

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-20/0603**  
**of 13 November 2020**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Trade name of the construction product

Product family  
to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment  
contains

This European Technical Assessment is  
issued in accordance with Regulation (EU)  
No 305/2011, on the basis of

Deutsches Institut für Bautechnik

fischer Injection system FIS V Plus

Bonded anchor for use in concrete

fischerwerke GmbH & Co. KG  
Otto-Hahn-Straße 15  
79211 Denzlingen  
DEUTSCHLAND

fischerwerke

37 pages including 3 annexes which form an integral part  
of this assessment

EAD 330499-01-0601 Edition 04/2020

**European Technical Assessment**

**ETA-20/0603**

English translation prepared by DIBt

**Page 2 of 37 | 13 November 2020**

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## Specific Part

### 1 Technical description of the product

The "fischer Injection system FIS V Plus" is a bonded anchor consisting of a cartridge with injection mortar according to Annex A 4 and a steel element according to Annex A 1 to A 3.

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 and/or 100 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, C 2, C 4 to C 9, B 4, B 5 |
| 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 10 to C 11                   |
| Characteristic resistance and displacements for seismic performance categories C1 and C2 | See Annex C 12 to C 15                   |

#### 3.2 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 the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

Issued in Berlin 13 November 2020 by Deutsches Institut für Bautechnik

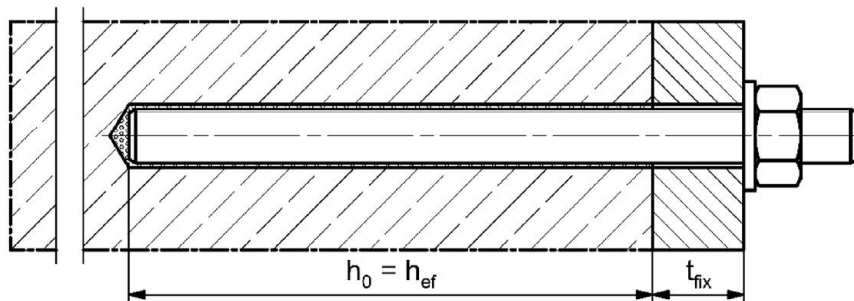
Dipl.-Ing. Beatrix Wittstock  
Head of Section

*beglaubigt:*  
Lange

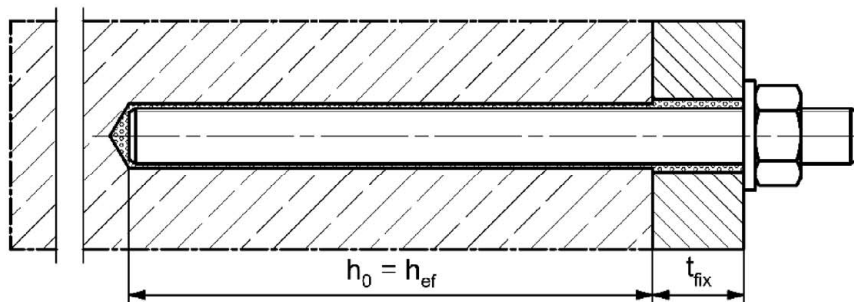
## Installation conditions part 1

### fischer anchor rod

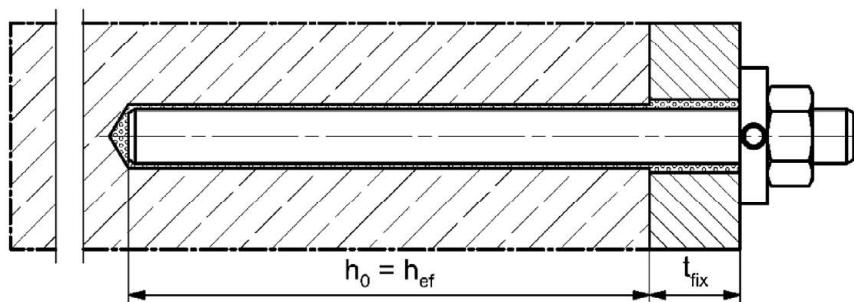
#### Pre-positioned installation



#### Push through installation (annular gap filled with mortar)



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



Figures not to scale

$h_0$  = drill hole depth

$h_{ef}$  = effective embedment depth

$t_{fix}$  = thickness of fixture

fischer injection system FIS V Plus

#### Product description

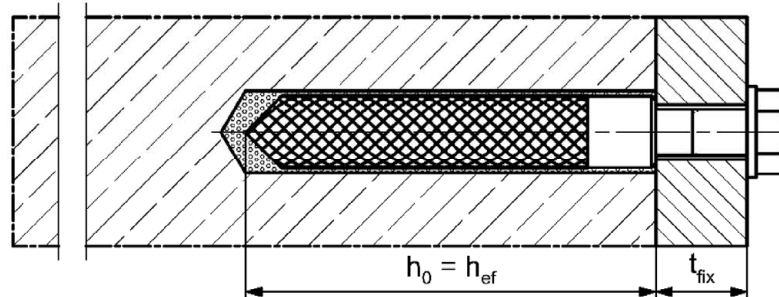
Installation conditions part 1

**Annex A 1**

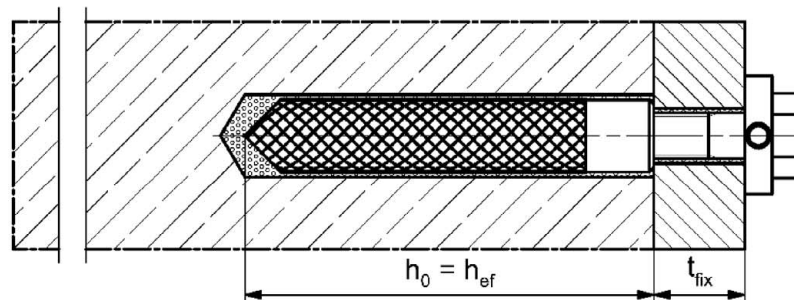
## Installation conditions part 2

### fischer internal threaded anchor RG MI

#### Pre-positioned installation



#### Pre-positioned installation with subsequently injected fischer filling disc (annular gap filled with mortar)



Figures not to scale

$h_0$  = drill hole depth

$h_{ef}$  = effective embedment depth

$t_{fix}$  = thickness of fixture

fischer injection system FIS V Plus

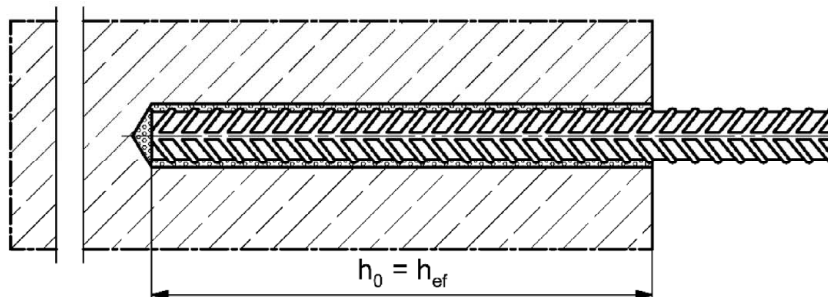
#### Product description

Installation conditions part 2

**Annex A 2**

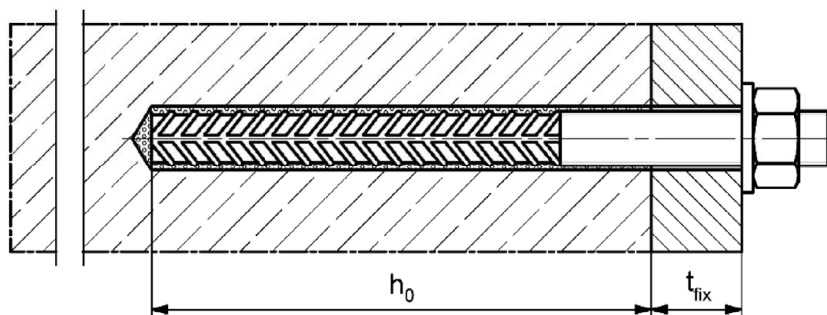
### Installation conditions part 3

#### Reinforcing bar

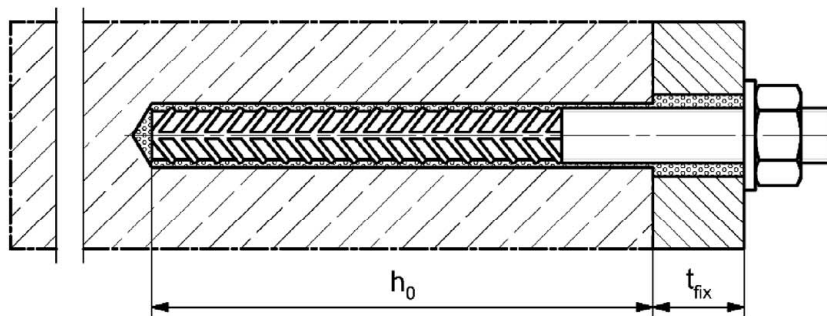


#### fischer rebar anchor FRA

##### Pre-positioned installation



##### Push through installation (annular gap filled with mortar)



Figures not to scale

$h_0$  = drill hole depth

$h_{ef}$  = effective embedment depth

$t_{fix}$  = thickness of fixture

fischer injection system FIS V Plus

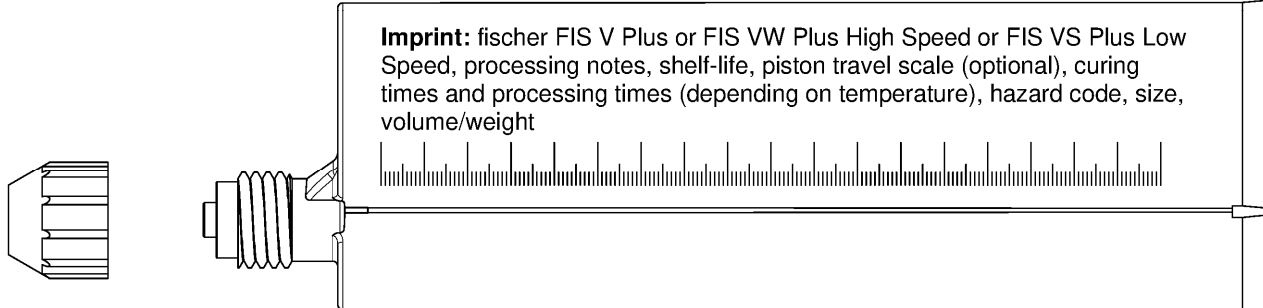
#### Product description

Installation conditions part 3

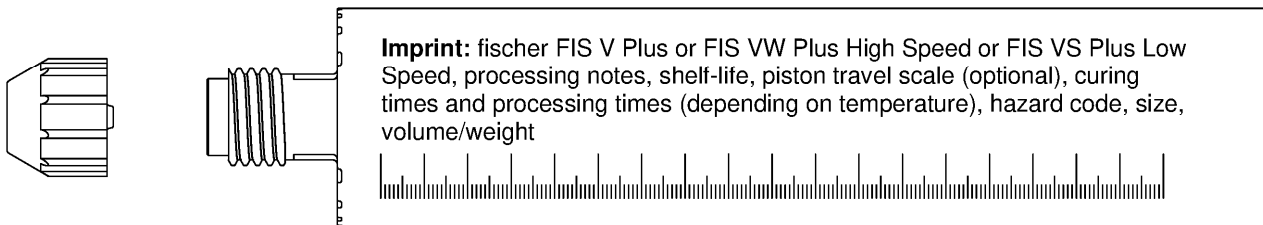
**Annex A 3**

## Overview system components part 1

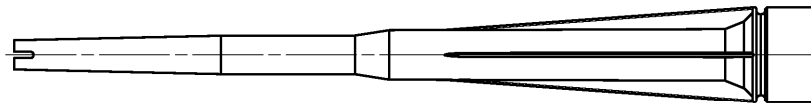
**Injection cartridge (shuttle cartridge) with sealing cap; Sizes: 350 ml, 360 ml, 390 ml, 550 ml, 1100 ml, 1500 ml**



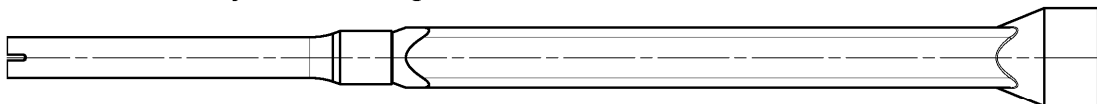
**Injection cartridge (coaxial cartridge) with sealing cap; Sizes: 100 ml, 150 ml, 300 ml, 380 ml, 400 ml, 410 ml**



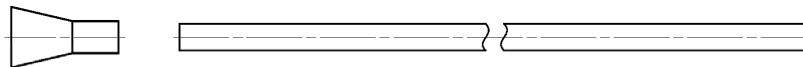
**Static mixer FIS MR Plus for injection cartridges up to 410 ml**



**Static mixer FIS UMR for injection cartridges from 550 ml**



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



**Cleaning brush BS**



**Blow-out pump**

**AB G:**



**ABP:**



Figures not to scale

fischer injection system FIS V Plus

### Product description

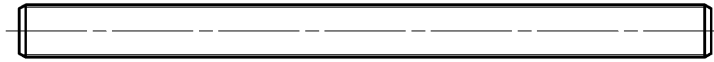
Overview system components part 1;  
cartridges / static mixer / accessories

**Annex A 4**

## Overview system components part 2

### fischer anchor rod

Size: M6, M8, M10, M12, M16, M20, M24, M27, M30

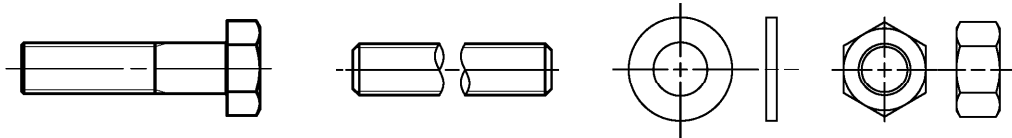


### fischer internal threaded anchor RG MI

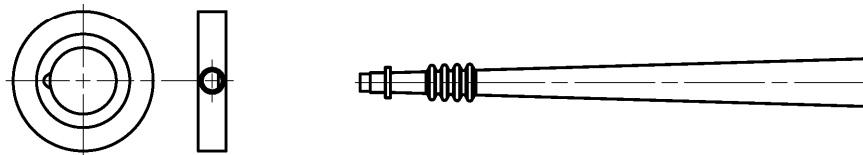
Size: M8, M10, M12, M16, M20



### Screw / threaded rod / washer / hexagon nut



### fischer filling disc with injection adapter



### Reinforcing bar

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



### fischer rebar anchor FRA

Size: M12, M16, M20, M24



Figures not to scale

fischer injection system FIS V Plus

#### Product description

Overview system components part 2;  
metal parts, injection adapter

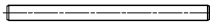
**Annex A 5**

**Table A6.1: 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<br>acc. to EN 1993-1-4:2015                                                                                                                                                                                                                                     | acc. to EN 10088-1:2014<br>Corrosion resistance class CRC V<br>acc. to EN 1993-1-4:2015                                                                                                                                       |
| 2                                   | Anchor rod                                                                                       | Property class 4.8, 5.8 or 8.8;<br>EN ISO 898-1:2013<br>zinc plated $\geq 5 \mu\text{m}$ ,<br>ISO 4042:2018/Zn5/An(A2K)<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004<br>$f_{uk} \leq 1000 \text{ N/mm}^2$<br>$A_5 > 12\%$<br>fracture elongation | Property class 50, 70 or 80<br>EN ISO 3506-1:2009<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>$A_5 > 12\%$<br>fracture elongation                                                                                             | Property class 50 or 80<br>EN ISO 3506-1:2009<br>or property class 70 with<br>$f_{yk} = 560 \text{ N/mm}^2$<br>1.4565; 1.4529;<br>EN 10088-1:2014<br>$f_{uk} \leq 1000 \text{ N/mm}^2$<br>$A_5 > 12\%$<br>fracture elongation |
|                                     |                                                                                                  | Fracture elongation $A_5 > 8 \%$ , for applications without requirements<br>for seismic performance category C2                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                               |
| 3                                   | Washer<br>ISO 7089:2000                                                                          | zinc plated $\geq 5 \mu\text{m}$ ,<br>ISO 4042:2018/Zn5/An(A2K)<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004                                                                                                                                     | 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 4, 5 or 8;<br>EN ISO 898-2:2012<br>zinc plated $\geq 5 \mu\text{m}$ ,<br>ISO 4042:2018/Zn5/An(A2K)<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004                                                                                   | Property class<br>50, 70 or 80<br>EN ISO 3506-1:2009<br>1.4401; 1.4404; 1.4578;<br>1.4571; 1.4439; 1.4362;<br>EN 10088-1:2014                                                                                                                                                                                                 | Property class<br>50, 70 or 80<br>EN ISO 3506-1:2009<br>1.4565; 1.4529;<br>EN 10088-1:2014                                                                                                                                    |
| 5                                   | fischer<br>internal threaded anchor<br>RG MI                                                     | Property class 5.8<br>ISO 898-1:2013<br>zinc plated $\geq 5 \mu\text{m}$ ,<br>ISO 4042:2018/Zn5/An(A2K)                                                                                                                                                                 | Property class 70<br>EN ISO 3506-1:2009<br>1.4401; 1.4404; 1.4578;<br>1.4571; 1.4439; 1.4362;<br>EN 10088-1:2014                                                                                                                                                                                                              | Property class 70<br>EN ISO 3506-1:2009<br>1.4565; 1.4529;<br>EN 10088-1:2014                                                                                                                                                 |
| 6                                   | Commercial standard<br>screw or threaded rod<br>for fischer internal<br>threaded anchor<br>RG MI | Property class 5.8 or 8.8;<br>EN ISO 898-1:2013<br>zinc plated $\geq 5 \mu\text{m}$ ,<br>ISO 4042:2018/Zn5/An(A2K)<br>$A_5 > 8 \%$<br>fracture elongation                                                                                                               | Property class 70<br>EN ISO 3506-1:2009<br>1.4401; 1.4404; 1.4578;<br>1.4571; 1.4439; 1.4362;<br>EN 10088-1:2014<br>$A_5 > 8 \%$ fracture elongation                                                                                                                                                                          | Property class 70<br>EN ISO 3506-1:2009<br>1.4565; 1.4529;<br>EN 10088-1:2014<br>$A_5 > 8 \%$<br>fracture elongation                                                                                                          |
| 7                                   | fischer filling disc<br>similar to DIN 6319-G                                                    | zinc plated $\geq 5 \mu\text{m}$ ,<br>ISO 4042:2018/Zn5/An(A2K)<br>or hot dip galvanised $\geq 40 \mu\text{m}$<br>EN ISO 10684:2004                                                                                                                                     | 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                                                                                                                                                                                            |
| 8                                   | Reinforcing bar<br>EN 1992-1-1:2004 and<br>AC:2010, Annex C                                      | Bars and de-coiled rods, class B or C with<br>$f_{yk}$ and $k$ according to NDP or NCL of according to EN 1992-1-1:2004/NA<br>$f_{uk} = f_{tk} = k \cdot f_{yk}$                                                                                                        |                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                               |
| 9                                   | fischer<br>rebar anchor FRA                                                                      | Rebar part:<br>Bars and de-coiled rods class B or C with $f_{yk}$<br>and $k$ according to NDP or NCL of EN<br>1992-1-1:2004+AC:2010<br>$f_{uk} = f_{tk} = k \cdot f_{yk}$                                                                                               | Threaded part: Property class 70 or 80<br>EN ISO 3506-1:2009<br>1.4401, 1.4404, 1.4571, 1.4578, 1.4439,<br>1.4362, 1.4062 acc. to EN 10088-1:2014<br>Corrosion resistance class CRC III<br>acc. to EN 1993-1-4:2015<br>1.4565; 1.4529 acc. to EN 10088-1:2014<br>Corrosion resistance class CRC V<br>acc. to EN 1993-1-4:2015 |                                                                                                                                                                                                                               |
|                                     |                                                                                                  |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                               |
| fischer injection system FIS V Plus |                                                                                                  |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                               | Annex A 6                                                                                                                                                                                                                     |
| Product description<br>Materials    |                                                                                                  |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                               |

## Specifications of intended use (part 1)

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

| FIS V Plus with ...                                                                                                                                                                                                                          |                        |                                                                                   |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------|
|                                                                                                                                                                                                                                              |                        | Anchor rod                                                                        |                                                  | fischer internal threaded anchor RG MI                                             |                                          | Reinforcing bar                                                                     |                                          | fischer rebar anchor FRA                                                            |                                          |
|                                                                                                                                                                                                                                              |                        |  |                                                  |  |                                          |  |                                          |  |                                          |
| Hammer drilling with standard drill bit                                                                                                                     |                        | all sizes                                                                         |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
| Hammer drilling with hollow drill bit <br>(fischer „FHD“, Heller „Duster Expert“, Bosch „Speed Clean“, Hilti „TE-CD, TE-YD“, DreBo „D-Plus“, DreBo „D-Max“) |                        | Nominal drill bit diameter (d <sub>0</sub> )<br>12 mm to 35 mm                    |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
| Static and quasi static load, in                                                                                                                                                                                                             | uncracked concrete     | all sizes                                                                         | Tables:<br>C1.1<br>C4.1<br>C5.1<br>C6.1<br>C10.1 | all sizes                                                                          | Tables:<br>C2.1<br>C4.1<br>C7.1<br>C10.2 | all sizes                                                                           | Tables:<br>C3.1<br>C4.1<br>C8.1<br>C11.1 | all sizes                                                                           | Tables:<br>C3.2<br>C4.1<br>C9.1<br>C11.2 |
|                                                                                                                                                                                                                                              | cracked concrete       | M8 to M30                                                                         |                                                  | ..2)                                                                               |                                          | φ 10 to φ 28                                                                        |                                          |                                                                                     |                                          |
| Seismic performance category                                                                                                                                                                                                                 | C1 <sup>1)</sup>       | M10 to M30                                                                        | Tables:<br>C12.1<br>C13.1<br>C14.1               | ..2)                                                                               |                                          | ..2)                                                                                |                                          | ..2)                                                                                |                                          |
|                                                                                                                                                                                                                                              | C2 <sup>1)</sup>       | M12<br>M16<br>M20                                                                 | Tables:<br>C12.1<br>C13.1<br>C15.1               |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
| Use category                                                                                                                                                                                                                                 | I1 dry or wet concrete | all sizes                                                                         |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
|                                                                                                                                                                                                                                              | I2 water filled hole   | M12 to M30                                                                        | all sizes                                        |                                                                                    | ..2)                                     |                                                                                     | ..2)                                     |                                                                                     |                                          |
| Installation direction                                                                                                                                                                                                                       |                        | D3 (downward and horizontal and upwards (e.g. overhead) installation)             |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
| Installation temperature                                                                                                                                                                                                                     |                        | T <sub>i,min</sub> = -10 °C to T <sub>i,max</sub> = +40 °C                        |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
| In-service temperature                                                                                                                                                                                                                       | Temperature range I    | -40 °C to +80 °C                                                                  |                                                  | (max. short term temperature +80 °C;<br>max. long term temperature +50 °C)         |                                          |                                                                                     |                                          |                                                                                     |                                          |
|                                                                                                                                                                                                                                              | Temperature range II   | -40 °C to +120 °C                                                                 |                                                  | (max. short term temperature +120 °C;<br>max. long term temperature +72 °C)        |                                          |                                                                                     |                                          |                                                                                     |                                          |
| 1) Not for FIS VW Plus High Speed and FIS VS Plus Low Speed<br>2) No performance assessed                                                                                                                                                    |                        |                                                                                   |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |
| fischer injection system FIS V Plus                                                                                                                                                                                                          |                        |                                                                                   |                                                  |                                                                                    |                                          |                                                                                     |                                          | Annex B 1                                                                           |                                          |
| Intended use<br>Specifications (part 1)                                                                                                                                                                                                      |                        |                                                                                   |                                                  |                                                                                    |                                          |                                                                                     |                                          |                                                                                     |                                          |

## 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+A1:2016

### 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 EN1993-1-4:2015 corresponding to corrosion resistance classes to Annex A 6 Table A6.1.

### Design:

- Anchorages have to be designed by a responsible engineer with experience of concrete anchor design.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed in accordance with:  
EN 1992-4:2018 and EOTA Technical Report TR 055, Edition February 2018.

### Installation:

- Anchor installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- In case of aborted hole: The hole shall be filled with mortar
- Anchorage depth should be marked and adhered to on installation
- Overhead installation is allowed

fischer injection system FIS V Plus

**Intended use**  
Specifications (part 2)

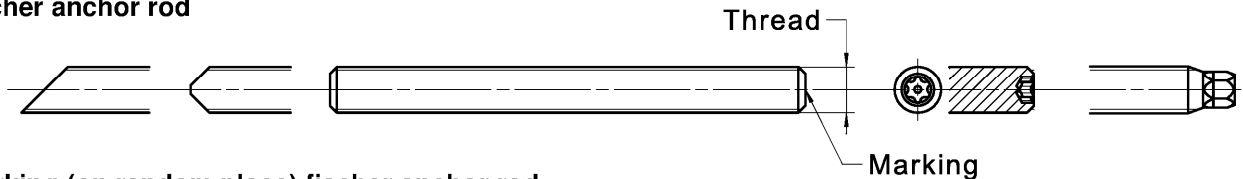
**Annex B 2**

**Table B3.1:** Installation parameters for **anchor rods** <sup>1)</sup>

| Anchor rods                                   |                             | Thread | M6                       | M8  | M10 | M12 | M16             | M20 | M24 | M27 | M30 |
|-----------------------------------------------|-----------------------------|--------|--------------------------|-----|-----|-----|-----------------|-----|-----|-----|-----|
| Width across flats                            | SW                          | [mm]   | 10                       | 13  | 17  | 19  | 24              | 30  | 36  | 41  | 46  |
| Nominal drill hole diameter                   | $d_0$                       |        | 8                        | 10  | 12  | 14  | 18              | 24  | 28  | 30  | 35  |
| Drill hole depth                              | $h_0$                       |        | $h_0 = h_{ef}$           |     |     |     |                 |     |     |     |     |
| Effective embedment depth                     | $h_{ef, min}$               |        | 50                       | 60  | 60  | 70  | 80              | 90  | 96  | 108 | 120 |
|                                               | $h_{ef, max}$               |        | 72                       | 160 | 200 | 240 | 320             | 400 | 480 | 540 | 600 |
| Minimum spacing and minimum edge distance     | $s_{min} = c_{min}$         |        | 40                       | 40  | 45  | 55  | 65              | 85  | 105 | 125 | 140 |
| Diameter of the clearance hole of the fixture | pre-positioned installation |        | 7                        | 9   | 12  | 14  | 18              | 22  | 26  | 30  | 33  |
|                                               | push through installation   |        | 9                        | 12  | 14  | 16  | 20              | 26  | 30  | 33  | 40  |
| Minimum thickness of concrete member          | $h_{min}$                   |        | $h_{ef} + 30 (\geq 100)$ |     |     |     | $h_{ef} + 2d_0$ |     |     |     |     |
| Maximum installation torque                   | $\max T_{inst}$             | [Nm]   | 5                        | 10  | 20  | 40  | 60              | 120 | 150 | 200 | 300 |

<sup>1)</sup> minimum spacing and minimum edge distance see Annex B 4

**fischer anchor rod**



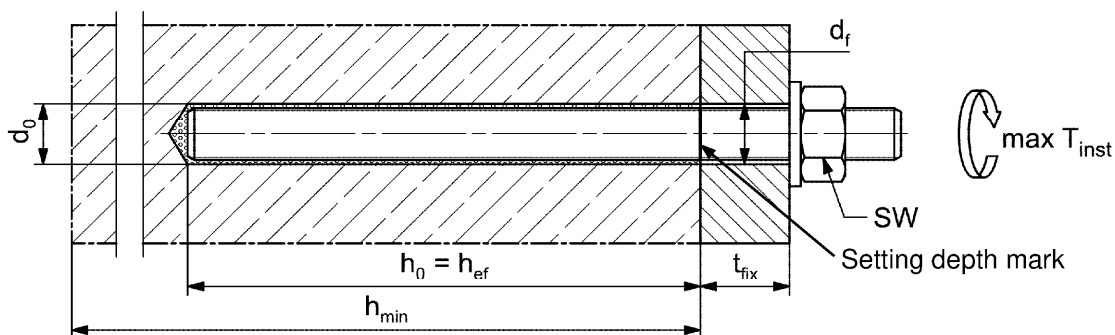
**Marking (on random place) fischer anchor rod:**

|                                                        |        |                                                        |   |
|--------------------------------------------------------|--------|--------------------------------------------------------|---|
| Steel zinc plated 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:**



**Commercial standard 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 6, Table A6.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- Setting depth is marked

Figures not to scale

fischer injection system FIS V Plus

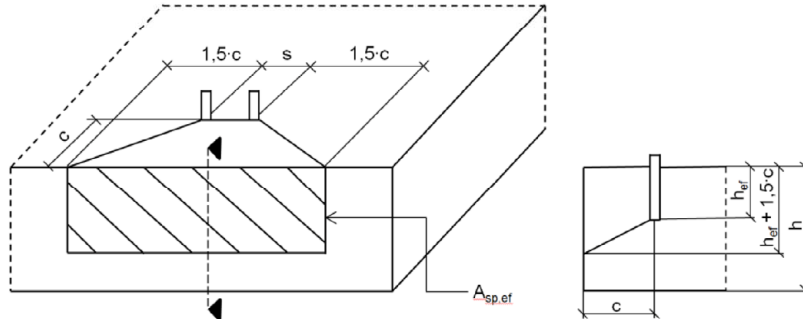
**Intended use**  
Installation parameters anchor rods

**Annex B 3**

**Table B4.1:** Minimum spacing and minimum edge distance for **anchor rods, reinforcing bars and fischer rebar anchor FRA**

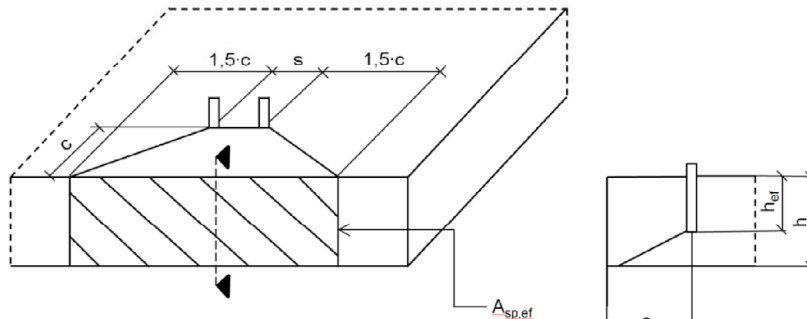
|                                                                                                                                                                                                           |                     |                   |                        |      |      |      |           |      |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------|------------------------|------|------|------|-----------|------|----|
| Anchor rods                                                                                                                                                                                               |                     |                   | M6                     | M8   | M10  | M12  | -         | M16  |    |
| Reinforcing bars / FRA<br>(nominal diameter)                                                                                                                                                              |                     |                   | φ                      | -    | 8    | 10   | 12        | 14   | 16 |
| Minimum edge distance                                                                                                                                                                                     |                     |                   |                        |      |      |      |           |      |    |
| Uncracked / cracked concrete                                                                                                                                                                              | C <sub>min</sub>    | [mm]              | 40                     | 40   | 45   | 45   | 45        | 50   |    |
| Minimum spacing                                                                                                                                                                                           | S <sub>min</sub>    |                   | according to Annex B 5 |      |      |      |           |      |    |
| Minimum spacing                                                                                                                                                                                           |                     |                   |                        |      |      |      |           |      |    |
| Uncracked / cracked concrete                                                                                                                                                                              | S <sub>min</sub>    | [mm]              | 40                     | 40   | 45   | 55   | 60        | 65   |    |
| Minimum edge distance                                                                                                                                                                                     | C <sub>min</sub>    |                   | according to Annex B 5 |      |      |      |           |      |    |
| Required projecting area                                                                                                                                                                                  |                     |                   |                        |      |      |      |           |      |    |
| Uncracked concrete                                                                                                                                                                                        | A <sub>sp,req</sub> | [1000             | 8,0                    | 8,0  | 13,0 | 22,0 | 23,0      | 24,0 |    |
| Cracked concrete                                                                                                                                                                                          |                     | mm <sup>2</sup> ] | 6,5                    | 6,5  | 10   | 16,5 | 17,5      | 18,5 |    |
|                                                                                                                                                                                                           |                     |                   |                        |      |      |      |           |      |    |
| Anchor rods                                                                                                                                                                                               |                     |                   | M20                    | M24  | -    | M27  | -         | M30  |    |
| Reinforcing bars / FRA<br>(nominal diameter)                                                                                                                                                              |                     |                   | φ                      | 20   | -    | 25   | -         | 28   | -  |
| Minimum edge distance                                                                                                                                                                                     |                     |                   |                        |      |      |      |           |      |    |
| Uncracked / cracked concrete                                                                                                                                                                              | C <sub>min</sub>    | [mm]              | 55                     | 60   | 75   | 75   | 80        | 80   |    |
| Minimum spacing                                                                                                                                                                                           | S <sub>min</sub>    |                   | according to Annex B 5 |      |      |      |           |      |    |
| Minimum spacing                                                                                                                                                                                           |                     |                   |                        |      |      |      |           |      |    |
| Uncracked / cracked concrete                                                                                                                                                                              | S <sub>min</sub>    | [mm]              | 85                     | 105  | 120  | 120  | 140       | 140  |    |
| Minimum edge distance                                                                                                                                                                                     | C <sub>min</sub>    |                   | according to Annex B 5 |      |      |      |           |      |    |
| Required projecting area                                                                                                                                                                                  |                     |                   |                        |      |      |      |           |      |    |
| Uncracked concrete                                                                                                                                                                                        | A <sub>sp,req</sub> | [1000             | 38,5                   | 40   | 47,5 | 47,5 | 64        | 64   |    |
| Cracked concrete                                                                                                                                                                                          |                     | mm <sup>2</sup> ] | 29,5                   | 30,5 | 36,5 | 36,5 | 49        | 49   |    |
|                                                                                                                                                                                                           |                     |                   |                        |      |      |      |           |      |    |
| <b>Splitting failure</b> for minimum edge distance and spacing in dependence of the effective embedment depth h <sub>ef</sub> .                                                                           |                     |                   |                        |      |      |      |           |      |    |
| 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: |                     |                   |                        |      |      |      |           |      |    |
| $A_{sp,req} < A_{sp,t}$                                                                                                                                                                                   |                     |                   |                        |      |      |      |           |      |    |
| A <sub>sp,req</sub> = required projecting area<br>A <sub>sp,t</sub> = A <sub>sp,ef</sub> = effective projecting area (according to Annex B 5)                                                             |                     |                   |                        |      |      |      |           |      |    |
|                                                                                                                                                                                                           |                     |                   |                        |      |      |      |           |      |    |
| fischer injection system FIS V Plus                                                                                                                                                                       |                     |                   |                        |      |      |      | Annex B 4 |      |    |
| Intended use<br>Minimum spacing and edge distance for anchor rods, reinforcing bars and fischer rebar anchor FRA                                                                                          |                     |                   |                        |      |      |      |           |      |    |

**Table B5.1:** Effective projecting area  $A_{sp,t}$  with concrete member thickness  $h > h_{ef} + 1,5 \cdot c$  and  $h \geq h_{min}$



|                                          |                                                           |                    |                                            |
|------------------------------------------|-----------------------------------------------------------|--------------------|--------------------------------------------|
| Single anchor                            | $A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$     | [mm <sup>2</sup> ] | with $c \geq c_{min}$                      |
| Group of anchors with $s > 3 \cdot c$    | $A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$     | [mm <sup>2</sup> ] |                                            |
| Group of anchors with $s \leq 3 \cdot c$ | $A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1,5 \cdot c)$ | [mm <sup>2</sup> ] | with $c \geq c_{min}$ and $s \geq s_{min}$ |

**Table B5.2:** Effective projecting area  $A_{sp,t}$  with concrete member thickness  $h \leq h_{ef} + 1,5 \cdot c$  and  $h \geq h_{min}$



|                                          |                                                       |                    |                                            |
|------------------------------------------|-------------------------------------------------------|--------------------|--------------------------------------------|
| Single anchor                            | $A_{sp,t} = 3 \cdot c \cdot \text{existing } h$       | [mm <sup>2</sup> ] | with $c \geq c_{min}$                      |
| Group of anchors with $s > 3 \cdot c$    | $A_{sp,t} = 6 \cdot c \cdot \text{existing } h$       | [mm <sup>2</sup> ] |                                            |
| Group of anchors with $s \leq 3 \cdot c$ | $A_{sp,t} = (3 \cdot c + s) \cdot \text{existing } h$ | [mm <sup>2</sup> ] | 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 V Plus

**Intended use**

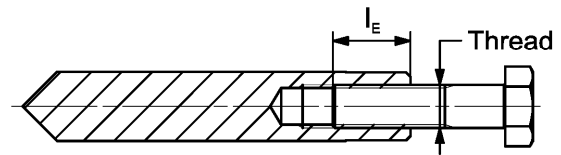
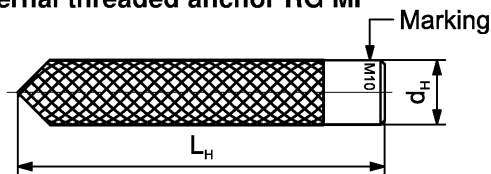
Minimum thickness of concrete member for anchor rods and reinforcing bars,  
minimum spacing and edge distance

**Annex B 5**

**Table B6.1:** Installation parameters for **fischer internal threaded anchors RG MI**

| Internal threaded anchors RG MI                 |                             | Thread | M8                   | M10 | M12 | M16 | M20 |
|-------------------------------------------------|-----------------------------|--------|----------------------|-----|-----|-----|-----|
| Diameter of anchor                              | $d_{nom} = d_H$             | [mm]   | 12                   | 16  | 18  | 22  | 28  |
| Nominal drill hole diameter                     | $d_0$                       |        | 14                   | 18  | 20  | 24  | 32  |
| Drill hole depth                                | $h_0$                       |        | $h_0 = h_{ef} = L_H$ |     |     |     |     |
| Effective embedment depth<br>( $h_{ef} = L_H$ ) | $h_{ef}$                    |        | 90                   | 90  | 125 | 160 | 200 |
| Minimum spacing and<br>minimum edge distance    | $s_{min}$<br>=<br>$c_{min}$ |        | 55                   | 65  | 75  | 95  | 125 |
| Diameter of clearance hole<br>in the fixture    | $d_f$                       |        | 9                    | 12  | 14  | 18  | 22  |
| Minimum thickness<br>of concrete member         | $h_{min}$                   |        | 120                  | 125 | 165 | 205 | 260 |
| Maximum screw-in depth                          | $l_{E,max}$                 |        | 18                   | 23  | 26  | 35  | 45  |
| Minimum screw-in depth                          | $l_{E,min}$                 |        | 8                    | 10  | 12  | 16  | 20  |
| Maximum installation torque                     | $\max T_{inst}$             | [Nm]   | 10                   | 20  | 40  | 80  | 120 |

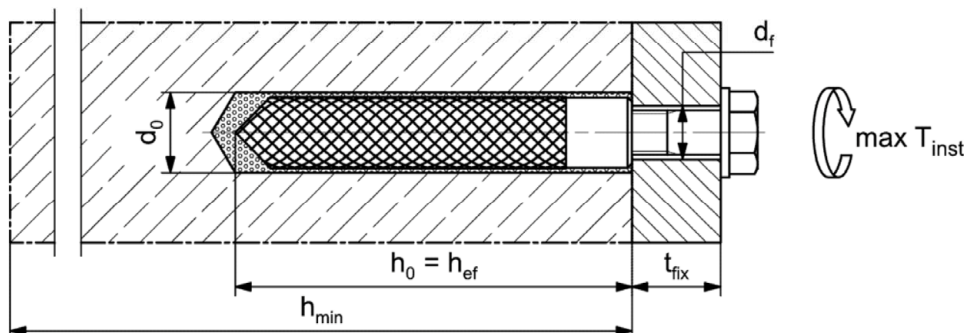
**fischer internal threaded anchor RG MI**



**Marking:** Anchor size e. g.: **M10**  
Stainless steel → additional **R**; e.g.: **M10 R**  
High corrosion resistant steel → additional **HCR**; e.g.: **M10 HCR**

Retaining bolt or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A 6, Table A6.1

**Installation conditions:**



Figures not to scale

fischer injection system FIS V Plus

**Intended use**  
Installation parameters internal threaded anchors RG MI

**Annex B 6**

**Table B7.1:** Installation parameters for reinforcing bars <sup>1)</sup>

| Nominal diameter of the bar               |                                           | $\phi$                          | 8 <sup>2)</sup>                  |     | 10 <sup>2)</sup> |     | 12 <sup>2)</sup>                  |     | 14  | 16  | 20 | 25 | 28 |
|-------------------------------------------|-------------------------------------------|---------------------------------|----------------------------------|-----|------------------|-----|-----------------------------------|-----|-----|-----|----|----|----|
| Nominal drill hole diameter               | d <sub>0</sub>                            | [mm]                            | 10                               | 12  | 12               | 14  | 14                                | 16  | 18  | 20  | 25 | 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               | 75  | 80                                | 90  | 100 | 112 |    |    |    |
|                                           | h <sub>ef,max</sub>                       |                                 | 160                              | 200 | 240              | 280 | 320                               | 400 | 500 | 560 |    |    |    |
| Minimum spacing and minimum edge distance | s <sub>min</sub><br>=<br>c <sub>min</sub> |                                 | 40                               | 45  | 55               | 60  | 65                                | 85  | 110 | 130 |    |    |    |
| 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> minimum spacing and minimum edge distance see Annex B 4

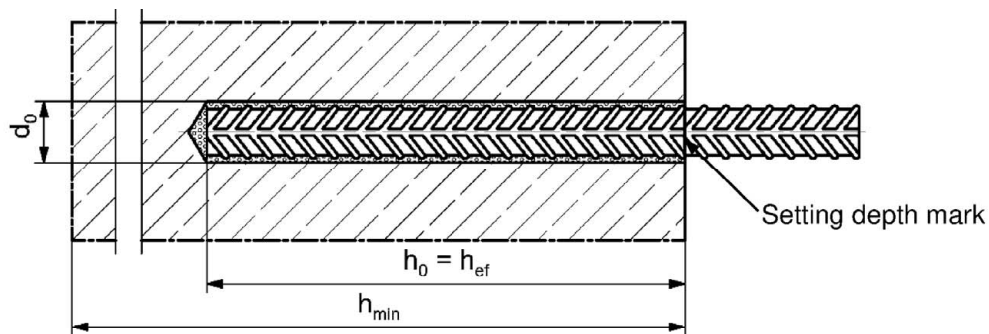
<sup>2)</sup> Both drill hole diameters can be used

#### Reinforcing bar



- 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 bar,  $h_{rib}$  = rib height)

#### Installation conditions:



Figures not to scale

fischer injection system FIS V Plus

#### Intended use

Installation parameters reinforcing bars

**Annex B 7**

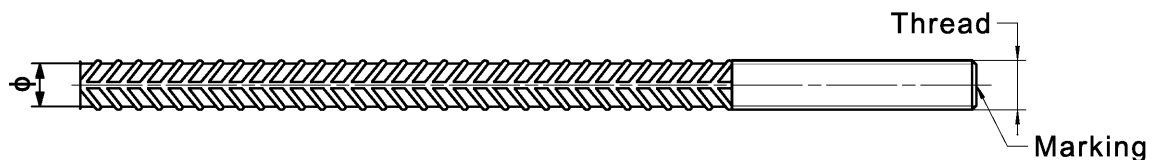
**Table B8.1:** Installation parameters for **fischer rebar anchor FRA** <sup>1)</sup>

| Rebar anchor FRA                          |                                     | Thread | M12 <sup>2)</sup> |              | M16 | M20 | M24 |
|-------------------------------------------|-------------------------------------|--------|-------------------|--------------|-----|-----|-----|
| Nominal diameter of the bar               | $\phi$                              | [mm]   | 12                |              | 16  | 20  | 25  |
| Width across flats                        | SW                                  |        | 19                |              | 24  | 30  | 36  |
| 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               |              |     |     |     |
| Minimum spacing and minimum edge distance | $s_{min} = c_{min}$                 |        | 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      | $h_{min}$                           |        | $h_0 + 30$        | $h_0 + 2d_0$ |     |     |     |
| Maximum installation torque               | $\max T_{inst}$                     | [Nm]   | 40                |              | 60  | 120 | 150 |

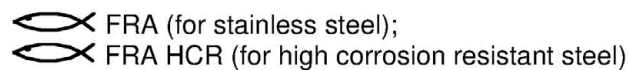
<sup>1)</sup> minimum spacing and minimum edge distance see Annex B 5

<sup>2)</sup> Both drill hole diameters can be used

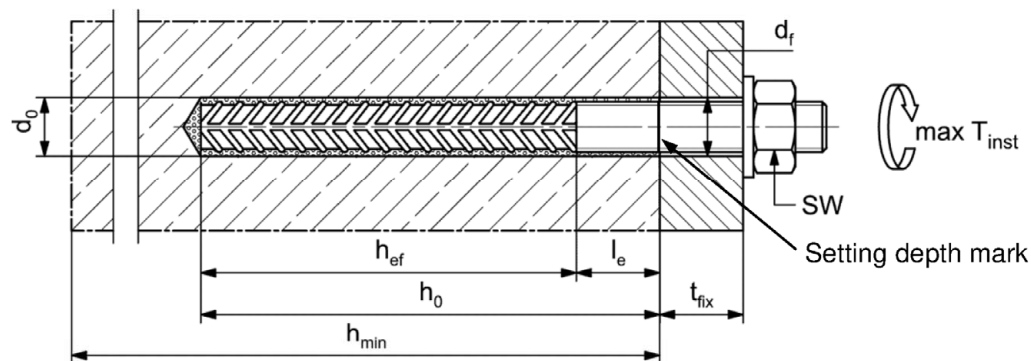
**fischer rebar anchor FRA**



Marking frontal e.g:



**Installation conditions:**



Figures not to scale

fischer injection system FIS V Plus

**Intended use**

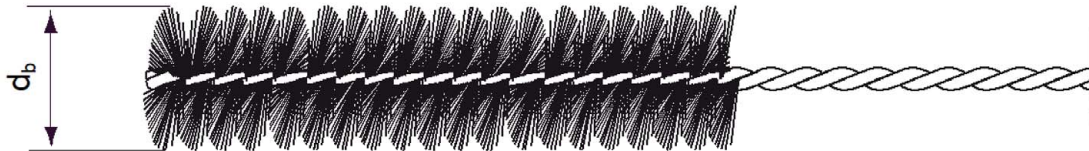
Installation parameters rebar anchor FRA

**Annex B 8**

**Table B9.1:** 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 | $d_0$ |      | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 25 | 28 | 30 | 35 |
| Steel brush diameter        | $d_b$ | [mm] | 9 | 11 | 14 | 16 | 20 | 25 | 26 | 27 | 30 | 40 |    |    |



**Table B9.2** **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<br>$t_{work}$ |            |                       | Minimum curing time <sup>1)</sup><br>$t_{cure}$ |            |                       |
|------------------------------------|---------------------------------------|------------|-----------------------|-------------------------------------------------|------------|-----------------------|
|                                    | FIS VW Plus High Speed                | FIS V Plus | FIS VS Plus Low Speed | FIS VW Plus High Speed                          | FIS V Plus | FIS VS Plus Low Speed |
| -10 to -5 <sup>2)</sup>            | -                                     | -          | -                     | 12 h                                            | -          | -                     |
| > -5 to 0 <sup>2)</sup>            | 5 min                                 | -          | -                     | 3 h                                             | 24 h       | -                     |
| > 0 to 5 <sup>2)</sup>             | 5 min                                 | 13 min     | -                     | 3 h                                             | 3 h        | 6 h                   |
| > 5 to 10                          | 3 min                                 | 9 min      | 20 min                | 50 min                                          | 90 min     | 3 h                   |
| > 10 to 20                         | 1 min                                 | 5 min      | 10 min                | 30 min                                          | 60 min     | 2 h                   |
| > 20 to 30                         | -                                     | 4 min      | 6 min                 | -                                               | 45 min     | 60 min                |
| > 30 to 40                         | -                                     | 2 min      | 4 min                 | -                                               | 35 min     | 30 min                |

<sup>1)</sup> In wet concrete or water filled holes the curing times must be doubled

<sup>2)</sup> Minimal cartridge temperature +5°C

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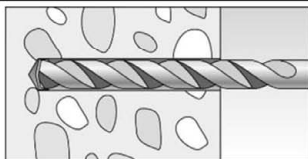
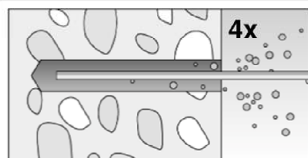
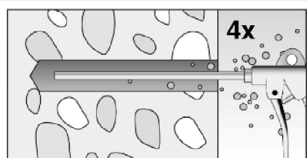
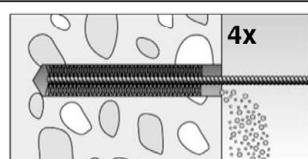
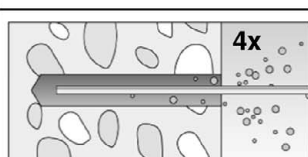
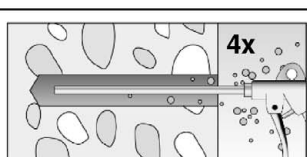
**Intended use**

Cleaning brush (steel brush)  
Processing time and curing time

**Annex B 9**

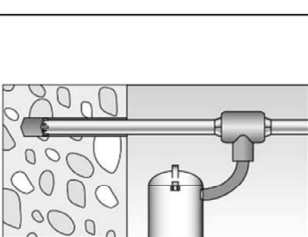
## Installation instructions part 1

### 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, B6.1, B7.1, B8.1</b>                                           |                                                                                     |                                                                                                                                      |
| 2 |   | Clean the drill hole:<br>For $h_{ef} \leq 12d$ and<br>$d_0 < 18$ mm<br>blow out the hole four<br>times by hand                                                        |   | For $h_{ef} > 12d$ and / or<br>$d_0 \geq 18$ mm blow out<br>the hole four times with<br>oil-free compressed air<br>( $p \geq 6$ bar) |
| 3 |   | Brush the drill hole four times. For drill hole diameter $\geq 30$ mm use a power drill. For deep holes use an extension. Corresponding brushes see <b>table B9.1</b> |                                                                                     |                                                                                                                                      |
| 4 |  | Clean the drill hole:<br>For $h_{ef} \leq 12d$ and<br>$d_0 < 18$ mm<br>blow out the hole four<br>times by hand                                                        |  | For $h_{ef} > 12d$ and / or<br>$d_0 \geq 18$ mm blow out<br>the hole four times with<br>oil-free compressed air<br>( $p \geq 6$ bar) |

Go to step 5

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

|   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Check a suitable hollow drill (see <b>table B1.1</b> )<br>for correct operation of the dust extraction                                                                                                                                                                                                                                                                                                                                     |
| 2 |  | Use a suitable dust extraction system, e.g.<br>fischer FVC 35 M or a comparable dust extraction system<br>with equivalent performance data<br><br>Drill the hole with hollow drill bit. The dust extraction system has to extract the<br>drill dust nonstop during the drilling process and must be adjusted to<br>maximum power. Nominal drill hole diameter $d_0$ and drill hole depth $h_0$<br>see <b>tables B3.1, B6.1, B7.1, B8.1</b> |

Go to step 5

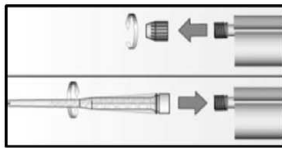
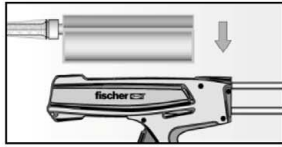
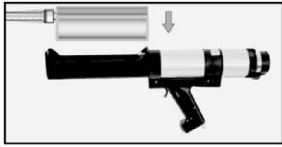
fischer injection system FIS V Plus

**Intended use**  
Installation instructions part 1

**Annex B 10**

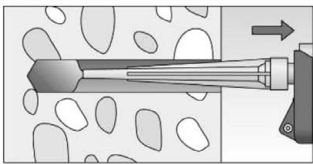
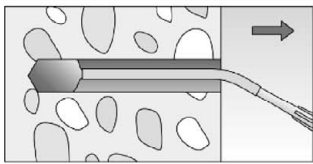
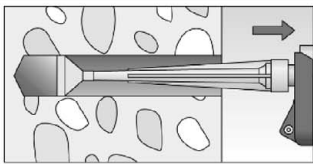
## Installation instructions part 2

### Preparing the cartridge

|   |                                                                                   |                                                                                                                 |                                                                                                                                    |
|---|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 5 |  | Remove the sealing cap<br>Screw on the static mixer<br>(the spiral in the static mixer must be clearly visible) |                                                                                                                                    |
| 6 |  |                                | Place the cartridge into the dispenser                                                                                             |
| 7 |  |                                | 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 8

### Injection of the mortar

|   |                                                                                    |                                                                                     |                                                                                      |                                                                                                                                                                                                                                                                                                             |
|---|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 |  |  |  | Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles<br>For drill hole depth $\geq 150$ mm use an extension tube<br>For overhead installation, deep holes ( $h_0 > 250$ mm) or drill hole diameter ( $d_0 \geq 40$ mm) use an injection adapter |
|---|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Go to step 9

fischer injection system FIS V Plus

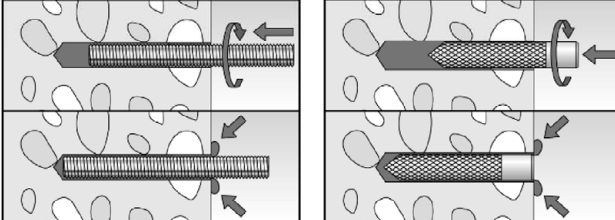
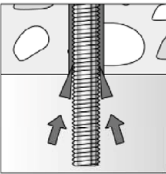
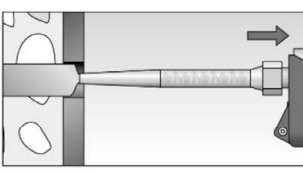
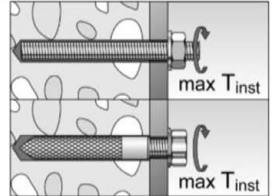
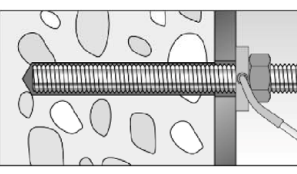
#### Intended use

Installation instructions part 2

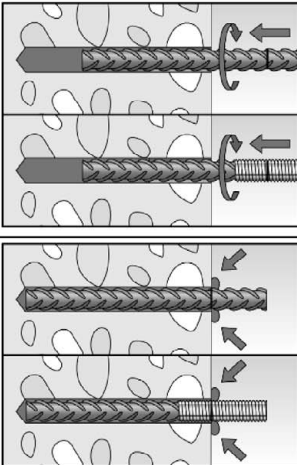
**Annex B 11**

### Installation instructions part 3

#### Installation of anchor rods or fischer internal threaded anchors RG MI

|        |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9      |                                                                                                                                  | <p>Only use clean and oil-free metal parts. Mark the setting depth of the metal part. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so. After inserting the metal parts, excess mortar must be emerged around the anchor element.</p>                                                                                                     |
|        |  <p>For overhead installations support the metal part with wedges (e.g. fischer centering wedges) or fischer overhead clips.</p> |  <p>For push through installation fill the annular gap with mortar</p>                                                                                                                                                                                                                                                                  |
| 10     |  <p>Wait for the specified curing time <math>t_{cure}</math> see <b>table B9.2</b></p>                                           | <p>11</p>  <p>Mounting the fixture<br/>max <math>T_{inst}</math> see <b>tables B3.1 and B6.1</b></p>                                                                                                                                                                                                                                   |
| Option |                                                                                                                                | <p>After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the fischer filling disc. Compressive strength <math>\geq 50 \text{ N/mm}^2</math> (e.g. fischer injection mortars FIS HB, FIS SB, FIS V, FIS V Plus, FIS EM Plus).<br/><b>ATTENTION:</b> Using fischer filling disc reduces <math>t_{fix}</math> (usable length of the anchor)</p> |

#### Installation reinforcing bars and fischer rebar anchor FRA

|    |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9  |                                                                                        | <p>Only use clean and oil-free reinforcing bars or fischer FRA. Mark the setting depth. Turn while using force to push the reinforcement bar or the fischer FRA into the filled hole up to the setting depth mark.</p> <p>When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.</p> |
| 10 |  <p>Wait for the specified curing time <math>t_{cure}</math> see <b>table B9.2</b></p> | <p>11</p>  <p>Mounting the fixture<br/>max <math>T_{inst}</math> see <b>table B8.1</b></p>                                                                                                                                                        |

fischer injection system FIS V Plus

**Intended use**  
Installation instructions part 3

**Annex B 12**

**Table C1.1: Characteristic values for steel failure under tension / shear load of fischer anchor rods and standard threaded rods**

| Anchor rod / standard threaded rod                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                |     | M6   | M8                        | M10    | M12    | M16 | M20       | M24 | M27 | M30  |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------|-----|------|---------------------------|--------|--------|-----|-----------|-----|-----|------|------|
| Bearing capacity under tension load, steel failure <sup>3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| Characteristic resistance $N_{Rk,s}$                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Steel zinc plated                                        | Property class | 4.8 | [kN] | 8                         | 15(13) | 23(21) | 33  | 63        | 98  | 141 | 184  | 224  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 10                        | 19(17) | 29(27) | 43  | 79        | 123 | 177 | 230  | 281  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 8.8 |      | 16                        | 29(27) | 47(43) | 68  | 126       | 196 | 282 | 368  | 449  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 10                        | 19     | 29     | 43  | 79        | 123 | 177 | 230  | 281  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 70  |      | 14                        | 26     | 41     | 59  | 110       | 172 | 247 | 322  | 393  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 80  |      | 16                        | 30     | 47     | 68  | 126       | 196 | 282 | 368  | 449  |
| Partial factors <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| Partial factor $\gamma_{Ms,N}$                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 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  |      | 1,50 <sup>2)</sup> / 1,87 |        |        |     |           |     |     |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 80  |      | 1,60                      |        |        |     |           |     |     |      |      |
| Bearing capacity under shear load, steel failure <sup>3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| without lever arm                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| Characteristic resistance $V_{Rk,s}^0$                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Steel zinc plated                                        | Property class | 4.8 | [kN] | 4                         | 9(8)   | 14(13) | 20  | 38        | 59  | 85  | 110  | 135  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 6                         | 11(10) | 17(16) | 25  | 47        | 74  | 106 | 138  | 168  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 8.8 |      | 8                         | 15(13) | 23(21) | 34  | 63        | 98  | 141 | 184  | 225  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 5                         | 9      | 15     | 21  | 39        | 61  | 89  | 115  | 141  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 70  |      | 7                         | 13     | 20     | 30  | 55        | 86  | 124 | 161  | 197  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 80  |      | 8                         | 15     | 23     | 34  | 63        | 98  | 141 | 184  | 225  |
| Ductility factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | $k_7$          | [-] | 1,0  |                           |        |        |     |           |     |     |      |      |
| with lever arm                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| Characteristic resistance $M_{Rk,s}^0$                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Steel zinc plated                                        | Property class | 4.8 | [Nm] | 6                         | 15(13) | 30(27) | 52  | 133       | 259 | 448 | 665  | 899  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 5.8 |      | 7                         | 19(16) | 37(33) | 65  | 166       | 324 | 560 | 833  | 1123 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 8.8 |      | 12                        | 30(26) | 60(53) | 105 | 266       | 519 | 896 | 1333 | 1797 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Stainless steel R and high corrosion resistant steel HCR |                | 50  |      | 7                         | 19     | 37     | 65  | 166       | 324 | 560 | 833  | 1123 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 70  |      | 10                        | 26     | 52     | 92  | 232       | 454 | 784 | 1167 | 1573 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 80  |      | 12                        | 30     | 60     | 105 | 266       | 519 | 896 | 1333 | 1797 |
| Partial factors <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| Partial factor $\gamma_{Ms,V}$                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 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  |      | 1,25 <sup>2)</sup> / 1,56 |        |        |     |           |     |     |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                | 80  |      | 1,33                      |        |        |     |           |     |     |      |      |
| <div><div><div><sup>1)</sup> In absence of other national regulations</div><div><sup>2)</sup> Only admissible for high corrosion resist. steel HCR, with <math>f_{yk} / f_{uk} \geq 0,8</math> and <math>A_5 &gt; 12 \%</math> (e.g. fischer anchor rods)</div><div><sup>3)</sup> Values in brackets are valid for undersized threaded rods with smaller stress area <math>A_s</math> for hot dip galvanised standard threaded rods according to EN ISO 10684:2004+AC:2009</div></div></div> |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |
| fischer injection system FIS V Plus                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          |                |     |      |                           |        |        |     | Annex C 1 |     |     |      |      |
| <div><div>Performances</div><div>Characteristic values for steel failure under tension / shear load of fischer anchor rods and standard threaded rods</div></div>                                                                                                                                                                                                                                                                                                                            |                                                          |                |     |      |                           |        |        |     |           |     |     |      |      |

| Table C2.1: Characteristic values for steel failure under tension / shear load of fischer internal threaded anchors RG MI    |                                |                |                |      |      |      |      |           |      |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------|----------------|------|------|------|------|-----------|------|
| fischer internal threaded anchors RG MI                                                                                      |                                |                |                | M8   | M10  | M12  | M16  | M20       |      |
| Bearing capacity under tension load, steel failure                                                                           |                                |                |                |      |      |      |      |           |      |
| Charact. resistance with screw                                                                                               | N <sub>Rk,s</sub>              | Property class | 5.8            | [kN] | 19   | 29   | 43   | 79        | 123  |
|                                                                                                                              |                                |                | 8.8            |      | 29   | 47   | 68   | 108       | 179  |
|                                                                                                                              |                                | Property class | R              |      | 26   | 41   | 59   | 110       | 172  |
|                                                                                                                              |                                | class 70       | HCR            |      | 26   | 41   | 59   | 110       | 172  |
| Partial factors <sup>1)</sup>                                                                                                |                                |                |                |      |      |      |      |           |      |
| Partial factors                                                                                                              | γ <sub>Ms,N</sub>              | Property class | 5.8            | [-]  | 1,50 |      |      |           |      |
|                                                                                                                              |                                |                | 8.8            |      | 1,50 |      |      |           |      |
|                                                                                                                              |                                | Property class | R              |      | 1,87 |      |      |           |      |
|                                                                                                                              |                                | class 70       | HCR            |      | 1,87 |      |      |           |      |
| Bearing capacity under shear load, steel failure                                                                             |                                |                |                |      |      |      |      |           |      |
| Without lever arm                                                                                                            |                                |                |                |      |      |      |      |           |      |
| Charact. resistance with screw                                                                                               | V <sup>0</sup> <sub>Rk,s</sub> | Property class | 5.8            | [kN] | 9,2  | 14,5 | 21,1 | 39,2      | 62,0 |
|                                                                                                                              |                                |                | 8.8            |      | 14,6 | 23,2 | 33,7 | 54,0      | 90,0 |
|                                                                                                                              |                                | Property class | R              |      | 12,8 | 20,3 | 29,5 | 54,8      | 86,0 |
|                                                                                                                              |                                | class 70       | HCR            |      | 12,8 | 20,3 | 29,5 | 54,8      | 86,0 |
| Ductility factor                                                                                                             |                                |                | k <sub>7</sub> | [-]  | 1,0  |      |      |           |      |
| With lever arm                                                                                                               |                                |                |                |      |      |      |      |           |      |
| Charact. resistance with screw                                                                                               | M <sup>0</sup> <sub>Rk,s</sub> | Property class | 5.8            | [Nm] | 20   | 39   | 68   | 173       | 337  |
|                                                                                                                              |                                |                | 8.8            |      | 30   | 60   | 105  | 266       | 519  |
|                                                                                                                              |                                | Property class | R              |      | 26   | 52   | 92   | 232       | 454  |
|                                                                                                                              |                                | class 70       | HCR            |      | 26   | 52   | 92   | 232       | 454  |
| Partial factors <sup>1)</sup>                                                                                                |                                |                |                |      |      |      |      |           |      |
| Partial factors                                                                                                              | γ <sub>Ms,V</sub>              | Property class | 5.8            | [-]  | 1,25 |      |      |           |      |
|                                                                                                                              |                                |                | 8.8            |      | 1,25 |      |      |           |      |
|                                                                                                                              |                                | Property class | R              |      | 1,56 |      |      |           |      |
|                                                                                                                              |                                | class 70       | HCR            |      | 1,56 |      |      |           |      |
| 1) In absence of other national regulations                                                                                  |                                |                |                |      |      |      |      |           |      |
| fischer injection system FIS V Plus                                                                                          |                                |                |                |      |      |      |      | Annex C 2 |      |
| Performances<br>Characteristic values for steel failure under tension / shear load of fischer internal threaded anchor RG MI |                                |                |                |      |      |      |      |           |      |

**Table C3.1: Characteristic values for steel failure under tension / shear load of reinforcing bars**

| Nominal diameter of the bar                        | $\phi$       | 8    | 10                                   | 12 | 14 | 16 | 20 | 25 | 28 |
|----------------------------------------------------|--------------|------|--------------------------------------|----|----|----|----|----|----|
| Bearing capacity under tension load, steel failure |              |      |                                      |    |    |    |    |    |    |
| Characteristic resistance                          | $N_{Rk,s}$   | [kN] | $A_s \cdot f_{uk}^{1)}$              |    |    |    |    |    |    |
| Bearing capacity under shear load, steel failure   |              |      |                                      |    |    |    |    |    |    |
| Without lever arm                                  |              |      |                                      |    |    |    |    |    |    |
| Characteristic resistance                          | $V^0_{Rk,s}$ | [kN] | $0,5 \cdot A_s \cdot f_{uk}^{1)}$    |    |    |    |    |    |    |
| Ductility factor                                   | $k_7$        | [-]  | 1,0                                  |    |    |    |    |    |    |
| With lever arm                                     |              |      |                                      |    |    |    |    |    |    |
| Characteristic resistance                          | $M^0_{Rk,s}$ | [Nm] | $1,2 \cdot W_{el} \cdot f_{uk}^{1)}$ |    |    |    |    |    |    |

<sup>1)</sup>  $f_{uk}$  or  $f_{yk}$  respectively must be taken from the specifications of the reinforcing bar

**Table C3.2: Characteristic values for steel failure under tension / shear load of fischer rebar anchors FRA**

| fischer rebar anchor FRA                           |                                |      | M12  | M16 | M20 | M24 |
|----------------------------------------------------|--------------------------------|------|------|-----|-----|-----|
| Bearing capacity under tension load, steel failure |                                |      |      |     |     |     |
| Characteristic resistance                          | N <sub>Rk,s</sub>              | [kN] | 63   | 111 | 173 | 270 |
| Partial factor <sup>1)</sup>                       |                                |      |      |     |     |     |
| Partial factor                                     | γ <sub>Ms,N</sub>              | [-]  | 1,4  |     |     |     |
| Bearing capacity under shear load, steel failure   |                                |      |      |     |     |     |
| Without lever arm                                  |                                |      |      |     |     |     |
| Characteristic resistance                          | V <sup>0</sup> <sub>Rk,s</sub> | [kN] | 30   | 55  | 86  | 124 |
| Ductility factor                                   | k <sub>7</sub>                 | [-]  | 1,0  |     |     |     |
| With lever arm                                     |                                |      |      |     |     |     |
| Characteristic resistance                          | M <sup>0</sup> <sub>Rk,s</sub> | [Nm] | 92   | 233 | 454 | 785 |
| Partial factor <sup>1)</sup>                       |                                |      |      |     |     |     |
| Partial factor                                     | γ <sub>Ms,V</sub>              | [-]  | 1,56 |     |     |     |

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

fischer injection system FIS V Plus

**Performances**

Characteristic values for steel failure under tension / shear load of reinforcing bars and fischer rebar anchors FRA

**Annex C 3**

| Table C4.1: Characteristic values for concrete failure under tension / shear load     |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
|---------------------------------------------------------------------------------------|--------------------------|-----------------|-----------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----|-----|----------------|-----------|-----|-----|-----|
| Size                                                                                  |                          |                 | All sizes       |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| Tension load                                                                          |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| Installation factor                                                                   |                          | $\gamma_{inst}$ | [-]             | See annex C 5 to C 12 and C 17 to C18 |                                                                                                                            |     |     |                |           |     |     |     |
| Factors for the compressive strength of concrete > C20/25                             |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| Increasing factor for $\tau_{Rk}$                                                     | C25/30                   | $\Psi_c$        | [-]             | 1,05                                  |                                                                                                                            |     |     |                |           |     |     |     |
|                                                                                       | C30/37                   |                 |                 | 1,10                                  |                                                                                                                            |     |     |                |           |     |     |     |
|                                                                                       | C35/45                   |                 |                 | 1,15                                  |                                                                                                                            |     |     |                |           |     |     |     |
|                                                                                       | C40/50                   |                 |                 | 1,19                                  |                                                                                                                            |     |     |                |           |     |     |     |
|                                                                                       | C45/55                   |                 |                 | 1,22                                  |                                                                                                                            |     |     |                |           |     |     |     |
|                                                                                       | C50/60                   |                 |                 | 1,26                                  |                                                                                                                            |     |     |                |           |     |     |     |
| 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 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 load                                                    |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| Temperature range                                                                     |                          |                 | [-]             | 50 °C / 80 °C                         |                                                                                                                            |     |     | 72 °C / 120 °C |           |     |     |     |
| Factor                                                                                |                          |                 | $\Psi_{sus}^0$  | [-]                                   | 0,76                                                                                                                       |     |     |                | 0,78      |     |     |     |
| Shear load                                                                            |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| 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 in 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) |     |     |                |           |     |     |     |
| Calculation diameters                                                                 |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| Size                                                                                  |                          |                 |                 | M6                                    | M8                                                                                                                         | M10 | M12 | M16            | M20       | M24 | M27 | M30 |
| fischer anchor rods and standard threaded rods                                        |                          | $d_{nom}$       | [mm]            | 6                                     | 8                                                                                                                          | 10  | 12  | 16             | 20        | 24  | 27  | 30  |
| fischer internal threaded anchors RG MI                                               |                          | $d_{nom}$       |                 | -1)                                   | 12                                                                                                                         | 16  | 18  | 22             | 28        | -1) | -1) | -1) |
| fischer rebar anchor FRA                                                              |                          | $d_{nom}$       |                 | -1)                                   | -1)                                                                                                                        | -1) | 12  | 16             | 20        | 25  | -1) | -1) |
| Size (nominal diameter of the bar)                                                    |                          |                 | $\phi$          | 8                                     | 10                                                                                                                         | 12  | 14  | 16             | 20        | 25  | 28  |     |
| Reinforcing bar                                                                       |                          |                 | $d_{nom}$       | [mm]                                  | 8                                                                                                                          | 10  | 12  | 14             | 16        | 20  | 25  | 28  |
| 1) Size of anchor type not part of the assessment                                     |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |
| fischer injection system FIS V Plus                                                   |                          |                 |                 |                                       |                                                                                                                            |     |     |                | Annex C 4 |     |     |     |
| Performances<br>Characteristic values for concrete failure under tension / shear load |                          |                 |                 |                                       |                                                                                                                            |     |     |                |           |     |     |     |

**Table C5.1: Characteristic values for combined pull-out and concrete failure for fischer anchor rods and standard threaded rods in hammer drilled holes; uncracked or cracked concrete; working life 50 years**

| Anchor rod / standard threaded rod                                                                                                                               |                    |                 | M6                   | M8              | M10             | M12             | M16  | M20  | M24       | M27  | M30  |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|----------------------|-----------------|-----------------|-----------------|------|------|-----------|------|------|-----|
| Combined pullout and concrete cone failure                                                                                                                       |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Calculation diameter                                                                                                                                             |                    | d               | [mm]                 | 6               | 8               | 10              | 12   | 16   | 20        | 24   | 27   | 30  |
| Uncracked concrete                                                                                                                                               |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Characteristic bond resistance in uncracked concrete C20/25                                                                                                      |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                                                |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Temperature range                                                                                                                                                | I: 50 °C / 80 °C   | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 9,0             | 16,0            | 16,0            | 15,0 | 14,0 | 12,0      | 11,0 | 10,0 | 9,0 |
|                                                                                                                                                                  | II: 72 °C / 120 °C |                 |                      | 6,5             | 15,0            | 14,0            | 13,0 | 12,0 | 11,0      | 9,0  | 8,0  | 8,0 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)                                                                                  |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Temperature range                                                                                                                                                | I: 50 °C / 80 °C   | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> | 9,5  | 8,5  | 8,0       | 7,5  | 7,0  | 7,0 |
|                                                                                                                                                                  | II: 72 °C / 120 °C |                 |                      | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> | 7,5  | 7,0  | 6,5       | 6,0  | 6,0  | 6,0 |
| Installation factors                                                                                                                                             |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Dry or wet concrete                                                                                                                                              |                    | $\gamma_{inst}$ | [-]                  | 1,0             |                 |                 |      |      |           |      |      |     |
| Water filled hole                                                                                                                                                |                    |                 |                      | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> | 1,2  |      |           |      |      |     |
| Cracked concrete                                                                                                                                                 |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Characteristic bond resistance in cracked concrete C20/25                                                                                                        |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                                                |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Temperature range                                                                                                                                                | I: 50 °C / 80 °C   | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | - <sup>1)</sup> | 5,5             | 6,0             | 6,5  | 6,0  | 5,5       | 5,0  | 5,0  | 4,5 |
|                                                                                                                                                                  | II: 72 °C / 120 °C |                 |                      | - <sup>1)</sup> | 4,5             | 5,0             | 6,0  | 5,5  | 5,0       | 4,5  | 4,0  | 4,0 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)                                                                                  |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Temperature range                                                                                                                                                | I: 50 °C / 80 °C   | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> | 5,0  | 5,0  | 4,5       | 4,0  | 3,5  | 3,5 |
|                                                                                                                                                                  | II: 72 °C / 120 °C |                 |                      | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> | 4,0  | 4,0  | 4,0       | 3,5  | 3,0  | 3,0 |
| Installation factors                                                                                                                                             |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| Dry or wet concrete                                                                                                                                              |                    | $\gamma_{inst}$ | [-]                  | 1,0             |                 |                 |      |      |           |      |      |     |
| Water filled hole                                                                                                                                                |                    |                 |                      | - <sup>1)</sup> | - <sup>1)</sup> | - <sup>1)</sup> | 1,2  |      |           |      |      |     |
| <sup>1)</sup> No performance assessed                                                                                                                            |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |
| fischer injection system FIS V Plus                                                                                                                              |                    |                 |                      |                 |                 |                 |      |      | Annex C 5 |      |      |     |
| <b>Performances</b><br>Characteristic values for combined pull-out and concrete failure for fischer anchor rod and standard threaded rods; working life 50 years |                    |                 |                      |                 |                 |                 |      |      |           |      |      |     |

**Table C6.1: Characteristic values for combined pull-out and concrete failure for fischer anchor rods and standard threaded rods in hammer drilled holes; uncracked or cracked concrete; working life 100 years**

| Anchor rod / standard threaded rod                                                                                                                         |                    |                     | M6      | M8  | M10  | M12  | M16  | M20  | M24       | M27  | M30  |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|---------|-----|------|------|------|------|-----------|------|------|-----|
| Combined pullout and concrete cone failure                                                                                                                 |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Calculation diameter                                                                                                                                       |                    | d                   | [mm]    | 6   | 8    | 10   | 12   | 16   | 20        | 24   | 27   | 30  |
| Uncracked concrete                                                                                                                                         |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Characteristic bond resistance in uncracked concrete C20/25                                                                                                |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                                          |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Temperature range                                                                                                                                          | I: 50 °C / 80 °C   | $\tau_{Rk,100,ucr}$ | [N/mm²] | -1) | 16,0 | 16,0 | 15,0 | 14,0 | 12,0      | 11,0 | 10,0 | 9,0 |
|                                                                                                                                                            | II: 72 °C / 120 °C |                     |         | -1) | 15,0 | 14,0 | 13,0 | 12,0 | 11,0      | 9,0  | 8,0  | 8,0 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)                                                                            |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Temperature range                                                                                                                                          | I: 50 °C / 80 °C   | $\tau_{Rk,100,ucr}$ | [N/mm²] | -1) | -1)  | -1)  | 9,5  | 8,5  | 8,0       | 7,5  | 7,0  | 7,0 |
|                                                                                                                                                            | II: 72 °C / 120 °C |                     |         | -1) | -1)  | -1)  | 7,5  | 7,0  | 6,5       | 6,0  | 6,0  | 6,0 |
| Installation factors                                                                                                                                       |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Dry or wet concrete                                                                                                                                        |                    | $\gamma_{inst}$     | [-]     | 1,0 |      |      |      |      |           |      |      |     |
| Water filled hole                                                                                                                                          |                    |                     |         | -1) | -1)  | -1)  | 1,2  |      |           |      |      |     |
| Cracked concrete                                                                                                                                           |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Characteristic bond resistance in cracked concrete C20/25                                                                                                  |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                                          |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Temperature range                                                                                                                                          | I: 50 °C / 80 °C   | $\tau_{Rk,100,cr}$  | [N/mm²] | -1) | 5,0  | 5,5  | 5,5  | 5,5  | 5,5       | 5,0  | 5,0  | 4,5 |
|                                                                                                                                                            | II: 72 °C / 120 °C |                     |         | -1) | 4,5  | 5,0  | 5,0  | 5,0  | 5,0       | 4,0  | 4,0  | 4,0 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)                                                                            |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Temperature range                                                                                                                                          | I: 50 °C / 80 °C   | $\tau_{Rk,100,cr}$  | [N/mm²] | -1) | -1)  | -1)  | 4,5  | 4,5  | 4,5       | 4,0  | 3,5  | 3,5 |
|                                                                                                                                                            | II: 72 °C / 120 °C |                     |         | -1) | -1)  | -1)  | 4,0  | 4,0  | 4,0       | 3,5  | 3,0  | 3,0 |
| Installation factors                                                                                                                                       |                    |                     |         |     |      |      |      |      |           |      |      |     |
| Dry or wet concrete                                                                                                                                        |                    | $\gamma_{inst}$     | [-]     | 1,0 |      |      |      |      |           |      |      |     |
| Water filled hole                                                                                                                                          |                    |                     |         | -1) | -1)  | -1)  | 1,2  |      |           |      |      |     |
| 1) No performance assessed                                                                                                                                 |                    |                     |         |     |      |      |      |      |           |      |      |     |
| fischer injection system FIS V Plus                                                                                                                        |                    |                     |         |     |      |      |      |      | Annex C 6 |      |      |     |
| Performances<br>Characteristic values for combined pull-out and concrete failure for fischer anchor rod and standard threaded rods; working life 100 years |                    |                     |         |     |      |      |      |      |           |      |      |     |

**Table C7.1: Characteristic values for combined pull-out and concrete failure for fischer internal threaded anchors RG MI in hammer drilled holes; uncracked concrete; working life 50 years**

| Internal threaded anchor RG MI                                                                                                                             |                    |                 | M8      | M10  | M12  | M16 | M20 |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|---------|------|------|-----|-----|-----|
| Combined pullout and concrete cone failure                                                                                                                 |                    |                 |         |      |      |     |     |     |
| Calculation diameter                                                                                                                                       |                    | d               | [mm]    | 12   | 16   | 18  | 22  | 28  |
| Uncracked concrete                                                                                                                                         |                    |                 |         |      |      |     |     |     |
| Characteristic bond resistance in uncracked concrete C20/25                                                                                                |                    |                 |         |      |      |     |     |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                                          |                    |                 |         |      |      |     |     |     |
| Tem-<br>perature<br>range                                                                                                                                  | I: 50 °C / 80 °C   | $\tau_{Rk,ucr}$ | [N/mm²] | 10,5 | 10,0 | 9,5 | 9,0 | 8,5 |
|                                                                                                                                                            | II: 72 °C / 120 °C |                 |         | 9,0  | 8,0  | 8,0 | 7,5 | 7,0 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)                                                                            |                    |                 |         |      |      |     |     |     |
| Tem-<br>perature<br>range                                                                                                                                  | I: 50 °C / 80 °C   | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,0  | 9,0 | 8,5 | 8,0 |
|                                                                                                                                                            | II: 72 °C / 120 °C |                 |         | 7,5  | 6,5  | 6,5 | 6,0 | 6,0 |
| Installation factors                                                                                                                                       |                    |                 |         |      |      |     |     |     |
| Dry or wet concrete                                                                                                                                        |                    | $\gamma_{inst}$ | [-]     | 1,0  |      |     |     |     |
| Water filled hole                                                                                                                                          |                    |                 |         | 1,2  |      |     |     |     |
|                                                                                                                                                            |                    |                 |         |      |      |     |     |     |
|                                                                                                                                                            |                    |                 |         |      |      |     |     |     |
| fischer injection system FIS V Plus                                                                                                                        |                    |                 |         |      |      |     |     |     |
| <b>Performances</b><br>Charactersitic values for combined pull-out and concrete failure for fischer internal threaded anchors RG MI; working life 50 years |                    |                 |         |      |      |     |     |     |
| Annex C 7                                                                                                                                                  |                    |                 |         |      |      |     |     |     |

**Table C8.1: Characteristic values for combined pull-out and concrete failure for reinforcing bars in hammer drilled holes; uncracked or cracked concrete; working life 50 years**

| Nominal diameter of the bar $\phi$                                                                                                     |                    |                 | 8                    | 10              | 12   | 14   | 16   | 20   | 25        | 28  |     |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|----------------------|-----------------|------|------|------|------|-----------|-----|-----|
| Combined pullout and concrete cone failure                                                                                             |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Calculation diameter                                                                                                                   |                    | d               | [mm]                 | 8               | 10   | 12   | 14   | 16   | 20        | 25  | 28  |
| Uncracked concrete                                                                                                                     |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Characteristic bond resistance in uncracked concrete C20/25                                                                            |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                      |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Tem-<br>perature<br>range                                                                                                              | I: 50 °C / 80 °C   | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 11,0            | 11,0 | 11,0 | 10,0 | 10,0 | 9,5       | 9,0 | 8,5 |
|                                                                                                                                        | II: 72 °C / 120 °C |                 |                      | 9,5             | 9,5  | 9,0  | 8,5  | 8,5  | 8,0       | 7,5 | 7,0 |
| Installation factor                                                                                                                    |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Dry or wet concrete                                                                                                                    |                    | $\gamma_{inst}$ | [-]                  | 1,0             |      |      |      |      |           |     |     |
| Cracked concrete                                                                                                                       |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Characteristic bond resistance in cracked concrete C20/25                                                                              |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)                                                      |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Tem-<br>perature<br>range                                                                                                              | I: 50 °C / 80 °C   | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | - <sup>1)</sup> | 3,0  | 5,0  | 5,0  | 5,0  | 4,5       | 4,0 | 4,0 |
|                                                                                                                                        | II: 72 °C / 120 °C |                 |                      | - <sup>1)</sup> | 3,0  | 4,5  | 4,5  | 4,5  | 4,0       | 3,5 | 3,5 |
| Installation factor                                                                                                                    |                    |                 |                      |                 |      |      |      |      |           |     |     |
| Dry or wet concrete                                                                                                                    |                    | $\gamma_{inst}$ | [-]                  | 1,0             |      |      |      |      |           |     |     |
| <sup>1)</sup> No performance assessed                                                                                                  |                    |                 |                      |                 |      |      |      |      |           |     |     |
| fischer injection system FIS V Plus                                                                                                    |                    |                 |                      |                 |      |      |      |      | Annex C 8 |     |     |
| <b>Performances</b><br>Characteristic values for combined pull-out and concrete failure for reinforcing bars;<br>working life 50 years |                    |                 |                      |                 |      |      |      |      |           |     |     |

**Table C9.1: Characteristic values for combined pull-out and concrete failure for fischer rebar anchors FRA in hammer drilled holes; uncracked or cracked concrete; working life 50 years**

| fischer rebar anchor 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 or hollow drill bit (dry or wet concrete) |                    |                 |                 |                      |      |      |     |     |
| Tem-<br>perature<br>range                                                         | I: 50 °C / 80 °C   |                 | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 11,0 | 10,0 | 9,5 | 9,5 |
|                                                                                   | II: 72 °C / 120 °C |                 |                 |                      | 9,0  | 8,5  | 8,0 | 7,5 |
| Installation factors                                                              |                    |                 |                 |                      |      |      |     |     |
| Dry or wet concrete                                                               |                    | $\gamma_{inst}$ | [-]             | 1,0                  |      |      |     |     |
| Cracked concrete                                                                  |                    |                 |                 |                      |      |      |     |     |
| Characteristic bond resistance in cracked concrete C20/25                         |                    |                 |                 |                      |      |      |     |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) |                    |                 |                 |                      |      |      |     |     |
| Tem-<br>perature<br>range                                                         | I: 50 °C / 80 °C   |                 | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 5,0  | 5,0  | 4,5 | 4,0 |
|                                                                                   | II: 72 °C / 120 °C |                 |                 |                      | 4,5  | 4,5  | 4,0 | 3,5 |
| Installation factors                                                              |                    |                 |                 |                      |      |      |     |     |
| Dry or wet concrete                                                               |                    | $\gamma_{inst}$ | [-]             | 1,0                  |      |      |     |     |
|                                                                                   |                    |                 |                 |                      |      |      |     |     |
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**Table C10.1: Displacements for anchor rods**

| Anchor rod                                             |                           | M6              | M8   | M10  | M12  | M16  | M20  | M24  | M27  | M30  |
|--------------------------------------------------------|---------------------------|-----------------|------|------|------|------|------|------|------|------|
| Displacement-Factors for tension load <sup>1)</sup>    |                           |                 |      |      |      |      |      |      |      |      |
| Uncracked concrete; Temperature range I, II            |                           |                 |      |      |      |      |      |      |      |      |
| δ <sub>N0</sub> -Factor                                | [mm/(N/mm <sup>2</sup> )] | 0,09            | 0,09 | 0,09 | 0,10 | 0,10 | 0,10 | 0,10 | 0,11 | 0,12 |
| δ <sub>N∞</sub> -Factor                                |                           | 0,10            | 0,10 | 0,10 | 0,12 | 0,12 | 0,12 | 0,12 | 0,13 | 0,13 |
| Cracked concrete; Temperature range I, II              |                           |                 |      |      |      |      |      |      |      |      |
| δ <sub>N0</sub> -Factor                                | [mm/(N/mm <sup>2</sup> )] | - <sup>3)</sup> | 0,12 | 0,12 | 0,12 | 0,13 | 0,13 | 0,13 | 0,14 | 0,15 |
| δ <sub>N0</sub> -Factor                                |                           | - <sup>3)</sup> | 0,25 | 0,27 | 0,30 | 0,30 | 0,30 | 0,30 | 0,35 | 0,35 |
| Displacement-Factors for shear load <sup>2)</sup>      |                           |                 |      |      |      |      |      |      |      |      |
| Uncracked or cracked concrete; Temperature range I, II |                           |                 |      |      |      |      |      |      |      |      |
| δ <sub>V0</sub> -Factor                                | [mm/kN]                   | 0,11            | 0,11 | 0,11 | 0,10 | 0,10 | 0,09 | 0,09 | 0,08 | 0,07 |
| δ <sub>V∞</sub> -Factor                                |                           | 0,12            | 0,12 | 0,12 | 0,11 | 0,11 | 0,10 | 0,10 | 0,10 | 0,09 |

1) Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau_{Ed}$$

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

( $\tau_{Ed}$ : Design value of the applied tensile stress)

<sup>3)</sup> No performance assessed

2) Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V_{Ed}$$

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

( $V_{Ed}$ : Design value of the applied shear force)

**Table C10.2: Displacements for fischer internal threaded anchors RG MI**

| Internal threaded anchor RG MI                      |              | M8   | M10  | M12  | M16  | M20  |
|-----------------------------------------------------|--------------|------|------|------|------|------|
| Displacement-Factors for tension load <sup>1)</sup> |              |      |      |      |      |      |
| Uncracked concrete; Temperature range I, II         |              |      |      |      |      |      |
| δ <sub>N0</sub> -Factor                             | [mm/(N/mm²)] | 0,10 | 0,11 | 0,12 | 0,13 | 0,14 |
| δ <sub>N∞</sub> -Factor                             |              | 0,13 | 0,14 | 0,15 | 0,16 | 0,18 |
| Displacement-Factors for shear load <sup>2)</sup>   |              |      |      |      |      |      |
| Uncracked concrete; Temperature range I, II         |              |      |      |      |      |      |
| δ <sub>V0</sub> -Factor                             | [mm/kN]      | 0,12 | 0,12 | 0,12 | 0,12 | 0,12 |
| δ <sub>V∞</sub> -Factor                             |              | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 |

1) Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau_{Ed}$$

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

( $\tau_{Ed}$ : Design value of the applied tensile stress)

2) Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V_{Ed}$$

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

( $V_{Ed}$ : Design value of the applied shear force)

fischer injection system FIS V Plus

**Performances**

Displacements for anchor rods and fischer internal threaded anchors RG MI

**Annex C 10**

**Table C11.1: Displacements for reinforcing bars**

| Nominal diameter of the bar $\phi$                                                                                                                                                                                                           |                           | 8               | 10   | 12   | 14                                                                                                                                                                                                                               | 16   | 20   | 25   | 28   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------|------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Displacement-Factors for tension load <sup>1)</sup>                                                                                                                                                                                          |                           |                 |      |      |                                                                                                                                                                                                                                  |      |      |      |      |
| Uncracked concrete; Temperature range I, II                                                                                                                                                                                                  |                           |                 |      |      |                                                                                                                                                                                                                                  |      |      |      |      |
| $\delta_{N0}$ -Factor                                                                                                                                                                                                                        | [mm/(N/mm <sup>2</sup> )] | 0,09            | 0,09 | 0,10 | 0,10                                                                                                                                                                                                                             | 0,10 | 0,10 | 0,10 | 0,11 |
| $\delta_{N\infty}$ -Factor                                                                                                                                                                                                                   |                           | 0,10            | 0,10 | 0,12 | 0,12                                                                                                                                                                                                                             | 0,12 | 0,12 | 0,13 | 0,13 |
| Cracked concrete; Temperature range I, II                                                                                                                                                                                                    |                           |                 |      |      |                                                                                                                                                                                                                                  |      |      |      |      |
| $\delta_{N0}$ -Factor                                                                                                                                                                                                                        | [mm/(N/mm <sup>2</sup> )] | - <sup>3)</sup> | 0,12 | 0,13 | 0,13                                                                                                                                                                                                                             | 0,13 | 0,13 | 0,13 | 0,14 |
| $\delta_{N\infty}$ -Factor                                                                                                                                                                                                                   |                           | - <sup>3)</sup> | 0,27 | 0,30 | 0,30                                                                                                                                                                                                                             | 0,30 | 0,30 | 0,35 | 0,37 |
| Displacement-Factors for shear load <sup>2)</sup>                                                                                                                                                                                            |                           |                 |      |      |                                                                                                                                                                                                                                  |      |      |      |      |
| Uncracked or cracked concrete; Temperature range I, II                                                                                                                                                                                       |                           |                 |      |      |                                                                                                                                                                                                                                  |      |      |      |      |
| $\delta_{V0}$ -Factor                                                                                                                                                                                                                        | [mm/kN]                   | 0,11            | 0,11 | 0,10 | 0,10                                                                                                                                                                                                                             | 0,10 | 0,09 | 0,09 | 0,08 |
| $\delta_{V\infty}$ -Factor                                                                                                                                                                                                                   |                           | 0,12            | 0,12 | 0,11 | 0,11                                                                                                                                                                                                                             | 0,11 | 0,10 | 0,10 | 0,09 |
| 1) Calculation of effective displacement:<br>$\delta_{N0} = \delta_{N0}\text{-Factor} \cdot \tau_{Ed}$<br>$\delta_{N\infty} = \delta_{N\infty}\text{-Factor} \cdot \tau_{Ed}$<br>( $\tau_{Ed}$ : Design value of the applied tensile stress) |                           |                 |      |      | 2) Calculation of effective displacement:<br>$\delta_{V0} = \delta_{V0}\text{-Factor} \cdot V_{Ed}$<br>$\delta_{V\infty} = \delta_{V\infty}\text{-Factor} \cdot V_{Ed}$<br>( $V_{Ed}$ : Design value of the applied shear force) |      |      |      |      |
| 3) No performance assessed                                                                                                                                                                                                                   |                           |                 |      |      |                                                                                                                                                                                                                                  |      |      |      |      |

**Table C11.2: Displacements for fischer rebar anchors FRA**

| fischer rebar anchor<br>FRA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           | M12  | M16  | M20  | M24        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------|------|------|------------|
| Displacement-Factors for tension load <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |      |      |      |            |
| Uncracked concrete; Temperature range I, II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |      |      |      |            |
| δ <sub>N0</sub> -Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [mm/(N/mm <sup>2</sup> )] | 0,10 | 0,10 | 0,10 | 0,10       |
| δ <sub>N∞</sub> -Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           | 0,12 | 0,12 | 0,12 | 0,13       |
| Cracked concrete; Temperature range I, II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |      |      |      |            |
| δ <sub>N0</sub> -Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [mm/(N/mm <sup>2</sup> )] | 0,12 | 0,13 | 0,13 | 0,13       |
| δ <sub>N∞</sub> -Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           | 0,30 | 0,30 | 0,30 | 0,35       |
| Displacement-Factors for shear load <sup>2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |      |      |      |            |
| Uncracked or cracked concrete; Temperature range I, II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |      |      |      |            |
| δ <sub>V0</sub> -Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [mm/kN]                   | 0,10 | 0,10 | 0,09 | 0,09       |
| δ <sub>V∞</sub> -Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           | 0,11 | 0,11 | 0,10 | 0,10       |
| <div>1) Calculation of effective displacement:<br/><math>\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau_{Ed}</math><br/><math>\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}</math><br/>(<math>\tau_{Ed}</math>: Design value of the applied tensile stress)</div> <div>2) Calculation of effective displacement:<br/><math>\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V_{Ed}</math><br/><math>\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V_{Ed}</math><br/>(<math>V_{Ed}</math>: Design value of the applied shear force)</div> |                           |      |      |      |            |
| fischer injection system FIS V Plus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |      |      |      | Annex C 11 |
| Performances<br>Displacements for reinforcing bars and fischer rebar anchors FRA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                           |      |      |      |            |

**Table C12.1: Characteristic values for steel failure under tension / shear load of fischer anchor rods and standard threaded rods under seismic action performance category C1 or C2**

| Anchor rod / standard threaded rod                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                          |                |                         | M10  | M12             | M16 | M20 | M24 | M27             | M30             |                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------|-------------------------|------|-----------------|-----|-----|-----|-----------------|-----------------|-----------------|
| Bearing capacity under tension load, steel failure <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| fischer anchor rods and standard threaded rods, performance category C1 <sup>2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| Characteristic resistance<br>$N_{Rk,s,C1}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Steel zinc plated                                        | Property class | 5.8                     | [kN] | 29(27)          | 43  | 79  | 123 | 177             | 230             | 281             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 8.8                     |      | 47(43)          | 68  | 126 | 196 | 282             | 368             | 449             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50                      |      | 29              | 43  | 79  | 123 | 177             | 230             | 281             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 70                      |      | 41              | 59  | 110 | 172 | 247             | 322             | 393             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 80                      |      | 47              | 68  | 126 | 196 | 282             | 368             | 449             |
| fischer anchor rods, performance category C2 <sup>2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| Characteristic resistance<br>$N_{Rk,s,C2}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Steel zinc plated                                        | Property class | 5.8                     | [kN] | - <sup>4)</sup> | 39  | 72  | 108 | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 8.8                     |      | - <sup>4)</sup> | 61  | 116 | 173 | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50                      |      | - <sup>4)</sup> | 39  | 72  | 108 | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 70                      |      | - <sup>4)</sup> | 53  | 101 | 152 | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 80                      |      | - <sup>4)</sup> | 61  | 116 | 173 | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
| Bearing capacity under shear load, steel failure without lever arm <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| fischer anchor rods, performance category C1 <sup>2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| Characteristic resistance<br>$V_{Rk,s,C1}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Steel zinc plated                                        | Property class | 5.8                     | [kN] | 17(16)          | 25  | 47  | 74  | 106             | 138             | 168             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 8.8                     |      | 23(21)          | 34  | 63  | 98  | 141             | 184             | 225             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50                      |      | 15              | 21  | 39  | 61  | 89              | 115             | 141             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 70                      |      | 20              | 30  | 55  | 86  | 124             | 161             | 197             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 80                      |      | 23              | 34  | 63  | 98  | 141             | 184             | 225             |
| Standard threaded rods, performance category C1 <sup>2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| Characteristic resistance<br>$V_{Rk,s,C1}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Steel zinc plated                                        | Property class | 5.8                     | [kN] | 12(11)          | 17  | 33  | 52  | 74              | 97              | 118             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 8.8                     |      | 16(14)          | 24  | 44  | 69  | 99              | 129             | 158             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50                      |      | 11              | 15  | 27  | 43  | 62              | 81              | 99              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 70                      |      | 14              | 21  | 39  | 60  | 87              | 113             | 138             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 80                      |      | 16              | 24  | 44  | 69  | 99              | 129             | 158             |
| fischer anchor rods, performance category C2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| Characteristic resistance<br>$V_{Rk,s,C2}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Steel zinc plated                                        | Property class | 5.8                     | [kN] | - <sup>4)</sup> | 14  | 27  | 43  | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 8.8                     |      | - <sup>4)</sup> | 22  | 44  | 69  | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50                      |      | - <sup>4)</sup> | 14  | 27  | 43  | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 70                      |      | - <sup>4)</sup> | 20  | 39  | 60  | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                | 80                      |      | - <sup>4)</sup> | 22  | 44  | 69  | - <sup>4)</sup> | - <sup>4)</sup> | - <sup>4)</sup> |
| Factor for the annular gap                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $\alpha_{gap}$                                           | [-]            | 0,5 (1,0) <sup>3)</sup> |      |                 |     |     |     |                 |                 |                 |
| <div><div><div><div><div><div><sup>1)</sup> Partial factors for performance category C1 or C2 see table C13.1;<br/>for fischer anchor rods FIS A / RGM the factor for steel ductility is 1,0</div><div><sup>2)</sup> Values in brackets are valid for undersized threaded rods with smaller stress area <math>A_s</math> and for hot dip galvanised standard threaded rods according to EN ISO 10684:2004+AC:2009.</div><div><sup>3)</sup> Values in brackets are valid for filled annular gaps between the anchor rod and the through-hole in the attachment. It is necessary to use the fischer filling disc according to Annex A 5</div><div><sup>4)</sup> No performance assessed</div></div></div></div></div></div> |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |
| fischer injection system FIS V Plus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                |                         |      |                 |     |     |     | Annex C 12      |                 |                 |
| <div>Performances</div> <div>Characteristic values for steel failure under tension / shear load for fischer anchor rods and standard threaded rods under seismic action (performance category C1 / C2)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                |                         |      |                 |     |     |     |                 |                 |                 |

**Table C13.1: Partial factors for fischer anchor rods, standard threaded rods under seismic action performance category C1 or C2**

| Anchor rod / standard threaded rod        |                                                          |                |     | M10 | M12                       | M16 | M20 | M24 | M27 | M30 |
|-------------------------------------------|----------------------------------------------------------|----------------|-----|-----|---------------------------|-----|-----|-----|-----|-----|
| Tension load, steel failure <sup>1)</sup> |                                                          |                |     |     |                           |     |     |     |     |     |
| Partial factor<br>$\gamma_{Ms,N}$         | Steel zinc plated                                        | Property class | 5.8 | [-] | 1,50                      |     |     |     |     |     |
|                                           |                                                          |                | 8.8 |     | 1,50                      |     |     |     |     |     |
|                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50  |     | 2,86                      |     |     |     |     |     |
|                                           |                                                          |                | 70  |     | 1,50 <sup>2)</sup> / 1,87 |     |     |     |     |     |
|                                           |                                                          |                | 80  |     | 1,60                      |     |     |     |     |     |
|                                           |                                                          |                |     |     |                           |     |     |     |     |     |
| Shear load, steel failure <sup>1)</sup>   |                                                          |                |     |     |                           |     |     |     |     |     |
| Partial factor<br>$\gamma_{Ms,V}$         | Steel zinc plated                                        | Property class | 5.8 | [-] | 1,25                      |     |     |     |     |     |
|                                           |                                                          |                | 8.8 |     | 1,25                      |     |     |     |     |     |
|                                           | Stainless steel R and high corrosion resistant steel HCR |                | 50  |     | 2,38                      |     |     |     |     |     |
|                                           |                                                          |                | 70  |     | 1,25 <sup>2)</sup> / 1,56 |     |     |     |     |     |
|                                           |                                                          |                | 80  |     | 1,33                      |     |     |     |     |     |
|                                           |                                                          |                |     |     |                           |     |     |     |     |     |

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

<sup>2)</sup> Only admissible for high corrosion resistant steel HCR, with  $f_{yk} / f_{uk} \geq 0,8$  and  $A_5 > 12 \%$  (e.g. fischer anchor rods)

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**Performances**

Partial factors under seismic action (performance category C1 and C2) for fischer anchor rods and standard threaded rods

**Annex C 13**

**Table C14.1: Characteristic values** for combined pull-out and concrete failure for **fischer anchor rods** and **standard threaded rods** in hammer drilled holes under seismic action performance category **C1**, **working life 50 and 100 years**

| Anchor rod / standard threaded rod                                                |                    |                 | M10                  | M12             | M16 | M20 | M24 | M27 | M30 |     |
|-----------------------------------------------------------------------------------|--------------------|-----------------|----------------------|-----------------|-----|-----|-----|-----|-----|-----|
| Characteristic bond resistance, combined pullout and concrete cone failure        |                    |                 |                      |                 |     |     |     |     |     |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) |                    |                 |                      |                 |     |     |     |     |     |     |
| Tem-<br>perature<br>range                                                         | I: 50 °C / 80 °C   | $\tau_{Rk,C1}$  | [N/mm <sup>2</sup> ] | 4,5             | 5,5 | 5,5 | 5,5 | 4,5 | 4,0 | 4,0 |
|                                                                                   | II: 72 °C / 120 °C |                 |                      | 4,0             | 4,5 | 4,5 | 4,5 | 4,0 | 3,5 | 3,5 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   |                    |                 |                      |                 |     |     |     |     |     |     |
| Tem-<br>perature<br>range                                                         | I: 50 °C / 80 °C   | $\tau_{Rk,C1}$  | [N/mm <sup>2</sup> ] | - <sup>1)</sup> | 5,0 | 5,0 | 4,5 | 4,0 | 3,5 | 3,5 |
|                                                                                   | II: 72 °C / 120 °C |                 |                      | - <sup>1)</sup> | 4,0 | 4,0 | 4,0 | 3,5 | 3,0 | 3,0 |
| Installation factors                                                              |                    |                 |                      |                 |     |     |     |     |     |     |
| Dry or wet concrete                                                               |                    | $\gamma_{inst}$ | [-]                  | 1,0             |     |     |     |     |     |     |
| Water filled hole                                                                 |                    |                 |                      | - <sup>1)</sup> | 1,2 |     |     |     |     |     |

<sup>1)</sup> No performance assessed

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**Performances**

Characteristic values under seismic action (performance category C1) for fischer anchor rods and standard threaded rods, working life 50 and 100 years

**Annex C 14**

**Table C15.1: Characteristic values** for combined pull-out and concrete failure for **fischer anchor rods** in hammer drilled holes under seismic action performance category **C2; working life 50 and 100 years**

| Anchor rod / standard threaded rod                                                |                    |                           | M12                  | M16  | M20  |     |
|-----------------------------------------------------------------------------------|--------------------|---------------------------|----------------------|------|------|-----|
| Characteristic bond resistance, combined pullout and concrete cone failure        |                    |                           |                      |      |      |     |
| Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) |                    |                           |                      |      |      |     |
| Tem-<br>perature<br>range                                                         | I: 50 °C / 80 °C   | $\tau_{Rk,C2}$            | [N/mm <sup>2</sup> ] | 1,5  | 1,3  | 2,1 |
|                                                                                   | II: 72 °C / 120 °C |                           |                      | 1,3  | 1,2  | 1,9 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   |                    |                           |                      |      |      |     |
| Tem-<br>perature<br>range                                                         | I: 50 °C / 80 °C   | $\tau_{Rk,C2}$            | [N/mm <sup>2</sup> ] | 1,3  | 1,1  | 1,8 |
|                                                                                   | II: 72 °C / 120 °C |                           |                      | 1,1  | 1,0  | 1,6 |
| Displacement-Factors for tension load <sup>1)</sup>                               |                    |                           |                      |      |      |     |
| $\delta_{N,C2}$ (DLS)-Factor                                                      |                    | [mm/(N/mm <sup>2</sup> )] | 0,20                 | 0,13 | 0,21 |     |
| $\delta_{N,C2}$ (ULS)-Factor                                                      |                    |                           | 0,38                 | 0,18 | 0,24 |     |
| Displacement-Factors for shear load <sup>2)</sup>                                 |                    |                           |                      |      |      |     |
| $\delta_{V,C2}$ (DLS)-Factor                                                      |                    | [mm/kN]                   | 0,18                 | 0,10 | 0,07 |     |
| $\delta_{V,C2}$ (ULS)-Factor                                                      |                    |                           | 0,25                 | 0,14 | 0,11 |     |

1) Calculation of effective displacement:

$$\delta_{N,C2} (DLS) = \delta_{N,C2} (DLS)\text{-Factor} \cdot \tau_{Ed}$$

$$\delta_{N,C2} (ULS) = \delta_{N,C2} (ULS)\text{-Factor} \cdot \tau_{Ed}$$

( $\tau_{Ed}$ : Design value of the applied tensile stress)

2) Calculation of effective displacement:

$$\delta_{V,C2} (DLS) = \delta_{V,C2} (DLS)\text{-Factor} \cdot V_{Ed}$$

$$\delta_{V,C2} (ULS) = \delta_{V,C2} (ULS)\text{-Factor} \cdot V_{Ed}$$

( $V_{Ed}$ : Design value of the applied shear force)

3) No performance assessed

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**Performances**

Characteristic values under seismic action (performance category C2) for fischer anchor rods; working life 50 and 100 years

**Annex C 15**