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European Technical Assessment Body for construction products



European Technical Assessment

ETA-17/0979 of 22 April 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the **European Technical Assessment:**

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

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

This version replaces

Deutsches Institut für Bautechnik

fischer Injection System FIS EM PLUS

Bonded fasteners and bonded expansion fasteners for use in concrete

fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen **DEUTSCHLAND**

fischerwerke

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

EAD 330499-02-0601, Edition 12/2023

ETA-17/0979 issued on 17 June 2020

Z43971.24

European Technical Assessment ETA-17/0979

English translation prepared by DIBt



Page 2 of 79 | 22 April 2024

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Z43971.24 8.06.01-188/23



Page 3 of 79 | 22 April 2024

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

Z43971.24 8.06.01-188/23

European Technical Assessment ETA-17/0979

English translation prepared by DIBt



Page 4 of 79 | 22 April 2024

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

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

The system to be applied is: 1

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

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

Issued in Berlin on 22 April 2024 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock Head of Section beglaubigt: Stiller

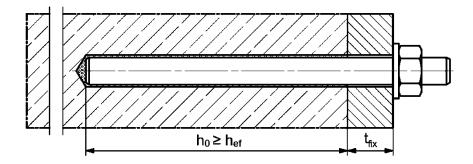
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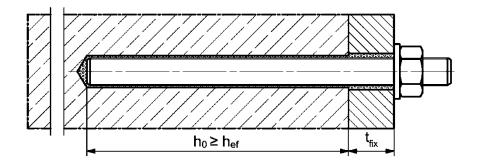
Installation conditions part 1

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

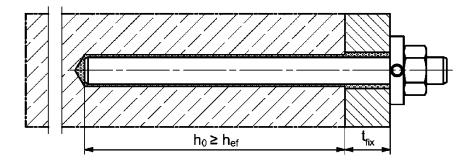
Pre-positioned installation



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

h₀ = drill hole depth

hef = effective embedment depth

 t_{fix} = thickness of fixture

fischer injection system FIS EM Plus

Product description

Installation conditions part 1

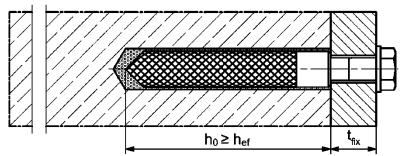
Annex A1



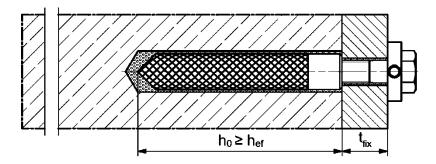
Installation conditions part 2

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

hef = effective embedment depth

 t_{fix} = thickness of fixture

fischer injection system FIS EM Plus

Product description

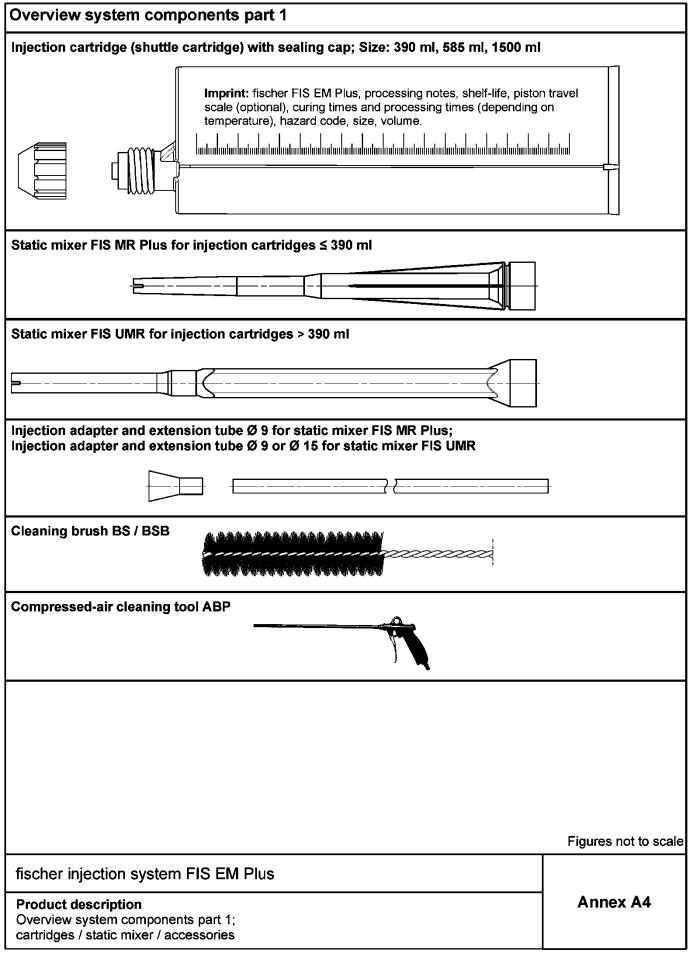
Installation conditions part 2

Annex A2



Installation conditions part 3 Reinforcing bar h₀ ≥ h_{ef} 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 = effective embedment depth h_{ef} overall fastener embedment depth in the t_{fix} = thickness of fixture $\mathbf{h}_{\mathsf{nom}}$ concrete fischer injection system FIS EM Plus Annex A3 **Product description** Installation conditions part 3







Overview system components part 2

Anchor rod / Threaded rod

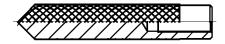
Metric size: M8, M10, M12, M14, M16, M20, M22, M24, M27, M30

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

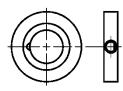








fischer filling disc with injection adapter

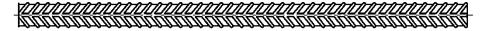




Reinforcing bar

Nominal diameter:

Metric size: \$\ddot 8, \ddot 10, \ddot 12, \ddot 14, \ddot 16, \ddot 18, \ddot 20, \ddot 22, \ddot 24, \ddot 25, \ddot 26, \ddot 28, \ddot 30, \ddot 32, \ddot 34, \ddot 36, \ddot 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

fischer injection system FIS EM Plus

Product description

Overview system components part 2; steel components

Annex A5



Tabl	Table A6.1: Materials, metric sizes										
Part	Designation		Material								
1	Injection cartridge		Mortar, hardener, filler								
		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	acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 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 N/mm ² A ₅ > 12 % fracture elongation ¹⁾	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} ≤ 1000 N/mm ²	Property class 50, 70 or 80; EN ISO 3506-1:2020 or property class HCR 70 with f_{yk} = 560 N/mm ² ; 1.4565;1.4529; EN 10088-1:2014 $f_{uk} \le 1000 \text{ N/mm}^2$ As > 12 % fracture elongation ¹⁾							
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	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	Property class 70 EN 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 A ₅ > 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 ₅ > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2014 A ₅ > 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 I according to EN 1992-1-1/NA; f	B or C with fyk and k according to	NDP or NCI							
9	according to EN 1992-1-1/NA; fuk = fit = k · fyk (A5 > 12 %) ¹⁾ Rebar part: Bars and de-coiled rods class B or C with fyk and k according to NDP or NCI acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015										
¹⁾ F	racture elongation	$A_5 > 8$ %, for applications withou	it requirements for seismic perfo	rmance category C1 or C2							
Proc	her injection system the highest description periods, metric sizes	Annex A6									



Tabl	e A7.1: M	aterials, fractional sizes		
Part	Designation	Mat	erial	
1	Injection cartridge	Mortar, har		
		Steel	Stainle	ss steel R
	Steel grade	zinc plated (zp, hdg)		e class CRC III acc. to : 2006+A1:2015
2	Fractional Threaded rod	$\begin{array}{c} \text{ASTM F568M-07, Class } 5.8 \\ \text{f}_{uk} = 500 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \text{ASTM F1554-20, Grade } 36 \\ \text{f}_{uk} = 400 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \text{ASTM F1554-20, Grade } 55 \\ \text{f}_{uk} = 517 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm; EN ISO } 4042:2022 \\ \text{ASTM F1554-20, Grade } 105 \\ \text{f}_{uk} = 862 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \text{ASTM A193/A193M-23, Grade B7} \\ \text{f}_{uk} = 862 \text{ N/mm}^2, A_5 > 12 \text{ % fracture elongation}^{1)}; \\ \text{zinc plated} \geq 5 \text{ µm, EN ISO } 4042:2022 \\ \end{array}$	$\begin{array}{c} f_{uk} = 689 \text{ N/mm}^2, \\ f_{uk} = 586 \text{ N/mm}^2, \\ A_5 > 12 \% \text{ frac} \\ ASTM A193/A193M-2 \\ f_{uk} = 517 \text{ N/mm}^2, A_5 > 1 \\ ASTM A193/A193M-2 \\ f_{uk} = 655 \text{ N/mm}^2, A_5 > 1 \\ \end{array}$	Bae1, Alloy Group 2 f _{uk} , ≤ 5/8 in. (CW1) f _{uk} , ≥ 3/4 in. (CW2) ture elongation ¹⁾ ; 23, Grade B8M, Class 1 2 % fracture elongation ¹⁾ ; 3, Grade B8M, Class 2B 12 % fracture elongation ¹⁾
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	40M-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	for Threade ASTM F593M-13 ASTM A193/A19 for Threade ASTM A193/A193M-2	Bae1, Alloy Group 2 d rod material: ae1, Alloy Group 2 / 93M-23, Grade 8M d rod material: 23, Grade B8M, Class 1 or 3, Grade B8M, Class 2B
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; 8; 1.4571; 1.4439; 1.4362; 88-1:2014
6	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 EN 100	1404; 1.4578; 1439; 1.4362; 88-1:2014
8	Reinforcing bar	ASTM A615/A615M-22 (ASTM A767/A767M-19) Grade 40, f_{uk} = 414 N/mm², f_{yk} = 276 N/mm², A_5 : Grade 60, f_{uk} = 621 N/mm², f_{yk} = 414 N/mm², A_5 : Grade 75, f_{uk} = 689 N/mm², f_{yk} = 517 N/mm², A_5 : Grade 60, f_{uk} = 552 N/mm², f_{yk} = 414 N/mm², A_5 : Grade 80, f_{uk} = 689 N/mm², f_{yk} = 552 N/mm², A_5 : Grade 80, A_5 : A_5	12 % fracture elongati12 % fracture elongati12 % fracture elongati12 % fracture elongati	on ¹⁾ on ¹⁾ on ¹⁾
¹⁾ F	racture elongatio	in A_5 > 8 %, for applications without requirements	for seismic performanc	e category C1 or C2
fisch	ner injection s	system FIS EM Plus		
	duct description erials, fractional			Annex A7



Anchorages subject	to				FIS EI	VI Plus	with			
,			Anchor rod / fischer RG M I Reinforcing to Threaded rod					par fischer FRA		
		==				HERRITA				
Hammer drilling with standard drill bit	***************************************					izes				
Hammer drilling with hollow drill bit		(fiso	cher "FHD", H	12	Nominal drill b 2 mm to 35 mr 'Duster Expert'	n; 7/16	5" to 1 3/8"	ean"; H	lilti "TE-CD,	
		`			D",DreBo "D-P	lus", D				
Diamond drilling				1	all s	izes				
Static and quasi	Metric sizes	M8 to M30	Annexes: C1, C4 – C6, C17	M8 to M20	Annexes: C2, C4, C7, C8, C17	ф8 to ф40	Annexes: C3, C4, C9 – C13 C18	M12 to M24	Annexes: C3, C4, C14 – C16, C18	
uncracked / cracked concrete	Fractional sizes	3/8" to 1 1/8"	Annexes: C19, C20, C24 – C28, C35	3/8" to 3/4"	Annexes: C21, C22, C24, C29 – C31, C35	#3 to #10	Annexes: C23, C24, C32 – C34, C36		_1)	
Seismic performance category (only hammer	C1	M10 to M30 3/8" to 1 1/8"	Annexes: C37, C39, C40 Annexes: C43, C45, C46	φ 1 φ * 1			Annexes: C38, C39, C41 Annexes: C44, C45, C47	_1)		
drilling with standard / hollow drill bits)	C2	M12 M16 M20 M24	Annexes: C38, C39, C42				_1)			
11	dry or wet concrete	all \$17 6 \$								
use ————————————————————————————————————	water filled hole				all s itted for diamo ed concrete ar					
Installation direction		D:	3 (downward		orizontal and ι			ead) in	stallation)	
Installation temperate	ure		for the s		T _{i,min} = -5 °C to rd variation of			nstallati	ion	
Resistance to fire			Annexes: :48 – C51		_1)		_1)		_1)	
	Temperature range l		0 °C to +40 °0	C	(max. short te max. long ter					
In-service temperature	Temperature range II	-4	0 °C to +60 °	С	(max. short te max. long ter					
	Temperature range III	-4	0 °C to +72 °(0	(max. short te max. long ter					
1) no performance	assessed.				-					
fischer injection	system FIS	EM P	lus							
Intended use								Δn	nex B1	



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:

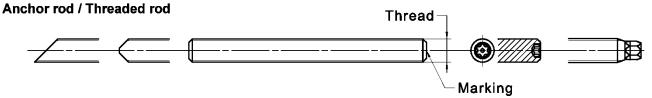
- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Fastening depth should be marked and adhered to installation.
- Overhead installation is allowed (necessary equipment see installation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

fischer injection system FIS EM Plus	
Intended use Specifications part 2	Annex B2
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Table B3.1:	Table B3.1: Installation parameters for metric Anchor rods / Threaded rods																				
Anchor rods / Ti	readed rods			М8	M10	M12	M14	M16	M20	M22	M24	M27	M30								
Nominal drill hole	diameter	d ₀		10	12	14	16	18	22 24 ¹⁾	25	28	30	35								
Drill hole depth h₀							h₀≥	h _{ef}													
Effective		h _{ef, min}		60	60	70	75	80	90	93	96	108	120								
embedment dept	h	h _{ef, max}	[mm]	160	200	240	280	320	400	440	480	540	600								
Diameter of the	pre-positioned installation	d _f		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	9	12	14	16	18	22	24	26	30	33
clearance hole of the fixture	push through installation	d _f		12	14	16	18	20	26	28	30	33	40								
Minimum thickness of concrete member		h _{min}			h _{ef} + 30	כ			h	lef + 20	lo										
Maximum installa	tion torque	max T _{inst}	[Nm]	10	20	40	50	60	120	135	150	200	300								

¹⁾ Both drill hole diameters can be used.



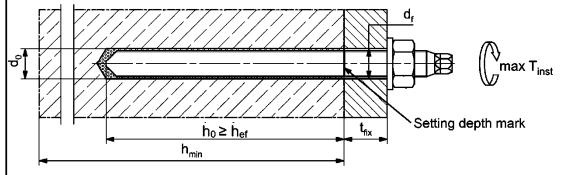
Marking (on random place) anchor rod:

Steel zinc plated PC ¹⁾ 8.8	• or +	Steel hot-dip PC ¹⁾ 8.8	•
High corrosion resistant steel HCR PC1) 50	•	High corrosion resistant steel HCR PC ¹⁾ 70	-
High corrosion resistant steel HCR PC1) 80	(Stainless steel R property class 50	١
Stainless steel R property class 80	*		

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

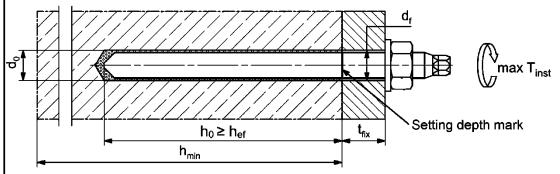


Table B4.1:	Table B4.1: Installation parameters for fractional Threaded rods										
Threaded rods				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	
Nominal drill hale	diameter	d₀	[mm]	11,1	14,3	19,1	22,2	25,4	28,6	31,8	
Nominal drill hole diameter		u ₀	[inch]	7/16	9/16	3/4	7/8	1	1 1/8	1 1/4	
Drill hole depth		h ₀	h ₀ ≥ h _{ef}								
Effective		h _{ef, min}		60,0	70,0	79,0	89,0	89,0	102,0	178,0	
embedment dept	th	h _{ef, max}		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	d _f		11,9	14,0	16,0	18,0	20,1	25,9	27,9	
Minimum thickness of concrete member		h _{min}		h _{ef} -	+ 30			h _{ef} + 20	d ₀		
Maximum installa	ation torque	max T _{inst}	[Nm]	18	41	60	107	136	173	180	

¹⁾ 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.

Figures not to scale

fischer injection system FIS EM Plus

Intended use
Installation parameters Threaded rods (fractional size)

Annex B4



Table B5.1: Minimum sp metric reinf	_		nimur	n edge	e dista	nce fo	r metr	ric An	chor r	ods a	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				-			-				-
Uncracked / cracked concrete	C _{min}	[mm]	40	45	45	45	50	55	55	55	60
Minimum spacing	Smin	funui				accordi	ng to Ar	nnex B7	7		70
Minimum spacing									v,		
Uncracked / cracked concrete	Smin	[200.00]	40	45	55	60	65	85	85	95	105
Minimum edge distance	C _{min}	[mm]	,	2	3	accordi	ng to Ar	nnex B7	7	2	10
Required projecting area											
Uncracked concrete	_ ^	[1000	8	13	21,5	23	24	38,5	38,5	39,5	40
Cracked concrete	- A _{sp,req}	mm²]	6,5	10	16,5	17,5	18,5	29,5	29,5	30	30,5
Anabannada					8407		8420				
Anchor rods			-	-	M27	-	M30	-	-	-	-
Reinforcing bars (nominal diam	eter)	ф	25	26	-	28	30	32	34	36	40
Minimum edge distance	-		7.	7.5	7.5	- 00		400	400	405	475
Uncracked / cracked concrete	Cmin	[mm]	75	75	75	80	80	120	120	135	175
Minimum spacing	Smin					accordi	ng to Ai	nnex B	<u> </u>		
Minimum spacing	122	Í	100	400	400	4.40	440	400	400	400	400
Uncracked / cracked concrete	Smin	[mm]	120	120	120	140	140	160	160	160	160
Minimum edge distance	Cmin				-	accordi	ng to Ar	nnex B7			
Required projecting area											
Uncracked concrete	- A _{sp,req}	[1000	47,5	47,5	47,5	64	64	64	64	64	64
Cracked concrete		mm²]	36,5	36,5	36,5	49	49	49	49	49	49

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

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

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

A_{sp,req} = required projecting area

A_{sp,t} = effective projecting area (according to **Annex B7**)

fischer injection system FIS EM Plus	
Intended use Minimum spacing and edge distance for Anchor rods and reinforcing bars	Annex B5



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	C _{min}	[mm]	45	45	50	55	60	75	80	120			
Minimum spacing	Smin	[mm]	according to Annex B7										
Minimum spacing													
Uncracked / cracked concrete	S _{min}	[mm]	45	60	65	85	105	120	140	160			
Minimum edge distance	Cmin	[mm]	according to Annex B7										
Required projecting area													
Uncracked concrete	_ ^	[1000	12,5	21,0	24,5	36,0	39,5	43,5	40,5	64,5			
Cracked concrete	- A _{sp,req}	mm²]	9,5	16,0	18,5	27,5	30,0	33,5	31,0	49,5			

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

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

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

A_{sp,req} = required projecting area

A_{sp,t} = effective projecting area (according to **Annex B7**)

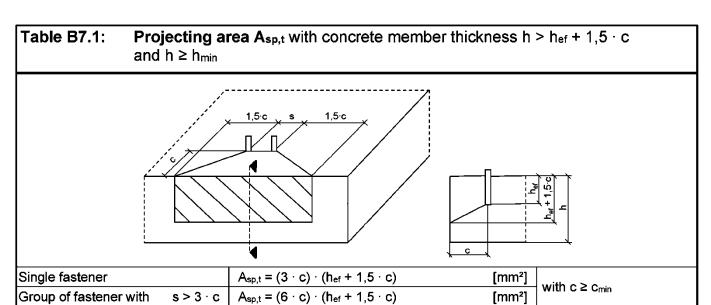
fischer injection system FIS EM Plus	
Intended use Minimum spacing and edge distance for Anchor rods and reinforcing bars	Annex B6

Group of fastener with



[mm²]

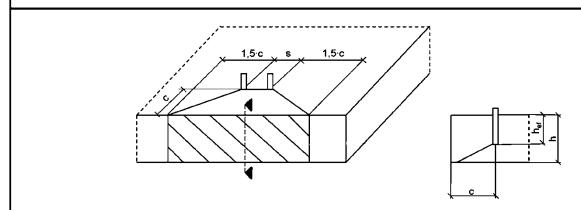
with $c \ge c_{min}$ and $s \ge s_{min}$



 $A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1, 5 \cdot c)$

Table B7.2: Projecting area $A_{sp,t}$ with concrete member thickness $h \le h_{ef} + 1,5 \cdot c$ and $h \ge h_{min}$

s ≤ 3 · c



Single anchor		A _{sp,t} = 3 · c · existing h	[mm²]	with c ≥ c _{min}
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 ≥ c _{min} and s ≥ s _{min}

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

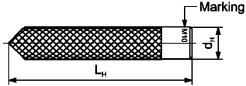
Figures not to scale

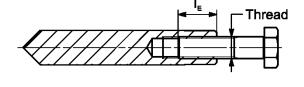
fischer injection system FIS EM Plus	
Intended use Minimum thickness of concrete member for Anchor rods / Threaded rods, minimum spacing and edge distance	Annex B7



Table B8.1: Installation	on param	eters fo	or metric f	ischer 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	d ₀		14	18	24	32							
Drill hole depth	h ₀		$h_0 \ge h_{ef} = L_H$										
Effective embedment depth $(h_{ef} = L_H)$	h _{ef}		90	90	125	160	200						
Minimum spacing and minimum edge distance	Smin = Cmin	[mm]	55	65	75	95	125						
Diameter of clearance hole in the fixture	d _f		9	12	14	18	22						
Minimum thickness of concrete member	h _{min}		120	125	165	205	260						
Maximum screw-in depth	I _{E,max}] [18	23	26	35	45						
Minimum screw-in depth	I _{E,min}] [8	10	12	16	20						
Maximum installation torque	max T _{inst}	[Nm]	10	20	40	80	120						







Marking:

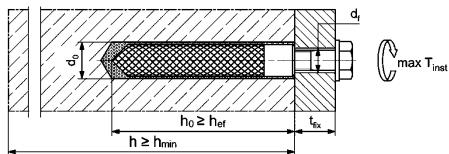
Anchor size e. g.: M10

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:



Figures not to scale

fischer injection system FIS EM Plus

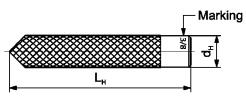
Intended use
Installation parameters internal threaded anchors RG M I (metric size)

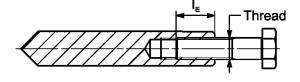
Annex B8



Table B9.1: Installation	on parame	eters fo	or fractional f	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	Al.	[mm]	18	20	24	32
liameter do		[inch]	3/4	13/16	1	1 1/4
Drill hole depth	h₀			h₀ ≥ h	_{ef} = L _H	
Effective embedment depth (hef = LH)	h _{ef}		90	125	160	200
Minimum spacing and minimum edge distance	S _{min} = C _{min}		65	75	95	125
Diameter of clearance hole in the fixture	df	[mm]	12	14	18	22
Minimum thickness of concrete member	h _{min}		125	165	205	260
Maximum screw-in depth	I _{E,max}		23	26	35	45
Minimum screw-in depth	I _{E,min}		10	12	16	20
Maximum installation torque	max T _{inst}	[Nm]	20	40	80	120

fischer RG M I



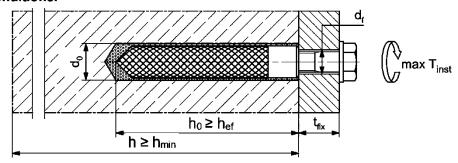


Marking: Anchor size e. g.: M 3/8

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:



Figures not to scale

fischer injection system FIS EM Plus

Intended use
Installation parameters internal threaded anchors RG M I (fractional size)

Annex B9



Table B10.1: Installation	param	eters f	or me f	ric re	infore	ing ba	ars ¹⁾					
Nominal diameter of the bar		ф	8 ²⁾	10 ²⁾	12 ²⁾	14	16	18	20	22	24	
Nominal drill hole diameter	d 0		10 12	12 14	14 16	18	20	25	25	30	30	
Drill hole depth	h ₀			h₀ ≥ h _{ef}								
Effective	h _{ef,min}	[mm]	60	60	70	75	80	85	90	94	98	
embedment depth	h _{ef,max}	וויייין	160	200	240	280	320	360	400	440	480	
Minimum thickness of concrete member	h _{min}		he	h _{ef} + 30 h _{ef} + 2d ₀								
						_						
Nominal diameter of the bar		ф	25	26	28	30	32	34	36	40	-	
Nominal drill hole diameter	d o		30	35	35	40	40	40	45	55	-	
Drill hole depth	h₀						h₀ ≥ hef					
Effective	h _{ef,min}	[mm]	100	104	112	120	128	136	144	160	-	
embedment depth	h _{ef,max}	[[,,,,,,,]	500	520	560	600	640	680	720	800	-	
Minimum thickness of concrete member	h _{min}			•		•	h _{ef} + 2d)				

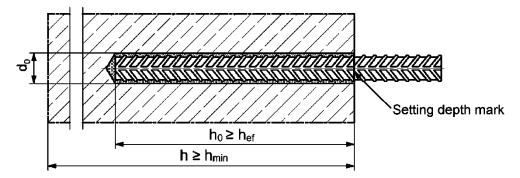
¹⁾ Detailed calculation according to Annex B7.

Reinforcing bar



- The minimum value of related rib area f_{R,min} must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range: 0,05 · φ ≤ h_{rib} ≤ 0,07 · φ
 (φ = Nominal diameter of the bar, h_{rib} = rib height)

Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use
Installation parameters reinforcing bars (metric size)

Annex B10

²⁾ Both drill hole diameters can be used.



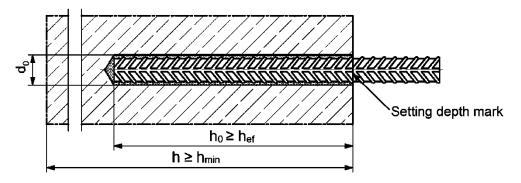
Table B11.1: Installatio	n param	eters f	or frac	tional ı	reinfor	cing b	ars ¹⁾					
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10		
Nominal drill hole diameter	ا م	[mm]	12,7	15,9	19,1	22,2	28,6	31,8	34,9	38,1		
	d₀	[inch]	1/2	5/8	3/4	7/8	1 1/8	1 1/4	1 3/8	1 1/2		
Drill hole depth		h₀ ≥ hef										
Effective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

¹⁾ 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:



Figures not to scale

fischer injection system FIS EM Plus

Intended use
Installation parameters reinforcing bars (fractional size)

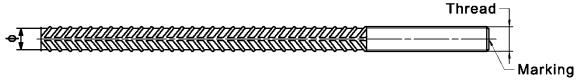
Annex B11



fischer FRA	٦	Thread	M1	2 ¹⁾	M16	M20	M24			
Nominal diameter of the bar	ф		1	2	16	20	25			
Nominal drill hole diameter	d₀		14 16		20	25	30			
Drill hole depth	h₀				h _{ef} + l _e	= h _{nom}				
Effective embedment death	h _{ef,min}		7	0	80	90	96			
Effective embedment depth	h _{ef,max}		14	1 0	220	300	380			
Distance concrete surface to welded joint	le		100							
Minimum spacing and minimum edge distance	S _{min} = C _{min}	[mm]	55		65	85	105			
Diameter of anchorage	≤ d _f		1	4	18	22	26			
clearance hole in the fixture push through anchorage	≤ d _f		1	8	22	26	32			
Minimum thickness of concrete member	h _{min}		h₀ +	- 30		h ₀ + 2d ₀				
Maximum installation torque	max T _{inst}	[Nm]	4	0	60	120	150			

¹⁾ Both drill hole diameters can be used.

fischer FRA

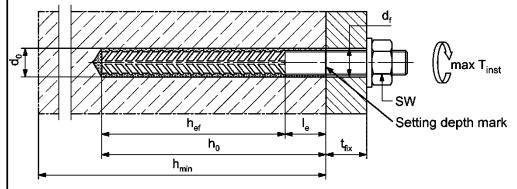


Marking frontal e.g.:

FRA (for stainless steel R)

> FRA HCR (for high corrosion resistant steel HCR)

Installation conditions:



Figures not to scale

Intended use Installation parameters fischer FRA (metric size)

Annex B12



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	لم	[mm]	10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
hole diameter	d ₀	[inch]	-	7/16	1/2	5/8	3/4	13/16		1	1 1/8	1 1/4 1 3/8		1 1/2	-	-	
Steel brush diameter BS	dь	[mm]	11	14	16	2	0	25	26	27	30		40		-	-	-
Steel brush diameter BSB	dь	[mm]	-	-	-	-		-	-	-	-	-			42	47	58

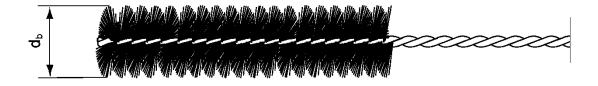


Table B13.2: Conditions for use static mixer without an extension tube

Nominal drill hole diameter	d₀	[mm]	10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
		[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		•
Drill hole depth h₀ by using	FIS MR Plus	[mm]	\	≤ 90 ≤ 120 ≤ 140 ≤ 150 ≤ 160 ≤ 190 ≤ 210													
	FIS UMR	[mm]	,	=	≤ 90	≤ 160	≤ 180	≤ 190	≤ 2	20	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 _{work}	Minimum curing time ¹⁾ t _{cure}				
-5 to 0 ²⁾	240 min	200 h				
> 0 to 5 ²⁾	150 min	90 h				
> 5 to 10	120 min	40 h				
> 10 to 20	30 min	18 h				
> 20 to 30	14 min	10 h				
> 30 to 40	7 min	5 h				

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

²⁾ Minimal cartridge temperature +5 °C.

fischer injection system FIS EM Plus	
Intended use	Annex B13
Cleaning brush (steel brush)	
Processing time and curing time	

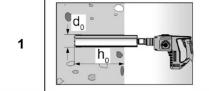


Installation instructions part 1 Drilling and cleaning the hole (hammer drilling with standard drill bit) Drill the hole. Nominal drill hole diameter do and drill hole depth ho 1 see Tables B3.1, B4.1, B8.1, B9.1, B10.1, B11.1, B12.1. Cleaning the drill hole: 2 Blow out the drill hole twice, with oil 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: 4 Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar). Go to step 6 Drilling and cleaning the hole (hammer drilling with hollow drill bit) Check a suitable hollow drill (see **Table B1.1**) 1 for correct operation of the dust extraction. Use a suitable dust extraction system, e. g. 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 Annex B14 Intended use Installation instructions part 1

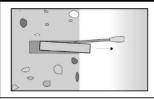


Installation instructions part 2

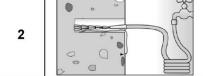
Drilling and cleaning the hole (wet drilling with diamond drill bit)



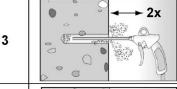
Drill the hole.
Drill hole diameter d₀ and nominal drill hole depth h₀ see Tables B3.1, B4.1, B8.1, B9.1, B10.1, B11.1, B12.1.



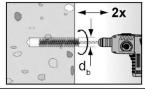
Break the drill core and remove it



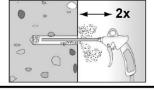
Flush the drill hole with clean water until it flows clear



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



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

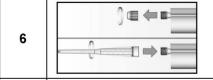


Blow out the drill hole twice, using oil-free compressed air (p > 6 bar)

Preparing the cartridge

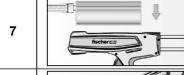
4

5



Remove the sealing cap

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





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

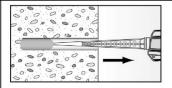
Installation instructions part 2

Annex B15



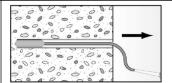
Installation instructions part 3

Injection of the mortar



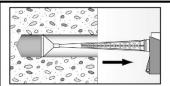
9

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**

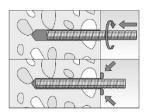
For deeper drill holes, than those mentioned in **Table B13.2**, use a suitable extension tube.

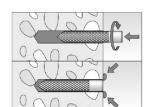


For overhead installation, deep holes ($h_0 > 250$ mm) or drill hole diameter ($d_0 \ge 30$ mm / 1 1/8") use an injection-adapter.

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

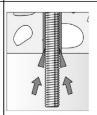
10



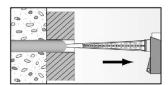


Only use clean and oil-free metal parts. Mark the setting depth of the metal parts. Push the anchor rod, threaded rod or fischer RG M I anchor down to the bottom of the hole, turning it slightly while doing so.

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



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



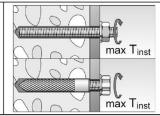
For push through installation fill the annular gap with mortar.

11



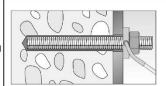
Wait for the specified curing time t_{cure} see **Table B13.3**.

12



Mounting the fixture max T_{inst} 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_{fix} (usable length of the anchor).

fischer injection system FIS EM Plus

Intended use

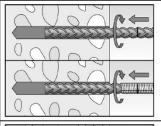
Installation instructions part 3

Annex B16



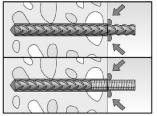
Installation instructions part 4

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



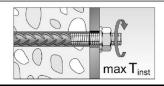
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole. If not, pull out the anchor element immediately and reinject mortar.

11



Wait for the specified curing time t_{cure} see Table B13.3.

12



Mounting the fixture max T_{inst} see **Table B12.1**.

fischer injection system FIS EM Plus

Intended use

Installation instructions part 4

Annex B17



											2000		Messile					
Tab						e to steel eaded ro		re un	der te	ensior	n / she	ear lo	ading	of				
Anch	or rod / Threaded ro	d			M8	M10	M12	M14	M16	M20	M22	M24	M27	M30				
Chara	acteristic resistance	to s	stee	l failu	re under t	ension loa	ding ³⁾											
(0			4.8	r		23,2(21,4)		46,0	62,8	98,0	121,2	141,2	183,6	224,4				
istic N _{RK,s}	Steel zinc plated	class	5.8			29,0(26,8)	42,1	57,5	78,5	100//		176,5	229,5	280,5				
Characteristic esistance N _{RK}	•	y C	8.8		29,2(26,5)	46,4(42,8)	67,4	92,0	125,6	196,0	242,4	282,4	367,2	448,8				
aracter stance	Stainless steel R	Property	50	[kN]	18,3	29,0	42,1	57,5	78,5	122,5	151,5	176,5	229,5	280,5				
Cha	and high corrosion	Jo.	70	ĺ	25,6	40,6	59,0	80,5	109,9	171,5	212,1	247,1	321,3	392,7				
و ت	resistant steel HCR	п	80		29,2	46,4	67,4	92,0	125,6	196,0	242,4	282,4	367,2	448,8				
Partia	al factors 1)																	
			4.8						1,50									
호	Steel zinc plated	ass	5.8			1,50												
fac s, r		S C	8.8			1,50												
Partial factor	Stainless steel R	ert	50	[-]					2,86									
Par	and high corrosion	Property class	70				1,8	37 / fisc	cher H	CR: 1	,50							
	resistant steel HCR	п	80						1,60									
Chara	acteristic resistance	to	stee	l failu	re under s	hear loadi	ng³)											
	ut lever arm																	
ø			4.8		8,7(7,9)	13,9(12,8)	20,2	27,6	37,6	58,8	72,7	84,7	110,1	134,6				
Characteristic	Steel zinc plated	Property class	5.8		10,9(9,9)	17,4(16,0)		34,5	47,1	73,5	90,9	105,9	137,7	168,3				
e te		C	8.8			23,2(21,4)		46,0	62,8	98,0	121,2	141,2	183,6	224,4				
Sharacter sistance	Stainless steel R	ert	50	[kN]	9,1	14,5	21,0	28,7	39,2	61,2	75,7	88,2	114,7	140,2				
ha Sist	and high corrosion	rop	70		12,8	20,3	29,5	40,2	54,9	85,7	106,0	123,5	160,6	196,3				
ق م	resistant steel HCR	П	80		14,6	23,2	33,7	46,0	62,8	98,0	121,2	141,2	183,6	224,4				
Ductili	ity factor		k ₇	[-]					1,0					***				
with I	ever arm																	
s			4.8		14,9(12,9)	29,9(26,5)	52,3	83,5	132,9	259,6	357,1	448,8	665,7	899,5				
it. M ^o rk,s	Steel zinc plated	class	5.8		18,7(16,1)	37,3(33,2)	65,4	104,4	166,2	324,6	446,4	561,0	832,2	1124,4				
		S C	8.8	[N.L]	29,9(25,9)	59,8(53,1)	104,6	167,0	265,9	519,3	714,2	897,6	1331,5	1799,0				
Charact. sistance M	Stainless steel R	Property	50	[Nm]	18,7	37,3	65,4	104,4	166,2	324,6	446,4	561,0	832,2	1124,4				
Sist	and high corrosion	ιğ	70		26,2	52,3	91,5	146,1	232,6	454,4	624,9	785,4	1165,0	1574,1				
ě	resistant steel HCR	п	80		29,9	59,8	104,6	167,0	265,9	519,3	714,2	897,6	1331,5	1799,0				
Partia	al factors 1)																	
			4.8						1,25									
ģ	Steel zinc plated	Property class	5.8						1,25									
Partial factor		S	8.8						1,25									
tial X	Stainless steel R	bert	50	[-]					2,38									
Par	and high corrosion	rop	70				1,5	6 / fisc	her H	CR: 1,:	25 ²⁾							
10-0	resistant steel HCR	ш	80						1,33									
2) C 3) V	n absence of other nat only admissible for hig alues in brackets are hreaded rods accordi	h co vali	orros d for	ion re unde	esist. steel lersized thre	aded rods	with sr							sed				
fisc	her injection syste	m I	FIS	EM I	Plus													
Cha	formance racteristic resistance ric Anchor rods / Thre				e under ten	sion / shea	r loadi	ng of				An	nex C	:1				



Characteristic resistar Characteristic resistance with NRk,s screw Partial factors 1) Partial factors γMs,N	Property class Property class Property class	5.8 R-70 / HCR-70	5.8 8.8 R-70 / commercial standard HCR-70	g [kN]	18,3 29,2	29,0 46,4	42,1	78,3		
resistance with N _{Rk,s} screw Partial factors ¹⁾	Property class Property	R-70 /	8.8 R-70 / commercial standard	[kN]	29,2		42,1	78.3	20 10 21 02	
resistance with N _{Rk,s} screw Partial factors ¹⁾	Property class Property	R-70 /	R-70 / commercial standard	[kN]		46.4		10,5	122,4	
Partial factors ¹⁾	Class		standard	[kN]		.0, .	67,4	106,7	180,2	
Doubled Contains	Property	TICK-70	HCR-70	[kN]	25,6	40,6	59,0	109,6	171,3	
Doubled Contains	15 5				25,6	40,6	59,0	109,6	171,3	
Partial factors γ _{Ms,N}	15 5									
Partial factors γ _{Ms,N}	class	5.8	5.8				1,50			
Partial factors γ _{Ms,N}		3.0	8.8				1,50			
	Property class	R-70 / HCR-70	R-70/ commercial standard	[-]	1,87					
	Class	TICIX-70	HCR-70				1,50			
Characteristic resistar	ice to steel t	failure un	der shear loading							
Without lever arm	,									
	Property	5.8	5.8		10,9	17,4	25,2	47,1	73,5	
Characteristic	class	0.0	8.8		14,6	23,2	33,7	62,8	98,0	
resistance with V ⁰ _{Rk,s} screw	Property class	R-70 / HCR-70	R-70 / commercial standard	[kN]	12,8	20,3	29,5	54,9	85,7	
		1101070	HCR-70		12,8	20,3	29,5	54,9	85,7	
Ductility factor			k 7	[-]			1,0			
With lever arm										
	Property	5.8	5.8		18,7	37,3	65,4	166,2	324,6	
Characteristic resistance with M ⁰ _{Rks}	class	,	8.8	[NIma]	29,9	59,8	104,6	265,9	519,3	
resistance with M ⁰ _{Rk,s} screw	Property class	R-70/ HCR-70	R-70 / commercial standard	[Nm]	26,2	52,3	91,5	232,6	454,4	
	Octobra Mesoc e es Co		HCR-70		26,2	52,3	91,5	232,6	454,4	
Partial factors ¹⁾	95001 W		5.0				4.05			
	Property class	5.8	5.8				1,25			
Partial factors	Class		8.8	.,			1,25			
		R-70 / HCR-70	R-70 / commercial standard	[-]	1,56					
			HCR-70				1,25			

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

Characteristic resistance



 $1,2 \cdot W_{el} \cdot f_{uk}^{1)}$

Table C3.1: Character metric rei				teel fai	ilure 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 s	teel failure	unde	er tensio	n loadi	ng						
Characteristic resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}^{1}$								
Characteristic resistance to s	teel failure	unde	er shear	loading	<u> </u>						
Without lever arm											
Characteristic resistance	$V^0_{Rk,s}$	[kN]				k ₆ ²⁾ ⋅ A	∖s · f _{uk} 1)				

Ductility factor [-] 1,0 With lever arm

- M⁰Rk,s [Nm] fuk respectively shall be taken from the specifications of the reinforcing bar.
- 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/mm² < f_{uk} ≤ 1000 N/mm²,
 - = 0,5 for fasteners made of stainless steel.

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

						T
fischer FRA			M12	M16	M20	M24
Characteristic resistance to	steel failure	unde	r tension loadi	ng		
Characteristic resistance	N _{Rk,s}	[kN]	62,1	110,5	172,7	263,0
Partial factor ¹⁾						
Partial factor	γMs,N	[-]		1,	40	
Characteristic resistance to	steel failure	unde	r shear loading	l		
Without lever arm						
Characteristic resistance	$V^0_{Rk,s}$	[kN]	33,7	62,8	98,0	141,2
Ductility factor	k ₇	[-]		1	,0	
With lever arm						
Characteristic resistance	M^0 Rk,s	[Nm]	104,8	266,3	519,2	898,0
Partial factor ¹⁾						
Partial factor	γMs,V	[-]		1,	25	

¹⁾ In absence of other national regulations.

fischer injection system FIS EM Plus Annex C3 Performance Characteristic resistance to steel failure under tension / shear loading of metric reinforcing bars and metric fischer FRA



Size										ΑII	siz	es					
Tension loading																	
Installation factor	γinst	[-]					See	ann	ex (25 to	C1	16. C	40 and	C4	1		
Factors for the compressive strer			rete	> C2	20/2							, .					
C25/30											1,02	2					
C20/27											1,04						
Increasing factor ψ_c for cracked or uncracked C35/45											1,06						
concrete C40/50	Ψ_{c}	[-]									1,07						
$\tau_{Rk(X,Y)} = \psi_c \cdot \tau_{Rk(C20/25)}$ C45/55											1,08	3					
C50/60											1,09)					
Splitting failure																	
h / h _{ef} ≥ 2,0										1	,0 h	lef					
Edge distance $2,0 > h / h_{ef} > 1,3$	C _{cr,sp}	[mm]							4	1,6 h	lef -	1,8 h					
h / h _{ef} ≤ 1,3		[[[[[]]								2,	26 ł	h _{ef}					
Spacing	S _{cr,sp}			2 C _{cr,sp}													
Concrete cone failure																	
Uncracked concrete	k ucr,N	[-]									11,0)					
Cracked concrete	k cr,N		7,7 1,5 h _{ef}														
Edge distance	C _{cr,N}	[mm]								1	,5 h	lef					
Spacing	Scr,N	[]								2	Ccr,	,N					
Factors for sustained tension loa	ding																
Temperature range			24 °C / 40 °C 35 °C / 60 °C 50 °C / 72 °C						°C								
Factor	ψ^{0}_{sus}				0,7	7				(0,60)			(0,48	
Factor	J ⁰ sus,100				0,7	7				(0,60)			(0,71	
Shear loading																	
Installation factor	γinst	[-]									1,0						
Concrete pry-out failure																	
Factor for pry-out failure	k 8	[-]									2,0						
Concrete edge failure																	
Effective length of fastener for shear loading	l _f	[mm]										2 d _{no} nax (m) 8 d _{nom} ;	300	mr	n))	
Effective diameter of the fastener	d _{nom}	10															
Size			M	8 1	M10	N	/ 112	M	14	M16	3 N	M20	M22	M2	4	M27	МЗС
Anchor rods and Threaded rods	d _{nom}		8		10		12	1.	4	16		20	22	24	ı	27	30
fischer RG M I	d_{nom}	[mm]	12	2 '	15,7	2	18	_1)	22		28	_1)	_1))	_1)	_1)
fischer FRA	d _{nom}		_1)	_1)		12	_1)	16		20	_1)	25	5	_1)	_1)
Size (nominal diameter of the bar)		ф	8	10	12	14	16	18	20	22	24	25	26 28	30	32	34	36 4
Reinforcing bar	d _{nom}	[mm]	8	10	12	14	16	18	20	22	24	25	26 28	30	32	34	36 4
1) Anchor type not part of the asse	ssmer	ıt.											'				
fischer injection system FIS I	EM PI	us															
Performance Characteristic resistance for concr	ete fail	ure un	der t	ensi	on /	she	ear I	oad	ina					Ar	nne	ex C	1



Table C	5.1: Characte	ristic	resistar	ice to	coml	oined	pull-	out a	nd co	ncret	e fail	u re fo	r
	metric Aı	nchor	rods an	d Thr	eade	d rods	s in ha	amme	er or d				
Anchorre	uncracke od / Threaded rod	ea or c	гаскеа	M8 ¹⁾	M10	MOTKI M12			M20	M22	M24	M27	M30
	d pull-out and concre	te cone	failure	IVIO "	IVITO	IVIIZ	10114	IVIIO	IVIZU	IVIZZ	IVI Z4	IVIZI	IVISU
	n diameter	d d	[mm]	8	10	12	14	16	20	22	24	27	30
	d concrete												
	ristic bond resistance	in unc	racked co	ncrete	C20/25	5							
Hammer-c	drilling with standard dr	ill bit or	hollow drill	bit (dr	or we	concre	ete)						
Tem-	I: 24 °C / 40 °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	$\tau_{\text{Rk},\text{ucr}}$	[N/mm ²]		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
	drilling with standard dr	ill bit or	<u>hollow drill</u>	T									
Tem-	l: 24 °C / 40 °C		27	20,8	19,7	18,8	17,9	16,9	15,3	14,4	13,8	13,2	12,3
perature	II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]		16,0	15,0	13,0	13,0	11,0	11,0	10,0	10,0	9,0
range	III: 50 °C / 72 °C		:4141	15,0	14,0	14,0	13,0	12,0	11,0	10,0	10,0	9,0	9,0
	on factors; Hammer-d	rilling v	vith stand	ard dri	ii bit or	nollov	v ariii i		0				
Dry or wet Water fille		γinst	[-]	-					,0 ,4				
	a noie drilling (dry or wet cond	rete)							,↔				
Tem-	I: 24 °C / 40 °C	<u> </u>		16,0	15,0	13,5	12,8	12,4	11,6	11,3	10,9	10,5	10,3
perature	II: 35 °C / 60 °C	T	[N/mm ²]		15,0	13,0	12,0	12,0	10,0	10,0	10,0	9,0	9,0
range	III: 50 °C / 72 °C	$ au_{Rk,ucr}$	[]	15,0	14,0	12,0	11,0	11,0	10,0	9,0	9,0	8,0	8,0
	drilling (water filled hole	9)		10,0	1 1,0	12,0	11,0	11,0	10,0	0,0	0,0	0,0	0,0
Tem-	I: 24 °C / 40 °C	<u>- , </u>		16,0	16,8	15,5	14,3	13,6	12,0	11,5	10,9	10,3	9,9
perature	II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]		15,0	13,0	12,0	12,0	10,0	10,0	10,0	9,0	9,0
range	III: 50 °C / 72 °C	VIXK, GCI		15,0	14,0	12,0	11,0	11,0	10,0	9,0	9,0	8,0	8,0
	on factors; Diamond-o	drilling											
Dry or wet			F 3					1	,0				
Water fille	d hole	γinst	[-]					1	,4				
Cracked of													
	ristic bond resistance												
	drilling with standard dr	ill bit or	<u>hollow drill</u>			1077-2013/2013/2013/2013/2013/2013/2013/2013/							
Tem-	I: 24 °C / 40 °C			7,7	9,0	10,1	8,5	9,5	8,5	8,5	8,5	8,5	8,5
perature	II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	7,7	9,0	10,1	8,5	9,5	8,5	8,5	8,5	8,5	8,5
range	III: 50 °C / 72 °C			7,2	8,5	9,5	8,5	8,9	8,5	8,5	8,5	8,5	8,5
	drilling with standard dr	ill bit or	hollow drill				7.0	7 7	0.0	0.0		0.0	0.0
Tem-	l: 24 °C / 40 °C		[N1/mamma2]	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	$ au_{Rk,cr}$	[N/mm ²]		7,7	8,7	7,0	7,7	6,0	6,0	6,0	6,0	6,0
range	III: 50 °C / 72 °C on factors; Hammer-d	rillina :-	gith stand	6,2	7,3	8,1	7,0	7,3	6,0	6,0	6,0	6,0	6,0
Dry or wet		rinnig W		aru uri	וו טונ טו	HOHOV	v umili l		,0				
Water fille		γ inst	[-]			1,2		<u></u>	,,,		1,4		
	drilling (dry or wet cond	rete)	1			1,4					т,-т		
Tem-	I: 24 °C / 40 °C			7,0	7,0	7,0	7,0	6,0	6,0	7,0	7,0	7,0	7,0
perature	II: 35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	7,0	7,0	7,0	7,0	6,0	6,0	7,0	7,0	7,0	7,0
range	III: 50 °C / 72 °C	V KK,CI	[7,0	7,0	7,0	7,0	6,0	6,0	7,0	7,0	7,0	7,0
	drilling (water filled hole	<u>e)</u>			. , -							, ,-	
Tem-	I: 24 °C / 40 °C	-		6,0	7,5	7,5	7,0	6,0	6,0	6,0	6,0	6,0	6,0
perature	II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	6,0	7,5	7,5	7,0	6,0	6,0	6,0	6,0	6,0	6,0
range	III: 50 °C / 72 °C			6,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	6,0	6,0
	on factors; Diamond-o	drilling											
Dry or wet		\\·	[-]					1	,0				
Water fille		γinst	[-]			1,2					1,4		
1) Not a	llowed for hollow drill	bit.											
fischer	injection system F	IS EN	1 Plus										
	nance eristic resistance to co d rods; working life 50		d pull-out a	and co	ncrete	failure	for And	hor ro	ds and		Ann	ex C	5



Table C6.1: Charact						•						10000
metric /										nd dril	led ho	oles;
uncracl	ked or c	racked										
Anchor rod / Threaded rod			M8 ¹⁾	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pull-out and conc	rete cone	failure								,		
Calculation diameter	d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked concrete												
Characteristic bond resistan	ce in unci	acked co	ncrete	C20/25	5							
Hammer-drilling with standard	drill bit or I	nollow drill	bit (dry	or wet	concre	ete)						
Tem- <u>I: 24 °C / 40 °C</u>			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	$\tau_{\text{Rk,100,ucr}}$	[N/mm ²]	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		<u> </u>	9,9	10,2	10,2	10,4	10,4	9,8	9,1	9,1	9,1	8,5
Hammer-drilling with standard	drill bit or i	<u>nollow drill</u>					40.0	10.5	44.0	44.0	40.0	40.4
Tem- 1: 24 °C / 40 °C		[N1/2]	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	$ au_{ m Rk,100,ucr}$	[N/mm ²]	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 6,5	7,5 6,5	7,5 5,9	6,8 5,9
range III: 50 °C / 72 °C Installation factors; Hammer	drilling	ith stand:						1,2	0,5	0,5	5,9	5,9
Dry or wet concrete	-urilling w	Turstand	aru urii	i bit oi	HOHOV	w uriii i		0				
Water filled hole	γinst	[-]						,0 ,4				
	noroto\							,=				
<u>Diamond-drilling (dry or wet co</u> Tem- I: 24 °C / 40 °C	<u>ncrete)</u>		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	~	[N/mm ²]	12,0	11,3	9,8	9,0	9,0	7,5	7,5	7,5	6,8	6,8
range III: 50 °C / 72 °C	Rk,100,ucr	ן וואיווווון	8,3	8,4	7,2	7,2	7,2	6,5	5,9	5,9	5,2	5,2
Diamond-drilling (water filled he	ole)		0,0	0,1	,,_	,,_	, <u>-</u>	0,0	0,0	0,0	0,2	0,2
Tem- I: 24 °C / 40 °C	<u>0107</u>		12,0	13,8	12,7	11,7	11,2	10,0	9,4	8,9	8,4	8,1
	$ au_{Rk,100,ucr}$	[N/mm ²]	12,0	11,3	9,8	9,0	9,0	7,5	7,5	7,5	6,8	6,8
range III: 50 °C / 72 °C	V RK, 100,dCl		8,3	8,4	7,2	7,2	7,2	6,5	5,9	5,9	5,2	5,2
Installation factors		•										
Dry or wet concrete							1	,0				
Water filled hole	— γinst	[-]						4				
Cracked concrete												
Characteristic bond resistan	ce in crac	ked conc	rete C2	0/25								
Hammer-drilling with standard	drill bit or l	nollow drill	bit (dry	or wet	concre	ete)						
Tem- I: 24 °C / 40 °C			5,7	7,0	7,6	7,4	7,2	6,9	6,8	6,7	6,5	6,3
perature II: 35 °C / 60 °C	$ au_{Rk,100,cr}$	[N/mm ²]	5,7	7,0	7,6	7,4	7,2	6,9	6,8	6,7	6,5	6,3
range III: 50 °C / 72 °C			5,4	6,6	7,2	7,0	6,8	6,4	6,4	6,3	6,1	6,0
Hammer-drilling with standard	drill bit or I	nollow drill	_									
Tem- <u>I: 24 °C / 40 °C</u>			4,9	6,0	6,5	6,1	5,9	4,9	4,8	4,7	4,6	4,4
perature II: 35 °C / 60 °C	$ au_{\text{Rk,100,cr}}$	[N/mm ²]	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	اللوام	ith stand	4,6	5,7	6,1	5,7	5,5	4,5	4,5	4,4	4,3	4,3
Installation factors; Hammer	-urilling W	iui standa	aru ürli	ו טונ סו	HOHOV	w uriii k		^				
Dry or wet concrete Water filled hole	γinst	[-]			4.0		1	,0		1 1		
	RI				1,2					1,4		
Diamond-drilling (dry or wet co	<u>ncrete)</u>		4.0	6.0	E C	4.0	2.0	2.0	4.0	4.0	4.0	4.0
Tem- perature I: 24 °C / 40 °C II: 35 °C / 60 °C	_	[N/mm ²]	4,2 4,2	6,0	5,6 5,6	4,6 4,6	3,9	3,9 3,9	4,6 4,6	4,6 4,6	4,6 4,6	4,6
range III: 50 °C / 72 °C	$ au_{ ext{Rk,100,cr}}$	[[N/11111-]	4,2	6,0 6,0	5,6	4,6	3,9	3,9	4,6	4,6	4,6	4,6 4,6
Installation factors			→ ,∠	0,0	J J,U	-1 ,∪	5,9	٥,٣	_ +,∪	_+,∪	-1 ,∪	-1 ,∪
Dry or wet concrete	7/in-1	[-]					1	,0				
	γinst	[[-]					- '	,,,				
1) Not allowed for hollow dr	III DIT.											
fischer injection system	FIS EN	l Plus										
Performance Characteristic resistance to Threaded rods in hammer of								ds and		Ann	ex C	6



					out and co		u re for
Without the Committee of the Committee o				or diamond working lif	drilled hole	S,	
fischer RG M I	ved of c	Tackeu	M8	M10	M12	M16	M20
Combined pull-out and conc	rete cone	failure	IVIO	IVITO	IVITZ	IVITO	IVIZU
Calculation diameter	d	[mm]	12	15,7	18	22	28
Uncracked concrete				,			
Characteristic bond resistan							
Hammer-drilling with standard	drill bit or	hollow drill					
Tem- <u>I: 24 °C / 40 °C</u>			18,8	17,6	17,0	16,2	15,3
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	15,0	14,0	14,0	13,0	12,0
range III: 50 °C / 72 °C			14,0	13,0	13,0	12,0	11,0
Hammer-drilling with standard	drill bit or	hollow drill			450	440	40.0
Tem- 1: 24 °C / 40 °C		[N.1/21	18,8	16,9	15,8	14,3	12,8
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	14,0	12,0	12,0	11,0	10,0
range III: 50 °C / 72 °C Installation factors; Hammer	drilling	rith atand	13,0	12,0	11,0	10,0	9,0
Dry or wet concrete	-urilling w	Tilli Stallu	ard drill bit of	nonow drin	1,0		
Water filled hole	γ inst	[-]			1,4		
Diamond-drilling (dry or wet co	ncrete)				1,7		
Tem- I: 24 °C / 40 °C	noroto ₁		13,3	12,3	11,9	11,2	10,4
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	13,0	12,0	11,0	10,0	9,0
range III: 50 °C / 72 °C	€ KK, UCT		12,0	11,0	10,0	9,0	8,0
Diamond-drilling (water filled he	ole)			,-			-,-
Tem- I: 24 °C / 40 °C			15,1	13,6	12,6	11,4	10,2
perature II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	13,0	12,0	11,0	10,0	9,0
range III: 50 °C / 72 °C	Trix, doi		12,0	11,0	10,0	9,0	8,0
Installation factors; Diamond	d-drilling						
Dry or wet concrete	- 0/: .	r 1			1,0		
Water filled hole	— γinst	[-]			1,4		
Cracked concrete							
Characteristic bond resistan							
Hammer-drilling with standard	drill bit or	hollow drill				7.0	7.0
Tem- 1: 24 °C / 40 °C		[N1/21	7,0	6,0	6,0	7,0	7,0
perature II: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	7,0 7,0	6,0	6,0	7,0	7,0
range III: 50 °C / 72 °C Hammer-drilling with standard	drill bit or	hallow drill		6,0	6,0	7,0	7,0
Tem- 1: 24 °C / 40 °C	uriii bit oi		7,0	6,5	6,0	6,0	6,0
	1.00	[N/mm ²]					
range II: 35 °C / 60 °C range III: 50 °C / 72 °C	$ au_{Rk,cr}$	[14/11111]	7,0 7,0	6,5 6,0	6,0 6,0	6,0 6,0	6,0 6,0
Installation factors; Hammer	-drilling w	⊥ ⁄ith stand:				0,0	0,0
Dry or wet concrete	arming v				1,0		
Water filled hole	γ inst	[-]		1,2	.,0	1	,4
Diamond-drilling (dry or wet co	ncrete)	1		- ,-			
Tem- I: 24 °C / 40 °C			7,0	6,0	6,0	7,0	7,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	7,0	6,0	6,0	7,0	7,0
range III: 50 °C / 72 °C	3 1 111,01		7,0	6,0	6,0	7,0	7,0
Diamond-drilling (water filled he	ole)			200		=	
Tem- <u>I: 24 °C / 40 °C</u>			7,0	6,5	6,0	6,0	6,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	7,0	6,5	6,0	6,0	6,0
range III: 50 °C / 72 °C			7,0	6,0	6,0	6,0	6,0
Installation factors; Diamond	l-drilling				-		
Dry or wet concrete	— γinst	[-]			1,0		
Water filled hole	Luist	LJ		1,2		1	,4
fischer injection system	FIS EM	1 Plus				Ann	ex C7
Performance Characteristic resistance to working life 50 years	combined	d pull-out a	and concrete	failure for fisc	her RG M I;	Aiiii	GA U/



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

fischer 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
Uncracked concrete	130		0.450		O Principal	20 5 70	9.0,000
Characteristic bond resistar	nce in unc	racked co	ncrete C20/25	5			
Hammer-drilling with standard							
Tem- I: 24 °C / 40 °C	a dilli bit or		15,4	14,4	14,0	13,3	12,6
perature II: 35 °C / 60 °C	_ τ _{Rk,100,ucr}	[N/mm ²]	11,3	10,5	10,5	9,8	9,0
range III: 50 °C / 72 °C	_ C RK, 100,ucr	[7,7	7,8	7,8	7,8	7,2
Hammer-drilling with standard	d drill bit or	hollow drill				,	,
Tem- I: 24 °C / 40 °C			15,4	13,9	13,0	11,7	10,5
	_ τ _{Rk,100,ucr}	[N/mm ²]	10,5	9,0	9,0	8,3	7,5
range III: 50 °C / 72 °C			7,2	7,2	6,6	6,5	5,9
Installation factors; Hamme	r-drilling v	vith stand	ard drill bit or	hollow drill b	oit		
Dry or wet concrete	Manager for	F 1			1,0		
Water filled hole	- γinst	[-]			1,4		
Diamond-drilling (dry or wet c	oncrete)						
Tem- I: 24 °C / 40 °C			10,9	10,1	9,8	9,2	8,6
perature II: 35 °C / 60 °C	_ τ _{Rk,100,ucr}	[N/mm ²]	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
<u>Diamond-drilling (water filled l</u>	hole)						
Tem- <u>I: 24 °C / 40 °C</u>	_		12,5	11,2	10,3	9,3	8,4
perature II: 35 °C / 60 °C	_ τ _{Rk,100,ucr}	[N/mm ²]	9,8	9,0	8,3	7,5	6,8
range III: 50 °C / 72 °C	- W- W		6,6	6,6	6,0	5,9	5,2
Installation factors; Diamon	d-drilling	T					
Dry or wet concrete		[-]			1,0		
Water filled hole	γinst	[-]			1,4		
Cracked concrete							
Characteristic bond resistai	nce in crac	ked conc	rete C20/25				
Hammer-drilling with standard	d drill bit or	hollow drill	bit (dry or wet	t concrete)			
Tem- <u>I: 24 °C / 40 °C</u>	_		4,2	5,1	4,8	4,6	4,6
perature II: 35 °C / 60 °C	_ τ _{Rk,100,cr}	[N/mm ²]	4,2	5,1	4,8	4,6	4,6
range III: 50 °C / 72 °C	24 - Dani, e500000 - Dan 19990		4,2	5,1	4,8	4,6	4,6
Hammer-drilling with standard	d drill bit or	hollow drill					
Tem- I: 24 °C / 40 °C	_		4,2	5,5	4,8	3,9	3,9
perature II: 35 °C / 60 °C	$_{-}$ $ au_{ m Rk,100,cr}$	[N/mm ²]	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
Installation factors; Hamme	r-drilling v	vith stand	ard drill bit or	hollow drill b			
Dry or wet concrete	- γinst	[-]			1,0		
Water filled hole		L J		1,2		1	,4
Diamond-drilling (dry or wet c	oncrete)			2			_
Tem- I: 24 °C / 40 °C			4,2	5,1	4,8	4,6	4,6
perature II: 35 °C / 60 °C	_ TRk,100,cr	[N/mm ²]	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
Installation factors; Diamon Dry or wet concrete	d-drilling		Г				
	γinst	[-]	I		1,0		

fischer injection system FIS EM Plus

Performance

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

Annex C8



Table C9.1: Characteristic resistance to combined pull-out and concrete failure for metric reinforcing bars in hammer or diamond drilled holes;												
								drilled	holes	3;		
unc	racke	ed con	crete; w	orkin/	g life 5	50 yea	ırs					
Nominal diameter of the	bar		ф	8 ¹⁾	10	12	14	16	18	20	22	24
Combined pull-out and	concre	te cone	failure									
Calculation diameter		d	[mm]	8	10	12	14	16	18	20	22	24
Uncracked concrete												
Characteristic bond res	istance	in unc	racked co	ncrete (C20/25							
Hammer-drilling with stan	dard dr	ill bit or	hollow drill	bit (dry	or wet c	oncrete	<u>e)</u>			- 1-		
Tem I: 24 °C / ·	40 °C			16,0	16,8	16,1	15,5	15,0	14,6	14,2	14,0	13,6
perature II: 35 °C /	60 °C	$ au_{Rk,ucr}$	[N/mm ²]	16,0	15,0	15,0	14,0	14,0	13,0	13,0	13,0	12,0
range III: 50 °C /	72 °C	%		15,0	14,0	14,0	13,0	13,0	12,0	12,0	12,0	12,0
Hammer-drilling with stan	dard dr	ill bit or	hollow drill	bit (wat	er filled	hole)						
Tem- I: 24 °C / 4	40 °C			16,0	16,8	16,1	14,9	14,4	13,4	13,0	12,1	11,8
perature II: 35 °C /	60 °C	$ au_{Rk,ucr}$	[N/mm ²]	16,0	16,0	14,0	13,0	12,0	12,0	11,0	11,0	10,0
range III: 50 °C /				15,0	14,0	13,0	12,0	12,0	11,0	11,0	10,0	10,0
Installation factors; Har	nmer-d	rilling w	vith stand	ard drill	bit or h	ollow	rill bit					
Dry or wet concrete								1,0				
Water filled hole		γinst	[-]					1,4				
Diamond-drilling (dry or w	et cond	crete as	well as wa	ter filled	hole)							
Tem- I: 24 °C / •				16,0	15,0	13,0	12,0	12,0	11,0	10,0	10,0	10,0
perature II: 35 °C /		$ au_{Rk,ucr}$	[N/mm ²]	16,0	15,0	13,0	12,0	12,0	11,0	10,0	10,0	10,0
range III: 50 °C /		C RK, ucr	[]	15,0	14,0	12,0	11,0	11,0	10,0	10,0	9,0	9,0
Installation factors; Dia		drillina		1	,	, , , , ,			, ,	,		1
Dry or wet concrete								1,0				
Water filled hole		- γinst	[-]					1,4				
Nominal diameter of the	har		Ф	25	26	28	30		2 ¹⁾	34 ¹⁾	36 ¹⁾	40 ¹⁾
Combined pull-out and	C-1940-C-104V	te cone					1 00		_	U-T		
Calculation diameter	0011010	d	[mm]	25	26	28	30	0 :	32	34	36	40
Uncracked concrete												
Uncracked concrete Characteristic bond res	istance	in unc				1 20						
Characteristic bond res			racked co	ncrete (C20/25							
	dard dr		racked co	ncrete (C20/25 or wet c	concrete	2)	,9 1	2,7	12,5	12,4	
Characteristic bond res Hammer-drilling with stan	dard dr 40 °C	ill bit or	racked co	ncrete (C20/25		e) 1 12		2,7	12,5 11,0	12,4 11,0	12,1 11,0
Characteristic bond res Hammer-drilling with stan Tem- I: 24 °C / 4	dard dr 40 °C 60 °C		racked co	ncrete (bit (dry	020/25 or wet o	concrete 13,	e) 1 12 0 12	,0 1				12,1
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / 6	dard dr 40 °C 60 °C 72 °C	ill bit or τ _{Rk,ucr}	racked co hollow drill [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0	020/25 or wet o 13,3 12,0 11,0	13, 12,0	e) 1 12 0 12	,0 1	2,0	11,0	11,0	12,1 11,0
Characteristic bond res Hammer-drilling with stan Tem- I: 24 °C / / perature II: 35 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- I: 24 °C / /	dard dr 40 °C 60 °C 72 °C dard dr 40 °C	ill bit or τ _{Rk,ucr}	racked co hollow drill [N/mm²] hollow drill	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5	020/25 or wet of 13,3 12,0 11,0 er filled 11,4	13, 12,0	e) 1 12 0 12 0 11	,0 1 ,0 1 ,5 1	2,0 1,0	11,0 11,0 9,0	11,0 10,0	12,1 11,0 10,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 24 °C / / perature II: 35 °C / /	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C	ill bit or τ _{Rk,ucr}	racked co hollow drill [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0	020/25 or wet of 13,3 12,0 11,0 er filled 11,4 10,0	13,7 12,0 11,0 hole)	2) 1 12 0 12 0 11 6 10 0 9,	,0 1 ,0 1 ,5 1 0 9	2,0 1,0 0,3 0,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 24 °C / / perature II: 35 °C / / range III: 50 °C / /	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C	TRK,UCT	racked co hollow drill [N/mm²] hollow drill [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0	020/25 or wet of 13,3 12,0 11,0 er filled 11,4 10,0 9,0	13,7 12,0 11,0 hole) 10,6 9,0	2) 1 12 0 12 0 11 6 10 0 9,	,0 1 ,0 1 ,5 1 0 9	2,0 1,0	11,0 11,0 9,0	11,0 10,0	12,1 11,0 10,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 24 °C / / perature II: 35 °C / / range III: 50 °C / / Installation factors; Har	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C	TRK,UCT	racked co hollow drill [N/mm²] hollow drill [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0	020/25 or wet of 13,3 12,0 11,0 er filled 11,4 10,0 9,0	13,7 12,0 11,0 hole) 10,6 9,0	2) 1 12 0 12 0 11 6 10 0 9,	,0 1 ,0 1 ,5 1 0 9	2,0 1,0 0,3 0,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Tem- I: 24 °C / / perature II: 35 °C / / Hammer-drilling with stan Tem- I: 24 °C / / perature II: 35 °C / / perature II: 35 °C / / Installation factors; Ham Dry or wet concrete	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C	TRK, UCT TRK, UCT TRK, UCT	racked co hollow drill [N/mm²] hollow drill [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0	020/25 or wet of 13,3 12,0 11,0 er filled 11,4 10,0 9,0	13,7 12,0 11,0 hole) 10,6 9,0	2) 1 12 0 12 0 11 6 10 0 9,	,0 1 ,0 1 ,5 1 0 9 0 8	2,0 1,0 0,3 0,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Temperature II: 24 °C / / perature III: 50 °C / / Hammer-drilling with stan Temperature II: 24 °C / / perature II: 35 °C / / perature III: 50 °C / / Installation factors; Ham Dry or wet concrete Water filled hole	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d	ill bit or τ _{Rk,ucr} ill bit or τ _{Rk,ucr} rilling w	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill	020/25 or wet of 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7 12,0 11,0 hole) 10,6 9,0	2) 1 12 0 12 0 11 6 10 0 9,	,0 1 ,0 1 ,5 1 0 9	2,0 1,0 0,3 0,0	11,0 11,0 9,0 9,0	11,0 10,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / range III: 50 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet)	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d	ill bit or τ _{Rk,ucr} ill bit or τ _{Rk,ucr} rilling w	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill	220/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	e) 1 12 0 12 0 11 6 10 0 9, 1 9,	,0 1 ,0 1 ,5 1 0 9 0 8 1,0	2,0 1,0 0,3 0,0 3,0	9,0 9,0 8,0	8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- I: 24 °C / / IIII	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d	till bit or τ _{Rk,ucr} till bit or τ _{Rk,ucr} rilling w γinst crete as	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled	220/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0	9,0 9,0 8,0	8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / perature III: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- perature II: 24 °C / / perature III: 35 °C / /	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C	ill bit or τ _{Rk,ucr} ill bit or τ _{Rk,ucr} rilling w	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled 9,0 9,0	C20/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0	9,0 9,0 8,0 8,0 8,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- perature II: 24 °C / / perature II: 35 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- perature II: 35 °C / / range III: 50 °C / /	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C	till bit or TRk,ucr till bit or TRk,ucr rilling w γinst crete as TRk,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled	220/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0	9,0 9,0 8,0	8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / perature III: 50 °C / / Hammer-drilling with stan Tem- perature III: 35 °C / / perature III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- perature II: 35 °C / / perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet) III: 50 °C / / Installation factors; Diamond-drilling (dry or wet)	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C	till bit or TRk,ucr till bit or TRk,ucr rilling w γinst crete as TRk,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled 9,0 9,0	C20/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 8 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0	9,0 9,0 8,0 8,0 8,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / perature II: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or w Tem- perature II: 35 °C / / perature II: 35 °C / / perature II: 35 °C / / Installation factors; Dia Dry or wet concrete	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C	till bit or TRk,ucr till bit or TRk,ucr rilling w γinst crete as TRk,ucr	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled 9,0 9,0	C20/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0	9,0 9,0 8,0 8,0 8,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- perature II: 24 °C / / perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet) Tem- perature II: 24 °C / / perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet) Tem- perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet)	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C mond-c	till bit or TRk,ucr till bit or TRk,ucr rilling w γinst Crete as TRk,ucr drilling γinst	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled 9,0 9,0	C20/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 8 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0	9,0 9,0 8,0 8,0 8,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / perature II: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or w Tem- perature II: 35 °C / / perature II: 35 °C / / perature II: 35 °C / / Installation factors; Dia Dry or wet concrete	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C mond-c	till bit or TRk,ucr till bit or TRk,ucr rilling w γinst Crete as TRk,ucr drilling γinst	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled 9,0 9,0	C20/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0	9,0 9,0 8,0 8,0 8,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0
Characteristic bond res Hammer-drilling with stan Tem- perature II: 24 °C / / range III: 50 °C / / Hammer-drilling with stan Tem- perature II: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or wet) Tem- perature II: 24 °C / / perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet) Tem- perature II: 24 °C / / perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet) Tem- perature III: 35 °C / / Installation factors; Diamond-drilling (dry or wet)	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 60 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C mond-o	till bit or τ _{Rk,ucr} till bit or τ _{Rk,ucr} rilling w γinst crete as τ _{Rk,ucr} drilling γinst	racked co hollow drill [N/mm²] hollow drill [N/mm²] with stand [-] well as wa [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill ter filled 9,0 9,0	C20/25 or wet c 13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7	2) 1 12 2 12 2 11 6 10 0 9, 9 9, drill bit	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0	9,0 9,0 8,0 8,0 8,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0
Characteristic bond res Hammer-drilling with stan Tem- I: 24 °C / / perature III: 35 °C / / Hammer-drilling with stan Tem- I: 24 °C / / perature III: 35 °C / / perature III: 35 °C / / range III: 50 °C / / Installation factors; Har Dry or wet concrete Water filled hole Diamond-drilling (dry or water filled hole) Diamond-drilling (dry or water filled hole) Tem- I: 24 °C / / perature III: 35 °C / / range III: 50 °C / / Installation factors; Diamond-drilling (dry or water filled hole) Tem- I: 24 °C / / perature III: 35 °C / / range III: 50 °C / / Installation factors; Diamond-drilling (dry or water filled hole)	dard dr 40 °C 60 °C 72 °C dard dr 40 °C 72 °C nmer-d vet conc 40 °C 60 °C 72 °C mond-c	till bit or τ _{Rk,ucr} till bit or τ _{Rk,ucr} rilling w γinst crete as τ _{Rk,ucr} drilling γinst bit.	racked co hollow drill [N/mm²] hollow drill [N/mm²] vith stand [-] well as wa [N/mm²]	ncrete (bit (dry 13,5 12,0 11,0 bit (wat 11,5 10,0 9,0 ard drill 9,0 9,0 9,0	13,3 12,0 11,0 er filled 11,4 10,0 9,0 bit or h	13,7 12,6 11,6 10,6	2) 1	,0 1 ,0 1 ,5 1 0 9 0 8 1,0 1,4	2,0 1,0 0,3 0,0 3,0 3,0 3,0 3,0	9,0 9,0 9,0 8,0 8,0 7,0	8,0 8,0 8,0 8,0 8,0	12,1 11,0 10,0 8,0 8,0 8,0 7,0 7,0



Nominal ul	iameter of the bar		ф	8 ¹⁾	10	12	14	16	18	20	22	24
Combined	pull-out and cond	rete co	ne failure									
Calculation	diameter	d	[mm]	8	10	12	14	16	18	20	22	24
Cracked co	oncrete											
	stic bond resistar	E/23%										
<u>Hammer-dr</u>	rilling with standard	drill bit	or hollow o									
Tem	I: 24 °C / 40 °C	0		7,0	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 ²]	7,0	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
range	III: 50 °C / 72 °C	1 201 1 27		7,0	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
	rilling with standard	drill bit o	or hollow o					0.5	0.0			
Tem- perature	I: 24 °C / 40 °C	_	[N/mm ²]	6,0	7,5	6,5	6,5	6,5	6,0	6,0	6,0	6,0
range	III: 50 °C / 72 °C	$ au_{Rk,cr}$	[[[]]]	6,0 6,0	7,5 6,5	6,5 6,5	6,5 6,0	6,5 6,0	6,0 6,0	6,0 6,0	6,0 6,0	6,0 6,0
	n factors; Hamme	-drilling	with etai		10.74.63104	0.000.000.000		5.415.60.600	0,0	6,0	0,0	0,0
		-arming	With Stai	luaru u	וווו טונ	or none	ov arm	1,0				
Ory or wet concrete Vater filled hole γin			[-]				<u> </u>	1,0			1,4	
					1,2 1,4							
Diamond-di	rilling (dry or wet co	oncrete)		7.0	7.0	7.0	7.0	C 0	C 0	C 0	7.0	7.0
Tem	I: 24 °C / 40 °C	.7	FA.17 23	7,0	7,0	7,0	7,0	6,0	6,0	6,0	7,0	7,0
perature range	II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	7,0	7,0	7,0	7,0	6,0	6,0	6,0	7,0	7,0
	III: 50 °C / 72 °C			7,0	7,0	7,0	7,0	6,0	6,0	6,0	7,0	7,0
<u>Diamond-d</u>	rilling (water filled h	<u>iole)</u>		0.00	W-W GA	200 200	200 000					
Tem	I: 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 ²]	6,0	7,5	6,5	6,5	6,5	6,0	6,0	6,0	6,0
range	III: 50 °C / 72 °C			6,0	6,5	6,5	6,0	6,0	6,0	6,0	6,0	6,0
Installatior	n factors; Diamon	d-drillin	g									
Dry or wet	concrete							1,0				
Water filled	l hole	γinst	[-]			1,	,2				1,4	
1) Not allo	owed for hollow dril	l hit										
TVOT GITC	owed for fremow drift	Dit.										

fischer injection system FIS EM Plus	
Performance Characteristic resistance to combined pull-out and concrete failure for reinforcing bars; working life 50 years part 1	Annex C10



Table C11.1: Characteristic resistance to combined pull-out and concrete failure for metric reinforcing bars in hammer or diamond drilled holes; cracked concrete; working life 50 years part 2											
Nominal diamete		2011016	ф	25	26	28	30 ¹⁾	32 ¹⁾	34 ¹⁾	36 ¹⁾	40 ¹⁾
Combined pull-or	ut and conci	ete cor	ne failure		-						
Calculation diame		d	[mm]	25	26	28	30	32	34	36	40
Cracked concrete	e										
Characteristic bo	nd resistan	ce in cr	acked coi	ncrete C	20/25						
Hammer-drilling w	ith standard	drill bit c	r hollow d	rill bit (d	ry or wet	t concret	<u>e)</u>				
Tem- 1: 2	4 °C / 40 °C			8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
6612-000-00-00	5 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
range III: 5	0 °C / 72 °C			8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
Hammer-drilling w	ith standard	drill bit c	r hollow d	rill bit (w	ater fille	d hole)					
Tem- l: 2	4 °C / 40 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
86 E STREET	5 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
range III: 5	0 °C / 72 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
Installation facto	rs; Hammer-	drilling	with star	ndard di	ill bit or	hollow	drill bit				
Dry or wet concret	te	neer w					1,	,0			
Water filled hole		γinst	[-]				1,	,4			
Diamond-drilling (d	dry or wet co	ncrete)									
Tem l: 24	4 °C / 40 °C			7,0	7,0	7,0	7,0	5,0	5,0	5,0	5,0
	5 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	7,0	7,0	7,0	7,0	5,0	5,0	5,0	5,0
range III: 5	0 °C / 72 °C			7,0	7,0	7,0	7,0	5,0	5,0	5,0	5,0
Diamond-drilling (v	water filled ho	ole)				~					
Tem- I: 2	4 °C / 40 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
	5 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
range III: 5	0 °C / 72 °C			6,0	6,0	6,0	6,0	5,0	5,0	5,0	5,0
Installation facto	rs; Diamond	-drilling	3				•				
Dry or wet concret	te						1,	,0			
Water filled hole		γinst	[-]				1,	,4			
- Vinst [-]											
fischer injection	on system F	FIS EM	1 Plus						Aı	nnex C	11

Characteristic resistance to combined pull-out and concrete failure for reinforcing bars;

working life 50 years part 2



metric	teristic reinforc	ing bars	s in ha	mmer	or diar	mond				ailure f	or
uncrac	ked con	crete; w	orkin/	g life '	100 ye	ars					
Nominal diameter of the bar	C .	ф	8 ¹⁾	10	12	14	16	18	20	22	24
Combined pull-out and cond	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	drill bit or	hollow drill	bit (dry	or wet o	concrete	2)					
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	$ au_{\text{Rk,100,ucr}}$	[N/mm ²]	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	drill bit or	hollow drill	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	τ _{Rk,100,ucr}	[N/mm ²]	12,0	12,0	10,5	9,8	9,0	9,0	8,3	8,3	7,5
range III: 50 °C / 72 °C	CRK, 100,uci	1	8,3	8,4	7,8	7,8	7,8	7,2	7,2	6,5	6,5
Installation factors; Hamme	r-drillina v	vith stand:			(C. A.C.)		0.7.5		1	1.5	
Dry or wet concrete				~ VI I			1,0				
Water filled hole	γinst	[-]					1,4				
Diamond-drilling (dry or wet co	norete ac	well as wa	ter filler	hole)			1,-				
	JIIOI ELE AS	vven as wa	12,0	11,3	9,8	9,0	9,0	8,3	7,5	7,5	7,5
	_	[N1/mm21	12,0	11,3	9,8	9,0	9,0	8,3	7,5	7,5	7,5
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	τ _{Rk,100,ucr}	[N/mm ²]								5,9	
W11011			8,3	8,4	7,2	7,2	7,2	6,5	6,5	5,9	5,9
Installation factors; Diamon	a-arilling	1									
Dry or wet concrete	γinst	[-]					1,0				
Water filled hole	a £ 000005-90	100 1001					1,4				
Nominal diameter of the bar		ф	25	26	28	30	1) 3	32 ¹⁾	34 ¹⁾	36 ¹⁾	40 ¹⁾
Combined pull-out and cond	crete cone	failure			1				т		
Calculation diameter	d	[mm]	25	26	28	30	0 :	32	34	36	40
Uncracked concrete											
		racked co	noroto	220125							
Characteristic bond resistar	THE PERSON NAMED IN COLUMN TO SERVICE AND ADDRESS OF THE PERSON NAMED IN COLUMN TO SE			STATE ACCOUNTS COME							
Hammer-drilling with standard	THE PERSON NAMED IN COLUMN TO SERVICE AND ADDRESS OF THE PERSON NAMED IN COLUMN TO SE		bit (dry	or wet o							
Hammer-drilling with standard	drill bit or	hollow drill	bit (dry 11,1	or wet o	10,8	3 10		0,5	10,3	10,1	9,9
Hammer-drilling with standard Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C	drill bit or		bit (dry 11,1 9,0	or wet of 10,9 9,0	10,8 9,0	3 10 9,	0 9	9,0	8,3	8,3	8,3
Hammer-drilling with standardTem- perature1:24 °C / 40 °CII:35 °C / 60 °CrangeIII:50 °C / 72 °C	drill bit or τ _{Rk,100,ucr}	hollow drill [N/mm²]	bit (dry 11,1 9,0 7,2	or wet of 10,9 9,0 7,2	10,8 9,0 7,2	3 10 9,	0 9				
Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard	drill bit or τ _{Rk,100,ucr}	hollow drill [N/mm²]	bit (dry 11,1 9,0 7,2 bit (wat	or wet of 10,9 9,0 7,2 er filled	10,8 9,0 7,2 hole)	3 10 9, 7,	0 9	9,0 7,2	8,3 7,2	8,3 6,5	8,3 6,5
Hammer-drilling with standard Temperature II: 24 °C / 40 °C perature III: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard Tem- II: 24 °C / 40 °C	$\frac{\text{drill bit or}}{\tau_{\text{Rk,100,ucr}}}$	hollow drill [N/mm²] hollow drill	bit (dry 11,1 9,0 7,2 bit (wat 9,4	or wet 0 10,9 9,0 7,2 er filled 9,3	10,8 9,0 7,2 hole) 8,7	3 10 9, 7,	6 8	9,0 7,2 3,5	8,3 7,2 6,8	8,3 6,5 6,0	8,3 6,5 6,0
Hammer-drilling with standard Tem- perature II: 35 °C / 60 °C range III: 50 °C / 72 °C Hammer-drilling with standard Tem- perature II: 24 °C / 40 °C perature III: 35 °C / 60 °C	drill bit or τ _{Rk,100,ucr}	hollow drill [N/mm²]	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5	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	3 10 9, 7, 8, 6,	0 9 2 7 6 8 8 6	9,0 7,2 3,5 6,8	8,3 7,2 6,8 6,8	8,3 6,5 6,0 6,0	8,3 6,5 6,0 6,0
Hammer-drilling with standard Temperature II: 24 °C / 40 °C range III: 35 °C / 60 °C range III: 50 °C / 72 °C range II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C	$\frac{\text{drill bit or}}{\tau_{\text{Rk,100,ucr}}}$	hollow drill [N/mm²] hollow drill [N/mm²]	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9	or wet of 10,9 9,0 7,2 er filled 9,3 7,5 5,9	10,8 9,0 7,2 hole) 8,7 7,5 5,9	8, 10 9, 7, 8, 6, 5,	0 9 2 7 6 8 8 6	9,0 7,2 3,5	8,3 7,2 6,8	8,3 6,5 6,0	8,3 6,5 6,0
Hammer-drilling with standard Tem-perature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange II: 50 °C / 72 °C Hammer-drilling with standard Tem-perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Hamme	$\frac{\text{drill bit or}}{\tau_{\text{Rk,100,ucr}}}$	hollow drill [N/mm²] hollow drill [N/mm²]	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9	or wet of 10,9 9,0 7,2 er filled 9,3 7,5 5,9	10,8 9,0 7,2 hole) 8,7 7,5 5,9	8, 10 9, 7, 8, 6, 5,	0 9 2 5 6 8 8 6 9 8	9,0 7,2 3,5 6,8	8,3 7,2 6,8 6,8	8,3 6,5 6,0 6,0	8,3 6,5 6,0 6,0
Hammer-drilling with standard Tem-perature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Hammer-drilling with standard Tem-perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Dry or wet concrete Tem-perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Tem-perature Tangent Tangent	$\frac{\text{drill bit or}}{\tau_{\text{Rk,100,ucr}}}$	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	or wet of 10,9 9,0 7,2 er filled 9,3 7,5 5,9	10,8 9,0 7,2 hole) 8,7 7,5 5,9	8, 10 9, 7, 8, 6, 5,	0 9 2 7 6 8 8 6 9 4	9,0 7,2 3,5 6,8	8,3 7,2 6,8 6,8	8,3 6,5 6,0 6,0	8,3 6,5 6,0 6,0
Hammer-drilling with standard Temperature II: 24 °C / 40 °C III: 35 °C / 60 °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	drill bit or τ _{Rk,100,uer} drill bit or τ _{Rk,100,uer} τ _{Rk,100,uer} r-drilling v	hollow drill [N/mm²] hollow drill [N/mm²] [N/mm²] vith stand	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill	or wet of 10,9 9,0 7,2 er filled 9,3 7,5 5,9 bit or I	10,8 9,0 7,2 hole) 8,7 7,5 5,9	8, 10 9, 7, 8, 6, 5,	0 9 2 5 6 8 8 6 9 8	9,0 7,2 3,5 6,8	8,3 7,2 6,8 6,8	8,3 6,5 6,0 6,0	8,3 6,5 6,0 6,0
Hammer-drilling with standard Temperature II: 24 °C / 40 °C Perature III: 35 °C / 60 °C IIII: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C Perature III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete)	drill bit or τ _{Rk,100,uer} drill bit or τ _{Rk,100,uer} τ _{Rk,100,uer} r-drilling v	hollow drill [N/mm²] hollow drill [N/mm²] [N/mm²] vith stand	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill	or wet of 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	8 10 9, 7, 8, 6, 5,	6 8 8 6 9 1,0 1,4	9,0 7,2 3,5 3,8 5,2	8,3 7,2 6,8 6,8 5,2	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2
Hammer-drilling with standard Temperature I: 24 °C / 40 °C perature II: 35 °C / 60 °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 I: 24 °C / 40 °C	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} τ _{Rk,100,ucr} r-drilling v γ _{inst} oncrete as	hollow drill [N/mm²] hollow drill [N/mm²] vith stand: [-] well as wa	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, Irill bit	6 8 8 6 9 1,0 1,4	9,0 7,2 3,5 5,8 5,2	6,8 6,8 5,2	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2
Hammer-drilling with standard Tem-perature I: 24 °C / 40 °C Perature II: 35 °C / 60 °C Hammer-drilling with standard Tem-perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete Tem-perature I: 24 °C / 40 °C Perature II: 35 °C / 60 °C Tem-perature II: 35 °C / 60	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} τ _{Rk,100,ucr} r-drilling v γ _{inst} oncrete as	hollow drill [N/mm²] hollow drill [N/mm²] [N/mm²] vith stand	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	6 8 8 6 9 1,0 1,4	9,0 7,2 3,5 3,8 5,2 3,0 6,0	6,8 6,8 5,2 6,0 6,0	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2 5,3 5,3
Hammer-drilling with standard Tem-perature I: 24 °C / 40 °C range III: 50 °C / 72 °C Hammer-drilling with standard Tem-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 II: 24 °C / 40 °C perature II: 35 °C / 60 °C range III: 50 °C / 72 °C IIII: 50 °C / 72 °C IIIII IIII IIIII IIIIII	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} r-drilling v γ _{inst} concrete as	hollow drill [N/mm²] hollow drill [N/mm²] vith stand: [-] well as wa	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	6 8 8 6 9 1,0 1,4	9,0 7,2 3,5 5,8 5,2	6,8 6,8 5,2	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2
Hammer-drilling with standard Temperature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Hammer-drilling with standard Temperature I: 24 °C / 40 °C Perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete Temperature I: 24 °C / 40 °C Perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Diamond	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} r-drilling v γ _{inst} concrete as	hollow drill [N/mm²] hollow drill [N/mm²] vith stand: [-] well as wa	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	0 9 2 1 6 8 8 6 9 3 1,0 1,4	9,0 7,2 3,5 3,8 5,2 3,0 6,0	6,8 6,8 5,2 6,0 6,0	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2 5,3 5,3
Hammer-drilling with standard Temperature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C Tange 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 Temperature II: 35 °C / 60 °C Temperature II: 35 °C / 60 °C Temperature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} r-drilling v γinst cncrete as τ _{Rk,100,ucr}	[N/mm²]	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	0 9 2 1 6 8 8 6 9 4 1,0 1,4	9,0 7,2 3,5 3,8 5,2 3,0 6,0	6,8 6,8 5,2 6,0 6,0	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2 5,3 5,3
Hammer-drilling with standard Temperature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Hammer-drilling with standard Temperature I: 24 °C / 40 °C Perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Hamme Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete Temperature I: 24 °C / 40 °C Perature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Diamond	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} r-drilling v γ _{inst} concrete as	hollow drill [N/mm²] hollow drill [N/mm²] vith stand: [-] well as wa	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	0 9 2 1 6 8 8 6 9 3 1,0 1,4	9,0 7,2 3,5 3,8 5,2 3,0 6,0	6,8 6,8 5,2 6,0 6,0	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2 5,3 5,3
Hammer-drilling with standard Temperature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Hammer-drilling with standard Temperature II: 35 °C / 60 °C Tange 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 Temperature II: 35 °C / 60 °C Temperature II: 35 °C / 60 °C Temperature II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} r-drilling v γinst concrete as τ _{Rk,100,ucr} d-drilling	[N/mm²]	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	0 9 2 1 6 8 8 6 9 4 1,0 1,4	9,0 7,2 3,5 3,8 5,2 3,0 6,0	6,8 6,8 5,2 6,0 6,0	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2 5,3 5,3
Hammer-drilling with standard Tem-perature I: 24 °C / 40 °C II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Hammer-drilling with standard Tem-perature II: 35 °C / 60 °C Tange 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 Tange II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete Water filled hole Diamond-drilling (dry or wet concrete II: 35 °C / 60 °C Tange III: 50 °C / 72 °C Installation factors; Diamon Dry or wet concrete Water filled hole	drill bit or τ _{Rk,100,ucr} drill bit or τ _{Rk,100,ucr} τ-drilling v γinst σης της της της της της της της της της τ	hollow drill [N/mm²] hollow drill [N/mm²] vith stand: [-] well as wa [N/mm²] [-]	bit (dry 11,1 9,0 7,2 bit (wat 9,4 7,5 5,9 ard drill ter filled 6,8 6,8	or wet of 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 o	8 10 9, 7, 8, 6, 5, 4rill bit	0 9 2 1 6 8 8 6 9 4 1,0 1,4	9,0 7,2 3,5 3,8 5,2 3,0 6,0	6,8 6,8 5,2 6,0 6,0	8,3 6,5 6,0 6,0 5,2	8,3 6,5 6,0 6,0 5,2 5,3 5,3



	cteristic				10000					ailure f	or
	reinforc						drilled	hole	s;		
	ed concre	ete; wor	king li	fe 100	years	S					
Nominal diameter of the ba	r	ф	8 ¹⁾	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
Cracked concrete											
Characteristic bond resista	nce in crac	ked conc	rete C20	0/25							
Hammer-drilling with standard	d drill bit or	hollow drill	bit (dry	or wet o	oncrete	<u>e)</u>			77-	97	.02
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 _{Rk,100,cr}	[N/mm ²]	4,2	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
range III: 50 °C / 72 °C			4,2	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
Hammer-drilling with standard	d 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 _{Rk,100,cr}	[N/mm ²]	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	er-drilling v	vith standa					,			2000	11000
Dry or wet concrete	<u> </u>						1,0				
Water filled hole	- γinst	[-]			1,	2	1,0			1,4	
Diamond-drilling (dry or wet or	concrete)				• • •	, <u>-</u>				1,71	
1 011011000	<u>Jonorete j</u>		4,2	6,0	5,6	4,6	3,9	3,9	3,9	4,6	4,6
Tem- I: 24 °C / 40 °C perature II: 35 °C / 60 °C		[N/mm ²]	4,2	6,0	5,6	4,6	3,9	3,9	1.53	4,6	4,6
range III: 50 °C / 72 °C	_ T _{Rk,100,cr}		4,2	6,0	5,6	4,6	3,9	3,9	3,9	4,6	4,6
	م مادالانمام		4,2	0,0	3,0	4,0	3,9	3,9	3,9	4,0	4,0
Installation factor; Diamond		r 1					4.0				
Dry or wet concrete	γinst	[-]					1,0	1\	2.41)	2.21	4.0.1)
Nominal diameter of the ba		ф	25	26	28	30	"	32 ¹⁾	34 ¹⁾	36 ¹⁾	40 ¹⁾
Combined pull-out and con		D 0.00	0.5	00	1 00	20	2	20	24	20	40
Calculation diameter	d	[mm]	25	26	28	30)	32	34	36	40
Cracked concrete			1 00	2/05							
Characteristic bond resista						`					
Hammer-drilling with standard	a arill bit or	<u>nollow drill</u>		_			_	5.0	50	5 0	.
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	$_{ extsf{L}}$ $ au_{ extsf{Rk},100, ext{cr}}$	[N/mm ²]	5,2	5,2	5,2			5,2	5,2	5,2	5,2
range III: 50 °C / 72 °C	ACT OF HARMS OF HAR		5,2	5,2	5,2	5,	2	5,2	5,2	5,2	5,2
Hammer-drilling with standard	<u>d drill bit or</u>	hollow drill		T							
Tem- <u>I: 24 °C / 40 °C</u>	_	8	3,9	3,9	3,9	7.53		3,3	3,8	3,8	3,8
perature II: 35 °C / 60 °C	TRk,100,cr	[N/mm ²]	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	3,	9	3,3	3,3	3,3	3,3
Installation factors; Hamme	er-drilling v	vith stand	ard drill	bit or h	ollow o	irill bit					
Dry or wet concrete		r.1					1,0				
Water filled hole	- γinst	[-]					1,4				
Diamond-drilling (dry or wet or	concrete)										
Tem- I: 24 °C / 40 °C			4,6	4,6	4,6	4,	6	3,3	3,3	3,3	3,3
perature II: 35 °C / 60 °C	- _ τ _{Rk,100,cr}	[N/mm ²]	4,6	4,6	4,6	4,	6	3,3	3,3	3,3	3,3
range III: 50 °C / 72 °C	,. 30,01	•	4,6	4,6	4,6	4,	6	3,3	3,3	3,3	3,3
Installation factor; Diamond	d-drilling						,				
Dry or wet concrete	γinst	[-]					1,0				
1) Not allowed for hollow of	drill bit.										
fischer injection system	m FIS EM	1 Plus									
Performance Characteristic resistance f working life 100 years	or combine	ed pull-out	and cor	ncrete fa	ailure fo	or reinfo	rcing k	oars;	Ar	nnex C	13



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

fischer F	RA				M12	M16	M20	M24
Combine	d pı	ıll-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-	drilli	ng with standard	drill bit c	r hollow d	rill bit (dry or wet	t concrete)		
Tem-	l:	24 °C / 40 °C			16,1	15,0	14,2	13,5
perature	II:	35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	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	rill 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 ²]	14,0	12,0	11,0	10,0
range	111:	50 °C / 72 °C			13,0	12,0	11,0	9,0
Installatio	on fa	actors; Hammer	-drilling	with star	ndard drill bit or	hollow drill bit	8 8	55.
Dry or we	t cor	ncrete		r 1		1	,0	
Water fille	ed ho	ole	γinst	[-]		1	,4	
Diamond-	drilli	ng (dry or wet co	ncrete a	s well as v	water filled hole)) X		
Tem-	l:	24 °C / 40 °C			13,0	12,0	10,0	9,0
perature	II:	35 °C / 60 °C	$\tau_{\text{Rk,ucr}}$	[N/mm ²]	13,0	12,0	10,0	9,0
range	III:	50 °C / 72 °C			12,0	11,0	10,0	9,0
Installatio	on fa	actors; Diamon	d-drilling	9				
Dry or we	t cor	ncrete	0.0	r 1		1	,0	
Water fille	d ho	ole	γinst	[-]		1	,4	

fischer inj	jection system	FIS EM Plus
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Performance

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

Annex C14



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

		- 5				
fischer FRA			M12	M16	M20	M24
Combined pull-out and con-	crete cor	ne failure		B:		
Calculation diameter	d	[mm]	12	16	20	25
Cracked concrete						
Characteristic bond resistar	nce in cr	acked cor	ncrete C20/25			
Hammer-drilling with standard	drill bit c	r hollow d	rill bit (dry or wet	concrete)		
Tem- l: 24 °C / 40 °C			8,0	8,0	8,0	8,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	8,0	8,0	8,0	8,0
range III: 50 °C / 72 °C			8,0	8,0	8,0	8,0
Hammer-drilling with standard	drill bit c	r hollow d	rill bit (water fille	d hole)		
Tem- I: 24 °C / 40 °C			6,5	6,5	6,0	6,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	6,5	6,5	6,0	6,0
range III: 50 °C / 72 °C			6,5	6,0	6,0	6,0
Installation factors; Hamme	r-drilling	with star	ndard drill bit or	hollow drill bit	6 8	***
Dry or wet concrete	26	[-]		1	,0	
Water filled hole	γinst	[-]	1,	,2	1	,4
Diamond-drilling (dry or wet c	oncrete)					
Tem I: 24 °C / 40 °C			7,0	6,0	6,0	7,0
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	7,0	6,0	6,0	7,0
range III: 50 °C / 72 °C			7,0	6,0	6,0	7,0
Diamond-drilling (water filled ho	ole)	2	7 Y		20	70
Tem- <u>I: 24 °C / 40 °C</u>			6,5	6,5	6,0	6,0
perature II: 35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	6,5	6,5	6,0	6,0
range III: 50 °C / 72 °C	***		6,5	6,0	6,0	6,0
Installation factors; Diamon	d-drilling					
Dry or wet concrete	27: 1	[-]		1	,0	
Water filled hole	γinst	[-]	1,	,2	1	,4

fischer injection system FIS EM Plus	
Performance Characteristic resistance to combined pull-out and concrete failure for fischer FRA; working life 50 years	Annex C15



Table C16.1: Characteristic			- to the property of the		failure for
metric fischer				90000-00-0000-0-00 - 0	
uncracked or	cracked	concrete; wo	rking life 100	years	
fischer FRA		M12	M16	M20	M24
Combined pull-out and concrete con-	e failure				
Calculation diameter d	[mm]	12	16	20	25
Uncracked concrete					
Characteristic bond resistance in und	racked co	ncrete C20/25			
Hammer-drilling with standard drill bit or	hollow drill	bit (dry or wet co	ncrete)		
Tem- I: 24 °C / 40 °C		13,2	12,3	11,6	11,1
perature II: 35 °C / 60 °C $\tau_{Rk,100,ucr}$	[N/mm ²]	11,3	10,5	9,8	9,0
range III: 50 °C / 72 °C		8,4	8,5	7,8	7,2
Hammer-drilling with standard drill bit or	hollow drill	0.00.00.0		350 -	30 7 30
Tem- I: 24 °C / 40 °C		13,2	11,8	10,7	9,4
perature II: 35 °C / 60 °C T _{Rk,100,ucr}	[N/mm ²]	10,5	9,0	8,3	7,5
range III: 50 °C / 72 °C	[]	7,8	7,8	7,2	5,9
Installation factors; Hammer-drilling	with stand:			7,2	0,0
Dry or wet concrete	Gtana	a. a arm bit or no		,0	
Water filled hole	[-]			, <u>o</u> ,4	
Diamond-drilling (dry or wet concrete as	well ac wa	tor filled hole)	1	,-	
	Well as Wa		0.0	7.5	6.0
	[N]/mm21	9,8	9,0	7,5	6,8
perature II: 35 °C / 60 °C τ _{Rk,100,ucr}	[N/mm ²]	9,8	9,0	7,5	6,8
range III: 50 °C / 72 °C		7,2	7,2	6,5	5,9
Installation factors; Diamond-drilling	1				
Dry or wet concrete	[-]			,0	
vvater filled note	LI			,4	
fischer FRA		M12	M16	M20	M24
Combined pull-out and concrete con-	e failure		r		
Calculation diameter d	[mm]	12	16	20	25
Cracked concrete					
Characteristic bond resistance in cra					
Hammer-drilling with standard drill bit or	hollow drill	bit (dry or wet co	<u>ncrete)</u>		
Tem- I: 24 °C / 40 °C		6,4	5,2	5,2	5,2
perature II: 35 °C / 60 °C $\tau_{Rk,100,cr}$	[N/mm ²]	6,4	5,2	5,2	5,2
range III: 50 °C / 72 °C		6,4	5,2	5,2	5,2
Hammer-drilling with standard drill bit or	hollow drill	bit (water filled he			
Tem- I: 24 °C / 40 °C		5,2	4,2	3,9	3,9
perature II: 35 °C / 60 °C TRk,100,cr	[N/mm ²]	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-drilling	with stand:			0,0	0,0
Dry or wet concrete	T Starra	ara arm bit or no	10	,0	
Water filled hole	[-]	1	,2		1,4
Diamond-drilling (dry or wet concrete)		J.	,∠		1,7
		5,6	3,9	3.0	16
U 05.00 / 00.00	[NI/mm21			3,9	4,6
perature II: 35 °C / 60 °C range III: 50 °C / 72 °C τ _{Rk,100,cr}	[N/mm ²]	5,6	3,9	3,9	4,6
31111 00000 0000 0000		5,6	3,9	3,9	4,6
Installation factors; Diamond-drilling			. 2	0	
Dry or wet concrete γ_{inst}	[-]		1	,0	
fischer injection system FIS EI	VI Plus				
Performance Characteristic resistance to combine working life 100 years	d pull-out a	and concrete fail	ure for fischer FR	and the second s	Annex C16



Table (Table C17.1: Displacements for metric Anchor rods / Threaded rods												
Anchor I		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30		
Displace	ment-Factors	for tensi	on loadii	ng ¹⁾									
Uncrack	ed or cracked	concrete	e; Tempe	rature ra	nge I, II,	III							
δ _{N0-Factor}	[mm/(N/mm ²)]	0,07	0,08	0,09	0,09	0,10	0,11	0,11	0,12	0,12	0,13		
δ _{N∞-Factor}	[[mm/(N/mm-)]	0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19		
Displace	ment-Factors	for shea	r loading	2)									
Uncrack	ed or cracked	concrete	e; Tempe	rature ra	nge I, II,	III							
δv0-Factor	[rea rea /ls N 1]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05		
δ∨∞-Factor	[mm/kN]	0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07		

1) Calculation of effective displacement:

²⁾ Calculation of effective displacement:

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

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

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

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

 τ = acting bond strength under tension loading

V = acting shear loading

Table C17.2: Displacements for metric fischer RG M I

fischer F	RGMI	M8	M10	M12	M16	M20	
Displace	Displacement-Factors for tension loading ¹⁾						
Uncracked or cracked concrete; Temperature range I, II, III							
δ N0-Factor	[mm/(N/mm ²)	0,09	0,10	0,10	0,11	0,13	
δ _{N∞-Factor}	[[[[[[[]]	0,13 0,15		0,16	0,17	0,19	
Displace	ment-Factors	for shear loading	J ²⁾				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II,	III			
δ V0-Factor	[mm/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	

 Calculation of effective displacer 	ment:
--	-------

²⁾ Calculation of effective displacement:

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

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

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

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

 τ = acting bond strength under tension loading

V = acting shear loading

	Γ
fischer injection system FIS EM Plus	
Performance Displacements for metric Anchor rods / Threaded rods and fischer RG M I	Annex C17



Table 0	Table C18.1: Displacements for metric reinforcing bars																		
Nominal of the ba	diameter ar	ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Displace	Displacement-Factors for tension loading ¹⁾																		
Uncracked or cracked concrete; Temperature range I, II, III																			
δ N0-Factor	[mm/(N/mr	-2\1	0,07	0,08	0,09	0,09	0,10	0,10	0,11	0,11	0,12	0,12	0,12	0,13	0,13	0,13	0,14	0,14	0,15
δ _{N∞-Factor}	ן נווווע(וא/וווו 	11-)]	0,11	0,12	0,13	0,14	0,15	0,16	0,16	0,17	0,18	0,18	0,18	0,19	0,19	0,20	0,20	0,21	0,22
Displace	ment-Fact	ors	for s	hear	loadi	ng²)		-	-										
Uncrack	ed or cracl	ked	conc	rete;	Tem	perat	ure ra	ange	I, II, I										
δv0-Factor	France /IcN1	,	0,18	0,15	0,12	0,10	0,09	0,08	0,07	0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,04	0,04	0,04
δv∞-Factor	[mm/kN	J	0,27	0,22	0,18	0,16	0,14	0,12	0,11	0,10	0,09	0,09	0,08	0,08	0,07	0,07	0,06	0,06	0,05

1) Calculation of effective displacement:

2) Calculation of effective displacement:

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

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

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

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

 τ = acting bond strength under tension loading

V = acting shear loading

Table C18.2: Displacements for metric fischer FRA

fischer F	RA	M12	M16	M20	M24			
Displace	Displacement-Factors for tension loading ¹⁾							
Uncracked or cracked concrete; Temperature range I, II, III								
δ _{N0-Factor}	[mm/(N/mm ²)]	0,09	0,10	0,11	0,12			
δ _{N∞-Factor}	[[[[[[[]]	0,13	0,15	0,16	0,18			
Displace	ment-Factors	for shear loading ²⁾						
Uncrack	ed or cracked	concrete; Temperatu	re range I, II, III					
δ V0-Factor	[mm/kNI]	0,12	0,09	0,07	0,06			
δ∨∞-Factor	[mm/kN]	0,18	0,18 0,14		0,09			

1) Calculation of effective displacement:

2) Calculation of effective displacement:

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

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

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

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

 τ = acting bond strength under tension loading

V = acting shear loading

	át.
fischer injection system FIS EM Plus	
Performance Displacements for reinforcing bars and fischer FRA	Annex C18

8.06.01-188/23 Z108749.23



	fra		cteristic resistance to nal Threaded rods p								
Threaded rod 3/8" 1/2" 5/8" 3/4" 7/8" 1" 1 1/8"											
Charact	Characteristic resistance to steel failure under tension loading										
			F568M, Class 5.8		25,0	45,7	72,9	107,9	148,9	195,4	246,0
_	V 101 101		F1554, Grade 36	1	19,9	36,5	58,3	86,2	119,1	156,2	196,7
S S	teel zinc ated	ဟု –	F1554, Grade 55]	25,8	47,3	75,3	111,5	154,0	202,0	254,4
Characteristic resistance N _{Rk,s}	atou	class	F1554, Grade 105		43,0	78,8	125,6	185,9	256,7	336,8	424,0
acte		orty.	A193, B7	[kN]	43,0	78,8	125,6	185,9	256,7	336,8	424,0
hara sista 		Property	F593, Alloy Group 2		34,4	63,0	100,5	126,4	174,5	229,0	288,
- 5	tainless eel R	<u>.</u> _	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
Partial f	factors 1)										
		_	F568M, Class 5.8					1,50			
9	teel zinc	_	F1554, Grade 36	_				1,94			
, n	plated	ss –	F1554, Grade 55					1,64			
Partial factor YMS,N T		class	F1554, Grade 105					1,43			
ial fa	-	erty	A193, B7	[-]				1,43			
Parti	Stainless steel R	Property	F593, Alloy Group 2			1,85 2,27					
S		<u> </u>	A193, Grade B8M, Class 1		3,00						
55000	6-10guerosas 55 39		A193, Grade B8M, Class 2B					1,52			
			ational regulations.								

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



Characteristic re	Threaded rod 3/8 1/2" 5/8" 3/4"									1 1/8"	
	sista	nce to steel failure un	der she	ar loadi	ng						
vithout lever an					J						
		F568M, Class 5.8		15,0	27,4	43,7	64,7	89,3	117,2	147,6	
90	S-T	F1554, Grade 36		11,9	21,9	34,9	51,7	71,4	93,7	118,0	
Steel	_ω -	F1554, Grade 55		12,9	23,6	37,6	55,7	77,0	101,0	127,2	
zinc plated	class	F1554, Grade 105		21,5	39,4	62,8	92,9	128,3	168,4	212,0	
Vork's	5−	A193, B7	[kN]	21,5	39,4	62,8	92,9	128,3	168,4	212,0	
Sirist S	Property	F593, Alloy Group 2		17,2	31,5	50,2	63,2	87,2	114,5	144,1	
Oharacteristic resistance Steel Store Stance Stance Stainless Steel R	P.S	A193, Grade B8M, Class 1		12,9	23,6	37,6	55,7	77,0	101,0	127,2	
Ö		A193, Grade B8M, Class 2B		16,3	29,9	47,7	70,6	97,5	127,9	161,1	
Ductility factor	5.22	k 6	[-]		2		1,0				
vith lever arm											
(0		F568M, Class 5.8		29,9	74,0	148,9	268,2	435,1	653,8	923,5	
ર્જું ≧ Steel	_	F1554, Grade 36		23,9	59,2	119,1	214,5	348,0	522,9	738,6	
zinc plated	_ω _	F1554, Grade 55		30,9	76,6	154,0	277,4	450,0	676,1	955,1	
	class –	F1554, Grade 105		51,5	127,6	256,8	462,4	750,0	1126,9	1591,	
	_ <i>≨</i> _	A193, B7	[Nm]	51,5	127,6	256,8	462,4	750,0	1126,9	1591,	
res S	Property	F593, Alloy Group 2	_[]	41,2	102,1	205,4	314,4	510,0	766,3	1082,	
Charact. resistance Months and stance of the	Pro	A193, Grade B8M, Class 1		30,9	76,6	154,0	277,4	450,0	676,1	955,1	
5		A193, Grade B8M, Class 2B		39,1	97,0	195,1	351,4	570,0	856,4	1209,	
Partial factors 1)											
	_	F568M, Class 5.8					1,25				
Steel	_	F1554, Grade 36		1,61							
zinc plated	_ω _	F1554, Grade 55					1,36				
Yarial factor	class	F1554, Grade 105					1,50				
ial fa	,	A193, B7	[-]	1,50							
intia ≽	Property	F593, Alloy Group 2		1,54 1,89							
Stainless steel R	Pre –	A193, Grade B8M, Class 1		2,50							
		A193, Grade B8M, Class 2B					1,27				



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 i	resist	ance to s	teel fail	ure under tension loa	ding					
		Property		F568M, Class 5.8		25,0	45,7	72,9	107,9	
Characteristic resistance with N _{Rk,s} screw		class,		F1554, Grade 36		20,0	36,6	58,3	86,3	
		Steel	5.8	F1554, Grade 55		25,8	47,3	75,3	111,5	
		zinc		F1554, Grade 105	[kN]	43,1	76,4	110,8	186,0	
	Neks	plated		A193, B7		43,1	76,4	110,8	186,0	
	1111,3			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⁾)								•	
		Droporty		F568M, Class 5.8			1,	50		
		Property class.		F1554, Grade 36		1,94				
		Steel	5.8	F1554, Grade 55		1,64				
		zinc		F1554, Grade 105		1,43	1,50			
Partial factors	γMs.N	plated		A193, B7	[-]	1,43		1,50		
T ditial labiolo	7 1015,14			F593, Alloy Group 2] []		1,85		2,27	
		Property class, Stainless	70	A193, Grade B8M, Class 1		3,00				
		steel R		A193, Grade B8M, Class 2B		1,52				

¹⁾ In absence of other national regulations.

fischer injection system FIS EM Plus	
Performance Characteristic resistance to steel failure under tension loading for fractional fischer RG M I part 1	Annex C21



1001			esistance to steel er RG M I part 2	failuı	re under	shear load	ling for			
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		so.				2		9		
	Duna in a setu i		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		
resistance with V ⁰ _{Rk,s}			A193, B7	[kN]	21,5	39,4	62,8	92,9		
screw	Dan a satu		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		
With lever arm		1	6.5 5.5 5.00 Sales Sales	Г	8 <u>- 1</u> 738	27 co 100 - 1000	250 10000 500	1_ 2000000 040		
	Property		F568M, Class 5.8		29,9	74,0	148,9	268,2		
	class,	MT00 (100)	F1554, Grade 36		23,9	59,2	119,1	214,5		
	Steel zinc	5.8	F1554, Grade 55		30,9	76,6	154,0	277,4		
Characteristic	plated		F1554, Grade 105		51,5	127,6	256,8	462,4		
resistance with M ⁰ Rk,s	S		A193, B7	[Nm]	51,5	127,6	256,8	462,4		
screw	Property		F593, Alloy Group 2		41,2	102,1	205,4	314,4		
	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)		1								
	Property		F568M, Class 5.8		1,25					
	class,		F1554, Grade 36		1,61					
	Steel zinc	5.8	F1554, Grade 55		1,36					
	plated		F1554, Grade 105		1,50					
Partial factors γ _{Ms,V}	-		A193, B7	[-]	1,50					
	Property		F593, Alloy Group 2	-		1,54		1,89		
	class, Stainless	70	A193, Grade B8M, Class 1			2,	50			
	steel R		A193, Grade B8M, Class 2B			1,	27			
fischer injection										
Performance Characteristic resistance to steel failure under shear loading for fractional fischer RG M I part 2 Annex C22							x C22			



Table C23.1: Character fractional				steel fa	ailure u	ınder te	ension /	shear	loadin	g for
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 ¹⁾
Characteristic resistance to s	Characteristic resistance to steel failure under tension loading									
Characteristic resistance N _{Rk,s} [kN] A _s · f _{uk} ³⁾										
Characteristic resistance to s	teel failure	unde	er shear	loading]					
Without lever arm										
Characteristic resistance	$V^0_{Rk,s}$	[kN]				$\mathbf{k}_{6}^{2)} \cdot \mathbf{A}$	$(s \cdot f_{uk}^3)$			
Ductility factor	k ₇	[-]				1	,0			
With lever arm										
Characteristic resistance	M^0 Rk,s	[Nm]				1,2 · W	$f_{\rm el} \cdot f_{\rm uk}^{3)}$			

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

²⁾ 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/mm² < f_{uk} ≤ 1000 N/mm²,

^{= 0,5} for fasteners made of stainless steel.

³⁾ f_{uk} respectively shall be taken from the specifications of the reinforcing bar.



Size								Α	II sizes				
Characteristic resistance to o	oncrete	e fail	ure u	nder ten	sion loa	adin	ıg						
Installation factor	γir	nst	[-]		Se	e A	nnex	C25	to C34	, C46	and C	C47	
Factors for the compressive	strength	n of	concr	ete > C2	0/25								
C25	5/30								1,02				
Increasing factor ψ _c for C30	0/37								1,04				
cracked or uncracked C3	5/45	.							1,06				
concrete C40	0/50	<i>y</i> _c	[-]						1,07				
$\tau_{Rk(X,Y)} = \psi_c \cdot \tau_{Rk(C20/25)} $	5/55								1,08				
C50	0/60								1,09				
Splitting failure													
h / h _{ef} ≥	2,0							135	1,0 h _{ef}				
Edge distance2,0 > h / h _{ef} >	1,3 Ccr	r,sp	[mm]					4,6	h _{ef} - 1,8	h			
h / h _{ef} ≤	1,3							2	2,26 h _{ef}				
Spacing	Scr	r,sp							2 C _{cr,sp}				
Concrete cone failure													
Uncracked concrete	k uc	cr,N	[-]						11,0				
Cracked concrete	k c	r,N							7,7				
Edge distance	Cc	r,N	[mm]						1,5 h _{ef}				
Spacing	2007	r,N	[]						2 C _{cr,N}				
Factors for sustained tension	loadin	g									_		
Temperature range				24 °	C / 40 °(2	_	35 °	C / 60 °	°C		50 °C / 7	′2 °C
Factor	Ψ	0 sus			0,77				0,60			0,48	3
Factor	Ψ^0 sus	s,100			0,77				0,60			0,71	ĺ
Characteristic resistance to o	oncrete	fail	ure u	nder she	ar load	ina							
Installation factor		nst	[-]			3			1,0				
Concrete pry-out failure	,	101											
Factor for pry-out failure	k	8	[-]						2,0				
Concrete edge failure		-											
Effective length of fastener in shear loading	I _f	f	[mm]		r d _{nom} ≤: r d _{nom} >						om; 30	0 mm))	
Calculation diameters	-												
Size				3/8"	1/2"	T	5/8'	,	3/4"	7/8	3"	1"	1 1/8'
Anchor rods and Threaded rods	s d _{no}	om		9,5	12,7	7.5	15,9	9	19,1	22	,2	25,4	28,6
fischer RG M I	dno		[mm]	15,7	18,0		22,0	_	28,0	_1		_1)	_1)
Rebar size				#3	#4	#	£5	#6	#	7	#8	#9	#10
Reinforcing bar	d _{no}	om	[mm]	9,5	12,7	15	5,9	19,	1 22	,2	25,4	28,7	32,3
1) Anchor type not part of the			1										
fischer injection system F	IS EM	Plu	ıs										
Performance Characteristic resistance for concrete failure und fractional sizes				ler tensio	on / she	ar Io	adin	a for			Α	nnex (224



Table C2	25.1:	Characte fractiona uncracke	I Thre	aded ro	d s in ha	mmer o	r diamor			failure	for
Threaded r	od	unoraone	 	0.010, 1.	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Combined	pull-ou	ıt and conci	rete cor	ne failure	S S						1
Calculation	diamet	er	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6
Uncracked	concr	ete			,	500 000					
Characteri	stic bo	nd resistan	ce in un	cracked	concrete	C20/25					
Hammer-dr	illing wi	th standard	drill bit c	r hollow d	rill bit (dr	or wet co	oncrete)				
Tem	l: 24	°C / 40 °C			20,0	18,6	17,7	16,8	16,2	15,8	15,3
perature	II: 35	5 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	18,0	18,0	17,0	16,0	15,0	15,0	14,0
range -	III: 50	°C / 72 °C			17,0	17,0	16,0	15,0	14,0	14,0	13,0
Hammer-dr	illing wi	th standard	drill bit c	r hollow d	rill bit (wa	ter filled h	nole)				
Tem	l: 24	°C / 40 °C			20,0	18,6	17,0	15,4	14,3	13,7	12,8
perature	II: 35	5 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	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
Installation	factor	s; Hammer-	drilling	with star	dard dri	ll bit or h	ollow dril	l bit		b.	
Dry or wet o	concrete	е		F 3				1,0			
Water filled	hole	*	γinst	[-]				1,4			
Diamond-dı	rilling (d	lry or wet co	ncrete)							~	~
Tem	l: 24	1 °C / 40 °C	$ au_{Rk,ucr}$	[N/mm ²]	14,4	13,3	12,3	11,8	11,3	10,8	10,3
perature	II: 35	5 °C / 60 °C			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-dı	rilling (v	vater filled ho	ole)								is .
Tem	l: 24	1 °C / 40 °C			17,3	15,0	13,6	12,4	11,5	10,8	10,1
perature	II: 35	5 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	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
Installation	ı factor	rs; Diamond	-drilling	3							
Dry or wet o	concrete	е	0.0	[]				1,0			
Water filled	hole	,	γinst	[-]				1,4			
fischer ir	nce	n system F		a						Annex	C25

Characteristic resistance to combined pull-out and concrete failure for

fractional Threaded rods; working life 50 years



Table C	fraction	al Thre	resistan aded roe	d s in ha	ımmer o	r diamor			e failure	for	
Threaded			oto, 110.	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	
Combine	d pull-out and con	crete co	ne failure								
Calculation	on diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6	
Cracked	concrete				•					<u>'</u>	
Characte	ristic bond resista	nce in cr	acked co	ncrete C	20/25						
Hammer-	drilling with standard	drill bit	or hollow d	rill bit (dr	y or wet c	oncrete)					
Tem-	I: 24 °C / 40 °C	1		8,7	9,9	9,5	8,5	8,5	8,5	8,5	
perature	II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	8,7	9,9	9,5	8,5	8,5	8,5	8,5	
range	III: 50 °C / 72 °C	7		8,2	9,3	8,9	8,5	8,5	8,5	8,5	
Hammer-	drilling with standard	drill bit	or hollow d	rill bit (wa	ater filled l	nole)					
Tem-	I: 24 °C / 40 °C	;	[N/mm ²]	7,5	8,5	7,8	6,0	6,0	6,0	6,0	
perature	II: 35 °C / 60 °C	$ au_{Rk,cr}$		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	on factors; Hamme	r-drilling	with star	ndard dri	ll bit or h	ollow dril	l bit				
Dry or we	t concrete	_	F 1				1,0				
Water fille	ed hole	— γinst	[-]	4	1,2			1	1,4		
Diamond-	drilling (dry or wet c	oncrete)									
Tem-	I: 24 °C / 40 °C	<u> </u>		7,0	7,0	6,0	6,0	7,0	7,0	7,0	
perature	II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	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 (water filled	nole)									
Tem-	I: 24 °C / 40 °C	; 		7,5	7,5	6,0	6,0	6,0	6,0	6,0	
perature	II: 35 °C / 60 °C	_	[N/mm ²]	7,5	7,5	6,0	6,0	6,0	6,0	6,0	
range	range III: 50 °C / 72 °C			7,0	7,0	6,0	6,0	6,0	6,0	6,0	
Installation	on factors; Diamon	d-drillin	g								
	t concrete	– γ _{inst}	[-]				1,0				
Water filled hole		Tinst	LJ		1,2			1	,4		

fischer injection system FIS EM Plus	
Performance Characteristic resistance to combined pull-out and concrete failure for fractional Threaded rods; working life 50 years	Annex C26



Table (fraction	teristic nal Threa ked con	aded ro	d s in ha	mmer o	r diamor			failure	for
Threade		Keu con	Ciete, W	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Combin	ed pull-out and cor	crete cor	ne failure							
	ion diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6
Uncrack	red concrete		No.		3000					
Charact	eristic bond resista	ince in un	cracked	concrete	C20/25					
<u>Hammer</u>	-drilling with standar	d drill bit c	r hollow d	rill bit (dr	y or wet co	oncrete)				
Tem-	I: 24 °C / 40 °C			16,4	15,3	14,5	13,8	13,3	12,9	12,6
perature	II: 35 °C / 60 °C	τ _{Rk,100,ucr}	[N/mm ²]	13,5	13,5	12,8	12,0	11,3	11,3	10,5
range	III: 50 °C / 72 °C			10,2	10,2	10,4	9,8	9,1	9,1	8,5
<u>Hammer</u>	-drilling with standar	d drill bit c	r hollow d	rill bit (wa	ater filled h	nole)	×	35	70.	
Tem-	I: 24 °C / 40 °C	-	[N/mm ²]	16,4	15,3	13,9	12,6	11,7	11,2	10,5
perature	II: 35 °C / 60 °C			12,0	11,3	9,8	8,3	8,3	7,5	6,8
range	III: 50 °C / 72 °C			8,4	8,4	7,8	7,2	6,5	5,9	5,9
Installat	ion factors; Hamme	er-drilling	with star	ndard dri	ll bit or h	ollow dril	l bit			
Dry or w	et concrete	— γinst	[-]				1,0			
Water fill	led hole						1,4			
Diamono	d-drilling (dry or wet o	concrete)				~	14			
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 _{Rk,100,ucr}	[N/mm ²]	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
Diamono	d-drilling (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	τ _{Rk,100,ucr}	[N/mm ²]	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
Installat	ion factors; Diamo	nd-drilling)							
Dry or w	et concrete	- 26	[]				1,0			
Water fill	led hole	— γinst	[-]				1,4			

C27
×



Table 0	1	fraction	teristic i al Threa I concre	aded ro	d s in ha	mmer o	r diamor			failure	for
Threaded	d rod				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Combine	ed pull-out	and con	crete con	e failure							
Calculation	on diamete	r	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,6
Cracked	concrete										
Characte	eristic bon	d resista	nce in cra	acked cor	ncrete C2	20/25					
Hammer-	drilling with	ı standar	d drill bit o	r hollow d	rill bit (dry	or wet co	oncrete)				
Tem	I: 24 °C	/ 40 °C			7,0	7,5	7,2	6,9	6,8	6,5	6,3
perature	II: 35 °C	/ 60 °C	τ _{Rk,100,cr}	[N/mm ²]	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
Hammer-	drilling with	ı standar	d drill bit o	r hollow d	rill bit (wa	ter filled h	nole)			· ·	
Tem	I: 24 °C	/ 40 °C	2	[N/mm ²]	6,0	6,5	5,9	4,9	4,8	4,6	4,4
perature	II: 35 °C	/ 60 °C	τ _{Rk,100,cr}		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	on factors	; Hamme	er-drilling	with star	dard dri	ll bit or h	ollow dril	l bit			
Dry or we	et concrete		— Vinat	[-]				1,0			
Water fille	ed hole		— γinst	r_1		1,2		v	1	,4	
Diamond-	-drilling (dr	y or wet c	concrete)			ri-	-		r	ř	,
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 _{Rk,100,cr}	[N/mm ²]	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
Installati	on factors	; Diamor	nd-drilling	ı							
Dry or we	et concrete	1	γ inst	[-]				1,0			

fischer injection system FIS EM Plus	
Performance	Annex C28
Characteristic resistance to combined pull-out and concrete failure for	
fractional Threaded rods in hammer or diamond drilled holes; working life 100 years	



Combine	GMI			3/8"	1/2"	5/8"	3/4"
	d pull-out and conc	rete co	ne failure				
Calculatio	n diameter	d	[mm]	15,7	18,0	22,0	28,0
Uncracke	d concrete						
Characte	ristic bond resistan	ce in ur	cracked co	oncrete C20/25	;		
Hammer-d	drilling with standard	drill bit o	r hollow dri	ll bit (dry or wet	concrete)		
Tem	I: 24 °C / 40 °C			17,6	17,0	16,2	15,3
perature	II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	14,0	14,0	13,0	12,0
range	III: 50 °C / 72 °C	2000		13,0	13,0	12,0	11,0
Hammer-d	drilling with standard	drill bit o	r hollow dri	ll bit (water fille	d hole)		
Tem	I: 24 °C / 40 °C			16,9	15,8	14,3	12,8
perature	II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	12,0	12,0	11,0	10,0
range [–]	III: 50 °C / 72 °C			12,0	11,0	10,0	9,0
Installatio	on factors; Hammer	-drilling	with stanc	lard drill bit or	hollow drill bit		
Dry or we	t concrete	200000	F.1		1,	0	
Water fille	d hole	γinst	[-]		1,	4	
Diamond-	drilling (dry or wet co	ncrete)					
Tem	I: 24 °C / 40 °C			12,3	11,9	11,2	10,4
perature _	II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	12,0	11,0	10,0	9,0
range	III: 50 °C / 72 °C	,		11,0	10,0	9,0	8,0
Diamond-	drilling (water filled h	ole)					
Tem	I: 24 °C / 40 °C	,		13,6	12,6	11,4	10,2
perature	II: 35 °C / 60 °C	$ au_{Rk,ucr}$	[N/mm ²]	12,0	11,0	10,0	9,0
range [–]	III: 50 °C / 72 °C			11,0	10,0	9,0	8,0
Installatio	on factors; Diamon	d-drilling	3	_			
Dry or we	t concrete		r 1		1,	0	
Water fille	d hole	γinst	[-]		1,	4	

Characteristic resistance to combined pull-out and concrete failure for

fractional fischer RG M I; working life 50 years



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

		Clacked	COHCIE	ste, worr	king ine 50 ye	cais			
fischer R	G M	1			3/8"	1/2"	5/8"	3/4"	
Combine	d pı	ıll-out and conc	rete cor	ne failure				B	
Calculation	n di	ameter	d	[mm]	15,7	18,0	22,0	28,0	
Cracked	con	crete	-	15- 15		7.	*	<u> </u>	
Characte	risti	c bond resistan	ce in cr	acked cor	ncrete C20/25				
<u> Hammer-</u>	drillir	ng with standard	drill bit c	r hollow d	rill bit (dry or wet	concrete)			
Tem	l:	24 °C / 40 °C			6,0	6,0	7,0	7,0	
perature	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	6,0	6,0	7,0	7,0	
range	III:	50 °C / 72 °C			6,0	6,0	7,0	7,0	
<u> Hammer-</u>	drillir	ng with standard	drill bit c	r hollow d	rill bit (water fille	d hole)			
Tem-	l:	24 °C / 40 °C	$ au_{Rk,cr}$		6,5	6,0	6,0	6,0	
perature	II:	35 °C / 60 °C		[N/mm ²]	6,5	6,0	6,0	6,0	
range	III:	50 °C / 72 °C			6,0	6,0	6,0	6,0	
Installati	on fa	actors; Hammer	-drilling	with stan	idard drill bit or	hollow drill bit	20. E S		
Dry or we	t cor	ncrete	26	[-]		1	,0		
Water fille	ed ho	ole	γinst	[-]	1,2 1,4				
Diamond-	<u>drilli</u>	ng (dry or wet co	ncrete)						
Tem-	l:	24 °C / 40 °C			6,0	6,0	7,0	7,0	
perature __	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	6,0	6,0	7,0	7,0	
range	III:	50 °C / 72 °C			6,0	6,0	7,0	7,0	
Diamond-	-drilli	ng (water filled h	ole)						
Tem-	l:	24 °C / 40 °C			6,5	6,0	6,0	6,0	
perature	II:	35 °C / 60 °C	$\tau_{\text{Rk,cr}}$	[N/mm ²]	6,5	6,0	6,0	6,0	
range	III:	50 °C / 72 °C			6,0	6,0	6,0	6,0	
Installati	on fa	actors; Diamono	l-drilling	3			~		
Dry or we	t cor	ncrete	γinst	[-]		1	,0		
Water fille	ed ho	ole	yınsı	r 1	1,	,2	1	,4	

	0.0
fischer injection system FIS EM Plus	
Performance	Annex C30
Characteristic resistance to combined pull-out and concrete failure for fractional fischer RG M I; working life 50 years	



f	Characteristic fractional fisc uncracked or	her RG M	I I in hammer	or diamond dr	illed holes;	ailure for
fischer RG M I			3/8"	1/2"	5/8"	3/4"
Combined pull-out a	and concrete con	e failure				
Calculation diameter	d	[mm]	15,7	18,0	22,0	28,0
Uncracked concrete						
Characteristic bond	resistance in un	cracked cor	ncrete C20/25			
Hammer-drilling with		r hollow drill	bit (dry or wet co	ncrete)		
Tem- <u>I: 24 °C /</u>	COURT MAKE		14,4	14,0	13,3	12,6
perature II: 35 °C /		r N/mm²]	10,5	10,5	9,8	9,0
range III: 50 °C /			7,8	7,8	7,8	7,2
Hammer-drilling with		r hollow drill		T		
Tem- <u>I: 24 °C /</u>			13,9	13,0	11,7	10,5
perature II: 35 °C /	<u>60 °C</u> τ _{Rk,100,uc}	r [N/mm²]	9,0	9,0	8,3	7,5
range III: 50 °C /	(2000k0) 1-20		7,2	6,6	6,5	5,9
Installation factors;	Hammer-drilling	with standa	ırd drill bit or ho		V-24	
Dry or wet concrete	γinst	[-]			,0	
Water filled hole Diamond-drilling (dry	•				,4	
			10,1	9,8	9,2	8,6
Tem- <u> </u>		. [N/mm²]	9,0	8,3	7,5	6,8
range III: 35 °C /		, [IM/IIIII]	9,0 6,6	6,0	5,9	5,2
Diamond-drilling (wat	MADELLA COLLEGE		0,0	0,0	5,8	5,2
			11,2	10,3	9,3	8,4
Tem- <u> </u>		, [N/mm²]	9,0	8,3	7,5	6,8
range III: 50 °C /	- Tikk, 100,40	r [18/11111]	6,6	6,0	5,9	5,2
Installation factors;			0,0	0,0	5,5	٥,٧
Dry or wet concrete	Diamona-arining				,0	
Water filled hole	γinst	[-]			,4	
Cracked concrete						
Characteristic bond	resistance in cra	cked concr	ete C20/25			
Hammer-drilling with	standard drill bit or	r hollow drill	bit (dry or wet cor	ncrete)		
Tem- I: 24 °C /	40 °C		5,1	4,8	4,6	4,6
perature II: 35 °C /	760 °C τ _{Rk,100,cr}	. [N/mm²]	5,1	4,8	4,6	4,6
range III: 50 °C /			5,1	4,8	4,6	4,6
Hammer-drilling with	standard drill bit o	r hollow drill	bit (water filled ho	ole)		
Tem- <u>I: 24 °C /</u>			5,5	4,8	3,9	3,9
perature II: 35 °C /		[N/mm ²]	5,5	4,8	3,9	3,9
range III: 50 °C /	Michigan Sept		5,1	4,8	3,9	3,9
Installation factors;	Hammer-drilling	with standa	ırd drill bit or ho			
Dry or wet concrete		[-]			,0	
Water filled hole	•	11	1.	,2	1	,4
Diamond-drilling (dry						1.0
Tem- <u>I: 24 °C /</u>		22	5,1	4,8	4,6	4,6
perature II: 35 °C /		[N/mm ²]	5,1	4,8	4,6	4,6
range III: 50 °C /	10000 666		5,1	4,8	4,6	4,6
Installation factors; Dry or wet concrete		T T			,0	
Dry of wet concrete	γinst	[-]		1,	,0	
fischer injection	system FIS E	M Plus				

fractional fischer RG M I; working life 100 years



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

uncraci	ked con	crete; w	orking	lite 50) years					
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 ¹⁾
Combined pull-out and con	crete cor	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 resista	nce in un	cracked o	concrete	e C20/25	5					
Hammer-drilling with standard	d drill bit c	r hollow d	rill bit (d	ry or wet	concret	<u>e)</u>				
Tem- <u>I: 24 °C / 40 °C</u>			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 ²]	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 standard	d drill bit c	r hollow d	rill bit (w	ater fille	d hole)					,-
Tem- I: 24 °C / 40 °C	$ au_{Rk,ucr}$	[N/mm²]	17,0	15,9	14,5	13,2	12,3	11,6	10,5	10,2
perature II: 35 °C / 60 °C			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; Hamme	er-drilling	with stan	dard dr	ill bit or	hollow	drill bit		20		
Dry or wet concrete						1	,0			
Water filled hole	γinst	[-]				1	,4			
Diamond-drilling (dry or wet or	oncrete a	s well as v	vater fille	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 ²]	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; Diamor	nd-drilling]								
Dry or wet concrete		r 1				1	,0			
Water filled hole	— γinst	[-]	1,4							

¹⁾ Not allowed for drilling with hollow drill bit.

fischer injection system FIS EM Plus	
Performance	Annex C32
Characteristic resistance to combined pull-out and concrete failure for	
fractional reinforcing bars; working life 50 years	



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

cracke	d concr	ete; wor	king li	te 50 y	ears					
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 ¹⁾
Combined pull-out and co	ncrete co	ne failure								
Calculation diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,7	32,3
Cracked concrete									ā.	
Characteristic bond resista	ance in cr	acked cor	ncrete C	20/25						
Hammer-drilling with standa	rd drill bit o	or hollow d	rill bit (d	ry or we	t concret	<u>e)</u>				
Tem- <u>I: 24 °C / 40 °C</u>	_		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 ²]	7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
range III 50 °C / 72 °C			7,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
Hammer-drilling with standa	rd drill bit o	or hollow d	rill bit (w	ater fille	d hole)		27	27		
Tem- l: 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	τ _{Rk,cr}	[N/mm ²]	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; Hamm	er-drilling	with star	idard di	rill bit or	hollow	drill bit		-27	20	
Dry or wet concrete		r 1				1	,0			
Water filled hole	- γinst	[-]		1,2				1,4		
Diamond-drilling (dry or wet	concrete)	9.57								
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 ²]	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	l hole)							***	2	
Tem- l: 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 ²]	7,5	6,5	6,5	6,0	6,0	6,0	6,0	5,0
range III 50 °C / 72 °C	972		6,5	6,5	6,0	6,0	6,0	6,0	6,0	5,0
Installation factors; Diamo	nd-drilling	g								
Dry or wet concrete		r 1				1	,0			
Water filled hole	— γinst	[-]		1,2				1,4		

¹⁾ Not allowed for drilling with hollow drill bit.

	70
fischer injection system FIS EM Plus	
Performance	Annex C33
Characteristic resistance to combined pull-out and concrete failure for	
fractional reinforcing bars; working life 50 years	



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

uncrac	keu and	Clacket	COILC	icic, w	Orking	ille 10	o year	3		
Rebar size			#3	#4	#5	#6	#7	#8	#9	#10 ¹⁾
Combined pull-out and cor	ncrete cor	ne failure		0.5		61				
Calculation diameter	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	28,7	32,3
Uncracked concrete										
Characteristic bond resista	ance in un	cracked o	concret	e C20/25	5					
Hammer-drilling with standar	d drill bit c	r hollow d	rill bit (d	ry or wet	t concret	<u>e)</u>				
Tem- I: 24 °C / 40 °C			14,0	13,0	12,4	11,9	11,4	11,0	10,8	10,5
perature II: 35 °C / 60 °C	τ _{Rk,100,ucr}	[N/mm ²]	11,3	11,3	10,5	9,8	9,8	9,0	9,0	9,0
range III 50 °C / 72 °C			8,4	8,4	8,5	7,8	7,8	7,2	7,2	7,2
Hammer-drilling with standar	d drill bit c	r hollow d	rill bit (w	ater fille	d hole)					
Tem- <u>I: 24 °C / 40 °C</u>	-		13,9	13,0	11,9	11,0	10,1	9,5	8,6	8,5
	$ au_{ m Rk,100,ucr}$	[N/mm ²]	12,0	10,5	9,0	8,3	8,3	7,5	7,5	6,8
range III 50 °C / 72 °C			8,4	7,8	7,8	7,2	6,5	5,9	5,9	5,2
Installation factors; Hamme	er-drilling	with star	dard di	ill bit or	hollow					
Dry or wet concrete	γinst	[-]					,0			
Water filled hole	*	50000000000				1,	,4			
Diamond-drilling (dry or wet	concrete a	s well as v				5,000 000	92.00.00	523. 700	2000 800	2000 0000
Tem- <u>I: 24 °C / 40 °C</u>			11,3	9,8	9,0	7,5	7,5	6,8	6,8	6,0
	TRk,100,ucr	[N/mm ²]	11,3	9,8	9,0	7,5	7,5	6,8	6,8	6,0
range III 50 °C / 72 °C			8,4	7,2	7,2	6,5	5,9	5,9	5,2	5,2
Installation factors										
Dry or wet concrete	— γ _{inst}	[-]					,0			
Water filled hole	Imar	LJ				1,	,4			
Cracked concrete										
Characteristic bond resista	ance in cr	acked cor	ncrete C	20/25						
Hammer-drilling with standar	d drill bit c	r hollow d	rill bit (d	ry or wet	t concret	<u>e)</u>	00	95		
Tem- <u>I: 24 °C / 40 °C</u>			6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
perature II: 35 °C / 60 °C	τ _{Rk,100,cr}	[N/mm ²]	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
range III 50 °C / 72 °C	or ha bridge ha well	EX 1995 E	6,0	6,4	5,2	5,2	5,2	5,2	5,2	5,2
Hammer-drilling with standar	<u>d drill bit c</u>	r hollow d	rill bit (w		d hole)		r		T	r
Tem- <u>I: 24 °C / 40 °C</u>			6,4	5,2	4,2	3,9	3,9	3,9	3,9	3,3
perature II: 35 °C / 60 °C	τ _{Rk,100,cr}	[N/mm ²]	6,4	5,2	4,2	3,9	3,9	3,9	3,9	3,3
range III 50 °C / 72 °C			5,5	5,2	3,9	3,9	3,9	3,9	3,9	3,3
Installation factors; Hamme	er-drilling	with star	dard di	ill bit or	hollow	drill bit				
Dry or wet concrete	0.0	r 1				1,	,0			
Water filled hole	γinst	[-]		1,2				1,4		
Diamond-drilling (dry or wet	concrete)			26	-		50		200	200
Tem- <u>I: 24 °C / 40 °C</u>			6,0	5,6	3,9	3,9	4,6	4,6	4,6	3,3
perature II: 35 °C / 60 °C	$ au_{Rk,cr}$	[N/mm ²]	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							800			
Dry or wet concrete	γinst	[-]				1,	,0			
1) Not allowed for drilling w	ith hollow	drill bit.						_		
fischer injection system	n FIS EM	l Plus								
Performance Characteristic resistance to reinforcing bars; uncracked							Aı	nnex C	34	



Table (Table C35.1: Displacements for fraction Threaded rods										
Threade	d rod	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"			
Displacement-Factors for tension loading ¹⁾											
Uncracked or cracked concrete; Temperature range I, II, III											
δ N0-Factor	[mm/(N/mm ²)]	0,08	0,09	0,10	0,11	0,11	0,12	0,13			
$\delta_{\text{N}\infty\text{-Factor}}$	[[[]]]]	0,12	0,13	0,15	0,16	0,17	0,19	0,19			
Displace	ment-Factors	for shear loa	ading ²⁾	·				5			
Uncrack	ed or cracked	concrete; Te	emperature i	ange I, II, III							
δ V0-Factor	[mm/kN]	0,15	0,12	0,09	0,07	0,07	0,05	0,05			
δv∞-Factor	[IIIII/KIN]	0,22	0,18	0,14	0,11	0,10	0,08	0,07			

1) Calculation of effective displacement:

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

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

 τ = acting bond strength under tension loading

²⁾ Calculation of effective displacement:

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

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

V = acting shear loading

Table C35.2: Displacements for fractional fischer RG M I

			y									
fischer F	RG M I	3/8"	1/2"	5/8"	3/4"							
Displace	Displacement-Factors for tension loading ¹⁾											
Uncracked or cracked concrete; Temperature range I, II, III												
$\delta_{\text{N0-Factor}}$	[mm/(N/mm ²)]	0,10	0,10	0,11	0,13							
δ _{N∞-Factor}	[[[[[[]]	0,15	0,16	0,17	0,19							
Displace	ement-Factors	for shear loading ²⁾										
Uncrack	ed or cracked	concrete; Temperatu	re range I, II, III									
δv0-Factor	[mm/kNI]	0,09	0,08	0,07	0,05							
δ∨∞-Factor	[mm/kN]	0,14	0,12	0,10	0,08							

1)	Calculation	of	effective	disp	lacemen [*]	t
	Calcalation	0.	CHOCKIVO	AICP	accinon	۰

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

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

 τ = acting bond strength under tension loading

²⁾ Calculation of effective displacement:

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

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

V = acting shear loading

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Performance Displacements for fractional Threaded rods and fractional fischer RG M I	Annex C35



Table (Table C36.1: Displacements for fractional reinforcing bars													
Rebar si	ze	#3	#4	#5	#6	#7	#8	#9	#10					
Displace	Displacement-Factors for tension loading ¹⁾													
Uncracked or cracked concrete; Temperature range I, II, III														
δ N0-Factor	[mm/(N/mm²)]	0,08	0,09	0,10	0,11	0,11	0,12	0,13	0,13					
$\delta_{\text{N}\infty\text{-Factor}}$	[[[[[[]]	0,12	0,13	0,15	0,16	0,17	0,18	0,19	0,20					
Displace	ment-Factors	for shear I	oading ²⁾											
Uncrack	ed or cracked	concrete;	Temperatu	re range I,	II, III	,								
δ V0-Factor	[mm/kN]	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					

1) Calculation of effective displacement:

 $^{2)}$ Calculation of effective displacement:

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

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

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

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

 τ = acting bond strength under tension loading

V = acting shear loading

	-
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Performance Displacements for fractional reinforcing bars	Annex C36



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	M16	M20	M22	M24	M27	M30							
Characte	eristic resistance to	steel fa	ailure	e und	er tension I	oading	J ¹⁾							
Anchor	rods and Threaded re	ods, p	erfor	mano	e category	C1 ²⁾								
			4.8		23,2(21,4)	33,7	46,0	62,8	98,0	121,2	141,2	183,6	224,4	
istic	Steel zinc plated		5.8		29,0(26,8)	42,1	57,5	78,5	122,5	151,5	176,5	229,5	280,5	
ter tand		Property class	8.8	[kN]	46,4(42,8)	67,4	92,0	125,6	196,0	242,4	282,4	367,2	448,8	
Characteristic resistance Stainless steel R and high corrosion	Stainless steel R	<u>ğ</u> 8	50	[KIN]	29,0	42,1	57,5	78,5	122,5	151,5	176,5	229,5	280,5	
- re Sh	and high corresion	L	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	
Characte	Characteristic resistance to steel failure under shear loading without lever arm 1)													
Anchor	rods, performance ca	ategor	y C1	2)							3			
1.5		Property class	4.8		13,9(12,8)	20,2	27,6	37,6	58,8	72,7	84,7	110,1	134,6	
istic Se	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	
Characteristic resistance V _{Rks,C1}			8.8	[kN]	23,2(21,4)	33,7	46,0	62,8	98,0	121,2	141,2	183,6	224,4	
aracte sista V _{Rks,0}	Stainless steel R	Q 8	50		14,5	21,0	28,7	39,2	61,2	75,7	88,2	114,7	140,2	
Cha re	and high corrosion	L	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 ²⁾							-			
0			4.8		9,7(9,0)	14,1	19,3	26,3	41,1	50,9	59,3	77,1	97,2	
istic	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	
Characteristic resistance VRK,s,C1		ropert	8.8	[kN]	16,2(15,0)	23,6	32,2	43,9	68,6	84,8	98,8	128,5	157,0	
arac sist	Stainless steel R	Property class	50	[KIN]	10,1	14,7	20,1	27,4	42,8	53,0	61,7	80,3	98,1	
Sh. a	and high corrosion		70		14,2	20,6	28,1	38,4	60,0	74,2	86,4	112,4	137,4	
	resistant steel HCR		80		16,2	23,6	32,2	43,9	68,6	84,8	98,8	128,5	157,0	

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

fischer injection system FIS EM Plus	
Performance Characteristic resistance to steel failure under tension / shear loading for metric Anchor	Annex C37

rods / Threaded rods under seismic action performance category C1

²⁾ Values in brackets are valid for undersized Threaded rods with smaller stress area A_s 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 ¹⁾						
Anchor	rods and Threaded r	ods, p	erfor	mano	e cate	gory C2	2						
0			4.8	4.8 5.8	_2)	30,3	_2)	56,5	88,2	_2)	141,2	_2)	_2)
istic	Steel zinc plated	-5			_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)
arac sist	Stainless steel R	\ \tilde{D} \tilde{D} \ \tilde	50	[KIN]	_2)	37,9	_2)	70,6	110,2	_2)	176,5	_2)	_2)
Cha re	and high corrosion	п.	70		_2)	53,1	_2)	98,9	154,3	_2)	247,1	_2)	_2)
	resistant steel HCR		80		_2)	60,6	_2)	113,0	176,4	_2)	282,4	_2)	_2)
Characteristic resistance to steel failure under shear loading without lever 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)
istic Se	Steel zinc plated	Property class	5.8	1	_2)	16,6	_2)	35,3	56,5	_2)	96,3	_2)	_2)
teri and	10		8.8		_2)	22,2	_2)	47,1	75,4	_2)	128,4	_2)	_2)
Characteristic resistance V _{Rks,C2}	Stainless steel R	g 8	50	[kN]	_2)	13,9	_2)	29,4	47,1	_2)	80,3	_2)	_2)
Cha re	and high corrosion	<u> </u>	70		_2)	19,4	_2)	41,2	66,0	_2)	112,4	_2)	_2)
	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)
istic	Steel zinc plated		5.8		_2)	17,7	_2)	32,9	51,4	_2)	74,1	_2)	_2)
ter tand		ropert	8.8	נוגאוז	_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)
She _	and high corrosion	ו הבי	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⁾ 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

	J			5	,										
Nominal diameter of the bar	ф	10	12	14	16	18	20	22	24	25	26	28	30	32	
Characteristic resistance to steel failure under tension loading 1)															
Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1															
Characteristic esistance N _{Rk,s,C1} [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 s	teel fa	ilure u	nder	shear I	oadin	g, with	out le	ver ar	m ¹⁾		3		
Reinforcing bar B	500B a	cc. to	DIN 4	188-2:2	2009-0	8, perl	forma	псе са	tegory	/ C1					,
Characteristic resistance	1 V _{Pko C4} 14 8 21 3 29 1 37 9 48 0 59 3 71 8 85 4 92 7 1100 1 1116 4 133 4 151 9														
1) Partial factors	for perfo	rmar	ice cat	egory	C1 se	e table	C39.1								
1												1			

fischer injection system FIS EM Plus

Performance

Characteristic resistance to steel failure for metric Anchor rods / Threaded rods and reinforcing bars under seismic action performance category C2 and C1 respectively

Annex C38

²⁾ 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 zing plated		5.8		1,50
γms,	Steel zinc plated Stainless steel R and high corrosion resistant steel HCR	₹.,	8.8		1,50
ctor	Stainless steel R and	<u> </u>		r 1	2,86
al fa	high corrosion			[-]	1,87 / Anchor rod HCR: 1,50
artik	resistant steel HCR		80		1,60
"	Reinforcing bar	В	500B		1,40
Shea	r loading, steel failure	3)			
>	Ctool zine plated		5.8		1,25
γMs,	Steel zinc plated	₹.,	8.8		1,25
ctor	Stainless steel R and	Property class	50	r 1	2,38
a fa	high corrosion	۾ م	70	[-]	1,56 / Anchor rod HCR: 1,25 ²⁾
Partial factor γ _{Ms,∨}	resistant steel HCR	R 80			1,33
"	Reinforcing bar	В	500B		1,50

¹⁾ Anchor type not part of the assessment.

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Performance	Annex C39
Partial factors for metric Anchor rods, Threaded rods, and reinforcing bars (B500B) under seismic action performance category C1 or C2	

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

³⁾ 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	rod /	Threaded rod			M10	M12	M14	M16	M20	M22	M24	M27	M30
Characte	Characteristic bond resistance, combined pull-out and concrete cone failure												
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)													
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	TRK,C1	[N/mm ²]	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	Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)												
Tem-	I:	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	τ _{Rk,C1}	[N/mm ²]	7,5	7,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7
range	III:	50 °C / 72 °C	7		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	ry or wet concrete			r 1					1,0				
Water fill	ed ho	ole	γinst	[-]		1	,2				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 I	od /	Threaded rod			M10	M12	M14	M16	M20	M22	M24	M27	M30	
Characte	Characteristic bond resistance, combined pull-out and concrete cone failure													
Hammer	-drill	ing with standa	rd drill k	it or holl	ow drill	l bit (dr	y or we	t conc	rete)	2 0	100			
Tem-	l:	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	TRK,C1	[N/mm ²]	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	lammer-drilling with standard drill bit or hollow drill bit (water filled hole)													
Tem-	l:	24 °C / 40 °C		[N/mm ²]	5,9	5,6	5,7	4,3	4,6	4,6	4,5	4,3	4,2	
perature	II:	35 °C / 60 °C	τ _{Rk,C1}		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			2						·			
Tension	load	ing	·											
Dry or we	et cor	ncrete		r.1	·				1,0					
Water fille	ed ho	ole	γinst	[-]		1	2				1,4			

	ch.
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Performance	Annex C40
Characteristic resistance for combined pull-out and concrete failure under	
seismic action (C1) for Anchor rods / Threaded rods: working life 50 and 100 years	l



Table C	Table C41.1: Characteristic resistance for combined pull-out and concrete failure for metric reinforcing bars in hammer drilled holes under seismic action performance category C1; working life 50 years																
Nominal	diame	ter of the bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Characte	eristic	bond resistan	ce, com	bined pu	II-out	and	cond	rete	cone	failu	ıre						
Hammer-	-drillin	g with standa	rd drill k	it or holl	ow d	rill bi	t (dry	or v	vet c	oncre	ete)						
Tom	l: 2	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
Tem- perature	II: 3	85 °C / 60 °C	TRk,C1	[N/mm ²]	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: 5	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-	-drillin	g with standa	rd drill k	it or holl	ow d	rill bi	t (wa	ter fi	lled I	nole)							
Tem-	l: 2	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: 3	35 °C / 60 °C	τ _{Rk,C1}	[N/mm ²]	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: 5	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 fac	tors		<u> </u>													
Tension																	
Dry or we	2004 1002-100-015-20	All States (1975)	γinst	[-]						ſ	1,0						
Water fille	ed hole		Tilloc	.,			1,2						1	,4			
Nominal	diame	performa ter of the bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Characte	eristic	bond resistan	ce, com	bined pu	II-out	and	cond	rete	cone	failu	ire						
Hammer-	-drillin	g with standa	rd drill k	it or holl	ow d	rill bi	t (dry	or v	vet c	oncre	ete)						
Tem	l: 2	24 °C / 40 °C			6,0	5,6	4,4	3,7	3,7	3,7	4,4	4,4	4,4	4,4	4,4	4,4	3,1
perature	II: 3	85 °C / 60 °C	$\tau_{\text{Rk,C1}}$	[N/mm ²]	6,0	5,6	4,4	3,7	3,7	3,7	4,4	4,4	4,4	4,4	4,4	4,4	3,1
range	III: 5	50 °C / 72 °C			6,0	5,6	4,4	3,7	3,7	3,7	4,4	4,4	4,4	4,4	4,4	4,4	3,1
Hammer-	-drillin	g with standa	rd drill b	it or holl	ow d	rill bi	t (wa	ter fi	lled I	nole)							
Tem	l: 2	24 °C / 40 °C			6,4	5,2	4,2	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,1
perature range	II: 3	85 °C / 60 °C	$ au_{\text{Rk,C1}}$	[N/mm ²]	6,4	5,2	4,2	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,1
range	III: 5	50 °C / 72 °C			5,5	5,2	3,8	3,8	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,1
Installati																	
Tension	44.1	_			1												
Dry or we			γinst	[-]	1		4.0				1,0						
Water fille	ea noie	•	67 V				1,2						7	,4			
fischer	· injec	tion system	FIS EM	I Plus									Τ				
Perform Charact	Performance Characteristic resistance for combined pull-out and concrete failure under seismic action (C1) for and reinforcing bars; working life 50 and 100 years Annex C41																



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

Anchor r	od /	Threaded rod			M12	M16	M20	M24
Characte	risti	c bond resistan	ce, com	bined pu	ll-out and conci	rete cone failure		
Hammer-	-drill	ing with standa	rd drill l	oit or holl	ow drill bit (dry	or wet concrete	e)	
Tem-	I:	24 °C / 40 °C			3,5	5,8	5,0	3,1
perature	II:	35 °C / 60 °C	$ au_{ ext{Rk,C2}}$	[N/mm ²]	3,5	5,8	5,0	3,1
range	III:	50 °C / 72 °C			3,3	5,5	4,7	2,9
Hammer-	-drill	ing with standa	rd drill l	oit or holl	ow drill bit (wat	er filled hole)		
Tem-	l:	24 °C / 40 °C			3,5	5,8	5,0	3,1
perature	erature II: 35 °C / 60 °C		$ au_{ ext{Rk,C2}}$	[N/mm ²]	3,5	5,8	5,0	3,1
range	III:	50 °C / 72 °C			3,3	5,5	4,7	2,9
Installati	on fa	actors					•	
Tension	load	ing						
Dry or we	t cor	ncrete	200	[]		1	,0	
Water fille	ed ho	ole	γinst	[-]	1	,2	1	,4
Displace	men	t-Factors for ter	sion lo	ading ¹⁾				
δ N,C2(50%)-F	actor		lmm	/(N/mm²)]	0,09	0,10	0,11	0,12
δ N,C2(100%)	Factor	4	[[11111]	((14/111111))]	0,15	0,17	0,17	0,18
Displace	men	t-Factors for sh	ear load	ling ²⁾				
δ V,C2(50%)-F	actor		Γm	nm/kN]	0,18	0,10	0,07	0,06
δ V,C2(100%)-	Factor	š		III/KINJ	0,25	0,14	0,11	0,09

1) Calculation of effective displacement:

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

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

 τ = acting bond strength under tension loading

²⁾ Calculation of effective displacement:

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

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

V = acting shear loading

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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



Tab			stic resistance to		el failu	re und	er tens	sion or	shear	loading	3
			al Threaded rods			C1					
		seisi	nic action performa	ance							
	aded rod				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
			eel failure under tens	ion Id	pading ¹)					
Threa	ded 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 2	Steel zinc plated	Property class	F1554, Grade 55		25,8	47,3	75,3	111,5	154,0	202,0	254,4
ristic N _{RK,S}			F1554, Grade 105		43,0	78,8	125,6	185,9	256,7	336,8	424,0
Characteristic resistance NRK,s,C1		arty	A193, B7	[kN]	43,0	78,8	125,6	185,9	256,7	336,8	424,0
Shar istar		op	F593, Alloy Group 2		34,4	63,0	100,5	126,4	174,5	229,0	288,3
res	Stainless steel R	_ <u>_</u>	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
Char	acteristic resistance	to ste	eel failure under shea	ır loa	ding wi	thout le	ever arn	n ¹⁾			
Threa	aded 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
istic /Rks,		class	F1554, Grade 105		15,0	27,6	43,9	65,0	89,8	117,8	148,4
cter		_ 	A193, B7	[kN]	17,2	31,5	50,2	74,3	77,0	101,0	127,2
Characteristic esistance V _{RKs,C1}		Property	F593, Alloy Group 2		13,7	25,2	40,2	50,5	52,3	68,7	86,5
Ch resis	Stainless steel R	Prc	A193, Grade B8M, Class 1		10,3	18,9	30,1	44,6	46,2	60,6	76,3

13,1

23,9

38,1

56,5

58,5

76,7

96,6

A193, Grade B8M,

Class 2B

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Performance	Annex C43
Characteristic resistance to steel failure under tension or shear loading for Anchor rods	
and Threaded rods under seismic action (performance category C1)	1

¹⁾ Partial factors for performance category C1 or see table C45.1



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

	periormance ca	alegoi	y C i							
Rebar	size		#3	#4	#5	#6	#7	#8	#9	#10
Charac	teristic resistance to steel fa	ilure u	nder ten	sion loa	ding ¹⁾					
Reinfo	rcing bar materials, performa	ance c	ategory (C1	r	r .				
o ,c1	A615 (A767), Grade 40		29,3	53,3	82,3	117,4	160,0	210,9	266,8	338,8
steristi e N _{Rk,}	A615 (A767), Grade 60	[kN]	44,0	80,0	123,4	176,2	240,1	316,4	400,2	508,2
Characteristic resistance N _{RK,S,C1}	A615 (A767), Grade 75	נאואן	48,9	88,9	137,2	195,8	266,8	351,6	444,7	564,6
seJ	A706 (A767), Grade 60		39,1	71,1	109,7	156,6	213,4	281,3	355,7	451,7
Charac	teristic resistance to steel fa	ilure u	nder she	ear loadi	ng, with	out lever	arm ¹⁾			
Reinfo	rcing bar materials, performa	ance c	ategory (C1						
o , c1	A615 (A767), Grade 40		13,0	23,6	36,5	52,1	71,0	93,6	118,4	150,4
teristic e V _{Rk,s,C1}	A615 (A767), Grade 60	[LNI]	16,3	29,6	45,6	65,2	88,8	117,0	148,0	188,0
Characteristic resistance V _{RK,s,}	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

¹⁾ Partial factors for performance category C1 see table C45.1.

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Performance
Characteristic resistance to steel failure under tension/shear loading for fractional reinforcing bars under seismic action (performance category C1)

Annex C44



8 10	ded rod			3/8"		1/2"	5/8		3/4'	•	7/8"		1"	1 1/8'
Rebai	r size			#3	#	4	#5	#6	5	#7	#8		#9	#10
Tensi	on loading, st	eel failure ¹⁾			57	70		75			199			5
		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	3				
Ns,N		A193, B7							1,43	3				
or y	Threaded	F593, Alloy Group 2				1,85					2	,27		
Partial factor y _{Ms,N}	rod, stainless	A193, Grade B8M, Class 1	[-]						3,00)				
Parti	steel R	A193, Grade B8M, Class 2B							1,52	2				
								1,80)					
	Reinforcing	A615 (A767), Grade 60							1,80)				
	bar	A615 (A767), Grade 75							1,60)				
		A706 (A767), Grade 60							1,60)				
Shear	· loading, stee	el failure ¹⁾												
		F568M, Class 5.8							1,25	5				
	Threaded	F1554, Grade 36							1,61					
	rod,	F1554, Grade 55							1,36	6				
	zinc plated	F1554, Grade 105]						1,50)				
V,s/V		A193, B7							1,50)				
actor γ _{Ms,V}	Threaded	F593, Alloy Group 2				1,54					1,	,89		
4	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	3				
		A706 (A767), Grade 60							1,33	3				



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	c bond resista	nce, cor	nbined p	ull-out an	d concre	te cone f	ailure	J	3.			
Hammer	-dril	ling with standa	ard drill	bit or ho	llow drill	bit (dry o	r wet con	crete)					
Tem-	l:	24 °C / 40 °C			8,5	9,0	9,1	8,5	8,5	8,2	7,1		
perature	II:	35 °C / 60 °C	$ au_{ ext{Rk,C1}}$	[N/mm ²]	8,5	9,0	9,1	8,5	8,5	8,2	7,1		
range	III:	50 °C / 72 °C			8,0	8,5	8,5	8,5	8,5	8,2	7,1		
Hammer	Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)												
Tem-	l:	24 °C / 40 °C		[N/mm ²]	7,4	7,7	7,5	6,0	6,0	5,8	5,0		
perature	II:	35 °C / 60 °C	τ _{Rk,C1}		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	ncrete		r 1				1,0					
Water filled hole [-] 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

Threade	d ro	d			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Characte	eristi	c bond resista	nce, cor	nbined p	ull-out an	d concre	te cone f	ailure			
Hammer	-dril	ling with standa	ard drill	bit or hol	llow drill	bit (dry o	r wet con	crete)			100
Tem-	1:	24 °C / 40 °C			6,8	6,8	6,9	6,9	6,8	6,3	5,3
perature	II:	35 °C / 60 °C	τ _{Rk,C1}	[N/mm ²]	6,8	6,8	6,9	6,9	6,8	6,3	5,3
range	III:	50 °C / 72 °C	•		6,4	6,4	6,5	6,4	6,4	5,9	5,1
Hammer	-dril	ling with standa	ard drill	bit or ho	low drill	bit (wateı	r filled ho	le)			
Tem-	l:	24 °C / 40 °C	·	[N/mm ²]	5,9	5,9	5,7	4,9	4,8	4,4	3,7
perature	II:	35 °C / 60 °C	τ _{Rk,C1}		5,9	5,9	5,7	4,9	4,8	4,4	3,7
range	III:	50 °C / 72 °C			5,5	5,5	5,3	4,5	4,5	4,2	3,6
Installat	ion f	actors									
Tension	load	ling									
Dry or we	et co	ncrete		r.1				1,0			
Water fill	ed h	ole	γinst	[-]		1,2			1,	,4	

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Performance	Annex C46
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)	



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 siz	ze				#3	#4	#5	#6	#7	#8	#9	#10 ¹⁾	
Characte	risti	c bond resista	nce, con	nbined p	ull-out a	nd conc	rete cor	ne failur	9				
Hammer-	drill	ing with standa	ard drill	bit or ho	llow dril	l bit (dry	or wet	concrete	e)				
Tem	l:	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	$\tau_{\text{Rk,C1}}$	[N/mm ²]	6,2	7,0	7,0	7,0	7,0	7,0	7,0	7,0	
range -	III:	50 °C / 72 °C			6,2	7,0	7,0	7,0	7,0	7,0	7,0	7,0	
Hammer	Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)												
Tem	l:	24 °C / 40 °C		[N/mm ²]	6,6	5,7	5,7	5,3	5,3	5,3	5,3	4,4	
perature	II:	35 °C / 60 °C	$ au_{\text{Rk,C1}}$		6,6	5,7	5,7	5,3	5,3	5,3	5,3	4,4	
range -	III:	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	ing	·								·	·	
Dry or we	t cor	ncrete		r 1	1,0								
Vater filled hole γ _{inst} [-]					1,2								

¹⁾ 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	ze				#3	#4	#5	#6	#7	#8	#9	#10 ¹⁾
Characte	characteristic bond resistance, combined pull-out and concrete cone failure											
Hammer	lammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Tem-	1:	24 °C / 40 °C			5,2	5,6	4,6	4,6	4,6	4,6	4,6	4,6
perature	11:	35 °C / 60 °C	$ au_{ ext{Rk,C1}}$	[N/mm ²]	5,2	5,6	4,6	4,6	4,6	4,6	4,6	4,6
range	III:	50 °C / 72 °C	8		5,2	5,6	4,6	4,6	4,6	4,6	4,6	4,6
Hammer	-drill	ling with standa	ard drill	bit or hol	llow dril	l bit (wa	ter filled	hole)				
Tem-	I:	24 °C / 40 °C	- τ _{rk,} c1	[N/mm²]	5,6	4,6	3,7	3,4	3,4	3,4	3,4	2,9
perature	II:	35 °C / 60 °C			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
Installati	on f	actors										
Tension	load	ling										
Dry or wet concrete 1,0												
Water fill			γinst [-]	[-]	1,2 1,4							
1) Not c	1) Not allowed for drilling with hollow drill bit											

¹⁾ Not allowed for drilling with hollow drill bit.

fischer injection system FIS EM Plus	
Performance 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)	Annex C47

M30



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 stee	l failure	under	tension	and	shear	loading

Anchor rod / Threaded rod ISO 898-1 Class 5.8 and higher		R30			R60		
_	N _{Rk,s,fi,30}	V _{Rk,s,fi,30}	M ⁰ Rk,s,fi,30	N _{Rk,s,fi,60}	V _{Rk,s,fi,60}	M ⁰ Rk,s,fi,60	
	[kN]	[kN]	[Nm]	[kN]	[kN]	[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 _{Rk,s,fi,90}	V _{Rk,s,fi,90}	M ⁰ Rk,s,fi,90	N _{Rk,s,fi,120}	V _{Rk,s,fi,120}	M ⁰ Rk,s,fi,120	
	[kN]	[kN]	[Nm]	[kN]	[kN]	[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	
M22	6,6	6,6	19,5	4,8	4,8	14,3	
M24	7,7	7,7	24,6	5,6	5,6	18,0	
M27	10,0	10,0	36,4	7,3	7,3	26,7	
\$18150C1			1		1		

12,3

49,3

9,0

9,0

36,1

12,3

	000
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	



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

Illetile Allelle	i ious and i	in eaded i	ous part z			
Anchor rods R and HCR and Threaded rod, EN ISO 3506-1 Class A4-50 and higher		R30			R60	
	N _{Rk,s,fi,30} [kN]	V _{Rk,s,fi,30} [kN]	M ⁰ _{Rk,s,fi,30} [Nm]	N _{Rk,s,fi,60} [kN]	V _{Rk,s,fi,60} [kN]	M ⁰ _{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
M30	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		
	NRk,s,fi,90 [kN]	V _{Rk,s,fi,90} [kN]	M ⁰ Rk,s,fi,90 [Nm]	N _{Rk,s,fi,120} [kN]	V _{Rk,s,fi,120} [kN]	M ⁰ Rk,s,fi,120 [Nm]
M8	0,4	0,4	0,4	0,3	0,3	0,3
M10	0,9	0,9	1,2	0,8	0,8	1,0
M12	1,6	1,6	3,9	1,3	1,3	3,9
M14	2,3	2,3	6,2	1,8	1,8	6,2
M16	3,1	3,1	9,9	2,5	2,5	9,9
M20	4,9	4,9	19,4	3,9	3,9	19,4
M22	6,0	6,0	26,7	4,8	4,8	26,7
M24	7,0	7,0	22,4	5,6	5,6	17,9
M27	9,1	9,1	33,2	7,3	7,3	26,6
M30	11,2	11,2	44,9	8,9	8,9	35,9

fischer injection system FIS EM Plus	
Performance Fire resistance to steel failure under tension and shear loading for	Annex C49

metric Anchor rods and Threaded rods part 2



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

	r tension and					
Threaded rod	R30			R60		
Steel zinc plated; detailed materials see Table A7.1, part No 2 1)	N _{Rk,s,fi,30} [kN]	V _{Rk,s,fi,30} [kN]	M ⁰ _{Rk,s,fi,30} [Nm]	N _{Rk,s,fi,60} [kN]	V _{Rk,s,fi,60} [kN]	M ⁰ _{Rk,s,fi,60} [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 _{Rk,s,fi,90} [kN]	V _{Rk,s,fi,90} [kN]	M ⁰ Rk,s,fi,90 [Nm]	N _{Rk,s,fi,120} [kN]	V _{Rk,s,fi,120} [kN]	M ⁰ _{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	10,7	R30	10,5	7,5	R60	23,0
	N	Ť	T 8 40	N.		5.40
Stainless steel R; detailed materials see Table A7.1, part No 2	N _{Rk,s,fi,30} [kN]	V _{Rk,s,fi,30} [kN]	M ⁰ _{Rk,s,fi,30} [Nm]	N _{Rk,s,fi,60} [kN]	V _{Rk,s,fi,60} [kN]	M ⁰ Rk,s,fi,60 [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 see Table A7.1, part No 2	N _{Rk,s,fi,90} [kN]	V _{Rk,s,fi,90} [kN]	M ⁰ _{Rk,s,fi,90} [Nm]	N _{Rk,s,fi,120} [kN]	V _{Rk,s,fi,120} [kN]	M ⁰ Rk,s,fi,120 [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
1 1/8"	9,8	9,8	36,9	7,8	7,8	29,5

¹⁾ No performance assessed for ASTM F1554 Grade 36.

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

 $k_{fi,p}(\theta)$



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 $\tau_{Rk,fi}(\theta)$ has to be calculated by the following equation:

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

Temperature in °C in the mortar layer

Characteristic bond resistance for cracked concrete under fire exposure for a given temperature in $\tau_{\text{Rk,fi}}(\theta)$ N/mm² for concrete classes C20/25 to C50/60

Characteristic bond resistance for cracked concrete C20/25 in N/mm², TRk,cr,C20/25

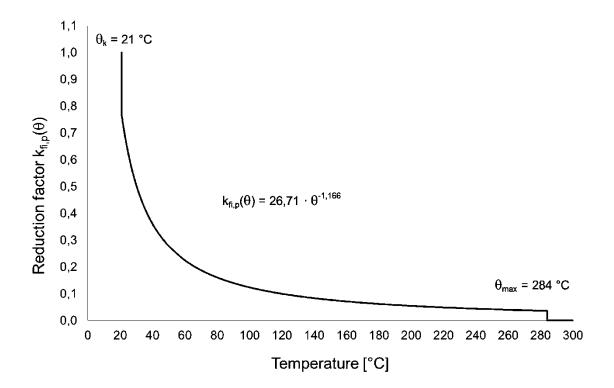
given in Table C5.1, Table C6.1, Table C26.1 or Table C28.1, respectively

 $k_{fi,p}(\theta) = 26,71 \cdot \theta^{-1,166} \le 1,0$ If: $\theta > 21$ °C Anchor rods or

Reduction factor under fire conditions

see Figure C51.1 Threaded rods $\mathbf{k}_{\mathrm{fi,p}}(\mathbf{\theta}) = \mathbf{0}$ If: $\theta > \theta_{max} = 284 \, ^{\circ}\text{C}$

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



fischer injection system FIS EM Plus **Annex C51 Performance** Characteristic bond resistance under fire conditions for anchor rods and threaded rods