Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-19/0612 of 6 December 2019

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 FORZA PRO
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	fischerwerke GmbH & Co. KG Klaus-Fischer-Straße 1 72178 Waldachtal DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	18 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

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Specific Part

1 Technical description of the product

The fischer injection system FORZA PRO is a bonded anchor consisting of a cartridge with injection mortar fischer FORZA PRO, FORZA PRO High Speed or FORZA PRO Low Speed and a steel element. The steel element consist of a fischer anchor rod with washer and hexagon nut in the range of M8 to M24

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 C 1, C 2, C 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 2
Displacements (static and quasi-static loading)	See Annex C 3
Characteristic resistance and displacements for seismic performance category C1 and C2	No performance assessed
Durability	See Annex B 1

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

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 6 December 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Baderschneider

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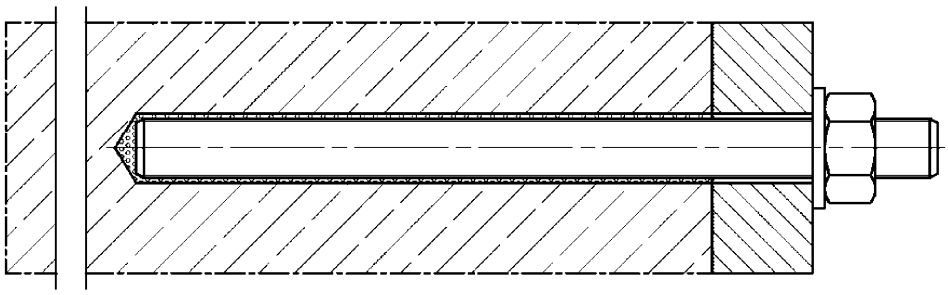
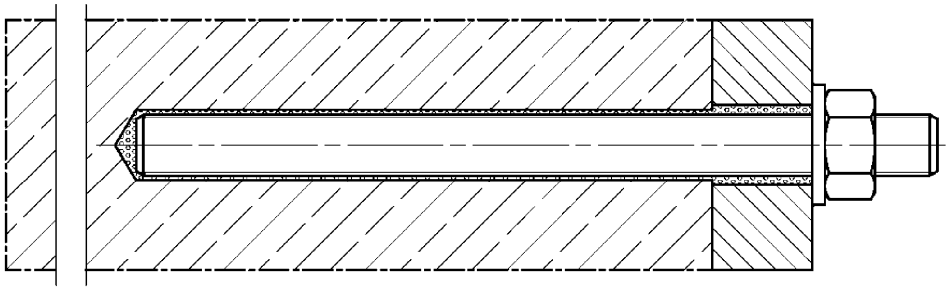
Installation conditions

fischer anchor rod

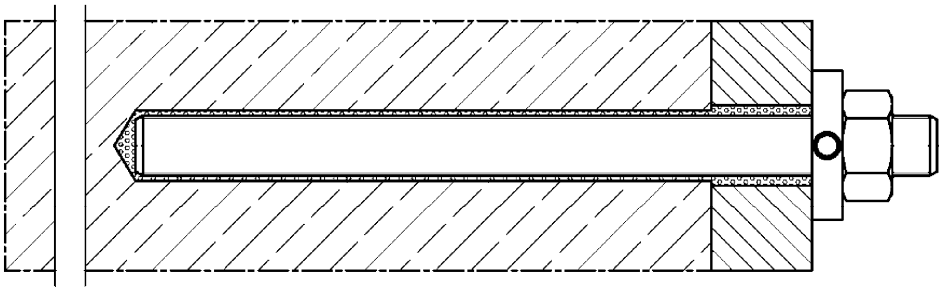
Pre-positioned installation



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

fischer injection system FORZA PRO	
Product description Installation conditions	**Annex A 1**

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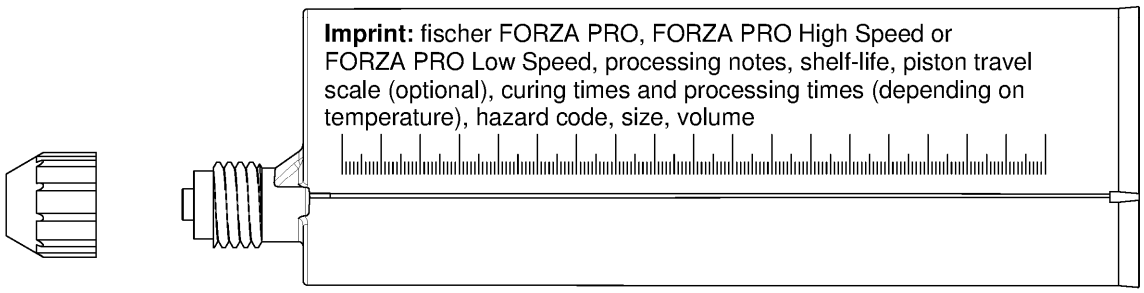
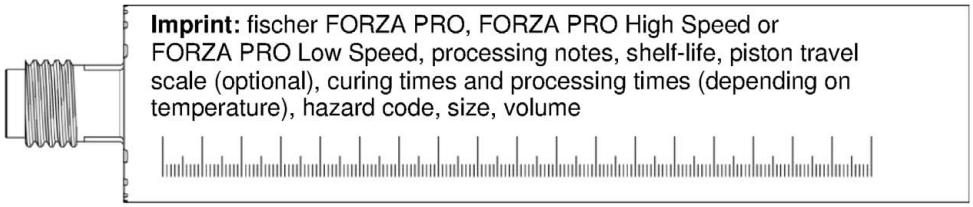
Overview system components part 1

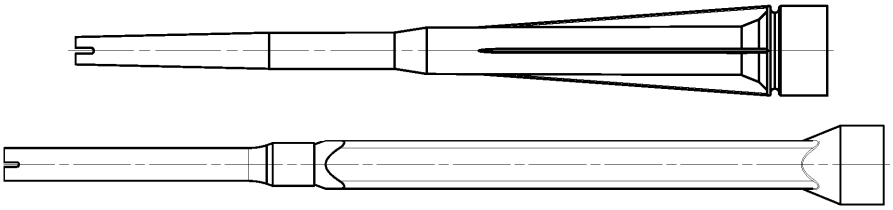
Injection cartridge (shuttle cartridge) with sealing cap; Size: 350 ml, 360 ml, 390 ml, 550 ml, 950 ml, 1500 ml



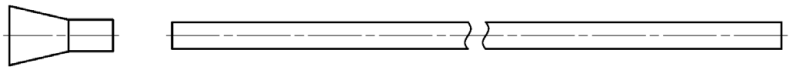
Injection cartridge (coaxial cartridge) with sealing cap; Size: 100 ml, 150 ml, 300 ml, 380 ml, 400 ml, 410 ml



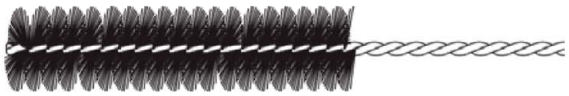
Static mixer FIS MR Plus or UMR



Injection adapter and Extension tube for static mixer



Cleaning brush BS / BSB



Blow-out pump ABG or ABP

Figures not to scale

fischer injection system FORZA PRO	**Annex A 2**
System description Overview system components part 1; cartridges / static mixer / accessories	

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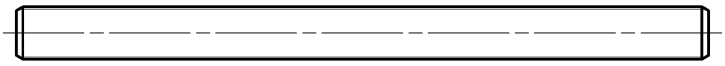
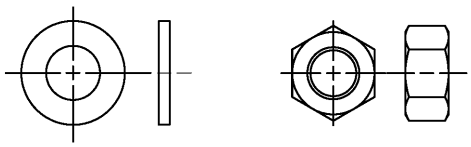
Overview system components part 2

fischer anchor rod

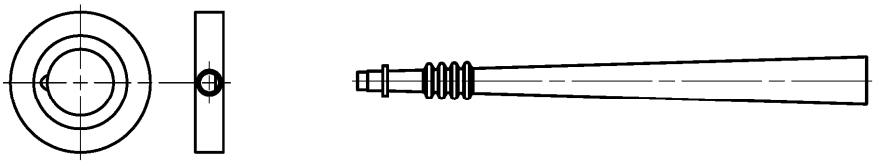
Size: M8, M10, M12, M16, M20, M24



washer / hexagon nut



fischer filling disk FFD with injection adapter



Figures not to scale

fischer injection system FORZA PRO	**Annex A 3**
System description Overview system components part 2; steel components	

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Table A4.1: Materials

Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel, zinc plated	Stainless steel A4 [1]	High corrosion resistant steel C [2]
2	Anchor rod	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanized ≥ 40 µm EN ISO 10684:2004 f_{uk} ≤ 1000 N/mm² A_5 > 8% 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/mm² A_5 > 8% fracture elongation	Property class 50 or 80 EN ISO 3506-1:2009 or property class 70 with f_{yk}= 560 N/mm² 1.4565; 1.4529; EN 10088-1:2014 f_{uk} ≤ 1000 N/mm² A_5 > 8% fracture elongation
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, EN ISO 4042:1999 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 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 µm, ISO 4042:1999 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 filling disk FFD similar to DIN 6319-G	zinc plated ≥ 5 µm, EN ISO 4042:1999 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

[1] acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2015
[2] acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4:2015

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Specifications of intended use (part 1)

Table B1.1: Overview use and performance categories

Anchorages subject to			**FORZA PRO with …**	
			Anchor rod 	
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") 			Nominal drill bit diameter (d_0) 12 mm to 28 mm	
Static and quasi static load, in		uncracked concrete	all sizes	Tables: C1.1 C2.1 C3.1 C3.2
Use category	I1	dry or wet concrete	all sizes	
	I2	Flooded hole	M12 to M24	
Installation direction			D3 (downward and horizontal and upwards (e.g. overhead) installation)	
Installation method			pre-positioned or push through installation	
Installation temperature			$T_{i,min}$ = 0 °C to $T_{i,max}$ = +40 °C	
In-service temperature		Temperature range I	-40 °C to +40 °C	T_{st} = +40 °C / T_{lt} = +24 °C
		Temperature range II	-40 °C to +80 °C	T_{st} = +80 °C / T_{lt} = +50 °C

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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 4 table 4.1

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.)
- The Anchorages are designed in accordance to EN 1992-4:2018 and 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 FORZA PRO	**Annex B 2**
Intended use Specifications (part 2)	

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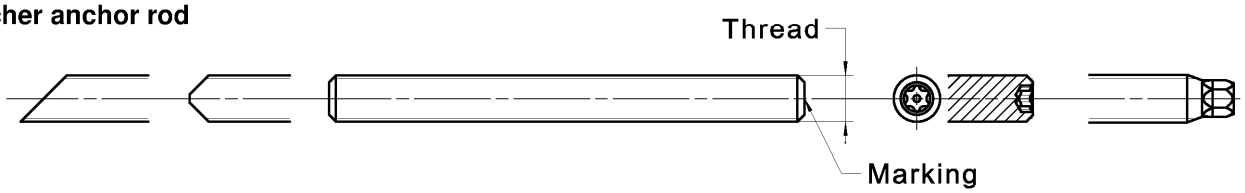
Table B3.1: Installation parameters plus minimum spacing and minimum edge distance for anchor rods

Anchor rods			**Thread**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Width across flats		SW	[mm]	13	17	19	24	30	36
Nominal drill hole diameter		d_0		10	12	14	18	24	28
Drill hole depth		h_0		$h_0 = h_{ef}$					
Effective embedment depth		$h_{ef,\,min}$		60	60	70	80	90	96
		$h_{ef,\,max}$		160	200	240	320	400	480
Minimum spacing and minimum edge distance		s_{min} = c_{min}		40	45	55	65	85	105
Diameter of the clearance hole of the fixture	Pre-positioned installation	d_f		9	12	14	18	22	26
	push through installation	d_f		11	14	16	20	26	30
Minimum thickness of concrete member		h_{min}		h_{ef} + 30 (≥ 100)			h_{ef} + $2d_0$		
Maximum torque moment for attachment of the fixture		max T_{fix}	[Nm]	10	20	40	60	120	150

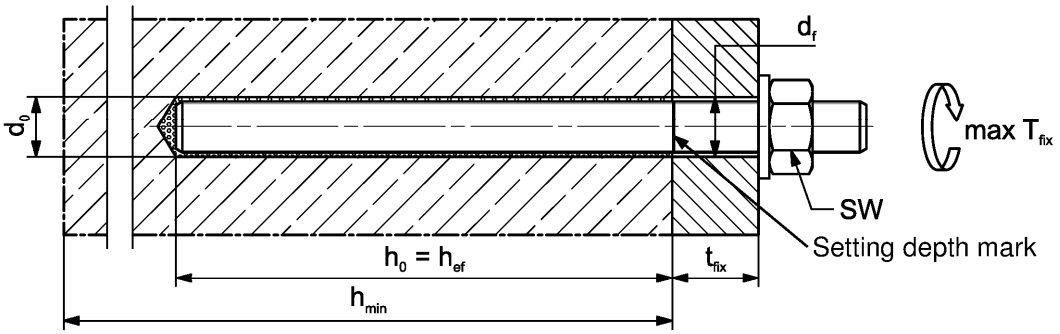
fischer anchor rod



Marking (on random place) fischer anchor rod:

Property class 8.8, stainless steel, property class 80 and high corrosion resistant steel, property class 80: •
Stainless steel A4, property class 50 and high corrosion resistant steel, property class 50: ••
Alternatively: Colour coding according to DIN 976-1

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 4, Table A4.1
- 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 FORZA PRO

Intended use
Installation parameters anchor rods

Annex B 3

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Table B4.1: 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	[mm]	10	12	14	18	24	28
Steel brush diameter	d_b		11	14	16	20	26	30

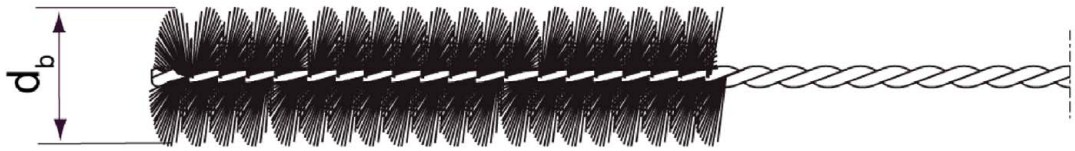

Table B4.2: Maximum processing time of the mortar and minimum curing time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature. Minimal cartridge temperature +5 °C)

Temperature at anchoring base [°C]	Maximum processing time t_{work}			Minimum curing time [1] t_{cure}		
	FORZA PRO High Speed	FORZA PRO	FORZA PRO Low Speed	FORZA PRO High Speed	FORZA PRO	FORZA PRO Low Speed
> ±0 to +5	5 min	13 min	---	3 h	3 h	6 h
> +5 to +10	3 min	9 min	20 min	50 min	90 min	3 h
> +10 to +20	1 min	5 min	10 min	30 min	60 min	2 h
> +20 to +30	---	4 min	6 min	---	45 min	60 min
> +30 to +40	---	2 min	4 min	---	35 min	30 min

[1] In wet concrete or water filled holes the curing times must be doubled

fischer injection system FORZA PRO

Intended use
Parameters of the cleaning brush (steel brush)
Processing time and curing time

Annex B 4

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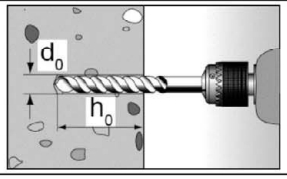
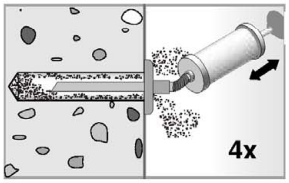
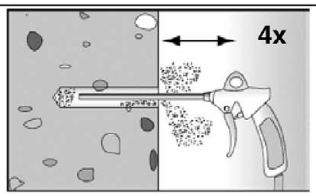
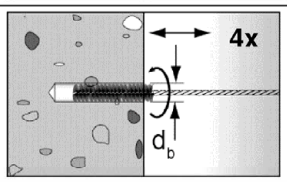
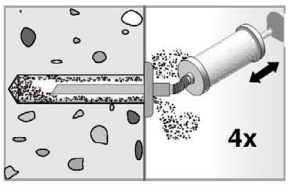
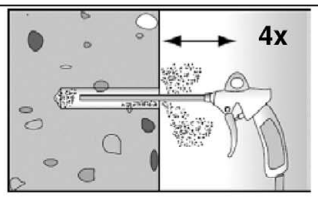
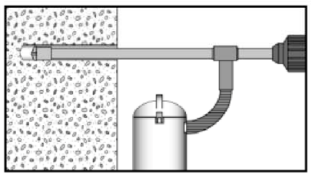
Installation instructions part 1

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 **table B3.1**
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)
3		Brush the drill hole four times. For deep holes use an extension. Corresponding brushes see **table B4.1**
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)

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 **table B3.1**

Go to step 5

fischer injection system FORZA PRO	**Annex B 5**
Intended use Installation instructions part 1	

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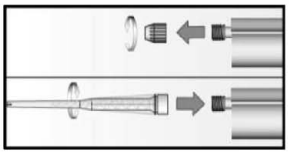
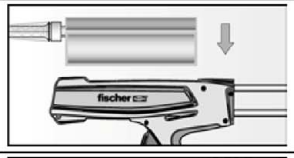
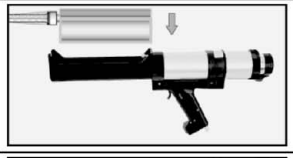
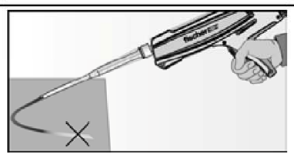
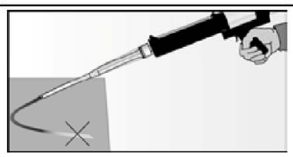
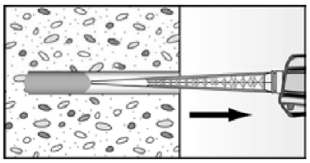
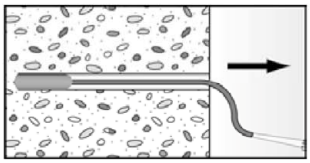
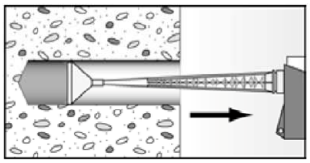
Installation instructions part 2

Preparing the cartridge

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

Injection of the mortar

8			
	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) use an injection-adapter

Go to step 9

fischer injection system FORZA PRO

Intended use
Installation instructions part 2

Annex B 6

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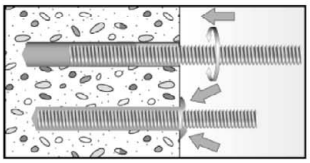
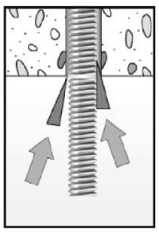
Installation instructions part 3

Installation of anchor rods

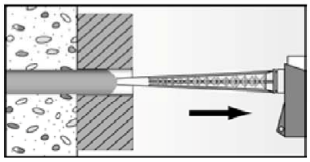
9



Only use clean and oil-free anchor elements.
Mark the setting depth of the anchor. Push the anchor rod 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.



For overhead installations support the anchor rod with wedges.
(e. g. fischer centering wedges)

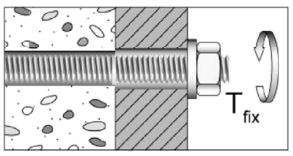


For push through installation fill the annular gap with mortar

10

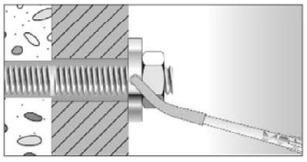
Wait for the specified curing time t_{cure} see **table B4.2**

11



Mounting the fixture max T_{fix} see **table B3.1**

Option



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 FFD.
Compressive strength ≥ 50 N/mm² (e.g. fischer injection mortars FIS HB, FIS SB, FIS V, FIS EM Plus, FORZA PRO)
ATTENTION: Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

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Intended use
Installation instructions part 3

Annex B 7

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Table C1.1: Essential characteristic for the **steel bearing capacity** under tensile / shear load of **fischer anchor rods** and **standard threaded rods**

Anchor rod / standard threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Bearing capacity under tensile load, steel failure[3]									
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	5.8	19 (17)	29 (27)	43	79	123	177
			8.8	29 (27)	47 (43)	68	126	196	282
	Stainless steel A4 and high corrosion resistant steel C		50	19	29	43	79	123	177
			70	26	41	59	110	172	247
			80	30	47	68	126	196	282
Partial factors[1]									
Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	5.8	1,50					
			8.8	1,50					
	Stainless steel A4 and high corrosion resistant steel C		50	2,86					
			70	1,50[2] / 1,87					
			80	1,60					
Bearing capacity under shear load, steel failure									
without lever arm[3]									
Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	5.8	9 (8)	15 (13)	21	39	61	89
			8.8	15 (13)	23 (21)	34	63	98	141
	Stainless steel A4 and high corrosion resistant steel C		50	9	15	21	39	61	89
			70	13	20	30	55	86	124
			80	15	23	34	63	98	141
Ductility factor		k_7	[-]	1,0					
with lever arm[3]									
Charact. resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	5.8	19 (16)	37 (33)	65	166	324	560
			8.8	30 (26)	60 (53)	105	266	519	896
	Stainless steel A4 and high corrosion resistant steel C		50	19	37	65	166	324	560
			70	26	52	92	232	454	784
			80	30	60	105	266	519	896
Partial factors[1]									
Partial factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	5.8	1,25					
			8.8	1,25					
	Stainless steel A4 and high corrosion resistant steel C		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 undersized threaded rods with smaller stress area A_s for hotdip galvanized standard threaded rods according to EN ISO 10684:2004+AC:2009.

fischer injection system FORZA PRO

Performance
Essential characteristics for the steel bearing capacity of fischer anchor rods and standard threaded rods

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C2.1: Essential characteristics under tensile / shear load

Size				**All sizes**
Tensile load				
Uncracked concrete		$k_{ucr,N}$	[-]	11,0
Factors for the compressive strength of concrete > C20/25				
Increasing factor for τ_{Rk}	C25/30	Ψ_c	[-]	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				
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$
Spacing		$s_{cr,N}$		$2\ c_{cr,N}$
Installation factor tensile load		γ_{inst}	[-]	1,2
Shear load				
Installation factor shear load		γ_{inst}	[-]	1,0
Concrete pry-out failure				
Factor for pry-out failure		k_8	[-]	2,0
Concrete edge failure				
value of h_{ef} (= l_f) under shear load			[-]	Conditions according to EN 1992-4:2018: chapter 7.2.2.5; Section 6; equation 7.43

Calculation diameters							
Size			M8	M10	M12	M16	M20	M24
fischer anchor rods and standard threaded rods		d_{nom}	[mm]	8	10	12	16	20	24

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Performance
Essential characteristics under tensile / shear load

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3.1: Essential characteristics of **tensile resistance** for **fischer anchor rods** and **standard threaded rods** in hammer drilled holes; **uncracked concrete**

Anchor rod / standard threaded rod			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Combined pullout and concrete cone failure								
Calculation diameter	d	[mm]	8	10	12	16	20	24
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: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	7,5	7,5	7,5	7,5	7	7
Temperature range II: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	6,5	6	6
Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)								
Temperature range I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	---	---	7,5	7,5	7	7
Temperature range II: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	---	---	6,5	6,5	6	6
Reduction factor ψ^0_{sus} in uncracked concrete C20/25								
All Temerature ranges	ψ^0_{sus}	[-]	No performance assessed					
Installation factors								
Dry or wet concrete	γ_{inst}	[-]	1,0					
Flooded hole	γ_{inst}	[-]	---		1,2[1)]			

[1)] Only with coaxial cartridges: 380ml, 400 ml, 410 ml

Table C3.2: **Displacements** for **anchor rods**

Anchor rod		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement-Factors for tensile load[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
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,10	0,12	0,12	0,12	0,13
Displacement-Factors for shear load[2)]							
Uncracked concrete; Temperature range I, II							
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,11	0,11	0,10	0,10	0,09	0,09
$\delta_{V\infty\text{-Factor}}$	[mm/kN]	0,12	0,12	0,11	0,11	0,10	0,10

[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)

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Performance
Essential characteristics of tensile resistance (uncracked concrete) for fischer anchor rod, standard threaded rods, Displacement for anchor rods

Annex C 3