

# FERBOX<sup>®</sup> Rebend connections



Technical information



ETA-  
20/0842

Joint category  
always  
"indented"



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# FERBOX® rebind connections

For connecting reinforced concrete components of different concreted sections

## The product

FERBOX® rebend connections are used for the simple, secure connection of reinforced concrete components of different building sections or concreted sections. This solution allows a wide variety of structural components such as walls, floors/ceilings, corbels and staircases to be joined together by means of a frictional connection. FERBOX® rebend connections are installed in the first concreted section. After concreting and removing the formwork from the first structural component, the cover is removed and the reinforcement in the second concreted section is folded out.



## Advantages

- ETA-20/0842
- Planning success guaranteed thanks to top joint category, "indented" joints, in transverse and longitudinal directions
- Quick and cost-effective to install
- Variety of different bent shapes for a wide range of load and installation situations
- Simplified product selection thanks to knubbed casing
- Dimensionally stable sheet metal cover
- FERBOX® Design structural design software

## Application areas



FERBOX® rebend connections can be used wherever structural components need to be joined together by means of a frictional connection. The new FERBOX® generation is a truly multi-talented solution for connecting walls, floors/ceilings, corbels and staircases.

# The new FERBOX® generation

## A rebend connection for all applications

The new FERBOX® casing features a knubbed texture that combines the previous versions with their transverse or longitudinal indented profiles into a single casing design. This makes the product selection process considerably simpler. These rebend connections comply with the structural design requirements set out in DIN EN 1992-1-1 and have undergone ETA-20/0842 for use in Europe.

**NEW**

### Casing

Knubbed, galvanised steel casing. Supersedes the previous casing designs with transverse or longitudinal indented profiles.

The height  $F$  of the casing is 12.5 mm; the height including the cover varies depending on the bar diameter:

For dia.  $\leq 10$  mm,  $F = 30$  mm

For dia.  $\geq 12$  mm,  $F = 40$  mm

Casing width  $B$  depends on type:

60 mm - 260 mm

**NEW**

### Cover

Dimensionally stable galvanised steel cover  
Supersedes the previously used plastic cover, making recycling easier.

### Reinforcement bars

Dia. 8/10/12/14, made from B500B reinforcing steel, Stainless steel reinforcement (B500NR) available on request.

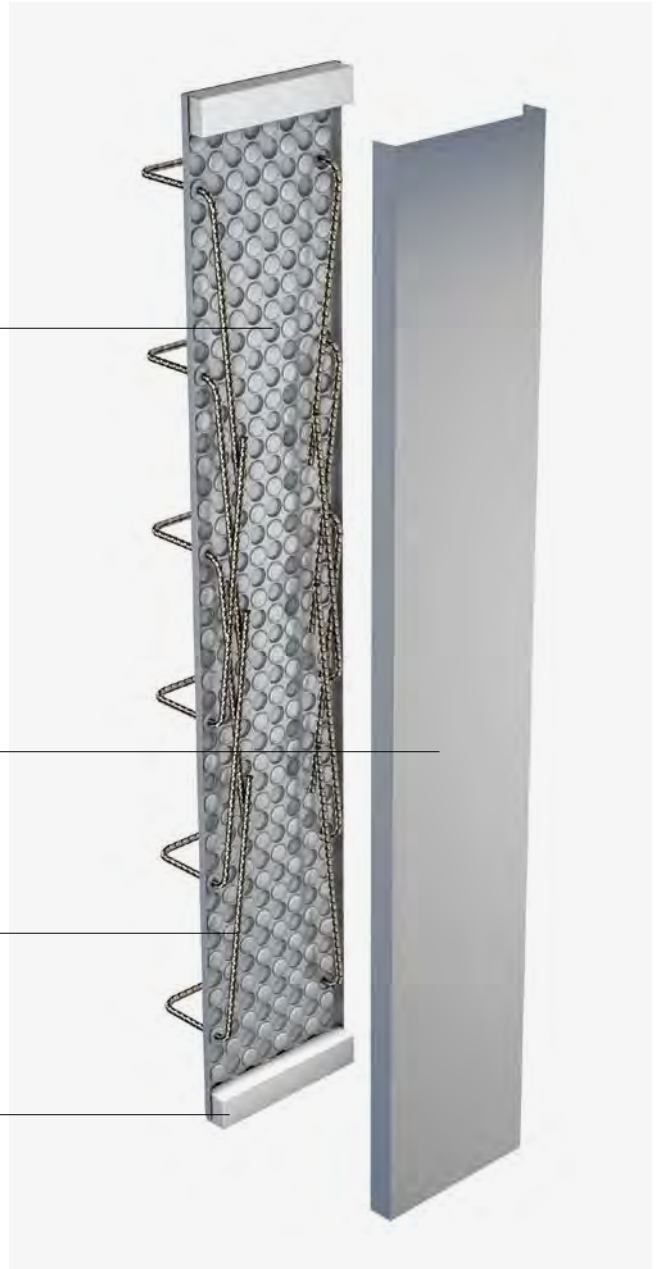
### Foam stopper strip

Prevents the ingress of concrete while the first concreted section is being constructed.

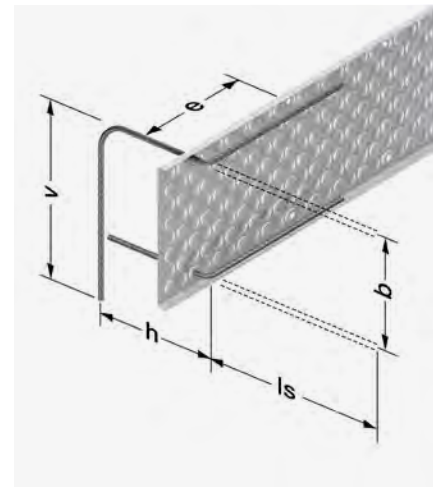
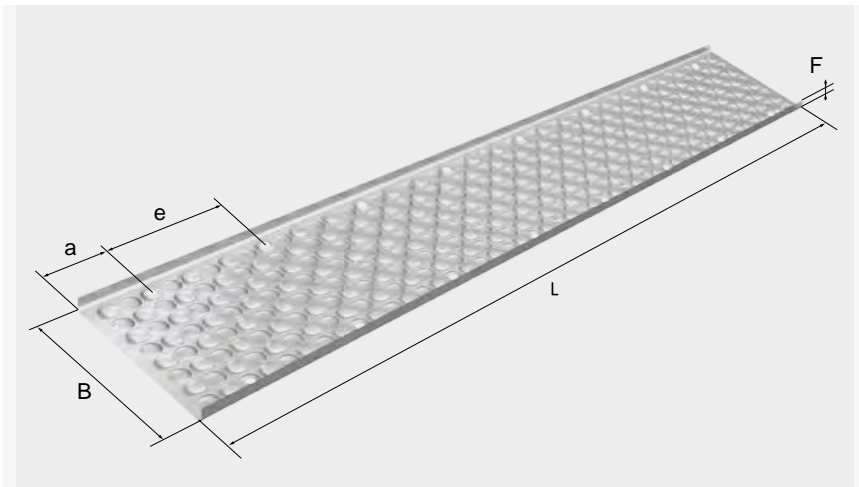
**NEW**

### Approved for use in Europe by undergoing ETA-20/0842

The FERBOX® has undergone this European technical assessment (ETA) to verify its technical suitability for use in Europe. This means that it can be used for connections for both structural design and constructional purposes; because there is only one type, there is no risk of using the wrong type.



## Profile geometry



B: Casing width  
 L: Casing length  
 F: Casing height

Dia.: Reinforcement diameter  
 a: Clearance from edge  
 e: Bar spacing

ls: Lap length  
 v: Hook length  
 b: Stirrup width

h: Anchorage length

## Number of stirrups and bar spacings

Casing length L mm	Bar spacing e mm	Clearance from edge a mm	No. of stirrups
1200	100	50	12
	150	75	8
	200	100	6
	250	100	5
800	100	50	8
	150	25	6
	200	100	4
	250	25	4

The number of reinforcement stirrups and their classification depend on the length of the casing:

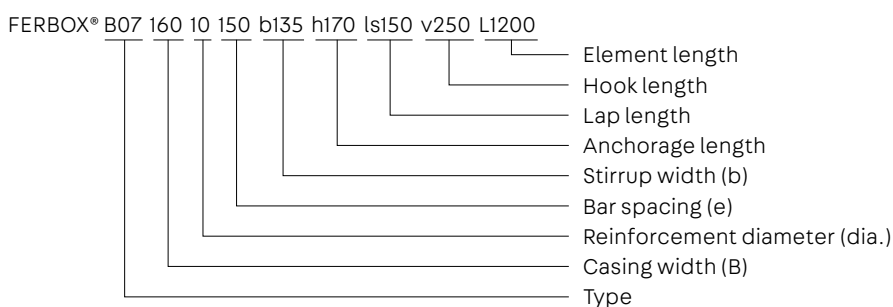
## Different lengths for added flexibility

FERBOX® rebend connections are available in standard lengths 0.8 m and 1.2 m. We are happy to supply short and custom lengths on request. We recommend that you do not cut the FERBOX® to size on the construction site. In most cases, adapted lengths can be obtained by combining the 0.8 m and 1.2 m standard lengths.

### Example

Installation length:  
 4.0 m  
 Installation parts:  
 2 x (1.2 + 0.8 m)

## Type designation

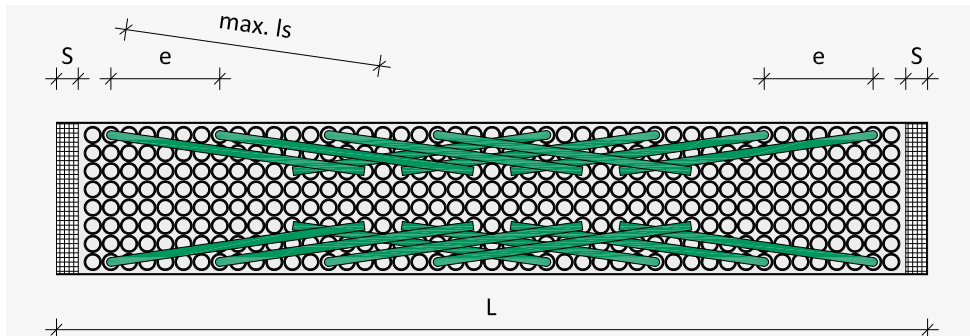


Ascertaining the stirrup width b for a double-row FERBOX®

$b = \text{casing width } B - 25 \text{ mm}$



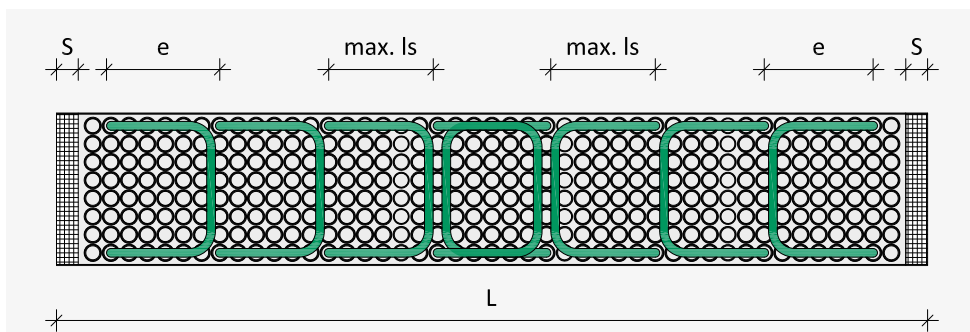
## Reinforcement bar arrangement and maximum lap length $l_s$



### B01, B02, B03, B05

#### Requirement:

No more than one reinforcement bar may cross another reinforcement bar at any one point



### B04, B06, B07, B08, B09

#### Bent normally

#### Stirrups remain straight under the following conditions:

Reinforcement dia. 8 mm:

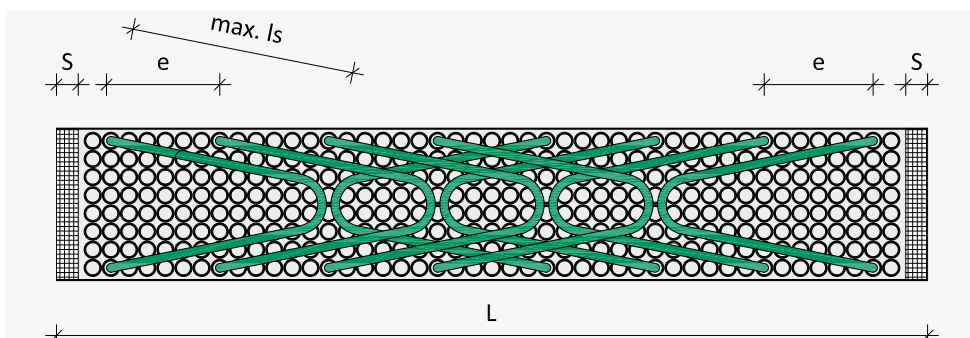
$l_s \leq e - 20$  mm

Reinforcement dia. 10 mm:

$l_s \leq e - 30$  mm

Reinforcement dia. 12 mm:

$l_s \leq e - 30$  mm



### B04, B06, B07, B08, B09

#### Bent conically

Reinforcement dia. 8 mm:

$l_s \geq e - 20$  mm

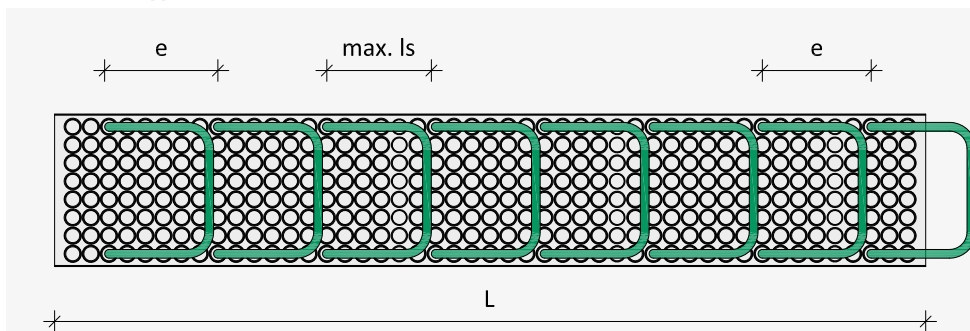
Reinforcement dia. 10 mm:

$l_s \geq e - 30$  mm

Reinforcement dia. 12 mm:

$l_s \geq e - 30$  mm

### FERBOX® "S" types



### B04S, B06S, B07S, B08S, B09S

All bars bent in the same direction

Reinforcement dia. 8/10/12 mm:

Max  $l_s = (2 \cdot e) - 50$  mm



Due to production constraints, with FERBOX® types B04, B06, B07, B08 and B09, the foldout stirrups ( $l_s$ ) must be bent conically for small reinforcement spacings and large  $l_s$  values. This situation can make it more difficult to configure the reinforcement and can complicate the structural design. With the "S" version, small stirrup spacings can be achieved without having to bend the stirrups conically.



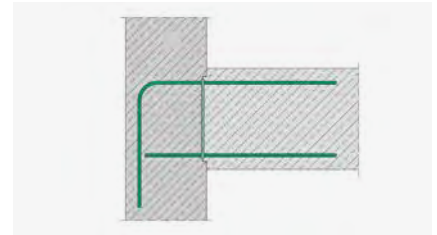
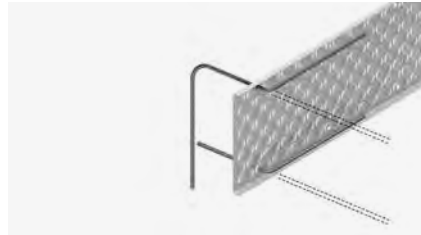
#### Assembly instructions for "S" types

- Elements are fitted together on site
- Casings have no polystyrene stopper strip at either end - element ends must be sealed on site
- Element joints must be adhesively bonded on site such that there are no gaps
- The final stirrup in a linear corbel may need to be removed on site

# Type overview

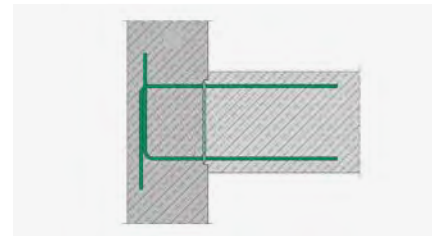
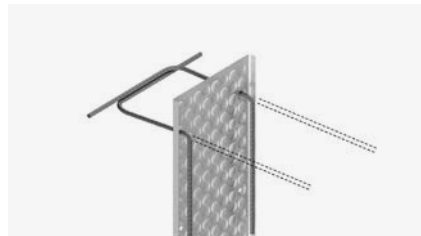
## FERBOX® B01

Bending roller diameter  $h/v$ : 10 ds

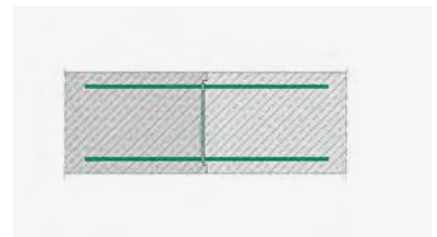
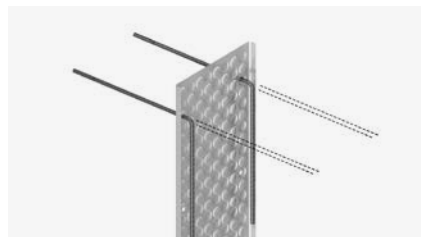


## FERBOX® B02

Bending roller diameter  $h/v$ : 4 ds  
(also available with  $h/v = 10 ds$ )

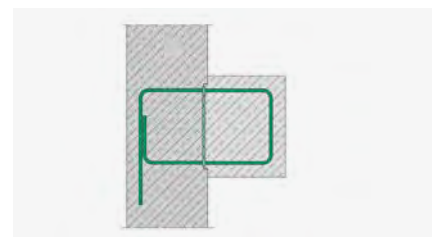
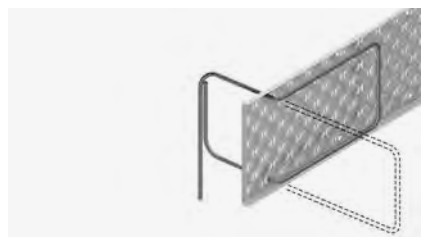


## FERBOX® B03

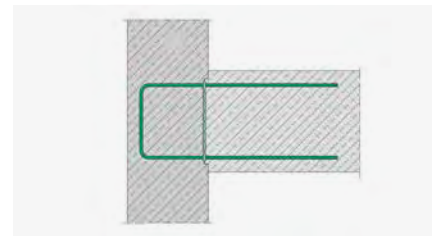
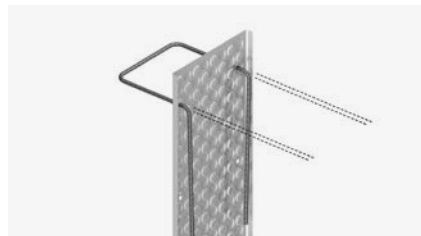


## FERBOX® B04/B04S

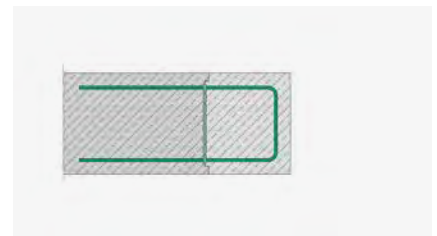
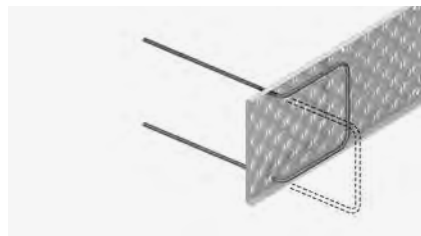
Bending roller diameter  $h/v$ : 4 ds



## FERBOX® B05



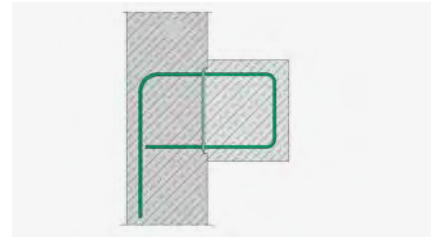
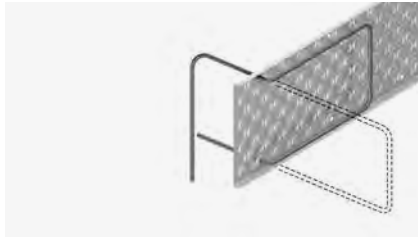
## FERBOX® B06/B06S



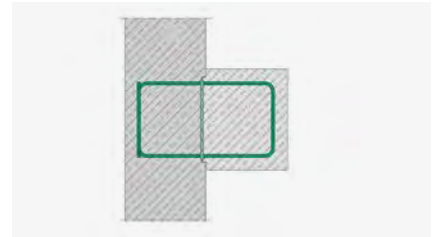


**FERBOX® B07/B07S**

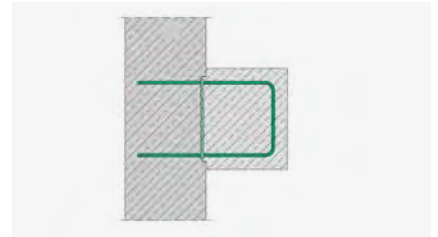
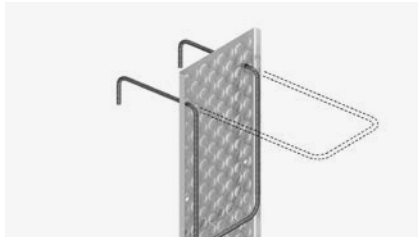
Bending roller diameter h/v: 10 ds  
(also available with h/v = 4 ds)



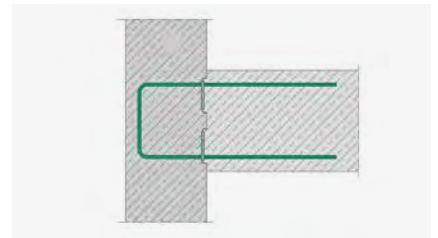
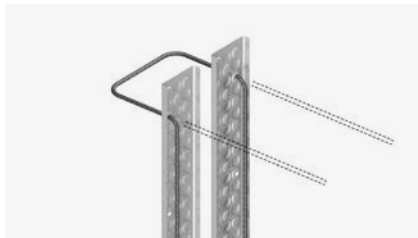
**FERBOX® B08/B08S**



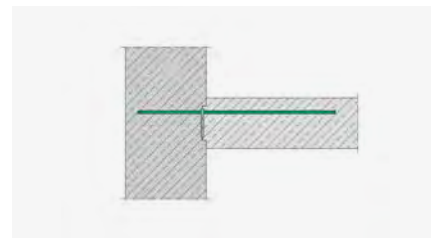
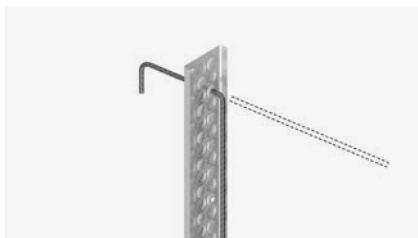
**FERBOX® B09/B09S**



**FERBOX® EE**

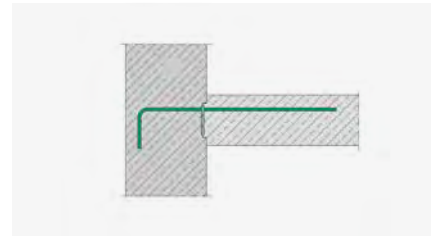
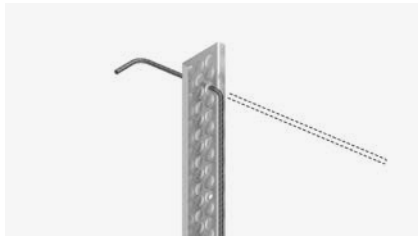


**FERBOX® E01**

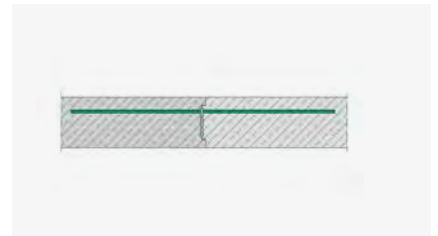
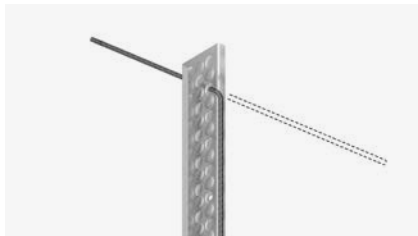


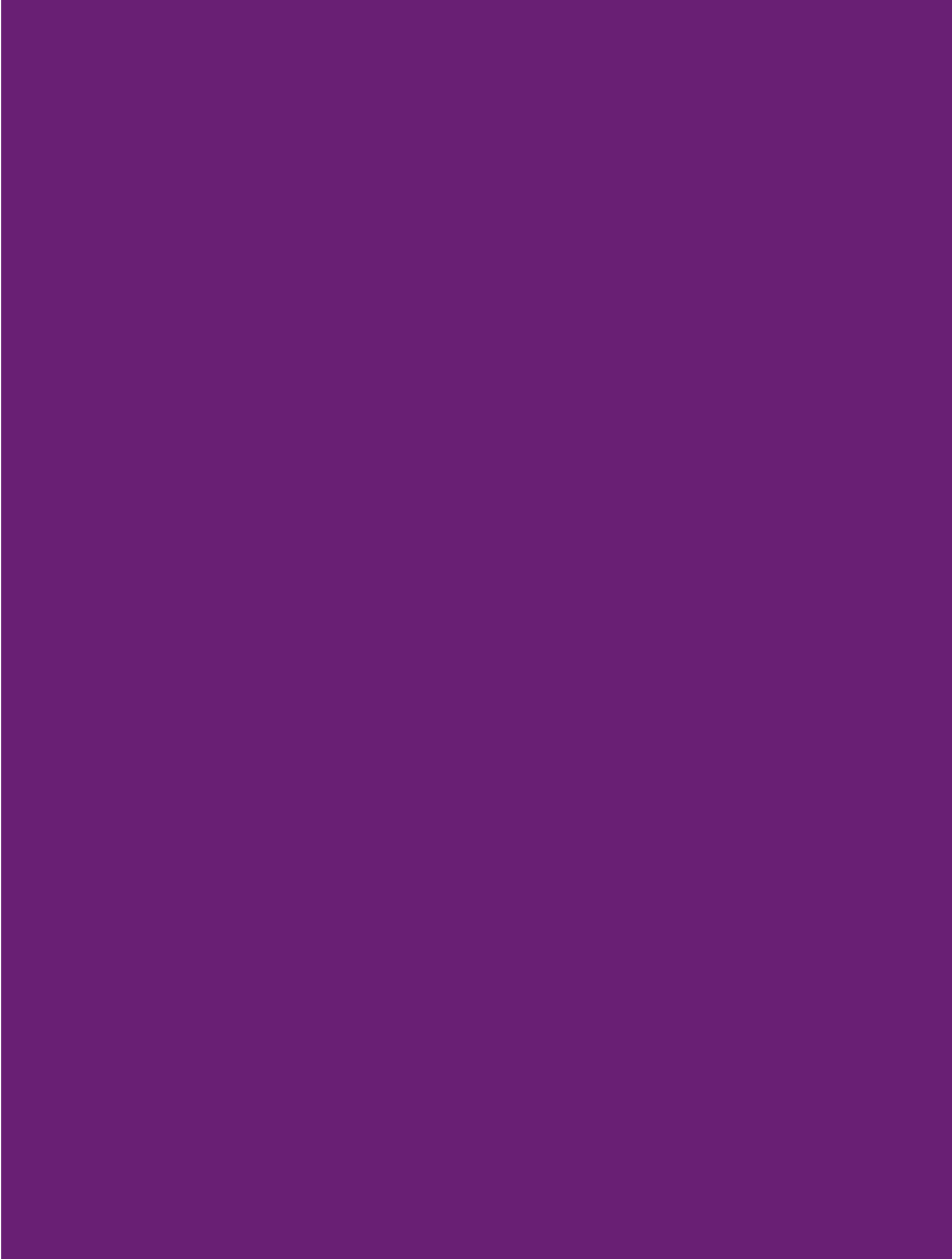
**FERBOX® E02**

Bending roller diameter h/v: 4 ds  
(also available with h/v = 10 ds)



**FERBOX® E03**





# Application overview

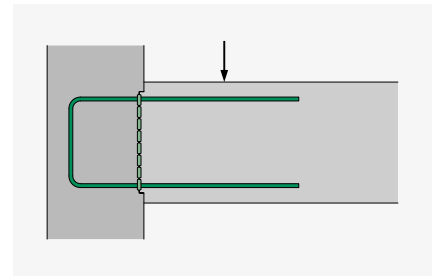
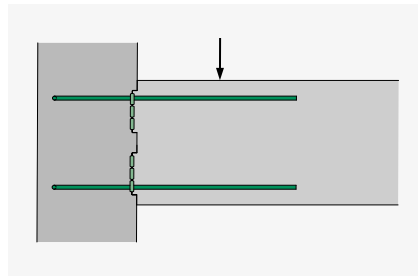
# Shearing force in transverse direction with respect to casing

Single-row ↻

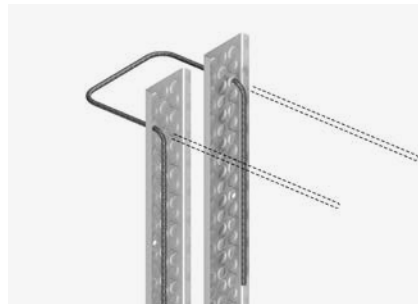
Double-row ↻

**Type of connection**  
e.g. wall - floor/ceiling

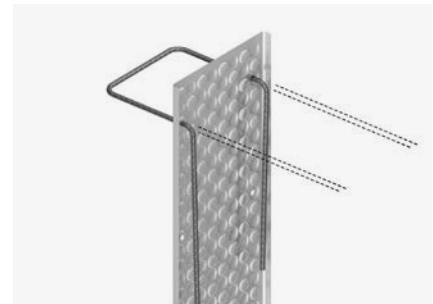
**Load**  
Shearing force



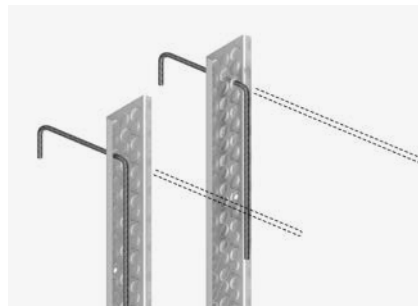
**Possible product selection**



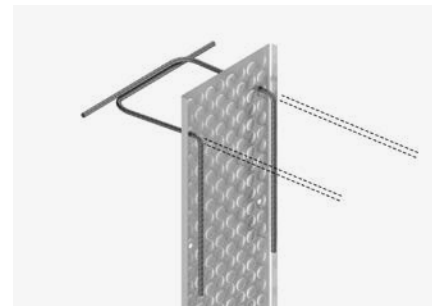
FERBOX® EE



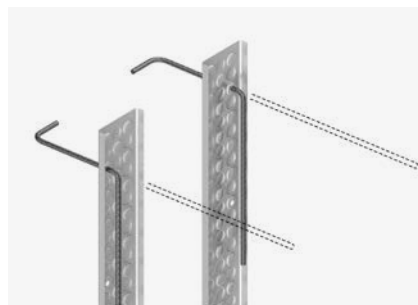
FERBOX® B05



2 x FERBOX® E01



FERBOX® B02 (4 ds)



2 x FERBOX® E02

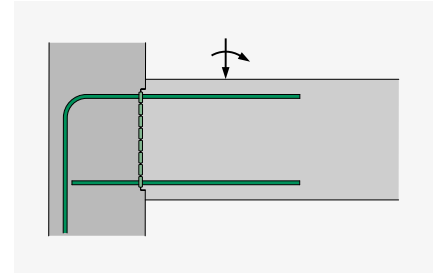
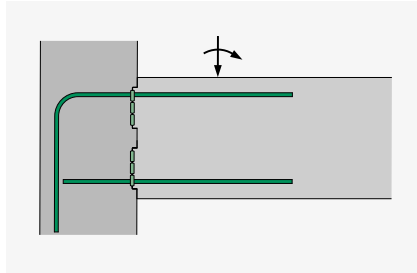
# Shearing force and torque in transverse direction with respect to casing

Single-row ↻

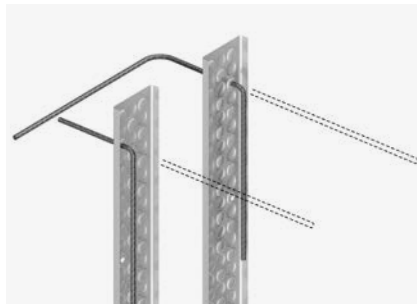
Double-row ↻

**Type of connection**  
e.g. wall - floor/ceiling

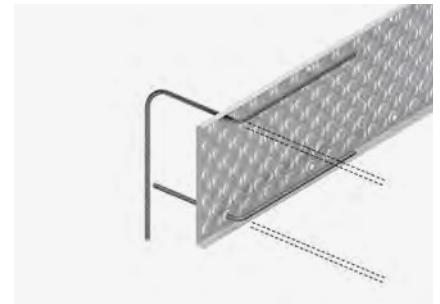
**Load**  
Shearing force/torque



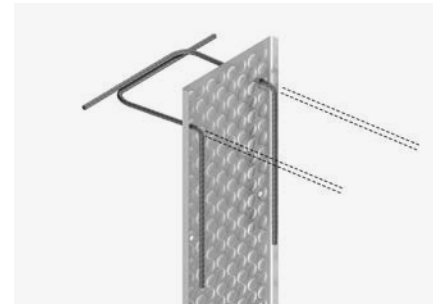
**Possible product selection**



1 x FERBOX® E02 (10 ds) + 1 x E03



FERBOX® B01 (10 ds)



FERBOX® B02 (10 ds)



A smarter way to plan your connections:  
Our FERBOX® Design structural design software is just  
the tool for the job.

# Shearing force in transverse direction with respect to casing

Single-row ↗

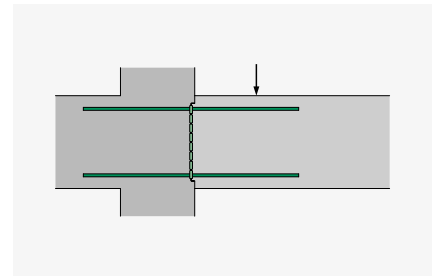
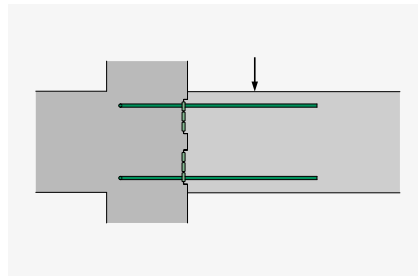
Double-row ↗

## Type of connection

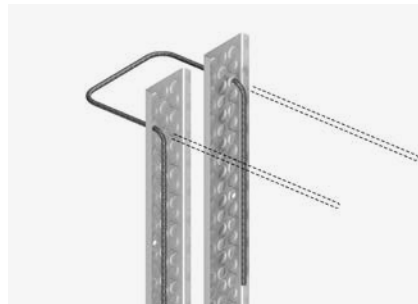
e.g. wall - floor/ceiling - floor/ceiling

## Load

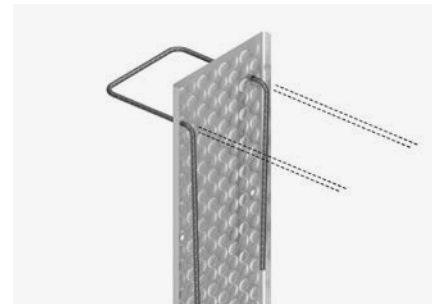
Shearing force



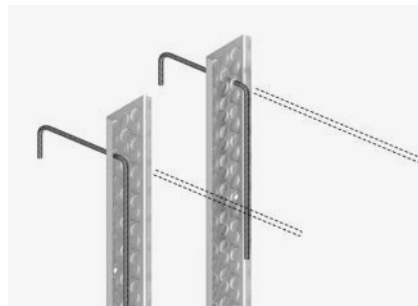
## Possible product selection



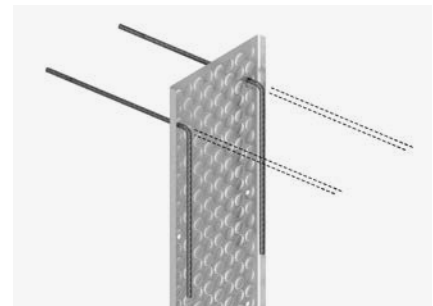
FERBOX® EE



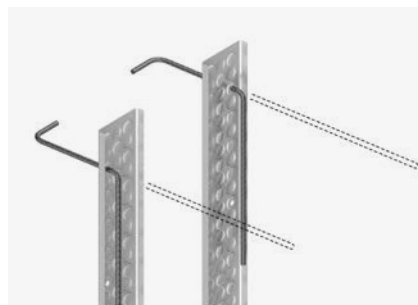
FERBOX® B05



2 x FERBOX® E01



FERBOX® B03



2 x FERBOX® E02



# Shearing force and torque in transverse direction with respect to casing

Single-row ↻

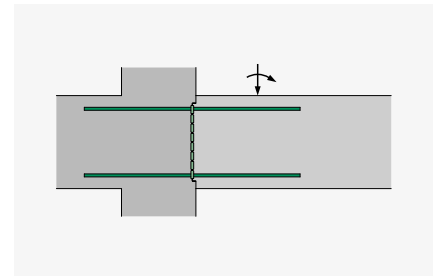
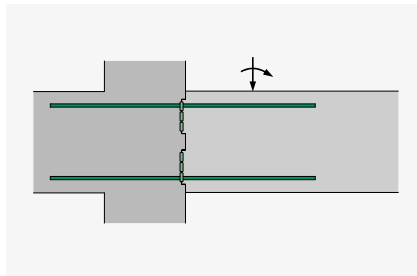
Double-row ↻

## Type of connection

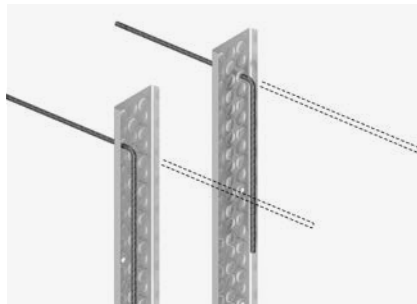
e.g. wall - floor/ceiling - floor/ceiling

## Load

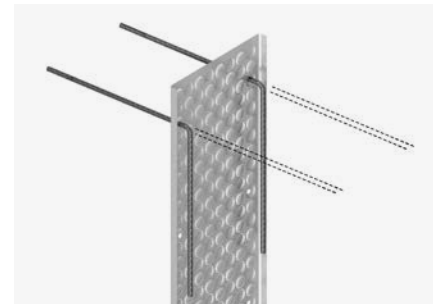
Shearing force/torque



## Possible product selection



2 x FERBOX® E03



FERBOX® B03



A smarter way to plan your connections:  
Our FERBOX® Design structural design software is just  
the tool for the job.

# Shearing force and torque in transverse direction with respect to casing

Single-row ↻

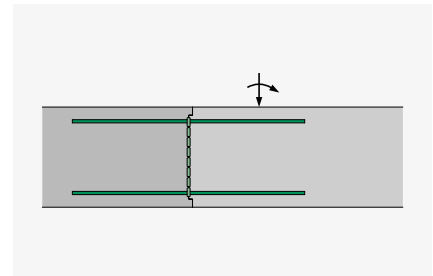
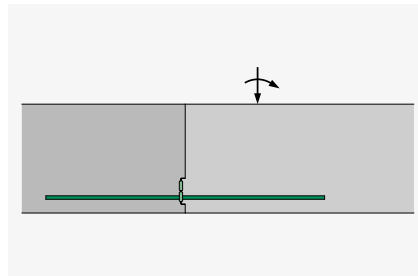
Double-row ↻

## Type of connection

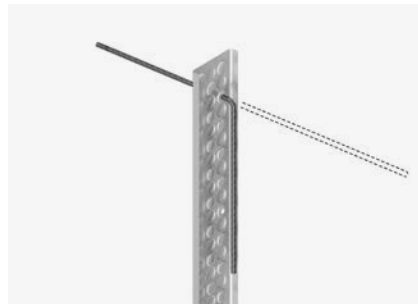
e.g. floor/ceiling - floor/ceiling

## Load

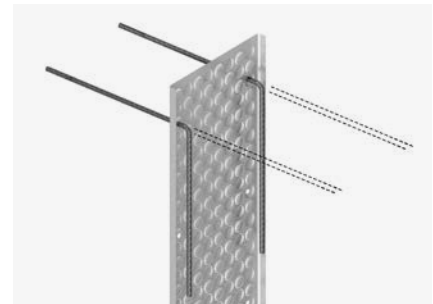
Shearing force/torque



## Possible product selection



FERBOX® E03



FERBOX® B03

# Shearing force in longitudinal direction with respect to casing

Single-row ↻

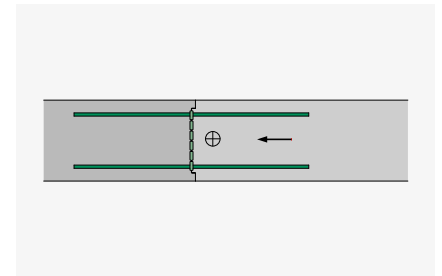
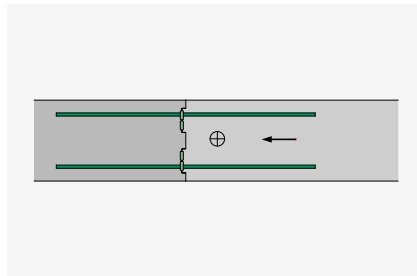
Double-row ↻

## Type of connection

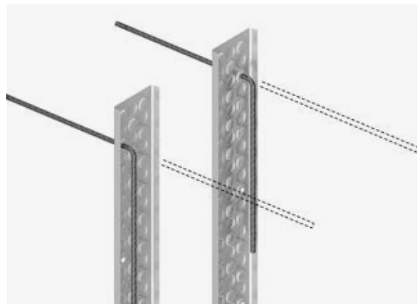
e.g. wall - wall

## Load

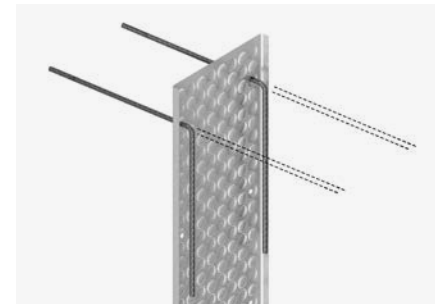
Shearing force  
Shearing force/normal force



## Possible product selection



2 x FERBOX® E03



FERBOX® B03



A smarter way to plan your connections:  
Our FERBOX® Design structural design software is just  
the tool for the job.

# Shearing force in longitudinal direction with respect to casing

Single-row ↻

Double-row ↻

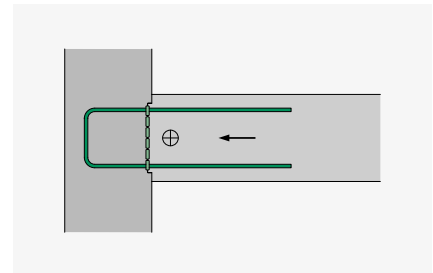
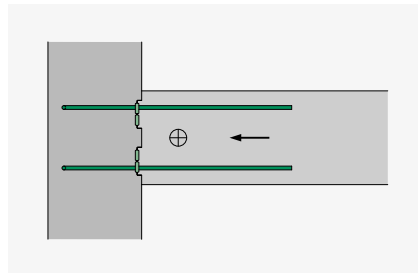
## Type of connection

e.g. vertical wall - wall

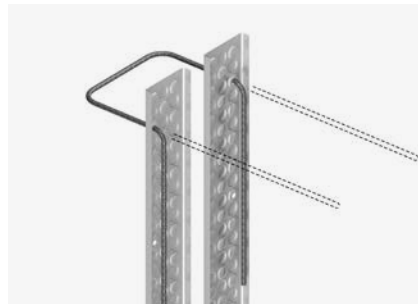
## Load

Shearing force

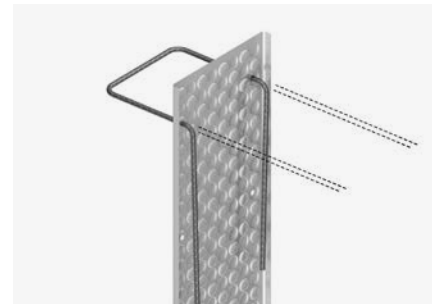
Shearing force/normal force



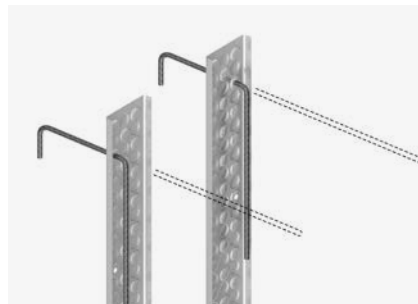
## Possible product selection



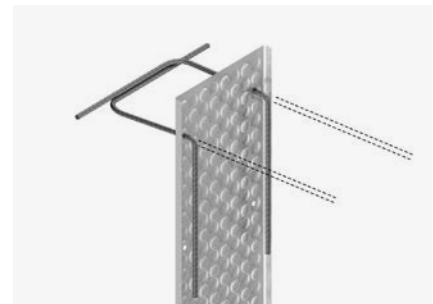
FERBOX® EE



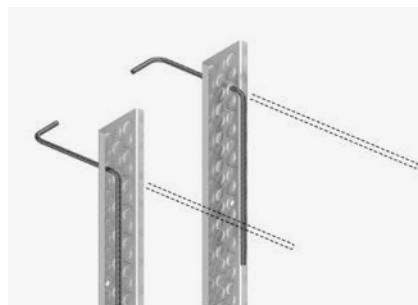
FERBOX® B05



2 x FERBOX® E01



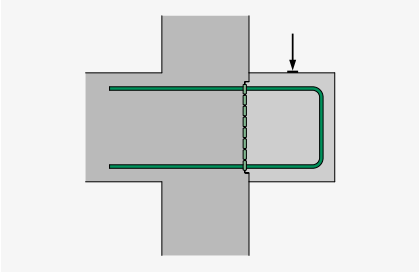
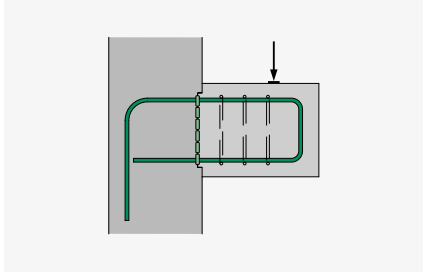
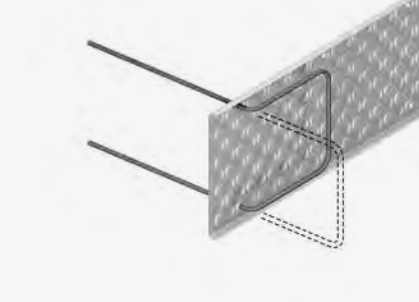
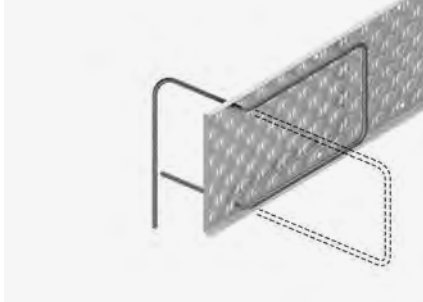



FERBOX® B02 (4 ds)



2 x FERBOX® E02

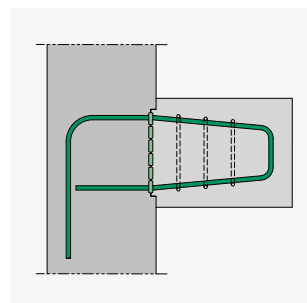
# Corbels

	Double-row 	Double-row 
<p><b>Type of connection</b>                      e.g. floor/ceiling - corbel                      e.g. wall - corbel</p> <p><b>Load</b>                      Shearing force</p>		
<p><b>Possible product selection</b></p>	 <p><b>FERBOX® B06/B06S</b></p>	 <p><b>FERBOX® B07/B07S</b></p>

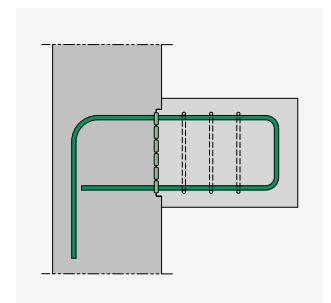
 Depending on the ratio of the corbel's height to its cantilever, it may be necessary due to production constraints to bend the FERBOX®'s stirrups in the corbel so that they form a conical shape. Alternatively, you can opt for one of the FERBOX® "S" types, which allow for straight stirrups (see "S" types on page 11).

Our application engineers are happy to provide you with additional information on individual geometries.


Tel.: +49 (0) 7742 9215-300  
 E-mail: technik@h-bau.de

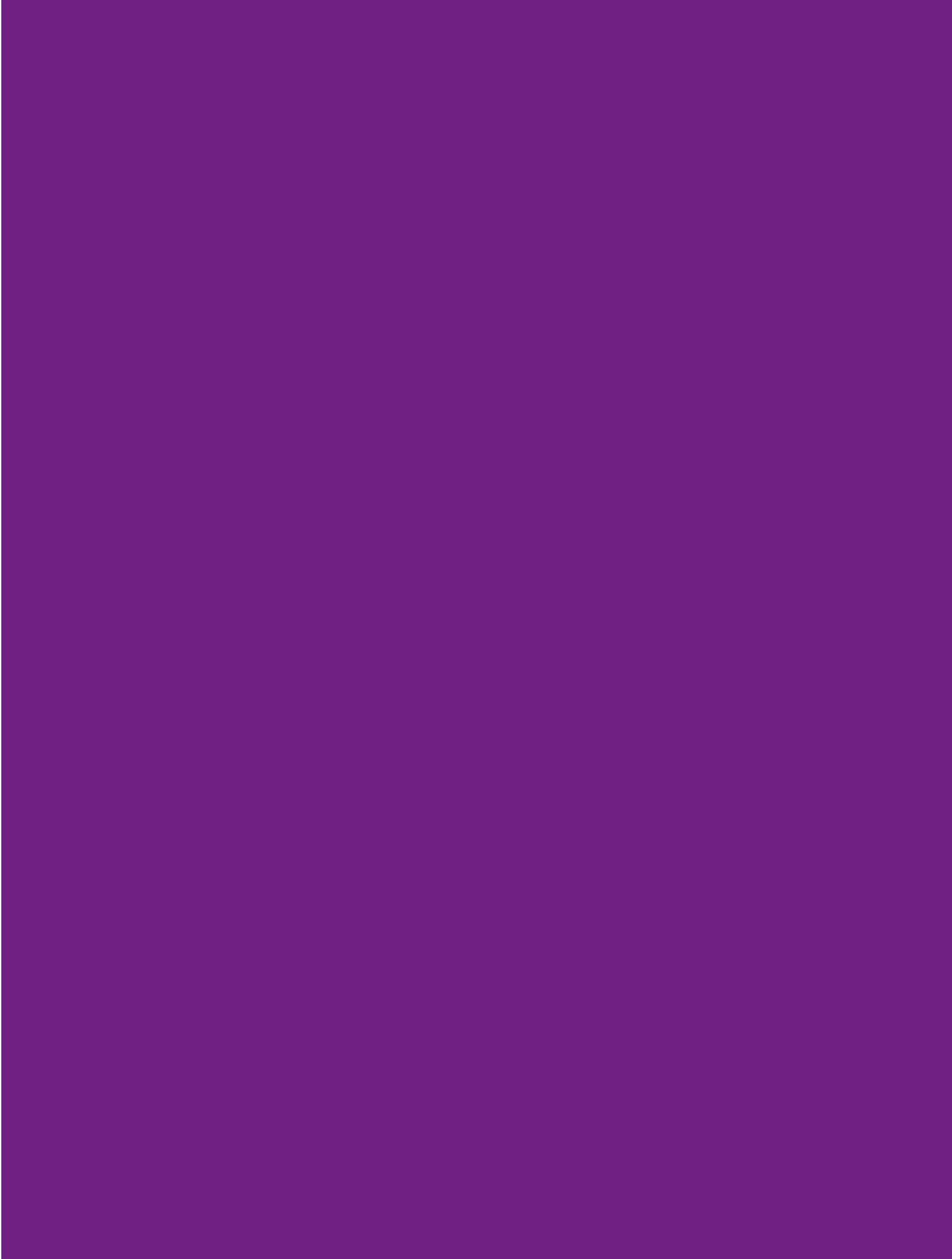


FERBOX® B07  
 with stirrup bent conically



FERBOX® B07S

 A smarter way to plan your connections:  
 Our FERBOX® Design structural design software is just the tool for the job.





# Technical data

## Single-row types: E01, E02, E03

Possible combinations and dimensions that can be produced (L = 1200 mm):

B mm	Dia./e mm	h mm		ls mm			v mm			
		E01 E02	E03	E01 E02 E03	E01	E02	E01	E02		
60	8/100	100-600	150-600	150-210	75-90	90-600				
	8/150			150-510						
	8/200			150-600						
	8/250			150-600						
	10/100	110-600		150-200					90-100	
	10/150			150-390						
	10/200			150-510						
	10/250			150-510						
85	8/100	100-600	150-600	150-430	75-90	90-600				
	8/150			150-510						
	8/200			150-600						
	8/250			150-600						
	10/100	110-600		150-430	90-100					
	10/150			150-510						
	10/200			150-600						
	10/250			150-600						
	12/100	120-600		200-430	110				110-600	
	12/150			200-510						
	12/200			200-600						
	12/250			200-600						
	14/100	140-600		200-360	110				110-600	
	14/150			200-510						
14/200	200-600									
14/250	200-600									
110	10/100	110-600	150-600	150-500	90-100	100-600				
	10/150			150-600						
	10/200			150-600						
	10/250			150-600						
	12/100	120-600		200-600	110				110-600	
	12/150			200-600						
	12/200			200-600						
	12/250			200-600						
	14/100	140-600		200-510	110				110-600	
	14/150			200-600						
14/200	200-600									
14/250	200-600									
135	12/100	120-600	200-600	200-600	110	110-600				
	12/150			200-600						
	12/200			200-600						
	12/250			200-600						
	14/100	140-600		200-600					110	110-600
	14/150			200-600						
	14/200			200-600						
	14/250			200-600						

B: Casing width | Dia.: Bar diameter | e: Bar spacing | h: Anchorage length | ls: Lap length | v: Hook length

## Single-row types: EE

Possible combinations and dimensions that can be produced (L = 1200 mm):

<b>B</b>	<b>Dia./e</b>	<b>b</b>	<b>h</b>	<b>ls</b>
mm	mm	mm	mm	mm
		<b>EE</b>	<b>EE</b>	<b>EE</b>
<b>60</b>	8/100	130-500	100-300	200-210
	8/150			200-510
	8/200			200-600
	8/250			200-600
	10/100	-	-	-
	10/150	130-500	110-300	300-390
	10/200			300-510
	10/250			300-510
	300-510			
<b>85</b>	8/100	180-500	100-300	200-430
	8/150			200-510
	8/200			200-600
	8/250			200-600
	10/100		110-300	300-430
	10/150			300-510
	10/200			300-600
	10/250			300-600
	12/100	-	-	-
	12/150	180-500	120-300	360-510
	12/200			360-600
	12/250			360-600
				360-600
	14/100	-	-	-
	14/150	180-500	130-300	420-510
	14/200			420-600
14/250	420-600			
	420-600			
<b>110</b>	10/100	-	-	-
	10/150	-	-	-
	10/200	-	-	-
	10/250	-	-	-
	12/100	230-500	120-300	360-600
	12/150			360-600
	12/200			360-600
	12/250			360-600
	14/100		140-300	420-510
	14/150			420-600
	14/200			420-600
	14/250			420-600
<b>135</b>	12/100	280-500	120-300	360-600
	12/150			360-600
	12/200			360-600
	12/250			360-600
	14/100		140-300	420-600
	14/150			420-600
	14/200			420-600
	14/250			420-600

B: Casing width | Dia.: Bar diameter | e: Bar spacing | b: Stirrup width | h: Anchorage length | ls: Lap length

## Double-row types: B01, B02, B03, B05

Possible combinations and dimensions that can be produced (L = 1200 mm):

B mm	Dia./e mm	h mm			ls mm			v mm
		B01 B02 (10 ds)	B03	B05 B02 (4 ds)*	B01 B02 B03 B05	B01 B02 (10 ds)	B02 (4 ds)	
135	8/100	150-300	150-600	100-300	200-390	140-600	90-600	
	8/150				200-500			
	8/200				200-600			
	8/250				200-600			
	10/100	-	150-600	110-300	-	150-600		
	10/150	-						
	10/200	-						
	10/250	-						
	12/100	-	170-600	120-300	-	160-600		
	12/150	-						
	12/200	-						
12/250	-							
160	8/100	150-300	150-600	100-300	200-460	140-600	90-600	
	8/150				200-550			
	8/200				200-600			
	8/250				200-600			
	10/100	-	150-600	110-300	300-430	150-600		
	10/150	300-550						
	10/200	300-600						
	10/250	300-600						
	12/100	-	170-300	170-600	360-430	160-600		
	12/150	360-600						
	12/200	360-600						
12/250	360-600							
185	8/100	150-300	150-600	100-300	200-540	140-600	90-600	
	8/150				200-600			
	8/200				200-600			
	8/250				200-600			
	10/100	-	110-300	110-300	300-510	150-600		
	10/150	300-590						
	10/200	300-600						
	10/250	300-600						
	12/100	-	170-300	170-600	360-480	160-600		
	12/150	360-600						
	12/200	360-600						
12/250	360-600							
210**	10/100	150-300	150-600	110-300	300-550	150-600	90-600	
	10/150				300-600			
	10/200				300-600			
	10/250				300-600			
	12/100	-	170-300	170-600	360-520	160-600		
	12/150	360-600						
	12/200	360-600						
12/250	-			360-600				

B: Casing width | Dia.: Bar diameter | e: Bar spacing | h: Anchorage length | ls: Lap length | v: Hook length

\*From B = 160 mm | \*\*With large casing widths (max. B = 260 mm), the values do not change significantly. Further details available on request.

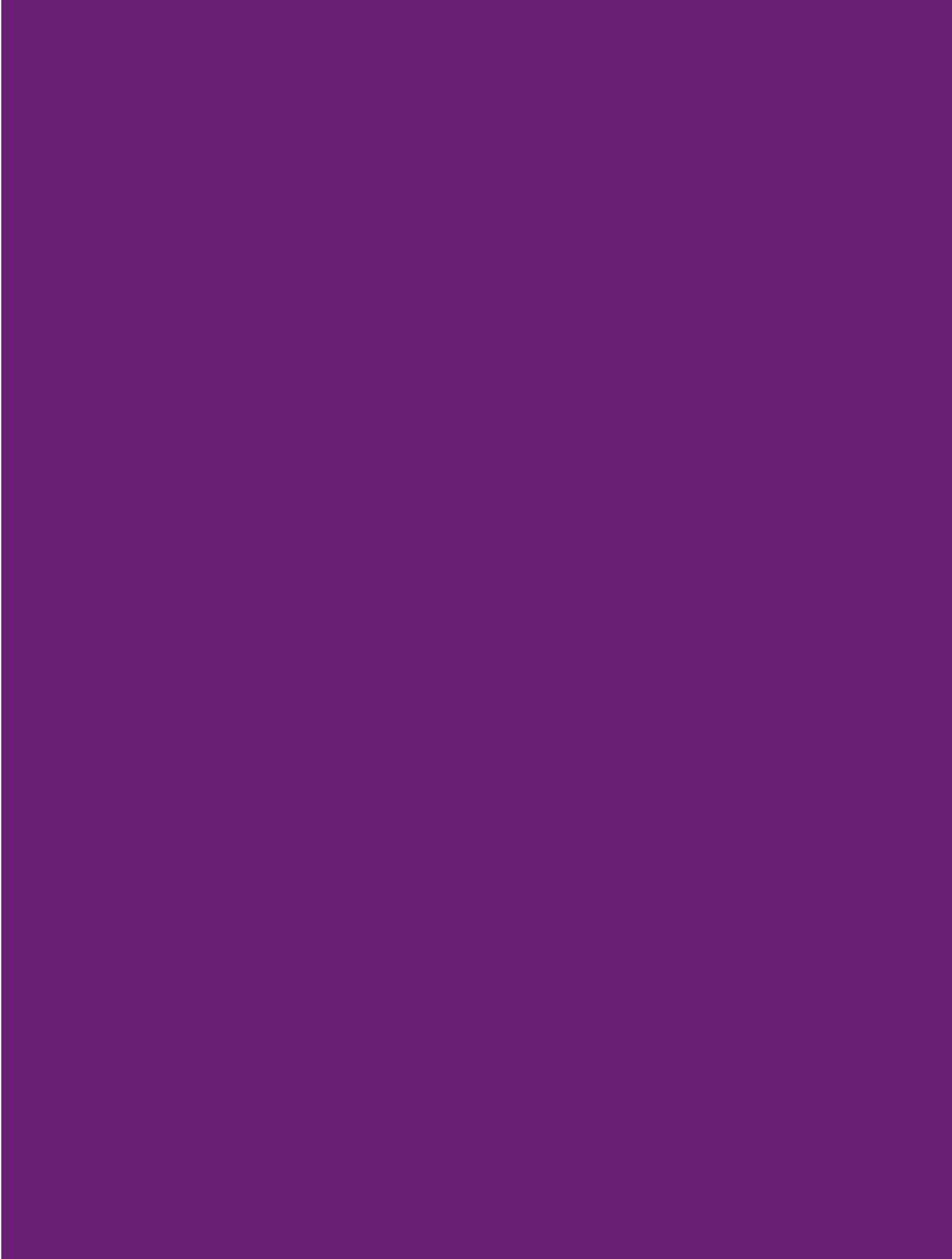
## Double-row types: B04, B06, B07, B08, B09

Possible combinations and dimensions that can be produced (L = 1200 mm):

B mm	Dia./e mm	h mm			ls mm		v mm		
		B06/B06S	B07/B07S (10 ds)	B09/B09S B04/B04S** B07 (4 ds)* B08/B08S*	B04** B06 B07** B08** B09	B04S B06S B07S B08S B09S		B04**/B04S** B07**/B07S (4 ds and 10 ds)	
85	8/100	150-600	-	100-300	70-100	70-150	-	70-90	
	8/150		-		70-120	70-250	-	70-140	
	8/200		-		70-180	70-350	-	70-190	
	8/250		-		70-230	70-450	-	70-240	
	10/100	150-600	-	110-300	80	80-150	-	80-90	
	10/150		-		80-130	80-250	-	80-140	
	10/200		-		80-180	80-350	-	80-190	
	10/250		-		80-230	80-450	-	80-240	
110	8/100	150-600	-	100-300	70-100	70-150	140-600	70-90	
	8/150		-		70-150	70-250		70-140	
	8/200		-		70-210	70-350		70-190	
	8/250		-		70-260	70-450		70-240	
	10/100	150-600	-	110-300	80	80-150	150-600	80-90	
	10/150		-		80-130	80-250		80-140	
	10/200		-		80-180	80-350		80-190	
	10/250		-		80-230	80-450		80-240	
	12/100	170-600	-	120-300	90	90-150	-	90	
	12/150		-		90-130	90-250	-	90-140	
	12/200		-		90-170	90-350	-	90-190	
	12/250		-		90-230	90-450	-	90-240	
135	8/100	150-600	150-300	100-300	70-100	70-150	140-600	70-90	
	8/150		-		70-150	70-250		70-140	
	8/200		-		70-210	70-350		70-190	
	8/250		-		70-260	70-450		70-240	
	10/100	150-600	-	110-300	80-90	80-150	150-600	80-90	
	10/150		-		80-140	80-250		80-140	
	10/200		-		80-190	80-350		80-190	
	10/250		-		80-240	80-450		80-240	
	12/100	170-600	-	120-300	90	90-150	160-600	90	
	12/150		-		90-150	90-250		90-140	
	12/200		-		90-200	90-350		90-190	
	12/250		-		90-250	90-450		90-240	
160***	8/100	150-600	150-300	100-300	70-100	70-150	140-600	70-90	
	8/150				-	70-150		70-250	70-140
	8/200				-	70-210		70-350	70-190
	8/250				-	70-260		70-450	70-240
	10/100	150-600	150-300	110-300	80-110	80-150	150-600	80-90	
	10/150				-	80-170		80-250	80-140
	10/200				-	80-220		80-350	80-190
	10/250				-	80-280		80-450	80-240
	12/100	170-600	170-600	120-300	90	90-150	160-600	90	
	12/150				-	90-170		90-250	90-140
	12/200				-	90-200		90-350	90-190
	12/250				-	90-250		90-450	90-240

B: Casing width | Dia.: Bar diameter | e: Bar spacing | h: Anchorage length | ls: Lap length | v: Hook length

\*From B = 110 mm | \*\*From B = 135 mm | \*\*\*With large casing widths (max. B = 260 mm), the values do not change significantly. Further details available on request.





# Structural design

# Structural design principles

In Germany, the structural design of reinforced concrete structures must comply with DIN EN 1992-1-1. Rebend connections are used at the interface between different building sections in order to join together reinforced concrete components by means of a frictional connection. However, DIN EN 1992-1-1 does not explicitly set out the requirements pertaining to these because reinforcement that is bent down and installed in this position to begin with and then bent back again to its planned connection position once the formwork has been removed constitutes a special case. For this reason, the Deutscher Beton- und Bautechnik-Verein e.V. (DBV) [German Concrete and Structural Engineering Association] has published the bulletin entitled "Rückbiegen von Betonstahl und Anforderungen an Verwahrkästen nach EC2" ["Rebending reinforcing steel and requirements for casing in accordance with EC2"].

Alongside plentiful information regarding construction and, in particular, rebending reinforcing steel, the bulletin also contains detailed information on the planning and structural design of rebend connections.

In addition to using the structural design requirements set out in DIN EN 1992-1-1 and the ETA, the design conducted on the FERBOX® rebend connections is also based on the six structural design cases described in the DBV bulletin. The same applies to the technical information in this document and to the FERBOX® Design software.

The tables on the following pages list examples of design values and possible products for cases a, b, c and e and for the special case that is corbels. Individual structural design situations for the different cases can easily be modelled and verified using the FERBOX® Design structural design software.



## Indented joints

When it comes to the surface properties of joints, DIN EN 1992-1-1 distinguishes between very smooth, smooth, rough, and indented joints. The profiled, knubbed texture of the new FERBOX® casings means that every joint can be treated as an indented joint, and the structural design and design values of the joint can be configured accordingly. The only exception to this is the combination of shearing force in the longitudinal direction with respect to the joint and reinforcement with a diameter of 14 mm. In this case, the joint category is "rough".

For structural design that involves joining together structural components of different concrete strength classes using FERBOX® connections, the lower of the concrete strength classes is the one that must be taken into account.

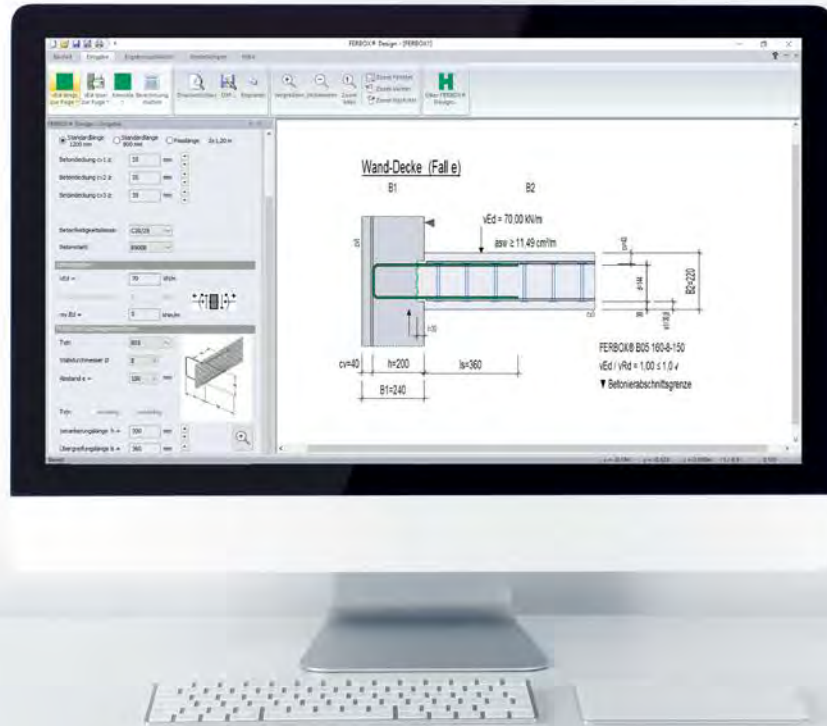
## Steel stress

In accordance with DIN EN 1992-1-1 and the DBV bulletin, the reinforcement may only be utilised up to 80% for rebend connections in the ultimate limit state (ULS). Due to the 20% reduction in steel stress, the anchorage length can also be reduced by 20%.

## Combined loading

In cases of combined loading (loading in both the transverse and the longitudinal direction with respect to the joint), the proof may be provided separately.

# FERBOX® Design



NEW

## FERBOX® Design structural design software

With the latest version of FERBOX® Design, the planning and structural design process for all our reinforcement attachments is now even easier. This software eliminates the need for complex manual calculations and actively guides you to the most appropriate choice of FERBOX® for your application.

The new FERBOX® Design software version comes with all the variants of the latest product generation, offering you all the benefits of user-friendly, state-of-the-art software in conjunction with an improved product portfolio.

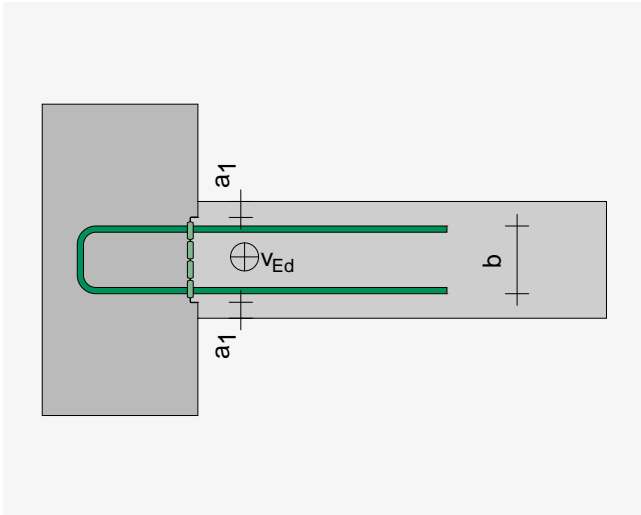


## Advantages

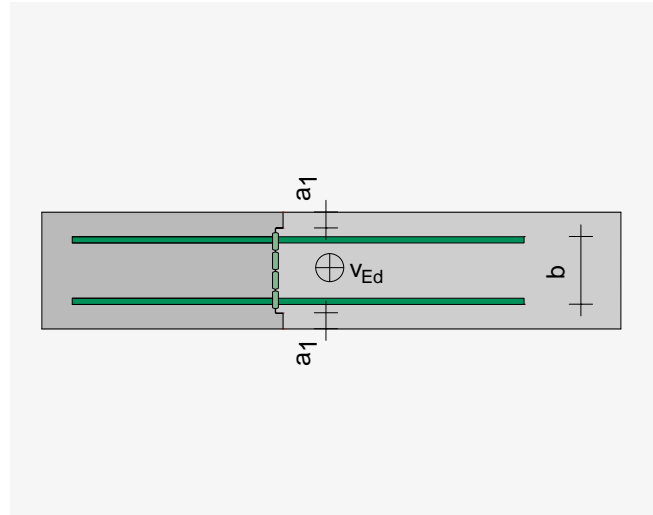
- Easy graphical selection of different structural design cases
- $v_{Ed}$ ,  $n_{Ed}$  and  $m_{Ed}$  can be input
- Absorbable shearing force including or not including the floor/ceiling's shearing force reinforcement
- Floor/ceiling's shearing force reinforcement included as additional structural design step; structural design can use JORDAHL JDA-S shear reinforcement or B500B stirrup reinforcement
- Structural design printout with all the necessary information for verification purposes

# Structural design case a according to DBV bulletin

## Shearing force in longitudinal direction with respect to concreted joint



Case a, vertical wall



Case a, continuous wall



### Notes on structural design

Load-bearing capacity of the joint in accordance with case a in the DBV bulletin entitled "Rückbiegen..." ["Rebending..."]

If  $a_1 \leq 50$  mm:

Not included in the structural design

If  $a_1 \geq 50$  mm:

May be additionally included in the structural design if a profiled embodiment of the design is possible.

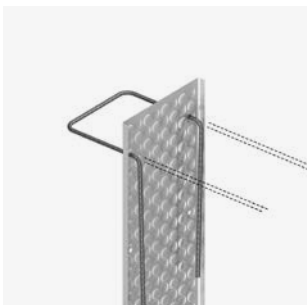
The requisite minimum concrete covering for the rebend reinforcement in accordance with the ETA must be provided.

Good bond conditions in accordance with EC2 are assumed.

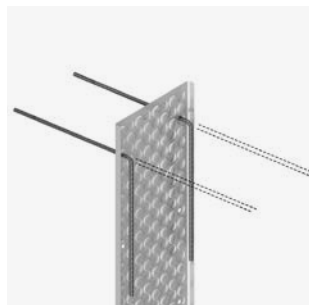
$n_{Ed} \geq 0$

(Positive compression) has a positive effect on the structural design and the values are on the safe side.

### Suitable products



Double-row connection, e.g. B05



Double-row connection, e.g. B03



Higher design values are possible with greater anchorage and lap lengths. Please contact our Application Engineering team or use our FERBOX® Design software.

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 E-mail: technik@h-bau.de

**Absorbable shearing force  $v_{Rd}$  in kN/m in longitudinal direction with respect to joint, design values DBV bulletin**

Concrete quality	Dia./e mm	Shearing force $v_{Rd}$ kN/m							
		b = 85	b = 110	b = 135	b = 160	b = 185	b = 210	b = 235	b = 260
C20/25	8/100	300.2	311.2	322.1	333.1	344.1	355.0	366.0	376.9
	8/150	216.2	227.2	238.1	249.1	260.1	271.0	282.0	292.9
	8/200	174.2	185.2	196.1	207.1	218.1	229.0	240.0	250.9
	8/250	149.0	160.0	170.9	181.9	192.9	203.8	214.8	225.7
	10/100	363.2	374.2	385.1	396.1	407.1	418.0	429.0	439.9
	10/150	258.2	269.2	280.1	291.1	302.1	313.0	324.0	334.9
	10/200	205.7	216.7	227.6	238.6	249.6	260.5	271.5	282.4
	10/250	174.2	185.2	196.1	207.1	218.1	229.0	240.0	250.9
	12/100	399.2	410.2	421.1	432.1	443.1	454.0	465.0	475.9
	12/150	282.2	293.2	304.1	315.1	326.1	337.0	348.0	358.9
	12/200	223.7	234.7	245.6	256.6	267.6	278.5	289.5	300.4
	12/250	188.6	199.6	210.5	221.5	232.5	243.4	254.4	265.3
C25/30	8/100	348.4	361.1	373.8	386.5	399.2	412.0	424.7	437.4
	8/150	250.9	263.6	276.3	289.1	301.8	314.5	327.2	339.9
	8/200	202.2	214.9	227.6	240.3	253.0	265.8	278.5	291.2
	8/250	172.9	185.6	198.4	211.1	223.8	236.5	249.2	261.9
	10/100	421.5	434.2	446.9	459.6	472.3	485.1	497.8	510.5
	10/150	299.6	312.4	325.1	337.8	350.5	363.2	375.9	388.7
	10/200	238.7	251.4	264.2	276.9	289.6	302.3	315.0	327.7
	10/250	202.2	214.9	227.6	240.3	253.0	265.8	278.5	291.2
	12/100	463.2	476.0	488.7	501.4	514.1	526.8	539.6	552.3
	12/150	327.5	340.2	352.9	365.6	378.4	391.1	403.8	416.5
	12/200	259.6	272.3	285.0	297.8	310.5	323.2	335.9	348.6
	12/250	218.9	231.6	244.3	257.0	269.7	282.5	295.2	307.9
C30/37	8/100	393.4	407.8	422.1	436.5	450.8	465.2	479.6	493.9
	8/150	283.3	297.7	312.1	326.4	340.8	355.1	369.5	383.9
	8/200	228.3	242.7	257.0	271.4	285.7	300.1	314.5	328.8
	8/250	195.3	209.6	224.0	238.4	252.7	267.1	281.4	295.8
	10/100	475.9	490.3	504.7	519.0	533.4	547.8	562.1	576.5
	10/150	338.4	352.7	367.1	381.4	395.8	410.2	424.5	438.9
	10/200	269.6	283.9	298.3	312.7	327.0	341.4	355.7	370.1
	10/250	228.3	242.7	257.0	271.4	285.7	300.1	314.5	328.8
	12/100	523.1	537.5	551.8	566.2	580.6	594.9	609.3	623.6
	12/150	369.8	384.2	398.5	412.9	427.3	441.6	456.0	470.3
	12/200	293.2	307.5	321.9	336.2	350.6	365.0	379.3	393.7
	12/250	247.2	261.5	275.9	290.2	304.6	319.0	333.3	347.7

Dia.: Bar diameter | e: Bar spacing | b: Stirrup width

**Information regarding values in table**

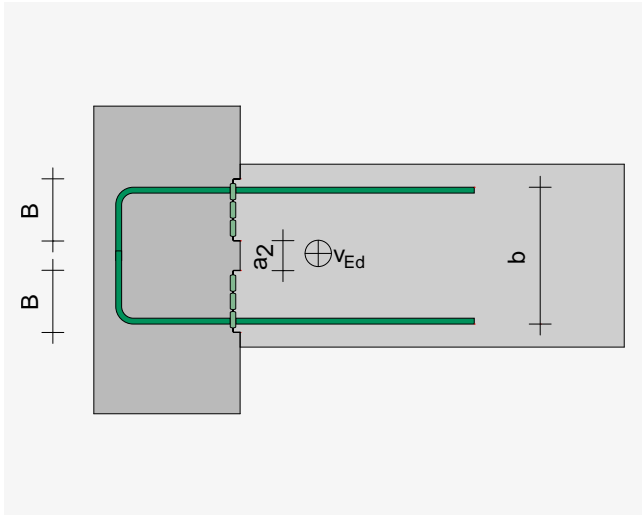
The values listed in the table apply to the FERBOX® B05 for structural design according to DBV bulletin:  
 h = 170 mm  
 Dia. 8, ls = 320 mm  
 Dia. 10, ls = 390 mm  
 Dia. 12, ls = 460 mm



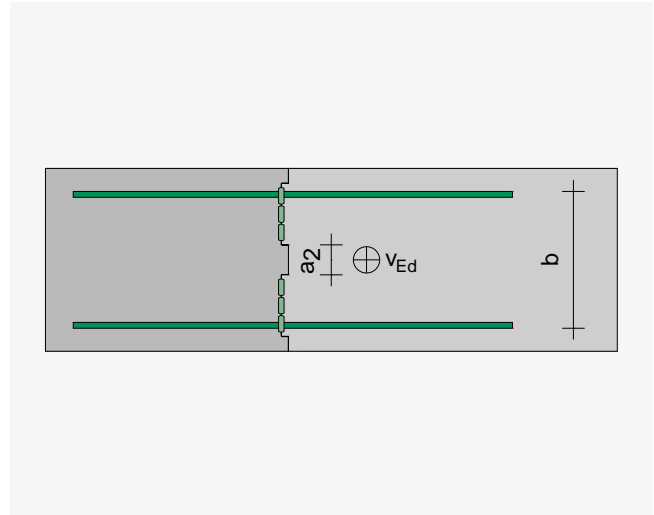
For certain h and ls values, it may be possible to achieve higher load-bearing capacities. We recommend using FERBOX® Design for your structural design needs.

# Structural design case b according to DBV bulletin

## Shearing force in longitudinal direction with respect to concreted joint



Case b, vertical wall



Case b, continuous wall

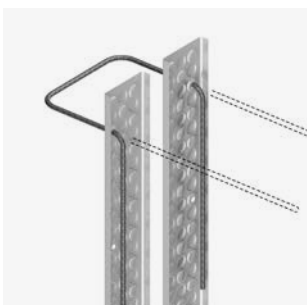


### Notes on structural design

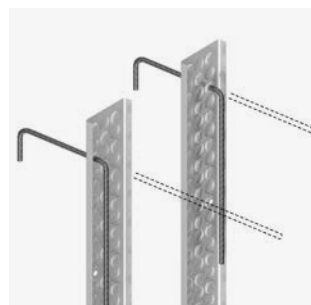
Structural design for two casings with hooks, angled hooks or loops in accordance with EC2.  
 The suggested stirrup shapes may be replaced with other shapes with angled hooks.

Structural design assumes that the joint in the area  $a_2$  is in the "indented" joint category and  $a_2 \geq 50$  mm.

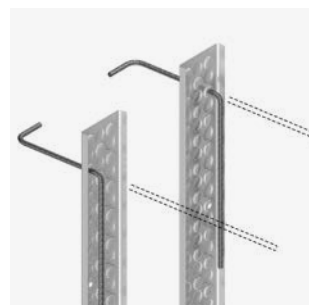
### Suitable products



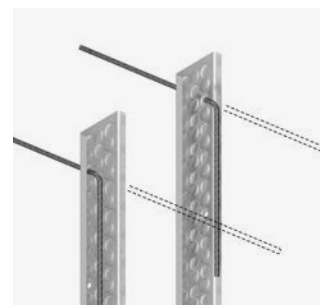
Single-row connection,  
e.g. EE



Single-row connection,  
e.g. 2 x E01



Single-row connection,  
e.g. 2 x E02



Single-row connection,  
e.g. 2 x E03

**Absorbable shearing force  $v_{Rd}$  in kN/m in longitudinal direction with respect to joint, design values DBV bulletin**

Concrete quality	Dia./e mm	B mm	Shearing force $v_{Rd}$ kN/m									
			b = 180	b = 200	b = 220	b = 240	b = 260	b = 280	b = 300	b = 320	b = 340	b = 360
C20/25	8/100	60	341.9	350.6	359.4	368.2	376.9	385.7	394.5	403.2	412.0	420.8
	8/150	60	257.9	266.6	275.4	284.2	292.9	301.7	310.5	319.2	328.0	336.8
	8/200	60	215.9	224.6	233.4	242.2	250.9	259.7	268.5	277.2	286.0	294.8
	8/250	60	190.7	199.4	208.2	217.0	225.7	234.5	243.3	252.0	260.8	269.6
	10/100	60	404.9	413.6	422.4	431.2	439.9	448.7	457.5	466.2	475.0	483.8
	10/150	60	299.9	308.6	317.4	326.2	334.9	343.7	352.5	361.2	370.0	378.8
	10/200	60	247.4	256.1	264.9	273.7	282.4	291.2	300.0	308.7	317.5	326.3
	10/250	60	215.9	224.6	233.4	242.2	250.9	259.7	268.5	277.2	286.0	294.8
	12/100	85	440.9	449.6	458.4	467.2	475.9	484.7	493.5	502.2	511.0	519.8
	12/150	85	323.9	332.6	341.4	350.2	358.9	367.7	376.5	385.2	394.0	402.8
	12/200	85	265.4	274.1	282.9	291.7	300.4	309.2	318.0	326.7	335.5	344.3
	12/250	85	230.3	239.0	247.8	256.6	265.3	274.1	282.9	291.6	300.4	309.2
C25/30	8/100	60	396.7	406.9	417.0	427.2	437.4	447.6	457.7	467.9	478.1	488.3
	8/150	60	299.2	309.4	319.6	329.8	339.9	350.1	360.3	370.4	380.6	390.8
	8/200	60	250.5	260.7	270.8	281.0	291.2	301.4	311.5	321.7	331.9	342.1
	8/250	60	221.3	231.4	241.6	251.8	261.9	272.1	282.3	292.5	302.6	312.8
	10/100	60	469.8	480.0	490.2	500.3	510.5	520.7	530.8	541.0	551.2	561.4
	10/150	60	348.0	358.1	368.3	378.5	388.7	398.8	409.0	419.2	429.4	439.5
	10/200	60	287.0	297.2	307.4	317.6	327.7	337.9	348.1	358.3	368.4	378.6
	10/250	60	250.5	260.7	270.8	281.0	291.2	301.4	311.5	321.7	331.9	342.1
	12/100	85	511.6	521.7	531.9	542.1	552.3	562.4	572.6	582.8	593.0	603.1
	12/150	85	375.8	386.0	396.2	406.3	416.5	426.7	436.9	447.0	457.2	467.4
	12/200	85	307.9	318.1	328.3	338.5	348.6	358.8	369.0	379.2	389.3	399.5
	12/250	85	267.2	277.4	287.6	297.7	307.9	318.1	328.2	338.4	348.6	358.8
C30/37	8/100	60	448.0	459.5	470.9	482.4	493.9	505.4	516.9	528.4	539.9	551.4
	8/150	60	337.9	349.4	360.9	372.4	383.9	395.3	406.8	418.3	429.8	441.3
	8/200	60	282.9	294.4	305.8	317.3	328.8	340.3	351.8	363.3	374.8	386.3
	8/250	60	249.8	261.3	272.8	284.3	295.8	307.3	318.8	330.3	341.8	353.3
	10/100	60	530.5	542.0	553.5	565.0	576.5	588.0	599.5	610.9	622.4	633.9
	10/150	60	392.9	404.4	415.9	427.4	438.9	450.4	461.9	473.4	484.8	496.3
	10/200	60	324.1	335.6	347.1	358.6	370.1	381.6	393.1	404.6	416.1	427.5
	10/250	60	282.9	294.4	305.8	317.3	328.8	340.3	351.8	363.3	374.8	386.3
	12/100	85	577.7	589.2	600.7	612.2	623.6	635.1	646.6	658.1	669.6	681.1
	12/150	85	424.4	435.9	447.4	458.9	470.3	481.8	493.3	504.8	516.3	527.8
	12/200	85	347.7	359.2	370.7	382.2	393.7	405.2	416.7	428.2	439.6	451.1
	12/250	85	301.7	313.2	324.7	336.2	347.7	359.2	370.7	382.2	393.7	405.1

Dia.: Bar diameter | e: Barspacing | B: Casing width | b: Stirrup width

**Information regarding values in table**

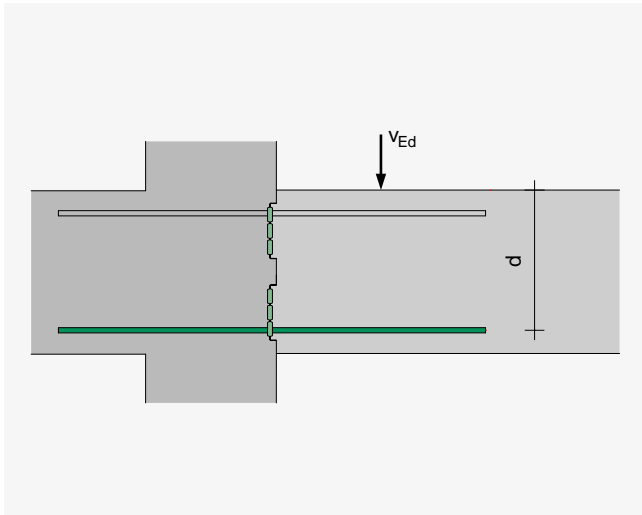
The values listed in the table apply to the FERBOX® E02 for structural design case b according to DBV bulletin:  
 h = 170 mm  
 Dia. 8, ls = 320 mm  
 Dia. 10, ls = 390 mm  
 Dia. 12, ls = 460 mm



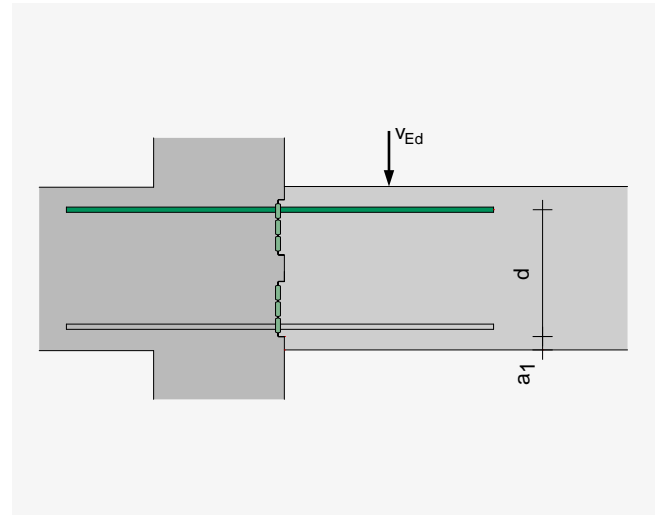
For certain h and ls values, it may be possible to achieve higher load-bearing capacities. We recommend using FERBOX® Design for your structural design needs.

## Structural design cases c and e acc. to DBV bulletin

### Shearing force in transverse direction with respect to concreted joint without shear reinforcement



Case c



Case e



Since the tensile zone can be located at the upper or lower edge of the component, the effective structural height  $d$  is crucial to determine the suitable FERBOX®.

#### Example case c

Component height 200 mm  
 Reinforcement dia.10/150  
 Concrete covering at the top and bottom: 30 mm

Eff. structural height  $d = \text{component height} - cv - \text{dia.}/2$   
 $d = 200 - 30 - 5 = 165 \text{ mm}$

Stirrup width  $b = \text{component height} - cv \text{ top} - cv \text{ bottom}$   
 $b = 200 - 30 - 30 = 140 \text{ mm}$

With double-row casings, the  $cv$  value is obtained from the component geometry.

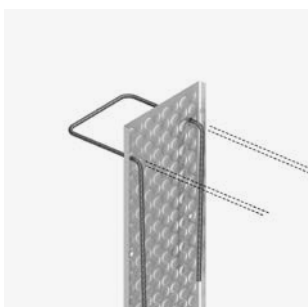
#### Example case e (tensile forces acting at top)

Component height 200 mm  
 Reinforcement dia.10/150  
 Concrete covering at the top and bottom: 30 mm

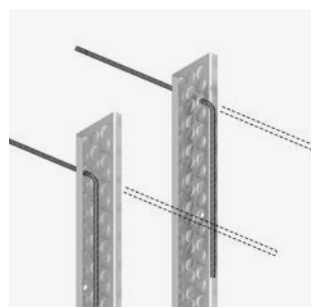
Assumption:  $a_1 = 25 \text{ mm}$

Eff. structural height  $d = \text{component height} - cv - \text{dia.}/2 - a_1$   
 $d = 200 - 30 - 5 - 25 = 140 \text{ mm}$

#### Suitable products



Double-row connection,  
 e.g. B05



Single-row connection,  
 e.g. 2 x E03



#### Notes on structural design

In addition to using DIN EN 1992-1-1, the structural design is also based on structural design cases c (non-restrained bearing) and e (shearing force with restraint) described in the DBV bulletin entitled "Rückbiegen von Betonstahl und Anforderungen an Verwahrkästen nach Eurocode 2" ["Rebending reinforcing steel and requirements for casing in accordance with Eurocode 2"].

The structural design assumes good bond conditions. When using two single-row casings, the joint must be an indented joint.



**Absorbable shearing force  $v_{Rd}$  in kN/m as a function of the structural height  $d$  in mm**

Concrete quality	Dia./e mm	Shearing force $v_{Rd}$ kN/m									
		d = 100	d = 120	d = 140	d = 160	d = 180	d = 200	d = 220	d = 240	d = 260	d = 280
C20/25	8/100	44.3	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
	8/150	44.3	53.1	62.0	70.8	79.7	88.5	94.0	94.4	94.4	94.4
	8/200	44.3	53.1	62.0	70.8	70.8	70.8	70.8	70.8	70.8	70.8
	8/250	44.3	53.1	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7
	10/100	50.1	56.6	62.7	70.8	79.7	88.5	94.0	99.4	104.7	109.8
	10/150	44.3	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
	10/200	44.3	53.1	62.0	70.8	79.7	88.5	88.5	88.5	88.5	88.5
	10/250	44.3	53.1	62.0	70.8	70.8	70.8	70.8	70.8	70.8	70.8
	12/100	56.6	63.9	70.8	77.4	83.7	89.8	94.0	99.4	104.7	109.8
	12/150	49.4	55.8	62.0	70.8	79.7	88.5	94.0	99.4	104.7	109.8
	12/200	44.9	53.1	62.0	70.8	79.7	88.5	94.0	99.4	104.7	106.2
	12/250	44.3	53.1	62.0	70.8	79.7	85.0	85.0	85.0	85.0	85.0
C25/30	8/100	49.5	59.4	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
	8/150	49.5	59.4	69.3	79.2	89.1	99.0	104.9	104.9	104.9	104.9
	8/200	49.5	59.4	69.3	78.7	78.7	78.7	78.7	78.7	78.7	78.7
	8/250	49.5	59.4	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
	10/100	54.0	60.9	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
	10/150	49.5	59.4	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
	10/200	49.5	59.4	69.3	79.2	89.1	99.0	102.7	102.7	102.7	102.7
	10/250	49.5	59.4	69.3	79.2	82.2	82.2	82.2	82.2	82.2	82.2
	12/100	60.9	68.8	76.3	83.4	90.2	99.0	105.1	111.1	117.0	122.8
	12/150	53.2	60.1	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
	12/200	49.5	59.4	69.3	79.2	89.1	99.0	105.1	111.1	117.0	122.8
	12/250	49.5	59.4	69.3	79.2	89.1	98.6	98.6	98.6	98.6	98.6
C30/37	8/100	54.2	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
	8/150	54.2	65.1	75.9	86.8	97.6	104.9	104.9	104.9	104.9	104.9
	8/200	54.2	65.1	75.9	78.7	78.7	78.7	78.7	78.7	78.7	78.7
	8/250	54.2	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
	10/100	57.3	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
	10/150	54.2	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
	10/200	54.2	65.1	75.9	86.8	97.6	108.4	115.1	116.0	116.0	116.0
	10/250	54.2	65.1	75.9	86.8	92.8	92.8	92.8	92.8	92.8	92.8
	12/100	64.7	73.1	81.0	88.6	97.6	108.4	115.1	121.7	128.2	134.5
	12/150	56.6	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
	12/200	54.2	65.1	75.9	86.8	97.6	108.4	115.1	121.7	128.2	134.5
	12/250	54.2	65.1	75.9	86.8	97.6	108.4	111.4	111.4	111.4	111.4

Dia.: Bar diameter | e: Bar spacing | d: Structural height

**Information regarding values in table**

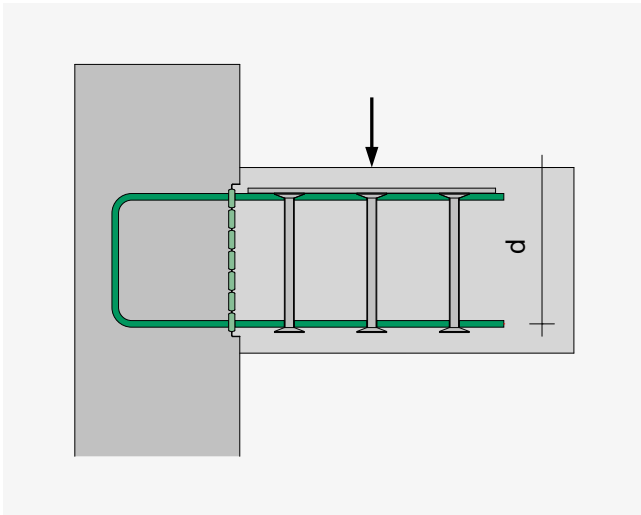
The values listed in the table apply to the FERBOX® B05 for structural design cases c and e according to DBV bulletin:  
 h = 170 mm  
 Dia. 8,  $l_s$  = 320 mm  
 Dia. 10,  $l_s$  = 390 mm  
 Dia. 12,  $l_s$  = 460 mm



Good bond conditions in all structural components are assumed. For certain  $h$  and  $l_s$  values, it may be possible to achieve higher load-bearing capacities. We recommend using FERBOX® Design for your structural design needs.

# Structural design case c according to DBV bulletin

## Shearing force in transverse direction with respect to concreted joint with shear reinforcement



Case c



### Notes on structural design

In addition to using DIN EN 1992-1-1, the structural design is also based on structural design cases c and e described in the DBV bulletin entitled "Rückbiegen von Betonstahl und Anforderungen an Verwahrkästen nach Eurocode 2" ["Rebending reinforcing steel and requirements for casing in accordance with Eurocode 2"].

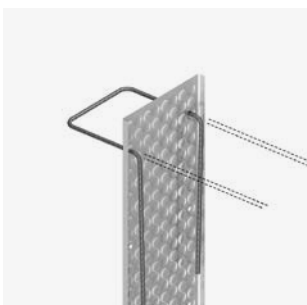
The maximum load-bearing capacity of connection components with shearing force reinforcement depends on the angle of the shear reinforcement. The structural design assumes an orientation perpendicular to the component axis.

The maximum shearing force that can be absorbed is subject to the following constraint in the structural design:  $V_{Rd} \leq 0.3 \cdot V_{Rd,max}$ .

### Ascertaining the effective structural height d

Because the zone that is subject to tensile forces can be at the top or the bottom edge of the structural component, the effective structural height d is the parameter that is to be used to ascertain which FERBOX® is most appropriate.

### Suitable products



Double-row connection, e.g. B05



JORDAHL® JDA-S shear reinforcement



The structural design of the shear reinforcement can use either JORDAHL® JDA-S or stirrup reinforcement in FERBOX® Design.

**Absorbable shearing force  $v_{Rd}$  in kN/m as a function of the structural height  $d$  in mm**

Concrete quality	Dia./e mm	Shearing force $v_{Rd}$ kN/m									
		d = 100	d = 120	d = 140	d = 160	d = 180	d = 200	d = 220	d = 240	d = 260	d = 280
<b>C20/25</b>	8/100	61.2	86.7	112.2	137.7	163.2	174.8	174.8	174.8	174.8	174.8
	8/150	61.2	86.7	112.2	116.6	116.6	116.6	116.6	116.6	116.6	116.6
	8/200	61.2	86.7	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
	8/250	61.2	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9
	10/100	61.2	86.7	112.2	137.7	163.2	188.7	214.2	239.7	265.2	273.2
	10/150	61.2	86.7	112.2	137.7	163.2	182.1	182.1	182.1	182.1	182.1
	10/200	61.2	86.7	112.2	136.6	136.6	136.6	136.6	136.6	136.6	136.6
	10/250	61.2	86.7	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
	12/100	61.2	86.7	112.2	137.7	163.2	188.7	214.2	239.7	265.2	287.5
	12/150	61.2	86.7	112.2	137.7	163.2	188.7	214.2	239.7	262.3	262.3
	12/200	61.2	86.7	112.2	137.7	163.2	188.7	196.7	196.7	196.7	196.7
	12/250	61.2	86.7	112.2	137.7	157.4	157.4	157.4	157.4	157.4	157.4
<b>C25/30</b>	8/100	76.5	108.4	140.3	172.1	174.8	174.8	174.8	174.8	174.8	174.8
	8/150	76.5	108.4	116.6	116.6	116.6	116.6	116.6	116.6	116.6	116.6
	8/200	76.5	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
	8/250	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9
	10/100	76.5	108.4	140.3	172.1	204.0	235.9	267.8	273.2	273.2	273.2
	10/150	76.5	108.4	140.3	172.1	182.1	182.1	182.1	182.1	182.1	182.1
	10/200	76.5	108.4	136.6	136.6	136.6	136.6	136.6	136.6	136.6	136.6
	10/250	76.5	108.4	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
	12/100	76.5	108.4	140.3	172.1	204.0	235.9	267.8	299.6	331.5	333.6
	12/150	76.5	108.4	140.3	172.1	204.0	235.9	262.3	262.3	262.3	262.3
	12/200	76.5	108.4	140.3	172.1	196.7	196.7	196.7	196.7	196.7	196.7
	12/250	76.5	108.4	140.3	157.4	157.4	157.4	157.4	157.4	157.4	157.4
<b>C30/37</b>	8/100	91.8	130.1	168.3	174.8	174.8	174.8	174.8	174.8	174.8	174.8
	8/150	91.8	116.6	116.6	116.6	116.6	116.6	116.6	116.6	116.6	116.6
	8/200	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
	8/250	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9
	10/100	91.8	130.1	168.3	206.6	244.8	273.2	273.2	273.2	273.2	273.2
	10/150	91.8	130.1	168.3	182.1	182.1	182.1	182.1	182.1	182.1	182.1
	10/200	91.8	130.1	136.6	136.6	136.6	136.6	136.6	136.6	136.6	136.6
	10/250	91.8	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
	12/100	91.8	130.1	168.3	206.6	244.8	283.1	321.3	359.6	376.7	376.7
	12/150	91.8	130.1	168.3	206.6	244.8	262.3	262.3	262.3	262.3	262.3
	12/200	91.8	130.1	168.3	196.7	196.7	196.7	196.7	196.7	196.7	196.7
	12/250	91.8	130.1	157.4	157.4	157.4	157.4	157.4	157.4	157.4	157.4

Dia.: Bar diameter | e: Bar spacing | d: Structural height

**Information regarding values in table**

The values listed in the table apply to the FERBOX® B05 for structural design case c according to DBV bulletin:

h = 170 mm

Dia. 8, ls = 320 mm

Dia. 10, ls = 390 mm

Dia. 12, ls = 460 mm

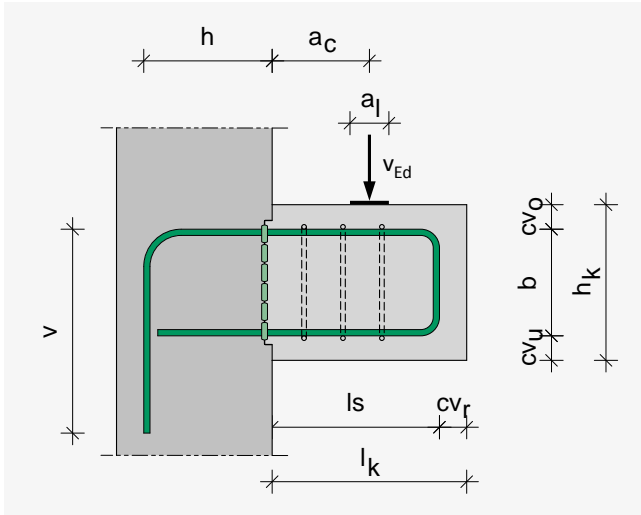


Good bond conditions in all structural components are assumed. The values listed assume direct and non-restrained bearing.

We recommend using FERBOX® Design for your structural design needs.

# Structural design case: Corbel

## Shearing force in transverse direction with respect to casing



Corbels



### Notes on structural design

Structural design of the connection for corbels with  $0.5 \leq a_c / h_c \leq 1.0$  as per DAfStb book 600

### Support thickness

10 mm

### Proof for concrete compression strut

$$V_{Rd,FERBOX} = 0.3 \cdot V_{Rd,max}$$

$$V_{Rd,max} = 0.5 \cdot v \cdot z \cdot \frac{f_{ck}}{\gamma_c}$$

$$v \leq 0.7 - \frac{f_{ck}}{200} \leq 0.5$$

### Proof for tension strut

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

$$H_{Ed} = 0.2 \cdot V_{Ed}$$

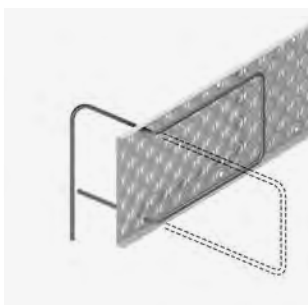
### Ascertaining the inner lever arm $z_o$

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

For  $V_{Rd,2} < V_{Ed} \leq V_{Rd,1}$ , closed vertical stirrups must be arranged for stirrup forces of  $0.7 \cdot V_{Ed}$  in total.

For  $V_{Ed} \leq V_{Rd,2}$ , no additional vertical stirrups are required.

### Suitable products



Double-row connection,  
 e.g. B07/B07S

**Absorbable shearing force  $v_{Rd,1}$  and  $v_{Rd,2}$  in kN/m**

Concrete quality	Dia./e mm	Shearing force $v_{Rd}$ kN/m							
		Example 1		Example 2		Example 3		Example 4	
		$h_k = 160$ mm	$h_k = 180$ mm	$h_k = 200$ mm	$h_k = 260$ mm				
		$l_k = 180$ mm	$l_k = 170$ mm	$l_k = 220$ mm	$l_k = 300$ mm				
		$b = 110$ mm	$b = 135$ mm	$b = 160$ mm	$b = 210$ mm				
		$a_c = 90$ mm	$a_c = 100$ mm	$a_c = 110$ mm	$a_c = 150$ mm				
		$cv_b/cv_t = 25$ mm	$cv_b/cv_t = 22.5$ mm	$cv_b/cv_t = 20$ mm	$cv_b/cv_t = 25$ mm				
		$cv_r = 25$ mm	$cv_r = 25$ mm	$cv_r = 25$ mm	$cv_r = 25$ mm				
		$a_l = 50$ mm	$a_l = 50$ mm	$a_l = 50$ mm	$a_l = 50$ mm				
		$V_{Rd,1}$	$V_{Rd,2}$	$V_{Rd,1}$	$V_{Rd,2}$	$v_{Rd,1}$	$v_{Rd,2}$	$v_{Rd,1}$	$v_{Rd,2}$
C20/25	8/200	52.5	52.7	63.5	63.4	74.6	74.0	93.6	91.3
	8/250	52.5	42.5	63.5	51.1	74.6	59.7	93.6	73.6
	10/200	52.0	64.6	63.1	77.9	74.2	91.1	93.3	120.3
	10/250	52.0	52.2	63.1	62.9	74.2	73.6	93.3	97.2
	12/200	51.6	76.1	62.6	91.9	73.7	107.6	93.1	142.3
C25/30	8/200	58.7	61.2	71.0	73.6	83.4	86.0	104.7	91.9
	8/250	58.7	49.3	71.0	59.3	83.4	69.3	104.7	74.0
	10/200	58.2	75.1	70.5	90.5	82.9	105.9	104.4	139.8
	10/250	58.2	60.7	70.5	73.1	82.9	85.5	104.4	112.9
	12/200	57.7	88.5	70.0	106.8	82.4	125.1	104.1	165.4
C30/37	8/200	64.3	69.1	77.8	83.2	91.4	94.4	114.7	92.2
	8/250	64.3	55.7	77.8	67.1	91.4	76.1	114.7	74.2
	10/200	63.7	84.9	77.3	102.3	90.8	119.6	114.3	141.3
	10/250	63.7	68.5	77.3	82.6	90.8	96.6	114.3	114.0
	12/200	63.2	100.0	76.7	120.7	90.3	141.4	114.0	187.0
	12/250	63.2	80.9	76.7	97.7	90.3	114.4	114.0	151.3

Dia.: Bar diameter | e: Bar spacing |  $h_k$ : Corbel height |  $l_k$ : Corbel cantilever | b: Stirrup width |  $a_c$ : Load distance | cv: Concrete covering |  $a_l$ : Load support width |  $V_{Rd,1}$  Load-bearing capacity without shear reinforcement |  $V_{Rd,2}$  Load-bearing capacity with shear reinforcement

**Information regarding values in table**

The values listed in the table are a selection of structural design tests to provide some examples of corbel connections.

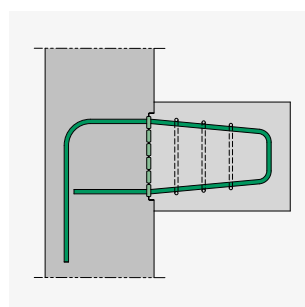
We recommend using FERBOX® Design to ascertain exact design values for individual geometries.



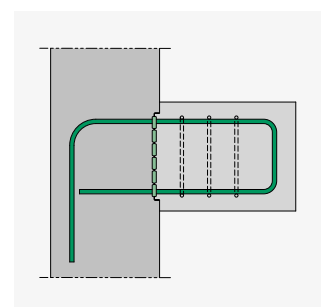
Depending on the ratio of the corbel's height to its cantilever, it may be necessary due to production constraints to bend the FERBOX®'s stirrups in the corbel so that they form a conical shape. Alternatively, you can opt for one of the FERBOX® "S" types, which allow for straight stirrups (see "S" types on page 11).

Our application engineers are happy to provide you with additional information on individual geometries.

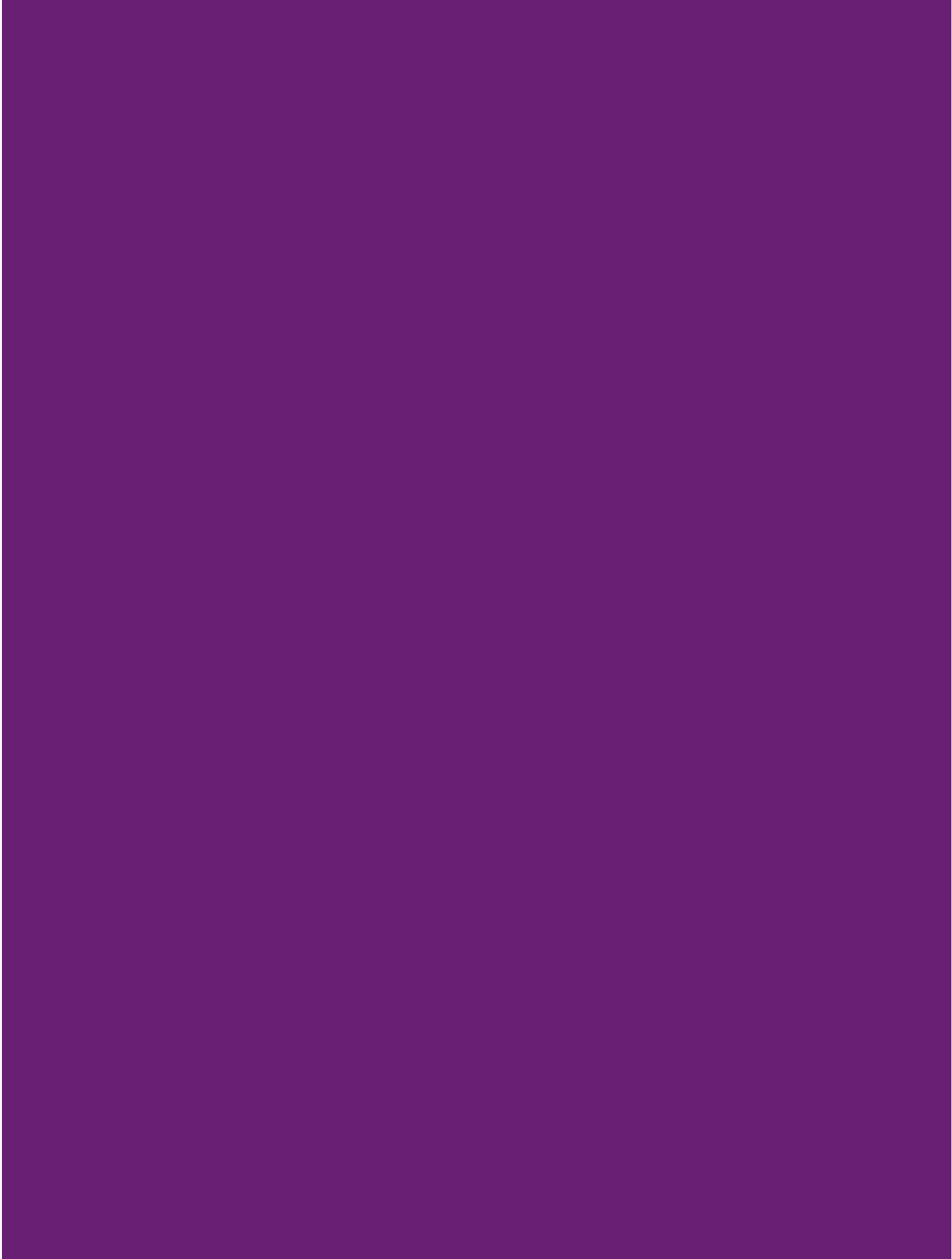
Tel.: +49 (0) 7742 9215-300  
 E-mail: technik@h-bau.de



FERBOX® B07  
 with stirrup bent conically

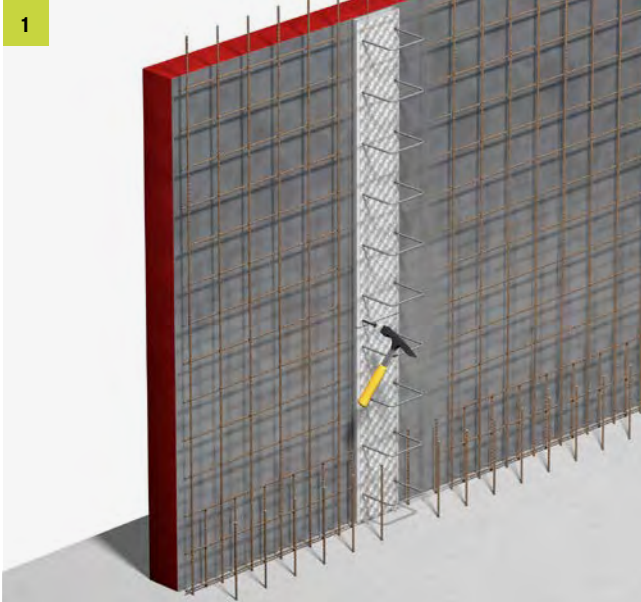


FERBOX® B07S



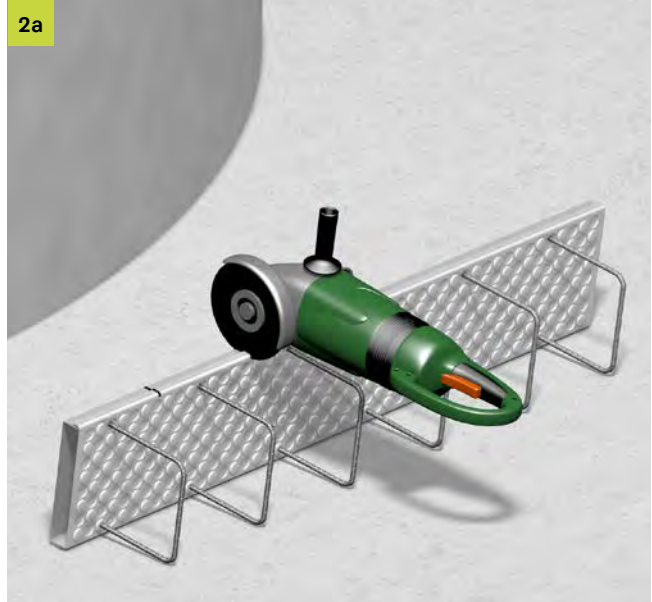
# Installation instructions

## Installation instructions



Fasten the FERBOX® rebend connection in the correct position on the formwork:

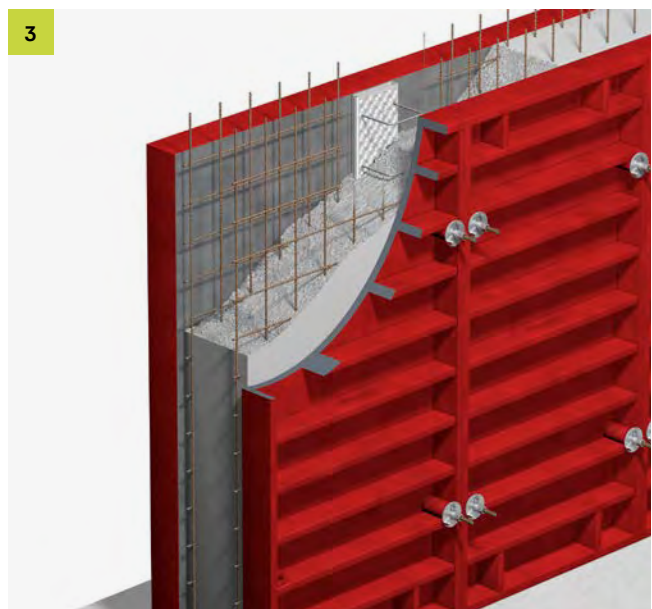
- Fasten it to the formwork using nails or magnets
- Fasten it to the reinforcements using tie wire



For round formwork, depending on the formwork radius, make several cuts with uniform spacing using an abrasive cutter on the side walls on both sides of the casing. Care must be taken to ensure that the inner reinforcement bars are not damaged.

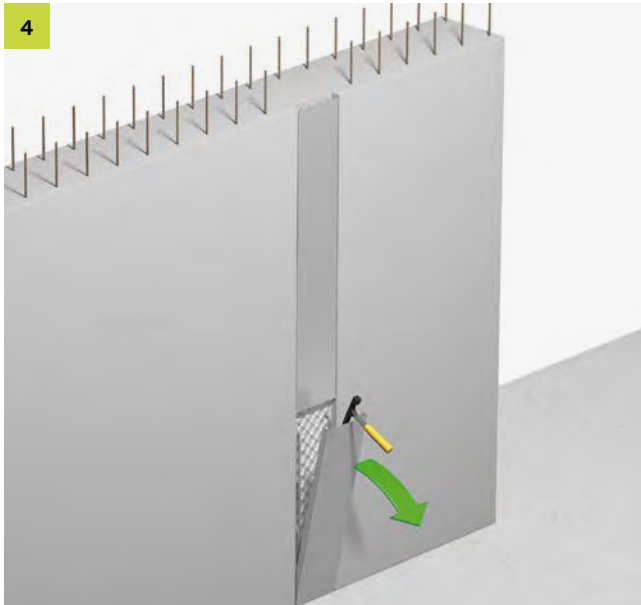


Carefully bend the casing to the correct shape so that it conforms to the shape of the formwork. Fasten it as described in step 1.

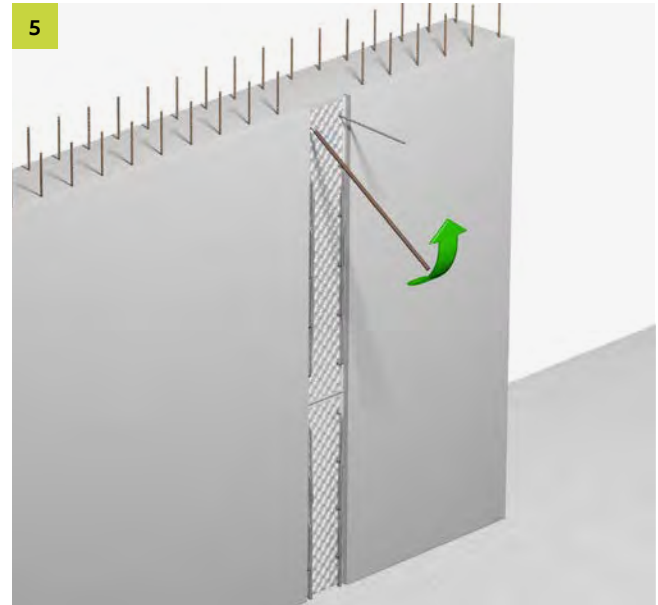


Finish erecting the formwork and finish the concreting

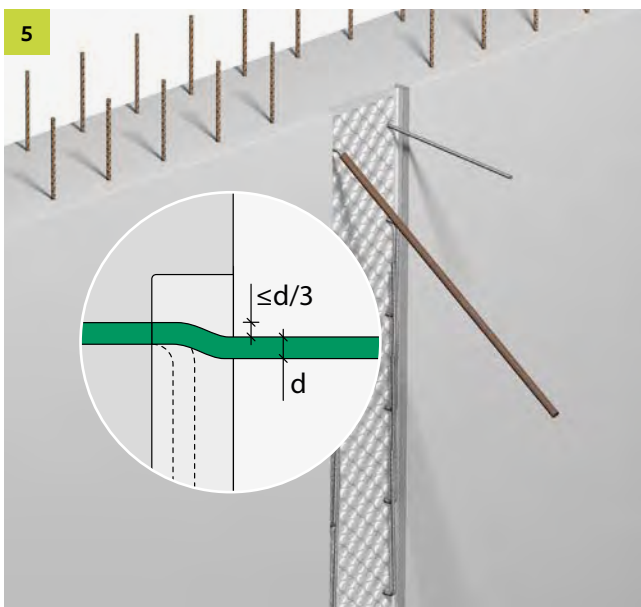




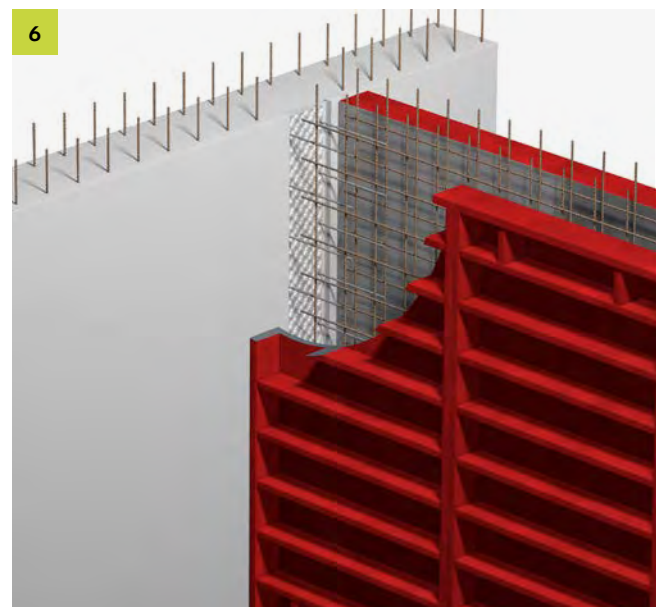
After the first concreted section, remove the covers and the polystyrene stopper strips at the ends. Never apply formwork release oil to the casing remaining in the joint. Remove any unwanted matter (e.g. laitance) before the concreting stage.



Bend the reinforcement bars back to the planned position using a rebending pipe with an inner diameter that is only slightly larger than the bar diameter. Slide the pipe up to the start of the bend and move the reinforcement bars into the correct position by gradually bending them towards the rebending point, edging gently the pipe forwards. Avoid bending it back and forth.



The permissible crimping value and other recommendations with regard to rebending can be found in the DBV bulletin entitled "Rückbiegen von Betonstahl und Anforderungen an Verwahrkästen" ["Rebending reinforcing steel and requirements for casing"].

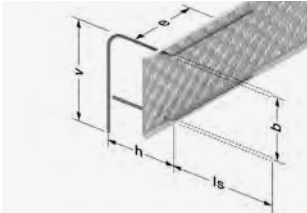


Once all the bars have been fully bent back to the planned position, erect the formwork for the second concreted section and concrete it.

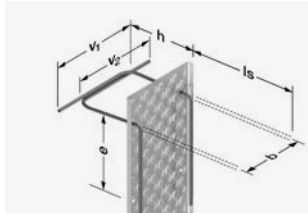


## Type overview

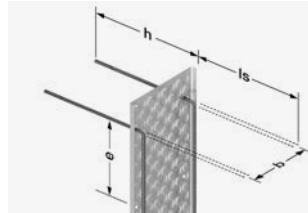
### Double-row



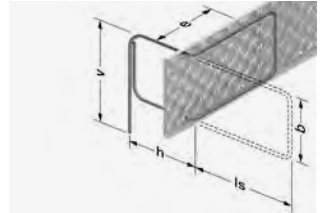
FERBOX® B01



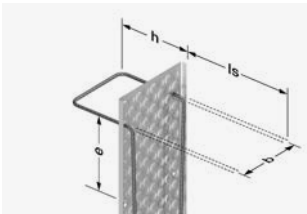
FERBOX® B02



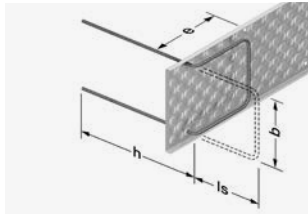
FERBOX® B03



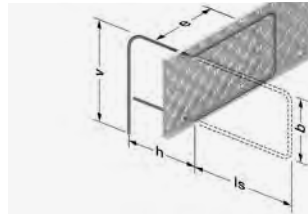
FERBOX® B04/B04S



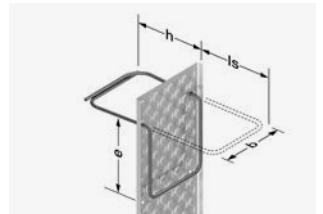
FERBOX® B05



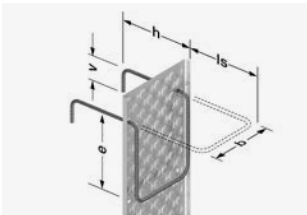
FERBOX® B06/B06S



FERBOX® B07/B07S

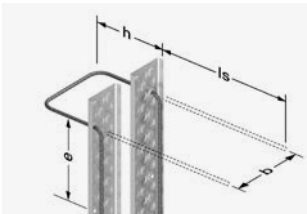


FERBOX® B08/B08S

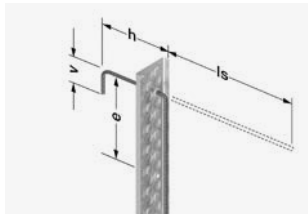


FERBOX® B09/B09S

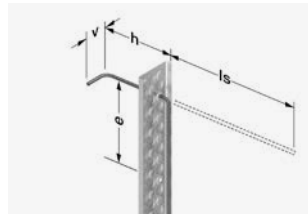
### Single-row



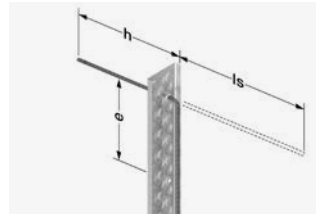
FERBOX® EE



FERBOX® E01



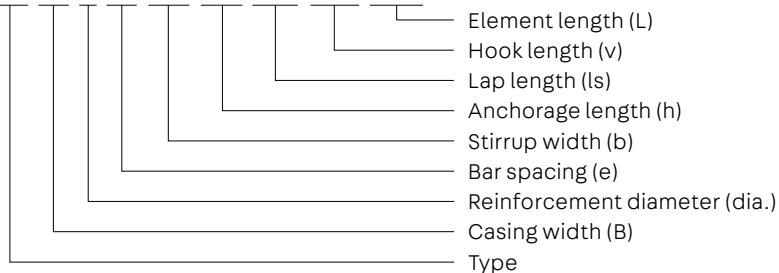
FERBOX® E02



FERBOX® E03

### Type designation

FERBOX® B07 160 10 150 b135 h170 ls150 v250 L1200



Ascertaining the stirrup width  $b$  for a double-row FERBOX®

$b = \text{casing width } B - 25 \text{ mm}$

Hook length  $v$ :  
 For FERBOX® B02 there are two different hook lengths  $v_1$  and  $v_2$ . Please specify both values.

# Our synergy concept for your benefit

**With us, you benefit from the collective experience of three established manufacturers, who combine products and expertise in a comprehensive range. That is the PohlCon synergy concept.**



## **Full-service consulting**

Our extensive network of consultants is available to answer all your questions about our products on site. From planning to use, you can enjoy personal support from our qualified employees.



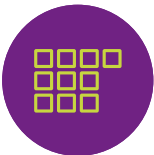
## **Digital solutions**

Our digital solutions provide targeted support in planning with our products. From tender texts to CAD details and BIM data, right through to modern software solutions, we offer customized support for your planning process.



## **7 fields of application**

We think in terms of holistic solutions. This is why we have combined our products into seven fields of application, where you can benefit from their synergy and the overall PohlCon product range.



## **10 product categories**

In order to find the right product in our extensive range even faster, we have divided our products into ten product categories. This way you can navigate clearly and precisely between our products.



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Is there no series product on the market that is suitable for your project? We realize unique construction projects and deal with exceptional challenges using the many years of expertise of the three manufacturing brands.



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