Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

# European Technical Assessment ETA-12/0555 of 27 June 2018

English translation prepared by DIBt - Original version in German language

**General Part**

| | |
|---|---|
| Technical Assessment Body issuing the European Technical Assessment: | Deutsches Institut für Bautechnik |
| Trade name of the construction product | Rebar connection with fischer injection mortar FIS HF |
| Product family to which the construction product belongs | Systems for post-installed rebar connections with mortar |
| Manufacturer | fischerwerke GmbH & Co. KG<br>Otto-Hahn-Straße 15<br>79211 Denzlingen<br>DEUTSCHLAND |
| Manufacturing plant | fischerwerke |
| This European Technical Assessment contains | 20 pages including 3 annexes which form an integral part of this assessment |
| This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of | EAD 330087-00-0601 |

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## Specific Part

### 1 Technical description of the product

The subject of this European Technical Assessment is the post-installed connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the "Rebar connection with fischer injection mortar FIS HF" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter $\phi$ from 8 to 28 mm or the rebar anchor FRA from sizes 12, 16 and 20 according to Annex A and injection mortar FIS HF are used for rebar connections. The rebar is placed into a drilled hole filled with injection mortar and is anchored via the bond between rebar, injection mortar and concrete.

The product description is given in Annex A.

### 2 Specification of the intended use in accordance with the applicable European assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the rebar connection of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

### 3 Performance of the product and references to the methods used for its assessment

### 3.1 Mechanical resistance and stability (BWR 1)

| Essential characteristic | Performance |
|---|---|
| Characteristic resistance under static and quasi-static loading | See Annex C 1 |

### 3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Class A1 |
| Resistance to fire | No performance assessed |

### 4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with European Assessment Document EAD No. 330087-00-0601, the applicable European legal act is: [96/582/EC].

The system(s) to be applied is (are): 1

## 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 27 June 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

*beglaubigt:*
Baderschneider

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## Installation anchor

**Figure A1:**
Overlap joint with existing reinforcement for rebar connections of slabs and beams

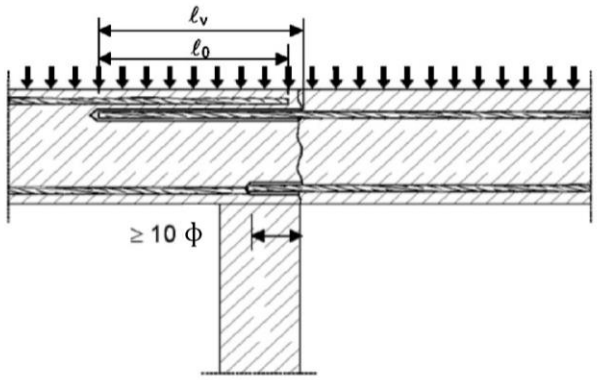



**Figure A2:**
Overlap joint with existing reinforcement at a foundation of a column or wall where the rebars are stressed

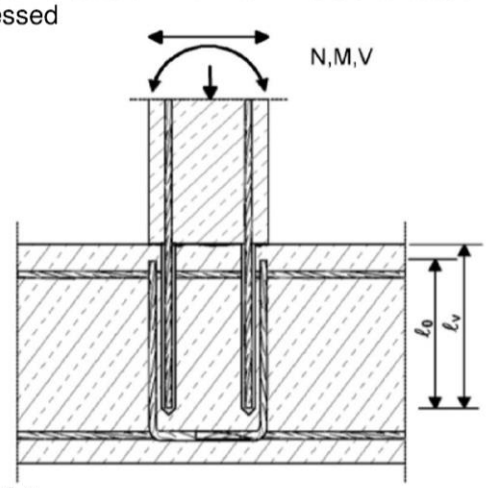



**Figure A3:**
End anchoring of slabs of beams (e.g. designed as simply supported)

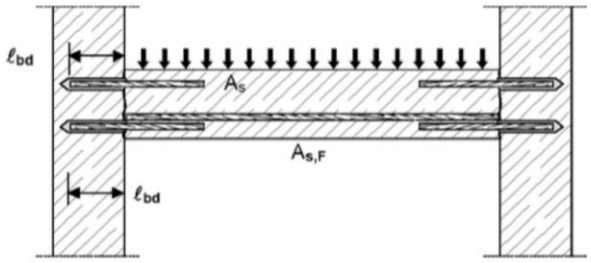



**Figure A4:**
Rebar connection for stressed primarily in compression

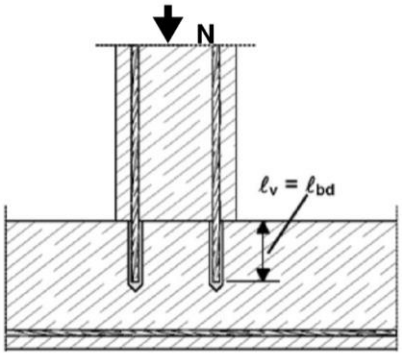
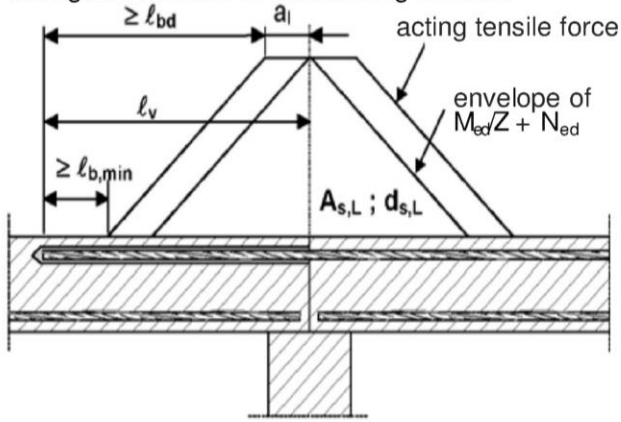



**Figure A5:**
Anchoring of reinforcement to cover the enveloped line of acting tensile force in the bending member




Note to **Figure A1** to **A5**

In the Figures no traverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1: 2004+AC:2010.

Preparing of joints according to **Annex B 2**

| | |
|---|---|
| **Rebar connection with fischer injection mortar FIS HF** | |
| **Product description**<br>Installed condition and examples of use for rebars | **Annex A 1** |

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**Installation anchor**

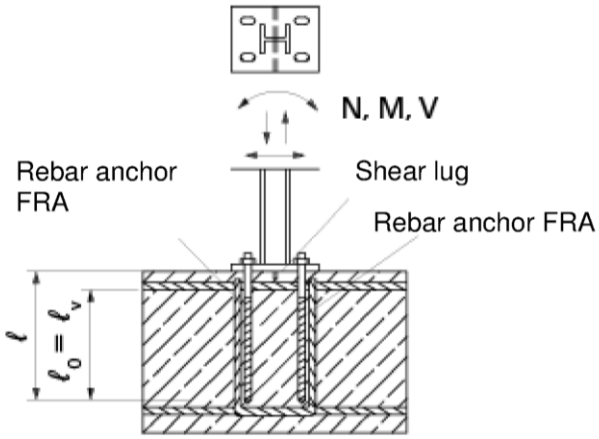


**Figure A6:** Lap to a foundation of a column under bending.

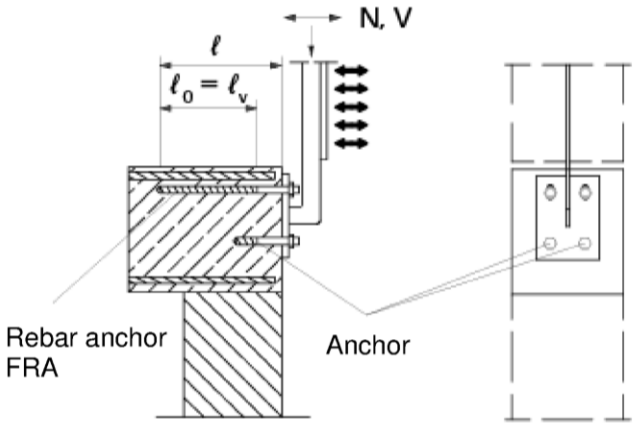


**Figure A7:** Lap of the anchoring of guardrail posts.
In the anchor plate, the drill holes for the rebar anchors FRA have to be designed as elongated holes with axial direction to the shear force.

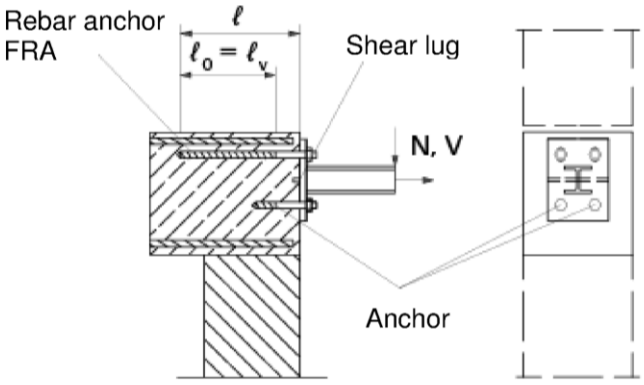


**Figure A8:** Lap of the anchoring of cantilevered building components.
In the anchor plate, the drill holes for the rebar anchors FRA have to be designed as elongated holes with axial direction to the

The required transverse reinforcement acc. to EN 1992-1-1:2004+AC:2010 is not shown in the figures. **The rebar anchor FRA may be only used for axial tensile force**. The tensile force must transferred by lap to the existing reinforcement of the building. The transfer of the shear force has to be ensured by suitable measure, e.g. by means of shear force or anchors with European Technical Approval/Assessment (ETA)

| **Rebar connection with fischer injection mortar FIS HF** | **Annex A 2** |
|---|---|
| **Product description**<br>Installed condition and examples of use for rebar anchor FRA | |

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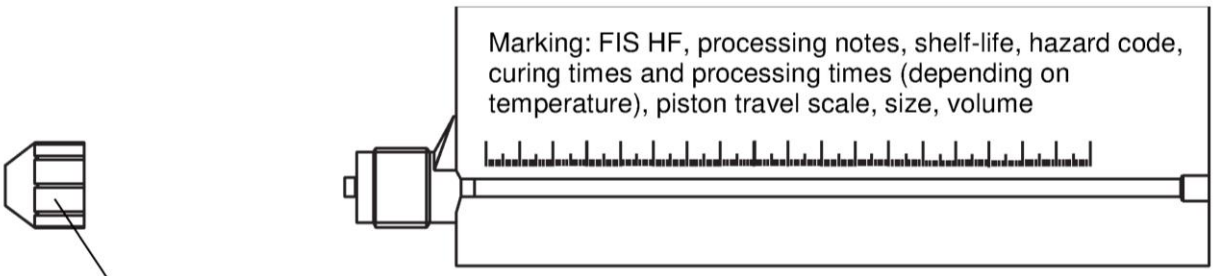
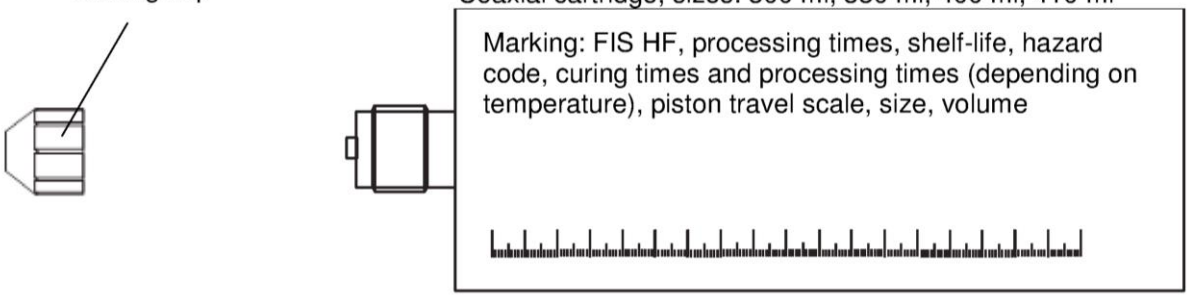
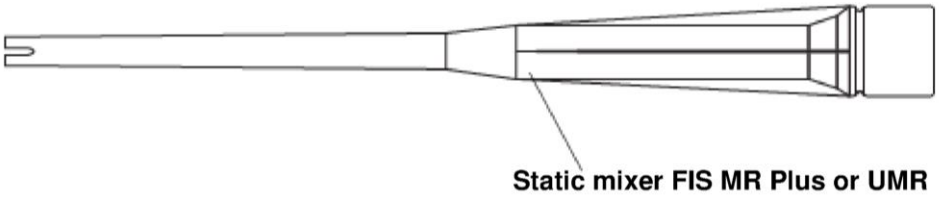
## Injection cartridge fischer FIS HF

Shuttle cartridge, sizes: 345 ml, 360 ml, 390 ml, 550 ml,1500 ml



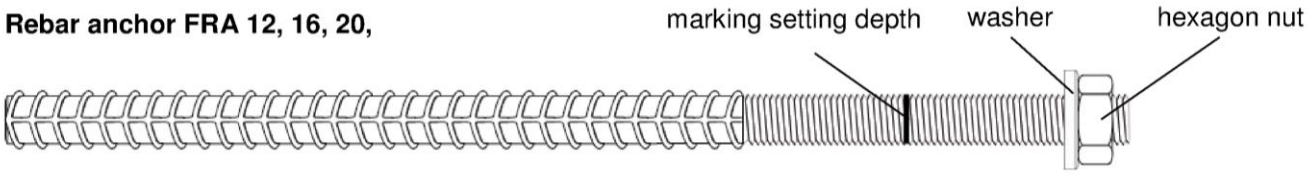

Coaxial cartridge, sizes: 300 ml, 380 ml, 400 ml, 410 ml



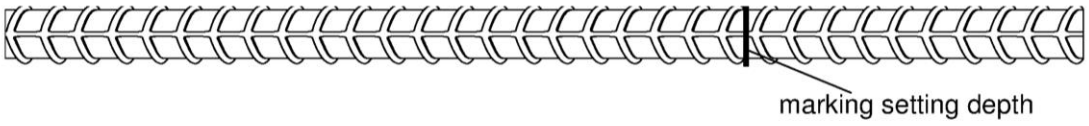



**Static mixer FIS MR Plus or UMR**

**Rebar anchor FRA 12, 16, 20,**




**Reinforcing bar (rebar) ϕ 8, ϕ 10, ϕ 12, ϕ 14, ϕ 16, ϕ 20, ϕ 25, ϕ 28**




| **Rebar connection with fischer injection mortar FIS HF** | **Annex A 3** |
|---|---|
| **Product description**<br>Injection mortar; rebar anchor FRA; reinforcing bar | |

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**Figure A9: Properties of reinforcing bars (rebar)**

- The minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- The maximum outer rebar diameter over the rips shall be:
  - The nominal diameter of the rip $\phi + 2 * h$ ($h \leq 0{,}07 * \phi$)
  - ($\phi$: Nominal diameter of the bar; h: rip height of the bar)

**Table A1: Materials of rebars**

| Designation | Reinforcing bar (rebar) |
|---|---|
| Reinforcing bar<br>EN 1992-1-1:2004+AC:2010, Annex C | Bars and de-coiled rods class B or C with<br>$f_{yk}$ and k according to NDP or NCL of EN 1992-1-1/NA<br>$f_{uk} = f_{tk} = k \cdot f_{yk}$ |



**Rebar connection with fischer injection mortar FIS HF**

**Product description**
Properties and materials of rebars

**Annex A 4**

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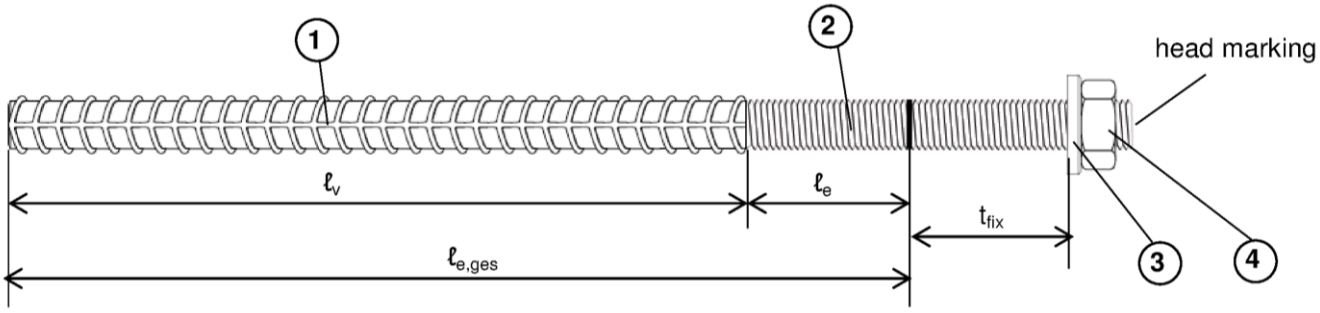
**Figure A10:** Properties of fischer rebar anchors FRA




Head marking e.g.: FRA (for stainless steel)

FRA C (for high corrosion-resistant steel C)

**Table A2: Installation parameters for fischer rebar anchors FRA**

| **Threaded diameter** | | | | **M12** | | **M16** | **M20** |
|---|---|---|---|---|---|---|---|
| Nominal diameter of the bar | | $\phi$ | [mm] | 12 | | 16 | 20 |
| Width across flat | | SW | [mm] | 19 | | 24 | 30 |
| Nominal drill bit diameter | | $d_0$ | [mm] | 14[1)] | 16 | 10 | 25 |
| Drill hole depth($h_0 = \ell_{e,ges}$) | | $\ell_{e,ges}$ | [mm] | $\ell_v + \ell_e$ | | | |
| Effective embedment depth | | $\ell_v$ | [mm] | acc. to static calculation | | | |
| Distance concrete surface to welded join | | $\ell_e$ | [mm] | 100 | | | |
| Diameter of clearance hole in the fixture | Pre-positioned ≤ $d_f$ | | [mm] | 14 | | 18 | 22 |
| | Push through ≤ $d_f$ | | [mm] | 18 | | 22 | 26 |
| Minimum thickness of concrete member | | $h_{min}$ | [mm] | $h_0$+30 ≥ 100 | | $h_0 + 2d_0$ | |
| Maximum torque moment | | $T_{inst,max}$ | [Nm] | 50 | | 100 | 150 |

[1)] Both drill bit diameters can be used

**Table A3: Materials of fischer rebar anchors FRA**

| Part | Description | Materials | |
|---|---|---|---|
| | | FRA | FRA C |
| 1 | Reinforcing bar | Class B according to NDP or NCL acc. to EN 1992-1-1/NA;$f_{uk} = f_{tk} = k \cdot f_{yk}$ | |
| 2 | Round bar with partial or full thread | Stainless steel acc. to EN 10088-1:2014 | High corrosion-resistant steel acc. to EN 10088-1:2014 |
| 3 | Washer | Stainless steel acc. to EN 10088-1:2014 | High corrosion-resistant steel acc. to EN 10088-1:2014 |
| 4 | Hexagon nut | Stainless steel acc. to EN 10088-1:2014 Strength class 80; acc. to EN ISO 3506:2009 | High corrosion-resistant steel acc. to EN 10088-1:2014 Strength class 80; acc. to EN ISO 3506:2009 |

**Rebar connection with fischer injection mortar FIS HF**

**Product description**
Properties and materials of fischer rebar anchors FRA

**Annex A 5**

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## Specifications of intended use

**Anchorages subject to:**

- Static and quasi-static loads

**Base materials:**

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000
- Strength classes C12/15 to C50/60 according to EN 206-1:2000
- Maximum chloride concrete of 0,40% (CL 0.40) related to the cement content according to EN 206-1:2000
- Non-carbonated concrete
  Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post-installed rebar connection with a diameter of $\phi$ + 60 mm prior to the installation of the new rebar
  The depth of concrete to be removed shall correspond to at least the minimum concrete cover in accordance with EN 1992-1-1 :2004+AC:2010
  The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions

**Temperature Range:**

- -40°C to +80°C (max. short term temperature +80°C and max long term temperature +50°C)

**Use conditions (Environmental conditions) for fischer rebar anchors FRA:**

- Structures subject to dry internal conditions (fischer rebar anchors FRA and FRA C)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions fischer rebar anchors FRA and FRA C)
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (fischer rebar anchors FRA C)
  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used)

**Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted
- Design according to EN 1992-1-1:2004+AC:2010 and Annex B 2 and Annex B3
- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing

**Installation:**

- Dry or wet concrete
- It must not be installed in flooded holes
- Overhead installation allowed
- Hole drilling by hammerdrill or compressed airdrill mode
- The installation of post-installed rebar respectively fischer rebar anchor FRA shall be done only by suitable trained installer and under Supervision on site; the conditions under which an installer may be considered as suitable trained and the conditions for Supervision on site are up to the Member States in which the installation is done
- Check the position of the existing rebars (if the position of existing rebars is not known, it shall be determined using a rebar detector suitable for this purpose as well as on the basis of the construction documentation and then marked on the building component for the overlap joint)

| **Rebar connection with fischer injection mortar FIS HF** | **Annex B 1** |
|---|---|
| **Intended use**<br>Specifications | |

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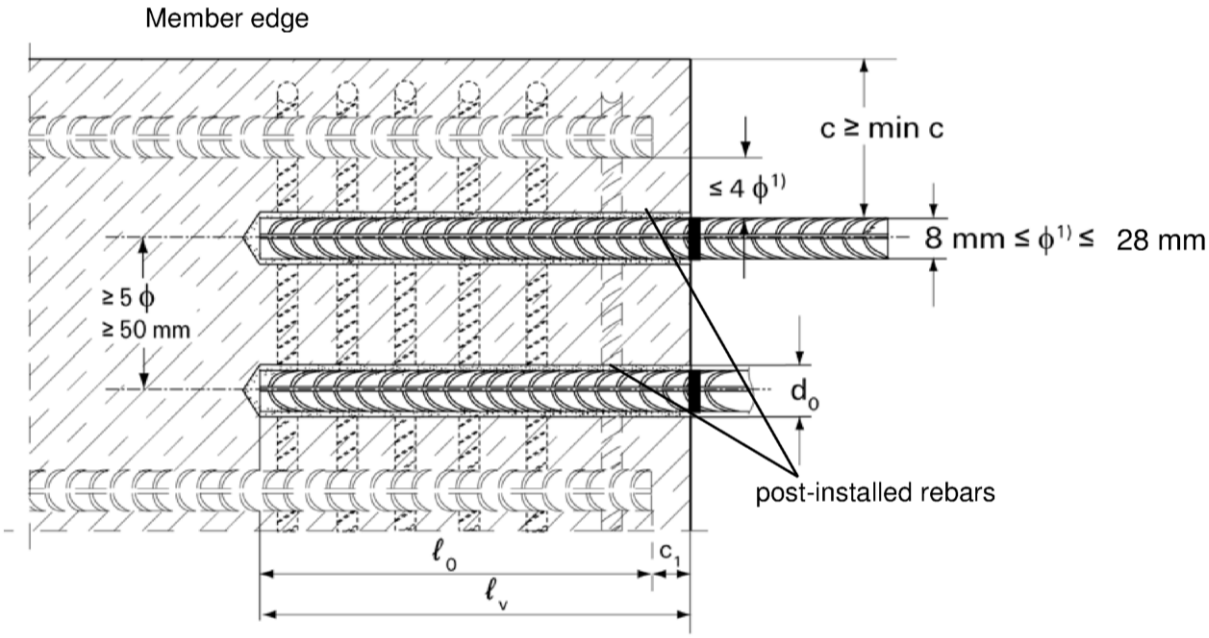
## Figure B1: General construction rules for post-installed rebars

- Only tension forces in the axis of the rebar may be transmitted
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1:2004+AC:2010
- The joints for concreting must be roughened to at least such an extent that aggregate protrude




1) If the clear distance between lapped bars exceeds 4 ϕ then the lap length shall be increased by the difference between the clear bar distance and 4 ϕ

| | |
|---|---|
| c | concrete cover of post-installed rebar |
| $c_1$ | concrete cover at end-face of existing rebar |
| min c | minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2 |
| ϕ | nominal diameter of the bar |
| $\ell_0$ | lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3 |
| $\ell_v$ | effective embedment depth, $\geq \ell_0 + c_1$ |
| $d_0$ | nominal drill bit diameter, see Annex B 5 |

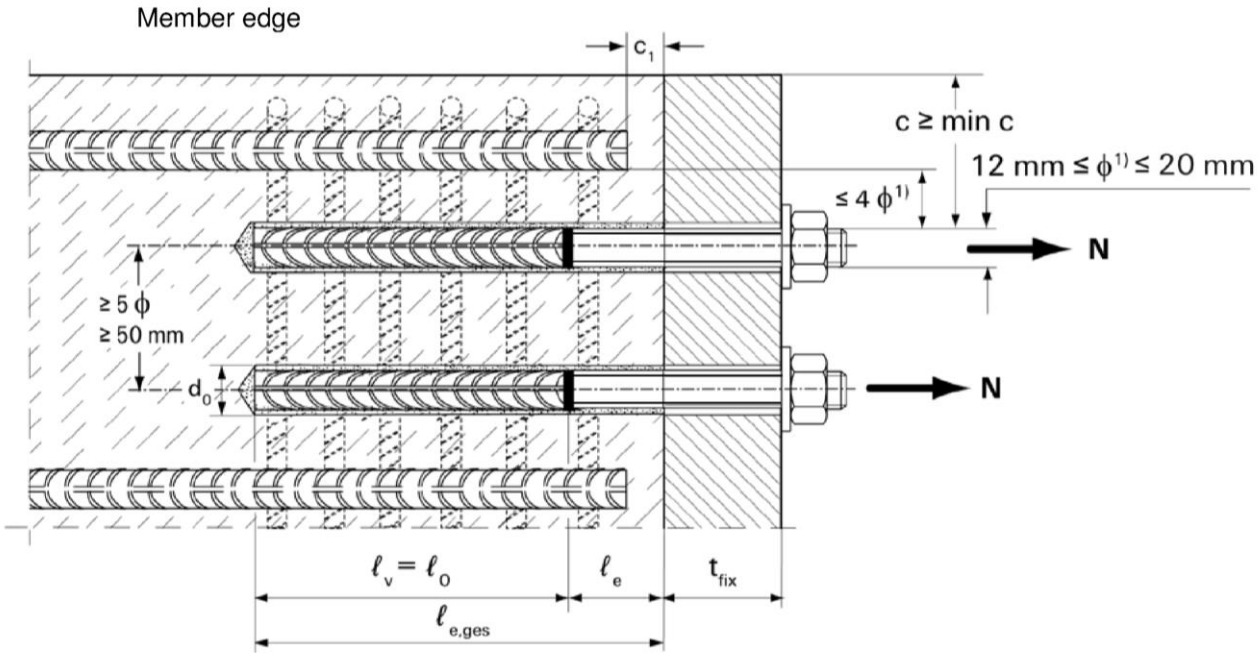
**Rebar connection with fischer injection mortar FIS HF**

**Intended use**
General construction rules for post-installed rebars

**Annex B 2**

## Figure B2: General construction rules for post-installed rebar anchors FRA

- Only tension forces in the axis of the FRA may be transmitted
- The tension force must be transferred via an overlap joint to the reinforcement in the building part.
- The transmission of the shear load shall be ensured by appropriate additional measures, e.g. by shear lugs or by anchors with an European Technical Assessment (ETA).
- In the anchor plate, the holes for the tension anchor shall be executed as elongated holes with the axis in the direction of the shear force.




[1)] If the clear distance between lapped bars exceeds 4 ϕ then the lap length shall be increased by the difference between the clear bar distance and 4 ϕ

| | |
|---|---|
| c | concrete cover of post-installed FRA |
| $c_1$ | concrete cover at end-face of existing rebar |
| min c | minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2 |
| ϕ | nominal diameter of the bar |
| $\ell_0$ | lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3 |
| $\ell_{e,ges}$ | overall embedment depth, $\geq \ell_v + \ell_e$ |
| $\ell_e$ | length of the bonded in threaded part |
| $d_0$ | nominal drill bit diameter, see Annex B 5 |
| $t_{fix}$ | thickness of the fixture |
| $\ell_v$ | effective embedment depth |



**Rebar connection with fischer injection mortar FIS HF**

**Intended use**
General construction rules for post-installed rebar anchors FRA

**Annex B 3**

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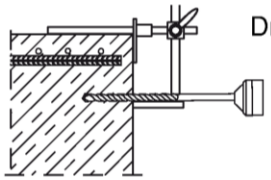
**Table B1:**
**Minimum concrete cover c[1] depending of the drilling method and the drilling tolerance**




| Drilling method | Nominal diameter of the bar ϕ [mm] | Minimum concrete cover min c | |
|---|---|---|---|
| | | Without drilling aid [mm] | With drilling aid [mm] |
| Hammer drilling | ≤ 20 | 30 mm + 0,06 $\ell_v$ | 30 mm + 0,02 $\ell_v \geq 2\ \phi$ |
| | ≥ 25 | 40 mm + 0,06 $\ell_v$ | 40 mm + 0,02 $\ell_v \geq 2\ \phi$ |
| Compressed air drilling | ≤ 20 | 50 mm + 0,08 $\ell_v$ | 50 mm + 0,02 $\ell_v$ |
| | ≥ 25 | 60 mm + 0,08 $\ell_v$ | 60 mm + 0,02 $\ell_v$ |

[1] See Annex B2, Figure B1 and Annex B3, Figure B2
Note: The minimum concrete cover as specified in EN 1992-1-1:2004+AC:2010 must be observed

**Table B2:**
**Dispensers and cartridge sizes correspondending to maximum embedment depth $\ell_{v,max}$**

| Rebar / FRA | Manuel dispenser | Accu and pneumatic dispenser (smal) | pneumatic dispenser (great) |
|---|---|---|---|
| | Cartridge size | | |
| | < 500 ml; | | >500 ml |
| ϕ [mm] | $\ell_{v,max}$ / $\ell_{e,ges,max}$ [mm] | $\ell_{v,max}$ / $\ell_{e,ges,max}$ [mm] | |
| 8 | 1000 | 1000 | 1800 |
| 10 | | | |
| 12 / FRA 12 | | 1200 | |
| 14 | | | |
| 16 / FRA 16 | | 1500 | |
| 20 / FRA 20 | 700 | 1300 | |
| 25 | | 1000 | 2000 |
| 28 | 500 | 700 | |

**Table B3: Working times $t_{work}$ and curing times $t_{cure}$**

| Temperature in the anchorage base [°C] | Maximum working times [1] $t_{work}$ [minutes] | Minimum curing times [2] $t_{cure}$ [minutes] |
|---|---|---|
| | **FIS HF** | **FIS HF** |
| >±0 to +5 | 13 [3] | 180 |
| >+5 to +10 | 9 [3] | 90 |
| >+10 to +20 | 5 | 60 |
| >+20 to +30 | 4 | 45 |
| >+30 to +40 | 2 [4] | 35 |

[1] Maximum time from the beginning of the injection to rebar / FRA setting and positioning
[2] For wet concrete the curing time must be doubled
[3] If the temperature in the concrete falls below 0°C the cartridge has to be warmed up to +15°C.
[4] If temperatures exceed 30 °C, cool the cartridge to +15°C…+20°C



| **Rebar connection with fischer injection mortar FIS HF** | **Annex B 4** |
|---|---|
| **Intended use**<br>Minimum concrete cover/ Maximum embedment depth per dispenser and cartridge size/ Working times and curing times | |

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**Table B4:**
**Installation tools for drilling and cleaning the bore hole and injection of the mortar**

| Rebar / FRA ϕ [mm] | Drilling and cleaning | | | | | | | Injection | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nominal drill bit diameter $d_0$ [mm] | | Diameter of cutting edge $d_{cut}$ [mm] | | Steel brush diameter $d_b$ [mm] | | Cleaning nozzle [mm] | Extension tube [mm] | Injection adapter [colour] | |
| 8 | 10[1)] | 12[1)] | ≤ 10,5 | ≤ 12,5 | 11,0 | 12,5 | 11 | 9 | - | nature |
| 10 | 12[1)] | 14[1)] | ≤ 12,5 | ≤ 14,5 | 12,5 | 15 | | | nature | blue |
| 12 / FRA 12 | 14[1)] | 16[1)] | ≤ 14,5 | ≤ 16,5 | 15 | 17 | 15 | | blue | red |
| 14 | 18 | | ≤ 18,5 | | 19 | | | 9 or 15 | yellow | |
| 16 / FRA 16 | 20 | | ≤ 20,55 | | 25 | | 19 | | green | |
| 20 / FRA 20 | 25 | | ≤ 25,55 | | 26,5 | | | | black | |
| 25 | 30 | | ≤ 30,55 | | 32 | | 28 | | grey | |
| 28 | 35 | | ≤ 35,70 | | 37 | | | | brown | |

[1)] Both drill bit diameters can be used



**Rebar connection with fischer injection mortar FIS HF**

**Intended use**
Installation tools for drilling and cleaning the bore hole and injection installation of the mortar

**Annex B 5**

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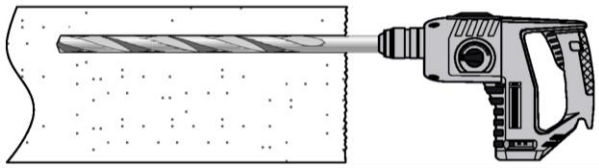
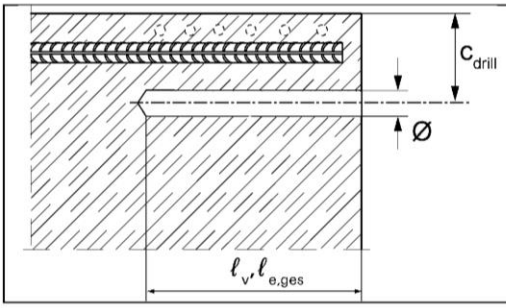
| **Safety regulations**  | Review the Material Safety Data Sheet (SDS) before use for proper and safe handling!<br>Wear well-fitting protective goggles and protective gloves when working with mortar fischer FIS HF<br>Important: Observe the instructions for use provided with each cartridge. |
|---|---|

## 1. Drill hole

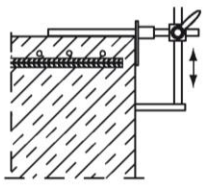
Note: Before drilling, remove carbonized concrete; clean contact areas (see Annex B 1)
In case of aborted drill hole the drill hole shall be filled with mortar.

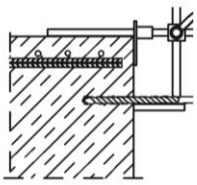


Drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode or a compressed air drill.
Drill bit sizes see Table B4.




Measure and control concrete cover c
$c_{drill} = c + \phi/2$
Drill parallel to surface edge and to existing rebar
Where applicable use fischer drilling aid.





For holes $\ell_v$ > 20 cm use drilling aid.
Three different options can be considered:

A) fischer drilling aid
B) Slat or spirit level
C) Visual check

| **Rebar connection with fischer injection mortar FIS HF** | **Annex B 6** |
|---|---|
| **Intended use**<br>Installation instruction part 1 | |

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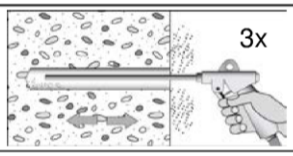
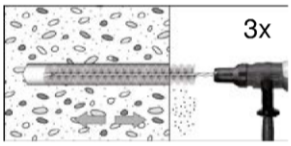
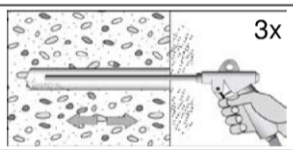
## 2.1 Compressed air cleaning

| | |
|---|---|
|   | **Blowing**<br>three times from the back of the hole with oil-free compressed air (min. 6 bar) until return air stream is free of noticeable dust. |
|   | **Brushing (with power drill)**<br>three times with the specified brush size (brush diameter >: borehole diameter) by inserting the round steel brush to the back of the hole in a twisting motion. The brush shall produce natural resistance as it enters the anchor hole. If this is not the case, please use a new brush or a brush with a larger diameter.<br>For appropriate brushes see Table B4. |
|   | **Blowing**<br>three times from the back of the hole with oil-free compressed air (min. 6 bar) until return air stream is free of noticeable dust. |



| | |
|---|---|
| **Rebar connection with fischer injection mortar FIS HF** | **Annex B 7** |
| **Intended use**<br>Installation instruction part 2 | |

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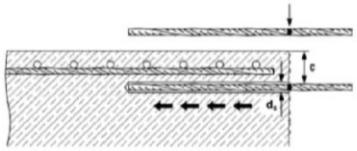
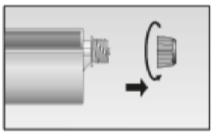
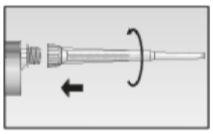
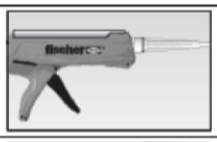
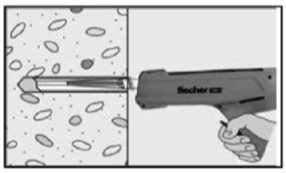
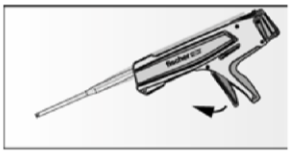
## 3. Preparation of the rebar or rebar anchor FRA and the cartridge

| | |
|---|---|
|  | Before use, make asure that the rebar or the rebar anchor FRA is dry and free of oil or other residue.<br>Mark the embedment depth on the rebar (e.g. with tape) $\ell_v$<br>Insert rebar in borehole, to verify hole and setting depth $\ell_v$ resp. $\ell_{e,ges}$ |
| **Injection system preparation** | |
|  | No. 1: Twist off the sealing cap |
|  | No. 2: Twist on the static mixer (the spiral in the static mixer must be clearly visible). |
|  | No. 3: Place the cartridge into a suitable dispenser. |
|  | No. 4: Press out approximately 10 cm of mortar until the resin is permanently grey in colour. mortar which is not grey in colour will not cure and must be disposed of. |

## 4. Inject mortar into borehole
## 4.1 borehole depth ≤ 250 mm:

| | |
|---|---|
|  | Inject the mortar from the back of the hole towards the front and slowly withdraw the mixing nozzle step by step after each trigger pull.<br>Fill approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length. |
|  | After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle. |



| | |
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| **Rebar connection with fischer injection mortar FIS HF** | **Annex B 8** |
| **Intended use**<br>Installation instruction part 3 | |

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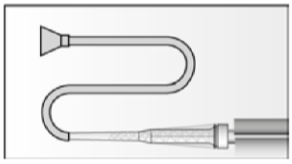
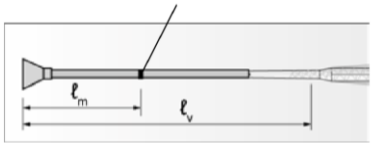
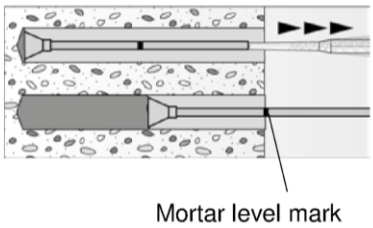
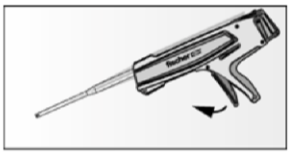
## 4.2 borehole depth > 250 mm:

| | |
|---|---|
|  | Assemble mixing nozzle, extension tube and injection adapter (see Table B 4) |
|   | Mark the required mortar level $\ell_m$ and embedment depth $\ell_v$ resp. $\ell_{e,ges}$ with tape or marker on the injection extension tube.<br>a) Estimation:<br>$l_m = \frac{1}{3} * l_v \; resp. \; l_m = \frac{1}{3} * l_{e,ges}$<br>b) Precise formula for optimum mortar volume:<br>$l_m = l_v \; resp. \; l_{e,ges} \left( (1{,}2 * \frac{d_s^2}{d_0^2} - 0{,}2) \right)$ [mm] |
|   | Insert injection adapter to back of the hole. Begin injection allowing the pressure of the injected adhesive mortar to push the injection adapter towards the front of the hole.<br>Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length.<br>When using an injection adapter continue injection until the mortar level mark $\ell_m$ becomes visible.<br>Maximum embedment depth see Table B 2 |
|  | After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle. |



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| **Rebar connection with fischer injection mortar FIS HF** | **Annex B 9** |
| **Intended use**<br>Installation instruction part 4 | |

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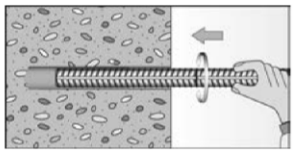
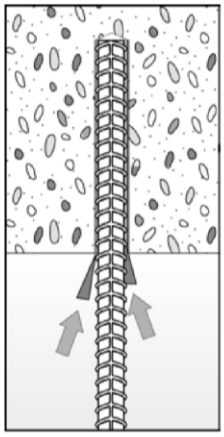
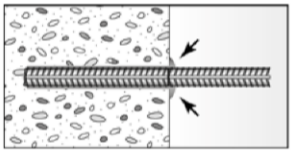
## 4.3 Insert rebar or rebar anchor FRA

| | |
|---|---|
|  | For each installation insert the rebar / rebar anchor FRA slowly twisted into the borehole until the embedment mark is at the concrete surface level. |
|  | For overhead installation support rebar / rebar anchor FRA and secure it from falling till mortar started to harden, e.g. using wedges. |
|  | After installing the rebar / rebar anchor FRA the annular gap must be completely filled with mortar.<br><br>Proper installation<br>• Desired anchoring embedment is reached $\ell_v$: embedment mark at concrete surface.<br>• Excess mortar flows out of the borehole after the rebar has been fully inserted until the embedment mark. |
|  | Observe the working time "$t_{work}$" (see Table B3), which varies according to temperature of base material. Minor adjustments to the rebar / rebar anchor FRA position may be performed during the working time |
| | Full load may be applied only after the curing time "$t_{cure}$" has elapsed (see Table B 3) |

**Rebar connection with fischer injection mortar FIS HF**

**Intended use**
Installation instruction part 5

**Annex B 10**

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## Minimum anchorage length and minimum lap length

The minimum anchorage length $\ell_{b,min}$ and the minimum lap length $\ell_{o,min}$ according to EN 1992-1-1:2004+AC:2010 ($\ell_{b,min}$ acc. to Eq. 8.6 and Eq. 8.7 and $\ell_{o,min}$ acc. to Eq. 8.11) shall be multiply by an amplification factor $\alpha_{lb}$ according to Table C1.

### Table C1: Amplification factor $\alpha_{lb}$ related to concrete class and drilling method

| Concrete class | Drilling method | Amplification factor $\alpha_{lb}$ |
|---|---|---|
| C12/15 to C50/60 | Hammer drilling and compressed air drilling | 1,0 |

### Table C2: Reduction factor $k_b$ for all drilling methods

| Rebar / FRA | Reduction factor $k_b$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Concrete class | | | | | | | | |
| ϕ [mm] | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 bis 28<br>FRA M10 to M20 | 1,0 | | | | | | | | |

### Table C3: Design values of the ultimate bond resistance $f_{bd,PIR}$ in N/mm² for all drilling methods and for good bond conditions

$f_{bd,PIR} = k_b \cdot f_{bd}$

$f_{bd}$: Design value of the ultimate bond stress in N/mm² considering the concrete classes and the rebar diameter according to EN 1992-1-1: 2004+AC:2010
(for all other bond conditions multiply the values by 0,7)
$k_b$: Reduction factor according to Table C2

| Rebar / FRA | Bond resistance $f_{bd,PIR}$ [N/mm²] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Concrete class | | | | | | | | |
| ϕ [mm] | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 bis 28<br>FRA M10 to M20 | 1,6 | 2,0 | 2,3 | 2,7 | 3,0 | 3,4 | 3,7 | 4,0 | 4,3 |



**Rebar connection with fischer injection mortar FIS HF**

**Performances**
Amplification factor $\alpha_{lb}$, Reduction factor $k_b$
Design values of ultimate bond resistance $f_{bd,PIR}$

**Annex C 1**