

DICHIARAZIONE DI PRESTAZIONE

DoP 0190

per il Sistema a Iniezione fischer FIS EM Plus (ancorante chimico per l'utilizzo nel calcestruzzo)

IT

1. <u>Codice di identificazione unico del prodotto-tipo:</u>	DoP 0190		
2. <u>Usi previsti:</u>	Fissaggio post-installato in calcestruzzo fessurato o non fessurato. Vedi appendice, in particolare gli allegati da B1- B13		
3. <u>Fabbricante:</u>	fischerwerke GmbH & Co. KG, Otto-Hahn-Straße 15, 79211 Denzlingen, Germany		
4. <u>Mandatario:</u>	-		
5. <u>Sistemi di VVCP:</u>	1		
6. <u>Documento per la valutazione europea:</u>	EAD 330499-01-0601		
Valutazione tecnica europea:	ETA-17/0979; 2020-06-17		
Organismo di valutazione tecnica:	DIBt- Deutsches Institut für Bautechnik		
Organismi notificati:	1343 MPA Darmstadt / 2873 TU Darmstadt		
7. <u>Prestazioni dichiarate:</u>			
Resistenza meccanica e stabilità (BWR 1)			
Resistenza caratteristica al carico di tensione (carico statico e quasi-statico):	Resistenza alla rottura dell'acciaio:	Allegati C1- C3	$E_s = 210\,000\text{ MPa}$ $\psi^0_{sus} = \text{NPD}$
	Resistenza alla rottura del calcestruzzo combinata con sfilamento:	Allegati C5- C12	
	Resistenza alla rottura del cono di calcestruzzo:	Allegati C4	
	Distanza dal bordo per evitare lo splitting sotto carico:	Allegati C4	
	Robustezza:	Allegato C4	
Resistenza caratteristica al carico di taglio (carico statico e quasi statico):	Massima coppia di installazione:	Allegati B6- B8	
	Distanza dal bordo e interassi minimi:	Allegati B4, B5	
	Resistenza alla rottura dell'acciaio:	Allegati C1- C3	
	Resistenza alla rottura per pry-out:	Allegato C4	
	Resistenza alla rottura del bordo di calcestruzzo:	Allegato C4	
Resistenza e spostamenti caratteristici per le categorie di prestazione sismica C1 e C2	Resistenza al carico di trazione, spostamenti, categoria C1:	Allegati C15- C17	
	Resistenza al carico di trazione, spostamenti, categoria C2:	Allegati C15, C16, C18	
	Resistenza al carico di taglio, spostamenti, categoria C1:	Allegati C15- C17	
	Resistenza al carico di taglio, spostamenti, categoria C2:	Allegati C15, C16, C18	
	Fattore spazio anulare:	Allegato C15	
Spostamenti con carichi a breve e a lungo termine:	Spostamenti con carichi a breve e a lungo termine:	Allegati C13, C14	
Igiene, salute e ambiente (BWR 3)			
Contenuto, emissione e/o rilascio di sostanze pericolose	NPA		



8. Documentazione tecnica appropriata e/o
documentazione tecnica specifica:

La prestazione del prodotto sopra identificato è conforme all'insieme delle prestazioni dichiarate. La presente dichiarazione di prestazione è emessa, in conformità al regolamento (UE) n. 305/2011, sotto la sola responsabilità del fabbricante sopra identificato.

Firmato a nome e per conto del fabbricante da:

Thilo Pregartner, Dr.-Ing.
Tumlingen, 2020-07-02

Peter Schillinger, Dipl.-Ing.

Questa Dichiarazione di Prestazione (DoP) è stata preparata in varie lingue. In caso di contestazioni sull'interpretazione, prevarrà sempre la versione inglese.

L'Appendice include informazioni volontarie e complementari in lingua inglese che superano i requisiti di legge (lingua specificata in modo neutrale).

Specific Part

1 Technical description of the product

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

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

The product description is given in Annex A.

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

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

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

3.2 Hygiene, health and the environment (BWR 3)

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

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

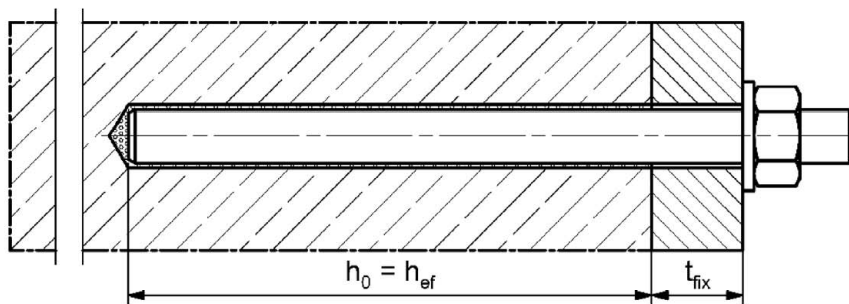
In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

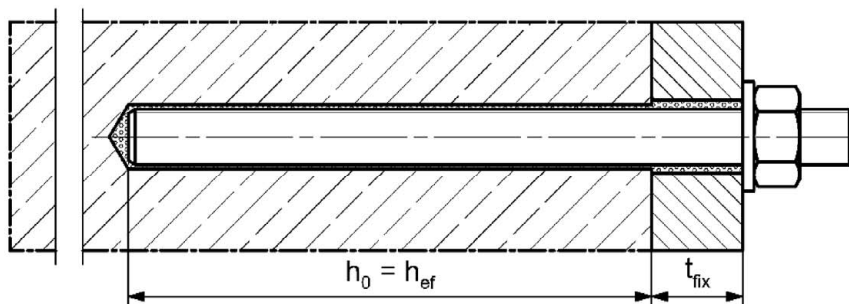
Installation conditions part 1

fischer anchor rod

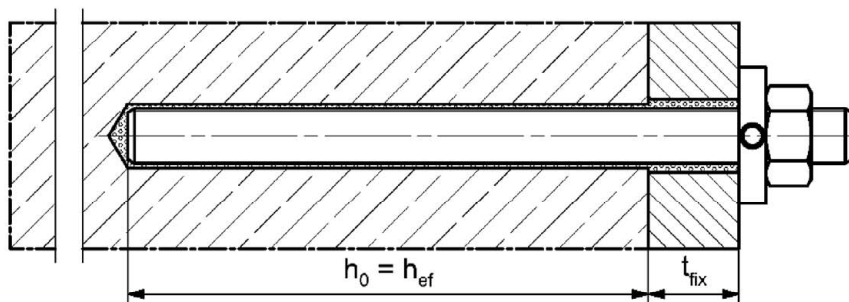
Pre-positioned installation



Push through installation (annular gap filled with mortar)



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



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

fischer injection system FIS EM Plus

Product description

Installation conditions part 1

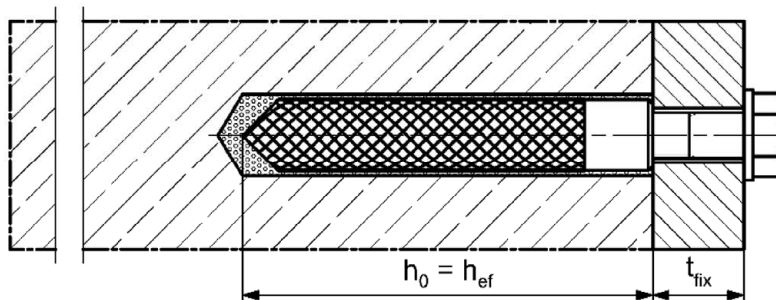
Annex A 1

Appendix 3/ 39

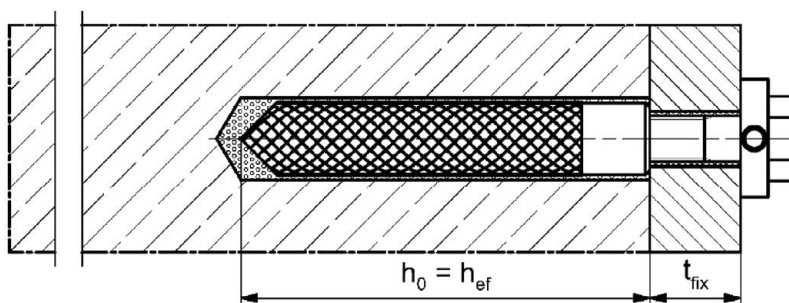
Installation conditions part 2

fischer internal threaded anchor RG MI

Pre-positioned installation



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



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

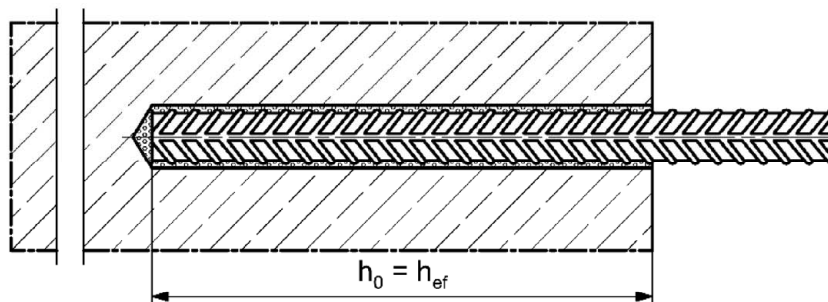
fischer injection system FIS EM Plus

Product description
Installation conditions part 2

Annex A 2
Appendix 4/ 39

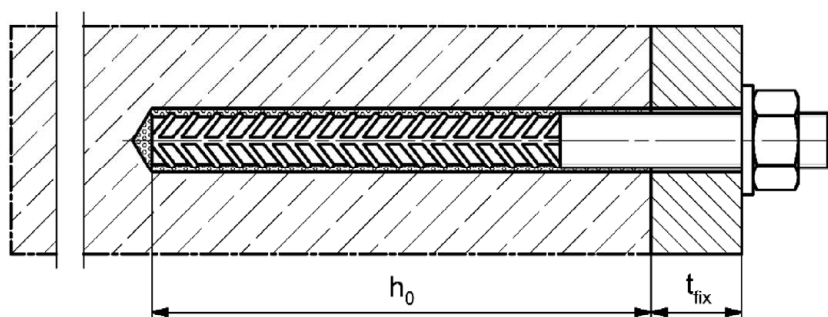
Installation conditions part 3

Reinforcing bar

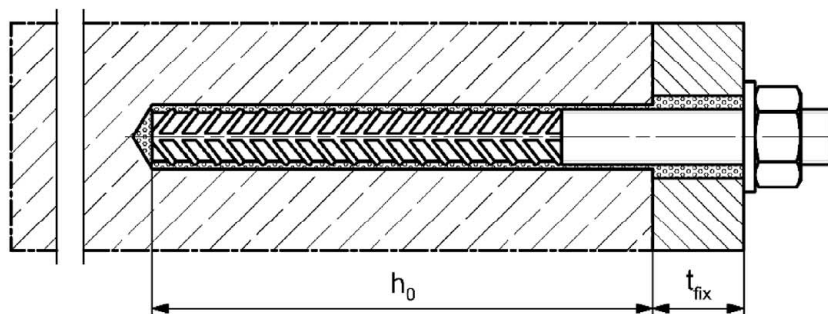


fischer rebar anchor FRA

Pre-positioned installation



Push through installation (annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

fischer injection system FIS EM Plus

Product description

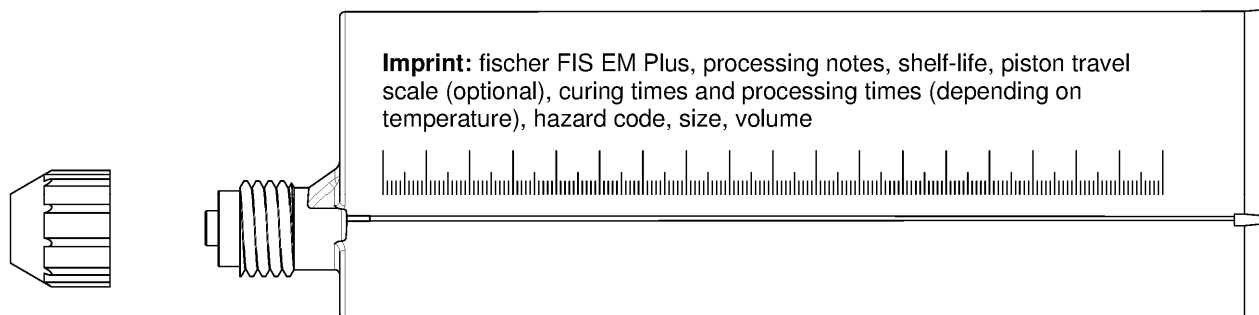
Installation conditions part 3

Annex A 3

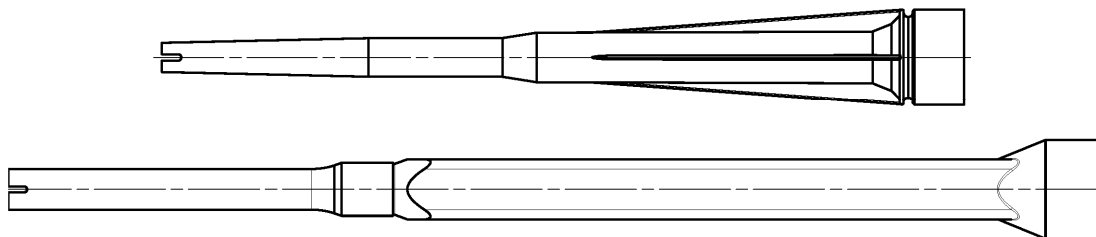
Appendix 5/ 39

Overview system components part 1

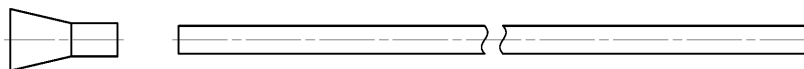
Injection cartridge (shuttle cartridge) with sealing cap; Size: 390 ml, 585 ml, 1100 ml, 1500 ml



Static mixer FIS MR Plus or UMR



Injection adapter and Extension tube for static mixer



Cleaning brush BS / BSB



Blow-out pump ABP



Figures not to scale

fischer injection system FIS EM Plus

Product description

Overview system components part 1;
cartridges / static mixer / accessories

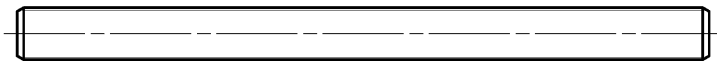
Annex A 4

Appendix 6/ 39

Overview system components part 2

fischer anchor rod

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

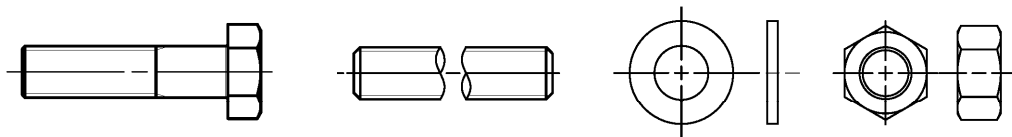


fischer internal threaded anchor RG MI

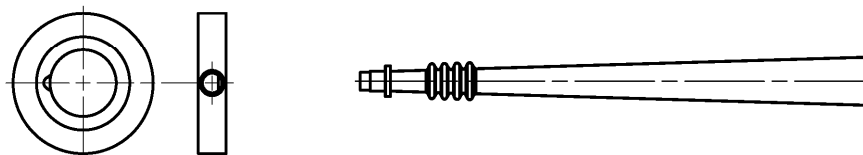
Size: M8, M10, M12, M16, M20



Screw / threaded rod / washer / hexagon nut



fischer filling disc with injection adapter



Reinforcing bar

Nominal diameter: $\phi 8$, $\phi 10$, $\phi 12$, $\phi 14$, $\phi 16$, $\phi 18$, $\phi 20$, $\phi 22$, $\phi 24$, $\phi 25$, $\phi 26$, $\phi 28$, $\phi 30$, $\phi 32$, $\phi 34$, $\phi 36$, $\phi 40$



fischer rebar anchor FRA

Size: M12, M16, M20, M24



Figures not to scale

fischer injection system FIS EM Plus

Product description

Overview system components part 2;
steel components

Annex A 5
Appendix 7/ 39

Table A6.1: Materials				
Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel	Stainless steel R	High corrosion resistant steel HCR
		zinc plated	acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2015	acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4:2015
2	Anchor rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004 f _{uk} ≤ 1000 N/mm ² A ₅ > 12% fracture elongation	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462; EN 10088-1:2014 f _{uk} ≤ 1000 N/mm ² A ₅ > 12% fracture elongation	Property class 50 or 80 EN ISO 3506-1:2009 or property class 70 with f _{yk} = 560 N/mm ² 1.4565; 1.4529; EN 10088-1:2014 f _{uk} ≤ 1000 N/mm ² A ₅ > 12% fracture elongation
		Fracture elongation A ₅ > 8 %, for applications without requirements for seismic performance category C2		
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004	1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362; EN 10088-1:2014	1.4565; 1.4529; EN 10088-1:2014
4	Hexagon nut	Property class 4, 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014
5	fischer internal threaded anchor RG MI	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K)	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014
6	Commercial standard screw or threaded rod for fischer internal threaded anchor RG MI	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) A ₅ > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014 A ₅ > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014 A ₅ > 8 % fracture elongation
7	fischer filling disc similar to DIN 6319-G	zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	1.4565;1.4529; EN 10088-1:2014
8	Reinforcing bar EN 1992-1-1:2004 and AC:2010, Annex C	Bars and de-coiled rods, class B or C with f _{yk} and k according to NDP or NCL according to EN 1992-1-1/NA f _{uk} = f _{tk} = k · f _{yk}		
9	fischer rebar anchor FRA	Rebar part: Bars and de-coiled rods class B or C with f _{yk} and k according to NDP or NCL of EN 1992-1-1:2004+AC:2010 f _{uk} = f _{tk} = k · f _{yk}	Threaded part: Property class 70 or 80 EN ISO 3506-1:2009 1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2015 1.4565; 1.4529 acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4:2015	
fischer injection system FIS EM Plus				
Product description Materials				Annex A 6 Appendix 8/ 39

Table B1.1: Overview use and performance categories

Annex B 1
Appendix 9/ 39

Specifications of intended use (part 2)

Base materials:

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

Use conditions (Environmental conditions):

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

Design:

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

Installation:

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

fischer injection system FIS EM Plus

Intended use
Specifications (part 2)

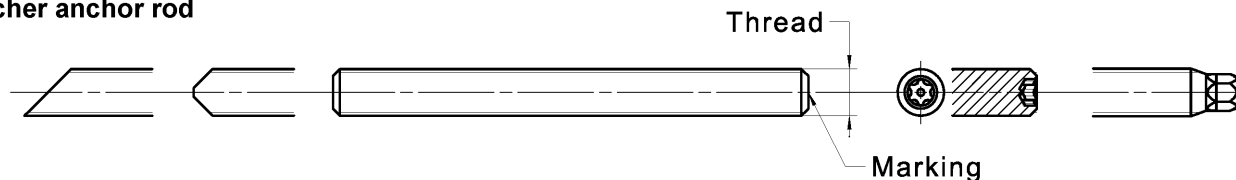
Annex B 2
Appendix 10/ 39

Table B3.1: Installation parameters for anchor rods

Anchor rods		Thread	M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Width across flats	SW	[mm]	13	17	19	22	24	30	32	36	41	46
Nominal drill hole diameter	d_0		10	12	14	16	18	22 24 ¹⁾	25	28	30	35
Drill hole depth	h_0		$h_0 = h_{ef}$									
Effective embedment depth	$h_{ef, min}$		60	60	70	75	80	90	93	96	108	120
	$h_{ef, max}$		160	200	240	280	320	400	440	480	540	600
Diameter of the clearance hole of the fixture	pre-positioned installation d_f		9	12	14	16	18	22	24	26	30	33
	push through installation d_f		12	14	16	18	20	26	28	30	33	40
Minimum thickness of concrete member	h_{min}		$h_{ef} + 30$ (≥ 100)			$h_{ef} + 2d_0$						
Maximum installation torque	$\max T_{inst}$	[Nm]	10	20	40	50	60	120	135	150	200	300

¹⁾ Both drill hole diameters can be used

fischer anchor rod



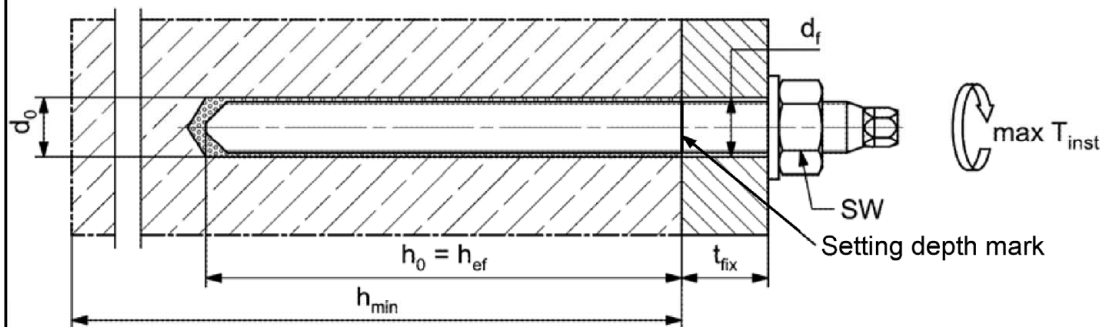
Marking (on random place) fischer anchor rod:

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

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

¹⁾ PC = property class

Installation conditions:



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

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

Figures not to scale

fischer injection system FIS EM Plus

Intended use

Installation parameters anchor rods

Annex B 3

Appendix 11/ 39

Table B4.1: Minimum spacing and minimum edge distance for **anchor rods** and **reinforcing bars**

Anchor rods			M8	M10	M12	M14	M16	-	M20	M22	M24
Reinforcing bars (nominal diameter) ϕ			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	s_{min}		according to Annex B5								
Minimum spacing											
Uncracked / cracked concrete	s_{min}	[mm]	40	45	55	60	65	85	85	95	105
Minimum edge distance	c_{min}		according to Annex B5								
Required projecting area											
Uncracked concrete	$A_{sp,req}$	[1000 mm ²]	8	13	22	23	24	38,5	38,5	39,5	40
Cracked concrete			6,5	10	16,5	17,5	18,5	29,5	29,5	30	30,5

Anchor rods			-	-	M27	-	M30	-	-	-	-		
Reinforcing bars (nominal diameter)			ϕ	25	26	-	28	30	32	34	36	40	
Minimum edge distance													
Uncracked / cracked concrete			C _{min}	[mm]	75	75	75	80	80	120	120	135	175
Minimum spacing			S _{min}		according to Annex B5								
Minimum spacing													
Uncracked / cracked concrete			S _{min}	[mm]	120	120	120	140	140	160	160	160	160
Minimum edge distance			C _{min}		according to Annex B5								
Required projecting area													
Uncracked concrete			A _{sp,req}	[1000 mm²]	47,5	47,5	47,5	64	64	64	64	64	64
Cracked concrete					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} .

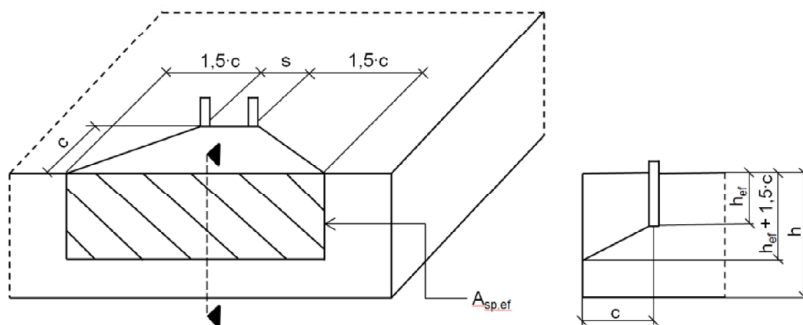
For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

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

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

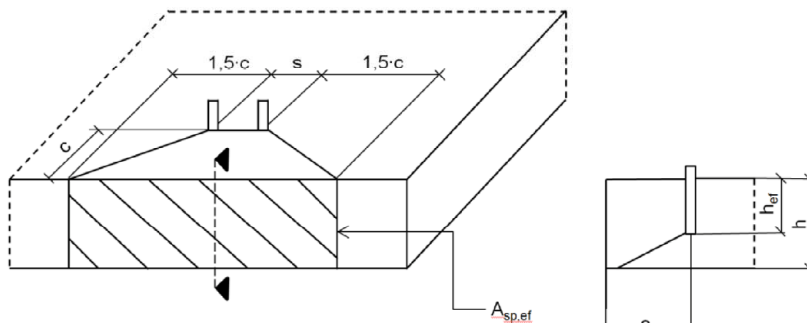
$A_{sp,t} = A_{sp,ef}$ = effective projecting area (according to Annex B5)

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



Single anchor	$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$	$[mm^2]$	with $c \geq c_{min}$
Group of anchors with $s > 3 \cdot c$	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$	$[mm^2]$	
Group of anchors with $s \leq 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1,5 \cdot c)$	$[mm^2]$	

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



Single anchor	$A_{sp,t} = 3 \cdot c \cdot \text{existing } h$	$[mm^2]$	with $c \geq c_{min}$
Group of anchors with $s > 3 \cdot c$	$A_{sp,t} = 6 \cdot c \cdot \text{existing } h$	$[mm^2]$	
Group of anchors with $s \leq 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot \text{existing } h$	$[mm^2]$	

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

Figures not to scale

fischer injection system FIS EM Plus

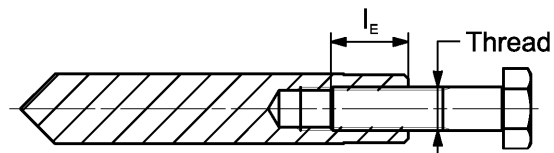
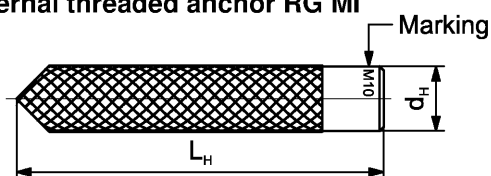
Intended use

Minimum thickness of concrete member for anchor rods,
minimum spacing and edge distance

Annex B 5
Appendix 13/ 39

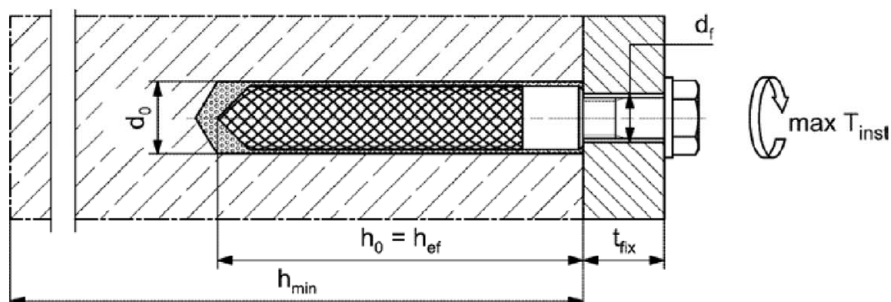
Table B6.1: Installation parameters for **fischer internal threaded anchors RG MI**

Internal threaded anchors RG MI		Thread	M8	M10	M12	M16	M20
Diameter of anchor	$d_{nom} = d_H$	[mm]	12	16	18	22	28
Nominal drill hole diameter	d_0		14	18	20	24	32
Drill hole depth	h_0		$h_0 = h_{ef} = L_H$				
Effective embedment depth ($h_{ef} = L_H$)	h_{ef}		90	90	125	160	200
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		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	$l_{E,max}$		18	23	26	35	45
Minimum screw-in depth	$l_{E,min}$		8	10	12	16	20
Maximum installation torque	$\max T_{inst}$	[Nm]	10	20	40	80	120

fischer internal threaded anchor RG MI

Marking: Anchor size e. g.: **M10**
 Stainless steel → additional **R**; e.g.: **M10 R**
 High corrosion resistant steel → additional **HCR**; e.g.: **M10 HCR**

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

Installation conditions:

Figures not to scale

fischer injection system FIS EM Plus

Intended use

Installation parameters internal threaded anchors RG MI

Annex B 6

Appendix 14/ 39

Table B7.1: Installation parameters for reinforcing bars ¹⁾

Nominal diameter of the bar		ϕ	8 ²⁾		10 ²⁾		12 ²⁾		14	16	18	20	22	24
Nominal drill hole diameter	d ₀	[mm]	10	12	12	14	14	16	18	20	25	25	30	30
Drill hole depth	h ₀		h ₀ = h _{ef}											
Effective	h _{ef,min}		60	60	70	75	80	85	90	94	98			
embedment depth	h _{ef,max}		160	200	240	280	320	360	400	440	480			
Minimum thickness of concrete member	h _{min}		h _{ef} + 30 (≥ 100)					h _{ef} + 2d ₀						

Nominal diameter of the bar ϕ		25	26	28	30	32	34	36	40	-
Nominal drill hole diameter d_0	[mm]	30	35	35	40	40	40	45	55	-
Drill hole depth h_0		$h_0 = h_{ef}$								
Effective embedment depth $h_{ef,min}$		100	104	112	120	128	136	144	160	-
$h_{ef,max}$		500	520	560	600	640	680	720	800	-
Minimum thickness of concrete member h_{min}		$h_{ef} + 2d_0$								

¹⁾ minimum spacing and minimum edge distance see Annex B 4

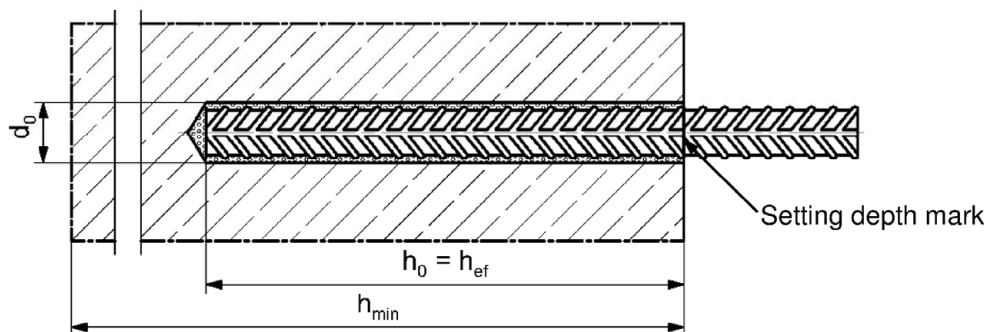
²⁾ Both drill hole diameters can be used

Reinforcing bar



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

Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use

Installation parameters reinforcing bars

Annex B 7

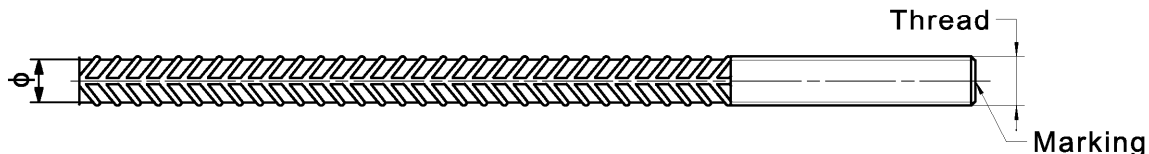
Appendix 15/ 39

Table B8.1: Installation parameters for **fischer rebar anchor FRA**

Rebar anchor FRA		Thread	M12 ¹⁾		M16	M20	M24
Nominal diameter of the bar	ϕ	[mm]	12		16	20	25
Width across flats	SW		19		24	30	36
Nominal drill hole diameter	d_0		14	16	20	25	30
Drill hole depth	h_0		$h_{ef} + l_e$				
Effective embedment depth	$h_{ef,min}$		70		80	90	96
	$h_{ef,max}$		140		220	300	380
Distance concrete surface to welded joint	l_e		100				
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		55		65	85	105
Diameter of clearance hole in the fixture	pre-positioned anchorage $\leq d_f$		14		18	22	26
	push through anchorage $\leq d_f$		18		22	26	32
Minimum thickness of concrete member	h_{min}		$h_0 + 30$		$h_0 + 2d_0$		
Maximum installation torque	$\max T_{inst}$	[Nm]	40		60	120	150

¹⁾ Both drill hole diameters can be used

fischer rebar anchor FRA

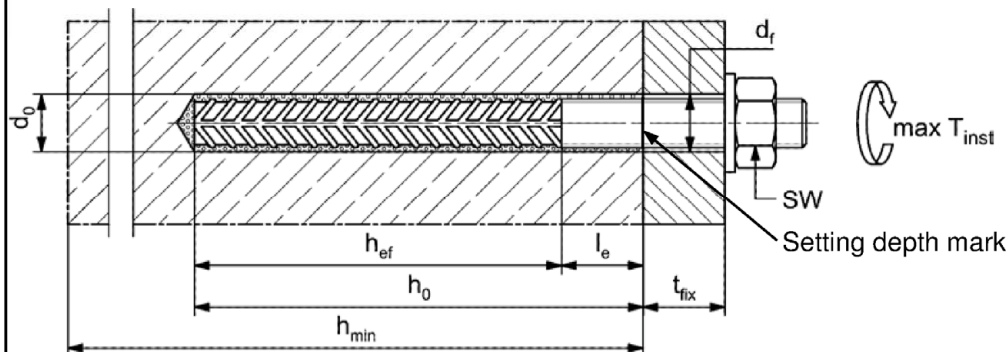


Marking frontal e. g:

 FRA (for stainless steel);

 FRA HCR (for high corrosion resistant steel)

Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use

Installation parameters rebar anchor FRA

Annex B 8

Appendix 16/ 39

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

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

Nominal drill hole diameter	d_0		10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
Steel brush diameter BS	d_b	[mm]	11	14	16	20		25	26	27	30	40			-	-	-
Steel brush diameter BSB	d_b		-	-	-	-		-	-	-	-	-			42	47	58

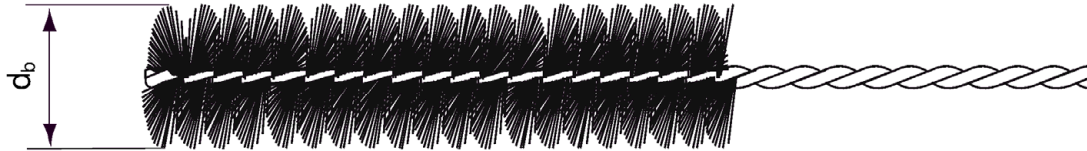


Table B9.2 **Maximum processing time** of the mortar and **minimum curing time**
(During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]	Maximum processing time t_{work}	Minimum curing time 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

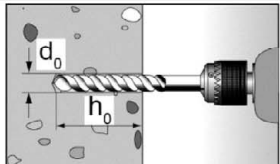
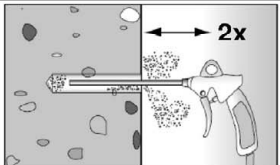
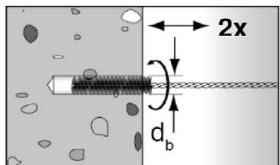
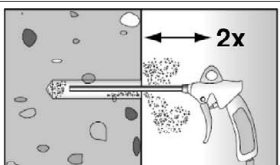
Intended use

Cleaning brush (steel brush)
Processing time and curing time

Annex B 9
Appendix 17/ 39

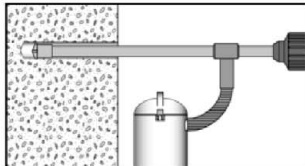
Installation instructions part 1

Drilling and cleaning the hole (hammer drilling with standard drill bit)

1		Drill the hole. Nominal drill hole diameter d_0 and drill hole depth h_0 see tables B3.1, B6.1, B7.1, B8.1	
2		Cleaning the drill hole: Blow out the drill hole twice, with oil free compressed air ($p \geq 6$ bar)	
3		Brush the drill hole twice. For drill hole diameter ≥ 30 mm use a power drill. For deep holes use an extension. Corresponding brushes see table B9.1	
4		Cleaning the drill hole: Blow out the drill hole twice, with oil free compressed air ($p \geq 6$ bar)	

Go to step 6

Drilling and cleaning the hole (hammer drilling with hollow drill bit)

1		Check a suitable hollow drill (see table B1.1) for correct operation of the dust extraction	
2		Use a suitable dust extraction system, e. g. fischer FVC 35 M or a comparable dust extraction system with equivalent performance data 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 d_0 and drill hole depth h_0 see tables B3.1, B6.1, B7.1, B8.1	

Go to step 6

fischer injection system FIS EM Plus

Intended use

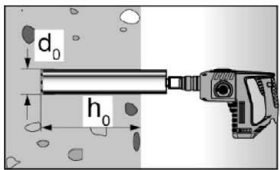
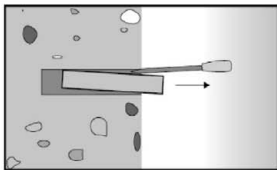
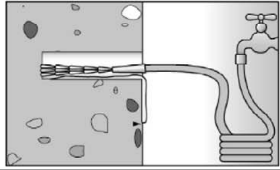
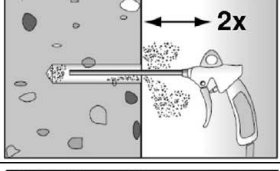
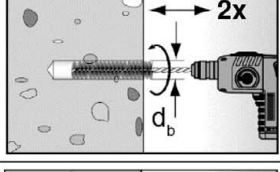
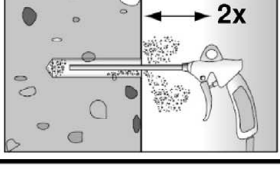
Installation instructions part 1

Annex B 10

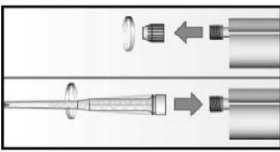
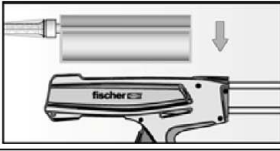
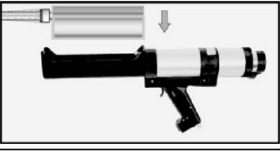
Appendix 18/ 39

Installation instructions part 2

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

1		Drill the hole. Drill hole diameter d_0 and nominal drill hole depth h_0 see tables B3.1, B6.1, B7.1, B8.1		Break the drill core and remove it
2		Flush the drill hole with clean water until it flows clear		
3		Blow out the drill hole twice, using oil-free compressed air ($p > 6$ bar)		
4		Brush the drill hole twice using a power drill. Corresponding brushes see table B9.1		
5		Blow out the drill hole twice, using oil-free compressed air ($p > 6$ bar)		

Preparing the cartridge

6		Remove the sealing cap Screw on the static mixer (the spiral in the static mixer must be clearly visible)		
7			Place the cartridge into the dispenser	
8			Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey	

fischer injection system FIS EM Plus

Intended use

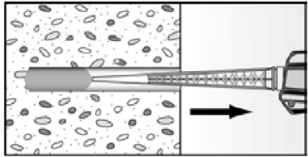
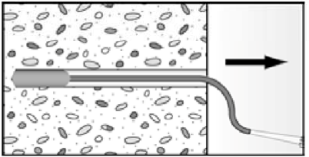
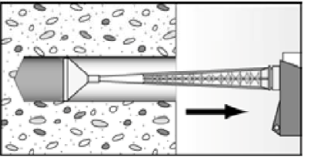
Installation instructions part 2

Annex B 11

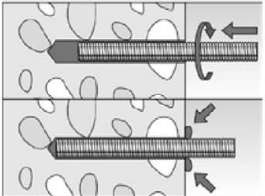
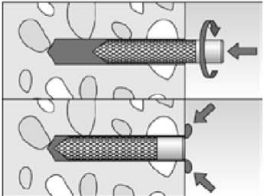
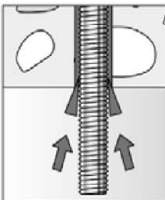
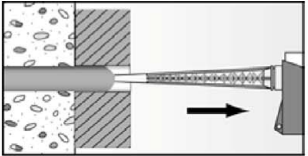
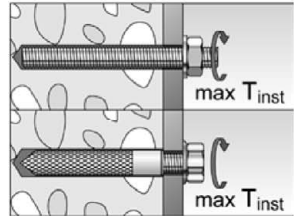
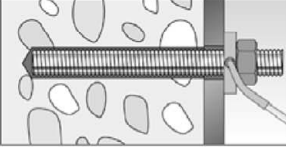
Appendix 19/ 39

Installation instructions part 3

Injection of the mortar

9	 Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles	 For drill hole depth ≥ 150 mm use an extension tube	 For overhead installation, deep holes ($h_0 > 250$ mm) or drill hole diameter ($d_0 \geq 40$ mm) use an injection-adaptor
---	---	--	---

Installation of anchor rods or fischer internal threaded anchors RG MI

10	 	Only use clean and oil-free metal parts. Mark the setting depth of the metal parts. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so. After inserting the metal part, excess mortar must be emerged around the anchor element.
	 For overhead installations support the metal part with wedges (e. g. fischer centering wedges) or fischer overhead clips.	 For push through installation fill the annular gap with mortar
11	 Wait for the specified curing time t_{cure} see table B9.2	12  Mounting the fixture max T_{inst} see tables B3.1 and B6.1
Option		After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the fischer filling disc. Compressive strength ≥ 50 N/mm² (e.g. fischer injection mortars FIS HB, FIS SB, FIS V, FIS EM Plus) ATTENTION: Using fischer filling disc reduces t_{fix} (usable length of the anchor)

fischer injection system FIS EM Plus

Intended use

Installation instructions part 3

Annex B 12

Appendix 20/ 39

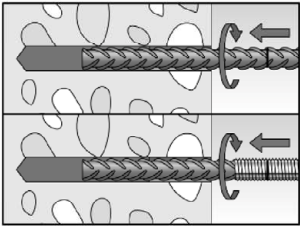
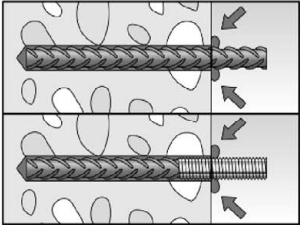
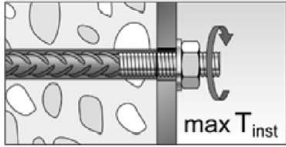
Installation instructions part 4 Installation reinforcing bars and fischer rebar anchor FRA			
10		Only use clean and oil-free reinforcing bars or fischer FRA. Mark the setting depth. Turn while using force to push the reinforcement bar or the fischer FRA into the filled hole up to the setting depth mark	
		When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.	
11		Wait for the specified curing time t_{cure} see table B9.2	12  Mounting the fixture $\max T_{inst}$ see table B8.1

Table C1.1: Characteristic values for **steel failure** under tension / shear load of **fischer anchor rods** and **standard threaded rods**

Anchor rod / standard threaded rod				M8	M10	M12	M14	M16	M20	M22	M24	M27	M30	
Bearing capacity under tension load, steel failure ³⁾														
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	[kN]	15(13)	23(21)	33	46	63	98	121	141	184	224
			5.8		19(17)	29(27)	43	58	79	123	152	177	230	281
			8.8		29(27)	47(43)	68	92	126	196	243	282	368	449
	Stainless steel R and high corrosion resistant steel HCR		50		19	29	43	58	79	123	152	177	230	281
			70		26	41	59	81	110	172	212	247	322	393
			80		30	47	68	92	126	196	243	282	368	449

Partial factors ¹⁾

Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	4.8	[-]	1,50
			5.8		1,50
			8.8		1,50
	Stainless steel R and high corrosion resistant steel HCR		50		2,86
			70		1,50 ²⁾ / 1,87
			80		1,60

Bearing capacity under shear load, steel failure³⁾

without lever arm

Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	4.8	[kN]	9(8)	14(13)	20	28	38	59	73	85	110	135	
					11(10)	17(16)	25	34	47	74	91	106	138	168	
					15(13)	23(21)	34	46	63	98	122	141	184	225	
	Stainless steel R and high corrosion resistant steel HCR				50	9	15	21	29	39	61	76	89	115	141
					70	13	20	30	40	55	86	107	124	161	197
					80	15	23	34	46	63	98	122	141	184	225
Ductility factor		k_7	[-]	1,0											

with lever arm

Charact. resistance $M_{Rk,s}$	Steel zinc plated	Property class	4.8 5.8 8.8 50 70 80	[Nm]	15(13)	30(27)	52	83	133	259	357	448	665	899
					19(16)	37(33)	65	104	166	324	447	560	833	1123
					30(26)	60(53)	105	167	266	519	716	896	1333	1797
					19	37	65	104	166	324	447	560	833	1123
					26	52	92	146	232	454	626	784	1167	1573
					30	60	105	167	266	519	716	896	1333	1797
Stainless steel R and high corrosion resistant steel HCR														

Partial factors ¹⁾

Partial factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	4.8	[-]	1,25	
					5.8	1,25
					8.8	1,25
	Stainless steel R and high corrosion resistant steel HCR				50	2,38
					70	1,25 ²⁾ / 1,56
					80	1,33

¹⁾ In absence of other national regulations

²⁾ Only admissible for high corrosion resist. steel HCR, with $f_{yk}/f_{uk} \geq 0,8$ and $A_5 > 12\%$ (e.g. fischer anchor rods)

³⁾ Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot dip galvanised standard threaded rods according to EN ISO 10684:2004+AC:2009

fischer injection system FIS EM Plus

Performances

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

Annex C 1

Appendix 22/ 39

Table C2.1: Characteristic values for **steel failure** under tension / shear load of **fischer internal threaded anchors RG MI**

fischer internal threaded anchors RG MI				M8	M10	M12	M16	M20	
Bearing capacity under tension load, steel failure									
Charact. resistance with screw	N _{Rk,s}	Property class	5.8	[kN]	19	29	43	79	123
			8.8		29	47	68	108	179
		Property class 70	R		26	41	59	110	172
			HCR		26	41	59	110	172
Partial factors ¹⁾									
Partial factors	γ _{Ms,N}	Property class	5.8	[-]	1,50				
			8.8		1,50				
		Property class 70	R		1,87				
			HCR		1,87				
Bearing capacity under shear load, steel failure									
Without lever arm									
Charact. resistance with screw	V ⁰ _{Rk,s}	Property class	5.8	[kN]	9,2	14,5	21,1	39,2	62,0
			8.8		14,6	23,2	33,7	54,0	90,0
		Property class 70	R		12,8	20,3	29,5	54,8	86,0
			HCR		12,8	20,3	29,5	54,8	86,0
Ductility factor			k ₇	[-]	1,0				
With lever arm									
Charact. resistance with screw	M ⁰ _{Rk,s}	Property class	5.8	[Nm]	20	39	68	173	337
			8.8		30	60	105	266	519
		Property class 70	R		26	52	92	232	454
			HCR		26	52	92	232	454
Partial factors ¹⁾									
Partial factors	γ _{Ms,V}	Property class	5.8	[-]	1,25				
			8.8		1,25				
		Property class 70	R		1,56				
			HCR		1,56				

¹⁾ In absence of other national regulations

fischer injection system FIS EM Plus

Performances

Characteristic values for steel failure under tension / shear load of fischer internal threaded anchor RG MI

Annex C 2

Appendix 23/ 39

Table C3.1: Characteristic values for steel failure under tension / shear load of reinforcing bars																					
Nominal diameter of the bar				ϕ	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Bearing capacity under tension load, steel failure																					
Characteristic resistance				$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}^{1)}$															
Bearing capacity under shear load, steel failure																					
Without lever arm																					
Characteristic resistance				$V^0_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}^{1)}$															
Ductility factor				k_7	[-]	1,0															
With lever arm																					
Characteristic resistance				$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}^{1)}$															
¹⁾ f_{uk} or f_{yk} respectively must be taken from the specifications of the reinforcing bar																					
Table C3.2: Characteristic values for steel failure under tension / shear load of fischer rebar anchors FRA																					
fischer rebar anchor FRA					M12			M16			M20			M24							
Bearing capacity under tension load, steel failure																					
Characteristic resistance				$N_{Rk,s}$	[kN]	63			111			173			270						
Partial factor ¹⁾																					
Partial factor				$\gamma_{Ms,N}$	[-]	1,4															
Bearing capacity under shear load, steel failure																					
Without lever arm																					
Characteristic resistance				$V^0_{Rk,s}$	[kN]	30			55			86			124						
Ductility factor				k_7	[-]	1,0															
With lever arm																					
Characteristic resistance				$M^0_{Rk,s}$	[Nm]	92			233			454			785						
Partial factor ¹⁾																					
Partial factor				$\gamma_{Ms,V}$	[-]	1,56															
¹⁾ In absence of other national regulations																					
fischer injection system FIS EM Plus														Annex C 3 Appendix 24/ 39							
Performances Characteristic values for steel failure under tension / shear load of reinforcing bars and fischer rebar anchors FRA																					

Table C4.1: Characteristic values for concrete failure under tension / shear load																					
Size				All sizes																	
Tension load																					
Installation factor			γ_{inst}	[-]	See annex C 5 to C 12 and C 17 to C 18																
Factors for the compressive strength of concrete > C20/25																					
Increasing factor for τ_{Rk}	C25/30		Ψ_c	[-]	1,02																
	C30/37				1,04																
	C35/45				1,06																
	C40/50				1,07																
	C45/55				1,08																
	C50/60				1,09																
Splitting failure																					
Edge distance	$h / h_{\text{ef}} \geq 2,0$		$C_{\text{cr,sp}}$	[mm]	1,0 h_{ef}																
	$2,0 > h / h_{\text{ef}} > 1,3$				4,6 $h_{\text{ef}} - 1,8 h$																
	$h / h_{\text{ef}} \leq 1,3$				2,26 h_{ef}																
Spacing			$S_{\text{cr,sp}}$		2 $C_{\text{cr,sp}}$																
Concrete cone failure																					
Uncracked concrete			$k_{\text{ucr,N}}$	[-]	11,0																
Cracked concrete			$k_{\text{cr,N}}$		7,7																
Edge distance			$C_{\text{cr,N}}$	[mm]	1,5 h_{ef}																
Spacing			$S_{\text{cr,N}}$		2 $C_{\text{cr,N}}$																
Factors for sustained tension load																					
Factor			Ψ_{sus}^0	[-]	_1)																
Shear load																					
Installation factor			γ_{inst}	[-]	1,0																
Concrete pry-out failure																					
Factor for pry-out failure			k_8	[-]	2,0																
Concrete edge failure																					
Effective length of fastener in shear loading			l_f	[mm]	for $d_{\text{nom}} \leq 24 \text{ mm}$: min (h_{ef} ; 12 d_{nom}) for $d_{\text{nom}} > 24 \text{ mm}$: min (h_{ef} ; 8 d_{nom} ; 300 mm)																
Calculation diameters																					
Size					M8	M10	M12	M14	M16	M20	M22	M24	M27	M30							
fischer anchor rods and standard threaded rods			d_{nom}	[mm]	8	10	12	14	16	20	22	24	27	30							
fischer internal threaded anchors RG MI			d_{nom}		12	16	18	_2)	22	28	_2)	_2)	_2)	_2)							
fischer rebar anchor FRA			d_{nom}		_2)	_2)	12	_2)	16	20	_2)	25	_2)	_2)							
Size (nominal diameter of the bar)			ϕ		8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Reinforcing bar			d_{nom}	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
¹⁾ No performance assessed ²⁾ Anchor type not part of the ETA																					
fischer injection system FIS EM Plus															Annex C 4 Appendix 25/ 39						
Performances Characteristic values for concrete failure under tension / shear load																					

Table C5.1: Characteristic values for combined pull-out and concrete failure for fischer anchor rods and standard threaded rods in hammer or diamond drilled holes; uncracked or cracked concrete; working life 50 years													
Anchor rod / standard threaded rod			M8	M10	M12	M14	M16	M20	M22	M24	M27	M30	
Combined pullout and concrete cone failure													
Calculation diameter		d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked concrete													
Characteristic bond resistance in uncracked concrete C20/25													
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)													
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm²]	18	18	18	17	17	16	15	15	15	14
	II: 50 °C / 72 °C			18	17	17	16	16	15	14	14	14	13
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)													
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm²]	16	16	15	13	13	11	11	10	10	9
	II: 50 °C / 72 °C			15	14	14	13	12	11	10	10	9	9
Diamond-drilling (dry or wet concrete as well as water filled hole)													
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm²]	16	15	13	12	12	10	10	10	9	9
	II: 50 °C / 72 °C			15	14	12	11	11	10	9	9	8	8
Installation factors													
Dry or wet concrete		γ_{inst}	[-]	1,0									
Water filled hole				1,4									
Cracked concrete													
Characteristic bond resistance in cracked concrete C20/25													
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)													
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm²]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
	II: 50 °C / 72 °C			7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Diamond - drilling (dry or wet concrete)													
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm²]	7	7	7	7	6	6	7	7	7	7
	II: 50 °C / 72 °C			7	7	7	7	6	6	7	7	7	7
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole)													
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm²]	6	7,5	7,5	7	6	6	6	6	6	6
	II: 50 °C / 72 °C			6	7	7	7	6	6	6	6	6	6
Installation factors													
Dry or wet concrete		γ_{inst}	[-]	1,0									
Water filled hole				1,2					1,4				
fischer injection system FIS EM Plus										Annex C 5 Appendix 26/ 39			
Performances Characteristic values for combined pull-out and concrete failure for fischer anchor rod and standard threaded rods; working life 50 years													

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

Internal threaded anchor RG MI			M8	M10	M12	M16	M20		
Combined pullout and concrete cone failure									
Calculation diameter		d	[mm]	12	16	18	22	28	
Uncracked concrete									
Characteristic bond resistance in uncracked concrete C20/25									
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)									
Temperature range	I: 35 °C / 60 °C		$\tau_{Rk,ucr}$	[N/mm ²]	15	14	14	13	12
	II: 50 °C / 72 °C				14	13	13	12	11
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)									
Temperature range	I: 35 °C / 60 °C		$\tau_{Rk,ucr}$	[N/mm ²]	14	12	12	11	10
	II: 50 °C / 72 °C				13	12	11	10	9
Diamond-drilling (dry or wet concrete as well as water filled hole)									
Temperature range	I: 35 °C / 60 °C		$\tau_{Rk,ucr}$	[N/mm ²]	13	12	11	10	9
	II: 50 °C / 72 °C				12	11	10	9	8
Installation factors									
Dry or wet concrete		γ_{inst}	[-]	1,0					
Water filled hole				1,4					
Cracked concrete									
Characteristic bond resistance in cracked concrete C20/25									
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete)									
Temperature range	I: 35 °C / 60 °C		$\tau_{Rk,cr}$	[N/mm ²]	7	6	6	7	7
	II: 50 °C / 72 °C				7	6	6	7	7
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole)									
Temperature range	I: 35 °C / 60 °C		$\tau_{Rk,cr}$	[N/mm ²]	7	6,5	6	6	6
	II: 50 °C / 72 °C				7	6	6	6	6
Installation factors									
Dry or wet concrete		γ_{inst}	[-]	1,0					
Water filled hole				1,2			1,4		

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

Internal threaded anchor RG MI			M8	M10	M12	M16	M20	
Combined pullout and concrete cone failure								
Calculation diameter		d	[mm]	12	16	18	22	28
Uncracked concrete								
Characteristic bond resistance in uncracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)								
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	15	14	14	13	12
	II: 50 °C / 72 °C			14	13	13	12	11
Diamond-drilling (dry or wet concrete)								
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	13	12	11	10	9
	II: 50 °C / 72 °C			12	11	10	9	8
Installation factors								
Dry or wet concrete		γ_{inst}	[-]	1,0				
Working life 100 years	I: 35 °C / 60 °C	$\alpha_{100\ years}$	[-]	0,75	0,75	0,75	0,75	0,75
	II: 50 °C / 72 °C			0,55	0,60	0,60	0,65	0,65
Cracked concrete								
Characteristic bond resistance in cracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete)								
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	7	6	6	7	7
	II: 50 °C / 72 °C			7	6	6	7	7
Installation factors								
Dry or wet concrete		γ_{inst}	[-]	1,0				
Working life 100 years	I: 35 °C / 60 °C	$\alpha_{100\ years}$	[-]	0,60	0,85	0,80	0,65	0,65
	II: 50 °C / 72 °C			0,60	0,85	0,80	0,65	0,65

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

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

2) Calculation of characteristic bond resistance in cracked concrete $\tau_{RK,100,cr}$:

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

fischer injection system FIS EM Plus

Performances

Characteristic values for combined pull-out and concrete failure for fischer internal threaded anchors RG MI; working life 100 years

Annex C 8

Appendix 29/ 39

Table C9.1: Characteristic values for **combined pull-out** and concrete failure for **reinforcing bars** in hammer or diamond drilled holes; **uncracked or cracked concrete; working life 50 years**

Nominal diameter of the bar			ϕ	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combined pullout and concrete cone failure																				
Calculation diameter		d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracked concrete																				
Characteristic bond resistance in uncracked concrete C20/25																				
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)																				
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	16	15	15	14	14	13	13	13	12	12	12	12	12	11	11	11	
	II: 50 °C / 72 °C			15	14	14	13	13	12	12	12	12	11	11	11	11	11	11	10	10
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)																				
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	16	16	14	13	12	12	11	11	10	10	10	10	9	9	9	8	8
	II: 50 °C / 72 °C			15	14	13	12	12	11	11	10	10	9	9	9	9	9	8	8	8
Diamond-drilling (dry or wet concrete as well as water filled hole)																				
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	16	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
	II: 50 °C / 72 °C			15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Installation factors																				
Dry or wet concrete		γ_{inst}	[-]	1,0																
Water filled hole				1,4																
Cracked concrete																				
Characteristic bond resistance in cracked concrete C20/25																				
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)																				
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	II: 50 °C / 72 °C			7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Diamond-drilling (dry or wet concrete)																				
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
	II: 50 °C / 72 °C			7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole)																				
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	6	7,5	6,5	6,5	6,5	6	6	6	6	6	6	6	6	5	5	5	5
	II: 50 °C / 72 °C			6	6,5	6,5	6	6	6	6	6	6	6	6	6	6	5	5	5	5
Installation factors																				
Dry or wet concrete		γ_{inst}	[-]	1,0																
Water filled hole				1,2					1,4											

fischer injection system FIS EM Plus

Performances

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

Annex C 9

Appendix 30/ 39

Table C10.1: Characteristic values for **combined pull-out** and concrete failure for **reinforcing bars** in hammer or diamond drilled holes; **uncracked or cracked concrete; working life 100 years**

[illegible]

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

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

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

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

fischer injection system FIS EM Plus

Performances

Characteristic values for combined pull-out and concrete failure for reinforcing bars;
working life 100 years

Annex C 10

Appendix 31/ 39

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

fischer rebar anchor FRA			M12	M16	M20	M24	
Combined pullout and concrete cone failure							
Calculation diameter		d	[mm]	12	16	20	25
Uncracked concrete							
Characteristic bond resistance in uncracked concrete C20/25							
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	15	14	13	12
	II: 50 °C / 72 °C			14	13	12	12
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	14	12	11	10
	II: 50 °C / 72 °C			13	12	11	9
Diamond-drilling (dry or wet concrete as well as water filled hole)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	13	12	10	9
	II: 50 °C / 72 °C			12	11	10	9
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,0			
Water filled hole				1,4			
Cracked concrete							
Characteristic bond resistance in cracked concrete C20/25							
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	8	8	8	8
	II: 50 °C / 72 °C			8	8	8	8
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	7	6	6	6
	II: 50 °C / 72 °C			7	6	6	6
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,0			
Water filled hole				1,2		1,4	

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

fischer rebar anchor FRA			M12	M16	M20	M24	
Combined pullout and concrete cone failure							
Calculation diameter		d	[mm]	12	16	20	25
Uncracked concrete							
Characteristic bond resistance in uncracked concrete C20/25							
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	15	14	13	12
	II: 50 °C / 72 °C			14	13	12	12
Diamond-drilling (dry or wet concrete)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$	[N/mm ²]	13	12	10	9
	II: 50 °C / 72 °C			12	11	10	9
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,0			
Working life 100 years	I: 35 °C / 60 °C	$\alpha_{100\ years}$	[N/mm ²]	0,75	0,75	0,75	0,75
	II: 50 °C / 72 °C			0,60	0,65	0,65	0,65
Cracked concrete							
Characteristic bond resistance in cracked concrete C20/25							
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$	[N/mm ²]	8	8	8	8
	II: 50 °C / 72 °C			8	8	8	8
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,0			
Working life 100 years	I: 35 °C / 60 °C	$\alpha_{100\ years}$	[-]	0,80	0,65	0,65	0,65
	II: 50 °C / 72 °C			0,80	0,65	0,65	0,65

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

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

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

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

fischer injection system FIS EM Plus

Performances

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

Annex C 12

Appendix 33/ 39

Table C13.1: Displacements for anchor rods

Anchor rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Displacement-Factors for tension load ¹⁾											
Uncracked or cracked concrete; Temperature range I, II											
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
$\delta_{N\infty}$ -Factor		0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19
Displacement-Factors for shear load ²⁾											
Uncracked or cracked concrete; Temperature range I, II											
δ_{V0} -Factor	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05
$\delta_{V\infty}$ -Factor		0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07
¹⁾ Calculation of effective displacement: $\delta_{N0} = \delta_{N0}\text{-Factor} \cdot \tau_{Ed}$ $\delta_{N\infty} = \delta_{N\infty}\text{-Factor} \cdot \tau_{Ed}$ $(\tau_{Ed}: \text{Design value of the applied tensile stress})$						²⁾ Calculation of effective displacement: $\delta_{V0} = \delta_{V0}\text{-Factor} \cdot V_{Ed}$ $\delta_{V\infty} = \delta_{V\infty}\text{-Factor} \cdot V_{Ed}$ $(V_{Ed}: \text{Design value of the applied shear force})$					

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

Internal threaded anchor RG MI		M8	M10	M12	M16	M20
Displacement-Factors for tension load¹⁾						
Uncracked or cracked concrete; Temperature range I, II						
δ_{N0} -Factor	[mm/(N/mm ²)]	0,09	0,10	0,10	0,11	0,13
$\delta_{N\infty}$ -Factor		0,13	0,15	0,16	0,17	0,19
Displacement-Factors for shear load²⁾						
Uncracked or cracked concrete; Temperature range I, II						
δ_{V0} -Factor	[mm/kN]	0,12	0,09	0,08	0,07	0,05
$\delta_{V\infty}$ -Factor		0,18	0,14	0,12	0,10	0,08
¹⁾ Calculation of effective displacement: $\delta_{N0} = \delta_{N0}\text{-Factor} \cdot \tau_{Ed}$ $\delta_{N\infty} = \delta_{N\infty}\text{-Factor} \cdot \tau_{Ed}$ (τ_{Ed} : Design value of the applied tensile stress)				²⁾ Calculation of effective displacement: $\delta_{V0} = \delta_{V0}\text{-Factor} \cdot V_{Ed}$ $\delta_{V\infty} = \delta_{V\infty}\text{-Factor} \cdot V_{Ed}$ (V_{Ed} : Design value of the applied shear force)		

fischer injection system FIS EM Plus

Performances

Displacements for anchor rods and fischer internal threaded anchors RG MI

Annex C 13

Appendix 34/ 39

Table C14.1: Displacements for reinforcing bars																			
Nominal diameter of the bar		φ	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Displacement-Factors for tension load ¹⁾																			
Uncracked or cracked concrete; Temperature range I, II																			
δ _{N0} -Factor	[mm/(N/mm ²)]	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	0,14	0,15
δ _{N∞} -Factor		0,11	0,12	0,13	0,14	0,15	0,16	0,16	0,17	0,18	0,18	0,18	0,19	0,19	0,20	0,20	0,21	0,22	
Displacement-Factors for shear load ²⁾																			
Uncracked or cracked concrete; Temperature range I, II																			
δ _{V0} -Factor	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,08	0,07	0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,04	0,04	0,04	0,04
δ _{V∞} -Factor		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: δ _{N0} = δ _{N0} -Factor · τ _{Ed} δ _{N∞} = δ _{N∞} -Factor · τ _{Ed} (τ _{Ed} : Design value of the applied tensile stress)									2) Calculation of effective displacement: δ _{V0} = δ _{V0} -Factor · V _{Ed} δ _{V∞} = δ _{V∞} -Factor · V _{Ed} (V _{Ed} : Design value of the applied shear force)										

Table C14.2: Displacements for fischer rebar anchors FRA

fischer rebar anchor FRA		M12	M16	M20	M24
Displacement-Factors for tension load ¹⁾					
Uncracked or cracked concrete; Temperature range I, II					
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
Displacement-Factors for shear load ²⁾					
Uncracked or cracked concrete; Temperature range I, II					
δ _{V0} -Factor	[mm/kN]	0,12	0,09	0,07	0,06
δ _{V∞} -Factor		0,18	0,14	0,11	0,09
1) Calculation of effective displacement: δ _{N0} = δ _{N0} -Factor · τ _{Ed} δ _{N∞} = δ _{N∞} -Factor · τ _{Ed} (τ _{Ed} : Design value of the applied tensile stress)			2) Calculation of effective displacement: δ _{V0} = δ _{V0} -Factor · V _{Ed} δ _{V∞} = δ _{V∞} -Factor · V _{Ed} (V _{Ed} : Design value of the applied shear force)		

fischer injection system FIS EM Plus	Annex C 14 Appendix 35/ 39
Performance Displacements for reinforcing bars and fischer rebar anchors FRA	

Table C16.1: Characteristic values for steel failure under tension / shear load for reinforcing bars (B500B) under seismic action performance category C1															
Nominal diameter of the bar	ϕ	10	12	14	16	18	20	22	24	25	26	28	30	32	
Bearing capacity under tension load, steel failure ¹⁾															
Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1															
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	44	63	85	111	140	173	209	249	270	292	339	389	443
Bearing capacity under shear load, steel failure without lever arm ¹⁾															
Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1															
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	15	22	30	39	49	61	74	88	95	102	119	137	155
¹⁾ Partial factors for performance category C1 see table C16.2															

Table C16.2: Partial factors for fischer anchor rods, standard threaded rods and reinforcing bars (B500B) under seismic action performance category C1 or C2																													
Anchor rod / standard threaded rod				M10		M12		M14		M16		M20		M22		M24		M27		M30									
Nominal diameter of the bar ϕ				10		12		14		16		18		20		22		24		25		26		28		30		32	
Tension load, steel failure ¹⁾																													
Partial factor $\gamma_{M_s,N}$	Steel zinc plated	Property class	5.8	[-]	1,50																								
			8.8		1,50																								
	Stainless steel R and high corrosion resistant steel HCR		50		2,86																								
			70		1,50 ²⁾ / 1,87																								
			80		1,60																								
	Reinforcing bar	B500B	1,40																										
Shear load, steel failure ¹⁾																													
Partial factor $\gamma_{M_s,V}$	Steel zinc plated	Property class	5.8	[-]	1,25																								
			8.8		1,25																								
	Stainless steel R and high corrosion resistant steel HCR		50		2,38																								
			70		1,25 ²⁾ / 1,56																								
			80		1,33																								
	Reinforcing bar	B500B	1,50																										

¹⁾ In absence of other national regulations

²⁾ Only admissible for high corrosion resistant steel HCR, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12 \%$ (e.g. fischer anchor rods)

fischer injection system FIS EM Plus		Annex C 16 Appendix 37/ 39
Performances Characteristic values for steel failure under tension/shear load for reinforcing bars under seismic action (performance category C1); partial factors (perform. category C1 / C2)		

Table C17.1: Characteristic values for combined pull-out and concrete failure for fischer anchor rods and standard threaded rods in hammer drilled holes under seismic action performance category C1 ; working life 50 and 100 years															
Anchor rod / standard threaded rod			M10	M12	M14	M16	M20	M22	M24	M27	M30				
Characteristic bond resistance, combined pullout and concrete cone failure															
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)															
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C1}$	[N/mm²]	7,0	7,0	6,7	6,0	5,7	6,7	6,7	6,7	6,7	6,7	6,7	
	II: 50 °C / 72 °C			7,0	7,0	6,7	5,7	5,7	6,7	6,7	6,7	6,7	6,7		
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)															
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C1}$	[N/mm²]	7,5	7,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	
	II: 50 °C / 72 °C			6,8	6,8	6,5	5,7	5,7	5,7	5,7	5,7	5,7	5,7		
Installation factors															
Dry or wet concrete		γ_{inst}	[-]	1,0											
Water filled hole				1,2 ¹⁾					1,4 ¹⁾						
¹⁾ Not permitted in combination with working life 100 years															
Table C17.2: Characteristic values for combined pull-out and concrete failure for reinforcing bars in hammer drilled holes under seismic action performance category C1 ; working life 50 and 100 years															
Nominal diameter of the bar ϕ			10	12	14	16	18	20	22	24	25	26	28	30	32
Characteristic bond resistance, combined pullout and concrete cone failure															
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)															
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C1}$	[N/mm²]	7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	6,7	4,8
	II: 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	4,8
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)															
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C1}$	[N/mm²]	7,5	6,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7	5,7	5,7	4,8
	II: 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	4,8
Installation factors															
Dry or wet concrete		γ_{inst}	[-]	1,0											
Water filled hole				1,2 ¹⁾					1,4 ¹⁾						
¹⁾ Not permitted in combination with working life 100 years															
fischer injection system FIS EM Plus												Annex C 17 Appendix 38/ 39			
Performances															
Characteristic values for combined pull-out and concrete failure under seismic action (C1) for fischer anchor rods, stand. thread. rods and reinf. bars; working life 50 and 100 years															

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

Anchor rod / standard threaded rod			M12	M16	M20	M24	
Characteristic bond resistance, combined pullout and concrete cone failure							
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C2}$	[N/mm ²]	3,5	5,8	5,0	3,1
	II: 50 °C / 72 °C			3,3	5,5	4,7	2,9
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)							
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C2}$	[N/mm ²]	3,5	5,8	5,0	3,1
	II: 50 °C / 72 °C			3,3	5,5	4,7	2,9
Installation factors							
Dry or wet concrete	γ_{inst}	[-]	1,0				
Water filled hole			1,2 ¹⁾		1,4 ¹⁾		

¹⁾ Not permitted in combination with working life 100 years

Displacement-Factors for tension load¹⁾

$\hat{\delta}_{N,C2}$ (DLS)-Factor	[mm/(N/mm ²)]	0,09	0,10	0,11	0,12
$\hat{\delta}_{N,C2}$ (ULS)-Factor		0,15	0,17	0,17	0,18

Displacement-Factors for shear load²⁾

$\delta_{V,C2}$ (DLS)-Factor	[mm/kN]	0,18	0,10	0,07	0,06
$\delta_{V,C2}$ (ULS)-Factor		0,25	0,14	0,11	0,09

1) Calculation of effective displacement:

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

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

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

2) Calculation of effective displacement:

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

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

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

fischer injection system FIS EM Plus

Performances

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

Annex C 18

Appendix 39/ 39