# DECLARAÇÃO DE DESEMPENHO

## DoP 0296

para sistema de injeção fischer FIS EB II (Argamassa para conexões de armaduras pós-instaladas) PT

1. Código de identificação único do produto-tipo: **DoP 0296**

2. Utilização(ões) prevista(s): **Sistema para conexão de armaduras pós-instaladas com argamassa para uso em betão, Ver anexoss, especialmente anexos B1-B12.**

3. Fabricante: **fischerwerke GmbH & Co. KG, Otto-Hahn-Straße 15, 79211 Denzlingen, Alemanha**

4. Representante autorizado: **–**

5. Sistema(s) de avaliação e verificação da regularidade do desempenho (AVCP): **1**

6. Documento de Avaliação Europeu: **EAD 330087-01-0601 Edition 06/2021**
   Avaliação Técnica Europeia: **ETA-21/0470; 2022-03-03**
   Organismo de Avaliação Técnica: **DIBt- Deutsches Institut für Bautechnik**
   Organismo(s) notificado(s): **2873 TU Darmstadt**

7. Desempenho(s) declarado(s):

**Resistência mecânica e estabilidade (BWR 1)**

**Resistência característica sob ação estática e quase estática:**

| | |
|---|---|
| Tensão de aderência de armaduras pós-instaladas: Anexo C2 | $f_{bd,PIR,100y}$= NPD |
| Fator de redução: Anexo C1 | $k_{b,100y}$= NPD |
| Fator de amplificação para comprimento mínimo de ancoragem: Anexo C1 | $\alpha_{lb,100y}$= NPD |
| Resistência característica à rotura do aço sob tensão de tração do varão: Anexo C1 | |

**Resistência característica sob ação sísmica:**

Tensão de aderência sob ação sísmica, fator de eficiência de aderência sísmico: NPD
Recobrimento mínimo sob ação sísmica: NPD

**Segurança em caso de incêndio (BWR 2)**

Reação ao fogo: Classe (A1)

**Resistência ao fogo:**

Tensão de aderência para temperaturas para armaduras pós-instaladas avaliadas para 50 anos: Anexo C3
Tensão de aderência para temperaturas para armaduras pós-instaladas avaliadas para 100 anos: NPD
Resistência característica à rotura do aço sob tensão de tração do varão sob exposição ao fogo: Anexo C2

8. Documentação Técnica Adequada e/ou Documentação Técnica Específica: **–**

O desempenho do produto identificado acima está em conformidade com o conjunto de desempenhos declarados. A presente declaração de desempenho é emitida, em conformidade com o Regulamento (UE) n.o 305/2011, sob a exclusiva responsabilidade do fabricante identificado acima.

Assinado por e em nome do fabricante por:

Dr.-Ing. Oliver Geibig, Diretor Administrativo de Unidades de Negócios e Engenharia

Jürgen Grün, Diretor Administrativo de Química e Qualidade

Tumlingen, 2022-03-17

Este DoP foi preparado em diferentes línguas. Em caso de litígio sobre a interpretação, a versão em inglês prevalecerá sempre.

O Anexo inclui informações voluntárias e complementares em inglês que excedem os requisitos legais (linguisticamente especificados).

**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 system FIS EB II" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter $\phi$ from 8 to 32 mm or the fischer rebar anchor FRA of sizes M12 to M24 according to Annex A and injection mortar FIS EB II are used for rebar connections. The steel element is placed into a drilled hole filled with injection mortar FIS EB II 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 rebar connection 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 connections 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 |
| Characteristic resistance under seismic loading | No performance assessed |

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

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Class A1 |
| Resistance to fire | See Annex C 2 to C 3 |

## 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. 330087-01-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

## Installation conditions and application examples reinforcing bars, part 1

**Figure A1.1:**

Overlap joint with existing reinforcement for rebar connections of slabs and beams

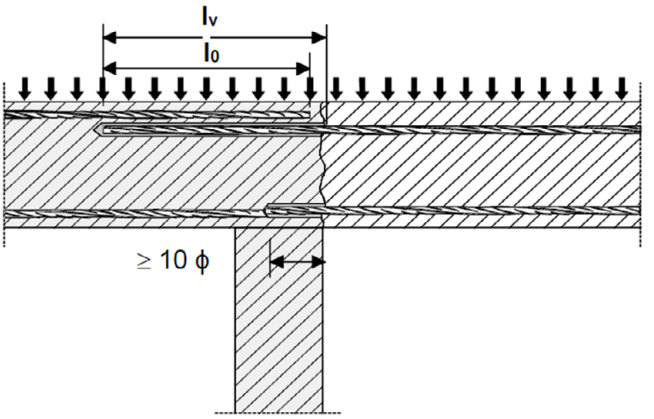



**Figure A1.2:**

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

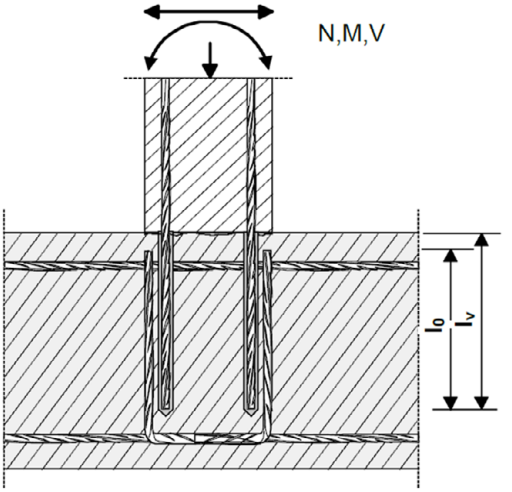
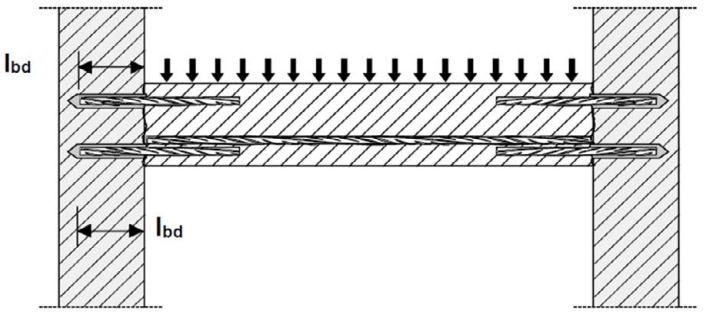



**Figure A1.3:**

End anchoring of slabs or beams (e.g. designed as simply supported)




Figures not to scale

## Installation conditions and application examples reinforcing bars, part 2

**Figure A2.1:**

Rebar connection for components stressed primarily in compression

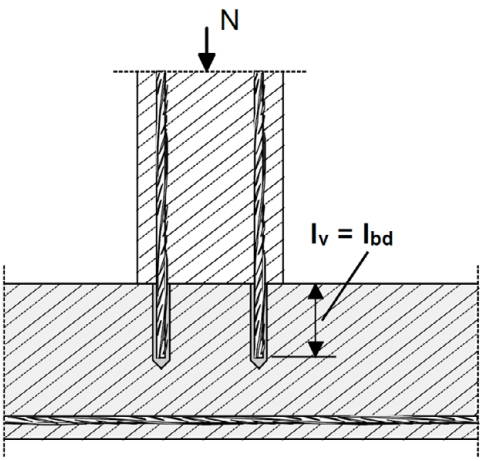
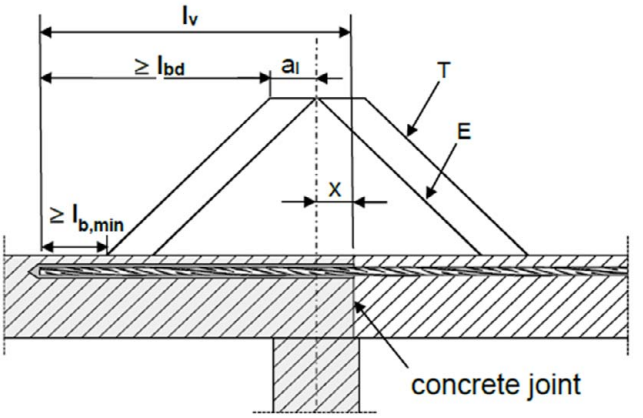



**Figure A2.2:**

Anchoring of reinforcement to cover the line of acting tensile force in the bending member




(only post-installed rebar is plotted)

Key to Figure

| | |
|---|---|
| T | Acting tensile force |
| E | Envelope of $M_{ed}$ / z + $N_{ed}$ (see EN 1992-1-1:2004+AC:2010) |
| x | Distance between the theoretical point of support and concrete joint |

Note to **figure A1.1** to **A1.3** and **figure A2.1** to **A2.2**

In the figures no traverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1:2004+AC:2010 shall be present.

The shear transfer between old and new concrete shall be designed according to EN 1992-1-1:2004+AC:2010 Preparation of joints according to **Annex B 3** of this document.

Figures not to scale

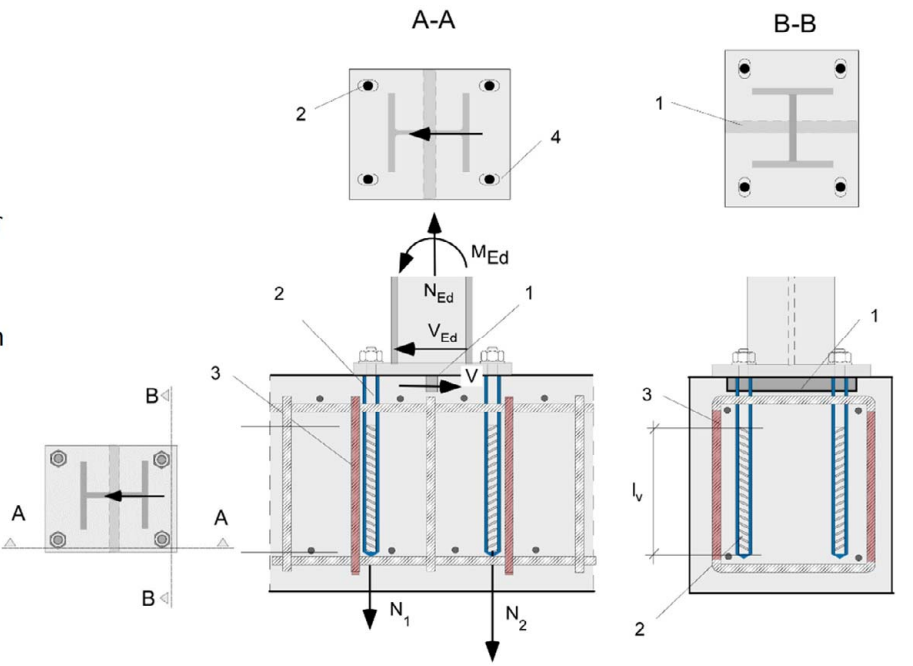



**Figure A3.1:**

Lap to a foundation of a column under bending.

1. Shear lug (or fastener loaded in shear)
2. fischer rebar anchor (tension only)
3. Existing stirrup / reinforcement for overlap (lap splice)
4. Slotted hole

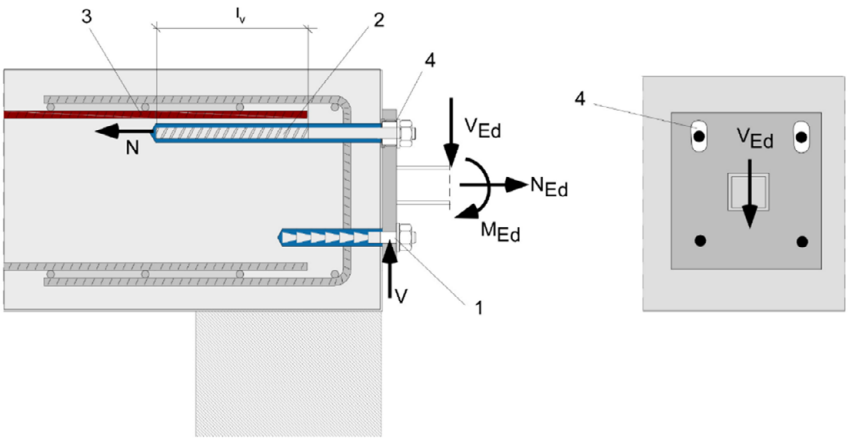



**Figure A3.2:**

Lap of the anchoring of guardrail posts or anchoring of cantilevered building components.
In the anchor plate, the drill holes for the fischer rebar anchors have to be designed as slotted holes with axial direction to the shear force.

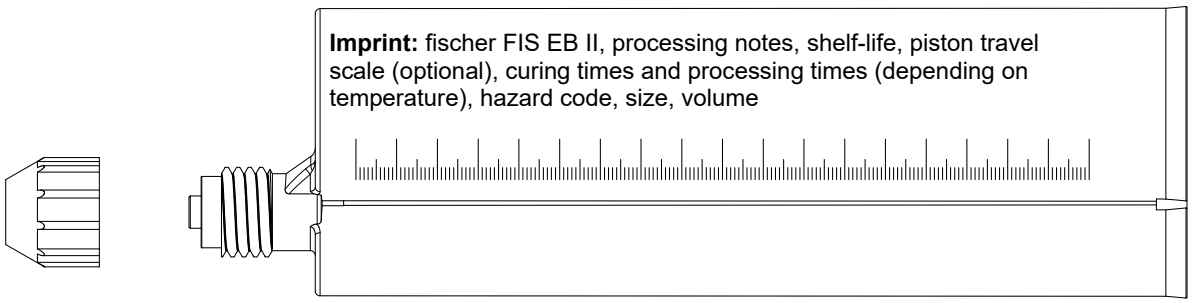
1. Fastener for shear load transfer
2. fischer rebar anchor (tension only)
3. Existing stirrup / reinforcement for overlap (lap splice)
4. Slotted hole

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

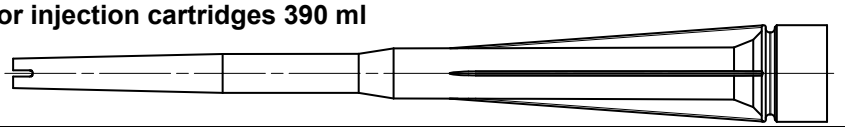
Figures not to scale

## Overview system components

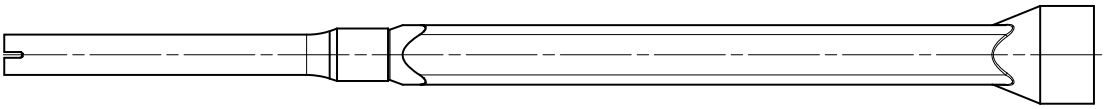
**Injection cartridge (shuttle cartridge) FIS EB II with sealing cap; Sizes: 390 ml, 585 ml, 1100 ml, 1500 ml**



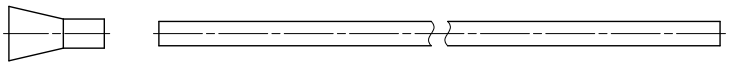

**Static mixer FIS MR Plus for injection cartridges 390 ml**



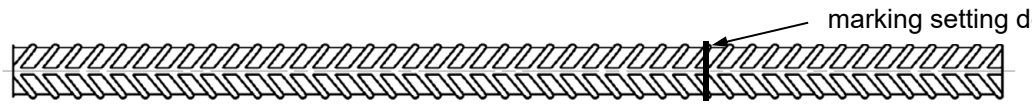
**Static mixer FIS UMR for injection cartridges ≥ 585 ml**



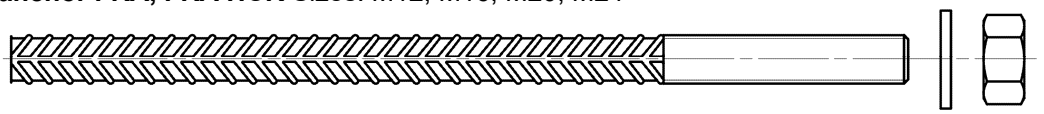
**Injection adapter and extension tube Ø 9 for static mixer FIS MR Plus;**
**Injection adapter and extension tube Ø 9 or Ø 15 for static mixer FIS UMR**



**Reinforcing bar (rebar)** Sizes: ϕ8, ϕ10, ϕ12, ϕ14, ϕ16, ϕ20, ϕ25, ϕ26, ϕ28, ϕ30, ϕ32

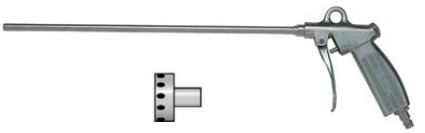



**fischer rebar anchor FRA, FRA HCR** Sizes: M12, M16, M20, M24



**Blow out pump AB G**


**Compressed-air cleaning tool ABP with compressed-air nozzle**



Figures not to scale

**Rebar connection with fischer injection system FIS EB II**

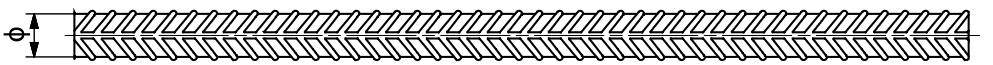
**Product description**
Overview system components: injection mortar, static mixer, injection adapter, reinforcing bar, fischer rebar anchor, blow out pump

**Annex A 4**

Appendix 5/22

## Properties of reinforcing bars (rebar)

**Figure A5.1:**



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

## Table A5.1: Installation conditions for rebars

| **Nominal diameter of the bar** | | **$\phi$** | **8[1)]** | | **10[1)]** | | **12[1)]** | | **14** | **16** | **20** | **25** | **26** | **28** | **30** | **32** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_0$ | [mm] | 10 | 12 | 12 | 14 | 14 | 16 | 18 | 20 | 25 | 30 | 35 | 35 | 40 | 40 |
| Drill hole depth | $h_0$ | | $h_0 = l_v$ | | | | | | | | | | | | | |
| Effective embedment depth | $l_v$ | | acc. to static calculation | | | | | | | | | | | | | |
| Minimum thickness of concrete member | $h_{min}$ | | $l_v + 30$ ($\geq 100$) | | | | | | $l_v + 2d_0$ | | | | | | | |

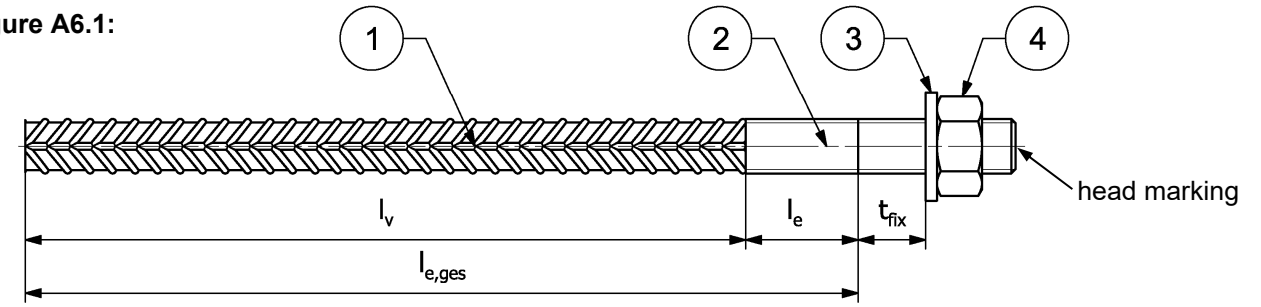
[1)] Both drill hole diameters can be used

## Table A5.2: 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 NCI of EN 1992-1-1/NA<br>$f_{uk} = f_{tk} = k \cdot f_{yk}$ |

## Properties of fischer rebar anchors

**Figure A6.1:**




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

FRA HCR (for high corrosion-resistant steel)

## Table A6.1: Installation conditions for fischer rebar anchors

| **Thread diameter** | | | **M12** [2] | | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|
| Nominal diameter | $\phi$ | [mm] | 12 | | 16 | 20 | 25 |
| Nominal drill bit diameter | $d_0$ | [mm] | 14 | 16 | 20 | 25 | 30 |
| Drill hole depth ($h_0 = l_{e,ges}$) | $l_{e,ges}$ | [mm] | $l_v + l_e$ | | | | |
| Effective embedment depth | $l_v$ | [mm] | acc. to static calculation | | | | |
| Distance concrete surface to welded joint | $l_e$ | [mm] | 100 | | | | |
| Diameter of clearance hole in the fixture[1] Pre-positioned | ≤ $d_f$ | [mm] | 14 | | 18 | 22 | 26 |
| Diameter of clearance hole in the fixture[1] Push through | ≤ $d_f$ | [mm] | 16 | 18 | 22 | 26 | 32 |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | $h_0$+30 (≥ 100) | | $h_0 + 2d_0$ | | |
| Maximum torque moment for attachment of the fixture | max $T_{inst}$ | [Nm] | 50 | | 100 | 150 | 150 |

[1] For bigger clearance holes in the fixture see EN 1992-4:2018
[2] Both drill bit diameters can be used

## Table A6.2: Materials of fischer rebar anchors

| Part | Description | Materials | |
|---|---|---|---|
| | | FRA<br>Corrosion resistance class CRC III<br>acc. to EN 1993-1-4:2006+A1:2015 | FRA HCR<br>Corrosion resistance class CRC V<br>acc. to EN 1993-1-4:2006+A1:2015 |
| 1 | Reinforcing bar | Bars and de-coiled rods class B or C with $f_{yk}$ and k according to NDP or NCI of EN 1992-1-1:NA; $f_{uk} = f_{tk} = k \cdot f_{yk;}$ ($f_{yk}$ = 500 N/mm²) | |
| 2 | Round bar with partial or full thread | Stainless steel, strength class 80, according to EN 10088-1:2014 | Stainless steel, strength class 80, according to EN 10088-1:2014 |
| 3 | Washer ISO 7089:2000 | Stainless steel, according to EN 10088-1:2014 | Stainless steel, according to EN 10088-1:2014 |
| 4 | Hexagon nut | Stainless steel, strength class 80, acc. to EN ISO 3506-2:2020, according to EN 10088-1:2014 | Stainless steel, strength class 80, acc. to EN ISO 3506-2:2020, according to EN 10088-1:2014 |

## Specifications of intended use part 1

**Table B1.1:** Overview use and performance categories

| Fastenings subject to | | FIS EB II with … | | | |
|---|---|---|---|---|---|
| | | Reinforcing bar  | | fischer rebar anchor  | |
| Hammer drilling with standard drill bit or compressed air drilling  | | all sizes | | | |
| Use category | I1 dry or wet concrete | all sizes | | | |
| Characteristic resistance under static and quasi static loading, | in cracked concrete | all sizes | Tables: C1.1 C1.2 C2.1 | all sizes | Tables: C1.1 C1.2 C1.3 C1.4 C2.1 C2.2 |
| | in uncracked concrete | | | | |
| Characteristic resistance under seismic loading | | -[1)] | | -[1)] | |
| Installation direction | | D3 (downward and horizontal and upwards (e.g. overhead)) | | | |
| Installation temperature | | $T_{i,min}$ = +5 °C to $T_{i,max}$ = +40 °C | | | |
| Service temperature | Temperature range | -40°C to +80°C | | (max. short term temperature +80°C; max long term temperature +50°C) | |
| Resistance to fire | | all sizes | Annex C 3 | all sizes | Table C2.2 |

[1)] No performance assessed

## Specifications of intended use part 2

**Anchorages subject to:**

- Static and quasi-static loading: reinforcing bar (rebar) size 8 mm to 32 mm
- Resistance to fire

**Base materials:**

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013+A1:2016.
- Concrete strength classes C12/15 to C50/60 according to EN 206:2013+A1:2016
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206:2013+A1:2016
- 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.

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

- For all conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A 6 table A6.2

**Design:**

- Fastenings are designed under the responsibility of an engineer experienced in fastenings 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, EN 1992-1-2:2004+AC:2008 and Annex B 3 and B 4.
- 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.

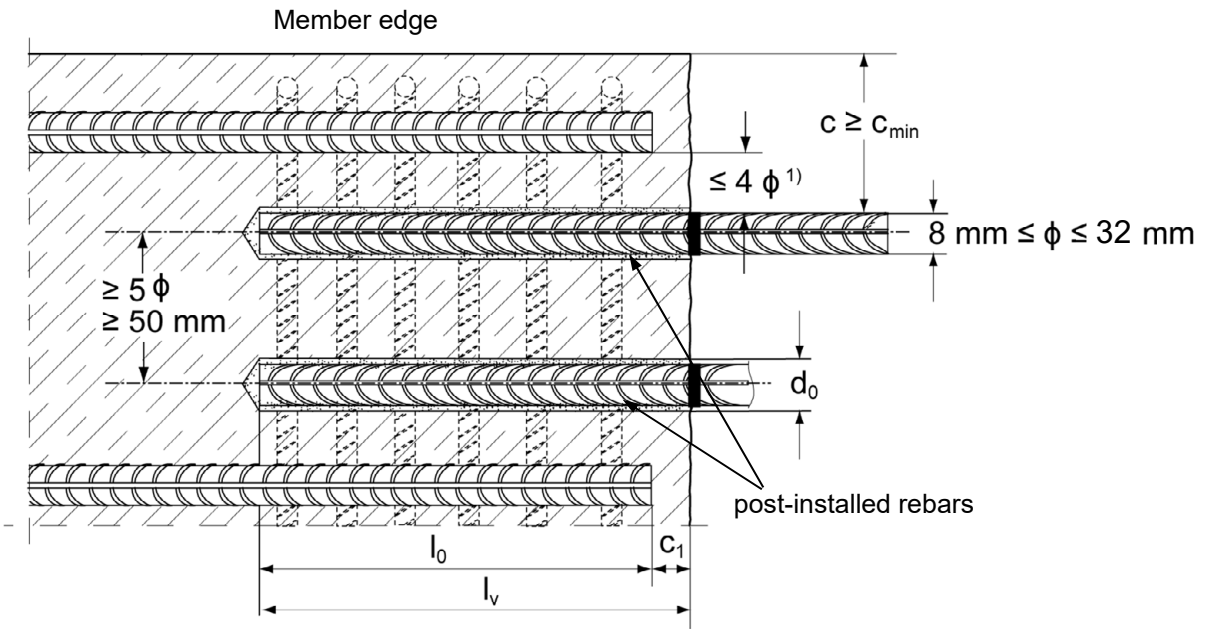
**Installation:**

- The installation of post-installed rebar respectively fischer rebar anchor 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).

## General construction rules for post-installed rebars

**Figure B3.1:**

- 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

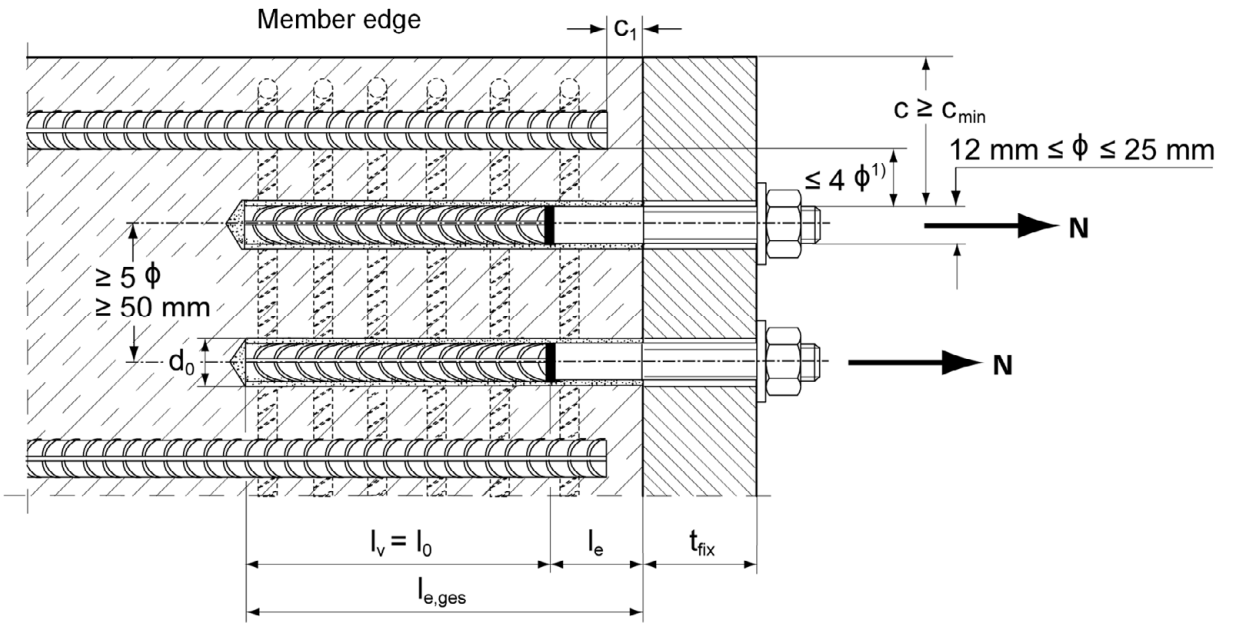
| | |
|---|---|
| $c$ | concrete cover of post-installed rebar |
| $c_1$ | concrete cover at end-face of existing rebar |
| $c_{min}$ | minimum concrete cover according to table B5.1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2 |
| $\phi$ | nominal diameter of reinforcing bar |
| $l_0$ | lap length, according to EN 1992-1-1:2004+AC:2010 |
| $l_v$ | effective embedment depth, $\geq l_0 + c_1$ |
| $d_0$ | nominal drill bit diameter, see Annex B 6 |

Figures not to scale

## General construction rules for post-installed fischer rebar anchors

**Figure B4.1:**

- Only tension forces in the axis of the fischer rebar anchor 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 loading shall be ensured by appropriate additional measures, e.g. by shear lugs or by anchors with a European Technical Assessment (ETA).
- In the anchor plate, the holes for the tension anchor shall be executed as slotted holes with the axis in the direction of the shear force.



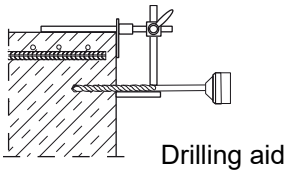

1) If the clear distance between lapped bars exceeds 4 ϕ then the lap length shall be increased by the difference between the clear bar distance and 4 ϕ.

| | |
|---|---|
| c | concrete cover of post-installed fischer rebar anchor |
| $c_1$ | concrete cover at end-face of existing rebar |
| $c_{min}$ | minimum concrete cover according to table B5.1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2 |
| ϕ | nominal diameter of reinforcing bar |
| $l_0$ | lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3 |
| $l_{e,ges}$ | overall embedment depth, ≥ $l_0$ + $l_e$ |
| $d_0$ | nominal drill bit diameter, see Annex B 6 |
| $l_e$ | length of the bonded in threaded part |
| $t_{fix}$ | thickness of the fixture |
| $l_v$ | effective embedment depth |

Figures not to scale

**Table B5.1: Minimum concrete cover $c_{min}$[1] depending on the drilling method and the drilling tolerance**

| Drilling method | nominal diameter of reinforcing bar ϕ [mm] | Minimum concrete cover $c_{min}$ | |
|---|---|---|---|
| | | Without drilling aid [mm] | With drilling aid [mm] |
| Hammer drilling with standard drill bit | < 25 | 30 mm + 0,06 $l_v$ ≥ 2 ϕ | 30 mm + 0,02 $l_v$ ≥ 2 ϕ |
| | ≥ 25 | 40 mm + 0,06 $l_v$ ≥ 2 ϕ | 40 mm + 0,02 $l_v$ ≥ 2 ϕ |
| Compressed air drilling | < 25 | 50 mm + 0,08 $l_v$ | 50 mm + 0,02 $l_v$ |
| | ≥ 25 | 60 mm + 0,08 $l_v$ ≥ 2 ϕ | 60 mm + 0,02 $l_v$ ≥ 2 ϕ |


Drilling aid

[1] See Annex B 3, figure B3.1 and Annex B 4, figure B4.1
Note: The minimum concrete cover as specified in EN 1992-1-1:2004+AC:2010 must be observed.

**Table B5.2:** Dispensers and cartridge sizes corresponding to maximum embedment depth $l_{v,max}$ resp. $l_{e,ges,max}$

| reinforcing bars (rebar) | fischer rebar anchor | Manual dispenser | Pneumatic or cordless dispenser (small) | Pneumatic or cordless dispenser (large) |
|---|---|---|---|---|
| | | Cartridge size ≥390 ml (e.g. 390 ml, 585 ml, 1100 ml, 1500 ml) | | |
| ϕ [mm] | Designation | $l_{v,max}$ / $l_{e,ges,max}$ [mm] | | |
| 8 to 10 | --- | 2000 | | |
| 12 | FRA M12<br>FRA HCR M12 | | | |
| 14 | --- | | | |
| 16 | FRA M16<br>FRA HCR M16 | | | |
| 20 | FRA M20<br>FRA HCR M20 | | | |
| 25 | FRA M24<br>FRA HCR M24 | | | |
| 26 to 32 | --- | | | |

**Table B5.3:** Conditions for use **static mixer** without an **extension tube**

| Nominal drill hole diameter | $d_0$ | [mm] | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 25 | 28 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drill hole depth $h_0$ by using | FIS MR Plus | | ≤90 | | ≤120 | ≤140 | ≤150 | ≤160 | ≤190 | ≤210 | | | | |
| | FIS UMR | | - | - | ≤90 | ≤160 | ≤180 | ≤190 | ≤220 | | ≤250 | | | |

**Rebar connection with fischer injection system FIS EB II**

**Intended Use**
Minimum concrete cover;
dispenser and cartridge sizes corresponding to maximum embedment depth

**Annex B 5**

Appendix 12/22

**Table B6.1: Working times $t_{work}$ and curing times $t_{cure}$**

| Temperature at anchoring base [°C] [2] | Maximum processing time [1] $t_{work}$ | Minimum curing time $t_{cure}$ |
|---|---|---|
| 5 to 10 | 180 min | 96 h |
| > 10 to 15 | 90 min | 60 h |
| > 15 to 20 | 60 min | 36 h |
| > 20 to 30 | 30 min | 24 h |
| > 30 to 40 | 15 min | 12 h |

[1] Maximum time from the beginning of the injection to rebar / fischer rebar anchor setting and positioning
[2] If the temperature in the concrete falls below 10 °C the cartridge has to be warmed up to +20 °C.

**Table B6.2:** Installation tools for drilling and cleaning the bore hole and injection of the mortar

| reinforcing bars (rebar) | fischer rebar anchor | Drilling and cleaning | | | | Injection | |
|---|---|---|---|---|---|---|---|
| | | Nominal drill bit diameter | Diameter of cutting edge | Steel brush diameter | Diameter of cleaning nozzle | extension tube 9 mm | extension tube 15 mm |
| | | | | | | Injection adapter | Injection adapter |
| ϕ [mm] | Designation | $d_0$ [mm] | $d_{cut}$ [mm] | $d_b$ [mm] | [mm] | [colour] | [colour] |
| 8[1] | --- | 10 [2] | ≤ 10,50 | 11 | --- | --- | --- |
| | | 12 | ≤ 12,50 | 14 | 11 | nature | --- |
| 10[1] | --- | 12 | ≤ 12,50 | 14 | | | |
| | | 14 | ≤ 14,50 | 16 | | blue | --- |
| 12[1] | FRA M12[1] FRA HCR M12[1] | 14 | ≤ 14,50 | 16 | 15 | | |
| | | 16 | ≤ 16,50 | 20 | | red | --- |
| 14 | --- | 18 | ≤ 18,50 | 20 | | yellow | --- |
| 16 | FRA M16 FRA HCR M16 | 20 | ≤ 20,55 | 25 | 19 | green | green |
| 20 | FRA M20 FRA HCR M20 | 25 | ≤ 25,55 | 27 | | black | black |
| 25 | FRA M24[1] FRA HCR M24[1] | 30 | ≤ 30,55 | 32 | 28 | grey | grey |
| 26 | --- | 35 | ≤ 35,70 | 37 | 28 | brown | brown |
| 28 | --- | 35 | ≤ 35,70 | 37 | 28 | brown | brown |
| 30 | --- | 40 | ≤ 40,70 | 42 | 38 | red | red |
| 32 | --- | 40 | ≤ 40,70 | 42 | 38 | red | red |

[1] Both drill bit diameters can be used
[2] Only hammer drilling with standard drill bit

## Safety regulations

Review the Safety Data Sheet (SDS) before use for proper and safe handling!

Wear well-fitting protective goggles and protective gloves when working with mortar FIS EB II.

Important: Observe the instructions for use provided with each cartridge.

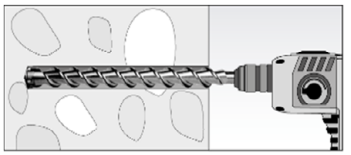
## Installation instruction part 1

Hole drilling

Note: Before drilling, remove carbonated concrete; clean contact areas (see Annex B 2)
In case of aborted drill holes the drill hole shall be filled with mortar.

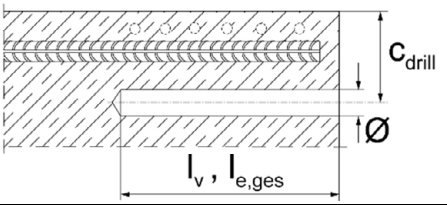
**Hammer drilling or compressed air drilling**

**1**

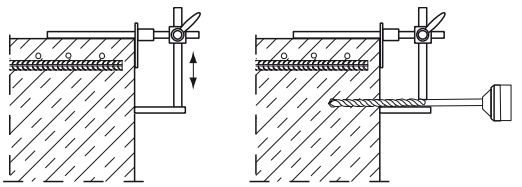


Drill the hole to the required embedment depth using a hammer drill with carbide drill bit set in rotation hammer mode or a pneumatic drill.
Drill bit sizes see **table B6.2**.

**2**




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



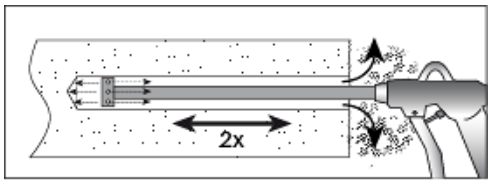
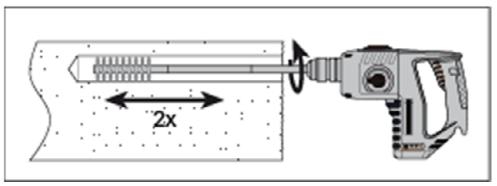
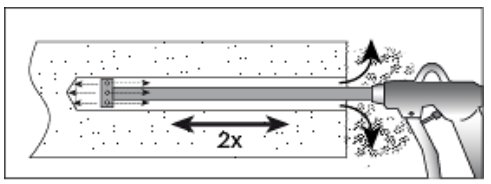
For holes $l_v$ > 20 cm use drilling aid.
Three different options can be considered:

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

Minimum concrete cover $c_{min}$ see **table B5.1**

## Installation instruction part 2

Drill hole cleaning with oil-free compressed air

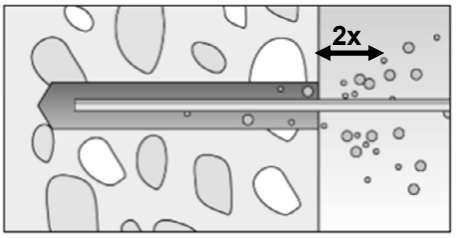
| | | |
|---|---|---|
| **3a** |  | **Blowing**<br>twice from the back of the hole with the appropriate nozzle (oil-free compressed air ≥ 6 bar) until return air stream is free of noticeable dust.<br>Personal protective equipment must be used (see safety regulations **Annex B 7**). |
| |  | **Brushing (with power drill)**<br>Check steel brush with brush control template. The brush must produce a noticeable resistance when it is inserted into the drill hole.<br>Fix an adequate steel brush with an extension into a drilling machine and brush the bore hole twice. |
| |  | **Blowing**<br>twice from the back of the hole with the appropriate nozzle (oil-free compressed air ≥ 6 bar) until return air stream is free of noticeable dust.<br>Personal protective equipment must be used (see safety regulations **Annex B 7**). |

Go to step 4

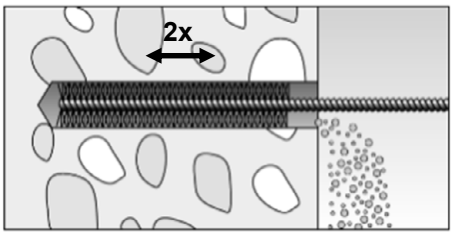
## Installation instruction part 3

Drill hole cleaning: manual cleaning is permitted for hammer drilled boreholes up to hole diameters $d_0 < 18$ mm and depths $l_v$ resp. $l_{e,ges} \leq 12 \cdot \phi$

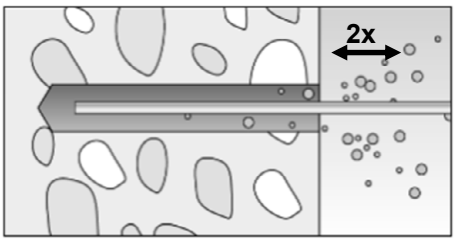
**3b**




**Blowing**
blow out the hole twice by hand from the back of the hole. Use only the fischer blow out pump AB G.
Personal protective equipment must be used (see safety regulations **Annex B 7**).




**Brushing**
Twice with the specified brush size by inserting the round steel brush to the back of the hole and twisting motion. The brush must produce a noticeable resistance when it is inserted into the drill hole. Corresponding brushes see **table B6.2**.

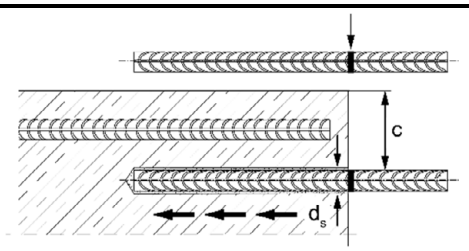
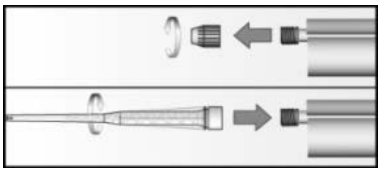
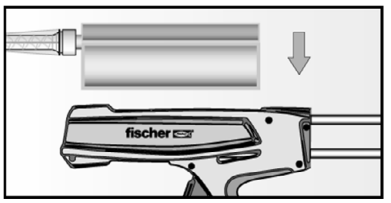
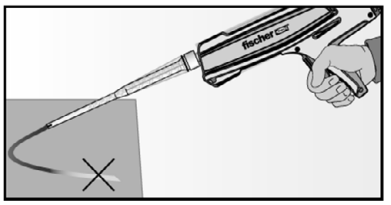



**Blowing**
blow out the hole twice by hand from the back of the hole. Use only the fischer blow out pump AB G.
Personal protective equipment must be used (see safety regulations **Annex B 7**).

Go to step 4

## Installation instruction part 4

reinforcing bars (rebar) / fischer rebar anchor and cartridge preparation

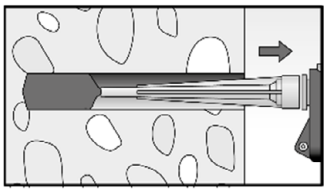
| | | |
|---|---|---|
| **4** |  | Before use, make asure that the rebar or the fischer rebar anchor is dry and free of oil or other residue.<br>Mark the embedment depth (e.g. with tape)<br>Insert rebar in borehole, to verify drill hole depth and setting depth |
| **5** |  | Twist off the sealing cap<br>Twist on the static mixer (the spiral in the static mixer must be clearly visible). |
| **6** |  | Place the cartridge into a suitable dispenser. |
| **7** |  | 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. |

Go to step 8

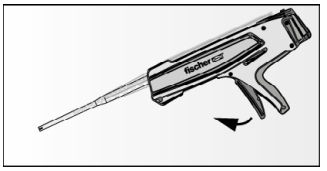
## Installation instruction part 5; Installation with FIS EB II

Injection of the mortar without extension tube

**8a**



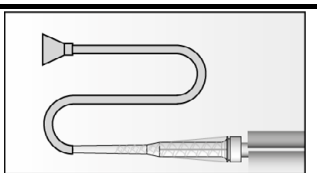
Inject the mortar from the back of the hole towards the front and slowly withdraw the static mixer step by step with each trigger pull.
Avoid bubbles.
Fill holes approximately 2/3 full, to ensure that the annular gap between the rebar and the concrete will be completely filled with adhesive over the entire embedment length.
The conditions for mortar injection without extension tube can be found in **table B5.3**



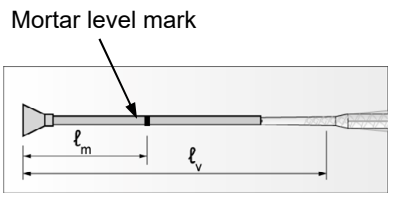
After injecting, release the dispenser. This will prevent further mortar discharge from the static mixer.

Injection of the mortar with extension tube

**8b**



Assemble mixing nozzle FIS MR Plus or FIS UMR, extension tube and appropriate injection adapter (see **table B6.2**)

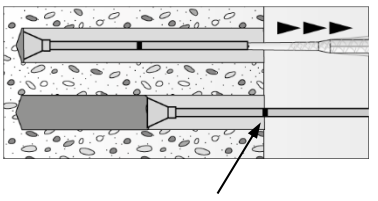



Mark the required mortar level $l_m$ and embedment depth $l_v$ resp. $l_{e,ges}$ with tape or marker on the injection extension tube.
a) Estimation:

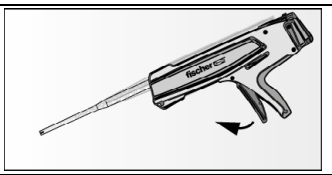
$$l_m = \frac{1}{3} \cdot l_v \; resp. \; l_m = \frac{1}{3} \cdot l_{e,ges} \text{ [mm]}$$

b) Precise equation for optimum mortar volume:

$$l_m = l_v \; resp. \; l_{e,ges} \left( (1{,}2 \cdot \frac{d_s^2}{d_0^2} - 0{,}2) \right) \text{ [mm]}$$




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. Do not actively pull out!
Fill holes approximately 2/3 full, to ensure that the annular gap between the rebar and the concrete will be completely filled with adhesive over the embedment length.
When using an injection adapter continue injection until the mortar level mark $l_m$ becomes visible.
Maximum embedment depth, see **table B5.2**

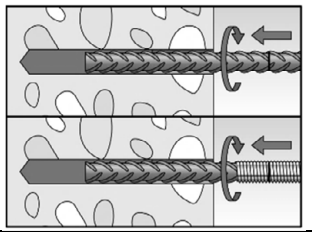
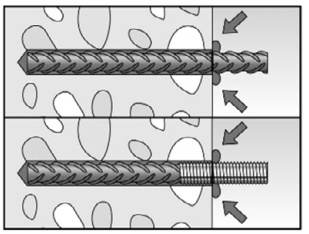
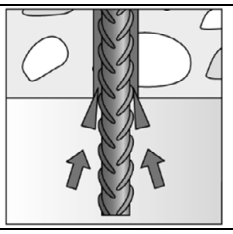
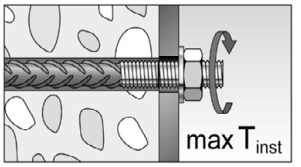


After injecting, release the dispenser. This will prevent further mortar discharge from the static mixer.

Go to step 9

## Installation instruction part 6; Inatallation with FIS EB II

Insert rebar / fischer rebar anchor

| | | |
|---|---|---|
| **9** |  | Insert the rebar / fischer rebar anchor slowly twisted into the borehole until the embedment mark is reached.<br>Recommendation:<br>Rotation back and forth of the reinforcement bar or the fischer rebar anchor makes pushing easy |
| **10** |  | After installing the rebar or fischer rebar anchor the annular gap must be completely filled with mortar.<br><br>Proper installation<br>• Desired embedment depth is reached $l_v$ resp. $l_{e,ges}$: embedment mark at concrete surface<br>• Excess mortar flows out of the borehole after the rebar or fischer rebar anchor have been fully inserted up to the embedment mark. |
| **11** |  | For overhead installation, support the rebar / fischer rebar anchor and secure it from falling till mortar started to harden, e.g. using wedges. |
| **12** |  | Observe the working time "$t_{work}$" (see **table B6.1**), which varies according to temperature of base material. Minor adjustments to the rebar / fischer rebar anchor position may be performed during the working time<br><br>Full load may be applied only after the curing time "$t_{cure}$" has elapsed (see **table B6.1**) |
| **13** |  | Mounting the fixture,<br>max $T_{inst}$ see **table A6.1** |

## Minimum anchorage length and minimum lap length

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{o,min}$ according to EN 1992-1-1:2004+AC:2010 shall be multiplied by the relevant amplification factor $\alpha_{lb}$ according to **table C1.1**.

**Table C1.1:** Amplification factor $\alpha_{lb}$ related to concrete strength class and drilling method

| **Hammer drilling and compressed air drilling** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Rebar / fischer rebar anchor** | **Amplification factor $\alpha_{lb}$** | | | | | | | | |
| | Concrete strength class | | | | | | | | |
| ϕ [mm] | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 to 32 | 1,0 | | | | | | | | |

**Table C1.2:** Bond efficiency factor $k_b$ for hammer drilling and compressed air drilling

| **Hammer drilling and compressed air drilling** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Rebar / fischer rebar anchor** | **Bond efficiency factor $k_b$** | | | | | | | | |
| | Concrete strength class | | | | | | | | |
| ϕ [mm] | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 to 32 | 1,0 | | | | | | | | |

**Table C1.3:** Characteristic **tensile yield strength** for rebar part of **fischer rebar anchors**

| **fischer rebar anchor FRA / FRA HCR** | | | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|
| **Characteristic tensile yield strength for rebar part** | | | | | | |
| Rebar diameter | ϕ | [mm] | 12 | 16 | 20 | 25 |
| Characteristic tensile yield strength | $f_{yk}$ | [N/mm²] | 500 | 500 | 500 | 500 |
| Partial factor for rebar part | $\gamma_{Ms,N}$ [1)] | [-] | 1,15 | | | |

1) In absence of national regulations

**Table C1.4:** Characteristic resistance to **steel failure** under tension loading of **fischer rebar anchors**

| **fischer rebar anchor FRA / FRA HCR** | | | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|
| **Characteristic resistance to steel failure under tension loading** | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 62 | 111 | 173 | 263 |
| **Partial factor** | | | | | | |
| Partial factor | $\gamma_{Ms,N}$ [1)] | [-] | 1,4 | | | |

1) In absence of national regulations

**Rebar connection with fischer injection system FIS EB II**

**Performances**
Amplification factor $\alpha_{lb}$, bond efficiency factor $k_b$, characteristic resistance to steel failure of fischer rebar anchors; characteristic tensile yield strength for rebar part

**Annex C 1**

**Table C2.1:** Design values of the bond strength $f_{bd,PIR}$ in N/mm² for hammer drilling, compressed air drilling

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

$f_{bd}$: Design value of the bond strength in N/mm² considering the concrete strength classes and the rebar diameter for good bond condition (for all other bond conditions multiply the values by $\eta_1 = 0,7$) and recommended partial factor $\gamma_c = 1,5$ according to EN 1992-1-1: 2004+AC:2010

$k_b$: Bond efficiency factor according to **table C1.2**

**Hammer drilling and compressed air drilling**

| **Rebar / fischer rebar anchor** $\phi$ [mm] | **bond strength $f_{bd,PIR}$ [N/mm²]** Concrete strength class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 to 32 | 1,7 | 2,0 | 2,3 | 2,7 | 3,0 | 3,4 | 3,7 | 4,0 | 4,3 |

**Table C2.2:** Characteristics resistance to **steel failure** for **fischer rebar anchors** under tension loading and fire exposure R30 to R120

| **fischer rebar anchor FRA / FRA HCR** | | | | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|
| Characteristic resistance to steel failure under tension loading and fire exposure | R30 | $N_{Rk,s,fi}$ | [kN] | 2,5 | 4,7 | 7,4 | 10,6 |
| | R60 | | | 2,1 | 3,9 | 6,1 | 8,8 |
| | R90 | | | 1,7 | 3,1 | 4,9 | 7,1 |
| | R120 | | | 1,3 | 2,5 | 3,9 | 5,6 |

## The bond strength $f_{bd,fi}$ at increased temperature for concrete strength classes C12/15 to C50/60 (all drilling methods)

The bond strength $f_{bd,fi}$ at increased temperature has to be calculated by the following equation:

$$f_{bd,fi} = k_{fi}(\theta) \cdot f_{bd,PIR} \cdot \frac{\gamma_c}{\gamma_{m,fi}}$$

If: θ > 49 °C $\quad k_{fi}(\theta) = \frac{39924 \cdot \theta^{-2,134}}{f_{bd,PIR} \cdot 4,3} \leq 1.0$

If: θ > $\theta_{max}$ (200 °C) $\quad k_{fi}(\theta) = 0$

| | | |
|---|---|---|
| $f_{bd,fi}$ | = | The bond strength at increased temperature in N/mm² |
| (θ) | = | Temperature in °C in the mortar layer |
| $k_{fi}$ (θ) | = | Reduction factor at increased temperature |
| $f_{bd,PIR}$ | = | Design value of the bond strength in N/mm² in cold condition according to table C2.1 considering the concrete strength classes, the rebar diameter, the drilling method and the bond conditions according to EN 1992-1-1:2004+AC:2010 |
| $\gamma_C$ | = | 1,5 recommended partial factor according to EN 1992-1-1:2004+AC:2010 |
| $\gamma_{m,fi}$ | = | 1,0 recommended partial factor |

For evidence at increased temperature the anchorage length shall be calculated according to EN 1992-1-1:2004+AC:2010 Equation 8.3 using the temperature-dependent ultimate bond strength $f_{bd,fi}$.

**Figure C3.1:** Example of the graph of reduction factor $k_{fi}$ (θ) for concrete strength class C20/25 for good bond conditions