

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-21/0469
of 9 December 2021

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

fischer injection system FIS EB II

Product family
to which the construction product belongs

Bonded fastener for use in concrete

Manufacturer

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

Manufacturing plant

fischerwerke

This European Technical Assessment
contains

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

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

EAD 330499-01-0601 Edition 04/2020

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Specific Part

1 Technical description of the product

The fischer injection system FIS EB II is a bonded fastener consisting of a cartridge with injection mortar fischer FIS EB II and a steel element according to Annex A4.

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 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 C1 to C6, B3 to B6
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1 to C3
Displacements under short-term and long-term loading	See Annex C7 to C8
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Hygiene, health and the environment (BWR 3)

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

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

In accordance with EAD 330499-01-0601 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 13. Dezember 2021 by Deutsches Institut für Bautechnik

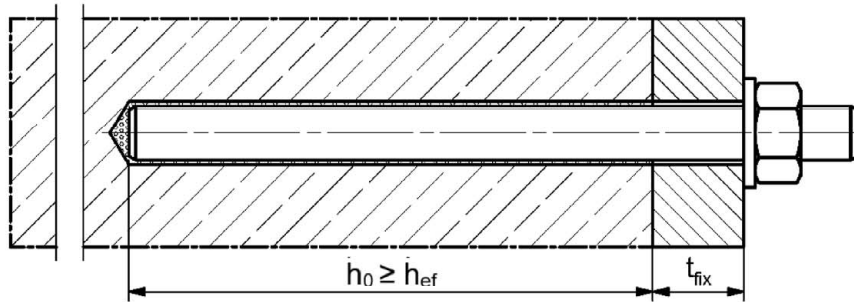
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Lange

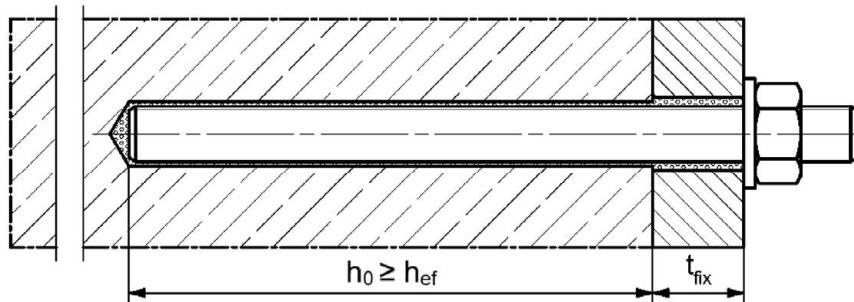
Installation conditions part 1

fischer anchor rod

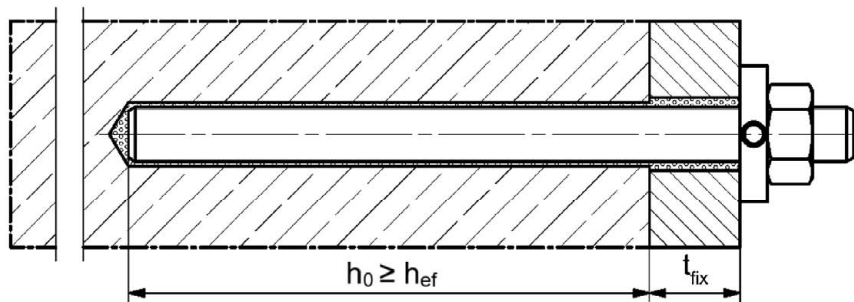
Pre-positioned installation



Push through installation (annular gap filled with mortar)



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



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

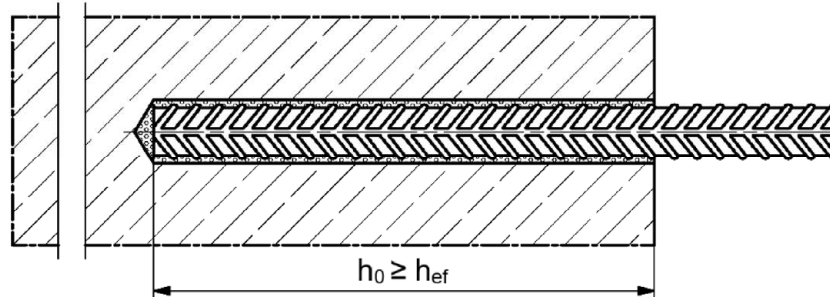
fischer injection system FIS EB II

Product description
Installation conditions part 1

Annex A 1

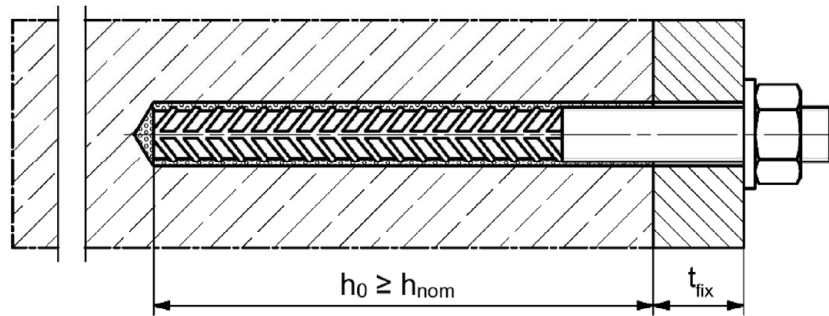
Installation conditions part 2

Reinforcing bar

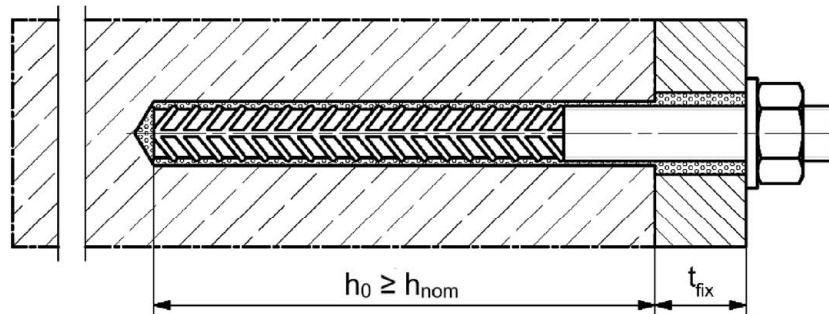


fischer rebar anchor

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

h_{nom} = overall fastener embedment depth in the concrete

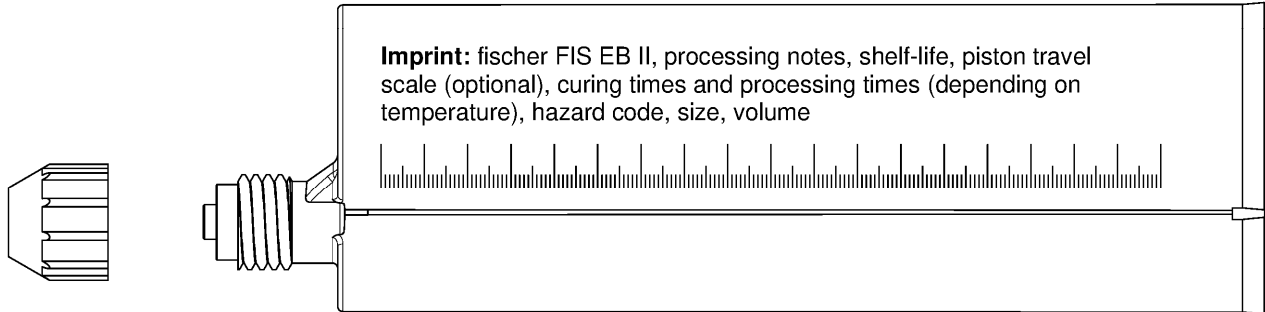
fischer injection system FIS EB II

Product description
Installation conditions part 2

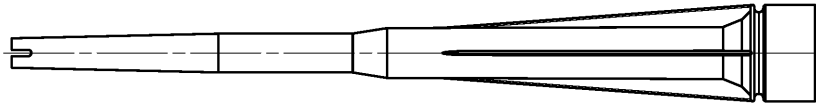
Annex A 2

Overview system components part 1

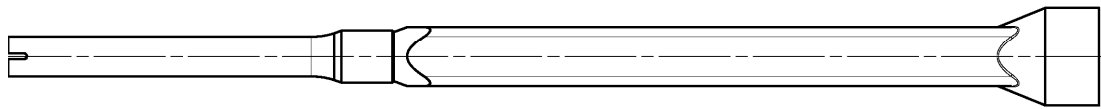
Injection cartridge (shuttle cartridge) with sealing cap; Size: 390 ml, 585 ml, 1100 ml, 1500 ml



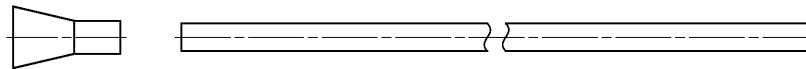
Static mixer FIS MR Plus for Injection cartridge 390 ml



Static mixer FIS UMR Injection cartridges ≥ 585 ml



**Injection adapter and extension tube $\varnothing 9$ for static mixer FIS MR Plus;
Injection adapter and extension tube $\varnothing 9$ or $\varnothing 15$ for static mixer FIS UMR**



Cleaning brush BS



Blow-out pump AB G



Compressed-air cleaning tool ABP



Figures not to scale

fischer injection system FIS EB II

Product description

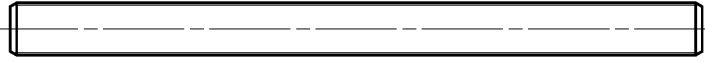
Overview system components part 1; cartridges / static mixer / accessories

Annex A 3

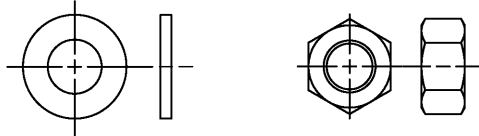
Overview system components part 2

fischer anchor rod

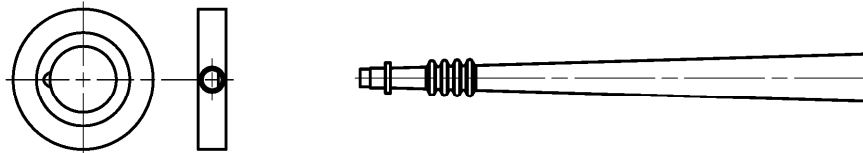
Size: M8, M10, M12, M16, M20, M24, M27, M30



washer / hexagon nut



fischer filling disk with injection adapter



Reinforcing bar

Nominal diameter: $\phi 8$, $\phi 10$, $\phi 12$, $\phi 14$, $\phi 16$, $\phi 20$, $\phi 25$, $\phi 26$, $\phi 28$, $\phi 30$, $\phi 32$



fischer rebar anchor FRA, FRA HCR

Size: M12, M16, M20, M24



Figures not to scale





fischer injection system FIS EB II

Product description

Overview system components part 2; steel components, injection adapter

Annex A 4

Table A5.1: Materials				
Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel zinc plated	Stainless steel R acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A1:2015	High corrosion resistant steel HCR acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015
2	Anchor rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 electroplated $\geq 5 \mu\text{m}$, EN ISO 4042:2018 Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ EN ISO 10684:2004+AC:2009 $f_{uk} \leq 1000 \text{ N/mm}^2$ $A_5 > 8\%$ fracture elongation	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 $f_{uk} \leq 1000 \text{ N/mm}^2$ $A_5 > 8\%$ fracture elongation	Property class 50 or 80 EN ISO 3506-1:2020 or property class 70 with $f_{yk} = 560 \text{ N/mm}^2$ 1.4565; 1.4529; EN 10088-1:2014 $f_{uk} \leq 1000 \text{ N/mm}^2$ $A_5 > 8\%$ fracture elongation
3	Washer ISO 7089:2000	electroplated $\geq 5 \mu\text{m}$, EN ISO 4042:2018 Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ 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 5 or 8 acc. EN ISO 898-2:2012 electroplated $\geq 5 \mu\text{m}$, EN ISO 4042:2018 Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ 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 filling disk	electroplated $\geq 5 \mu\text{m}$, EN ISO 4042:2018 Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ 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
6	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 NCI according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk} (A_5 > 8\%)$		
7	fischer rebar anchor	Rebar part: Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCI of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$	Threaded part: Property class 70 or for M24 PC 80, EN ISO 3506-1:2020 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 1993-1-4:2006+A1:2015 1.4565; 1.4529 acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015	
fischer injection system FIS EB II				
Product description Materials				Annex A 5

Specifications of intended use part 1							
Table B1.1: Overview use and performance categories							
Anchorages subject to		FIS EB II with ...					
		Anchor rod 		Reinforcing bar 		fischer rebar anchor 	
Hammer drilling with standard drill bit 		all sizes					
Static and quasi static loading, in	uncracked concrete	all sizes	Tables: C1.1 C3.1 C4.1 C7.1	all sizes	Tables: C2.1 C3.1 C5.1 C7.2	all sizes	Tables: C2.2 C3.1 C6.1 C8.1
	cracked concrete						
Use category	I1 dry or wet concrete	all sizes					
	I2 water filled hole	all sizes					
Seismic performance category	C1	-1)		-1)		-1)	
	C2						
Installation direction		D3 (downward and horizontal and upwards (e.g. overhead))					
Installation temperature		$T_{i,min} = +5\text{ °C}$ to $T_{i,max} = +40\text{ °C}$					
Service temperature	Temperature range I	-40 °C to +43 °C		(max. short term temperature +43 °C; max. long term temperature +24 °C)			
	Temperature range II	-40 °C to +60 °C		(max. short term temperature +60 °C; max. long term temperature +43 °C)			
	Temperature range III	-40 °C to +72 °C		(max. short term temperature +72 °C; max. long term temperature +50 °C)			
1) No performance assessed							
fischer injection system FIS EB II						Annex B 1	
Intended use Specifications part 1							

Specifications of intended use part 2

Base materials:

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

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A 5 Table 5.1.

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 EOTA Technical Report TR 055, Edition February 2018.

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 EB II

Intended use
Specifications part 2

Annex B 2


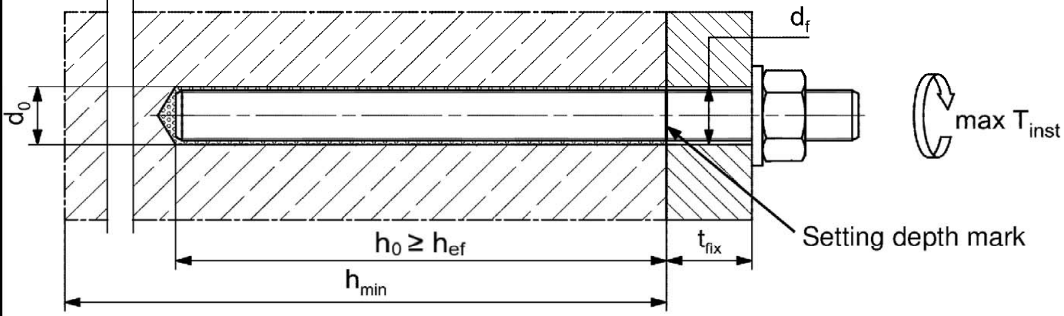
Table B3.1: Installation parameters for anchor rods																									
Anchor rods		Thread	M8	M10	M12	M16	M20	M24	M27	M30															
Nominal drill hole diameter	d_0	[mm]	10	12	14	18	24	28	30	35															
Drill hole depth	h_0		$h_0 = h_{ef}$																						
Effective embedment depth	$h_{ef, min}$		60	60	70	80	90	96	108	120															
	$h_{ef, max}$		160	200	240	320	400	480	540	600															
Simplified spacing and edge distance ¹⁾	s		40	45	55	65	85	105	120	140															
	c																								
Diameter of the clearance hole of the fixture	pre-positioned installation d_f		9	12	14	18	22	26	30	33															
	push through installation d_f	12	14	16	20	26	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	60	120	150	200	300															
<p>¹⁾ Detailed calculation according to Annex B 6 and B 7</p> <p>fischer anchor rod</p>  <p>Marking (on random place) fischer anchor rod:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Steel electroplated PC¹⁾ 8.8</td> <td style="text-align: center;">• or +</td> <td>Steel hot-dip PC¹⁾ 8.8</td> <td style="text-align: center;">•</td> </tr> <tr> <td>High corrosion resistant steel HCR PC¹⁾ 50</td> <td style="text-align: center;">•</td> <td>High corrosion resistant steel HCR PC¹⁾ 70</td> <td style="text-align: center;">-</td> </tr> <tr> <td>High corrosion resistant steel HCR PC¹⁾ 80</td> <td style="text-align: center;">(</td> <td>Stainless steel R property class 50</td> <td style="text-align: center;">~</td> </tr> <tr> <td>Stainless steel R property class 80</td> <td style="text-align: center;">*</td> <td></td> <td></td> </tr> </table> <p>Alternatively: Colour coding according to DIN 976-1: 2016</p> <p>¹⁾ PC = property class</p> <p>Installation conditions:</p>  <p>Commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled</p> <ul style="list-style-type: none"> • Materials, dimensions and mechanical properties according to Annex A 5, Table A5.1 • Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored • Setting depth is marked <p style="text-align: right;">Figures not to scale</p>										Steel electroplated 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	*		
Steel electroplated 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	*																								
fischer injection system FIS EB II									Annex B 3																
Intended use Installation parameters anchor rods																									

Table B4.1: Installation parameters for reinforcing bars

Nominal diameter of the bar		ϕ	8 ¹⁾		10 ¹⁾		12 ¹⁾		14	16	20	25	26	28	30	32	
Nominal drill hole diameter	d_0	[mm]	10	12	12	14	14	16	18	20	25	30	35	35	40	40	
Drill hole depth	h_0		$h_0 = h_{ef}$														
Effective embedment depth	$h_{ef,min}$		60	60	70	75	80	90	100	104	112	120	128				
	$h_{ef,max}$		160	200	240	280	320	400	500	520	560	600	640				
Simplified spacing and edge distance ²⁾	$s = c$		40	45	55	60	65	85	120	120	140	140	160				
Minimum thickness of concrete member	h_{min}	$h_{ef} + 30$ (≥ 100)						$h_{ef} + 2d_0$									

1) Both drill hole diameters can be used

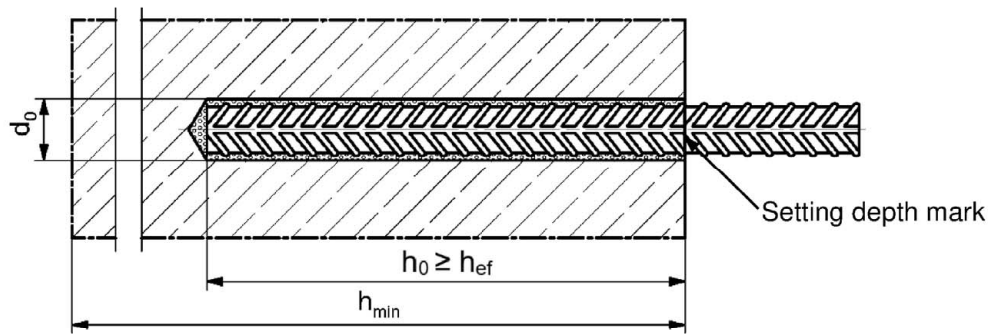
2) Detailed calculation according to Annex B 6 und B 7

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 EB II

Intended use
Installation parameters reinforcing bars

Annex B 4

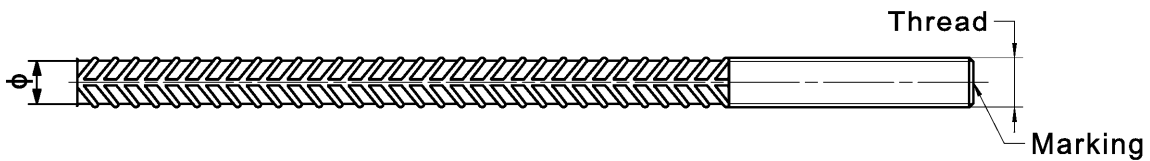
Table B5.1: Installation parameters for **fischer rebar anchor**



fischer Rebar anchor		Thread	M12 ¹⁾	M16	M20	M24	
Nominal diameter of the bar	ϕ	[mm]	12	16	20	25	
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				
Simplified spacing and edge distance ²⁾	s = c		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}		$h_0 + 30$ (≥ 100)	$h_0 + 2d_0$			
Maximum torque moment for attachment of the fixture	$\max T_{inst}$	[Nm]	40	60	120	150	

¹⁾ Both drill hole diameters can be used

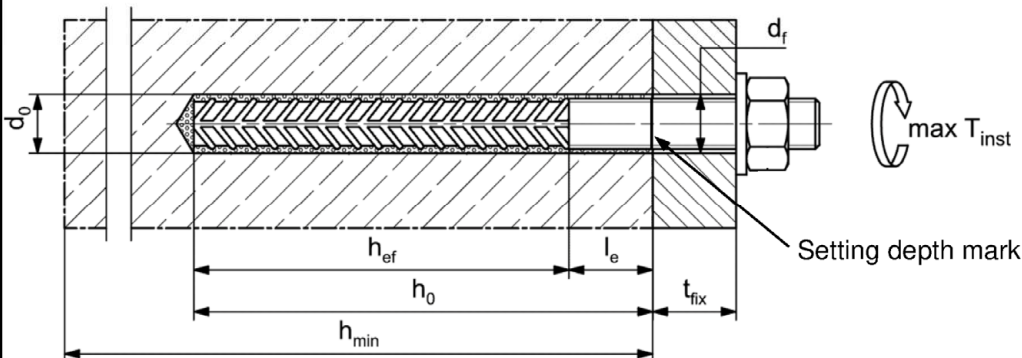
²⁾ Detailed calculation according to Annex B 6 and B 7

fischer rebar anchor



Marking frontal e. g:  FRA (for stainless steel);
 FRA HCR (for high corrosion resistant steel)

Installation conditions:



Figures not to scale

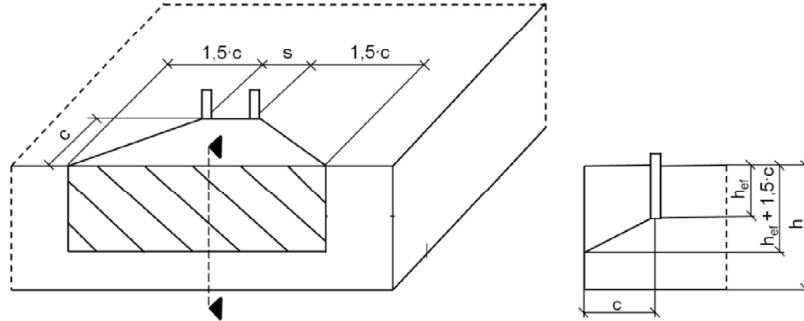
fischer injection system FIS EB II

Intended use
Installation parameters fischer rebar anchor

Annex B 5

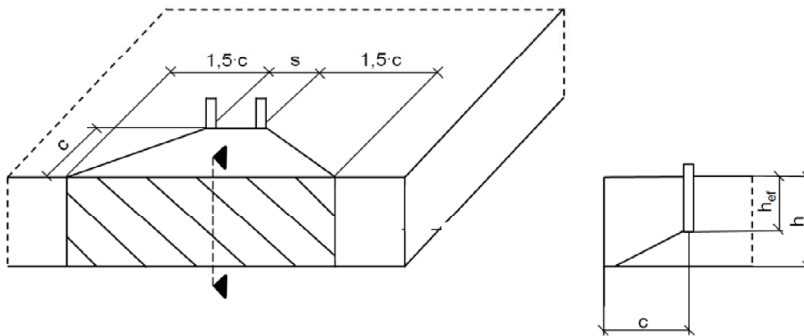
Table B6.1: Minimum spacing and minimum edge distance for anchor rods, reinforcing bars and fischer rebar anchor									
Anchor rods			M8	M10	M12	-	M16	M20	
Reinforcing bars, fischer rebar anchor (nominal diameter)		ϕ	8	10	12	14	16	20	
Minimum edge distance									
Uncracked / cracked concrete	c_{min}	[mm]	40	45	45	45	50	55	
Spacing	s		according to Annex B 7						
Minimum spacing									
Uncracked / cracked concrete	s_{min}	[mm]	40	45	55	60	65	85	
Edge distance	c		according to Annex B 7						
Required projecting area									
Uncracked concrete	$A_{sp,req}$	[1000 mm ²]	8,0	13,0	22,0	23,0	24,0	38,5	
Cracked concrete			6,5	10,0	16,5	17,5	18,5	29,5	
Anchor rods									
			M24	-	-	M27	-	M30	-
Reinforcing bars, fischer rebar anchor (nominal diameter)		ϕ	-	25	26	-	28	30	32
Minimum edge distance									
Uncracked / cracked concrete	c_{min}	[mm]	60	75	75	75	80	80	120
Spacing	s		according to Annex B 7						
Minimum spacing									
Uncracked / cracked concrete	s_{min}	[mm]	105	120	120	120	140	140	160
Edge distance	c		according to Annex B 7						
Required projecting area									
Uncracked concrete	$A_{sp,req}$	[1000 mm ²]	40,0	47,5	47,5	47,5	64,0	64,0	64,0
Cracked concrete			30,5	36,5	36,5	36,5	49,0	49,0	49,0
<p>Splitting failure for minimum edge distance and spacing in dependence of the effective embedment depth h_{ef}.</p> <p>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:</p> $A_{sp,req} < A_{sp}$ <p>$A_{sp,req}$ = required projecting area $A_{sp} = A_{sp,ef}$ = effective projecting area (according to Annex B 7)</p>									
fischer injection system FIS EB II							Annex B 6		
Intended use Minimum spacing and edge distance for anchor rods, reinforcing bars and fischer rebar anchor									

Table B7.1: Effective projecting area A_{sp} with concrete member thickness
 $h > h_{ef} + 1,5 \cdot c$ and $h \geq h_{min}$



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

Table B7.2: Effektive projecting area A_{sp} with concrete member thickness
 $h \leq h_{ef} + 1,5 \cdot c$ and $h \geq h_{min}$



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

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

Figures not to scale

fischer injection system FIS EB II

Intended use

Minimum thickness of concrete member for anchor rods, reinforcing bar, fischer rebar anchor and minimum spacing and edge distance

Annex B 7

Table B8.1: Parameters of the **cleaning brush BS** (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	35	40
Steel brush diameter BS	d_b	[mm]	11	14	16	20		25	26	27	30	40		42

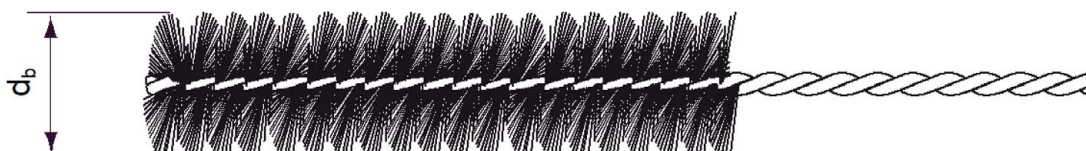


Table B8.2: Conditions for use **static mixer** without an **extension tube**

Nominal drill hole diameter	d_0		10	12	14	16	18	20	24	25	28	30	35	40
Drill hole depth h_0 by using	FIS MR Plus	[mm]	≤ 90		≤ 120	≤ 140	≤ 150	≤ 160	≤ 190	≤ 210				
	FIS UMR		-	-	≤ 90	≤ 160	≤ 180	≤ 190	≤ 220		≤ 250			

Table B8.3 **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 t_{cure}
	FIS EB II	FIS EB II
> 5 to 10	180 min	96 h
> 10 to 15	90 min	60 h
> 15 to 20	60 min	36 h
> 20 to 30	30 min	24 h
> 30 to 40	15 min	12 h

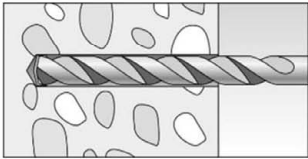

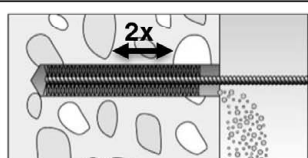
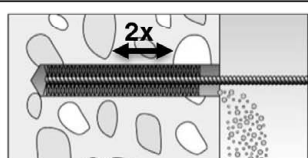
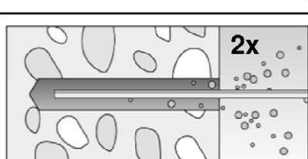
fischer injection system FIS EB II

Intended use
Cleaning brush (steel brush)
Processing time and curing time

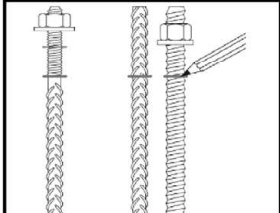
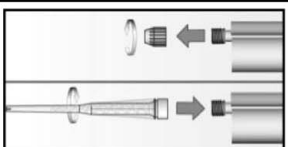
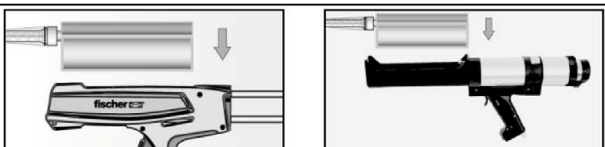

Annex B 8

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, B4.1, B5.1
2		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole twice by hand
3		Brush the drill hole twice. For drill hole diameter $d_0 \geq 18$ mm and / or $h_{ef} > 12d$ use a power drill. For deep holes use an extension. Corresponding brushes see Table B8.1
4		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole twice by hand
		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole twice with oil-free compressed air ($p \geq 6$ bar)

Preparing

5		Mark the setting depth of the steel element
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

Go to Step 9

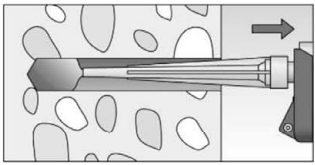
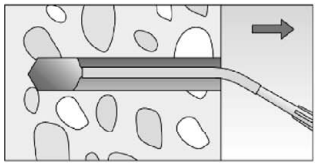
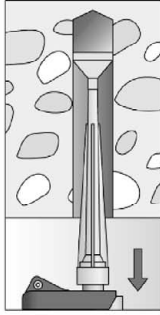
fischer injection system FIS EB II

Intended use
Installation instructions part 1

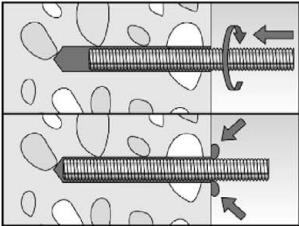
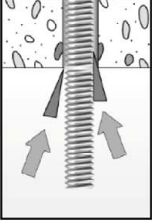
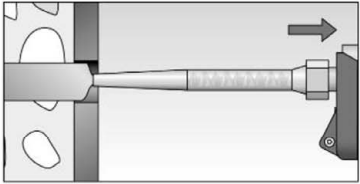

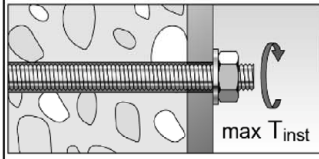
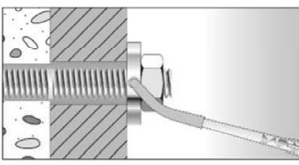
Annex B 9

Installation instructions part 2

Injection of the mortar

<p>9</p>	 <p>Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles</p>	 <p>The conditions for mortar injection without extension tube can be found in Table B8.2 For deeper drill holes, than those mentioned in Table B8.2, use a suitable extension tube</p>	 <p>For overhead installation, deep holes ($h_0 > 250$ mm) or drill hole diameter ($d_0 \geq 30$ mm) use an injection-adapter</p>
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Installation of anchor rods

<p>10</p>		<p>Only use clean and oil-free anchor elements. Push the anchor rod with the setting depth mark down to the bottom of the hole, turning it slightly while doing so. After inserting the anchor element, excess mortar must be emerged around the anchor element.</p>
	 <p>For overhead installations support the anchor rod with wedges (e. g. fischer centering wedges) or fischer overhead clips.</p>	 <p>For push through installation fill the annular gap with mortar</p>
<p>11</p>	 <p>Wait for the specified curing time t_{cure} see Table B8.3</p>	<p>12</p>  <p>Mounting the fixture $\max T_{inst}$ see Table B3.1</p>
<p>Option</p>		<p>After the minimum curing time is reached, the gap between anchor and fixture (annular clearance) may be filled with mortar via the fischer filling disc. Compressive strength ≥ 50 N/mm² (e.g. fischer injection mortars FIS EB II, FIS SB, FIS V Plus, FIS EM Plus) ATTENTION: Using fischer filling disk reduces t_{fix} (usable length of the anchor)</p>

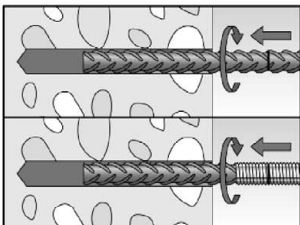
fischer injection system FIS EB II

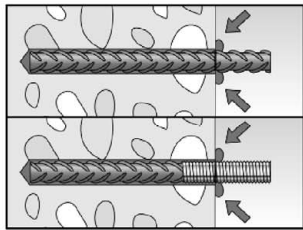
Intended use
Installation instructions part 2

Annex B 10

Installation instructions part 3

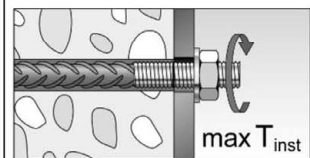
Installation reinforcing bars and fischer rebar anchor

9		<p>Only use clean and oil-free reinforcing bars or fischer rebar anchor. Push the reinforcement bar or the fischer rebar anchor with the setting depth mark into the filled hole up to the setting depth mark.</p> <p>Recommendation: Rotation back and forth of the reinforcement bar or the fischer rebar anchor makes pushing easy</p>
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When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

10		<p>Wait for the specified curing time t_{cure} see Table B8.3</p>
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11		<p>Mounting the fixture $\max T_{inst}$ see Table B5.1</p>
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fischer injection system FIS EB II

Intended use
Installation instructions part 3

Annex B 11

Table C1.1: Characteristic resistance to steel failure under tension / shear loading of fischer anchor rods and standard threaded rods											
Anchor rod / standard threaded rod			M8	M10	M12	M16	M20	M24	M27	M30	
Characteristic resistance to steel failure under tension loading ³⁾											
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	15(13)	23(21)	33	63	98	141	184	224
			5.8	19(17)	29(27)	43	79	123	177	230	281
			8.8	29(27)	47(43)	68	126	196	282	368	449
	Stainless steel R and high corrosion resistant steel HCR		50	19	29	43	79	123	177	230	281
			70	26	41	59	110	172	247	322	393
			80	30	47	68	126	196	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							
Characteristic resistance to steel failure under shear loading ³⁾											
without lever arm											
Characteristic resistance $V_{Rk,s}^0$	Steel zinc plated	Property class	4.8	9(8)	14(13)	20	38	59	85	110	135
			5.8	11(10)	17(16)	25	47	74	106	138	168
			8.8	15(13)	23(21)	34	63	98	141	184	225
	Stainless steel R and high corrosion resistant steel HCR		50	9	15	21	39	61	89	115	141
			70	13	20	30	55	86	124	161	197
			80	15	23	34	63	98	141	184	225
Ductility factor		k ₇	[-]							1,0	
with lever arm											
Characteristic resistance $M_{Rk,s}^0$	Steel zinc plated	Property class	4.8	15(13)	30(27)	52	133	259	448	665	899
			5.8	19(16)	37(33)	65	166	324	560	833	1123
			8.8	30(26)	60(53)	105	266	519	896	1333	1797
	Stainless steel R and high corrosion resistant steel HCR		50	19	37	65	166	324	560	833	1123
			70	26	52	92	232	454	784	1167	1573
			80	30	60	105	266	519	896	1333	1797
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 resistant steel C, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12 \%$ (e.g. fischer anchor rods) ³⁾ Values in brackets are valid for hot dip galvanised standard threaded rods											
fischer injection system FIS EB II									Annex C 1		
Performance Characteristic resistance to steel failure under tension / shear loading of fischer anchor rods and standard threaded rods											

Table C2.1: Characteristic resistance to steel failure under tension / shear loading of reinforcing bars												
Nominal diameter of the bar	ϕ	8	10	12	14	16	20	25	26	28	30	32
Characteristic resistance to steel failure under tension loading												
Characteristic resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}^{(2)}$									
Characteristic resistance to steel failure under shear loading												
Without lever arm												
Characteristic resistance	$V^0_{Rk,s}$	[kN]	$k_6^{(1)} \cdot A_s \cdot f_{uk}^{(2)}$									
Ductility factor	k_7	[-]	1,0									
With lever arm												
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}^{(2)}$									
<p>1) In accordance with EN 1992-4:2018 section 7.2.2.3.1 $k_6 = 0,6$ for fasteners made of carbon steel with $f_{uk} \leq 500 \text{ N/mm}^2$ $= 0,5$ for fasteners made of carbon steel with $500 < f_{uk} \leq 1000 \text{ N/mm}^2$ $= 0,5$ for fasteners made of stainless steel</p> <p>2) f_{uk} respectively shall be taken from the specifications of the reinforcing bar</p>												
Table C2.2: Characteristic resistance to steel failure under tension / shear loading of fischer rebar anchors												
fischer rebar anchor			M12	M16	M20	M24						
Characteristic resistance to steel failure under tension loading												
Characteristic resistance	$N_{Rk,s}$	[kN]	59	110	172	270						
Partial factor¹⁾												
Partial factor	$\gamma_{Ms,N}$	[-]	1,4									
Characteristic resistance to steel failure under shear loading												
Without lever arm												
Characteristic resistance	$V^0_{Rk,s}$	[kN]	30	55	86	141						
Ductility factor	k_7	[-]	1,0									
With lever arm												
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	92	233	454	898						
Partial factor¹⁾												
Partial factor	$\gamma_{Ms,V}$	[-]	1,56									
1) In absence of other national regulations												
fischer injection system FIS EB II										Annex C 2		
Performance Characteristic resistance to steel failure under tension / shear loading of reinforcing bars and fischer rebar anchors												

Table C3.1: Characteristic resistance to concrete failure under tension / shear loading															
Size		All sizes													
Tension loading															
Installation factor		γ_{inst}	[-]		See annex C 4 to C 6										
Factors for the compressive strength of concrete > C20/25															
		Uncracked concrete				Cracked concrete									
Increasing factor ψ_c for cracked or uncracked concrete $\tau_{Rk} = \psi_c \cdot \tau_{Rk} (C20/25)$	C25/30	[-]	1,05				1,02								
	C30/37		1,10				1,04								
	C35/45		1,13				1,06								
	C40/50		1,17				1,07								
	C45/55		1,20				1,09								
	C50/60		1,23				1,10								
Splitting failure															
Edge distance	$h / h_{ef} \geq 2,0$	$C_{cr,sp}$	[mm]	1,0 h_{ef}											
	$2,0 > h / h_{ef} > 1,3$			4,6 h_{ef} - 1,8 h											
	$h / h_{ef} \leq 1,3$			2,26 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											
Edge distance		$C_{cr,N}$	[mm]	1,5 h_{ef}											
Spacing		$S_{cr,N}$		2 $C_{cr,N}$											
Factors for sustained tension loading															
Temperature range		[-]		24 °C / 43 °C			43 °C / 60 °C			50 °C / 72 °C					
Factor		ψ^{0}_{sus}	[-]		0,68			0,60			0,68				
Shear loading															
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 for shear loading		l_f	[mm]	for $d_{nom} \leq 24$ mm: min (h_{ef} ; 12 d_{nom}) for $d_{nom} > 24$ mm: min (h_{ef} ; 8 d_{nom} ; 300 mm)											
Calculation diameters															
Size				M8	M10	M12	M16	M20	M24	M27	M30				
fischer anchor rods and standard threaded rods	d_{nom}	[mm]	8		10		12		16		20		24		
	d_{nom}		- ¹⁾		- ¹⁾		12		16		20		25		
Size (nominal diameter of the bar)		ϕ	8	10	12	14	16	20	25	26	28	30	32		
Reinforcing bar		d_{nom}	[mm]	8	10	12	14	16	20	25	26	28	30	32	
1) Anchor type not part of the assessment															
fischer injection system FIS EB II											Annex C 3				
Performance			Characteristic resistance to concrete failure under tension / shear loading												

Table C4.1: Characteristic resistance to combined pull-out and concrete failure for fischer anchor rods and standard threaded rods in hammer drilled holes; uncracked or cracked concrete												
Anchor rod / standard threaded rod		M8	M10	M12	M16	M20	M24	M27	M30			
Combined pullout and concrete cone failure												
Calculation diameter d		[mm]	8	10	12	16	20	24	27	30		
Uncracked concrete												
Characteristic bond resistance in uncracked concrete C20/25												
<u>Hammer-drilling with standard drill bit (dry or wet concrete)</u>												
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,ucr}$	[N/mm ²]	14	14	14	14	14	13	12	12
	II: 43 °C / 60 °C				14	13	13	12	11	10	8,5	8,5
	III: 50 °C / 72 °C				9	9	9	9	9	8,5	8	7,5
<u>Hammer-drilling with standard drill bit (water filled hole)</u>												
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,ucr}$	[N/mm ²]	14	14	14	14	14	12	12	12
	II: 43 °C / 60 °C				12	11	11	10	9,5	8,5	8,5	8,5
	III: 50 °C / 72 °C				9	9	9	8,5	8	7,5	7	6,5
Installation factors												
Dry or wet concrete		γ_{inst}	[-]	1,2								
Water filled hole				1,4								
Cracked concrete												
Characteristic bond resistance in cracked concrete C20/25												
<u>Hammer-drilling with standard drill bit (dry or wet concrete)</u>												
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,cr}$	[N/mm ²]	7	7	7	6,5	6	6	5,5	5,5
	II: 43 °C / 60 °C				6,5	6,5	6,5	6	6	6	5,5	5,5
	III: 50 °C / 72 °C				6	6	6	5,5	5,5	5,5	5	5
<u>Hammer-drilling with standard drill bit (water filled hole)</u>												
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,cr}$	[N/mm ²]	7	7	7	6,5	6	6	5,5	5,5
	II: 43 °C / 60 °C				5,5	5,5	5,5	5	4,5	4,5	4	4
	III: 50 °C / 72 °C				5,5	5,5	5,5	5	4	4	4	4
Installation factors												
Dry or wet concrete		γ_{inst}	[-]	1,2								
Water filled hole				1,4								
fischer injection system FIS EB II										Annex C 4		
Performance Characteristic resistance to combined pull-out and concrete failure for fischer anchor rod and standard threaded rods												

Table C5.1: Characteristic resistance to combined pull-out and concrete failure for reinforcing bars in hammer drilled holes; uncracked or cracked concrete														
Reinforcing bars	ϕ	8	10	12	14	16	20	25	26	28	30	32		
Combined pullout and concrete cone failure														
Calculation diameter	d	[mm]	8	10	12	14	16	20	25	26	28	30	32	
Uncracked concrete														
Characteristic bond resistance in uncracked concrete C20/25														
<u>Hammer-drilling with standard drill bit (dry or wet concrete)</u>														
Tem- perature range	I: 24 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm ²]	14	14	14	13	13	12	11	11	11	11	
	II: 43 °C / 60 °C			14	13	13	12	11	10	10	9	8,5	8	8
	III: 50 °C / 72 °C			9	9	9	9	9	9	8,5	8,5	8	8	7,5
<u>Hammer-drilling with standard drill bit (water filled hole)</u>														
Tem- perature range	I: 24 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm ²]	14	14	14	12	12	12	11	11	11	11	
	II: 43 °C / 60 °C			11	11	10	9,5	9,5	9	8,5	8,5	8,5	7,5	7,5
	III: 50 °C / 72 °C			9	9	9	8,5	8	7,5	7	6,5	6,5	6	6
Installation factors														
Dry or wet concrete	γ_{inst}	[-]	1,2											
Water filled hole			1,4											
Cracked concrete														
Characteristic bond resistance in cracked concrete C20/25														
<u>Hammer-drilling with standard drill bit (dry or wet concrete)</u>														
Tem- perature range	I: 24 °C / 43 °C	$\tau_{Rk,cr}$	[N/mm ²]	7	7	7	6,5	6,5	6	6	5,5	5,5	5,5	
	II: 43 °C / 60 °C			6,5	6,5	6,5	6	6	6	5,5	5,5	5,5	5	5
	III: 50 °C / 72 °C			6	6	6	6	5,5	5,5	5,5	5	5	5	4,5
<u>Hammer-drilling with standard drill bit (water filled hole)</u>														
Tem- perature range	I: 24 °C / 43 °C	$\tau_{Rk,cr}$	[N/mm ²]	7	7	7	7	6,5	6	6	5,5	5,5	5,5	
	II: 43 °C / 60 °C			5,5	5,5	5,5	5	5	4,5	4	4	4	4	3,5
	III: 50 °C / 72 °C			5,5	5,5	5,5	5	5	4	4	4	4	4	3,5
Installation factors														
Dry or wet concrete	γ_{inst}	[-]	1,2											
Water filled hole			1,4											
fischer injection system FIS EB II												Annex C 5		
Performance Characteristic resistance to combined pull-out and concrete failure for reinforcing bars														

Table C6.1: Characteristic resistance for combined pull-out and concrete failure for fischer rebar anchors in hammer drilled holes; uncracked or cracked concrete							
fischer rebar anchor		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							
<u>Hammer-drilling with standard drill bit (dry or wet concrete)</u>							
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,ucr}$ [N/mm ²]	14	13	12	11
	II: 43 °C / 60 °C			13	11	10	10
	III: 50 °C / 72 °C			9	9	9	8,5
<u>Hammer-drilling with standard drill bit (water filled hole)</u>							
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,ucr}$ [N/mm ²]	14	12	12	11
	II: 43 °C / 60 °C			10	9,5	9	8,5
	III: 50 °C / 72 °C			9	8	7,5	7
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,2			
Water filled hole				1,4			
Cracked concrete							
Characteristic bond resistance in cracked concrete C20/25							
<u>Hammer-drilling with standard drill bit (dry or wet concrete)</u>							
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,cr}$ [N/mm ²]	7	6,5	6	6
	II: 43 °C / 60 °C			6,5	6	6	5,5
	III: 50 °C / 72 °C			6	5,5	5,5	5,5
<u>Hammer-drilling with standard drill bit (water filled hole)</u>							
Tem- perature range	I: 24 °C / 43 °C		$\tau_{Rk,cr}$ [N/mm ²]	7	6,5	6	6
	II: 43 °C / 60 °C			5,5	5	4,5	4
	III: 50 °C / 72 °C			5,5	5	4	4
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,2			
Water filled hole				1,4			
fischer injection system FIS EB II						Annex C 6	
Performance Characteristic resistance for combined pull-out and concrete failure for fischer rebar anchor							

Table C7.1: Displacements for anchor rods												
Anchor rod		M8	M10	M12	M16	M20	M24	M27	M30			
Displacement-Factors for tension loading¹⁾												
Uncracked or cracked concrete; Temperature range I, II, III												
δ_{N0} -Factor	[mm/(N/mm ²)]	0,07	0,08	0,09	0,10	0,11	0,12	0,12	0,13			
$\delta_{N\infty}$ -Factor		0,11	0,12	0,13	0,15	0,16	0,18	0,18	0,19			
Displacement-Factors for shear loading²⁾												
Uncracked or cracked concrete; Temperature range I, II, III												
δ_{V0} -Factor	[mm/kN]	0,18	0,15	0,12	0,09	0,07	0,06	0,06	0,05			
$\delta_{V\infty}$ -Factor		0,27	0,22	0,18	0,14	0,11	0,09	0,08	0,07			
¹⁾ Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\tau =$ 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							
Table C7.2: Displacements for reinforcing bars												
Nominal diameter of the bar	ϕ	8	10	12	14	16	20	25	26	28	30	32
Displacement-Factors for tension loading¹⁾												
Uncracked or cracked concrete; Temperature range I, II, III												
δ_{N0} -Factor	[mm/(N/mm ²)]	0,07	0,08	0,09	0,09	0,10	0,11	0,12	0,12	0,13	0,13	0,13
$\delta_{N\infty}$ -Factor		0,11	0,12	0,13	0,14	0,15	0,16	0,18	0,18	0,19	0,19	0,20
Displacement-Factors for shear loading²⁾												
Uncracked or cracked concrete; Temperature range I, II, III												
δ_{V0} -Factor	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,07	0,06	0,06	0,05	0,05	0,05
$\delta_{V\infty}$ -Factor		0,27	0,22	0,18	0,16	0,14	0,11	0,09	0,08	0,08	0,07	0,07
¹⁾ Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\tau =$ 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						
fischer injection system FIS EB II										Annex C 7		
Performance Displacements for anchor rods and reinforcing bars												

Table C8.1: Displacements for fischer rebar anchors					
fischer rebar anchor		M12	M16	M20	M24
Displacement-Factors for tension loading¹⁾					
Uncracked or cracked concrete; Temperature range I, II, III					
δ_{N0} -Factor	[mm/(N/mm ²)]	0,09	0,10	0,11	0,12
$\delta_{N\infty}$ -Factor		0,13	0,15	0,16	0,18
Displacement-Factors for shear loading²⁾					
Uncracked or cracked concrete; Temperature range I, II, III					
δ_{V0} -Factor	[mm/kN]	0,12	0,09	0,07	0,06
$\delta_{V\infty}$ -Factor		0,18	0,14	0,11	0,09
¹⁾ Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ 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		
fischer injection system FIS EB II					Annex C 8
Performance Displacements for fischer rebar anchors					