Deutsches Institut für Bautechnik DIBt

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

European Technical Assessment — ETA-22/0501 of 23 September 2025

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 RC II and FIS RC II Low Speed
Product family to which the construction product belongs	Bonded fasteners and bonded expansion fasteners for use in concrete
Manufacturer	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	23 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 330499-02-0601, Edition 12/2023
This version replaces	ETA-22/0501 issued on 20 September 2022

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific Part

1 Technical description of the product

The "fischer injection system FIS RC II and FIS RC II Low Speed" is a bonded fastener consisting of a cartridge with injection mortar fischer FIS RC II, fischer FIS RC II Low Speed, and a steel element according to Annex A3.

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 fastener 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 fastener 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 B3 to B6, C1 to C4
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1 and C2
Displacements under short-term and long-term loading	See Annex C5
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	**Performance**
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.3 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 330499-02-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

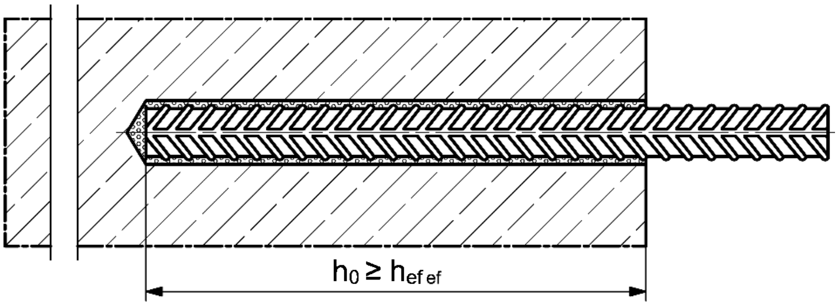
Issued in Berlin on 23 September 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Stiller

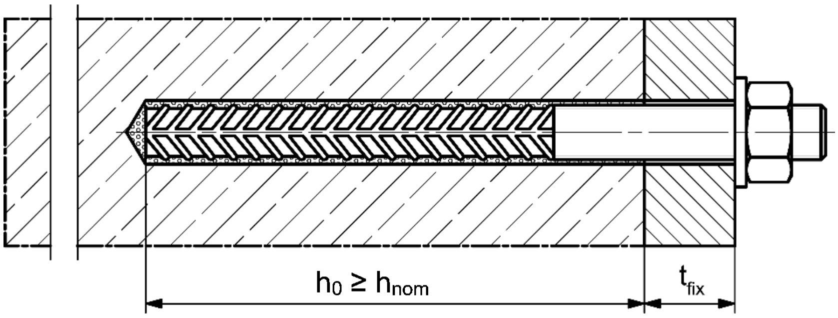
Installation conditions part 1

Reinforcing bar

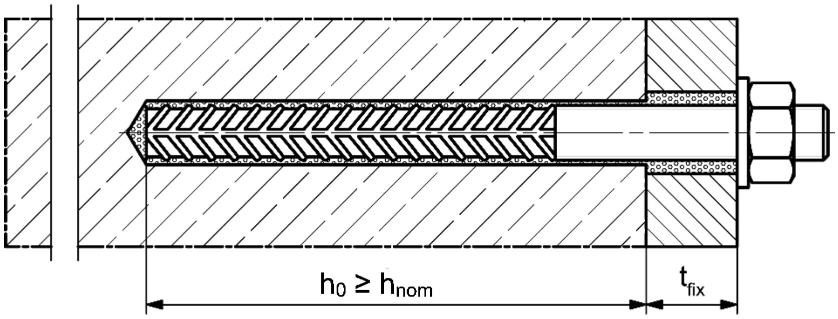


fischer rebar anchor FRA

Pre-positioned installation



Push through installation (annular gap filled with mortar)



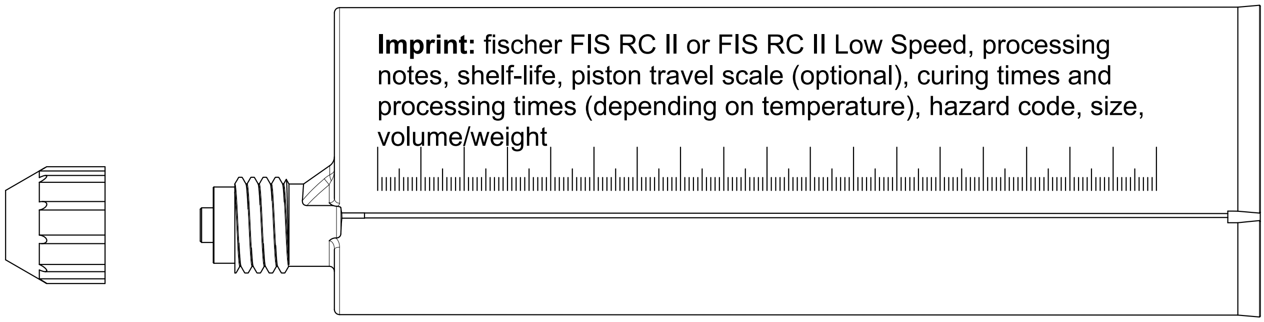
Figures not to scale

h_0	=	drill hole depth	h_{ef}	=	effective embedment depth
t_{fix}	=	thickness of fixture	h_{nom}	=	overall fastener embedment depth in the concrete

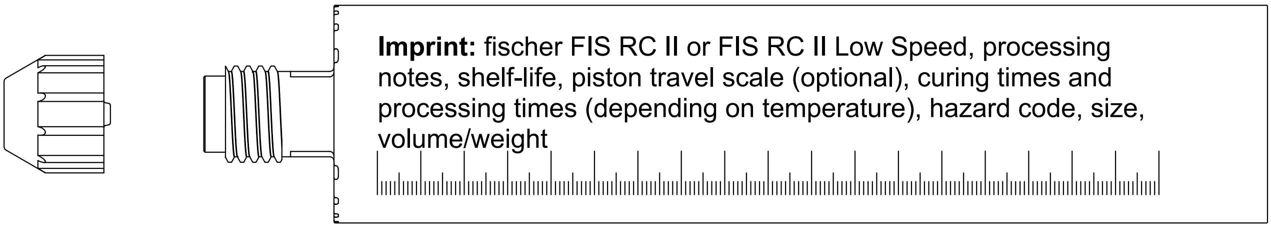
fischer injection system FIS RC II and FIS RC II Low Speed	**Annex A1**
Product description Installation conditions part 1	

Overview system components part 1

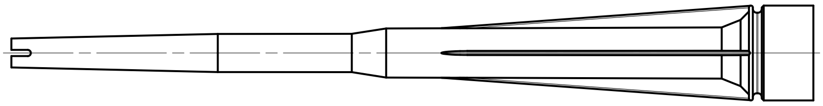
Injection cartridge (shuttle cartridge) with sealing cap; Sizes: 360 ml, 825 ml



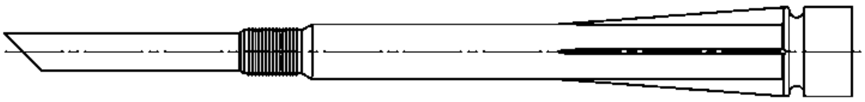
Injection cartridge (coaxial cartridge) with sealing cap; Sizes: 300 ml, 380 ml, 400 ml, 410 ml



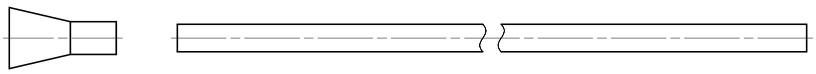
Static mixer FIS MR Plus for injection cartridges up to 410 ml



Static mixer FIS JMR for injection cartridges with 825 ml



Injection adapter and extension tube Ø 9 for static mixer FIS MR Plus;
Injection adapter and extension tube Ø 9 or Ø 15 for static mixer FIS JMR



fischer cleaning brush BS

Blow-out pump AB G **or** **Compressed-air cleaning tool ABP:**

Figures not to scale

fischer injection system FIS RC II and FIS RC II Low Speed

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

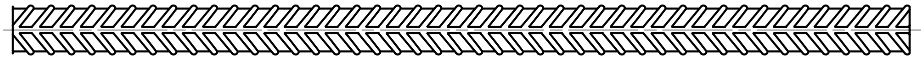
Annex A2

English translation prepared by DIBt

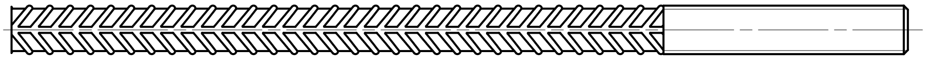
Overview system components part 2

Reinforcing bar

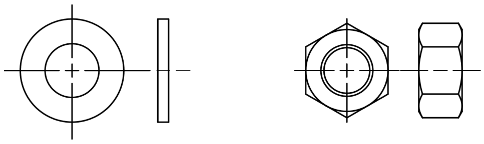
Nominal diameter: ϕ8, ϕ10, ϕ12, ϕ14, ϕ16, ϕ20, ϕ25, ϕ28



fischer rebar anchor FRA (fischer FRA)
Size: M12, M16, M20, M24



washer / hexagon nut



Figures not to scale

fischer injection system FIS RC II and FIS RC II Low Speed

Product description
Overview system components part 2; steel components

Annex A3

Table A4.1: Materials

Part	Designation	Material	
1	Injection cartridge	Mortar, hardener, filler	
	Steel grade	Stainless steel R	High corrosion resistant steel HCR
		acc. to EN 10088-1:2023 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A1:2015	acc. to EN 10088-1:2023 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015
2	Washer ISO 7089:2000 for fischer rebar anchor FRA	1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362; EN 10088-1:2023	1.4565; 1.4529; EN 10088-1:2023
3	Hexagon nut for fischer FRA	Property class 80 acc. to fischer specification for fischer FRA or EN ISO 3506-2:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	Property class 80 acc. to fischer specification for fischer FRA or EN ISO 3506-2:2020 1.4565; 1.4529 EN 10088-1:2023
4	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 %)	
5	fischer rebar anchor FRA	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 $f_{uk} = f_{tk} = k \cdot f_{yk}$ (A_5 > 8 %) Threaded part: Property class 80 EN ISO 3506-1:2020	1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 acc. to EN 10088-1:2023 Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015 1.4565; 1.4529 acc. to EN 10088-1:2023 Corrosion resistance class CRC V acc. to EN 1993-1-4:2006+A1:2015 $f_{uk} \leq 1000$ N/mm²; fracture elongation A_5 > 8 %

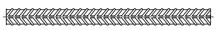
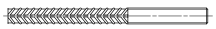
fischer injection system FIS RC II and FIS RC II Low Speed

Product description
Materials

Annex A4

Specifications of intended use part 1

Table B1.1: Overview use and performance categories

Anchorages subject to		FIS RC II with …			
		Reinforcing bar 		fischer FRA 	
Hammer drilling with standard drill bit		all sizes			
Hammer drilling with hollow drill bit (fischer „FHD“, Heller „Duster Expert“; Bosch „Speed Clean“; Hilti „TE-CD, TE-YD“, DreBo „D-Plus“, DreBo „D-Max“		Nominal drill bit diameter (d_0) 12 mm to 35 mm			
Static and quasi static loading, in	uncracked concrete	all sizes	Tables: C1.1 C2.1 C3.1 C5.1	all sizes	Tables: C1.2 C2.1 C4.1 C5.2
	cracked concrete				
Use category	I1 dry or wet concrete	all sizes			
	I2 water filled hole	-[1]		-[1]	
Seismic performance category	C1[1]	-[1]		-[1]	
	C2[1]				
Installation direction		D3 (downward and horizontal and upwards installation)			
Installation temperature		$T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C For the standard variation of temperature after installation			
In-service temperature	Temperature range I	-40 °C to +80 °C	(max. short term temperature +80 °C ; max. long term temperature +50 °C)		
	Temperature range II	-40 °C to +120°C	(max. short term temperature +120 °C ; max. long term temperature +72 °C)		

[1] No performance assessed

Specifications of intended use part 2

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021.

Use conditions (Environmental conditions):

- Fastener intended for use in structures subject to dry, internal conditions (all materials).
- For all other conditions according to EN1993-1-4:2015 corresponding to corrosion resistance classes to Annex A4 Table A4.1.

Design:

- Fastenings are designed in accordance with EN 1992-4:2018.
- The structural design is conducted under responsibility of a designer experienced in the field of anchorages and concrete works.
- 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.).

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.

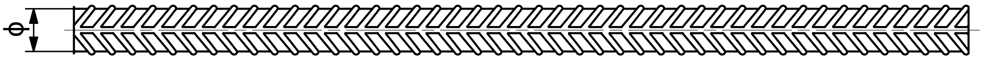
fischer injection system FIS RC II and FIS RC II Low Speed	**Annex B2**
Intended use Specifications part 2	

Table B3.1: Installation parameters for **reinforcing bars**

Nominal diameter of the bar		ϕ	8[1]		10[1]		12[1]		14	16	20	25	28
Nominal drill hole diameter	d_0	[mm]	10	12	12	14	14	16	18	20	25	30	35
Drill hole depth	h_0		$h_0 = h_{ef}$										
Effective embedment depth	$h_{ef,min}$		60		60		70		75	80	90	100	112
	$h_{ef,max}$		160		200		240		280	320	400	500	560
Simplified spacing and edge distance [2]	s = c		40		45		55		60	65	85	110	130
Minimum thickness of concrete member	h_{min}		$h_{ef} + 30$ (≥ 100)					$h_{ef} + 2d_0$					

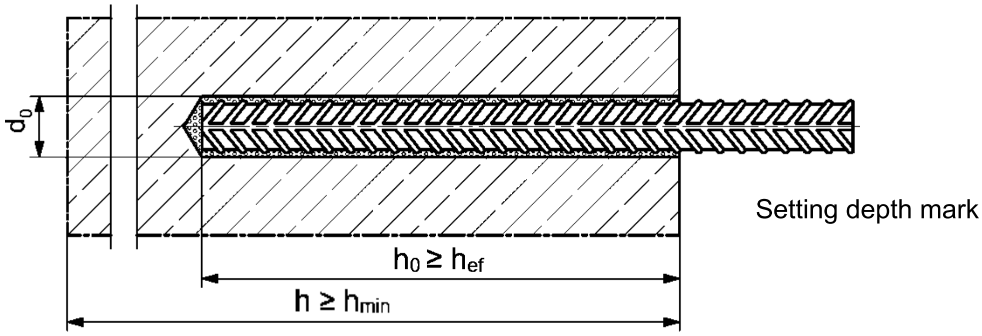
[1] Both drill hole diameters can be used
[2] Detailed calculation according to **Annex B5** and **B6**

Reinforcing bar



- The minimum value of related rib area $f_{R,min}$ must fulfil the requirements of EN 1992-1-1:2011
- 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

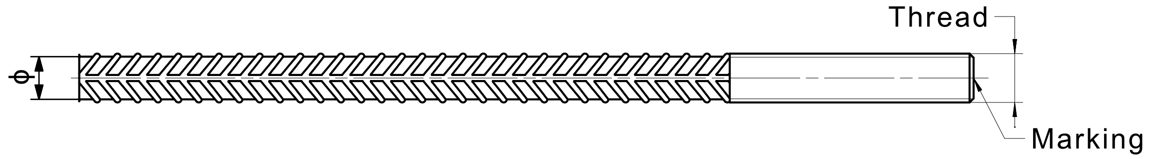
fischer injection system FIS RC II and FIS RC II Low Speed	**Annex B3**
Intended use Installation parameters reinforcing bars	

Table B4.1: Installation parameters for **fischer rebar anchor FRA**

Rebar anchor FRA		**Thread**	**M12[1)]**		**M16**	**M20**	**M24**
Nominal diameter of the bar	ϕ		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	[mm]	55		65	85	105
Maximum Diameter of clearance hole in the fixture — pre-positioned anchorage	d_f		14		18	22	26
Maximum Diameter of clearance hole in the fixture — push through anchorage	d_f		18		22	26	32
Minimum thickness of concrete member	h_{min}		$h_0 + 30$	$h_0 + 2d_0$			
Maximum torque moment for attachment of the fixture	max T_{inst}	[Nm]	40		60	120	150

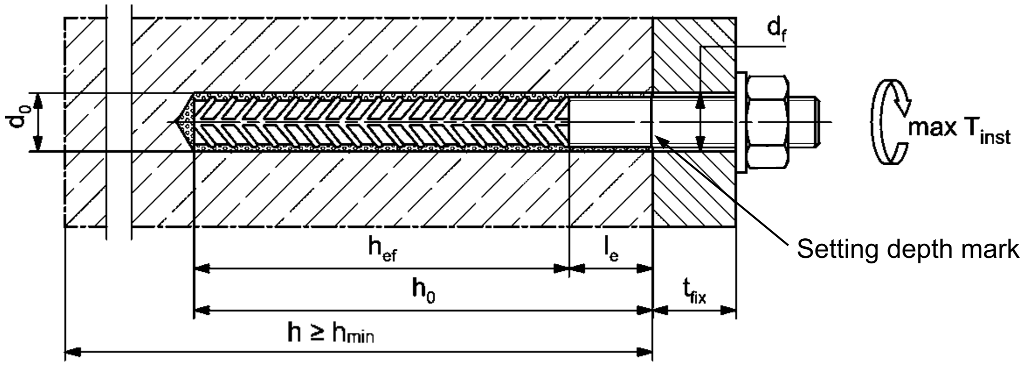
1) Both drill hole diameters can be used
2) Detailed calculation according to **Annex B5** and **B6**

fischer rebar anchor FRA



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

Installation conditions:



Figures not to scale

fischer injection system FIS RC II and FIS RC II Low Speed	**Annex B4**
Intended use Installation parameters rebar anchor FRA	

Table B5.1: Minimum spacing and minimum edge distance for **reinforcing bars** and **fischer rebar anchor FRA**

Reinforcing bars / FRA (Nominal diameter)		**ϕ**	**8**	**10**	**12**	**14**	**16**	**20**	**25**	**28**
Minimum edge distance										
Uncracked / cracked concrete	c_{min}	[mm]	40	45	45	45	50	55	75	80
Minimum spacing	s	[mm]	according to **Annex B6**							
Minimum spacing										
Uncracked / cracked concrete	s_{min}	[mm]	40	45	55	60	65	85	120	140
Minimum edge distance	c	[mm]	according to **Annex B6**							
Required projecting area										
Uncracked concrete	$A_{sp,req}$	[1000 mm²]	8,0	13,0	22,0	23,0	24,0	38,5	47,5	64,0
Cracked concrete	$A_{sp,req}$	[1000 mm²]	6,5	10,0	16,5	17,5	18,5	29,5	36,5	49,0

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:

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

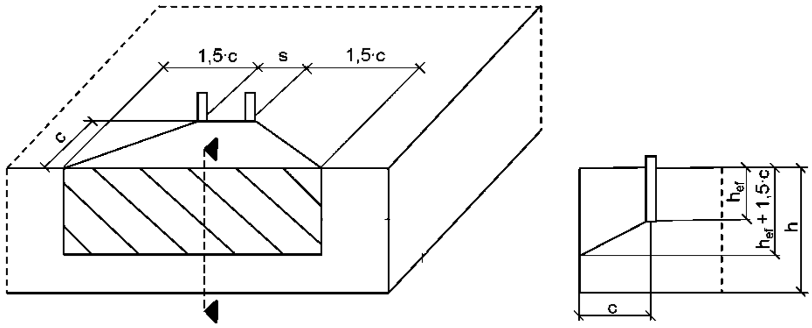
$A_{sp,req}$ = required projecting area
$A_{sp,t}$ = effective projecting area (according to **Annex B6**)

fischer injection system FIS RC II and FIS RC II Low Speed

Intended use
Minimum spacing and edge distance for reinforcing bars and fischer rebar anchor FRA

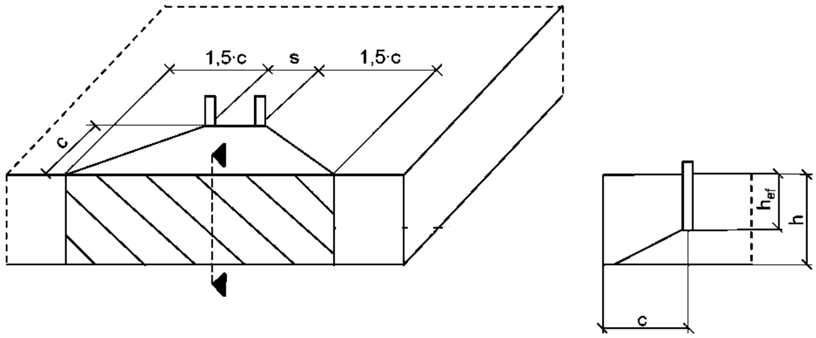
Annex B5

Table B6.1: Projecting area $A_{sp,t}$ with concrete member thickness $h > h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$



Single anchor		$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]	with $c \geq c_{min}$
Group of anchors with	$s > 3 \cdot c$	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]	
Group of anchors with	$s \leq 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]	with $c \geq c_{min}$ and $s \geq s_{min}$

Table B6.2: Projecting area $A_{sp,t}$ with concrete member thickness $h \leq h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$



Single anchor		$A_{sp,t} = 3 \cdot c \cdot$ existing h	[mm²]	with $c \geq c_{min}$
Group of anchors with	$s > 3 \cdot c$	$A_{sp,t} = 6 \cdot c \cdot$ existing h	[mm²]	
Group of anchors with	$s \leq 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot$ existing h	[mm²]	with $c \geq c_{min}$ and $s \geq s_{min}$

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

Figures not to scale

fischer injection system FIS RC II and FIS RC II Low Speed	**Annex B6**
Intended use Minimum thickness of concrete member for anchor rods, minimum spacing and edge distance	

Table B7.1: 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	[mm]	10	12	14	16	18	20	25	35
Steel brush diameter BS	d_b		11	14	16	20		25	27	40

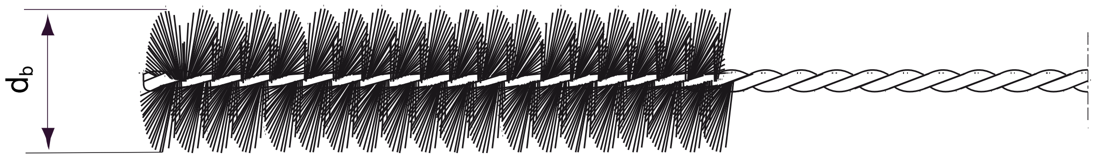


Table B7.2: Conditions for use **static mixer** without an **extension tube**

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

Table B7.3 **Maximum processing time** of the mortar and **minimum curing time**
(During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

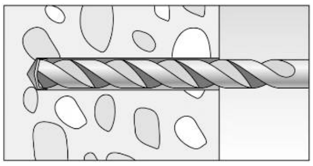
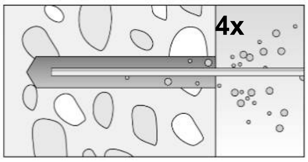
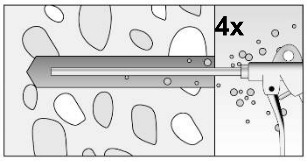
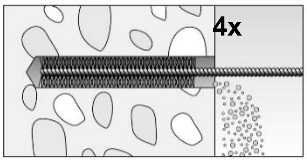
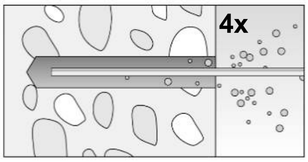
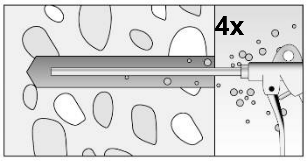
Temperature at anchoring base [°C]	Maximum processing time t_{work}		Minimum curing time 1) t_{cure}	
	FIS RC II	**FIS RC II Low Speed**	**FIS RC II**	**FIS RC II Low Speed**
> -5 to 0 2)	20 min	40 min	24 h	5 d
> 0 to 5 2)	13 min	30 min	3 h	48 h
> 5 to 10	9 min	20 min	90 min	24 h
> 10 to 20	5 min	13 min	60 min	120 min
> 20 to 30	4 min	9 min	45 min	60 min
> 30 to 40	2 min	7 min	35 min	45 min

1) In wet concrete or water filled holes the curing times must be doubled
2) Minimal cartridge temperature +5°C

fischer injection system FIS RC II and FIS RC II Low Speed	**Annex B7**
Intended use Cleaning brush (steel brush) Processing time and curing time	

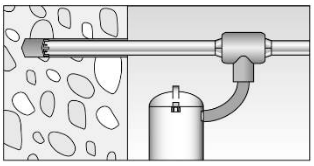
Installation instructions part 1

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

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables B3.1, B4.1.**		
2		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand.		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar). Use suitable compressed-air nozzle.
3		Brush the drill hole four times. For drill hole diameter ≥ 30 mm use a power drill. For deep holes use an extension. Use suitable brushes (see **Table B7.1**)		
4		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand.		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar). Use suitable compressed-air nozzle.

Go to step 5

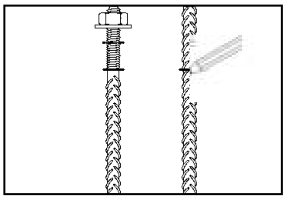
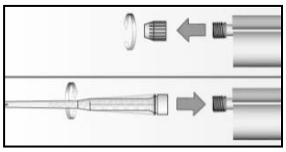
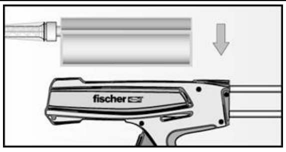
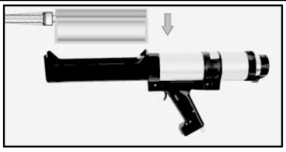
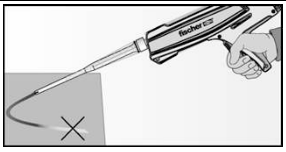
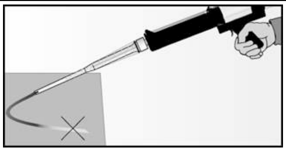
Drilling and cleaning the hole (hammer drilling with hollow drill bit)

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 $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables B3.1, B4.1.**

Go to step 5

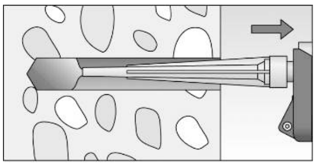
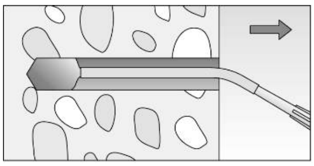
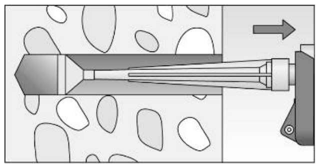
Installation instructions part 2

Preparing the cartridge

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

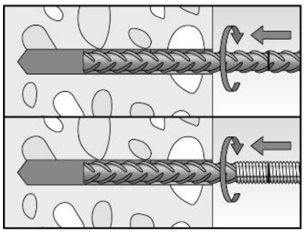
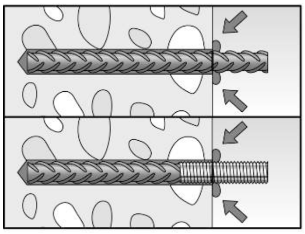
Injection of the mortar

9	 For $h_0 = h_{ef}$ fill approximately 2/3 of the drill hole with mortar. For $h_0 > h_{ef}$ more mortar is needed. Always begin from the bottom of the hole and avoid bubbles.	 The conditions for mortar injection without extension tube can be found in **Table B7.2.** For deeper drill holes, than those mentioned in **Table B7.2,** use a suitable extension tube.	 For deep holes (h_0 > 250 mm) use an injection adapter.

Go to step 10

Installation instructions part 3

Installation reinforcing bars and fischer rebar anchor FRA

10		Only use clean and oil-free reinforcing bars or fischer FRA. Insert the rebar / fischer FRA slowly twisted into the borehole until the embedment mark is reached. Recommendation: Rotation back and forth of the reinforcement bar or the fischer FRA makes pushing easy.
		When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

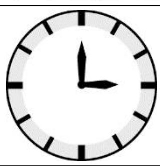
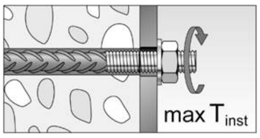
11		Wait for the specified curing time t_{cure} see **Table B7.3**	**12**		Mounting the fixture max T_{inst} for fischer FRA see **Table B4.1**

Table C1.1: 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	28
Characteristic resistance to steel failure under tension loading										
Characteristic resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ 1)							
Characteristic resistance to steel failure under shear loading										
Without lever arm										
Characteristic resistance	$V^0_{Rk,s}$	[kN]	k_6 2) $\cdot A_s \cdot f_{uk}$ 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} respectively shall be taken from the specifications of the reinforcing bar.

2) In accordance with EN 1992-4:2018 section 7.2.2.3.1:
k_6 = 0,6 for fasteners made of carbon steel with $f_{uk} \leq 500$ N/mm²,
= 0,5 for fasteners made of carbon steel with 500 N/mm² $< f_{uk} \leq 1000$ N/mm²,
= 0,5 for fasteners made of stainless steel.

Table C1.2: Characteristic resistance to **steel failure** under **tension / shear loading** of **fischer rebar anchors FRA**

fischer rebar anchor FRA			M12	M16	M20	M24
Characteristic resistance to steel failure under tension loading						
Characteristic resistance	$N_{Rk,s}$	[kN]	62,0	111,0	173,0	236,5
Partial factor 1)						
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]	34,5	64,3	100,4	144,7
Ductility factor	k_7	[-]	1,0			
With lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	107,4	273,0	532,2	920,4
Partial factor 1)						
Partial factor	$\gamma_{Ms,V}$	[-]	1,5			

1) In absence of other national regulations

fischer injection system FIS RC II and FIS RC II Low Speed	**Annex C1**
Performance Characteristic resistance to steel failure under tension / shear loading of reinforcing bars and fischer rebar anchors FRA	

Table C2.1: Characteristic resistance to **concrete failure** under **tension / shear loading**

Size				**All sizes**							
Characteristic resistance to concrete failure under tension loading											
Installation factor	γ_{inst}		[-]	See annex C3 to C4							
Factors for the compressive strength of concrete > C20/25											
Increasing factor ψ_c for cracked or uncracked concrete $\tau_{Rk\,(X,Y)} = \psi_c \cdot \tau_{Rk\,(C20/25)}$		C25/30	[-]	1,05							
		C30/37		1,10							
		C35/45		1,15							
		C40/50		1,19							
		C45/55		1,22							
		C50/60		1,26							
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			[°C]	50 / 80				72 / 120			
Factor		Ψ^0_{sus}	[-]	0,74				0,87			
Characteristic resistance to concrete failure under 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 in 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}; max (8 d_{nom}; 300 mm))							
Calculation diameters											
Size				M12		M16		M20		M24	
fischer rebar anchor FRA		d_{nom}	[mm]	12		16		20		25	
Size (nominal diameter of the bar)		ϕ	[mm]	8	10	12	14	16	20	25	28
Reinforcing bar		d_{nom}		8	10	12	14	16	20	25	28

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Performance
Characteristic resistance to concrete failure under tension / shear loading

Annex C2

Table C3.1: Characteristic resistance to **combined pull-out** and **concrete failure** for **reinforcing bars** in hammer drilled holes; **uncracked or cracked concrete**

Nominal diameter of the bar			**ϕ**	**8**	**10**	**12**	**14**	**16**	**20**	**25**	**28**
Combined pull-out and concrete cone failure											
Calculation diameter		d	[mm]	8	10	12	14	16	20	25	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: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	11,0	11,0	11,0	10,0	10,0	9,5	9,0	8,5
	II: 72 °C / 120 °C			9,5	9,5	9,0	8,5	8,5	8,0	7,5	7,0
Installation factor											
Dry or wet concrete		γ_{inst}	[-]	1,0							
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: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1)]	3,0	5,0	5,0	5,0	4,5	4,0	4,0
	II: 72 °C / 120 °C			-[1)]	3,0	4,5	4,5	4,5	4,0	3,5	3,5
Installation factor											
Dry or wet concrete		γ_{inst}	[-]	1,0							

[1)] No performance assessed

fischer injection system FIS RC II and FIS RC II Low Speed

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

Annex C3

Table C4.1: Characteristic resistance to **combined pull-out** and **concrete failure** for **fischer rebar anchors FRA** in hammer drilled holes; **uncracked or cracked concrete**

fischer rebar anchor FRA					**M12**	**M16**	**M20**	**M24**
Combined pull-out 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:	50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	11,0	10,0	9,5	9,5
	II:	72 °C / 120 °C			9,0	8,5	8,0	7,5
Installation factors								
Dry or wet concrete			γ_{inst}	[-]	1,0			
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:	50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	5,0	5,0	4,5	4,0
	II:	72 °C / 120 °C			4,5	4,5	4,0	3,5
Installation factors								
Dry or wet concrete			γ_{inst}	[-]	1,0			

Table C5.1: Displacements for reinforcing bars

Nominal diameter of the bar	ϕ	8	10	12	14	16	20	25	28
Displacement-Factors for tension loading[1)]									
Uncracked concrete; Temperature range I, II									
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,09	0,09	0,10	0,10	0,10	0,10	0,10	0,11
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,10	0,12	0,12	0,12	0,12	0,13	0,13
Cracked concrete; Temperature range I, II									
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	-[3)]	0,12	0,13	0,13	0,13	0,13	0,13	0,14
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	-[3)]	0,27	0,30	0,30	0,30	0,30	0,35	0,37
Displacement-Factors for shear loading[2)]									
Uncracked or cracked concrete; Temperature range I, II									
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,11	0,11	0,10	0,10	0,10	0,09	0,09	0,08
$\delta_{V\infty\text{-Factor}}$	[mm/kN]	0,12	0,12	0,11	0,11	0,11	0,10	0,10	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

[3)] No performance assessed

Table C5.2: Displacements for fischer rebar anchors FRA

fischer rebar anchor FRA		M12	M16	M20	M24
Displacement-Factors for tension loading[1)]					
Uncracked concrete; Temperature range I, II					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,10	0,10	0,10
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	0,12	0,12	0,12	0,13
Cracked concrete; Temperature range I, II					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,12	0,13	0,13	0,13
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	0,30	0,30	0,30	0,35
Displacement-Factors for shear loading[2)]					
Uncracked or cracked concrete; Temperature range I, II					
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,10	0,10	0,09	0,09
$\delta_{V\infty\text{-Factor}}$	[mm/kN]	0,11	0,11	0,10	0,10

[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

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Performance
Displacements for reinforcing bars and fischer rebar anchors FRA

Annex C5