

## PRESTATIEVERKLARING

### DoP 0340

voor fischer injectiesysteem FIS EB II (Verbindingsbevestiging voor gebruik in beton)

NL

1. Unieke identificatiecode van het producttype: DoP 0340
2. Beoogd(e) gebruik(en): Bevestigingen in gescheurd of ongescheurd beton, zie bijlage, met name de bijlagen B1 - B11.
3. Fabrikant: fischerwerke GmbH & Co. KG, Otto-Hahn-Straße 15, 79211 Denzlingen, Duitsland
4. Gemachtigde: -
5. Het systeem of de systemen voor de beoordeling en verificatie van de prestatiebestendigheid: 1
6. Europees beoordelingsdocument: EAD 330499-02-0601, Edition 04/2023  
Europese technische beoordeling: ETA-21/0469; 2023-07-25  
Technische beoordelingsinstantie: DIBt- Deutsches Institut für Bautechnik  
Aangemelde instantie(s): 2873 TU Darmstadt
7. Aangegeven prestatie(s):  
**Mechanische weerstand en stabiliteit (BWR 1)**  
**Kenmerkende weerstand tegen trekbelasting (statische en quasi-statische belasting):**
  - 1) Weerstand tegen staalbreuk: zie bijlage, met name de bijlagen C1, C2
  - 2) Weerstand tegen gecombineerd uittrekken en betonnen kegelbreuk: zie bijlage, met name de bijlagen C4 - C6
  - 3) Weerstand tegen betonnen kegelbreuk: zie bijlage, met name bijlage C3
  - 4) Randafstand om spleetbreuk onder belasting te voorkomen: zie bijlage, met name bijlage C3
  - 5) Robuustheid: zie bijlage, met name de bijlagen C3 - C6
  - 6) Maximaal montagekoppel: zie bijlage, met name de bijlagen B3, B5
  - 7) Minimale rand- en hartafstand, Dikte van het onderdeel: zie bijlage, met name de bijlagen B3 - B7**Kenmerkende weerstand tegen schuifbelasting (statische en quasi-statische belasting):**
  - 8) Weerstand tegen staalbreuk: zie bijlage, met name de bijlagen C1, C2
  - 9) Weerstand tegen uitbreken (pryout): zie bijlage, met name bijlage C3
  - 10) Weerstand tegen bezwijken van betonranden: zie bijlage, met name bijlage C3**Verplaatsingen onder korte- en langetermijnbelasting:**
  - 11) Verplaatsingen onder korte- en langetermijnbelasting: zie bijlage, met name bijlage C7
  - 12) Weerstand in staalvezelversterkt beton: NPD**Kenmerkende weerstand en verplaatsingen voor de seismische prestatiecategorieën C1 en C2:**
  - 13) Trekkraftweerstand, categorie C1: zie bijlage, met name de bijlagen C8 - C11
  - 14) Trekkraftweerstand, categorie C2: zie bijlage, met name de bijlagen C8 - C10, C12, C13
  - 15) Weerstand afschuifbelasting, categorie C1: zie bijlage, met name de bijlagen C8 - C10
  - 16) Weerstand afschuifbelasting, categorie C2: zie bijlage, met name de bijlagen C8 - C10, C12, C13**Veiligheid in geval van brand (BWR 2)**
  - 17) Reactie op brand: Klasse (A1)**Weerstand tegen vuur:**
  - 18) Weerstand bij brand, staalbreuk (trekbelasting): zie bijlage, met name de bijlagen C14, C15
  - 19) Weerstand tegen hechting onder brandomstandigheden: zie bijlage, met name bijlage C16
  - 20) Weerstand bij brand, staalbreuk (afschuifbelasting): zie bijlage, met name de bijlagen C14, C15**Hygiëne, gezondheid en milieu (BWR 3)**
  - 21) Content, emission and/or release of dangerous substances: NPD
8. Geëigende technische documentatie en/of specifieke technische documentatie: -

De prestaties van het hierboven omschreven product zijn conform de aangegeven prestaties. Deze prestatieverklaring wordt in overeenstemming met Verordening (EU) nr. 305/2011 onder de exclusieve verantwoordelijkheid van de hierboven vermelde fabrikant verstrekt.

Ondertekend voor en namens de fabrikant door:



Dr.-Ing. Oliver Geibig, Directeur Business Units & Engineering  
Tumlingen, 2023-08-15



Jürgen Grün, Directeur Chemie & Kwaliteit

Deze DoP is opgesteld in meerdere talen. In het geval van geschillen over de interpretatie zal de Engelse tekst altijd prevaleren.

Het aanhangsel bevat vrijwillige en aanvullende informatie in het Engels die de (taal-neutraal gespecificeerde) wettelijke vereisten overschrijdt.

Translation guidance Essential Characteristics and Performance Parameters for Annexes

**Vertaal assistent van de essentiële kenmerken en eigenschappen voor bijlagen**

|                                                                                                  |                                                                                                                                       |                                                                                                                             |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Mechanical resistance and stability (BWR 1)                                                      |                                                                                                                                       |                                                                                                                             |
| <b>Mechanische weerstand en stabiliteit (BWR 1)</b>                                              |                                                                                                                                       |                                                                                                                             |
| Characteristic resistance to tension load (static and quasi-static loading):                     |                                                                                                                                       |                                                                                                                             |
| <b>Kenmerkende weerstand tegen trekbelasting (statische en quasi-statische belasting):</b>       |                                                                                                                                       |                                                                                                                             |
| 1                                                                                                | Resistance to steel failure:<br><b>Weerstand tegen staalbreuk:</b>                                                                    | $N_{Rk,s}$ [kN]                                                                                                             |
| 2                                                                                                | Resistance to combined pull- out and concrete cone failure:<br><b>Weerstand tegen gecombineerd uittrekken en betonnen kegelbreuk:</b> | $T_{Rk}$ and/or $T_{Rk,100}$ [N/mm <sup>2</sup> ],<br>$\psi_c$ , $\psi_{sus}$ , $\psi_{sus,100}$ [-] (BF)                   |
|                                                                                                  | Resistance to pull-out failure:<br><b>Weerstand tegen uittrekken:</b>                                                                 | $N_{Rk,p}$ and/or $N_{Rk,p,100}$ [kN], $\psi_c$ [-] (BEF)                                                                   |
| 3                                                                                                | Resistance to concrete cone failure:<br><b>Weerstand tegen betonnen kegelbreuk:</b>                                                   | $c_{cr,N}$ [mm], $k_{cr,N}$ , $k_{ucr,N}$ [-]                                                                               |
| 4                                                                                                | Edge distance to prevent splitting under load:<br><b>Randafstand om spleetbreuk onder belasting te voorkomen:</b>                     | $c_{cr,sp}$ [mm]                                                                                                            |
| 5                                                                                                | Robustness:<br><b>Robuustheid:</b>                                                                                                    | $\gamma_{inst}$ [-]                                                                                                         |
| 6                                                                                                | Maximum installation torque:<br><b>Maximaal montagekoppel:</b>                                                                        | $\max T_{inst}$ [Nm] (BF)                                                                                                   |
|                                                                                                  | Installation torque:<br><b>Montagekoppel:</b>                                                                                         | $T_{inst}$ [Nm] (BEF)                                                                                                       |
| 7                                                                                                | Minimum edge distance, spacing and member thickness:<br><b>Minimale rand- en hartafstand, Dikte van het onderdeel:</b>                | $c_{min}$ , $s_{min}$ , $h_{min}$ [mm]                                                                                      |
| Characteristic resistance to shear load (static and quasi-static loading):                       |                                                                                                                                       |                                                                                                                             |
| <b>Kenmerkende weerstand tegen schuifbelasting (statische en quasi-statische belasting):</b>     |                                                                                                                                       |                                                                                                                             |
| 8                                                                                                | Resistance to steel failure:<br><b>Weerstand tegen staalbreuk:</b>                                                                    | $V_{Rk,s}$ [kN], $M_{Rk,s}^0$ [Nm], $k_7$ [-]                                                                               |
| 9                                                                                                | Resistance to pry-out failure:<br><b>Weerstand tegen uitbreken (pryout):</b>                                                          | $k_8$ [-]                                                                                                                   |
| 10                                                                                               | Resistance to concrete edge failure:<br><b>Weerstand tegen bezwijken van betonranden:</b>                                             | $d_{nom}$ , $l_f$ [mm]                                                                                                      |
| Displacements under short-term and long-term loading:                                            |                                                                                                                                       |                                                                                                                             |
| <b>Verplaatsingen onder korte- en langetermijnbelading:</b>                                      |                                                                                                                                       |                                                                                                                             |
| 11                                                                                               | Displacements under short-term and long-term loading:<br><b>Verplaatsingen onder korte- en langetermijnbelading:</b>                  | $\delta_0$ , $\delta_{\infty}$ [mm or mm/(N/mm <sup>2</sup> )]                                                              |
| 12                                                                                               | Resistance in steel fibre reinforced concrete:<br><b>Weerstand in staalvezelversterkt beton:</b>                                      | Description                                                                                                                 |
| Characteristic resistance and displacements for seismic performance categories C1 and C2:        |                                                                                                                                       |                                                                                                                             |
| <b>Kenmerkende weerstand en verplaatsingen voor de seismische prestatiecategorieën C1 en C2:</b> |                                                                                                                                       |                                                                                                                             |
| 13                                                                                               | Resistance to tension for seismic performance category C1<br><b>Trekkrachtweerstand, categorie C1:</b>                                | $N_{Rk,s,C1}$ [kN] (all)<br>$T_{Rk,C1}$ [N/mm <sup>2</sup> ] (BF)<br>$N_{Rk,p,C1}$ [kN] (BEF)                               |
| 14                                                                                               | Resistance to tension for seismic performance category C2<br><b>Trekkrachtweerstand, categorie C2:</b>                                | $N_{Rk,s,C2}$ [kN] (all)<br>$T_{Rk,C2}$ [N/mm <sup>2</sup> ] (BF)<br>$N_{Rk,p,C2}$ [kN] (BEF)<br>$\delta_{N,C2}$ [mm] (all) |
| 15                                                                                               | Resistance to tension for seismic performance category C1<br><b>Weerstand afschuifbelasting, categorie C1:</b>                        | $V_{Rk,s,C1}$ [kN] (all)                                                                                                    |
| 16                                                                                               | Resistance to tension for seismic performance category C2<br><b>Weerstand afschuifbelasting, categorie C2:</b>                        | $V_{Rk,s,C2}$ [kN] (all)<br>$\delta_{V,C2}$ [mm] (all)                                                                      |
| Hygiene, health and the environment (BWR 3)                                                      |                                                                                                                                       |                                                                                                                             |
| <b>Hygiëne, gezondheid en milieu (BWR 3)</b>                                                     |                                                                                                                                       |                                                                                                                             |
| 17                                                                                               | Reaction to fire<br><b>Reactie op brand:</b>                                                                                          | Class<br>Klasse (A1)                                                                                                        |
| Resistance to fire                                                                               |                                                                                                                                       |                                                                                                                             |
| <b>Weerstand tegen vuur:</b>                                                                     |                                                                                                                                       |                                                                                                                             |
| 18                                                                                               | Fire resistance to steel failure (tension load):<br><b>Weerstand bij brand, staalbreuk (trekbelasting):</b>                           | $N_{Rk,s,fi}$ [kN]                                                                                                          |
| 19                                                                                               | Bond resistance under fire conditions:<br><b>Weerstand tegen hechting onder brandomstandigheden:</b>                                  | $k_{fi,p}$ ( $\theta$ ) [-],<br>$T_{Rk,fi}$ ( $\theta$ ) [N/mm <sup>2</sup> ] (BF)                                          |
| 20                                                                                               | Fire resistance to steel failure under shear loading:<br><b>Weerstand bij brand, staalbreuk (afschuifbelasting):</b>                  | $V_{Rk,s,fi}$ [kN], $M_{Rk,s,fi}^0$ [Nm]                                                                                    |
| Hygiene, health and the environment (BWR 3)                                                      |                                                                                                                                       |                                                                                                                             |
| <b>Hygiëne, gezondheid en milieu (BWR 3)</b>                                                     |                                                                                                                                       |                                                                                                                             |
| 21                                                                                               | Content, emission and/or release of dangerous substances:<br><b>Content, emission and/or release of dangerous substances:</b>         | Description/Level                                                                                                           |

## Specific Part

### 1 Technical description of the product

The fischer injection system FIS EB II is a bonded fastener consisting of a cartridge with injection mortar fischer FIS EB II and a steel element according to Annex A 4.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, 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 anchor 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 to tension load (static and quasi-static loading)              | See Annex C 1 to C 6, B 3 to B7 |
| Characteristic resistance to shear load (static and quasi-static loading)                | See Annex C 1 to C 3            |
| Displacements under short-term and long-term loading                                     | See Annex C 7                   |
| Characteristic resistance and displacements for seismic performance categories C1 and C2 | See Annex C 8 to C 13           |

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

| Essential characteristic | Performance            |
|--------------------------|------------------------|
| Reaction to fire         | Class A1               |
| Resistance to fire       | See Annex C 14 to C 16 |

#### 3.3 Hygiene, health and the environment (BWR 3)

| Essential characteristic                                 | Performance             |
|----------------------------------------------------------|-------------------------|
| Content, emission and/or release of dangerous substances | No performance assessed |

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

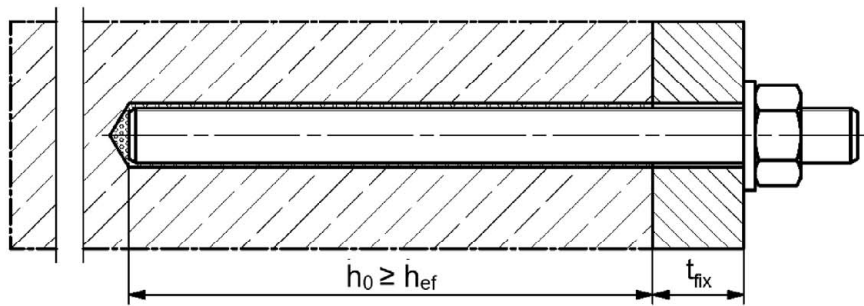
In accordance with EAD 330499-02-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

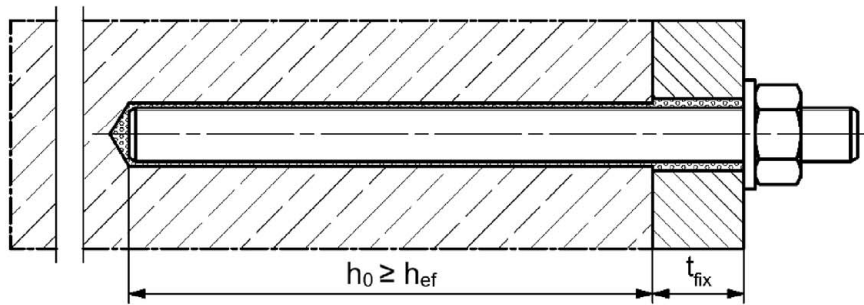
Installation conditions part 1

fischer anchor rod FIS A / RG (Anchor rod) and  
commercial standard threaded rods (Threaded rod)

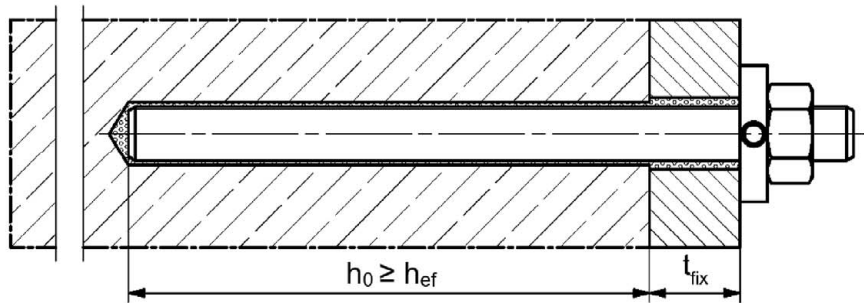
Pre-positioned installation



Push through installation (annular gap filled with mortar)



Pre-positioned or push through installation with subsequently injected filling disk  
(annular gap filled with mortar)



Figures not to scale

$h_0$  = drill hole depth  
 $t_{fix}$  = thickness of fixture

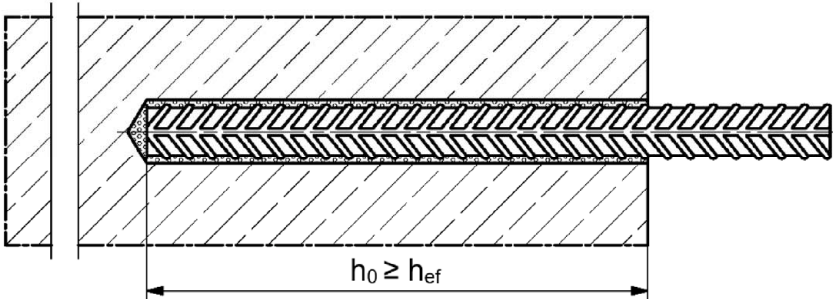
$h_{ef}$  = effective embedment depth

fischer injection system FIS EB II

Product description  
Installation conditions part 1

Installation conditions part 2

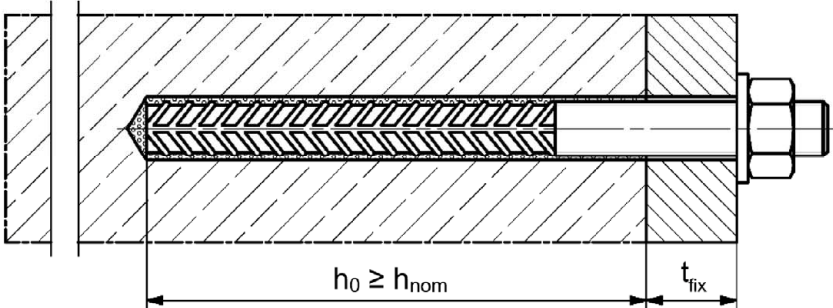
Reinforcing bar (Rebar)



$h_0 \geq h_{ef}$

fischer rebar anchor FRA (fischer FRA)

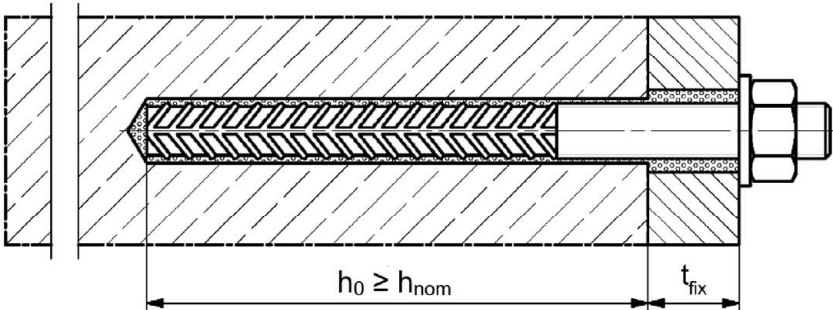
Pre-positioned installation



$h_0 \geq h_{nom}$

$t_{fix}$

Push through installation (annular gap filled with mortar)



$h_0 \geq h_{nom}$

$t_{fix}$

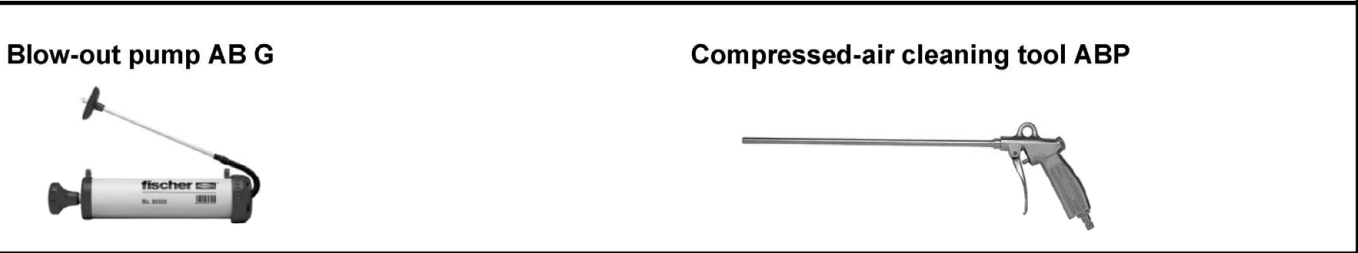
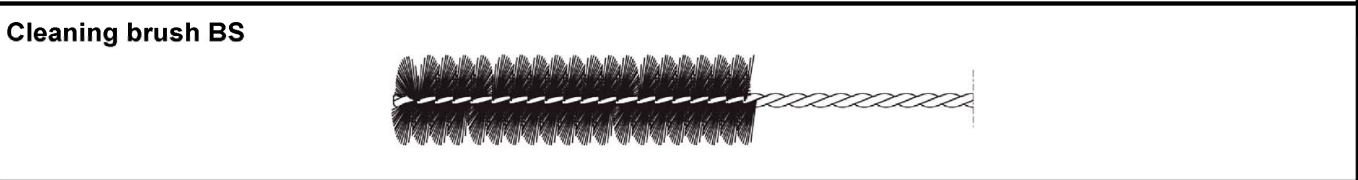
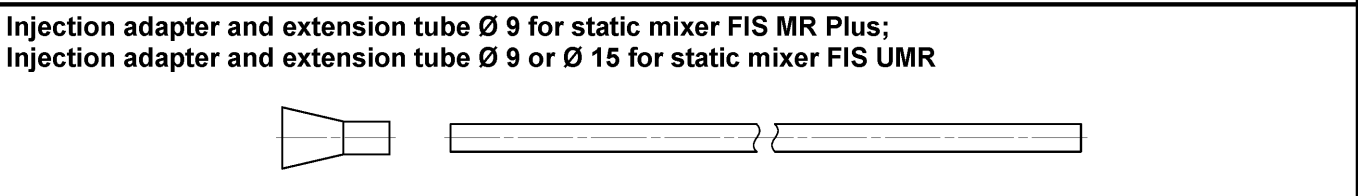
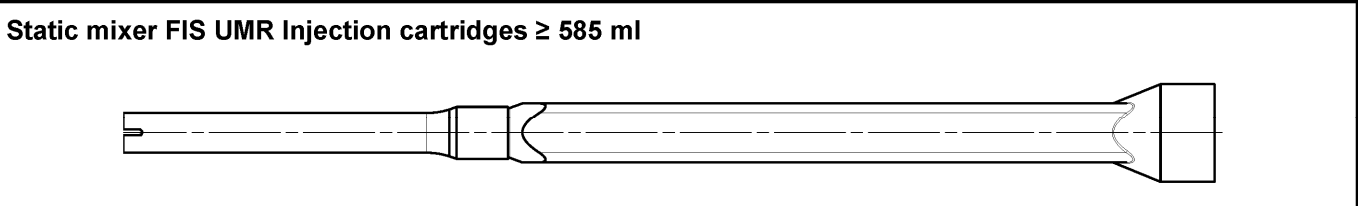
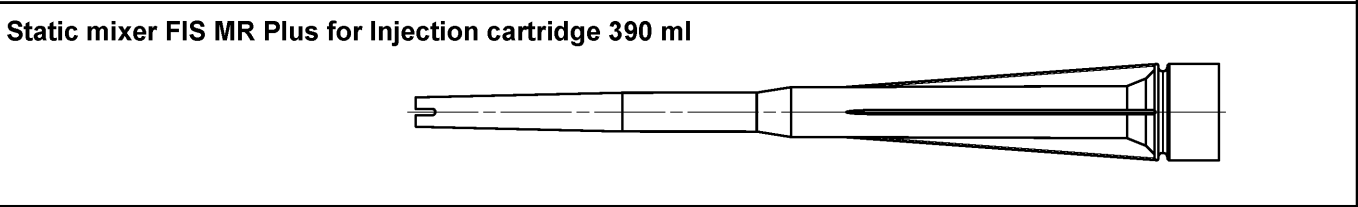
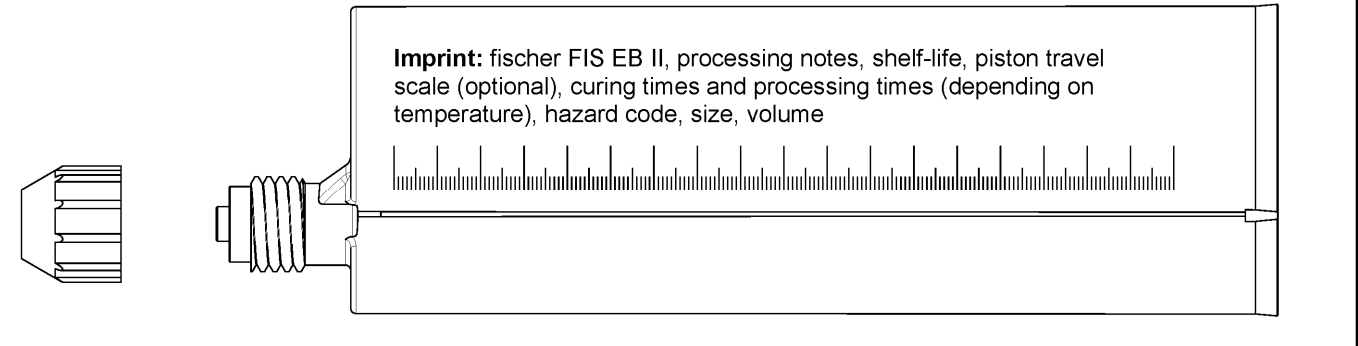
Figures not to scale

|                                  |                                                              |
|----------------------------------|--------------------------------------------------------------|
| $h_0$ = drill hole depth         | $h_{ef}$ = effective embedment depth                         |
| $t_{fix}$ = thickness of fixture | $h_{nom}$ = overall fastener embedment depth in the concrete |

|                                                              |                                     |
|--------------------------------------------------------------|-------------------------------------|
| fischer injection system FIS EB II                           | <b>Annex A 2</b><br>Appendix 4 / 34 |
| <b>Product description</b><br>Installation conditions part 2 |                                     |

Overview system components part 1

Injection cartridge (shuttle cartridge) with sealing cap; Size: 390 ml, 585 ml, 1100 ml, 1500 ml

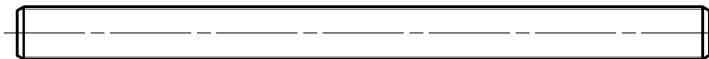


Figures not to scale

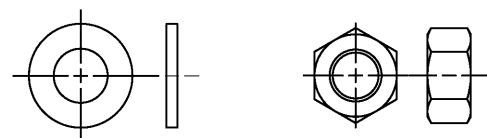
Overview system components part 2

**Anchor rod**

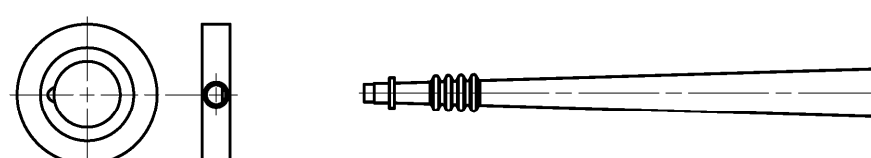
Size: M8, M10, M12, M16, M20, M24, M27, M30



**Washer / hexagon nut**



**fischer filling disk with injection adapter**



**Rebar**

Nominal diameter:  $\phi 8$ ,  $\phi 10$ ,  $\phi 12$ ,  $\phi 14$ ,  $\phi 16$ ,  $\phi 20$ ,  $\phi 25$ ,  $\phi 26$ ,  $\phi 28$ ,  $\phi 30$ ,  $\phi 32$



**fischer FRA, FRA HCR**

Size: M12, M16, M20, M24



Figures not to scale

|                                                                                                      |                                     |
|------------------------------------------------------------------------------------------------------|-------------------------------------|
| fischer injection system FIS EB II                                                                   | <b>Annex A 4</b><br>Appendix 6 / 34 |
| <b>Product description</b><br>Overview system components part 2; steel components, injection adapter |                                     |

| Table A5.1: Materials              |                                                |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
|------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Part                               | Designation                                    | Material                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
| 1                                  | Injection cartridge                            | Mortar, hardener, filler                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
|                                    | Steel grade                                    | Steel                                                                                                                                                                                                                                                                      | Stainless steel R                                                                                                                                                                                                                                                                                                                                 | High corrosion resistant steel HCR                                                                                                                                                     |
|                                    |                                                | zinc plated                                                                                                                                                                                                                                                                | acc. to EN 10088-1:2014<br>Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015                                                                                                                                                                                                                                                    | acc. to EN 10088-1:2014<br>Corrosion resistance class CRC V acc. to EN 1993-1-4:2006+A1:2015                                                                                           |
| 2                                  | Anchor rod or Threaded rod                     | Property class 4.8, 5.8 or 8.8;<br>EN ISO 898-1:2013<br>electroplated $\geq 5 \mu\text{m}$ ,<br>DIN EN ISO 4042:2022<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004+AC:2009<br>$f_{uk} \leq 1000 \text{ N/mm}^2$<br>fracture elongation $A_5 > 12 \%$ | Property class 50, 70 or 80;<br>EN ISO 3506-1:2020<br>1.4401; 1.4404; 1.4578;<br>1.4571; 1.4439; 1.4362;<br>1.4062, 1.4662, 1.4462;<br>EN 10088-1:2014<br>$f_{uk} \leq 1000 \text{ N/mm}^2$<br>fracture elongation $A_5 > 12 \%$                                                                                                                  | Property class 50 or 80;<br>EN ISO 3506-1:2020<br>or property class 70<br>1.4565; 1.4529;<br>EN 10088-1:2014<br>$f_{uk} \leq 1000 \text{ N/mm}^2$<br>fracture elongation $A_5 > 12 \%$ |
|                                    |                                                | Fracture elongation $A_5 > 8 \%$ for applications without requirements for seismic performance category C2                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
| 3                                  | Washer<br>ISO 7089:2000                        | electroplated $\geq 5 \mu\text{m}$ ,<br>EN ISO 4042:2022<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004+AC:2009                                                                                                                                       | 1.4401; 1.4404;<br>1.4578;1.4571;<br>1.4439; 1.4362;<br>EN 10088-1:2014                                                                                                                                                                                                                                                                           | 1.4565; 1.4529;<br>EN 10088-1:2014                                                                                                                                                     |
| 4                                  | Hexagon nut                                    | Property class 5 or 8 acc.<br>EN ISO 898-2:2012<br>electroplated $\geq 5 \mu\text{m}$ ,<br>EN ISO 4042:2022<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004+AC:2009                                                                                    | Property class 50, 70 or 80 acc.<br>EN ISO 3506-2:2020<br>1.4401; 1.4404; 1.4578;<br>1.4571; 1.4439; 1.4362;<br>EN 10088-1:2014                                                                                                                                                                                                                   | Property class 50, 70 or 80 acc.<br>EN ISO 3506-2:2020<br>1.4565; 1.4529<br>EN 10088-1:2014                                                                                            |
| 5                                  | fischer filling disk                           | electroplated $\geq 5 \mu\text{m}$ ,<br>EN ISO 4042:2022<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004+AC:2009                                                                                                                                       | 1.4401; 1.4404; 1.4578;<br>1.4571; 1.4439; 1.4362;<br>EN 10088-1:2014                                                                                                                                                                                                                                                                             | 1.4565;1.4529;<br>EN 10088-1:2014                                                                                                                                                      |
| 6                                  | Rebar<br>EN 1992-1-1:2004 and AC:2010, Annex C | Bars and de-coiled rods, class B or C with $f_{yk}$ and k according to NDP or NCI according to EN 1992-1-1/NA<br>$f_{uk} = f_{tk} = k \cdot f_{yk} (A_5 > 12 \%)$                                                                                                          |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
|                                    |                                                | Fracture elongation $A_5 > 8 \%$ for applications without requirements for seismic performance category C2                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
| 7                                  | fischer FRA                                    | Rebar part:<br>Bars and de-coiled rods class B or C with $f_{yk}$ and k according to NDP or NCI of EN 1992-1-1:2004+AC:2010<br>$f_{uk} = f_{tk} = k \cdot f_{yk} (A_5 > 12 \%)$<br>Threaded part: Property class 80<br>EN ISO 3506-1:2020                                  | 1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 acc. to EN 10088-1:2014<br>Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015<br>1.4565; 1.4529 acc. to EN 10088-1:2014<br>Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015<br>$f_{uk} \leq 1000 \text{ N/mm}^2$ ;<br>fracture elongation $A_5 > 12 \%$ |                                                                                                                                                                                        |
|                                    |                                                | Fracture elongation $A_5 > 8 \%$ for applications without requirements for seismic performance category C2                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
|                                    |                                                |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |
| fischer injection system FIS EB II |                                                |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                   | Annex A 5<br>Appendix 7 / 34                                                                                                                                                           |
| Product description<br>Materials   |                                                |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                        |

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

1) No performance assessed

**Intended use**  
Specifications part 1

Appendix 8 / 34

## Specifications of intended use part 2

### Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021.

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A 5 Table 5.1.

### Design:

- Fastenings are designed under the responsibility of an engineer experienced in fastenings and concrete work.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Fastenings are designed in accordance with:  
EN 1992-4:2018 and TR 082 from June 2023.

### Installation:

- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Fastening depth should be marked and adhered to installation.
- Overhead installation is allowed (necessary equipment see installation instruction).

fischer injection system FIS EB II

**Intended use**  
Specifications part 2

**Annex B 2**

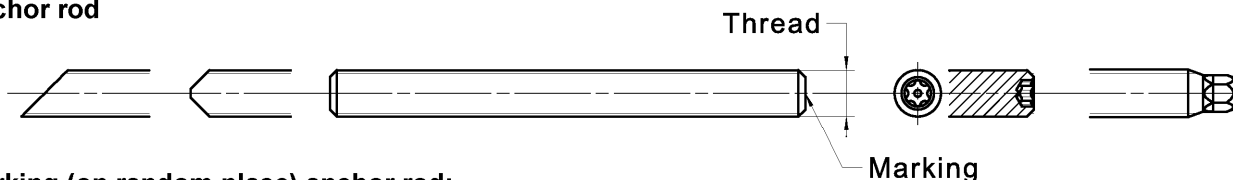
Appendix 9 / 34

**Table B3.1: Installation parameters for Anchor rods**

| Anchor rods                                        |                                               |      | M8                               | M10 | M12 | M16                               | M20 | M24 | M27 | M30 |  |
|----------------------------------------------------|-----------------------------------------------|------|----------------------------------|-----|-----|-----------------------------------|-----|-----|-----|-----|--|
| Nominal drill hole diameter                        | d <sub>0</sub>                                | [mm] | 10                               | 12  | 14  | 18                                | 24  | 28  | 30  | 35  |  |
| Drill hole depth                                   | h <sub>0</sub>                                |      | h <sub>0</sub> ≥ h <sub>ef</sub> |     |     |                                   |     |     |     |     |  |
| Effective embedment depth                          | h <sub>ef, min</sub>                          |      | 60                               | 60  | 70  | 80                                | 90  | 96  | 108 | 120 |  |
|                                                    | h <sub>ef, max</sub>                          |      | 160                              | 200 | 240 | 320                               | 400 | 480 | 540 | 600 |  |
| Simplified spacing and edge distance <sup>1)</sup> | s<br>=<br>c                                   |      | 40                               | 45  | 55  | 65                                | 85  | 105 | 120 | 140 |  |
| Diameter of the clearance hole of the fixture      | pre-positioned installation<br>d <sub>f</sub> |      | 9                                | 12  | 14  | 18                                | 22  | 26  | 30  | 33  |  |
|                                                    | push through installation<br>d <sub>f</sub>   |      | 12                               | 14  | 16  | 20                                | 26  | 30  | 33  | 40  |  |
| Minimum thickness of concrete member               | h <sub>min</sub>                              |      | h <sub>ef</sub> + 30<br>(≥ 100)  |     |     | h <sub>ef</sub> + 2d <sub>0</sub> |     |     |     |     |  |
| Maximum installation torque                        | max T <sub>inst</sub>                         | [Nm] | 10                               | 20  | 40  | 60                                | 120 | 150 | 200 | 300 |  |

<sup>1)</sup> Detailed calculation according to Annex B 6 and B 7

#### Anchor rod



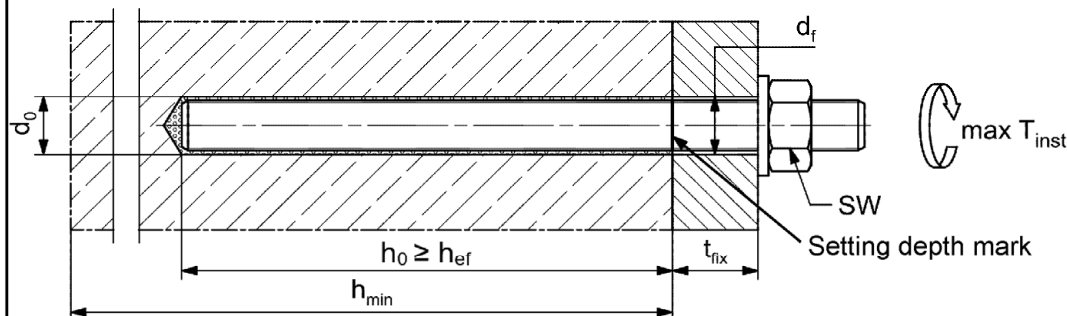
#### Marking (on random place) anchor rod:

|                                                        |        |                                                        |   |
|--------------------------------------------------------|--------|--------------------------------------------------------|---|
| Steel electroplated PC <sup>1)</sup> 8.8               | • or + | Steel hot-dip PC <sup>1)</sup> 8.8                     | • |
| High corrosion resistant steel HCR PC <sup>1)</sup> 50 | •      | High corrosion resistant steel HCR PC <sup>1)</sup> 70 | - |
| High corrosion resistant steel HCR PC <sup>1)</sup> 80 | (      | Stainless steel R property class 50                    | ~ |
| Stainless steel R property class 80                    | *      |                                                        |   |

Alternatively: Colour coding according to DIN 976-1: 2016

<sup>1)</sup> PC = property class

#### Installation conditions:



**Threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled**

- Materials, dimensions and mechanical properties according to Annex A 5, Table A5.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents shall be stored
- Setting depth is marked

Figures not to scale

fischer injection system FIS EB II

#### Intended use

Installation parameters Anchor rods

#### Annex B 3

Appendix 10 / 34

**Table B4.1: Installation parameters for Rebars**

| Nominal diameter of the rebar                      |                     | $\phi$ | 8 <sup>1)</sup>                  |    | 10 <sup>1)</sup> |    | 12 <sup>1)</sup> |                                   | 14  | 16  | 20  | 25  | 26  | 28  | 30  | 32  |
|----------------------------------------------------|---------------------|--------|----------------------------------|----|------------------|----|------------------|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Nominal drill hole diameter                        | d <sub>0</sub>      | [mm]   | 10                               | 12 | 12               | 14 | 14               | 16                                | 18  | 20  | 25  | 30  | 35  | 35  | 40  | 40  |
| Drill hole depth                                   | h <sub>0</sub>      |        | h <sub>0</sub> ≥ h <sub>ef</sub> |    |                  |    |                  |                                   |     |     |     |     |     |     |     |     |
| Effective embedment depth                          | h <sub>ef,min</sub> |        | 60                               |    | 60               |    | 70               |                                   | 75  | 80  | 90  | 100 | 104 | 112 | 120 | 128 |
|                                                    | h <sub>ef,max</sub> |        | 160                              |    | 200              |    | 240              |                                   | 280 | 320 | 400 | 500 | 520 | 560 | 600 | 640 |
| Simplified spacing and edge distance <sup>2)</sup> | s<br>=<br>c         |        | 40                               |    | 45               |    | 55               |                                   | 60  | 65  | 85  | 120 | 120 | 140 | 140 | 160 |
| Minimum thickness of concrete member               | h <sub>min</sub>    |        | h <sub>ef</sub> + 30<br>(≥ 100)  |    |                  |    |                  | h <sub>ef</sub> + 2d <sub>0</sub> |     |     |     |     |     |     |     |     |

<sup>1)</sup> Both drill hole diameters can be used

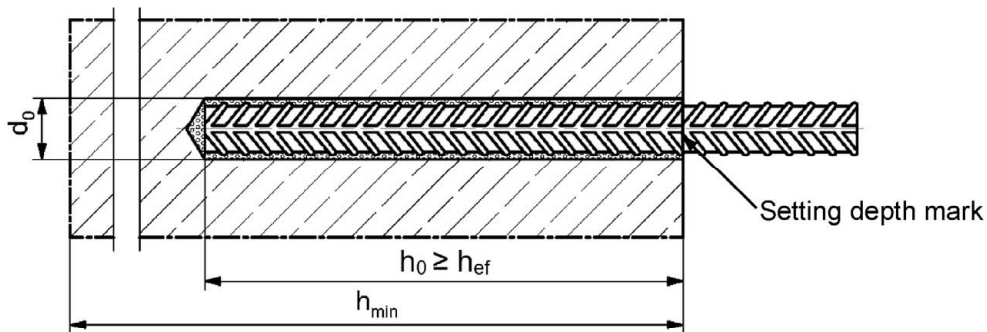
<sup>2)</sup> Detailed calculation according to Annex B 6 und B 7

### Rebar



- The minimum value of related rib area  $f_{R,min}$  must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range:  $0,05 \cdot \phi \leq h_{rib} \leq 0,07 \cdot \phi$   
( $\phi$  = Nominal diameter of the rebar,  $h_{rib}$  = rib height)

### Installation conditions:



Figures not to scale

fischer injection system FIS EB II

**Intended use**  
Installation parameters Rebars

**Annex B 4**

Appendix 11 / 34

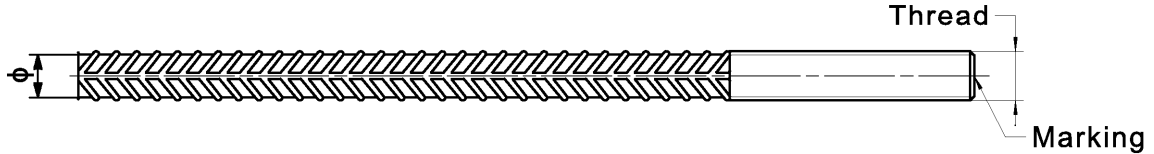
**Table B5.1: Installation parameters for fischer FRA**

| fischer FRA                                         |                                     |      | M12 <sup>1)</sup>            |              | M16 | M20 | M24 |
|-----------------------------------------------------|-------------------------------------|------|------------------------------|--------------|-----|-----|-----|
| Nominal diameter of the rebar                       | $\phi$                              | [mm] | 12                           |              | 16  | 20  | 25  |
| Nominal drill hole diameter                         | $d_0$                               |      | 14                           | 16           | 20  | 25  | 30  |
| Drill hole depth                                    | $h_0$                               |      | $h_{ef} + l_e$               |              |     |     |     |
| Effective embedment depth                           | $h_{ef,min}$                        |      | 70                           |              | 80  | 90  | 96  |
|                                                     | $h_{ef,max}$                        |      | 140                          |              | 220 | 300 | 380 |
| Distance concrete surface to welded joint           | $l_e$                               |      | 100                          |              |     |     |     |
| Simplified spacing and edge distance <sup>2)</sup>  | $s = c$                             |      | 55                           |              | 65  | 85  | 105 |
| Diameter of clearance hole in the fixture           | pre-positioned anchorage $\leq d_f$ |      | 14                           |              | 18  | 22  | 26  |
|                                                     | push through anchorage $\leq d_f$   |      | 18                           |              | 22  | 26  | 32  |
| Minimum thickness of concrete member                | $h_{min}$                           |      | $h_0 + 30$<br>( $\geq 100$ ) | $h_0 + 2d_0$ |     |     |     |
| Maximum torque moment for attachment of the fixture | $\max T_{inst}$                     | [Nm] | 40                           |              | 60  | 120 | 150 |

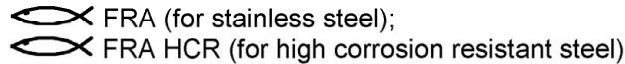
<sup>1)</sup> Both drill hole diameters can be used

<sup>2)</sup> Detailed calculation according to Annex B 6 and B 7

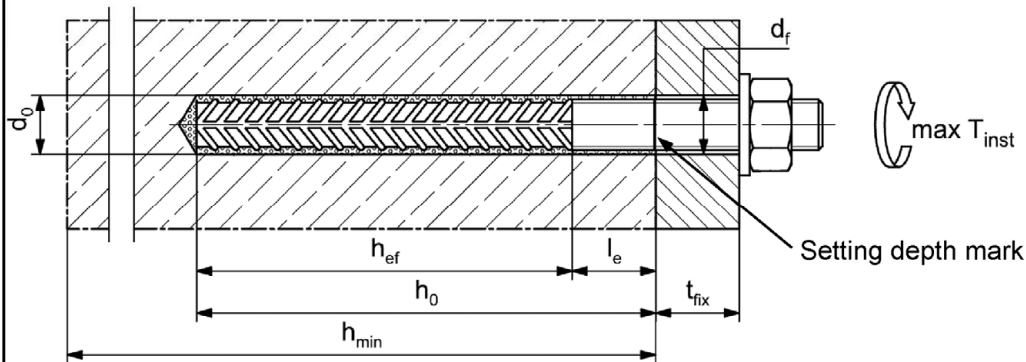
#### fischer FRA



Marking frontal e. g:



#### Installation conditions:



Figures not to scale

fischer injection system FIS EB II

#### Intended use

Installation parameters fischer FRA

#### Annex B 5

Appendix 12 / 34

**Table B6.1:** Minimum spacing and minimum edge distance for **Anchor rods, Rebars and fischer FRA**

|                                                   |              |                            |                        |      |      |      |      |      |
|---------------------------------------------------|--------------|----------------------------|------------------------|------|------|------|------|------|
| Anchor rods                                       |              |                            | M8                     | M10  | M12  | -    | M16  | M20  |
| Rebars / fischer FRA<br>(nominal diameter) $\phi$ |              |                            | 8                      | 10   | 12   | 14   | 16   | 20   |
| Minimum edge distance                             |              |                            |                        |      |      |      |      |      |
| Uncracked / cracked concrete                      | $c_{min}$    | [mm]                       | 40                     | 45   | 45   | 45   | 50   | 55   |
| Spacing                                           | s            |                            | according to Annex B 7 |      |      |      |      |      |
| Minimum spacing                                   |              |                            |                        |      |      |      |      |      |
| Uncracked / cracked concrete                      | $s_{min}$    | [mm]                       | 40                     | 45   | 55   | 60   | 65   | 85   |
| Edge distance                                     | c            |                            | according to Annex B 7 |      |      |      |      |      |
| Required projecting area                          |              |                            |                        |      |      |      |      |      |
| Uncracked concrete                                | $A_{sp,req}$ | [1000<br>mm <sup>2</sup> ] | 8,0                    | 13,0 | 22,0 | 23,0 | 24,0 | 38,5 |
| Cracked concrete                                  |              |                            | 6,5                    | 10,0 | 16,5 | 17,5 | 18,5 | 29,5 |

|                                                   |              |                            |                        |      |      |      |      |      |      |
|---------------------------------------------------|--------------|----------------------------|------------------------|------|------|------|------|------|------|
| Anchor rods                                       |              |                            | M24                    | -    | -    | M27  | -    | M30  | -    |
| Rebars / fischer FRA<br>(nominal diameter) $\phi$ |              |                            | -                      | 25   | 26   | -    | 28   | 30   | 32   |
| Minimum edge distance                             |              |                            |                        |      |      |      |      |      |      |
| Uncracked / cracked concrete                      | $c_{min}$    | [mm]                       | 60                     | 75   | 75   | 75   | 80   | 80   | 120  |
| Spacing                                           | s            |                            | according to Annex B 7 |      |      |      |      |      |      |
| Minimum spacing                                   |              |                            |                        |      |      |      |      |      |      |
| Uncracked / cracked concrete                      | $s_{min}$    | [mm]                       | 105                    | 120  | 120  | 120  | 140  | 140  | 160  |
| Edge distance                                     | c            |                            | according to Annex B 7 |      |      |      |      |      |      |
| Required projecting area                          |              |                            |                        |      |      |      |      |      |      |
| Uncracked concrete                                | $A_{sp,req}$ | [1000<br>mm <sup>2</sup> ] | 40,0                   | 47,5 | 47,5 | 47,5 | 64,0 | 64,0 | 64,0 |
| Cracked concrete                                  |              |                            | 30,5                   | 36,5 | 36,5 | 36,5 | 49,0 | 49,0 | 49,0 |

**Splitting failure** for minimum edge distance and spacing in dependence of the effective embedment depth  $h_{ef}$ .

For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

$$A_{sp, req} < A_{sp}$$

$$A_{sp, req} = \text{required projecting area}$$

$A_{sp}$  = projecting area (according to Annex B 7)

fischer injection system FIS EB II

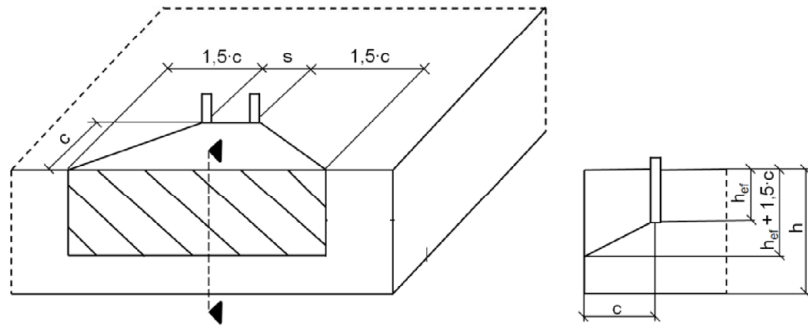
Intended use

Minimum spacing and edge distance for Anchor rods, Rebars and fischer FRA

## Annex B 6

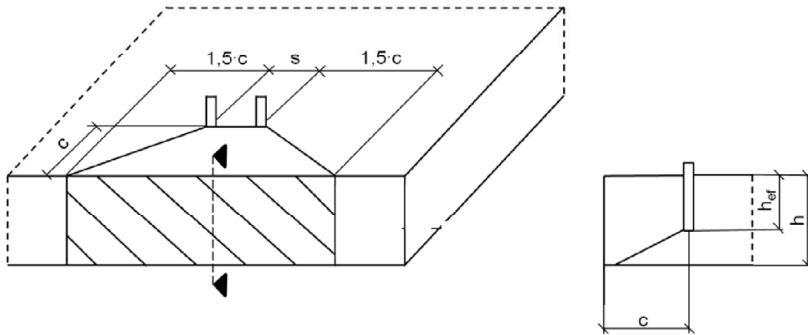
Appendix 13 / 34

**Table B7.1: Projecting area  $A_{sp}$  with concrete member thickness**  
 $h > h_{ef} + 1,5 \cdot c$  and  $h \geq h_{min}$



|                                           |                                                         |          |                       |
|-------------------------------------------|---------------------------------------------------------|----------|-----------------------|
| Single fastener                           | $A_{sp} = (3 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$     | $[mm^2]$ | with $c \geq c_{min}$ |
| Group of fastener with $s > 3 \cdot c$    | $A_{sp} = (6 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$     | $[mm^2]$ |                       |
| Group of fastener with $s \leq 3 \cdot c$ | $A_{sp} = (3 \cdot c + s) \cdot (h_{ef} + 1,5 \cdot c)$ | $[mm^2]$ |                       |

**Table B7.2: Projecting area  $A_{sp}$  with concrete member thickness**  
 $h \leq h_{ef} + 1,5 \cdot c$  and  $h \geq h_{min}$



|                                           |                                                     |          |                                            |
|-------------------------------------------|-----------------------------------------------------|----------|--------------------------------------------|
| Single fastener                           | $A_{sp} = 3 \cdot c \cdot \text{existing } h$       | $[mm^2]$ | with $c \geq c_{min}$                      |
| Group of fastener with $s > 3 \cdot c$    | $A_{sp} = 6 \cdot c \cdot \text{existing } h$       | $[mm^2]$ |                                            |
| Group of fastener with $s \leq 3 \cdot c$ | $A_{sp} = (3 \cdot c + s) \cdot \text{existing } h$ | $[mm^2]$ | with $c \geq c_{min}$ and $s \geq s_{min}$ |

Edge distance and axial spacing shall be rounded up to at least 5 mm

Figures not to scale

fischer injection system FIS EB II

**Intended use**

Minimum thickness of concrete member for Anchor rods, Rebar, fischer FRA and minimum spacing and edge distance

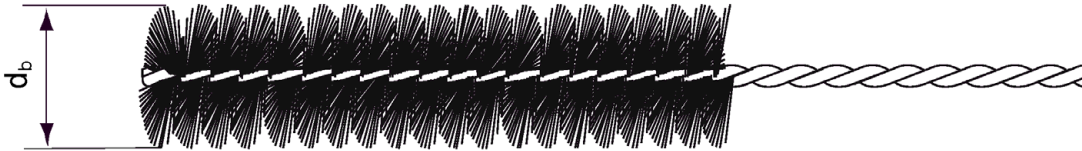
**Annex B 7**

Appendix 14 / 34

**Table B8.1: Parameters of the cleaning brush BS (steel brush with steel bristles)**

The size of the cleaning brush refers to the drill hole diameter

|                             |       |      |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------------------|-------|------|----|----|----|----|----|----|----|----|----|----|----|----|
| Nominal drill hole diameter | $d_0$ | [mm] | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 25 | 28 | 30 | 35 | 40 |
| Steel brush diameter BS     | $d_b$ |      | 11 | 14 | 16 | 20 |    | 25 | 26 | 27 | 30 | 40 |    | 42 |

**Table B8.2: 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 |      | $\leq 90$ |    | $\leq 120$ | $\leq 140$ | $\leq 150$ | $\leq 160$ | $\leq 190$ | $\leq 210$ |            |    |    |    |
|                                 | FIS UMR     |      | -         | -  | $\leq 90$  | $\leq 160$ | $\leq 180$ | $\leq 190$ | $\leq 220$ |            | $\leq 250$ |    |    |    |

**Table B8.3 Maximum processing time of the mortar and minimum curing time**  
 (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

| Temperature at anchoring base [°C] | Maximum processing time $t_{work}$ | 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                           |

fischer injection system FIS EB II

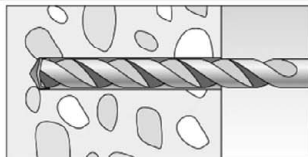
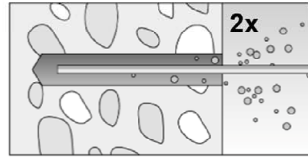
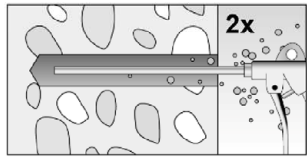
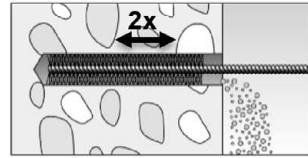
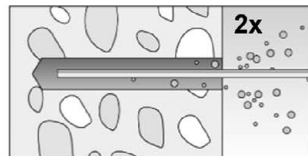
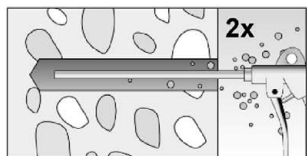
**Intended use**  
 Cleaning brush (steel brush)  
 Processing time and curing time

**Annex B 8**

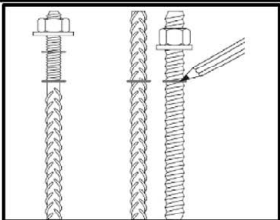
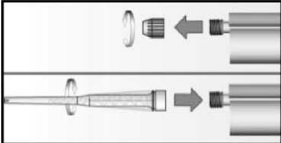
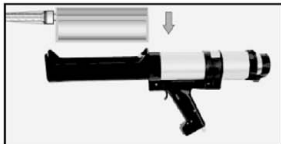
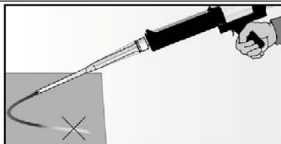
Appendix 15 / 34

## Installation instructions part 1

### Drilling and cleaning the hole (hammer drilling with standard drill bit)

|   |                                                                                   |                                                                                                                                                                                               |                                                                                    |                                                                                                                                  |
|---|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Drill the hole.<br>Nominal drill hole diameter $d_0$ and drill hole depth $h_0$<br>see <b>Tables B3.1, B4.1, B5.1.</b>                                                                        |                                                                                    |                                                                                                                                  |
| 2 |  | Clean the drill hole:<br>For $h_{ef} \leq 12d$ and<br>$d_0 < 18$ mm<br>blow out the hole twice<br>by hand.                                                                                    |  | For $h_{ef} > 12d$ and / or<br>$d_0 \geq 18$ mm blow out<br>the hole twice with<br>oil-free compressed air<br>( $p \geq 6$ bar). |
| 3 |  | Brush the drill hole twice. For drill hole diameter $d_0 \geq 18$ mm and / or $h_{ef} > 12d$ use a power drill. For deep holes use an extension. Corresponding brushes see <b>Table B8.1.</b> |                                                                                    |                                                                                                                                  |
| 4 |  | Clean the drill hole:<br>For $h_{ef} \leq 12d$ and<br>$d_0 < 18$ mm<br>blow out the hole twice<br>by hand.                                                                                    |  | For $h_{ef} > 12d$ and / or<br>$d_0 \geq 18$ mm blow out the<br>hole twice with<br>oil-free compressed air<br>( $p \geq 6$ bar). |

### Preparing

|   |                                                                                     |                                                                                                                  |                                                                                                                                     |
|---|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 5 |   | Mark the setting depth of the steel element                                                                      |                                                                                                                                     |
| 6 |  | Remove the sealing cap<br>Screw on the static mixer<br>(the spiral in the static mixer must be clearly visible). |                                                                                                                                     |
| 7 |  |                               | Place the cartridge into the dispenser.                                                                                             |
| 8 |  |                               | Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey. |

Go to Step 9

fischer injection system FIS EB II

#### Intended use

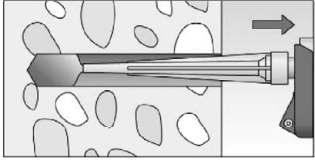
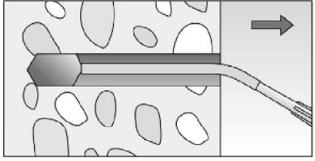
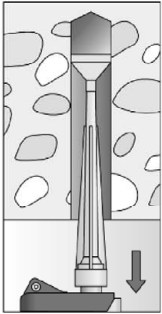
Installation instructions part 1

#### Annex B 9

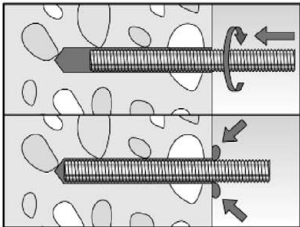
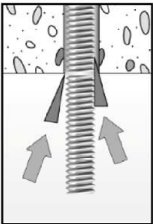
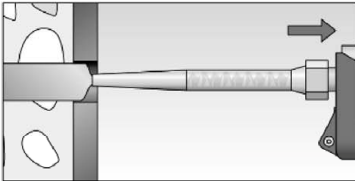
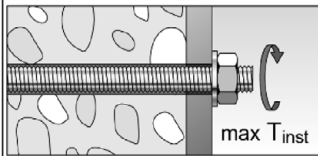
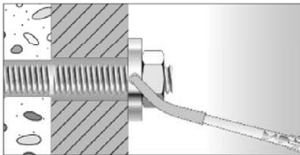
Appendix 16 / 34

## Installation instructions part 2

### Injection of the mortar

|   |                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9 |  <p>Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles.</p> |  <p>The conditions for mortar injection without extension tube can be found in <b>Table B8.2</b></p> <p>For deeper drill holes, than those mentioned in <b>Table B8.2</b>, use a suitable extension tube.</p> |  <p>For overhead installation, deep holes (<math>h_0 &gt; 250 \text{ mm}</math>) or drill hole diameter (<math>d_0 \geq 30 \text{ mm}</math>) use an injection-adapter.</p> |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Installation of Anchor rods

|        |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                      |                                                                                      |                                                                                         |
|--------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 10     |    | <p>Only use clean and oil-free anchor elements.</p> <p>Push the anchor rod with the setting depth mark down to the bottom of the hole, turning it slightly while doing so.</p> <p>After inserting the anchor element, excess mortar must be emerged around the anchor element.</p>                                                                                                                                                  |                                                                                      |                                                                                      |                                                                                         |
|        |  | <p>For overhead installations support the anchor rod with wedges (e. g. fischer centering wedges) or fischer overhead clips.</p>                                                                                                                                                                                                                                                                                                    |  | <p>For push through installation fill the annular gap with mortar.</p>               |                                                                                         |
| 11     |  | <p>Wait for the specified curing time <math>t_{\text{cure}}</math> see <b>Table B8.3</b>.</p>                                                                                                                                                                                                                                                                                                                                       | 12                                                                                   |  | <p>Mounting the fixture<br/>max <math>T_{\text{inst}}</math> see <b>Table B3.1</b>.</p> |
| Option |  | <p>After the minimum curing time is reached, the gap between anchor and fixture (annular clearance) may be filled with mortar via the fischer filling disc.</p> <p>Compressive strength <math>\geq 50 \text{ N/mm}^2</math> (e.g. fischer injection mortars FIS EB II, FIS SB, FIS V Plus, FIS EM Plus).</p> <p>ATTENTION:</p> <p>Using fischer filling disk reduces <math>t_{\text{fix}}</math> (usable length of the anchor).</p> |                                                                                      |                                                                                      |                                                                                         |

fischer injection system FIS EB II

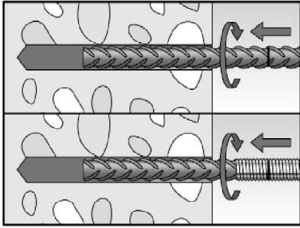
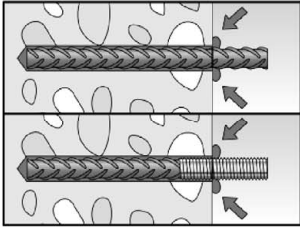
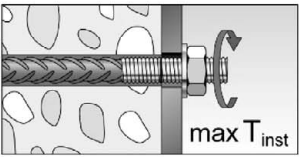
**Intended use**  
Installation instructions part 2

**Annex B 10**

Appendix 17 / 34

Installation instructions part 3

Installation Rebars and fischer FRA

|    |                                                                                    |                                                                                                                                                                                                                                                                                   |  |
|----|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 10 |   | <p>Only use clean and oil-free rebars or fischer FRA. Push the rebar or the fischer FRA with the setting depth mark into the filled hole up to the setting depth mark.</p> <p>Recommendation:<br/>Rotation back and forth of the rebar or the fischer FRA makes pushing easy.</p> |  |
|    |   | <p>When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.</p>                                                                                                                                                                    |  |
| 11 |   | Wait for the specified curing time $t_{cure}$ see <b>Table B8.3</b>                                                                                                                                                                                                               |  |
| 12 |  | Mounting the fixture<br>$max T_{inst}$<br>see <b>Table B5.1</b>                                                                                                                                                                                                                   |  |

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

|                                                  |  |                                       |
|--------------------------------------------------|--|---------------------------------------|
| fischer injection system FIS EB II               |  | <b>Annex B 11</b><br>Appendix 18 / 34 |
| Intended use<br>Installation instructions part 3 |  |                                       |

**Table C1.1: Characteristic resistance to steel failure under tension and shear loading of Anchor rods and Threaded rods**

| Anchor rod / Threaded rod                                                                                                                                                           |                                                          |                |     | M8   | M10                                    | M12         | M16   | M20   | M24   | M27   | M30    |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------|-----|------|----------------------------------------|-------------|-------|-------|-------|-------|--------|--------|
| Characteristic resistance to steel failure under tension loading <sup>3)</sup>                                                                                                      |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| Characteristic resistance $N_{Rk,s}$                                                                                                                                                | Steel zinc plated                                        | Property class | 4.8 | [kN] | 14,6 (13,2)                            | 23,2 (21,4) | 33,7  | 62,8  | 98,0  | 141,2 | 183,6  | 224,4  |
|                                                                                                                                                                                     |                                                          |                | 5.8 |      | 18,3 (16,6)                            | 29,0 (26,8) | 42,1  | 78,5  | 122,5 | 176,5 | 229,5  | 280,5  |
|                                                                                                                                                                                     |                                                          |                | 8.8 |      | 29,2 (26,5)                            | 46,4 (42,8) | 67,4  | 125,6 | 196,0 | 282,4 | 367,2  | 448,8  |
|                                                                                                                                                                                     | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 18,3                                   | 29,0        | 42,1  | 78,5  | 122,5 | 176,5 | 229,5  | 280,5  |
|                                                                                                                                                                                     |                                                          |                | 70  |      | 25,6                                   | 40,6        | 59,0  | 109,9 | 171,5 | 247,1 | 321,3  | 392,7  |
|                                                                                                                                                                                     |                                                          |                | 80  |      | 29,2                                   | 46,4        | 67,4  | 125,6 | 196,0 | 282,4 | 367,2  | 448,8  |
| Partial factors <sup>1)</sup>                                                                                                                                                       |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| Partial factor $\gamma_{Ms}$                                                                                                                                                        | Steel zinc plated                                        | Property class | 4.8 | [-]  | 1,50                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 5.8 |      | 1,50                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 8.8 |      | 1,50                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 2,86                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 70  |      | 1,87 / fischer HCR: 1,50               |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 80  |      | 1,60                                   |             |       |       |       |       |        |        |
| Characteristic resistance to steel failure under shear loading <sup>3)</sup>                                                                                                        |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| without lever arm                                                                                                                                                                   |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| Characteristic resistance $V_{Rk,s}^0$                                                                                                                                              | Steel zinc plated                                        | Property class | 4.8 | [kN] | 8,7 (7,9)                              | 13,9 (12,8) | 20,2  | 37,6  | 58,8  | 84,7  | 110,1  | 134,6  |
|                                                                                                                                                                                     |                                                          |                | 5.8 |      | 10,9 (9,9)                             | 17,4 (16,0) | 25,2  | 47,1  | 73,5  | 105,9 | 137,7  | 168,3  |
|                                                                                                                                                                                     |                                                          |                | 8.8 |      | 14,6 (13,2)                            | 23,2 (21,4) | 33,7  | 62,8  | 98,0  | 141,2 | 183,6  | 224,4  |
|                                                                                                                                                                                     | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 9,1                                    | 14,5        | 21,0  | 39,2  | 61,2  | 88,2  | 114,7  | 140,2  |
|                                                                                                                                                                                     |                                                          |                | 70  |      | 12,8                                   | 20,3        | 29,5  | 54,9  | 85,7  | 123,5 | 160,6  | 196,3  |
|                                                                                                                                                                                     |                                                          |                | 80  |      | 14,6                                   | 23,2        | 33,7  | 62,8  | 98,0  | 141,2 | 183,6  | 224,4  |
| Ductility factor                                                                                                                                                                    |                                                          | k <sub>7</sub> | [-] | 1,0  |                                        |             |       |       |       |       |        |        |
| with lever arm                                                                                                                                                                      |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| Characteristic resistance $M_{Rk,s}^0$                                                                                                                                              | Steel zinc plated                                        | Property class | 4.8 | [Nm] | 14,9 (12,9)                            | 29,9 (26,5) | 52,3  | 132,9 | 259,6 | 448,8 | 665,7  | 899,5  |
|                                                                                                                                                                                     |                                                          |                | 5.8 |      | 18,7 (16,1)                            | 37,3 (33,2) | 65,4  | 166,2 | 324,6 | 561,0 | 832,2  | 1124,4 |
|                                                                                                                                                                                     |                                                          |                | 8.8 |      | 29,9 (25,9)                            | 59,8 (53,1) | 104,6 | 265,9 | 519,3 | 897,6 | 1331,5 | 1799,0 |
|                                                                                                                                                                                     | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 18,7                                   | 37,3        | 65,4  | 166,2 | 324,6 | 561,0 | 832,2  | 1124,4 |
|                                                                                                                                                                                     |                                                          |                | 70  |      | 26,2                                   | 52,3        | 91,5  | 232,6 | 454,4 | 785,4 | 1165   | 1574,1 |
|                                                                                                                                                                                     |                                                          |                | 80  |      | 29,9                                   | 59,8        | 104,6 | 265,9 | 519,3 | 897,6 | 1331,5 | 1799,0 |
| Partial factors <sup>1)</sup>                                                                                                                                                       |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| Partial factor $\gamma_{Ms}$                                                                                                                                                        | Steel zinc plated                                        | Property class | 4.8 | [-]  | 1,25                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 5.8 |      | 1,25                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 8.8 |      | 1,25                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 2,38                                   |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 70  |      | 1,56 / fischer HCR: 1,25 <sup>2)</sup> |             |       |       |       |       |        |        |
|                                                                                                                                                                                     |                                                          |                | 80  |      | 1,33                                   |             |       |       |       |       |        |        |
| <sup>1)</sup> In absence of other national regulations.                                                                                                                             |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| <sup>2)</sup> Only admissible for high corrosion resistant steel HCR, with $f_{yk}/f_{uk} \leq 0,8$ and $f_{uk} \leq 800 \text{ N/mm}^2$ (e.g. anchor rods).                        |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |
| <sup>3)</sup> Values in brackets are valid for undersized threaded rods with smaller stress area $A_s$ for hot dip galvanized threaded rods according to EN ISO 10684:2004+AC:2009. |                                                          |                |     |      |                                        |             |       |       |       |       |        |        |

fischer injection system FIS EB II

**Performance**

Characteristic resistance to steel failure under tension and shear loading of Anchor rods and Threaded rods

**Annex C 1**

Appendix 19 / 34

**Table C2.1: Characteristic resistance to steel failure under tension and shear loading of Rebars**

| Nominal diameter of the rebar                                                                                                                                                                                                                                                                                                                                                                                                                                          |              | $\phi$ | 8                                       | 10 | 12 | 14 | 16 | 20 | 25 | 26 | 28 | 30 | 32 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|-----------------------------------------|----|----|----|----|----|----|----|----|----|----|
| Characteristic resistance to steel failure under tension loading                                                                                                                                                                                                                                                                                                                                                                                                       |              |        |                                         |    |    |    |    |    |    |    |    |    |    |
| Characteristic resistance                                                                                                                                                                                                                                                                                                                                                                                                                                              | $N_{Rk,s}$   | [kN]   | $A_s \cdot f_{uk}^{2)}$                 |    |    |    |    |    |    |    |    |    |    |
| Characteristic resistance to steel failure under shear loading                                                                                                                                                                                                                                                                                                                                                                                                         |              |        |                                         |    |    |    |    |    |    |    |    |    |    |
| Without lever arm                                                                                                                                                                                                                                                                                                                                                                                                                                                      |              |        |                                         |    |    |    |    |    |    |    |    |    |    |
| Characteristic resistance                                                                                                                                                                                                                                                                                                                                                                                                                                              | $V^0_{Rk,s}$ | [kN]   | $k_6^{1)}) \cdot A_s \cdot f_{uk}^{2)}$ |    |    |    |    |    |    |    |    |    |    |
| Ductility factor                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $k_7$        | [-]    | 1,0                                     |    |    |    |    |    |    |    |    |    |    |
| With lever arm                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |        |                                         |    |    |    |    |    |    |    |    |    |    |
| Characteristic resistance                                                                                                                                                                                                                                                                                                                                                                                                                                              | $M^0_{Rk,s}$ | [Nm]   | $1,2 \cdot W_{el} \cdot f_{uk}^{2)}$    |    |    |    |    |    |    |    |    |    |    |
| <div>1) In accordance with EN 1992-4:2018 section 7.2.2.3.1<br/><math>k_6 = 0,6</math> for fasteners made of carbon steel with <math>f_{uk} \leq 500 \text{ N/mm}^2</math><br/><math>= 0,5</math> for fasteners made of carbon steel with <math>500 &lt; f_{uk} \leq 1000 \text{ N/mm}^2</math><br/><math>= 0,5</math> for fasteners made of stainless steel</div> <div>2) <math>f_{uk}</math> respectively shall be taken from the specifications of the rebar.</div> |              |        |                                         |    |    |    |    |    |    |    |    |    |    |

**Table C2.2: Characteristic resistance to steel failure under tension and shear loading of fischer FRA**

| fischer FRA                                                      |                                |      | M12   | M16   | M20   | M24   |
|------------------------------------------------------------------|--------------------------------|------|-------|-------|-------|-------|
| Characteristic resistance to steel failure under tension loading |                                |      |       |       |       |       |
| Characteristic resistance                                        | N <sub>Rk,s</sub>              | [kN] | 62,1  | 110,5 | 172,7 | 263,0 |
| Partial factor <sup>1)</sup>                                     |                                |      |       |       |       |       |
| Partial factor                                                   | γ <sub>Ms</sub>                | [-]  | 1,4   |       |       |       |
| Characteristic resistance to steel failure under shear loading   |                                |      |       |       |       |       |
| Without lever arm                                                |                                |      |       |       |       |       |
| Characteristic resistance                                        | V <sup>0</sup> <sub>Rk,s</sub> | [kN] | 33,7  | 62,8  | 98,0  | 141,2 |
| Ductility factor                                                 | k <sub>7</sub>                 | [-]  | 1,0   |       |       |       |
| With lever arm                                                   |                                |      |       |       |       |       |
| Characteristic resistance                                        | M <sup>0</sup> <sub>Rk,s</sub> | [Nm] | 104,8 | 266,3 | 519,2 | 898,0 |
| Partial factor <sup>1)</sup>                                     |                                |      |       |       |       |       |
| Partial factor                                                   | γ <sub>Ms</sub>                | [-]  | 1,25  |       |       |       |

<sup>1)</sup> In absence of other national regulations.

fischer injection system FIS EB II

**Performance**

Characteristic resistance to steel failure under tension and shear loading of Rebars and fischer FRA

**Annex C 2**

Appendix 20 / 34

**Table C3.1:** Characteristic resistance to **concrete failure** under tension and shear loading

| Size                                                                                                              |                          |                 | All sizes       |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
|-------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------|-----------------|----------------------|----------------------------------------------------------------------------------------------------------------------------|-----|-----|---------------|------------------|----------------|----------------|-------------------------------|------|----|----|----|
| Tension loading                                                                                                   |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Installation factor                                                                                               |                          | $\gamma_{inst}$ | [-]             | See annex C 4 to C 6 |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Factors for the compressive strength of concrete > C20/25                                                         |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
|                                                                                                                   |                          |                 |                 | Uncracked concrete   |                                                                                                                            |     |     |               | Cracked concrete |                |                |                               |      |    |    |    |
| Increasing factor $\psi_c$ for cracked or uncracked concrete<br>$\tau_{RK}(X,Y) = \psi_c \cdot \tau_{RK}(C20/25)$ | C25/30                   | [-]             |                 | 1,05                 |                                                                                                                            |     |     |               | 1,02             |                |                |                               |      |    |    |    |
|                                                                                                                   | C30/37                   |                 | 1,09            |                      |                                                                                                                            |     |     | 1,05          |                  |                |                |                               |      |    |    |    |
|                                                                                                                   | C35/45                   |                 | 1,12            |                      |                                                                                                                            |     |     | 1,06          |                  |                |                |                               |      |    |    |    |
|                                                                                                                   | C40/50                   |                 | 1,16            |                      |                                                                                                                            |     |     | 1,08          |                  |                |                |                               |      |    |    |    |
|                                                                                                                   | C45/55                   |                 | 1,19            |                      |                                                                                                                            |     |     | 1,09          |                  |                |                |                               |      |    |    |    |
|                                                                                                                   | C50/60                   |                 | 1,21            |                      |                                                                                                                            |     |     | 1,11          |                  |                |                |                               |      |    |    |    |
| Splitting failure                                                                                                 |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Edge distance                                                                                                     | $h / h_{ef} \geq 2,0$    |                 | $c_{cr,sp}$     | [mm]                 | 1,0 $h_{ef}$                                                                                                               |     |     |               |                  |                |                |                               |      |    |    |    |
|                                                                                                                   | $2,0 > h / h_{ef} > 1,3$ |                 |                 |                      | 4,6 $h_{ef}$ - 1,8 h                                                                                                       |     |     |               |                  |                |                |                               |      |    |    |    |
|                                                                                                                   | $h / h_{ef} \leq 1,3$    |                 |                 |                      | 2,26 $h_{ef}$                                                                                                              |     |     |               |                  |                |                |                               |      |    |    |    |
| Spacing                                                                                                           |                          | $s_{cr,sp}$     |                 |                      | 2 $c_{cr,sp}$                                                                                                              |     |     |               |                  |                |                |                               |      |    |    |    |
| Concrete cone failure                                                                                             |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Uncracked concrete                                                                                                |                          | $k_{ucr,N}$     | [-]             | 11,0                 |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Cracked concrete                                                                                                  |                          | $k_{cr,N}$      |                 | 7,7                  |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Edge distance                                                                                                     |                          | $c_{cr,N}$      | [mm]            | 1,5 $h_{ef}$         |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Spacing                                                                                                           |                          | $s_{cr,N}$      |                 | 2 $c_{cr,N}$         |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Factors for sustained tension loading                                                                             |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Temperature range                                                                                                 |                          |                 | [-]             | 24 °C / 43 °C        |                                                                                                                            |     |     | 43 °C / 60 °C |                  |                |                | 50 °C / 72 °C                 |      |    |    |    |
| Factor                                                                                                            |                          |                 | $\psi_{sus}^0$  | [-]                  | 0,66                                                                                                                       |     |     |               | 0,61             |                |                |                               | 0,60 |    |    |    |
| Shear loading                                                                                                     |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Installation factor                                                                                               |                          |                 | $\gamma_{inst}$ | [-]                  | 1,0                                                                                                                        |     |     |               |                  |                |                |                               |      |    |    |    |
| Concrete pry-out failure                                                                                          |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Factor for pry-out failure                                                                                        |                          |                 | $k_8$           | [-]                  | 2,0                                                                                                                        |     |     |               |                  |                |                |                               |      |    |    |    |
| Concrete edge failure                                                                                             |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Effective length of fastener for shear loading                                                                    |                          |                 | $l_f$           | [mm]                 | for $d_{nom} \leq 24$ mm: min ( $h_{ef}$ , 12 $d_{nom}$ )<br>for $d_{nom} > 24$ mm: min ( $h_{ef}$ , 8 $d_{nom}$ ; 300 mm) |     |     |               |                  |                |                |                               |      |    |    |    |
| Effective diameter of the fastener $d_{nom}$                                                                      |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| Size                                                                                                              |                          |                 |                 | M8                   | M10                                                                                                                        | M12 | M16 | M20           | M24              | M27            | M30            |                               |      |    |    |    |
| Anchor rods and Threaded rods                                                                                     |                          | $d_{nom}$       | [mm]            | 8                    | 10                                                                                                                         | 12  | 16  | 20            | 24               | 27             | 30             |                               |      |    |    |    |
| fischer FRA                                                                                                       |                          | $d_{nom}$       |                 | <sup>-1)</sup>       | <sup>-1)</sup>                                                                                                             | 12  | 16  | 20            | 25               | <sup>-1)</sup> | <sup>-1)</sup> |                               |      |    |    |    |
| Size (nominal diameter of the rebar)                                                                              |                          |                 |                 | $\phi$               | 8                                                                                                                          | 10  | 12  | 14            | 16               | 20             | 25             | 26                            | 28   | 30 | 32 |    |
| Rebar                                                                                                             |                          |                 |                 | $d_{nom}$            | [mm]                                                                                                                       | 8   | 10  | 12            | 14               | 16             | 20             | 25                            | 26   | 28 | 30 | 32 |
| <sup>1)</sup> Anchor type not part of the assessment                                                              |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |
| fischer injection system FIS EB II                                                                                |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                | Annex C 3<br>Appendix 21 / 34 |      |    |    |    |
| Performance<br>Characteristic resistance to concrete failure under tension / shear loading                        |                          |                 |                 |                      |                                                                                                                            |     |     |               |                  |                |                |                               |      |    |    |    |

**Table C4.1:** Characteristic resistance to **combined pull-out and concrete failure** for **Anchor rods and Threaded rods** in hammer drilled holes; **uncracked or cracked concrete**

| Anchor rod / Threaded rod                                                                                           |                    |                 | M8              | M10     | M12  | M16  | M20  | M24  | M27                           | M30  |      |      |
|---------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|-----------------|---------|------|------|------|------|-------------------------------|------|------|------|
| Combined pullout and concrete cone failure                                                                          |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Calculation diameter                                                                                                |                    | d               | [mm]            | 8       | 10   | 12   | 16   | 20   | 24                            | 27   | 30   |      |
| Uncracked concrete                                                                                                  |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Characteristic bond resistance in uncracked concrete C20/25                                                         |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Hammer-drilling with standard drill bit (dry or wet concrete)                                                       |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Temperature range                                                                                                   | I: 24 °C / 43 °C   |                 | $\tau_{Rk,ucr}$ | [N/mm²] | 14,0 | 14,0 | 14,0 | 14,0 | 14,0                          | 13,0 | 12,0 | 12,0 |
|                                                                                                                     | II: 43 °C / 60 °C  |                 |                 |         | 14,0 | 13,0 | 13,0 | 12,0 | 11,0                          | 10,0 | 8,5  | 8,5  |
|                                                                                                                     | III: 50 °C / 72 °C |                 |                 |         | 9,0  | 9,0  | 9,0  | 9,0  | 9,0                           | 8,5  | 8,0  | 7,5  |
| Hammer-drilling with standard drill bit (water filled hole)                                                         |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Temperature range                                                                                                   | I: 24 °C / 43 °C   |                 | $\tau_{Rk,ucr}$ | [N/mm²] | 14,0 | 14,0 | 14,0 | 14,0 | 14,0                          | 12,0 | 12,0 | 12,0 |
|                                                                                                                     | II: 43 °C / 60 °C  |                 |                 |         | 12,0 | 11,0 | 11,0 | 10,0 | 9,5                           | 8,5  | 8,5  | 8,5  |
|                                                                                                                     | III: 50 °C / 72 °C |                 |                 |         | 9,0  | 9,0  | 9,0  | 8,5  | 8,0                           | 7,5  | 7,0  | 6,5  |
| Installation factors                                                                                                |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Dry or wet concrete                                                                                                 |                    | $\gamma_{inst}$ | [-]             | 1,2     |      |      |      |      |                               |      |      |      |
| Water filled hole                                                                                                   |                    |                 |                 | 1,4     |      |      |      |      |                               |      |      |      |
| Cracked concrete                                                                                                    |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Characteristic bond resistance in cracked concrete C20/25                                                           |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Hammer-drilling with standard drill bit (dry or wet concrete)                                                       |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Temperature range                                                                                                   | I: 24 °C / 43 °C   |                 | $\tau_{Rk,cr}$  | [N/mm²] | 7,0  | 7,0  | 7,0  | 6,5  | 6,0                           | 6,0  | 5,5  | 5,5  |
|                                                                                                                     | II: 43 °C / 60 °C  |                 |                 |         | 6,5  | 6,5  | 6,5  | 6,0  | 6,0                           | 6,0  | 5,5  | 5,5  |
|                                                                                                                     | III: 50 °C / 72 °C |                 |                 |         | 6,0  | 6,0  | 6,0  | 5,5  | 5,5                           | 5,5  | 5,0  | 5,0  |
| Hammer-drilling with standard drill bit (water filled hole)                                                         |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Temperature range                                                                                                   | I: 24 °C / 43 °C   |                 | $\tau_{Rk,cr}$  | [N/mm²] | 7,0  | 7,0  | 7,0  | 6,5  | 6,0                           | 6,0  | 5,5  | 5,5  |
|                                                                                                                     | II: 43 °C / 60 °C  |                 |                 |         | 5,5  | 5,5  | 5,5  | 5,0  | 4,5                           | 4,5  | 4,0  | 4,0  |
|                                                                                                                     | III: 50 °C / 72 °C |                 |                 |         | 5,5  | 5,5  | 5,5  | 5,0  | 4,0                           | 4,0  | 4,0  | 4,0  |
| Installation factors                                                                                                |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| Dry or wet concrete                                                                                                 |                    | $\gamma_{inst}$ | [-]             | 1,2     |      |      |      |      |                               |      |      |      |
| Water filled hole                                                                                                   |                    |                 |                 | 1,4     |      |      |      |      |                               |      |      |      |
|                                                                                                                     |                    |                 |                 |         |      |      |      |      |                               |      |      |      |
| fischer injection system FIS EB II                                                                                  |                    |                 |                 |         |      |      |      |      | Annex C 4<br>Appendix 22 / 34 |      |      |      |
| Performance<br>Characteristic resistance to combined pull-out and concrete failure for Anchor rod and Threaded rods |                    |                 |                 |         |      |      |      |      |                               |      |      |      |

| Table C5.1: Characteristic resistance to combined pull-out and concrete failure for Rebars in hammer drilled holes; uncracked or cracked concrete |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|---------|------|------|------|------|------|------|------|-------------------------------|------|------|------|
| Rebars                                                                                                                                            |                    | ϕ                   | 8       | 10   | 12   | 14   | 16   | 20   | 25   | 26   | 28                            | 30   | 32   |      |
| Combined pullout and concrete cone failure                                                                                                        |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Calculation diameter                                                                                                                              |                    | d                   | [mm]    | 8    | 10   | 12   | 14   | 16   | 20   | 25   | 26                            | 28   | 30   | 32   |
| Uncracked concrete                                                                                                                                |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Characteristic bond resistance in uncracked concrete C20/25                                                                                       |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Hammer-drilling with standard drill bit (dry or wet concrete)                                                                                     |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Tem-<br>perature<br>range                                                                                                                         | I: 24 °C / 43 °C   | τ <sub>Rk,ucr</sub> | [N/mm²] | 14,0 | 14,0 | 14,0 | 13,0 | 13,0 | 12,0 | 11,0 | 11,0                          | 11,0 | 11,0 | 11,0 |
|                                                                                                                                                   | II: 43 °C / 60 °C  |                     |         | 14,0 | 13,0 | 13,0 | 12,0 | 11,0 | 10,0 | 10,0 | 9,0                           | 8,5  | 8,0  | 8,0  |
|                                                                                                                                                   | III: 50 °C / 72 °C |                     |         | 9,0  | 9,0  | 9,0  | 9,0  | 9,0  | 9,0  | 8,5  | 8,5                           | 8,0  | 8,0  | 7,5  |
| Hammer-drilling with standard drill bit (water filled hole)                                                                                       |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Tem-<br>perature<br>range                                                                                                                         | I: 24 °C / 43 °C   | τ <sub>Rk,ucr</sub> | [N/mm²] | 14,0 | 14,0 | 14,0 | 12,0 | 12,0 | 12,0 | 11,0 | 11,0                          | 11,0 | 11,0 | 11,0 |
|                                                                                                                                                   | II: 43 °C / 60 °C  |                     |         | 11,0 | 11,0 | 10,0 | 9,5  | 9,5  | 9,0  | 8,5  | 8,5                           | 8,5  | 7,5  | 7,5  |
|                                                                                                                                                   | III: 50 °C / 72 °C |                     |         | 9,0  | 9,0  | 9,0  | 8,5  | 8,0  | 7,5  | 7,0  | 6,5                           | 6,5  | 6,0  | 6,0  |
| Installation factors                                                                                                                              |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Dry or wet concrete                                                                                                                               |                    | γ <sub>inst</sub>   | [-]     | 1,2  |      |      |      |      |      |      |                               |      |      |      |
| Water filled hole                                                                                                                                 |                    |                     |         | 1,4  |      |      |      |      |      |      |                               |      |      |      |
| Cracked concrete                                                                                                                                  |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Characteristic bond resistance in cracked concrete C20/25                                                                                         |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Hammer-drilling with standard drill bit (dry or wet concrete)                                                                                     |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Tem-<br>perature<br>range                                                                                                                         | I: 24 °C / 43 °C   | τ <sub>Rk,cr</sub>  | [N/mm²] | 7,0  | 7,0  | 7,0  | 6,5  | 6,5  | 6,0  | 6,0  | 5,5                           | 5,5  | 5,5  | 5,5  |
|                                                                                                                                                   | II: 43 °C / 60 °C  |                     |         | 6,5  | 6,5  | 6,5  | 6,0  | 6,0  | 6,0  | 5,5  | 5,5                           | 5,5  | 5,0  | 5,0  |
|                                                                                                                                                   | III: 50 °C / 72 °C |                     |         | 6,0  | 6,0  | 6,0  | 6,0  | 5,5  | 5,5  | 5,5  | 5,0                           | 5,0  | 5,0  | 4,5  |
| Hammer-drilling with standard drill bit (water filled hole)                                                                                       |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Tem-<br>perature<br>range                                                                                                                         | I: 24 °C / 43 °C   | τ <sub>Rk,cr</sub>  | [N/mm²] | 7,0  | 7,0  | 7,0  | 7,0  | 6,5  | 6,0  | 6,0  | 5,5                           | 5,5  | 5,5  | 5,5  |
|                                                                                                                                                   | II: 43 °C / 60 °C  |                     |         | 5,5  | 5,5  | 5,5  | 5,0  | 5,0  | 4,5  | 4,0  | 4,0                           | 4,0  | 4,0  | 3,5  |
|                                                                                                                                                   | III: 50 °C / 72 °C |                     |         | 5,5  | 5,5  | 5,5  | 5,0  | 5,0  | 4,0  | 4,0  | 4,0                           | 4,0  | 4,0  | 3,5  |
| Installation factors                                                                                                                              |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |
| Dry or wet concrete                                                                                                                               |                    | γ <sub>inst</sub>   | [-]     | 1,2  |      |      |      |      |      |      |                               |      |      |      |
| Water filled hole                                                                                                                                 |                    |                     |         | 1,4  |      |      |      |      |      |      |                               |      |      |      |
| fischer injection system FIS EB II                                                                                                                |                    |                     |         |      |      |      |      |      |      |      | Annex C 5<br>Appendix 23 / 34 |      |      |      |
| Performance<br>Characteristic resistance to combined pull-out and concrete failure for Rebars                                                     |                    |                     |         |      |      |      |      |      |      |      |                               |      |      |      |

**Table C6.1:** Characteristic resistance for **combined pull-out and concrete failure** for **fischer FRA** in hammer drilled holes; **uncracked or cracked concrete**

| fischer FRA                                                   |                    |                 | M12                  | M16  | M20  | M24  |      |
|---------------------------------------------------------------|--------------------|-----------------|----------------------|------|------|------|------|
| Combined pullout and concrete cone failure                    |                    |                 |                      |      |      |      |      |
| Calculation diameter                                          |                    | d               | [mm]                 | 12   | 16   | 20   | 25   |
| Uncracked concrete                                            |                    |                 |                      |      |      |      |      |
| Characteristic bond resistance in uncracked concrete C20/25   |                    |                 |                      |      |      |      |      |
| Hammer-drilling with standard drill bit (dry or wet concrete) |                    |                 |                      |      |      |      |      |
| Temperature range                                             | I: 24 °C / 43 °C   | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 14,0 | 13,0 | 12,0 | 11,0 |
|                                                               | II: 43 °C / 60 °C  |                 |                      | 13,0 | 11,0 | 10,0 | 10,0 |
|                                                               | III: 50 °C / 72 °C |                 |                      | 9,0  | 9,0  | 9,0  | 8,5  |
| Hammer-drilling with standard drill bit (water filled hole)   |                    |                 |                      |      |      |      |      |
| Temperature range                                             | I: 24 °C / 43 °C   | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 14,0 | 12,0 | 12,0 | 11,0 |
|                                                               | II: 43 °C / 60 °C  |                 |                      | 10,0 | 9,5  | 9,0  | 8,5  |
|                                                               | III: 50 °C / 72 °C |                 |                      | 9,0  | 8,0  | 7,5  | 7,0  |
| Installation factors                                          |                    |                 |                      |      |      |      |      |
| Dry or wet concrete                                           |                    | $\gamma_{inst}$ | [-]                  | 1,2  |      |      |      |
| Water filled hole                                             |                    |                 |                      | 1,4  |      |      |      |
| Cracked concrete                                              |                    |                 |                      |      |      |      |      |
| Characteristic bond resistance in cracked concrete C20/25     |                    |                 |                      |      |      |      |      |
| Hammer-drilling with standard drill bit (dry or wet concrete) |                    |                 |                      |      |      |      |      |
| Temperature range                                             | I: 24 °C / 43 °C   | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 7,0  | 6,5  | 6,0  | 6,0  |
|                                                               | II: 43 °C / 60 °C  |                 |                      | 6,5  | 6,0  | 6,0  | 5,5  |
|                                                               | III: 50 °C / 72 °C |                 |                      | 6,0  | 5,5  | 5,5  | 5,5  |
| Hammer-drilling with standard drill bit (water filled hole)   |                    |                 |                      |      |      |      |      |
| Temperature range                                             | I: 24 °C / 43 °C   | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 7,0  | 6,5  | 6,0  | 6,0  |
|                                                               | II: 43 °C / 60 °C  |                 |                      | 5,5  | 5,0  | 4,5  | 4,0  |
|                                                               | III: 50 °C / 72 °C |                 |                      | 5,5  | 5,0  | 4,0  | 4,0  |
| Installation factors                                          |                    |                 |                      |      |      |      |      |
| Dry or wet concrete                                           |                    | $\gamma_{inst}$ | [-]                  | 1,2  |      |      |      |
| Water filled hole                                             |                    |                 |                      | 1,4  |      |      |      |

fischer injection system FIS EB II

## Performance

Characteristic resistance for combined pull-out and concrete failure for fischer FRA

## Annex C 6

Appendix 24 / 34

**Table C7.1: Displacements for Anchor rods and Threaded rods**

| Anchor rod                                                     |                           | M8   | M10  | M12  | M16                                                         | M20  | M24  | M27  | M30  |
|----------------------------------------------------------------|---------------------------|------|------|------|-------------------------------------------------------------|------|------|------|------|
| Displacement-Factors for tension loading <sup>1)</sup>         |                           |      |      |      |                                                             |      |      |      |      |
| Uncracked or cracked concrete; Temperature range I, II, III    |                           |      |      |      |                                                             |      |      |      |      |
| $\delta_{N0}$ -Factor                                          | [mm/(N/mm <sup>2</sup> )] | 0,08 | 0,08 | 0,09 | 0,10                                                        | 0,11 | 0,12 | 0,12 | 0,13 |
| $\delta_{N\infty}$ -Factor                                     |                           | 0,11 | 0,12 | 0,13 | 0,15                                                        | 0,16 | 0,17 | 0,18 | 0,19 |
| Displacement-Factors for shear loading <sup>2)</sup>           |                           |      |      |      |                                                             |      |      |      |      |
| Uncracked or cracked concrete; Temperature range I, II, III    |                           |      |      |      |                                                             |      |      |      |      |
| $\delta_{V0}$ -Factor                                          | [mm/kN]                   | 0,19 | 0,15 | 0,13 | 0,10                                                        | 0,08 | 0,07 | 0,06 | 0,05 |
| $\delta_{V\infty}$ -Factor                                     |                           | 0,28 | 0,22 | 0,19 | 0,14                                                        | 0,11 | 0,10 | 0,09 | 0,08 |
| 1) Calculation of effective displacement:                      |                           |      |      |      | 2) Calculation of effective displacement:                   |      |      |      |      |
| $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$           |                           |      |      |      | $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$           |      |      |      |      |
| $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ |                           |      |      |      | $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$ |      |      |      |      |
| $\tau$ = acting bond strength under tension loading            |                           |      |      |      | $V$ = acting shear loading                                  |      |      |      |      |

**Table C7.2: Displacements for Rebars and fischer FRA**

|                                                                    |                           |          |           |           |           |           |           |           |           |           |           |           |
|--------------------------------------------------------------------|---------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>Nominal diameter of the rebar</b>                               | $\phi$                    | <b>8</b> | <b>10</b> | <b>12</b> | <b>14</b> | <b>16</b> | <b>20</b> | <b>25</b> | <b>26</b> | <b>28</b> | <b>30</b> | <b>32</b> |
| <b>fischer FRA</b>                                                 |                           | 1)       | 1)        | M12       | 1)        | M16       | M20       | M24       | 1)        | 1)        | 1)        | 1)        |
| <b>Displacement-Factors for tension loading<sup>2)</sup></b>       |                           |          |           |           |           |           |           |           |           |           |           |           |
| <b>Uncracked or cracked concrete; Temperature range I, II, III</b> |                           |          |           |           |           |           |           |           |           |           |           |           |
| $\delta_{N0}$ -Factor                                              | [mm/(N/mm <sup>2</sup> )] | 0,08     | 0,08      | 0,09      | 0,10      | 0,10      | 0,11      | 0,12      | 0,12      | 0,13      | 0,13      | 0,13      |
| $\delta_{N\infty}$ -Factor                                         |                           | 0,11     | 0,12      | 0,13      | 0,14      | 0,15      | 0,16      | 0,18      | 0,18      | 0,19      | 0,19      | 0,20      |
| <b>Displacement-Factors for shear loading<sup>3)</sup></b>         |                           |          |           |           |           |           |           |           |           |           |           |           |
| <b>Uncracked or cracked concrete; Temperature range I, II, III</b> |                           |          |           |           |           |           |           |           |           |           |           |           |
| $\delta_{V0}$ -Factor                                              | [mm/kN]                   | 0,19     | 0,15      | 0,13      | 0,11      | 0,10      | 0,08      | 0,06      | 0,06      | 0,06      | 0,05      | 0,05      |
| $\delta_{V\infty}$ -Factor                                         |                           | 0,28     | 0,22      | 0,19      | 0,16      | 0,14      | 0,11      | 0,09      | 0,09      | 0,08      | 0,08      | 0,07      |

1) Anchor type not part of the assessment

2) Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0}\text{-Factor} \cdot \tau$$

$$\delta_{N\infty} = \delta_{N\infty}\text{-Factor} \cdot \tau$$

$\tau$  = acting bond strength under tension loading

3) Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0}\text{-Factor} \cdot V$$

$$\delta_{V\infty} = \delta_{V\infty}\text{-Factor} \cdot V$$

$V$  = acting shear loading

fischer injection system FIS EB II

## Performance

Displacements for Anchor rods, Threaded rods, Rebars and fischer FRA

## Annex C 7

Appendix 25 / 34

| Table C8.1: Characteristics resistance to <b>steel failure</b> under tension / shear loading of <b>Anchor rods</b> and <b>Threaded rods</b> under seismic action performance category <b>C1</b> or <b>C2</b> |                                                          |                |     |      |      |      |       |       |       |       |       |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------|-----|------|------|------|-------|-------|-------|-------|-------|-------|
| Anchor rod / Threaded rod                                                                                                                                                                                    |                                                          |                |     | M12  | M14  | M16  | M20   | M22   | M24   | M27   | M30   |       |
| Characteristic resistance to steel failure under tension loading <sup>1)</sup>                                                                                                                               |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Anchor rods and Threaded rods, performance category C1                                                                                                                                                       |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Characteristic resistance $N_{Rk,s,C1}$                                                                                                                                                                      | Steel zinc plated                                        | Property class | 4.8 | [kN] | 33,7 | 46,0 | 62,8  | 98,0  | 121,2 | 141,2 | 183,6 | 224,4 |
|                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 42,1 | 57,5 | 78,5  | 122,5 | 151,5 | 176,5 | 229,5 | 280,5 |
|                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 8.8 |      | 67,4 | 92,0 | 125,6 | 196,0 | 242,4 | 282,4 | 367,2 | 448,8 |
|                                                                                                                                                                                                              |                                                          |                | 50  |      | 42,1 | 57,5 | 78,5  | 122,5 | 151,5 | 176,5 | 229,5 | 280,5 |
|                                                                                                                                                                                                              |                                                          |                | 70  |      | 59,0 | 80,5 | 109,9 | 171,5 | 212,1 | 247,1 | 321,3 | 392,7 |
|                                                                                                                                                                                                              |                                                          |                | 80  |      | 67,4 | 92,0 | 125,6 | 196,0 | 242,4 | 282,4 | 367,2 | 448,8 |
| Anchor rods and Threaded rods, performance category C2                                                                                                                                                       |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Characteristic resistance $N_{Rk,s,C2}$                                                                                                                                                                      | Steel zinc plated                                        | Property class | 4.8 | [-]  | 30,3 | -2)  | 56,5  | 88,2  | -2)   | 141,2 | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 37,9 | -2)  | 70,6  | 110,2 | -2)   | 176,5 | -2)   | -2)   |
|                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 8.8 |      | 60,6 | -2)  | 113,0 | 176,4 | -2)   | 282,4 | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 50  |      | 37,9 | -2)  | 70,6  | 110,2 | -2)   | 176,5 | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 70  |      | 53,1 | -2)  | 98,9  | 154,3 | -2)   | 247,1 | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 80  |      | 60,6 | -2)  | 113,0 | 176,4 | -2)   | 282,4 | -2)   | -2)   |
| Characteristic resistance to steel failure under shear loading without lever arm <sup>1)</sup>                                                                                                               |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Anchor rods, performance category C1                                                                                                                                                                         |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Characteristic resistance $V_{Rk,s,C1}^0$                                                                                                                                                                    | Steel zinc plated                                        | Property class | 4.8 | [kN] | 20,2 | 27,6 | 37,6  | 58,8  | 72,7  | 84,7  | 110,1 | 134,6 |
|                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 25,2 | 34,5 | 47,1  | 73,5  | 90,9  | 105,9 | 137,7 | 168,3 |
|                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 8.8 |      | 33,7 | 46,0 | 62,8  | 98,0  | 121,2 | 141,2 | 183,6 | 224,4 |
|                                                                                                                                                                                                              |                                                          |                | 50  |      | 21,0 | 28,7 | 39,2  | 61,2  | 75,7  | 88,2  | 114,7 | 140,2 |
|                                                                                                                                                                                                              |                                                          |                | 70  |      | 29,5 | 40,2 | 54,9  | 85,7  | 106,0 | 123,5 | 160,6 | 196,3 |
|                                                                                                                                                                                                              |                                                          |                | 80  |      | 33,7 | 46,0 | 62,8  | 98,0  | 121,2 | 141,2 | 183,6 | 224,4 |
| Threaded rods, performance category C1                                                                                                                                                                       |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Characteristic resistance $V_{Rk,s,C1}^0$                                                                                                                                                                    | Steel zinc plated                                        | Property class | 4.8 | [kN] | 14,1 | 19,3 | 26,3  | 41,1  | 50,9  | 59,3  | 77,1  | 94,2  |
|                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 17,7 | 24,1 | 32,9  | 51,4  | 63,6  | 74,1  | 96,3  | 117,8 |
|                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 8.8 |      | 23,6 | 32,2 | 43,9  | 68,6  | 84,8  | 98,8  | 128,5 | 157,0 |
|                                                                                                                                                                                                              |                                                          |                | 50  |      | 14,7 | 20,1 | 27,4  | 42,8  | 53,0  | 61,7  | 80,3  | 98,1  |
|                                                                                                                                                                                                              |                                                          |                | 70  |      | 20,6 | 28,1 | 38,4  | 60,0  | 74,2  | 86,4  | 112,4 | 137,4 |
|                                                                                                                                                                                                              |                                                          |                | 80  |      | 23,6 | 32,2 | 43,9  | 68,6  | 84,8  | 98,8  | 128,5 | 157,0 |
| Anchor rods and Threaded rods, performance category C2                                                                                                                                                       |                                                          |                |     |      |      |      |       |       |       |       |       |       |
| Characteristic resistance $V_{Rk,s,C2}^0$                                                                                                                                                                    | Steel zinc plated                                        | Property class | 4.8 | [-]  | 13,3 | -2)  | 28,2  | 45,2  | -2)   | 77,0  | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 16,6 | -2)  | 35,3  | 56,5  | -2)   | 96,3  | -2)   | -2)   |
|                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 8.8 |      | 22,2 | -2)  | 47,1  | 75,4  | -2)   | 128,4 | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 50  |      | 13,9 | -2)  | 29,4  | 47,1  | -2)   | 80,3  | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 70  |      | 19,4 | -2)  | 41,2  | 66,0  | -2)   | 112,4 | -2)   | -2)   |
|                                                                                                                                                                                                              |                                                          |                | 80  |      | 22,2 | -2)  | 47,1  | 75,4  | -2)   | 128,4 | -2)   | -2)   |
| <sup>1)</sup> Partial factors for performance category C1 or C2 see <b>table C10.1</b> ;<br>for anchor rods the factor for steel ductility is 1,0<br><sup>2)</sup> No performance assessed                   |                                                          |                |     |      |      |      |       |       |       |       |       |       |

|                                                                                                                                                        |                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| fischer injection system FIS EB II                                                                                                                     | <b>Annex C 8</b><br>Appendix 26 / 34 |
| <b>Performance</b><br>Characteristic resistance to steel failure for Anchor rods and Threaded rods under seismic action (performance category C1 / C2) |                                      |

**Table C9.1:** Characteristic resistance to **steel failure** under tension / shear loading of **Rebars (B500B)** under seismic action performance category **C1 or C2**

| Nominal diameter of the rebar                                                                   | $\phi$          | 12   | 14   | 16   | 20    | 25    | 26    | 28    | 30    |       |
|-------------------------------------------------------------------------------------------------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|
| Characteristic resistance to steel failure under tension loading <sup>1)</sup>                  |                 |      |      |      |       |       |       |       |       |       |
| Rebar B500B acc. to DIN 488-2:2009-08, performance category C1                                  |                 |      |      |      |       |       |       |       |       |       |
| Characteristic resistance                                                                       | $N_{Rk,s,C1}$   | [kN] | 61,0 | 83,1 | 108,5 | 169,5 | 265,1 | 286,2 | 332,6 | 381,2 |
| Rebar B500B acc. to DIN 488-2:2009-08, performance category C2                                  |                 |      |      |      |       |       |       |       |       |       |
| Characteristic resistance                                                                       | $N_{Rk,s,C2}$   | [kN] | 54,9 | -2)  | 97,6  | 152,6 | -2)   | -2)   | -2)   | -2)   |
| Characteristic resistance to steel failure under shear loading, without lever arm <sup>1)</sup> |                 |      |      |      |       |       |       |       |       |       |
| Rebar B500B acc. to DIN 488-2:2009-08, performance category C1                                  |                 |      |      |      |       |       |       |       |       |       |
| Characteristic resistance                                                                       | $V^0_{Rk,s,C1}$ | [kN] | 21,3 | 29,1 | 37,9  | 59,3  | 92,7  | 100,1 | 116,4 | 133,4 |
| Rebar B500B acc. to DIN 488-2:2009-08, performance category C2                                  |                 |      |      |      |       |       |       |       |       |       |
| Characteristic resistance                                                                       | $V^0_{Rk,s,C2}$ | [kN] | 20,1 | -2)  | 40,7  | 65,2  | -2)   | -2)   | -2)   | -2)   |

<sup>1)</sup> Partial factors for performance category C1 or C2 see table C10.1

2) No performance assessed

**Table C9.2:** Characteristic resistance to **steel failure** under tension / shear loading of **fischer FRA** under seismic action performance category **C1 or C2**

| fisher FRA                                                                                      |                      | M12  | M16   | M20   | M24              |
|-------------------------------------------------------------------------------------------------|----------------------|------|-------|-------|------------------|
| Characteristic resistance to steel failure under tension loading <sup>1)</sup>                  |                      |      |       |       |                  |
| fisher FRA, performance category C1                                                             |                      |      |       |       |                  |
| Characteristic resistance                                                                       | $N_{Rk,s,C1}$ [kN]   | 62,1 | 110,5 | 172,7 | 263,0            |
| fisher FRA, performance category C2                                                             |                      |      |       |       |                  |
| Characteristic resistance                                                                       | $N_{Rk,s,C2}$ [kN]   | 55,8 | 99,4  | 155,4 | .. <sup>2)</sup> |
| Characteristic resistance to steel failure under shear loading, without lever arm <sup>1)</sup> |                      |      |       |       |                  |
| fisher FRA, performance category C1                                                             |                      |      |       |       |                  |
| Characteristic resistance                                                                       | $V^0_{Rk,s,C1}$ [kN] | 33,7 | 62,8  | 98,0  | 141,2            |
| fisher FRA, performance category C2                                                             |                      |      |       |       |                  |
| Characteristic resistance                                                                       | $V^0_{Rk,s,C2}$ [kN] | 22,2 | 47,1  | 75,4  | .. <sup>2)</sup> |

<sup>1)</sup> Partial factors for performance category C1 or C2 see table C10.1

2) No performance assessed

|                                                                                                                                                                             |                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| fischer injection system FIS EB II                                                                                                                                          | <b>Annex C 9</b><br>Appendix 27 / 34 |
| <b>Performance</b><br>Characteristic resistance to steel failure under tension / shear loading of Rebars and fischer FRA under seismic action performance category C1 or C2 |                                      |

| Table C10.1: Partial factors for Anchor rods, Threaded rods, Rebars (B500B) and fischer FRA under seismic action performance category C1 or C2                                                                                                                                                                                          |                                                          |       |     |                                        |     |     |                                |     |     |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------|-----|----------------------------------------|-----|-----|--------------------------------|-----|-----|----|
| Anchor rod / Threaded rod                                                                                                                                                                                                                                                                                                               |                                                          |       | M12 | M16                                    | M20 | M24 | M27                            | M30 |     |    |
| Nominal diameter of the rebar $\phi$                                                                                                                                                                                                                                                                                                    |                                                          |       | 12  | 14                                     | 16  | 20  | 25                             | 26  | 28  | 30 |
| fischer FRA                                                                                                                                                                                                                                                                                                                             |                                                          |       | M12 | M16                                    | M20 | M24 | _3)                            |     | _3) |    |
| Tension loading, steel failure <sup>1)</sup>                                                                                                                                                                                                                                                                                            |                                                          |       |     |                                        |     |     |                                |     |     |    |
| Partial factor $\gamma_{Ms}$                                                                                                                                                                                                                                                                                                            | Steel zinc plated                                        | 4.8   | [-] | 1,50                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 5.8   |     | 1,50                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 8.8   |     | 1,50                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         | Stainless steel R and high corrosion resistant steel HCR | 50    |     | 2,86                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 70    |     | 1,87 / fischer HCR: 1,50               |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 80    |     | 1,60                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         | Rebar                                                    | B500B |     | 1,40                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         | fischer                                                  | FRA   |     | 1,40                                   |     |     |                                |     |     |    |
| Shear loading, steel failure <sup>1)</sup>                                                                                                                                                                                                                                                                                              |                                                          |       |     |                                        |     |     |                                |     |     |    |
| Partial factor $\gamma_{Ms}$                                                                                                                                                                                                                                                                                                            | Steel zinc plated                                        | 4.8   | [-] | 1,25                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 5.8   |     | 1,25                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 8.8   |     | 1,25                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         | Stainless steel R and high corrosion resistant steel HCR | 50    |     | 2,38                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 70    |     | 1,56 / fischer HCR: 1,25 <sup>2)</sup> |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         |                                                          | 80    |     | 1,33                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         | Rebar                                                    | B500B |     | 1,50                                   |     |     |                                |     |     |    |
|                                                                                                                                                                                                                                                                                                                                         | fischer                                                  | FRA   |     | 1,50                                   |     |     |                                |     |     |    |
| <div><div><sup>1)</sup> In absence of other national regulations</div><div><sup>2)</sup> Only admissible for high corrosion resistant steel HCR, with <math>f_{yk}/f_{uk} \leq 0,8</math> and <math>f_{uk} \leq 800 \text{ N/mm}^2</math> (e.g. anchor rods)</div><div><sup>3)</sup> Anchor type not part of the assessment</div></div> |                                                          |       |     |                                        |     |     |                                |     |     |    |
| fischer injection system FIS EB II                                                                                                                                                                                                                                                                                                      |                                                          |       |     |                                        |     |     | Annex C 10<br>Appendix 28 / 34 |     |     |    |
| Performance<br>Partial factors for Anchor rods, Threaded rods, Rebars and fischer FRA under seismic action performance category C1 or C2                                                                                                                                                                                                |                                                          |       |     |                                        |     |     |                                |     |     |    |

**Table C11.1:** Characteristics resistance for combined pull-out and concrete failure for **Anchor rods** and **Threaded rods** in hammer drilled holes under seismic action performance category **C1**

| Anchor rod / Threaded rod                                                                |                    | M12                                 | M16 | M20 | M24 | M27 | M30 |
|------------------------------------------------------------------------------------------|--------------------|-------------------------------------|-----|-----|-----|-----|-----|
| <b>Characteristic bond resistance, combined pull-out and concrete cone failure</b>       |                    |                                     |     |     |     |     |     |
| <b>Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)</b> |                    |                                     |     |     |     |     |     |
| Temperature range                                                                        | I: 24 °C / 43 °C   | $\tau_{Rk,C1}$ [N/mm <sup>2</sup> ] | 6,5 | 5,6 | 5,0 | 5,5 | 5,5 |
|                                                                                          | II: 43 °C / 60 °C  |                                     | 6,5 | 5,6 | 5,0 | 5,5 | 5,5 |
|                                                                                          | III: 50 °C / 72 °C |                                     | 5,7 | 5,5 | 5,0 | 5,0 | 5,0 |
| <b>Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)</b>   |                    |                                     |     |     |     |     |     |
| Temperature range                                                                        | I: 24 °C / 43 °C   | $\tau_{Rk,C1}$ [N/mm <sup>2</sup> ] | 6,5 | 5,0 | 4,7 | 4,7 | 4,7 |
|                                                                                          | II: 43 °C / 60 °C  |                                     | 6,5 | 5,0 | 4,7 | 4,7 | 4,7 |
|                                                                                          | III: 50 °C / 72 °C |                                     | 5,7 | 5,5 | 5,0 | 5,0 | 5,0 |
| <b>Installation factors</b>                                                              |                    |                                     |     |     |     |     |     |
| <b>Tension loading</b>                                                                   |                    |                                     |     |     |     |     |     |
| Dry or wet concrete                                                                      | $\gamma_{inst}$    | [-]                                 | 1,2 |     |     |     |     |
| Water filled hole                                                                        |                    |                                     | 1,4 |     |     |     |     |

**Table C11.2:** Characteristics resistance for combined pull-out and concrete failure for **Rebars** and **fischer FRA** in hammer drilled holes under seismic action performance category **C1**

| Nominal diameter of the rebar                                                     |                    | $\phi$         | 12                   | 14              | 16  | 20  | 25  | 26              | 28              | 30              |     |
|-----------------------------------------------------------------------------------|--------------------|----------------|----------------------|-----------------|-----|-----|-----|-----------------|-----------------|-----------------|-----|
| fischer FRA                                                                       |                    |                | M12                  | - <sup>1)</sup> | M16 | M20 | M24 | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> |     |
| Characteristic bond resistance, combined pull-out and concrete cone failure       |                    |                |                      |                 |     |     |     |                 |                 |                 |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) |                    |                |                      |                 |     |     |     |                 |                 |                 |     |
| Temperature range                                                                 | I: 24 °C / 43 °C   | $\tau_{Rk,C1}$ | [N/mm <sup>2</sup> ] | 6,5             | 6,0 | 6,0 | 6,0 | 5,5             | 5,5             | 5,5             | 5,5 |
|                                                                                   | II: 43 °C / 60 °C  |                |                      | 6,5             | 6,0 | 6,0 | 6,0 | 5,5             | 5,5             | 5,5             | 5,5 |
|                                                                                   | III: 50 °C / 72 °C |                |                      | 5,7             | 5,5 | 5,5 | 5,0 | 5,0             | 5,0             | 5,0             | 5,0 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   |                    |                |                      |                 |     |     |     |                 |                 |                 |     |
| Temperature range                                                                 | I: 24 °C / 43 °C   | $\tau_{Rk,C1}$ | [N/mm <sup>2</sup> ] | 6,5             | 6,0 | 5,0 | 4,7 | 4,7             | 4,7             | 4,7             | 4,7 |
|                                                                                   | II: 43 °C / 60 °C  |                |                      | 6,5             | 6,0 | 5,0 | 4,7 | 4,7             | 4,7             | 4,7             | 4,7 |
|                                                                                   | III: 50 °C / 72 °C |                |                      | 5,7             | 5,5 | 5,5 | 4,7 | 4,7             | 4,7             | 4,7             | 4,7 |
| Installation factors                                                              |                    |                |                      |                 |     |     |     |                 |                 |                 |     |
| Tension loading                                                                   |                    |                |                      |                 |     |     |     |                 |                 |                 |     |
| Dry or wet concrete                                                               | $\gamma_{inst}$    | [-]            | 1,2                  |                 |     |     |     |                 |                 |                 |     |
| Water filled hole                                                                 |                    |                | 1,4                  |                 |     |     |     |                 |                 |                 |     |

<sup>1)</sup> Anchor type not part of the assessment

|                                                                                                                                                        |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| fischer injection system FIS EB II                                                                                                                     | <b>Annex C 11</b><br>Appendix 29 / 34 |
| <b>Performance</b><br>Characteristics resistance under seismic action (performance category C1) for Anchor rods, Threaded rods, Rebars and fischer FRA |                                       |

**Table C12.1:** Characteristics resistance for combined pull-out and concrete failure for **Anchor rods** and **Threaded rods** in hammer drilled holes under seismic action performance category **C2**

| Anchor rod / Threaded rod                                                         |                    | M12                       |                      | M16  |                                                               | M20  |     | M24 |  |
|-----------------------------------------------------------------------------------|--------------------|---------------------------|----------------------|------|---------------------------------------------------------------|------|-----|-----|--|
| Characteristic bond resistance, combined pull-out and concrete cone failure       |                    |                           |                      |      |                                                               |      |     |     |  |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) |                    |                           |                      |      |                                                               |      |     |     |  |
| Temperature range                                                                 | I: 24 °C / 43 °C   | $\tau_{Rk,C2}$            | [N/mm <sup>2</sup> ] | 3,5  | 5,0                                                           | 3,5  | 3,5 |     |  |
|                                                                                   | II: 43 °C / 60 °C  |                           |                      | 3,5  | 5,0                                                           | 3,5  | 3,5 |     |  |
|                                                                                   | III: 50 °C / 72 °C |                           |                      | 2,7  | 3,8                                                           | 2,6  | 2,9 |     |  |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   |                    |                           |                      |      |                                                               |      |     |     |  |
| Temperature range                                                                 | I: 24 °C / 43 °C   | $\tau_{Rk,C2}$            | [N/mm <sup>2</sup> ] | 3,5  | 5,6                                                           | 3,8  | 3,0 |     |  |
|                                                                                   | II: 43 °C / 60 °C  |                           |                      | 3,5  | 5,2                                                           | 3,6  | 3,0 |     |  |
|                                                                                   | III: 50 °C / 72 °C |                           |                      | 2,7  | 3,8                                                           | 2,6  | 2,8 |     |  |
| Installation factors                                                              |                    |                           |                      |      |                                                               |      |     |     |  |
| Tension loading                                                                   |                    |                           |                      |      |                                                               |      |     |     |  |
| Dry or wet concrete                                                               |                    | $\gamma_{inst}$           | [-]                  | 1,2  |                                                               |      |     |     |  |
| Water filled hole                                                                 |                    |                           |                      | 1,4  |                                                               |      |     |     |  |
| Displacement-Factors for tension loading <sup>1)</sup>                            |                    |                           |                      |      |                                                               |      |     |     |  |
| $\delta_{N,(DLS)}\text{-Factor}$                                                  |                    | [mm/(N/mm <sup>2</sup> )] | 0,06                 | 0,11 | 0,08                                                          | 0,12 |     |     |  |
| $\delta_{N,(ULS)}\text{-Factor}$                                                  |                    |                           | 0,13                 | 0,14 | 0,09                                                          | 0,18 |     |     |  |
| Displacement-Factors for shear loading <sup>2)</sup>                              |                    |                           |                      |      |                                                               |      |     |     |  |
| $\delta_{V,(DLS)}\text{-Factor}$                                                  |                    | [mm/kN]                   | 0,18                 | 0,10 | 0,07                                                          | 0,06 |     |     |  |
| $\delta_{V,(ULS)}\text{-Factor}$                                                  |                    |                           | 0,25                 | 0,14 | 0,11                                                          | 0,09 |     |     |  |
| 1) Calculation of effective displacement:                                         |                    |                           |                      |      | 2) Calculation of effective displacement:                     |      |     |     |  |
| $\delta_{N,C2(DLS)} = \delta_{N,(DLS)}\text{-Factor} \cdot \tau$                  |                    |                           |                      |      | $\delta_{V,C2(DLS)} = \delta_{V,(DLS)}\text{-Factor} \cdot V$ |      |     |     |  |
| $\delta_{N,C2(ULS)} = \delta_{N,(ULS)}\text{-Factor} \cdot \tau$                  |                    |                           |                      |      | $\delta_{V,C2(ULS)} = \delta_{V,(ULS)}\text{-Factor} \cdot V$ |      |     |     |  |
| $\tau$ = acting bond strength under tension loading                               |                    |                           |                      |      | $V$ = acting shear loading                                    |      |     |     |  |

fischer injection system FIS EB II

## Performance

Characteristics resistance under seismic action (performance category C2) for Anchor rods. Threaded rods.

## Annex C 12

Appendix 30 / 34

| Table C13.1: Characteristics resistance for combined pull-out and concrete failure for Rebars and fischer FRA in hammer drilled holes under seismic action performance category C2 |                    |                           |                      |                                                               |      |                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------|----------------------|---------------------------------------------------------------|------|--------------------------------|
| Nominal diameter of the rebar $\phi$                                                                                                                                               |                    |                           | 12                   | 16                                                            | 20   |                                |
| fischer FRA                                                                                                                                                                        |                    |                           | M12                  | M16                                                           | M20  |                                |
| Characteristic bond resistance, combined pull-out and concrete cone failure                                                                                                        |                    |                           |                      |                                                               |      |                                |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                                                                  |                    |                           |                      |                                                               |      |                                |
| Tem-<br>perature<br>range                                                                                                                                                          | I: 24 °C / 43 °C   | $\tau_{Rk,C2}$            | [N/mm <sup>2</sup> ] | 3,5                                                           | 5,0  | 3,5                            |
|                                                                                                                                                                                    | II: 43 °C / 60 °C  |                           |                      | 3,5                                                           | 5,0  | 3,5                            |
|                                                                                                                                                                                    | III: 50 °C / 72 °C |                           |                      | 2,7                                                           | 3,8  | 2,6                            |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)                                                                                                    |                    |                           |                      |                                                               |      |                                |
| Tem-<br>perature<br>range                                                                                                                                                          | I: 24 °C / 43 °C   | $\tau_{Rk,C2}$            | [N/mm <sup>2</sup> ] | 3,5                                                           | 5,6  | 3,8                            |
|                                                                                                                                                                                    | II: 43 °C / 60 °C  |                           |                      | 3,5                                                           | 5,2  | 3,6                            |
|                                                                                                                                                                                    | III: 50 °C / 72 °C |                           |                      | 2,7                                                           | 3,8  | 2,6                            |
| Installation factors                                                                                                                                                               |                    |                           |                      |                                                               |      |                                |
| Tension loading                                                                                                                                                                    |                    |                           |                      |                                                               |      |                                |
| Dry or wet concrete                                                                                                                                                                |                    | $\gamma_{inst}$           | [-]                  | 1,2                                                           |      |                                |
| Water filled hole                                                                                                                                                                  |                    |                           |                      | 1,4                                                           |      |                                |
| Displacement-Factors for tension loading <sup>1)</sup>                                                                                                                             |                    |                           |                      |                                                               |      |                                |
| $\delta_{N,(DLS)}\text{-Factor}$                                                                                                                                                   |                    | [mm/(N/mm <sup>2</sup> )] | 0,06                 | 0,11                                                          | 0,08 |                                |
| $\delta_{N,(ULS)}\text{-Factor}$                                                                                                                                                   |                    |                           | 0,13                 | 0,14                                                          | 0,09 |                                |
| Displacement-Factors for shear loading <sup>2)</sup>                                                                                                                               |                    |                           |                      |                                                               |      |                                |
| $\delta_{V,(DLS)}\text{-Factor}$                                                                                                                                                   |                    | [mm/kN]                   | 0,18                 | 0,10                                                          | 0,07 |                                |
| $\delta_{V,(ULS)}\text{-Factor}$                                                                                                                                                   |                    |                           | 0,25                 | 0,14                                                          | 0,11 |                                |
| 1) Calculation of effective displacement:                                                                                                                                          |                    |                           |                      | 2) Calculation of effective displacement:                     |      |                                |
| $\delta_{N,C2(DLS)} = \delta_{N,(DLS)\text{-Factor}} \cdot \tau$                                                                                                                   |                    |                           |                      | $\delta_{V,C2(DLS)} = \delta_{V,(DLS)\text{-Factor}} \cdot V$ |      |                                |
| $\delta_{N,C2(ULS)} = \delta_{N,(ULS)\text{-Factor}} \cdot \tau$                                                                                                                   |                    |                           |                      | $\delta_{V,C2(ULS)} = \delta_{V,(ULS)\text{-Factor}} \cdot V$ |      |                                |
| $\tau$ = acting bond strength under tension loading                                                                                                                                |                    |                           |                      | $V$ = acting shear loading                                    |      |                                |
| fischer injection system FIS EB II                                                                                                                                                 |                    |                           |                      |                                                               |      | Annex C 13<br>Appendix 31 / 34 |
| Performance<br>Characteristics resistance under seismic action (performance category C2) for Rebar and fischer FRA.                                                                |                    |                           |                      |                                                               |      |                                |

**Table C14.1: Fire resistance to steel failure under tension and shear loading of Anchor rods and Threaded rods**

| Fire resistance to steel failure under tension and shear loading |                          |                          |                            |                           |                           |                             |
|------------------------------------------------------------------|--------------------------|--------------------------|----------------------------|---------------------------|---------------------------|-----------------------------|
| Anchor rod / Threaded rod                                        | R30                      |                          |                            | R60                       |                           |                             |
| Steel zinc plated                                                | $N_{Rk,s,fi,30}$<br>[kN] | $V_{Rk,s,fi,30}$<br>[kN] | $M^0_{Rk,s,fi,30}$<br>[Nm] | $N_{Rk,s,fi,60}$<br>[kN]  | $V_{Rk,s,fi,60}$<br>[kN]  | $M^0_{Rk,s,fi,60}$<br>[Nm]  |
| M8                                                               | 0,4                      | 0,4                      | 0,4                        | 0,3                       | 0,3                       | 0,3                         |
| M10                                                              | 0,9                      | 0,9                      | 1,1                        | 0,8                       | 0,8                       | 1,0                         |
| M12                                                              | 1,7                      | 1,7                      | 2,6                        | 1,3                       | 1,3                       | 2,0                         |
| M16                                                              | 3,1                      | 3,1                      | 6,7                        | 2,4                       | 2,4                       | 5,0                         |
| M20                                                              | 4,9                      | 4,9                      | 13,0                       | 3,7                       | 3,7                       | 9,7                         |
| M24                                                              | 7,1                      | 7,1                      | 22,5                       | 5,3                       | 5,3                       | 16,8                        |
| M27                                                              | 9,2                      | 9,2                      | 33,3                       | 6,9                       | 6,9                       | 25,0                        |
| M30                                                              | 11,2                     | 11,2                     | 45,0                       | 8,4                       | 8,4                       | 33,7                        |
| Anchor rod / Threaded rod                                        | R90                      |                          |                            | R120                      |                           |                             |
| Steel zinc plated                                                | $N_{Rk,s,fi,90}$<br>[kN] | $V_{Rk,s,fi,90}$<br>[kN] | $M^0_{Rk,s,fi,90}$<br>[Nm] | $N_{Rk,s,fi,120}$<br>[kN] | $V_{Rk,s,fi,120}$<br>[kN] | $M^0_{Rk,s,fi,120}$<br>[Nm] |
| M8                                                               | 0,3                      | 0,3                      | 0,3                        | 0,2                       | 0,2                       | 0,2                         |
| M10                                                              | 0,6                      | 0,6                      | 0,7                        | 0,5                       | 0,5                       | 0,6                         |
| M12                                                              | 1,1                      | 1,1                      | 1,7                        | 0,8                       | 0,8                       | 1,3                         |
| M16                                                              | 2,0                      | 2,0                      | 4,3                        | 1,6                       | 1,6                       | 3,3                         |
| M20                                                              | 3,2                      | 3,2                      | 8,4                        | 2,5                       | 2,5                       | 6,5                         |
| M24                                                              | 4,6                      | 4,6                      | 14,6                       | 3,5                       | 3,5                       | 11,2                        |
| M27                                                              | 6,0                      | 6,0                      | 21,6                       | 4,6                       | 4,6                       | 16,6                        |
| M30                                                              | 7,3                      | 7,3                      | 29,2                       | 5,6                       | 5,6                       | 22,5                        |
| Anchor rod / Threaded rod                                        | R30                      |                          |                            | R60                       |                           |                             |
| Stainless steel R and high corrosion resistant steel HCR         | $N_{Rk,s,fi,30}$<br>[kN] | $V_{Rk,s,fi,30}$<br>[kN] | $M^0_{Rk,s,fi,30}$<br>[Nm] | $N_{Rk,s,fi,60}$<br>[kN]  | $V_{Rk,s,fi,60}$<br>[kN]  | $M^0_{Rk,s,fi,60}$<br>[Nm]  |
| M8                                                               | 0,7                      | 0,7                      | 0,7                        | 0,6                       | 0,6                       | 0,6                         |
| M10                                                              | 1,5                      | 1,5                      | 1,9                        | 1,2                       | 1,2                       | 1,5                         |
| M12                                                              | 2,5                      | 2,5                      | 3,9                        | 2,1                       | 2,1                       | 3,3                         |
| M16                                                              | 4,7                      | 4,7                      | 10,0                       | 3,9                       | 3,9                       | 8,3                         |
| M20                                                              | 7,4                      | 7,4                      | 19,5                       | 6,1                       | 6,1                       | 16,2                        |
| M24                                                              | 10,6                     | 10,6                     | 33,7                       | 8,8                       | 8,8                       | 28,1                        |
| M27                                                              | 13,8                     | 13,8                     | 49,9                       | 11,5                      | 11,5                      | 41,6                        |
| M30                                                              | 16,8                     | 16,8                     | 67,5                       | 14,0                      | 14,0                      | 56,2                        |
| Anchor rod / Threaded rod                                        | R90                      |                          |                            | R120                      |                           |                             |
| Stainless steel R and high corrosion resistant steel HCR         | $N_{Rk,s,fi,90}$<br>[kN] | $V_{Rk,s,fi,90}$<br>[kN] | $M^0_{Rk,s,fi,90}$<br>[Nm] | $N_{Rk,s,fi,120}$<br>[kN] | $V_{Rk,s,fi,120}$<br>[kN] | $M^0_{Rk,s,fi,120}$<br>[Nm] |
| M8                                                               | 0,4                      | 0,4                      | 0,4                        | 0,4                       | 0,4                       | 0,4                         |
| M10                                                              | 0,9                      | 0,9                      | 1,2                        | 0,8                       | 0,8                       | 1,0                         |
| M12                                                              | 1,7                      | 1,7                      | 2,6                        | 1,3                       | 1,3                       | 2,1                         |
| M16                                                              | 3,1                      | 3,1                      | 6,7                        | 2,5                       | 2,5                       | 5,3                         |
| M20                                                              | 4,9                      | 4,9                      | 13,0                       | 3,9                       | 3,9                       | 10,4                        |
| M24                                                              | 7,1                      | 7,1                      | 22,5                       | 5,6                       | 5,6                       | 18,0                        |
| M27                                                              | 9,2                      | 9,2                      | 33,3                       | 7,3                       | 7,3                       | 26,6                        |
| M30                                                              | 11,2                     | 11,2                     | 45,0                       | 9,0                       | 9,0                       | 36,0                        |

fischer injection system FIS EB II

**Performance**

Fire resistance to steel failure under tension and shear loading of Anchor rods and Threaded rods

**Annex C 14**

Appendix 32 / 34

**Table C15.1: Fire resistance to steel failure under tension and shear loading of Rebars and fischer FRA**

| Fire resistance to steel failure under tension and shear loading |                          |                          |                            |                           |                           |                             |
|------------------------------------------------------------------|--------------------------|--------------------------|----------------------------|---------------------------|---------------------------|-----------------------------|
| Rebar                                                            | R30                      |                          |                            | R60                       |                           |                             |
| Bars and de-coiled rods                                          | $N_{Rk,s,fi,30}$<br>[kN] | $V_{Rk,s,fi,30}$<br>[kN] | $M^0_{Rk,s,fi,30}$<br>[Nm] | $N_{Rk,s,fi,60}$<br>[kN]  | $V_{Rk,s,fi,60}$<br>[kN]  | $M^0_{Rk,s,fi,60}$<br>[Nm]  |
| φ 8                                                              | 0,5                      | 0,5                      | 0,6                        | 0,5                       | 0,5                       | 0,5                         |
| φ 10                                                             | 1,2                      | 1,2                      | 1,8                        | 1,0                       | 1,0                       | 1,5                         |
| φ 12                                                             | 2,3                      | 2,3                      | 4,1                        | 1,7                       | 1,7                       | 3,0                         |
| φ 14                                                             | 3,1                      | 3,1                      | 6,5                        | 2,3                       | 2,3                       | 4,9                         |
| φ 16                                                             | 4,0                      | 4,0                      | 9,6                        | 3,0                       | 3,0                       | 7,2                         |
| φ 20                                                             | 6,3                      | 6,3                      | 18,8                       | 4,7                       | 4,7                       | 14,1                        |
| φ 25                                                             | 9,8                      | 9,8                      | 36,8                       | 7,4                       | 7,4                       | 27,6                        |
| φ 26                                                             | 10,6                     | 10,6                     | 41,4                       | 8,0                       | 8,0                       | 31,1                        |
| φ 28                                                             | 12,3                     | 12,3                     | 51,8                       | 9,2                       | 9,2                       | 38,8                        |
| φ 30                                                             | 14,1                     | 14,1                     | 63,6                       | 10,6                      | 10,6                      | 47,7                        |
| φ 32                                                             | 16,1                     | 16,1                     | 77,2                       | 12,1                      | 12,1                      | 57,9                        |
| Rebar                                                            | R90                      |                          |                            | R120                      |                           |                             |
| Bars and de-coiled rods                                          | $N_{Rk,s,fi,90}$<br>[kN] | $V_{Rk,s,fi,90}$<br>[kN] | $M^0_{Rk,s,fi,90}$<br>[Nm] | $N_{Rk,s,fi,120}$<br>[kN] | $V_{Rk,s,fi,120}$<br>[kN] | $M^0_{Rk,s,fi,120}$<br>[Nm] |
| φ 8                                                              | 0,4                      | 0,4                      | 0,4                        | 0,3                       | 0,3                       | 0,3                         |
| φ 10                                                             | 0,8                      | 0,8                      | 1,2                        | 0,6                       | 0,6                       | 0,9                         |
| φ 12                                                             | 1,5                      | 1,5                      | 2,6                        | 1,1                       | 1,1                       | 2,0                         |
| φ 14                                                             | 2,0                      | 2,0                      | 4,2                        | 1,5                       | 1,5                       | 3,2                         |
| φ 16                                                             | 2,6                      | 2,6                      | 6,3                        | 2,0                       | 2,0                       | 4,8                         |
| φ 20                                                             | 4,1                      | 4,1                      | 12,2                       | 3,1                       | 3,1                       | 9,4                         |
| φ 25                                                             | 6,4                      | 6,4                      | 23,9                       | 4,9                       | 4,9                       | 18,4                        |
| φ 26                                                             | 6,9                      | 6,9                      | 26,9                       | 5,3                       | 5,3                       | 20,7                        |
| φ 28                                                             | 8,0                      | 8,0                      | 33,6                       | 6,2                       | 6,2                       | 25,9                        |
| φ 30                                                             | 9,2                      | 9,2                      | 41,4                       | 7,1                       | 7,1                       | 31,8                        |
| φ 32                                                             | 10,5                     | 10,5                     | 50,2                       | 8,0                       | 8,0                       | 38,6                        |
| fischer FRA                                                      | R30                      |                          |                            | R60                       |                           |                             |
| Stainless steel R<br>and high corrosion resistant steel HCR      | $N_{Rk,s,fi,30}$<br>[kN] | $V_{Rk,s,fi,30}$<br>[kN] | $M^0_{Rk,s,fi,30}$<br>[Nm] | $N_{Rk,s,fi,60}$<br>[kN]  | $V_{Rk,s,fi,60}$<br>[kN]  | $M^0_{Rk,s,fi,60}$<br>[Nm]  |
| M12                                                              | 2,5                      | 2,5                      | 3,9                        | 2,1                       | 2,1                       | 3,3                         |
| M16                                                              | 4,7                      | 4,7                      | 10,0                       | 3,9                       | 3,9                       | 8,3                         |
| M20                                                              | 7,4                      | 7,4                      | 19,5                       | 6,1                       | 6,1                       | 16,2                        |
| M24                                                              | 10,6                     | 10,6                     | 33,7                       | 8,8                       | 8,8                       | 28,1                        |
| fischer FRA                                                      | R90                      |                          |                            | R120                      |                           |                             |
| Stainless steel R<br>and high corrosion resistant steel HCR      | $N_{Rk,s,fi,90}$<br>[kN] | $V_{Rk,s,fi,90}$<br>[kN] | $M^0_{Rk,s,fi,90}$<br>[Nm] | $N_{Rk,s,fi,120}$<br>[kN] | $V_{Rk,s,fi,120}$<br>[kN] | $M^0_{Rk,s,fi,120}$<br>[Nm] |
| M12                                                              | 1,7                      | 1,7                      | 2,6                        | 1,3                       | 1,3                       | 2,1                         |
| M16                                                              | 3,1                      | 3,1                      | 6,7                        | 2,5                       | 2,5                       | 5,3                         |
| M20                                                              | 4,9                      | 4,9                      | 13,0                       | 3,9                       | 3,9                       | 10,4                        |
| M24                                                              | 7,1                      | 7,1                      | 22,5                       | 5,6                       | 5,6                       | 18,0                        |

fischer injection system FIS EB II

**Performance**

Fire resistance to steel failure under tension and shear loading of Rebars an fischer FRA

**Annex C 15**

Appendix 33 / 34

Characteristic bond resistance for cracked concrete under fire conditions for Anchor rods, Threaded rods, Rebars and fischer FRA for hammer drilled holes

The characteristic bond resistance for cracked concrete under fire conditions for a given temperature

$\tau_{Rk,fi}(\theta)$  has to be calculated by the following equation:

$$\tau_{Rk,fi}(\theta) = k_{fi,p}(\theta) \cdot \tau_{Rk,cr,C20/25}$$

|                               |                                                                            |                                                                                                                                                                          |  |                  |
|-------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------|
| $\theta$                      | =                                                                          | Temperature in °C in the mortar layer                                                                                                                                    |  |                  |
| $\tau_{Rk,fi}(\theta)$        | =                                                                          | Characteristic bond resistance for cracked and uncracked concrete under fire exposure for a given temperature in N/mm <sup>2</sup> for concrete classes C20/25 to C50/60 |  |                  |
| $k_{fi,p}(\theta)$            | =                                                                          | Reduction factor under fire conditions                                                                                                                                   |  |                  |
| $\tau_{Rk,cr,C20/25}$         | =                                                                          | Characteristic bond resistance for cracked concrete C20/25 in N/mm <sup>2</sup> , given in Table C4.1, Table C5.1 or Table C6.1, respectively                            |  |                  |
| Anchor rods and Threaded rods | If: $\theta > 20\text{ °C}$<br>If: $\theta > \theta_{max} = 373\text{ °C}$ | $k_{fi,p}(\theta) = 61,573 \cdot \theta^{-1,400} \geq 1,0$<br>$k_{fi,p}(\theta) = 0$                                                                                     |  | see Figure C16.1 |
| Rebars and fischer FRA        | If: $\theta > 23\text{ °C}$<br>If: $\theta > \theta_{max} = 236\text{ °C}$ | $k_{fi,p}(\theta) = 252,678 \cdot \theta^{-1,777} \geq 1,0$<br>$k_{fi,p}(\theta) = 0$                                                                                    |  | see Figure C16.2 |

Figure C16.1: Graph of reduction factor  $k_{fi,p}(\theta)$  for anchor rods threaded rods

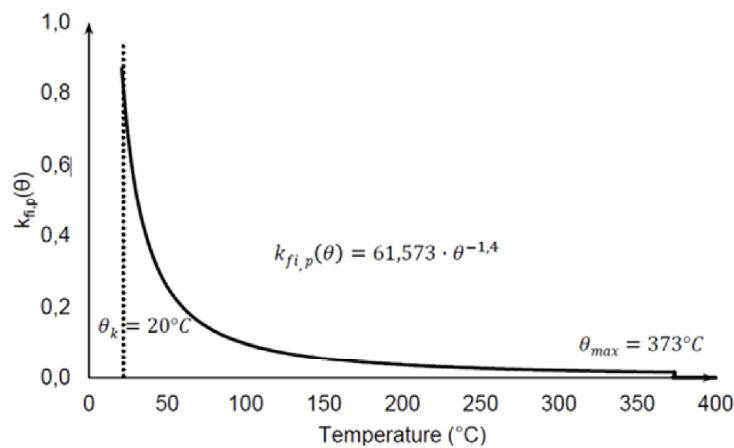
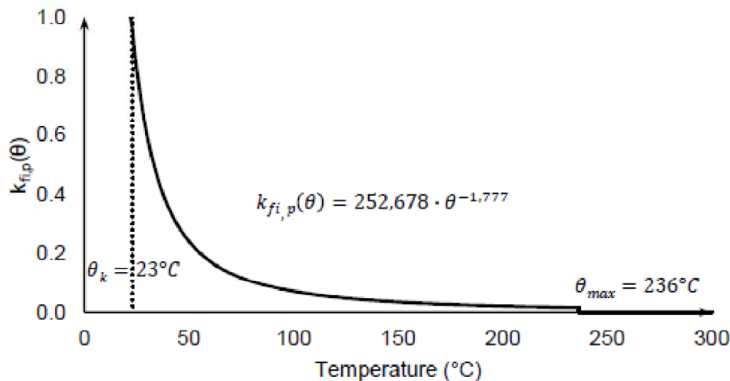


Figure C16.2: Graph of reduction factor  $k_{fi,p}(\theta)$  for rebars and fischer FRA



fischer injection system FIS EB II

Performance  
Characteristic bond resistance under fire conditions