



Approval body for construction products and types of construction

**Bautechnisches Prüfamt** 

An institution established by the Federal and Laender Governments



# **European Technical Assessment**

ETA-17/0979 of 6 April 2018

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 EM Plus

Bonded fastener 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 330499-00-0601



# European Technical Assessment ETA-17/0979

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English translation prepared by DIBt

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Z22321.18 8.06.01-380/17



# **European Technical Assessment ETA-17/0979**

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#### **Specific Part**

#### 1 Technical description of the product

The fischer injection system FIS EM Plus is a bonded anchor 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 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

# 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 on 6 April 2018 by Deutsches Institut für Bautechnik

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# **European Technical Assessment ETA-17/0979**

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BD Dipl.-Ing. Andreas Kummerow Head of Department

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Installation conditions part 1



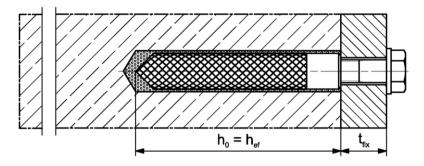
# Installation conditions part 1 fischer anchor rod Pre positioned installation $h_0 = h_{ef}$ Push through installation (annular gap filled with mortar) $h_0 = h_{ef}$ Pre-positioned or push through installation with subsequently pressed filling disk (annular gap filled with mortar) $h_0 = h_{ef}$ Figures not to scale $h_0$ = drill hole depth h<sub>ef</sub> = effective embedment depth $t_{\text{fix}}$ = thickness of fixture fischer injection system FIS EM Plus Annex A 1 **Product description**



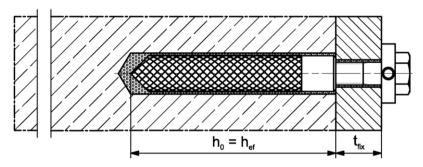
## Installation conditions part 2

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<sub>ef</sub> = effective embedment depth

 $t_{\text{fix}}$  = thickness of fixture

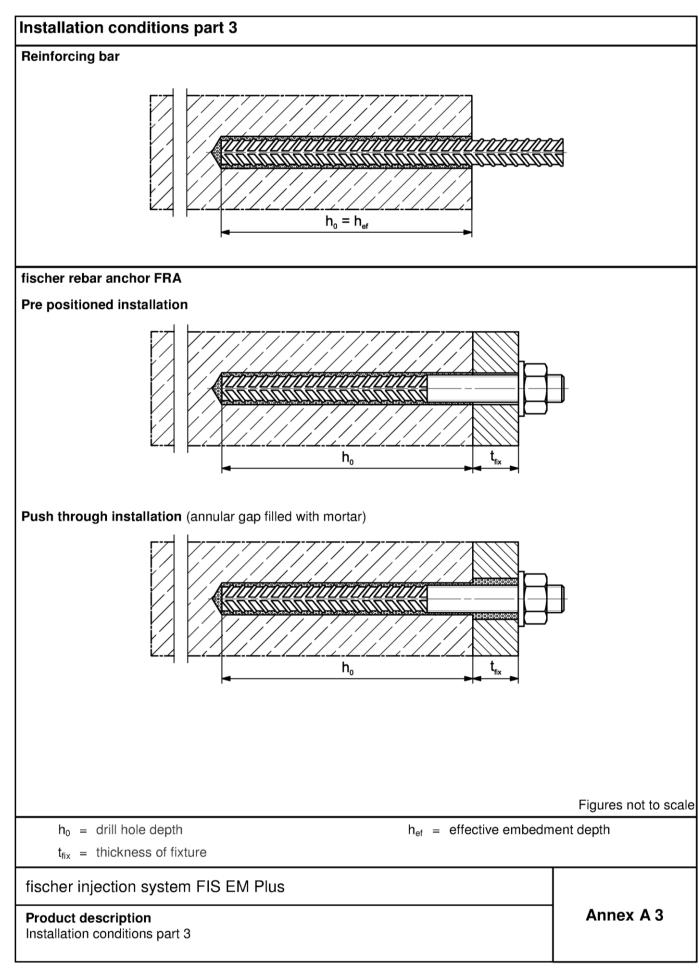
fischer injection system FIS EM Plus

### **Product description**

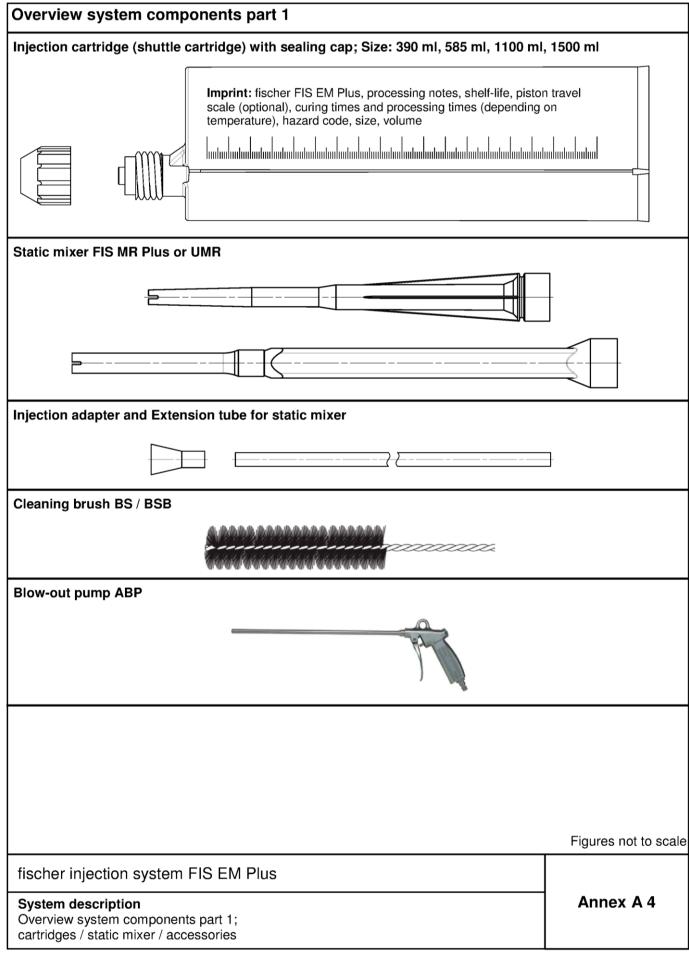
Installation conditions part 2

Annex A 2











# 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: \$\phi 8\$, \$\phi 10\$, \$\phi 12\$, \$\phi 14\$, \$\phi 16\$, \$\phi 18\$, \$\phi 20\$, \$\phi 22\$, \$\phi 24\$, \$\phi 25\$, \$\phi 26\$, \$\phi 28\$, \$\phi 30\$, \$\phi 32\$, \$\phi 34\$, \$\phi 36\$, \$\phi 40\$ fischer rebar anchor FRA Size: M12, M16, M20, M24 Figures not to scale fischer injection system FIS EM Plus Annex A 5 System description Overview system components part 2; steel components



Tabl	e A6.1: Materials	3			
Part	Designation		Mate	erial	
1	Injection cartridge		Mortar, har	dener, filler	
	Steel grade	Steel, zinc plated	1	ess steel A4	High corrosion resistant steel C
		Property class 5.8 or 8.8; EN ISO 898-1:2013	EN ISO 3	ss 50, 70 or 80 506-1:2009	Property class 50 or 80 EN ISO 3506-1:2009
2	Anchor rod	zinc plated $\geq 5 \mu m$ , EN ISO 4042:1999 A2K or hot-dip galvanized $\geq 40 \mu m$ EN ISO 10684:2004 $f_{uk} \leq 1000 \text{ N/mm}^2$	1.4571; 1.4 1.4062, 1.4 EN 1008 f <sub>uk</sub> ≤ 100	404; 1.4578; 439; 1.4362; 662, 1.4462; 38-1:2014 00 N/mm <sup>2</sup>	or property class 70 with $f_{yk}$ = 560 N/mm <sup>2</sup> 1.4565; 1.4529; EN 10088-1:2014 $f_{uk} \le 1000$ N/mm <sup>2</sup>
		$A_5 > 12\%$ fracture elongation		· 12% elongation	$A_5 > 12\%$ fracture elongation
		Fracture elongation	A5 > 8 %, for		hout requirements
3	Washer ISO 7089:2000	zinc plated ≥ 5 μm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 μm EN ISO 10684:2004	1.4578 1.4439	; 1.4404; ;1.4571; ; 1.4362; 38-1:2014	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	50, 70 EN ISO 39 1.4401; 1.4 1.4571; 1.4	rty class 0 or 80 506-1:2009 404; 1.4578; 439; 1.4362; 38-1:2014	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	EN ISO 35 1.4401; 1.4 1.4571; 1.4	/ class 70 506-1:2009 404; 1.4578; 439; 1.4362; 38-1:2014	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 $\geq$ 5 $\mu$ m, ISO 4042:1999 A2K $A_5 > 8 \%$ fracture elongation	EN ISO 35 1.4401; 1.4 1.4571; 1.4 EN 1008	/ class 70 506-1:2009 404; 1.4578; 439; 1.4362; 38-1:2014 ture 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	1.4571; 1.4	404; 1.4578; 439; 1.4362; 38-1:2014	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 $f_{yk}$ and $k$ according to NDP of $f_{uk} = f_{tk} = k \cdot f_{yk}$			AC:2010
9	fischer rebar anchor FRA	Rebar part: Bars and de-coiled rods clas $f_{yk}$ and k according to NDP of 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$	70 or 80 :2009 , 1.4401, 1.4404, 1.4571, , 1.4362, 1.4062 114		
Proc	her injection system duct description erials	FIS EM Plus			Annex A 6



#### Specifications of intended use (part 1) Table B1.1: Overview use and performance categories FIS EM Plus with ... Anchorages subject to Anchor rod fischer internal Reinforcing bar fischer rebar threaded anchor anchor RG MI FRA KKKKKKKKKKKKKKK HARRAMAN KANTAN KAN Hammer drilling with standard drill all sizes bit Hammer drilling with hollow drill bit (Heller "Duster Nominal drill bit diameter (d<sub>0</sub>) Expert"; Bosch 12 mm to 35 mm Speed Clean"; Hilti "TE-CD, TE-YD")<sup>1)</sup> Diamond drilling all sizes Tables: Tables: Tables: Tables: uncracked C2.1 C3.1 C3.2 C1.1 concrete Static and quasi C4.1 C4.1 C4.1 C4.1 all sizes all sizes all sizes all sizes static load, in cracked C5.1 C6.1 C7.1 C8.1 concrete C9.1 C9.2 C10.1 C10.2 Tables: Tables: M10 φ10 C11.1 C12.1 Seismic C<sub>1</sub> to to C12.2 C12.2 performance M30 ф32 C13.1 C13.2 category (only hammer drilling with M12 Tables: standard / hollow M16 C11.1 C2 drill bits) M20 C12.2 M24 C14.1 dry or wet 11 all sizes concrete Use category water filled 12 all sizes hole D3 Installation direction (downward and horizontal and upwards (e.g. overhead) installation) Installation $T_{i,min} = 0$ °C to $T_{i,max} = +40$ °C temperature (max. short term temperature +60 °C; Temperature -40 °C to +60 °C range I max. long term temperature +35 °C) In-service temperature Temperature (max. short term temperature +72 °C; -40 °C to +72 °C range II max. long term temperature +50 °C) 1) Further applicable hollow drill bits can be found on the homepage of fischer: www.fischer.de fischer injection system FIS EM Plus Annex B 1 Intended Use Specifications (part 1)



## Specifications of intended use (part 2)

#### **Base materials:**

 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 are designed in accordance with FprEN 1992-4:2017 and EOTA Technical Report TR 055

#### 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 EM Plus	
Intended Use Specifications (part 2)	Annex B 2



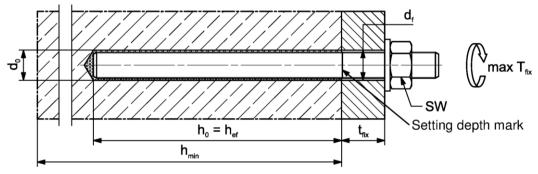
Table B3.1: Installation parameters for anchor rods													
Anchor rods Thread M8 M10 M12 M14 M16 M20 M22 M24 M27 M3												M30	
Width across flats		SW		13	17	19	22	24	30	32	36	41	46
Nominal drill hole dia	ameter	$d_0$		10	12	14	16	18	24	25	28	30	35
Drill hole depth		$h_0$						h <sub>0</sub> =	h <sub>ef</sub>				
Effective		h <sub>ef, min</sub>		60	60	70	75	80	90	93	96	108	120
embedment depth		h <sub>ef, max</sub>		160	200	240	280	320	400	440	480	540	600
Diameter of the	pre positioned installation	d <sub>f</sub>	[mm]	9	12	14	16	18	22	24	26	30	33
clearance hole of the fixture	push through installation	d <sub>f</sub>		12	14	16	18	20	26	28	30	33	40
Minimum thickness of concrete h <sub>min</sub>		h <sub>min</sub>			n <sub>ef</sub> + 30 (≥ 100)				h	l <sub>ef</sub> + 2d	l <sub>o</sub>		
Maximum torque moment for attachment of the fixture		max T <sub>fix</sub>	[Nm]	10	20	40	50	60	120	135	150	200	300



#### 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



<b>Table B4.1:</b> Minimum spacing and minimum edge distance for anchor rods and reinforcing bars												
Anchor rods			М8	M10	M12	M14	M16	-	M20	M22	M24	
Reinforcing bars (nominal diam	eter)	ф	8	10	12	14	16	18	20	22	24	
Minimum edge distance												
Uncracked / cracked concrete	C <sub>min</sub>	[mm]	40	45	45	45	50	55	55	55	60	
Minimum spacing	S <sub>min</sub>	[mm]				accordi	ng to Ar	nnex B5	5			
Minimum spacing												
Uncracked / cracked concrete	S <sub>min</sub>	[mm]	40	45	55	60	65	85	85	95	105	
Minimum edge distance	C <sub>min</sub>	[mm]				accordii	ng to Ar	nnex B5	5			
Required projecting area												
Uncracked concrete	oncrete	[1000	8	13	22	23	24	38,5	38,5	39,5	40	
Officiacked concrete	_ ^	[ 1000										
Cracked concrete	- A <sub>sp,req</sub>	mm <sup>2</sup> ]	6,5	10	16,5	17,5	18,5	29,5	29,5	30	30,5	
	- A <sub>sp,req</sub>			10	16,5 <b>M27</b>	17,5	18,5 <b>M30</b>	29,5	29,5	30	30,5	
Cracked concrete				- 26	•			29,5 - 32	29,5 - 34	30 - 36	30,5 - 40	
Cracked concrete  Anchor rods		mm²]	6,5	-	M27	-	M30	-	-	-	-	
Cracked concrete  Anchor rods  Reinforcing bars (nominal diam		mm²]	6,5	-	M27	-	M30	-	-	-	-	
Anchor rods Reinforcing bars (nominal diam Minimum edge distance	eter)	mm²]	6,5 - <b>25</b>	- 26	<b>M27</b> - 75	- 28	<b>M30 30</b>	- <b>32</b>	- <b>34</b>	- 36	- 40	
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete	eter)	mm²]	6,5 - <b>25</b>	- 26	<b>M27</b> - 75	- 28	<b>M30 30</b>	- <b>32</b>	- <b>34</b>	- 36	- 40	
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing	eter)	ф [mm]	6,5 - <b>25</b>	- 26	<b>M27</b> - 75	- 28	<b>M30 30</b>	- <b>32</b>	- <b>34</b>	- 36	- 40	
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing	eter) C <sub>min</sub> S <sub>min</sub>	mm²]	- <b>25</b> 75	- 26 75	<b>M27</b> - 75	- 28	M30 30 80 ng to Ai	- 32 120 nnex B5	- 34 120	- <b>36</b> 135	- 40 175	
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete	eter)  C <sub>min</sub> S <sub>min</sub>	ф [mm]	- <b>25</b> 75	- 26 75	<b>M27</b> - 75	- 28 80 accordin	M30 30 80 ng to Ai	- 32 120 nnex B5	- 34 120	- <b>36</b> 135	- 40 175	
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete Minimum edge distance	eter)  C <sub>min</sub> S <sub>min</sub>	ф [mm]	- <b>25</b> 75	- 26 75	<b>M27</b> - 75	- 28 80 accordin	M30 30 80 ng to Ai	- 32 120 nnex B5	- 34 120	- <b>36</b> 135	- 40 175	

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

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

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

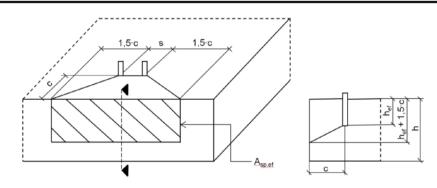
 $A_{\text{sp,req}} = \text{required projecting area}$ 

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

fischer injection system FIS EM Plus	
Intended Use Minimum spacing and edge distance for anchor rods and reinforcing bars	Annex B 4

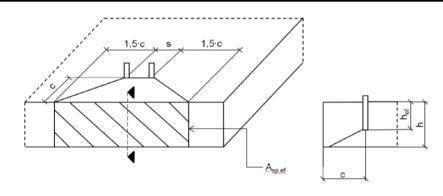


**Table B5.1:** Effective projecting area  $A_{sp,t}$  with concrete member thickness  $h > h_{ef} + 1,5 \cdot c$  and  $h \ge h_{min}$ 



Single anchor		$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with a > a
Group of anchors with	s > 3 · c	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$	[mm²]	with $c \ge c_{min}$
Group of anchors with	s ≤ 3 · c	$A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with $c \ge c_{min}$ and $s \ge s_{min}$

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



Single anchor		$A_{sp,t} = 3 \cdot c \cdot existing h$	[mm²]	with c ≥ c <sub>min</sub>
Group of anchors with	s > 3 · c	$A_{sp,t} = 6 \cdot c \cdot existing h$	[mm²]	With C ≥ C <sub>min</sub>
Group of anchors with	s ≤ 3 · c	$A_{sp,t} = (3 \cdot c + s) \cdot existing h$	[mm²]	with $c \ge c_{min}$ and $s \ge s_{min}$

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

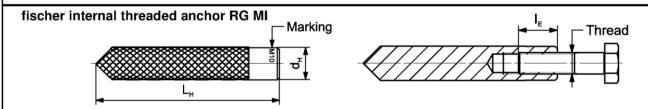
Figures not to scale

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 threeded anchers D	C MI	Throad	Mo	M10	Mido	M16	MAGG
Internal threaded anchors R	G WII	Thread	М8	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 <sub>0</sub>				$h_0 = h_{ef} = L_H$		
Effective embedment depth $(h_{ef} = L_H)$	h <sub>ef</sub>		90	90	125	160	200
Minimum spacing and minimum edge distance	S <sub>min</sub> = C <sub>min</sub>	[mm]	55	65	75	95	125
Diameter of clearance hole in the fixture	d <sub>f</sub>		9	12	14	18	22
Minimum thickness of concrete member	h <sub>min</sub>		120	125	165	205	260
Maximum screw-in depth	$I_{E,max}$	] [	18	23	26	35	45
Minimum screw-in depth	$I_{E,min}$		8	10	12	16	20
Maximum torque moment for attachment of the fixture	max T <sub>fix</sub>	[Nm]	10	20	40	80	120



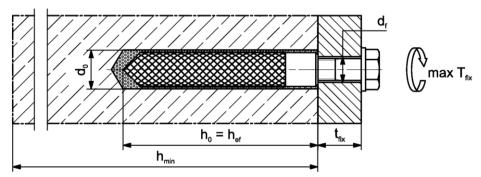
Marking: Anchor size e. g.: M10

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 <sup>1)</sup> 10 <sup>1)</sup> 12 <sup>1)</sup> 14 16 18 20 22 24												
Nominal drill hole diameter	d <sub>0</sub>		10 12	12 14	14 16	18	20	25	25	30	30	
Drill hole depth	$h_0$						$h_0 = h_{ef}$					
Effective	h <sub>ef,min</sub>	[mm]	60	60	70	75	80	85	90	94	98	
embedment depth	h <sub>ef,max</sub>	[]	160	200	240	280	320	360	400	440	480	
Minimum thickness of concrete member	h <sub>min</sub>		h <sub>ef</sub> + 30 (≥ 100)			h <sub>ef</sub> + 2d <sub>0</sub>						
Nominal diameter of the bar		ф	25	26	28	30	32	34	36	40	•	
Nominal drill hole diameter	$d_0$		30	35	35	40	40	40	45	55	-	
Drill hole depth	$h_0$						$h_0 = h_{ef}$					
Effective	h <sub>ef,min</sub>	[mm]	100	104	112	120	128	136	144	160	-	
embedment depth	h <sub>ef,max</sub>	[]	500	520	560	600	640	680	720	800	-	
Minimum thickness of concrete member	h <sub>min</sub>						h <sub>ef</sub> + 2d <sub>0</sub>	)				

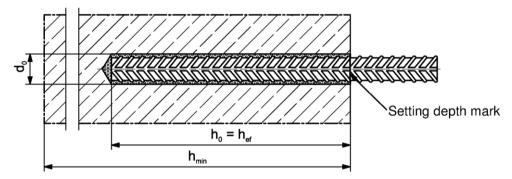
<sup>1)</sup> Both drill hole diameters can be used

#### Reinforcing bar



- The minimum value of related rib area f<sub>R,min</sub> must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range:  $0.05 \cdot \phi \le h_{rib} \le 0.07 \cdot \phi$ ( $\phi$  = 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 F	RA		Thread	M1:	2 <sup>1)</sup>	M16	M20	M24
Nominal diamete	er of the bar	ф		12	2	16	20	25
Width across flat	S	SW		19	9	24	30	36
Nominal drill hole	e diameter	d <sub>0</sub>		14	16	20	25	30
Drill hole depth		h <sub>0</sub>				h <sub>ef</sub>	+ l <sub>e</sub>	
Effective embed	mont donth	$h_{\text{ef},\text{min}}$		70	)	80	90	96
Effective embedi	пені аеріп	h <sub>ef,max</sub>		14	0	220	300	380
Distance concret welded joint	te surface to	l <sub>e</sub>	[]			10	00	
Minimum spacin minimum edge d		S <sub>min</sub> = C <sub>min</sub>	[mm]	55	5	65	85	105
Diameter of clearance hole	pre positioned anchorage	≤ d <sub>f</sub>		14	4	18	22	26
in the fixture	push through anchorage	≤ d <sub>f</sub>		18	3	22	26	32
Minimum thickne of concrete mem		$h_{min}$		h <sub>0</sub> + (≥ 1			$h_0 + 2d_0$	
Maximum torque attachment of the		max T <sub>fix</sub>	[Nm]	40	)	60	120	150

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

#### fischer rebar anchor FRA

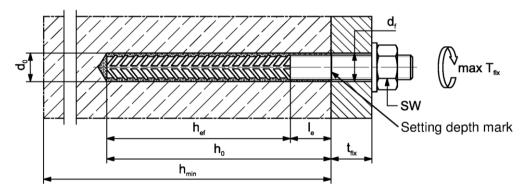


Marking frontal e. g:

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



<b>Table B9.1:</b> 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 <sub>0</sub>	[mm]	10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
Steel brush diameter	d <sub>b</sub>	[mm]	11	14	16	2	0	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 <sub>work</sub>	Minimum curing time t <sub>cure</sub>
±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

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

fischer injection system FIS EM Plus

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) Drill the hole. Nominal drill hole diameter do and drill hole depth ho 1 see tables B3.1, B6.1, B7.1, B8.1 Cleaning the drill hole: 2 Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) 2x Brush the drill hole twice. For drill hole diameter ≥ 30 mm use a power drill. 3 For deep holes use an extension. Corresponding brushes see table B9.1 Cleaning the drill hole: 4 Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) Go to step 6 Drilling and cleaning the hole (hammer drilling with hollow drill bit) Check a suitable hollow drill (see table B1.1) 1 for correct operation of the dust extraction Use a suitable dust extraction system, e. g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data 2 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 do and drill hole depth ho see tables B3.1, B6.1, B7.1, B8.1 Go to step 6 fischer injection system FIS EM Plus Annex B 10 Intended Use Installation instructions part 1



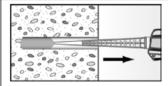
## Installation instructions part 2 Drilling and cleaning the hole (wet drilling with diamond drill bit) Drill the hole. Drill hole diameter **d**<sub>0</sub> and Break the drill core 1 nominal drill hole depth ho and remove it see tables B3.1, B6.1, B7.1, B8.1 2 Flush the drill hole with clean water until it flows clear 3 Blow out the drill hole twice, using oil-free compressed air (p > 6 bar) Brush the drill hole twice using a power drill. 4 Corresponding brushes see table B9.1 5 Blow out the drill hole twice, using oil-free compressed air (p > 6 bar) Preparing the cartridge Remove the sealing cap 6 Screw on the static mixer (the spiral in the static mixer must be clearly visible) 7 Place the cartridge into the dispenser Extrude approximately 10 cm of material out until 8 the resin is evenly grey in colour. Do not use mortar that is not uniformly grey fischer injection system FIS EM Plus Annex B 11 Intended use Installation instructions part 2



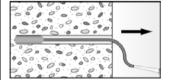
## Installation instructions part 3

Injection of the mortar

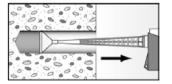




Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles



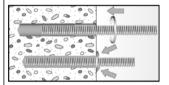
For drill hole depth ≥ 150 mm use an extension tube

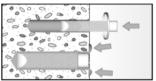


For overhead installation, deep holes ( $h_0 > 250$  mm) or drill hole diameter ( $d_0 \ge 40$  mm) use an injection-adapter

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

10



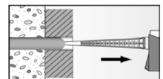


Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so.

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)



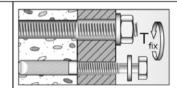
For push through installation fill the annular gap with mortar

11



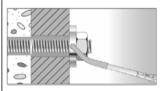
Wait for the specified curing time  $t_{\text{cure}}$  see **table B9.2** 

12



Mounting the fixture max T<sub>fix</sub> 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  $t_{\mbox{\scriptsize fix}}$  (usable length of the anchor)

fischer injection system FIS EM Plus

Intended use

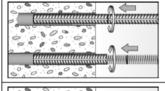
Installation instructions part 3

Annex B 12



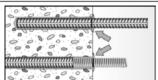
## Installation instructions part 4

Installation reinforcing bars and fischer rebar anchor FRA



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

10



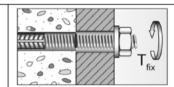
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

11



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

12



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

fischer injection system FIS EM Plus

Intended use

Installation instructions part 4

Annex B 13



Tabl		ntial chara of <b>fischer</b>						_	•	-		tensile	e / she	ear
Anch	or rod / standard th	readed rod			М8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Beari	ng capacity under t	ensile load	, stee	l failu	ıre									
O X v	Steel zinc plated		5.8		19	29	43	58	79	123	152	177	230	281
erstic N <sub>RK,s</sub>	Steel Zillo plated		8.8		29	47	68	92	126	196	243	282	368	449
racter	Stainless steel A4	Property class	50	[kN]	19	29	43	58	79	123	152	177	230	281
Characterstic resistance N <sub>Rk</sub>	and high corrosion	J. G.	70		26	41	59	81	110	172	212	247	322	393
و کا	resistant steel C		80		30	47	68	92	126	196	243	282	368	449
Partia	al factors 1)													
_	Steel zinc plated		5.8						1,	50				
acto	·		8.8						1,	50				
ial fa Yms.n	Stainless steel A4	Property class	50	[-]					2,	86				
Partial factor	and high corrosion		70						1,50 <sup>2)</sup>	/ 1,87				
	resistant steel C		80						1,	60				
	ng capacity under s	shear load,	steel	failu	re									
	ut lever arm					1			1	<u> </u>			<u> </u>	
rstic V <sup>0</sup> RK.s	Steel zinc plated		5.8		9	15	21	29	39	61	76	89	115	141
erst e Vº		Property	8.8		15	23	34	46	63	98	122	141	184	225
ract	Stainless steel A4	class	50	[kN]	9	15	21	29	39	61	76	89	115	141
Characterstic esistance V <sup>0</sup> Rk	and high corrosion		70		13	20	30	40	55	86	107	124	161	197
9	resistant steel C		80		15	23	34	46	63	98	122	141	184	225
	ity factor		k <sub>7</sub>	[-]					1	,0				
with	ever arm	Ι												
ct. M <sup>o</sup> Rk,s	Steel zinc plated		5.8		19	37	65	104	166	324	447	560	833	1123
l æ o		Property	8.8		30	60	105	167	266	519	716	896	1333	1797
Charact. istance M	Stainless steel A4	class	-	[Nm]	19	37	65	104	166	324	447	560	833	1123
Cesist	and high corrosion resistant steel C		70		26	52	92	146	232	454	626	784	1167	1573
_			80		30	60	105	167	266	519	716	896	1333	1797
Partia	al factors 1)		F 0						<u> </u>	05				
'n	Steel zinc plated		5.8							25 05				
fact		Property	8.8							25				
Partial factor		class	50	[-]						38				
Pa	and high corrosion resistant steel C		70							/ 1,56				
4)			80						1,	33				
<sup>1)</sup> Ir <sup>2)</sup> C	n absence of other na Only admissible for ste	itional regulated C, with f	ations <sub>/k</sub> / f <sub>uk</sub>	; ≥ 0,8	and A	<sub>5</sub> > 12	% (e.g	. fische	er anch	or rods	s)			
Peri Ess	her injection systematics formances ential characteristics identifying threaded rods				ıpacity	of fisc	her and	chor ro	ds and			Ann	ex C	1
stan	dard threaded rods													



Table C2.1:						el bearing inchors R0	<b>capacity</b> u <b>3 MI</b>	nder tensil	e / shear
fischer internal	threade	ed anchors	RG MI		М8	M10	M12	M16	M20
Bearing capacit	y unde	r tensile loa	ad, stee	el fail	ure				
		Property	5.8		19	29	43	79	123
Charact. resistance with	$N_{Rk,s}$	class	8.8	[kN]	29	47	68	108	179
screw	NRk,s	Property	_A4	וְנְאוֹן	26	41	59	110	172
		class 70	С		26	41	59	110	172
Partial factors <sup>1)</sup>									
		Property	5.8				1,50		
Partial factors	2/	class	8.8	[-]			1,50		
r artial lactors	$\gamma_{Ms,N}$	Property	_A4	ן נ־ז			1,87		
		class 70	С				1,87		
Bearing capacit	y unde	r shear load	d, steel	failu	re				
Without lever ar	m								
Observest		Property	5.8		9,2	14,5	21,1	39,2	62,0
Charact. resistance with	$V^0_{Rk,s}$	class	8.8	[kN]	14,6	23,2	33,7	54,0	90,0
screw	▼ Rk,s	Property	_A4	ווייין	12,8	20,3	29,5	54,8	86,0
		class 70	С		12,8	20,3	29,5	54,8	86,0
Ductility factor			k <sub>7</sub>	[-]			1,0		
With lever arm									
Charact		Property	5.8		20	39	68	173	337
Charact. resistance with	${\sf M^0}_{\sf Rk,s}$	class	8.8	[Nm]	30	60	105	266	519
screw	IVI RK,S	Property	_A4	[,,,,,,	26	52	92	232	454
		class 70	С		26	52	92	232	454
Partial factors <sup>1)</sup>									
		Property	5.8				1,25		
Partial factors	V. 4- 16	class	8.8	[-]			1,25		1,25 / 1,50 <sup>2)</sup>
artial lactors	$\gamma_{Ms,V}$	Property	_A4	' '			1,56		
		class 70	С				1,56		

<sup>1)</sup> In absence of other national regulations 2) Only for steel failure without lever arm

fischer injection system FIS EM Plus	
Performances Essential characteristics for the steel bearing capacity of fischer internal threaded anchor RG MI	Annex C 2



•	ential characteri d of <b>reinforcing</b>			the	ste	el	bea	arin	g	сар	aci	ty ι	ınd	er t	ens	ile	/ sh	ear	,
Nominal diameter of the	ne bar	ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Bearing capacity unde	r tensile load, stee	el failu	ure																
Characterstic resistance	N <sub>Rk,s</sub>	[kN]								A,	· f <sub>ul</sub>	(1) K							
Bearing capacity unde	r shear load, steel	failu	re																
Without lever arm																			
Characterstic resistance	v <sup>0</sup> <sub>Rk,s</sub>	[kN]							(	),5 ·	A <sub>s</sub> ·	$f_{uk}^{-1}$	)						
Ductility factor	k <sub>7</sub>	[-]									0,8								
With lever arm																			
Characteristic resistance	e M <sup>0</sup> <sub>Rk,s</sub>	[Nm]							1	,2 ·	W <sub>el</sub>	· f <sub>uk</sub>	1)						

 $<sup>^{1)}</sup>$   $f_{uk}$  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 tens	ile load, stee	l failu	ire			
Characterstic resistance	$N_{Rk,s}$	[kN]	63	111	173	270
Partial factors <sup>1)</sup>						
Partial factors	γ <sub>Ms,N</sub>	[-]		1	,4	
Bearing capacity under shea	ar load, steel	failur	е			
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 <sup>0</sup> <sub>Rk,s</sub>	[Nm]	92	233	454	785
Partial factors <sup>1)</sup>				•	•	
Partial factors	γ <sub>Ms,V</sub>	[-]		1,	56	

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

fischer injection system FIS EM Plus

Performances
Essential characteristics for the steel bearing capacity of reinforcing bars and fischer rebar anchors FRA

Annex C 3



Caracked concrete   K <sub>Ucr.N</sub>   [-]   11,0   7,7   Cotors for the compressive strength of concrete   C20/25	Size									Alls	sizes				
Time	Tensile load														
Total   Tota	Uncracked conc	rete	k <sub>ucr,N</sub>							11	1,0				
C25/30   C30/37   Teasing   C35/45   Tor for τ <sub>Rix</sub>   C40/50   C45/55   C50/60   To for τ <sub>Rix</sub>   C40/50   To for τ <sub>Rix</sub>   C45/55   To for τ <sub>Rix</sub>   To for τ <sub>Rix</sub>	Cracked concret	te		[-]						7	,7				
C30/37   C35/45   C40/50   C45/55   C50/60   T1,006   T1,007   T1,008   T1,009	Factors for the	compressive strer	ngth of	concr	ete	> C2	20/25	,							
Casing tor for τ <sub>Rik</sub>   Cab/55   Cab/55   Cab/55   Cab/55   Cab/55   Cab/55   Cab/60   Cab		C25/30								1,	02				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	_	C30/37								1,	04				
	Increasing -	C35/45	176	.,						1,	06				
	factor for $\tau_{Rk}$	C40/50	$\Psi_{c}$	[-]						1,	07				
Ititing failure	_	C45/55								1,	08				
$\frac{\text{n / h}_{\text{ef}} \geq 2.0}{2.0 > \text{h / h}_{\text{ef}} > 1.3} \ \text{h / h}_{\text{ef}} \leq 1.3} \ \text{c}_{\text{cr,sp}} \  _{\text{Imm}} \   \  \  \  \  \  \  \  \  \  \  \  \ $	_	C50/60								1,	09				
Core	Splitting failure	)													
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		h / h <sub>ef</sub> ≥ 2,0								1,0	h <sub>ef</sub>				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Edge distance	$2.0 > h / h_{ef} > 1.3$	$C_{cr,sp}$	[mm]						4,6 h <sub>ef</sub>	- 1,8 ł	ı			
Cor.N   Cor				_ [[[[[[[]]]]						2,2	6 h <sub>ef</sub>				
The property of the part of	Spacing		S <sub>cr,sp</sub>							2 0	cr,sp				
Core	Concrete cone	failure													
Scr,N   Scr	Edge distance		$C_{cr,N}$	[mm]						1,5	h <sub>ef</sub>				
bustness factor γ <sub>inst</sub> [-] 1,0  ncrete pry-out failure ctor for pry-out failure ctor for pry-out failure	Spacing		$s_{\text{cr},N}$	נייייין						2 (	cr,N				
Color for pry-out failure   K8   [-]   2,0	Shear load														
Color for pry-out failure   K8   [-]   2,0	Robustness fact	or	γinst	[-]						1	,0				
M8   M10   M12   M14   M16   M20   M22   M24   M27   M32   M34   M35	Concrete pry-o	ut failure													
M8         M10         M12         M14         M16         M20         M22         M24         M27         M24           Cher anchor rods and indard threaded rods         dnom         8         10         12         14         16         20         22         24         27         3           Cher retrial threaded anchors RG MI cher rebar anchor FRA         dnom         12         16         18         -         22         28         -	Factor for pry-ou	ıt failure	k <sub>8</sub>	[-]						2	,0				
ther anchor rods and indard threaded rods does does does does does does does d	Calculation dia	meters													
Indicated threaded rods     Image: square of the bar of the ba	Size				M	8 1	M10	M12	M14	M16	M20	M22	M24	M27	МЗ
ther remail threaded anchors RG MI dom cher rebar anchor FRA dom dom dom dom dom dom cher rebar anchor FRA dom			٦		Ω		10	12	14	16	20	22	24	27	30
ernal threaded anchors RG MI	standard thread	ed rods	Unom		0		10	12	14	10	20	22	24	21	30
e (nominal diameter of the bar)				[mm]	12	2	16		-			-		-	-
	fischer rebar and	chor FRA	$d_{nom}$		-	Д,	-	12	-	16	20	-	25		<u> </u>
inforcing bar d <sub>nom</sub> [mm] 8 10 12 14 16 18 20 22 24 25 26 28 30 32 34 36	Size (nominal di	ameter of the bar)		ф	8	10	12 1	4 16	18 20	22 2	4 25	26 28	30 3	2 34	36 4
	Reinforcing bar		$d_{nom}$	[mm]	8	10	12 1	4 16	18 20	22 2	4 25	26 28	30 3	2 34	36 4
	fischer internal threaded fischer rebar and	d anchors RG MI chor FRA	d <sub>nom</sub>	ф	12	2	16 - 12 1	18 12 4 16	- 18 20	22 16 22 2	28 20 4 25	- 26 28	- 25 30 3	- 2 34	
<del>-</del>	fischer inject	tion system FIS I	EM PI	us											
scher injection system FIS EM Plus		<b>,</b>										$\neg$	Ann	_	



s	ssential standard incracke	thread	ded rod	<b>s</b> in h	amme						nor ro	ods ar	nd
Anchor rod / standa	ard thread	led rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pullout a	and concr	ete con	e failure										
Calculation diameter		d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked concrete	e												
Characteristic bond	l resistan	ce in un	cracked (	concre	te C20	)/25							
Hammer-drilling with	standard	drill bit o	r hollow d	rill bit (	dry or	wet co	ncrete)	!					
Tem- I: 35 °C	/ 60 °C		2-	18	18	18	17	17	16	15	15	15	14
perature II: 50 °C	/ 72 °C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	18	17	17	16	16	15	14	14	14	13
Hammer-drilling with	standard	drill bit o	r hollow d	rill bit (	water i	filled ho	 ole)						
Tem- I: 35 °C				16	16	15	13	13	11	11	10	10	9
perature		$\tau_{\text{Rk},\text{ucr}}$	[N/mm <sup>2</sup> ]	15	14	14	13	12	11	10	10	9	9
range II: 50 °C Diamond-drilling (dry		ncrete a	s well as v						_ ''	1 .0			
Tem- I: 35 °C		oto a		16	15	13	12	12	10	10	10	9	9
perature 50 0		$\tau_{\text{Rk},\text{ucr}}$	[N/mm <sup>2</sup> ]										
range				15	14	12	11	11	10	9	9	8	8
Robustness factors	5							1	0				
Dry or wet concrete Water filled hole		$\gamma_{inst}$	[-]						,0 ,4				
Cracked concrete								1	,+				
Characteristic bond	l resistan	ce in cr	cked co	ncrete	C20/2	5							
Hammer-drilling with							ncrete						
Tem- I: 35 °C				7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
perature 50 0		$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]			9				<u> </u>	<u> </u>		
range		000urt-1		7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Diamond - drilling (dr Tem- 1: 35 °C	•	<u>oncrete)</u>		_	_	-	_		_	_	_	_	-
perature — oo o		$ au_{Rk,cr}$	[N/mm²]	7	7	7	7	6	6	7	7	7	7
range II: 50 °C	/ 72 °C	TINJUI		7	7	7	7	6	6	7	7	7	7
Hammer-drilling with	standard	drill bit o	r hollow d	rill bit a	and dia	mond-	drilling	(water	filled	nole)			
Tem- I: 35 °C	/ 60 °C	_	[N]/ma :== 21	6	7,5	7,5	7	6	6	6	6	6	6
perature II: 50 °C	/ 72 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6	7	7	7	6	6	6	6	6	6
Robustness factors	3				·				·				'
Dry or wet concrete		۸,	ſ_ <b>1</b>					1	,0				
Water filled hole		γinst	[-]			1,2					1,4		
										_			
fischer injection  Performances Essential character threaded rods				or fisch	er anch	nor rod	and st	andarc	i		Ann	ex C	5
R75 18												8.06.01.	



Internal threaded		•				holes; <b>unc</b> i		
<u> </u>	anchor RG	МІ		M8	M10	M12	M16	M20
0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	and concr	ete con	e failure					
Calculation diamete	er	d	[mm]	12	16	18	22	28
Uncracked concre	ete							
Characteristic bor	nd resistan	ce in un	cracked	concrete C20	)/25			
Hammer-drilling wit	h standard	drill bit c	r hollow d	Irill bit (dry or	wet concrete)			
	C / 60 °C		22	15	14	14	13	12
perature ———— range II: 50 °	C / 72 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	14	13	13	12	11
Hammer-drilling wit	th standard	drill bit c	r hollow d	ı Irill bit (water i	filled hole)			
	C / 60 °C			14	12	12	11	10
perature	C / 72 °C	$\tau_{\text{Rk},\text{ucr}}$	[N/mm <sup>2</sup> ]	13	12	11	10	9
ango		norete -	o woll as :			11	10	<u> </u>
<u>Diamond-drilling (d</u> Tem- 1: 35 º		ncrete a	s well as v				- 10	
perature ———	C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	13	12	11	10	9
range II: 50 °	C / 72 °C	- m,ucr		12	11	10	9	8
Robustness facto	rs							
Dry or wet concrete	<del>)</del>	24	[-]			1,0		
Water filled hole		$\gamma$ inst	[-]			1,4		
Cracked concrete								
Characteristic bor	nd resistan	ce in cr	acked co	ncrete C20/2	5			
Hammer-drilling wit	h standard	drill bit c	r hollow d	Irill bit and dia	mond-drilling	(dry or wet co	oncrete)	
	C / 60 °C		22	7	6	6	7	7
perature ———— range II: 50 °	C / 72 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7	6	6	7	7
Hammer-drilling wit		drill bit c	r hollow d	lrill bit and dia	mond-drilling	(water filled h	nole)	
	C / 60 °C	arm bit c	11011011	7	6,5	6	6	6
perature 55		$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]				-	
ange	C / 72 °C			7	6	6	6	6
Robustness facto								
Dry or wet concrete Water filled hole	<del></del>	γinst	[-]			1,0		
Matar fillad bala		, 11130			1,2		1,	4



	Essential hammer (														_					
Nominal diameter	of the bar		ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combined pullout	and concr	ete con	e failure																	
Calculation diamete	r	d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracked concre	te																			
Characteristic bon	d resistan	ce in un	cracked	con	cre	te C	20/2	25												
Hammer-drilling with	n standard	<u>drill bit o</u>	r hollow c	rill I	bit (d	dry c	r we	et co	ncre	ete)										
Tem- I: 35 °C	C / 60 °C		53.11 23	16	15	15	14	14	13	13	13	12	12	12	12	12	12	11	11	11
perature II: 50 °C	C / 72 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15	14	14	13	13	12	12	12	12	11	11	11	11	11	11	10	10
Hammer-drilling with	n standard	drill bit o	r hollow c	rill I	bit (\	∟ vate									<u> </u>					
	C / 60 °C			16			13				11	10	10	10	10	9	9	9	8	8
perature 50 c		$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]																	
range II: 50 °C				15		13	12	12	11	11	10	10	9	9	9	9	8	8	8	8
Diamond-drilling (dr	•	ncrete a	s well as y																	
Tem- I: 35 °C	C / 60 °C	τ	[N/mm²]	16	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
range II: 50 °C	C / 72 °C	$\tau_{Rk,ucr}$	[[[]	15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Robustness factor	s																			
Dry or wet concrete												1,0								
Water filled hole		γinst	[-]									1,4								
Cracked concrete																				
Characteristic bon	d resistan	ce in cra	acked co	ncr	ete (	C20/	25													
Hammer-drilling with	n standard	drill bit o	r hollow c	irill l	bit (d	dry c	r we	et co	ncre	ete)										
	C / 60 °C		2-	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
perature II: 50 °C	C / 72 °C	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Diamond-drilling (dr		ncrete)																		
Tem- I: 35 °C	-			7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
perature —		$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	<u>'</u>								_				-				
range II: 50 °C					7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Hammer-drilling with		<u>drill bit o</u>	<u>r hollow c</u>								<del>i                                     </del>			hole						
Tem- I: 35 °C	C / 60 °C	<i>T</i> =:	[N/mm²]	6	7,5	6,5	6,5	6,5	6	6	6	6	6	6	6	6	5	5	5	5
range II: 50 °C	C / 72 °C	$\tau_{Rk,cr}$	[[[, 4,]	6	6,5	6,5	6	6	6	6	6	6	6	6	6	6	5	5	5	5
Robustness factor	s																			
Dry or wet concrete			[]									1,0								
Water filled hole		$\gamma$ inst	[-]			1	,2								1,4					
fischer injection  Performances  Essential characte				or re	einfo	rcinç	g ba	rs								An	ine	x C	7	



Combined pullout and co			M12	M16	M20	M24
	ncrete con	e failure				
Calculation diameter	d	[mm]	12	16	20	25
Jncracked concrete						
Characteristic bond resis	tance in ur	cracked o	concrete C20/25	5		
Hammer-drilling with standa	ard drill bit o	r hollow d	rill bit (dry or wet	concrete)		1
Fem- I: 35 °C / 60 °C perature		[N/mm <sup>2</sup> ]	15	14	13	12
ange II: 50 °C / 72 °C	τ <sub>Rk,ucr</sub>	ן ניאיווווו	14	13	12	12
Hammer-drilling with standa	ard drill bit o	r hollow d	rill bit (water fille	d hole)		
Гет- I: 35°C / 60°C	<u> </u>	2-	14	12	11	10
perature II: 50 °C / 72 °C	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	13	12	11	9
ange II: 50 °C / 72 °C Diamond-drilling (dry or we		ıs well as v				
Fem- I: 35 °C / 60 °C		1.011 40	13	12	10	9
perature	τ <sub>Βk μοτ</sub>	[N/mm <sup>2</sup> ]				
ango			12	11	10	9
Robustness factors				1,	0	
Ory or wet concrete  Water filled hole	—— γ <sub>inst</sub>	[-]		1,		
Cracked concrete				',	<del>-</del>	
Characteristic bond resis	tance in cr	acked cor	ncrete C20/25			
Hammer-drilling with standa				nd-drilling (dry o	wet concrete)	
Гет- I: 35 °C / 60 °С			8	8	8	8
perature II: 50 °C / 72 °C	τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	8	8	8	8
ange II: 50 °C / 72 °C Hammer-drilling with standa		r hollow d				
Tem- I: 35 °C / 60 °C		1	7	6	6	6
perature —	Tp.	[N/mm <sup>2</sup> ]	7			
ange II: 50 °C / 72 °C	<i></i>		/	6	6	6
Robustness factors						
Ory or wet concrete  Water filled hole	— γ <sub>inst</sub>	[-]	4	1,		1
vater filled flole			- 1	,2	l	,4



Table (	C9.1: Dis	placem	ents for	ancho	r rods						
Anchor	rod	M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Displace	ment-Factors	for tensi	le load <sup>1)</sup>								
Uncrack	ed or cracked	concrete	; Tempe	rature ra	nge I, II						
$\delta_{\text{N0-Factor}}$	[mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10	0,11	0,11	0,12	0,12	0,13
$\delta_{\text{N}\infty\text{-Factor}}$	[[[[[[]]/([N/[[[[]]/])]	0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19
Displace	ment-Factors	for shea	r load <sup>2)</sup>								
Uncrack	ed or cracked	concrete	; Tempe	rature ra	nge I, II						
$\delta_{\text{V0-Factor}}$	[mm/kN]]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05
$\delta_{\text{V}_{\infty}\text{-Factor}}$	[mm/kN]	0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07

<sup>1)</sup> Calculation of effective displacement:

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

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

(τ<sub>Ed</sub>: Design value of the applied tensile stress)

<sup>2)</sup> Calculation of effective displacement:

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

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

(V<sub>Ed</sub>: Design value of the applied shear force)

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

Internal anchor F	threaded RG MI	M8	M10	M12	M16	M20
Displace	ement-Factors	for tensile load1)				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
$\delta_{\text{N0-Factor}}$	[mm/(N/mm <sup>2</sup> )]	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
Displace	ment-Factors	for shear load <sup>2)</sup>				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
$\delta_{\text{V0-Factor}}$	[mm/kN]]	0,12	0,09	0,08	0,07	0,05
δ <sub>V∞-Factor</sub>	[mm/kN]	0,18	0,14	0,12	0,10	0,08

1) Calculation of	effective di	splacement:
-------------------	--------------	-------------

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

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

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

<sup>2)</sup> Calculation of effective displacement:

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

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

(V<sub>Ed</sub>: Design value of the applied shear force)

fischer injection system FIS EM Plus

#### **Performances**

Displacements for anchor rods and fischer internal threaded anchors RG MI



	diameter $\Phi$	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
of the ba	ar ·																	
	ement-Factors ed or cracked					uro r	ange											
$\delta_{N0-Factor}$									0 11	0 12	0.12	0 12	0.13	0.13	0.13	0 14	0 14	0 -
δ <sub>N∞-Factor</sub>	[mm/(N/mm²)]	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	0.2
	ement-Factors					0,10	0,10	0,10	0,17	0,10	0,10	0,10	0,10	0,10	0,20	0,20	0,21	Ο,.
	ed or cracked					ure r	ange	I, II										
S <sub>V0-Factor</sub>							0,08		0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,04	0,04	0,
δ <sub>V∞-Factor</sub>	[mm/kN]		_			_	0,12			_						_	_	-
	lation of effecti	ve dis	splace	ement	::			<sup>2)</sup> C	alcul	ation	of effe	ective	displ	acem	ent:			
	$\delta_{\text{N0-Factor}} \cdot \tau_{\text{Ed}}$		-							S <sub>V0-Fac</sub>								
	$\delta_{N_{\infty}\text{-Factor}} \cdot \tau_{Ed}$									δ <sub>V∞-Fac</sub>								
	Design value of	f the a	applie	d tens	sile s	tress)				Desig			he ap	plied	shea	r forc	e)	
ischer r	ebar anchor		N	112				M16				M20				M2	24	
			!! -		.1\					_								_
	ment-Factors	tor te	ansiie	i load	• /													
Displace	ement-Factors ed or cracked					ure r	ange	I, II										
Displace Uncrack	ed or cracked	conc	rete;			ure r		<b>I, II</b> 0,10				0,11				0,1	12	
Displace Uncrack δ <sub>N0-Factor</sub>		conc	rete;	Tem		ure r						0,11				0,1		
Displace Uncrack S <sub>N0-Factor</sub> S <sub>N∞-Factor</sub>	ed or cracked	conc	rete; 0 0	<b>Tem</b> ,09 ,13	perat	ure r		0,10										
Displace Uncrack Š <sub>N0-Factor</sub> Š <sub>N∞-Factor</sub> Displace	ed or cracked [mm/(N/mm <sup>2</sup> )]	for s	orete; 0 0 hear	<b>Tem</b> ,09 ,13 <b>load</b> <sup>2</sup>	perat			0,10 0,15										
Displace Uncrack  No-Factor  Displace Uncrack	[mm/(N/mm²)] ement-Factors ed or cracked	for s	o hear crete;	Tem <sub>1</sub> ,09 ,13 load <sup>2</sup> Tem <sub>1</sub>	perat		ange	0,10 0,15 <b>I, II</b> 0,09				0,16				0,1	06	
Displace Uncrack No-Factor N∞-Factor	ed or cracked [mm/(N/mm²)] ement-Factors ed or cracked	for s	o hear crete;	Tem <sub>1</sub> ,09 ,13 load <sup>2</sup> Tem <sub>1</sub>	perat		ange	0,10 0,15 <b>I, II</b>				0,16				0,1	06	
Displace Uncrack  No-Factor  N∞-Factor  Displace Uncrack  No-Factor  Ovo-Factor	[mm/(N/mm²)] ement-Factors ed or cracked	for s	crete; 0 0 hear crete; 0	Tem <sub> </sub> ,09 ,13 load <sup>2</sup> Tem <sub> </sub> ,12 ,18	perat		ange	0,10 0,15 <b>I, II</b> 0,09	<sup>2)</sup> Ca	lculat	on of	0,16		isplac	ceme	0,0	06	
Displace Uncrack  No-Factor  Displace Uncrack  Ovo-Factor  1) Calcu  δ <sub>N0</sub> =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effection $\delta_{\text{N0-Factor}} \cdot \tau_{\text{Ed}}$	for s	crete; 0 0 hear crete; 0	Tem <sub> </sub> ,09 ,13 load <sup>2</sup> Tem <sub> </sub> ,12 ,18	perat		ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m VC}$	$\delta_{V0} = \delta_{V0}$	-Factor	0,16 0,07 0,11 effec		isplac	ceme	0,0	06	
Displace Jncrack No-Factor Displace Jncrack Vo-Factor  1) Calcu δ <sub>N0</sub> = δ <sub>N∞</sub> =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack SN0-Factor Displace Jncrack SV0-Factor  SV∞-Factor  1) Calcu δN0 = δN∞ =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effection $\delta_{\text{N0-Factor}} \cdot \tau_{\text{Ed}}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V0} = \delta_{V0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Uno-Factor Vo-Factor  1) Calcut δ <sub>N0</sub> = δ <sub>N∞</sub> =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack No-Factor Displace Jncrack Vo-Factor  1) Calcu δ <sub>N0</sub> = δ <sub>N∞</sub> =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Uno-Factor Vo-Factor  1) Calcut δ <sub>N0</sub> = δ <sub>N∞</sub> =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack No-Factor Displace Jncrack Vo-Factor  1) Calcu δ <sub>N0</sub> = δ <sub>N∞</sub> =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack δNo-Factor Displace Jncrack δVo-Factor 1) Calcu δNo = δNo =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack δNo-Factor Displace Jncrack δVo-Factor 1) Calcu δNo = δNo =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack δNo-Factor Displace Jncrack δVo-Factor 1) Calcu δNo = δNo =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack SN0-Factor Displace Jncrack SV0-Factor  SV∞-Factor  1) Calcu δN0 = δN∞ =	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s	o hear crete; 0 0	Tem ,09 ,13 load <sup>2</sup> Tem ,12 ,18	perat	ure r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	
Displace Jncrack SNo-Factor Displace Jncrack SVo-Factor  1) Calcu δNo =  δNo =  (τEd:	ed or cracked $[mm/(N/mm^2)]$ ement-Factors ed or cracked $[mm/kN]$ ulation of effecti $\delta_{N0\text{-Factor}} \cdot \tau_{Ed}$ $\delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$	for s cond	hear o o splace	Temponda (1900) Temponda (1900	perat	ture r	ange	0,10 0,15 <b>I, II</b> 0,09	$\delta_{ m Vo}$	$\delta_{V_0} = \delta_{V_0}$ $\delta_{V_0} = \delta_{V_0}$	-Factor -Factor	0,16 0,07 0,11 effec · V <sub>Ed</sub> · V <sub>Ed</sub>	tive d	·		0,0 0,0 0,0	06	



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				M10	M12	M14	M16	M20	M22	M24	M27	M30
Bearing capacity unde												
fischer anchor rods a	nd standard t		ed ro	ds, per		ice cate	egory (	<b>)</b> 1				
୍ରଥ Steel zinc plated		5.8		29	43	58	79	123	152	177	230	281
Steel zinc plated		8.8		47	68	92	126	196	243	282	368	449
항 Stainless steel A	Property 4 class	50	[kN]	29	43	58	79	123	152	177	230	281
sta and high corrosic		70		41	59	81	110	172	212	247	322	393
resistant steel C		80		47	68	92	126	196	243	282	368	449
fischer anchor rods a	nd standard t	hreade	ed ro	ds, per	formar	ice cate	egory C	2				
,,C2		5.8		-	39	-	72	108	-	177	-	-
N Steel zinc plated		8.8		-	61	-	116	173	-	282	-	-
Stainless steel A	Property 4 class	50	[-]	-	39	-	72	108	-	177	-	-
ਬ੍ਰਿਸ਼ and high corrosic		70		-	53	-	101	152	-	247	-	-
resistant steel C		80		-	61	-	116	173	-	282	-	-
Bearing capacity unde	er shear load,	steel	failur	e with	out lev	er arm <sup>1</sup>	)					
fischer anchor rods, p												
, 0		5.8		15	21	29	39	61	76	89	115	141
୍ଥି Steel zinc plated		8.8		23	34	46	63	98	122	141	184	225
Characterstic Standard Standar	Property 4 class	50	[kN]	15	21	29	39	61	76	89	115	141
and high corrosio		70		20	30	40	55	86	107	124	161	197
resistant steel C		80		23	34	46	63	98	122	141	184	225
Standard threaded roo	ds, performan	ice cat	egor	y C1								
, C1		5.8		11	15	20	27	43	53	62	81	99
<u>ನ್ ಜ್ಞೆ</u> Steel zinc plated		8.8		16	24	32	44	69	85	99	129	158
Characterstic Stance Constant Stance Stainless steel A and high corrosic resistant steel C	Property 4 class	50	[kN]	11	15	20	27	43	53	62	81	99
Stainless steel A and high corrosic		70		14	21	28	39	60	75	87	113	138
o resistant steel C		80		16	24	32	44	69	85	99	129	158
fischer anchor rods a	nd standard t	hreade	ed ro		∟ ·formar		eaorv C					
22		5.8		-	14	-	27	43	-	62	-	_
Characterstic Stance Costs Stainless steel A and high corrosic resistant steel C		8.8		-	22	-	44	69	_	99	-	_
Se Ver	Property	50	[-]	-	14	-	27	43	_	62	-	-
हिंदू Stainless steel A and high corrosid		70	.,	-	20	-	39	60	_	87	-	_
Stainless steel A and high corrosic resistant steel C		80		-	22	-	44	69	-	99	-	-
1) Partial safety factor	s for performa		tegor	v C1 o		e table						L

'' Partial safety 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

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#### **Performances**

Essential characteristics for the steel bearing capacity for fischer anchor rods and standard threaded rods under seismic action (performance category C1 / C2)



**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<sup>1)</sup>

Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1

Characterstic resistance N<sub>Rk,s,C1</sub> [kN] 44 63 85 111 140 173 209 249 270 292 339 389 443

Bearing capacity under shear load, steel failure without lever arm<sup>1)</sup>

Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1

Characterstic resistance V<sup>0</sup><sub>Rk,s,C1</sub> [kN] 15 | 22 | 30 | 39 | 49 | 61 | 74 | 88 | 95 | 102 | 119 | 137 | 155

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

Anch	or rod / standard thi	readed rod			M10	N	<b>/</b> 112	M14	М	16	M20	M:	22	M24	M2	7	M30
Nomi	nal diameter of the l	bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Tens	ile load, steel failure	1)															
7	Ota al mina relate d		5.8								1,50						
YMs,h	Steel zinc plated		8.8								1,50						
ctor	Stainless steel A4	Property class	50								2,86						
al fa	and high corrosion	Olado	70	[-]						1,5	$50^{2)} / 1$	,87					
Partial factor <sub>YMs,N</sub>	resistant steel C		80								1,60						
"	Reinforcing bar	В	500B								1,40						
Shea	r load, steel failure <sup>1)</sup>																
>	Stool zine plated		5.8								1,25						
YMs,	Steel zinc plated		8.8								1,25						
ctor	Stainless steel A4	Property class	50	. 1							2,38						
Partial factor ‱,v	and high corrosion	o la o o	70	[-]						1,2	25 <sup>2)</sup> / 1	,56					
artië	resistant steel C		80								1,33						
"	Reinforcing bar	В	500B								1,50						

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

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#### **Performances**

Essential characteristics for the steel bearing capacity for reinforcing bars under seismic action (performance category C1); partial safety factors (performance category C1 / C2)

<sup>1)</sup> Partial factors for performance category C1 see table C12.2

<sup>&</sup>lt;sup>2)</sup> Only admissible for steel C, with  $f_{yk}$  /  $f_{uk} \ge 0.8$  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 ro	od /	standard threa	ded rod		M10	M12	M14	M16	M20	M22	M24	M27	M30
Characte	risti	c bond resista	nce, com	bined pu	llout ar	d cond	rete co	ne fail	ure				
Hammer-	drill	ing with standa	ard drill k	oit or holl	ow drill	bit (dr	y or we	t conc	rete)				
Tem- perature -	l:	35 °C / 60 °C	_ ~	[N/mm <sup>2</sup> ]	7,0	7,0	6,7	6,0	5,7	6,7	6,7	6,7	6,7
range	II:	50 °C / 72 °C	- τ <sub>Rk,C1</sub>		7,0	7,0	6,7	5,7	5,7	6,7	6,7	6,7	6,7
Hammer-	drill	ing with standa	ard drill k	oit or holl	ow drill	bit (wa	ater fille	ed hole	)				
Tem- perature -	l:	35 °C / 60 °C		[N/mm <sup>2</sup> ]	7,5	7,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7
range	II:	50 °C / 72 °C	— τ <sub>Rk,C1</sub>		6,8	6,8	6,5	5,7	5,7	5,7	5,7	5,7	5,7
Robustne	ess f	actors											
tensile lo	ad												
Dry or wet	cor	ncrete		r 1					1,0				
Water fille	d ho	ole	— γinst	[-]		1	,2				1,4		
shear loa	d												
All installa	tion	conditions	γinst	[-]					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		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Characteristic bond resistan	ce, com	bined pu	llout	and o	conc	rete d	cone	failu	re						
Hammer-drilling with standa	rd drill b	oit or holl	ow di	rill bi	t (dry	or v	vet c	oncre	ete)						
Tem- I: 35 °C / 60 °C	_	[N/mm <sup>2</sup> ]	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
range II: 50 °C / 72 °C	τ <sub>Rk,C1</sub>		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 standa	rd drill k	oit or holl	ow di	rill bi	t (wa	ter fi	lled h	nole)							
Tem- I: 35 °C / 60 °C		[N/mm <sup>2</sup> ]	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
perature II: 50 °C / 72 °C	τ <sub>Rk,C1</sub>		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
Robustness factors															
Tensile load															
Dry or wet concrete									1,0						
Water filled hole	γinst	[-]			1,2						1	,4			
Shear load															
All installation conditions	γinst	[-]							1,0						

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### **Performances**

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



**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 threa	ded rod		M12	M16	M20	M24
Characteristic bond resistar	ice, com	bined pu	llout and concre	ete cone failure		
Hammer-drilling with standa	ırd drill k	oit or holle	ow drill bit (dry	or wet concrete	<del>)</del>	
Tem- I: 35 °C / 60 °C		[N/mm <sup>2</sup> ]	2,2	3,5	1,8	2,4
perature II: 50 °C / 72 °C	τ <sub>Rk,C2</sub>		2,2	3,5	1,8	2,4
Hammer-drilling with standa	ırd drill k	oit or holl	ow drill bit (wat	er filled hole)		
Tem- I: 35 °C / 60 °C	_	[N/mm <sup>2</sup> ]	2,3	3,5	1,8	2,1
perature II: 50 °C / 72 °C	τ <sub>Rk,C2</sub>	[[M/MM]]	2,3	3,5	1,8	2,1
Robustness factors						
Tensile load						
Dry or wet concrete	,	[-]		1	,0	
Water filled hole	γinst	[-]	1	,2	1,	4
Shear load						
All installation conditions	$\gamma$ inst	[-]		1	,0	
Displacement-Factors for te	nsile loa	ıd¹)				
$\delta_{N,(DLS)}$ -Factor	[mm	/(N/mm²)]	0,09	0,10	0,11	0,12
$\delta_{N,(ULS) ext{-}Factor}$		(14/111111 )]	0,15	0,17	0,17	0,18
Displacement-Factors for sh	near load	12)				
$\delta_{ m V,(DLS) ext{-}Factor}$	[m	ım/kN]	0,18	0,10	0,07	0,06
$\delta$ V,(ULS)-Factor	["	III/KINJ	0,25	0,14	0,11	0,09

<sup>1)</sup> Calculation of effective displacement:

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

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

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

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

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

(V<sub>Ed</sub>: Design value of the applied shear force)

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#### **Performances**

Essential characteristics under seismic action (performance category C2) for fischer anchor rods and standard threaded rods

<sup>&</sup>lt;sup>2)</sup> Calculation of effective displacement: