



ΕN

#### **DECLARATION OF PERFORMANCE**

1. Unique identification code of the product-type:

#### DoP 0351

for fischer injection system FIS EM PLUS (Bonded fastener for use in concrete)

DoP 0351

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

annexes B1 - B17.

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 330499-02-0601, Edition 12/2023

European Technical Assessment: ETA-17/0979; 2024-04-22

Technical Assessment Body: DIBt- Deutsches Institut für Bautechnik

Notified body/ies: 2873 TU Darmstadt

7. Declared performance/s:

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

#### Characteristic resistance to tension load (static and quasi-static loading):

- 1) Resistance to steel failure: see appendix, especially annexes C1, C2, C3, C19, C21, C23
- 2) Resistance to combined pull- out and concrete cone failure: see appendix, especially annexes C4 C16, C24 C34
- 3) Resistance to concrete cone failure: see appendix, especially annex C4, C24
- 4) Edge distance to prevent splitting under load: see appendix, especially annex C4, C24
- 5) Robustness: see appendix, especially annexes C4 C16, C24 C34
- 6) Maximum installation torque: see appendix, especially annexes B3, B4, B8, B9, B12
- 7) Minimum edge distance and spacing, member thickness: see appendix, especially annexes B3 B12

#### Characteristic resistance to shear load (static and quasi-static loading):

- 8) Resistance to steel failure: see appendix, especially annexes C1, C2, C3, C20, C22, C23
- 9) Resistance to pry-out failure: see appendix, especially annexes C4, C24
- 10) Resistance to concrete edge failure: see appendix, especially annexes C4, C24

#### Displacements under short-term and long-term loading:

- $11) \ \ Displacements \ under short-term \ and \ long-term \ loading: see \ appendix, \ especially \ annexes \ C17, \ C18, \ C35, \ C36$
- 12) Resistance in steel fibre reinforced concrete: NPD

#### Characteristic resistance and displacements for seismic performance categories C1 and C2:

- 13) Resistance to tension load, category C1: see appendix, especially annexes C37 C41, C43 C47
- 14) Resistance to tension load, category C2: see appendix, especially annexes C38, C39, C42
- 15) Resistance to shear load, category C1: see appendix, especially annexes C37 C39, C43 C45
- 16) Resistance to shear load, category C2: see appendix, especially annexes C38, C39

#### Safety in case of fire (BWR 2)

17) Reaction to fire: Class (A1)

#### Resistance to fire:

- 18) Fire resistance to steel failure (tension load): see appendix, especially annexes C48 C51
- 19) Bond resistance under fire conditions: see appendix, especially annex C51
- 20) Fire resistance to steel failure under shear loading: see appendix, especially annexes C48 C51

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

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

Dr.-Ing. Oliver Geibig, Managing Director Business Units & Engineering

Tumlingen, 2024-05-06

Jürgen Grün, Managing Director Chemistry & Quality

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.

Fischer DATA DOP\_ECs\_V96.xlsm 1/1



Translation guidance Essential Characteristics and Performance Parameters for Annexes

	aracteristic resistance to tension load (static and quasi-static loading):	
	Ta	lu nun
1	Resistance to steel failure:	N <sub>Rk,s</sub> [kN]
2	Resistance to combined pull- out and concrete cone failure:	$ au_{Rk}$ and/or $ au_{Rk,100}$ [N/mm $^2$ ],
		$\Psi_{c}, \Psi_{sus}^{0}, \Psi_{sus,100}^{0}$ [-] (BF)
		Ψc, Ψ sus,Ψsus,100 [ ] (Di )
	Resistance to pull-out failure:	$N_{Rk,p}$ and/or $N_{Rk,p,100}$ [kN], $\psi_c$ [-] (BEF)
3	Resistance to concrete cone failure:	c <sub>cr,N</sub> [mm], k <sub>cr,N</sub> , k <sub>ucr,N</sub> [-]
4	Edge distance to prevent splitting under load:	c <sub>cr,sp</sub> [mm]
5	Robustness:	Yinst [-]
6	Maximum installation torque:	max T <sub>inst</sub> [Nm] (BF)
	Installation torque:	T <sub>inst</sub> [Nm] (BEF)
7	Minimum edge distance, spacing and member thickness:	c <sub>min</sub> , s <sub>min</sub> , h <sub>min</sub> [mm]
′	ivinimum edge distance, spacing and member unickness.	O <sub>min</sub> , S <sub>min</sub> , II <sub>min</sub> [IIIII]
Cha	aracteristic resistance to shear load (static and quasi-static loading):	
8	Resistance to steel failure:	$V_{Rk,s}^0$ [kN], $M_{Rk,s}^0$ [Nm], $k_7$ [-]
9	Resistance to pry-out failure:	k <sub>8</sub> [-]
10	Resistance to concrete edge failure:	d <sub>nom</sub> , I <sub>f</sub> [mm]
Dia	pleasements under short term and long term leading	
UIS	placements under short-term and long-term loading:	
11	Displacements under short-term and long-term loading:	$\delta_0,  \delta_{\scriptscriptstyle \infty}  [\text{mm or mm/(N/mm}^2)]$
12	Resistance in steel fibre reinforced concrete:	Description
Cha	aracteristic resistance and displacements for seismic performance categories C	C1 and C2:
	T	To the second of
13	Resistance to tension for seismic performance category C1	N <sub>Rk,s,C1</sub> [kN] (all)
		$T_{Rk,C1}$ [N/mm <sup>2</sup> ] (BF)
		N <sub>Rk,p,C1</sub> [kN] (BEF)
14	Resistance to tension for seismic performance category C2	N <sub>Rk,s,C2</sub> [kN] (all)
		$T_{Rk,C2}[N/mm^2](BF)$
		N <sub>Rk,p,C2</sub> [kN] (BEF)
1.5	Designation of the property of	δ <sub>N,C2</sub> [mm] (all)
15	Resistance to shear for seismic performance category C1	V <sub>Rk,s,C1</sub> [kN] (all)
16	Resistance to shear for seismic performance category C2	V <sub>Rk,s,C2</sub> [kN] (all)
Saf	ety in case of fire (BWR 2)	δ <sub>V,C2</sub> [mm] (all)
17	Reaction to fire	Class
Res	I sistance to fire	
10	Fire resistance to steel failure (tension lead):	IN [knij
18	Fire resistance to steel failure (tension load):	$N_{Rk,s,fi}[kN]$
19	Bond resistance under fire conditions:	$k_{fi,p}(\theta)[-],$
	Fire resistance to steel failure under shear loading:	$T_{Rk,fi}(\theta) [N/mm^2]$ (BF) $V_{Rk,s,fi}[kN], M^0_{Rk,s,fi}[Nm]$
20	· ·	
	giene, health and the environment (BWR 3)	

Fischer DATA DOP\_ECs\_V96.xlsm Appendix 0

#### **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 B3 to B12, C1 to C16, C19, C21, C23, C24, C25 to C34
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1 to C4, C20, C22, C23, C24
Displacements under short-term and long-term loading	See Annex C17, C18, C35, C36
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C37 to C47

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance				
Reaction to fire	Class A1				
Resistance to fire	See Annex C48 to C51				

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

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

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

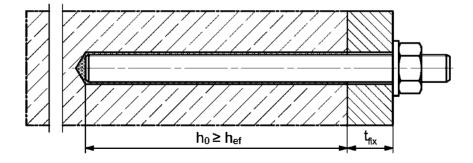
In accordance with the European Assessment Document EAD 330499-02-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

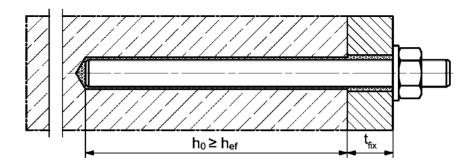
# Installation conditions part 1

fischer Anchor rod FIS A / RG M (Anchor rod) and commercial standard threaded rod (Threaded rod)

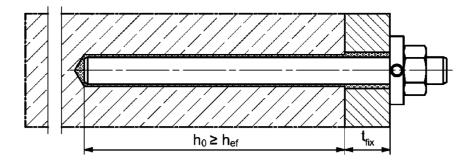
#### Pre-positioned installation



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

t<sub>fix</sub> = thickness of fixture

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

# fischer injection system FIS EM Plus

#### **Product description**

Installation conditions part 1

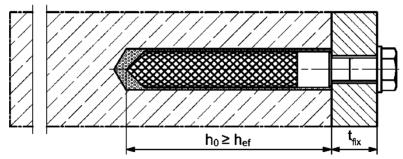
Annex A1

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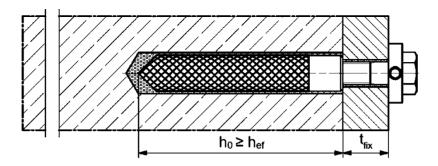
# Installation conditions part 2

fischer internal threaded anchor RG M I (fischer RG M I)

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

 $t_{fix}$  = thickness of fixture

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

fischer injection system FIS EM Plus

Product description
Installation conditions part 2

Annex A2

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# Installation conditions part 3 Reinforcing bar h₀≥ hef fischer rebar anchor FRA (fischer FRA) Pre-positioned installation $h_0 \ge h_{nom}$ Push through installation (annular gap filled with mortar) $h_0 \ge h_{nom}$ Figures not to scale $h_0$ = drill hole depth hef = effective embedment depth overall fastener embedment depth in the t<sub>fix</sub> = thickness of fixture $\mathbf{h}_{\mathsf{nom}}$ concrete fischer injection system FIS EM Plus Annex A3 **Product description** Installation conditions part 3 Appendix 5 / 77

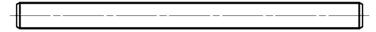
# Overview system components part 1 Injection cartridge (shuttle cartridge) with sealing cap; Size: 390 ml, 585 ml, 1500 ml Imprint: fischer FIS EM Plus, processing notes, shelf-life, piston travel scale (optional), curing times and processing times (depending on temperature), hazard code, size, volume. Static mixer FIS MR Plus for injection cartridges ≤ 390 ml Static mixer FIS UMR for injection cartridges > 390 ml Injection adapter and extension tube Ø 9 for static mixer FIS MR Plus; Injection adapter and extension tube Ø 9 or Ø 15 for static mixer FIS UMR Cleaning brush BS / BSB Compressed-air cleaning tool ABP Figures not to scale fischer injection system FIS EM Plus Annex A4 **Product description** Overview system components part 1; Appendix 6 / 77 cartridges / static mixer / accessories

# Overview system components part 2

#### Anchor rod / Threaded rod

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

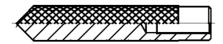
Fractional size: 3/8", 1/2", 5/8", 3/4", 7/8", 1", 1 1/8"



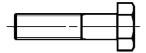
#### fischer RG M I

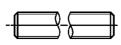
Metric size: M8, M10, M12, M16, M20

Fractional size: 3/8", 1/2", 5/8", 3/4"



#### Screw / Anchor rod / Threaded rod / washer / hexagon nut

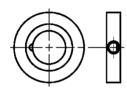


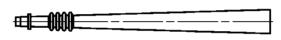






#### fischer filling disc with injection adapter

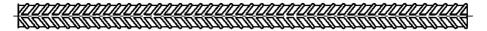




#### Reinforcing bar

Nominal diameter:

Metric size: \$\ddot 8, \dot 10, \dot 12, \dot 14, \dot 16, \dot 18, \dot 20, \dot 22, \dot 24, \dot 25, \dot 26, \dot 28, \dot 30, \dot 32, \dot 34, \dot 36, \dot 40 \\
Fractional size: \$\#3 (3/8"), #4 (1/2"), #5 (5/8"), #6 (3/4"), #7 (7/8"), #8 (1"), #9 (1,128"), #10 (1,270")



#### fischer FRA

Metric size: M12, M16, M20, M24



Figures not to scale

# $\ \ \, \text{fischer injection system FIS EM Plus}$

#### Product description

Overview system components part 2; steel components

Annex A5

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Tabl	Table A6.1: Materials, metric sizes								
Part	Designation		Material						
1	Injection cartridge								
		Steel	Stainless steel R	!	High corrosion resistant steel HCR				
	Steel grade	zinc plated (zp, hdg)	acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A2:2020	Cor	c. to EN 10088-1:2014 rosion resistance class CRC V acc. to 993-1-4: 2006+A2:2020				
2	Anchor rod / Threaded rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 $zp ≥ 5 μm$ , EN ISO 4042:2022 or hot dip galvanised ≥ 40 μm EN ISO 10684:2004+AC:2009 $f_{uk} ≤ 1000 \text{ N/mm}^2$ A <sub>5</sub> > 12 % fracture elongation <sup>1)</sup>	Property class 50, 70 or 80; EN ISO 3506-1:2020 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 <sub>5</sub> > 12 % fracture elongation <sup>1)</sup>	EÑ prop	perty class 50, 70 or 80; N ISO 3506-1:2020 or perty class HCR 70 with $f_{yk}$ = 560 N/mm <sup>2</sup> ; 1.4565;1.4529; EN 10088-1:2014 $f_{uk} \le 1000$ N/mm <sup>2</sup> 2 % fracture elongation <sup>1)</sup>				
3	Washer ISO 7089:2000	zinc plated ≥ 5 μm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 μm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014		1.4565; 1.4529; EN 10088-1:2014				
4	Hexagon nut	Property class 4, 5 or 8 acc. EN ISO 898-2:2012 zinc plated ≥ 5 µm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	Property class 50, 70 or 80 acc. EN ISO 3506-2:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	E	Property class 50, 70 or 80 acc. EN ISO 3506-2:2020 1.4565; 1.4529; EN 10088-1:2014				
5	fischer RG M I	Property class 5.8 EN ISO 898-1:2013 zinc plated ≥ 5 μm, EN ISO 4042:2022	Property class 70 EN ISO 3506-1:2020; 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	E	Property class 70 :N ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2014				
6	Commercial standard screw or Anchor rod / Threaded rod for fischer RG M I	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:2022 A₅ > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2020 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 3506-1:2020 1.4565; 1.4529; EN 10088-1:2014 8 % fracture elongation				
7	fischer filling disc similar to DIN 6319-G	zinc plated ≥ 5 μm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 μm EN ISO 10684:2004+AC:2009	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	Rebar	EN 1992-1-1:2004 and AC:2010 Bars and de-coiled rods, class b according to EN 1992-1-1/NA; f	B or C with fyk and k according to	NDP	or NCI				
9	fischer FRA	0088-1 C III :2006- to EN C V : 2006	4578, 1.4439, 1.4362, :2014 Corrosion -A1:2015 10088-1:2014 Corrosion +A1:2015 elongation A <sub>5</sub> > 8 %						
1) F	racture elongation	$A_5 > 8$ %, for applications withou	t requirements for seismic perfo	rmanc	e category C1 or C2				
fiscl	ner injection sv	stem FIS EM Plus							
	luct description p				Annex A6				
	erials, metric sizes		Appendix 8 / 77						

Part	Designation	Mate	erial			
1 Injection cartridge		Mortar, har	dener, filler			
		Steel	Stainles	ss steel R		
	Steel grade	zinc plated (zp, hdg)		e class CRC III acc. to 2006+A1:2015		
2	Fractional Threaded rod	$\begin{array}{c} \text{ASTM F568M-07, Class } 5.8 \\ f_{uk} = 500 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \text{ASTM F1554-20, Grade } 36 \\ f_{uk} = 400 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \text{ASTM F1554-20, Grade } 55 \\ f_{uk} = 517 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm; EN ISO } 4042:2022 \\ \text{ASTM F1554-20, Grade } 105 \\ f_{uk} = 862 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \text{ASTM A193/A193M-23, Grade B7} \\ f_{uk} = 862 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \end{array}$	$\begin{array}{c} f_{uk} = 689 \text{ N/mm}^2, \\ f_{uk} = 586 \text{ N/mm}^2, \\ A_5 > 12 \% \text{ fract} \\ ASTM A193/A193M-2 \\ f_{uk} = 517 \text{ N/mm}^2, A_5 > 1 \\ ASTM A193/A193M-2 \\ f_{uk} = 655 \text{ N/mm}^2, A_5 > 1 \\ \end{array}$	eae1, Alloy Group 2 $f_{uk}$ , ≤ 5/8 in. (CW1) $f_{uk}$ , ≥ 3/4 in. (CW2) ture elongation <sup>1)</sup> ; 23, Grade B8M, Class 1 2 % fracture elongation 3, Grade B8M, Class 2E 2 % fracture elongation		
3	Washer	ASTM F436/F436M-19 zinc plated ≥ 5 µm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	ASTM A240/A24	10M-23a Type 316		
4	Hexagon nut	ASTM A563/A563M-23, Grade DH or ASTM A194/A194M-23, Grade 2H for Threaded rod material ASTM F568M-07, Class 5.8 or ASTM F1554-20, Grade 36, 55, 105  ASTM A194/A194M-23, Grade 2H / 4 / 7 for Threaded rod material ASTM A193/A193M-23, B7 zinc plated ≥ 5 µm, EN ISO 4042:2022	ASTM A194/A194M-23, Grade 2H for Threaded rod material ASTM F568M-07, Class 5.8 or ASTM F1554-20, Grade 36, 55, 105  M A194/A194M-23, Grade 2H / 4 / 7 for Threaded rod material ASTM A193/A193M-23, B7  ASTM A193/A193M-23 ASTM A193/A193M-3			
5	fischer RG M I	Property class 5.8 EN ISO 898-1:2013 zinc plated ≥ 5 μm, ISO 4042:2022	1.4401; 1.4404; 1.4578	EN ISO 3506-1:2020; ; 1.4571; 1.4439; 1.436 88-1:2014		
	Commercial standard screw or Threaded rod for fischer RG M I	See Table A7.1, line 2, steel zinc plated, EN ISO 4042:2022		A7.1, line 2, ss steel R		
7	fischer filling disc similar to DIN 6319-G	zinc plated ≥ 5 μm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 μm EN ISO 10684:2004+AC:2009	1.4571; 1.4	.404; 1.4578; .439; 1.4362; 88-1:2014		
8	Reinforcing bar	) > 12 % fracture elongations of the secondation of the secondations of the secondation o	on <sup>1)</sup> on <sup>1)</sup> on <sup>1)</sup>			
<sup>1)</sup> F	racture elongatio	on $A_5 > 8$ %, for applications without requirements	for seismic performance	e category C1 or C2		
fisch	her injection s	system FIS EM Plus				
Proc	duct description	 n		Annex A7		
	erials, fractional		Į.			

#### Specifications of intended use part 1 Table B1.1: Overview use and performance categories Anchorages subject to FIS EM Plus with ... Anchor rod / fischer RG M I Reinforcing bar fischer FRA Threaded rod THE STATE OF THE S Hammer drilling with standard drill all sizes bit Nominal drill bit diameter (d<sub>0</sub>) Hammer drilling 12 mm to 35 mm: 7/16" to 1 3/8" with hollow drill bit (fischer "FHD", Heller "Duster Expert"; Bosch "Speed Clean"; Hilti "TE-CD, TE-YD", DreBo "D-Plus", DreBo "D-Max") Diamond drilling all sizes Annexes: Annexes: Annexes: М8 М8 Annexes: M12 ф8 Metric C3. C4. C3. C4. C1. to to C2, C4, C7, to to C9 - C13C14 - C16sizes C4 - C6Static and quasi M30 M20 C8. C17 ф40 M24 C17 C18 C18 static load in Annexes: uncracked / Annexes: Annexes: 3/8" 3/8" C21, C22, #3 cracked concrete Fractional C19, C20, C23, C24, \_1) to to C24. to C24 - C28. C32 - C34sizes 1 1/8" 3/4" C29 - C31. #10 C36 C35 C35 M10 Annexes: **φ10** Annexes: to C37, C39, to C38, C39, Seismic C40 ф32 M30 C41 C1 performance 3/8" Annexes: #3 Annexes: category C43, C45, C44, C45. tο to \_1) \_1) (only hammer 1 1/8" #10 C46 C47 drilling with M12 standard / hollow Annexes: M16 \_1) drill bits) C2 C38, C39, M20 C42 M24 dry or wet 11 all sizes concrete Use all sizes category water filled 12 (not permitted for diamond drilling in combination hole with cracked concrete and working life 100 years) D3 (downward and horizontal and upwards (e.g. overhead) installation) Installation direction $T_{i,min} = -5 \,^{\circ}\text{C}$ to $T_{i,max} = +40 \,^{\circ}\text{C}$ Installation temperature for the standard variation of temperature after installation Annexes: \_1) Resistance to fire C48 - C51 (max. short term temperature +40 °C: Temperature -40 °C to +40 °C max. long term temperature +24 °C) range I (max, short term temperature +60 °C: Temperature In-service -40 °C to +60 °C temperature range II max. long term temperature +35 °C) Temperature (max. short term temperature +72 °C; -40 °C to +72 °C range III max. long term temperature +50 °C) 1) no performance assessed. fischer injection system FIS EM Plus Annex B1 Intended use Specifications part 1 Appendix 10 / 77

#### 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+A2:2021.

#### Use conditions (Environmental conditions):

- Fastener intended for use in structures subject to dry, internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A6 table A6.1 (metric sizes) or Annex A7 table A7.1 (fractional sizes).

#### Design:

- Fastenings are designed under the responsibility of an engineer experienced in fastenings and concrete work.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Fastenings are designed in accordance with: EN 1992-4:2018 and TR 082 from June 2023.

#### Installation:

- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Fastening depth should be marked and adhered to installation.
- Overhead installation is allowed (necessary equipment see installation instruction).

fischer injection system FIS EM Plus	
Intended use	Annex B2
Specifications part 2	Appendix 11 / 77

Table B3.1: Installation parameters for metric Anchor rods / Threaded rods														
Anchor rods / Threaded rods				M8	M10	M12	M14	M16	M20	M22	M24	M27	M30	
Nominal drill hole diameter		<b>d</b> <sub>0</sub>		10	12	14	16	18	22 24 <sup>1)</sup>	25	28	30	35	
Drill hole depth		h₀						h₀≥	h <sub>ef</sub>					
Effective		h <sub>ef, min</sub>		60	60	70	75	80	90	93	96	108	120	
embedment dept	h	h <sub>ef, max</sub>		160	200	240	280	320	400	440	480	540	600	
Diameter of the	Installation	d <sub>f</sub>	[mm]	9	12	14	16	18	22	24	26	30	33	
clearance hole of the fixture	push through installation	d <sub>f</sub>			12	14	16	18	20	26	28	30	33	40
Minimum thickness of concrete member		h <sub>min</sub>			h <sub>ef</sub> + 36	כ			h	lef + 20	l <sub>o</sub>			
Maximum installation torque		max T <sub>inst</sub>	[Nm]	10	20	40	50	60	120	135	150	200	300	

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



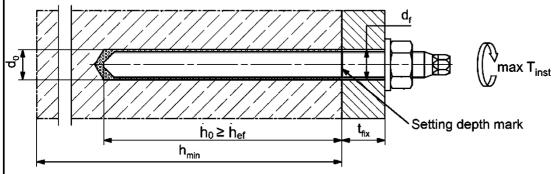
#### Marking (on random place) anchor rod:

1			
Steel zinc plated PC <sup>1)</sup> 8.8	• or +	Steel hot-dip PC <sup>1)</sup> 8.8	•
High corrosion resistant steel HCR PC1) 50	•	High corrosion resistant steel HCR PC1) 70	-
High corrosion resistant steel HCR PC1) 80	(	Stainless steel R property class 50	٨
Stainless steel R property class 80	*		
		- 1)	

Alternatively: Colour coding according to DIN 976-1:2016

1) PC = property class

#### Installation conditions:



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

- Materials, dimensions and mechanical properties according to Annex A6, 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

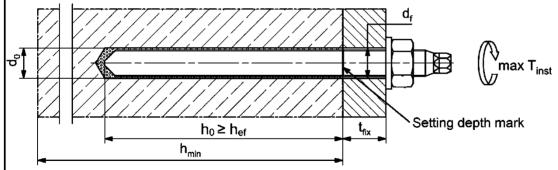
# fischer injection system FIS EM Plus Intended use Installation parameters Anchor rods / Threaded rods (metric size) Annex B3 Appendix 12 / 77

Table B4.1: Installation parameters for fractional Threaded rods											
Threaded rods				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	
Nominal drill hole	a diamatan	d	[mm]	11,1	14,3	19,1	22,2	25,4	28,6	31,8	
Nominal drill not	e diameter	d₀	[inch]	7/16	9/16	3/4	7/8	1	1 1/8	1 1/4	
Drill hole depth		h <sub>0</sub>		h₀≥ h <sub>ef</sub>							
Effective		h <sub>ef, min</sub>		60,0	70,0	79,0	89,0	89,0	102,0	178,0	
embedment dep	th	h <sub>ef, max</sub>		191,0	254,0	318,0	381,0	445,0	508,0	572,0	
Diameter of the	pre-positioned installation	df	[mm]	8,9	11,9	14,0	16,0	18,0	22,1	23,9	
clearance hole of the fixture	push through installation	df		11,9	14,0	16,0	18,0	20,1	25,9	27,9	
Minimum thickness of concrete member		h <sub>min</sub>		h <sub>ef</sub> -	+ 30			h <sub>ef</sub> + 20	d <sub>0</sub>		
Maximum installation torque max T <sub>inst</sub>		[Nm]	18	41	60	107	136	173	180		

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



#### Installation conditions:



#### Additional requirements for Threaded rods, washers and hexagon nuts:

- Materials, dimensions, and mechanical properties according to Annex A7, Table A7.1.
- Inspection certificate 3.1 according to EN 10204:2004, the documents shall be stored.
- · Setting depth is marked.

fischer injection system FIS EM Plus	
Intended use	Annex B4
Installation parameters Threaded rods (fractional size)	Appendix 13 / 77

Table B5.1: Minimum spacing and minimum edge distance for metric Anchor rods and metric reinforcing bars										nd	
Metric Anchor rods		M8	M10	M12	M14	M16	-	M20	M22	M24	
Metric Reinforcing bars (nominal diameter)	ф	8	10	12	14	16	18	20	22	24	
Minimum edge distance				NG.		5.00					
Uncracked / cracked concrete	C <sub>min</sub>	40	45	45	45	50	55	55	55	60	
Minimum spacing	S <sub>min</sub> [mm	1			accordi	ng to A	nnex B7	7		**	
Minimum spacing											
Uncracked / cracked concrete	S <sub>min</sub> [mm	40	45	55	60	65	85	85	95	105	
Minimum edge distance	Cmin	1	according to Annex B7								
Required projecting area						,		,,			
Uncracked concrete	_ <sub>^</sub> [100	8 0	13	21,5	23	24	38,5	38,5	39,5	40	
Cracked concrete	- A <sub>sp,req</sub> mm <sup>2</sup>	] 6,5	10	16,5	17,5	18,5	29,5	29,5	30	30,5	
Anchor rods			-	M27	-	M30	-	-	-		
Reinforcing bars (nominal diam	eter) ф	25	26	-	28	30	32	34	36	40	
Minimum edge distance										NV	
Uncracked / cracked concrete	Cmin	75	75	75	80	80	120	120	135	175	
Minimum spacing	S <sub>min</sub> [mm	1			accordi	ng to Ai	nnex B7	7			
Minimum spacing			200			20			40		
Uncracked / cracked concrete	Smin	120	120	120	140	140	160	160	160	160	
Minimum edge distance	C <sub>min</sub> [mm	1	according to Annex B7								
Required projecting area	Required projecting area										

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

36,5

[1000 47,5

mm<sup>2</sup>]

 $A_{sp,req}$ 

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:

47,5

36,5

47,5

36,5

64

49

64

49

64

49

64

49

64

49

64

49

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

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

Uncracked concrete

Cracked concrete

A<sub>sp,t</sub> = effective projecting area (according to **Annex B7**)

fischer injection system FIS EM Plu	ıs	
Intended use		Annex B5
Minimum spacing and edge distance for A	nchor rods and reinforcing bars	Appendix 14 / 77

Table B6.1: Minimum spacing and minimum edge distance for fractional Threaded rods and reinforcing bars											
Fractional Threaded rods			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"		
Fractional Reinforcing bars			#3	#4	#5	#6	#7	#8	#9	#10	
Minimum edge distance							-		-		
Uncracked / cracked concrete	Cmin	[mm]	45	45	50	55	60	75	80	120	
Minimum spacing	Smin	[mm]		according to Annex B7							
Minimum spacing											
Uncracked / cracked concrete	Smin	[mm]	45	60	65	85	105	120	140	160	
Minimum edge distance	Cmin	[mm]			acc	ording t	o Annex	B7			

21.0

16.0

24.5

18.5

36.0

27,5

39.5

30.0

43.5

33.5

40.5

31.0

64.5

49.5

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

12.5

9.5

[1000

mm<sup>2</sup>]

 $A_{sp,req}$ 

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

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

A<sub>sp,req</sub> = required projecting area

Required projecting area
Uncracked concrete

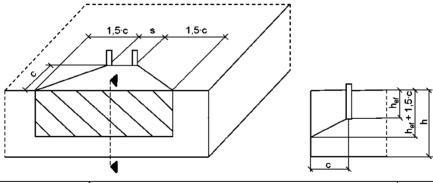
Cracked concrete

A<sub>sp,t</sub> = effective projecting area (according to **Annex B7**)

fischer injection sys	stem FIS EM Plus

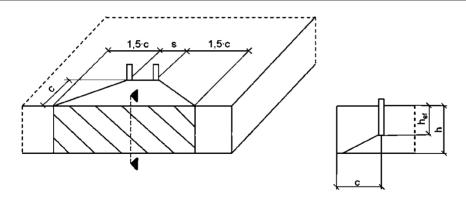
Minimum spacing and edge distance for Anchor rods and reinforcing bars

**Table B7.1:** Projecting area  $A_{sp,t}$  with concrete member thickness  $h > h_{ef} + 1,5 \cdot c$  and  $h \ge h_{min}$ 



l .				
Single fastener		$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with c ≥ c <sub>min</sub>
Group of fastener with	s > 3 · c	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	WILLI C 2 Cmin
Group of fastener with	s ≤ 3 · c	$A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with c ≥ c <sub>min</sub> and s ≥ s <sub>min</sub>

**Table B7.2:** Projecting area  $A_{sp,t}$  with concrete member thickness  $h \le h_{ef} + 1.5 \cdot c$  and  $h \ge h_{min}$ 

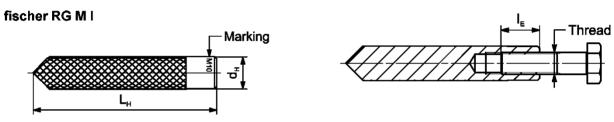


Single anchor		$A_{sp,t} = 3 \cdot c \cdot existing h$	[mm²]	with c ≥ c <sub>min</sub>
Group of fastener with	s > 3 · c	$A_{sp,t} = 6 \cdot c \cdot existing h$	[mm²]	WILLI C = Cmin
Group of fastener with	s ≤ 3 · c	$A_{sp,t} = (3 \cdot c + s) \cdot existing h$	[mm²]	with $c \ge c_{min}$ and $s \ge s_{min}$

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

fischer injection system FIS EM Plus	
Intended use	Annex B7
Minimum thickness of concrete member for Anchor rods / Threaded rods, minimum spacing and edge distance	Appendix 16 / 77

Table B8.1: Installation parameters for metric fischer RG M I										
fischer RG M I		Thread	M8	M10	M12	M16	M20			
Diameter of anchor	$d_{nom} = d_H$		12	15,7	18	22	28			
Nominal drill hole diameter	<b>d</b> <sub>0</sub>		14	18	20	24	32			
Drill hole depth	h <sub>0</sub>				$h_0 \ge h_{\text{ef}} = L_{\text{H}}$					
Effective embedment depth $(h_{ef} = L_H)$	h <sub>ef</sub>		90	90	125	160	200			
Minimum spacing and minimum edge distance	S <sub>min</sub> = C <sub>min</sub>	[mm]	55	65	75	95	125			
Diameter of clearance hole in the fixture	d <sub>f</sub>		9	12	14	18	22			
Minimum thickness of concrete member	h <sub>min</sub>		120	125	165	205	260			
Maximum screw-in depth	I <sub>E,max</sub>	] [	18	23	26	35	45			
Minimum screw-in depth	I <sub>E,min</sub>	] [	8	10	12	16	20			
Maximum installation torque	max T <sub>inst</sub>	[Nm]	10	20	40	80	120			



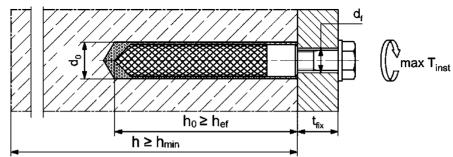
Marking: Anchor size e. g.: M10

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

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

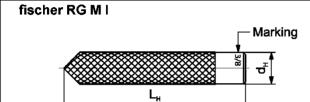
Retaining screw or threaded rods (including nut and washer) must comply with the appropriate material and strength class of **Annex A6**, **Table A6.1**.

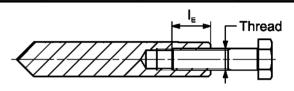
#### Installation conditions:



fischer injection system FIS EM Plus	
Intended use Installation parameters internal threaded anchors RG M I (metric size)	Annex B8 Appendix 17 / 77

Table B9.1: Installation	Table B9.1: Installation parameters for fractional fischer RG M I										
fischer RG M I	•	Thread	3/8"	1/2"	5/8"	3/4"					
Diameter of anchor	$d_{nom} = d_H$	[mana]	15,7	18	22	28					
Nominal drill hole	d.	[mm]	18	20	24	32					
diameter	$d_0$	[inch]	3/4	13/16	1	1 1/4					
Drill hole depth	h₀			h₀ ≥ h	<sub>ef</sub> = L <sub>H</sub>						
Effective embedment depth (hef = L <sub>H</sub> )	h <sub>ef</sub>		90	125	160	200					
Minimum spacing and minimum edge distance	S <sub>min</sub> = C <sub>min</sub>		65	75	95	125					
Diameter of clearance hole in the fixture	df	[mm]	12	14	18	22					
Minimum thickness of concrete member	h <sub>min</sub>		125	165	205	260					
Maximum screw-in depth	I <sub>E,max</sub>		23	26	35	45					
Minimum screw-in depth	I <sub>E,min</sub>		10	12	16	20					
Maximum installation torque	max T <sub>inst</sub>	[Nm]	20	40	80	120					



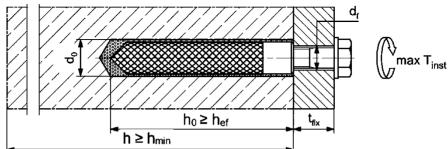


Marking:

Anchor size e. g.: M 3/8 Stainless steel → additional R; e.g.: M 3/8 R

Retaining screw or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A7, Table A7.1.

#### Installation conditions:



fischer injection system FIS EM Plus	
Intended use	Annex B9
Installation parameters internal threaded anchors RG M I (fractional size)	Appendix 18 / 77

Table B10.1: Installation	able B10.1: Installation parameters for metric reinforcing bars 1)												
Nominal diameter of the bar		ф	8 <sup>2)</sup>		10 <sup>2)</sup>	12	<b>2</b> 2)	14	16	18	20	22	24
Nominal drill hole diameter	<b>d</b> 0		10 1	2	12 14	14	16	18	20	25	25	30	30
Drill hole depth	h <sub>0</sub>								h₀ ≥ hef				
Effective	h <sub>ef,min</sub>	[mm]	60		60	7	0	75	80	85	90	94	98
embedment depth	<b>h</b> ef,max	[	160	)	200	24	40	280	320	360	400	440	480
Minimum thickness of concrete member	h <sub>min</sub>			h <sub>ef</sub> + 30						h <sub>ef</sub> + 2	<b>!d</b> ₀		

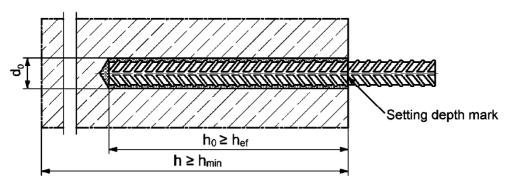
Nominal diameter of the bar		ф	25	26	28	30	32	34	36	40	•
Nominal drill hole diameter	<b>d</b> o		30	35	35	40	40	40	45	55	-
Drill hole depth	h <sub>0</sub>						h₀ ≥ h <sub>ef</sub>				
Effective	h <sub>ef,min</sub>	[mm]	100	104	112	120	128	136	144	160	-
embedment depth	h <sub>ef,max</sub>	[]	500	520	560	600	640	680	720	800	-
Minimum thickness of concrete member	h <sub>min</sub>		h <sub>ef</sub> + 2d <sub>0</sub>								

<sup>1)</sup> Detailed calculation according to Annex B7.

#### 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 · φ ≤ h<sub>rib</sub> ≤ 0,07 · φ
   (φ = Nominal diameter of the bar, h<sub>rib</sub> = rib height)

#### Installation conditions:



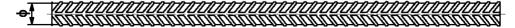
fischer injection system FIS EM Plus	
Intended use	Annex B10
Installation parameters reinforcing bars (metric size)	Appendix 19 / 77

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

Table B11.1: Installation	n param	eters f	or <b>frac</b>	tional ı	reinfor	cing b	ars 1)			
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10
Naminal drill hala diamatan	ما	[mm]	12,7	15,9	19,1	22,2	28,6	31,8	34,9	38,1
Nominal drill hole diameter	d₀	[inch]	1/2	5/8	3/4	7/8	1 1/8	1 1/4	1 3/8	1 1/2
Drill hole depth	h₀		h₀ ≥ h <sub>ef</sub>							
Effective	h <sub>ef,min</sub>		60	70	79	89	89	102	114	127
embedment depth	h <sub>ef,max</sub>	[mm]	191	254	318	381	445	508	572	635
Minimum thickness of concrete member	h <sub>min</sub>		h <sub>ef</sub> -	+ 30			h <sub>ef</sub> +	2d <sub>0</sub>		

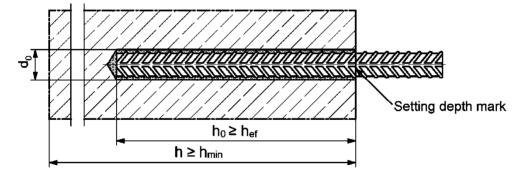
<sup>1)</sup> Detailed calculation according to Annex B7.

#### Reinforcing bar



Reinforcing bars, acc. to ASTM A615/A615M-22 (ASTM A767/A767M-19).
 Materials, dimensions, and mechanical properties according to Annex A7, Table A7.1.

#### Installation conditions:



fischer injection system FIS EM Plus	
Intended use	Annex B11
Installation parameters reinforcing bars (fractional size)	Appendix 20 / 77

fischer FRA		•	Thread	M1	(2 <sup>1)</sup>	M16	M20	M24
Nominal diamet	er of the bar	ф		1	2	16	20	25
Nominal drill ho	le diameter	d₀	] [	14	16	20	25	30
Drill hole depth		h₀	] [	·		h <sub>ef</sub> + l <sub>e</sub>	∍ = h <sub>nom</sub>	
Effective embes	lmont donth	h <sub>ef,min</sub>	] [	7	0	80	90	96
Effective embed	iment depth	h <sub>ef,max</sub>	] [	14	40	220	300	380
Distance concre welded joint	le				1	00		
Minimum spacing and minimum edge distance		S <sub>min</sub> = C <sub>min</sub>	[mm]	55		65	85	105
Diameter of	pre-positioned anchorage	≤ d <sub>f</sub>		1	4	18	22	26
clearance hole in the fixture	push through anchorage	≤ d <sub>f</sub>		1	8	22	26	32
Minimum thickn of concrete mer		h <sub>min</sub>		h <sub>0</sub> +	- 30		h <sub>0</sub> + 2d <sub>0</sub>	
Maximum instal	lation torque	max T <sub>inst</sub>	[Nm]	4	0	60	120	150

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

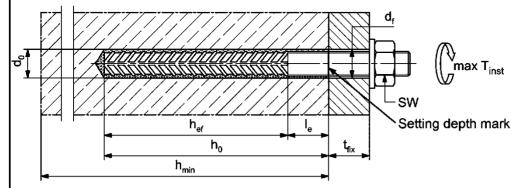
#### fischer FRA



Marking frontal e.g.:

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

#### Installation conditions:



fischer injection system FIS EM Plus	
Intended use	Annex B12
Installation parameters fischer FRA (metric size)	Appendix 21 / 77

Table B13.1: 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	d.	[mm]	10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
diameter	<b>d</b> <sub>0</sub>	[inch]	1	7/16	1/2	5/8	3/4	13/16	,	1	1 1/8	1 -	1/4	1 3/8	1 1/2	1	ı
Steel brush diameter BS	dь	[mm]	11	14	16	2	0	25	26	27	30		40		-	ı	1
Steel brush diameter BSB	dь	[mm]	-	1	ı		-	-	-	-	-		-		42	47	58



Table B13.2: Conditions for use static mixer without an extension tube

Nominal	al.	[mm]	10	12	14	16	18	20	24	25	28	30	32	35 40 45 55 1 3/8 1 1/2 3 210 ≤ 250			
Drill hole	d₀	[inch]	ı	7/16	1/2	5/8	3/4	13/16	1	1	1 1/8	1 '	1/4	1 3/8	1 1/2	•	•
	FIS MR Plus	[mm]	≤	90	≤ 120	≤ 140	≤ 150	≤ 160	≤ 190				≤ 2	210			
depth h <sub>0</sub> by using	FIS UMR	[mm]	,	-	≤ 90	≤ 160	≤ 180	≤ 190	≤ 2	20				≤ 250			

**Table B13.3:** 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 to 5 <sup>2)</sup>	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 Cleaning brush (steel brush) Processing time and curing time	Annex B13 Appendix 22 / 77

<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 1 Nominal drill hole diameter do and drill hole depth ho see Tables B3.1, B4.1, B8.1, B9.1, B10.1, B11.1, B12.1 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 B13.1**. 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, B4.1, B8.1, B9.1, B10.1, B11.1, B12.1. Go to step 6 fischer injection system FIS EM Plus

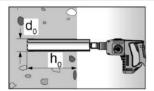
Intended use
Installation instructions part 1

Annex B14
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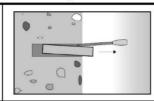
# Installation instructions part 2

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

1

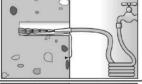


Drill the hole.
Drill hole diameter do and nominal drill hole depth ho see Tables B3.1, B4.1, B8.1, B9.1, B10.1, B11.1, B12.1



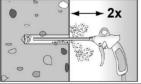
Break the drill core and remove it

2



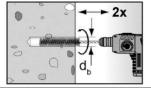
Flush the drill hole with clean water until it flows clear

3



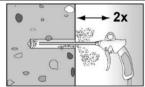
Blow out the drill hole twice, using oil-free compressed air (p > 6 bar)

4



Brush the drill hole twice using a power drill. Corresponding brushes see **Table B13.1** 

5



Blow out the drill hole twice, using oil-free compressed air (p > 6 bar)

# Preparing the cartridge

6



Remove the sealing cap

Screw on the static mixer (the spiral in the static mixer must be clearly visible)

7



Place the cartridge into the dispenser.

8





Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey.

# fischer injection system FIS EM Plus

Intended use

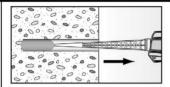
Installation instructions part 2

Annex B15

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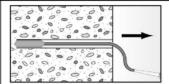
#### Installation instructions part 3

#### Injection of the mortar



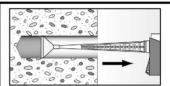
9

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



The conditions for mortar injection without extension tube can be found in **Table B13.2** 

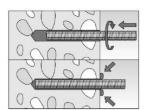
For deeper drill holes, than those mentioned in **Table B13.2**, use a suitable extension tube.

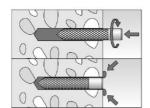


For overhead installation, deep holes ( $h_0 > 250$  mm) or drill hole diameter ( $d_0 \ge 30$  mm / 1 1/8") use an injection-adapter.

#### Installation of Anchor rods, threaded rods or fischer internal threaded anchors RG M I

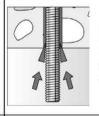
10



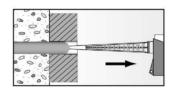


Only use clean and oil-free metal parts. Mark the setting depth of the metal parts. Push the anchor rod, threaded rod or fischer RG M I anchor down to the bottom of the hole, turning it slightly while doing so.

After inserting the metal part, excess mortar must be emerged around the anchor element. If not, pull out the metal part immediately and reiniect mortar.



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



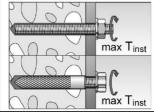
For push through installation fill the annular gap with mortar.

11



Wait for the specified curing time  $t_{\text{cure}}$  see **Table B13.3**.

12



Mounting the fixture max T<sub>inst</sub> see Tables B3.1, B4.1, B8.1 and B9.1.

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 EM Plus, FIS HB, FIS SB, FIS V Plus)

ATTENTION: Using fischer filling disc reduces  $t_{\text{\rm fix}}$  (usable length of the anchor).

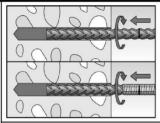
fischer injection system FIS EM Plus

Intended use Installation instructions part 3 Annex B16

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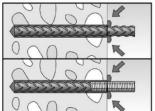
# Installation instructions part 4

#### Installation reinforcing bars and fischer 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



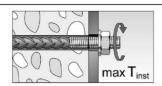
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole. If not, pull out the anchor element immediately and reinject mortar.

11



Wait for the specified curing time t<sub>cure</sub> see Table B13.3.

12



Mounting the fixture max T<sub>inst</sub> see **Table B12.1**.

fischer injection system FIS EM Plus

Intended use Installation instructions part 4 Annex B17

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Characteristic resistance to steel failure under tension / shear loading of Table C1.1: metric Anchor rods / Threaded rods Anchor rod / Threaded rod M8 M<sub>10</sub> M12 M14 M16 M20 M22 M24 M27 M30 Characteristic resistance to steel failure under tension loading<sup>3)</sup> 14.6(13.2) 23.2(21.4) 46.0 62.8 98,0 121,2 141,2 183,6 224.4 4.8 Property class Characteristic esistance N<sub>Rk</sub>, 5.8 18.3(16.6) 29.0(26.8) 42.1 78.5 122.5 151.5 176.5 229.5 280.5 Steel zinc plated 57.5 92.0 125,6 196,0 242,4 282,4 367.2 8.8 29,2(26,5) 46,4(42,8) 67,4 448.8 [kN] 57.5 78.5 122.5 151.5 176.5 229.5 50 18.3 280.5 29.0 42.1 Stainless steel R 80,5 109,9 171,5 212,1 247,1 25.6 321.3 392.7 and high corrosion 70 40.6 59.0 resistant steel HCR 92.0 125.6 196.0 242.4 282.4 80 29.2 46 4 67.4 367.2 448 8 Partial factors 1) 4.8 1.50 Property class Partial factor 5.8 Steel zinc plated 1.50 8.8 1.50 [-] 50 2.86 Stainless steel R and high corrosion 70 1.87 / fischer HCR: 1.50 resistant steel HCR 1.60 Characteristic resistance to steel failure under shear loading<sup>3)</sup> without lever arm 8,7(7,9) 13.9(12.8) 20.2 84.7 134.6 4.8 27.6 37.6 58.8 72.7 110.1 stance Vorks Property class Characteristic Steel zinc plated 5.8 10,9(9,9) | 17,4(16,0) | 25,2 | 168.3 34.5 47.1 73.5 90.9 105.9 137.7 8.8 14,6(13,2) 23,2(21,4) 33.7 46.0 62,8 98,0 | 121,2 | 141,2 | 183,6 224.4 [kN] 50 114.7 140.2 9.1 14.5 21.0 28.7 39.2 61.2 75.7 88.2 Stainless steel R and high corrosion 70 29.5 40.2 54.9 85,7 | 106,0 | 123,5 | 160,6 196.3 12.8 20,3 resistant steel HCR 80 14,6 23.2 33.7 46.0 62,8 98.0 121.2 141.2 183.6 224.4 **Ductility factor** [-] 1.0 k<sub>7</sub> with lever arm 14,9(12,9) 29,9(26,5) 52,3 83,5 132,9 259,6 357,1 448,8 665,7 4.8 899.5 Charact. resistance M<sup>0</sup>Rk. Property class 18,7(16,1) 37,3(33,2) 65,4 104,4 166,2 324,6 446,4 561,0 832,2 Steel zinc plated 5.8 1124.4 8.8 29,9(25,9) 59,8(53,1) 104,6 167,0 265,9 519,3 714,2 897,6 1331,5 1799,0 [Nm] 50 65,4 104,4 166,2 324,6 446,4 561,0 832,2 1124,4 18,7 37,3 Stainless steel R 91,5 | 146,1 | 232,6 | 454,4 | 624,9 | 785,4 | 1165,0 | 1574,1 and high corrosion 26.2 52.3 70 resistant steel HCR 80 29,9 59,8 104,6 167,0 265,9 519,3 714,2 897,6 1331,5 1799,0 Partial factors 1) 4.8 1,25 Property class Partial factor 5.8 Steel zinc plated 1,25 8.8 1,25 [-] 50 2.38 Stainless steel R

and high corrosion

resistant steel HCR

1,56 / fischer HCR: 1,252)

1.33

# fischer injection system FIS EM Plus

#### Performance

Characteristic resistance to steel failure under tension / shear loading of metric Anchor rods / Threaded rods

70

Annex C1

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

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

<sup>3)</sup> Values in brackets are valid for undersized threaded rods with smaller stress area A<sub>s</sub> for hot dip galvanised Threaded rods according to EN ISO 10684:2004+AC:2009.

Table C2.1: Characteristic resistance to steel failure under tension / shear loading of metric fischer RG M I

fischer RG M I			RG M I	Screw		M8	M10	M12	M16	M20	
Characteristic i	resistan	ce to steel	failure un	der tension loadin	ıg						
		Property		5.8		18,3	29,0	42,1	78,3	122,4	
Characteristic		class	5.8	8.8		29,2	46,4	67,4	106,7	180,2	
resistance with screw	$N_{Rk,s}$	Property class	R-70 / HCR-70	R-70 / commercial standard	[kN]	25,6	40,6	59,0	109,6	171,3	
		ciass	nck-/u	HCR-70		25,6	40,6	59,0	109,6	171,3	
Partial factors <sup>1)</sup>	)										
		Property	5.8	5.8				1,50			
		class	5.6	8.8				1,50			
Partial factors	γMs,N	Property	R-70 /	R-70/ commercial standard	[-]			1,87			
		class	HCR-70	HCR-70				1,50			
Characteristic i	resistan	ce to steel	el failure under shear loading								
Without lever a	rm										
		Property	5.8	5.8		10,9	17,4	25,2	47,1	73,5	
Characteristic		class	5.6	8.8		14,6	23,2	33,7	62,8	98,0	
resistance with screw	$V^0$ Rk,s	Property	R-70 /	R-70 / commercial standard	[kN]	12,8	20,3	29,5	54,9	85,7	
		class	HCR-70	HCR-70	1	12,8	20,3	29,5	54,9	85,7	
Ductility factor				<b>k</b> <sub>7</sub>	[-]	971	<b>.</b>	1,0		500	
With lever arm											
		Property	5.8	5.8		18,7	37,3	65,4	166,2	324,6	
Characteristic		class	5.6	8.8		29,9	59,8	104,6	265,9	519,3	
resistance with screw	M <sup>0</sup> Rk,s	Property	R-70/	R-70 / commercial standard	[Nm]	26,2	52,3	91,5	232,6	454,4	
		class	HCR-70	HCR-70		26,2	52,3	91,5	232,6	454,4	
Partial factors <sup>1)</sup>	)		•					•			
		Property	5.8	5.8				1,25			
		class	5.8	8.8	]	1,25					
Partial factors	γMs,V	Property	R-70 /	R-70 / commercial standard	[-]	1,56					
		class	HCR-70	HCR-70	1	1,25					

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

fischer injection system FIS EM Plus	
Performance Characteristic resistance to steel failure under tension / shear loading of metric fischer RG M I	Annex C2 Appendix 28 / 77

Table C3.1: Characteri metric reir			e to st	eel fa	i <b>lure</b> ur	nder tei	nsion /	shear I	oading	of
Nominal diameter of the bar		ф	8	10	12	14	16	20	25	28
Characteristic resistance to st	teel failure	unde	r tensio	n loadi	ng					
Characteristic resistance	N <sub>Rk,s</sub>	[kN]				As ·	f <sub>uk</sub> 1)			
Characteristic resistance to st	teel failure	unde	r shear	loading	I					
Without lever arm										
Characteristic resistance	$V^0$ Rk,s	[kN]				<b>k</b> <sub>6</sub> <sup>2)</sup> · A	s · fuk1)			
Ductility factor	<b>k</b> 7	[-]				1,	,0			
With lever arm		200								
Characteristic resistance	M <sup>0</sup> Rk,s	[Nm]				1,2 · W	/ <sub>el</sub> ⋅ f <sub>uk</sub> 1)			

<sup>1)</sup> f<sub>uk</sub> respectively shall be taken from the specifications of the reinforcing bar.

Table C3.2: Characteristic restistance to steel failure under tension / shear loading of metric fischer FRA

fischer FRA			M12	M16	M20	M24	
Characteristic resistance to steel failure under tension loading							
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	62,1	110,5	172,7	263,0	
Partial factor <sup>1)</sup>		vo 26					
Partial factor	γMs,N	[-]		1,	40		
Characteristic resistance to	steel failure	under	shear loading				
Without lever arm							
Characteristic resistance	$V^0$ Rk,s	[kN]	33,7	62,8	98,0	141,2	
Ductility factor	<b>k</b> <sub>7</sub>	[-]		1	,0		
With lever arm							
Characteristic resistance	$M^0$ Rk,s	[Nm]	104,8	266,3	519,2	898,0	
Partial factor <sup>1)</sup>					*	**	
Partial factor	γMs,V	[-]		1,	25		

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

fischer injection system	FIS	EM	Plus
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#### Performance

Characteristic resistance to steel failure under tension / shear loading of metric reinforcing bars and metric fischer FRA

#### Annex C3

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<sup>2)</sup> In accordance with EN 1992-4:2018 section 7.2.2.3.1:

 $k_6 = 0.6$  for fasteners made of carbon steel with  $f_{uk} \le 500 \text{ N/mm}^2$ ,

<sup>= 0,5</sup> for fasteners made of carbon steel with 500 N/mm² < f<sub>uk</sub> ≤ 1000 N/mm²,

<sup>= 0.5</sup> for fasteners made of stainless steel.

Size										All	siz	es				
Tension loading																
Installation factor		γinst	[-]				S	ee	annex	C5 to	C1	6, C	40 and	C41		
Factors for the compress	sive stren	<u> </u>	5.171	rete	> C2	20/25						, ,				
0 0000000000000 000000 000000000000000	C25/30	<u> </u>								1	1,02					
- Increasing factor ψ <sub>c</sub> for _	C30/37										1,04					
cracked or uncracked	C35/45										1,06					
concrete	C40/50	$\Psi_{\text{c}}$	[-]							1	1,07	6				
$\tau_{Rk(X,Y)} = \psi_c \cdot \tau_{Rk(C20/25)}$	C45/55									1	1,08					
-	C50/60									1	1,09					
Splitting failure				•												
h /	h <sub>ef</sub> ≥ 2,0									1,	,0 h∈	ef				
Edge distance 2,0 > h	h <sub>ef</sub> > 1,3	C <sub>cr,sp</sub>	[mm]							4,6 h	ef - 1	1,8 h				
h ,	' h <sub>ef</sub> ≤ 1,3		[[,,,,,,]							2,2	26 h	lef				
Spacing		Scr,sp								2	C <sub>cr,s</sub>	sp				
Concrete cone failure																
Uncracked concrete		<b>k</b> ucr,N	[-]								11,0					
Cracked concrete		$\mathbf{k}_{cr,N}$		7,7												
Edge distance		C <sub>cr,N</sub>	[mm]	1,5 h <sub>ef</sub>												
Spacing		<b>S</b> cr,N	[]							2	C <sub>cr,N</sub>	N				
Factors for sustained ter	nsion load	ding			**************************************	2006	2000 2000	. 100				55-W 1007 K2		Sector 2		data no
Temperature range					24 °	C / 4	0 °(	C		35 °C	6 / 6	0°C		50	°C / 72	°C
Factor		$\psi^0_{\text{sus}}$				0,77	ts.			C	0,60				0,48	
Factor	Ч	<sup>0</sup> sus,100				0,77	18			C	0,60				0,71	
Shear loading	7															
Installation factor		γinst	[-]								1,0					
Concrete pry-out failure																
Factor for pry-out failure		k <sub>8</sub>	[-]	,							2,0					
Concrete edge failure																
Effective length of fastene shear loading	r for	lf	[mm]						mm: n mm: n				m) B d <sub>nom</sub> ;	300 n	nm))	
Effective diameter of the	fastener	d <sub>nom</sub>														
Size				M	8 1	<b>/</b> 110	М	12	M14	M16	N	/120	M22	M24	M27	МЗ
Anchor rods and Threaded rods		d <sub>nom</sub>		8		10	1	2	14	16	:	20	22	24	27	30
fischer RG M I		$d_{nom}$	[mm]	12	2 1	15,7	1	8	_1)	22		28	_1)	_1)	_1)	_1
fischer FRA		$d_{nom}$		_1	)	_1)	1	2	_1)	16		20	_1)	25	_1)	_1
Size (nominal diameter of	the bar)		ф	8	10	12 1	14	16	18 20	22	24	25	26 28	30 3	32 34	36
Reinforcing bar							36									
1) Anchor type not part o	f the asse	ssmer	nt.													
fischer injection system FIS EM Plus																
Performance Characteristic resistance	for concre	ete fail	ure und	der t	ensid	on / :	she	ar le	oading	J					nex Condix 30 /	

1	Table C5.1: Characteristic resistance to combined pull-out and concrete failure for metric Anchor rods and Threaded rods in hammer or diamond drilled holes;												
0.00000	etric An icracke									iaiiii0i	ia arii	ieu na	JIES,
		a or c	rackeu	M8 <sup>1)</sup>	M10	M12	M14	M16		M22	M24	M27	Man
Anchor rod / Threaded Combined pull-out and		o cono	failuro	IVIO '	IVITU	IVITZ	IVI 14	IVITO	M20	IVIZZ	IVIZ4	IVIZI	M30
Calculation diameter	u concret	d d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked concrete			1111111										
Characteristic bond re	sistance	in uncr	acked co	ncrete	C20/25	j .							
Hammer-drilling with sta					2522212 Table 121 125		ete)						
Tem- I: 24 °C				20,8	19,7	18,8	18,1	17,6	16,7	16,3	16,0	15,5	15,1
perature II: 35 °C	/ 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	18,0	18,0	18,0	17,0	17,0	16,0	15,0	15,0	15,0	14,0
range III: 50 °C	/ 72 °C			18,0	17,0	17,0	16,0	16,0	15,0	14,0	14,0	14,0	13,0
Hammer-drilling with sta	andard dril	l bit or h	nollow drill	bit (wa		d hole)		-					
100 miles	/ 40 °C			20,8	19,7	18,8	17,9	16,9	15,3	14,4	13,8	13,2	12,3
perature II: 35 °C		$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	16,0	16,0	15,0	13,0	13,0	11,0	11,0	10,0	10,0	9,0
range III: 50 °C				15,0	14,0	14,0	13,0	12,0	11,0	10,0	10,0	9,0	9,0
Installation factors; Ha	ammer-dr	illing w	ith stand	ard dril	I bit or	hollov	v drill b						
Dry or wet concrete		γinst	[-]						,0				
Water filled hole		• =====================================	r 1					1	,4				
Diamond-drilling (dry or		ete)		400	45.0	10.5	100	40.4	44.0	44.0	40.0	10.5	400
Tem- 1: 24 °C	10000		TN1/ 25	16,0	15,0	13,5	12,8	12,4	11,6	11,3	10,9	10,5	10,3
•	/ 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	16,0	15,0	13,0	12,0	12,0	10,0	10,0	10,0	9,0	9,0
	/ 72 °C			15,0	14,0	12,0	11,0	11,0	10,0	9,0	9,0	8,0	8,0
Diamond-drilling (water		2		10.0	10.0	15.5	140	10.0	10.0	14.5	10.0	10.0	0.0
	/ 40 °C		FN 17 21	16,0	16,8	15,5	14,3	13,6	12,0	11,5	10,9	10,3	9,9
perature II: 35 °C		$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	16,0	15,0	13,0	12,0	12,0	10,0	10,0	10,0	9,0	9,0
range III: 50 °C				15,0	14,0	12,0	11,0	11,0	10,0	9,0	9,0	8,0	8,0
Installation factors; Di	amona-ai	rilling						-	0				
Dry or wet concrete		γinst	[-]	-				1					
Water filled hole								1	,4				
Cracked concrete Characteristic bond re	oiotonoo	in oroo	kad aana	roto C2	0/25								
Hammer-drilling with sta						concre	oto)						
	/ 40 °C	i bit oi i	lollow drill	7,7	9,0	10,1	8,5	9,5	8,5	8,5	8,5	8,5	8,5
		_	[N/mm <sup>2</sup> ]	7,7	9,0	10,1	8,5	9,5	8,5	8,5	8,5	8,5	8,5
range III: 50 °C		$ au_{Rk,cr}$	[14/11111]	7,2	8,5	9,5	8,5	8,9	8,5	8,5	8,5	8,5	8,5
Hammer-drilling with sta		l hit or h	ollow drill				0,5	0,3	0,5	0,5	0,5	0,5	0,5
	/ 40 °C	I DIL OI I	lollow drill	6,6	7,7	8,7	7,0	7,7	6,0	6.0	6,0	6,0	6,0
perature II: 35 °C	/ 60 °C	σ-	[N/mm <sup>2</sup> ]		7,7	8,7	7,0	7,7	6,0			6,0	6,0
range III: 50 °C	/ 72 °C	€Rk,cr	[ [IW/IIIII ]	6,2	7,3	8,1	7,0	7,3	6,0	6,0	6,0	6,0	6,0
Installation factors; Ha		illing w	ith stand:			,			_ U,U	0,0	0,0	0,0	0,0
Dry or wet concrete	ammor-ul	ıg w			. DIL UI	HOHOV	· MIIII k		,0				
Water filled hole		$\gamma$ inst	[-]			1,2					1,4		
Diamond-drilling (dry or	wet concr	ete)		I		.,			I		111		
	/ 40 °C			7,0	7,0	7,0	7,0	6,0	6,0	7,0	7,0	7,0	7,0
		$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,0	7,0	7,0	7,0	6,0	6,0	7,0	7,0	7,0	7,0
	/ 72 °C	VIKK,CF	[	7,0	7,0	7,0	7,0	6,0	6,0	7,0	7,0	7,0	7,0
Diamond-drilling (water	29 112420 12 12000	)		.,0	. , , -	.,-	. , , •	-10	,_	.,,•	.,0	.,,-	.,,-
	/ 40 °C	-		6,0	7,5	7,5	7,0	6,0	6,0	6,0	6,0	6,0	6,0
		$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6,0	7,5	7,5	7,0	6,0	6,0	6,0	6,0	6,0	6,0
	/ 72 °C	VIXI,CI		6,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	6,0	6,0
Installation factors; Di		rilling	· · · · · · · · · · · · · · · · · · ·	. ,	,	,	,		,		. ,	,	,
Dry or wet concrete			r ı					1	,0				
Water filled hole $\gamma_{\text{inst}}$ [-] 1,4													
1) Not allowed for ho	llow drill b	it.		-					•		*		
fischer injection system FIS EM Plus													
Performance Annex C5													
Characteristic resista	Characteristic resistance to combined pull-out and concrete failure for Anchor rods and Threaded rods; working life 50 years  Appendix 31 / 77												
ALBERT A CHEMICAN IN A STATEMENT OF COMMISSION OF COMMISSI													

Table C6.1: Characte						-						
metric A										nd dril	led ho	oles;
uncrack	ed or c	racked										
Anchor rod / Threaded rod	245		M8 <sup>1)</sup>	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pull-out and concre		T .										
Calculation diameter	d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked concrete					_							
Characteristic bond resistanc												
Hammer-drilling with standard d	<u> rill bit or  </u>	<u>nollow drill</u>					T				T 11217227 523	
Tem- 1: 24 °C / 40 °C		77	17,1	16,1	15,4	14,9	14,4	13,7	13,4	13,1	12,7	12,4
perature II: 35 °C / 60 °C	$ au_{ m Rk,100,ucr}$	[N/mm <sup>2</sup> ]	13,5	13,5	13,5	12,8	12,8	12,0	11,3	11,3	11,3	10,5
range III: 50 °C / 72 °C	اممائط النسا	التعديد طعناا	9,9	10,2	10,2	10,4	10,4	9,8	9,1	9,1	9,1	8,5
Hammer-drilling with standard d	riii bit or i	<u>10110W ariii</u>				117	12.0	10 E	11.0	11.0	10.0	10.1
Tem- 1: 24 °C / 40 °C		[NI/mm21	17,1	16,2	15,4	14,7	13,9	12,5	11,8	11,3	10,8	10,1
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	₹Rk,100,ucr	[N/mm <sup>2</sup> ]	12,0 8,3	12,0 8,4	11,3 8,4	9,8 8,5	9,8 7,8	8,3 7,2	8,3	7,5 6,5	7,5 5,9	6,8
range III: 50 °C / 72 °C Installation factors; Hammer-o	drilling v	ith stand						1,2	6,5	0,5	5,9	5,9
Dry or wet concrete	arming w	ini Stalida	aru urli	ו טונ טו	HOHOV	v urill l	122	0				
Water filled hole	γinst	[-]					1,					
	oroto)	i=n=i					1.	,4				
Diamond-drilling (dry or wet con	<u>crete)</u>	T	400	40.0	44.0	44.4	40.5	10.1	0.5		0.0	0.0
Tem- 1: 24 °C / 40 °C	7011	[N1/mmm2]	12,0	12,3	11,6	11,1	10,5	10,1	9,5	9,3	8,9	8,8
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	TRk,100,ucr	[N/mm <sup>2</sup> ]	12,0 8,3	11,3 8,4	9,8 7,2	9,0 7,2	9,0 7,2	7,5 6,5	7,5 5,9	7,5 5,9	6,8 5,2	6,8 5,2
	lo)	l.	0,3	0,4	1,2	1,2	1,2	6,5	5,9	5,9	5,2	5,2
Diamond-drilling (water filled hole) Tem- I: 24 °C / 40 °C	<u>ie)</u>	1	12.0	12.0	12,7	11,7	11,2	10.0	9,4	8,9	0.4	8,1
Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C	_	[N/mm <sup>2</sup> ]	12,0 12,0	13,8 11,3	9,8	9,0	9,0	10,0 7,5	7,5	7,5	8,4 6,8	6,8
range III: 50 °C / 72 °C	TRk,100,ucr	ן נוא/ווווורן	8,3	8,4	7,2	7,2	7,2	6,5	5,9	5,9	5,2	5,2
Installation factors			0,5	0,4	1,2	1,2	1,2	0,5	5,9	5,5	5,2	5,2
Dry or wet concrete			1				1.	0				
Water filled hole	γinst	[-]						, <del>0</del> ,4				
Cracked concrete								,4				
	o in oroo	kad aana	roto Co	0/25								
Characteristic bond resistanc	THE COURT SENSON SERVICES	A STATE OF THE STA	PORTUGE COURT	WARNA TO SEC		1-1						
Hammer-drilling with standard d	riii bit or i	Tollow arill					7.0	0.0	C 0	6.7	C.F.	
Tem- perature II: 24 °C / 40 °C	_	[NI/mm21	5,7	7,0	7,6 7,6	7,4 7,4	7,2 7,2	6,9 6,9	6,8 6,8	6,7 6,7	6,5 6,5	6,3 6,3
range II: 35 °C / 60 °C III: 50 °C / 72 °C	$ au_{Rk,100,cr}$	[N/mm <sup>2</sup> ]	5,7 5,4	7,0 6,6	7,0	7,4	6,8	6,4	6,4	6,3	6,1	6,0
Hammer-drilling with standard d	rill hit or l	l Jollow drill				7,0	0,0	0,4	0,4	0,3	0,1	0,0
Tem- I: 24 °C / 40 °C	i ili bit oi i	Tollow urlii	4,9	6,0	6,5	6,1	5,9	4,9	4,8	4,7	4,6	4,4
11 05 00 100 00	σ.	[N/mm <sup>2</sup> ]	4,9	6,0	6,5	6,1	5,9	4,9	4,8	4,7	4,6	4,4
range III: 50 °C / 72 °C	TRk,100,cr	[14/11111]	4,6	5,7	6,1	5,7	5,5	4,5	4,5	4,4	4,3	4,3
Installation factors; Hammer-	drillina w	ith stand	,				,			1,1	1,5	.,,0
Dry or wet concrete							1.	.0				
Water filled hole	γinst	[-]			1,2					1,4		
Diamond-drilling (dry or wet con	croto)				1,2					1,-		
Tem- 1: 24 °C / 40 °C	<u>Cretej</u>		4,2	6,0	5,6	4,6	3,9	3,9	4,6	4,6	4,6	4,6
	<b>T</b>	[N/mm <sup>2</sup> ]	4,2	6,0	5,6	4,6	3,9	3,9	4,6	4,6	4,6	4,6
range III: 50 °C / 72 °C	$ au_{\text{Rk,100,cr}}$	ן נואיווווו ן	4,2	6,0	5,6	4,6	3,9	3,9	4,6	4,6	4,6	4,6
Installation factors		I .	T,4	J,J		1,0	5,5	J,J	1,0	1,0	1,0	1,0
Dry or wet concrete	Vinat	[-]					1.	0				
	γinst	<u> </u>						,,,				
1) Not allowed for hollow drill bit.												
fischer injection system	fischer injection system FIS EM Plus											
Performance	Performance Annex C6							3				
Characteristic resistance to combined pull-out and concrete failure for Anchor rods and Threaded rods in hammer or diamond drilled holes; working life 100 years  Appendix 32 / 77							77					
The state of the s												

Table C7.1: Charac	torictic	rocietan	co to com	bined pull-	out and co	noroto faile	uro for
metric	fischer	RG M I i	n hammer o	or diamond	drilled hole		uie ioi
	kea or c	сгаскеа		working lif			
ischer RG M I	•		M8	M10	M12	M16	M20
Combined pull-out and cond			10	45.7	40	- 00	- 00
Calculation diameter	d	[mm]	12	15,7	18	22	28
Incracked concrete			C00/0/	•			
Characteristic bond resistar							
Hammer-drilling with standard	arili bit or	Tiollow arili			17.0	16.0	45.0
Tem- I: 24 °C / 40 °C	II = 0.00	[N1/mamm2]	18,8	17,6	17,0	16,2	15,3
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15,0	14,0	14,0	13,0 12,0	12,0 11,0
range      III:    50 °C / 72 °C Hammer-drilling with standard	drill bit or	hallow drill	14,0	13,0	13,0	12,0	11,0
	unii bit or	Tiollow drill	18,8	16,9	15,8	14,3	12,8
Tem- <u>I: 24 °C / 40 °C</u> perature II: 35 °C / 60 °C	,	[N1/mm21					
	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	14,0 13,0	12,0 12,0	12,0 11,0	11,0 10,0	10,0 9,0
range III: 50 °C / 72 °C nstallation factors; Hamme	r drilling :	with stand				10,0	9,0
Ory or wet concrete	r-arming V	vitii Standi	aru urili bil bil	nonow arm i			
Nater filled hole	γinst	[-]			1,0 1,4		
Diamond-drilling (dry or wet co	oncreto)	-	I		1,4		
Tem- I: 24 °C / 40 °C	muere)		13,3	12,3	11,9	11,2	10,4
perature II: 35 °C / 60 °C		[N/mm <sup>2</sup> ]	13,0	12,0	11,9	10,0	9,0
range III: 50 °C / 72 °C	$ au_{Rk,ucr}$	ן וווווו ן	12,0	11,0	10,0	9,0	8,0
Diamond-drilling (water filled h	volo)		12,0	11,0	10,0	9,0	0,0
Fem- I: 24 °C / 40 °C	<u>iole)</u>	1	15,1	13,6	12,6	11,4	10,2
perature II: 35 °C / 60 °C	<u></u>	[N/mm <sup>2</sup> ]	13,1	12,0	11,0	10,0	9,0
range III: 50 °C / 72 °C	$_{\scriptscriptstyle{-}}$ $ au_{\scriptscriptstyle{Rk},ucr}$		12,0	11,0	10,0	9,0	8,0
nstallation factors; Diamon	d drilling		12,0	11,0	10,0	9,0	0,0
Dry or wet concrete	u-uriiiiig				1,0		
Water filled hole	— γ <sub>inst</sub>	[-]			1,4		
Cracked concrete		7547434			1,4		
Characteristic bond resistar	nce in crae	rked conc	rete C20/25				
Hammer-drilling with standard	pro-control parameter per management	Selventi i nuncosco - noscono esta con concerna de como con con con con con con con con con co	HIRTOGORDON TOURS TOURS TO THE STREET	t concrete)			
Tem- I: 24 °C / 40 °C	unii bit or		7,0	6,0	6,0	7,0	7,0
perature II: 35 °C / 60 °C	-	[N/mm <sup>2</sup> ]	7,0	6,0	6,0	7,0	7,0
range III: 50 °C / 72 °C	. $ au_{Rk,cr}$	[14/11111]	7,0	6,0	6,0	7,0	7,0
Hammer-drilling with standard	drill bit or	hollow drill			0,0	1,0	1,0
Tem- I: 24 °C / 40 °C	unii bit oi	Tionow arm	7,0	6,5	6,0	6,0	6,0
Derature II: 35 °C / 60 °C		[N/mm <sup>2</sup> ]	7,0	6,5	6,0	6,0	6,0
range III: 50 °C / 72 °C	. $ au_{Rk,cr}$	[IA/IIIII.]	7,0	6,0	6,0	6,0	6,0
Installation factors; Hamme	r_drilling \	with stand				0,0	0,0
Dry or wet concrete	i-urilling v	VILII SLAIIU		nonow arm i	1,0		
Nater filled hole	γinst	[-]		1,2	1,0	1	,4
Diamond-drilling (dry or wet co	ncrete)			1,2		<u> </u>	, –
Tem- I: 24 °C / 40 °C	<u> </u>		7,0	6,0	6,0	7,0	7,0
perature II: 35 °C / 60 °C	-	[N/mm <sup>2</sup> ]	7,0	6,0	6,0	7,0	7,0
range III: 50 °C / 72 °C	$ au_{Rk,cr}$	[14/11111]	7,0	6,0	6,0	7,0	7,0
Diamond-drilling (water filled h	nole)	Ţ	1,0	0,0	0,0	1,0	1,0
	ioie)		7,0	6,5	6,0	6,0	6,0
Tem- 1: 24 °C / 40 °C	_	[N1/mm21					
perature II: 35 °C / 60 °C	$_{\scriptscriptstyle{\perp}}$ $ au_{\scriptscriptstyle{Rk},cr}$	[N/mm <sup>2</sup> ]	7,0	6,5	6,0	6,0	6,0
range III: 50 °C / 72 °C	م ماللوالم		7,0	6,0	6,0	6,0	6,0
nstallation factors; Diamon	u-ariiiing	1			1.0		
Ory or wet concrete	— γinst	[-]		4.0	1,0	12 <b>4</b>	4
Water filled hole	,	and the		1,2		1	,4

fischer	injection syster	m FIS EM Plus
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# Performance

Characteristic resistance to combined pull-out and concrete failure for fischer RG M I; working life 50 years

Annex C7

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Table C8.1: Characteristic resistance to combined pull-out and concrete failure for metric fischer RG M I in hammer or diamond drilled holes; uncracked or cracked concrete; working life 100 years

ischer RG M I			M8	M10	M12	M16	M20
Combined pull-out and con	crete cone	failure					
Calculation diameter	d	[mm]	12	15,7	18	22	28
Jncracked concrete							
Characteristic bond resista	nce in unc	racked co	ncrete C20/2	5			
Hammer-drilling with standard	d drill bit or	hollow drill	bit (dry or we	t concrete)			
Tem- I: 24 °C / 40 °C			15,4	14,4	14,0	13,3	12,6
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	11,3	10,5	10,5	9,8	9,0
range III: 50 °C / 72 °C	_ • • • • • • • • • • • • • • • • • • •		7,7	7,8	7,8	7,8	7,2
Hammer-drilling with standard	drill bit or	hollow drill	bit (water fille	d hole)			
Tem- I: 24 °C / 40 °C	_		15,4	13,9	13,0	11,7	10,5
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	10,5	9,0	9,0	8,3	7,5
ange III: 50 °C / 72 °C			7,2	7,2	6,6	6,5	5,9
nstallation factors; Hamme	r-drilling w	vith standa	ard drill bit or	hollow drill l	0.00		
Ory or wet concrete	- 00 .	[ [,1			1,0		
Vater filled hole	γinst	[-]			1,4		
Diamond-drilling (dry or wet c	oncrete)						
Гет- I: 24 °С / 40 °С			10,9	10,1	9,8	9,2	8,6
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	9,8	9,0	8,3	7,5	6,8
range III: 50 °C / 72 °C	***************************************		6,6	6,6	6,0	5,9	5,2
Diamond-drilling (water filled	nole)						
Гет- <u>I: 24 °С / 40 °С</u>	_		12,5	11,2	10,3	9,3	8,4
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	9,8	9,0	8,3	7,5	6,8
range III: 50 °C / 72 °C	W.1 W.		6,6	6,6	6,0	5,9	5,2
nstallation factors; Diamon	d-drilling						
Ory or wet concrete		[-]			1,0		
Nater filled hole	— γinst	[]			1,4		
Cracked concrete							
Characteristic bond resista	nce in crac	ked conc	rete C20/25				
Hammer-drilling with standard	drill bit or	hollow drill	bit (dry or we	t concrete)			
Tem- <u>l: 24 °C / 40 °C</u>			4,2	5,1	4,8	4,6	4,6
perature II: 35 °C / 60 °C	T <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	4,2	5,1	4,8	4,6	4,6
ange III: 50 °C / 72 °C			4,2	5,1	4,8	4,6	4,6
Hammer-drilling with standard	d drill bit or	hollow drill					
Гет- <u>I: 24 °С / 40 °С</u>		_	4,2	5,5	4,8	3,9	3,9
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	4,2	5,5	4,8	3,9	3,9
range III: 50 °C / 72 °C			4,2	5,1	4,8	3,9	3,9
nstallation factors; Hamme	r-drilling w	vith standa	ard drill bit or	hollow drill l			
Ory or wet concrete	- γinst	[-]			1,0		
Nater filled hole	1.5	L J		1,2		1	,4
Diamond-drilling (dry or wet c	oncrete)						
em- <u>I: 24 °C / 40 °C</u>		444	4,2	5,1	4,8	4,6	4,6
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	4,2	5,1	4,8	4,6	4,6
range III: 50 °C / 72 °C			4,2	5,1	4,8	4,6	4,6
nstallation factors; Diamon	d-drilling						
Ory or wet concrete	γinst	[-]			1,0		

fischer injection sy	stem FIS EM Plus
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#### Performance

Characteristic resistance to combined pull-out and concrete failure for fischer RG M I; working life 100 years

Annex C8

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Table C9.1: Charact	orietic	resistar	oce to	combi	ned n	ull-ou	ıt and	Lcon	croto	failura f	or
metric r	einforc	ing bars	s in ha	mmer	or diar	mond				ialiule i	Oi
uncrack	ed con	crete; v	vorkin	g life 5	0 yea	rs					-
Nominal diameter of the bar		ф	8 <sup>1)</sup>	10	12	14	16	18	3 20	22	24
Combined pull-out and concr		1	1 - 1								T
Calculation diameter	d	[mm]	8	10	12	14	16	18	3 20	22	24
Uncracked concrete				200/05							
Characteristic bond resistand											
Hammer-drilling with standard of Tem- 1: 24 °C / 40 °C	irili bit or	nollow arii	16,0	16,8		<u>)</u> 15,5	15,0	14,	6 14,	2 14,0	13,6
2	- ×	[NI/mm2]	16,0	15,0	16,1 15,0	14,0	14,0				12,0
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15,0	14,0	14,0	13,0	13,0			1 (5)	12,0
Hammer-drilling with standard of	Irill bit or	hollow drill			- 2	13,0	13,0	12,	0 12,	0 12,0	12,0
1 040044000	iiii bit oi	Tiollow drill	16,0	16,8	16,1	14,9	14,4	13,	4 13,	0 12,1	11,8
Tem- 1: 24 °C / 40 °C   perature II: 35 °C / 60 °C	-	[N/mm <sup>2</sup> ]	16,0	16,0	14,0	13,0	12,0				10,0
range III: 50 °C / 72 °C	τ <sub>Rk,ucr</sub>	ן ווווווו ן	15,0	14,0	13,0	12,0	12,0	_			10,0
Installation factors; Hammer-	drilling v	vith stand					12,0	11,	0 11,	0   10,0	10,0
Dry or wet concrete	urming V	Titil Stallu	ara ariii	DIE OF I	SHOW C	DIL	1,0				
Water filled hole	- γinst	[-]					1,4				
Diamond-drilling (dry or wet cor	crete as	well as wa	ter filled	hole)			1,7				
Tem- I: 24 °C / 40 °C	iorete de	Vicin do vic	16,0	15,0	13,0	12,0	12,0	11,	0 10,	0 10,0	10,0
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	16,0	15,0	13,0	12,0	12,0				10,0
range III: 50 °C / 72 °C	- KRK,ucr	[ [ ] ]	15,0	14,0	12,0	11,0	11,0	_	1 1		9,0
Installation factors; Diamond	-drillina		,	,e	,	, •	,.	1.0,	,	0,0	,-
Dry or wet concrete	g						1,0				
Water filled hole	— γinst	[-]					1,4				
Nominal diameter of the bar		Φ	25	26	28	30		32 <sup>1)</sup>	34 <sup>1)</sup>	36 <sup>1)</sup>	40 <sup>1)</sup>
Combined pull-out and concr	ete cone	failure									
Calculation diameter	d	[mm]	25	26	28	30	)	32	34	36	40
Uncracked concrete											
Characteristic bond resistand	e in unc	racked co	ncrete (	220/25							
Hammer-drilling with standard of	Irill bit or	hollow dril		or wet c							
Tem- I: 24 °C / 40 °C	- 1		13,5	or wet c	13,1	12		12,7	12,5	12,4	12,1
Tem- perature	Irill bit or τ <sub>Rk,ucr</sub>	hollow drill [N/mm²]	13,5 12,0	or wet c 13,3 12,0	13,1 12,0	12	,0	12,0	11,0	11,0	11,0
Tem- perature   I:   24 °C / 40 °C     II:   35 °C / 60 °C     range   III:   50 °C / 72 °C	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	13,5 12,0 11,0	or wet of 13,3 12,0 11,0	13,1 12,0 11,0	12	,0				
Tem- perature II: 24 °C / 40 °C III: 35 °C / 60 °C III: 50 °C / 72 °C Hammer-drilling with standard of	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	13,5 12,0 11,0 bit (wat	or wet of 13,3 12,0 11,0 er filled	13,1 12,0 11,0 hole)	12	,0	12,0 11,0	11,0 11,0	11,0 10,0	11,0 10,0
Tem-   I:   24 °C / 40 °C	- τ <sub>Rk,ucr</sub>	[N/mm²] hollow drill	13,5 12,0 11,0 I bit (wat	or wet o 13,3 12,0 11,0 er filled 11,4	13,1 12,0 11,0 hole)	12 0 12 0 11	,0 ,0 ,5	12,0 11,0 10,3	11,0 11,0	11,0 10,0	11,0 10,0
Tem-	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	13,5 12,0 11,0 bit (wat	or wet of 13,3 12,0 11,0 er filled	13,1 12,0 11,0 hole)	12 0 12 0 11 0 11 0 9,	,0 ,0 ,5 0	12,0 11,0	11,0 11,0	11,0 10,0	11,0 10,0 8,0 8,0
Tem-	TRK,ucr	[N/mm²] hollow drill [N/mm²]	13,5 12,0 11,0 1 bit (wat 11,5 10,0 9,0	or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0	13,1 12,0 11,0 hole) 10,0 9,0	12 0 12 0 11 0 11 6 10 0 9,	,0 ,0 ,5 0	12,0 11,0 10,3 9,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	11,0 10,0 8,0
I: 24 °C / 40 °C	TRK,ucr  drill bit or  TRK,ucr  TRK,ucr	[N/mm²] hollow drill [N/mm²] vith stand	13,5 12,0 11,0 1 bit (wat 11,5 10,0 9,0	or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0	13,1 12,0 11,0 hole) 10,0 9,0	12 0 12 0 11 0 11 6 10 0 9,	,0 ,0 ,5 0	12,0 11,0 10,3 9,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	11,0 10,0 8,0 8,0
Tem-   perature	TRK,ucr	[N/mm²] hollow drill [N/mm²]	13,5 12,0 11,0 1 bit (wat 11,5 10,0 9,0	or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0	13,1 12,0 11,0 hole) 10,0 9,0	12 0 12 0 11 0 11 6 10 0 9,	,0 ,0 ,5 0	12,0 11,0 10,3 9,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	11,0 10,0 8,0 8,0
Tem-   perature	- T <sub>Rk,ucr</sub> drill bit or  - T <sub>Rk,ucr</sub> drilling v  - γinst	[N/mm²] hollow drill [N/mm²] vith stand	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill	or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,1 12,0 11,0 hole) 10,0 9,0	12 0 12 0 11 0 11 6 10 0 9,	,0 ,0 ,5 0 0	12,0 11,0 10,3 9,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	11,0 10,0 8,0 8,0
Temperature I: 24 °C / 40 °C III: 35 °C / 60 °C IIII: 50 °C / 72 °C IIII: 35 °C / 60 °C IIII: 50 °C / 72 °C IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	- T <sub>Rk,ucr</sub> drill bit or  - T <sub>Rk,ucr</sub> drilling v  - γinst	[N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	120 120 110 110 110 110 110 110 110 110	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0	9,0 9,0 9,0 8,0	11,0 10,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0
Tem-   perature	- T <sub>Rk,ucr</sub> drill bit or  - T <sub>Rk,ucr</sub> drilling v  - γinst	[N/mm²] hollow drill [N/mm²] vith stand	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0 8,0 8,0	9,0 9,0 9,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0 7,0
Tem-   perature   I:   24 °C / 40 °C     perature   II:   35 °C / 60 °C	TRk,ucr  drill bit or  TRk,ucr  drilling v  yinst  ncrete as  TRk,ucr	[N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0	9,0 9,0 9,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0
Tem-   perature	TRk,ucr  drill bit or  TRk,ucr  drilling v  yinst  ncrete as  TRk,ucr	[N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0 8,0 8,0	9,0 9,0 9,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0 7,0
Tem-   perature   II:   35 °C / 60 °C     range   III:   50 °C / 72 °C     Hammer-drilling with standard of the standard of	TRk,ucr  drill bit or  TRk,ucr  drilling v  yinst  ncrete as  TRk,ucr	[N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0 8,0 8,0	9,0 9,0 9,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0 7,0
Tem-   perature   I:   24 °C / 40 °C     perature   II:   35 °C / 60 °C     perature   III:   50 °C / 72 °C     Hammer-drilling with standard of the content of the conte	TRK,ucr  drill bit or  TRK,ucr  drilling v  Yinst  TRK,ucr  drilling v  TRK,ucr	[N/mm²] hollow drill [N/mm²] vith stand [-] well as wa [N/mm²]	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0 8,0 8,0	9,0 9,0 9,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0 7,0
Tem-   perature   II:   35 °C / 60 °C     range   III:   50 °C / 72 °C     Hammer-drilling with standard of the standard of	TRK,ucr  drill bit or  TRK,ucr  drilling v  Yinst  TRK,ucr  drilling v  TRK,ucr	[N/mm²] hollow drill [N/mm²] vith stand [-] well as wa [N/mm²]	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0 8,0 8,0	9,0 9,0 9,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0 7,0
Tem-   perature   I:   24 °C / 40 °C     perature   II:   35 °C / 60 °C     perature   III:   50 °C / 72 °C     Hammer-drilling with standard of the content of the conte	TRK,ucr  drill bit or  TRK,ucr  drilling v  yinst  crete as  TRK,ucr  drilling  yinst	[N/mm²]  hollow drill  [N/mm²]  vith stand  [-]  well as wa  [N/mm²]	13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill tter filled 9,0 9,0	or wet c   13,3   12,0   11,0   er filled   11,4   10,0   9,0   bit or h	13,1 12,0 11,0 hole) 10,6 10,0 9,0 ollow o	12 0 12 0 11 6 10 0 9, 9, Irill bit	,0 ,0 ,5 0 0 1,0 1,4	12,0 11,0 10,3 9,0 8,0 8,0 8,0	9,0 9,0 9,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 8,0	11,0 10,0 8,0 8,0 8,0 7,0 7,0

Table C	10.1	Characte metric re cracked	inforc	ing bars	in ha	mmer	or dia	mond	drilled			lure fo	or
Nominal d	liame	ter of the bar		ф	8 <sup>1)</sup>	10	12	14	16	18	20	22	24
Combined	lluq l	-out and conc	rete coi	ne failure			2						ř-
Calculation	n dian	neter	d	[mm]	8	10	12	14	16	18	20	22	24
Cracked c													
		bond resistan		ENGLISHED ENGLISHED									
<u>Hammer-d</u>		with standard	drill bit c	r hollow d				rete)					
Tem-		24 °C / 40 °C			7,0	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
perature	00000000	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	7,0	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
range	III:				7,0	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
<u>Hammer-d</u>		with standard	<u>drill bit c</u>	or hollow d						0.444 0000		0.004 2000	Antonia (Santa
Tem-	307544	24 °C / 40 °C			6,0	7,5	6,5	6,5	6,5	6,0	6,0	6,0	6,0
perature		35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	6,0	7,5	6,5	6,5	6,5	6,0	6,0	6,0	6,0
range	0.03093581	50 °C / 72 °C	E2 U 890000000	000000000000000000000000000000000000000	6,0	6,5	6,5	6,0	6,0	6,0	6,0	6,0	6,0
		tors; Hammer	-drilling	with star	ndard c	Irill bit	or holl	ow drill	bit				
Dry or wet	conc	rete	0.0	, ,					1,0				
Water filled	d hole	•	γinst	[7]	[-]					1,4			
Diamond-d	rilling	dry or wet co	ncrete)										
Tem-	I:	24 °C / 40 °C			7,0	7,0	7,0	7,0	6,0	6,0	6,0	7,0	7,0
perature	П:	35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,0	7,0	7,0	7,0	6,0	6,0	6,0	7,0	7,0
range	III:	50 °C / 72 °C			7,0	7,0	7,0	7,0	6,0	6,0	6,0	7,0	7,0
Diamond-d	rilling	(water filled h	ole)		1000	177	***			l			
Tem-	1:	24 °C / 40 °C			6,0	7,5	6,5	6,5	6,5	6,0	6,0	6,0	6,0
perature	II:	35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6,0	7,5	6,5	6,5	6,5	6,0	6,0	6,0	6,0
range	III:	50 °C / 72 °C	- 1 111,01		6,0	6,5	6,5	6,0	6,0	6,0	6,0	6,0	6,0
Installatio	n fac	tors; Diamond	l-drilling	g	460	N*	0.014		000			700	Aus
Dry or wet	conc	rete	· · · · · · · · · · · · · · · · · · ·						1,0				
Water filled	d hole	2	γinst	[-]			1	,2	5654			1,4	

<sup>1)</sup> Not allowed for hollow drill bit.

fischer injection syste	m FIS EM Plus
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Characteristic resistance to combined pull-out and concrete failure for reinforcing bars; working life 50 years part 1

Annex C10

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Table C11	me	etric re	inforc	resistan ing bars ete; wor	in har	nmer o	r diamo	nd dril			ailure t	for
Nominal dia	ameter of t	he bar		ф	25	26	28	30 <sup>1)</sup>	32 <sup>1)</sup>	34 <sup>1)</sup>	36 <sup>1)</sup>	40 <sup>1)</sup>
Combined p	oull-out an	d conc	rete cor	ne failure								
Calculation of	diameter		d	[mm]	25	26	28	30	32	34	36	40
Cracked co	ncrete											
Characteris	tic bond r	esistan	ce in cr	acked co	ncrete C	20/25						
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)												
Tem	l: 24 °C				8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
perature _	II: 35 °C	/ 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
range	III: 50 °C	/ 72 °C			8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
<u>Hammer-dril</u>	lling with st	andard	drill bit c	or hollow d	rill bit (w	ater fille	d hole)	-				
Tem	I: 24 °C	/ 40 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
perature	II: 35 °C	/ 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
range	III: 50 °C	/ 72 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
Installation	factors; H	ammer	drilling-	with star	ıdard dı	ill bit or	hollow	drill bit				
Dry or wet co	oncrete			r 1				1	,0			
Water filled I	hole		γinst	[-]				1	,4			
Diamond-dri	lling (dry o	r wet co	ncrete)									
Tem	I: 24 °C	/ 40 °C			7,0	7,0	7,0	7,0	5,0	5,0	5,0	5,0
perature	II: 35 °C	/ 60 °C	$ au_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	7,0	7,0	7,0	7,0	5,0	5,0	5,0	5,0
range	III: 50 °C	/ 72 °C			7,0	7,0	7,0	7,0	5,0	5,0	5,0	5,0
Diamond-dri	lling (water	filled h	ole)									
Tem-	I: 24 °C	/ 40 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
perature	II: 35 °C	/ 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
range	III: 50 °C	/ 72 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
Installation	factors; D	iamond	l-drilling	9					•	•		
Dry or wet co	Ory or wet concrete							1	,0			
Water filled I	hole		γinst	[-]				1	,4			

<sup>1)</sup> Not allowed for hollow drill bit.

fischer injection :	system FIS	EM Plus
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Characteristic resistance to combined pull-out and concrete failure for reinforcing bars; working life 50 years part 2

#### Annex C11

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	teristic				12524					ailure f	or
	reinforcked con						drille	d hole	es;		
Nominal diameter of the bar		ф	8 <sup>1)</sup>	10	12	14	16	18	20	22	24
Combined pull-out and con-	crete cone	failure									
Calculation diameter	d	[mm]	8	10	12	14	16	18	20	22	24
Uncracked concrete											
Characteristic bond resistar	nce in unc	racked co	ncrete	C20/25							
Hammer-drilling with standard	I drill bit or	hollow dril	bit (dry	or wet c	concrete	<u>e)</u>					
Tem- I: 24 °C / 40 °C			12,0	13,8	13,2	12,7	12,3	12,0	11,6	11,5	11,2
perature II: 35 °C / 60 °C	τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	12,0	11,3	11,3	10,5	10,5	9,8	9,8	9,8	9,0
range III: 50 °C / 72 °C			8,3	8,4	8,4	8,5	8,5	7,8	7,8	7,8	7,8
Hammer-drilling with standard	I drill bit or	hollow dril	bit (wat	er filled	hole)						•
Tem- I: 24 °C / 40 °C			12,0	13,8	13,2	12,2	11,8	11,0	10,7	9,9	9,7
perature II: 35 °C / 60 °C	$ au_{ m Rk,100,ucr}$	[N/mm <sup>2</sup> ]	12,0	12,0	10,5	9,8	9,0	9,0	8,3	8,3	7,5
range III: 50 °C / 72 °C		1000	8,3	8,4	7,8	7,8	7,8	7,2	7,2	6,5	6,5
Installation factors; Hamme	r-drilling v	vith stand	ard drill	bit or h	ollow	drill bit		•			•
Dry or wet concrete		r 1					1,0				
Water filled hole	γinst	[-]					1,4				
Diamond-drilling (dry or wet c	oncrete as	well as wa	ter filled	hole)							
Tem- I: 24 °C / 40 °C			12,0	11,3	9,8	9,0	9,0	8,3	7,5	7,5	7,5
perature II: 35 °C / 60 °C	τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	12,0	11,3	9,8	9,0	9,0	8,3	7,5	7,5	7,5
range III: 50 °C / 72 °C	- 1111,100,401		8,3	8,4	7,2	7,2	7,2	6,5	6,5	5,9	5,9
Installation factors; Diamon	d-drilling										
Dry or wet concrete							1,0				
Water filled hole	γinst	[-]					1,4				
Nominal diameter of the bar	<b>■</b> 16	ф	25	26	28	30	1)	32 <sup>1)</sup>	34 <sup>1)</sup>	36 <sup>1)</sup>	40 <sup>1)</sup>
Combined pull-out and con-	crete cone	failure									
Calculation diameter	d	[mm]	25	26	28	3	0	32	34	36	40
Calculation diameter Uncracked concrete	d	[mm]	25	26	28	3	0	32	34	36	40
					28	3	0	32	34	36	40
Uncracked concrete	nce in unc	racked co	ncrete	C20/25			0	32	34	36	40
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Tem- I: 24 °C / 40 °C	nce in unc	racked co	ncrete	C20/25 or wet c		2)	,6	10,5	10,3	10,1	9,9
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Tem- perature II: 24 °C / 40 °C perature II: 35 °C / 60 °C	nce in unc	racked co	ncrete (bit (dry 11,1 9,0	020/25 or wet 0	10,8 9,0	<u>e)</u> 3   10	,6 0	10,5	10,3	10,1	9,9 8,3
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Tem- perature II: 24 °C / 40 °C III: 35 °C / 60 °C range III: 50 °C / 72 °C	nce in unc	racked co hollow drill [N/mm²]	ncrete ( bit (dry 11,1 9,0 7,2	C20/25 or wet of 10,9 9,0 7,2	10,8 9,0 7,2	<u>e)</u> 3   10	,6 0	10,5	10,3	10,1	9,9
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard	nce in unc	racked co hollow drill [N/mm²]	ncrete ( bit (dry 11,1 9,0 7,2 bit (wat	020/25 or wet c 10,9 9,0 7,2 er filled	10,8 9,0 7,2 hole)	2) 3 10 9 9,	,6 0 2	10,5 9,0 7,2	10,3 8,3 7,2	10,1 8,3 6,5	9,9 8,3 6,5
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard Tem- I: 24 °C / 40 °C	TRK,100,ucr	racked co hollow drill [N/mm²] hollow drill	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 9,4	020/25 or wet o 10,9 9,0 7,2 eer filled 9,3	2000 10,8 9,0 7,2 hole)	2) 3 10 9 9, 7 7,	,6 0 2	10,5 9,0 7,2	10,3 8,3 7,2	10,1 8,3 6,5	9,9 8,3 6,5
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C	nce in unc	racked co hollow drill [N/mm²]	ncrete ( bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5	020/25 or wet of 10,9 9,0 7,2 er filled 9,3 7,5	10,8 9,0 7,2 hole) 8,7 7,5	2) 3 10 9, 7, 8, 6 6,	6 8	10,5 9,0 7,2 8,5 6,8	10,3 8,3 7,2	10,1 8,3 6,5 6,0 6,0	9,9 8,3 6,5 6,0 6,0
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	TRK,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9	020/25 or wet of 10,9 9,0 7,2 eer filled 9,3 7,5 5,9	10,8 9,0 7,2 hole) 8,7 7,5	2) 3 10 9, 7, 8, 6, 6, 5,	6 8	10,5 9,0 7,2	10,3 8,3 7,2	10,1 8,3 6,5	9,9 8,3 6,5
Uncracked concrete Characteristic bond resistant Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme	TRK,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9	020/25 or wet of 10,9 9,0 7,2 eer filled 9,3 7,5 5,9	10,8 9,0 7,2 hole) 8,7 7,5	2) 3 10 9, 7, 8, 6, 6, 5,	6 8 9	10,5 9,0 7,2 8,5 6,8	10,3 8,3 7,2	10,1 8,3 6,5 6,0 6,0	9,9 8,3 6,5 6,0 6,0
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete	TRK,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9	020/25 or wet of 10,9 9,0 7,2 eer filled 9,3 7,5 5,9	10,8 9,0 7,2 hole) 8,7 7,5	2) 3 10 9, 7, 8, 6, 6, 5,	6 8 9 1,0	10,5 9,0 7,2 8,5 6,8	10,3 8,3 7,2	10,1 8,3 6,5 6,0 6,0	9,9 8,3 6,5 6,0 6,0
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole	TRk,100,ucr  TRk,100,ucr  TRk,100,ucr  TRk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand	bit (dry   11,1   9,0   7,2   bit (wat   9,4   7,5   5,9   ard drill	020/25 or wet of 10,9 9,0 7,2 eer filled 9,3 7,5 5,9 bit or h	10,8 9,0 7,2 hole) 8,7 7,5	2) 3 10 9, 7, 8, 6, 6, 5,	6 8 9	10,5 9,0 7,2 8,5 6,8	10,3 8,3 7,2	10,1 8,3 6,5 6,0 6,0	9,9 8,3 6,5 6,0 6,0
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete)	TRk,100,ucr  TRk,100,ucr  TRk,100,ucr  TRk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill ter filled	020/25 or wet of 10,9 9,0 7,2 eer filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9	2) 3 10 9, 7, 8, 6 6, 5, drill bit	6 8 9 1,0 1,4	10,5   9,0   7,2   8,5   6,8   5,2	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C Temperature III: 24 °C / 40 °C	rce in unc I drill bit or  TRK,100,ucr I drill bit or  TRK,100,ucr  Tredrilling v  γinst  oncrete as	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8	10,9   9,0   7,2   er filled   9,3   7,5   5,9   bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	6 8 9 1,0 1,4	10,5   9,0   7,2   8,5   6,8   5,2	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C Temperature III: 24 °C / 40 °C	TRk,100,ucr  TRk,100,ucr  TRk,100,ucr  TRk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill ter filled	020/25 or wet of 10,9 9,0 7,2 eer filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9	2) 3 10 9, 7, 8, 6, 5, drill bit	6 8 9 1,0 1,4 8 8 8	10,5   9,0   7,2   8,5   6,8   5,2	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C Temperature III: 35 °C / 60 °C	TRK,100,ucr  Trilling v  Trk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8 6,8	C20/25 or wet c 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	6 8 9 1,0 1,4 8 8 8	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   6,0	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2 5,3 5,3
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C range III: 50 °C / 72 °C	TRK,100,ucr  Trdrilling v  yinst  Trk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] with stand [-] well as wa [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8 6,8	C20/25 or wet c 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	6 8 9 1,0 1,4 8 8 8	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   6,0	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2 5,3 5,3
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C range II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Diamon	TRK,100,ucr  Trilling v  Trk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8 6,8	C20/25 or wet c 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	1,0 1,4 8 8 8 1 2 1,0	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   6,0	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2 5,3 5,3
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete	TRK,100,ucr TRK,100,ucr TRK,100,ucr Trdrilling v Trk,100,ucr Trdrilling v Trk,100,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] with stand [-] well as wa [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8 6,8	C20/25 or wet c 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	6 8 9 1,0 1,4 8 8 2	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   6,0	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2 5,3 5,3
Uncracked concrete Characteristic bond resistant Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C Temperature III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete Water filled hole	TRK,100,ucr  TRK,100,ucr  Truction of the truc	racked co hollow drill  [N/mm²]  hollow drill  [N/mm²]  vith stand  [-]  well as wa  [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8 6,8	C20/25 or wet c 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	1,0 1,4 8 8 8 1 2 1,0	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   6,0	10,3 8,3 7,2 6,8 6,8 5,2	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2 5,3 5,3
Uncracked concrete Characteristic bond resistar Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete Water filled hole  1) Not allowed for hollow defischer injection system	TRK,100,ucr  TRK,100,ucr  Truction of the truc	racked co hollow drill  [N/mm²]  hollow drill  [N/mm²]  vith stand  [-]  well as wa  [N/mm²]	ncrete (1) bit (dry 11,1 9,0 7,2 bit (wat 7,5 5,9 ard drill 6,8 6,8	C20/25 or wet c 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   nollow (	2) 3 10 9, 7, 8, 6, 5, drill bit	1,0 1,4 8 8 8 1 2 1,0	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   6,0	10,3 8,3 7,2 6,8 6,8 5,2 6,0 6,0 4,6	10,1 8,3 6,5 6,0 6,0 5,2 6,0 6,0 4,6	9,9 8,3 6,5 6,0 6,0 5,2 5,3 4,6
Uncracked concrete Characteristic bond resistant Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C range III: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete) Temperature II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete Water filled hole  1) Not allowed for hollow descriptions.	TRK,100,ucr I drill bit or TRK,100,ucr I drill bit or TRK,100,ucr Trdrilling v  Yinst Oncrete as TRK,100,ucr d-drilling Yinst rill bit.	racked co hollow drill [N/mm²] hollow drill [N/mm²] with stand [-] well as wa [N/mm²] [-]	bit (dry   11,1   9,0   7,2   bit (wat   9,4   7,5   5,9   ard drill   6,8   6,8   5,9	10,9   9,0   7,2   eer filled   9,3   7,5   5,9   bit or h	10,8   9,0   7,2   hole)   8,7   7,5   5,9   hollow o	2) 3   10 9, 7, 8, 6   6, 7, drill bit	1,0 1,4 8 8 2 1,0 1,4	10,5   9,0   7,2   8,5   6,8   5,2   6,0   6,0   5,2	10,3 8,3 7,2 6,8 6,8 5,2 6,0 6,0 4,6	10,1 8,3 6,5 6,0 6,0 5,2	9,9 8,3 6,5 6,0 6,0 5,2 5,3 4,6

(47)	teristic reinforc				10004					ailure f	or
	d concre						armee	111010	.3,		
Nominal diameter of the bar		φ	8 <sup>1)</sup>	10	12	14	16	18	20	22	24
Combined pull-out and cond			J	10	12	17	10	10			
Calculation diameter	d	[mm]	8	10	12	14	16	18	20	22	24
Cracked concrete	<u>~</u>	[]	-	, •	,						
Characteristic bond resistar	nce in crac	ked conc	rete C20	0/25							
Hammer-drilling with standard					concrete	•)					
Tem- I: 24 °C / 40 °C			4,2	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
perature II: 35 °C / 60 °C	τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	4,2	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
range III: 50 °C / 72 °C	_ • NK, 100,CI		4,2	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
Hammer-drilling with standard	drill bit or	hollow drill	bit (wat	er filled	hole)						
Tem- I: 24 °C / 40 °C			3,6	6,4	5,2	4,2	4,2	3,9	3,9	3,9	3,9
perature II: 35 °C / 60 °C	τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	3,6	6,4	5,2	4,2	4,2	3,9	3,9	3,9	3,9
range III: 50 °C / 72 °C			3,6	5,5	5,2	3,9	3,9	3,9	3,9	3,9	3,9
Installation factors; Hamme	r-drilling v	vith standa	ard drill	bit or h	ollow o	rill bit		•		1	
Dry or wet concrete							1,0				
Water filled hole	γinst	[-]			1,	2				1,4	
Diamond-drilling (dry or wet co	oncrete)										
Tem- I: 24 °C / 40 °C			4,2	6,0	5,6	4,6	3,9	3,9	3,9	4,6	4,6
perature II: 35 °C / 60 °C	τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	4,2	6,0	5,6	4,6	3,9	3,9	3,9	4,6	4,6
range III: 50 °C / 72 °C			4,2	6,0	5,6	4,6	3,9	3,9	3,9	4,6	4,6
Installation factor; Diamond	-drilling		2								
Dry or wet concrete	γinst	[-]					1,0				
Nominal diameter of the bar		ф	25	26	28	30	) <sup>1)</sup> ;	32 <sup>1)</sup>	34 <sup>1)</sup>	36 <sup>1)</sup>	40 <sup>1)</sup>
Combined pull-out and cond	crete cone	failure				110.1					
Calculation diameter	d	[mm]	25	26	28	3	0	32	34	36	40
Cracked concrete		``								,	
Characteristic bond resistar											
Hammer-drilling with standard	drill bit or	hollow drill		-							
Tem- <u>I: 24 °C / 40 °C</u>			5,2	5,2	5,2			5,2	5,2	5,2	5,2
perature II: 35 °C / 60 °C	$\tau_{\text{Rk,100,cr}}$	[N/mm <sup>2</sup> ]	5,2	5,2	5,2			5,2	5,2	5,2	5,2
range III: 50 °C / 72 °C			5,2	5,2	5,2	5,	2	5,2	5,2	5,2	5,2
Hammer-drilling with standard	drill bit or	hollow drill	_	_							
Tem- <u>I: 24 °C / 40 °C</u>			3,9	3,9	3,9		8	3,3	3,8	3,8	3,8
perature II: 35 °C / 60 °C	$ au_{\text{Rk,100,cr}}$	[N/mm <sup>2</sup> ]	3,9	3,9	3,9			3,3	3,8	3,8	3,8
range III: 50 °C / 72 °C			3,9	3,9	3,9		9	3,3	3,3	3,3	3,3
Installation factors; Hamme	r-drilling v	vith stand	ard drill	bit or h	ollow o	Irill bit	S 16				
Dry or wet concrete	γinst	[-]					1,0				
Water filled hole		1.1					1,4				
Diamond-drilling (dry or wet co	oncrete)		4.0	1 4 0	1.40	1 2	0	00	0.0	0.0	0.0
Tem- I: 24 °C / 40 °C		Th. 1.	4,6	4,6	4,6	7.5	25	3,3	3,3	3,3	3,3
perature II: 35 °C / 60 °C	$\tau_{\text{Rk,100,cr}}$	[N/mm <sup>2</sup> ]	4,6	4,6	4,6			3,3	3,3	3,3	3,3
range III: 50 °C / 72 °C	4.00		4,6	4,6	4,6	4,	ט	3,3	3,3	3,3	3,3
Installation factor; Diamond		F 1					4.0				
Dry or wet concrete	γinst	[-]					1,0				
1) Not allowed for hollow d	epidenticis Produktivinos kijos	1 Plus									
Performance Characteristic resistance for combined pull-out and concrete failure for reinforcing bars; working life 100 years  Annex C13  Appendix 39 / 77											

Table C14.1: Characteristic resistance to combined pull-out and concrete failure for metric fischer FRA in hammer or diamond drilled holes; uncracked concrete; working life 50 years

Cashau -	D 4				B//4.0	BAAC	1400	840.4
fischer F	-	A-4-1			M12	M16	M20	M24
Combine	d pu	III-out and conc	rete cor	ne failure				
Calculation	n di	ameter	d	[mm]	12	16	20	25
Uncracke	ed co	oncrete						
Characte	risti	c bond resistan	ce in ur	cracked	concrete C20/25	5		
Hammer-	drilliı	ng with standard	drill bit o	r hollow d	Irill bit (dry or wet	t concrete)		
Tem-	1:	24 °C / 40 °C			16,1	15,0	14,2	13,5
perature	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15,0	14,0	13,0	12,0
range	III:	50 °C / 72 °C			14,0	13,0	12,0	11,0
Hammer-	drilli	ng with standard	drill bit c	r hollow d	Irill bit (water fille	d hole)		
Tem-	l:	24 °C / 40 °C			16,1	14,4	13,0	11,5
perature	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	14,0	12,0	11,0	10,0
range	111:	50 °C / 72 °C		Albert Patriet	13,0	12,0	11,0	9,0
Installati	on fa	actors; Hammer	-drilling	with star	ndard drill bit or	hollow drill bit		N.
Dry or we	t cor	ncrete		F 3		1	,0	
Water fille	ed ho	ole	γinst	[-]		1	,4	
Diamond-	-drilli	ng (dry or wet co	ncrete a	s well as	water filled hole)		_	
Tem-	1:	24 °C / 40 °C			13,0	12,0	10,0	9,0
	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	13,0	12,0	10,0	9,0
range	III:	50 °C / 72 °C	3	1000	12,0	11,0	10,0	9,0
Installation	on fa	actors; Diamon	d-drilling	9		<del></del>	<del>5</del> 7	10
Dry or wet concrete 1,0							,0	
Water fille	ed ho	ole	γinst	[-]		1	,4	

fischer injection system	FIS	EM	Plus
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Characteristic resistance to combined pull-out and concrete failure for fischer FRA; working life 50 years

Table C15.1: Characteristic resistance to combined pull-out and concrete failure for metric fischer FRA in hammer or diamond drilled holes; cracked concrete; working life 50 years

		M12	M16	M20	M24
crete cor	ne failure				
d	[mm]	12	16	20	25
nce in cr	acked cor	ncrete C20/25			
drill bit c	r hollow d	rill bit (dry or wet	t concrete)		
		8,0	8,0	8,0	8,0
$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	8,0	8,0	8,0	8,0
		8,0	8,0	8,0	8,0
drill bit c	r hollow d	rill bit (water fille	d hole)		
		6,5	6,5	6,0	6,0
$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6,5	6,5	6,0	6,0
**************************************		6,5	6,0	6,0	6,0
r-drilling	with star	dard drill bit or	hollow drill bit	5 2	
202	F 7		1	,0	
γinst	[-]	1	,2	1	,4
oncrete)				_	_
		7,0	6,0	6,0	7,0
$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,0	6,0	6,0	7,0
	1000	7,0	6,0	6,0	7,0
ole)	N 20				- To
		6,5	6,5	6,0	6,0
$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6,5	6,5	6,0	6,0
		6,5	6,0	6,0	6,0
d-drilling	3				
	F 7		1	,0	
γinst	L-J	1	,2	1	,4
	d  nce in cr d drill bit c  TRk,cr d drill bit c  TRk,cr  r-drilling  yinst  oncrete)  TRk,cr	nce in cracked cord drill bit or hollow death to hollow death	crete cone failure d [mm] 12  nce in cracked concrete C20/25 d drill bit or hollow drill bit (dry or we) $T_{Rk,cr}$ [N/mm²] 8,0 8,0 d drill bit or hollow drill bit (water fille) $T_{Rk,cr}$ [N/mm²] 6,5 6,5 6,5 er-drilling with standard drill bit or $T_{Rk,cr}$ [N/mm²] 7,0 $T_{Rk,cr}$ [N/mm²] 7,0 $T_{Rk,cr}$ [N/mm²] 6,5 $T_{Rk,cr}$ [N/mm²] 7,0 $T_{Rk,cr}$ [N/mm²] 6,5	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Crete cone failure

fischer injection system	FIS	EM	Plus
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Characteristic resistance to combined pull-out and concrete failure for fischer FRA; working life 50 years

### Annex C15

101 2				ned pull-out a		failure for
01/2002-03/02/05/05/05 d				rking life 100	CONTRACTOR - CONTR	
fischer FRA	itou oi c	raonoa	M12	M16	M20	M24
Combined pull-out and cond	rete cone	failure	WIIZ	WITO	IVIZO	WAT
Calculation diameter	d	[mm]	12	16	20	25
Uncracked concrete	ч	[]	12	10	20	20
Characteristic bond resistan	co in unc	racked co	ncrete C20/25			
Hammer-drilling with standard				ncroto)		
1 040044000	uilli bit oi	Tiollow urill			11.6	11.1
		[N1/mmm21	13,2	12,3	11,6	11,1
perature II: 35 °C / 60 °C	$ au_{\text{Rk,100,ucr}}$	[N/mm <sup>2</sup> ]	11,3	10,5	9,8	9,0
range III: 50 °C / 72 °C	1.20 6.20	1	8,4	8,5	7,8	7,2
Hammer-drilling with standard	drill bit or	hollow drill				
Tem- <u>I: 24 °C / 40 °C</u>		2-	13,2	11,8	10,7	9,4
perature II: 35 °C / 60 °C	$ au_{Rk,100,ucr}$	[N/mm <sup>2</sup> ]	10,5	9,0	8,3	7,5
range III: 50 °C / 72 °C	700 2000		7,8	7,8	7,2	5,9
Installation factors; Hammer	r-drilling v	vith stand	ard drill bit or ho			
Dry or wet concrete	· ^/:+	[-]			,0	
Water filled hole	γinst	[-]		1,	,4	
Diamond-drilling (dry or wet co	ncrete as	well as wa	ter filled hole)			
Tem- I: 24 °C / 40 °C			9,8	9,0	7,5	6,8
perature II: 35 °C / 60 °C	$ au_{ m Rk,100,ucr}$	[N/mm <sup>2</sup> ]	9,8	9,0	7,5	6,8
range III: 50 °C / 72 °C	1111,100,401		7,2	7,2	6,5	5,9
Installation factors; Diamone	d-drilling					
Dry or wet concrete				1.	,0	
Water filled hole	γinst	[-]			,4	
fischer FRA			M12	M16	M20	M24
Combined pull-out and cond	rete cone	failura	WIIZ	IVITO	WZO	WET
Calculation diameter	d	[mm]	12	16	20	25
Cracked concrete	<u> </u>	[]	12	10	20	20
Characteristic bond resistan	ce in crac	ked conc	rete C20/25			
Hammer-drilling with standard	N N N N N N N N N N N N N N N N N N N		- 17 17 C C	ncrete)		
	unii bit oi	Tionow urm		5,2	5,2	5,2
	_	[N]/mm21	6,4		5,2	5,2
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	TRk,100,cr	[N/mm <sup>2</sup> ]	6,4	5,2		
	3.20 6.26	        - 1 - 1	6,4	5,2	5,2	5,2
Hammer-drilling with standard	arili bit or	nollow arili			0.0	
Tem- <u>I: 24 °C / 40 °C</u>			5,2	4,2	3,9	3,9
perature II: 35 °C / 60 °C	$ au_{\text{Rk,100,cr}}$	[N/mm <sup>2</sup> ]	5,2	4,2	3,9	3,9
range III: 50 °C / 72 °C			5,2	3,9	3,9	3,9
Installation factors; Hammer	r-drilling v	vith stand	ard drill bit or ho	10	800	
Dry or wet concrete	γinst	[-]			,0	
Water filled hole	(1 <u>₹</u> ) 4.050 Perk	1.1	1	,2		1,4
Diamond-drilling (dry or wet co	oncrete)					
Tem- <u>I: 24 °C / 40 °C</u>			5,6	3,9	3,9	4,6
perature II: 35 °C / 60 °C	$ au_{Rk,100,cr}$	[N/mm <sup>2</sup> ]	5,6	3,9	3,9	4,6
range III: 50 °C / 72 °C			5,6	3,9	3,9	4,6
Installation factors; Diamone	d-drilling					
Dry or wet concrete	γinst	[-]		1.	,0	
fischer injection system	n FIS EM	1 Plus				
Performance Characteristic resistance to	combined	d pull-out a	and concrete fail	ure for fischer FR	Δ.	Annex C16 Appendix 42 / 77

Anchor i Threade		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30		
Displacement-Factors for tension loading <sup>1)</sup>													
Uncracked or cracked concrete; Temperature range I, II, III													
δ <sub>N0-Factor</sub> [mm/(N/mm <sup>2</sup> )] 0,07 0,08 0,09 0,09 0,10 0,11 0,11 0,12									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		
Displacement-Factors for shear loading <sup>2)</sup>													
Uncracked or cracked concrete; Temperature range I, II, III													
$\delta$ V0-Factor	[mm/kN] 0,18 0,15 0,12 0,10 0,09 0,07 0,07 0,06 0,05 0,0									0,05			
δ∨∞-Factor	[IIIII/KIN]	0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07		
Calculation of effective displacement:     Calculation of effective displacement:													
$\delta_{N0} =$	$\delta$ N0-Factor $\cdot$ $\tau$					$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$							
δ <sub>N∞</sub> =	$\delta_{\text{N}\infty\text{-Factor}}\cdot \tau$					$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$							
τ = a	cting bond strer	ngth unde	er tension	loading		V = acting shear loading							

fischer F	RG M I	M8	M10	M12	M16	M20					
Displace	ment-Factors	for tension loadi	ng¹)								
Uncrack	Uncracked or cracked concrete; Temperature range I, II, III										
$\delta_{\text{N0-Factor}}$	[mm/(N/mm <sup>2</sup> )]	0,09	0,10	0,10	0,11	0,13					
$\delta_{\text{N}\infty\text{-Factor}}$	[[[]]]	0,13	0,15	0,16	0,17	0,19					
Displacement-Factors for shear loading <sup>2)</sup>											
Uncracked or cracked concrete; Temperature range I, II, III											
$\delta$ V0-Factor	[mama/kN]]	0,12	0,09	0,08	0,07	0,05					
δ∨∞-Factor	[mm/kN]	0,18	0,14	0,12	0,10	0,08					

# 1) Calculation of effective displacement:

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

 $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ 

 $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$ 

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

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

 $\tau$  = acting bond strength under tension loading

V = acting shear loading

fischer injection system FIS EM
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#### Performance

Displacements for metric Anchor rods / Threaded rods and fischer RG M I

Annex C17

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Displaceme Uncracked ( δνο-Factor  1) Calculation δνω-Factor  1) Calculation δνω = δνω τ = acting  Table C18 fischer FRA Displaceme Uncracked ( δνο-Factor  Displaceme Uncracked ( δνο-Factor δνω-Factor  δνω-Factor  δνω-Factor δνω-Factor δνω-Factor	or cracked m/(N/mm²)] ent-Factors or cracked [mm/kN] ion of effection-Factor · τ ing bond stren  8.2: Display ent-Factors or cracked m/(N/mm²)] ent-Factors	concrete; 0,07 0,08 0,11 0,12 for shear concrete; 0,18 0,15 0,27 0,22 ve displace  placeme  N for tensio concrete; 0 0	Temple 0,09 0,13 loadiu Temple 0,12 0,18 ement from loadiu Temple 0,09	on loading <sup>1</sup>	0,10 0,15 ure ra 0,09 0,14	0,10 0,16 ange 0,08 0,12	0,11 0,16 I, II, I 0,07 0,11 2) ( 3 4 Cher M16 I, II, I	$0,11$ $0,17$ II $0,07$ $0,10$ Calculation $\delta_{Vo} = \delta_{V\infty} = \delta_{V}$ V = acc	0,18  0,06  0,09  ation  5vo-Factors  cting s	0,18 0,06 0,09 of effector · V	0,18 0,06 0,08 ective	0,19 0,05 0,08 displ	0,19 0,05 0,07	0,20 0,05 0,07	0,20	0,21	0,22	
Uncracked (	or cracked m/(N/mm²)] ent-Factors or cracked [mm/kN] ion of effection-Factor · τ ing bond stren  8.2: Display ent-Factors or cracked m/(N/mm²)] ent-Factors	concrete; 0,07 0,08 0,11 0,12 for shear concrete; 0,18 0,15 0,27 0,22 ve displace  placeme  N for tensio concrete; 0 0	Temple 0,09 0,13 loadiu Temple 0,12 0,18 ement from loadiu Temple 0,09	on loading <sup>1</sup>	0,10 0,15 ure ra 0,09 0,14	0,10 0,16 ange 0,08 0,12	0,11 0,16 I, II, I 0,07 0,11 2) ( 3 4 Cher M16 I, II, I	$0,11$ $0,17$ II $0,07$ $0,10$ Calculation $\delta_{Vo} = \delta_{V\infty} = \delta_{V}$ V = acc	0,18  0,06  0,09  ation  5vo-Factors  cting s	0,18 0,06 0,09 of effector · V	0,18 0,06 0,08 ective	0,19 0,05 0,08 displ	0,19 0,05 0,07	0,20 0,05 0,07	0,20 0,04 0,06	0,21	0,22	
Displaceme Uncracked  δνο-Factor  1) Calculation  δνω-Factor  1) Calculation  δνω-Factor  Τable C18  Fischer FRA Displaceme Uncracked  Σκο-Factor  Displaceme Uncracked  Σκο-Factor  Displaceme Uncracked  Σκο-Factor  Σκο-Factor  Σκο-Factor  Σκο-Factor  Σκο-Factor  Σκο-Factor  Σκο-Factor  Σκο-Factor	ent-Factors or cracked [mm/kN] ion of effection-Factor · τ ing bond stren  8.2: Dis ent-Factors or cracked m/(N/mm²)] ent-Factors	o,11 0,12 for shear concrete; 0,18 0,15 0,27 0,22 ve displace  placeme  ngth under  placeme  for tensio concrete;	0,13 loadiu Temp 0,12 0,18 ement tension ents f //12 on loadiu Temp 0,09	0,14 ng²) perat 0,10 0,16 ::  on loa  for m  ding¹	0,15 ure ra 0,09 0,14 ading	0,16 ange 0,08 0,12 c fise	0,16  I, II, I  0,07  0,11  2) (  cher  M16  I, II, I  0,10	$0,17$ II $0,07$ $0,10$ Calculation $\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $\delta_{V} = \delta$	0,18  0,06  0,09  ation  5vo-Factors  cting s	0,18 0,06 0,09 of effector · V	0,18 0,06 0,08 ective	0,19 0,05 0,08 displ	0,19 0,05 0,07	0,20 0,05 0,07	0,20 0,04 0,06	0,21	0,22	
Displaceme Uncracked (  δνο-Factor  1) Calculation  δνω-Factor  1) Calculation  δνω- Factor  Table C18  Fischer FRA  Displaceme Uncracked (  δνο-Factor  Displaceme	ent-Factors or cracked [mm/kN] ion of effection-Factor · τ ing bond stren  8.2: Dis ent-Factors or cracked m/(N/mm²)] ent-Factors	o,11 0,12 for shear concrete; 0,18 0,15 0,27 0,22 ve displace  placeme  ngth under  placeme  for tensio concrete;	0,13 loadiu Temp 0,12 0,18 ement tension ents f //12 on loadiu Temp 0,09	0,14 ng²) perat 0,10 0,16 ::  on loa  for m  ding¹	0,15 ure ra 0,09 0,14 ading	0,16 ange 0,08 0,12 c fise	0,16  I, II, I  0,07  0,11  2) (  cher  M16  I, II, I  0,10	$0,17$ II $0,07$ $0,10$ Calculation $\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $\delta_{V} = \delta$	0,18  0,06  0,09  ation  5vo-Factors  cting s	0,18 0,06 0,09 of effector · V	0,18 0,06 0,08 ective	0,19 0,05 0,08 displ	0,19 0,05 0,07	0,20 0,05 0,07	0,20 0,04 0,06	0,21	0,0	
Jncracked (	or cracked [mm/kN] ion of effection-Factor · τ ing bond stren  8.2: Displayed a contractors or cracked m/(N/mm²)]	concrete; 0,18 0,15 0,27 0,22 ve displace ngth under placeme  for tension concrete;	o,12 0,18 ement tension ents f //12 on load Temp 1,09	on loading <sup>1</sup>	0,09 0,14 ading	0,08 0,12	0,07 0,11 2) ( 3 4 cher M16 I, II, I	$0.07$ $0.10$ Calculation $\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $V = accepted the second \delta_{V}$	0,09 ation δνο-Fact δν∞-Fact	0,09 of effe tor · V	0,08 ective	0,08 displang	0,07	0,07	0,06 M2	0,06		
SV0-Factor  OV∞-Factor  OV∞-Factor  OV∞-Factor  ON∞-Factor  Table C18  Sischer FRA  Displaceme  Jncracked of ON∞-Factor  Oisplaceme  Jncracked of ON∞-Factor  Oisplaceme  Jncracked of Ov∞-Factor  Oisplaceme  Jncracked of Ov∞-Factor  Oiv∞-Factor  OV∞-Factor	ion of effection	0,18 0,15 0,27 0,22 ve displace ngth under  placeme  M for tension concrete;	0,12 0,18 ement tension ents f	0,10 0,16 :: on load	0,09 0,14 ading	0,08 0,12	0,07 0,11 2) ( 3 4 cher M16 I, II, I	$0.07$ $0.10$ Calculation $\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $V = accepted the second \delta_{V}$	0,09 ation δνο-Fact δν∞-Fact	0,09 of effe tor · V	0,08 ective	0,08 displang	0,07	0,07	0,06 M2	0,06		
Table C18 Sischer FRA Displaceme Jincracked of Sino-Factor Displaceme	ion of effection-Factor · τ  ing bond stren  8.2: Display  ent-Factors  or cracked  m/(N/mm²)]	o,27 0,22 ve displace ngth under placeme  for tension concrete;	0,18 ement tension	0,16	0,14	0,12	0,11  2) (  2) (  2) (  Cher  M16  I, II, I  0,10	0,10 Calculo $\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $V = ac$	0,09 ation δνο-Fact δν∞-Fact	0,09 of effe tor · V	0,08 ective	0,08 displang	0,07	0,07	0,06 M2	0,06		
Table C18  Fischer FRA  Displaceme Uncracked of SNω-Factor	ion of effection of effection of effection of effection of effection of effection of effective part of the effective part of the effective part of effectiv	ngth under  placeme  N  for tensio  concrete;	ement ents f //12 on load Temp	on loa	ading netric	c fis	2) ( { { Cher M16 I, II, I	Calculo $\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $V = ac$	ation δvo-Fact δv∞-Fac eting s	of effe tor · V	ective	e displ			M2	24	0,0	
$\delta_{N0} = \delta_{N0}$ $\delta_{N\infty} = \delta_{N\infty}$ $\tau = acting$ Table C18  Fischer FRA  Displaceme  Uncracked of the properties of th	P-Factor · τ  ag bond stren  8.2: Dis  ent-Factors  or cracked  m/(N/mm²)]	placeme  Note to the concrete;	ents f	on loa for m	netri	c fis	cher M16	$\delta_{V0} = \delta$ $\delta_{V\infty} = \delta$ $V = ac$	Švo-Fact Šv∞-Fac sting s	<sub>tor</sub> · V	loadir	ng	lacem	nent:	35511136			
δ <sub>N∞</sub> = δ <sub>N∞</sub> τ = acting  Table C18  Fischer FRA  Displaceme  Uncracked of  Displaceme	ent-Factors  m/(N/mm²)]	placeme  M for tensio concrete;	ents f //12 on load Temp	or m	netri	c fis	<b>cher M16 I, II, I</b> 0,10	δ <sub>V∞</sub> = δ √ = ac	δv∞-Fac	<sub>otor</sub> · V	loadir M20	)			35511136			
Table C18 Fischer FRA Displaceme Jncracked of Nov-Factor Displaceme Jncracked of Nov-Factor Displaceme Jncracked of Nov-Factor Displaceme Jncracked of Nov-Factor	8.2: Dis ent-Factors or cracked m/(N/mm²)]	placeme  M for tensio concrete;	ents f //12 on load Temp	or m	netri	c fis	<b>M16</b> I, II, I	√= ac	ting s		loadir M20	)			35511136			
Table C18  Fischer FRA  Displaceme  Uncracked (  DNO-Factor  Displaceme  Uncracked (  DVO-Factor  DVO-Factor	8.2: Dis ent-Factors or cracked m/(N/mm²)]	placeme  M for tensio concrete;	ents f //12 on load Temp	or m	netri	c fis	<b>M16</b> I, II, I	FRA		shear	M20	)			35511136			
Fischer FRA Displaceme Uncracked ( DiNo-Factor Displaceme Uncracked ( Divo-Factor Divo-Factor Divo-Factor	ent-Factors or cracked m/(N/mm²)]	for tension concrete;	n load Temp	ding¹	)	ange	M16 I, II, I 0,10								35511136			
ischer FRA Displaceme Uncracked (	ent-Factors or cracked m/(N/mm²)]	for tension concrete;	n load Temp	ding¹	)	ange	M16 I, II, I 0,10		\ 						35511136			
Fischer FRA Displaceme Uncracked (  DiNo-Factor Displaceme Uncracked (  Displaceme Uncracked (  Divo-Factor	ent-Factors or cracked m/(N/mm²)]	for tension concrete;	n load Temp	ding¹	)	ange	M16 I, II, I 0,10								35511136			
Displaceme Uncracked (  \$\delta_{N\infty}\text{-Factor} [mi]  Displaceme Uncracked (  \$\delta_{V\infty}\text{-Factor}    \$\delta_{V\infty}\text{-Factor}	ent-Factors or cracked m/(N/mm <sup>2</sup> )] ent-Factors	for tensio concrete;	n load Temp			ange	<b>I, II, I</b> 0,10	II							35511136			
Jncracked  No-Factor  SNo-Factor  Displaceme  Jncracked  OV-Factor	or cracked m/(N/mm²)] ent-Factors	concrete; 0	<b>Tem</b> ,09				0,10	II			0 11				0,1	2		
ÖN0-Factor  ÖN∞-Factor  Displaceme  Uncracked of OV0-Factor  ÖV∞-Factor	m/(N/mm²)]	0	,09	poruc			0,10				0 11				0,1	2		
Displaceme Uncracked ( δνο-Factor δνω-Factor	ent-Factors	0					56								٠, ١	_		
Displaceme Uncracked ( δνο-Factor					[mm/(N/mm²)]										0,18			
Uncracked (		tor shear	<u> </u>	na²)							-,				-,			
δV∞-Factor	or cracked	10 3101 To 10			ure r	ange	I, II, I	II										
δV∞-Factor	F (L-N17	0	,12				0,09				0,07	•			0,0	)6		
1) Calculation	[mm/kN]	0	,18				0,14				0,11				0,0	)9		
	ion of effecti	ve displace	ement					2) Ca	lculati	ion of	effec	tive d	lisplad	ceme	nt:			
$\delta_{N0} = \delta_{N0}$	)-Factor · τ							δνα	$=\delta_{V0}$	)-Factor	· V							
$\delta_{N\infty} = \delta_{N\infty}$	∞-Factor · τ							δνα	$\delta = \delta_{V_0}$	∞-Factor	· V							
	ng bond strer	nath under	tensi	on loa	adina			V=	actir	ng she	ear lo	ading						
fischer inj	jection sys	stem FIS	EM	Plus									$\Box$	Ar	nnex	C18		

Characteristic resistance to steel failure under tension loading for Table C19.1: fractional Threaded rods part 1 5/8" 3/4" Threaded rod 3/8" 1/2" 7/8" 1" 1 1/8" Characteristic resistance to steel failure under tension loading F568M, Class 5.8 246,0 25.0 45.7 72.9 107.9 148.9 195.4 F1554. Grade 36 19.9 119,1 196.7 36.5 58.3 86.2 156.2 Steel zinc F1554. Grade 55 75.3 25.8 47.3 111,5 154.0 202.0 254.4 esistance N<sub>Rk,s</sub> plated Property class Characteristic 43.0 78.8 125.6 185.9 256.7 336.8 424.0 F1554, Grade 105 A193, B7 43.0 78.8 125.6 185.9 256,7 336.8 424,0 [kN] 34.4 63.0 100.5 126,4 174.5 229.0 288,3 F593, Alloy Group 2 A193 Grade B8M Stainless 25.8 47.3 75.3 111.5 154.0 202.0 254.4 Class 1 steel R A193, Grade B8M, 32.7 59.9 95.4 141.3 195.1 255.9 322.2 Class 2B Partial factors 1) 1.50 F568M, Class 5.8 1.94 F1554. Grade 36 Steel zinc 1.64 F1554, Grade 55 plated class Partial factor F1554, Grade 105 1.43 Property A193. B7 1,43 [-] 1.85 2.27 F593, Alloy Group 2 A193, Grade B8M, Stainless 3.00 Class 1 steel R A193, Grade B8M,

1.52

Class 2B

fischer injection system FIS EM Plus	
Performance	Annex C19
Characteristic resistance to steel failure under tension / shear loading for fractional Threaded rods part 1	Appendix 45 / 77

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

Steel   zinc plated   Steel   Allay   Stainless   Steel   zinc plated   Steel   Zinc plated   Stainless   Steel   Zinc plated   Zinc pla	Thre	aded rod				3/8	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	
Steel zinc plated  Steel zinc plated  Stainless steel R  Steel zinc plated  Steel zinc pl			sista	nce to steel failure un	der she		_	5.0	<u> </u>	1.10			
Steel zinc plated   F568M, Class 5.8   F1554, Grade 36   F1554, Grade 36   F1554, Grade 105   F1554, Grade 105   F1554, Grade 88M, Class 2B   F1554, Grade 89M, Class 1   F1554, Grade					uo: 0::0	ur rouun							
Steel zinc plated   F1554, Grade 36   F1554, Grade 55   F1554, Grade 105   F1554, Grade 55   F1554, Grade 55   F1554, Grade 105   Glass 2B   F1554, Grade 36   F1554, Grade 105   Glass 2B   F1554, Grade 36   F1554, Grade 105   Glass 2B   F1554, Grade 36   F1554, G				F568M, Class 5.8		15.0	27.4	43.7	64.7	89.3	117.2	147.6	
Steel zinc plated	9		27			565				25.0			
Stainless steel R	tan												
Stainless steel R	esis	0.50	<u>as</u>		1 1								
Stainless steel R	S			A193, B7	[FN]]	- 12 - 12 - 11 11 -			10 10 10 10 10 10 10 10 10 10 10 10 10 1	200000000000000000000000000000000000000	77.000.000.00		
Class 1	rist √		Per _	F593, Alloy Group 2	ן נאואן			50,2		87,2	114,5		
A193, Grade B8M, Class 2B  Steel zinc plated  Stainless steel R  Steel zinc plated  Steel zinc plated  Stainless steel R  A193, Grade B8M, Class 5.8  F1554, Grade 36 F1554, Grade 105 A193, Grade B8M, Class 1  A193, Grade B8M, Class 2B  F1554, Grade 36 F1554, Grade B8M, Class 5.8 F1554, Grade B8M, Class 1  A193, Grade B8M, Class 5.8 F1554, Grade 36 F15554, Grade	Characteristic resistance Vorks		Pro			12,9	23,6	37,6	55,7	77,0	101,0	127,2	
Steel zinc plated   F568M, Class 5.8   F1554, Grade 36   F1554, Grade 55   F1554, Grade 105   F1554, Grade 105   F1554, Grade 105   F1554, Grade B8M, Class 1   A193, Grade B8M, Class 2B   F1554, Grade 105   F1554, Grade 36   F1554, Grade 105   F1554, Grade 105   F1554, Grade 105   F1554, Grade 105   F1554, Grade B8M, Class 1   A193, Grade B8M, Class 2B   F1554, Grade 36   F1554, Grade 105   A193, B7   F593, Alloy Group 2   A193, Grade B8M, Class 5.8   F1554, Grade 105   A193, B7   F593, Alloy Group 2   A193, Grade B8M, Class 1   A193, Grade B8M, Class 2B   F1554, Grade B8M, Class 2B   T1,50	ပ်	300111				16,3	29,9	47,7	70,6	97,5	127,9	161,1	
Steel zinc plated	Ducti	lity factor		<b>k</b> 6	[-]				1,0		***		
Steel zinc plated	with	lever arm											
Steel zinc plated   F1554, Grade 55   F1554, Grade 105   A193, B7   F593, Alloy Group 2   A193, Grade B8M, Class 2B   F1554, Grade 105   A193, B7   F1554, Grade 36   F1554, Grade 36   F1554, Grade 105   A193, B7   F593, Alloy Group 2   A193, Grade B8M, Class 2B   F1554, Grade 36   F1554, Grade 36   F1554, Grade 105   A193, B7   F593, Alloy Group 2   A193, Grade B8M, Class 5   F1554, Grade 36   F1554, Grade 36   F1554, Grade 36   F1554, Grade 105   A193, B7   F593, Alloy Group 2   A193, Grade B8M, Class 1   A193, Grade B8M, Class 2B   F1554, Grade B8M, Class 2B   F1554, Grade B8M, Class 2B   I,50	Ø		_						7			923,5	
Stainless steel R   Steel zinc plated   Stainless steel R   Steel zinc plated   Stainless steel R   Stainless steel R   Steel zinc plated   Stainless steel R   Stai	S.X.	Steel	_	1.5%		190000000000000000000000000000000000000		The second second	100000 00 00 00				
Stainless steel R  Steel zinc plated  Stainless steel R  Stainless steel R  Steel zinc plated  Stainless steel R  Stainless steel R  Steel zinc plated  Stainless steel R  Stainless steel R  Steel zinc plated  Stainless steel R  Stainless steel R  Steel zinc plated  Stainless steel R  Stainless steel R  Steel zinc plated  Stainless steel R  Stainless ste	<b>≥</b>		ω <sub>-</sub>		_						<del>                                     </del>		
Stainless steel R  Stainless ste	SUC.		$-\frac{8}{3}$		4			7		1974)			
Class 1	siste	<u>&gt;</u>		An and Market Complete State Complet	[Nm]						,		
Class 1	<u>ë</u>		g_		ļ. <i>-</i> [	41,2	102,1	205,4	314,4	510,0	766,3	1082,5	
Class 2B   39,1   97,0   195,1   351,4   570,0   856,4   1209,8     Steel zinc plated   Stainless steel R   Stainless steel R   Class 2B	Charact. resistance M <sup>0</sup> Rk,s		_   P			30,9	76,6	154,0	277,4	450,0	676,1	955,1	
Steel zinc plated Steel R Stainless steel R St	ວົ					39,1	97,0	195,1	351,4	570,0	856,4	1209,8	
Steel zinc plated  Steel zinc plated  Steel zinc plated  Stainless steel R  Stainless ste	Parti	al factors 1)											
Steel zinc plated			_	to annual residence of the second	_								
Stainless steel R		Steel	_						120				
Stainless steel R    A193, B7	_	F1554. Grage 55     1.36											
Stainless steel R    A193, B7	cto	₩ F1554, Grade 105 1,50											
Stainless steel R         A193, Grade B8M, Class 1         2,50           A193, Grade B8M, Class 2B         1,27	al fa		₽-		- [- <u>]</u>		4.54		1,50		00		
steel R  A193, Grade B8M, Class 2B  1,27	artië ✓	-	<u>e</u> –	92 -ELECTRONICHE AN ROLLEGE • L. S. Bernstein Hall • S. S. S.	-		1,54			1,	89		
Class 2B	ď.		_   P			2,50							
n absence of other national regulations.									1,27				
cher injection system FIS EM Plus		Stainless steel R	other	F1554, Grade 55 F1554, Grade 105 A193, B7 F593, Alloy Group 2 A193, Grade B8M, Class 1 A193, Grade B8M, Class 2B national regulations.	[-]		1,54		1,36 1,50 1,50 2,50	1,	89		
		formance	eietar	nce to steel failure unde	. topolo	- / - b	1 11			A	nnex C	20	

Table C21.1: Characteristic resistance to steel failure under tension loading for fractional fischer RG M I part 1

fischer RG M I			RG M I	Screw		3/8"	1/2"	5/8"	3/4"	
Characteristic	resist	tance to s	teel fail	ure under tension loa	ding					
		Property		F568M, Class 5.8		25,0	45,7	72,9	107,9	
		class,		F1554, Grade 36		20,0	36,6	58,3	86,3	
		Steel zinc plated	5.8	F1554, Grade 55		25,8	47,3	75,3	111,5	
Characteristic				F1554, Grade 105		43,1	76,4	110,8	186,0	
resistance with	NRKS			A193, B7	[kN]	43,1	76,4	110,8	186,0	
screw				F593, Alloy Group 2	[ [	34,4	63,0	100,4	126,4	
		Property class, Stainless	70	A193, Grade B8M, Class 1		25,8	47,3	75,3	111,5	
		steel R		A193, Grade B8M, Class 2B		32,7	59,9	95,4	141,3	
Partial factors	1)									
		Property class, Steel zinc plated	5.8	F568M, Class 5.8		1,50				
				F1554, Grade 36		1,94				
				F1554, Grade 55		1,64				
				F1554, Grade 105		1,43	1,50			
Partial factors	γMs,N			A193, B7	[-]	1,43 1,50				
	71010,14	Property class, Stainless		F593, Alloy Group 2		1,85 2,27			2,27	
			70	A193, Grade B8M, Class 1		3,00				
		steel R		A193, Grade B8M, Class 2B			1,	52		

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

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Performance

Characteristic resistance to steel failure under tension loading for fractional fischer RG M I part 1

Annex C21

Table C22.1: Characteristic resistance to steel failure under shear loading for fractional fischer RG M I part 2

fischer RG M I		RG M I	Screw		3/8"	1/2"	5/8"	3/4"		
Characteristic resis	tance to s	teel fail	ure under shear load	ing						
Without lever arm		5				ω.		15		
			F568M, Class 5.8		15,0	27,4	43,7	64,7		
	Property class,		F1554, Grade 36		11,9	21,9	34,9	51,7		
	Steel	5.8	F1554, Grade 55		12,9	23,6	37,6	55,7		
Characteristic	zinc plated		F1554, Grade 105		21,5	39,4	62,8	92,9		
esistance with V <sup>0</sup> Rk			A193, B7	[kN]	21,5	39,4	62,8	92,9		
screw	-		F593, Alloy Group 2		17,2	31,5	50,2	63,2		
	Property class, Stainless	70	A193, Grade B8M, Class 1		12,9	23,6	37,6	55,7		
	steel R		A193, Grade B8M, Class 2B		16,3	29,9	47,7	70,6		
Nith lever arm										
	Describe		F568M, Class 5.8		29,9	74,0	148,9	268,2		
	Property class,	5.8	F1554, Grade 36		23,9	59,2	119,1	214,5		
	Steel		F1554, Grade 55		30,9	76,6	154,0	277,4		
Characteristic	zinc plated		F1554, Grade 105		51,5	127,6	256,8	462,4		
resistance with M <sup>0</sup> Rk	•		A193, B7	[Nm]	51,5	127,6	256,8	462,4		
screw	57		F593, Alloy Group 2		41,2	102,1	205,4	314,4		
	Property class, Stainless	70	A193, Grade B8M, Class 1		30,9	76,6	154,0	277,4		
	steel R		A193, Grade B8M, Class 2B		39,1	97,0	195,1	351,4		
Partial factors 1)										
	Property		F568M, Class 5.8	] [		1,	25			
	class,		F1554, Grade 36			1,	61			
	Steel	5.8	F1554, Grade 55		1,36					
	zinc plated		F1554, Grade 105		1,50					
Partial factors γ <sub>Ms,V</sub>			A193, B7	[-]	1,50					
,,			F593, Alloy Group 2		1,54 1,89					
	Property class, Stainless	70	A193, Grade B8M, Class 1			2,	50			
	steel R		A193, Grade B8M, Class 2B			1,	27			

<sup>&</sup>lt;sup>1)</sup> In absence of other national regulations.

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Characteristic resistance to steel failure under shear loading for fractional fischer RG M I part 2

Annex C22

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Table C23.1: Characteristic restistance to steel failure under tension / shear loading for fractional reinforcing bars										
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 <sup>1)</sup>
Characteristic resistance to	steel failure	unde	er tensio	n loadi	ng		1	-1	ai-	
Characteristic resistance	N <sub>Rk,s</sub>	[kN]				As ·	f <sub>uk</sub> 3)			
Characteristic resistance to steel failure under shear loading										
Without lever arm		- Al-								
Characteristic resistance	$V^0_{Rk,s}$	[kN]				<b>k</b> 6 <sup>2)</sup> · A	s · f <sub>uk</sub> 3)			
Ductility factor	<b>k</b> <sub>7</sub>	[-]				1	,0			
With lever arm										
Characteristic resistance	M <sup>0</sup> Rk,s	[Nm]				1,2 · W	∕ <sub>el</sub> · f <sub>uk</sub> ³)			

Not allowed for hollow drill bit.

fischer injection system FIS EM Plus	
Performance Characteristic resistance to steel failure under tension / shear loading for reinforcing bars	Annex C23 Appendix 49 / 77

In accordance with EN 1992-4:2018 section 7.2.2.3.1:

 $k_6$  = 0,6 for fasteners made of carbon steel with  $f_{uk} \le 500 \text{ N/mm}^2$ , = 0,5 for fasteners made of carbon steel with 500 N/mm<sup>2</sup> <  $f_{uk} \le 1000 \text{ N/mm}^2$ ,

<sup>= 0,5</sup> for fasteners made of stainless steel.

f<sub>uk</sub> respectively shall be taken from the specifications of the reinforcing bar.

Table C24.1: Character tension / s							nder					
Size			All sizes									
Characteristic resistance to co	oncrete fa	ilure u	nder ten	sion loa	ding							
Installation factor	γinst	[-]	See Annex C25 to C34, C46 and C47									
Factors for the compressive s	trength o	f concr	ete > C2	0/25								
C25	/30						1,02					
Increasing factor ψc for C30	/37						1,04					
cracked or uncracked C35	/45	r 1					1,06					
concrete C40	<del>/50</del> Ψ <sub>c</sub>	[-]					1,07					
$\tau_{Rk(X,Y)} = \psi_c \cdot \tau_{Rk(C20/25)} $ C45	/55						1,08					
C50	/60						1,09					
Splitting failure												
h / h <sub>ef</sub> ≥							1,0 h <sub>ef</sub>					
Edge distance 2,0 > h / h <sub>ef</sub> >	1,3 C <sub>cr,sp</sub>	[mm]				4,6	h <sub>ef</sub> - 1,8	3 h				
h / h <sub>ef</sub> ≤	1,3	_ []				2	2,26 h <sub>ef</sub>					
Spacing	<b>S</b> cr,sp						2 C <sub>cr,sp</sub>					
Concrete cone failure							-the Mil stroom					
Uncracked concrete	<b>k</b> ucr,N	[-]					11,0					
Cracked concrete	<b>k</b> cr,N						7,7					
Edge distance	C <sub>cr,N</sub>	[mm]	1,5 h <sub>ef</sub>									
Spacing	Scr,N						2 C <sub>cr,N</sub>					
Factors for sustained tension	loading		2									
Temperature range			24 °	C / 40 °C		35	°C / 60	°C	50 °C / 72 °C			
Factor	$\psi^0$ sus		0,77 0,60						0,48	}		
Factor	$\psi^0\text{sus,100}$		0,77 0,60 0,71					I				
Characteristic resistance to co	oncrete fa	ilure u										
Installation factor	γinst	[-]	1,0									
Concrete pry-out failure												
Factor for pry-out failure	k <sub>8</sub>	[-]	2,0									
Concrete edge failure												
Effective length of fastener in shear loading	lf	[mm]	for d <sub>nom</sub> ≤ 24 mm: min (h <sub>ef</sub> ; 12 d <sub>nom</sub> ) for d <sub>nom</sub> > 24 mm: min (h <sub>ef</sub> ; max (8 d <sub>nom</sub> ; 300 mm))									
Calculation diameters												
Size			3/8"	1/2"	5/8	3"	3/4"	7/8	"	1"	1 1/8"	
Anchor rods and Threaded rods	$d_{nom}$	[mm]	9,5	12,7	15,	9	19,1	22,	2	25,4	28,6	
fischer RG M I	$d_{nom}$	[mm]	15,7	18,0	22,	0	28,0	_1)		_1)	_1)	
Rebar size			#3	#4	#5	#6	6 #	7	#8	#9	#10	
Reinforcing bar	$d_{nom}$	[mm]	9,5	12,7	15,9	19,	1 22	2,2 2	25,4	28,7	32,3	
1) Anchor type not part of the a	assessme	nt.					·	•				
fischer injection system F	IS EM P	lus										
Performance Characteristic resistance for confractional sizes	oncrete fai	lure und	der tensio	on / shea	ar loadir	ng for			Annex C24 Appendix 50 / 77			

Table C	fraction	al Thre	resistan aded roc crete; w	d <b>s</b> in ha	mmer o	r diamor			failure	for
Threaded				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Combined	d pull-out and con	crete co	ne failure							
Calculation	n diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6
Uncracke	d concrete				-	•				
Characte	ristic bond resista	nce in ur	cracked o	concrete	C20/25					
Hammer-c	drilling with standar	d drill bit o	r hollow d	rill bit (dr	y or wet c	oncrete)				
Tem-	I: 24 °C / 40 °C	_		20,0	18,6	17,7	16,8	16,2	15,8	15,3
perature range	II: 35 °C / 60 °C	$\Sigma$ $\tau_{\rm Rk,ucr}$	[N/mm <sup>2</sup> ]	18,0	18,0	17,0	16,0	15,0	15,0	14,0
	III: 50 °C / 72 °C			17,0	17,0	16,0	15,0	14,0	14,0	13,0
Hammer-c	drilling with standar	d drill bit o	r hollow d	rill bit (wa	ater filled h	nole)				
Tem- perature	I: 24 °C / 40 °C			20,0	18,6	17,0	15,4	14,3	13,7	12,8
	II: 35 °C / 60 °C	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	16,0	15,0	13,0	11,0	11,0	10,0	9,0
range	III: 50 °C / 72 °C			14,0	14,0	12,0	11,0	10,0	9,0	9,0
Installatio	on factors; Hamme	er-drilling	with star	ıdard dri	II bit or h	ollow dril	l bit	***	MS	\.
Dry or wet	concrete		r 1				1,0			
Water fille	d hole	— γinst	[-]				1,4			
Diamond-o	drilling (dry or wet o	concrete)						×.	sS	×0
Tem-	I: 24 °C / 40 °C	2		14,4	13,3	12,3	11,8	11,3	10,8	10,3
perature	II: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15,0	13,0	12,0	10,0	10,0	9,0	9,0
range	III: 50 °C / 72 °C			14,0	12,0	11,0	10,0	9,0	8,0	8,0
Diamond-o	drilling (water filled	hole)			T.e					
Tem-	I: 24 °C / 40 °C			17,3	15,0	13,6	12,4	11,5	10,8	10,1
perature	II: 35 °C / 60 °C	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	15,0	13,0	12,0	10,0	10,0	9,0	9,0
range	III: 50 °C / 72 °C	>		14,0	12,0	11,0	10,0	9,0	8,0	8,0
Installatio	on factors; Diamoi	nd-drilling	9							
Dry or wet	concrete		[]				1,0			
Water fille	d hole	— γinst	[-]				1,4			

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Characteristic resistance to combined pull-out and concrete failure for fractional Threaded rods; working life 50 years

Table C26.1: Characteristic resistance to combined pull-out and concrete failure for fractional Threaded rods in hammer or diamond drilled holes; cracked concrete; working life 50 years

		oraonoa	0011010	, , , , ,	iking iiik	, 00 y 0a					
Threaded	rod				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Combine	d pull	l-out and conc	rete cor	ne failure							
Calculatio	n diar	neter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6
Cracked	concr	ete									
Characte	ristic	bond resistan	ce in cr	acked co	ncrete C2	20/25					
Hammer-d	drilling	with standard	drill bit c	r hollow d	rill bit (dr	or wet co	oncrete)			22	9
Tem-	50	24 °C / 40 °C			8,7	9,9	9,5	8,5	8,5	8,5	8,5
perature range	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	8,7	9,9	9,5	8,5	8,5	8,5	8,5
	III:	50 °C / 72 °C			8,2	9,3	8,9	8,5	8,5	8,5	8,5
Hammer-	drilling	with standard	drill bit c	r hollow d	rill bit (wa	ater filled h	nole)				
Tem-	l:	24 °C / 40 °C			7,5	8,5	7,8	6,0	6,0	6,0	6,0
perature	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	7,5	8,5	7,8	6,0	6,0	6,0	6,0
range	III:	50 °C / 72 °C			7,0	8,0	7,3	6,0	6,0	6,0	6,0
Installatio	n fac	tors; Hammer	-drilling	with star	ndard dri	ll bit or h	ollow dril	l bit			
Dry or we	conc	crete	26	[-]				1,0			
Water fille	d hole	Э	γinst	[-]	8	1,2 1,4					
Diamond-	drilling	g (dry or wet co	ncrete)								
Tem-	I:	24 °C / 40 °C			7,0	7,0	6,0	6,0	7,0	7,0	7,0
perature	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	7,0	7,0	6,0	6,0	7,0	7,0	7,0
range	III:	50 °C / 72 °C			7,0	7,0	6,0	6,0	7,0	7,0	7,0
Diamond-	drilling	g (water filled he	ole)								
Tem-	l:	24 °C / 40 °C			7,5	7,5	6,0	6,0	6,0	6,0	6,0
perature	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm <sup>2</sup> ]	7,5	7,5	6,0	6,0	6,0	6,0	6,0
range	III:	50 °C / 72 °C			7,0	7,0	6,0	6,0	6,0	6,0	6,0
Installatio	n fac	tors; Diamond	l-drilling	9							
Dry or we	conc	crete	04	[]				1,0			
Water filled hole		9	γinst	[-]		1,2			1	,4	

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Characteristic resistance to combined pull-out and concrete failure for fractional Threaded rods; working life 50 years

Annex C26

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Table C27.1:	Characteristic resistance to combined pull-out and concrete failure for
	fractional Threaded rods in hammer or diamond drilled holes;
	uncracked concrete: working life 100 years

		uncrac	ked con	crete; w	orking	lite 100	years					
Threade	d ro	d			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	
Combine	ed p	ull-out and cor	ncrete cor	ne failure								
Calculation	on d	iameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6	
Uncrack	ed c	oncrete										
Characte	erist	ic bond resista	nce in un	cracked o	concrete	C20/25						
Hammer-	-drilli	ing with standar	d drill bit c	r hollow d	rill bit (dr	y or wet co	oncrete)					
Tem-	l:	24 °C / 40 °C			16,4	15,3	14,5	13,8	13,3	12,9	12,6	
perature range	II:	35 °C / 60 °C	τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	13,5	13,5	12,8	12,0	11,3	11,3	10,5	
	III:	50 °C / 72 °C			10,2	10,2	10,4	9,8	9,1	9,1	8,5	
Hammer-	-drilli	ing with standar	d drill bit c	r hollow d	rill bit (wa	ater filled h	nole)					
Tem-	l:	24 °C / 40 °C			16,4	15,3	13,9	12,6	11,7	11,2	10,5	
perature	II:	35 °C / 60 °C	τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	12,0	11,3	9,8	8,3	8,3	7,5	6,8	
range	III:	50 °C / 72 °C	5		8,4	8,4	7,8	7,2	6,5	5,9	5,9	
Installati	on f	actors; Hamm	er-drilling	with star	ndard dri	ll bit or h	ollow dril	l bit				
Dry or we	et co	ncrete		[-]	1,0							
Water fill	ed h	ole	— γinst					1,4				
<u>Diamond</u>	-drill	ing (dry or wet	concrete)					20	Yn		***	
Tem-	I:	24 °C / 40 °C	_		11,8	10,8	10,1	9,7	9,3	8,8	8,5	
perature	II:	35 °C / 60 °C	τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	11,3	9,8	9,0	7,5	7,5	6,8	6,8	
range	III:	50 °C / 72 °C			8,4	7,2	7,2	6,5	5,9	5,2	5,2	
<u>Diamond</u>	-drill	ing (water filled	hole)									
Tem-	I:	24 °C / 40 °C			14,2	12,3	11,2	10,2	9,4	8,9	8,3	
perature	II:	35 °C / 60 °C	TRk,100,ucr	[N/mm <sup>2</sup> ]	11,3	9,8	9,0	7,5	7,5	6,8	6,8	
rongo	III:	50 °C / 72 °C			8,4	7,2	7,2	6,5	5,9	5,2	5,2	
Installati	on f	actors; Diamo	nd-drilling	)								
Dry or we	et co	ncrete		[]	1,0							
Water filled hole			— γinst	[-]			·	1,4	·			

fischer injection system	FIS	ΕM	Plus
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Characteristic resistance to combined pull-out and concrete failure for fractional Threaded rods in hammer or diamond drilled holes; working life 100 years

Annex C27

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Table C28.1:	Characteristic resistance to combined pull-out and concrete failure for
	fractional Threaded rods in hammer or diamond drilled holes;
	cracked concrete: working life 100 years

	cracked	concre	ete; worl	king life	e 100 ye	ars				
Threade	d rod			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Combine	ed pull-out and con	crete con	ne failure							
Calculati	on diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6
Cracked	concrete									
Characte	eristic bond resista	nce in cra	acked cor	ncrete C	20/25					
Hammer-	-drilling with standar	d drill bit o	r hollow d	rill bit (dr	y or wet co	oncrete)				
	I: 24 °C / 40 °C			7,0	7,5	7,2	6,9	6,8	6,5	6,3
	II: 35 °C / 60 °C	τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	7,0	7,5	7,2	6,9	6,8	6,5	6,3
range	III: 50 °C / 72 °C			6,6	7,1	6,8	6,4	6,4	6,1	6,0
<u>Hammer</u>	-drilling with standar	d drill bit o	r hollow d	rill bit (wa	ater filled h	nole)				
Tem-	I: 24 °C / 40 °C	TRk,100,cr	[N/mm²]	6,0	6,5	5,9	4,9	4,8	4,6	4,4
perature	II: 35 °C / 60 °C			6,0	6,5	5,9	4,9	4,8	4,6	4,4
range	III: 50 °C / 72 °C			5,6	6,1	5,5	4,5	4,5	4,3	4,3
Installati	ion factors; Hamme	er-drilling	with stan	dard dri	II bit or h	ollow dri	ll bit			
Dry or we	et concrete	— or	[-]	1,0						
Water fill	ed hole	— γinst	[-]	1,2			1,4			
Diamond	I-drilling (dry or wet o	concrete)					-			
Tem-	I: 24 °C / 40 °C	_		6,0	5,6	3,9	3,9	4,6	4,6	4,6
perature	II: 35 °C / 60 °C	τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	6,0	5,6	3,9	3,9	4,6	4,6	4,6
range	III: 50 °C / 72 °C			6,0	5,6	3,9	3,9	4,6	4,6	4,6
Installat	ion factors; Diamoi	nd-drilling	3							
Dry or we	et concrete	γinst	[-]				1,0			

fischer	injection	system	FIS	EM	Plus
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Characteristic resistance to combined pull-out and concrete failure for fractional Threaded rods in hammer or diamond drilled holes; working life 100 years

Table C29.1: Characteristic resistance to combined pull-out and concrete failure for fractional fischer RG M I in hammer or diamond drilled holes; uncracked concrete; working life 50 years

				,	3	7				
fischer R	G M	T .			3/8"	1/2"	5/8"	3/4"		
Combine	d pu	ıll-out and cond	rete cor	ne failure						
Calculation	n di	ameter	d	[mm]	15,7	18,0	22,0	28,0		
Uncrack	ed c	oncrete								
Characte	risti	c bond resistan	ice in un	cracked	concrete C20/25	5				
Hammer-	drilli	ng with standard	drill bit c	r hollow d	rill bit (dry or wet	t concrete)				
Tem-	l:	24 °C / 40 °C	77.		17,6	17,0	16,2	15,3		
perature _	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	14,0	14,0	13,0	12,0		
range	III:	50 °C / 72 °C			13,0	13,0	12,0	11,0		
Hammer-	drilliı	ng with standard	drill bit c	r hollow d	rill bit (water fille	d hole)				
Tem	I:	24 °C / 40 °C	e.		16,9	15,8	14,3	12,8		
perature	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	12,0	12,0	11,0	10,0		
range	III:	50 °C / 72 °C			12,0	11,0	10,0	9,0		
Installati	on fa	actors; Hammeı	r-drilling	with star	ndard drill bit or	hollow drill bit				
Dry or we	t cor	ncrete		[-]	1,0					
Water fille	ed ho	ole	γinst		1,4					
Diamond-	-drilli	ng (dry or wet co	oncrete)							
Tem	l:	24 °C / 40 °C			12,3	11,9	11,2	10,4		
perature	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	12,0	11,0	10,0	9,0		
range	III:	50 °C / 72 °C			11,0	10,0	9,0	8,0		
Diamond-	-drilli	ng (water filled h	iole)							
Tem-	l:	24 °C / 40 °C	ic.		13,6	12,6	11,4	10,2		
perature	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	12,0	11,0	10,0	9,0		
range	III:	50 °C / 72 °C			11,0	10,0	9,0	8,0		
Installati	on fa	actors; Diamon	d-drilling	3						
Dry or we	t cor	ncrete	- V:+	[-]		1,	0			
Water fille	ed ho	ole	γinst	[-]		1,	4			

fischer injection system	m FIS EM Plus
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Characteristic resistance to combined pull-out and concrete failure for fractional fischer RG M I; working life 50 years

Annex C29

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Table C30.1: Characteristic resistance to combined pull-out and concrete failure for fractional fischer RG M I in hammer or diamond drilled holes; cracked concrete; working life 50 years

			2/211	4 (01)	= (011	0/40
fischer RG M I	26.11	MAL DESIGN	3/8"	1/2"	5/8"	3/4"
Combined pull-out and cor	icrete coi	ne failure				
Calculation diameter	d	[mm]	15,7	18,0	22,0	28,0
Cracked concrete			·		**	
Characteristic bond resista	ınce in cr	acked cor	ncrete C20/25			
<u>Hammer-drilling with standar</u>	d drill bit o	or hollow d	rill bit (dry or we	t concrete)		
Tem- <u>l: 24 °C / 40 °C</u>			6,0	6,0	7,0	7,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6,0	6,0	7,0	7,0
range III: 50 °C / 72 °C			6,0	6,0	7,0	7,0
Hammer-drilling with standar	d drill bit o	or hollow d	rill bit (water fille	d hole)		
Tem- l: 24 °C / 40 °C			6,5	6,0	6,0	6,0
perature II: 35 °C / 60 °C	— τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	6,5	6,0	6,0	6,0
range III: 50 °C / 72 °C		1,000	6,0	6,0	6,0	6,0
Installation factors; Hamme	er-drilling	with star	ndard drill bit or	hollow drill bit	<u>.</u>	
Dry or wet concrete		F 3		1	,0	
Water filled hole	— γinst	[-]	1	,2	1	,4
Diamond-drilling (dry or wet o	concrete)					
Tem- I: 24 °C / 40 °C			6,0	6,0	7,0	7,0
perature II: 35 °C / 60 °C	— τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	6,0	6,0	7,0	7,0
range III: 50 °C / 72 °C	_		6,0	6,0	7,0	7,0
Diamond-drilling (water filled	hole)					
Tem- l: 24 °C / 40 °C			6,5	6,0	6,0	6,0
perature II: 35 °C / 60 °C	— τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	6,5	6,0	6,0	6,0
range III: 50 °C / 72 °C			6,0	6,0	6,0	6,0
Installation factors; Diamo	nd-drillin	g		in .		•
Dry or wet concrete		r 1		1	,0	
Water filled hole	— γinst	[-]	1	,2	1	,4

Characteristic resistance to combined pull-out and concrete failure for fractional fischer RG M I; working life 50 years

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Table C31.1:	Characteristic resistance to combined pull-out and concrete failure for
	fractional fischer RG M I in hammer or diamond drilled holes;
	uncracked or cracked concrete: working life 100 years

			3/8"	1/2"	5/8''	3/4"
Combined pull-out and con-		T T		40.0		<b>200</b> 5
Calculation diameter	d	[mm]	15,7	18,0	22,0	28,0
Uncracked concrete	The second second					
Characteristic bond resista	TO CONCENTRATION OF THE PARTY O		and a substitution of the			
Hammer-drilling with standard	a ariii bit or i	iollow drill b		7.70. 300. 100.	40.0	10.0
Tem- I: 24 °C / 40 °C	-		14,4	14,0	13,3	12,6
perature II: 35 °C / 60 °C	$_{ extstyle L}$ $ au_{ extstyle Rk,100,ucr}$	[N/mm <sup>2</sup> ]	10,5	10,5	9,8	9,0
range III: 50 °C / 72 °C			7,8	7,8	7,8	7,2
Hammer-drilling with standard	d drill bit or	nollow drill b	<u> </u>			
Tem- <u>I: 24 °C / 40 °C</u>	_		13,9	13,0	11,7	10,5
	$_{ m L}$ $ au_{ m Rk,100,ucr}$	[N/mm <sup>2</sup> ]	9,0	9,0	8,3	7,5
range III: 50 °C / 72 °C	Sec Johnson		7,2	6,6	6,5	5,9
nstallation factors; Hamme	r-drilling w	ith standar	d drill bit or hol			
Ory or wet concrete	- γinst	[-]			,0	
Nater filled hole	•	t 1		1,	,4	
Diamond-drilling (dry or wet c	oncrete)	F 1	10.1			
Tem- I: 24 °C / 40 °C	_	<u>.</u>	10,1	9,8	9,2	8,6
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	9,0	8,3	7,5	6,8
range III: 50 °C / 72 °C	h ve two		6,6	6,0	5,9	5,2
<u> Diamond-drilling (water filled l</u>	nole)		-			
Tem- <u>I: 24 °C / 40 °C</u>	_		11,2	10,3	9,3	8,4
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,ucr</sub>	[N/mm <sup>2</sup> ]	9,0	8,3	7,5	6,8
range III: 50 °C / 72 °C			6,6	6,0	5,9	5,2
nstallation factors; Diamon	d-drilling					
Dry or wet concrete	<b>√</b> :4	[-]			,0	
Nater filled hole	γinst	[-]		1,	,4	
Cracked concrete						
Characteristic bond resista			COMMON CONTRACTOR IN SYMPLETIC	or (62%		
Hammer-drilling with standard	d drill bit or l	nollow drill b				
Tem- I: 24 °C / 40 °C			5,1	4,8	4,6	
	-					4,6
perature II: 35 °C / 60 °C	_ τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]	5,1	4,8	4,6	4,6
	_ τ <sub>Rk,100,cr</sub>	[N/mm <sup>2</sup> ]				
perature II: 35 °C / 60 °C			5,1 5,1	4,8 4,8	4,6	4,6 4,6
Derature II: 35 °C / 60 °C range III: 50 °C / 72 °C			5,1 5,1	4,8 4,8	4,6	4,6
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard	drill bit or		5,1 5,1 oit (water filled ho	4,8 4,8 ble)	4,6 4,6	4,6 4,6
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C rammer-drilling with standard III: 24 °C / 40 °C		nollow drill b	5,1 5,1 oit (water filled ho 5,5	4,8 4,8 ole) 4,8	4,6 4,6 3,9	4,6 4,6 3,9
II:   35 °C / 60 °C   range   III:   50 °C / 72 °C	drill bit or    -   T <sub>Rk,100,cr</sub>	nollow drill b	5,1 5,1 bit (water filled ho 5,5 5,5 5,1	4,8 4,8 ble) 4,8 4,8 4,8	4,6 4,6 3,9 3,9	4,6 4,6 3,9 3,9
II:   35 °C / 60 °C	drill bit or l	nollow drill b	5,1 5,1 bit (water filled ho 5,5 5,5 5,1	4,8 4,8 ble) 4,8 4,8 4,8 Ilow drill bit	4,6 4,6 3,9 3,9	4,6 4,6 3,9 3,9
Derature ange III: 35 °C / 60 °C  Hammer-drilling with standard or ange III: 35 °C / 72 °C  Temperature III: 35 °C / 40 °C  Derature III: 35 °C / 60 °C  Tenge III: 50 °C / 72 °C	TRk,100,cr  r-drilling w	nollow drill b	5,1 5,1 bit (water filled ho 5,5 5,5 5,1	4,8 4,8 9le) 4,8 4,8 4,8 Ilow drill bit	4,6 4,6 3,9 3,9 3,9	3,9 3,9 3,9
II:   35 °C / 60 °C	TRk,100,cr  r-drilling w	nollow drill b	5,1 5,1 bit (water filled ho 5,5 5,5 5,1 rd drill bit or ho	4,8 4,8 9le) 4,8 4,8 4,8 Ilow drill bit	3,9 3,9 3,9 3,9	3,9 3,9 3,9
Derature ange III: 35 °C / 60 °C    Hammer-drilling with standard or correct of the correct of t	TRk,100,cr  r-drilling w	nollow drill b	5,1 5,1 bit (water filled ho 5,5 5,5 5,1 rd drill bit or ho	4,8 4,8 9le) 4,8 4,8 4,8 Ilow drill bit	3,9 3,9 3,9 3,9	3,9 3,9 3,9
Derature ange      III:	d drill bit or l  TRk,100,cr  r-drilling w  γinst oncrete)	nollow drill b	5,1 5,1 bit (water filled hot 5,5 5,5 5,1 d drill bit or hol	4,8 4,8 9le) 4,8 4,8 4,8 Ilow drill bit	3,9 3,9 3,9 3,9	4,6 4,6 3,9 3,9 3,9
Derature ange of the property	TRk,100,cr  r-drilling w	nollow drill b	5,1 5,1 bit (water filled hot 5,5 5,5 5,1 rd drill bit or hol	4,8 4,8 0le) 4,8 4,8 4,8 Ilow drill bit 1,2	4,6 4,6 3,9 3,9 3,9 3,9 4,6	4,6 4,6 3,9 3,9 3,9 4
II:   35 °C / 60 °C	r-drilling w  γinst oncrete)  τ <sub>Rk,cr</sub>	nollow drill b	5,1 5,1 bit (water filled hot 5,5 5,5 5,1 rd drill bit or hol 1,	4,8 4,8 9le) 4,8 4,8 4,8 8llow drill bit 2 4,8 4,8	4,6 4,6 3,9 3,9 3,9 3,9 4,6 4,6	4,6 4,6 3,9 3,9 3,9 4 4 4,6 4,6

fischer injection system FIS EM Plus

# Performance

Characteristic resistance to combined pull-out and concrete failure for fractional fischer RG M I; working life 100 years

Annex C31

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Table C32.1: Characteristic resistance to combined pull-out and concrete failure for fractional reinforcing bars in hammer or diamond drilled holes; uncracked concrete; working life 50 years

		421	(40)							
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 <sup>1)</sup>
Combined pull-out and c	oncrete co	ne failure								
Calculation diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,7	32,3
Uncracked concrete	-								-	
Characteristic bond resis	stance in ur	ncracked o	concret	e C20/2	5					
Hammer-drilling with stand	lard drill bit o	or hollow d	rill bit (d	ry or we	t concret	<u>e)</u>	25	20	-22	
Tem- I: 24 °C / 40 °C	;		17,0	15,9	15,1	14,4	13,9	13,4	13,1	12,7
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15,0	15,0	14,0	13,0	13,0	12,0	12,0	12,0
range III 50 °C / 72 °C			14,0	14,0	13,0	12,0	12,0	11,0	11,0	11,0
Hammer-drilling with stand	lard drill bit o	or hollow d	rill bit (w	ater fille	d hole)					70
Tem- I: 24 °C / 40 °C			17,0	15,9	14,5	13,2	12,3	11,6	10,5	10,2
perature II: 35 °C / 60 °C	τ <sub>Rk,ucr</sub>	[N/mm <sup>2</sup> ]	16,0	14,0	12,0	11,0	11,0	10,0	10,0	9,0
range III 50 °C / 72 °C	,		14,0	13,0	12,0	11,0	10,0	9,0	9,0	8,0
Installation factors; Ham	mer-drilling	with star	ıdard dı	rill bit or	hollow	drill bit				
Dry or wet concrete		r 1				1	,0			
Water filled hole	— γinst	[-]				1	,4			
Diamond-drilling (dry or we	et concrete a	as well as v	water fill	ed hole)						
Tem- I: 24 °C / 40 °C			15,0	13,0	12,0	10,0	10,0	9,0	9,0	8,0
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm <sup>2</sup> ]	15,0	13,0	12,0	10,0	10,0	9,0	9,0	8,0
range III 50 °C / 72 °C			14,0	12,0	11,0	10,0	9,0	9,0	8,0	8,0
Installation factors; Dian	nond-drilling	g					78		0	778
Dry or wet concrete		r 1				1	,0			
Water filled hole	γinst	[-]				1	,4			

<sup>1)</sup> Not allowed for drilling with hollow drill bit.

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Characteristic resistance to combined pull-out and concrete failure for fractional reinforcing bars; working life 50 years

#### Annex C32

Table C33.1: Characteristic resistance to combined pull-out and concrete failure for fractional reinforcing bars in hammer or diamond drilled holes; cracked concrete; working life 50 years

			23-50							
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 <sup>1)</sup>
Combined pull-out and cor	crete cor	ne failure								
Calculation diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,7	32,3
Cracked concrete	-				-	i.	-	•	-	•
Characteristic bond resista	nce in cr	acked cor	ncrete C	20/25						
Hammer-drilling with standar	d drill bit c	r hollow d	rill bit (d	ry or we	t concret	<u>e)</u>	-70		-20	
Tem- I: 24 °C / 40 °C			7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
range III 50 °C / 72 °C	1907		7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
Hammer-drilling with standar	d drill bit c	r hollow d	rill bit (w	vater fille	d hole)		27	277	244	77
Tem- <u>I: 24 °C / 40 °C</u>			7,5	6,5	6,5	6,0	6,0	6,0	6,0	5,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,5	6,5	6,5	6,0	6,0	6,0	6,0	5,0
range III 50 °C / 72 °C	to 90		6,5	6,5	6,0	6,0	6,0	6,0	6,0	5,0
Installation factors; Hamme	er-drilling	with stan	idard d	rill bit or	hollow	drill bit	5		55-	
Dry or wet concrete		F 3				1	,0			
Water filled hole	γinst	[-]		1,2				1,4		
Diamond-drilling (dry or wet	concrete)									
Tem- I: 24 °C / 40 °C			7,0	7,0	6,0	6,0	7,0	7,0	7,0	5,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,0	7,0	6,0	6,0	7,0	7,0	7,0	5,0
range III 50 °C / 72 °C			7,0	7,0	6,0	6,0	7,0	7,0	7,0	5,0
Diamond-drilling (water filled	hole)					2.4	5.5	***	227	
Tem- I: 24 °C / 40 °C			7,5	6,5	6,5	6,0	6,0	6,0	6,0	5,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	7,5	6,5	6,5	6,0	6,0	6,0	6,0	5,0
range III 50 °C / 72 °C			6,5	6,5	6,0	6,0	6,0	6,0	6,0	5,0
Installation factors; Diamo	nd-drilling	9								
Dry or wet concrete		[1				1	,0			
Water filled hole	— γinst	[-]		1,2				1,4		

<sup>1)</sup> Not allowed for drilling with hollow drill bit.

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Characteristic resistance to combined pull-out and concrete failure for fractional reinforcing bars; working life 50 years

Annex C33

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Table C34.1:	Characteristic resistance to combined pull-out and concrete failure for
	fractional reinforcing bars in hammer or diamond drilled holes;
	uncracked and cracked concrete; working life 100 years

Calculation diameter   d   [mm]   9,5   12,7   15,9   19,1   22,2   25,4   28,7   32,3		a ana	Orabitot								
Calculation diameter   d   [mm]   9,5   12,7   15,9   19,1   22,2   25,4   28,7   32,3	Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 <sup>1)</sup>
Uncracked concrete   Characteristic bond resistance in uncracked concrete   C20/25	-	-	T	c.		re I	¥I.	r -	Ÿ.	T	ı
Characteristic bond resistance in uncracked concrete C20/25   Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)   Tem-  : 24 °C / 40 °C   Care   Tek,100,ucr   In   In   In   In   In   In   In   I	Calculation diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,7	32,3
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)   Tem-	Uncracked concrete										
Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C TRIK 100, LUC Tem- II: 35 °C / 60 °C TRIK 100, LUC Tem- II: 24 °C / 40 °C perature II: 35 °C / 60 °C TRIK 100, LUC Tem- II: 24 °C / 40 °C perature II: 35 °C / 60 °C TRIK 100, LUC Tem- II: 24 °C / 40 °C TRIK 100, LUC Tem- II: 24 °C / 40 °C Perature III: 35 °C / 60 °C TRIK 100, LUC Tem- II: 24 °C / 40 °C PERATURE III: 35 °C / 60 °C TRIK 100, LUC Tem- IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Characteristic bond resista	nce in un	cracked o	concrete	C20/25	5					
Perature		d drill bit c	r hollow d	rill bit (d	ry or wet	concret	<u>e)</u>				
Fample											10,5
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   Tem-	perature <u>II: 35 °C / 60 °C</u>	$\tau_{\text{Rk,100,ucr}}$	[N/mm <sup>2</sup> ]				-	-		-	-
Tem-							7,8	7,8	7,2	7,2	7,2
Perature   II: 35 °C / 60 °C   TRK,100,ue   N/mm²   12,0   10,5   9,0   8,3   8,3   7,5   7,5   6,8   8,4   7,8   7,8   7,8   7,2   6,5   5,9   5,9   5,2		<u>d drill bit c</u>	r hollow d				9K 346 1 - C80	T × 800 000	5-0-200 SONE	F	
Tange   II   50 °C / 72 °C   8,4   7,8   7,8   7,8   7,8   7,8   5,9			0-		CONTRACTOR CONTRACTOR	12 131,140,000					
Installation factors;   Hammer-drilling with standard drill   bit or hollow drill   bit   1,0	perature II: 35 °C / 60 °C	$\tau_{\text{Rk,100,ucr}}$	[N/mm²]								
Dry or wet concrete   Value   Final								6,5	5,9	5,9	5,2
Value filled hole   Times		er-drilling	with stan	idard dr	ill bit or	hollow					
Diamond-drilling (dry or wet concrete as well as water filled hole)   Tem-		γinst	[-]								
Temperature   I: 24 °C / 40 °C   Telk, 100, ser   Tell,							1.	,4			
II: 35 °C / 60 °C   Trek, 100, μer		concrete a	s well as v			0.0	<b>-</b> -		0.0		
Installation factors   S,4   7,2   7,2   6,5   5,9   5,9   5,2			FN1/ 23						-		
Tem-   1: 24 °C / 40 °C   Tek,100,cr   [N/mm²]   6,4   5,2   4,2   3,9	range III: 35 °C / 60 °C	$ au_{Rk,100,ucr}$	[[N/mm²]								
Tem-   1: 24 °C / 40 °C   Tek, 100, or   Tem-   Tem-   Tem   Tem-   Te				8,4	1,2	1,2	6,5	5,9	5,9	5,2	5,2
Water filled hole         γ'inst         [-]         1,4           Cracked concrete           Characteristic bond resistance in cracked concrete C20/25           Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)           Tem- i: 24 °C / 40 °C perature ii: 35 °C / 60 °C TRk,100,cr range iiii 50 °C / 72 °C         [N/mm²]         6,0	estados en entratar en tratados en estados en entratos	1					<b>.</b>	•			
Cracked concrete   T,4		— γ <sub>inst</sub>	[-]								
Characteristic bond resistance in cracked concrete C20/25	Proc. Sept. 11	,					1.	,4			
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)   Tem-   I: 24 °C / 40 °C   Tek,100,cr   [N/mm²]   6,0   6,4   5,2   5,											
Temperature   I: 24 °C / 40 °C   TRK,100,cr   [N/mm²]   6,0   6,4   5,2			5 100 10 10 10 10 10 10 10 10 10 10 10 10	20 10 100			-				
Perfature   II: 35 °C / 60 °C   TRIK,100,cr   TRIK,100,		d drill bit c	r hollow d		-			F 9000 2000	F 200 200		200
Tange   III   50 °C / 72 °C   6,0   6,4   5,2											
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   Tem-		$ au_{ ext{Rk,100,cr}}$	[N/mm <sup>2</sup> ]						-		
Tem-perature   I: 24 °C / 40 °C   Tek,100,cr   [N/mm²]   6,4   5,2   4,2   3,9   3,9   3,9   3,9   3,9   3,9   3,3	2010 120000 1200001 604 NE 1700 0 1200	27					5,2	5,2	5,2	5,2	5,2
II: 35 °C / 60 °C   T <sub>Rk,100,cr</sub>   [N/mm²]   6,4   5,2   4,2   3,9   3,9   3,9   3,9   3,9   3,3   3,3   3,3   3,9   3,9   3,3   3,9		d drill bit o	r hollow d					1		1	Ĭ .
Tange   III   50 °C / 72 °C   5,5   5,2   3,9	CIII			2000				7/			- 2
Installation factors;   Hammer-drilling   with standard   drill   bit   or   hollow   drill   bit	perature II: 35 °C / 60 °C	$ au_{\text{Rk,100,cr}}$	[N/mm <sup>2</sup> ]			4,2	3,9	3,9	3,9	3,9	3,3
Dry or wet concrete   Water filled hole   γinst   [-]   1,2   1,4	range III 50 °C / 72 °C			5,5	5,2	3,9	3,9	3,9	3,9	3,9	3,3
Value   Filled hole   Vinst   I-J   1,2   1,4	Installation factors; Hamme	er-drilling	with stan	dard dr	ill bit or	hollow	drill bit				
Diamond-drilling (dry or wet concrete)   Tem-   I: 24 °C / 40 °C   Tek,cr   [N/mm²]   6,0   5,6   3,9   3,9   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   4,6   3,3   4,6   4,6   4,6   4,6   3,3   4,6   4,6   4,6   4,6   3,3   4,6   4,6   4,6   4,6   4,6   4,6   3,3   4,6   4	Dry or wet concrete	2/	[ ]				1	,0			
Tem- perature   I: 24 °C / 40 °C     II: 35 °C / 60 °C     III 50 °C / 72 °C     III 50	Water filled hole	Yinst	[-]		1,2				1,4		
Departure   II: 35 °C / 60 °C   τ <sub>Rk,cr</sub>   [N/mm²]   6,0   5,6   3,9   3,9   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   3,3   4,6   4,6   4,6   4,6   3,3   4,6	Diamond-drilling (dry or wet or	concrete)									
range III 50 °C / 72 °C 6,0 5,6 3,9 3,9 4,6 4,6 4,6 3,3 Installation factors  Dry or wet concrete γ <sub>inst</sub> [-] 1,0  1) Not allowed for drilling with hollow drill bit.  fischer injection system FIS EM Plus  Performance Annex C34	1 0111			6,0	5,6	3,9	3,9	4,6	4,6	4,6	3,3
range       III       50 °C / 72 °C       6,0       5,6       3,9       3,9       4,6       4,6       4,6       3,3         Installation factors         Dry or wet concrete       γ <sub>inst</sub> [-]       1,0         1) Not allowed for drilling with hollow drill bit.         Fischer injection system FIS EM Plus         Performance	Control of the Contro	$ au_{Rk,cr}$	[N/mm <sup>2</sup> ]	6,0	5,6	3,9	3,9	4,6	4,6	4,6	3,3
Dry or wet concrete γ <sub>inst</sub> [-] 1,0  1) Not allowed for drilling with hollow drill bit.  fischer injection system FIS EM Plus  Performance  Annex C34	range III 50 °C / 72 °C	20000M TO		6,0	5,6	3,9	3,9	4,6	4,6	4,6	3,3
Not allowed for drilling with hollow drill bit.  fischer injection system FIS EM Plus  Performance  Annex C34	Installation factors										
fischer injection system FIS EM Plus  Performance  Annex C34	Dry or wet concrete	γinst	[-]				1	,0			
Performance Annex C34	1) Not allowed for drilling wi	ith hollow	drill bit.								
	fischer injection system	FIS EN	l Plus								
	Performance								A	nnex C	34

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Characteristic resistance to combined pull-out and concrete failure for fractional reinforcing bars; uncracked and cracked concrete; working life 100 years

	Impact   I		d rod	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
No.Factor   (mm/(N/mm²))   0,08   0,09   0,10   0,11   0,11   0,12   0,0   0,12   0,13   0,15   0,16   0,17   0,19   0,0   0,10   0,12   0,19   0,0   0,10   0,11   0,11   0,12   0,0   0,10   0,15   0,16   0,17   0,19   0,0   0,07   0,07   0,05   0,0   0,07   0,07   0,05   0,0   0,07   0,07   0,05   0,0   0,07   0,07   0,05   0,0   0,07   0,07   0,05   0,0   0,07   0,07   0,08   0,0   0,07   0,07   0,08   0,0   0,07   0,07   0,08   0,0   0,07   0,08   0,0   0,07   0,05   0,0   0,05   0,0   0,00   0,	Non-Factor   Imm/(N/mm²)   0,08   0,09   0,10   0,11   0,11   0,12   0,13   0,19   0,10   0,10   0,08   0,07   0,05	Displace	ement-Factors	for tension le	oading <sup>1)</sup>					
		Jncrack	ed or cracked	concrete; Te	mperature	range I, II, III				
Displacement-Factors for shear loading   Displacement   Displac	Displacement-Factors for shear loading <sup>2)</sup>   Displacement   Dis	δN0-Factor	[mm/(N/mm <sup>2</sup> )]	0,08	0,09	0,10	0,11	0,11	0,12	0,13
Uncracked or cracked concrete; Temperature range I, II, III $\frac{\delta_{\text{NO-Factor}}}{\delta_{\text{NO-Factor}}}  [\text{mm/kN}]  \frac{0.15}{0.22}  0.12  0.09  0.07  0.07  0.05  0.09$	Contracted or cracked concrete; Temperature range I, II, III	δN∞-Factor	[[[[[]]]]]]	0,12	0,13	0,15	0,16	0,19	0,19	
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Displace	ement-Factors	for shear loa	ding <sup>2)</sup>				ā	
	mm/kN   0,22 0,18 0,14 0,11 0,10 0,08 0,07     Calculation of effective displacement: $\delta_{N0} = \delta_{N0-Factor} \cdot \tau$ $\delta_{V0} = \delta_{V0-Factor} \cdot V$ $\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau$ $\delta_{V\infty} = \delta_{V\infty-Factor} \cdot V$	Jncrack	ed or cracked	concrete; Te	mperature	range I, II, III		,		
1) Calculation of effective displacement: $δ_{NO} = δ_{NO-Factor} \cdot T$ $δ_{N∞} = δ_{N∞-Factor} \cdot T$ $δ_{N∞} = δ_{N∞-Factor} \cdot T$ $τ = acting bond strength under tension loading$ $δ_{NO-Factor} \cdot T$ $δ_{N∞} = δ_{N∞-Factor} \cdot T$ $τ = acting bond strength under tension loading$ $δ_{N∞} = δ_{N∞-Factor} \cdot V$ $τ = acting bond strength under tension loading$ $Table C35.2: Displacements for fractional fischer RG M I$ $δ_{N∞-Factor} \cdot T$	1 0,22 0,18 0,14 0,11 0,10 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,07 0,08 0,00 0,00	5V0-Factor	[mm/kN]				- 1	*	- 1	0,05
$\delta_{N0} = \delta_{N0-Factor} \cdot \tau \qquad \delta_{V\infty} = \delta_{V\infty-Factor} \cdot V$ $\tau = \text{acting bond strength under tension loading} \qquad V = \text{acting shear loading}$ $Table C35.2:  \text{Displacements for fractional fischer RG M I}$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Tischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/$	$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau \qquad \delta_{Vo} = \delta_{Vo\text{-Factor}} \cdot V$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau \qquad \delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$ $\tau = \text{acting bond strength under tension loading} \qquad V = \text{acting shear loading}$ $Table C35.2:  \text{Displacements for fractional fischer RG M I}$ $Sischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Displacement-Factors for tension loading^1)$ $Dicracked or cracked concrete; Temperature range I, II, III$ $SinO-Factor \qquad [mm/(N/mm^2)] \qquad 0,10 \qquad 0,10 \qquad 0,11 \qquad 0,13 \qquad 0,13 \qquad 0,15 \qquad 0,16 \qquad 0,17 \qquad 0,19$ $Displacement-Factors for shear loading^2)$ $Dicracked or cracked concrete; Temperature range I, II, III$ $SinO-Factor \qquad [mm/(N/mm^2)] \qquad 0,09 \qquad 0,08 \qquad 0,07 \qquad 0,05 \qquad 0,05 \qquad 0,07 \qquad 0,08$ $SinO-Factor \qquad [mm/kN] \qquad 0,09 \qquad 0,08 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,08 \qquad 0,07 \qquad 0,08 \qquad 0,07 \qquad 0,08 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,08 \qquad$	V∞-Factor	[	0,22	0,18	0,14	0,11	0,10	0,08	0,07
$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau \qquad \delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$ $\tau = \text{acting bond strength under tension loading} \qquad V = \text{acting shear loading}$ $Table C35.2:  \text{Displacements for fractional fischer RG M I}$ $Sischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Sischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Sischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Sischer RG M I \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $Since Factor \qquad [mm/(N/mm^2)] \qquad 0,10 \qquad 0,11 \qquad 0,13 \qquad 0,11 \qquad 0,13 \qquad 0,15 \qquad 0,16 \qquad 0,17 \qquad 0,19$ $Since Factor \qquad [mm/(N/mm^2)] \qquad 0,10 \qquad 0,16 \qquad 0,17 \qquad 0,19$ $Since Factor \qquad 0,09 \qquad 0,08 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,08$ $Since Factor \qquad [mm/kN] \qquad 0,09 \qquad 0,08 \qquad 0,07 \qquad 0,05 \qquad 0,07 \qquad 0,08$ $Since Factor \qquad T \qquad \delta_{V\infty\text{-Factor}} \cdot V \qquad \delta_{V\infty\text{-Factor}} \cdot V \qquad \delta_{V\infty\text{-Factor}} \cdot V \qquad \delta_{V\infty\text{-Factor}} \cdot V \qquad \delta_{V\infty\text{-Factor}} \cdot V$	$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau \qquad \delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V \\ \tau = \text{acting bond strength under tension loading} \qquad V = \text{acting shear loading}$ $\text{Table C35.2: Displacements for fractional fischer RG M I}$ $\text{Sischer RG M I} \qquad 3/8" \qquad 1/2" \qquad 5/8" \qquad 3/4"$ $\text{Displacement-Factors for tension loading}^{1)}$ $\text{Uncracked or cracked concrete; Temperature range I, II, III}$ $\text{SiNO-Factor} \\ \text{[mm/(N/mm^2)]} \qquad 0,10 \qquad 0,10 \qquad 0,11 \qquad 0,13 \qquad 0,13 \qquad 0,15 \qquad 0,16 \qquad 0,17 \qquad 0,19 $	1) Calcu	ulation of effecti	ve displaceme	ent:	<sup>2)</sup> Ca	lculation of e	effective displa	acement:	
Table C35.2: Displacements for fractional fischer RG M I  Sischer RG M I  Sissue I  Sischer RG M I  Sischer RG M I  Sischer RG M I  Sischer R	Table C35.2: Displacements for fractional fischer RG M I  ischer RG M I 3/8" 1/2" 5/8" 3/4"  Displacement-Factors for tension loading¹  Uncracked or cracked concrete; Temperature range I, II, III  iNO-Factor [mm/(N/mm²)] 0,10 0,10 0,11 0,13 0,13 0,15 0,16 0,17 0,19  Displacement-Factors for shear loading²  Uncracked or cracked concrete; Temperature range I, II, III  iNO-Factor [mm/kN] 0,09 0,08 0,07 0,05 0,04 0,14 0,12 0,10 0,08  1) Calculation of effective displacement: $\delta_{NO} = \delta_{NO-Factor} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau$	δ <sub>N0</sub> =	$\delta$ N0-Factor $\cdot$ $ au$			δν	$_0 = \delta_{\text{V0-Factor}} \cdot$	V		
Table C35.2: Displacements for fractional fischer RG M I  fischer RG M I  3/8"  1/2"  5/8"  3/4"  Displacement-Factors for tension loading¹)  Uncracked or cracked concrete; Temperature range I, II, III	Table C35.2: Displacements for fractional fischer RG M I  ischer RG M I 3/8" 1/2" 5/8" 3/4"  Displacement-Factors for tension loading¹)  Uncracked or cracked concrete; Temperature range I, II, III  iNO-Factor [mm/(N/mm²)] 0,10 0,10 0,11 0,13 0,15 0,16 0,17 0,19  Displacement-Factors for shear loading²)  Uncracked or cracked concrete; Temperature range I, II, III  iNO-Factor [mm/kN] 0,09 0,08 0,07 0,05 iNO-Factor 0,14 0,12 0,10 0,08  1) Calculation of effective displacement: $\delta_{N0} = \delta_{N0-Factor} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau$ $\delta_{V\infty} = \delta_{V\infty-Factor} \cdot V$	δ <sub>N∞</sub> =	- δN∞-Factor · τ			$\delta_{V}$	$_{\infty}$ = $\delta_{V\infty\text{-Factor}}$ ·	V		
Fischer RG M I 3/8" 1/2" 5/8" 3/4"  Displacement-Factors for tension loading¹)  Uncracked or cracked concrete; Temperature range I, II, III $ \frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} \begin{bmatrix} mm/(N/mm^2) \end{bmatrix} 0,10 & 0,10 & 0,11 & 0,13 \\ 0,15 & 0,16 & 0,17 & 0,19 \\ \hline  Displacement-Factors for shear loading²)  Uncracked or cracked concrete; Temperature range I, II, III   \frac{\delta_{VO-Factor}}{\delta_{V\infty-Factor}} \begin{bmatrix} mm/kN \end{bmatrix} 0,09 & 0,08 & 0,07 & 0,05 \\ 0,14 & 0,12 & 0,10 & 0,08 \\ \hline  1) Calculation of effective displacement:   \frac{\delta_{NO}}{\delta_{N\infty-Factor}} \cdot \tau \qquad \delta_{V\infty-Factor} \cdot V \\ \frac{\delta_{N\infty}}{\delta_{N\infty-Factor}} \cdot \tau \qquad \delta_{V\infty-Factor} \cdot V $	ischer RG M I 3/8" 1/2" 5/8" 3/4" Displacement-Factors for tension loading¹) Uncracked or cracked concrete; Temperature range I, II, III $\frac{INO-Factor}{INO-Factor} = \frac{INM/(N/mm^2)}{INM/(N/mm^2)} = \frac{0,10}{0,15} = \frac{0,10}{0,16} = \frac{0,11}{0,17} = \frac{0,13}{0,19}$ Displacement-Factors for shear loading²) Uncracked or cracked concrete; Temperature range I, II, III $\frac{INO-Factor}{INO-Factor} = \frac{INM/(N)}{INM/(N)} = \frac{0,09}{0,14} = \frac{0,09}{0,12} = \frac{0,07}{0,10} = \frac{0,05}{0,08}$ 1) Calculation of effective displacement: $\frac{\delta_{N0} = \delta_{N0-Factor} \cdot \tau}{\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau} = \frac{\delta_{V\infty-Factor} \cdot V}{\delta_{V\infty} = \delta_{V\infty-Factor} \cdot V}$	τ = a	cting bond stre	ngth under ter	nsion loading	g V:	= acting shea	ar loading		
Fischer RG M I 3/8" 1/2" 5/8" 3/4"  Displacement-Factors for tension loading¹)  Uncracked or cracked concrete; Temperature range I, II, III $ \frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} \begin{bmatrix} mm/(N/mm^2) \end{bmatrix} = 0,10 & 0,10 & 0,11 & 0,13 \\ 0,15 & 0,16 & 0,17 & 0,19 \\ \hline  Displacement-Factors for shear loading²)  Uncracked or cracked concrete; Temperature range I, II, III   \frac{\delta_{VO-Factor}}{\delta_{V\infty-Factor}} \begin{bmatrix} mm/kN \end{bmatrix} = 0,09 & 0,08 & 0,07 & 0,05 \\ 0,04 & 0,12 & 0,10 & 0,08 \\ \hline  1) Calculation of effective displacement:   \frac{\delta_{NO}}{\delta_{N\infty-Factor}} \cdot \tau = \frac{\delta_{VO-Factor} \cdot V}{\delta_{N\infty}} = \frac{\delta_{N\infty-Factor} \cdot V}{\delta_{N\infty-Factor} \cdot V} $	ischer RG M I 3/8" 1/2" 5/8" 3/4" Displacement-Factors for tension loading¹) Uncracked or cracked concrete; Temperature range I, II, III $\frac{INO-Factor}{INO-Factor} = \frac{INM/(N/mm^2)}{INM/(N/mm^2)} = \frac{0,10}{0,15} = \frac{0,10}{0,16} = \frac{0,11}{0,17} = \frac{0,13}{0,19}$ Displacement-Factors for shear loading²) Uncracked or cracked concrete; Temperature range I, II, III $\frac{INO-Factor}{INO-Factor} = \frac{INM/(N)}{INM/(N)} = \frac{0,09}{0,14} = \frac{0,09}{0,12} = \frac{0,07}{0,10} = \frac{0,05}{0,08}$ 1) Calculation of effective displacement: $\frac{\delta_{N0} = \delta_{N0-Factor} \cdot \tau}{\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau} = \frac{\delta_{V\infty-Factor} \cdot V}{\delta_{V\infty} = \delta_{V\infty-Factor} \cdot V}$									
Fischer RG M I 3/8" 1/2" 5/8" 3/4"  Displacement-Factors for tension loading¹)  Uncracked or cracked concrete; Temperature range I, II, III $ \frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} \begin{bmatrix} mm/(N/mm^2) \end{bmatrix} 0,10 & 0,10 & 0,11 & 0,13 \\ 0,15 & 0,16 & 0,17 & 0,19 \\ \hline  Displacement-Factors for shear loading²)  Uncracked or cracked concrete; Temperature range I, II, III   \frac{\delta_{VO-Factor}}{\delta_{V\infty-Factor}} \begin{bmatrix} mm/kN \end{bmatrix} 0,09 & 0,08 & 0,07 & 0,05 \\ 0,14 & 0,12 & 0,10 & 0,08 \\ \hline  1) Calculation of effective displacement:   \frac{\delta_{NO}}{\delta_{N\infty-Factor}} \cdot \tau \qquad \delta_{V\infty-Factor} \cdot V \\ \frac{\delta_{N\infty}}{\delta_{N\infty-Factor}} \cdot \tau \qquad \delta_{V\infty-Factor} \cdot V $	ischer RG M I 3/8" 1/2" 5/8" 3/4" Displacement-Factors for tension loading¹) Uncracked or cracked concrete; Temperature range I, II, III $\frac{INO-Factor}{INO-Factor} = \frac{INM/(N/mm^2)}{INM/(N/mm^2)} = \frac{0,10}{0,15} = \frac{0,10}{0,16} = \frac{0,11}{0,17} = \frac{0,13}{0,19}$ Displacement-Factors for shear loading²) Uncracked or cracked concrete; Temperature range I, II, III $\frac{INO-Factor}{INO-Factor} = \frac{INM/(N)}{INM/(N)} = \frac{0,09}{0,14} = \frac{0,09}{0,12} = \frac{0,07}{0,10} = \frac{0,05}{0,08}$ 1) Calculation of effective displacement: $\frac{\delta_{N0} = \delta_{N0-Factor} \cdot \tau}{\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau} = \frac{\delta_{V\infty-Factor} \cdot V}{\delta_{V\infty} = \delta_{V\infty-Factor} \cdot V}$	Tahle (	C35 2· Dis	nlacement	s for fract	ional fisch	er RG M I			
Displacement-Factors for tension loading <sup>1)</sup> Uncracked or cracked concrete; Temperature range I, II, III $\frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} \begin{bmatrix} [mm/(N/mm^2)] & 0,10 & 0,10 & 0,11 & 0,13 \\ 0,15 & 0,16 & 0,17 & 0,19 \end{bmatrix}$ Displacement-Factors for shear loading <sup>2)</sup> Uncracked or cracked concrete; Temperature range I, II, III $\frac{\delta_{VO-Factor}}{\delta_{V\infty-Factor}} \begin{bmatrix} [mm/kN] & 0,09 & 0,08 & 0,07 & 0,05 \\ 0,14 & 0,12 & 0,10 & 0,08 \end{bmatrix}$ 1) Calculation of effective displacement: $\delta_{NO} = \delta_{NO-Factor} \cdot \tau \qquad \delta_{V\infty} = \delta_{V\infty-Factor} \cdot V$ $\delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau \qquad \delta_{V\infty} = \delta_{V\infty-Factor} \cdot V$	Displacement-Factors for tension loading <sup>1)</sup> Uncracked or cracked concrete; Temperature range I, II, III $ \frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} \begin{bmatrix} mm/(N/mm^2) \end{bmatrix} & 0,10 & 0,10 & 0,11 & 0,13 \\ 0,15 & 0,16 & 0,17 & 0,19 \\ \hline Displacement-Factors for shear loading2) Uncracked or cracked concrete; Temperature range I, II, III  \frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} \begin{bmatrix} mm/kN \end{bmatrix} & 0,09 & 0,08 & 0,07 & 0,05 \\ 0,04 & 0,12 & 0,10 & 0,08 \\ \hline 1) Calculation of effective displacement:  \delta_{N0} = \delta_{N0-Factor} \cdot \tau & \delta_{V\infty} = \delta_{V\infty-Factor} \cdot V \\ \delta_{N\infty} = \delta_{N\infty-Factor} \cdot \tau & \delta_{V\infty} = \delta_{V\infty-Factor} \cdot V $			•	J TOT TIAGE		CI IXO III I			
Uncracked or cracked concrete; Temperature range I, II, III $\frac{\delta_{NO-Factor}}{\delta_{N\infty-Factor}} [mm/(N/mm^2)] = 0,10                                 $	$ \begin{array}{c} \textbf{Jncracked or cracked concrete; Temperature range I, II, III} \\ \hline \textbf{JNO-Factor} \\ \hline \textbf{Imm/(N/mm}^2)] & 0,10 & 0,10 & 0,11 & 0,13 \\ \hline \textbf{J0,No-Factor} \\ \hline \textbf{J0,No-Factor} \\ \hline \textbf{Jncracked or cracked concrete; Temperature range I, II, III} \\ \hline \textbf{JNO-Factor} \\ \hline \textbf{Imm/kN}] & 0,09 & 0,08 & 0,07 & 0,05 \\ \hline \textbf{J0,No-Factor} \\ \hline \textbf{J0,No-Factor} \\ \hline \textbf{Imm/kN}] & 0,09 & 0,08 & 0,07 & 0,05 \\ \hline \textbf{J0,No-Factor} \\ \hline J0,No-Facto$	0.0.00		***		1/2"		5/8"		3/4"
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c}$			14 14 14						
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		ed or cracked					0.44		0.40
Displacement-Factors for shear loading <sup>2)</sup> Uncracked or cracked concrete; Temperature range I, II, III	Displacement-Factors for shear loading²)  Uncracked or cracked concrete; Temperature range I, II, III	500	[mm/(N/mm <sup>2</sup> )]			The contract of the contract o			_	
Uncracked or cracked concrete; Temperature range I, II, III $\frac{\delta_{\text{V0-Factor}}}{\delta_{\text{V}\omega\text{-Factor}}} = \frac{0,09}{0,08} = \frac{0,07}{0,05} = \frac{0,05}{0,14} = \frac{0,09}{0,12} = \frac{0,09}{0,10} = \frac{0,05}{0,08}$ 1) Calculation of effective displacement: $\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau$ $\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau$ $\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau$ $\delta_{\text{V0}} = \delta_{\text{V0-Factor}} \cdot V$ $\delta_{\text{V0}} = \delta_{\text{V0-Factor}} \cdot V$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		ment Feeters	W70.0		0,10		0,17		0, 19
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					range I II III				
	mm/kN		led of cracked					0.07		0.05
1) Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$	1) Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$		[mm/kN]			10 * CONTROL		5000 <b>3</b> , 4800 000		0.00100 000
$\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau$ $\delta_{\text{V0}} = \delta_{\text{V0-Factor}} \cdot \text{V}$ $\delta_{\text{N\infty}} = \delta_{\text{N\infty-Factor}} \cdot \tau$ $\delta_{\text{V\infty}} = \delta_{\text{V\infty-Factor}} \cdot \text{V}$	$\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau$ $\delta_{\text{V0}} = \delta_{\text{V0-Factor}} \cdot \text{V}$ $\delta_{\text{N\infty}} = \delta_{\text{N\infty-Factor}} \cdot \tau$ $\delta_{\text{V\infty}} = \delta_{\text{V\infty-Factor}} \cdot \text{V}$		lation of effecti			*	Calculation			-1
$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$	$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau \qquad \qquad \delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$			ve displaceme	SIIL.	=/			эріасстісті.	
	au = acting bond strength under tension loading $ au$ = acting snear loading									
τ = acting bond strength under tension loading v – acting shear loading		τ = a	icting bond stre	ngth under ter	ision loading	g	v = acting s	near loading		
fischer injection system FIS FM Plus	fischer injection system FIS FM Plus	fische	r injection sv	stem FIS FI	M Plus				T	
fischer injection system FIS EM Plus		fische	r injection sy	stem FIS EI	M Plus					
	Performance Annex C35	Perfori	mance			English and Committee	han DO Mi		Anne	ex C35

Table (	C36.1: Dis	placeme	nts for fra	ctional re	einforcing	g bars			
Rebar si	ze	#3	#4	#5	#6	#7	#8	#9	#10
Displace	ement-Factors	for tension	loading <sup>1)</sup>						
Uncrack	ed or cracked	concrete;	Temperatu	re range I,	II, III				
δ <sub>N0-Factor</sub>	[mm/(N/mm <sup>2</sup> )]	0,08	0,09	0,10	0,11	0,11	0,12	0,13	0,13
δ <sub>N∞-Factor</sub>	[[[[[[]]]]	0,12	0,13	0,15	0,16	0,17	0,18	0,19	0,20
Displace	ement-Factors	for shear I	oading <sup>2)</sup>					55.	
Uncrack	ed or cracked	concrete;	Temperatu	re range I,	II, III	,			
δv0-Factor	[mama/lcN]]	0,15	0,12	0,09	0,07	0,07	0,06	0,05	0,05
δ∨∞-Factor	[mm/kN]	0,22	0,18	0,14	0,11	0,10	0,09	0,08	0,07

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

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

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

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

 $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$   $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$ 

 $\tau$  = acting bond strength under tension loading V = acting shear loading

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**Performance** 

Displacements for fractional reinforcing bars

Annex C36

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Table C37.1: Characteristic resistance to steel failure under tension / shear loading for metric Anchor rods and Threaded rods under seismic action performance category C1

Anchor	rod / Threaded rod				M10	M12	M14	M16	M20	M22	M24	M27	M30
Charact	eristic resistance to	steel fa	ailur	e und	er tension I	oading	<sup>1)</sup>						
Anchor	rods and Threaded r	ods, p	erfor	mano	ce category	C1 <sup>2)</sup>							
0			4.8		23,2(21,4)	33,7	46,0	62,8	98,0	121,2	141,2	183,6	224,4
Characteristic resistance NRK,S,C1	Steel zinc plated	ج	5.8		29,0(26,8)	42,1	57,5	78,5	122,5	151,5	176,5	229,5	280,5
haracterist resistance N <sub>Rk,s,C1</sub>		Property class	8.8	[LNI]	46,4(42,8)	67,4	92,0	125,6	196,0	242,4	282,4	367,2	448,8
aracte sistai N <sub>Rk,s,</sub> (	Stainless steel R	를 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등	50	[kN]	29,0	42,1	57,5	78,5	122,5	151,5	176,5	229,5	280,5
Sha Te	and high corrosion		70		40,6	59,0	80,5	109,9	171,5	212,1	247,1	321,3	392,7
~	resistant steel HCR		80		46,4	67,4	92,0	125,6	196,0	242,4	282,4	367,2	448,8
Charact	eristic resistance to	steel fa	ailur	e und	er shear loa	ading v	vithout	lever	arm 1)				
	rods, performance c												
			4.8		13,9(12,8)	20,2	27,6	37,6	58,8	72,7	84,7	110,1	134,6
stic Se Stic	Steel zinc plated	_	5.8		17,4(16,0)	25,2	34,5	47,1	73,5	90,9	105,9	137,7	168,3
teri and s,c1		ropert	8.8	FLAIT	23,2(21,4)	33,7	46,0	62,8	98,0	121,2	141,2	183,6	224,4
Characteristic resistance VRKs,C1	Stainless steel R	Property class	50	[kN]	14,5	21,0	28,7	39,2	61,2	75,7	88,2	114,7	140,2
Sha _	and high corrosion	_	70		20,3	29,5	40,2	54,9	85,7	106,0	123,5	160,6	196,3
~	resistant steel HCR		80		23,2	33,7	46,0	62,8	98,0	121,2	141,2	183,6	224,4
Threade	d rods, performance	categ	ory (	C1 <sup>2)</sup>	<del></del>					3			
			4.8		9,7(9,0)	14,1	19,3	26,3	41,1	50,9	59,3	77,1	97,2
Se sti	Steel zinc plated	>	5.8		12,1(11,2)	17,7	24,1	32,9	51,4	63,6	74,1	96,3	117,8
teri and s,c1		ropert	8.8	FIZ.N.13	16,2(15,0)	23,6	32,2	43,9	68,6	84,8	98,8	128,5	157,0
Characteristic resistance VRK,S,C1	Stainless steel R	Property class	50	[kN]	10,1	14,7	20,1	27,4	42,8	53,0	61,7	80,3	98,1
Sha	and high corrosion	6	70		14,2	20,6	28,1	38,4	60,0	74,2	86,4	112,4	137,4
١	resistant steel HCR		80		16,2	23,6	32,2	43,9	68,6	84,8	98,8	128,5	157,0
20 00 00	a statement to the			384 W		presidental di	1 22 50	-	et evat s	s teest			

<sup>&</sup>lt;sup>1)</sup> Partial factors for performance category C1 or C2 see table C39.1; for Anchor rods the factor for steel ductility is 1,0.

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Characteristic resistance to steel failure under tension / shear loading for metric Anchor rods / Threaded rods under seismic action performance category C1

Annex C37

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<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 Threaded rods according to EN ISO 10684:2004+AC:2009.

Table C38.1: Characteristic resistance to steel failure under tension / shear loading for metric Anchor rods and Threaded rods under seismic action performance category C2

				• • • • • • • • • • • • • • • • • • • •			,						
Anchor	rod / Threaded rod				M10	M12	M14	M16	M20	M22	M24	M27	M30
Charact	eristic resistance to	steel fa	ailur	e und	er tens	ion loa	ding <sup>1)</sup>						
Anchor	rods and Threaded r	ods, p	erfor	mano	ce cate	gory C2	2						
			4.8		_2)	30,3	_2)	56,5	88,2	_2)	141,2	_2)	_2)
istic e	Steel zinc plated	ج ا	5.8		_2)	37,9	_2)	70,6	110,2	_2)	176,5	_2)	_2)
Characteristic resistance NRK,S,C2		Property class	8.8	[kN]	_2)	60,6	_2)	113,0	176,4	_2)	282,4	_2)	_2)
aracte sistar N <sub>Rk,s,</sub> (	Stainless steel R	\overline{\overl	50	נעואן	_2)	37,9	_2)	70,6	110,2	_2)	176,5	_2)	_2)
l sk a _	and high corrosion	₾	70		_2)	53,1	_2)	98,9	154,3	_2)	247,1	_2)	_2)
L	resistant steel HCR		80		_2)	60,6	_2)	113,0	176,4	_2)	282,4	_2)	_2)
Charact	eristic resistance to	steel fa	ailur	e und	er shea	ar loadi	ng with	out lev	er arm	1)			
Anchor	rods, performance c	ategor	y C2					0					
			4.8		_2)	13,3	_2)	28,2	45,2	_2)	77,0	_2)	_2)
Characteristic resistance VRKs,C2	Steel zinc plated	<b> </b> >	5.8		_2)	16,6	_2)	35,3	56,5	_2)	96,3	_2)	_2)
teri and	E	ropert	8.8 50	FIZNIT.	_2)	22,2	_2)	47,1	75,4	_2)	128,4	_2)	_2)
haracterist resistance V <sub>Rks,C2</sub>	Stainless steel R	Property class	50	[kN]	_2)	13,9	_2)	29,4	47,1	_2)	80,3	_2)	_2)
Sha_	and high corrosion	<u> </u>	70		_2)	19,4	_2)	41,2	66,0	_2)	112,4	_2)	_2)
Ľ	resistant steel HCR		80		_2)	22,2	_2)	47,1	75,4	_2)	128,4	_2)	_2)
Threade	d rods, performance	categ	ory (	C2									
0			4.8		_2)	14,1	_2)	26,3	41,1	_2)	59,3	_2)	_2)
is getic	Steel zinc plated	ج ا	5.8		_2)	17,7	_2)	32,9	51,4	_2)	74,1	_2)	_2)
teri and	22	ropert	8.8	[LAN]	_2)	23,6	_2)	43,9	68,6	_2)	98,8	_2)	_2)
Characteristic resistance VRK,s,C2	Stainless steel R	Property class	50	[kN]	_2)	14,7	_2)	27,4	42,8	_2)	61,7	_2)	_2)
Sha_	and high corrosion	₾	70		_2)	20,6	_2)	38,4	60,0	_2)	86,4	_2)	_2)
	resistant steel HCR		80		_2)	23,6	_2)	43,9	68,6	_2)	98,8	_2)	_2)
1) Dorti	al factors for porformer	oco coto	aoni	C2 66	oo tabla	C20 1:							

<sup>&</sup>lt;sup>1)</sup> Partial factors for performance category C2 see table C39.1; for Anchor rods the factor for steel ductility is 1,0.

Table C38.2: Characteristic resistance to steel failure under tension / shear loading for metric reinforcing bars (B500B) under seismic action performance category C1

	p 0				,										
Nominal diameter of the bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Characteristic res	istance	to st	teel fa	ilure u	nder t	ensio	ı load	ing 1)			-	-			-
Reinforcing bar B	500B ad	cc. to	DIN 4	88-2:2	2009-0	8, perl	forma	тсе са	tegory	/ C1					
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	42,3	61,0	83,1	108,5	137,1	169,5	205,2	244,0	265,1	286,2	332,6	381,2	434,1
Characteristic res	istance	to st	teel fa	ilure u	nders	shear I	oadin	g, with	out le	ver ar	m <sup>1)</sup>	2		Št.	ž.
Reinforcing bar B	500B ad	cc. to	DIN 4	88-2:2	2009-0	8, perl	forma	тсе са	tegory	/ C1					
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	14,8	21,3	29,1	37,9	48,0	59,3	71,8	85,4	92,7	100,1	116,4	133,4	151,9
1) Partial factors t	for perfo	rman	ice cat	egory	C1 see	e table	C39.1								
fischer injection	n syste	m F	IS EN	/I Plus	8										
Performance												18	Anne	x C3	8

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Characteristic resistance to steel failure for metric Anchor rods / Threaded rods and

reinforcing bars under seismic action performance category C2 and C1 respectively

<sup>&</sup>lt;sup>2)</sup> No performance assessed.

Table C39.1: Partial factors for metric Anchor rods, Threaded rods and reinforcing bars (B500B) under seismic action performance category C1 or C2

Anch	or rod / Threaded rod				M10 to M30
Nom	inal diameter of the ba	ar		ф	10 to 32
Tens	ion loading, steel failu	ıre³)			
z	Stool 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
Partial factor γ <sub>Ms,N</sub>	high corrosion	g o	70	[-]	1,87 / Anchor rod HCR: 1,50
artii	resistant steel HCR		80		1,60
	Reinforcing bar	В	500B		1,40
Shea	r loading, steel failure	3)			
>	Stool zing plated		5.8		1,25
YMs,	Steel zinc plated	₹.,	8.8		1,25
cto	Stainless steel R and	Property class	50	r 1	2,38
<u>a</u> [a	high corrosion	۾ م	70	[-]	1,56 / Anchor rod HCR: 1,25 <sup>2)</sup>
Partial factor γ <sub>Ms,ν</sub>	resistant steel HCR		80		1,33
"	Reinforcing bar	В	500B		1,50

<sup>1)</sup> Anchor type not part of the assessment.

fisc	cher	injection	system	FIS	EM	Plus	
00-00							

Partial factors for metric Anchor rods, Threaded rods, and reinforcing bars (B500B) under seismic action performance category C1 or C2

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<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. Anchor rods).

<sup>3)</sup> In absence of other national regulations.

Table C40.1: Characteristic resistance for combined pull-out and concrete failure for metric Anchor rods and Threaded rods in hammer drilled holes under seismic action performance category C1: working life 50 years

Anchor i	od /	Threaded rod			M10	M12	M14	M16	M20	M22	M24	M27	M30
Characte	risti	c bond resistan	ce, com	bined pu	ll-out a	nd con	crete c	one fail	lure				
Hammer	-drill	ing with standa	rd drill k	it or holl	ow dril	bit (dr	y or we	t conc	rete)				
Tem-	l:	24 °C / 40 °C			7,0	7,0	6,7	6,0	5,7	6,7	6,7	6,7	6,7
perature	II:	35 °C / 60 °C	$ au_{ ext{Rk,C1}}$	[N/mm <sup>2</sup> ]	7,0	7,0	6,7	6,0	5,7	6,7	6,7	6,7	6,7
range	III:	50 °C / 72 °C			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	bit (wa	ater fille	ed hole	)				
Tem-	l:	24 °C / 40 °C			7,5	7,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7
perature	II:	35 °C / 60 °C	$ au_{ ext{Rk,C1}}$	[N/mm <sup>2</sup> ]	7,5	7,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7
range	III:	50 °C / 72 °C	,		6,8	6,8	6,5	5,7	5,7	5,7	5,7	5,7	5,7
Installati	on fa	actors											
Tension	load	ing											
Dry or we	et cor	ncrete		r 1					1,0				
Water fille	ed ho	ole	γinst	[-]		1	,2		3		1,4		·

Table C40.2: Characteristic resistance for combined pull-out and concrete failure for metric Anchor rods and Threaded rods in hammer drilled holes under seismic action performance category C1; working life 100 years

Anchor r	od /	Threaded rod			M10	M12	M14	M16	M20	M22	M24	M27	M30
Characte	risti	c bond resistan	ce, com	bined pul	l-out a	nd con	crete c	one fail	lure				
Hammer	-drill	ing with standa	rd drill k	oit or holle	ow drill	l bit (dr	y or we	t conc	rete)	2 22	100	2 -	
Tem-	1:	24 °C / 40 °C			5,5	5,3	5,8	4,6	4,6	5,4	5,3	5,1	5,0
perature	II:	35 °C / 60 °C	$ au_{Rk,C1}$	[N/mm <sup>2</sup> ]	5,5	5,3	5,8	4,6	4,6	5,4	5,3	5,1	5,0
range	III:	50 °C / 72 °C			5,5	5,3	5,5	4,3	4,3	5,0	5,0	4,8	4,8
Hammer	-drill	ing with standa	rd drill b	oit or holl	ow drill	bit (wa	ater fille	ed hole	)	32			
Tem-	l:	24 °C / 40 °C			5,9	5,6	5,7	4,3	4,6	4,6	4,5	4,3	4,2
perature	II:	35 °C / 60 °C	$ au_{\text{Rk,C1}}$	[N/mm <sup>2</sup> ]	5,9	5,6	5,7	4,3	4,6	4,6	4,5	4,3	4,2
range	III:	50 °C / 72 °C	'		5,3	5,1	5,3	4,3	4,3	4,3	4,2	4,1	4,0
Installati	on fa	actors		i.	2								
Tension	load	ing											
Dry or we	t cor	ncrete		r.1					1,0				
Water fille	ed ho	ole	γinst	[-]		1	,2				1,4		

fischer injection system	FIS EM Plus
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Characteristic resistance for combined pull-out and concrete failure under seismic action (C1) for Anchor rods / Threaded rods; working life 50 and 100 years

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Table C															e fo	•
	<b>metric r</b> operforma									unde	er se	ismi	c act	ion		
Nominal	diameter of the bar	,	ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Characte	eristic bond resistar	nce, com	bined pu	II-ou	and	cond	rete	cone	failu	ire		æ	•			ā e
Hammer	-drilling with standa	ard drill k	oit or holl	ow d	rill bi	t (dr	or v	vet c	oncre	ete)						
Tem-	I: 24 °C / 40 °C			7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	6,7	6,7	4,8
perature	II: 35 °C / 60 °C	- τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	6,7	6,7	4,8
range	III: 50 °C / 72 °C	_		7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	6,7	6,7	4,8
Hammer	-drilling with standa	ard drill b	oit or holl	ow d	rill bi	it (wa	ter fi	lled I	nole)							
Tem-	I: 24 °C / 40 °C			7,5	6,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	4,8
perature	II: 35 °C / 60 °C	- τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	7,5	6,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	4,8
range	III: 50 °C / 72 °C	-		6,5	6,5	5,8	5,8	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	4,8
Installati	on factors															
Tension	loading															
	et concrete	- Vin-t	[-]							1,0						
Water fille	ed hole	- γinst	[-]			1,2						1	,4			
	performa		i <b>ng bars</b> tegory <b>C</b>								er se	ISITII	c aci	.1011		
	performation perfo	ance cat	tegory C Φ	1; w	orki 12	ng I 14	ife 1 16	00 y 18	ears	22	24	25	26	28	30	32
Characte	performa diameter of the bar eristic bond resistar	nce cat	tegory C φ bined pu	1; w 10 II-ou	orki 12 t and	ng l	ife 1 16 crete	00 y 18 cone	ears 20 failt	22 ire	T			I	30	32
Characte	performa diameter of the bar eristic bond resistar drilling with standa	nce cat	tegory C φ bined pu	1; w 10 II-out ow d	orki 12 t and rill bi	ng I 14 cond t (dr)	16 rete	18 cone	20 failt	22 ire ete)	24	25	26	28		
Characte Hammer Tem-	performation perfo	ance cat nce, com ard drill b	φ bined pu bit or holl	1; w 10 II-ou ow d 6,0	12 t and rill bi	ng I 14 cond t (dr) 4,4	16 rete or v	18 cone vet cone 3,7	20 failu oncre	22 ire ete) 4,4	4,4	4,4	<b>26</b>	4,4	4,4	3,1
Characte Hammer Tem- perature	performation perfo	nce cat	tegory C φ bined pu	11; w 10 II-out ow d 6,0 6,0	12 t and rill bi 5,6 5,6	14 cond t (dr) 4,4 4,4	16 16 rete 7 or v 3,7 3,7	18 cone vet co 3,7 3,7	20 failu oncre 3,7 3,7	22 ure ete) 4,4 4,4	4,4	4,4	<b>26</b> 4,4 4,4	4,4 4,4	4,4	3,1
Characte Hammer Tem- perature range	performation performation performation performation period	nce, com ard drill b	tegory C  phined pu pit or holl  [N/mm²]	1; w 10 II-ou ow d 6,0 6,0 6,0	12 t and rill bi 5,6 5,6	14 cond t (dr) 4,4 4,4	16 rete or v 3,7 3,7 3,7	18 cone vet co 3,7 3,7 3,7	20 failu oncre 3,7 3,7 3,7	22 ire ete) 4,4	4,4	4,4	<b>26</b> 4,4 4,4	4,4 4,4	4,4	3,1
Characte Hammer Tem- perature range	performation performation performation performation period	nce, com ard drill b	tegory C  phined pu pit or holl  [N/mm²]	1; w 10 II-out ow d 6,0 6,0 6,0 ow d	12 t and rill bi 5,6 5,6 5,6	14 cond t (dr) 4,4 4,4 4,4 t (wa	16 crete or v 3,7 3,7 3,7 ter fi	18 cone vet co 3,7 3,7 3,7	20 failu oncre 3,7 3,7 3,7	22 lire ete) 4,4 4,4 4,4	4,4 4,4 4,4	4,4 4,4 4,4	4,4 4,4 4,4	4,4 4,4 4,4	4,4 4,4 4,4	3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer Tem-	performation performation performation performation period	nce, com ard drill k	tegory C  phined pu pit or holl  [N/mm²]	11; w 10 II-out 6,0 6,0 6,0 ow d 6,4	12 t and rill bi 5,6 5,6 5,6 rill bi	14 cond t (dr) 4,4 4,4 4,4 t (wa	16 16 17 16 16 17 16 17 16 17 17 17 17 17 17 17 17 17 17 17 17 17	18 cone vet con 3,7 3,7 3,7 lled I 3,7	20 failu oncre 3,7 3,7 3,7 nole)	22 ire ete) 4,4 4,4 4,4	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer	performation performation performation performation periodic bond resistant pe	nce, com ard drill b	tegory C  phined pu pit or holl  [N/mm²]	11; w 10 II-our 6,0 6,0 6,0 ow d 6,4 6,4	70rki 12 t and rill bi 5,6 5,6 5,6 rill bi 5,2	14 cond t (dr) 4,4 4,4 4,4 tt (wa 4,2 4,2	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	3,7 3,7 3,7 1led I 3,7	20 failu oncre 3,7 3,7 3,7 nole) 3,7	22 lre ete) 4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3,1 3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer Tem- perature range	performation performation performation period perio	nce, com ard drill k	tegory C  phined pu pit or holl  [N/mm²]	11; w 10 II-out 6,0 6,0 6,0 ow d 6,4	12 t and rill bi 5,6 5,6 5,6 rill bi	14 cond t (dr) 4,4 4,4 4,4 t (wa	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	18 cone vet con 3,7 3,7 3,7 lled I 3,7	20 failu oncre 3,7 3,7 3,7 nole)	22 ire ete) 4,4 4,4 4,4	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7	3,1 3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer Tem- perature range	performation performation performation period the bare ristic bond resistant description by the standard of the bare ristic bond resistant description by the standard of the bare risting with standard risting with ris	nce, com ard drill k	tegory C  phined pu pit or holl  [N/mm²]	11; w 10 II-our 6,0 6,0 6,0 ow d 6,4 6,4	70rki 12 t and rill bi 5,6 5,6 5,6 rill bi 5,2	14 cond t (dr) 4,4 4,4 4,4 tt (wa 4,2 4,2	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	3,7 3,7 3,7 1led I 3,7	20 failu oncre 3,7 3,7 3,7 nole) 3,7	22 lre ete) 4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3,1 3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer Tem- perature range Installati Tension	performation performation performation period perio	nce, com ard drill k	tegory C  phined pu pit or holl  [N/mm²]	11; w 10 II-our 6,0 6,0 6,0 ow d 6,4 6,4	70rki 12 t and rill bi 5,6 5,6 5,6 rill bi 5,2	14 cond t (dr) 4,4 4,4 4,4 tt (wa 4,2 4,2	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	3,7 3,7 3,7 1led I 3,7	20 failu oncre 3,7 3,7 3,7 nole) 3,7	22 lire ete) 4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3,1 3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer Tem- perature range Installati Tension	performation performation performation periodic bond resistant description between the bar existic bond resistant description between the bar existing with standard line and a	nce, com ard drill k	tegory C  phined pu pit or holl  [N/mm²]	11; w 10 II-our 6,0 6,0 6,0 ow d 6,4 6,4	70rki 12 t and rill bi 5,6 5,6 5,6 rill bi 5,2	14 cond t (dr) 4,4 4,4 4,4 tt (wa 4,2 4,2	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	3,7 3,7 3,7 1led I 3,7	20 failu oncre 3,7 3,7 3,7 nole) 3,7	22 lre ete) 4,4 4,4 4,4 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3,1 3,1 3,1
Characte Hammer Tem- perature range Hammer Tem- perature range Installati Tension Dry or we	performation performation performation periodic bond resistant description between the bar existic bond resistant description between the bar existing with standard line and a	ance cat	tegory C  phined purple of the or holl  [N/mm²]  [N/mm²]	11; w 10 II-our 6,0 6,0 6,0 ow d 6,4 6,4	70rki 12 t and rill bi 5,6 5,6 5,6 rill bi 5,2	14 cond t (dr) 4,4 4,4 4,4 t (wa 4,2 4,2 3,8	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	3,7 3,7 3,7 1led I 3,7	20 failu oncre 3,7 3,7 3,7 nole) 3,7	22 lire ete) 4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3
Characte Hammer Tem- perature range Hammer Tem- perature range Installati Tension Dry or we Water fille	performation performation performation periodic bond resistant description between the bar existic bond resistant description between the bar existing with standard line and a	ance cat	tegory C  phined purple of the or holl  [N/mm²]  [N/mm²]	11; w 10 II-our 6,0 6,0 6,0 ow d 6,4 6,4	70rki 12 t and rill bi 5,6 5,6 5,6 rill bi 5,2	14 cond t (dr) 4,4 4,4 4,4 t (wa 4,2 4,2 3,8	16 16 17 16 16 16 16 16 16 16 16 16 16 16 16 16	3,7 3,7 3,7 1led I 3,7	20 failu oncre 3,7 3,7 3,7 nole) 3,7	22 ire ete) 4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3,1 3,1 3,1 3,1
Characte Hammer Temperature range Hammer Temperature range Installati Tension Dry or we Water fille	performation performation diameter of the bare pristic bond resistary drilling with standary drilling with standar	ance cate fince, com fince, com find drill k  TRK,C1  TRK,C1  TRK,C1	tegory C  public or holl  [N/mm²]  [N/mm²]	11; w 10 II-our ow d 6,0 6,0 6,0 6,4 6,4 5,5	70rki 12 t and rill bi 5,6 5,6 5,6 7ill bi 5,2 5,2 5,2	14 cond it (dr) 4,4 4,4 4,4 4,2 4,2 3,8	ife 1 16 crete / or v 3,7 3,7 3,7 ter fi 3,7 3,8	00 y 18 cone vet c 3,7 3,7 3,7 Iled I 3,7 3,7	20 failu oncre 3,7 3,7 3,7 3,7 3,7 3,7 3,7	22 ire ete) 4,4 4,4 4,4 3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	4,4 4,4 4,4 3,7 3,7 3,7	3,7 3,7 3,7	4,4 4,4 4,4 3,7 3,7	3,7 3,7 3,7	3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3

Table C42.1: Characteristic resistance for combined pull-out and concrete failure for metric Anchor rods and Threaded rods in hammer drilled holes under seismic action performance category C2; working life 50 and 100 years

Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)   Temperature   I: 24 °C / 40 °C   Temperature   II: 35 °C / 60 °C   Temperature   III: 50 °C / 72 °C   Temperature   Temperature	Anchor r	od /	Threaded rod			M12	M16	M20	M24
Temperature perature perature range   I: 24 °C / 40 °C   TRK,C2   [N/mm²]   3,5   5,8   5,0   3,1	Characte	risti	c bond resistan	ce, com	bined pu	ll-out and conci	ete cone failure		•
Temperature range   II: 35 °C / 60 °C   $\tau_{Rk,C2}$   [N/mm²]   3,5   5,8   5,0   3,1   2,9	Hammer-	-drill	ling with standa	rd drill l	oit or holl	ow drill bit (dry	or wet concrete	e)	
Perature range   II: 35 °C / 60 °C   TRK,C2   [N/mm²]   3,5   5,8   5,0   3,1	Tem-	I:	24 °C / 40 °C			3,5	5,8	5,0	3,1
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)  Temperature range   I: 24 °C / 40 °C	perature	II:	35 °C / 60 °C	TRk,C2	[N/mm <sup>2</sup> ]	3,5	5,8	5,0	3,1
Temperature range   I: 24 °C / 40 °C   TRK,C2   [N/mm²]   3,5   5,8   5,0   3,1   3,5	range	III:	50 °C / 72 °C			3,3	5,5	4,7	2,9
Temperature range   II: 35 °C / 60 °C   TRK,C2   [N/mm²]   3,5   5,8   5,0   3,1   3,3   5,5   4,7   2,9	Hammer-	-drill	ling with standa	rd drill l	oit or holl	ow drill bit (wat	er filled hole)		
perature range         II: 35 °C / 60 °C         TRK,C2         [N/mm²]         3,5         5,8         5,0         3,1           Installation factors           Tension loading           Dry or wet concrete         1.0	Tem-	l:	24 °C / 40 °C			3,5	5,8	5,0	3,1
III: 50 °C / /2 °C 3,3 5,5 4,7 2,9  Installation factors  Tension loading  Dry or wet concrete 1.0	perature	II:	35 °C / 60 °C	TRk,C2	[N/mm <sup>2</sup> ]	3,5	5,8	5,0	3,1
Tension loading  Dry or wet concrete 1.0	range	III:	50 °C / 72 °C			3,3	5,5	4,7	2,9
Dry or wet concrete 1.0	Installati	on fa	actors						
Dry or wet concrete 1,0	Tension	load	ling		_				
	Dry or we	t cor	ncrete		r ı		1	,0	
Water filled hole 1,2 1,4	Water fille	ed ho	ole	γinst	[-]	1	,2	1	,4
	Dienlace	men	t-Factors for to	nsion lo	ading <sup>1)</sup>				
Displacement-Factors for tension loading <sup>1)</sup>	Displace	HIGH	וניו מטנטוס וטו נפו	13101110	adilig		W	r	-

0.09

0.15

0.18

0.25

 $[mm/(N/mm^2)]$ 

[mm/kN]

#### 1) Calculation of effective displacement:

Displacement-Factors for shear loading<sup>2)</sup>

 $\delta_{N,C2(50\%)} = \delta_{N,C2(50\%)\text{-Factor}} \cdot \tau$ 

δ<sub>N,C2(50%)</sub>-Factor

 $\delta$ N,C2(100%)-Factor

 $\delta$ V,C2(50%)-Factor

δy C2(100%)-Factor

 $\delta_{N,C2(100\%)} = \delta_{N,C2(100\%)\text{-Factor}} \cdot \tau$ 

 $\tau$  = acting bond strength under tension loading

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

0,11

0,17

0.07

0.11

0.12

0,18

0.06

0.09

 $\delta_{V,C2(50\%)} = \delta_{V,C2(50\%)\text{-Factor}} \cdot V$ 

 $\delta_{V,C2(100\%)} = \delta_{V,C2(100\%)-Factor} \cdot V$ 

V = acting shear loading

0,10

0,17

0.10

0.14

# fischer injection system FIS EM Plus

#### **Performance**

Characteristic resistance for combined pull-out and concrete failure under seismic action (C2) for Anchor rods and Threaded rods; working life 50 and 100 years

Annex C42

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Table C43.1: Characteristic resistance to steel failure under tension or shear loading for fractional Threaded rods

under seismic action performance category C1

	under	seisr	nic action performa	ance	catego	ory C1					
Threa	ided rod				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Chara	acteristic resistance	to ste	eel failure under tens	ion lo	ading 1	)					
Threa	ided rods, performa	nce ca	ategory C1								
			F568M, Class 5.8		25,0	45,7	72,9	107,9	148,9	195,4	246,0
			F1554, Grade 36		19,9	36,5	58,3	86,2	119,1	156,2	196,7
, 2	Steel zinc plated	s	F1554, Grade 55		25,8	47,3	75,3	111,5	154,0	202,0	254,4
ristic Ark,s		class	F1554, Grade 105		43,0	78,8	125,6	185,9	256,7	336,8	424,0
acte oce	Characteristic resistance N <sub>Rk,s,C1</sub>	arty	A193, B7	[kN]	43,0	78,8	125,6	185,9	256,7	336,8	424,0
Shar istar		Property	F593, Alloy Group 2		34,4	63,0	100,5	126,4	174,5	229,0	288,3
	Stainless steel R	₾.	A193, Grade B8M, Class 1		25,8	47,3	75,3	111,5	154,0	202,0	254,4
			A193, Grade B8M, Class 2B		32,7	59,9	95,4	141,3	195,1	255,9	322,2
Chara	acteristic resistance	to ste	eel failure under shea	r loa	ding wi	thout le	ver arn	n <sup>1)</sup>			
Threa	ided rods, performa	nce ca	ategory C1								
			F568M, Class 5.8		12,0	21,9	34,9	51,7	53,6	70,3	88,5
			F1554, Grade 36		8,3	15,3	24,4	36,2	50,0	65,6	82,6
5	Steel zinc plated		F1554, Grade 55	]	10,3	18,9	30,1	44,6	46,2	60,6	76,3
stic Rks,		lass	F1554, Grade 105		15,0	27,6	43,9	65,0	89,8	117,8	148,4
cter Se /		c A	A193, B7	[kN]	17,2	31,5	50,2	74,3	77,0	101,0	127,2
Characteristic sistance V <sub>Rks,0</sub>		Property class	F593, Alloy Group 2	[	13,7	25,2	40,2	50,5	52,3	68,7	86,5
Characteristic resistance V <sub>Rks,C1</sub>	Stainless steel R	Pro	A193, Grade B8M, Class 1		10,3	18,9	30,1	44,6	46,2	60,6	76,3
			A193, Grade B8M, Class 2B		13,1	23,9	38,1	56,5	58,5	76,7	96,6

<sup>1)</sup> Partial factors for performance category C1 or see table C45.1

fischer injection :	system FIS	EM Plus
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#### Performance

Characteristic resistance to steel failure under tension or shear loading for Anchor rods and Threaded rods under seismic action (performance category C1)

Class 2B

#### Annex C43

Table C44.1: Characteristic resistance to steel failure under tension / shear loading for fractional reinforcing bars under seismic action performance category C1

Rebar	size		#3	#4	#5	#6	#7	#8	#9	#10
Chara	cteristic resistance to steel fa	ilure u	nder ten	sion loa	ding <sup>1)</sup>	7.			9.	
Reinfo	orcing bar materials, performa	ance c	ategory	C1						
0 10,°	A615 (A767), Grade 40		29,3	53,3	82,3	117,4	160,0	210,9	266,8	338,8
teristic e N <sub>Rk,s,C1</sub>	A615 (A767), Grade 60	[LNI]	44,0	80,0	123,4	176,2	240,1	316,4	400,2	508,2
Characteristic resistance N <sub>RK,S,</sub>	A615 (A767), Grade 75	[kN]	48,9	88,9	137,2	195,8	266,8	351,6	444,7	564,6
res -	A706 (A767), Grade 60		39,1	71,1	109,7	156,6	213,4	281,3	355,7	451,7
Charae	cteristic resistance to steel fa	ilure u	nder sh	ear loadi	ng, with	out lever	arm <sup>1)</sup>			
Reinfo	orcing bar materials, performa	ance c	ategory	C1						
0 % -	A615 (A767), Grade 40		13,0	23,6	36,5	52,1	71,0	93,6	118,4	150,4
teristic e V <sub>Rk,s,C1</sub>	A615 (A767), Grade 60	[LAI]	16,3	29,6	45,6	65,2	88,8	117,0	148,0	188,0
Characteristic resistance V <sub>RK,S,</sub>	A615 (A767), Grade 75	[kN]	18,1	32,9	50,7	72,4	98,7	130,1	164,5	208,9
res -	A706 (A767), Grade 60		14,4	26,3	40,6	57,9	78,9	104,0	131,6	167,1

<sup>1)</sup> Partial factors for performance category C1 see table C45.1.

	tischer	injection	system	FIS EIV	Plus
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Characteristic resistance to steel failure under tension/shear loading for fractional reinforcing bars under seismic action (performance category C1)

#### Annex C44

haha	aded rod			3/8"	1/2"	5/8"	3	/4"	7/8"		1"	1 1/8	
vena	r size			#3	#4	#5	#6	#7	#	8	#9	#1	
ens	ion loading, st	eel failure <sup>1)</sup>			T 31	175			in-				
		F568M, Class 5.8	_				1	,50					
	Threaded	F1554, Grade 36	]				1	,94					
	rod,	F1554, Grade 55					1	,64					
	zinc plated	F1554, Grade 105					1	,43					
Ns,N		A193, B7					1	,43					
or	Throaded	hreaded F593, Alloy Group 2 1,85								2,27	7		
Partial factor y <sub>Ms,N</sub>	rod, stainless	A193, Grade B8M, Class 1	[-]				3	,00					
Parti	steel R	A193, Grade B8M, Class 2B					1	,52					
		A615 (A767), Grade 40					1	,80					
	Reinforcing	A615 (A767), Grade 60	]				1	,80					
	bar	A615 (A767), Grade 75					1	,60					
		A706 (A767), Grade 60					1	,60					
hea	r loading, stee	l failure <sup>1)</sup>											
		F568M, Class 5.8					1	,25					
	Threaded	F1554, Grade 36					1	,61					
	rod,	F1554, Grade 55					1	,36					
	zinc plated	F1554, Grade 105					1	,50					
√s/V		A193, B7					1	,50					
factor y <sub>Ms,∨</sub>	Threaded	F593, Alloy Group 2			1,54					1,89	9		
	rod, stainless	A193, Grade B8M, Class 1	[-]				2	,50					
Partial	steel R	A193, Grade B8M, Class 2B					1	,27					
		A615 (A767), Grade 40	]				1	,50					
	Reinforcing	A615 (A767), Grade 60	]				1	,50					
	bar	A615 (A767), Grade 75	]				1	,33					
		A706 (A767), Grade 60					1	,33					

Table C46.1: Characteristic resistance for combined pull-out and concrete failure for fractional Threaded rods in hammer drilled holes under seismic action performance category C1; working life 50 years

Threade	d ro	d			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Characte	eristi	ic bond resista	nce, cor	nbined pu	ıll-out an	d concre	te cone f	ailure			
Hammer	-dril	ling with stand	ard drill	bit or hol	low drill	bit (dry o	r wet con	crete)			
Tem-	1:	24 °C / 40 °C			8,5	9,0	9,1	8,5	8,5	8,2	7,1
perature	11:	35 °C / 60 °C	τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	8,5	9,0	9,1	8,5	8,5	8,2	7,1
range	III:	50 °C / 72 °C	=0		8,0	8,5	8,5	8,5	8,5	8,2	7,1
Hammer	-dril	ling with stand	ard drill	bit or hol	low drill	bit (wate	r filled ho	le)			
Tem-	I:	24 °C / 40 °C			7,4	7,7	7,5	6,0	6,0	5,8	5,0
perature	II:	35 °C / 60 °C	τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	7,4	7,7	7,5	6,0	6,0	5,8	5,0
range	III:	50 °C / 72 °C			6,9	7,3	7,0	6,0	6,0	5,8	5,0
Installat	ion f	actors									
Tension	load	ling									
Dry or we	et co	t concrete						1,0			
Water fill	ed h	ole	γinst	[-]		1,2			1	,4	

Table C46.2: Characteristic resistance for combined pull-out and concrete failure for fractional Threaded rods in hammer drilled holes under seismic action performance category C1; working life 100 years

d roc	d			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
risti	ic bond resista	nce, cor	nbined p	ull-out an	d concre	te cone f	ailure			
-dril	ling with stand	ard drill	bit or hol	llow drill	bit (dry o	r wet con	crete)	20		W0
1:	24 °C / 40 °C			6,8	6,8	6,9	6,9	6,8	6,3	5,3
II:	35 °C / 60 °C	$ au_{Rk,C1}$	1 [N/mm <sup>2</sup> ]	6,8	6,8	6,9	6,9	6,8	6,3	5,3
Ш:	50 °C / 72 °C			6,4	6,4	6,5	6,4	6,4	5,9	5,1
-dril	ling with stand	ard drill	bit or ho	low drill	bit (wate	r filled ho	le)			
1:	24 °C / 40 °C	20		5,9	5,9	5,7	4,9	4,8	4,4	3,7
II:	35 °C / 60 °C	τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	5,9	5,9	5,7	4,9	4,8	4,4	3,7
III:	50 °C / 72 °C			5,5	5,5	5,3	4,5	4,5	4,2	3,6
on f	actors					,	***			240
load	ling									
t co	ncrete		r 1				1,0			
ed hole		γinst	[-]		1,2			1	,4	
	eristi -drill  :   :   : -drill  : -drill  :   :   :   :   :   :   :   :   :	1: 24 °C / 40 °C     1: 35 °C / 60 °C     11: 50 °C / 72 °C     12: 4 °C / 40 °C     13: 50 °C / 72 °C     14: 35 °C / 60 °C     15: 50 °C / 72 °C     16: 50 °C / 72 °C     17: 50 °C / 72 °C     18: 50 °C / 72 °C     19: 50 °C / 72 °C	eristic bond resistance, cor- drilling with standard drill   : 24 °C / 40 °C      : 35 °C / 60 °C      : 50 °C / 72 °C	eristic bond resistance, combined produilling with standard drill bit or hold is 24 °C / 40 °C   TRK,C1   [N/mm²]   [N/mm²]	Pristic bond resistance, combined pull-out and   Pristic bond   Pri	Pristic bond resistance, combined pull-out and concretedrilling with standard drill bit or hollow drill bit (dry or bit of the concrete standard drill bit or hollow drill bit (dry or bit of the concrete standard drill bit or hollow drill bit (water bit of the concrete standard drill bit or hollow drill bit (water bit of the concrete standard drill bit or bi	Pristic bond resistance, combined pull-out and concrete cone fedrilling with standard drill bit or hollow drill bit (dry or wet conditions)    1: 24 °C / 40 °C	Contract   Contract	Contract   Contract	Pristic bond resistance, combined pull-out and concrete cone failure    drilling with standard drill bit or hollow drill bit (dry or wet concrete)   1: 24 °C / 40 °C

# fischer injection system FIS EM Plus

#### Performance

Characteristic resist. for combined pull-out and concrete failure under seismic action (C1) for Anchor rods / Threaded rods; working life 50 and 100 years (fractional size)

Annex C46

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Table C47.1: Characteristic resistance for combined pull-out and concrete failure for fractional reinforcing bars in hammer drilled holes under seismic action performance category C1; working life 50 years

Rebar si	ze				#3	#4	#5	#6	#7	#8	#9	#10 <sup>1)</sup>
Characte	eristi	ic bond resista	nce, cor	nbined p	ull-out a	nd cond	rete cor	ne failur	9			
Hammer	-drill	ling with stand	ard drill	bit or hol	llow dril	l bit (dry	or wet	concrete	e)			
Tem-	1:	24 °C / 40 °C			6,2	7,0	7,0	7,0	7,0	7,0	7,0	7,0
perature	II:	35 °C / 60 °C	TRK,C1	[N/mm <sup>2</sup> ]	6,2	7,0	7,0	7,0	7,0	7,0	7,0	7,0
	III:	50 °C / 72 °C			6,2	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Hammer	-drill	ling with stand	ard drill	bit or hol	llow dril	l bit (wa	ter filled	hole)			_	
Tem-	1:	24 °C / 40 °C	_		6,6	5,7	5,7	5,3	5,3	5,3	5,3	4,4
perature	11:	35 °C / 60 °C	τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	6,6	5,7	5,7	5,3	5,3	5,3	5,3	4,4
range	Ш:	50 °C / 72 °C			5,7	5,7	5,3	5,3	5,3	5,3	5,3	4,4
Installati	on fa	actors										
Tension	load	ling										
Dry or we	et concrete		- ••	r 1				1	,0			
Water fille	ed ho	ole	γinst	[-]		1,2				1,4		

<sup>1)</sup> Not allowed for drilling with hollow drill bit.

Table C47.2: Characteristic resistance for combined pull-out and concrete failure for fractional reinforcing bars in hammer drilled holes under seismic action performance category C1; working life 100 years

Rebar si	ize				#3	#4	#5	#6	#7	#8	#9	#10 <sup>1)</sup>
Characte	eristic bo	nd resista	nce, cor	nbined pu	ıll-out a	nd cond	rete cor	ne failur	е	i.		
Hammer	r-drilling v	vith stand	ard drill	bit or hol	low dril	l bit (dry	or wet	concret	e)		×	
Tem-	l: 24 °	C / 40 °C			5,2	5,6	4,6	4,6	4,6	4,6	4,6	4,6
perature	II: 35 °	C / 60 °C	τ <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	5,2	5,6	4,6	4,6	4,6	4,6	4,6	4,6
107.5	III: 50°	C / 72 °C	-		5,2	5,6	4,6	4,6	4,6	4,6	4,6	4,6
Hammer	r-drilling v	vith stand	ard drill	bit or hol	low dril	l bit (wa	ter filled	hole)				
Tem-	l: 24 °	C / 40 °C		[N/mm <sup>2</sup> ]	5,6	4,6	3,7	3,4	3,4	3,4	3,4	2,9
perature	II: 35 °	C / 60 °C	τ <sub>Rk,C1</sub>		5,6	4,6	3,7	3,4	3,4	3,4	3,4	2,9
range	III: 50°	C / 72 °C	-		4,9	4,6	3,4	3,4	3,4	3,4	3,4	2,9
Installat	ion factor	s									•	
Tension	loading											
Dry or we	et concrete	Э		F 1				1	,0			
Water fill	ed hole		γinst	[-]		1,2				1,4		
1) Not a	allowed for	r drilling wi	th hollow	drill bit.								

# Fischer injection system FIS EM Plus Performance Characteristic registeres for combined pull out and concrete failure under solomic

Annex C47
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Characteristic resistance for combined pull-out and concrete failure under seismic action (C1) for and reinforcing bars; working life 50 and 100 years (fractional size)

Table C48.1: Fire resistance to steel failure under tension and shear loading for metric Anchor rods and Threaded rods part 1

Fire resistance to steel failure under tension and shear loading

Anchor rod / Threaded rod ISO 898-1 Class 5.8 and higher		R30			R60	
	N <sub>Rk,s,fi,30</sub> [kN]	V <sub>Rk,s,fi,30</sub> [kN]	M <sup>0</sup> <sub>Rk,s,fi,30</sub> [Nm]	N <sub>Rk,s,fi,60</sub> [kN]	V <sub>Rk,s,fi,60</sub> [kN]	M <sup>0</sup> <sub>Rk,s,fi,60</sub> [Nm]
M8	1,6	1,6	1,7	1,2	1,2	1,2
M10	3,3	3,3	4,2	2,3	2,3	3,0
M12	5,8	5,8	9,1	4,0	4,0	6,2
M14	6,6	6,6	12,0	4,6	4,6	8,4
M16	10,9	10,9	15,1	7,5	7,5	11,2
M20	11,1	11,1	29,4	8,2	8,2	21,8
M22	13,7	13,7	40,5	10,1	10,1	30,0
M24	16,0	16,0	50,9	11,8	11,8	37,7
M27	20,8	20,8	75,5	15,4	15,4	56,0
M30	25,4	25,4	102,0	18,8	18,8	75,6
Anchor rod / Threaded rod ISO 898-1 Class 5.8 and higher		R90			R120	
	N <sub>Rk,s,fi,90</sub> [kN]	V <sub>Rk,s,fi,90</sub> [kN]	M <sup>0</sup> <sub>Rk,s,fi,90</sub> [Nm]	N <sub>Rk,s,fi,120</sub> [kN]	V <sub>Rk,s,fi,120</sub> [kN]	M <sup>0</sup> Rk,s,fi,120 [Nm]
M8	0,8	0,8	0,8	0,6	0,6	0,6
M10	1,4	1,4	1,8	0,9	0,9	1,1
M12	2,1	2,1	3,3	1,2	1,2	1,9
M14	2,7	2,7	4,9	1,7	1,7	3,2
M16	4,0	4,0	7,3	2,3	2,3	5,3
M20	5,3	5,3	14,2	3,9	3,9	10,4
	0.0	6,6	19,5	4,8	4,8	14,3
M22	6,6	0,0	10,0			
M22 M24	7,7	7,7	24,6	5,6	5,6	18,0
					The state of the s	18,0 26,7

fischer injection system FIS EM Plus	
Performance	Annex C48
Fire resistance to steel failure under tension and shear loading for metric Anchor rods and Threaded rods part 1	Appendix 74 / 77

Table C49.1: Fire resistance to steel failure under tension and shear loading for metric Anchor rods and Threaded rods part 2

Anchor rods R and HCR and Threaded rod, EN ISO 3506-1 Class A4-50 and higher		R30		R60			
<b>.</b>	N <sub>Rk,s,fi,30</sub> [kN]	V <sub>Rk,s,fi,30</sub> [kN]	M <sup>0</sup> Rk,s,fi,30 [Nm]	N <sub>Rk,s,fi,60</sub> [kN]	V <sub>Rk,s,fi,60</sub> [kN]	M <sup>0</sup> Rk,s,fi,60 [Nm]	
M8	0,7	0,7	0,7	0,5	0,5	0,6	
M10	1,4	1,4	1,8	1,1	1,1	1,5	
M12	2,5	2,5	3,9	2,1	2,1	3,9	
M14	3,4	3,4	6,2	2,8	2,8	6,2	
M16	4,7	4,7	9,9	3,9	3,9	9,9	
M20	7,3	7,3	19,4	6,1	6,1	19,4	
M22	9,0	9,0	26,7	7,5	7,5	26,7	
M24	10,5	10,5	33,6	8,8	8,8	28,0	
M27	13,7	13,7	49,9	11,4	11,4	41,6	
М30	16,8	16,8	67,4	14,0	14,0	56,2	
Anchor rods R and HCR and Threaded rod, EN ISO 3506-1 Class A4-50 and higher		R90			R120		
_	N <sub>Rk,s,fi,90</sub>	V <sub>Rk,s,fi,90</sub>	M <sup>0</sup> Rk,s,fi,90	N <sub>Rk,s,fi,120</sub>	V <sub>Rk,s,fi,120</sub>	M <sup>0</sup> Rk,s,fi,120	
	[kN]	[kN]	[Nm]	[kN]	[kN]	[Nm]	
M8	[kN] 0,4	[kN] 0,4		[kN] 0,3	[kN] 0,3	[Nm] 0,3	
M8 M10			[Nm]			[Nm]	
	0,4	0,4	[Nm] 0,4	0,3	0,3	[Nm] 0,3	
M10	0,4 0,9	0,4 0,9	[Nm] 0,4 1,2	0,3 0,8	0,3 0,8	[Nm] 0,3 1,0	
M10 M12	0,4 0,9 1,6	0,4 0,9 1,6	[Nm] 0,4 1,2 3,9	0,3 0,8 1,3	0,3 0,8 1,3	[Nm] 0,3 1,0 3,9	
M10 M12 M14	0,4 0,9 1,6 2,3	0,4 0,9 1,6 2,3	[Nm] 0,4 1,2 3,9 6,2	0,3 0,8 1,3 1,8	0,3 0,8 1,3 1,8	[Nm] 0,3 1,0 3,9 6,2	
M10 M12 M14 M16	0,4 0,9 1,6 2,3 3,1	0,4 0,9 1,6 2,3 3,1	[Nm] 0,4 1,2 3,9 6,2 9,9	0,3 0,8 1,3 1,8 2,5	0,3 0,8 1,3 1,8 2,5	[Nm] 0,3 1,0 3,9 6,2 9,9	
M10 M12 M14 M16 M20	0,4 0,9 1,6 2,3 3,1 4,9	0,4 0,9 1,6 2,3 3,1 4,9	[Nm] 0,4 1,2 3,9 6,2 9,9 19,4	0,3 0,8 1,3 1,8 2,5 3,9	0,3 0,8 1,3 1,8 2,5 3,9	[Nm] 0,3 1,0 3,9 6,2 9,9 19,4	
M10 M12 M14 M16 M20 M22	0,4 0,9 1,6 2,3 3,1 4,9 6,0	0,4 0,9 1,6 2,3 3,1 4,9 6,0	[Nm] 0,4 1,2 3,9 6,2 9,9 19,4 26,7	0,3 0,8 1,3 1,8 2,5 3,9 4,8	0,3 0,8 1,3 1,8 2,5 3,9 4,8	[Nm] 0,3 1,0 3,9 6,2 9,9 19,4 26,7	

fischer	injection	system	FIS	EM	Plus
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Fire resistance to steel failure under tension and shear loading for metric Anchor rods and Threaded rods part 2

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Table C50.1: Fire resistance to steel failure under tension and shear loading for fractional Threaded rods

Fire resistance to steel failure unde	r tension and	d shear load	ling				
Threaded rod		R30			R60		
Steel zinc plated; detailed materials	N <sub>Rk,s,fi,30</sub>	V <sub>Rk,s,fi,30</sub>	M <sup>0</sup> Rk,s,fi,30	N <sub>Rk,s,fi,60</sub>	V <sub>Rk,s,fi,60</sub>	M <sup>0</sup> Rk,s,fi,60	
see Table A7.1, part No 2 1)	[kN]	[kN]	[Nm]	[kN]	[kN]	[Nm]	
3/8"	2,7	2,7	3,2	1,9	1,9	2,3	
1/2"	5,9	5,9	9,6	4,1	4,1	6,7	
5/8"	6,7	6,7	13,7	4,9	4,9	10,1	
3/4"	9,7	9,7	24,3	7,2	7,2	18,0	
7/8"	13,5	13,5	39,4	10,0	10,0	29,2	
1"	17,7	17,7	59,3	13,1	13,1	43,9	
1 1/8"	22,3	22,3	83,8	16,5	16,5	62,2	
Threaded rod	R90		R120				
Steel zinc plated; detailed materials see Table A7.1, part No 2 1)	N <sub>Rk,s,fi,90</sub> [kN]	V <sub>Rk,s,fi,90</sub> [kN]	M <sup>0</sup> <sub>Rk,s,fi,90</sub> [Nm]	N <sub>Rk,s,fi,120</sub> [kN]	V <sub>Rk,s,fi,120</sub> [kN]	M <sup>0</sup> Rk,s,fi,120 [Nm]	
3/8"	1,1	1,1	1,4	0,8	0,8	0,9	
1/2"	2,3	2,3	3,7	1,3	1,3	2,2	
5/8"	3,6	3,6	7,5	2,2	2,2	4,5	
3/4"	4,7	4,7	11,7	3,4	3,4	8,6	
7/8"	6,5	6,5	19,0	4,7	4,7	13,9	
1"	8,5	8,5	28,6	6,2	6,2	20,9	
 1 1/8"	10,7	10,7	40,5	7,9	7,9	29,6	
Threaded rod	, .	R30		R60			
Stainless steel R; detailed materials	N <sub>Rk,s,fi,30</sub>	V <sub>Rk,s,fi,30</sub>	M <sup>0</sup> Rk,s,fi,30	N <sub>Rk,s,fi,60</sub>	V <sub>Rk,s,fi,60</sub>	M <sup>0</sup> Rk,s,fi,60	
see Table A7.1, part No 2	[kN]	[kN]	[Nm]	[kN]	[kN]	[Nm]	
3/8"	1,1	1,1	1,4	0,9	0,9	1,1	
1/2"	2,7	2,7	4,4	2,2	2,2	3,7	
5/8"	4,3	4,3	8,9	3,6	3,6	7,4	
3/4"	6,4	6,4	16,1	5,4	5,4	13,4	
7/8"	8,9	8,9	26,1	7,4	7,4	21,7	
1"	11,7	11,7	39,2	9,7	9,7	32,6	
1 1/8"	14,7	14,7	55,4	12,3	12,3	46,2	
Threaded rod	R90		R120				
Stainless steel R; detailed materials	N <sub>Rk,s,fi,90</sub>	V <sub>Rk,s,fi,90</sub>	M <sup>0</sup> Rk,s,fi,90	N <sub>Rk,s,fi,120</sub>	V <sub>Rk,s,fi,120</sub>	<b>M</b> <sup>0</sup> Rk,s,fi,120	
see Table A7.1, part No 2	[kN]	[kN]	[Nm]	[kN]	[kN]	[Nm]	
3/8"	0,7	0,7	0,9	0,6	0,6	0,7	
1/2"	1,8	1,8	2,9	1,4	1,4	2,3	
5/8"	2,9	2,9	5,9	2,3	2,3	4,7	
3/4"	4,3	4,3	10,7	3,4	3,4	8,5	
7/8"	5,9	5,9	17,4	4,7	4,7	13,9	
1"	7,8	7,8	26,1	6,2	6,2	20,9	
		CONTROL CO.	the second discount	10 March 20	200 (600	100000000000000000000000000000000000000	

<sup>1)</sup> No performance assessed for ASTM F1554 Grade 36.

fischer injection system FIS EM Plus	
Performance Fire resistance to steel failure under tension and shear loading for fractional Threaded rods	Annex C50 Appendix 76 / 77

# Characteristic bond resistance for cracked concrete under fire conditions for metric and fractional Anchor rods and Threaded rods in hammer drilled holes with standard drill bit or hollow drill bit

The characteristic bond resistance for cracked concrete under fire conditions for a given temperature  $\tau_{Rkfl}(\theta)$  has to be calculated by the following equation:

$$\tau_{Rk,fi}(\theta) = k_{fi,p}(\theta) \cdot \tau_{Rk,cr,C20/25}$$

θ = Temperature in °C in the mortar layer

τ<sub>Rk,fi</sub>(θ) = Characteristic bond resistance for cracked concrete under fire exposure for a given temperature in N/mm² for concrete classes C20/25 to C50/60

 $k_{\text{fi.p}}(\theta)$  = Reduction factor under fire conditions

τ<sub>Rk,cr,C20/25</sub> = Characteristic bond resistance for cracked concrete C20/25 in N/mm²,

given in Table C5.1, Table C6.1, Table C26.1 or Table C28.1, respectively

Anchor rods or

If: θ > 21 °C

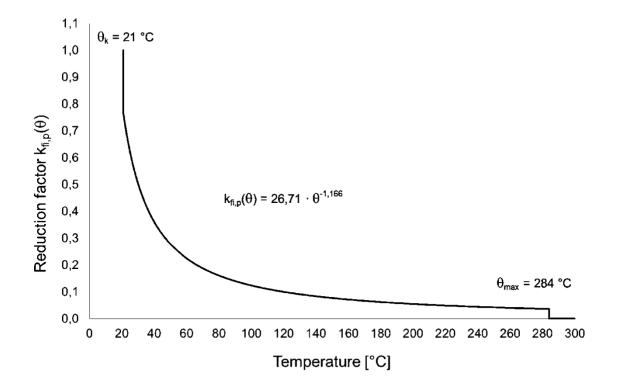
 $k_{fi,p}(\theta) = 26,71 \cdot \theta^{-1,166} \le 1,0$ 

see Figure C51.1

Threaded rods If:  $\theta > \theta_{\text{max}} = 284 \, ^{\circ}\text{C}$ 

 $\mathbf{k}_{\mathrm{fi,p}}(\mathbf{\theta}) = \mathbf{0}$ 

Figure C51.1: Graph of reduction factor  $k_{\text{fi,p}}$  ( $\theta$ ) for Anchor rods or Threaded rods



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#### Performance

Characteristic bond resistance under fire conditions for anchor rods and threaded rods

Annex C51

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