

DECLARATION OF PERFORMANCE



DoP: 0173

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

1. Unique identification code of the product-type: DoP: 0173

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

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

4. Authorised representative: --

5. System/s of AVCP: 1

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

European Technical Assessment: ETA-17/0979; 2019-07-22

Technical Assessment Body: DIBt

Notified body/ies: 1343 - MPA Darmstadt

7. Declared performance/s:

Mechanical resistance and stability (BWR 1)

Characteristic resistance to tension load (static and quasi-static loading):
 See appendix, especially Annexes C 1 – C 12, B 3, B 4, B 6 – B 8

- Characteristic resistance to shear load (static and quasi-static loading):
 See appendix, especially Annexes B 3, B 4, B 6 B 8, C 1 C 4
- Displacements under short-term and long-term loading: See appendix, especially Annexes C 13 C 14
- Durability: See appendix, especially Annexes A 6, B 2, B 3
- Characteristic resistance and displacements for seismic performance categories C1 and C2:
 See appendix, especially Annexes A6, C 15 C 18
 - \circ Factor for annular gap (α_{gap}): 1,0 (filled gap) respectively 0,5 (non-filled gap)

Hygiene, health and the environment (BWR 3)

- Content, emission and/or release of dangerous substances: See appendix, especially page 3 / NPD
- 8. Appropriate Technical Documentation and/or Specific Technical Documentation: ---

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

Signed for and on behalf of the manufacturer by:

Thilo Pregartner, Dr.-Ing.

 $Wolfgang\ Hengesbach,\ Dipl.\hbox{-Ing.,}\ Dipl.\hbox{-Wirtsch.-Ing.}$

i.V. W. Myelal

Tumlingen, 2019-08-01

ppa. The Mx

- This DoP has been prepared in different languages. In case there is a dispute on the interpretation the english version shall always prevail.

- The Appendix includes voluntary and complementary information in English language exceeding the (language-neutrally specified) legal requirements.

Specific Part

1 Technical description of the product

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

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

The product description is given in Annex A.

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

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 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 for static and quasi-static tension load	See Annex C 1 to C 12
Characteristic resistance for static and quasi-static shear load	See Annex C 1 to C 4
Displacements for static and quasi-static loads	See Annex C 13 to C 14
Characteristic resistance for seismic performance categories C1 and C2	See Annex C 15 to C 18
Durability	See Annex B 2

3.2 Hygiene, health and the environment (BWR 3)

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

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

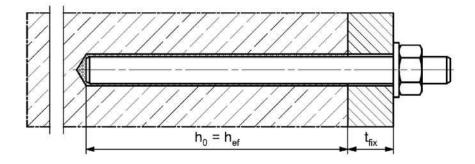
In accordance with EAD 330499-01-0601 according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

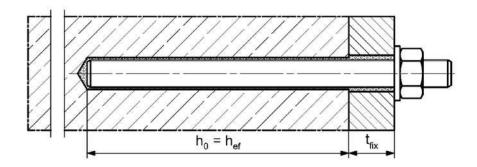
Installation conditions part 1

fischer anchor rod

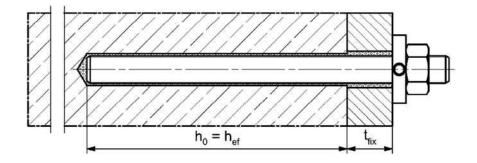
Pre-positioned installation



Push through installation (annular gap filled with mortar)



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



Figures not to scale

 h_0 = drill hole depth

h_{ef} = effective embedment depth

 t_{fix} = thickness of fixture

fischer injection system FIS EM Plus

Product description

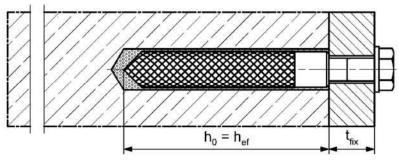
Installation conditions part 1

Annex A 1

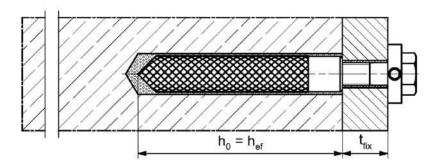
Installation conditions part 2

fischer internal threaded anchor RG MI

Pre-positioned installation



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



Figures not to scale

 h_0 = drill hole depth

h_{ef} = effective embedment depth

 t_{fix} = thickness of fixture

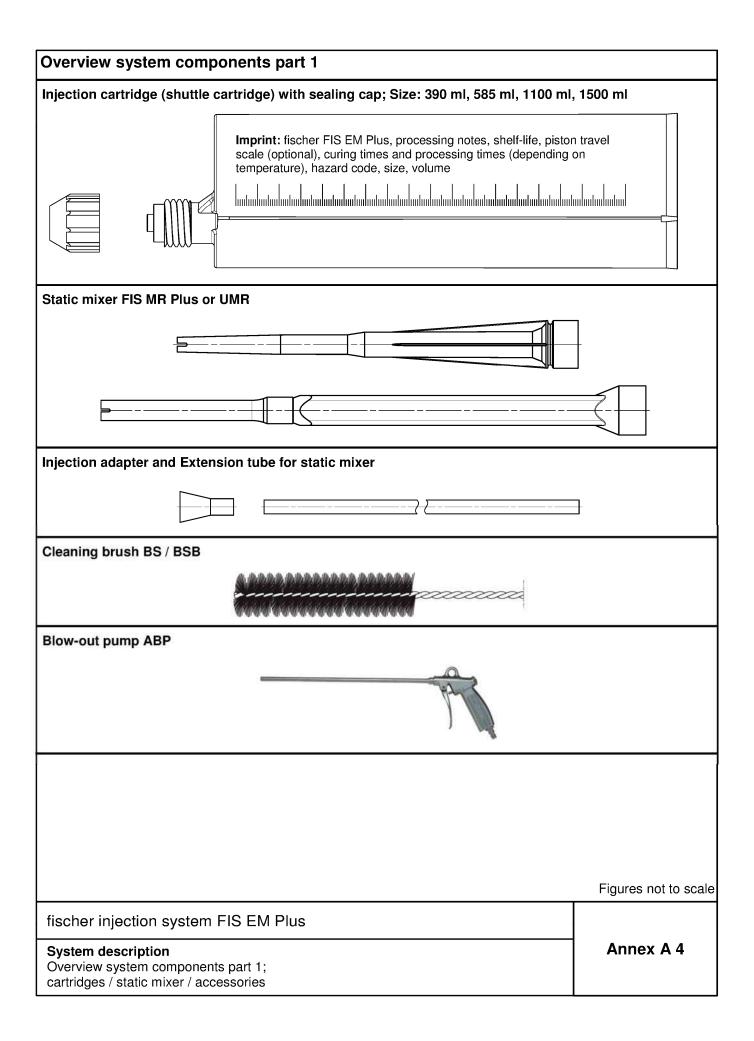
fischer injection system FIS EM Plus

Product description

Installation conditions part 2

Annex A 2

Installation conditions part 3 Reinforcing bar $h_0 = h_{ef}$ fischer rebar anchor FRA **Pre-positioned installation** h_0 Push through installation (annular gap filled with mortar) ho Figures not to scale h_0 = drill hole depth hef = effective embedment depth t_{fix} = thickness of fixture fischer injection system FIS EM Plus Annex A 3 **Product description** Installation conditions part 3



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

Part	Designation		Mate	erial		
1	Injection cartridge		Mortar, har	dener, filler		
	Steel grade	Steel, zinc plated	Stainless steel A4 ¹⁾		High corrosion resistant steel C ²⁾	
2	Anchor rod	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 μm, EN ISO 4042:1999 A2K or hot-dip galvanized ≥ 40 μm EN ISO 10684:2004 f_{uk} ≤ 1000 N/mm² $A_5 > 12\%$ fracture elongation Fracture elongation Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4062, 1.4662, 1.4462; EN 10088-1:2014) f_{uk} ≤ 1000 N/mm² $A_5 > 12\%$ fracture elongation Fracture elongation $A_5 > 8$ %, for applications with		$\begin{array}{llllllllllllllllllllllllllllllllllll$		
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; 3;1.4571; ; 1.4362; 88-1:2014	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, 7 EN ISO 3 1.4401; 1.4 1.4571; 1.4	Property class 50, 70 or 80 50, 70 EN ISO 3506-1:2009 EN ISO 3506-1:4401; 1.4404; 1.4578; 1.4565; 1.4571; 1.4439; 1.4362; EN 10088-1:2014		
5	fischer internal threaded anchor RG MI	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 μm, ISO 4042:1999 A2K	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014		Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014	
6	Commercial standard screw or anchor / threaded rod for fischer internal threaded anchor RG MI	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 μm, ISO 4042:1999 A2K A₅ > 8 % fracture elongation	EN ISO 3 1.4401; 1.4 1.4571; 1.4 EN 1008	y 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; 88-1:2014	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 $f_{uk} = f_{tk} = k \cdot f_{yk}$		92-1-1:2004+AC	:2010	
9	fischer rebar anchor FRA	70 or 80 :2009 , 1.4571, 1.4578, 1.4439, EN 10088-1:2014 ¹⁾ EN 10088-1:2014 ²⁾				
		:2014 Corrosion resistance of :2014 Corrosion resistance of				
	her injection system	FIS EM Plus			Annex A 6	

Specifications of intended use (part 1) Table B1.1: Overview use and performance categories Anchorages subject to FIS EM Plus with ... Anchor rod fischer internal Reinforcing bar fischer rebar threaded anchor anchor RG MI FRA KAKAKAKAKAKAKA Hammer drilling with standard drill all sizes Hammer drilling with hollow drill bit (fischer "FHD", Nominal drill bit diameter (do) Heller "Duster 12 mm to 35 mm Expert"; Bosch Speed Clean"; Hilti 'TE-CD, TE-YD") Diamond drilling all sizes Tables: Tables: Tables: Tables: uncracked C1.1 C2.1 C3.1 C3.2 concrete Static and quasi C4.1 C4.1 C4.1 C4.1 all sizes all sizes all sizes all sizes static load, in C5.1 C7.1 C9.1 C11.1 cracked C6.1 C8.1 C10.1 C12.1 concrete C13.2 C14.1 C14.2 C13.1 Tables: Tables: M₁₀ ф10 C15.1 C16.1 Seismic C1 to to C16.2 C16.2 performance M30 ф32 C17.1 C17.2 category (only hammer drilling with M12 Tables: standard / hollow M16 C15.1 C2 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 service life time 100 years) hole Installation direction D3 (downward and horizontal and upwards (e.g. overhead) installation) 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 max. long term temperature +35 °C) range I In-service temperature Temperature (max. short term temperature +72 °C; -40 °C to +72 °C range II max. long term temperature +50 °C) 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 6.1.

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.
 Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
 Fastening in stand-off installation or with a grout layer under seismic action are not covered in this European Technical Assessment (ETA).

Installation:

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

fischer injection system FIS EM Plus	
Intended use Specifications (part 2)	Annex B 2

Table B3.1:	Table B3.1: Installation parameters for anchor rods												
Anchor rods	Thread	М8	M10	M12	M14	M16	M20	M22	M24	M27	M30		
Width across flats		SW		13	17	19	22	24	30	32	36	41	46
Nominal drill hole di	ameter	d_0		10	12	14	16	18	22 24 ¹⁾	25	28	30	35
Drill hole depth		h ₀						h ₀ =	h _{ef}				
Effective		h _{ef, min}		60	60	70	75	80	90	93	96	108	120
embedment depth		h _{ef, max}	[mm]	160	200	240	280	320	400	440	480	540	600
Diameter of the clearance hole of the fixture pre-positioned installation push through installation		df		9	12	14	16	18	22	24	26	30	33
		df		12	14	16	18	20	26	28	30	33	40
Minimum thickness member	of concrete	h _{min}		h _{ef} + 30 (≥ 100) h _{ef} + 2d ₀									
Maximum torque mo		max T _{fix}	[Nm]	10	20	40	50	60	120	135	150	200	300

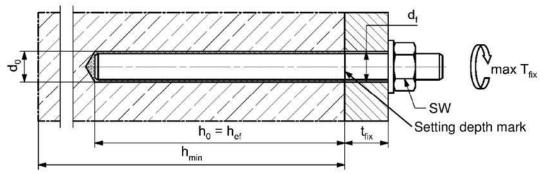
¹⁾ Both drill hole diameters can be used



Marking (on random place) fischer anchor rod:

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

reinforcing b		T	T							
Anchor rods	neter) ф	M8	M10	M12	M14	M16	-	M20	M22	M24
Reinforcing bars (nominal diam	8	10	12	14	16	18	20	22	24	
Minimum edge distance										
Uncracked / cracked concrete	C _{min} [mm	1 40	45	45	45	50	55	55	55	60
Minimum spacing	Smin	1			accordi	ng to Aı	nnex B	5		
Minimum spacing										
Uncracked / cracked concrete	Smin	40	45	55	60	65	85	85	95	105
Minimum edge distance	C _{min} [mr	,			accordi	ng to Aı	nnex B	5		
Required projecting area			ii ii ii ii							
Uncracked concrete	, [100	n 8	13	22	23	24	38,5	38,5	39,5	40
	, 100	J					00,0	00,0	, 00,0	
Cracked concrete	- A _{sp,req} nm	<u> </u>	10	16,5	17,5	18,5	29,5	29,5	30	
Cracked concrete Anchor rods	_ ^\ -	ັ⊢					-		<u> </u>	30,5
	- A _{sp,req} mm	ັ⊢		16,5		18,5	-		<u> </u>	
Anchor rods	- A _{sp,req} mm	6,5	10	16,5 M27	17,5	18,5 M30	29,5	29,5	30	30,5
Anchor rods Reinforcing bars (nominal diam	neter) ф	- 25	10	16,5 M27	17,5	18,5 M30	29,5	29,5	30	30,5
Anchor rods Reinforcing bars (nominal diam Minimum edge distance	- A _{sp,req} mm ²	- 25	10 - 26	16,5 M27 - 75	17,5 - 28	18,5 M30 30	29,5 - 32	29,5 - 34	30 - 36	30,5 - 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete	neter) ф	- 25	10 - 26	16,5 M27 - 75	17,5 - 28 80	18,5 M30 30	29,5 - 32	29,5 - 34	30 - 36	30,5 - 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing	neter) ф	- 25	10 - 26	16,5 M27 - 75	17,5 - 28 80	18,5 M30 30	29,5 - 32	29,5 - 34	30 - 36	30,5 - 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing	neter) ф	- 25	10 - 26 75	16,5 M27 - 75	17,5 - 28 80 accordi	M30 30 80 ng to Ai	29,5 - 32 120 nnex B5	29,5 - 34 120 5	30 - 36 135	30,5 - 40 175
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete	- Asp,req mm ² neter) φ Cmin Smin [mm	- 25	10 - 26 75	16,5 M27 - 75	17,5 - 28 80 accordi	M30 30 80 ng to Ai	29,5 - 32 120 nnex B5	29,5 - 34 120 5	30 - 36 135	30,5 - 40 175
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete Minimum edge distance	- Asp,req mm ² neter) φ Cmin Smin [mm	- 25 75 1 120	10 - 26 75	16,5 M27 - 75	17,5 - 28 80 accordi	M30 30 80 ng to Ai	29,5 - 32 120 nnex B5	29,5 - 34 120 5	30 - 36 135	30,5 - 40 175

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

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

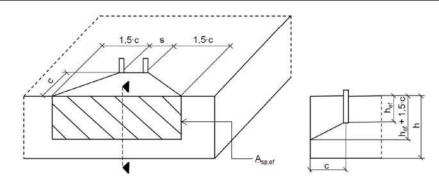
$$A_{sp,req} < A_{sp,t}$$

A_{sp,req} = required projecting area

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

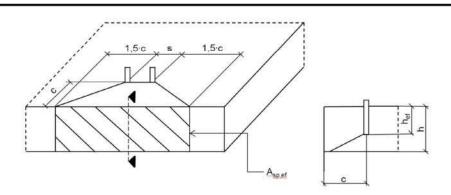
fischer injection system FIS EM Plus	
Intended use Minimum spacing and edge distance for anchor rods and reinforcing bars	Annex B 4

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 _{min}
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 ≥ c _{min} and s ≥ 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 _{min}
Group of anchors with	s > 3 · c	$A_{sp,t} = 6 \cdot c \cdot existing h$	[mm²]	WILIT C 2 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 $s \ge s_{min}$

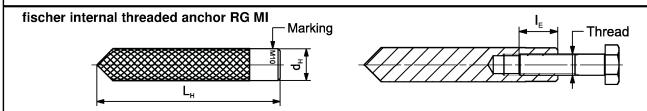
Edge distance and axial spacing shall be rounded up to at least 5 mm

Figures not to scale

fischer injection system FIS EM Plus	
Intended use Minimum thickness of concrete member for anchor rods, minimum spacing and edge distance	Annex B 5

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

Internal threaded anchors R	G MI	Thread	M8	M10	M12	M16	M20
Diameter of anchor	$d_{nom} = d_H$		12	16	18	22	28
Nominal drill hole diameter	d₀		14	18	20	24	32
Drill hole depth	h ₀				$h_0 = h_{\text{ef}} = L_{\text{H}}$		
Effective embedment depth (hef = LH)	h _{ef}		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 _{min}		120	125	165	205	260
Maximum screw-in depth	I _{E,max}		18	23	26	35	45
Minimum screw-in depth	l _{E,min}		8	10	12	16	20
Maximum torque moment for attachment of the fixture	max T _{fix}	[Nm]	10	20	40	80	120



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: $h_0 = h_{ef} \qquad t_{fix}$

Figures not to scale

fischer injection system FIS EM Plus

Intended use

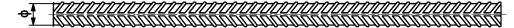
Installation parameters internal threaded anchors RG MI

Annex B 6

	param	CICIST	or rein	iorcini	j bars						
Nominal diameter of the bar		ф	8 ¹⁾	10 ¹⁾	12 ¹⁾	14	16	18	20	22	24
Nominal drill hole diameter	d ₀		10 12	12 14	14 16	18	20	25	25	30	30
Drill hole depth	h ₀		$h_0 = h_{ef}$								
Effective	$h_{\text{ef},\text{min}}$	[mm]	60	60	70	75	80	85	90	94	98
embedment depth	h _{ef,max}] ['''''	160	200	240 280 320 360 4			400	440	480	
Minimum thickness of concrete member	h_{min}		h _{ef} + 30 (≥ 100) h _{ef} + 2d ₀								
Name and discussion of the land			0.5	00	00	00		0.4	00	40	
Nominal diameter of the bar		<u>ф</u>	25	26	28	30	32	34	36	40	-
Nominal drill hole diameter	d_0		30	35	35	40	40	40	45	55	-
	h₀						$h_0 = h_{\text{ef}}$				
Drill hole depth	110										
Drill hole depth Effective	h _{ef,min}	[mm]	100	104	112	120	128	136	144	160	-
<u>'</u>		[mm]	100 500	104 520	112 560	120 600	128 640	136 680	144 720	160 800	-

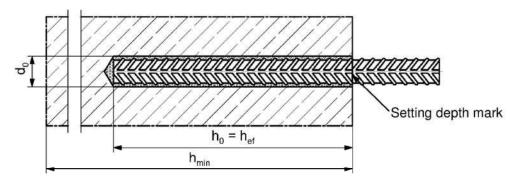
¹⁾ Both drill hole diameters can be used

Reinforcing bar



- The minimum value of related rib area f_{R,min} must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range: $0.05 \cdot \phi \le h_{rib} \le 0.07 \cdot \phi$ (ϕ = Nominal diameter of the bar , h_{rib} = rib height)

Installation conditions:



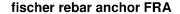
Figures not to scale

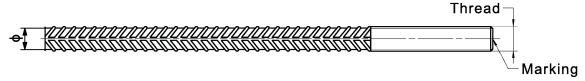
fischer injection system FIS EM Plus	
Installation parameters reinforcing bars	Annex B 7

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

Rebar anchor FRA		Thread	M1:	2 ¹⁾	M16	M20	M24	
Nominal diameter of the bar	ф		12	2	16	20	25	
Width across flats	SW		19)	24	30	36	
Nominal drill hole diameter	d₀		14	16	20	25	30	
Drill hole depth	h ₀				h _{ef}	+ le		
Effective embedment depth	h _{ef,min}		70)	80	90	96	
Linective embedinent deptin	$h_{\text{ef},\text{max}}$		14	0	220	300	380	
Distance concrete surface to welded joint	l _e	[]	100					
Minimum spacing and minimum edge distance	Smin = Cmin	[mm]	55		65	85	105	
Diameter of pre-positione anchorage	d ≤ d _f		14	1	18	22	26	
clearance hole in the fixture push through anchorage	l ≤ d _f		18	3	22	26	32	
Minimum thickness of concrete member	h_{min}		$h_0 + 30$ (≥ 100) $h_0 + 2d_0$					
Maximum torque moment for attachment of the fixture	max T _{fix}	[Nm]	40)	60	120	150	

¹⁾ Both drill hole diameters can be used



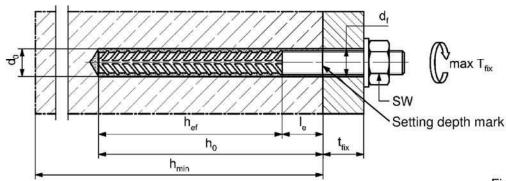


Marking frontal e. g:

FRA (for stainless steel);

FRA C (for high corrosion resistant steel)

Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use

Installation parameters rebar anchor FRA

Annex B 8

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

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

Nominal drill hole diameter	d₀	[mm]	10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
Steel brush diameter	dь	[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 _{work}	Minimum curing time t _{cure}
-5 to -1	240 min	200 h
±0 to +4	150 min	90 h
+5 to +9	120 min	40 h
+10 to +19	30 min	18 h
+20 to +29	14 min	10 h
+30 to +40	7 min	5 h

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

fischer injection system FIS EM Plus	
Intended use	Annex B 9
Cleaning brush (steel brush)	
Processing time and curing time	

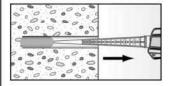
Installation instructions part 1 Drilling and cleaning the hole (hammer drilling with standard drill bit) Drill the hole. Nominal drill hole diameter d_0 and drill hole depth h_0 1 see tables B3.1, B6.1, B7.1, B8.1 Cleaning the drill hole: 2 Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) 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 do 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

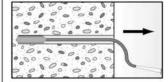
Installation instructions part 3

Injection of the mortar

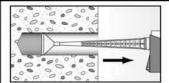
9



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



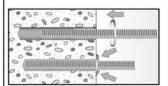
For drill hole depth ≥ 150 mm use an extension tube

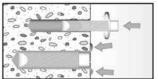


For overhead installation, deep holes ($h_0 > 250$ mm) or drill hole diameter ($d_0 \ge 40$ mm) use an injection-adapter

Installation of anchor rods or fischer internal threaded anchors RG MI

10



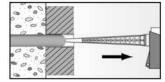


Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so.

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) or fischer overhead clips.



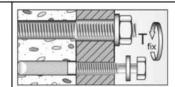
For push through installation fill the annular gap with mortar

11



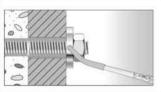
Wait for the specified curing time t_{cure} see table B9.2

12



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

Option



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

ATTENTION: Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

fischer injection system FIS EM Plus

Intended use

Installation instructions part 3

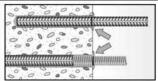
Annex B 12

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



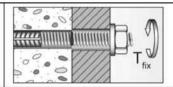
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

11



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

12



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

fischer injection system FIS EM Plus

Intended use

Installation instructions part 4

Annex B 13

Table C1.1:		ntial chara load of fis											le /	
Anchor rod / sta	andard th	readed rod			M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Bearing capacit	ty under t	ensile load	stee	el fail	ure					_				
당 존 Steel zinc	nlated		5.8		19(17)	29(27)	43	58	79	123	152	177	230	281
Presti	piateu	Dura va a vatur	8.8		29(27)	47(43)	68	92	126	196	243	282	368	449
Stainless	steel A4	Property class	50	[kN]	19	29	43	58	79	123	152	177	230	281
Stainless and high or resistant s			70		26	41	59	81	110	172	212	247	322	393
2 10010tant 0	80 30 47 68 92 126 19									196	243	282	368	449
Partial factors ¹	· · · · · · · · · · · · · · · · · · ·		5 0											
ြည် Steel zinc	5.8 1,50													
Bartial factor Steel zinc Award Harton Steel zinc Awar		Property	8.8						1,5					
<u>it</u> Stainless		class	50	[-]					2,8					
ਕਿ and high o			70 80		1,50 ²) / 1,87 1,60									
Bearing capacit	ty under s	hear load		failu	ro				1,0	.0				
without lever ar	-	inear road,	31001	Tanu	16									
() X ()			5.8		9(8)	15(13)	21	29	39	61	76	89	115	141
당 송 Steel zinc	plated		8.8		15(13)	23(21)	-	46	63	98	122	141	184	225
Stainless	steel A4	Property class	50	[kN]	9	15	21	29	39	61	76	89	115	141
हें डिं and high corrosion	corrosion	Class	70		13	20	30	40	55	86	107	124	161	197
C gresistant steel C 80 15 23						34	46	63	98	122	141	184	225	
Ductility factor			k ₇	[-]					1,0)				
with lever arm					ı	ı	I I			ı	Т			
Steel zinc	plated		5.8		<u> </u>	37(33)	-	104	166	324	447	560	833	1123
act.	•	Property	8.8		<u> </u>	60(53)		167	266	519	716	896	1333	1797
Steel zinc Wood Stainless and high of		class	-	[Nm]		37	65	104	166	324	447	560	833	1123
O <u>හි</u> and high d e resistant s			70		26	52	92	146	232	454	626	784	1167	1573
			80		30	60	105	167	266	519	716	896	1333	1797
Partial factors 1			50						1,2	5				
ာ် Steel zinc	plated		5.8 8.8						1,2					
Bartial factor Steel zinc Awy Stainless and high consistent of the standard factor of the s		Property	50	[-]					2,3					
and high of the second	steel A4	class	70	[-]					1,25 ²⁾ /					
resistant s			80						1,23 - 7	•				
1) In absence of 2) Only admiss rods) 3) Values in brastandard three	sible for hiç ackets are	gh corrosion valid for un	ations resis dersiz	tant s zed th	readed	rods w	th sm	aller st	d A ₅ >	12 % (_			ed
fischer inject	tion syste	em FIS EN	/ Plu	ıs								Anne	ex C	1

Essential characteristics for the steel bearing capacity of fischer anchor rods and

standard threaded rods

fischer internal	throade	nd anchore	DG MI		M8	M10	M12	M16	M20
Bearing capacit						IVITO	IVITZ	IVITO	IVIZU
bearing capacit	y unde		5.8	land	19	29	43	79	123
Charact.		Property class	8.8	1	29	47	68	108	179
resistance with	$N_{\text{Rk,s}}$		A4	[kN]	26	41	59	110	173
screw		Property class 70	C	1	26	41	59	110	172
Partial factors ¹⁾					20	41	[39	110	172
		Property	5.8				1,50		
		class	8.8				1,50		
Partial factors	$\gamma_{Ms,N}$	Property	A4	[-]			1,87		
		class 70	C	1			1,87		
Bearing capacit	y unde	r shear load	d, stee	failu	re		,,,,,,		
Without lever a	<u> </u>		,		-				
		Property	5.8		9,2	14,5	21,1	39,2	62,0
Charact.) (0	class	8.8		14,6	23,2	33,7	54,0	90,0
resistance with screw	V^0 Rk,s	Property	A4	[kN]	12,8	20,3	29,5	54,8	86,0
SCIEW		class 70	С	1	12,8	20,3	29,5	54,8	86,0
Ductility factor			k ₇	[-]			1,0		
With lever arm									_
		Property	5.8		20	39	68	173	337
Charact. resistance with	$M^0_{Rk,s}$	class	8.8	[Nm]	30	60	105	266	519
screw	IVI*RK,S	Property	_A4	וואוון	26	52	92	232	454
		class 70	С		26	52	92	232	454
Partial factors ¹⁾									
		Property	5.8				1,25		
Partial factors	γMs,V	class	8.8	[-]			1,25		
r ditial labible	/ IVIS, V	Property	_A4	' '			1,56		
		class 70	С				1,56		

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

Nominal diameter of the b	oar	ф	8	10	12	14	16	18	2	0 22	24	25	20	6 28	30	32	34	36	40
Bearing capacity under to	ensile load, ste	el failu	ure							·				·					
Characterstic resistance	$N_{Rk,s}$	[kN]								A	s · f u	k ¹⁾							
Bearing capacity under s	hear load, stee	l failu	re																
Without lever arm																			
Characterstic resistance	$V^0_{Rk,s}$	[kN]								0,5 ·	As ·	f _{uk} 1)						
Ductility factor	k ₇	[-]									0,8								
With lever arm																			
Characteristic resistance	M^0 Rk,s	[Nm]								1,2 ·	Wel	· f uk	1)						
1) fuk or fyk respectively m	ust be taken fror	n the s	spec	cifica	tior	is of	the	rei	nfc	orcing	bar								
l	tial character		_			_	be	ariı	ng	ј сар	aci	ty ι	ın	der t	ens	ile	/ sh	ear	

load of fis	scher rebar ar	ichors FRA			
fischer rebar anchor FRA		M12	M16	M20	M24
Bearing capacity under tensi	le load, steel fail	ure			
Characterstic resistance	N _{Rk,s} [kN]	63	111	173	270

Partial factor $\gamma_{Ms,N}$ [-] 1,4

Bearing capacity under shear load, steel failure Without lever arm Characterstic resistance V^0 Rk,s [kN] 30 55 86 124 **Ductility factor** k_7 [-] 1,0 With lever arm Characteristic resistance M_{0Rk,s} [Nm] 92 233 454 785 Partial factor¹⁾ Partial factor [-] 1,56 $\gamma_{\text{Ms,V}}$

fischer injection system FIS EM Plus	
Performance Essential characteristics for the steel bearing capacity of reinforcing bars and fischer rebar anchors FRA	Annex C 3

¹⁾ In absence of other national regulations

Size Tensile load Uncracked concrete											ΔΙΙ	si	zes						
Uncracked concrete											<u> </u>	-	203						
		k _{ucr,N}										11,	0						
Cracked concrete		k _{cr,N}	[-]									7,							
Factors for the comp	ressive strer		concr	ete	> (220/2	25					.,	·						
	C25/30	.9 0										1,0	12						
	C30/37											1,0							
Increasing	C35/45											1,0							
factor for τ_{Rk}	C40/50	Ψ_{c}	[-]									1,0							
	C45/55											1,0							
	C50/60			1,09															
Splitting failure																			
opiittiing idiidic	h / h _{ef} ≥ 2,0										1	n	h _{of}						
Edge distance 2,0 >		Coren		1,0 h _{ef} 4,6 h _{ef} - 1,8 h															
	$\frac{h / h_{\text{ef}} > 1,3}{h / h_{\text{ef}} \le 1,3}$	Ocr,sp	[mm]	1] 4,0 flet - 1,0 fl 2,26 h _{ef}															
Spacing	, 1,0	S _{cr,sp}	1	2 Ccr.sp															
Concrete cone failur	 e	- 61,5p	l																
Edge distance	-	Ccr,N		1,5 h _{ef}															
Spacing		Scr.N	[mm]	2 C _{cr,N}															
Shear load		- 5.,		Z GOLLY															
Installation factor		γinst	inst [-] 1,0																
Concrete pry-out fail	ure	Tillot	111	- 1															
	factor for pry-out failure k ₈ [-] 2,0																		
Concrete edge failure																			
The value of h_{ef} (= l_f)	-		Ī.,					Cond	itior	าร ส	accor	dir	a to	199	92-4:	2018	B:		
under shear load			[-]					hapte											
Calculation diameter	'S																		
Size				M	8	M10		M12	M	14	M16	3	M20	١	M22	M2	4	M27	M
fischer anchor rods ar		d _{nom}		8		10		12	1	4	16		20		22	24		27	3
standard threaded rod	ls	Glioili					4		₋ˈ	_		4		╀			_		
fischer internal threaded anch	noro DC MI	d _{nom}	[mm]	12	2	16	-	18		-	22	-	28		_	-		-	-
fischer rebar anchor F		۸	-			_	+	12			16	+	20	+	_	25			
		d _{nom}					<u> </u>	_	10	-	4	2	_	26		_	_	-	26
Size (nominal diamete	er of the bar)	لم	φ []	8	10		-			-	22		25 25	26			-	+ +	
Reinforcing bar		d _{nom}	[mm]	8	10	12	14	1 16	18	20	1 22	24	+ ZO	20	ว I / ห	130	32	34	30

Table C5.1: Essential characteristics of tensile resistance for fischer anchor rods and standard threaded rods in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 50 years													
Anchor rod / st	tandard thread	led rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pull			e failure						0				
Calculation dian		d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked cor													
Characteristic		ce in un	cracked (concre	ete C20)/25							
Hammer-drilling	with standard	drill bit c	r hollow d	rill bit (dry or	wet co	ncrete)						
Tem- I: 3	35 °C / 60 °C			18	18	18	17	17	16	15	15	15	14
perature II: 5	50 °C / 72 °C	τRk,ucr	[N/mm ²]	18	17	17	16	16	15	14	14	14	13
	ammer-drilling with standard drill bit or hollow drill bit (water filled hole)												
-	35 °C / 60 °C			16	16	15	13	13	11	11	10	10	9
perature	50 °C / 72 °C	τRk,ucr	[N/mm ²]	15	14	14	13	12	11	10	10	9	9
range		noroto -	 				13	14	''	10	10	ع ا	9
Diamond-drilling (dry or wet concrete as well as water filled hole) Tem- I: 35 °C / 60 °C													
perature —		τ _{Rk,ucr}	[N/mm ²]										
Tarigo	50 °C / 72 °C			15	14	12	11	11	10	9	9	8	8
Installation fac									_				
Dry or wet concrete Water filled hole γinst [-] 1,0													
water filled note 1,4													
Cracked concrete Characteristic bond resistance in cracked concrete C20/25													
Characteristic bond resistance in cracked concrete C20/25 Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)													
-		arııı bit c	Tiollow a					<u> </u>	0.5	0.5	0.5	0.5	0.5
perature —	35 °C / 60 °C	τRk,cr	[N/mm ²]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
range II: 5	50 °C / 72 °C			7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
<u>Diamond - drillir</u>		oncrete)			ı				1	1		ı	
Tem- I: 3	35 °C / 60 °C		[N/mm ²]	7	7	7	7	6	6	7	7	7	7
range II: 5	50 °C / 72 °C	TRk,cr	[[[]]]]	7	7	7	7	6	6	7	7	7	7
Hammer-drilling	with standard	drill bit c	r hollow d	rill bit a	and dia	mond-	<u>drilling</u>	(water	filled h	<u>nole)</u>		I	
	35 °C / 60 °C			6	7,5	7,5	7	6	6	6	6	6	6
perature II: 5	50 °C / 72 °C	τ _{Rk,cr}	[N/mm ²]	6	7	7	7	6	6	6	6	6	6
Installation fac	tors												
Dry or wet concr	ete		.,					1	,0				
Water filled hole		γinst	[-]			1,2					1,4		
fischer inice	tion system	EIQ EM	I Diuc										
Performance Essential characteristics of tensile resistance for fischer anchor rod and standard threaded rods; service life time 50 years Annex C 5													

8 10 Crete C20		14	16 17 16	20	22 15	M24 24	M27 27	M3 0			
bit (dry or 8 18 17	1/ 25 wet cor	ncrete) 17	17	16			27	30			
bit (dry or 8 18 17	1/ 25 wet cor	ncrete) 17	17	16			27	30			
bit (dry or 8 18 18 17	wet co	17			15	15					
bit (dry or 8 18 18 17	wet co	17			15	15					
8 18 8 17	18	17			15	15					
8 17					15		15	14			
	1/	16	16								
6 15				15	14	14	14	13			
6 1 15											
13	13	12	12	10	10	10	9	9			
5 14	12	11	11	10	9	9	8	8			
Dry or wet concrete γ _{inst} [-] 1,0 Service I: 35 °C / 60 °C 0.75 0.75 0.75 0.75 0.75 0.75 0.75 0.75											
75 0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,7			
55 0,60	0,60	0,65	0,65	0,65	0,65	0,65	0,65	0,6			
	•			,	,		•				
Cracked concrete Characteristic bond resistance in cracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
			8.5	8.5	8.5	8.5	8.5	8,			
7,5 7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,			
l.											
7 7	7	7	6	6	7	7	7	7			
7 7	7	7	6	6	7	7	7	7			
					•	•	·				
			1	0							
60 0 05	0.00	0.65			0.65	0.65	0.65	0.6			
								0,6			
0,85	0,80	0,65	0,65	CO,U	ี						
	75 0,75 55 0,60 ete C20/29 oit (dry or y 5 7,5 5 7,5	75 0,75 0,75 55 0,60 0,60 ete C20/25 bit (dry or wet co 5 7,5 9 5 7,5 9 7 7 7 7 7 7 7 7 7 7 80 0,85 0,80	75 0,75 0,75 0,75 55 0,60 0,60 0,65 ete C20/25 bit (dry or wet concrete) 5 7,5 9 8,5 5 7,5 9 8,5 7 7 7 7 7 7 7 7 7 7 7 7 7	1,75 0,75 0,75 0,75 0,75 0,65 0,65 0,60 0,60 0,65 0,	1,0 75 0,75 0,75 0,75 0,75 0,75 55 0,60 0,60 0,65 0,65 0,65 ete C20/25 bit (dry or wet concrete) 7 7,5 9 8,5 8,5 8,5 7 7 7 7 6 6 7 7 7 7 6 6 1,0 60 0,85 0,80 0,65 0,65 0,65	1,0 75 0,75 0,75 0,75 0,75 0,75 0,75 55 0,60 0,60 0,65 0,65 0,65 0,65 ete C20/25 bit (dry or wet concrete) 7,7 7,5 9 8,5 8,5 8,5 8,5 7,7 7 7 6 6 7 7 7 7 6 6 7 7 7 7 6 6 7 7 7 7 6 6 7	1,0 75 0,75 0,75 0,75 0,75 0,75 0,75 55 0,60 0,60 0,65 0,65 0,65 ete C20/25 Dit (dry or wet concrete) 5 7,5 9 8,5 8,5 8,5 8,5 5 7,5 9 8,5 8,5 8,5 8,5 7 7 7 7 6 6 7 7	1,0 75 0,75 0,75 0,75 0,75 0,75 0,75 0,75 0,			

chor RG MI nd concrete con	ıe failure	М8	M10	M12	M16	1400		
	e failure				IVITO	M20		
	Januie							
d	[mm]	12	16	18	22	28		
	or hollow d				<u> </u>			
	 N/mm ²]	15	14	14	13	12		
772 °C	[1.40.11.11.1	14	13	13	12	11		
standard drill bit	or hollow d	rill bit (water	filled hole)					
′ 60 °C	[N.17	14	12	12	11	10		
72 °C τ _{Rk,ucr}	[[N/mm²]	13	12	11	10	9		
or wet concrete a	as well as \	water filled h	ole)					
′ 60 °C		13	12	11	10	9		
772 °C	[N/mm²]	12	11	10	9	8		
26	[-]			1,0				
yinst	[-]	1,4						
	or hollow d							
	[N/mm ²]	7	6	6	7	7		
72 °C	[,	7	6	6	7	7		
standard drill bit	or hollow d	rill bit and di	amond-drilling	(water filled h	nole)			
′ 60 °C	[N] / see see 21	7	6,5	6	6	6		
72 °C	[IN/mm²]	7	6	6	6	6		
		<u>I</u>						
	[]			1,0				
———— γinst	[-]		1,2		1,	4		
	standard drill bit of 60 °C 72 °C TRk,ucr T	standard drill bit or hollow drill bit or holl	$ \frac{15}{14} = \frac{15}{12} = \frac{15}{14} = \frac{15}{13} = \frac{15}{12} = \frac{15}{12} = \frac{15}{12} = \frac{15}{13} = \frac{15}{14} = 1$	15	Standard drill bit or hollow drill bit (dry or wet concrete) 15	Standard drill bit or hollow drill bit (dry or wet concrete)		

PerformanceEssential characteristics of tensile resistance for fischer internal threaded anchors RG MI; service life time 50 years

fischer injection system FIS EM Plus

Table C8.1: Essential characteristics of tensile resistance for fischer internal threaded anchors RG MI in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 100 years

Combined pullout and concrete cone failure	M16	M20										
	•											
Calculation diameter d [mm] 12 16 1	18 22	28										
Uncracked concrete												
Characteristic bond resistance in uncracked concrete C20/25												
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)												
	14 13	12										
perature range II: 50 °C / 72 °C τ _{Rk,ucr} [N/mm²] 14 13 1	13 12	11										
Diamond-drilling (dry or wet concrete)												
	11 10	9										
perature range II: 50 °C / 72 °C τ _{Rk,ucr} [N/mm²] 12 11 1	10 9	8										
Installation factors	·											
Dry or wet concrete γ_{inst} [-]	,0											
Service I: 35 °C / 60 °C 0,75 0,75 0,	,75 0,75	0,75										
life time 100 years II: 50 °C / 72 °C 0,55 0,60 0,	,60 0,65	0,65										
Cracked concrete	•											
Characteristic bond resistance in cracked concrete C20/25												
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry o	or wet concrete)											
	6 7	7										
perature range II: 50 °C / 72 °C [N/mm²] 7 6	6 7	7										
Installation factors												
Dry or wet concrete γ_{inst} [-]	,0											
	,80 0,65	0,65										
life time	,80 0,65	0,65										

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

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

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

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

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Performance Essential characteristics of tensile resistance for fischer internal threaded anchors RG MI; service life time 100 years	Annex C 8

Table C9.1:	Table C9.1: Essential characteristic hammer or diamond dri service life time 50 ye														-					
Nominal diameter	er of the bar		Ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combined pullo		ete con	` _																	
Calculation diame		d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracked conc	rete																			
Characteristic be	ond resistan	ce in un	cracked	cond	cret	e C	20/2	:5												
Hammer-drilling v	vith standard	drill bit o	r hollow c	rill b	it (c	dry c	r we	et co	ncr	ete)										
	°C / 60 °C			16	15	15	14	14	13	13	13	12	12	12	12	12	12	11	11	11
perature II: 50	°C / 72 °C	τ _{Rk,ucr}	[N/mm²]	15	14	14	13	13	12	12	12	12	11	11	11	11	11	11	10	10
Hammer-drilling v	vith standard	drill bit o	r hollow c	drill b	it (v	vate	r fill	ed h	ole)				l	l	l		l			
Tem- I: 35	°C / 60 °C			16	16	14	13	12	12	11	11	10	10	10	10	9	9	9	8	8
perature II: 50	°C / 72 °C	τ _{Rk,ucr}	[N/mm²]	15	14	13	12	12	11	11	10	10	9	9	9	9	8	8	8	8
Diamond-drilling (ncrete a	l s well as v																	_
	°C / 60 °C				15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
perature	°C / 72 °C	$ au_{Rk,ucr}$	[N/mm ²]	\vdash	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
range II: 50				110	' -	12	• •	'''	10									_ ′	,	$\stackrel{\prime}{-}$
Dry or wet concre												1,0								
Water filled hole		γ inst	[-]									1,4								
Cracked concrete																				
Characteristic bond resistance in cracked concrete C20/25																				
Hammer-drilling v	vith standard	drill bit o	r hollow c	drill b	it (c	dry c	r we	et co	ncr	ete)										
Tem- I: 35	°C / 60 °C			7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
perature II: 50	°C / 72 °C	τ _{Rk,cr}	[N/mm²]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Diamond-drilling (drv or wet co	ncrete)											<u> </u>		l		l			
	°C / 60 °C			7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
perature II: 50	°C / 72 °C	τ _{Rk,cr}	[N/mm²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
range II: 50 Hammer-drilling v		drill hit o	r hollow c													′				$\overset{\circ}{-}$
	°C / 60 °C	driii bit o	111011044	т т		6,5			6	6	6	6	6	6	6	6	5	5	5	5
perature		τ _{Rk,cr}	[N/mm ²]																	
range	°C / 72 °C			0	ບ,ວ	6,5	6	6	6	6	6	6	6	6	6	6	5	5	5	5
Installation factors Dry or wet concre												1,0								
Water filled hole		γinst	[-]			1	2					1,0			1 4					
Water filled hole 1,2 1,4																				
Fischer injection system FIS EM Plus Performance Essential characteristics of tensile resistance for reinforcing bars; service life time 50 years Annex									x C	9										

Table C10.1: Essential characteristics of tensile resistance for reinforcing bars in hammer or diamond drilled holes; uncracked or cracked concrete;																					
		service					,											•			
Nominal	diameter	of the bar	r	Φ	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combine	d pullou	t and cond	rete con	e failure																	
Calculatio	n diamet	er	d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracke	d concre	ete																			
Characte	ristic bo	nd resista	nce in un	cracked	con	cret	e C	20/2	25												
Hammer-d	drilling wi	th standard	d drill bit o	r hollow c	Irill k	oit (c	dry c	r we	et co	ncre	ete)										
Tem- perature		C / 60 °C	- τ _{Rk,ucr}	[N/mm²]	16 15	15 14	15 14	14 13	14 13	13 12		13 12	12 12		12 11	12 11	12 11	12 11	11 11	11 10	11 10
range Diamond-			oncrete)		13	17	17	13	13	12	12	12	12			' '		• •			
Diamond-drilling (dry or wet concrete) Tem- 1: 35 °C / 60 °C 16 15 13 12 12 11 10 10 10 9 9 9 9												0	8	0	7						
perature range		C / 72 °C	- τ _{Rk,ucr}	[N/mm²]	15	14	12	11		10	10	9	9	9	8	8	8	8	7	8 7	7
Installatio	n factor	'S																			
Dry or wet concrete γ_{inst} [-] 1,0																					
Service		C / 60 °C	•		0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
life time 100 years	II: 50°	C / 72 °C	- α _{100 years}	[-]	0,55	0,60	09'0	9,65	0,65	9,65	0,65	0,65	0,65	9,65	9,0	0,65	0,65	9,0	9,65	0,65	0,65
Cracked concrete Characteristic bond resistance in cracked concrete C20/25																					
Characte	ristic bo	nd resista	nce in cra	acked co	ncre	ete (C20/	25													
Hammer-d	Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)																				
Tem- perature	Tem- perature I: 35 °C / 60 °C TRk.cr [N/mm²] 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8																				
range					7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		lry or wet c	oncrete)			_	_	_				_	_	_	_	_		_	_	_	_
Tem- perature	-	C / 60 °C	- τ _{Rk,cr}	 N/mm²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
range		C / 72 °C			7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Installatio				F																	
Dry or wet	t concrete		γinst	[-]			_	1.5					1,0								
Service life time	l: 35 °	C / 60 °C	-α _{100 years}	[-]	0,60	0,85	0,80	0,65	0,65	9,0	0,65	0,65	0,65	0,65	9,0	9,0	0,65	9,0	9,0	0,65	9,0
100 years	II: 50°	C / 72 °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
1) Calculation of characteristic bond resistance in uncracked concrete T _{Rk,100 years,ucr} : T _{Rk,100 years,ucr} = α _{100 years} · T _{Rk,ucr} 2) Calculation of characteristic bond resistance in cracked concrete T _{Rk,100 years,cr} : T _{Rk,100 years,cr} = α _{100 years} · T _{Rk,cr} fischer injection system FIS EM Plus Performance Annex C 10																					
	Performance Essential characteristics of tensile resistance for reinforcing bars; service life time 100 years Annex C 10																				

Table C11.1: Essential characteristics of tensile resistance for fischer rebar anchors FRA in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 50 years

	service me ume 50 years											
fischer re	bar anchor FRA			M12	M16	M20	M24					
Combine	d pullout and conci	ete con	e failure									
Calculation	n diameter	d	[mm]	12	16	20	25					
Uncracke	ed concrete											
Characte	ristic bond resistan	ce in un	cracked	concrete C20/25	5							
Hammer-	drilling with standard	drill bit c	r hollow d	rill bit (dry or wet	concrete)							
Tem-	I: 35 °C / 60 °C		[N1/mm2]	15	14	13	12					
perature range	II: 50 °C / 72 °C	τRk,ucr	[N/mm²]	14	13	12	12					
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)												
Tem-	I: 35 °C / 60 °C		FN.17 07	14	12	11	10					
perature range	II: 50 °C / 72 °C	τRk,ucr	[N/mm²]	13	12	11	9					
Diamond-	drilling (dry or wet co	ncrete a	s well as v	water filled hole)		1						
Tem-	I: 35 °C / 60 °C		[N/mm ²]	13	12	10	9					
perature range	II: 50 °C / 72 °C	τ _{Rk,ucr}	[N/mm²]	12	11	10	9					
Installatio	on factors					1						
Dry or we	t concrete				1,	0						
Water fille	ed hole	γinst	[-]		1,	4						
Cracked	concrete											
Characte	ristic bond resistan	ce in cr	acked co	ncrete C20/25								
<u> Hammer-</u>	drilling with standard	drill bit c	r hollow d	rill bit and diamo	nd-drilling (dry o	wet concrete)						
Tem- perature	I: 35 °C / 60 °C		[N/mm²]	8	8	8	8					
range	II: 50 °C / 72 °C	τ _{Rk,cr}	[[14/11111-]	8	8	8	8					
Hammer-	drilling with standard	drill bit c	r hollow d	rill bit and diamo	nd-drilling (water	filled hole)						
Tem-	I: 35 °C / 60 °C		[N.17]	7	6	6	6					
perature range	II: 50 °C / 72 °C	TRk,cr	[N/mm²]	7	6	6	6					
Installatio	on factors											
Dry or we	t concrete		[]		1,	0						
Water fille	ed hole	γinst	[-]	1	,2	1,	4					

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Essential characteristics of tensile resistance for fischer rebar anchors FRA; service life time 50 years	

Table C12.1: Essential characteristics of tensile resistance for fischer rebar anchors FRA in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 100 years

fischer re	bar anchor FRA			M12	M16	M20	M24
Combined	d pullout and conc	rete con	e failure				
Calculation	n diameter	d	[mm]	12	16	20	25
Uncracke	d concrete						
Character	istic bond resista	nce in un	cracked	concrete C20/25	5		
Hammer-c	Irilling with standard	l drill bit o	r hollow d	Irill bit (dry or wet	t concrete)		
Tem-	I: 35 °C / 60 °C		55.1 / 27	15	14	13	12
perature range	II: 50 °C / 72 °C	TRk,ucr	[N/mm²]	14	13	12	12
Diamond-	drilling (dry or wet c	oncrete)					
Tem-	I: 35 °C / 60 °C		FA.17 07	13	12	10	9
perature range	II: 50 °C / 72 °C	TRk,ucr	[N/mm²]	12	11	10	9
Installatio	n factors						
Dry or wet	concrete	γinst	[-]		1	,0	
Service	I: 35 °C / 60 °C		53. 17 03	0,75	0,75	0,75	0,75
life time 100 years	II: 50 °C / 72 °C	-α _{100 years}	[N/mm²]	0,60	0,65	0,65	0,65
Cracked o	-						
Character	istic bond resista	nce in cra	acked co	ncrete C20/25			
Hammer-c	drilling with standard	drill bit o	r hollow d	rill bit and diamo	nd-drilling (dry o	r wet concrete)	
Tem-	I: 35 °C / 60 °C		[N 1/ 2]	8	8	8	8
perature range	II: 50 °C / 72 °C	TRk,cr	[N/mm²]	8	8	8	8
Installatio	n factors						
Dry or wet	concrete	γinst	[-]		1	,0	
Service	I: 35 °C / 60 °C			0,80	0,65	0,65	0,65
life time 100 years	II: 50 °C / 72 °C	-α _{100 years}	[-]	0,80	0,65	0,65	0,65

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

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

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

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

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Performance Essential characteristics of tensile resistance for fischer rebar anchors FRA; service life time 100 years	Annex C 12

Table (Table C13.1: Displacements for anchor rods														
Anchor	rod	М8	M10	M12	M14	M16	M20	M22	M24	M27	M30				
Displace	ment-Factors	for tensi	le load ¹⁾												
Uncrack	Jncracked or cracked concrete; Temperature range I, II														
δ _{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				
δN∞-Factor	[[[[[[]]	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 ²⁾												
Uncrack	ed or cracked	concrete	e; Tempe	rature ra	nge I, II										
δ V0-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_{Ed}: Design value of the applied tensile stress)

²⁾ Calculation of effective displacement:

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

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

(V_{Ed}: 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	ement-Factors	for tensile load1)				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
δ _{N0} -Factor	[mm//N/mm2)]	0,09	0,10	0,10	0,11	0,13
δ _{N∞-} Factor	[mm/(N/mm²)]	0,13	0,15	0,16	0,17	0,19
Displace	ment-Factors	for shear load ²⁾				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
δvo-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

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_{Ed}: Design value of the applied tensile stress)

2) Calculation of effective displacement:

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

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

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

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Performance

Displacements for anchor rods and fischer internal threaded anchors RG MI

of the ba	diameter ar Φ	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
	ement-Factors	for te	ensile	load	1)													
Jncrack	ed or cracked																	
N0-Factor	[mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10	0,10	0,11	0,11	0,12	0,12	0,12	0,13	0,13	0,13	0,14	0,14	0,1
N∞-Factor	[[[[]]]	0,11	0,12	0,13	0,14	0,15	0,16	0,16	0,17	0,18	0,18	0,18	0,19	0,19	0,20	0,20	0,21	0,2
	ement-Factors																	
	ed or cracked							_										
V0-Factor	[mm/kN]	-			_	_	_	_	_							_	0,04	_
/∞-Factor	lation of effecti					0,14	0,12							0,07 acem		0,06	0,06	0,0
$\delta_{N\infty} = (\tau_{Ed}: $	δηο-Factor · τεd · δη∞-Factor · τεd Design value of		upplied			ŕ		3		òv∞-Fac Desigr	_{tor} · V n valu	e of ti	he ap	plied	shear	r forc	e)	
	ebar anchor	piac		112	01 11			M16		0.3		M20				M2	24	
isplace	ement-Factors	for te	ensile	load	1)													
Jncrack	ed or cracked	conc	rete;	Tem	perat	ure r	ange	I, II										
			0,	,09				0,10				0,11				0,1	12	
	[mm/(N/mm ²)]					\neg		_										
N∞-Factor	[mm/(N/mm²)]			13				0,15				0,16				0,1	8	
N∞-Factor Displace	ement-Factors	for s	hear l	load ²				0,15				0,16				0,1	8	
^{N∞-Factor} Displace Uncrack		for s	hear l	load ² Tem _l		ure ra	ange	0,15 I, II										
N∞-Factor Displace Uncrack V0-Factor	ement-Factors	for s	hear l rete;	load ² Tem _l 12		ure ra	ange	0,15 I, II 0,09				0,07				0,0	06	
N∞-Factor Displace Jncrack V0-Factor V∞-Factor	ement-Factors ed or cracked [mm/kN]	for s	hear l	load ² Tem _l 12	perat	ure ra	ange	0,15 I, II 0,09 0,14	2) (2)	oulst:	on of	0,07	,	ionlos		0,0	06	
N∞-Factor Displace Jncrack V0-Factor V∞-Factor 1) Calcu	ement-Factors ed or cracked [mm/kN]	for s	hear l	load ² Tem _l 12	perat	ure ra	ange	0,15 I, II 0,09 0,14				0,07 0,11 effec	,	isplac	cemer	0,0	06	
Displace Jncrack V0-Factor 1) Calcu δN0 =	ement-Factors ed or cracked [mm/kN] ulation of effecti δNO-Factor · τEd	for s	hear l	load ² Tem _l 12	perat	ure ra	ange	0,15 I, II 0,09 0,14	δνο	= δvo	on of	0,07 0,11 effec	,	isplac	cemer	0,0	06	
Displace D	ement-Factors ed or cracked [mm/kN]	for s conc ve dis	hear I rete; 0, 0,	Temp 12 18 ement	perat		ange	0,15 I, II 0,09 0,14	δνο δν∝	$= \delta v_0$ $= \delta v_0$	-Factor -Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d	•	cemer	0,0 0,0 nt:	06 09	
Jncrack δνο-Factor 1) Calcu δνο = δνω = (τεd:	ement-Factors ed or cracked [mm/kN] Ilation of effecti $\delta_{NO-Factor} \cdot \tau_{Ed}$ $\delta_{NO-Factor} \cdot \tau_{Ed}$	once ve dis	hear I	Temp 12 18 ement	erat	ress)	ange	0,15 I, II 0,09 0,14	δνο δν∝	$= \delta v_0$ $= \delta v_0$	-Factor -Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d	•		0,0 0,0 nt:	06 09	

Essential characteristics²⁾ for the **steel bearing capacity** under tensile / **Table C15.1:** shear load of fischer anchor rods and standard threaded rods under seismic action performance category C1 or C2

		10 4011011 p	0110	mai	100 0a								
Anch	or rod / standard th	readed rod			M10	M12	M14	M16	M20	M22	M24	M27	M30
Beari	ng capacity under to	ensile load,	stee	el failu	ure ¹⁾								
fische	er anchor rods and	standard th	read	ed ro	ds, per	forman	ce cate	egory C	1				
ic re-	Steel zinc plated		5.8		29(27)	43	58	79	123	152	177	230	281
erstic N _{RK,s,e}	Steer zinc plated		8.8		47(43)	68	92	126	196	243	282	368	449
e Z	Stainless steel A4	Property class	50	[kN]	29	43	58	79	123	152	177	230	281
Characterstic resistance NRK, s, eq. c	and high corrosion	o la so	70		41	59	81	110	172	212	247	322	393
Ch Sist	resistant steel C		80		47	68	92	126	196	243	282	368	449
fische	er anchor rods and	standard th	read	ed ro	ds, per	forman	ce cate	gory C	2				
; re- ,eq,C2	Steel zinc plated		5.8		-	39	-	72	108	-	177	-	-
10 0	Steer zinc plated		8.8		-	61	-	116	173	-	282	-	-
ctersti e N _{RK}	Stainless steel A4	Property class	50	[-]	-	39	-	72	108	-	177	-	-
Charact sistance	and high corrosion	o a do	70		-	53	ı	101	152	-	247	1	-
Sist	resistant steel C		80		-	61	1	116	173	-	282	-	-
Beari	ng capacity under s	hear load,	steel	failu	re with	out leve	er arm ¹)					
fische	er anchor rods, perf	ormance ca	atego	ory C	f								
6 - g,C1	Stool zine pleted		5.8		15(13)	21	29	39	61	76	89	115	141
terstic re- V ⁰ Rk,s,eq,(Steel zinc plated		8.8		23(21)	34	46	63	98	122	141	184	225
Characterstic resistance Vork, s, eq. C	Stainless steel A4	Property class	50	[kN]	15	21	29	39	61	76	89	115	141
Charact sistance	and high corrosion	Ciass	70		20	30	40	55	86	107	124	161	197
Ch Sista	resistant steel C		80		23	34	46	63	98	122	141	184	225
Stanc	lard threaded rods,	performand	се са	tegoi	y C1								
re-	Stool zine plated		5.8		11(9)	15	20	27	43	53	62	81	99
Characterstic restance Vork, s, eq. C	Steel zinc plated		8.8		16(14)	24	32	44	69	85	99	129	158
ters V°	Stainless steel A4	Property class	50	[kN]	11	15	20	27	43	53	62	81	99
arac ance	and high corrosion	Olass	70		14	21	28	39	60	75	87	113	138
Charact sistance	resistant steel C		80		16	24	32	44	69	85	99	129	158
	er anchor rods and	standard th	read	ed ro	ds, per	forman	ce cate	egory C	2				
.e -	Stool zing plated		5.8		_	14	_	27	43	-	62	-	-
terstic re- V ⁰ Rk,s,eq,C	Steel zinc plated		8.8		-	22	_	44	69	-	99	-	
ters Vo	Stainless steel A4	Property class	50	[-]	-	14	-	27	43	-	62	-	-
Characterstic resistance Vork, s, eq, c	and high corrosion	Jugg	70		-	20	-	39	60	-	87	ı	-
Ch sista	resistant steel C		80		-	22	-	44	69	-	99	-	-

¹⁾ Partial factors for performance category C1 or C2 see table C16.2; for fischer anchor rods FIS A / RGM the factor for steel ductility is 1,0

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Performance

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

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

Table C16.1: Essential characteristics for the **steel bearing capacity** under tensile / shear load of **reinforcing bars (B500B)** under seismic action performance category **C1**

Bearing capacity under shear load, steel failure without lever arm¹⁾

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

Characterstic resistance V⁰Rk,s,eq,C1 [KN] 15 | 22 | 30 | 39 | 49 | 61 | 74 | 88 | 95 | 102 | 119 | 137 | 155

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	or rod / standard thi		M10	1 (VI12	M14	М	16	M20	M2	22	M24	M2	7	M30		
Nom	nal diameter of the l	ф	10	12	14	16	18	20	22	24	25	26	28	30	32		
Tens	ile load, steel failure	,1)															
7	Ctool =ino mlotod		5.8		1,50												
λMs,r	Steel zinc plated		8.8		1,50												
ctor	Stainless steel A4	Property 50			2,86												
al fa	and high corrosion	Olass	70	[-]						1,5	02) / 1	,87					
Partial factor γ _{Ms,N}	resistant steel C										1,60						
"	Reinforcing bar	В	500B								1,40						
Shea	r load, steel failure ¹⁾																
>	Ctaal zina platad		5.8								1,25						
YMs,	Steel zinc plated	 _	8.8								1,25						
ctor	Stainless steel A4	Property class	50	r 1							2,38						
al fa	and high corrosion	o.a.oo	70	[-]						1,2	.5 ²⁾ / 1	,56					
Partial factor ‱,v	resistant steel C		80								1,33						
	Reinforcing bar	В	500B								1,50						

¹⁾ In absence of other national regulations

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Performance

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

¹⁾ Partial factors for performance category C1 see table C16.2

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

Table C17.1:	 Essential	charac	rtaristics	of re	eie.	tanc	• fo	r fie	chei	anc	hor	rod	e an			
Table 017.11.	standard performa	thread	ded rod	s in h	nam	mer	drille	ed h	oles	unde	er se	eismi	ic ac	_		
Anchor rod / sta	ndard thread	ded rod		M10) N	112	M14	M	16	M20	M	22	M24	M2	7	M30
Characteristic be	ond resistan	ce, com	bined pu	llout	and o	conc	rete o	cone	failu	re						
Hammer-drilling	with standa	rd drill b	it or holl	ow di	ill bi	t (dry	y or v	vet c	oncr	ete)						
	°C / 60 °C			7,0	7	7,0	6,7	6	5,0	5,7	6,	7	6,7	6,	7	6,7
perature II: 50	°C / 72 °C	TRk,eq,C1	[N/mm ²]	7,0	7	7,0	6,7	5	,7	5,7	6,	7	6,7	6,7	7	6,7
Hammer-drilling	with standa	rd drill b	it or holl	ow dr	ill bi	t (wa	ter fi	lled I	nole)							
	5 °C / 60 °C			7,5	7	',5	6,5	5	,7	5,7	5,	7	5,7	5,7	7	5,7
perature II: 50	°C / 72 °C	τ _{Rk,eq,C1}	[N/mm ²]	6,8	_	5,8	6,5	5	,7	5,7	5,	7	5,7	5,7	7	5,7
Installation factor				1 -,-		,,,	-,-		,-	-,-	1 -,		-,-	, ,,,	1	-,-
tensile load	,,,,															
Dry or wet concre	ete									1,0						
Water filled hole		γinst	[-]			1,	2			,-			1,4			
shear load									<u> </u>							
All installation cor	nditions	γinst	[-]							1,0						
Table C17.2:	Essential drilled ho time 50 a	les und	ler seisn) years	nic a	ctior	per	form	anc	е са	tego	ry C	1; s	ervio	e lif	e	
Manaimal diamanta	ar af tha har		Ф	10	12	14	16	18	20	22	24	25	26	28	30	20
Nominal diameter							16				24	25				32
Characteristic be	ond resistan		bined pu	llout	and o	conc	rete d	cone	failu	re	24	23	20		-	32
Characteristic be Hammer-drilling	ond resistan with standa		bined pu	llout a	and o	conc t (dry	rete o	one vet c	failu	re ete)						
Characteristic be Hammer-drilling Tem- I: 35 perature	ond resistan with standa	rd drill b	bined pu bit or holl	ow dr	and o	conc t (dry	rete o	vet c	failu oncre	re ete) 6,7	6,7	6,7	6,7	6,7	6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C	rd drill b	bined pu bit or holl [N/mm²]	7,0	and o rill bi 7,0 7,0	6,7	rete of 5,7	5,7	failu oncr 5,7 5,7	re ete) 6,7						
Characteristic be Hammer-drilling Tem- I: 35 perature range II: 50 Hammer-drilling	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C with standa	rd drill b	bined pu bit or holl [N/mm²]	7,0	and o rill bi 7,0 7,0	6,7	rete of 5,7	5,7	failu oncr 5,7 5,7	re ete) 6,7	6,7	6,7	6,7	6,7	6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Tem- I: 35	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C	rd drill b	bined pu bit or holl [N/mm²] bit or holl	7,0	and o rill bi 7,0 7,0	6,7	5,7 5,7	5,7	failu oncre 5,7 5,7 nole)	ete) 6,7 6,7	6,7	6,7	6,7	6,7 6,7	6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature II: 35	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C with standa	rd drill b	bined pu bit or holl [N/mm²]	7,0 7,0 ow dr	and of the state o	6,7 6,7 t (wa	5,7 5,7 ter fi	5,7	failu oncre 5,7 5,7 nole)	ete) 6,7 6,7	6,7	6,7	6,7 6,7 5,7	6,7 6,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature II: 35 perature II: 35	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C with standa 6 °C / 60 °C 0 °C / 72 °C	rd drill b	bined pu bit or holl [N/mm²] bit or holl	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	re ete) 6,7 6,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Tem- I: 35 perature range II: 50 Hammer-drilling Tem- I: 35 perature range II: 50	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C with standa 6 °C / 60 °C 0 °C / 72 °C	rd drill b	bined pu bit or holl [N/mm²] bit or holl	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	re ete) 6,7 6,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature range II: 50 Installation factors	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C with standa 6 °C / 60 °C 0 °C / 72 °C 0 °C / 72 °C	rd drill b	bined pu bit or holl [N/mm²] bit or holl [N/mm²]	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	re ete) 6,7 6,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature range II: 50 Installation factor Tensile load Dry or wet concretations	ond resistan with standa 6 °C / 60 °C 0 °C / 72 °C with standa 6 °C / 60 °C 0 °C / 72 °C 0 °C / 72 °C	rd drill b	bined pu bit or holl [N/mm²] bit or holl	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature range II: 50 Installation factors Tensile load Dry or wet concrete Water filled hole Shear load	with standa 6 °C / 60 °C 0 °C / 72 °C with standa 6 °C / 60 °C 0 °C / 72 °C ors	rd drill b	bined pu bit or holl [N/mm²] bit or holl [N/mm²]	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa 6,5 5,8	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	re ete) 6,7 6,7 5,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature range II: 50 Installation factor Tensile load Dry or wet concretations	with standa 6 °C / 60 °C 0 °C / 72 °C with standa 6 °C / 60 °C 0 °C / 72 °C ors	rd drill b	bined pu bit or holl [N/mm²] bit or holl [N/mm²]	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa 6,5 5,8	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	6,7 6,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7	6,7 6,7	4,8
Characteristic be Hammer-drilling Temperature range II: 50 Hammer-drilling Temperature range II: 50 Installation factors of the second of the	with standa o °C / 60 °C o °C / 72 °C with standa o °C / 60 °C o °C / 72 °C ors ete	rd drill b TRk,eq,C1 rd drill b TRk,eq,C1 yinst	ined pubit or hollowit or holl	7,0 7,0 0w dr 7,0 7,5	7,0 7,0 7,0 ill bi	6,7 6,7 t (wa 6,5 5,8	5,7 5,7 ter fi	5,7 5,7 Iled I	5,7 5,7 nole)	re ete) 6,7 6,7 5,7 5,7	6,7 6,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7 5,7	6,7 6,7 5,7	5,7 5,7	4,8 4,8 4,8 4,8

Table C18.1: Essential characteristics of resistance for fischer anchor rods and standard threaded rods in hammer drilled holes under seismic action performance category C2; service life time 50 and 100 years

Anchor r	od / standard threa	ded rod		M12	M16	M20	M24
Characte	ristic bond resistar	ice, com	bined pu	lout and concre	ete cone failure		
Hammer-	drilling with standa	rd drill b	it or holl	ow drill bit (dry	or wet concrete)	
Tem-	I: 35 °C / 60 °C	_	[N]/mm2]	3,5	5,8	5,0	3,1
perature range	II: 50 °C / 72 °C	TRk,eq,C2	[N/mm²]	3,3	5,5	4,7	2,9
Hammer-	drilling with standa	rd drill b	it or holl	ow drill bit (wat	er filled hole)		
Tem-	I: 35 °C / 60 °C	_	[N/mm²]	3,5	5,8	5,0	3,1
perature range	II: 50 °C / 72 °C	TRk,eq,C2	[IN/IIIII-]	3,3	5,5	4,7	2,9
Installatio	on factors						
Tensile le	oad						
Dry or we	t concrete		r 1		1	,0	
Water fille	ed hole	γinst	[-]	1.	,2	1,	,4
Shear loa	ad						
All installa	ation conditions	γinst	[-]		1	,0	
Displace	ment-Factors for te	nsile loa	d ¹⁾				
δ N,(DLS)-Fac	tor	[mm/	/N/mm2\1	0,09	0,10	0,11	0,12
δN,(ULS)-Fac	tor	[111/11/	(N/mm²)]	0,15	0,17	0,17	0,18
Displace	ment-Factors for sh	ear load	2)				
δ V,(DLS)-Fact	tor	[m	ım/kN]	0,18	0,10	0,07	0,06
δ v,(ULS)-Fact	tor	7 "	/٢.١٧]	0,25	0,14	0,11	0,09

¹⁾ Calculation of effective displacement:

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

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

(τ_{Ed} : Design value of the applied tensile stress)

2) Calculation of effective displacement:

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

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

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

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Essential characteristics under seismic action (performance category C2) for fischer anchor rods and standard threaded rods; service life time 50 and 100 years