



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 17 June 2020

English translation prepared by DIBt - Original version in German language

#### **General Part**

Technical Assessment Body issuing the European Technical Assessment:

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

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

This version replaces

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

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

EAD 330499-01-0601

ETA-17/0979 issued on 22 July 2019



# European Technical Assessment ETA-17/0979

Page 2 of 41 | 17 June 2020

English translation prepared by DIBt

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.



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

Page 3 of 41 | 17 June 2020

English translation prepared by DIBt

#### **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 or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

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

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex B 3 to B 8, C 1 to C 12
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 to C 4
Displacements under short-term and long-term loading	See Annex C 13 and C 14
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 15 to C 18

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

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



# European Technical Assessment ETA-17/0979

Page 4 of 41 | 17 June 2020

English translation prepared by DIBt

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

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

The system to be applied is: 1

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

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

Issued in Berlin on 17 June 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow Head of Department

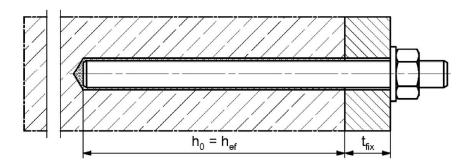
beglaubigt: Baderschneider



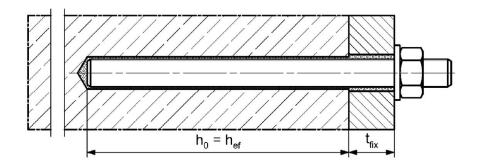
# Installation conditions part 1

fischer anchor rod

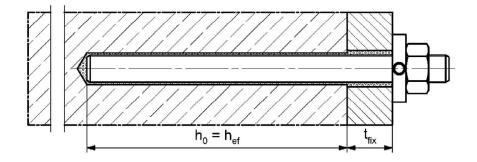
#### **Pre-positioned installation**



Push through installation (annular gap filled with mortar)



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



Figures not to scale

 $h_0 = drill hole depth$ 

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

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

fischer injection system FIS EM Plus

**Product description** 

Installation conditions part 1

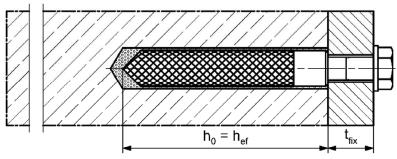
Annex A 1



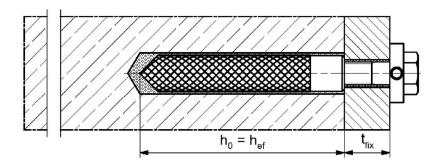
## Installation conditions part 2

fischer internal threaded anchor RG MI

#### **Pre-positioned installation**



Pre-positioned installation with subsequently injected fischer filling disc (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

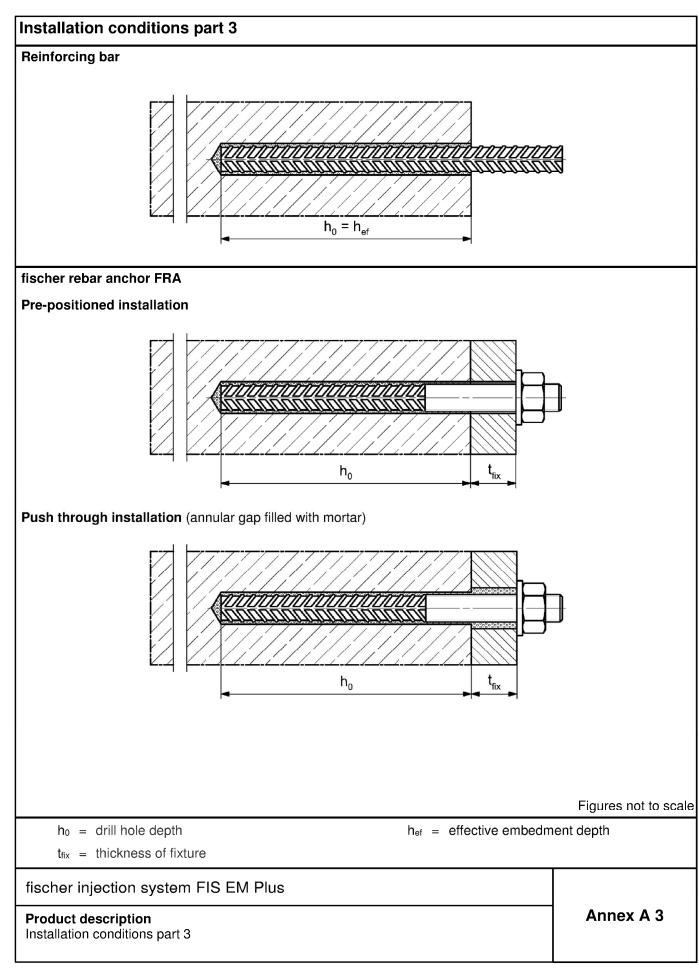
fischer injection system FIS EM Plus

**Product description** 

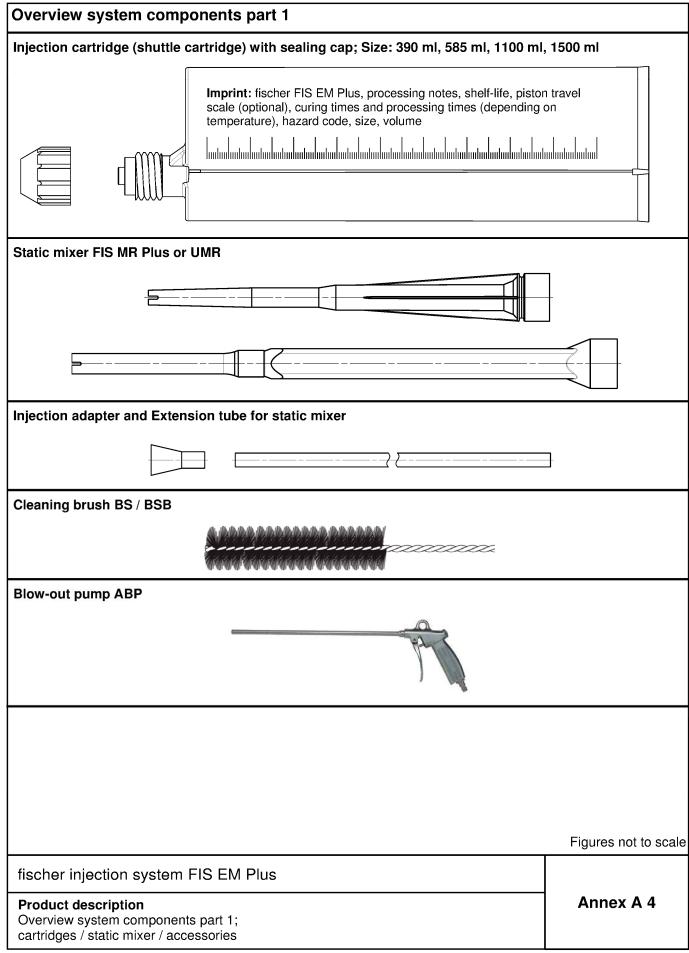
Installation conditions part 2

Annex A 2









Z51956.20



# 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 disc 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 **Product description** Overview system components part 2; steel components



Tabl	e A6.1: Material	s		
Part	Designation		Material	
1	Injection cartridge			
		Steel	Stainless steel R	High corrosion resistant steel HCR
	Steel grade	zinc plated	acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2015	acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4:2015
2	Anchor rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 zinc plated $\geq$ 5 $\mu$ m, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised $\geq$ 40 $\mu$ m EN ISO 10684:2004 fuk $\leq$ 1000 N/mm <sup>2</sup> A <sub>5</sub> > 12% fracture elongation	EN ISO $3506-1:2009$ 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462; EN $10088-1:2014$ $f_{uk} \le 1000 \text{ N/mm}^2$ $A_5 > 12\%$ fracture elongation	Property class 50 or 80 EN ISO 3506-1:2009 or property class 70 with $f_{yk}$ = 560 N/mm <sup>2</sup> 1.4565; 1.4529; EN 10088-1:2014 $f_{uk} \le 1000 \text{ N/mm}^2$ $A_5 > 12\%$ fracture elongation
		Fracture elongation for s	n A <sub>5</sub> > 8 %, for applications with seismic performance category	nout requirements C2
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004	1.4401; 1.4404; 1.4578;1.4571;	1.4565; 1.4529; EN 10088-1:2014
4	Hexagon nut	Property class 4, 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 μm, ISO 4042:2018/Zn5/An(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 4042:2018/Zn5/An(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 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 4042:2018/Zn5/An(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 <sub>5</sub> > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014 A <sub>5</sub> > 8 % fracture elongation
7	fischer filling disc similar to DIN 6319-G	zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(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 $f_{yk}$ and k according to NDP or $f_{uk} = f_{tk} = k \cdot f_{yk}$		/NA
9	fischer rebar anchor FRA	Rebar part: Bars and de-coiled rods class and k according to NDP or NC 1992-1-1:2004+AC:2010 fuk = ftk = k · fyk	B or C with f <sub>yk</sub> CL of EN  B or C with f <sub>yk</sub> Cl of EN  Corrosion resinance. to EN 198 1.4565; 1.4529	, 1.4571, 1.4578, 1.4439, acc. to EN 10088-1:2014 stance class CRC III 93-1-4:2015 acc. to EN 10088-1:2014 stance class CRC V
Prod	ner 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** Hammer drilling with standard drill all sizes bit Hammer drilling with hollow drill bit (fischer "FHD", Heller "Duster Nominal drill bit diameter (d<sub>0</sub>) Expert"; Bosch 12 mm to 35 mm Speed Clean"; Hilti "TE-CD, TE-YD", DreBo "D-Plus", DreBo "D-Max") Diamond drilling all sizes Tables: Tables: Tables: Tables: uncracked C3.2 concrete C1.1 C2.1 C3.1 Static and quasi C4.1 C4.1 C4.1 C4.1 all sizes all sizes all sizes all sizes C5.1 C7.1 C9.1 C11.1 static load, in cracked C6.1 C8.1 C10.1 C12.1 concrete C13.1 C13.2 C14.1 C14.2 Tables: Tables: M10 φ10 C15.1 C16.1 Seismic C1 to to C16.2 C16.2 performance M30 φ32 C17.1 C17.2 category (only \_1) \_1) hammer drilling with M12 Tables: standard / hollow M16 C15.1 C2 \_1) \_1) drill bits) M20 C16.2 M24 C18.1 dry or wet 11 all sizes concrete Use category water filled 12 all sizes (not permitted in combined with working life 100 years) hole D3 (downward and horizontal and upwards (e.g. overhead) installation) Installation direction Installation $T_{i,min} = -5$ °C to $T_{i,max} = +40$ °C temperature Temperature (max. short term temperature +60 °C; -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) no performance assessed fischer injection system FIS EM Plus Annex B 1 Intended use Specifications (part 1)



## Specifications of intended use (part 2)

#### **Base materials:**

 Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016

#### **Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN1993-1-4:2015 corresponding to corrosion resistance classes to Annex A 6 table A6.1.

#### Design:

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

#### Installation:

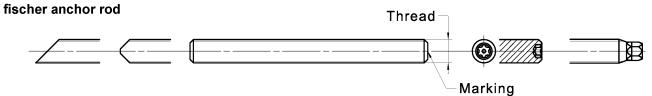
- Anchor installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- In case of aborted hole: The hole shall be filled with mortar
- · Anchorage depth should be marked and adhered to on installation
- ·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

fischer injection system FIS 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 M30													
Width across flats	3	SW		13	17	19	22	24	30	32	36	41	46
Nominal drill hole	diameter	<b>d</b> o		10	12	14	16	18	22 24 <sup>1)</sup>	25	28	30	35
Drill hole depth		h <sub>0</sub>						h₀ =	h <sub>ef</sub>				
Effective		$h_{\text{ef, min}}$		60	60	70	75	80	90	93	96	108	120
embedment dept	h	h <sub>ef, max</sub>	[mm]	160	200	240	280	320	400	440	480	540	600
Diameter of the	pre-positioned installation	d <sub>f</sub>	]	9	12	14	16	18	22	24	26	30	33
clearance hole of the fixture	push through installation	df		12	14	16	18	20	26	28	30	33	40
Minimum thickne member	ss of concrete	h <sub>min</sub>			n <sub>ef</sub> + 30 (≥ 100				h	lef + 2d	lo		
Maximum installa	tion torque	max T <sub>inst</sub>	[Nm]	10	20	40	50	60	120	135	150	200	300

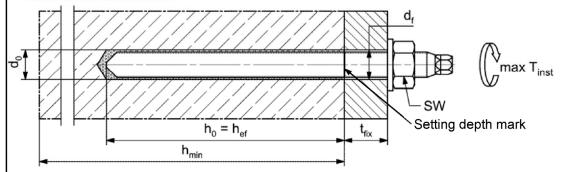
1) Both drill hole diameters can be used



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

Steel zinc plated PC <sup>1)</sup> 8.8	• or <b>+</b>	Steel hot-dip PC <sup>1)</sup> 8.8	•
High corrosion resistant steel HCR PC <sup>1)</sup> 50	•	High corrosion resistant steel HCR PC <sup>1)</sup> 70	-
High corrosion resistant steel HCR PC <sup>1)</sup> 80	(	Stainless steel R property class 50	~
Stainless steel R property class 80	*		
Alternatively: Colour coding according to DIN 97	6-1:2016	<sup>1)</sup> PC = property	class

#### Installation conditions:



# Commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled

- · Materials, dimensions and mechanical properties according to Annex A 6, Table A6.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- · Setting depth is marked

Figures not to scale

fischer injection system FIS EM Plus	
Intended use Installation parameters anchor rods	Annex B 3



Table B4.1: Minimum sp reinforcing	acing a <b>bars</b>	nd mi	nimun	n edge	dista	nce fo	r <b>anch</b>	or ro	<b>ds</b> and	d	
Anchor rods			M8	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	Cmin	[mm]	40	45	45	45	50	55	55	55	60
Minimum spacing	Smin	[mm]				accordii	ng to Ar	nnex B5	5		
Minimum spacing											
Uncracked / cracked concrete	Smin	[mm]	40	45	55	60	65	85	85	95	105
Minimum edge distance	Cmin	נוווווון			;	accordii	ng to Ar	nnex B5	5		
Required projecting area											
Uncracked concrete	_	[1000	8	13	22	23	24	38,5	38,5	39,5	40
0.10.00.00.00.00.00	_ ^	1									
Cracked concrete	- A <sub>sp,req</sub>	mm²]	6,5	10	16,5	17,5	18,5	29,5	29,5	30	30,5
	- A <sub>sp,req</sub>	-	6,5	-	16,5 <b>M27</b>	17,5	18,5 <b>M30</b>	29,5	29,5	30	30,5
Cracked concrete		-	6,5 - <b>25</b>	- 26	,	·	·	29,5 - 32	29,5 - 34	- 36	30,5 - 40
Cracked concrete  Anchor rods		mm²]	-	-	M27	-	M30	-	-	-	-
Cracked concrete  Anchor rods  Reinforcing bars (nominal diam		mm²]	-	-	M27	-	M30	-	-	-	-
Anchor rods Reinforcing bars (nominal diam Minimum edge distance	neter)	mm²]	- 25	- 26	<b>M27</b> - 75	- 28	<b>M30 30</b> 80	- <b>32</b>	- <b>34</b>	- 36	- 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete	neter)	mm²]	- 25	- 26	<b>M27</b> - 75	- 28	<b>M30 30</b> 80	- <b>32</b>	- <b>34</b>	- 36	- 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing	neter)	ф [mm]	- 25	- 26	<b>M27</b> - 75	- 28	<b>M30 30</b> 80	- <b>32</b>	- <b>34</b>	- 36	- 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing	Cmin Smin	mm²]	- <b>25</b> 75	- 26 75	<b>M27</b> - 75	- 28 80 accordin	M30 30 80 ng to Ar	- 32 120 nnex B5	- 34 120	- 36	- 40 175
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete	Cmin Smin	ф [mm]	- <b>25</b> 75	- 26 75	<b>M27</b> - 75	- 28 80 accordin	M30 30 80 ng to Ar	- 32 120 nnex B5	- 34 120	- 36	- 40 175
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete Minimum spacing Uncracked / distance	Cmin Smin	ф [mm]	- <b>25</b> 75	- 26 75	<b>M27</b> - 75	- 28 80 accordin	M30 30 80 ng to Ar	- 32 120 nnex B5	- 34 120	- 36	- 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:

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

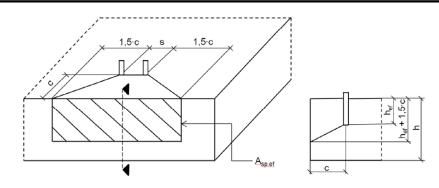
 $A_{sp,req}$  = required projecting area

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

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

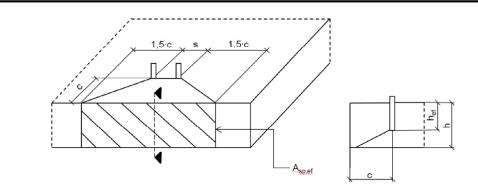


**Table B5.1:** Effective projecting area  $A_{sp,t}$  with concrete member thickness  $h > h_{ef} + 1,5 \cdot c$  and  $h \ge h_{min}$ 



Single anchor		$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with c ≥ c <sub>min</sub>
Group of anchors with	s > 3 · c	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	WILLI C Z Cmin
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]	WILLI C Z Cmin
Group of anchors with	s ≤ 3 · c	$A_{sp,t} = (3 \cdot c + s) \cdot existing h$	[mm²]	with $c \ge c_{min}$ and $s \ge s_{min}$

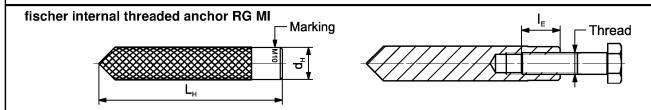
Edge distance and axial spacing shall be rounded up to at least 5 mm

Figures not to scale

	<u> </u>
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	on param	eters fo	or <b>fischer i</b>	nternal thi	eaded and	hors RG M	11
Internal threaded anchors R	G MI	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	$h_0$				$h_0 = h_{\text{ef}} = L_{\text{H}}$		
Effective embedment depth $(h_{ef} = L_H)$	h <sub>ef</sub>		90	90	125	160	200
Minimum spacing and minimum edge distance	Smin = Cmin	[mm]	55	65	75	95	125
Diameter of clearance hole in the fixture	df		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 installation torque	max T <sub>inst</sub>	[Nm]	10	20	40	80	120



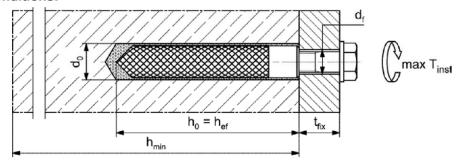
Marking: Anchor size e. g.: M10

Stainless steel → additional R; e.g.: M10 R

High corrosion resistant steel → additional HCR; e.g.: M10 HCR

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

#### Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use
Installation parameters internal threaded anchors RG MI

Annex B 6



Table B7.1: Installation	param	eters f	or <b>rein</b>	forcir	ıg bar	s <sup>1)</sup>					
Nominal diameter of the bar		ф	8 <sup>2)</sup>	10 <sup>2)</sup>	12 <sup>2)</sup>	14	16	18	20	22	24
Nominal drill hole diameter	d₀		10 12	12 14	14 16	18	20	25	25	30	30
Drill hole depth	h <sub>0</sub>						$h_0 = h_{ef}$				
Effective	$h_{\text{ef},\text{min}}$	[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>		1	f + 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	d₀		30	35	35	40	40	40	45	55	-
Drill hole depth	h <sub>0</sub>						$h_0 = h_{ef}$				
Effective	h <sub>ef,min</sub>	[mm]	100	104	112	120	128	136	144	160	-
embedment depth	h <sub>ef,max</sub>	ן ניייייז 	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>								

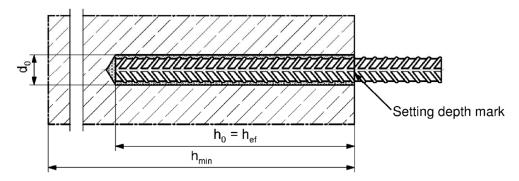
<sup>1)</sup> minimum spacing and minimum edge distance see Annex B 4

#### 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

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



Rebar anchor F	RA	•	Γhread	M1	(2 <sup>1)</sup>	M16	M20	M24	
Nominal diamete	er of the bar	ф		1	2	16	20	25	
Width across fla	ts	SW		1	9	24	30	36	
Nominal drill hol	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 embedment depth		h <sub>ef,min</sub>		7	0	80	90	96	
Ellective embed	тепі аеріп	h <sub>ef,max</sub>		140		220	300	380	
Distance concre welded joint	le	F 7			1	00			
Minimum spacing and minimum edge distance		Smin = Cmin	[mm]	55		65	85	105	
Diameter of clearance hole -	pre-positioned anchorage	≤ d <sub>f</sub>		1	4	18	22	26	
in the fixture	push through anchorage	≤ d <sub>f</sub>		1	8	22	26	32	
f concrete member			h <sub>0</sub> +	- 30		h <sub>0</sub> + 2d <sub>0</sub>			
Maximum install	ation torque	max T <sub>inst</sub>	[Nm]	4	.0	60	120	150	

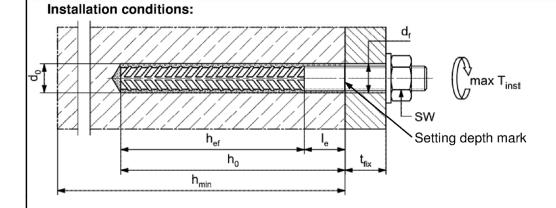
<sup>1)</sup> Both drill hole diameters can be used

#### fischer rebar anchor FRA



Marking frontal e. g:

FRA (for stainless steel);
FRA HCR (for high corrosion resistant steel)



Figures not to scale

Intended use Installation parameters rebar anchor FRA

Annex B 8



## Table B9.1: Parameters of the cleaning brush BS / BSB (steel brush with steel bristles)

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

Nominal drill hole diameter	d₀		10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
Steel brush diameter BS	d <sub>b</sub>	[mm]	11	14	16	20		25	26	27	30	40		ı	ı	-	
Steel brush diameter BSB	dь		-	-	-		-	-	-	-	-		-		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 <sup>1)</sup> t <sub>cure</sub>
-5 to 0 <sup>2)</sup>	240 min	200 h
$> 0 \text{ to } 5^{2}$	150 min	90 h
> 5 to 10	120 min	40 h
> 10 to 20	30 min	18 h
> 20 to 30	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	Annex B 9
Cleaning brush (steel brush)	
Processing time and curing time	

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



# 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: Blow out the drill hole twice, with oil free 4 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. fischer FVC 35 M 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



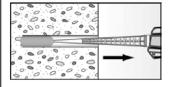
# Installation instructions part 2 Drilling and cleaning the hole (wet drilling with diamond drill bit) Drill the hole. Drill hole diameter do and Break the drill core nominal drill hole depth ho 1 and remove it see tables B3.1, B6.1, 0 B7.1, B8.1 2 Flush the drill hole with clean water until it flows 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 Screw on the static mixer 6 (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 the resin is evenly grey in colour. Do not use 8 mortar that is not uniformly grey fischer injection system FIS EM Plus Annex B 11 Intended use Installation instructions part 2



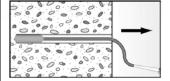
## Installation instructions part 3

Injection of the mortar

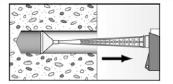




Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles



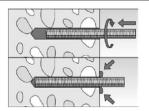
For drill hole depth ≥ 150 mm use an extension tube

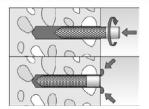


For overhead installation, deep holes ( $h_0 > 250$  mm) or drill hole diameter ( $d_0 \ge 40$  mm) use an injection-adapter

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

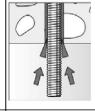
10



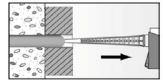


Only use clean and oil-free metal parts. Mark the setting depth of the metal parts. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so.

After inserting the metal part, excess mortar must be emerged around the anchor element.



For overhead installations support the metal part with wedges (e. g. fischer centering wedges) or fischer overhead clips.



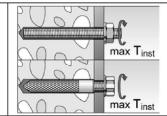
For push through installation fill the annular gap with mortar

11



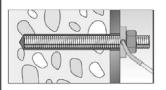
Wait for the specified curing time t<sub>cure</sub> see table B9.2

12



Mounting the fixture max T<sub>inst</sub> see tables B3.1 and B6.1

Option



After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the fischer filling disc. Compressive strength ≥ 50 N/mm² (e.g. fischer injection mortars FIS HB, FIS SB, FIS V, FIS EM Plus)

ATTENTION: Using fischer filling disc reduces t<sub>fix</sub> (usable length of the anchor)

fischer injection system FIS EM Plus

Intended use

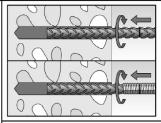
Installation instructions part 3

Annex B 12



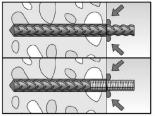
## Installation instructions part 4

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



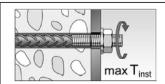
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

11



Wait for the specified curing time t<sub>cure</sub> see **table B9.2** 

12



Mounting the fixture max  $T_{\text{inst}}$  see **table B8.1** 

fischer injection system FIS EM Plus

Intended use

Installation instructions part 4

Annex B 13



Tabl		eristic va							sion /	shea	ar load	d of <b>fi</b>	sche	r
Anch	or rod / standard threa				M8	M10	M12		M16	M20	M22	M24	M27	M30
Beari	ng capacity under ten	sion load	i, ste	el fai	lure <sup>3)</sup>									
ο, o,			4.8		15(13)	23(21)	33	46	63	98	121	141	184	224
istic N <sub>Rk,s</sub>	Steel zinc plated	>	5.8		19(17)	29(27)	43	58	79	123	152	177	230	281
Characteristic esistance N <sub>Re</sub>		Property class	8.8	[kN]	29(27)	47(43)	68	92	126	196	243	282	368	449
Character esistance	Stainless steel R and	g g	50	וואון	19	29	43	58	79	123	152	177	230	281
Che esis	high corrosion	ш	70		26	41	59	81	110	172	212	247	322	393
	resistant steel HCR		80		30	47	68	92	126	196	243	282	368	449
Partia	al factors 1)													
							1,5	0						
ctor	Steel zinc plated	>-	5.8						1,5	0				
ial fac Yms,n		Property class	8.8	[-]	1,50									
Partial factor Yms,n	Stainless steel R and	50	[-]	2,86										
marietant et al UOD														
resistant steel HCR 80 1,60														
Beari	ng capacity under she	ear load,	steel	failu	re³)									
witho	ut lever arm													
C ×			4.8		9(8)	14(13)	20	28	38	59	73	85	110	135
ristic V <sup>0</sup> Rk,s	Steel zinc plated	>-	5.8		11(10)	17(16)	25	34	47	74	91	106	138	168
Characteristic sistem of stainless steel R and high corrosion	ropert class	8.8	[kN]	15(13)	23(21)	34	46	63	98	122	141	184	225	
arac tan	Stainless steel R and	Property class	50	נאואן	9	15	21	29	39	61	76	89	115	141
Character esistance	high corrosion	ш.	70		13	20	30	40	55	86	107	124	161	197
= =	resistant steel HCR		80	1	15	23	34	46	63	98	122	141	184	225
Ductil	ity factor		<b>k</b> <sub>7</sub>	[-]					1,0	)				
with I	ever arm			•										
ξ,s			4.8			30(27)	52	83	133	259	357	448	665	899
act.	Steel zinc plated	≥	5.8		19(16)	37(33)	65	104	166	324	447	560	833	1123
ract.		Property class	8.8	[Nm]	30(26)	60(53)	105	167	266	519	716	896	1333	1797
Char resistano	Stainless steel R and	흔	_50	[]	19	37	65	104	166	324	447	560	833	1123
) Sisis	high corrosion	_	_70		26	52	92	146	232	454	626	784	1167	1573
	resistant steel HCR		80		30	60	105	167	266	519	716	896	1333	1797
Partia	al factors 1)				1									
			4.8						1,2	5				
당	Steel zinc plated	≱	5.8						1,2					
Partial factor		Property class	8.8	[-]					1,2					
irtia  ×	Stainless steel R and	5 G 93	50						2,3					
Pa	high corrosion	_	70					-	1,25 <sup>2)</sup> /					
	resistant steel HCR		80						1,3	3				
<sup>2)</sup> C	n absence of other nationally ally admissible for high alues in brackets are va andard threaded rods a	corrosion alid for un	resis dersi	t. ste zed th	readed	rods w	ith sma	aller st	A <sub>5</sub> >12 ress ar	2% (e.ç ea A <sub>s</sub>	g. fisch for hot	er and dip ga	hor roc Ilvanise	ds) ed

fischer injection system FIS EM Plus

#### **Performances**

Characteristic values for steel failure under tension / shear load of fischer anchor rods and standard threaded rods



Table C2.1:					steel failu ors RG MI	re under te	nsion / she	ar load of <b>f</b> i	scher
fischer internal	threade	ed anchors	RG MI		М8	M10	M12	M16	M20
Bearing capacit	y unde	r tension lo	ad, ste	el fail	ure				
		Property	5.8		19	29	43	79	123
Charact. resistance with	Ne	class	8.8	[ [kN]	29	47	68	108	179
resistance with screw	$N_{Rk,s}$	Property	R	[KIN]	26	41	59	110	172
		class 70	HCR		26	41	59	110	172
Partial factors <sup>1)</sup>									
		Property	5.8				1,50		
Partial factors	264- 51	class	8.8	[-]			1,50		
raniai iaciois	γMs,N	Property	R				1,87		
		class 70	HCR				1,87		
Bearing capacit	y unde	r shear loa	d, steel	failur	'e				
Without lever ar	rm								
		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	V HK,S	Property	R	ן נייאן	12,8	20,3	29,5	54,8	86,0
		class 70	HCR		12,8	20,3	29,5	54,8	86,0
Ductility factor			<b>k</b> <sub>7</sub>	[-]			1,0		
With lever arm							,	,	
(0)		Property	5.8		20	39	68	173	337
Charact. resistance with	M <sup>0</sup> Rk,s	class	8.8	[Nm]	30	60	105	266	519
screw	IVI HK,S	Property	K	l	26	52	92	232	454
		class 70	HCR		26	52	92	232	454
Partial factors <sup>1)</sup>									
		Property	5.8				1,25		
Partial factors	201-14	class	8.8	[-]			1,25		
Farilai iaciois	γMs,V	Property	R	[-J [			1,56		
		class 70	HCR				1,56		

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

fischer injection system FIS EM Plus	
Performances Characteristic values for steel failure under tension / shear load of fischer internal threaded anchor RG MI	Annex C 2



Table C3.1: Characteristic values for steel failure under tension / shear load of reinforcing bars																			
Nominal diameter	of the bar		ф	8	10 12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Bearing capacity (	under tension	load, ste	el fai	lure															
Characteristic resis	tance	$N_{Rk,s}$	[kN]							As	· <b>f</b> uk	<sub>(</sub> 1)							
Bearing capacity (	under shear lo	oad, stee	failu	re															
Without lever arm																			
Characteristic resis	tance	$V^0_{Rk,s}$	[kN]						(	),5 ·	As ·	f <sub>uk</sub> 1	)						
Ductility factor		<b>k</b> <sub>7</sub>	[-]								1,0								
With lever arm																			
Characteristic resis	tance	M <sup>0</sup> Rk,s	[Nm]						1	,2 ·	Wel	· <b>f</b> uk	1)						

<sup>1)</sup> fuk or fyk respectively must be taken from the specifications of the reinforcing bar

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

fischer rebar anchor FRA			M12	M16	M20	M24
Bearing capacity under tens	ion load, ste	el fail	ure	-		
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	63	111	173	270
Partial factor <sup>1)</sup>						
Partial factor	γMs,N	[-]		-	,4	
Bearing capacity under shea	ır load, stee	failur	е			
Without lever arm						
Characteristic resistance	$V^0$ Rk,s	[kN]	30	55	86	124
Ductility factor	<b>k</b> <sub>7</sub>	[-]			,0	
With lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	92	233	454	785
Partial factor <sup>1)</sup>				•	•	•
Partial factor	γMs,V	[-]		1	,56	

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

fischer injection system FIS EM Plus	
Performances Characteristic values for steel failure under tension / shear load of reinforcing bars and fischer rebar anchors FRA	Annex C 3



Table C4.1:	Characteristic			- •											-	
Size											Alls	izes				
Tension load										_						
Installation facto		γinst	[-] -					See ar	nnex	C	5 to C	12 an	d C 17	to C	18	
Factors for the	compressive stren	gth of	concr	ete	> (	20/	25									
_	C25/30											02				
_	C30/37											04				
Increasing _	C35/45	$\Psi_{c}$	[-]									06				
factor for τ <sub>Rk</sub>	C40/50	_ •		1,07												
_	C45/55											80				
	C50/60										1,	09				
Splitting failure				I												
-	h / h <sub>ef</sub> ≥ 2,0											h <sub>ef</sub>				
Edge distance _		$\mathbf{C}_{\text{cr,sp}}$	[mm]							•	4,6 h <sub>ef</sub>		1			
	h / h <sub>ef</sub> ≤ 1,3										2,20	3 h <sub>ef</sub>				
Spacing		Scr,sp									2 c	cr,sp				
Concrete cone				ı												
Uncracked conc		<b>k</b> ucr,N	[-]									1,0				
Cracked concret	te	k <sub>cr,N</sub>		7,7												
Edge distance		Ccr,N	[mm]	1,5 h <sub>ef</sub>												
Spacing		Scr,N	[]								2 0	cr,N				
Factors for sus	tained tension load															
Factor		$\Psi^0_{\text{sus}}$	[-]								-	1)				
Shear load																
Installation facto	r	γinst	[-]								1	,0				
Concrete pry-o	ut failure															
Factor for pry-ou	ıt failure	<b>k</b> 8	[-]								2	,0				
Concrete edge	failure															
Effective length shear loading	of fastener in	lf	[mm]								in (h <sub>ef;</sub> in (h <sub>ef;</sub>		<sub>om</sub> ) n; 300 r	nm)		
Calculation dia	meters															
Size				М	8	M10	0	M12	M1	4	M16	M20	M22	M24	1 M2	7 M30
fischer anchor ro standard thread		$d_{nom}$		8	3	10		12	14		16	20	22	24	2	30
fischer internal threaded	d anchors RG MI	$d_{nom}$	[mm]	1:	2	16		18	_2)		22	28	_2)	_2)	_2	_2)
fischer rebar and	chor FRA	$d_{nom}$		_2	2)	_2)		12	_2)	'	16	20	_2)	25	2	_2)
Size (nominal di	ameter of the bar)		ф	8	10	12	1	4 16	18	20	22 2	4 25	26 28	30	32 3	1 36 40
Reinforcing bar		$d_{nom}$	[mm]	8	10	12	1	4 16	18	20	22 2	4 25	26 28	30	32 3	1 36 40
	ance assessed e not part of the ETA	Λ.														
Performances													$\blacksquare$	An	nex	C 4
Characteristic v	values for concrete t	allure	under t	ens	sion	/ sh	ea	r load								



Table C5.1:	Characte					•							er
	anchor r holes; un											rilled	
Anchor rod / star	ndard thread	ded rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pullor	it and concr	ete con	e failure										
Calculation diame	ter	d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked conci	rete												
Characteristic bo	ond resistan	ce in un	cracked (	concre	ete C20	0/25							
Hammer-drilling w	<u>rith standard</u>	drill bit o	r hollow d	rill bit (	dry or	wet co	ncrete)			ı	1	1	1
	°C / 60 °C		[N 1/22 22 2]	18	18	18	17	17	16	15	15	15	14
perature II: 50	°C / 72 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	18	17	17	16	16	15	14	14	14	13
Hammer-drilling w	rith standard	drill bit o	r hollow d	rill bit (	water '	filled h	ole)					l	
	°C / 60 °C			16	16	15	13	13	11	11	10	10	9
perature	°C / 72 °C	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]										
range			!!	15	14	14	13	12	11	10	10	9	9
Diamond-drilling (	-	ncrete a	<u>s well as \</u>									l .	l -
Tem- I: 35 perature	°C / 60 °C	$ au_{Rk,ucr}$	[N/mm²]	16	15	13	12	12	10	10	10	9	9
range II: 50	°C / 72 °C	€ HK,ucr	[[[, 4, ]	15	14	12	11	11	10	9	9	8	8
Installation facto	rs												
Dry or wet concre	te		r 1					1	,0				
Water filled hole		γinst	[-]					1	,4				
Cracked concrete	е												
Characteristic bo	nd resistan	ce in cra	acked co	ncrete	C20/2	5							
Hammer-drilling w	rith standard	drill bit o	r hollow d	rill bit (	dry or	wet co	ncrete)	1					
	°C / 60 °C			7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
perature II: 50	°C / 72 °C	τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Diamond - drilling	(dry or wet o	oncrete)		,	,		,	,	,			<u> </u>	
	°C / 60 °C	01101010)		7	7	7	7	6	6	7	7	7	7
perature :: 50		$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]										
range	°C / 72 °C			7	7	7	7	6	6	7	7	7	7
Hammer-drilling w		<u>drill bit a</u>	<u>r hollow d</u>	rill bit a			<u>drilling</u>	(water			T	ı	1
Tem- I: 35 perature	°C / 60 °C	σ-	[N/mm²]	6	7,5	7,5	7	6	6	6	6	6	6
range II: 50	°C / 72 °C	$ au_{ m Rk,cr}$	[14/11111 ]	6	7	7	7	6	6	6	6	6	6
Installation facto	rs					•	•			•		•	
Dry or wet concrete	<del>-</del>		r 1					1	,0				
Water filled hole		γinst	[-]			1,2					1,4		
fischer injection system FIS EM Plus  Performances Characteristic values for combined pull-out and concrete failure for fischer anchor rod and standard threaded rods; working life 50 years									Ann	ex C	5		



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

	holes; uncracked or cracked concrete; working life 100 years													
Anchor r	od /	standard threa	ded rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combine	d pı	Illout and conc	rete con	e failure										
Calculation	n di	ameter	d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracke	ed co	oncrete												
Characte	risti	c bond resista	nce in un	cracked (	concre	ete C20	0/25							
Hammer-	<u>drillir</u>	<u>ng with standard</u>	d drill bit o	r hollow d	rill bit (	dry or	wet co	ncrete)	<u> </u>		,			
Tem-	1:	35 °C / 60 °C		[N1/mm2]	18	18	18	17	17	16	15	15	15	14
perature range	II:	50 °C / 72 °C	T <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	18	17	17	16	16	15	14	14	14	13
Diamond-	drilli	ng (dry or wet c	oncrete)											
Tem-	l:	35 °C / 60 °C		FN 1/ 27	16	15	13	12	12	10	10	10	9	9
perature range	II:	50 °C / 72 °C	TRk,ucr	[N/mm <sup>2</sup> ]	15	14	12	11	11	10	9	9	8	8
Installation	Installation factors													
Dry or we	t cor	ncrete	γinst	[-]					1	,0				
Working	l:	35 °C / 60 °C			0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
life 100 years	II:	50 °C / 72 °C	α <sub>100 years</sub>	[-]	0,55	0,60	0,60	0,65	0,65	0,65	0,65	0,65	0,65	0,65
Cracked	con	crete		•										
Characte	risti	c bond resista	nce in cra	acked co	ncrete	C20/2	5							
Hammer-	drillir	ng with standard	drill bit o	r hollow d	rill bit (	dry or	wet co	ncrete)	<u>)</u>					
Tem-	l:	35 °C / 60 °C		[N 1 /ma ma 2]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
perature range	II:	50 °C / 72 °C	T <sub>Rk,cr</sub>	[N/mm²]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Diamond	- dril	lling (dry or wet	concrete)					ı					•	
Tem-	l:	35 °C / 60 °C		FN 1/ 27	7	7	7	7	6	6	7	7	7	7
perature range	II:	50 °C / 72 °C	_ τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	7	7	7	7	6	6	7	7	7	7
Installation	on fa	actors		•							•			
Dry or wet	con	crete	γinst	[-]					1	,0				
Working	l:	35 °C / 60 °C			0,60	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65
life 100 years	II:	50 °C / 72 °C	— <b>α</b> 100 years	[-]	0,60	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65

1) Calculation of characteristic bond resistance in uncracked concrete TRK,100, ucr:

 $\tau_{\text{Rk},\text{100, ucr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,ucr}}$ 

<sup>2)</sup> Calculation of characteristic bond resistance in cracked concrete  $\tau_{Rk,100,\,cr}$ :

 $\tau_{\text{Rk},\text{100, cr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,cr}}$ 

fischer injection system FIS EM Plus	
Performances Characteristic values for combined pull-out and concrete failure for fischer anchor rod and standard threaded rods; working life 100 years	Annex C 6



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

ed or c	racked	concrete;	working lif	e 50 years		
э мі		M8	M10	M12	M16	M20
rete con	e failure			•		
d	[mm]	12	16	18	22	28
nce in un	cracked	concrete C2	0/25			
d drill bit c	r hollow d	rill bit (dry or	wet concrete	)		
_	[N]/mmm21	15	14	14	13	12
<sup>−</sup> τ <sub>Rk,ucr</sub>	[IN/MM*]	14	13	13	12	11
d drill bit c	r hollow d	rill bit (water	filled hole)			
	[N ] /van van 2]	14	12	12	11	10
T <sub>Rk,ucr</sub>	[IN/MM²] 	13	12	11	10	9
oncrete a	s well as v	water filled ho	ole)	•		
	cr [N/mm²]	13	12	11	10	9
- τ <sub>Rk,ucr</sub>		12	11	10	9	8
				•		
	r 1			1,0		
γinst	[-]			1,4		
nce in cr	acked co	ncrete C20/2	5			
d drill bit c	r hollow d	rill bit and dia	<u>ımond-drilling</u>	(dry or wet c	oncrete)	
	[N.172]	7	6	6	7	7
TRk,cr	[N/mm²] 	7	6	6	7	7
d drill bit c	r hollow d	rill bit and dia	mond-drilling	(water filled I	hole <u>)</u>	•
	FN 1 / 21	7	6,5	6	6	6
– τ <sub>Rk,cr</sub>	[N/mm²]	7	6	6	6	6
				•		
- 00	[ ]			1,0		
γinst	[-]		1,2		1	,4
	G MI  crete cond d  nce in und drill bit co  τ <sub>Rk,ucr</sub> d drill bit co  τ <sub>Rk,ucr</sub> oncrete a  τ <sub>Rk,ucr</sub> γinst  nce in cradd drill bit co  τ <sub>Rk,cr</sub>	ince in uncracked of drill bit or hollow of the transfer of t	The content of the c	G MI         M8         M10           crete cone failure           d         [mm]         12         16           Ince in uncracked concrete C20/25           d drill bit or hollow drill bit (dry or wet concrete details)         15         14           14         13         14         13           d drill bit or hollow drill bit (water filled hole)         14         12           13         12         12         11           concrete as well as water filled hole)         13         12           TRIK,ucr         [N/mm²]         13         12           d drill bit or hollow drill bit and diamond-drilling         7         6           d drill bit or hollow drill bit and diamond-drilling         7         6,5           d drill bit or hollow drill bit and diamond-drilling         7         6,5           d drill bit or hollow drill bit and diamond-drilling         7         6,5           d drill bit or hollow drill bit and diamond-drilling         7         6,5           d drill bit or hollow drill bit and diamond-drilling         7         6,5           d drill bit or hollow drill bit and diamond-drilling         7         6,5	M8   M10   M12   M8   M10   M12   M12   M12   M12   M14   M15   M15	Transit   Tran

fischer injection system	FIS	ΕM	Plus
--------------------------	-----	----	------

#### **Performances**

Characteristic values for combined pull-out and concrete failure for fischer internal threaded anchors RG MI; working life 50 years



Table C8.1:	Characteristic values for <b>combined pull-out</b> and concrete failure for <b>fischer</b>
	internal threaded anchors RG MI in hammer or diamond drilled holes;
	uncracked or cracked concrete; working life 100 years

	uncrac	ked or c	racked	concrete; v	working lif	e 100 years	S	
Internal t	hreaded anchor F	RG MI		М8	M10	M12	M16	M20
Combine	d pullout and con	crete con	e failure					
Calculatio	n diameter	d	[mm]	12	16	18	22	28
Uncracke	ed concrete							
Characte	ristic bond resist	ance in un	cracked	concrete C20	0/25			
Hammer-	<u>drilling with standa</u>	<u>rd drill bit o</u>	r hollow d	<u>lrill bit (dry or</u>	wet concrete	<u>)</u>		
Tem-	I: 35 °C / 60 °C		[N/mm²]	15	14	14	13	12
perature range	II: 50 °C / 72 °C	$  au_{Rk,ucr}$	[18/111111-] 	14	13	13	12	11
Diamond-	drilling (dry or wet	concrete)						
Tem-	I: 35 °C / 60 °C		[N]//////22 /23	13	12	11	10	9
perature range	II: 50 °C / 72 °C	— τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	12	11	10	9	8
Installatio	on factors							
Dry or we	t concrete	γinst	[-]			1,0		
Working life 100	I: 35 °C / 60 °C	_		0,75	0,75	0,75	0,75	0,75
years	II: 50 °C / 72 °C	— α <sub>100 years</sub>	[-]	0,55	0,60	0,60	0,65	0,65
Cracked	concrete							
Characte	ristic bond resist	ance in cr	acked co	ncrete C20/2	5			
Hammer-	drilling with standa	rd drill bit o	r hollow d	Irill bit and dia	amond-drilling	(dry or wet c	oncrete)	
Tem-	I: 35 °C / 60 °C		[N]/ma ma 2]	7	6	6	7	7
perature range	II: 50 °C / 72 °C	— τ <sub>Rk,cr</sub>	[N/mm²]	7	6	6	7	7
Installatio	on factors							
Dry or we	t concrete	γinst	[-]			1,0		
Working life	I: 35 °C / 60 °C		r 1	0,60	0,85	0,80	0,65	0,65
ine 100 years	II: 50 °C / 72 °C	— <b>α</b> 100 years	[-]	0,60	0,85	0,80	0,65	0,65

## $^{\text{1})}$ Calculation of characteristic bond resistance in uncracked concrete $\tau_{\text{Rk},\text{100, ucr}}$ :

 $\tau_{\text{Rk,100, ucr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,ucr}}$ 

### $^{2)}$ Calculation of characteristic bond resistance in cracked concrete $\tau_{\text{Rk},100,\,\text{cr}}$ :

 $\tau_{\text{Rk,100, cr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,cr}}$ 

fischer injection system FIS EM Plus	
Performances Characteristic values for combined pull-out and concrete failure for fischer internal threaded anchors RG MI; working life 100 years	Annex C 8



Table C	9.1	: Characte reinforci cracked	ng bar	<b>s</b> in ham	ıme	r o	r di	am	ond	dri											
Nominal	dian	neter of the bar	COLICIE	φ	`	y '' 10			16		20	22	2/1	25	26	28	30	32	34	36	40
		illout and concr	ete con	<u> </u>	0	10	12	1-4	10	10	20	22	24	23	20	20	30	32	34	30	40
Calculatio	•		d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracke			<u>u</u>	[]		10	12	17	10	10	20		27	20	20	20	30	02	0-	30	1-0
		c bond resistan	ce in un	cracked	cone	crei	te C	20/2	25												
		ng with standard								ncr	ete)										
Tem-		35 °C / 60 °C			16		15	14				13	12	12	12	12	12	12	11	11	11
perature		50 °C / 72 °C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]		14		13		12				11	11	11	11	11	11	10	10
range		ng with standard	drill bit o	r hollow c								12	12	' '	' '	' '		' '	' '	10	10
Tem-		35 °C / 60 °C	dilli bit c	Hollow C		16	14	13			11	11	10	10	10	10	9	9	9	8	8
perature			$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	$\vdash$																
range		50 °C / 72 °C				14	13	12		11	11	10	10	9	9	9	9	8	8	8	8
		ng (dry or wet co	<u>ncrete a</u>	<u>s well as '</u> I	П			I	Ē		l										I _
Tem- perature		35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm²]	$\vdash$	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
range	II:	50 °C / 72 °C	CHK,UCI		15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Installatio	on fa	actors																			
Dry or we			γinst	[-]									1,0								
Water fille	d ho	ole	/ Illist	.,									1,4								
Cracked																					
		c bond resistan																			
		ng with standard	drill bit o	r hollow c	drill b																I
Tem- perature	_l:	35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm²]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
range	II:	50 °C / 72 °C	€ HK,Cr	[. 4/	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Diamond-	drilli	ng (dry or wet co	ncrete)																		
Tem-	l:	35 °C / 60 °C		[N.1721	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
perature range	II:	50 °C / 72 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
	drillir	ng with standard	drill bit o	r hollow c	irill b	it a	nd d	L liam	ond	-dril	L ling	wai	ter fi	lled	hole	∟ ∋)					l
Tem-		35 °C / 60 °C							6,5		6	6	6	6	6	6	6	5	5	5	5
perature		50 °C / 72 °C	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	$\vdash$		6,5		6	6	6	6	6	6	6	6	6	5	5	5	5
range Installation						0,0	0,0														
Dry or we													1,0								
Water fille			$\gamma$ inst	[-]			1	,2					1,0			1,4					
Perform	anc	ection system es ic values for com			I com	ıcre	te fa		e for	reir	nforc		bars				Ar	ne	x C	9	
working									01					- ,							



Table C	C10.1:	reinforc	Characteristic values for <b>combined pull-out</b> and concrete failure for reinforcing bars in hammer or diamond drilled holes; uncracked or cracked concrete; working life 100 years  of the bar																		
Nominal	diamete	r of the bar		φ	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combine	ed pullou	t and conc	rete con																		
Calculation	on diamet	ter	d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncrack	ed concr	ete																			
Characte	ristic bo	nd resistar	nce in un	cracked	con	cret	e C	20/2	25												
Hammer-	drilling w	ith standarc	l drill bit o	r hollow c	Irill b	oit (c	dry c	r we	et co	oncre	ete)										
Tem- perature	-	°C / 60 °C	- τ <sub>Rk,ucr</sub>	[N/mm²]	$\vdash$	15	15		14					12						11	
range		°C / 72 °C			15	14	14	13	13	12	12	12	12	11	11	11	11	11	11	10	10
		dry or wet co	oncrete)		I I									_	I _	l _		_		_	
Tem- perature		°C / 60 °C °C / 72 °C	- τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]		15 14	13 12	12 11	12 11	11 10	10 10	10 9	10 9	9	9	9	9	8	8 7	8 7	7
range Installati					13	'	12	' '	''	10	10		<u> </u>					0		_ ′	
Dry or we			Mines	[-]									1,0								
			γinst	[-]	2	2	2	2	2	2	5	2		5	2	2	2	2	2	2	2
Working life 100		°C / 60 °C	-α100 years	[-]	55 0,75	60 0,75	60 0,75	5 0,75	5 0,75	65 0,75	5 0,75	65 0,75	,65 0,75	65 0,75	,65 0,75	5 0,75	5 0,75	5 0,75	5 0,75	65 0,75	65 0,75
years		°C / 72 °C			0,5	9,0	9,0	0,65	0,65	9,0	0,65	9,0	9,0	9,0	9,0	0,65	0,65	0,65	0,65	9,0	9,0
Cracked							200	<u> </u>													
		nd resistar									- 1 - \										
Tem-	-	ith standard	drill bit o	r nollow c								0		0						0	
perature range		°C / 60 °C °C / 72 °C	- τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	-drillina (c	dry or wet co	oncrete)																		
Tem-		°C / 60 °C	<u> </u>		7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
perature range		°C / 72 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Installati	on factor	rs									<u> </u>			<u> </u>							l
Dry or we	t concret	е	γinst	[-]									1,0								
Working	l: 35 °	°C / 60 °C			0,60	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65
life 100 years	II: 50 °	°C / 72 °C	- <b>α</b> 100 years	[-]	09'0	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65
1) Calculation of characteristic bond resistance in uncracked concrete $\tau_{Rk,100,ucr}$ : $\tau_{Rk,100,ucr} = \alpha_{100years} \cdot \tau_{Rk,ucr}$ 2) Calculation of characteristic bond resistance in cracked concrete $\tau_{Rk,100,cr}$ : $\tau_{Rk,100,cr} = \alpha_{100years} \cdot \tau_{Rk,cr}$ fischer injection system FIS EM Plus																					
		lues for con ears	nbined pu	ıll-out and	l con	icre	te fa	ilure	e for	reir	nford	cing	bars	3;			An	nex	C	10	
																					_



Table C11.1: Characteristic values for combined pull-out and concrete failure for fischer rebar anchors FRA in hammer or diamond drilled holes; uncracked or cracked concrete; working life 50 years

стаскеа	concre	ete; wor	king lite 50 ye	ears					
ebar anchor FRA			M12	M16	M20	M24			
d pullout and conc	rete con	e failure							
on diameter	d	[mm]	12	16	20	25			
ed concrete									
ristic bond resistar	nce in un	cracked	concrete C20/25	5					
<u>drilling with standard</u>	drill bit c	r hollow d	rill bit (dry or wet	concrete)					
I: 35 °C / 60 °C		[N1/mamma27]	15	14	13	12			
II: 50 °C / 72 °C	TRk,ucr	[14/11111-]	14	13	12	12			
drilling with standard	drill bit c	r hollow d	rill bit (water fille	d hole)					
I: 35 °C / 60 °C			14	12	11	10			
II: 50 °C / 72 °C	τ <sub>Rk,ucr</sub>	[N/mm²]	13	12	11	9			
drilling (dry or wet co	oncrete a	s well as v	water filled hole)	I					
I: 35 °C / 60 °C			13	12	10	9			
II: 50 °C / 72 °C	τ <sub>Rk,ucr</sub>	[N/mm²]	12	11	10	9			
on factors		•							
t concrete				1	,0				
ed hole	γinst	[-]		1	,4				
concrete									
ristic bond resistar	nce in cr	acked cor	ncrete C20/25						
<u>drilling with standard</u>	drill bit c	r hollow d	rill bit and diamo	nd-drilling (dry o	r wet concrete)				
I: 35 °C / 60 °C		[N]/mm21	8	8	8	8			
II: 50 °C / 72 °C	TRk,cr	[13/171111-]	8	8	8	8			
drilling with standard	drill bit c	r hollow d	rill bit and diamo	nd-drilling (water	filled hole)				
I: 35 °C / 60 °C		[N 1/m : 27]	7	6	6	6			
II: 50 °C / 72 °C	T <sub>Rk,cr</sub>	[IN/mm²]	7	6	6	6			
on factors				1					
t concrete		[ ]		1	,0				
Vinet [-]									
	ebar anchor FRA d pullout and concent diameter ed concrete ristic bond resistar drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C drilling (dry or wet concrete ed hole concrete ristic bond resistar drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C confactors t concrete ristic bond resistar drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C drilling with standard I: 35 °C / 60 °C II: 50 °C / 72 °C confactors t concrete	ebar anchor FRA  d pullout and concrete content in diameter  on diameter  d concrete  ristic bond resistance in underilling with standard drill bit of the first	ebar anchor FRA  d pullout and concrete cone failure on diameter d [mm]  ed concrete ristic bond resistance in uncracked of drilling with standard drill bit or hollow d    1: 35 °C / 60 °C	debar anchor FRA  d pullout and concrete cone failure and diameter d [mm] 12  ded concrete ristic bond resistance in uncracked concrete C20/25 drilling with standard drill bit or hollow drill bit (dry or well fill: 50 °C / 72 °C   TRIK, ucr   TRI	d pullout and concrete cone failure and diameter d [mm] 12 16 ded concrete ristic bond resistance in uncracked concrete C20/25 drilling with standard drill bit or hollow drill bit (dry or wet concrete) $\frac{1: 35 \text{ °C} / 60 \text{ °C}}{\text{II: } 50 \text{ °C} / 72 \text{ °C}} \frac{\tau_{\text{Rik,ucr}}}{\tau_{\text{Rik,ucr}}} \frac{ \text{N/mm}^2 }{ \text{II}} \frac{15}{14} \frac{13}{14}$ $\frac{1: 35 \text{ °C} / 60 \text{ °C}}{\text{II: } 50 \text{ °C} / 72 \text{ °C}} \frac{\tau_{\text{Rik,ucr}}}{\tau_{\text{Rik,ucr}}} \frac{ \text{N/mm}^2 }{ \text{N/mm}^2 } \frac{14}{13} \frac{12}{12}$ $\frac{1: 35 \text{ °C} / 60 \text{ °C}}{\text{II: } 50 \text{ °C} / 72 \text{ °C}} \frac{\tau_{\text{Rik,ucr}}}{\tau_{\text{Rik,ucr}}} \frac{ \text{N/mm}^2 }{ \text{N/mm}^2 } \frac{13}{12} \frac{12}{12}$ $\frac{1: 35 \text{ °C} / 60 \text{ °C}}{\text{II: } 50 \text{ °C} / 72 \text{ °C}} \frac{\tau_{\text{Rik,ucr}}}{\tau_{\text{Rik,ucr}}} \frac{ \text{N/mm}^2 }{ \text{N/mm}^2 } \frac{13}{12} \frac{12}{11}$ $\frac{1: 35 \text{ °C} / 60 \text{ °C}}{\text{II: } 50 \text{ °C} / 72 \text{ °C}} \frac{1}{\tau_{\text{Rik,ucr}}} \frac{1}{\tau_{\text{Rik,ucr}}$	Sebar anchor FRA   M12   M16   M20   M20			

fischer injection system	FIS	ΕM	Plus
--------------------------	-----	----	------

#### **Performances**

Characteristic values for combined pull-out and concrete failure for fischer rebar anchors FRA; working life 50 years



Table C12.1: Characteristic values for combined pull-out and concrete failure for fischer rebar anchors FRA in hammer or diamond drilled holes; uncracked or cracked concrete; working life 100 years

	oracito.		,	9	, ou. o		
fischer re	ebar anchor FRA			M12	M16	M20	M24
Combine	ed pullout and con	crete con	e failure				
Calculation	on diameter	d	[mm]	12	16	20	25
Uncracke	ed concrete						
Characte	eristic bond resista	ance in un	cracked	concrete C20/25	5		
<u>Hammer-</u>	<u>drilling with standar</u>	<u>d drill bit c</u>	r hollow d	Irill bit (dry or wet	t concrete)		
Tem-	I: 35 °C / 60 °C		[N1/mm2]	15	14	13	12
perature range	II: 50 °C / 72 °C	$ op$ $ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	14	13	12	12
Diamond-	-drilling (dry or wet	concrete)					
Tem-	I: 35 °C / 60 °C		FN 1/ 27	13	12	10	9
perature range	II: 50 °C / 72 °C	$  au_{ ext{Rk,ucr}}$	[N/mm <sup>2</sup> ]	12	11	10	9
Installati	on factors						
Dry or we	et concrete	γinst	[-]		1	,0	
Working	I: 35 °C / 60 °C	_	FN 17 21	0,75	0,75	0,75	0,75
life 100 years	II: 50 °C / 72 °C	—α <sub>100 years</sub>	[N/mm²]	0,60	0,65	0,65	0,65
Cracked	concrete						
Characte	eristic bond resista	ance in cr	acked co	ncrete C20/25			
<u> Hammer-</u>	<u>drilling with standar</u>	d drill bit c	r hollow d	Irill bit and diamo	nd-drilling (dry o	r wet concrete)	
Tem-	I: 35 °C / 60 °C	_	[N1/mm21	8	8	8	8
perature range	II: 50 °C / 72 °C	— τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	8	8	8	8
Installati	on factors						
Dry or we	et concrete	γinst	[-]		1	,0	
Working	I: 35 °C / 60 °C	a		0,80	0,65	0,65	0,65
life 100 years	II: 50 °C / 72 °C	— α <sub>100 years</sub>	[-]	0,80	0,65	0,65	0,65

1)	Ca	lcul	atior	ı of	cha	racte	erist	ic	bond	l res	istano	ce in	uncra	acked	l cor	ncrete	TRK,100	), ucr:
----	----	------	-------	------	-----	-------	-------	----	------	-------	--------	-------	-------	-------	-------	--------	---------	---------

 $\tau_{\text{Rk,100, ucr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,ucr}}$ 

#### <sup>2)</sup> Calculation of characteristic bond resistance in cracked concrete T<sub>Rk,100, cr</sub>:

 $\tau_{\text{Rk,100, cr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,cr}}$ 

fischer	injection	system	FIS	EM Plus	;

#### **Performances**

Characteristic values for pull-out and concrete failure for fischer rebar anchors FRA; working life 100 years



Table (	Table C13.1: Displacements for anchor rods												
Anchor	rod	M8	M10	M12	M14	M16	M20	M22	M24	M27	M30		
Displace	ement-Factors	for tensi	on load <sup>1</sup>										
Uncrack	ed or cracked	concrete	e; Tempe	rature ra	nge I, II								
δ <sub>N0-Factor</sub>	[mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10	0,11	0,11	0,12	0,12	0,13		
δ <sub>N∞-Factor</sub>	[[[[[[]]	0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19		
Displace	ement-Factors	for shea	r load <sup>2)</sup>										
Uncrack	ed or cracked	concrete	; Tempe	rature ra	nge I, II								
δv0-Factor	[mm/kN]]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05		
δv∞-Factor	[mm/kN]	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:

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

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

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

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

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

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

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

## Table C13.2: Displacements for fischer internal threaded anchors RG MI

Internal anchor F	threaded RG MI	M8	M10	M12	M16	M20
Displace	ment-Factors	for tension load <sup>1</sup>				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
$\delta_{\text{N0-Factor}}$	[mm/(N/mm²)]	0,09	0,10	0,10	0,11	0,13
δ <sub>N∞</sub> -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			
$\delta$ V0-Factor	[mm/kN]]	0,12	0,09	0,08	0,07	0,05
δv∞-Factor	[mm/kN]	0,18	0,14	0,12	0,10	0,08

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

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

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

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

 $\delta v_0 = \delta v_{0\text{-Factor}} \cdot V_{\text{Ed}}$ 

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

(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



Table (	Table C14.1: Displacements for reinforcing bars																	
Nominal of the ba																		
Displace	ment-Factors	for te	ensio	n loa	d <sup>1)</sup>													
Uncrack	ed or cracked	cond	rete;	Tem	perat	ure ra	ange	I, II										
$\delta$ N0-Factor																		
δ <sub>N∞-Factor</sub>	[ [ [ [ [ ] ] ] ]	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
Displace	ment-Factors	for s	hear	load <sup>2</sup>	)													
Uncrack	ed or cracked	cond	rete;	Tem	perat	ure ra	ange	I, II										
δvo-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
δv∞-Factor	[mm/kN]	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:

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

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

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

<sup>2)</sup> 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<sub>Ed</sub>: Design value of the applied shear force)

## Table C14.2: Displacements for fischer rebar anchors FRA

fischer r FRA	ebar anchor	M12	M16	M20	M24
Displace	ment-Factors	for tension load1)			
Uncrack	ed or cracked	concrete; Temperatu	re range I, II		
$\delta_{\text{N0-Factor}}$	[mm/(N/mm²)]	0,09	0,10	0,11	0,12
δ <sub>N∞-Factor</sub>	[[[]]]]/([N/]]]]]	0,13	0,15	0,16	0,18
Displace	ment-Factors	for shear load <sup>2)</sup>			
Uncrack	ed or cracked	concrete; Temperatu	re range I, II		
δvo-Factor	[mm/kN]	0,12	0,09	0,07	0,06
δv∞-Factor	[IIIII/KIN]	0,18	0,14	0,11	0,09

1) Calculation	of offootive	dical acoments
-9 Gaiculation	or 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:

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

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

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

fischer injection system FIS EM Plus
--------------------------------------

#### **Performance**

Displacements for reinforcing bars and fischer rebar anchors FRA



Table C15.1: Characteristic values for steel failure under tension / shear load of fischer anchor rods and standard threaded rods under seismic action performance category C1 or C2

	periornal	ioc ca	.cgc	,, <u>,                                 </u>		<b>-</b>							
Anchor	rod / standard thread	ed rod			M10	M12	M14	M16	M20	M22	M24	M27	M30
Bearing	capacity under tension	on load	l, ste	el fai	lure <sup>1)</sup>								
fischer a	anchor rods and stand	dard th	read	ed ro	ds, per	formar	ice cat	egory C	C1 <sup>2)</sup>				
o	Ctool wine plated		5.8		29(27)	43	58	79	123	152	177	230	281
rristi oor	Steel zinc plated	₹,″	8.8		47(43)	68	92	126	196	243	282	368	449
naracteristi resistance NRK,S,C1	Stainless steel R and	Property class	50	[kN]	29	43	58	79	123	152	177	230	281
Characteristic resistance NRK,S,C1	riigir corrosion	g 0	70		41	59	81	110	172	212	247	322	393
0	resistant steel HCR		80		47	68	92	126	196	243	282	368	449
fischer a	anchor rods and stand	dard th	read	ed ro	ds, per	formar	nce cate	egory C	<b>2</b> <sup>2)</sup>				
. <u></u>	Steel zinc plated		5.8		_4)	39	_4)	72	108	_4)	177	_4)	_4)
Characteristic resistance NRK,S,C2	·	S if	8.8		_4)	61	_4)	116	173	_4)	282	_4)	_4)
aracte esistar N <sub>Rk,s,C</sub>	Stainless steel R and	Property class	50	[-]	_4)	39	_4)	72	108	_4)	177	_4)	_4)
har res		ا ج	_70		_4)	53	_4)	101	152	_4)	247	_4)	_4)
	resistant steel HCR		80		_4)	61	_4)	116	173	_4)	282	_4)	_4)
	capacity under shear					out lev	er arm <sup>1</sup>	)					
fischer a	anchor rods, performa	ance ca	atego	ory C	1 <sup>2)</sup>								
<u>ي</u> .	Steel zinc plated		5.8		17(16)	25	34	47	74	91	106	138	168
erist nce		ر کے ر	8.8		23(21)	34	46	63	98	122	141	184	225
naracteristi esistance VRks,C1	Stainless steel R and	Property class	50	[kN]	15	21	29	39	61	76	89	115	141
Characteristic resistance VRKS,C1	riigii corrosiori	٩ م	70		20	30	40	55	86	107	124	161	197
	resistant steel HCR		80		23	34	46	63	98	122	141	184	225
Standar	d threaded rods, perf	ormano	се са	tego	ry C1 <sup>2)</sup>								
ا <u>ن</u> ے ا	Steel zinc plated		5.8		12(11)	17	24	33	52	64	74	97	118
Characteristic resistance VRK,S,C1		is it	8.8		16(14)	24	32	44	69	85	99	129	158
iaracteris esistano V <sub>Rk.s,C1</sub>	Stainless steel R and	Property class	_50	[kN]	11	15	20	27	43	53	62	81	99
;har res	0	ا ج `	70		14	21	28	39	60	75	87	113	138
	resistant steel HCR		80		16	24	32	44	69	85	99	129	158
tischer a	anchor rods and stand	dard th		ed ro						4		4)	4)
stic	Steel zinc plated	_	5.8		_4)	14	_4)	27	43	_4) _4)	62	_4) _4)	_4) _4)
Characteristic resistance VRK,S,C2	· · · · · · · · · · · · · · · · · · ·	Property class	8.8	r 1	_4)	22	_4)	44	69	_4)	99	_4)	_4)
arac sist V <sub>RK</sub> ,	Stainless steel R and high corrosion	ල් සි	50 70	[-]	_4)	14 20	_4)	27 39	43 60	_4)	62 87	_4)	_4)
Ch.	resistant steel HCR	1	80		_4)	22	_4)	44	69	_4)	99	_4)	_4)
Factor fo	or the annular gap	(Yaar	00	[-]	<u>-</u> '/	<b></b>			,5 (1,0)		33	/	- '
actor ic	n the annual gap	$lpha_{\sf gap}$		[_]					,5 (1,0)				

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

fischer injection system FIS EM Plus

#### **Performances**

Characteristic values for steel failure under tension / shear load for fischer anchor rods and standard threaded rods under seismic action (performance category C1 / C2)

<sup>&</sup>lt;sup>2)</sup> Values in brackets are valid for undersized threaded rods with smaller stress area A<sub>s</sub> for hot dip galvanised standard threaded rods according to EN ISO 10684:2004+AC:2009.

<sup>&</sup>lt;sup>3)</sup> Values in brackets are valid for filled annular gaps between the anchor rod and the through-hole in the attachment. It is necessary to use the fischer filling disc according to Annex A 1

<sup>4)</sup> No performance assessed



Table C16.1:	Characteristic values for <b>steel failure</b> under tension / shear load for
	reinforcing bars (B500B) under seismic action performance category C1

	•							<u>'</u>							
Nominal diameter of the bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Bearing capacity under tension	n load, steel	failu	re <sup>1)</sup>												
Reinforcing bar B500B acc. to	DIN 488-2:20	0-90	8, pe	rforr	nanc	e ca	tegoı	y C1							
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	44	63	85	111	140	173	209	249	270	292	339	389	443
Bearing capacity under shear	load, steel fa	ilure	with	out I	ever	arm¹	1)								
Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1															
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	15	22	30	39	49	61	74	88	95	102	119	137	155

<sup>1)</sup> Partial factors for performance category C1 see table C16.2

Table C16.2: Partial factors for fischer anchor rods, standard threaded rods and reinforcing bars (B500B) under seismic action performance category C1 or C2

Anch	nor rod / standard thre		M10	)   r	VI12	M14	М	16	M20	M:	22	M24	M2	7	M30		
Nom	inal diameter of the ba	ır		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Tens	ion load, steel failure <sup>1</sup>	)															
z	Ctool zine plated		5.8								1,50						
γMs,	Steel zinc plated	≥ 8.8			1,50												
cto	Stainless steel R and	Property class	50	r 1							2,86						
2   E	— night corrosion — /\(\frac{1}{2}\)		70	[-]	1,50 <sup>2)</sup> / 1,87												
arti			80	80		1,60											
	Reinforcing bar	B!	500B								1,40						
Shea	ır load, steel failure <sup>1)</sup>																
>	Stool zing plated		5.8			1,25											
Partial factor y <sub>Ms,v</sub>	Steel zinc plated	s r <del>t</del>	8.8								1,25						
ctor	Stainless steel R and	Property class	50	r 1							2,38						
al fa	high corrosion	P.	70	[-]						1,2	5 <sup>2)</sup> / 1	,56					
arti	resistant steel HCR		80		1,33												
Reinforcing bar B500B											1,50						

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

fischer injection system FIS EM Plus

Performances
Characteristic values for steel failure under tension/shear load for reinforcing bars under seismic action (performance category C1); partial factors (perform. category C1 / C2)

Annex C 16

<sup>&</sup>lt;sup>2)</sup> Only admissible for high corrosion resistant steel HCR, with  $f_{yk}$  /  $f_{uk} \ge 0.8$  and  $A_5 > 12$  % (e.g. fischer anchor rods)



Table C17.1:	Characteristic values for <b>combined pull-out</b> and concrete failure for <b>fischer</b>
	anchor rods and standard threaded rods in hammer drilled holes under
	seismic action performance category C1; working life 50 and 100 years

Anchor r	od /	standard thread	ded rod		M10	M12	M14	M16	M20	M22	M24	M27	M30	
Characte	risti	c bond resistan	ce, com	bined pu	lout ar	d cond	rete co	ne fail	ure					
Hammer-	drill	ing with standa	rd drill b	oit or holl	ow dril	bit (dr	y or we	t conc	rete)					
Tem-	l:	35 °C / 60 °C		[N ] /ma ma 2]	7,0	7,0	6,7	6,0	5,7	6,7	6,7	6,7	6,7	
perature range	II:	50 °C / 72 °C	τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	7,0	7,0	6,7	5,7	5,7	6,7	6,7	6,7	6,7	
Hammer-	drill	ing with standa	rd drill b	oit or holl	ow dril	l bit (wa	ater fille	ed hole	)					
Tem-	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	
perature range	II:	50 °C / 72 °C	τ <sub>Rk,C1</sub>	[IN/IIIII-] 	6,8	6,8	6,5	5,7	5,7	5,7	5,7	5,7	5,7	
Installation	on fa	actors												
Dry or we	t cor	ncrete		[ ]					1,0					
Water filled hole		γinst	[-]		1,2 1) 1,4 1)									

<sup>1)</sup> Not permitted in combination with working life 100 years

Table C17.2: Characteristic values for combined pull-out and concrete failure for reinforcing bars in hammer drilled holes under seismic action performance category C1; working life 50 and 100 years

Nominal (	dian	neter of the bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Characte	Characteristic bond resistance, combined pullout and concrete cone failure																
Hammer-	drill	ing with standa	rd drill b	it or holl	ow d	rill bi	t (dry	or v	vet c	oncre	ete)						
Tem- perature -	l:	35 °C / 60 °C	<b>-</b>	  [N/mm²]	7,0			5,7				6,7		6,7	6,7	6,7	4,8
range	II:	50 °C / 72 °C	τ <sub>Rk,C1</sub>	[14/11111]	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-	Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)																
Tem-		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	1			5,7	4,8
perature - range	II:	50 °C / 72 °C	τ <sub>Rk,C1</sub>	ן נוא/וווווו ן	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
Installatio	on fa	actors															
Dry or we	t cor	ncrete		r 1							1,0						
Water fille	Water filled hole		γinst	[-]			1,2 <sup>1)</sup>						1,4	<b>1</b> 1)			

<sup>1)</sup> Not permitted in combination with working life 100 years

fischer injection system FIS EM Plus

#### **Performances**

Characteristic values for combined pull-out and concrete failure under seismic action (C1) for fischer anchor rods, stand. thread. rods and reinf. bars; working life 50 and 100 years



Table C18.1: Characteristic values for combined pull-out and concrete failure for fischer anchor rods and standard threaded rods in hammer drilled holes under seismic action performance category C2; working life 50 and 100 years

Anchor r	od / s	standard thread	ded rod		M12	M16	M20	M24
Characte	ristic	bond resistan	ce, com	bined pu	llout and concre	ete cone failure		
Hammer-	-drilli	ing with standa	rd drill b	oit or holl	ow drill bit (dry	or wet concrete	<del>)</del>	
Tem- perature	l:	35 °C / 60 °C	_	[N/mm <sup>2</sup> ]	3,5	5,8	5,0	3,1
range	II:	50 °C / 72 °C	τ <sub>Rk,C2</sub>	[14/11111-]	3,3	5,5	4,7	2,9
Hammer-	-drilli	ing with standa	rd drill k	oit or holl	ow drill bit (wat	er filled hole)		
Tem-	l:	35 °C / 60 °C	_	[N/mm²]	3,5	5,8	5,0	3,1
perature range	II:	50 °C / 72 °C	τ <sub>Rk,C2</sub>	[[14/111111-]	3,3	5,5	4,7	2,9
Installatio	on fa	ctors						
Dry or we	t con	crete		r 1		1	,0	
Water filled hole γ <sub>inst</sub> [-]		[-]	1,	2 <sup>1)</sup>	1,	1,41)		
1) NI a t 10 a 11		ورجانه ومراجا ومرجوع والمراج		م مانا بمصنادات	100			

<sup>1)</sup> Not permitted in combination with working life 100 years

Displacement-Factors for tension load <sup>1)</sup>											
$\delta$ N,C2 (DLS)-Factor	[mm/(N/mm²)]	0,09	0,10	0,11	0,12						
δN,C2 (ULS)-Factor	[[[]]]	0,15	0,17	0,17	0,18						
Displacement-Factors for shear load <sup>2)</sup>											
δv,C2 (DLS)-Factor		0,18	0,10	0,07	0,06						
	[mm/kN]	,	,	,	,						

#### 1) Calculation of effective displacement:

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

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

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

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

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

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

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

fischer injection system FIS EM Plus

#### **Performances**

Characteristic values for combined pull-out and concrete failure under seismic action (C2) for fischer anchor rods and standard threaded rods; working life 50 and 100 years