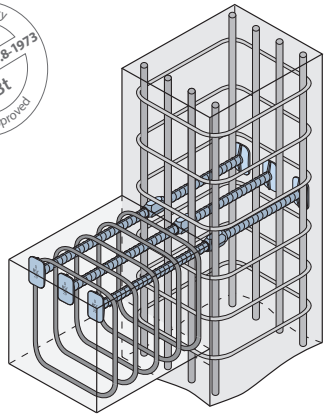


No torque wrench or special tools required — a visual check is sufficient

HALFEN HSC Stud Connector

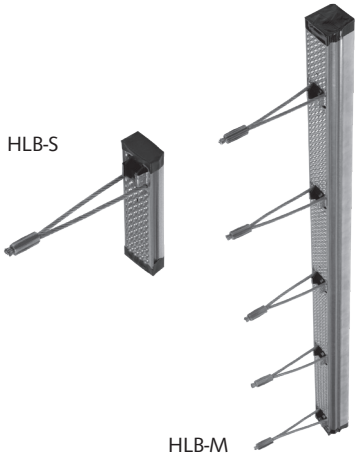
The HALFEN HSC Stud connector is a building authority approved reinforcement optimized for anchorage in concrete. Maximum exploitation of the reinforcement is possible with extremely short anchorage lengths.
HALFEN HSC Anchor is especially advantageous for use in high-density reinforced areas, for example; corbels and frame corner nodes.

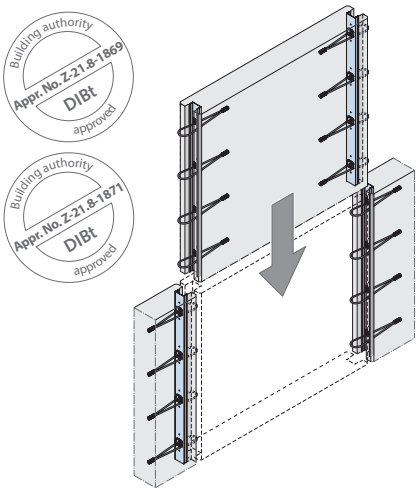




HALFEN HLB Loop Box

The HALFEN HLB Loop Box is an efficient and time saving method for connecting concrete elements. HLB Loop boxes are cast into concrete elements (e.g. wall elements) in the precast plant. The prepared concrete elements are transported to site, lifted and correctly placed with a crane. The joint between the elements is then cement-grouted.





HALFEN HBT REBEND CONNECTIONS
References

Kö-Bogen, Düsseldorf, Germany

The Kö-Bogen complex designed by Daniel Libeskind offers commercial space for business as well as a shopping centre with restaurants etc. The Kö-Bogen (curve) is located at the end of the Königsallee in Düsseldorf, Germany.

We supplied HALFEN HBT Rebend connections for the Kö-Bogen. Other HALFEN products also used in this project include;

- HALFEN HTA Cast-in channels
- HALFEN Masonry connection channels
- HALFEN HDB Shear rails
- HALFEN HBS-05 Threaded couplers


Kopernikus Science centre, Warsaw, Poland

The Science centre in Warsaw, Poland, named after Nikolaus Kopernikus, is a collection of buildings with six exhibition areas.

We supplied HALFEN HBT Rebend connections for this project.

DATEV IT-Campus, Nuremberg, Germany

The DATEV IT-Campus on Fürther Strasse in Nuremberg offers 1800 workspaces including 200 individual offices and conference rooms of various sizes.
The building was inaugurated in 2015.

We supplied HDB Shear rails and HBT Rebend connections for this project.

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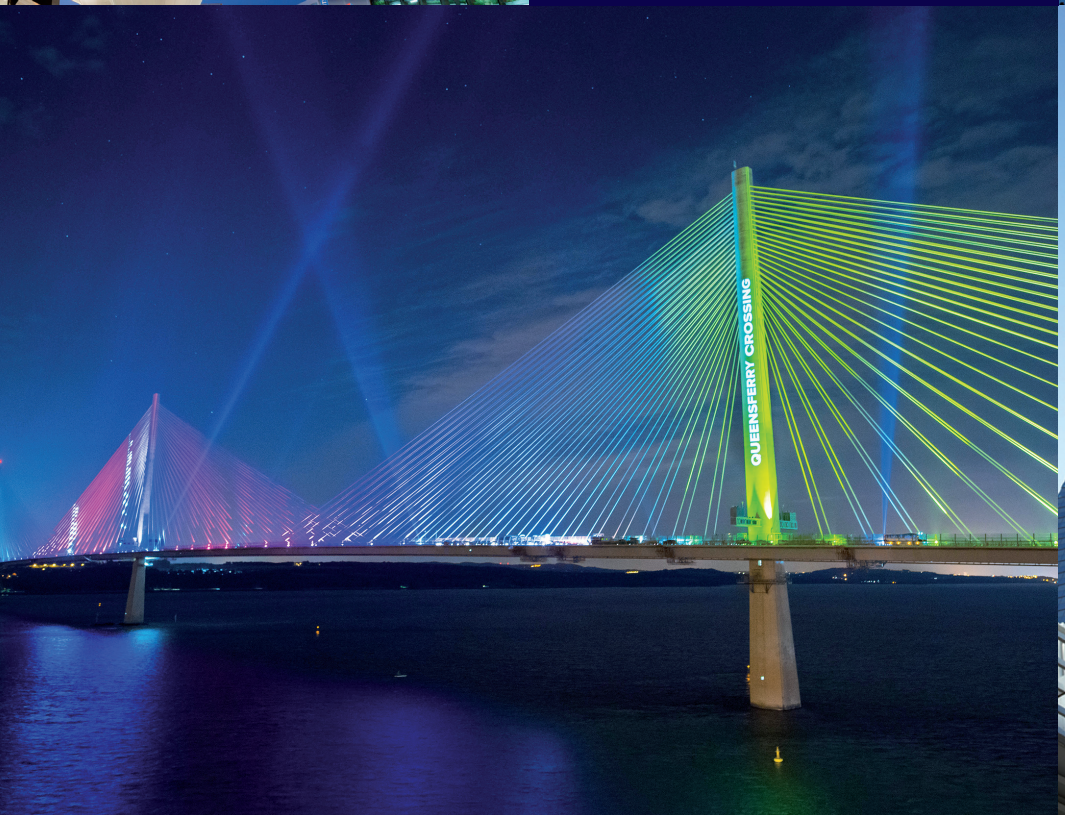

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