

FERBOX® Rebend connections

Technical information



ETA-
20/0842

Joint category
always
"indented"

Table of contents

FERBOX®

Product information 4

Type overview 8

Application overview

Shearing force in transverse direction with respect to casing 12

Shearing force in longitudinal direction with respect to casing 17

Corbels 19

Technical data

Single-row types 22

Double-row types 24

Structural design

Structural design principles 28

FERBOX® Design 29

Case a according to DBV bulletin 31

Case b according to DBV bulletin 32

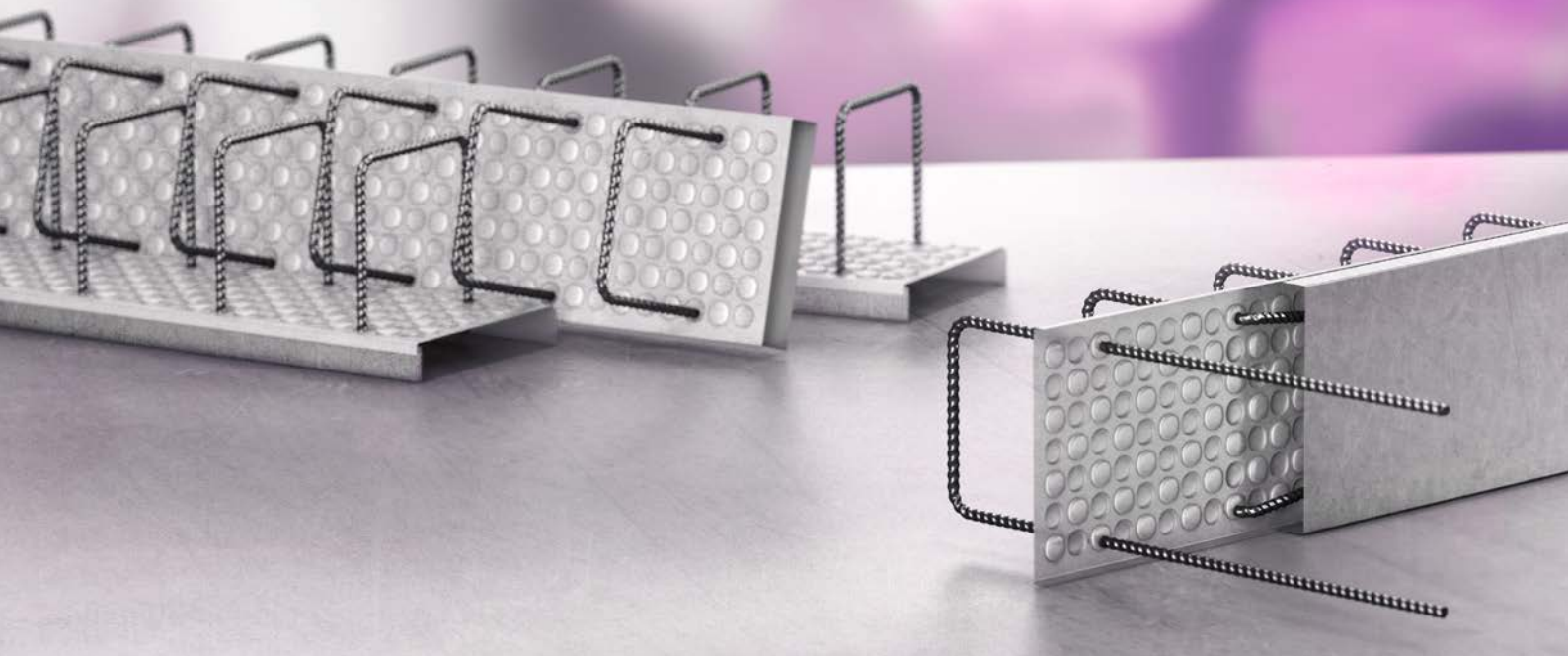
Cases c and e acc. to DBV bulletin without shear reinforcement 34

Case c according to DBV bulletin with shear reinforcement 36

Corbels 38

Installation instructions 40

Order form 44



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. ≤ 10 mm, F = 30 mm

For dia. ≥ 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.

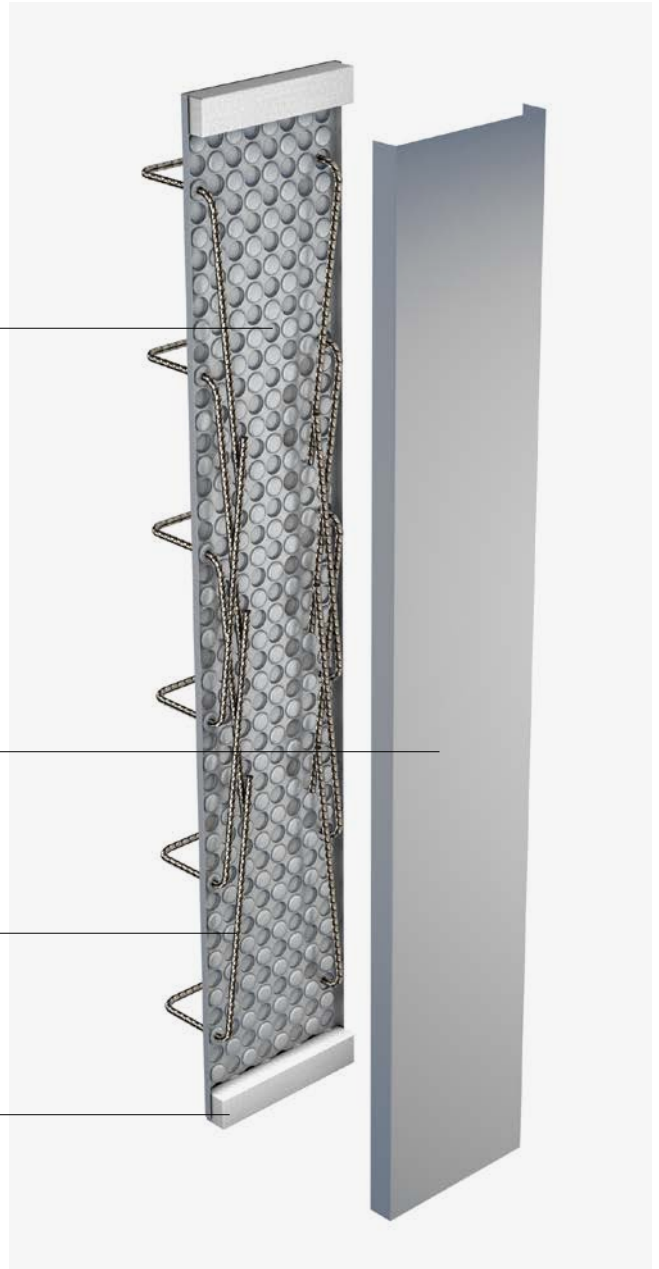
Foam stopper strip

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

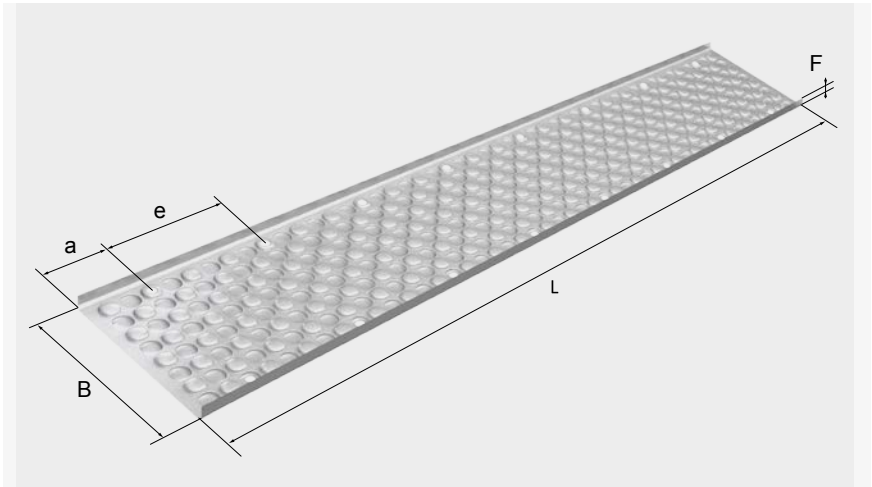
NEW

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

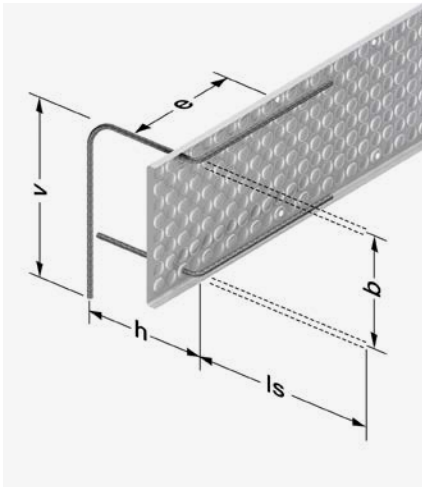
The FERBOX® has undergone this European technical assessment (ETA) to verify its technical suitability for use in Europe. This means that it can be used for connections for both structural design and constructional purposes; because there is only one type, there is no risk of using the wrong type.



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

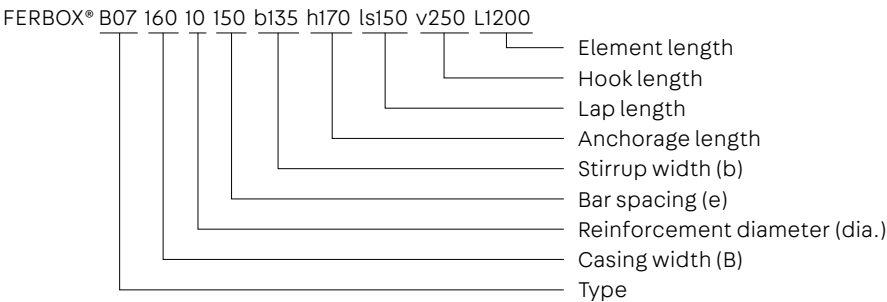
The number of reinforcement stirrups and their classification depend on the length of the casing:

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.

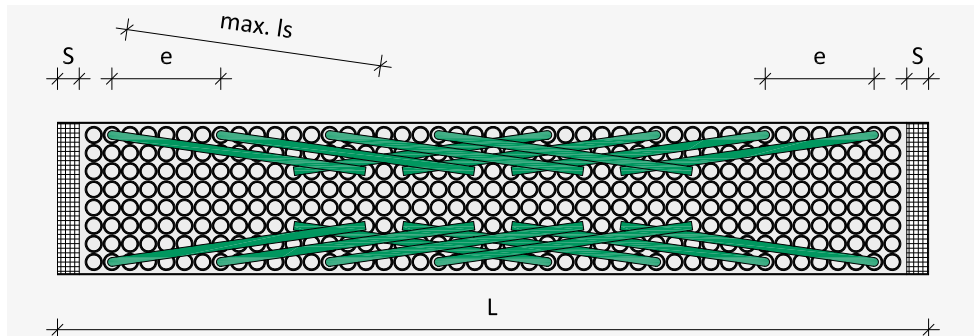
Example
 Installation length:
 4.0 m
 Installation parts:
 2 x (1.2 + 0.8 m)

Type designation



Ascertaining the stirrup width b for a double-row FERBOX®
 b = casing width B - 25 mm

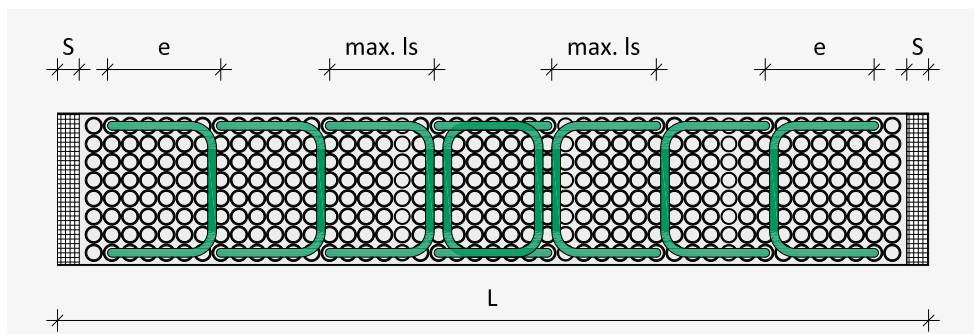
Reinforcement bar arrangement and maximum lap length l_s



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:

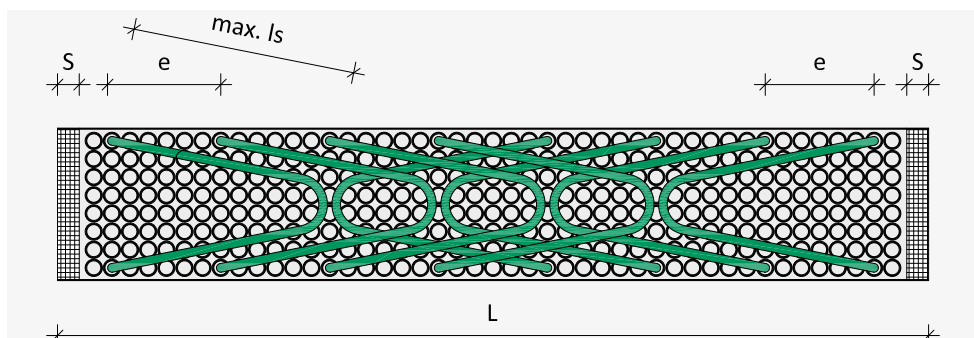
$l_s \leq e - 20 \text{ mm}$

Reinforcement dia. 10 mm:

$l_s \leq e - 30 \text{ mm}$

Reinforcement dia. 12 mm:

$l_s \leq e - 30 \text{ mm}$



B04, B06, B07, B08, B09

Bent conically

Reinforcement dia. 8 mm:

$l_s \geq e - 20 \text{ mm}$

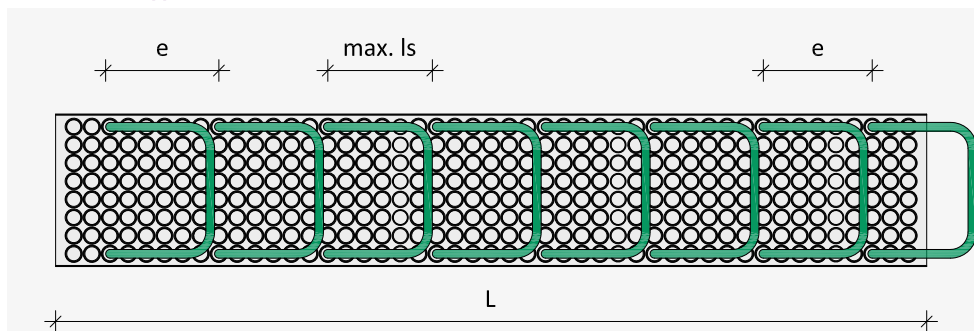
Reinforcement dia. 10 mm:

$l_s \geq e - 30 \text{ mm}$

Reinforcement dia. 12 mm:

$l_s \geq e - 30 \text{ mm}$

FERBOX® "S" types



B04S, B06S, B07S, B08S, B09S

All bars bent in the same direction

Reinforcement dia. 8/10/12 mm:

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



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.



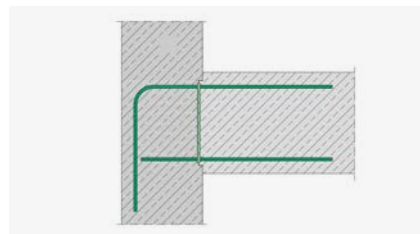
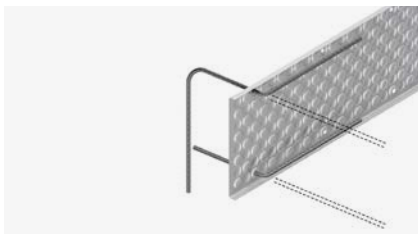
Assembly instructions for "S" types

- 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

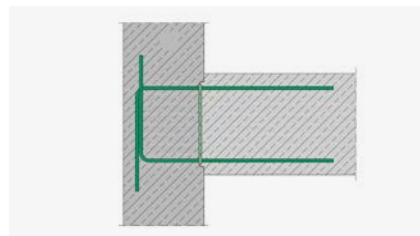
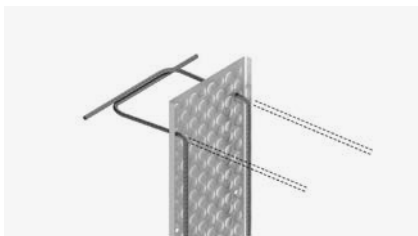
FERBOX® B01

Bending roller diameter h/v : 10 ds

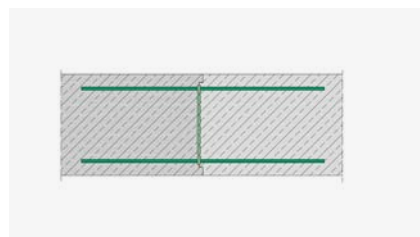
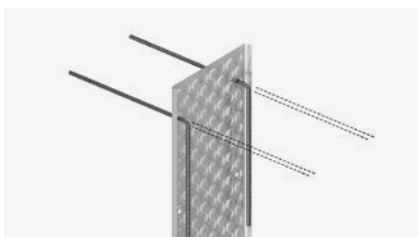


FERBOX® B02

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

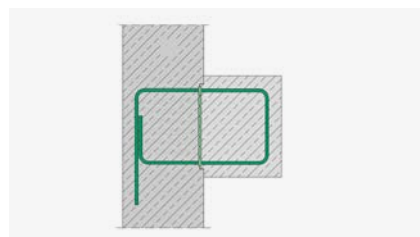
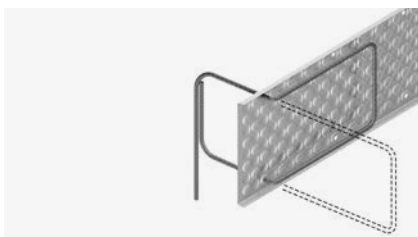


FERBOX® B03

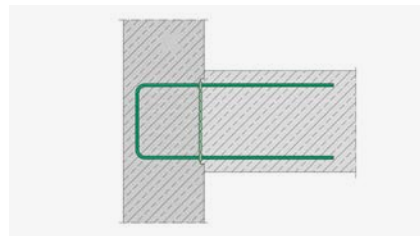
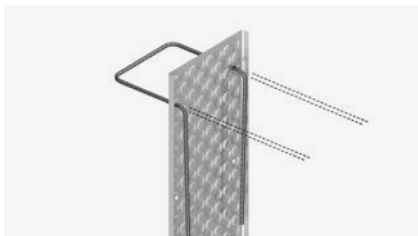


FERBOX® B04/B04S

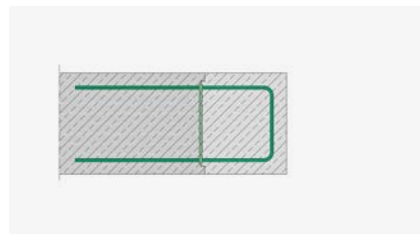
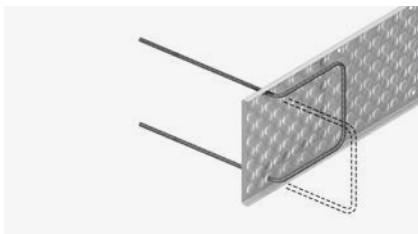
Bending roller diameter h/v : 4 ds



FERBOX® B05

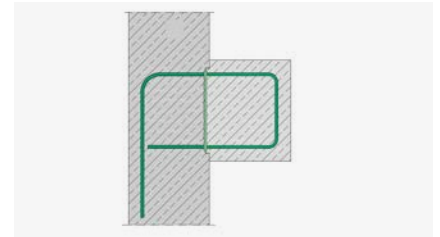
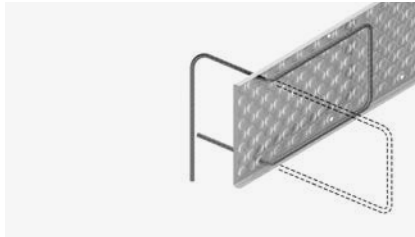


FERBOX® B06/B06S

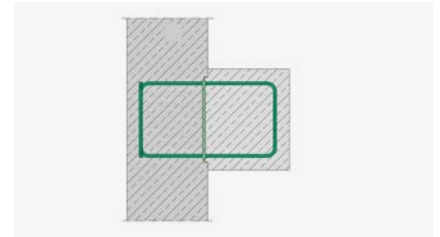
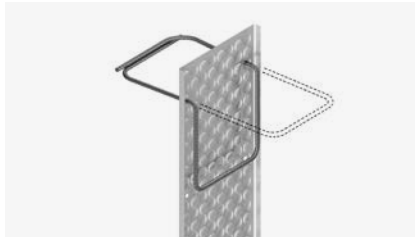


FERBOX® B07/B07S

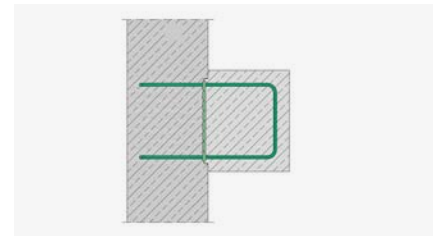
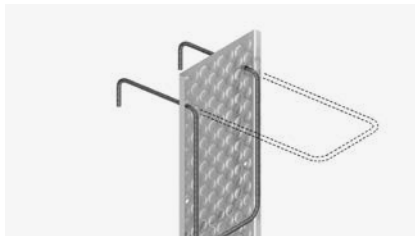
Bending roller diameter h/v : 10 d_s
(also available with $h/v = 4 d_s$)



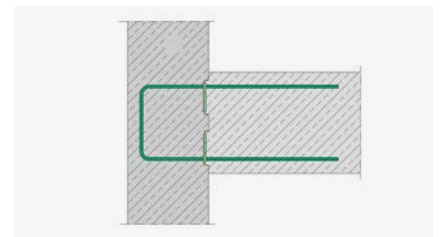
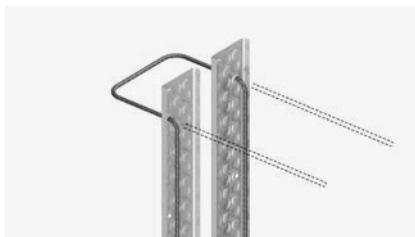
FERBOX® B08/B08S



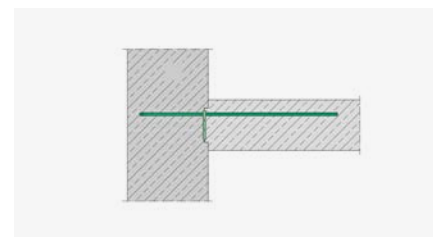
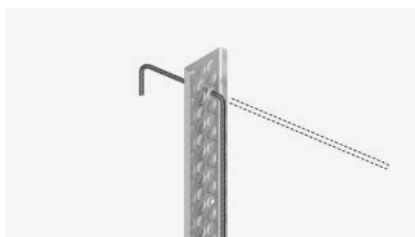
FERBOX® B09/B09S



FERBOX® EE

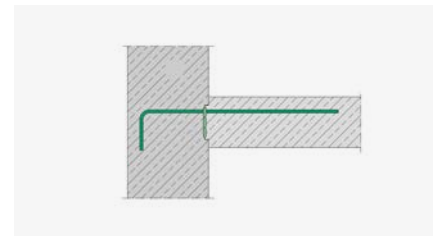
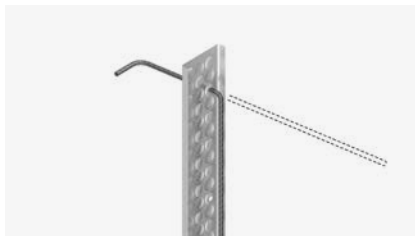


FERBOX® E01

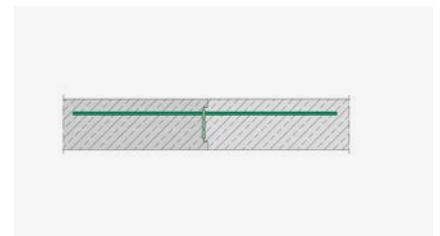
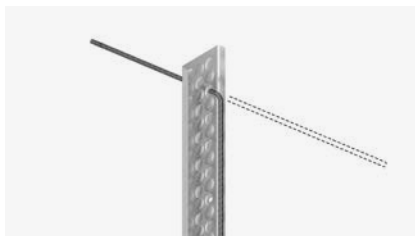


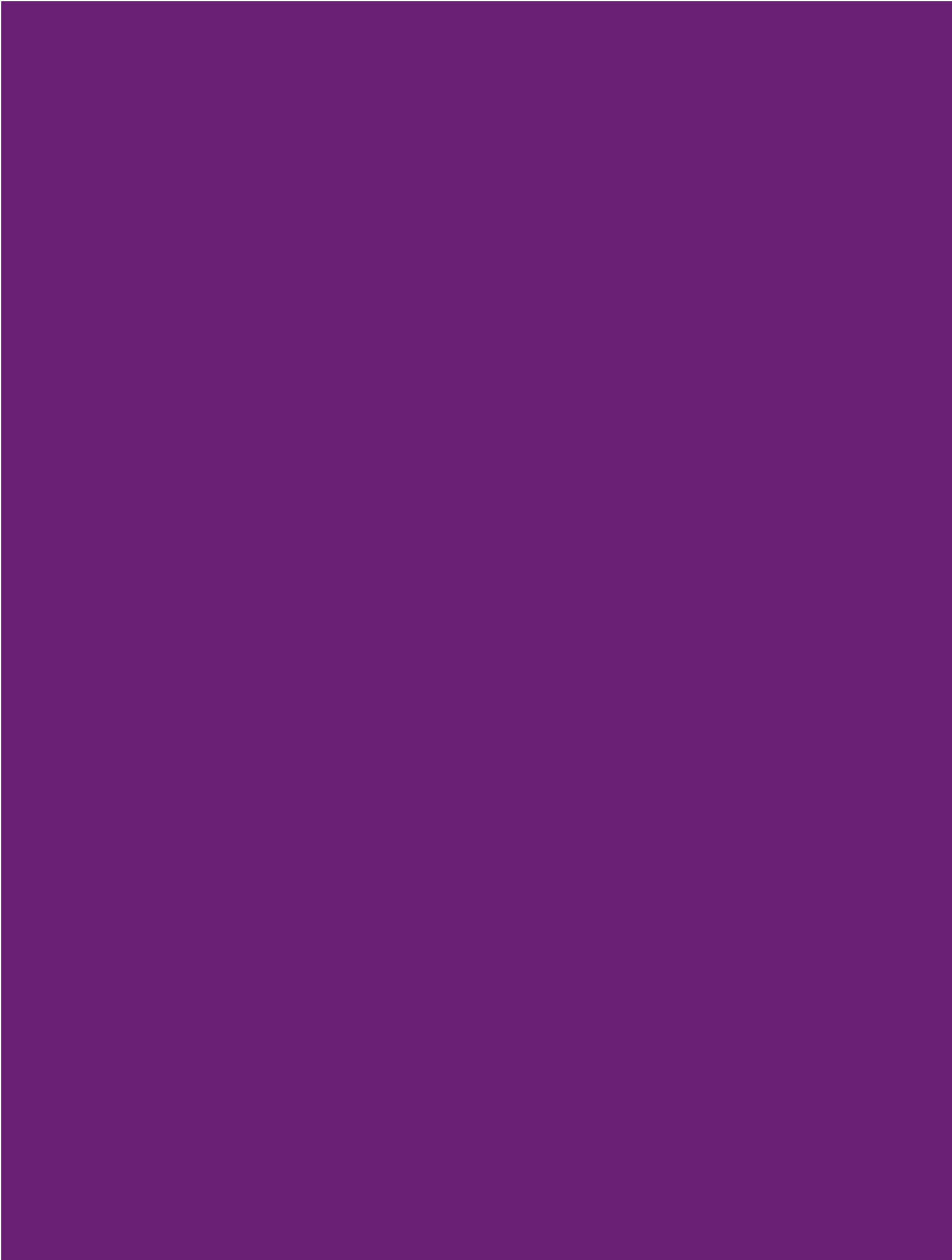
FERBOX® E02

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



FERBOX® E03





Application overview

Shearing force in transverse direction with respect to casing

Single-row ↻

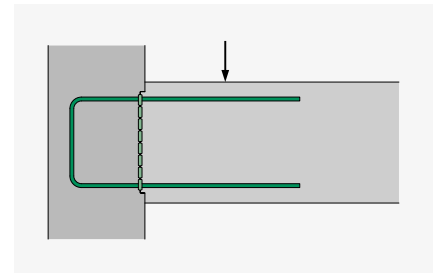
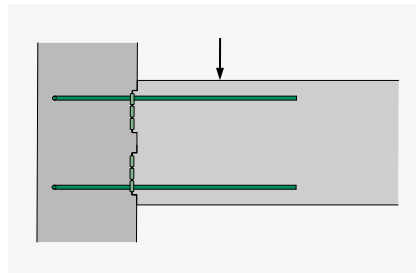
Double-row ↻

Type of connection

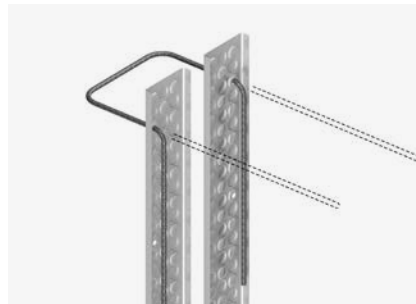
e.g. wall - floor/ceiling

Load

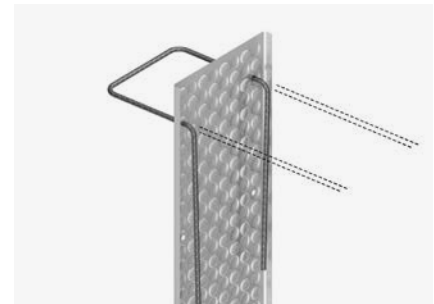
Shearing force



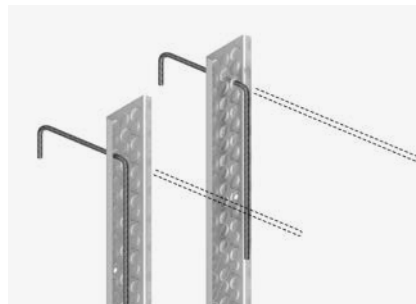
Possible product selection



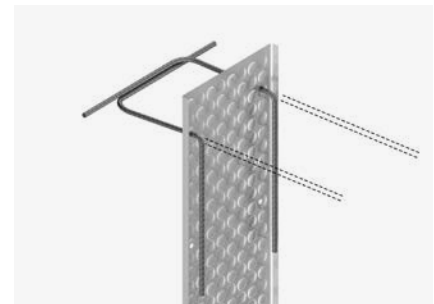
FERBOX® EE



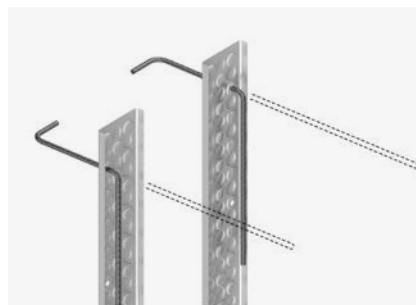
FERBOX® B05



2 x FERBOX® E01



FERBOX® B02 (4 ds)



2 x FERBOX® E02

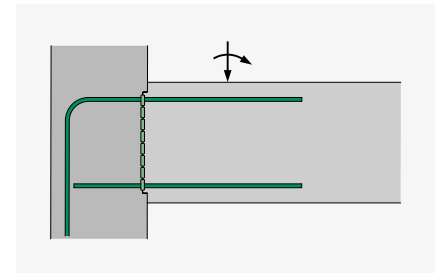
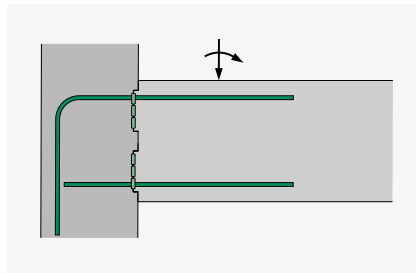
Shearing force and torque in transverse direction with respect to casing

Single-row ↱

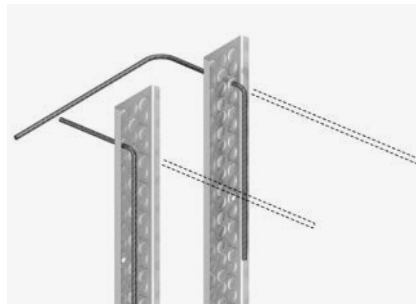
Double-row ↱

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

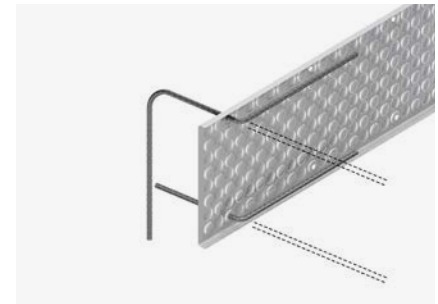
Load
Shearing force/torque



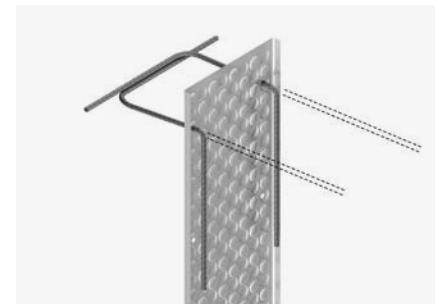
Possible product selection



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 ↻

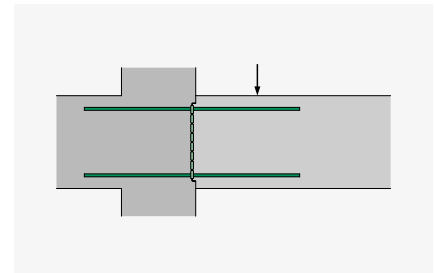
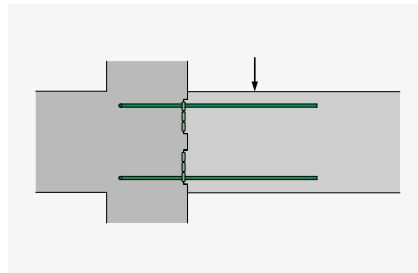
Double-row ↻

Type of connection

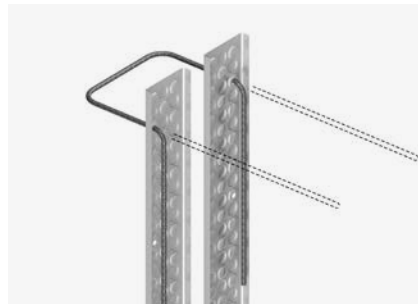
e.g. wall - floor/ceiling - floor/ceiling

Load

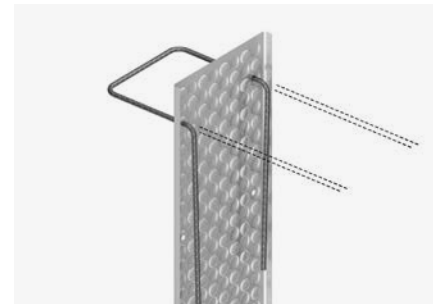
Shearing force



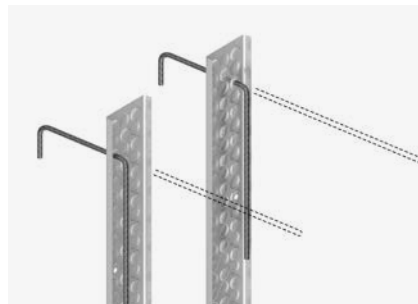
Possible product selection



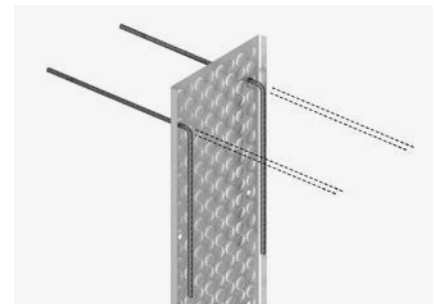
FERBOX® EE



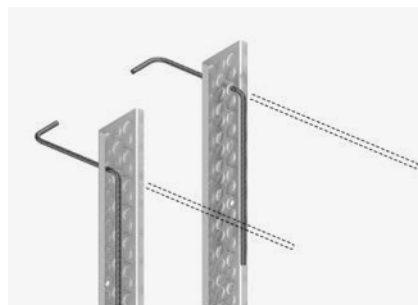
FERBOX® B05



2 x FERBOX® E01

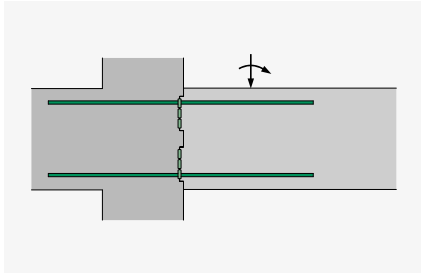
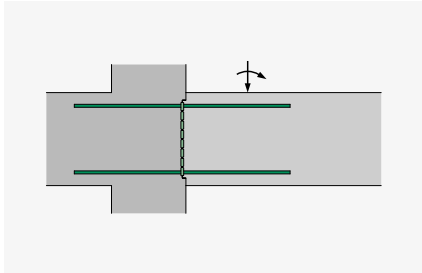
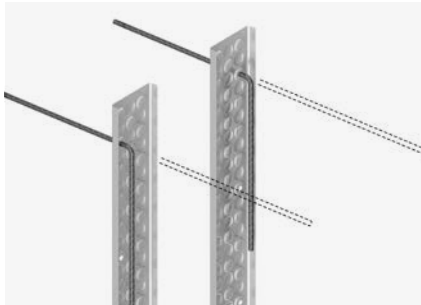
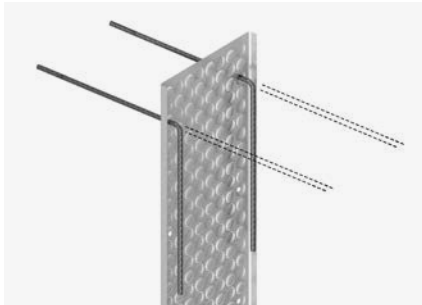


FERBOX® B03



2 x FERBOX® E02

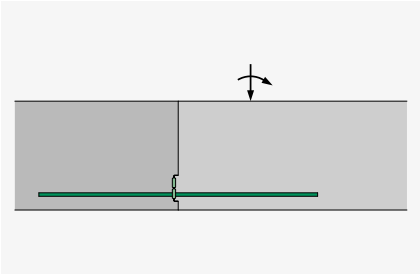
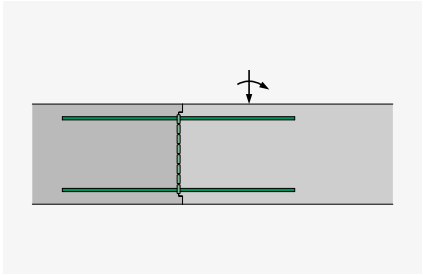
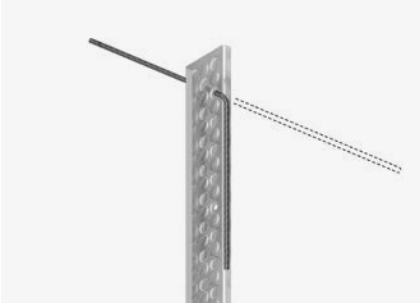
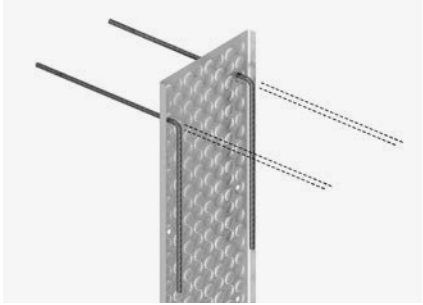
Shearing force and torque in transverse direction with respect to casing

	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

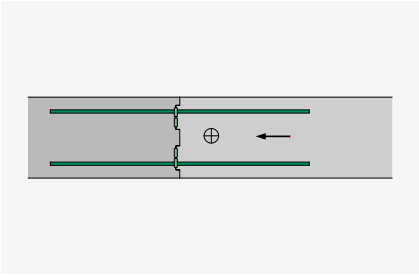
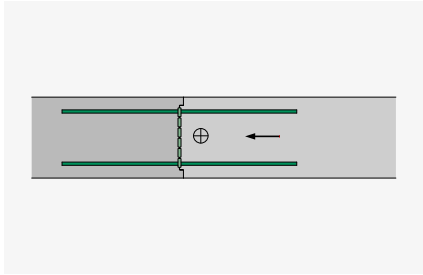
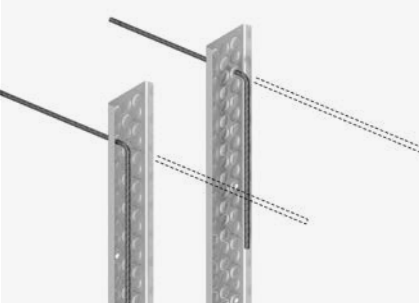
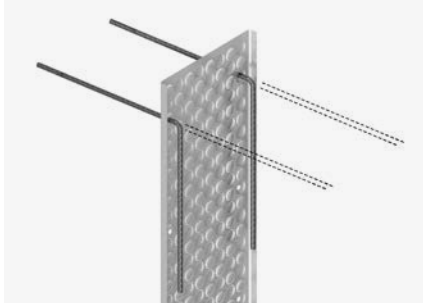


A smarter way to plan your connections:
Our FERBOX® Design structural design software is just
the tool for the job.

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 ↻

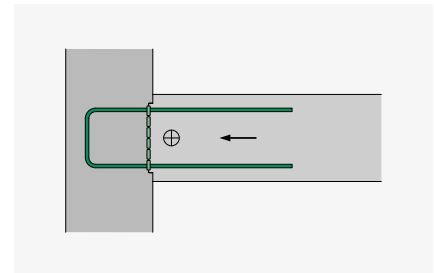
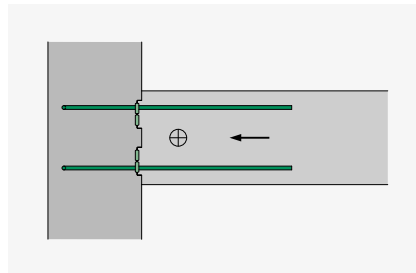
Type of connection

e.g. vertical wall – wall

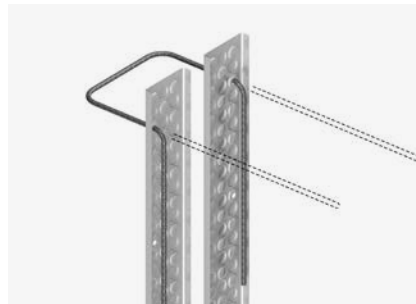
Load

Shearing force

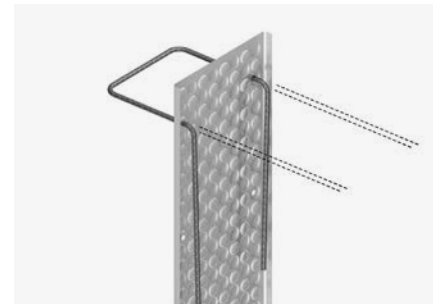
Shearing force/normal force



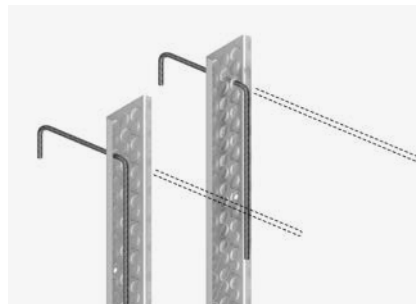
Possible product selection



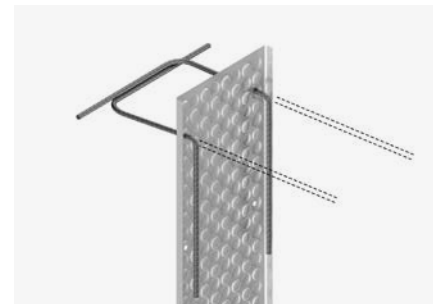
FERBOX® EE



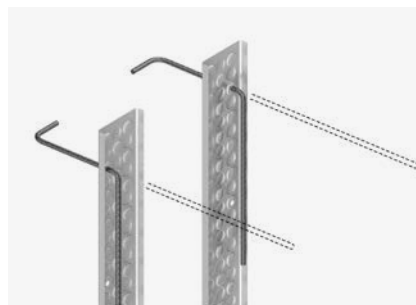
FERBOX® B05



2 x FERBOX® E01

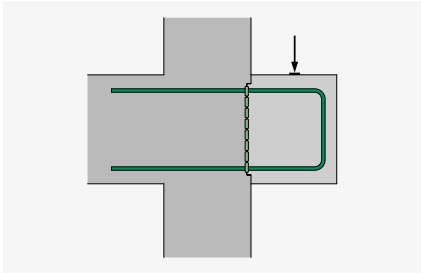
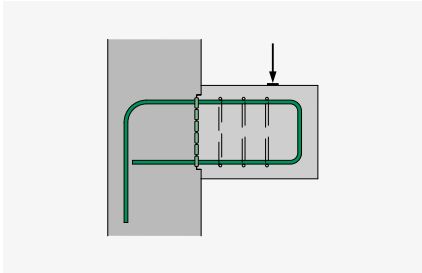
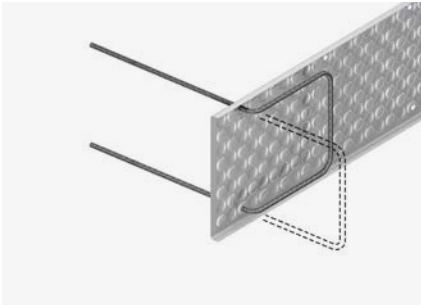
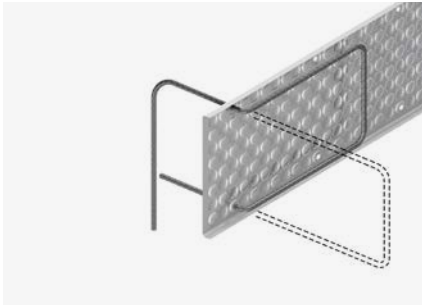


FERBOX® B02 (4 ds)



2 x FERBOX® E02

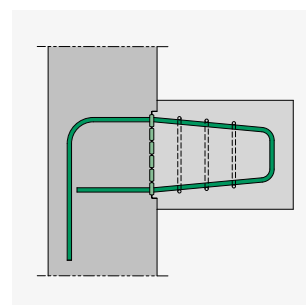
Corbels

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

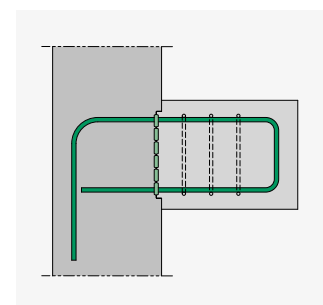
 Depending on the ratio of the corbel's height to its cantilever, it may be necessary due to production constraints to bend the FERBOX®'s stirrups in the corbel so that they form a conical shape. Alternatively, you can opt for one of the FERBOX® "S" types, which allow for straight stirrups (see "S" types on page 7).

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

T +49 7742 9215-300
technik-hbau@pohlcon.com

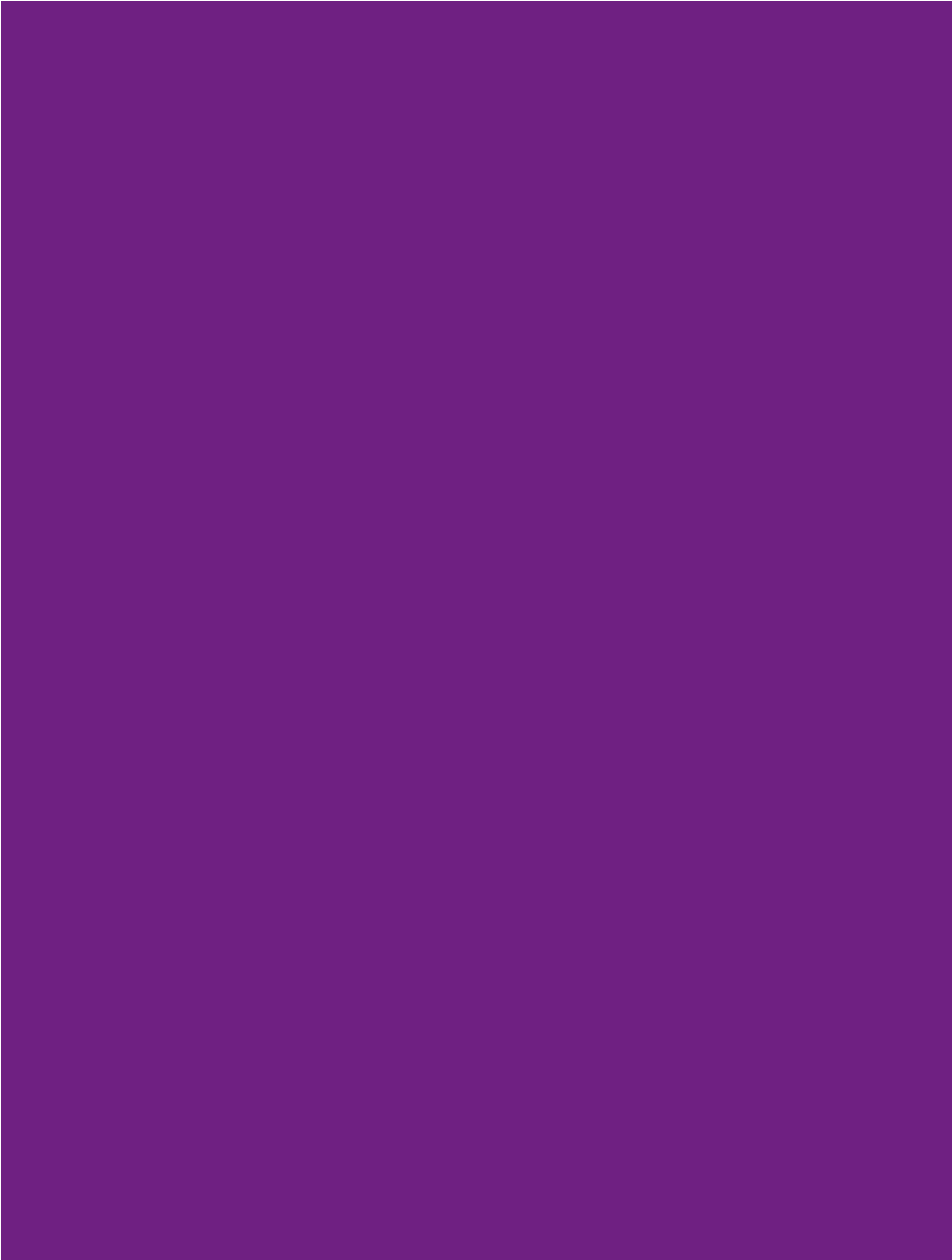


FERBOX® B07
with stirrup bent conically



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	Dia./e			h	ls		
mm	mm			mm	mm		
		E01 E02		E03	E01 E02 E03	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		
	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	200-600	200-430	110	110-600	
	12/150			200-510			
	12/200			200-600			
	12/250			200-600			
	14/100	140-600		200-360			
	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	200-600	110	110-600	
	12/150			200-600			
	12/200			200-600			
	12/250			200-600			
	14/100	140-600		200-510			
	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			
	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	Dia./e	b	h	ls
mm	mm	mm	mm	mm
		EE	EE	EE
60	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
10/250	300-510			
85	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
	14/100			-
	14/150	180-500	130-300	420-510
	14/200			420-600
	14/250			420-600
14/250	420-600			
110	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
135	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	Dia./e				h	ls			v
mm	mm				mm	mm			mm
		B01	B03	B05			B01	B01	B02 (4 ds)
		B02 (10 ds)		B02 (4 ds)*			B02	B02 (10 ds)	
							B03		
							B05		
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	110-600	
	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	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	120-300	360-430		160-600	110-600	
	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	150-600	150-600	110-300	300-510		150-600		
	10/150				300-590				
	10/200				300-600				
	10/250				300-600				
	12/100	170-300	170-600	120-300	360-480		160-600	110-600	
	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	120-300	360-520		160-600	110-600	
	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

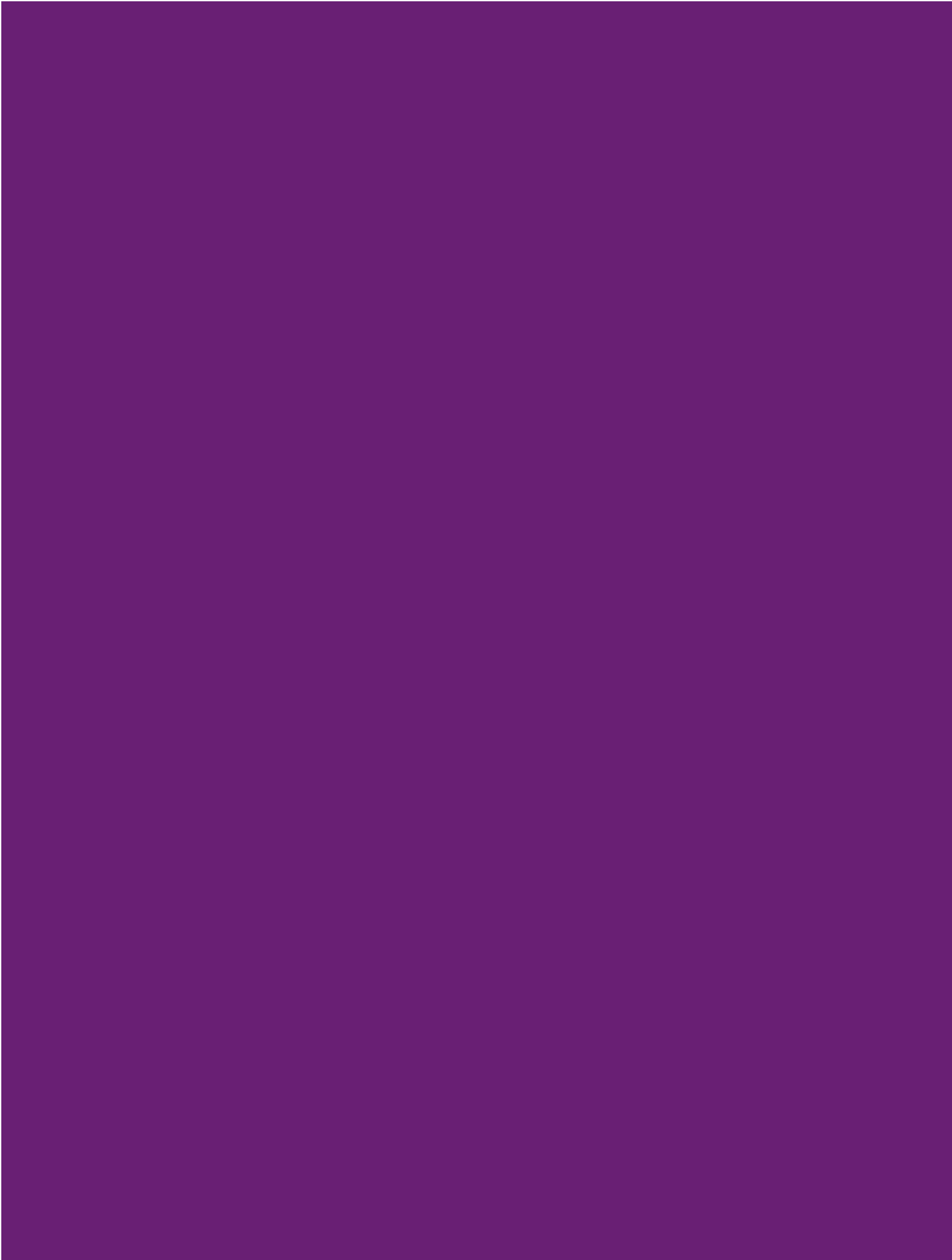
*From B = 160 mm | **With large casing widths (max. B = 260 mm), the values do not change significantly. Further details available on request.

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

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

B	Dia./e				h	ls		v	
mm	mm			mm		mm		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)	B09/B09S	
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.

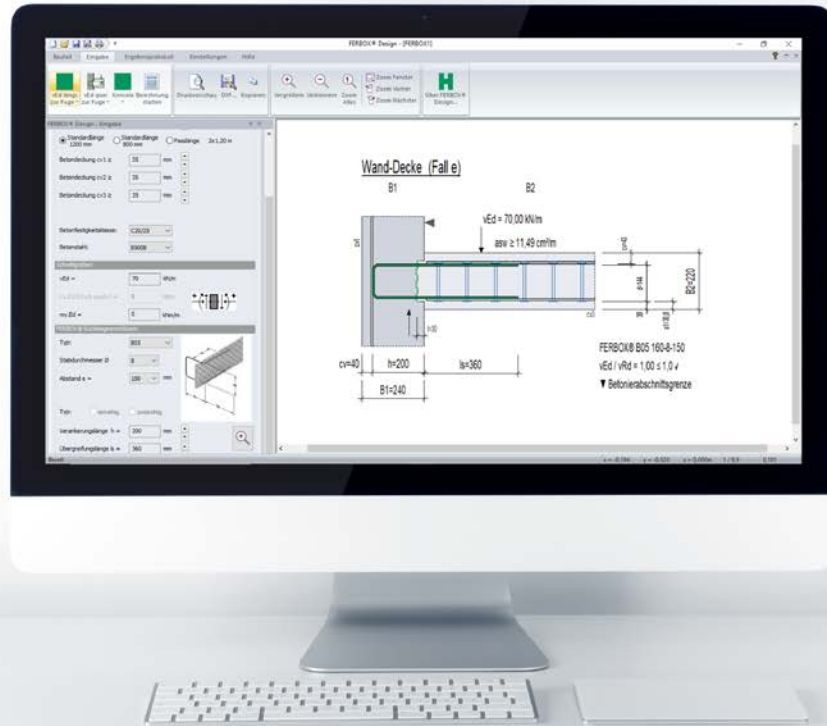
Steel stress

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.

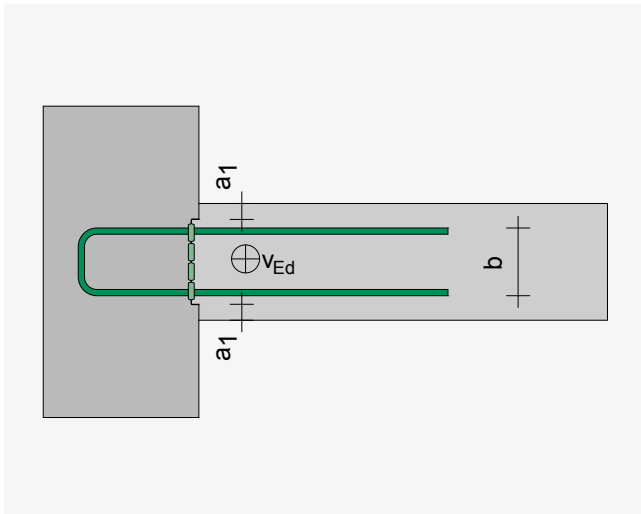


Advantages

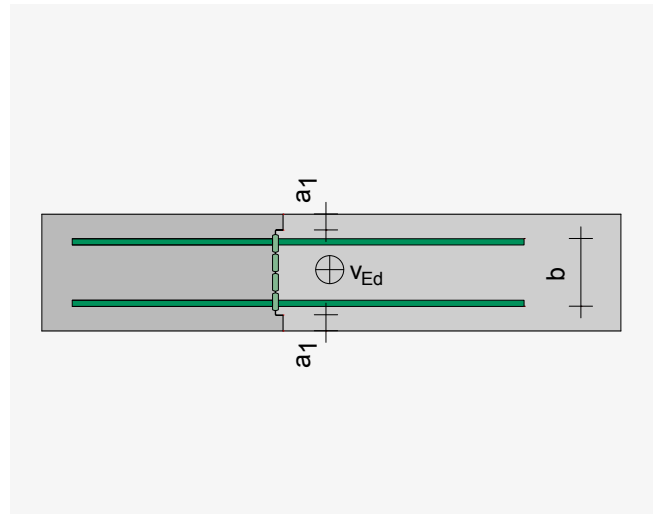
- Easy graphical selection of different structural design cases
- V_{Ed} , n_{Ed} and m_{Ed} can be input
- Absorbable shearing force including or not including the floor/ceiling's shearing force reinforcement
- Floor/ceiling's shearing force reinforcement included as additional structural design step; 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 $a_1 \leq 50 \text{ mm}$:

Not included in the structural design

If $a_1 \geq 50 \text{ mm}$:

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

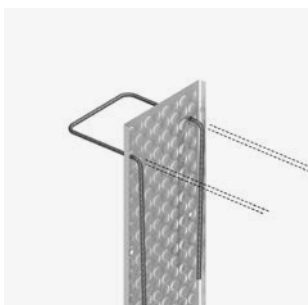
The requisite minimum concrete covering for the rebend reinforcement in accordance with the ETA must be provided.

Good bond conditions in accordance with EC2 are assumed.

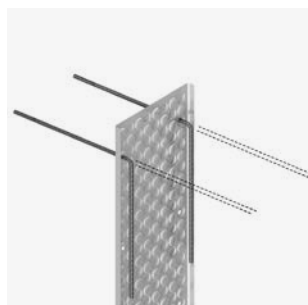
$n_{Ed} \geq 0$

(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.

T +49 7742 9215-300
technik-hbau@pohlcon.com

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, l_s = 320 mm

Dia. 10, l_s = 390 mm

Dia. 12, l_s = 460 mm

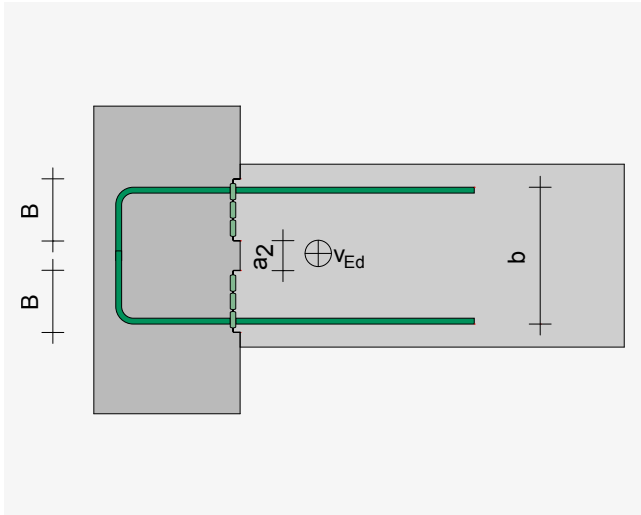


For certain h and l_s values, it may be possible to achieve higher load-bearing capacities.

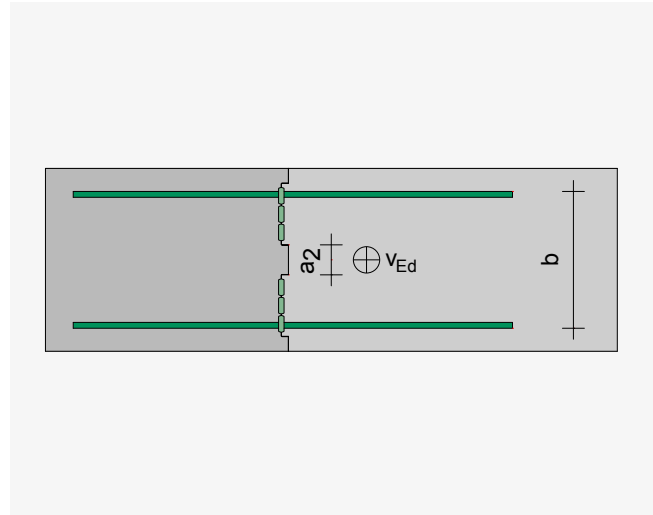
We recommend using FERBOX® Design for your structural design needs.

Structural design case b according to DBV bulletin

Shearing force in longitudinal direction with respect to concreted joint



Case b, vertical wall



Case b, continuous wall

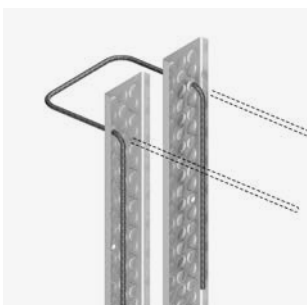


Notes on structural design

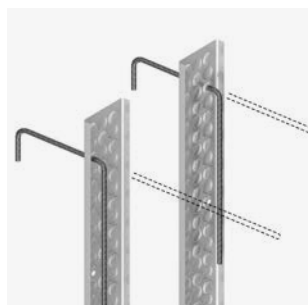
Structural design for two casings with hooks, angled hooks or loops in accordance with EC2.
The suggested stirrup shapes may be replaced with other shapes with angled hooks.

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

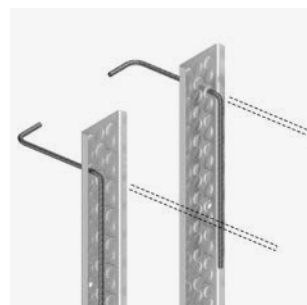
Suitable products



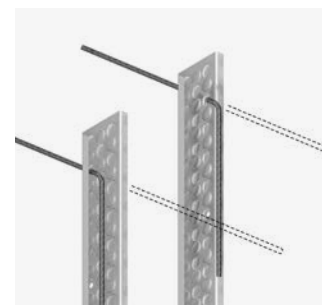
Single-row connection,
e.g. EE



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

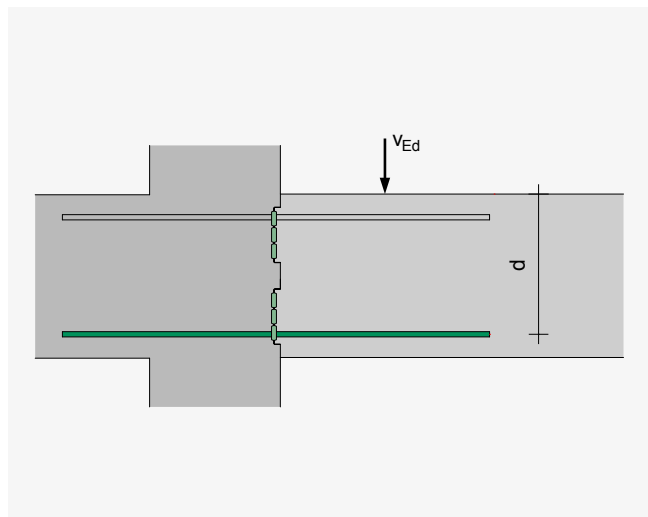
The values listed in the table apply to the FERBOX® E02 for structural design case b according to DBV bulletin:
h = 170 mm
Dia. 8, ls = 320 mm
Dia. 10, ls = 390 mm
Dia. 12, ls = 460 mm



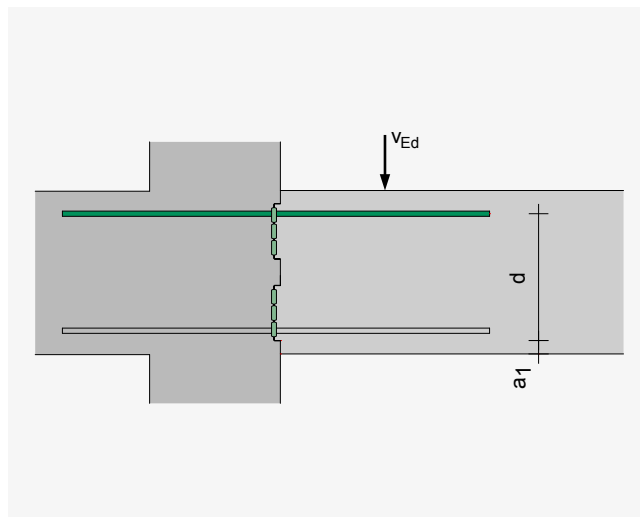
For certain h and ls values, it may be possible to achieve higher load-bearing capacities.
We recommend using FERBOX® Design for your structural design needs.

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

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

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

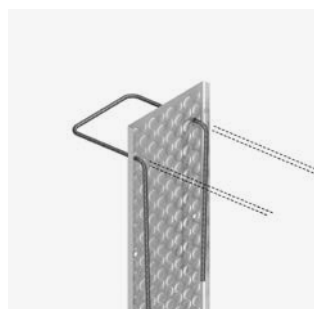
Example case e (tensile forces acting at top)

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

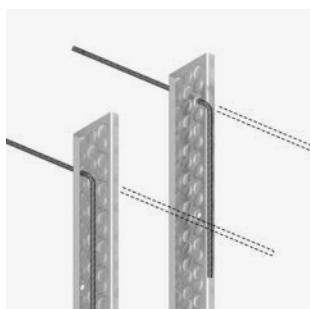
Assumption: $a_1 = 25 \text{ mm}$

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

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

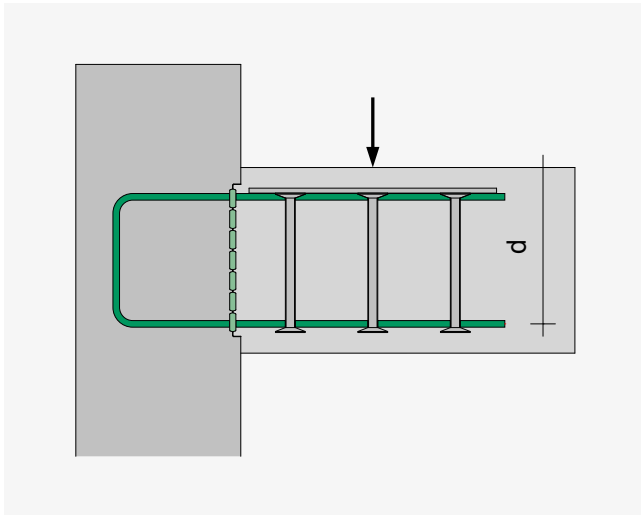
Dia. 12, $l_s = 460$ mm



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"].

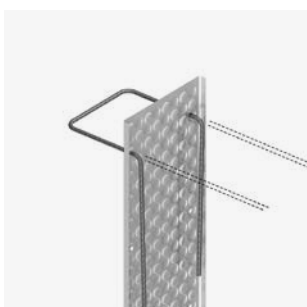
The maximum load-bearing capacity of connection components with shearing force reinforcement depends on the angle of the shear reinforcement. The structural design assumes an orientation perpendicular to the component axis.

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
C20/25	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
C25/30	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
C30/37	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, $l_s = 320$ mm

Dia. 10, $l_s = 390$ mm

Dia. 12, $l_s = 460$ mm

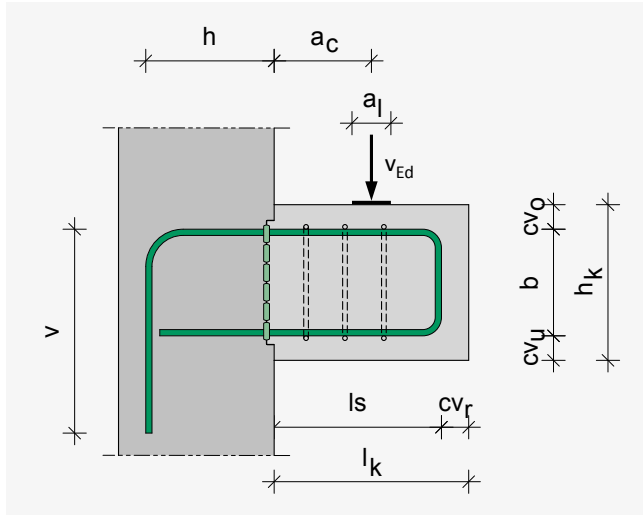


Good bond conditions in all structural components are assumed. The values listed assume direct and non-restrained bearing.

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

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

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

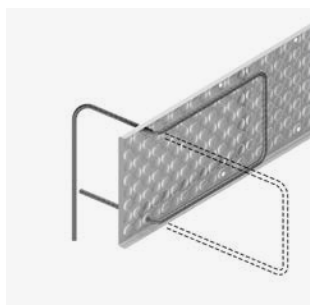
Ascertaining the inner lever arm z_o

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

For $V_{Rd,2} < V_{Ed} \leq V_{Rd,2'}$, 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	Example 1		Example 2		Example 3		Example 4	
		$h_k = 160$ mm $l_k = 180$ mm $b = 110$ mm $a_c = 90$ mm $cv_b/cv_t = 25$ mm $cv_r = 25$ mm $a_l = 50$ mm		$h_k = 180$ mm $l_k = 170$ mm $b = 135$ mm $a_c = 100$ mm $cv_b/cv_t = 22.5$ mm $cv_r = 25$ mm $a_l = 50$ mm		$h_k = 200$ mm $l_k = 220$ mm $b = 160$ mm $a_c = 110$ mm $cv_b/cv_t = 20$ mm $cv_r = 25$ mm $a_l = 50$ mm		$h_k = 260$ mm $l_k = 300$ mm $b = 210$ mm $a_c = 150$ mm $cv_b/cv_t = 25$ mm $cv_r = 25$ 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	12/250	51.6	61.6	62.6	74.4	73.7	87.1	93.1	115.2
	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
C30/37	12/200	57.7	88.5	70.0	106.8	82.4	125.1	104.1	165.4
	12/250	57.7	71.6	70.0	86.4	82.4	101.2	104.1	133.9
	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.

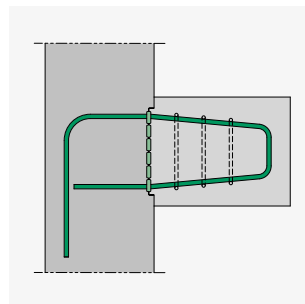
We recommend using FERBOX® Design to ascertain exact design values for individual geometries.



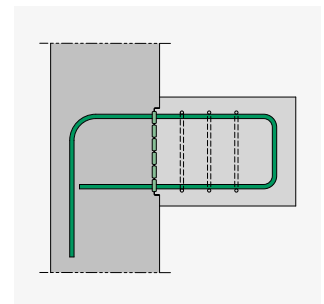
Depending on the ratio of the corbel's height to its cantilever, it may be necessary due to production constraints to bend the FERBOX®'s stirrups in the corbel so that they form a conical shape. Alternatively, you can opt for one of the FERBOX® "S" types, which allow for straight stirrups (see "S" types on page 7).

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

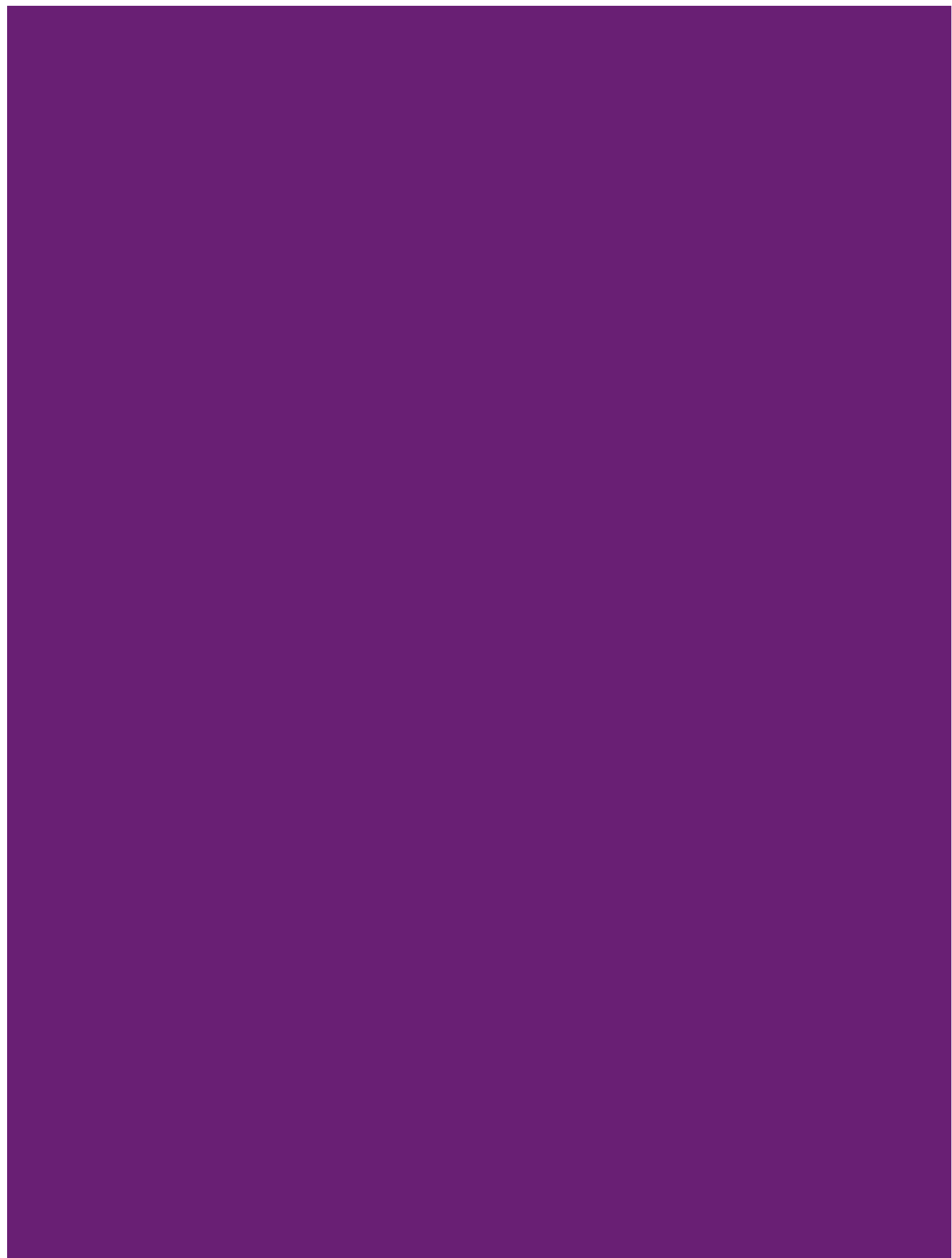
T +49 7742 9215-300
technik-hbau@pohlcon.com



FERBOX® B07
with stirrup bent conically

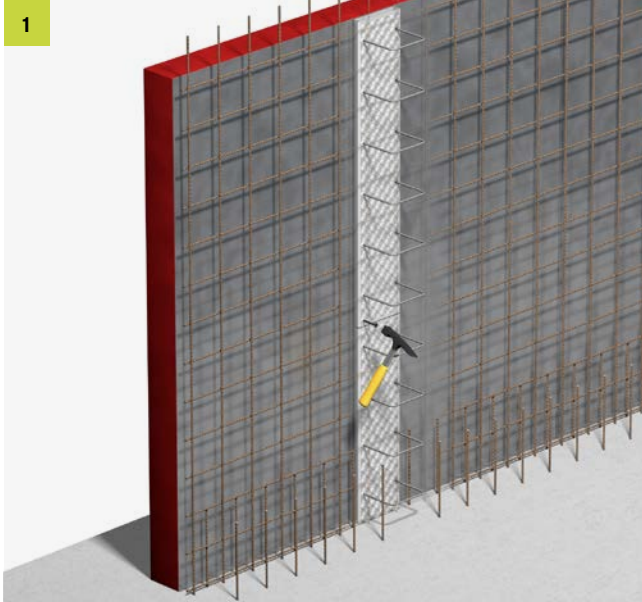


FERBOX® B07S



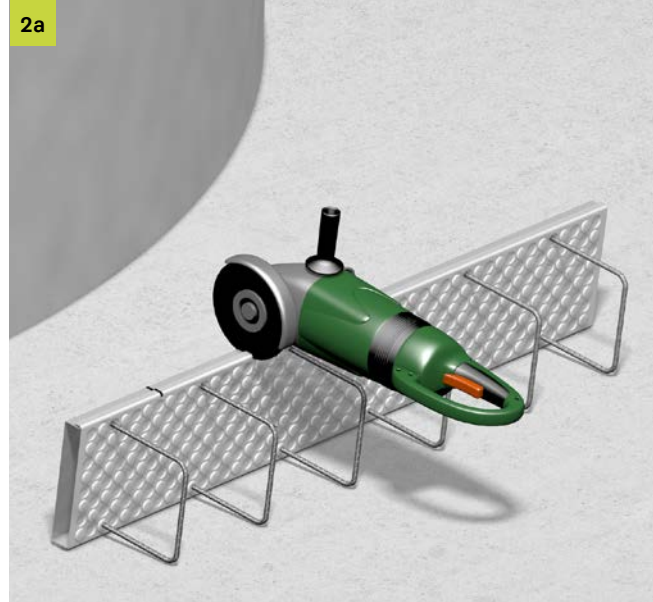
Installation instructions

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

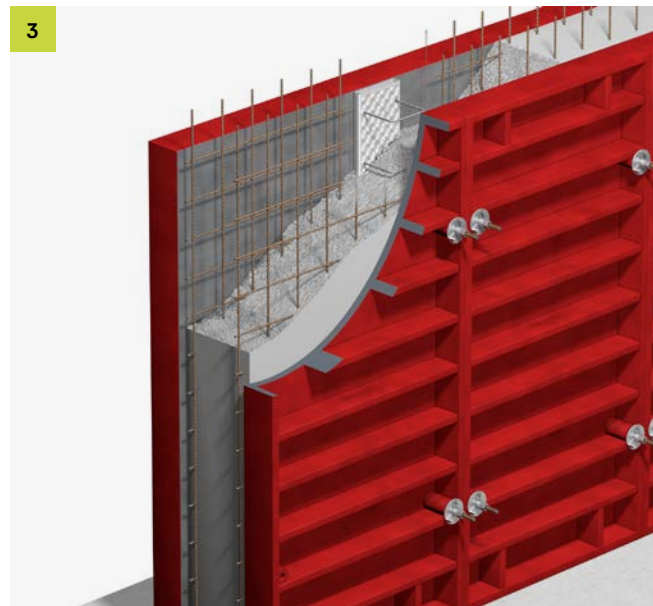


For round formwork, depending on the formwork radius, make several cuts with uniform spacing using an abrasive cutter on the side walls on both sides of the casing.

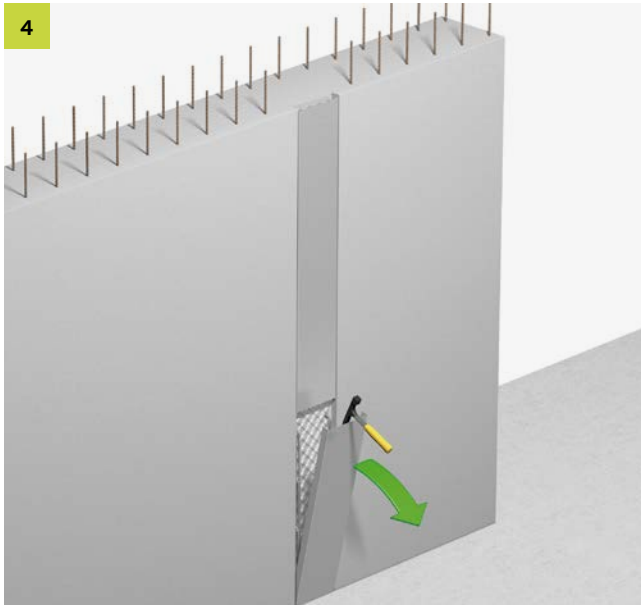
Care must be taken to ensure that the inner reinforcement bars are not damaged.



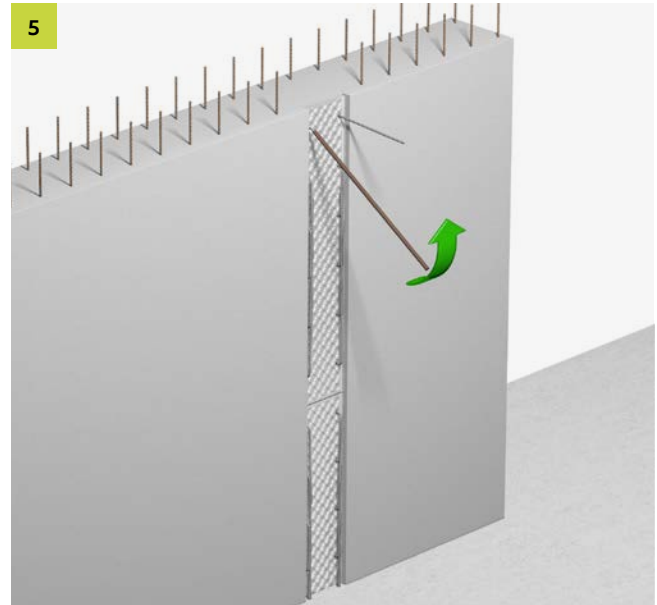
Carefully bend the casing to the correct shape so that it conforms to the shape of the formwork. Fasten it as described in step 1.



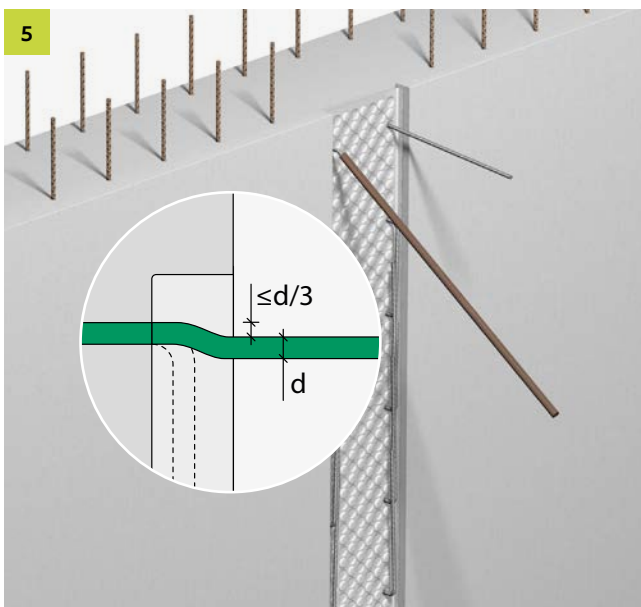
Finish erecting the formwork and finish the concreting



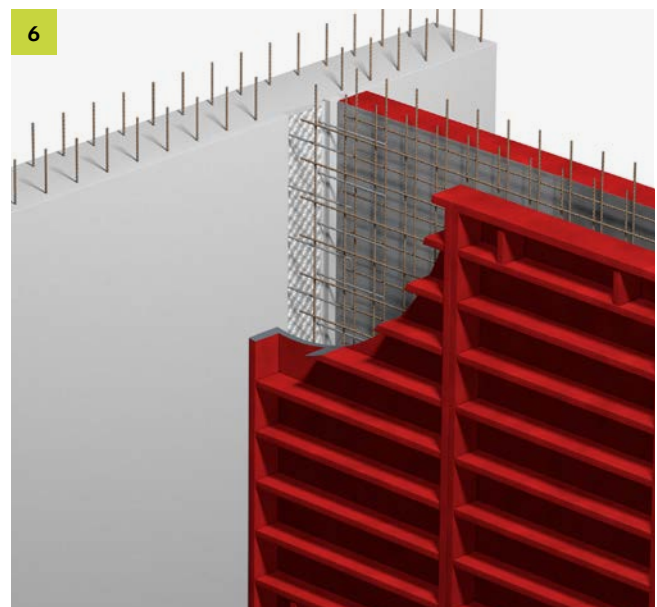
After the first concreted section, remove the covers and the polystyrene stopper strips at the ends. Never apply formwork release oil to the casing remaining in the joint. Remove any unwanted matter (e.g. laitance) before the concreting stage.



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.

1. Building project

Company _____

Contact _____

Tel. _____ Fax _____

E-mail _____

Adress _____

Country _____ Company stamp _____

☐ Costing _____

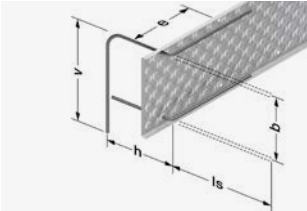
☐ Requirement Construction company _____

For a clear type definition, please use the type overview and designation on the following page.

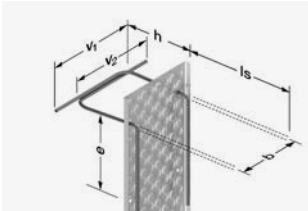
[illegible]

Type overview

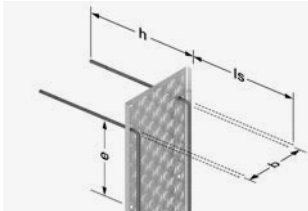
Double-row



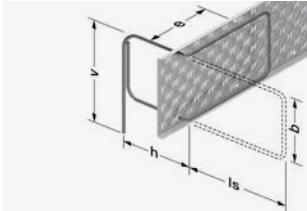
FERBOX® B01



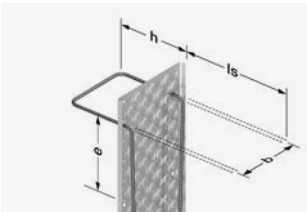
FERBOX® B02



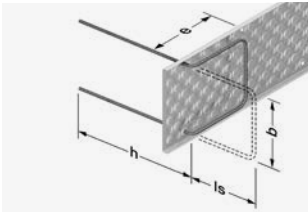
FERBOX® B03



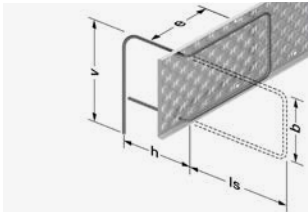
FERBOX® B04/B04S



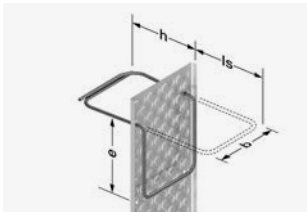
FERBOX® B05



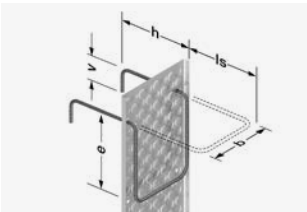
FERBOX® B06/B06S



FERBOX® B07/B07S

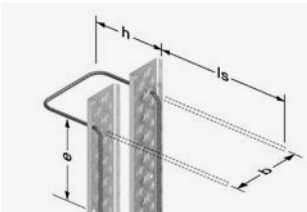


FERBOX® B08/B08S

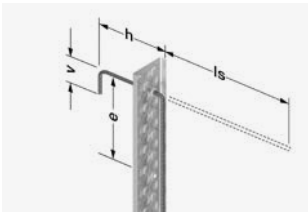


FERBOX® B09/B09S

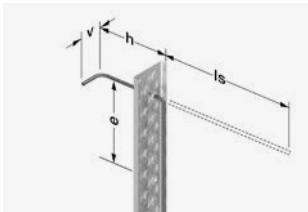
Single-row



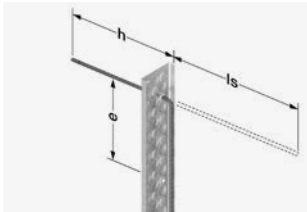
FERBOX® EE



FERBOX® E01



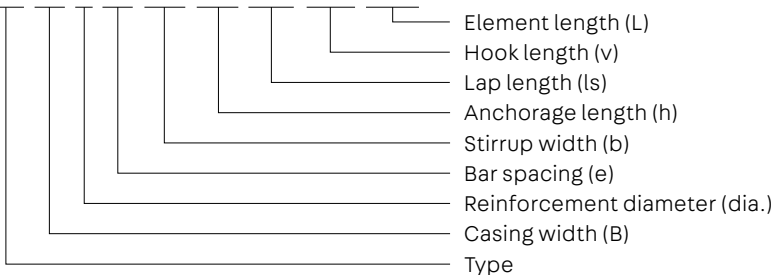
FERBOX® E02



FERBOX® E03

Type designation

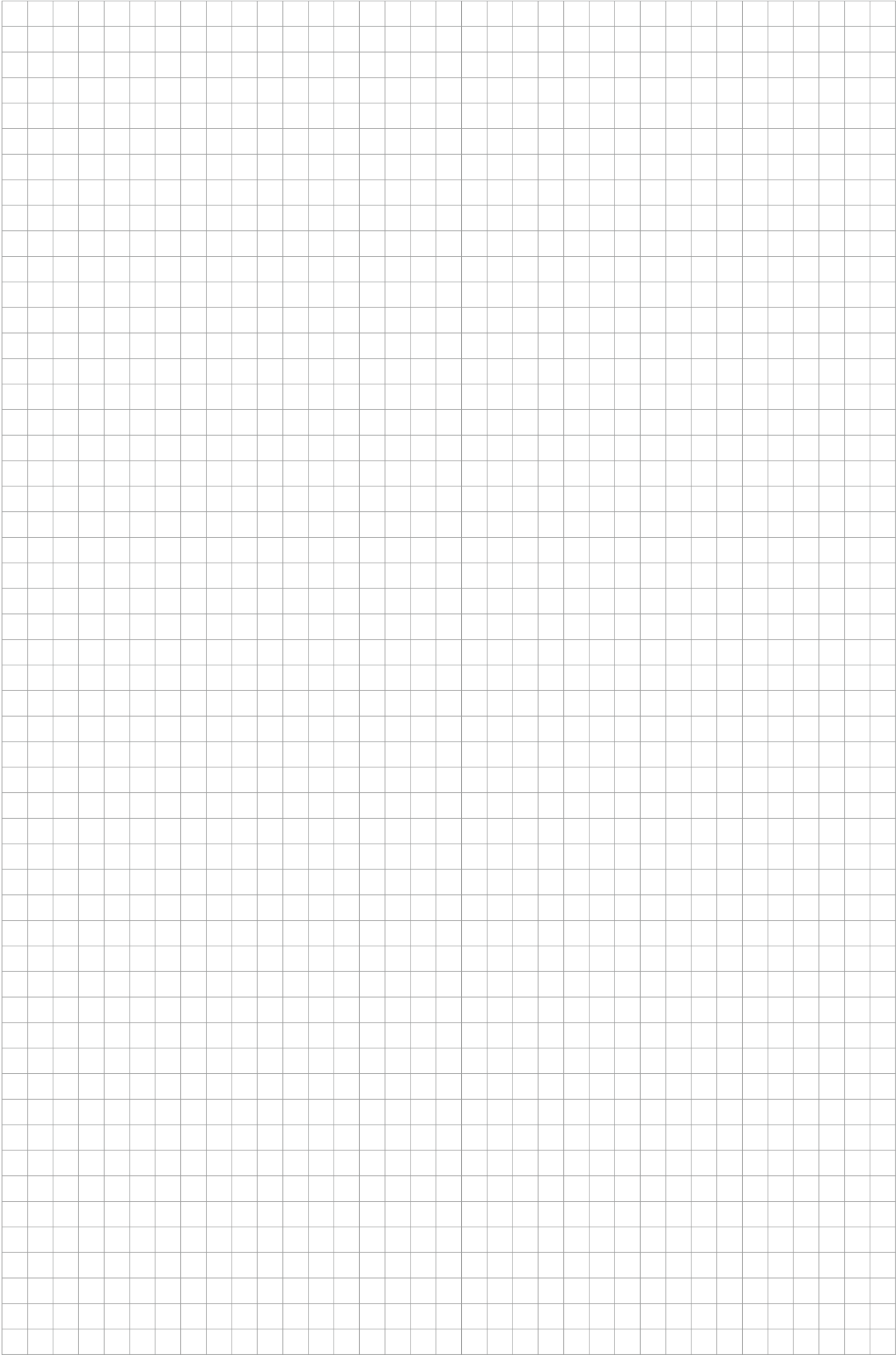
FERBOX® B07 160 10 150 b135 h170 ls150 v250 L1200



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.





Content subject to technical change without notice. Errors and omissions excepted. This document may not be reprinted or electronically reproduced without our prior written permission. This document supersedes all previous documentation; its publication renders all previous documentation invalid.

PohlCon GmbH

Nobelstr. 51
12057 Berlin
Germany

T +49 30 68 283-04
F +49 30 68 283-383

www.pohlcon.com