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-22/0504 of 21 October 2022

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	Injection mortar FAKKT IM Z
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	Keller & Kalmbach GmbH Siemensstraße 19 85716 Unterschleißheim DEUTSCHLAND
Manufacturing plant	Werk Keller & Kalmbach
This European Technical Assessment contains	23 pages including 4 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601, Edition 04/2020

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Specific Part

1 Technical description of the product

The "Injection mortar FAKKT IM Z" is a bonded fastener consisting of a cartridge with injection injection mortar FAKKT IM Z and a steel element according to Annex A4.

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

The product description is given in Annex A.

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

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

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

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex B 3 and B 4, C 1 to C 5
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 to C 3
Displacements under short-term and long-term loading	See Annex C 6
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

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 21 October 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

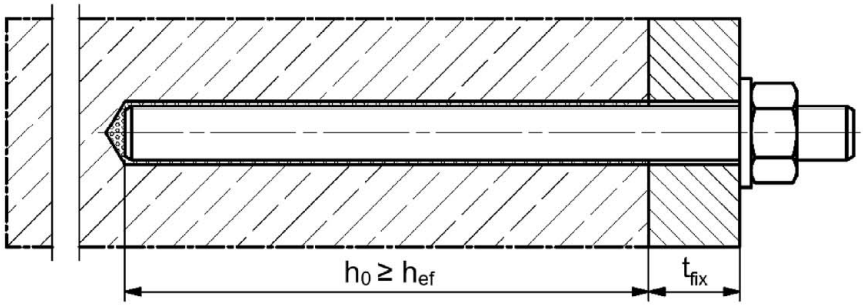
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

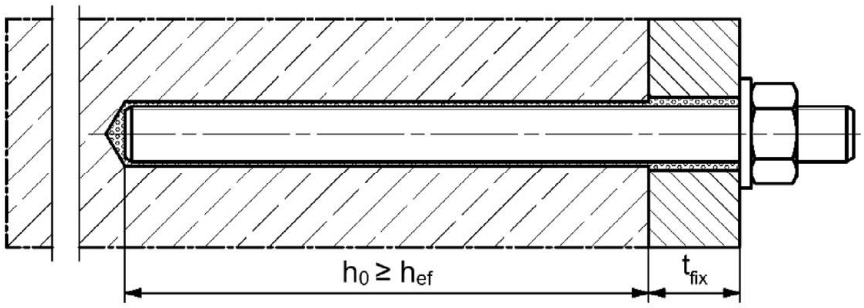
Installation conditions part 1

FAKKT Anchor rod

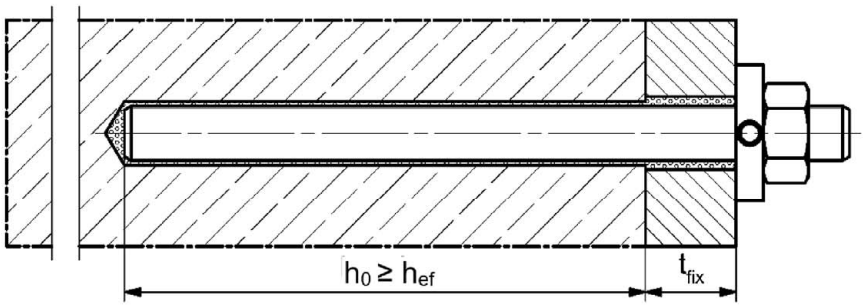
Pre-positioned installation



Push through installation (annular gap filled with mortar)



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



Figures not to scale

h_0 = drill hole depth
h_{ef} = effective embedment depth
t_{fix} = thickness of fixture

Injection mortar FAKKT IM Z

Product description
Installation conditions part 1

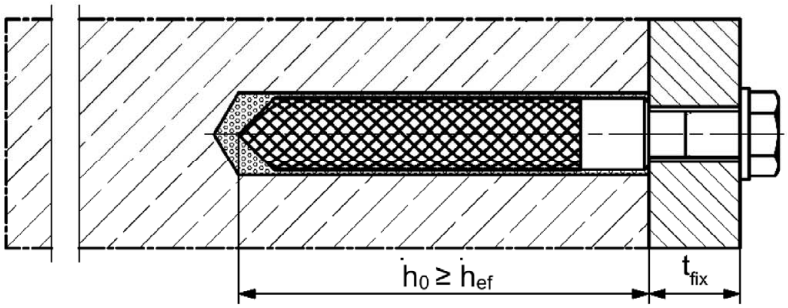
Annex A 1

Deutsches Institut für Bautechnik DIBt

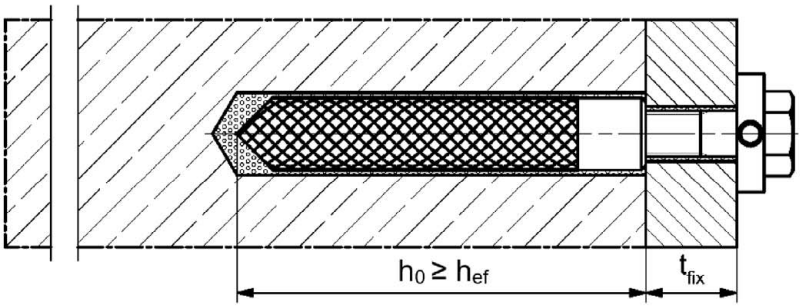
Installation conditions part 2

FAKKT Internal threaded anchor

Pre-positioned installation



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



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

Injection mortar FAKKT IM Z

Product description
Installation conditions part 2

Annex A 2

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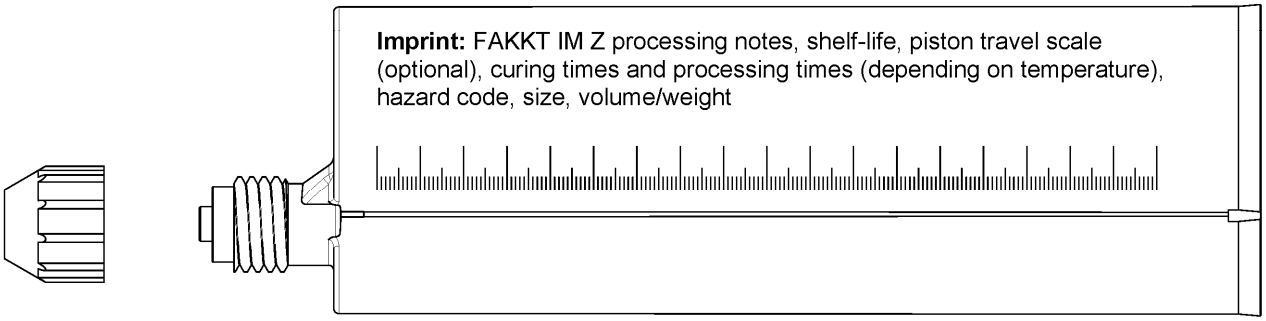
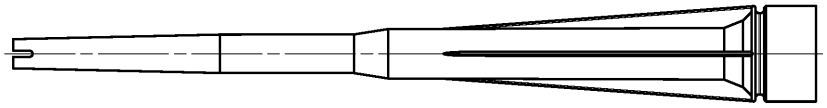
Overview system components part 1

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

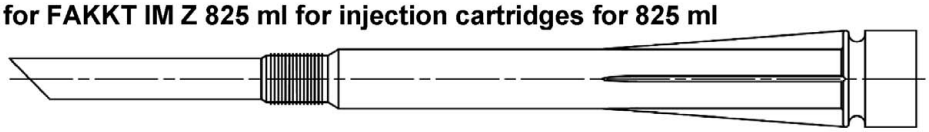


Injection cartridge (coaxial cartridge) with sealing cap; Sizes: 100 ml, 150 ml, 300 ml, 380 ml, 400 ml, 410 ml

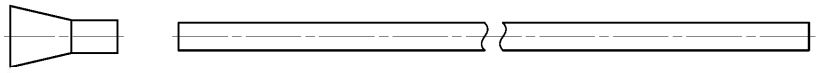
Static mixer for FAKKT IM Z 300 & 360 ml for injection cartridges up to 410 ml



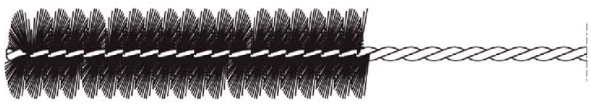
Static mixer for FAKKT IM Z 825 ml for injection cartridges for 825 ml



Injection adapter and extension tube Ø 9 for static mixer for FAKKT IM Z 300 & 360 ml;
Injection adapter and extension tube Ø 9 or Ø 15 for static mixer for FAKKT IM Z 825 ml



FAKKT Cleaning brush



FAKKT Blow-out pump

Compressed-air cleaning tool

Figures not to scale

Injection mortar FAKKT IM Z	**Annex A 3**
Product description Overview system components part 1; cartridges / static mixer / accessories	

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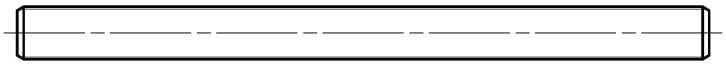
Overview system components part 2

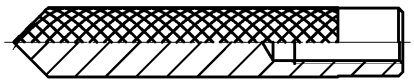
FAKKT Anchor rod

Size: M6, M8, M10, M12, M16, M20, M24, M27, M30

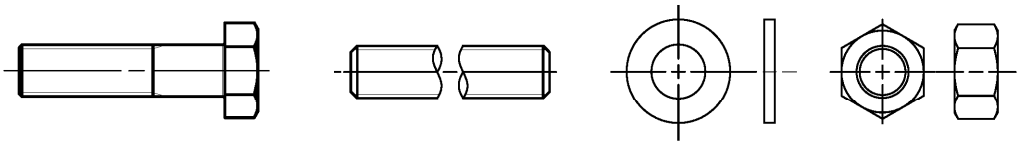


FAKKT Internal threaded anchor

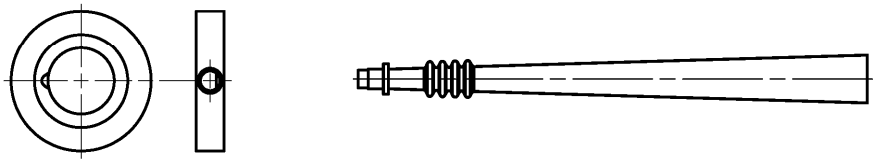
Size: M8, M10, M12, M16, M20



Screw / threaded rod / washer / hexagon nut



Filling disc with injection adapter



Figures not to scale

Injection mortar FAKKT IM Z	**Annex A 4**
Product description Overview system components part 2; steel components	

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Table A5.1: Materials

Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel zinc plated	Stainless steel R acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015	High corrosion resistant steel HCR acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015
2	Anchor rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 electroplated ≥ 5 µm, EN ISO 4042:2018Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009 f_{uk} ≤ 1000 N/mm² A_5 > 8% fracture elongation	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462; EN 10088-1:2014 f_{uk} ≤ 1000 N/mm² A_5 > 8% fracture elongation	Property class 50 or 80 EN ISO 3506-1:2020 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	electroplated ≥ 5 µm, EN ISO 4042:2018Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362; EN 10088-1:2014	1.4565; 1.4529; EN 10088-1:2014
4	Hexagon nut	Property class 4, 5 or 8 acc. EN ISO 898-2:2012 electroplated ≥ 5 µm, EN ISO 4042:2018Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	Property class 50, 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 50, 70 or 80 EN ISO 3506-2:2020 1.4565; 1.4529 EN 10088-1:2014
5	FAKKT Internal threaded anchor	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:2018/Zn5/An(A2K)	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2014
6	Commercial standard screw or threaded rod for FAKKT internal threaded anchor	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:2018/Zn5/An(A2K) A_5 > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014 A_5 > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2014 A_5 > 8 % fracture elongation
7	filling disc	electroplated ≥ 5 µm, EN ISO 4042:2018Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	1.4565;1.4529; EN 10088-1:2014

Injection mortar FAKKT IM Z

Product description
Materials

Annex A 5

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Specifications of intended use part 1

Table B1.1: Overview use and performance categories

Anchorages subject to			**FAKKT IM Z with …**		
			Anchor rod 	FAKKT Internal threaded anchor 	
Hammer drilling with standard drill bit			all sizes		
Hammer drilling with hollow drill bit (fischer FHD, Heller "Duster Expert"; Bosch „Speed Clean“; Hilti "TE-CD, TE-YD", DreBo „D-Plus“, DreBo „D-Max“) 			Nominal drill bit diameter (d_0) 12 mm to 35 mm		
Static and quasi static loading, in		uncracked concrete	all sizes	Tables: C1.1 C3.1 C4.1 C6.1	all sizes	Tables: C2.1 C3.1 C5.1 C6.2
		cracked concrete	M10 to M20		-[2]	
Use category	I1	dry or wet concrete	all sizes			
	I2	water filled hole [1]	M 12 to M 30		all sizes	
Installation direction			D3 (downward and horizontal and upwards (e.g. overhead) installation)			
Installation temperature			$T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C			
In-service temperature		Temperature range I	-40 °C to +80 °C	(max. short term temperature +80 °C; max. long term temperature +50 °C)		
		Temperature range II	-40 °C to +120 °C	(max. short term temperature +120 °C; max. long term temperature +72 °C)		

[1] Valid for shuttle cartridges with 360 ml,825 ml and coaxial cartridges with 380ml, 400 ml, 410 ml
[2] No performance assessed

Injection mortar FAKKT IM Z

Intended use
Specifications part 1

Annex B 1

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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 5 table A5.1.

Design:

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

Installation:

- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Fastening depth should be marked and adhered to installation
- Overhead installation is allowed (necessary equipment see installation instruction)

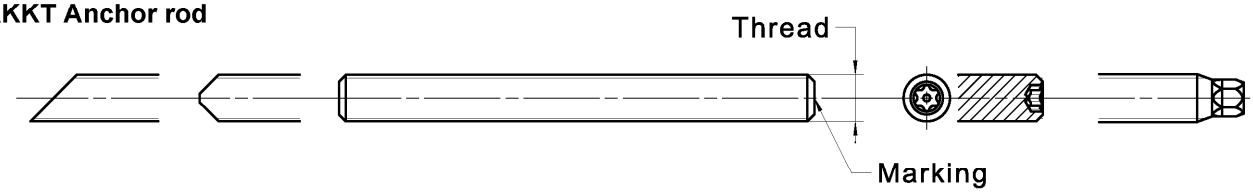
Injection mortar FAKKT IM Z	**Annex B 2**
Intended use Specifications part 2	

Deutsches Institut für Bautechnik DIBt

Table B3.1: Installation parameters for **anchor rods**

Anchor rods			**Thread**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal drill hole diameter		d_0		8	10	12	14	18	24	28	30	35
Drill hole depth		h_0		$h_0 \geq h_{ef}$								
Effective embedment depth		$h_{ef,\,min}$		50	60	60	70	80	90	96	108	120
		$h_{ef,\,max}$		72	160	200	240	320	400	480	540	600
Minimum spacing and minimum edge distance		s_{min} = c_{min}	[mm]	40	40	45	55	65	85	105	125	140
Maximum Diameter of the clearance hole of the fixture	pre-positioned installation	d_f		7	9	12	14	18	22	26	30	33
	push through installation	d_f		9	12	14	16	20	26	30	33	40
Minimum thickness of concrete member		h_{min}		h_{ef} + 30 (≥100)				h_{ef} + 2d_0				
Maximum installation torque		max T_{inst}	[Nm]	5	10	20	40	60	120	150	200	300

FAKKT Anchor rod



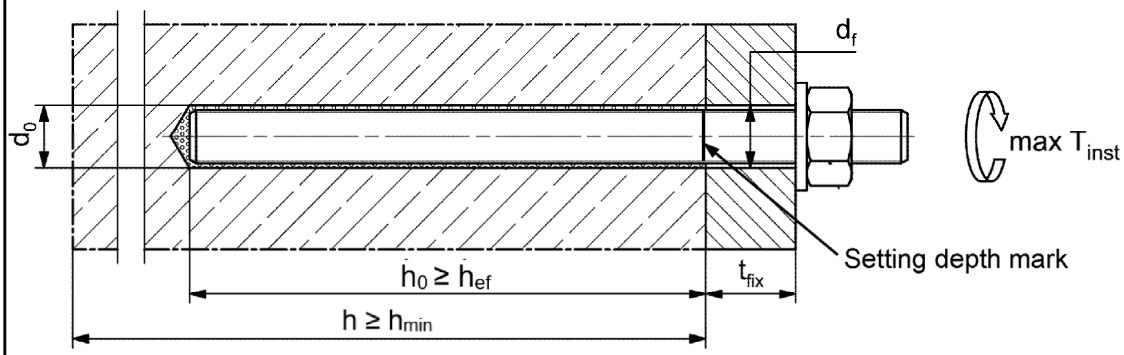
Marking (on random place) FAKKT anchor rod:

Steel zinc plated PC[1] 8.8	● or +	Steel hot-dip PC[1] 8.8	●
High corrosion resistant steel HCR PC[1] 50	●	High corrosion resistant steel HCR PC[1] 70	-
High corrosion resistant steel HCR PC[1] 80	(	Stainless steel R property class 50	~
Stainless steel R property class 80	✳		

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

[1] PC = property class

Installation conditions:



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

- Materials, dimensions and mechanical properties according to Annex A 5, Table A5.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- Setting depth is marked

Figures not to scale

Injection mortar FAKKT IM Z

Intended use
Installation parameters anchor rods

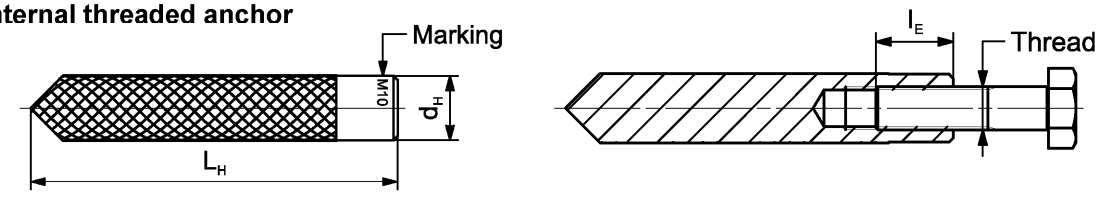
Annex B 3

Deutsches Institut für Bautechnik DIBt

Table B4.1: Installation parameters for **FAKKT internal threaded anchors**

Internal threaded anchors		**Thread**	**M8**	**M10**	**M12**	**M16**	**M20**
Diameter of anchor	$d_{nom} = d_H$		12	16	18	22	28
Nominal drill hole diameter	d_0		14	18	20	24	32
Drill hole depth	h_0		$h_0 \geq h_{ef} = L_H$				
Effective embedment depth ($h_{ef} = L_H$)	h_{ef}		90	90	125	160	200
Minimum spacing and minimum edge distance	s_{min} = c_{min}	[mm]	55	65	75	95	125
Diameter of clearance hole in the fixture	d_f		9	12	14	18	22
Minimum thickness of concrete member	h_{min}		120	125	165	205	260
Maximum screw-in depth	$l_{E,max}$		18	23	26	35	45
Minimum screw-in depth	$l_{E,min}$		8	10	12	16	20
Maximum installation torque	max T_{inst}	[Nm]	10	20	40	80	120

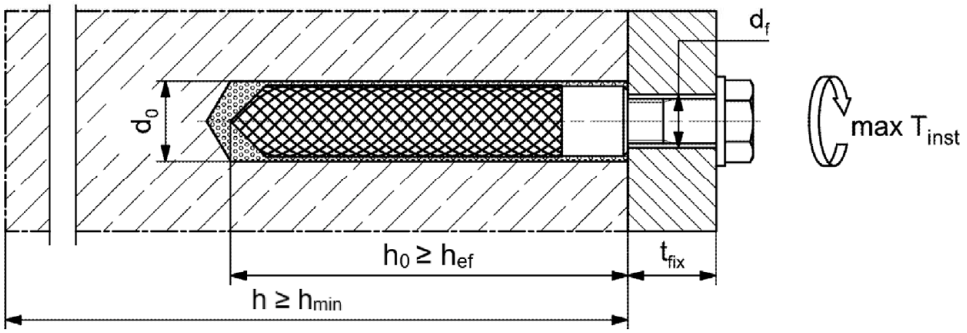
FAKKT Internal threaded anchor



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

Retaining bolt or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A 5, Table A5.1

Installation conditions:



Figures not to scale

Injection mortar FAKKT IM Z

Intended use
Installation parameters FAKKT internal threaded anchors

Annex B 4

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Table B5.1: Parameters of the **FAKKT cleaning brush** (steel brush with steel bristles)

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

Nominal drill hole diameter	d_0	[mm]	8	10	12	14	16	18	20	24	25	28	30	35
Steel brush diameter	d_b		9	11	14	16	20		25	26	27	30	40	

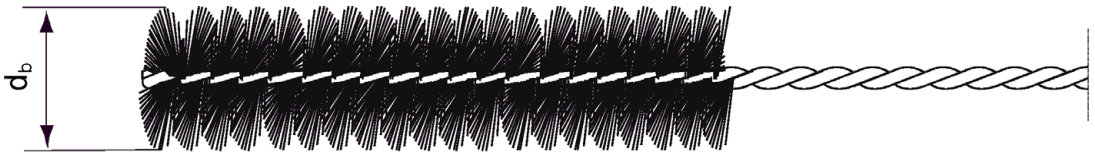


Table B5.2 **Maximum processing time** of the mortar and **minimum curing time** (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]	Maximum processing time t_{work}	Minimum curing time [1] t_{cure}
	FAKKT IM Z	FAKKT IM Z
-5 to 0 [2]	-	24 h
> 0 to 5 [2]	13 min	3 h
> 5 to 10	9 min	90 min
> 10 to 20	5 min	60 min
> 20 to 30	4 min	45 min
> 30 to 40	2 min	35 min

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

Injection mortar FAKKT IM Z

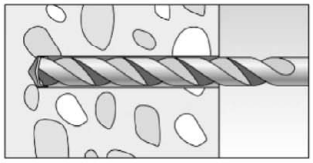
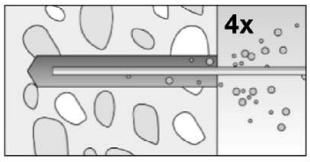
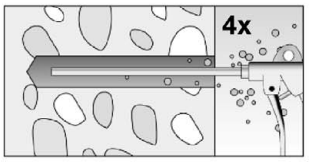
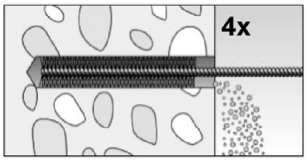
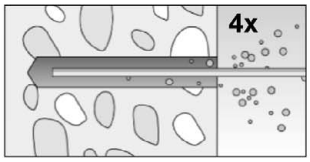
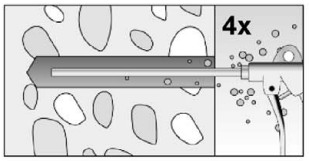
Intended use
Cleaning brush (steel brush)
Processing time and curing time

Annex B 5

Deutsches Institut für Bautechnik DIBt

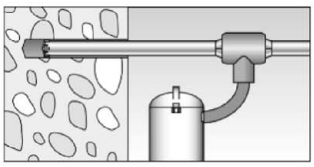
Installation instructions part 1

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

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **tables B3.1, B4.1.**		
2		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand.		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar). Use suitable compressed-air nozzle.
3		Brush the drill hole four times. For deep holes use an extension. Use suitable brushes (see **table B5.1**).		
4		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand.		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar). Use suitable compressed-air nozzle.

Go to step 5

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

1		Check a suitable hollow drill (see **table B1.1**) for correct operation of the dust extraction
2		Use a suitable dust extraction system, e. g. fischer FVC 35 M or a comparable dust extraction system with equivalent performance data. Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **tables B3.1, B4.1**

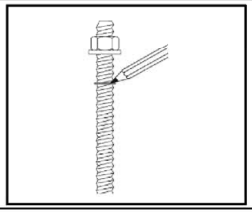
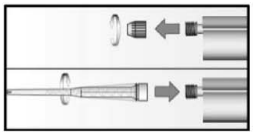
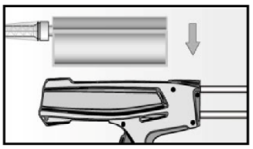
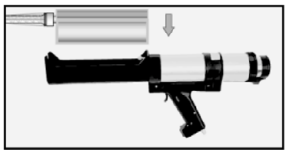
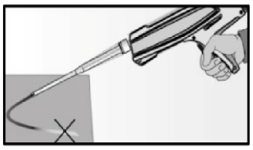
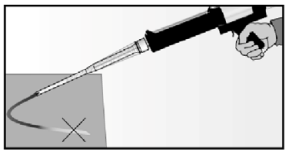
Go to step 5

Injection mortar FAKKT IM Z	**Annex B 6**
Intended use Installation instructions part 1	

Deutsches Institut für Bautechnik DIBt

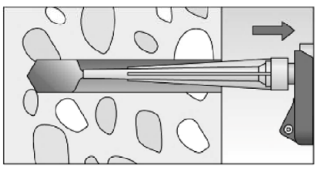
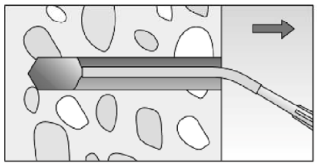
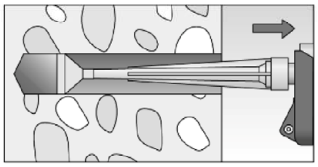
Installation instructions part 2

Preparing the cartridge

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

Go to step 9

Injection of the mortar

9	 For $h_0 = h_{ef}$ fill approximately 2/3 of the drill hole with mortar. For $h_0 > h_{ef}$ more mortar is needed. Always begin from the bottom of the hole and avoid bubbles	 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 10

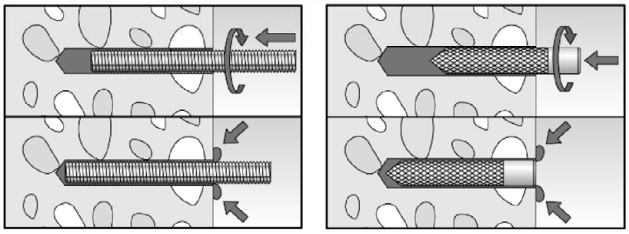
Injection mortar FAKKT IM Z	**Annex B 7**
Intended use Installation instructions part 2	

Deutsches Institut für Bautechnik DIBt

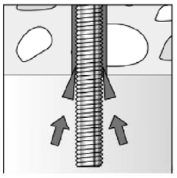
Installation instructions part 3

Installation of anchor rods or internal threaded anchors

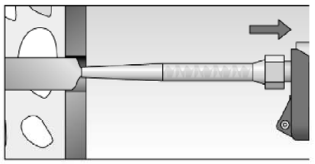
10



Only use clean and oil-free metal parts.
Mark the setting depth of the metal part. Push the anchor rod or FAKKT internal threaded anchor down to the bottom of the hole, turning it slightly while doing so.
After inserting the metal parts, excess mortar must be emerged around the anchor element.



For overhead installations support the metal part with wedges (e. g. centering wedges) or overhead clips.

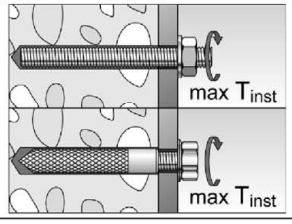


For push through installation fill the annular gap with mortar

11

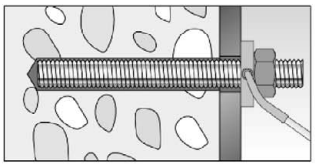
Wait for the specified curing time t_{cure} see **table B5.2**

12



Mounting the fixture
max T_{inst} see **tables B3.1 and B4.1**

Option



After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the filling disc.
Compressive strength ≥ 50 N/mm² (e.g. FAKKT IM Z).
ATTENTION: Using filling disc reduces t_{fix} (usable length of the anchor)

Injection mortar FAKKT IM Z

Intended use
Installation instructions part 3

Annex B 8

Deutsches Institut für Bautechnik DIBt

Table C1.1: Characteristic resistance to steel failure under tension / shear loading of FAKKT anchor rods and standard threaded rods

Anchor rod / standard threaded rod				M6	M8	M10	M12	M16	M20	M24	M27	M30
Characteristic resistance to steel failure under tension loading [3)]												
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	8	15(13)	23(21)	33	63	98	141	184	224
			5.8	10	19(17)	29(27)	43	79	123	177	230	281
			8.8	16	29(27)	47(43)	68	126	196	282	368	449
	Stainless steel R and high corrosion resistant steel HCR		50	10	19	29	43	79	123	177	230	281
			70	14	26	41	59	110	172	247	322	393
			80	16	30	47	68	126	196	282	368	449
		[kN]										
Partial factors [1)]												
Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	4.8	1,50								
			5.8	1,50								
			8.8	1,50								
	Stainless steel R and high corrosion resistant steel HCR		50	2,86								
			70	1,50[2)] / 1,87								
			80	1,60								
		[-]										
Characteristic resistance to steel failure under shear loading [3)]												
without lever arm												
Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	4.8	4	9(8)	14(13)	20	38	59	85	110	135
			5.8	6	11(10)	17(16)	25	47	74	106	138	168
			8.8	8	15(13)	23(21)	34	63	98	141	184	225
	Stainless steel R and high corrosion resistant steel HCR		50	5	9	15	21	39	61	89	115	141
			70	7	13	20	30	55	86	124	161	197
			80	8	15	23	34	63	98	141	184	225
		[kN]										
Ductility factor		k_7	[-]	1,0								
with lever arm												
Charact. resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	4.8	6	15(13)	30(27)	52	133	259	448	665	899
			5.8	7	19(16)	37(33)	65	166	324	560	833	1123
			8.8	12	30(26)	60(53)	105	266	519	896	1333	1797
	Stainless steel R and high corrosion resistant steel HCR		50	7	19	37	65	166	324	560	833	1123
			70	10	26	52	92	232	454	784	1167	1573
			80	12	30	60	105	266	519	896	1333	1797
		[Nm]										
Partial factors [1)]												
Partial factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	4.8	1.25								
			5.8	1.25								
			8.8	1.25								
	Stainless steel R and high corrosion resistant steel HCR		50	2.38								
			70	1.25[2)] / 1.56								
			80	1.33								
		[-]										

[1)] In absence of other national regulations
[2)] Only admissible for high corrosion resistant steel HCR, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. FAKKT anchor rods)
[3)] Values in brackets are valid for hot dip galvanised FAKKT anchor rods or hot dip galvanised standard threaded rods acc. to EN ISO 10684:2004+AC:2009

Injection mortar FAKKT IM Z

Performances
Characteristic resistance to steel failure under tension / shear loading of FAKKT anchor rods and standard threaded rods

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C2.1: Characteristic resistance to steel failure under tension / shear loading of FAKKT internal threaded anchors

FAKKT Internal threaded anchors					M8	M10	M12	M16	M20
Characteristic resistance to steel failure under tension loading									
Charact. resistance with screw	$N_{Rk,s}$	Property class	5.8	[kN]	19	29	43	79	123
			8.8		29	47	68	108	179
		Property class 70	R		26	41	59	110	172
			HCR		26	41	59	110	172
Partial factors[1)]									
Partial factors	$\gamma_{Ms,N}$	Property class	5.8	[-]	1,50				
			8.8		1,50				
		Property class 70	R		1,87				
			HCR		1,87				
Characteristic resistance to steel failure under shear loading									
Without lever arm									
Charact. resistance with screw	$V^0_{Rk,s}$	Property class	5.8	[kN]	9,2	14,5	21,1	39,2	62,0
			8.8		14,6	23,2	33,7	54,0	90,0
		Property class 70	R		12,8	20,3	29,5	54,8	86,0
			HCR		12,8	20,3	29,5	54,8	86,0
Ductility factor			k_7	[-]	1,0				
With lever arm									
Charact. resistance with screw	$M^0_{Rk,s}$	Property class	5.8	[Nm]	20	39	68	173	337
			8.8		30	60	105	266	519
		Property class 70	R		26	52	92	232	454
			HCR		26	52	92	232	454
Partial factors[1)]									
Partial factors	$\gamma_{Ms,V}$	Property class	5.8	[-]	1,25				
			8.8		1,25				
		Property class 70	R		1,56				
			HCR		1,56				

[1)] In absence of other national regulations

Injection mortar FAKKT IM Z

Performances
Characteristic resistance to steel failure under tension / shear loading of FAKKT internal threaded anchor

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3.1: Characteristic resistance to **concrete failure** under **tension / shear loading**

Size			**All sizes**								
Characteristic resistance to concrete failure under tension loading											
Installation factor	γ_{inst}	[-]	See annex C 4 to C 5								
Factors for the compressive strength of concrete > C20/25											
Increasing factor ψ_c for cracked or uncracked concrete $\tau_{Rk\,(X,Y)} = \psi_c \cdot \tau_{Rk\,(C20/25)}$	C25/30	[-]	1,05								
	C30/37		1,10								
	C35/45		1,15								
	C40/50		1,19								
	C45/55		1,22								
	C50/60		1,26								
Splitting failure											
Edge distance $h / h_{ef} \geq 2{,}0$	$c_{cr,sp}$	[mm]	$1{,}0\ h_{ef}$								
Edge distance $2{,}0 > h / h_{ef} > 1{,}3$	$c_{cr,sp}$	[mm]	$4{,}6\ h_{ef} - 1{,}8\ h$								
Edge distance $h / h_{ef} \leq 1{,}3$	$c_{cr,sp}$	[mm]	$2{,}26\ h_{ef}$								
Spacing	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$								
Concrete cone failure											
Uncracked concrete	$k_{ucr,N}$	[-]	11,0								
Cracked concrete	$k_{cr,N}$	[-]	7,7								
Edge distance	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$								
Spacing	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$								
Factors for sustained tension loading											
Temperature range		[°C]	50 / 80					72 / 120			
Factor	Ψ^0_{sus}	[-]	0,74					0,87			
Characteristic resistance to concrete failure under shear loading											
Installation factor	γ_{inst}	[-]	1,0								
Concrete pry-out failure											
Factor for pry-out failure	k_8	[-]	2,0								
Concrete edge failure											
Effective length of fastener in shear loading	l_f	[mm]	for $d_{nom} \leq 24$ mm: min (h_{ef}; 12 d_{nom}) for $d_{nom} > 24$ mm: min (h_{ef}; 8 d_{nom}; 300 mm)								
Calculation diameters											
Size			M6	M8	M10	M12	M16	M20	M24	M27	M30
FAKKT anchor rods and standard threaded rods	d_{nom}	[mm]	6	8	10	12	16	20	24	27	30
FAKKT internal threaded anchors	d_{nom}	[mm]	-[1)]	12	16	18	22	28	-[1)]	-[1)]	-[1)]

[1)] Anchor type not part of the assessment

Injection mortar FAKKT IM Z

Performances
Characteristic resistance to concrete failure under tension / shear loading

Annex C 3

Deutsches Institut für Bautechnik DIBt

Table C4.1: Characteristic resistance to combined pull-out and concrete failure for **FAKKT anchor rods** and **standard threaded rods** in hammer drilled holes; **uncracked or cracked concrete**

Anchor rod / standard threaded rod				**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Combined pull-out and concrete cone failure												
Calculation diameter		d	[mm]	6	8	10	12	16	20	24	27	30
Uncracked concrete												
Characteristic bond resistance in uncracked concrete C20/25												
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)												
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,0	11,0	11,0	11,0	10,0	9,5	9,0	8,5	8,5
	II: 72 °C / 120 °C			6,5	9,5	9,5	9,0	8,5	8,0	7,5	7,0	7,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)[1]												
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	-[2]	-[2]	-[2]	9,5	8,5	8,0	7,5	7,0	7,0
	II: 72 °C / 120 °C			-[2]	-[2]	-[2]	7,5	7,0	6,5	6,0	6,0	6,0
Installation factors												
Dry or wet concrete		γ_{inst}	[-]	1,0								
Water filled hole				-[2]	-[2]	-[2]	1,2 [1]					
Cracked concrete												
Characteristic bond resistance in cracked concrete C20/25												
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)												
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	-[2]	-[2]	6,0	6,0	6,0	5,5	-[2]	-[2]	-[2]
	II: 72 °C / 120 °C			-[2]	-[2]	5,0	6,0	6,0	5,0	-[2]	-[2]	-[2]
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)[1]												
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	-[2]	-[2]	-[2]	5,0	5,0	4,5	-[2]	-[2]	-[2]
	II: 72 °C / 120 °C			-[2]	-[2]	-[2]	4,0	4,0	4,0	-[2]	-[2]	-[2]
Installation factors												
Dry or wet concrete		γ_{inst}	[-]	-[2]	-[2]	1,0				-[2]	-[2]	-[2]
Water filled hole				-[2]	-[2]	-[2]	1,2 [1]			-[2]	-[2]	-[2]

[1] Valid for shuttle cartridges with 360 ml,825 ml and coaxial cartridges with 380ml, 400 ml, 410 ml
[2] No Performance assessed

Injection mortar FAKKT IM Z

Performances
Characteristic resistance to combined pull-out and concrete failure for FAKKT anchor rod and standard threaded rods

Annex C 4

Deutsches Institut für Bautechnik DIBt

Table C5.1: Characteristic resistance to combined pull-out and concrete failure for **FAKKT internal threaded anchors** in hammer drilled holes; **uncracked concrete**

FAKKT Internal threaded anchor				**M8**	**M10**	**M12**	**M16**	**M20**
Combined pull-out and concrete cone failure								
Calculation diameter		d	[mm]	12	16	18	22	28
Uncracked concrete								
Characteristic bond resistance in uncracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)								
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	10,5	10,0	9,5	9,0	8,5
	II: 72 °C / 120 °C			9,0	8,0	8,0	7,5	7,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)[1)]								
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	10,0	9,0	9,0	8,5	8,0
	II: 72 °C / 120 °C			7,5	6,5	6,5	6,0	6,0
Installation factors								
Dry or wet concrete		γ_{inst}	[-]	1,0				
Water filled hole				1,2 [1)]				

[1)] Valid for shuttle cartridges with 360 ml,825 ml and coaxial cartridges with 380ml, 400 ml, 410 ml

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Table C6.1: Displacements for anchor rods

Anchor rod		M6	M8	M10	M12	M16	M20	M24	M27	M30
Displacement-Factors for tension loading[1)]										
Uncracked concrete; Temperature range I, II										
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,10	0,10	0,11	0,12
$\delta_{N\infty\text{-Factor}}$		0,10	0,10	0,10	0,12	0,12	0,12	0,13	0,13	0,14
Cracked concrete; Temperature range I, II										
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	-[3)]	-[3)]	0,12	0,12	0,13	0,13	-[3)]	-[3)]	-[3)]
$\delta_{N0\text{-Factor}}$		-[3)]	-[3)]	0,27	0,30	0,30	0,30	-[3)]	-[3)]	-[3)]
Displacement-Factors for shear loading[2)]										
Uncracked or cracked concrete; Temperature range I, II										
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,11	0,11	0,11	0,10	0,10	0,09	0,09	0,08	0,07
$\delta_{V\infty\text{-Factor}}$		0,12	0,12	0,12	0,11	0,11	0,10	0,10	0,09	0,09

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

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

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$

V = acting shear loading

[3)] No performance assessed

Table C6.2: Displacements for FAKKT internal threaded anchors

Internal threaded anchor		M8	M10	M12	M16	M20
Displacement-Factors for tension loading[1)]						
Uncracked concrete; Temperature range I, II						
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,11	0,12	0,13	0,14
$\delta_{N\infty\text{-Factor}}$		0,13	0,14	0,15	0,16	0,18
Displacement-Factors for shear loading[2)]						
Uncracked concrete; Temperature range I, II						
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,12	0,12	0,12	0,12	0,12
$\delta_{V\infty\text{-Factor}}$		0,14	0,14	0,14	0,14	0,14

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

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

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$

V = acting shear loading

Injection mortar FAKKT IM Z

Performances
Displacements for anchor rods and FAKKT internal threaded anchors

Annex C 6