**DECLARATION OF PERFORMANCE**

**DoP: 0157**

for fischer injection system FIS EM Plus (Bonded anchor for use in concrete) – **EN**

1. Unique identification code of the product-type: **DoP: 0157**

2. Intended use/es: **Post-installed fastening in cracked or uncracked concrete, see appendix, especially Annexes B 1 to B 13**

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

4. Authorised representative: **--**

5. System/s of AVCP: **1**

6. European Assessment Document: **EAD 330499-01-0601**

   European Technical Assessment: **ETA-17/0979; 2018-12-06**

   Technical Assessment Body: **DIBt**

   Notified body/ies: **1343 – MPA Darmstadt**

7. Declared performance/s:

**Mechanical resistance and stability (BWR 1)**

- **Characteristic resistance for static and quasi static action, displacements: See appendix, especially Annexes C 1 to C 10**
- **Characteristic resistance for Seismic performance categories C1 and C2, displacements: See appendix, especially Annexes C 11 to C 14**

**Hygiene, health and the environment (BWR 3)**

- **Content, emission and/or release of dangerous substances: NPD**

8. Appropriate Technical Documentation and/or Specific Technical Documentation: ---

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Andreas Bucher, Dipl.-Ing.

Wolfgang Hengesbach, Dipl.-Ing., Dipl.-Wirtsch.-Ing.

Tumlingen, 2018-12-14

- This DoP has been prepared in different languages. In case there is a dispute on the interpretation the english version shall always prevail.
- The Appendix includes voluntary and complementary information in English language exceeding the (language-neutrally specified) legal requirements.

**Specific Part**

## 1 Technical description of the product

The "fischer injection system FIS EM Plus" is a bonded fastener consisting of a cartridge with injection mortar fischer FIS EM Plus and a steel element according to Annex A5.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The product description is given in Annex A.

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

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

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

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

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

| Essential characteristic | Performance |
|---|---|
| Characteristic values under static and quasi-static action, displacements | See Annex C 1 to C 10 |
| Characteristic values for seismic performance categories C1 and C2, displacements | See Annex C 11 to C 14 |

### 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

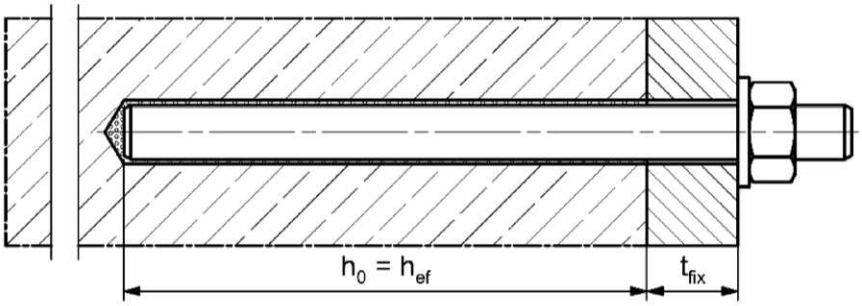
In accordance with EAD 330499-01-0601 according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

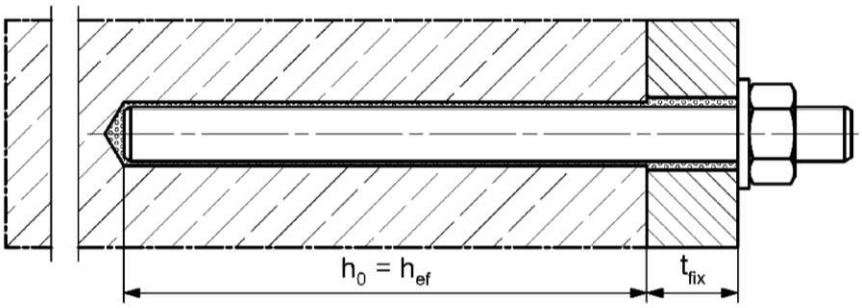
## Installation conditions part 1

**fischer anchor rod**

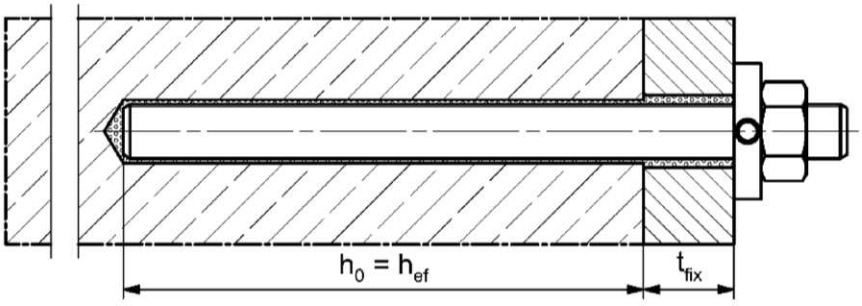
**Pre positioned installation**




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




**Pre-positioned or push through installation with subsequently pressed filling disk**
(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 EM Plus

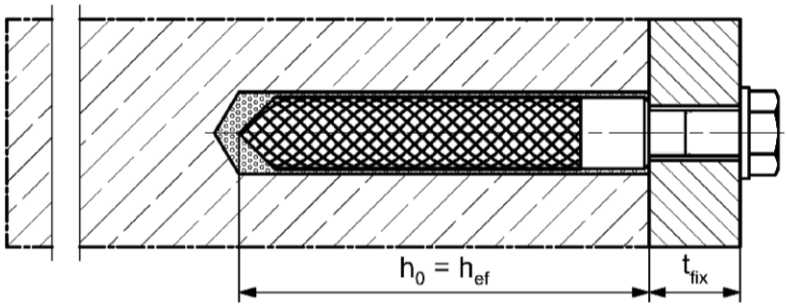
**Product description**
Installation conditions part 1

**Annex A 1**

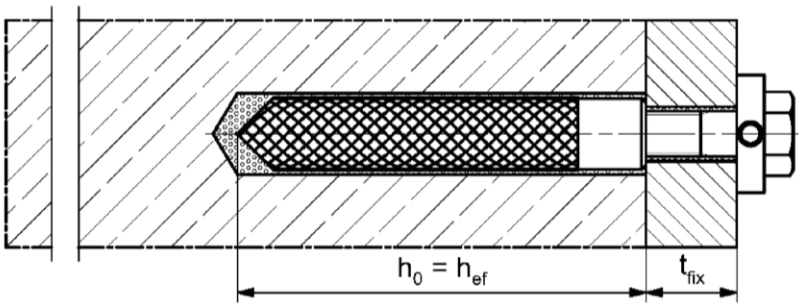
## Installation conditions part 2

**fischer internal threaded anchor RG MI**

**Pre positioned installation**




**Pre-positioned installation with subsequently pressed filling disk** (annular gap filled with mortar)




Figures not to scale

$h_0$ = drill hole depth

$h_{ef}$ = effective embedment depth

$t_{fix}$ = thickness of fixture

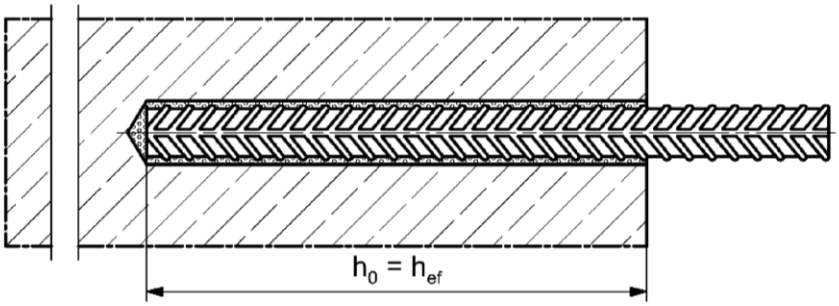
fischer injection system FIS EM Plus

**Product description**
Installation conditions part 2

**Annex A 2**

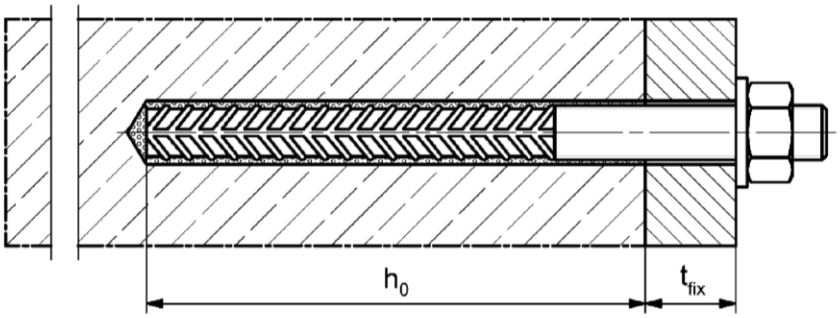
## Installation conditions part 3

**Reinforcing bar**

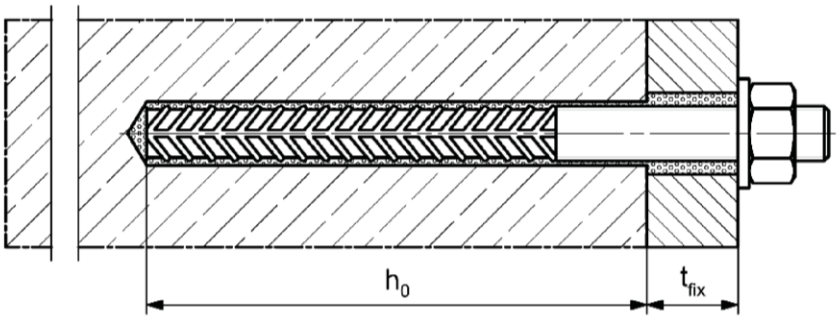



**fischer rebar anchor FRA**

**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

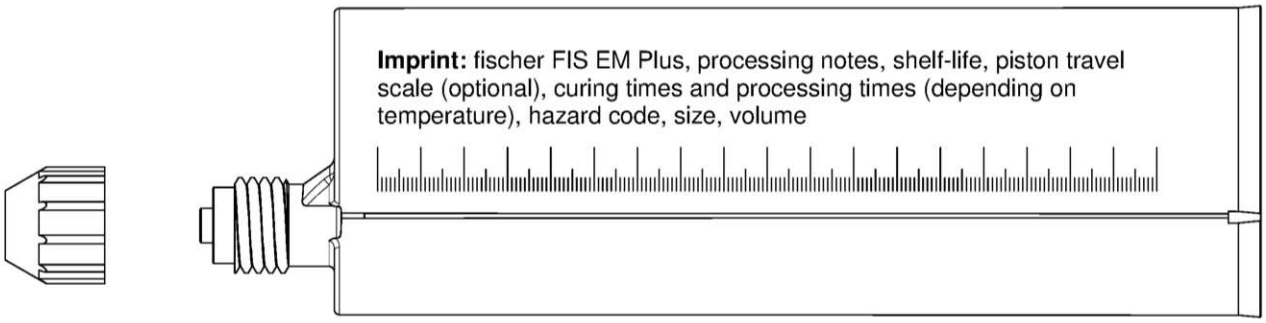
fischer injection system FIS EM Plus

**Product description**
Installation conditions part 3

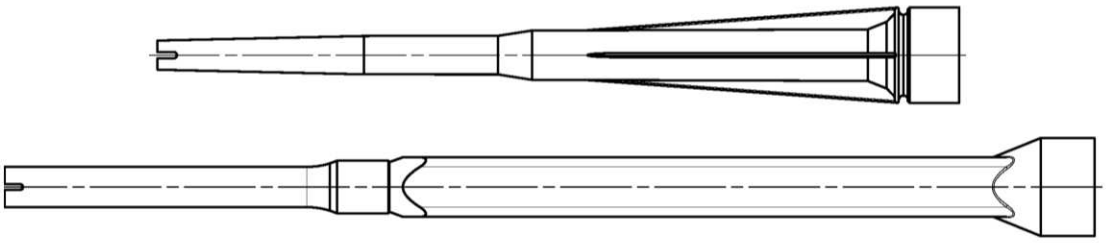
**Annex A 3**

## Overview system components part 1

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




**Static mixer FIS MR Plus or UMR**



**Injection adapter and Extension tube for static mixer**

**Cleaning brush BS / BSB**

**Blow-out pump ABP**

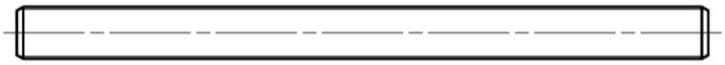
Figures not to scale

| | |
|---|---|
| fischer injection system FIS EM Plus | **Annex A 4** |
| **System description**<br>Overview system components part 1;<br>cartridges / static mixer / accessories | |

## Overview system components part 2

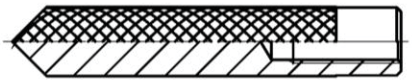
**fischer anchor rod**

Size: M8, M10, M12, M14, M16, M20, M22, M24, M27, M30

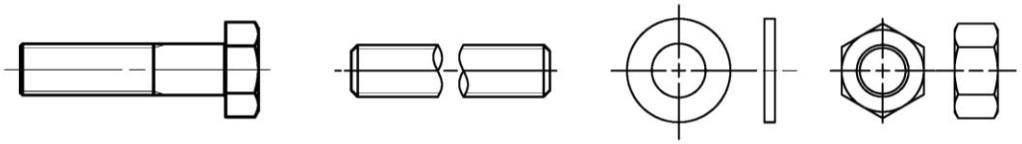


**fischer internal threaded anchor RG MI**

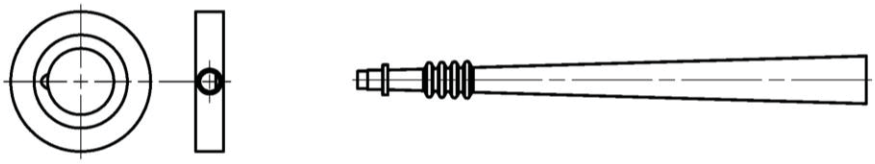
Size: M8, M10, M12, M16, M20



**Screw / threaded rod / washer / hexagon nut**



**fischer filling disk FFD with injection adapter**

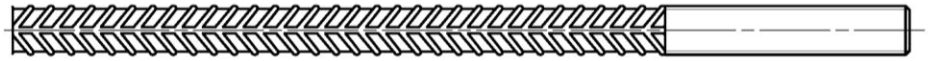


**Reinforcing bar**

Nominal diameter: ϕ8, ϕ10, ϕ12, ϕ14, ϕ16, ϕ18, ϕ20, ϕ22, ϕ24, ϕ25, ϕ26, ϕ28, ϕ30, ϕ32, ϕ34, ϕ36, ϕ40

**fischer rebar anchor FRA**

Size: M12, M16, M20, M24



Figures not to scale

| | |
|---|---|
| fischer injection system FIS EM Plus | **Annex A 5** |
| **System description**<br>Overview system components part 2;<br>steel components | |

**Table A6.1:** Materials

| Part | Designation | Material | | |
|---|---|---|---|---|
| 1 | Injection cartridge | Mortar, hardener, filler | | |
| | Steel grade | Steel, zinc plated | Stainless steel A4 | High corrosion resistant steel C |
| 2 | Anchor rod | Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanized ≥ 40 µm EN ISO 10684:2004 $f_{uk} \leq 1000$ N/mm² $A_5 > 12\%$ fracture elongation | Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462; EN 10088-1:2014 $f_{uk} \leq 1000$ N/mm² $A_5 > 12\%$ fracture elongation | Property class 50 or 80 EN ISO 3506-1:2009 or property class 70 with $f_{yk}$= 560 N/mm² 1.4565; 1.4529; EN 10088-1:2014 $f_{uk} \leq 1000$ N/mm² $A_5 > 12\%$ fracture elongation |
| | | Fracture elongation A5 > 8 %, for applications without requirements for seismic performance category C2 | | |
| 3 | Washer ISO 7089:2000 | zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 µm EN ISO 10684:2004 | 1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362; EN 10088-1:2014 | 1.4565; 1.4529; EN 10088-1:2014 |
| 4 | Hexagon nut | Property class 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 µm, ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 µm EN ISO 10684:2004 | Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014 | Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014 |
| 5 | fischer internal threaded anchor RG MI | Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:1999 A2K | Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014 | Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014 |
| 6 | Commercial standard screw or anchor / threaded rod for fischer internal threaded anchor RG MI | Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:1999 A2K $A_5 > 8$ % fracture elongation | Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014 $A_5 > 8$ % fracture elongation | Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014 $A_5 > 8$ % fracture elongation |
| 7 | fischer filling disk FFD similar to DIN 6319-G | zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 µm EN ISO 10684:2004 | 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014 | 1.4565;1.4529; EN 10088-1:2014 |
| 8 | Reinforcing bar EN 1992-1-1:2004 and AC:2010, Annex C | Bars and de-coiled rods, class B or C with $f_{yk}$ and k according to NDP or NCL of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$ | | |
| 9 | fischer rebar anchor FRA | Rebar part: Bars and de-coiled rods class B or C with $f_{yk}$ and k according to NDP or NCL of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$ | Threaded part: Property class 70 or 80 EN ISO 3506-1:2009 1.4565; 1.4529, 1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 EN 10088-1:2014 | |

**Specifications of intended use (part 1)**

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

| Anchorages subject to | | | **FIS EM 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 (fischer "FHD", Heller "Duster Expert"; Bosch „Speed Clean"; Hilti "TE-CD, TE-YD") | | | Nominal drill bit diameter ($d_0$) 12 mm to 35 mm | | | | | | | |
| Diamond drilling | | | all sizes | | | | | | | |
| Static and quasi static load, in | | uncracked concrete | all sizes | Tables: C1.1 C4.1 C5.1 C9.1 | all sizes | Tables: C2.1 C4.1 C6.1 C9.2 | all sizes | Tables: C3.1 C4.1 C7.1 C10.1 | all sizes | Tables: C3.2 C4.1 C8.1 C10.2 |
| | | cracked concrete | | | | | | | | |
| Seismic performance category (only hammer drilling with standard / hollow drill bits) | | C1 | M10 to M30 | Tables: C11.1 C12.2 C13.1 | - | | ϕ10 to ϕ32 | Tables: C12.1 C12.2 C13.2 | - | |
| | | C2 | M12 M16 M20 M24 | Tables: C11.1 C12.2 C14.1 | | | - | - | | |
| Use category | I1 | dry or wet concrete | all sizes | | | | | | | |
| | I2 | water filled hole | all sizes | | | | | | | |
| Installation direction | | | D3 (downward and horizontal and upwards (e.g. overhead) installation) | | | | | | | |
| Installation temperature | | | $T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C | | | | | | | |
| In-service temperature | | Temperature range I | -40 °C to +60 °C | | (max. short term temperature +60 °C ; max. long term temperature +35 °C) | | | | | |
| | | Temperature range II | -40 °C to +72 °C | | (max. short term temperature +72 °C ; max. long term temperature +50 °C) | | | | | |

## 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 206-1:2013

**Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure, to permanently damp internal conditions or in other particular aggressive conditions (high corrosion resistant steel)

  Note: Particular aggressive conditions are e. g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used)

**Design:**

- Anchorages 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 under seismic loading are designed in accordance with:
  EN 1992-4:2018 and EOTA Technical Report TR 055.
  Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastening in stand-off installation or with a grout layer under seismic action are not covered in this European Technical Assessment (ETA).

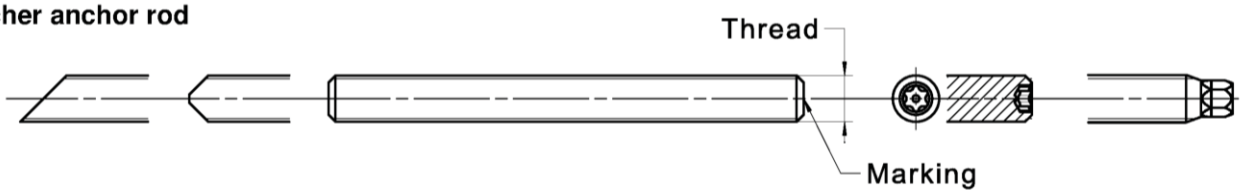
**Installation:**

- 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

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

| **Anchor rods** | | | **Thread** | **M8** | **M10** | **M12** | **M14** | **M16** | **M20** | **M22** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Width across flats | | SW | [mm] | 13 | 17 | 19 | 22 | 24 | 30 | 32 | 36 | 41 | 46 |
| Nominal drill hole diameter | | $d_0$ | | 10 | 12 | 14 | 16 | 18 | 24 | 25 | 28 | 30 | 35 |
| Drill hole depth | | $h_0$ | | $h_0 = h_{ef}$ | | | | | | | | | |
| Effective embedment depth | | $h_{ef,\,min}$ | | 60 | 60 | 70 | 75 | 80 | 90 | 93 | 96 | 108 | 120 |
| | | $h_{ef,\,max}$ | | 160 | 200 | 240 | 280 | 320 | 400 | 440 | 480 | 540 | 600 |
| Diameter of the clearance hole of the fixture | pre positioned installation | $d_f$ | | 9 | 12 | 14 | 16 | 18 | 22 | 24 | 26 | 30 | 33 |
| | push through installation | $d_f$ | | 12 | 14 | 16 | 18 | 20 | 26 | 28 | 30 | 33 | 40 |
| Minimum thickness of concrete member | | $h_{min}$ | | $h_{ef} + 30$ ($\geq 100$) | | | $h_{ef} + 2d_0$ | | | | | | |
| Maximum torque moment for attachment of the fixture | | max $T_{fix}$ | [Nm] | 10 | 20 | 40 | 50 | 60 | 120 | 135 | 150 | 200 | 300 |

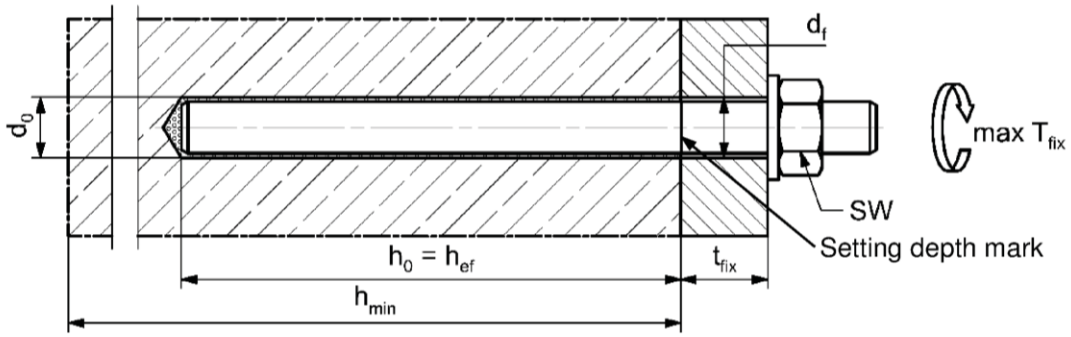
**fischer anchor rod**




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

Property class 8.8, stainless steel, property class 80 and high corrosion resistant steel, property class 80: •
Stainless steel A4, property class 50 and high corrosion resistant steel, property class 50: ••
Alternatively: Colour coding according to DIN 976-1

**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 EM Plus

**Intended use**
Installation parameters anchor rods

**Annex B 3**

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

| **Anchor rods** | | | **M8** | **M10** | **M12** | **M14** | **M16** | **-** | **M20** | **M22** | **M24** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Reinforcing bars (nominal diameter)** | | **ϕ** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** |
| **Minimum edge distance** | | | | | | | | | | | |
| Uncracked / cracked concrete | $c_{min}$ | [mm] | 40 | 45 | 45 | 45 | 50 | 55 | 55 | 55 | 60 |
| Minimum spacing | $s_{min}$ | | according to Annex B5 | | | | | | | | |
| **Minimum spacing** | | | | | | | | | | | |
| Uncracked / cracked concrete | $s_{min}$ | [mm] | 40 | 45 | 55 | 60 | 65 | 85 | 85 | 95 | 105 |
| Minimum edge distance | $c_{min}$ | | according to Annex B5 | | | | | | | | |
| **Required projecting area** | | | | | | | | | | | |
| Uncracked concrete | $A_{sp,req}$ | [1000 mm²] | 8 | 13 | 22 | 23 | 24 | 38,5 | 38,5 | 39,5 | 40 |
| Cracked concrete | | | 6,5 | 10 | 16,5 | 17,5 | 18,5 | 29,5 | 29,5 | 30 | 30,5 |

| **Anchor rods** | | | **-** | **-** | **M27** | **-** | **M30** | **-** | **-** | **-** | **-** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Reinforcing bars (nominal diameter)** | | **ϕ** | **25** | **26** | **-** | **28** | **30** | **32** | **34** | **36** | **40** |
| **Minimum edge distance** | | | | | | | | | | | |
| Uncracked / cracked concrete | $c_{min}$ | [mm] | 75 | 75 | 75 | 80 | 80 | 120 | 120 | 135 | 175 |
| Minimum spacing | $s_{min}$ | | according to Annex B5 | | | | | | | | |
| **Minimum spacing** | | | | | | | | | | | |
| Uncracked / cracked concrete | $s_{min}$ | [mm] | 120 | 120 | 120 | 140 | 140 | 160 | 160 | 160 | 160 |
| Minimum edge distance | $c_{min}$ | | according to Annex B5 | | | | | | | | |
| **Required projecting area** | | | | | | | | | | | |
| Uncracked concrete | $A_{sp,req}$ | [1000 mm²] | 47,5 | 47,5 | 47,5 | 64 | 64 | 64 | 64 | 64 | 64 |
| Cracked concrete | | | 36,5 | 36,5 | 36,5 | 49 | 49 | 49 | 49 | 49 | 49 |

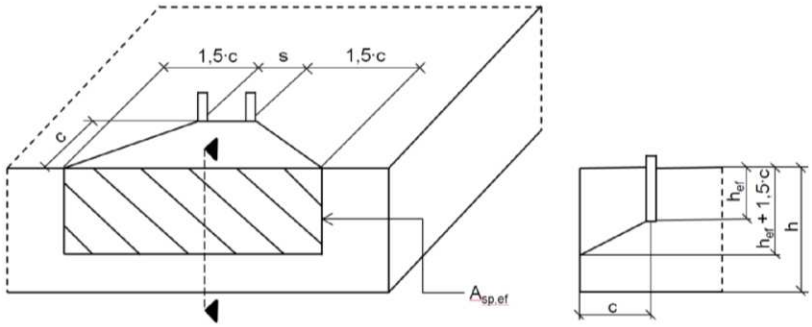
**Splitting failure** for minimum edge distance and spacing in dependence of the effective embedment depth $h_{ef}$.

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

$$\mathbf{A_{sp,req} < A_{sp,t}}$$

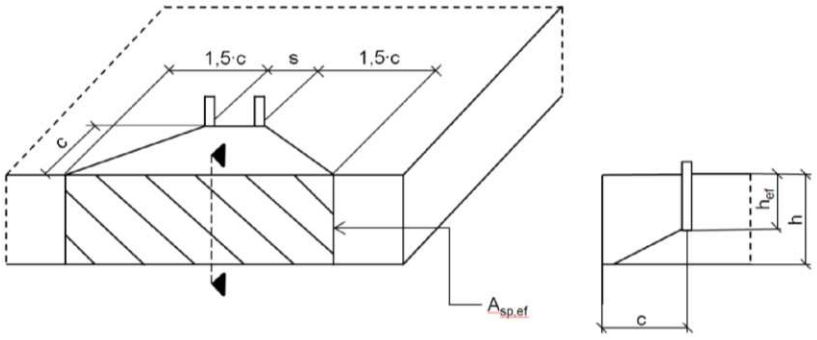
$A_{sp,req}$ = required projecting area
$A_{sp,t} = A_{sp,ef}$ = effective projecting area (according to Annex B5)

**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 | $A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$ | [mm²] | with $c \geq c_{min}$ |
| Group of anchors with $s > 3 \cdot c$ | $A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$ | [mm²] | |
| Group of anchors with $s \leq 3 \cdot c$ | $A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1{,}5 \cdot c)$ | [mm²] | with $c \geq c_{min}$ and $s \geq s_{min}$ |

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




| | | | |
|---|---|---|---|
| Single anchor | $A_{sp,t} = 3 \cdot c \cdot$ existing h | [mm²] | with $c \geq c_{min}$ |
| Group of anchors with $s > 3 \cdot c$ | $A_{sp,t} = 6 \cdot c \cdot$ existing h | [mm²] | |
| Group of anchors with $s \leq 3 \cdot c$ | $A_{sp,t} = (3 \cdot c + s) \cdot$ existing h | [mm²] | with $c \geq c_{min}$ and $s \geq s_{min}$ |

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

Figures not to scale

fischer injection system FIS EM Plus

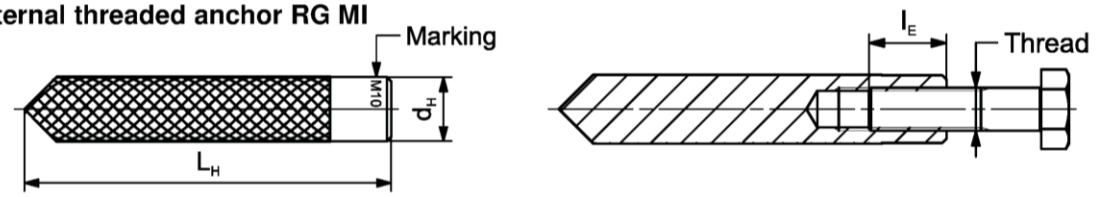
**Intended use**
Minimum thickness of concrete member for anchor rods, minimum spacing and edge distance

**Annex B 5**

**Table B6.1:** Installation parameters plus minimum spacing and minimum edge distance for fischer internal threaded anchors RG MI

| **Internal threaded anchors RG MI** | **Thread** | | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|---|
| Diameter of anchor | $d_{nom} = d_H$ | | 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 ($h_{ef} = L_H$) | $h_{ef}$ | | 90 | 90 | 125 | 160 | 200 |
| Minimum spacing and minimum edge distance | $s_{min}$ = $c_{min}$ | [mm] | 55 | 65 | 75 | 95 | 125 |
| Diameter of clearance hole in the fixture | $d_f$ | | 9 | 12 | 14 | 18 | 22 |
| Minimum thickness 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 torque moment for attachment of the fixture | max $T_{fix}$ | [Nm] | 10 | 20 | 40 | 80 | 120 |

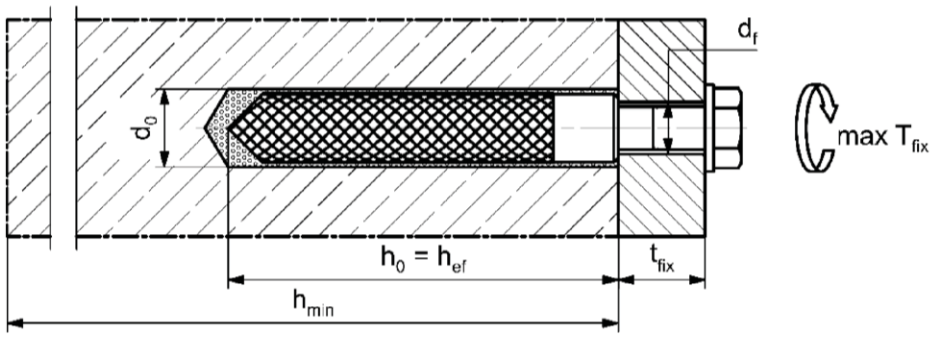
**fischer internal threaded anchor RG MI**




**Marking:** Anchor size e. g.: **M10**
Stainless steel → additional **A4**; e.g.: **M10 A4**
High corrosion resistant steel → additional C; e.g.: **M10 C**

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 EM Plus

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

**Annex B 6**

**Table B7.1:** Installation parameters for reinforcing bars

| **Nominal diameter of the bar** | | **ϕ** | **8[1)]** | | **10[1)]** | | **12[1)]** | | **14** | **16** | **18** | **20** | **22** | **24** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_0$ | [mm] | 10 | 12 | 12 | 14 | 14 | 16 | 18 | 20 | 25 | 25 | 30 | 30 |
| Drill hole depth | $h_0$ | | $h_0 = h_{ef}$ | | | | | | | | | | | |
| Effective embedment depth | $h_{ef,min}$ | | 60 | | 60 | | 70 | | 75 | 80 | 85 | 90 | 94 | 98 |
| | $h_{ef,max}$ | | 160 | | 200 | | 240 | | 280 | 320 | 360 | 400 | 440 | 480 |
| Minimum thickness of concrete member | $h_{min}$ | | $h_{ef} + 30$ ($\geq 100$) | | | | | | $h_{ef} + 2d_0$ | | | | | |

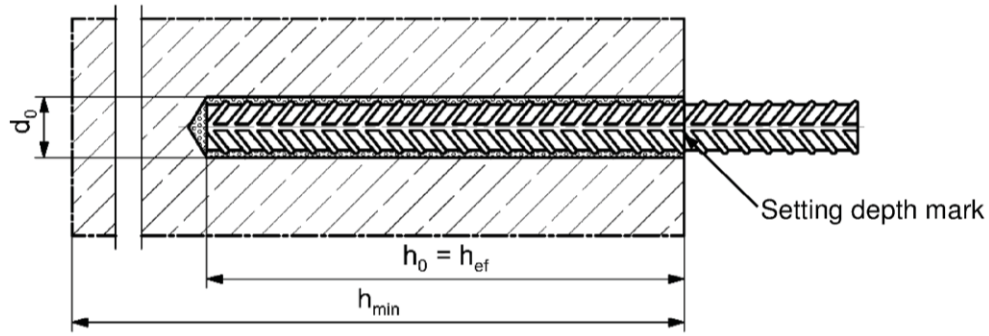
| **Nominal diameter of the bar** | | **ϕ** | **25** | **26** | **28** | **30** | **32** | **34** | **36** | **40** | **-** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_0$ | [mm] | 30 | 35 | 35 | 40 | 40 | 40 | 45 | 55 | - |
| Drill hole depth | $h_0$ | | $h_0 = h_{ef}$ | | | | | | | | |
| Effective embedment depth | $h_{ef,min}$ | | 100 | 104 | 112 | 120 | 128 | 136 | 144 | 160 | - |
| | $h_{ef,max}$ | | 500 | 520 | 560 | 600 | 640 | 680 | 720 | 800 | - |
| Minimum thickness of concrete member | $h_{min}$ | | $h_{ef} + 2d_0$ | | | | | | | | |

[1)] 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 EM Plus

**Intended use**
Installation parameters reinforcing bars

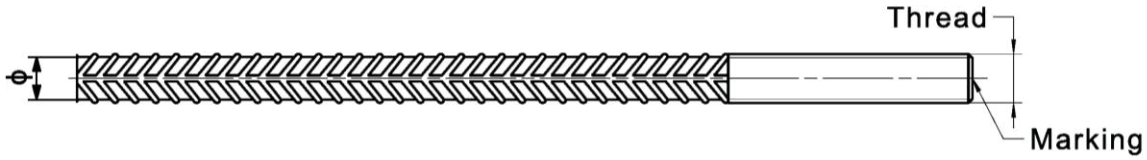
**Annex B 7**

**Table B8.1:** Installation parameters plus minimum spacing and minimum edge distance for fischer rebar anchor FRA

| Rebar anchor FRA | | Thread | | M12[1)] | | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Nominal diameter of the bar | $\phi$ | | | 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 | $s_{min}$ = $c_{min}$ | | [mm] | 55 | | 65 | 85 | 105 |
| Diameter of clearance hole in the fixture – pre positioned anchorage | $\leq d_f$ | | | 14 | | 18 | 22 | 26 |
| Diameter of clearance hole in the fixture – push through anchorage | $\leq d_f$ | | | 18 | | 22 | 26 | 32 |
| Minimum thickness of concrete member | $h_{min}$ | | | $h_0 + 30$ ($\geq 100$) | | $h_0 + 2d_0$ | | |
| Maximum torque moment for attachment of the fixture | max $T_{fix}$ | | [Nm] | 40 | | 60 | 120 | 150 |

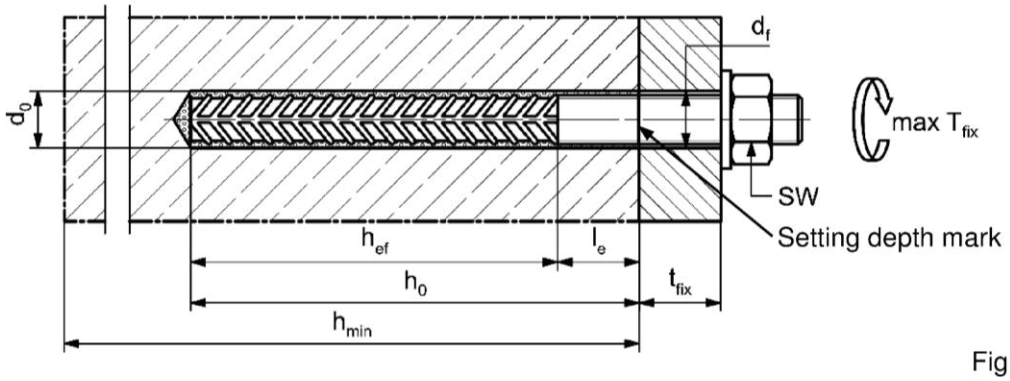
[1)] Both drill hole diameters can be used

**fischer rebar anchor FRA**




Marking frontal e. g: FRA (for stainless steel);
FRA C (for high corrosion resistant steel)

**Installation conditions:**




Figures not to scale

fischer injection system FIS EM Plus

**Intended use**
Installation parameters rebar anchor FRA

**Annex B 8**

**Table B9.1:** Parameters of the cleaning brush BS (steel brush)

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

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_0$ | [mm] | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 25 | 28 | 30 | 32 | 35 | 40 | 45 | 55 |
| Steel brush diameter | $d_b$ | | 11 | 14 | 16 | 20 | | 25 | 26 | 27 | 30 | 40 | | | 42 | 47 | 58 |

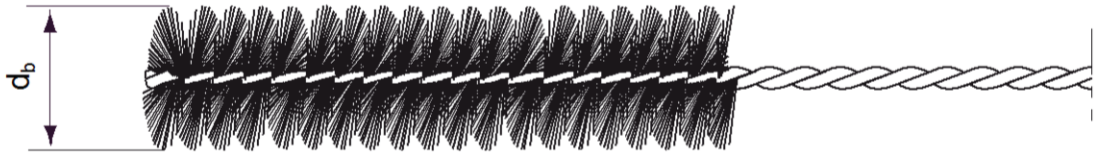


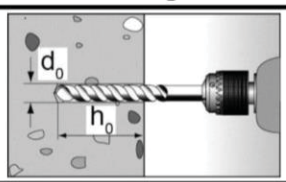
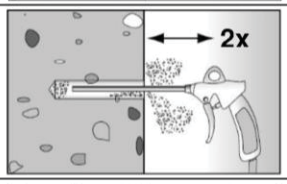
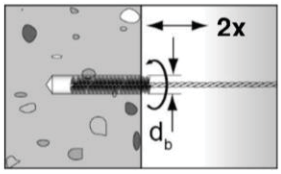
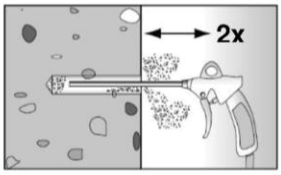

**Table B9.2** Maximum processing time of the mortar and minimum curing time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

| Temperature at anchoring base [°C] | Maximum processing time $t_{work}$ | Minimum curing time $t_{cure}$ |
|---|---|---|
| -5 to -1 | 240 min | 200 h |
| ±0 to +4 | 150 min | 90 h |
| +5 to +9 | 120 min | 40 h |
| +10 to +19 | 30 min | 18 h |
| +20 to +29 | 14 min | 10 h |
| +30 to +40 | 7 min | 5 h |

[1] In wet concrete or water filled holes the curing times must be doubled

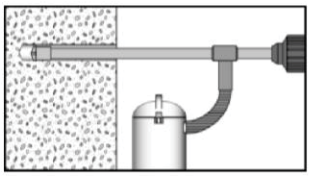
**Installation instructions part 1**

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

| | | |
|---|---|---|
| 1 |  | Drill the hole.<br>Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$<br>see **tables B3.1, B6.1, B7.1, B8.1** |
| 2 |  | Cleaning the drill hole:<br>Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar)<br>  |
| 3 |  | Brush the drill hole twice. For drill hole diameter ≥ 30 mm use a power drill.<br>For deep holes use an extension. Corresponding brushes see **table B9.1** |
| 4 |  | Cleaning the drill hole:<br>Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar)<br>  |

Go to step 6

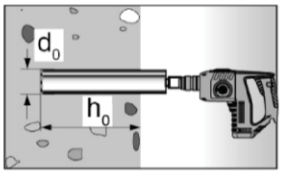
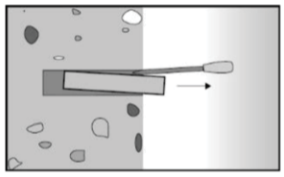
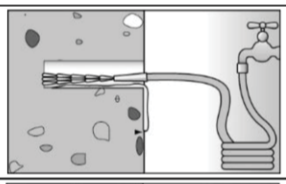
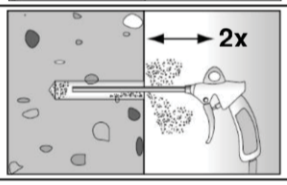
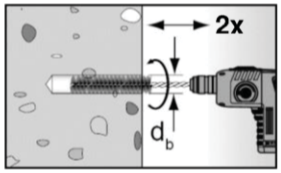
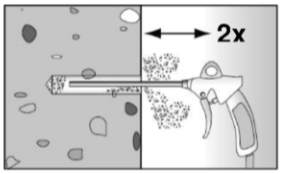
Drilling and cleaning the hole (hammer drilling with hollow drill bit)

| | | |
|---|---|---|
| 1 |  | Check a suitable hollow drill (see **table B1.1**)<br>for correct operation of the dust extraction |
| 2 |  | Use a suitable dust extraction system, e. g.<br>Bosch GAS 35 M AFC 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 drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$<br>see **tables B3.1, B6.1, B7.1, B8.1** |

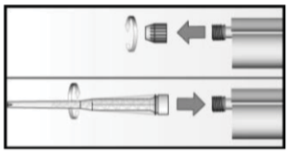
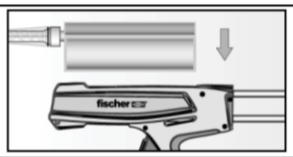
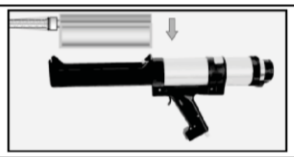
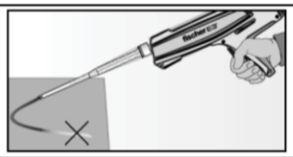
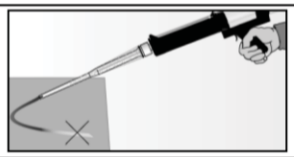
Go to step 6

**Installation instructions part 2**

Drilling and cleaning the hole (wet drilling with diamond drill bit)

| | | | | |
|---|---|---|---|---|
| 1 |  | Drill the hole.<br>Drill hole diameter **$d_0$** and nominal drill hole depth **$h_0$** see **tables B3.1, B6.1, B7.1, B8.1** |  | Break the drill core and remove it |
| 2 |  | Flush the drill hole with clean water until it flows clear | | |
| 3 |  | Blow out the drill hole twice, using oil-free compressed air (p > 6 bar) | | |
| 4 |  | Brush the drill hole twice using a power drill.<br>Corresponding brushes see **table B9.1** | | |
| 5 |  | Blow out the drill hole twice, using oil-free compressed air (p > 6 bar) | | |

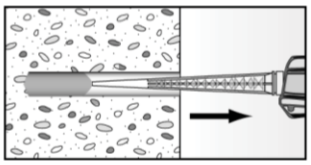
Preparing the cartridge

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

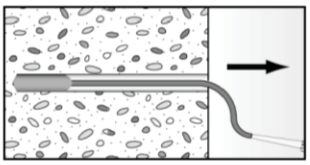
**Installation instructions part 3**

Injection of the mortar

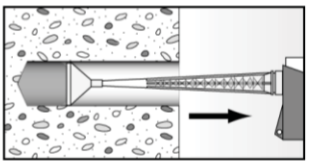
**9**



Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles



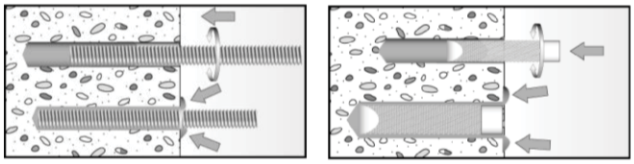
For drill hole depth ≥ 150 mm use an extension tube



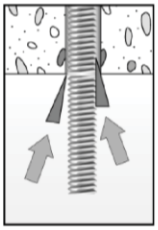
For overhead installation, deep holes ($h_0$ > 250 mm) or drill hole diameter ($d_0$ ≥ 40 mm) use an injection-adapter

Installation of anchor rods or fischer internal threaded anchors RG MI

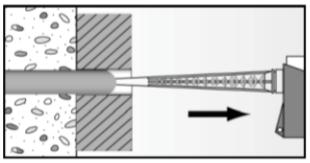
**10**



Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. 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 anchor element, excess mortar must be emerged around the anchor element.



For overhead installations support the anchor rod with wedges.
(e. g. fischer centering wedges)

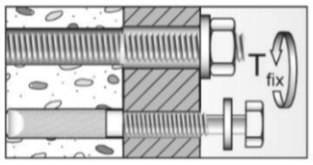


For push through installation fill the annular gap with mortar

**11**

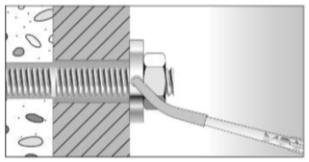
Wait for the specified curing time $t_{cure}$ see **table B9.2**

**12**




Mounting the fixture max $T_{fix}$ see **tables B3.1 and B6.1**

**Option**

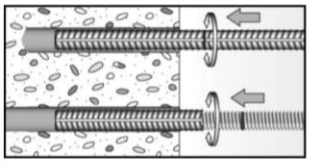


After the minimum curing time is reached, the gap between anchor and fixture (annular clearance) may be filled with mortar via the fischer filling disc FFD. Compressive strength ≥ 50 N/mm² (e.g. fischer injection mortars FIS HB, FIS SB, FIS V, FIS EM Plus)
ATTENTION: Using fischer filling disk FFD reduces $t_{fix}$ (usable length of the anchor)

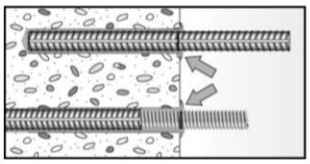
**Installation instructions part 4**

Installation reinforcing bars and fischer rebar anchor FRA

**10**



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

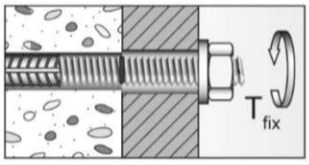


When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

**11**

Wait for the specified curing time $t_{cure}$ see **table B9.2**

**12**




Mounting the fixture max $T_{fix}$ see **table B8.1**

| | |
|---|---|
| fischer injection system FIS EM Plus | **Annex B 13** |
| **Intended use**<br>Installation instructions part 4 | |

**Table C1.1:** Essential characteristics for the **steel bearing capacity** under tensile / shear load of **fischer anchor rods** and **standard threaded rods**

| **Anchor rod / standard threaded rod** | | | | **M8** | **M10** | **M12** | **M14** | **M16** | **M20** | **M22** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bearing capacity under tensile load, steel failure** | | | | | | | | | | | | | |
| Characteristic resistance $N_{Rk,s}$ | Steel zinc plated | Property class | 5.8 | [kN] | 19(17) | 29(27) | 43 | 58 | 79 | 123 | 152 | 177 | 230 | 281 |
| | | | 8.8 | | 29(27) | 47(43) | 68 | 92 | 126 | 196 | 243 | 282 | 368 | 449 |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 19 | 29 | 43 | 58 | 79 | 123 | 152 | 177 | 230 | 281 |
| | | | 70 | | 26 | 41 | 59 | 81 | 110 | 172 | 212 | 247 | 322 | 393 |
| | | | 80 | | 30 | 47 | 68 | 92 | 126 | 196 | 243 | 282 | 368 | 449 |
| **Partial factors** [1] | | | | | | | | | | | | | |
| Partial factor $\gamma_{Ms,N}$ | Steel zinc plated | Property class | 5.8 | [-] | 1,50 | | | | | | | | |
| | | | 8.8 | | 1,50 | | | | | | | | |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 2,86 | | | | | | | | |
| | | | 70 | | 1,50[2] / 1,87 | | | | | | | | |
| | | | 80 | | 1,60 | | | | | | | | |
| **Bearing capacity under shear load, steel failure** | | | | | | | | | | | | | |
| **without lever arm** | | | | | | | | | | | | | |
| Characterstic resistance $V^0_{Rk,s}$ | Steel zinc plated | Property class | 5.8 | [kN] | 9(8) | 15(13) | 21 | 29 | 39 | 61 | 76 | 89 | 115 | 141 |
| | | | 8.8 | | 15(13) | 23(21) | 34 | 46 | 63 | 98 | 122 | 141 | 184 | 225 |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 9 | 15 | 21 | 29 | 39 | 61 | 76 | 89 | 115 | 141 |
| | | | 70 | | 13 | 20 | 30 | 40 | 55 | 86 | 107 | 124 | 161 | 197 |
| | | | 80 | | 15 | 23 | 34 | 46 | 63 | 98 | 122 | 141 | 184 | 225 |
| Ductility factor | | | $k_7$ | [-] | 1,0 | | | | | | | | | |
| **with lever arm** | | | | | | | | | | | | | |
| Charact. resistance $M^0_{Rk,s}$ | Steel zinc plated | Property class | 5.8 | [Nm] | 19(16) | 37(33) | 65 | 104 | 166 | 324 | 447 | 560 | 833 | 1123 |
| | | | 8.8 | | 30(26) | 60(53) | 105 | 167 | 266 | 519 | 716 | 896 | 1333 | 1797 |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 19 | 37 | 65 | 104 | 166 | 324 | 447 | 560 | 833 | 1123 |
| | | | 70 | | 26 | 52 | 92 | 146 | 232 | 454 | 626 | 784 | 1167 | 1573 |
| | | | 80 | | 30 | 60 | 105 | 167 | 266 | 519 | 716 | 896 | 1333 | 1797 |
| **Partial factors** [1] | | | | | | | | | | | | | |
| Partial factor $\gamma_{Ms,V}$ | Steel zinc plated | Property class | 5.8 | [-] | 1,25 | | | | | | | | |
| | | | 8.8 | | 1,25 | | | | | | | | |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 2,38 | | | | | | | | |
| | | | 70 | | 1,25[2] / 1,56 | | | | | | | | |
| | | | 80 | | 1,33 | | | | | | | | |

[1] In absence of other national regulations
[2] Only admissible for steel C, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. fischer anchor rods)
[3] Values in brackets are valid for undersized threaded rods with smaller stress area As for hotdip galvanized standard threaded rods according to EN ISO 10684:2004+AC:2009

**Table C2.1:** Essential characteristics for the **steel bearing capacity** under tensile / shear load of **fischer internal threaded anchors RG MI**

| **fischer internal threaded anchors RG MI** | | | | | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|---|---|---|
| **Bearing capacity under tensile load, steel failure** | | | | | | | | | |
| Charact. resistance with screw | $N_{Rk,s}$ | Property class | 5.8 | [kN] | 19 | 29 | 43 | 79 | 123 |
| | | | 8.8 | | 29 | 47 | 68 | 108 | 179 |
| | | Property class 70 | A4 | | 26 | 41 | 59 | 110 | 172 |
| | | | C | | 26 | 41 | 59 | 110 | 172 |
| **Partial factors**[1] | | | | | | | | | |
| Partial factors | $\gamma_{Ms,N}$ | Property class | 5.8 | [-] | 1,50 | | | | |
| | | | 8.8 | | 1,50 | | | | |
| | | Property class 70 | A4 | | 1,87 | | | | |
| | | | C | | 1,87 | | | | |
| **Bearing capacity under shear load, steel failure** | | | | | | | | | |
| **Without lever arm** | | | | | | | | | |
| Charact. resistance with screw | $V^0_{Rk,s}$ | 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 70 | A4 | | 12,8 | 20,3 | 29,5 | 54,8 | 86,0 |
| | | | C | | 12,8 | 20,3 | 29,5 | 54,8 | 86,0 |
| Ductility factor | | | $k_7$ | [-] | 1,0 | | | | |
| **With lever arm** | | | | | | | | | |
| Charact. resistance with screw | $M^0_{Rk,s}$ | Property class | 5.8 | [Nm] | 20 | 39 | 68 | 173 | 337 |
| | | | 8.8 | | 30 | 60 | 105 | 266 | 519 |
| | | Property class 70 | A4 | | 26 | 52 | 92 | 232 | 454 |
| | | | C | | 26 | 52 | 92 | 232 | 454 |
| **Partial factors**[1] | | | | | | | | | |
| Partial factors | $\gamma_{Ms,V}$ | Property class | 5.8 | [-] | 1,25 | | | | |
| | | | 8.8 | | 1,25 | | | | |
| | | Property class 70 | A4 | | 1,56 | | | | |
| | | | C | | 1,56 | | | | |

[1] In absence of other national regulations
[2] Only for steel failure without lever arm

**Table C3.1:** Essential characteristics for the **steel bearing capacity** under tensile / shear load of **reinforcing bars**

| **Nominal diameter of the bar** | | **ϕ** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **25** | **26** | **28** | **30** | **32** | **34** | **36** | **40** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bearing capacity under tensile load, steel failure** | | | | | | | | | | | | | | | | | | | |
| Characterstic resistance | $N_{Rk,s}$ | [kN] | $A_s \cdot f_{uk}$ [1)] | | | | | | | | | | | | | | | | |
| **Bearing capacity under shear load, steel failure** | | | | | | | | | | | | | | | | | | | |
| **Without lever arm** | | | | | | | | | | | | | | | | | | | |
| Characterstic resistance | $V^0_{Rk,s}$ | [kN] | $0,5 \cdot A_s \cdot f_{uk}$ [1)] | | | | | | | | | | | | | | | | |
| Ductility factor | $k_7$ | [-] | 0,8 | | | | | | | | | | | | | | | | |
| **With lever arm** | | | | | | | | | | | | | | | | | | | |
| Characteristic resistance | $M^0_{Rk,s}$ | [Nm] | $1,2 \cdot W_{el} \cdot f_{uk}$ [1)] | | | | | | | | | | | | | | | | |

[1)] $f_{uk}$ or $f_{yk}$ respectively must be taken from the specifications of the reinforcing bar

**Table C3.2:** Essential characteristics for the **steel bearing capacity** under tensile / shear load of **fischer rebar anchors FRA**

| **fischer rebar anchor FRA** | | | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|
| **Bearing capacity under tensile load, steel failure** | | | | | | |
| Characterstic resistance | $N_{Rk,s}$ | [kN] | 63 | 111 | 173 | 270 |
| **Partial factor[1)]** | | | | | | |
| Partial factor | $\gamma_{Ms,N}$ | [-] | 1,4 | | | |
| **Bearing capacity under shear load, steel failure** | | | | | | |
| **Without lever arm** | | | | | | |
| Characterstic resistance | $V^0_{Rk,s}$ | [kN] | 30 | 55 | 86 | 124 |
| Ductility factor | $k_7$ | [-] | 1,0 | | | |
| **With lever arm** | | | | | | |
| Characteristic resistance | $M^0_{Rk,s}$ | [Nm] | 92 | 233 | 454 | 785 |
| **Partial factor[1)]** | | | | | | |
| Partial factor | $\gamma_{Ms,V}$ | [-] | 1,56 | | | |

[1)] In absence of other national regulations

**Table C4.1:** Essential characteristics under tensile / shear load

| Size | | | | All sizes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tensile load** | | | | | | | | | | | | | | | | | |
| Uncracked concrete | | $k_{ucr,N}$ | [-] | 11,0 | | | | | | | | | | | | | |
| Cracked concrete | | $k_{cr,N}$ | [-] | 7,7 | | | | | | | | | | | | | |
| **Factors for the compressive strength of concrete > C20/25** | | | | | | | | | | | | | | | | | |
| Increasing factor for $\tau_{Rk}$ | C25/30 | $\Psi_c$ | [-] | 1,02 | | | | | | | | | | | | | |
| | C30/37 | | | 1,04 | | | | | | | | | | | | | |
| | C35/45 | | | 1,06 | | | | | | | | | | | | | |
| | C40/50 | | | 1,07 | | | | | | | | | | | | | |
| | C45/55 | | | 1,08 | | | | | | | | | | | | | |
| | C50/60 | | | 1,09 | | | | | | | | | | | | | |
| **Splitting failure** | | | | | | | | | | | | | | | | | |
| Edge distance | $h / h_{ef} \geq 2,0$ | $c_{cr,sp}$ | [mm] | $1,0\ h_{ef}$ | | | | | | | | | | | | | |
| | $2,0 > h / h_{ef} > 1,3$ | | | $4,6\ h_{ef} - 1,8\ h$ | | | | | | | | | | | | | |
| | $h / h_{ef} \leq 1,3$ | | | $2,26\ h_{ef}$ | | | | | | | | | | | | | |
| Spacing | | $s_{cr,sp}$ | | $2\ c_{cr,sp}$ | | | | | | | | | | | | | |
| **Concrete cone failure** | | | | | | | | | | | | | | | | | |
| Edge distance | | $c_{cr,N}$ | [mm] | $1,5\ h_{ef}$ | | | | | | | | | | | | | |
| Spacing | | $s_{cr,N}$ | | $2\ c_{cr,N}$ | | | | | | | | | | | | | |
| **Shear load** | | | | | | | | | | | | | | | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | | | | | | | |
| **Concrete pry-out failure** | | | | | | | | | | | | | | | | | |
| Factor for pry-out failure | | $k_8$ | [-] | 2,0 | | | | | | | | | | | | | |
| **Concrete edge failure** | | | | | | | | | | | | | | | | | |
| The value of $h_{ef}$ ($=l_f$) under shear load | | | [-] | Conditions according to 1992-4:2018; Section 7.43 | | | | | | | | | | | | | |
| **Calculation diameters** | | | | | | | | | | | | | | | | | |
| Size | | | | M8 | M10 | M12 | M14 | M16 | M20 | M22 | M24 | M27 | M30 | | | | |
| fischer anchor rods and standard threaded rods | | $d_{nom}$ | [mm] | 8 | 10 | 12 | 14 | 16 | 20 | 22 | 24 | 27 | 30 | | | | |
| fischer internal threaded anchors RG MI | | $d_{nom}$ | | 12 | 16 | 18 | - | 22 | 28 | - | - | - | - | | | | |
| fischer rebar anchor FRA | | $d_{nom}$ | | - | - | 12 | - | 16 | 20 | - | 25 | - | - | | | | |
| Size (nominal diameter of the bar) | | | $\phi$ | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 25 | 26 | 28 | 30 | 32 | 34 | 36 | 40 |
| Reinforcing bar | | $d_{nom}$ | [mm] | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 25 | 26 | 28 | 30 | 32 | 34 | 36 | 40 |

**Table C5.1:** Essential characteristics of **tensile resistance** for **fischer anchor rods** and **standard threaded rods** in hammer or diamond drilled holes; **uncracked or cracked concrete**

| **Anchor rod / standard threaded rod** | | | **M8** | **M10** | **M12** | **M14** | **M16** | **M20** | **M22** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Combined pullout and concrete cone failure** | | | | | | | | | | | | |
| Calculation diameter | d | [mm] | 8 | 10 | 12 | 14 | 16 | 20 | 22 | 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: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 18 | 18 | 18 | 17 | 17 | 16 | 15 | 15 | 15 | 14 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 18 | 17 | 17 | 16 | 16 | 15 | 14 | 14 | 14 | 13 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole) | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 16 | 16 | 15 | 13 | 13 | 11 | 11 | 10 | 10 | 9 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 14 | 13 | 12 | 11 | 10 | 10 | 9 | 9 |
| Diamond-drilling (dry or wet concrete as well as water filled hole) | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 16 | 15 | 13 | 12 | 12 | 10 | 10 | 10 | 9 | 9 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 12 | 11 | 11 | 10 | 9 | 9 | 8 | 8 |
| **Installation factors** | | | | | | | | | | | | |
| Dry or wet concrete | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | | | |
| Water filled hole | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | | | |
| **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: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7,5 | 7,5 | 9 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7,5 | 7,5 | 9 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 |
| Diamond - drilling (dry or wet concrete) | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 |
| Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole) | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 6 | 7,5 | 7,5 | 7 | 6 | 6 | 6 | 6 | 6 | 6 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,cr}$ | [N/mm²] | 6 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Installation factors** | | | | | | | | | | | | |
| Dry or wet concrete | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | | | |
| Water filled hole | $\gamma_{inst}$ | [-] | 1,2 | | | | | 1,4 | | | | |

**Table C6.1:** Essential characteristics of **tensile resistance** for **fischer internal threaded anchors RG MI** in hammer or diamond drilled holes; **uncracked or cracked concrete**

| **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) | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 14 | 13 | 12 |
| | II: 50 °C / 72 °C | | | 14 | 13 | 13 | 12 | 11 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole) | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 14 | 12 | 12 | 11 | 10 |
| | II: 50 °C / 72 °C | | | 13 | 12 | 11 | 10 | 9 |
| Diamond-drilling (dry or wet concrete as well as water filled hole) | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 13 | 12 | 11 | 10 | 9 |
| | II: 50 °C / 72 °C | | | 12 | 11 | 10 | 9 | 8 |
| **Installation factors** | | | | | | | | |
| Dry or wet concrete | | $\gamma_{inst}$ | [-] | 1,0 | | | | |
| Water filled hole | | | | 1,4 | | | | |
| **Cracked concrete** | | | | | | | | |
| **Characteristic bond resistance in cracked concrete C20/25** | | | | | | | | |
| Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete) | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 6 | 6 | 7 | 7 |
| | II: 50 °C / 72 °C | | | 7 | 6 | 6 | 7 | 7 |
| Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole) | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 6,5 | 6 | 6 | 6 |
| | II: 50 °C / 72 °C | | | 7 | 6 | 6 | 6 | 6 |
| **Installation factors** | | | | | | | | |
| Dry or wet concrete | | $\gamma_{inst}$ | [-] | 1,0 | | | | |
| Water filled hole | | | | 1,2 | | | 1,4 | |

**Table C7.1:** Essential characteristics of **tensile resistance** for **reinforcing bars** in hammer or diamond drilled holes; **uncracked or cracked concrete**

| **Nominal diameter of the bar** | | **ϕ** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **25** | **26** | **28** | **30** | **32** | **34** | **36** | **40** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Combined pullout and concrete cone failure** | | | | | | | | | | | | | | | | | | | |
| Calculation diameter | d | [mm] | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 25 | 26 | 28 | 30 | 32 | 34 | 36 | 40 |
| **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: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 16 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 14 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 10 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole) | | | | | | | | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 16 | 16 | 14 | 13 | 12 | 12 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 8 | 8 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 13 | 12 | 12 | 11 | 11 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 |
| Diamond-drilling (dry or wet concrete as well as water filled hole) | | | | | | | | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 16 | 15 | 13 | 12 | 12 | 11 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 7 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 12 | 11 | 11 | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 7 |
| **Installation factors** | | | | | | | | | | | | | | | | | | | |
| Dry or wet concrete | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | | | | | | | | | | |
| Water filled hole | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | | | | | | | | | | |
| **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: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Diamond-drilling (dry or wet concrete) | | | | | | | | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 5 | 5 | 5 | 5 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 5 | 5 | 5 | 5 |
| Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole) | | | | | | | | | | | | | | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 6 | 7,5 | 6,5 | 6,5 | 6,5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,cr}$ | [N/mm²] | 6 | 6,5 | 6,5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 |
| **Installation factors** | | | | | | | | | | | | | | | | | | | |
| Dry or wet concrete | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | | | | | | | | | | |
| Water filled hole | $\gamma_{inst}$ | [-] | 1,2 | | | | | | 1,4 | | | | | | | | | | |

**Table C8.1:** Essential characteristics of **tensile resistance** for **fischer rebar anchors FRA** in hammer or diamond drilled holes; **uncracked or cracked concrete**

| **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) | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 15 | 14 | 13 | 12 |
| | II: 50 °C / 72 °C | | | 14 | 13 | 12 | 12 |
| Hammer-drilling with standard drill bit or hollow drill bit (water filled hole) | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 14 | 12 | 11 | 10 |
| | II: 50 °C / 72 °C | | | 13 | 12 | 11 | 9 |
| Diamond-drilling (dry or wet concrete as well as water filled hole) | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 13 | 12 | 10 | 9 |
| | II: 50 °C / 72 °C | | | 12 | 11 | 10 | 9 |
| **Installation factors** | | | | | | | |
| Dry or wet concrete | | $\gamma_{inst}$ | [-] | 1,0 | | | |
| Water filled hole | | | | 1,4 | | | |
| **Cracked concrete** | | | | | | | |
| **Characteristic bond resistance in cracked concrete C20/25** | | | | | | | |
| Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete) | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 8 | 8 | 8 | 8 |
| | II: 50 °C / 72 °C | | | 8 | 8 | 8 | 8 |
| Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole) | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,cr}$ | [N/mm²] | 7 | 6 | 6 | 6 |
| | II: 50 °C / 72 °C | | | 7 | 6 | 6 | 6 |
| **Installation factors** | | | | | | | |
| Dry or wet concrete | | $\gamma_{inst}$ | [-] | 1,0 | | | |
| Water filled hole | | | | 1,2 | | 1,4 | |

**Table C9.1: Displacements for anchor rods**

| Anchor rod | | M8 | M10 | M12 | M14 | M16 | M20 | M22 | M24 | M27 | M30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Displacement-Factors for tensile load[1)]** | | | | | | | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | | | | | | | |
| $\delta_{N0\text{-Factor}}$ | [mm/(N/mm²)] | 0,07 | 0,08 | 0,09 | 0,09 | 0,10 | 0,11 | 0,11 | 0,12 | 0,12 | 0,13 |
| $\delta_{N\infty\text{-Factor}}$ | | 0,11 | 0,12 | 0,13 | 0,14 | 0,15 | 0,16 | 0,17 | 0,18 | 0,19 | 0,19 |
| **Displacement-Factors for shear load[2)]** | | | | | | | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | | | | | | | |
| $\delta_{V0\text{-Factor}}$ | [mm/kN] | 0,18 | 0,15 | 0,12 | 0,10 | 0,09 | 0,07 | 0,07 | 0,06 | 0,05 | 0,05 |
| $\delta_{V\infty\text{-Factor}}$ | | 0,27 | 0,22 | 0,18 | 0,16 | 0,14 | 0,11 | 0,10 | 0,09 | 0,08 | 0,07 |

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)

**Table C9.2: Displacements for fischer internal threaded anchors RG MI**

| Internal threaded anchor RG MI | | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|
| **Displacement-Factors for tensile load[1)]** | | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | | |
| $\delta_{N0\text{-Factor}}$ | [mm/(N/mm²)] | 0,09 | 0,10 | 0,10 | 0,11 | 0,13 |
| $\delta_{N\infty\text{-Factor}}$ | | 0,13 | 0,15 | 0,16 | 0,17 | 0,19 |
| **Displacement-Factors for shear load[2)]** | | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | | |
| $\delta_{V0\text{-Factor}}$ | [mm/kN] | 0,12 | 0,09 | 0,08 | 0,07 | 0,05 |
| $\delta_{V\infty\text{-Factor}}$ | | 0,18 | 0,14 | 0,12 | 0,10 | 0,08 |

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)

**Table C10.1: Displacements for reinforcing bars**

| Nominal diameter of the bar $\phi$ | | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 25 | 26 | 28 | 30 | 32 | 34 | 36 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Displacement-Factors for tensile load[1)]** | | | | | | | | | | | | | | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | | | | | | | | | | | | | | |
| $\delta_{N0\text{-Factor}}$ | [mm/(N/mm²)] | 0,07 | 0,08 | 0,09 | 0,09 | 0,10 | 0,10 | 0,11 | 0,11 | 0,12 | 0,12 | 0,12 | 0,13 | 0,13 | 0,13 | 0,14 | 0,14 | 0,15 |
| $\delta_{N\infty\text{-Factor}}$ | | 0,11 | 0,12 | 0,13 | 0,14 | 0,15 | 0,16 | 0,16 | 0,17 | 0,18 | 0,18 | 0,18 | 0,19 | 0,19 | 0,20 | 0,20 | 0,21 | 0,22 |
| **Displacement-Factors for shear load[2)]** | | | | | | | | | | | | | | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | | | | | | | | | | | | | | |
| $\delta_{V0\text{-Factor}}$ | [mm/kN] | 0,18 | 0,15 | 0,12 | 0,10 | 0,09 | 0,08 | 0,07 | 0,07 | 0,06 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 |
| $\delta_{V\infty\text{-Factor}}$ | | 0,27 | 0,22 | 0,18 | 0,16 | 0,14 | 0,12 | 0,11 | 0,10 | 0,09 | 0,09 | 0,08 | 0,08 | 0,07 | 0,07 | 0,06 | 0,06 | 0,05 |

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)

**Table C10.2: Displacements for fischer rebar anchors FRA**

| fischer rebar anchor FRA | | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|
| **Displacement-Factors for tensile load[1)]** | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | |
| $\delta_{N0\text{-Factor}}$ | [mm/(N/mm²)] | 0,09 | 0,10 | 0,11 | 0,12 |
| $\delta_{N\infty\text{-Factor}}$ | | 0,13 | 0,15 | 0,16 | 0,18 |
| **Displacement-Factors for shear load[2)]** | | | | | |
| **Uncracked or cracked concrete; Temperature range I, II** | | | | | |
| $\delta_{V0\text{-Factor}}$ | [mm/kN] | 0,12 | 0,09 | 0,07 | 0,06 |
| $\delta_{V\infty\text{-Factor}}$ | | 0,18 | 0,14 | 0,11 | 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)

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 C11.1:** Essential characteristics for the **steel bearing capacity** under tensile / 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** | **M14** | **M16** | **M20** | **M22** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bearing capacity under tensile load, steel failure[1)]** | | | | | | | | | | | | |
| **fischer anchor rods and standard threaded rods, performance category C1** | | | | | | | | | | | | |
| Characteristic resistance $N_{Rk,s,eq,C1}$ | Steel zinc plated | Property class | 5.8 | 29(27) | 43 | 58 | 79 | 123 | 152 | 177 | 230 | 281 |
| | | | 8.8 | 47(43) | 68 | 92 | 126 | 196 | 243 | 282 | 368 | 449 |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | 29 | 43 | 58 | 79 | 123 | 152 | 177 | 230 | 281 |
| | | | 70 | 41 | 59 | 81 | 110 | 172 | 212 | 247 | 322 | 393 |
| | | | 80 | 47 | 68 | 92 | 126 | 196 | 243 | 282 | 368 | 449 |
| | | [kN] | | | | | | | | | | |
| **fischer anchor rods and standard threaded rods, performance category C2** | | | | | | | | | | | | |
| Characteristic resistance $N_{Rk,s,eq,C2}$ | Steel zinc plated | Property class | 5.8 | - | 39 | - | 72 | 108 | - | 177 | - | - |
| | | | 8.8 | - | 61 | - | 116 | 173 | - | 282 | - | - |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | - | 39 | - | 72 | 108 | - | 177 | - | - |
| | | | 70 | - | 53 | - | 101 | 152 | - | 247 | - | - |
| | | | 80 | - | 61 | - | 116 | 173 | - | 282 | - | - |
| | | [-] | | | | | | | | | | |
| **Bearing capacity under shear load, steel failure without lever arm[1)]** | | | | | | | | | | | | |
| **fischer anchor rods, performance category C1** | | | | | | | | | | | | |
| Characteristic resistance $V^0_{Rk,s,eq,C1}$ | Steel zinc plated | Property class | 5.8 | 15(13) | 21 | 29 | 39 | 61 | 76 | 89 | 115 | 141 |
| | | | 8.8 | 23(21) | 34 | 46 | 63 | 98 | 122 | 141 | 184 | 225 |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | 15 | 21 | 29 | 39 | 61 | 76 | 89 | 115 | 141 |
| | | | 70 | 20 | 30 | 40 | 55 | 86 | 107 | 124 | 161 | 197 |
| | | | 80 | 23 | 34 | 46 | 63 | 98 | 122 | 141 | 184 | 225 |
| | | [kN] | | | | | | | | | | |
| **Standard threaded rods, performance category C1** | | | | | | | | | | | | |
| Characteristic resistance $V^0_{Rk,s,eq,C1}$ | Steel zinc plated | Property class | 5.8 | 11(9) | 15 | 20 | 27 | 43 | 53 | 62 | 81 | 99 |
| | | | 8.8 | 16(14) | 24 | 32 | 44 | 69 | 85 | 99 | 129 | 158 |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | 11 | 15 | 20 | 27 | 43 | 53 | 62 | 81 | 99 |
| | | | 70 | 14 | 21 | 28 | 39 | 60 | 75 | 87 | 113 | 138 |
| | | | 80 | 16 | 24 | 32 | 44 | 69 | 85 | 99 | 129 | 158 |
| | | [kN] | | | | | | | | | | |
| **fischer anchor rods and standard threaded rods, performance category C2** | | | | | | | | | | | | |
| Characteristic resistance $V^0_{Rk,s,eq,C2}$ | Steel zinc plated | Property class | 5.8 | - | 14 | - | 27 | 43 | - | 62 | - | - |
| | | | 8.8 | - | 22 | - | 44 | 69 | - | 99 | - | - |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | - | 14 | - | 27 | 43 | - | 62 | - | - |
| | | | 70 | - | 20 | - | 39 | 60 | - | 87 | - | - |
| | | | 80 | - | 22 | - | 44 | 69 | - | 99 | - | - |
| | | [-] | | | | | | | | | | |

[1)] Partial factors for performance category C1 or C2 see table C12.2;
for fischer anchor rods FIS A / RGM the factor for steel ductility is 1,0

[2)] Values in brackets are valid for undersized threaded rods with smaller stress area As for hotdip galvanized standard threaded rods according to EN ISO 10684:2004+AC:2009.

**Table C12.1:** Essential characteristics for the **steel bearing capacity** under tensile / shear load of **reinforcing bars (B500B)** under seismic action performance category C1

| **Nominal diameter of the bar** | $\phi$ | | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **25** | **26** | **28** | **30** | **32** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bearing capacity under tensile load, steel failure[1)]** | | | | | | | | | | | | | | | |
| **Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1** | | | | | | | | | | | | | | | |
| Characterstic resistance | $N_{Rk,s,eq,C1}$ | [kN] | 44 | 63 | 85 | 111 | 140 | 173 | 209 | 249 | 270 | 292 | 339 | 389 | 443 |
| **Bearing capacity under shear load, steel failure without lever arm[1)]** | | | | | | | | | | | | | | | |
| **Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1** | | | | | | | | | | | | | | | |
| Characterstic resistance | $V^0_{Rk,s,eq,C1}$ | [kN] | 15 | 22 | 30 | 39 | 49 | 61 | 74 | 88 | 95 | 102 | 119 | 137 | 155 |

[1)] Partial factors for performance category C1 see table C12.2

**Table C12.2:** **Partial factors** for **fischer anchor rods, standard threaded rods** and **reinforcing bars (B500B)** under seismic action performance category **C1 or C2**

| **Anchor rod / standard threaded rod** | | | | | **M10** | **M12** | **M14** | **M16** | **M20** | **M22** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nominal diameter of the bar** | | | $\phi$ | | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **25** | **26** | **28** | **30** | **32** |
| **Tensile load, steel failure[1)]** | | | | | | | | | | | | | | | | | |
| Partial factor $\gamma_{Ms,N}$ | Steel zinc plated | Property class | 5.8 | [-] | 1,50 | | | | | | | | | | | | |
| | | | 8.8 | | 1,50 | | | | | | | | | | | | |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 2,86 | | | | | | | | | | | | |
| | | | 70 | | 1,50[2)] / 1,87 | | | | | | | | | | | | |
| | | | 80 | | 1,60 | | | | | | | | | | | | |
| | Reinforcing bar | B500B | | | 1,40 | | | | | | | | | | | | |
| **Shear load, steel failure[1)]** | | | | | | | | | | | | | | | | | |
| Partial factor $\gamma_{Ms,V}$ | Steel zinc plated | Property class | 5.8 | [-] | 1,25 | | | | | | | | | | | | |
| | | | 8.8 | | 1,25 | | | | | | | | | | | | |
| | Stainless steel A4 and high corrosion resistant steel C | | 50 | | 2,38 | | | | | | | | | | | | |
| | | | 70 | | 1,25[2)] / 1,56 | | | | | | | | | | | | |
| | | | 80 | | 1,33 | | | | | | | | | | | | |
| | Reinforcing bar | B500B | | | 1,50 | | | | | | | | | | | | |

[1)] In absence of other national regulations
[2)] Only admissible for steel C, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. fischer anchor rods)

**Table C13.1:** Essential characteristics of **resistance** for **fischer anchor rods** and **standard threaded rods** in hammer drilled holes under seismic action performance category **C1**

| **Anchor rod / standard threaded rod** | | | **M10** | **M12** | **M14** | **M16** | **M20** | **M22** | **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)** | | | | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,eq,C1}$ [N/mm²] | 7,0 | 7,0 | 6,7 | 6,0 | 5,7 | 6,7 | 6,7 | 6,7 | 6,7 |
| | II: 50 °C / 72 °C | | 7,0 | 7,0 | 6,7 | 5,7 | 5,7 | 6,7 | 6,7 | 6,7 | 6,7 |
| **Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)** | | | | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,eq,C1}$ [N/mm²] | 7,5 | 7,5 | 6,5 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 |
| | II: 50 °C / 72 °C | | 6,8 | 6,8 | 6,5 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 |
| **Installation factors** | | | | | | | | | | | |
| **tensile load** | | | | | | | | | | | |
| Dry or wet concrete | | $\gamma_{inst}$ [-] | 1,0 | | | | | | | | |
| Water filled hole | | | 1,2 | | | | 1,4 | | | | |
| **shear load** | | | | | | | | | | | |
| All installation conditions | | $\gamma_{inst}$ [-] | 1,0 | | | | | | | | |

**Table C13.2:** Essential characteristics of **resistance** for **reinforcing bars** in hammer drilled holes under seismic action performance category **C1**

| **Nominal diameter of the bar** | | **ϕ** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **25** | **26** | **28** | **30** | **32** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance, combined pullout and concrete cone failure** | | | | | | | | | | | | | | | |
| **Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)** | | | | | | | | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,eq,C1}$ [N/mm²] | 7,0 | 7,0 | 6,7 | 5,7 | 5,7 | 5,7 | 6,7 | 6,7 | 6,7 | 6,7 | 6,7 | 6,7 | 4,8 |
| | II: 50 °C / 72 °C | | 7,0 | 7,0 | 6,7 | 5,7 | 5,7 | 5,7 | 6,7 | 6,7 | 6,7 | 6,7 | 6,7 | 6,7 | 4,8 |
| **Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)** | | | | | | | | | | | | | | | |
| Temperature range | I: 35 °C / 60 °C | $\tau_{Rk,eq,C1}$ [N/mm²] | 7,5 | 6,5 | 6,5 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 4,8 |
| | II: 50 °C / 72 °C | | 6,5 | 6,5 | 5,8 | 5,8 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 5,7 | 4,8 |
| **Installation factors** | | | | | | | | | | | | | | | |
| **Tensile load** | | | | | | | | | | | | | | | |
| Dry or wet concrete | | $\gamma_{inst}$ [-] | 1,0 | | | | | | | | | | | | |
| Water filled hole | | | 1,2 | | | | | 1,4 | | | | | | | |
| **Shear load** | | | | | | | | | | | | | | | |
| All installation conditions | | $\gamma_{inst}$ [-] | 1,0 | | | | | | | | | | | | |

fischer injection system FIS EM Plus

**Performance**
Essential characteristics under seismic action (performance category C1) for fischer anchor rods, standard threaded rods and reinforcing bars

**Annex C 13**

**Table C14.1:** Essential characteristics of **resistance** for **fischer anchor rods** and **standard threaded rods** in hammer drilled holes under seismic action performance category **C2**

| **Anchor rod / standard threaded rod** | | | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|
| **Characteristic bond resistance, combined pullout and concrete cone failure** | | | | | | |
| **Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)** | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,eq,C2}$ | [N/mm²] | 3,5 | 5,8 | 5,0 | 3,1 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,eq,C2}$ | [N/mm²] | 3,3 | 5,5 | 4,7 | 2,9 |
| **Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)** | | | | | | |
| Temperature range I: 35 °C / 60 °C | $\tau_{Rk,eq,C2}$ | [N/mm²] | 3,5 | 5,8 | 5,0 | 3,1 |
| Temperature range II: 50 °C / 72 °C | $\tau_{Rk,eq,C2}$ | [N/mm²] | 3,3 | 5,5 | 4,7 | 2,9 |
| **Installation factors** | | | | | | |
| **Tensile load** | | | | | | |
| Dry or wet concrete | $\gamma_{inst}$ | [-] | 1,0 | | | |
| Water filled hole | $\gamma_{inst}$ | [-] | 1,2 | | 1,4 | |
| **Shear load** | | | | | | |
| All installation conditions | $\gamma_{inst}$ | [-] | 1,0 | | | |
| **Displacement-Factors for tensile load[1)]** | | | | | | |
| $\delta_{N,(DLS)\text{-Factor}}$ | | [mm/(N/mm²)] | 0,09 | 0,10 | 0,11 | 0,12 |
| $\delta_{N,(ULS)\text{-Factor}}$ | | [mm/(N/mm²)] | 0,15 | 0,17 | 0,17 | 0,18 |
| **Displacement-Factors for shear load[2)]** | | | | | | |
| $\delta_{V,(DLS)\text{-Factor}}$ | | [mm/kN] | 0,18 | 0,10 | 0,07 | 0,06 |
| $\delta_{V,(ULS)\text{-Factor}}$ | | [mm/kN] | 0,25 | 0,14 | 0,11 | 0,09 |

1) Calculation of effective displacement:

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

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

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

2) Calculation of effective displacement:

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

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

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