DÉCLARATION DES PERFORMANCES

DoP 0280

pour fischer Highbond-Anchor FHB / FHB dyn / FDA (cheville à scellement à expansion pour utilisation dans le béton) FR

1. Code d'identification unique du type de produit: **DoP 0280**

2. Usage(s) prévu(s): **Fixation dans du béton fissuré ou non fissuré, voir annexes, en particulier les annexes B1 - B19.**

3. Fabricant: **fischerwerke GmbH & Co. KG, Klaus-Fischer-Str. 1, 72178 Waldachtal, Allemagne**

4. Mandataire: **–**

5. Système(s) d'évaluation et de vérification de la constance des performances: **1**

6. Document d'évaluation européen: **EAD 330499-01-0601**
   Evaluation Technique Européenne: **ETA-06/0171; 2021-06-23**
   Organisme d'évaluation technique: **DIBt- Deutsches Institut für Bautechnik**
   Organisme(s) notifié(s): **2873 TU Darmstadt**

7. Performance(s) déclarée(s):
   Résistance mécanique et stabilité (BWR 1)
   Résistance caractéristique à la charge de traction (charge statique et quasi-statique):
   Résistance à la rupture de l'acier (charge de traction): Annexe C1
   Résistance à la rupture par extraction glissement: et rupture du cône béton: Annexe C3
   Résistance à la rupture du cône béton: Annexe C2
   Distance au bord pour éviter la rupture par fendage sous charge: Annexe C2
   Robustesse: Annexes C2, C3
   Couple de serrage: Annexes B5 - B8
   Distance au bord et entraxe mini: Annexes B5 - B8

   Résistance caractéristique à la charge de cisaillement (charge statique et quasi-statique):
   Résistance à la rupture de l'acier: Annexe C1
   Résistance à la rupture par effet de levier: Annexe C2
   Résistance à la rupture du béton en bord de dalle: Annexe C2

   Déplacements sous charge à court et long terme:
   Déplacements sous charge à court et long terme: Annexe C3

   Résistance caractéristique et déplacements pour les catégories de performance sismique C1 et C2:
   Résistance à la charge de traction, catégorie C1: NPD
   Résistance à la charge de traction, catégorie C2: NPD
   Résistance à la charge de cisaillement, catégorie C1: NPD
   Résistance à la charge de cisaillement, catégorie C2: NPD
   Facteur espace annulaire: NPD

   Hygiène, santé et environnement (BWR 3)
   Contenu, émission et/ou rejet de substances dangereuses: NPD

8. Documentation technique appropriée et/ou documentation technique spécifique: **–**

Les performances du produit identifié ci-dessus sont conformes aux performances déclarées. Conformément au règlement (UE) no 305/2011, la présente déclaration des performances est établie sous la seule responsabilité du fabricant mentionné ci-dessus.

Signé pour le fabricant et en son nom par:

Dr.-Ing. Oliver Geibig, Directeur Général Business Units & Ingénierie

Jürgen Grün, Directeur Général Chimie & Qualité

Tumlingen, 2021-06-30

Cette DoP a été préparée en plusieurs langues. En cas de différend relatif à l'interprétation, la version anglaise prévaudra.

L'annexe comprend des informations volontaires et complémentaires en langue anglaise dépassant les exigences légales (spécifiées de manière neutre).

Specific Part

1 Technical description of the product

The fischer Highbond-Anchor FHB / FHB dyn / FDA is a bonded expansion fastener consisting of an injection cartridge FIS HB and a steel element. The steel element is made of zinc plated or stainless steel.

The load transfer is realized by mechanical interlock of several cones in the bonding mortar and a combination of bonding and friction forces in the 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 to C 3, B 5 to B 8
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 and C 2
Displacements under short-term and long-term loading	See Annex C 3
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

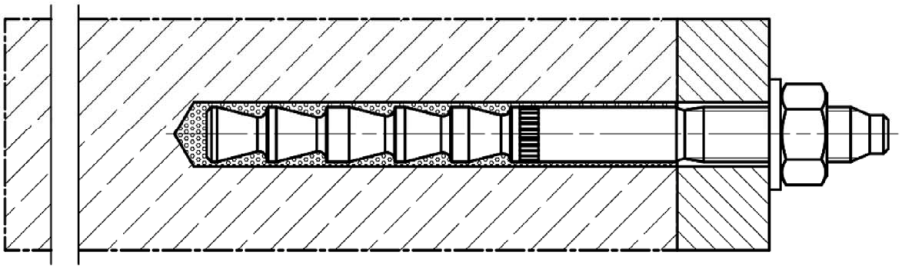
In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

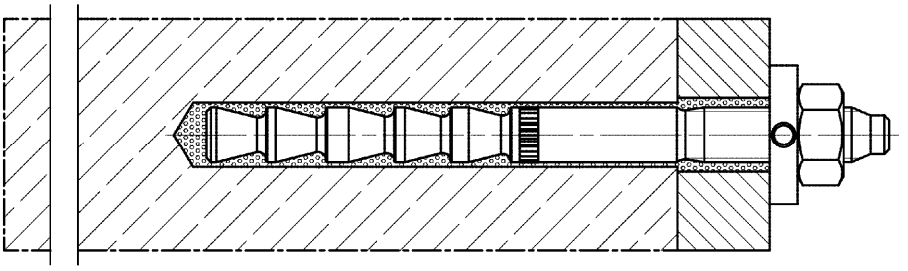
Installation conditions Part 1, FHB / FHB N

fischer Highbond-Anchor FHB / **FHB N** with fischer injection system FIS HB

Pre-positioned installation



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

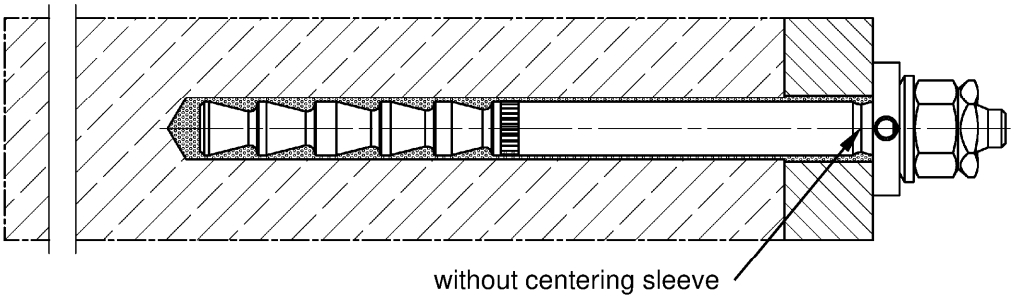


Figures not to scale

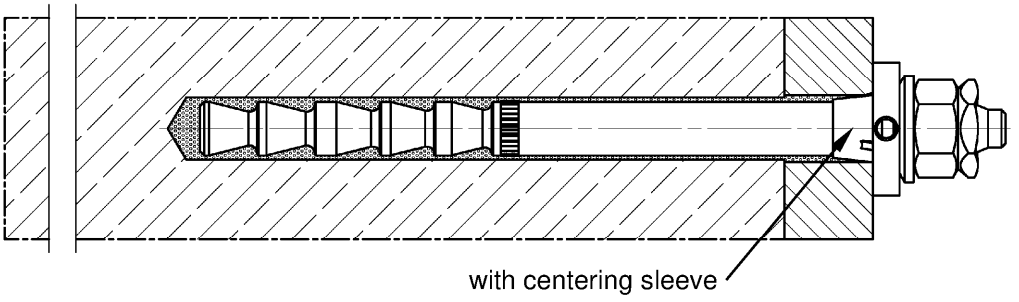
Installation conditions Part 2, FHB dyn

fischer Highbond-Anchor dynamic FHB dyn with fischer injection system FIS HB

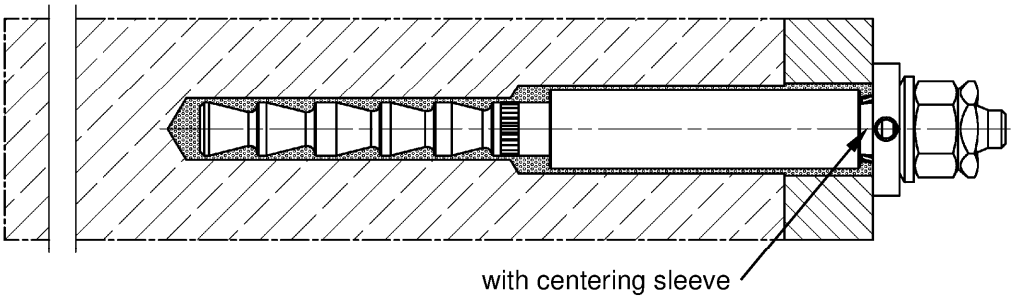
Pre-positioned installation without shear force sleeve, FHB dyn (annular gap filled with mortar)



Push through installation without shear force sleeve, FHB dyn (annular gap filled with mortar)



Push through installation with shear force sleeve, FHB dyn V (annular gap filled with mortar)

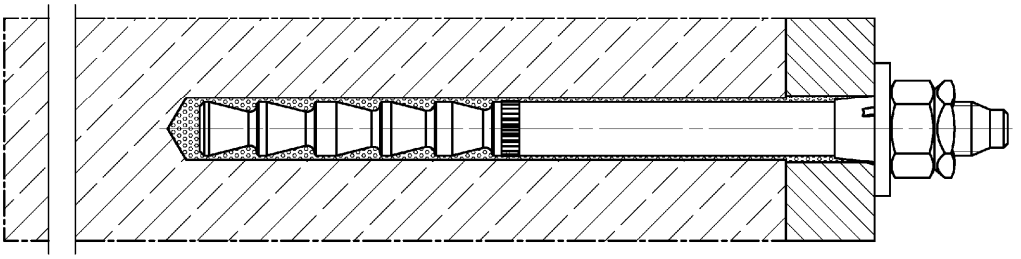


Figures not to scale

Installation conditions Part 3, FDA

fischer Dynamic-Anchor FDA with fischer injection system FIS HB

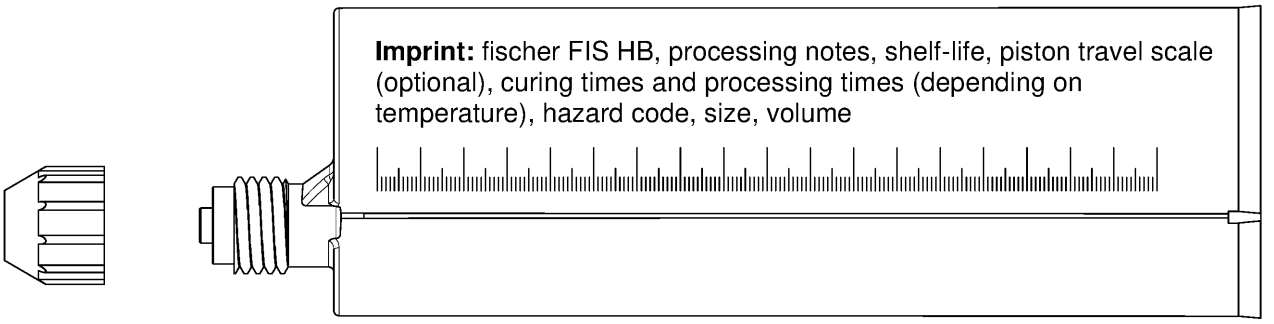
Push through installation



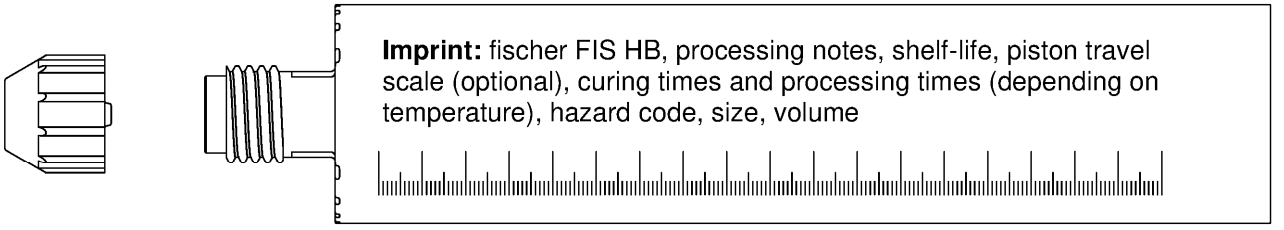
Figures not to scale

Overview system components part 1

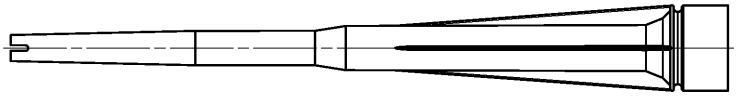
Injection cartridge (shuttle cartridge) with sealing cap
Size: 345 ml, 360 ml, 825 ml



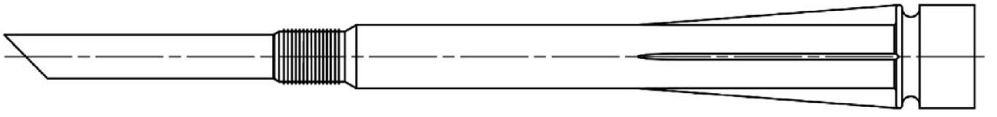
Injection cartridge (coaxial cartridge) with sealing cap
Size: 150 ml, 300 ml, 380 ml, 400 ml, 410 ml



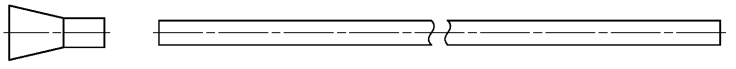
Static mixer FIS MR Plus for injection cartridges up to 410 ml



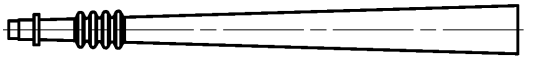
Static mixer FIS JMR for injection cartridge 825 ml



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



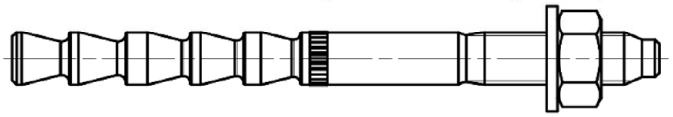
Injection adapter

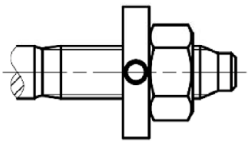


Figures not to scale

Overview system components part 2

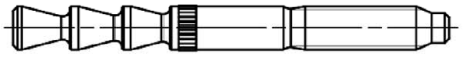
fischer Highbond-Anchor FHB / **FHB N** (alternative designation)



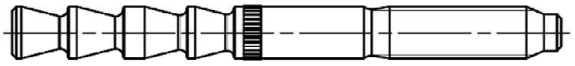


alternative version

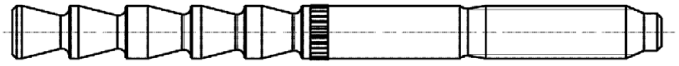
fischer anchor rod FHB-A / FHB-A N; Size: M10x60



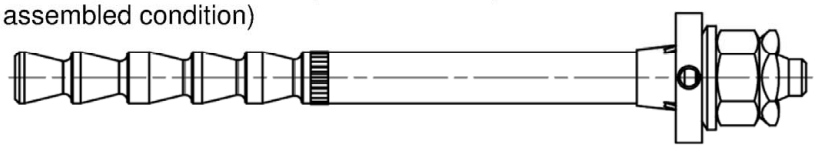
fischer anchor rod FHB-A / FHB-A N; Size: M12x80

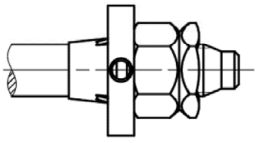


fischer anchor rod FHB-A / FHB-A N; Size: M12x100, M16x125, M20x170, M24x220



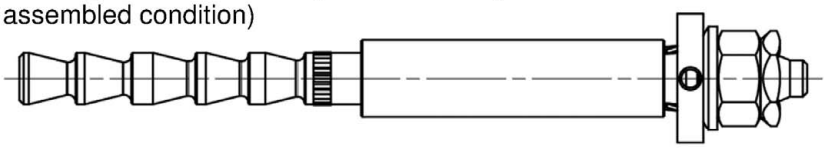
fischer Highbond-Anchor dynamic FHB dyn without shear force sleeve
(in assembled condition)

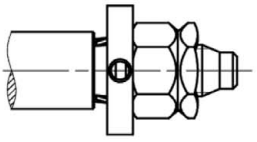




alternative version:
hexagonal nut with
spherical contact surface

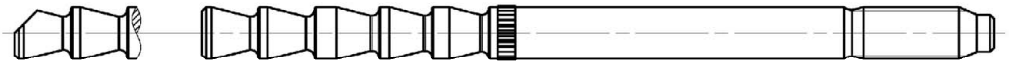
fischer Highbond-Anchor dynamic FHB dyn V with shear force sleeve
(in assembled condition)



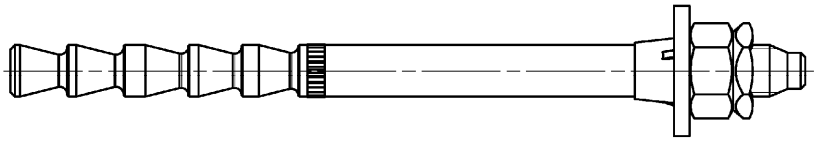


fischer anchor rod FHB-A dyn; Size: M12, M16, M20, M24

alternative

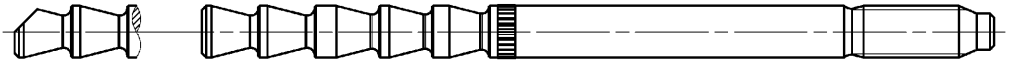


fischer Dynamic-Anchor FDA



fischer anchor rod FDA-A; Size: M12, M16

alternative

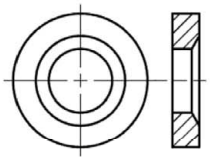


Figures not to scale

Overview system components part 3

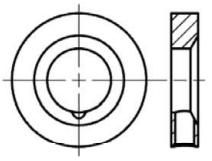
conical washer

without drill hole

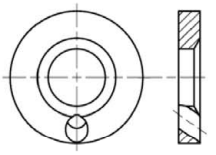


fischer filling disc (various versions)

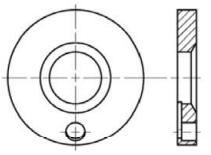
radial



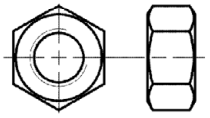
angular



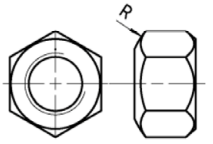
axial



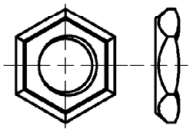
hexagon nut



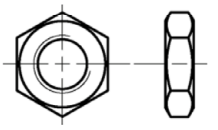
hexagonal nut with spherical contact surface



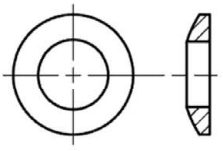
lock nut



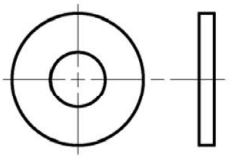
hexagon nut, flat



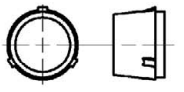
spherical washer



washer

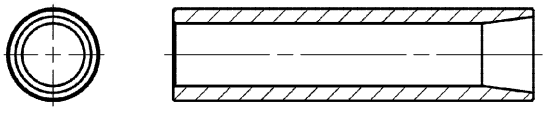


centering sleeve

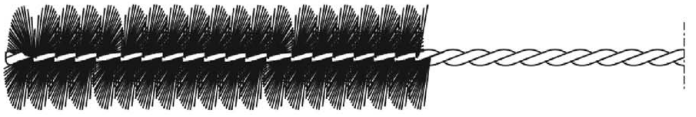


only push through installation; FHB dyn and FDA

shear force sleeve (only FHB dyn V)



cleaning brush BS



blow-out pump ABP with cleaning nozzle or ABG

Figures not to scale

fischer Highbond-Anchor FHB / FHB dyn / FDA

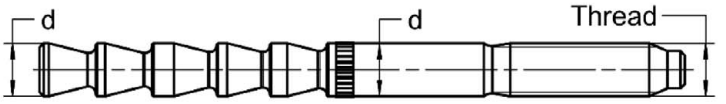
Product description
Overview system components part 3
Metal parts / cleaning brush / blow-out pump

Annex A 6

Table A7.1: Dimensions system components, FHB / FHB N

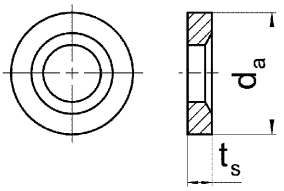
Designation			FHB 10x60	FHB 12x80	FHB 12x100	FHB 16x125	FHB 20x170	FHB 24x220
Thread		[-]	M10	M12	M12	M16	M20	M24
Anchor rod	d	[mm]	10	12	12	16,5	22	24,5
Conical washer / fischer filling disc	$\geq d_a$	[mm]	26	30	30	38	46	54
	t_s	[mm]	6	6	6	7	8	10

Anchor rod:



Conical washer / fischer filling disc:

(various versions see Annex A 6)

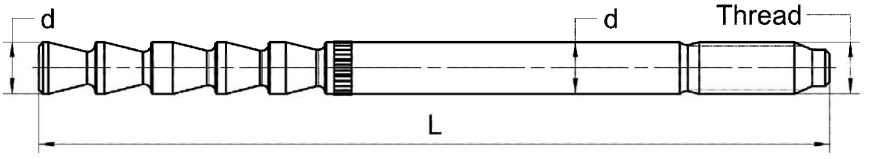


Figures not to scale

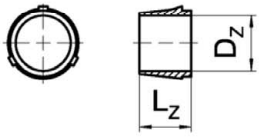
Table A8.1: Dimensions system components, FHB dyn / FHB dyn V

Designation			FHB dyn without shear force sleeve				FHB dyn V with shear force sleeve	
			FHB dyn 12x100	FHB dyn 16x125	FHB dyn 20x170	FHB dyn 24x220	FHB dyn 12x100 V	FHB dyn 16x125 V
Thread		[-]	M12	M16	M20	M24	M12	M16
Anchor rod	d	[mm]	12	16,5	22	24,5	12	16,5
	L_{min}		135	168	220	280	140	173
	L_{max}		332	365	415	475	337	367
Centering sleeve	D_z		11,8	16,3	21,8	24,3	11,8	16,3
	L_z		11	13	15	15	11	13
Conical washer / fischer filling disc	$\geq d_a$		30	38	46	54	30	38
	t_s		6	7	8	10	6	7
Shear force sleeve	$L_{Q,min}$		-	-	-	-	40	55
	$L_{Q,max}$		-	-	-	-	230	245
	D_Q		-	-	-	-	17,5	23,5

Anchor rod:

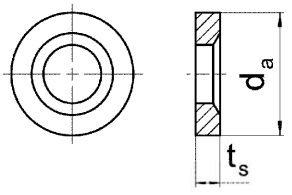


Centering sleeve:
(only push through installation)

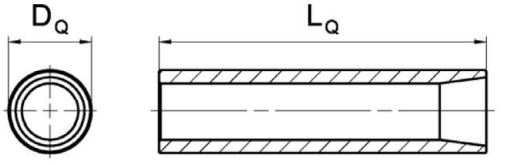


Conical washer / fischer filling disc:

(various versions see Annex A 6)



Shear force sleeve:
(only FHB dyn V)

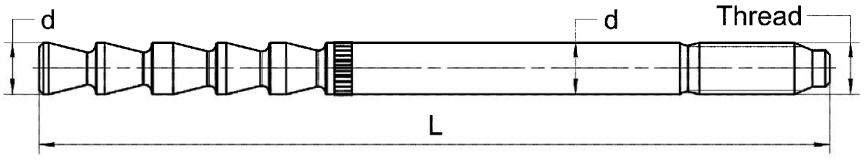


Figures not to scale

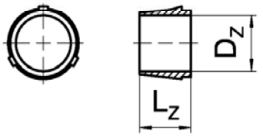
Table A9.1: Dimensions system components, FDA

Designation			FDA 12x100	FDA 16x125
Thread		[-]	M12	M16
Anchor rod	d	[mm]	12	16,5
	L_{min}		135	168
	L_{max}		332	365
Centering sleeve	D_z		11,8	16,3
	L_z		11	13
Washer	$\geq d_a$		30	40
	$t_{s,min}$		3,5	4
	$t_{s,max}$		7	8

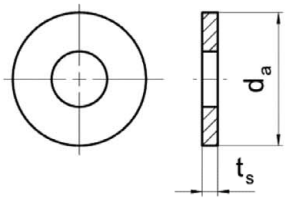
Anchor rod:



Centering sleeve:



Washer:



Figures not to scale

Table A10.1: Materials, FHB / FHB N zinc plated

Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel		
		electroplated (gvz)		hot dip galvanised (hdg)
		M10 to M16	M20 to M24	M10 to M24
2	fischer anchor rod FHB-A and FHB-A N	Property class 5.8 Property class 8.8 EN ISO 898-1:2013 electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018 A_5 > 12% fracture elongation coated	f_{uk} = 550 N/mm² f_{yk} = 440 N/mm² EN ISO 898-1:2013 electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018 A_5 > 12% fracture elongation coated	Property class 8.8 EN ISO 898-1:2013 hot dip galvanised ≥ 40 µm EN ISO 10684:2004 A_5 > 12% fracture elongation varnish layer coated (M16 to M24)
3	Washer ISO 7089:2000	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018		hot dip galvanised ≥ 40 µm EN ISO 10684:2004
4	Conical washer or fischer filling disc similar to DIN 6319-G	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018		hot dip galvanised ≥ 40 µm EN ISO 10684:2004
5	Hexagon nut	Property class 8 EN ISO 898-2:2012 electroplated ≥ 5 µm, Zn5/An (A2K) acc. to EN ISO 4042:2018		Property class 8 EN ISO 898-2:2012 hot dip galvanised ≥ 40 µm EN ISO 10684:2004

Table A11.1: Materials, FHB / FHB N stainless steel

Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Stainless steel R		High corrosion resistant steel HCR
		acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2015		acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4:2015
		M10 to M16	M20 to M24	M10 to M24
2	fischer anchor rod FHB-A and FHB-A N	f_{uk} = 800 N/mm² f_{yk} = 640 N/mm² 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 A_5 > 12% fracture elongation coated	f_{uk} = 700 N/mm² f_{yk} = 560 N/mm² 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 A_5 > 12% fracture elongation coated	f_{uk} = 700 N/mm² f_{yk} = 560 N/mm² EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014 A_5 > 12% fracture elongation coated
3	Washer ISO 7089:2000	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	Conical washer or fischer filling disc similar to DIN 6319-G	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014		1.4565; 1.4529; EN 10088-1:2014
5	Hexagon nut	Property class 70 or 80 EN ISO 3506-2:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014		Property class 70 or 80 EN ISO 3506-2:2020 1.4565; 1.4529; EN 10088-1:2014

Table A12.1: Materials, FHB dyn

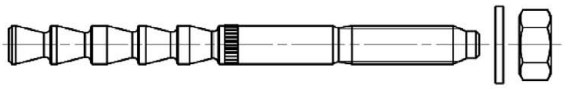
Part	Designation	Material	
1	Injection cartridge	Mortar, hardener, filler	
	Steel grade	Steel	High corrosion resistant steel HCR
		electroplated (gvz)	acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4:2015
		M12 to M24	M12 to M16
2	fischer anchor rod FHB-A dyn	Property class 8.8 EN ISO 898-1:2013 electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018 A_5 > 12% fracture elongation coated	EN ISO 3506-1:2009 1.4529 EN 10088-1:2014 f_{uk} ≥ 700 N/mm² A_5 > 12 % fracture elongation coated
3	Centering sleeve	Plastic	
4	Conical washer or fischer filling disc similar to DIN 6319-G	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018	1.4529 EN 10088-1:2014
5	Spherical washer	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018	1.4529 EN 10088-1:2014
6a	Hexagon nut	Property class 8 EN ISO 898-2:2012 electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018	Property class 70 EN ISO 3506-2:2020 1.4529 EN 10088-1:2014
6b	hexagonal nut with spherical contact surface		
7a	Lock nut	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018	1.4529 EN 10088-1:2014
7b	hexagon nut, flat		
8	Shear force sleeve	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018	---

Table A13.1: Materials, FDA

Part	Designation	Material
1	Injection cartridge	Mortar, hardener, filler
	Steel grade	Steel
		electroplated (gvz)
		M12 to M16
2	fischer anchor rod FDA-A	Property class 8.8 EN ISO 898-1:2013 electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018 A_5 > 12 % fracture elongation coated
3	Centering sleeve	Plastic
4	Washer	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018
5	Hexagon nut	Property class 8 EN ISO 898-2:2012 electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018
6	Lock nut	electroplated ≥ 5 µm Zn5/An (A2K) acc. to EN ISO 4042:2018

Specifications of intended use (part 1), FHB / FHB N

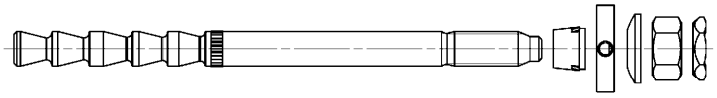
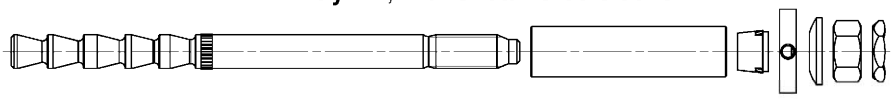
Table B1.1: Overview use and performance categories, FHB / FHB N

		fischer Highbond-Anchor FHB / FHB N with FIS HB	
			
Hammer drilling with standard drill bit		all sizes; Nominal drill bit diameter (d_0) 12 mm to 28 mm	
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“)			
Static and quasi static load, in	uncracked concrete	all sizes; M10 to M24	Tables: C1.1 C2.1 C3.1
	cracked concrete		
Use category	I1 dry or wet concrete	all sizes; M10 to M24	
	I2 water filled hole	all sizes; M10 to M24	
Installation direction		D3 Downwards, horizontal and upwards (overhead) installation	
Installation method		pre-positioned or push through installation	
Installation temperature [1)]		FIS HB: $T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C	
In-service temperature	Temperature range I:	-40 °C to +40 °C	(max. short term temperature +40 °C; max. long term temperature +24 °C)
	Temperature range II:	-40 °C to +80 °C	(max. short term temperature +80 °C; max. long term temperature +50 °C)

[1)] For the standard variation of temperature after installation

Specifications of intended use (part 2), FHB dyn

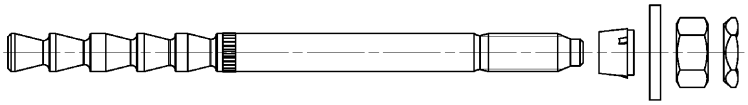
Table B2.1: Overview use and performance categories, FHB dyn

			fischer Highbond-Anchor dynamic FHB dyn with FIS HB		
			FHB-A dyn, without shear force sleeve (picture with centering sleeve; use only for push through installation) 		
			FHB-A dyn V, with shear force sleeve 		
			FHB dyn		**FHB dyn V**	
Hammer drilling with standard drill bit 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“)			all sizes; Nominal drill bit diameter (d_0) 14 mm to 28 mm		all sizes; Nominal drill bit diameter (d_0) 14 mm and 18 mm Nominal drill bit diameter (d_1) 20 mm and 28 mm	
Static and quasi static load, in	uncracked concrete		all sizes; M12 to M24	Tables: C1.1 C2.1 C3.1	all sizes; M12 and M16	Tables: C1.1 C2.1 C3.1
	cracked concrete					
Use category	I1	dry or wet concrete	all sizes; M12 to M24		all sizes; M12 and M16	
	I2	water filled hole	all sizes; M12 to M24		all sizes; M12 and M16	
Installation direction			D3 Downwards, horizontal and upwards (overhead) installation			
Installation method			pre-positioned or push through installation		push through installation	
Installation temperature [1]			FIS HB: $T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C			
In-service temperature	Temperature range I:		-40 °C to +40 °C	(max. short term temperature +40 °C; max. long term temperature +24 °C)		
	Temperature range II:		-40 °C to +80 °C	(max. short term temperature +80 °C; max. long term temperature +50 °C)		

[1] For the standard variation of temperature after installation

Specifications of intended use (part 3), FDA

Table B3.1: Overview use and performance categories, FDA

		fischer Dynamic-Anchor FDA with FIS HB	
			
Hammer drilling with standard drill bit		all sizes; Nominal drill bit diameter (d_0) 14 mm and 18 mm	
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“)			
Static and quasi static load, in	uncracked concrete	all sizes; M12 and M16	Tables: C1.1 C2.1 C3.1
	cracked concrete		
Use category	I1 dry or wet concrete	all sizes; M12 and M16	
	I2 water filled hole	all sizes; M12 and M16	
Installation direction		D3 Downwards, horizontal and upwards (overhead) installation	
Installation method		push through installation	
Installation temperature [1]		FIS HB: $T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C	
In-service temperature	Temperature range I:	-40 °C to +40 °C	(max. short term temperature +40 °C; max. long term temperature +24 °C)
	Temperature range II:	-40 °C to +80 °C	(max. short term temperature +80 °C; max. long term temperature +50 °C)

[1] For the standard variation of temperature after installation

Specifications of intended use (part 4)

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibers of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016+A2:2021

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (zinc plated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN 1993-1-4:2015 corresponding to corrosion resistance classes to Annex A 11 table A11.1 (FHB / FHB N) or Annex A 12 table A12.1 (FHB dyn).

Design:

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

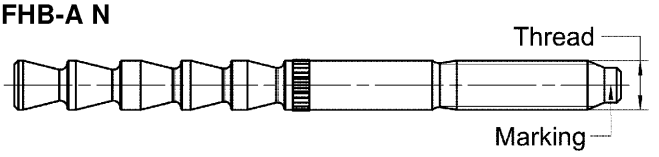
Installation:

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

Table B5.1: Installation parameters for fischer Highbond-Anchor FHB / FHB N

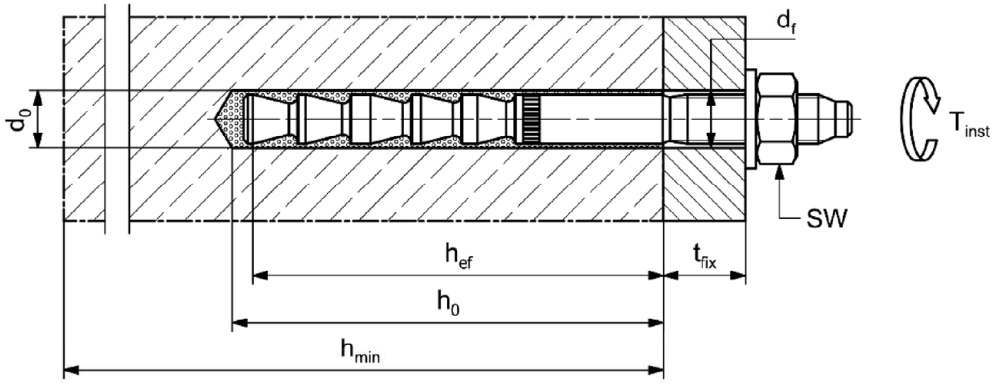
Designation				FHB 10x60	FHB 12x80	FHB 12x100		FHB 16x125		FHB 20x170	FHB 24x220
Thread			[-]	M10	M12	M12		M16		M20	M24
Width across flats		SW	[mm]	17	19	19		24		30	36
Nominal drill hole diameter		d_0	[mm]	12	14	14		18		24	28
Drill hole depth		h_0	[mm]	65	85	105		130		175	225
Effective embedment depth		h_{ef}	[mm]	60	80	100		125		170	220
Minimum thickness of concrete member		h_{min}	[mm]	120	160	130	200	160	250	220	440
Minimum spacing		s_{min}	[mm]	60	80	100	100	100	100	80	180
Minimum edge distance		c_{min}	[mm]			200	100	200	100		
For $h_{min} \leq h \leq 2h_{ef}$:	$s_1 \geq s_{min} = 100$ mm $c_1 \geq c_{min} = 100$ mm		[mm]	-		$[(3 \cdot c_1 + s_1) \cdot h] \geq 88000$				-	
Calculation c_{reg} : s_1 and h available			[mm]			$c_{reg} \geq (88000/h - s_1) / 3$					
Calculation s_{reg} : c_1 and h available			[mm]			$s_{reg} \geq 88000/h - 3 \cdot c_1$					
Diameter of clearance hole of the fixture	pre-positioned installation	d_f	[mm]	12	14	14		18		22	26
	push through installation	d_f	[mm]	14	16	16		20		26	30
Installation torque		T_{inst}	[Nm]	20	40	40		60		100	120

fischer anchor rod FHB-A / FHB-A N



Marking fischer anchor rod:
work symbol, thread diameter, embedment depth e.g.: 16 x 125
For anchor rod property class 5.8 additional “5.8”
For stainless steel additional “R” and for high corrosion resistant steel additional “HCR“.

Installation conditions:

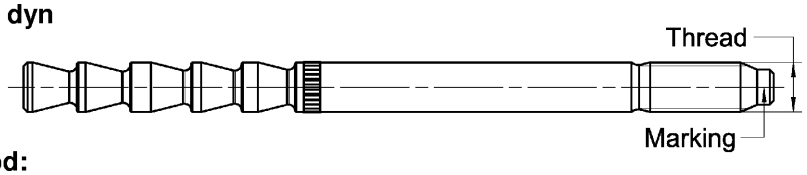


Figures not to scale

Table B6.1: Installation parameters for **fischer Highbond-Anchor dynamic** without shear force sleeve **FHB dyn**

Designation			**FHB dyn 12x100**		**FHB dyn 16x125**		**FHB dyn 20x170**	**FHB dyn 24x220**
Thread		[-]	M12		M16		M20	M24
Width across flats	SW	[mm]	19		24		30	36
Nominal drill hole diameter	d_0	[mm]	14		18		24	28
Drill hole depth	$h_{0,min}$	[mm]	105		130		175	225
Effective embedment depth	h_{ef}	[mm]	100		125		170	220
Minimum thickness of concrete member	h_{min}	[mm]	130	200	160	250	220	440
Minimum spacing	s_{min}	[mm]	100	100	100	100	80	180
Minimum edge distance	c_{min}	[mm]	200	100	200	100	80	180
For $h_{min} \leq h \leq 2h_{ef}$: $s_1 \geq s_{min}$ = 100 mm, $c_1 \geq c_{min}$ = 100 mm		[mm]	$[(3 \cdot c_1 + s_1) \cdot h] \geq 88000$				-	
Calculation c_{reg} : s_1 and h available		[mm]	$c_{reg} \geq (88000/h - s_1) / 3$					
Calculation s_{reg} : c_1 and h available		[mm]	$s_{reg} \geq 88000/h - 3 \cdot c_1$					
Diameter of the clearance hole of the fixture	d_f	[mm]	15		19		25	29
Thickness of fixture	$t_{fix,min}$	[mm]	8		10		12	14
	$t_{fix,max}$	[mm]	200					
Minimum projection length	$h_{p,min}$	[mm]	$30 + t_{fix}$		$35 + t_{fix}$		$40 + t_{fix}$	$50 + t_{fix}$
Installation torque	T_{inst}	[Nm]	40		60		100	120

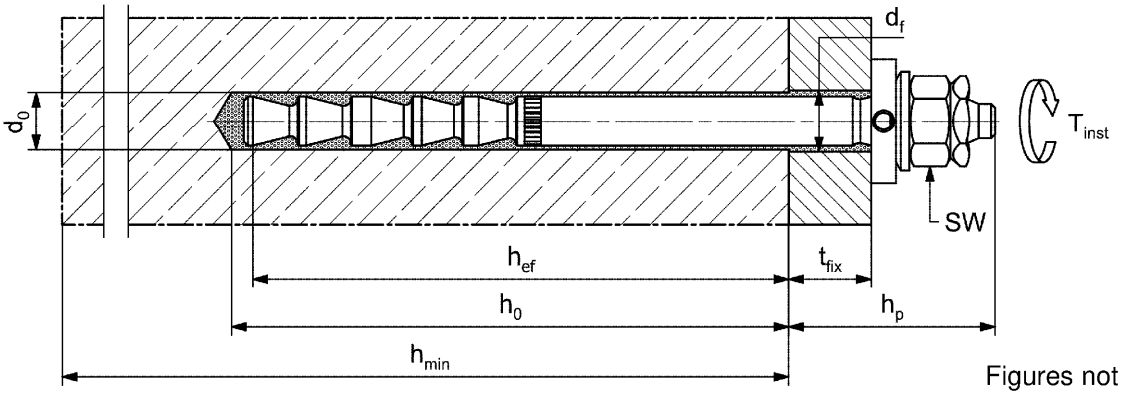
fischer anchor rod FHB-A dyn



Marking fischer anchor rod:

work symbol, thread diameter, embedment depth, intended use e.g: 16 x 125 dyn
For high corrosion resistant steel additional "HCR".

Installation conditions: (picture without centering sleeve; pre-positioned installation)



Figures not to scale

fischer Highbond-Anchor FHB / FHB dyn / FDA

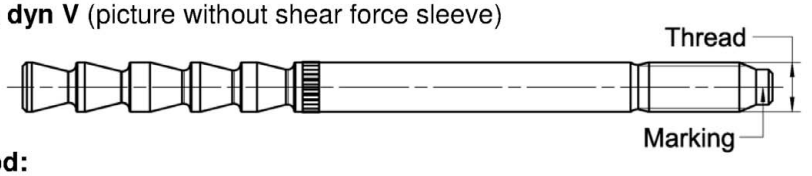
Intended use
Installation parameters fischer Highbond-Anchor dynamic FHB dyn (without shear force sleeve)

Annex B 6

Table B7.1: Installation parameters for **fischer Highbond-Anchor dynamic** with shear force sleeve **FHB dyn V**

Designation			**FHB dyn 12x100 V**		**FHB dyn 16x125 V**	
Thread		[-]	M12		M16	
Width across flats	SW	[mm]	19		24	
Nominal drill hole diameter	d_0		14		18	
Drill hole depth	$h_{0,min}$		110		135	
Nominal drill hole diameter	d_1		20		28	
Drill hole depth	$h_{1,min}$		35		50	
Effective embedment depth	$h_{ef,}$		105		130	
Minimum thickness of concrete member	h_{min}		130	200	160	250
Minimum spacing	s_{min}		100	100	100	100
Minimum edge distance	c_{min}		200	100	200	100
For $h_{min} \leq h \leq 2h_{ef}$:	$s_1 \geq s_{min} = 100$ mm $c_1 \geq c_{min} = 100$ mm		$[(3 \cdot c_1 + s_1) \cdot h] \geq 88000$			
Calculation c_{reg} : s_1 and h available			$c_{reg} \geq (88000/h - s_1) / 3$			
Calculation s_{reg} : c_1 and h available			$s_{reg} \geq 88000/h - 3 \cdot c_1$			
Diameter of the clearance hole of the fixture	d_f		21		29	
Thickness of fixture	$t_{fix,min}$		8		10	
	$t_{fix,max}$		200			
Installation torque	T_{inst}	[Nm]	40		60	

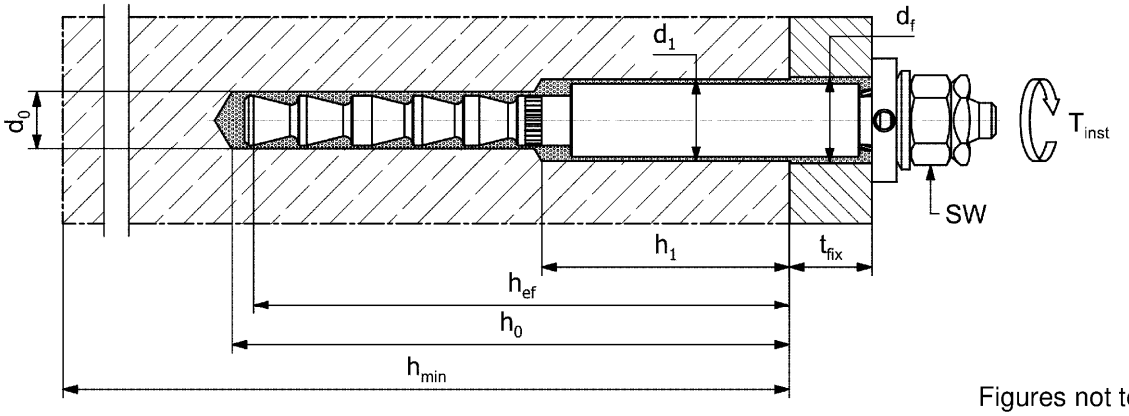
fischer anchor rod FHB-A dyn V (picture without shear force sleeve)



Marking fischer anchor rod:

work symbol, thread diameter, embedment depth, intended use e.g.: 16 x 125 dyn V

Installation conditions:



Figures not to scale

fischer Highbond-Anchor FHB / FHB dyn / FDA

Intended use

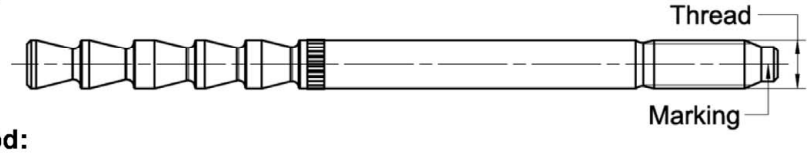
Installation parameters fischer Highbond-Anchor dynamic FHB dyn V (with shear force sleeve)

Annex B 7

Table B8.1: Installation parameters for fischer Dynamic-Anchor FDA

Designation			FDA 12x100		FDA 16x125	
Thread		[-]	M12		M16	
Width across flats	SW	[mm]	19		24	
Nominal drill hole diameter	d_0	[mm]	14		18	
Drill hole depth	$h_{0,min}$	[mm]	105		130	
Effective embedment depth	h_{ef}	[mm]	100		125	
Minimum thickness of concrete member	h_{min}	[mm]	130	200	160	250
Minimum spacing	s_{min}	[mm]	100	100	100	100
Minimum edge distance	c_{min}	[mm]	200	100	200	100
For $h_{min} \leq h \leq 2h_{ef}$: $s_1 \geq s_{min} = 100$ mm, $c_1 \geq c_{min} = 100$ mm		[mm]	$[(3 \cdot c_1 + s_1) \cdot h] \geq 88000$			
Calculation c_{reg} : s_1 and h available		[mm]	$c_{reg} \geq (88000/h - s_1) / 3$			
Calculation s_{reg} : c_1 and h available		[mm]	$s_{reg} \geq 88000/h - 3 \cdot c_1$			
Diameter of the clearance hole of the fixture	d_f	[mm]	15		19	
Thickness of fixture	$t_{fix,min}$	[mm]	12		16	
	$t_{fix,max}$	[mm]	200			
Installation torque	T_{inst}	[Nm]	40		60	

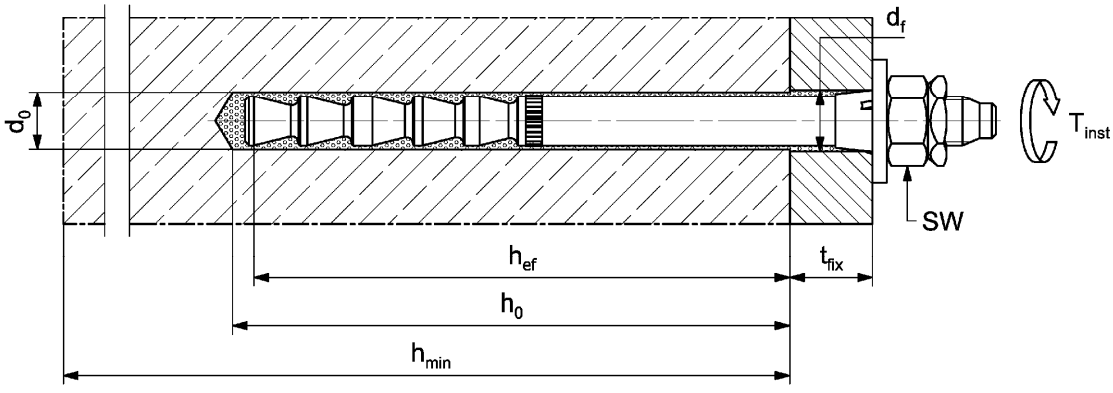
fischer anchor rod FDA-A



Marking fischer anchor rod:

work symbol, thread diameter, embedment depth, intended use e.g.: 16 x 125 dyn

Installation conditions:



Figures not to scale

Table B9.1: 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]	12	14	18	24	28
Steel brush diameter	d_b		14	16	20	26	30

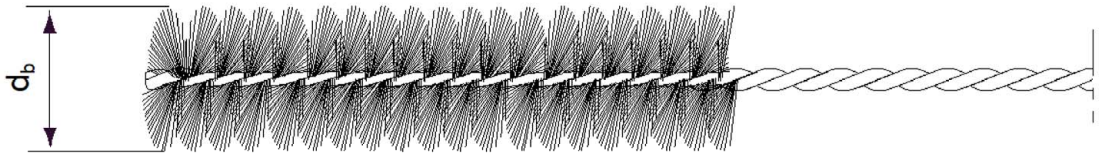


Table B9.2: Processing time t_{work} and curing time t_{cure} (FIS HB)

Temperature at anchoring base [1] [°C]	Maximum processing time t_{work}	Minimum curing time [2] t_{cure}
-5 to 0 [3]	-	6 h
> 0 to 5 [3]	-	3 h
> 5 to 10	15 min	90 min
> 10 to 20	6 min	35 min
> 20 to 30	4 min	20 min
> 30 to 40	2 min	12 min

[1] During the curing time of the mortar the temperature of the anchoring base may not fall below -5°C
[2] In wet concrete or water filled holes the curing time must be doubled
[3] Minimal cartridge temperature +5 °C

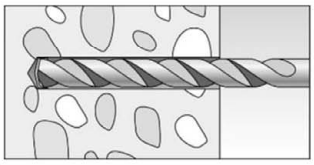
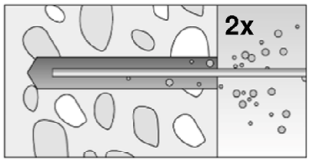
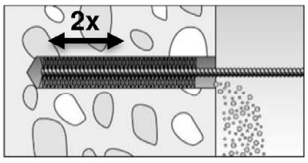
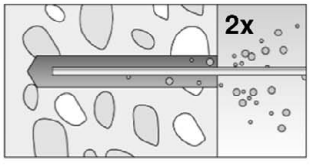
Figures not to scale

Overview installation instructions

	Anchor type			
	FHB / FHB N	**FHB dyn**	**FHB dyn V**	**FDA**
Drilling and cleaning hammer drilling with standard drill bit	Annex B 11 Step 1a to 4a	Annex B 11 Step 1a to 4a	Annex B 12 Step 1c to 4c	Annex B 11 Step 1a to 4a
Drilling and cleaning hammer drilling with hollow drill bit	Annex B 11 Step 1b to 2b	Annex B 11 Step 1b to 2b	Annex B 12 Step 1d to 2d	Annex B 11 Step 1b to 2b
Preparing the cartridge	Annex B 13 Step 5a to 7a			
Pre-positioned installation	Annex B 14 Step 8a to 12a	Annex B 16 Step 8c to 12c	-	-
Push through installation	Annex B 15 Step 8b to 11b	Annex B 17 Step 8d to 11d	Annex B 18 Step 8e to 11e	Annex B 19 Step 8f to 11f

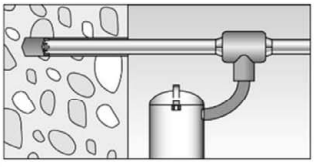
Installation instructions part 1; Drilling and cleaning FHB, FHB N, FHB dyn and FDA

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

1a		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see tables: FHB / FHB N → **table B5.1** FHB dyn → **table B6.1** FDA → **table B8.1**
2a		Clean the drill hole. Blow out the drill hole twice For drill hole diameter $\mathbf{d_0 < 24}$ **mm** blow out the hole by hand or oil-free compressed air (≥ 6 bar). For drill hole diameter $\mathbf{d_0 \geq 24}$ **mm** blow out the hole with oil-free compressed air (≥ 6 bar). Use a cleaning nozzle. 
3a		Brush the drill hole twice with steel brush. Corresponding brushes see **table B9.1**
4a		Clean the drill hole. Blow out the drill hole twice For drill hole diameter $\mathbf{d_0 < 24}$ **mm** blow out the hole by hand or oil-free compressed air (≥ 6 bar). For drill hole diameter $\mathbf{d_0 \geq 24}$ **mm** blow out the hole with oil-free compressed air (≥ 6 bar). Use a cleaning nozzle. 

Go to step 5a (Annex B 13)

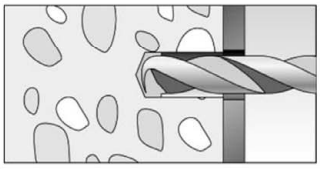
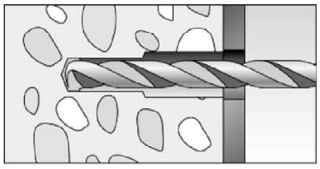
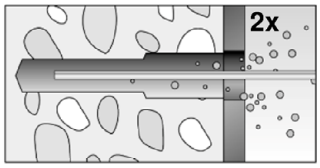
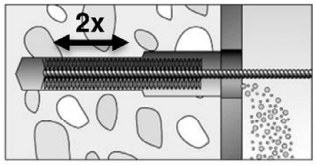
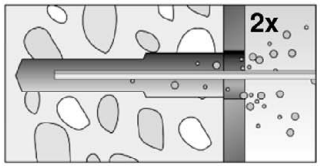
Drilling and cleaning the drill hole (hammer drilling with hollow drill bit)

1b		Check a suitable hollow drill (see **table B1.1, B2.1 resp. B3.1**) for correct operation of the dust extraction
2b		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: FHB / FHB N → **table B5.1** FHB dyn → **table B6.1** FDA → **table B8.1**

Go to step 5a (Annex B 13)

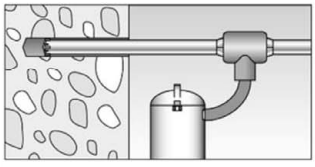
Installation instructions part 2; Drilling and cleaning FHB dyn V

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

1c		Drill hole 1 of the stepped borehole. Nominal drill hole diameter $\mathbf{d_1}$ and drill hole depth $\mathbf{h_1}$ see **table B7.1**
		Drill hole 2 of the stepped borehole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **table B7.1**
2c		Clean the drill hole. Blow out the drill hole twice by hand or oil-free compressed air (≥ 6 bar). 
3c		Brush the drill hole 2 of the borehole twice with a steel brush. Corresponding brushes see **table B9.1**
4c		Clean the drill hole. Blow out the drill hole twice by hand or oil-free compressed air (≥ 6 bar). 

Go to step 5a (Annex B 13)

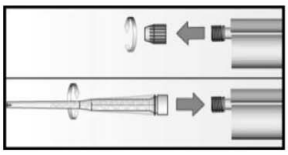
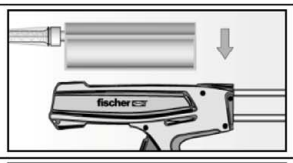
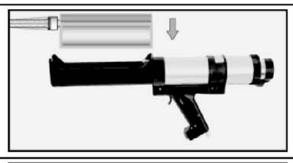
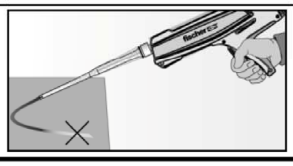
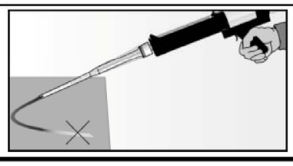
Drilling and cleaning the hole (hammer drilling with hollow drill bit)

1d		Check a suitable hollow drill (see **table B2.1**) for correct operation of the dust extraction.
2d		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. First drill hole 1 of the stepped borehole with nominal drill hole diameter $\mathbf{d_1}$ and drill hole depth $\mathbf{h_1}$ (see **table B7.1**). Then drill hole 2 of the stepped borehole with nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ (see **table B7.1**).

Go to step 5a (Annex B 13)

Installation instructions part 3; injection mortar system FIS HB

Preparing the cartridge

5a			Remove the sealing cap Screw on the static mixer (the spiral in the static mixer must be clearly visible)
6a			Place the cartridge into the dispenser
7a			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:

8a: FHB / FHB N - Pre-positioned installation see Annex B 14
8b: FHB / FHB N - Push through installation see Annex B 15

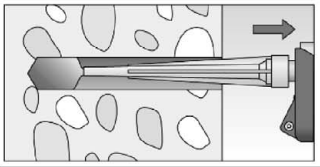
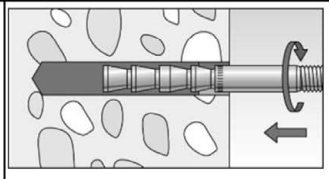
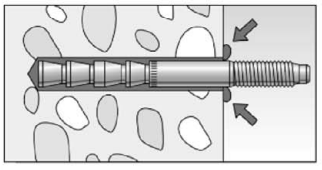
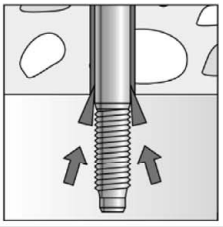
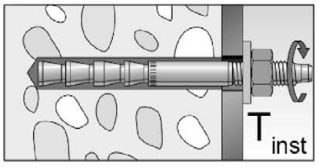
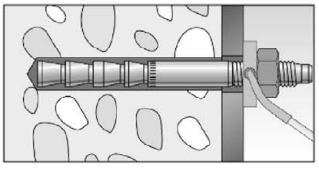
8c: FHB dyn - Pre-positioned installation see Annex B 16
8d: FHB dyn - Push through installation see Annex B 17

8e: FHB dyn V - Push through installation see Annex B 18

8f: FDA - Push through installation see Annex B 19

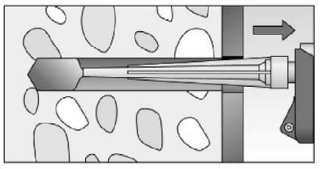
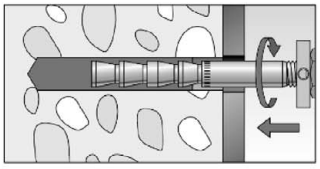
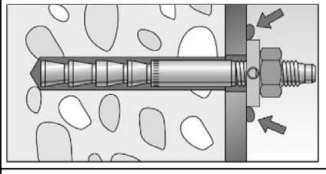
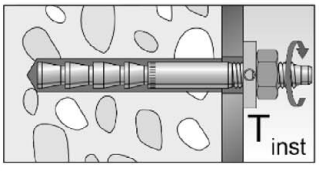
Installation instructions part 4; Pre-positioned installation FHB / FHB N

Pre-positioned installation FHB / FHB N

8a		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 $h_0 \geq 150$ mm use an extension tube. For overhead installation or deep holes ($h_0 > 250$ mm) use an injection adapter.
9a		Push the anchor rod down to the bottom of the hole, turning it slightly while doing so. Only use clean and oil-free metal parts.
		After inserting the anchor rod, excess mortar must be emerged around the anchor element. If not, pull out the anchor rod immediately and reinject mortar.
		For overhead installations support the anchor rod with wedges. (e.g. fischer centering wedges)
10a		Wait for the specified curing time t_{cure} see **table B9.2**
11a		Attach the fixture and install the washer and hexagon nut. Ensure the correct position of the metal parts. Tighten the hexagon nut with installation torque T_{inst} (see **table B5.1**).
12a Option		The gap between metal parts and fixture (annular gap) may be filled with mortar (FIS HB) via the fischer filling disc. ATTENTION: Using fischer filling disc reduces t_{fix} (usable length of the anchor)

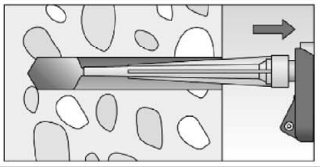
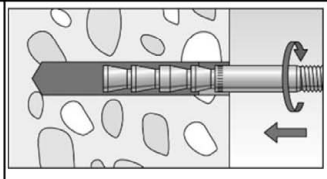
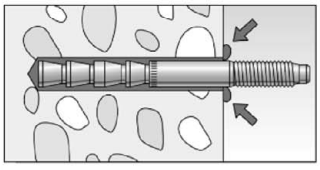
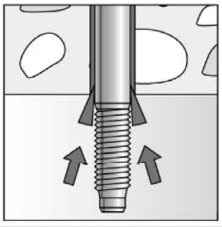
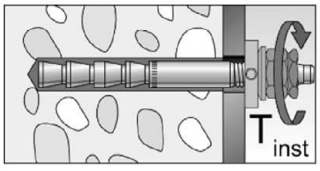
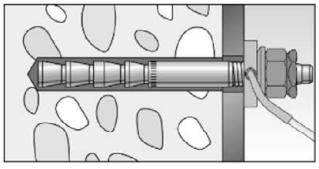
Installation instructions part 5; Push through installation FHB / FHB N

Push through installation FHB / FHB N

8b		Fill approximately 2/3 of the drill hole incl. fixture with mortar. Always begin from the bottom of the hole and avoid bubbles. For drill hole depth $h_0 \geq 150$ mm use an extension tube. For overhead installation or deep holes ($h_0 > 250$ mm) use an injection adapter.
9b	 	Push the pre-assembled fischer anchor rod (with fischer filling disc and hexagon nut) into the drill hole until the fischer filling disc is in full contact with the surface, turning it slightly while doing so. Ensure the correct position of the metal parts. Only use clean and oil-free metal parts. After inserting the pre-assembled anchor rod, excess mortar must be emerged around the fischer filling disc (minimum on one point). If not, pull out the assembled anchor rod immediately and reinject mortar.
10b		Wait for the specified curing time t_{cure} see **table B9.2**
11b		Tighten the hexagon nut with installation torque T_{inst} (see **table B5.1**).

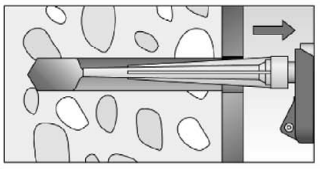
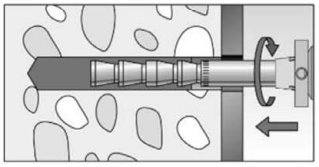
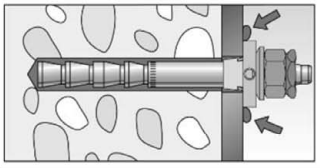
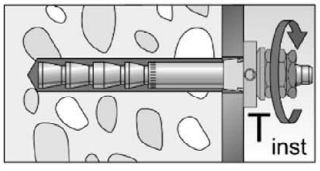
Installation instructions part 6; Pre-positioned installation FHB dyn

Pre-positioned installation FHB dyn

8c		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 $h_0 \geq 150$ mm use an extension tube. For overhead installation or deep holes ($h_0 > 250$ mm) use an injection adapter.
9c		Push the anchor rod down to the bottom of the hole, turning it slightly while doing so. Observe projection length h_p (see **table B6.1**) Only use clean and oil-free metal parts.
		After inserting the anchor rod, excess mortar must be emerged around the anchor element. If not, pull out the anchor rod immediately and reinject mortar.
		For overhead installations support the anchor rod with wedges. (e.g. fischer centering wedges)
10c		Wait for the specified curing time t_{cure} see **table B9.2**
11c		Attach the fixture and install the fischer filling disc, the spherical washer and nuts **(without centering sleeve)**. Ensure the correct position of the metal parts. Tighten the hexagon nut with installation torque T_{inst} (see **table B6.1**). Tighten lock nut manually, then use wrench to give another quarter or half turn. In the high corrosion resistant steel version, the lock nut is a thin nut. Tighten it with a torque of ¼ T_{inst}.
12c		The gap between metal parts and fixture (annular gap) has to be filled with mortar (FIS HB) via the fischer filling disc. This installation step can be omitted for anchors with pure tension load.

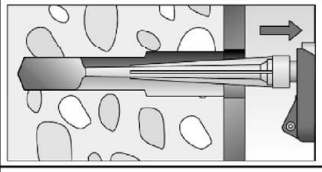
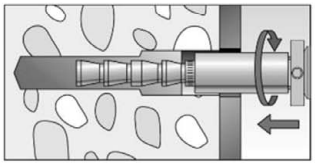
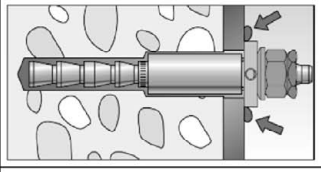
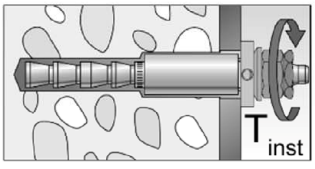
Installation instructions part 7; Push through installation FHB dyn

Push through installation FHB dyn

8d		Fill approximately 2/3 of the drill hole incl. fixture with mortar. Always begin from the bottom of the hole and avoid bubbles. For drill hole depth $h_0 \geq 150$ mm use an extension tube. For overhead installation or deep holes ($h_0 > 250$ mm) use an injection-adapter.
9d	 	Push the pre-assembled fischer anchor rod (with centering sleeve, fischer filling disc, spherical washer, hexagon nut and lock nut) into the drill hole until the fischer filling disc is in full contact with the surface, turning it slightly while doing so. Ensure the correct position of the metal parts and the centering sleeve. Only use clean and oil-free metal parts. After inserting the pre-assembled anchor rod, excess mortar must be emerged around the fischer filling disc (minimum on one point). If not, pull out the assembled anchor rod immediately and reinject mortar.
10d		Wait for the specified curing time t_{cure} see **table B9.2**
11d		Tighten the hexagon nut with installation torque T_{inst} (see **table B6.1**). Tighten lock nut manually, then use wrench to give another quarter to half turn. In the high corrosion resistant steel version, the lock nut is a thin nut. Tighten it with a torque of ¼ T_{inst}.

Installation instructions part 8; Push through installation FHB dyn V

Push through installation FHB dyn V

8e		Fill approximately 2/3 of the drill hole incl. fixture with mortar. Always begin from the bottom of the hole and avoid bubbles. For drill hole depth $h_0 \geq 150$ mm use an extension tube. For overhead installation or deep holes ($h_0 > 250$ mm) use an injection adapter.
9e	 	Push the pre-assembled fischer anchor rod (with shear force sleeve, centering sleeve, fischer filling disc, spherical washer, hexagon nut and lock nut) into the drill hole until the fischer filling disc is in full contact with the surface, turning it slightly while doing so. Ensure the correct position of the metal parts and the centering sleeve. Only use clean and oil-free metal parts. After inserting the pre-assembled anchor rod, excess mortar must be emerged around the fischer filling disc (minimum on one point). If not, pull out the assembled anchor rod immediately and reinject mortar.
10e		Wait for the specified curing time t_{cure} see **table B9.2**
11e		Tighten the hexagon nut with installation torque T_{inst} (see **table B7.1**). Tighten lock nut manually, then use wrench to give another quarter to half turn.

Installation instructions part 9; Push through installation FDA

Push through installation FDA

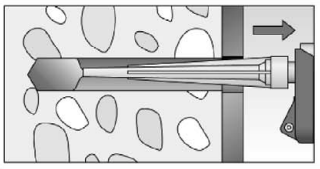
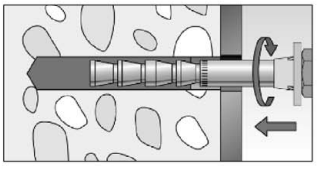
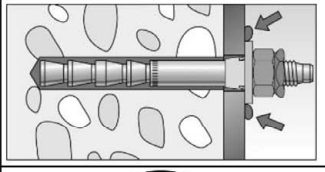
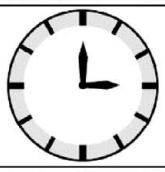
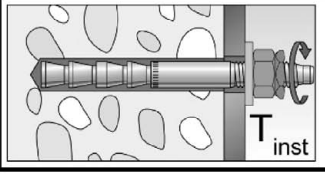
8f		Fill approximately 2/3 of the drill hole incl. fixture with mortar. Always begin from the bottom of the hole and avoid bubbles. For drill hole depth $h_0 \geq 150$ mm use an extension tube. For overhead installation or deep holes ($h_0 > 250$ mm) use an injection adapter.
9f	 	Push the pre-assembled fischer anchor rod (with centering sleeve, washer, hexagon nut and lock nut) into the drill hole until the washer is in full contact with the surface, turning it slightly while doing so. Gently hammer the anchor to the setting depth. Ensure the correct position of the metal parts and the centering sleeve. Only use clean and oil-free metal parts. After inserting the pre-assembled anchor rod, excess mortar must be emerged under the entire washer. If not, pull out the assembled anchor rod immediately and reinject mortar.
10f		Wait for the specified curing time t_{cure} see **table B9.2**
11f		Tighten the hexagon nut with installation torque T_{inst} (see **table B8.1**). Tighten lock nut manually, then use wrench to give another quarter to half turn.

Table C1.1: Characteristic values for steel failure under tension / shear load of fischer anchor rods FHB-A / FHB-A N / FHB-A dyn (V) / FDA

Anchor rod size					10x60	12x80	12x100	16x125	20x170	24x220
Bearing capacity under tension load, steel failure										
Characteristic resistance $N_{Rk,s}$	FHB-A / FHB-A N	gvz	8.8	[kN]	25,8	44,3	44,3	81,7	130,8 [2]	179,8 [2]
		gvz	5.8		16,1	27,7	27,7	51,1	- [3]	- [3]
		hdg	8.8		25,8	44,3	44,3	81,7	190,2	261,5
		R	80		25,8	44,3	44,3	81,7	166,5 [4]	228,8 [4]
		HCR	70		22,5	38,8	38,8	71,5	166,5	228,8
	FHB-A dyn	gvz	8.8		- [3]	- [3]	44,3	81,7	190,2	261,5
		HCR	70		- [3]	- [3]	38,8	71,5	- [3]	- [3]
	FHB-A dyn V	gvz	8.8		- [3]	- [3]	44,3	81,7	- [3]	- [3]
	FDA	gvz	8.8		- [3]	- [3]	44,3	81,7	- [3]	- [3]
Partial factors [1]										
Partial factor		$\gamma_{Ms,N}$		[-]	1,50					
Bearing capacity under shear load, steel failure										
without lever arm										
Characteristic resistance $V^0_{Rk,s}$	FHB-A / FHB-A N	gvz	8.8	[kN]	16,6	28,1	28,1	52,2	61,1 [2]	90,8 [2]
		gvz	5.8		10,4	17,6	17,6	32,7	- [3]	- [3]
		hdg	8.8		16,6	28,1	28,1	52,2	98,0	141,2
		R	80		24,8	32,8	32,8	62,8	85,8 [4]	152,6 [4]
		HCR	70		25,1	36,9	36,9	55,0	85,8	141,1
	FHB-A dyn	gvz	8.8		- [3]	- [3]	28,1	52,2	98,0	141,2
		HCR	70		- [3]	- [3]	36,9	55,0	- [3]	- [3]
	FHB-A dyn V	gvz	8.8		- [3]	- [3]	56,9	96,2	- [3]	- [3]
	FDA	gvz	8.8		- [3]	- [3]	28,1	52,2	- [3]	- [3]
Ductility factor		k_7		[-]	1,0					
with lever arm										
Characteristic resistance $M^0_{Rk,s}$	FHB-A / FHB-A N	gvz	8.8	[Nm]	59,8	104,8	104,8	266,4	357,0 [2]	617,4 [2]
		gvz	5.8		37,4	65,5	65,5	166,5	- [3]	- [3]
		hdg	8.8		59,8	104,8	104,8	266,4	519,3	898,0
		R	80		59,8	104,8	104,8	266,4	454,4 [4]	785,8 [4]
		HCR	70		52,3	91,7	91,7	233,1	454,4	785,8
	FHB-A dyn	gvz	8.8		- [3]	- [3]	104,8	266,4	519,3	898,0
		HCR	70		- [3]	- [3]	91,7	233,1	- [3]	- [3]
	FHB-A dyn V	gvz	8.8		- [3]	- [3]	104,8	266,4	- [3]	- [3]
	FDA	gvz	8.8		- [3]	- [3]	104,8	266,4	- [3]	- [3]
Partial factors [1]										
Partial factor		$\gamma_{Ms,V}$		[-]	1,25					

[1] In absence of other national regulations
[2] f_{yk} = 440 N/mm² / f_{uk} = 550 N/mm²
[3] No performance assessed
[4] f_{yk} = 560 N/mm² / f_{uk} = 700 N/mm²

Table C2.1: Characteristic values for concrete failure under tension / shear load

				FHB / FHB N / FHB dyn / FDA					
Size				**All sizes**					
Tension load									
Installation factor		γ_{inst}	[-]	See annex C 3					
Factors for the compressive strength of concrete > C20/25									
Increasing factor for $N_{Rk,p}$	C25/30	Ψ_c	[-]	1,10					
	C30/37			1,22					
	C35/45			1,34					
	C40/50			1,41					
	C45/55			1,48					
	C50/60			1,55					
Splitting failure									
Edge distance		$c_{cr,sp}$	[mm]	2 h_{ef}					
Spacing		$s_{cr,sp}$		4 h_{ef}					
Concrete 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		$s_{cr,N}$		3 h_{ef}					
Shear load									
Installation factor		γ_{inst}	[-]	1,0					
Concrete pry-out failure									
Factor for pry-out failure		k_8	[-]	2,0					
Concrete edge failure									
Anchor size				10x60	12x80	12x100	16x125	20x170	24x220
Effective length of anchor		l_f	[mm]	60	80	100	125	170	220
Calculation diameter		d_{nom}		10	12	12	17	22	25

Table C3.1: Characteristic values for pull-out failure
for fischer anchor rods FHB-A / FHB-A N / FHB-A dyn (V) / FDA

Anchor rod size				10x60	12x80	12x100	16x125	20x170	24x220
Pull-out failure									
Calculation diameter		d	[mm]	10	12	12	16	20	24
Uncracked concrete									
Characteristic resistance in uncracked concrete C20/25									
Temperature range	I: 24 °C / 40 °C	$N_{Rk,p}$	[kN]	26,9	41,3	42,1	70,5	113,6	122,2
	II: 50 °C / 80 °C			23,7	36,3	37,0	62,0	100,0	107,5
Cracked concrete									
Characteristic resistance in cracked concrete C20/25									
Temperature range	I: 24 °C / 40 °C	$N_{Rk,p}$	[kN]	15,5	25,0	30,0	47,8	58,9	89,4
	II: 50 °C / 80 °C			13,6	22,0	26,4	42,1	51,8	78,7
Installation factors									
Dry or wet concrete		γ_{inst}	[-]	1,0					
Water filled hole				1,0	1,0	1,0	1,2	1,0	1,0

Table C3.2: Displacements for fischer anchor rods
FHB-A / FHB-A N / FHB-A dyn (V) / FDA

Anchor rod size			10x60	12x80	12x100	16x125	20x170	24x220
Displacement-Factors for tension load [1)]								
Uncracked concrete; Temperature range I, II								
Displacements	δ_{N0}	[mm/kN]	0,025	0,01	0,01	0,007	0,006	0,006
	$\delta_{N\infty}$		0,05	0,02	0,02	0,014	0,012	0,012
Cracked concrete; Temperature range I, II								
Displacements	δ_{N0}	[mm/kN]	0,04	0,02	0,02	0,02	0,02	0,02
	$\delta_{N\infty}$		0,06	0,03	0,03	0,03	0,03	0,03
Displacement-Factors for shear load [2)]								
Uncracked or cracked concrete; Temperature range I, II								
Displacements	δ_{V0}	[mm/kN]	0,025	0,01	0,01	0,007	0,006	0,006
	$\delta_{V\infty}$		0,05	0,02	0,02	0,014	0,012	0,012

1) Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot N_{Ed}$

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

(N_{Ed}: Design value of the applied tensile force)

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)