Deutsches Institut für Bautechnik
DIBt

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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-05/0069 of 3 July 2017

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	fischer Bolt Anchor FAZ II
Product family to which the construction product belongs	Torque controlled expansion anchor for use in concrete
Manufacturer	fischerwerke GmbH & Co. KG Klaus-Fischer-Straße 1 72178 Waldachtal DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	18 pages including 3 annexes
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	European Assessment Document (EAD) 330232-00-0601
This version replaces	ETA-05/0069 issued on 5 August 2016

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Specific Part

1 Technical description of the product

The fischer Bolt Anchor FAZ II is an anchor made of galvanised steel (FAZ II) or made of stainless steel (FAZ II A4) or high corrosion resistant steel (FAZ II C) which is placed into a drilled hole and anchored by torque-controlled expansion.

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 for static and quasi static action	See Annex C 1 and C 2
Characteristic resistance for seismic performance categories C1 and C2	See Annex C 4
Displacements	See Annex C 5

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Characteristic resistance under fire exposure	See Annex C 3

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

In accordance with EAD 330232-00-0601, 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 3 July 2017 by Deutsches Institut für Bautechnik

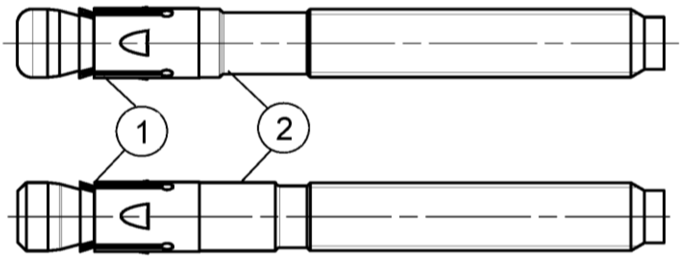
BD Dipl.-Ing. Andreas Kummerow
Head of Department

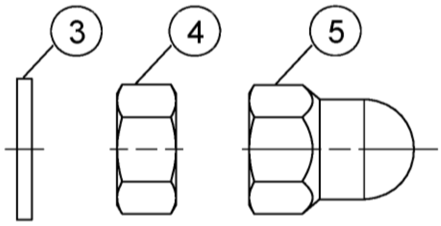
beglaubigt:
Lange

Deutsches Institut für Bautechnik DIBt

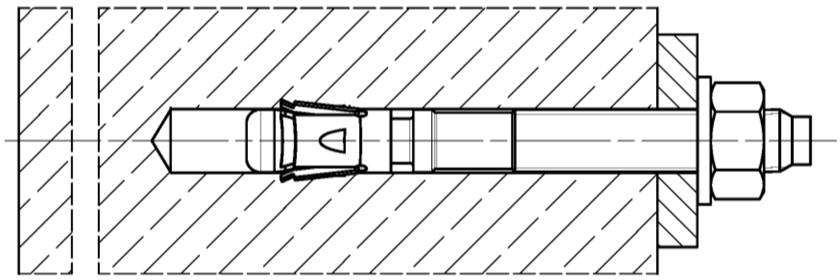
Cone bolt manufactured by cold - forming:

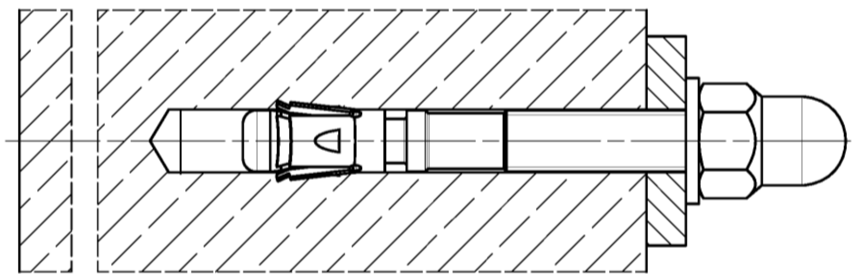
Cone bolt manufactured by turning:





① Expansion sleeve
② Cone bolt (cold – formed or turned)
③ Washer
④ Hexagon nut
⑤ fischer FAZ II dome nut





(Fig. not to scaled)

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C	**Annex A 1**
Product description Installed condition	

English translation prepared by DIBt

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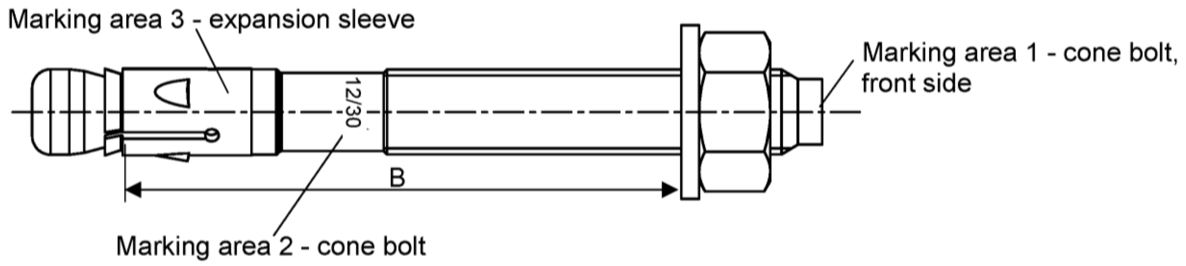
Product label and letter-code:



Product label, example: FAZ II 12/30 A4

Brand | type of fastener placed at marking area 2 or marking area 3

Thread size / max. thickness of the fixture (t_{fix}) identification A4 or C placed at marking area 2

FAZ II: carbon steel, galvanized
FAZ II A4: stainless steel
FAZ II C: high corrosion resistant steel

Table A2.1: Letter - code at marking area 1:

Marking		(a)	(b)	(c)	(d)	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(K)
Max. t_{fix}		5	10	15	20	5	10	15	20	25	30	35	40	45	50
B ≥ [mm]	M6	-				45	50	55	60	65	70	75	80	85	90
	M8	40	45	-		50	55	60	65	70	75	80	85	90	95
	M10	45	50	55	60	65	70	75	80	85	90	95	100	105	110
	M12	55	60	65	70	75	80	85	90	95	100	105	110	115	120
	M16	70	75	80	85	90	95	100	105	110	115	120	125	130	135
	M20	-				105	110	115	120	125	130	135	140	145	150
	M24					130	135	140	145	150	155	160	165	170	175

Marking		(L)	(M)	(N)	(O)	(P)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)	(Z)
Max. t_{fix}		60	70	80	90	100	120	140	160	180	200	250	300	350	400
B ≥ [mm]	M6	100	110	120	130	140	160	180	200	220	240	290	340	390	440
	M8	105	115	125	135	145	165	185	205	225	245	295	345	395	445
	M10	120	130	140	150	160	180	200	220	240	260	310	360	410	460
	M12	130	140	150	160	170	190	210	230	250	270	320	370	420	470
	M16	145	155	165	175	185	205	225	245	265	285	335	385	435	485
	M20	160	170	180	190	200	220	240	260	280	300	350	400	450	500
	M24	185	195	205	215	225	245	265	285	305	325	375	425	475	525

Calculation existing h_{ef} for installed fasteners:

existing h_{ef} = $B_{(according\ to\ table\ A2.1)}$ – existing t_{fix}

Thickness of the fixture t_{fix} including thickness of fastener plate t and e.g. thickness of grout layer t_{grout} or other non-structural layers

(Fig. not to scaled)

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C

Product description
Product label and letter code

Annex A 2

Product dimensions

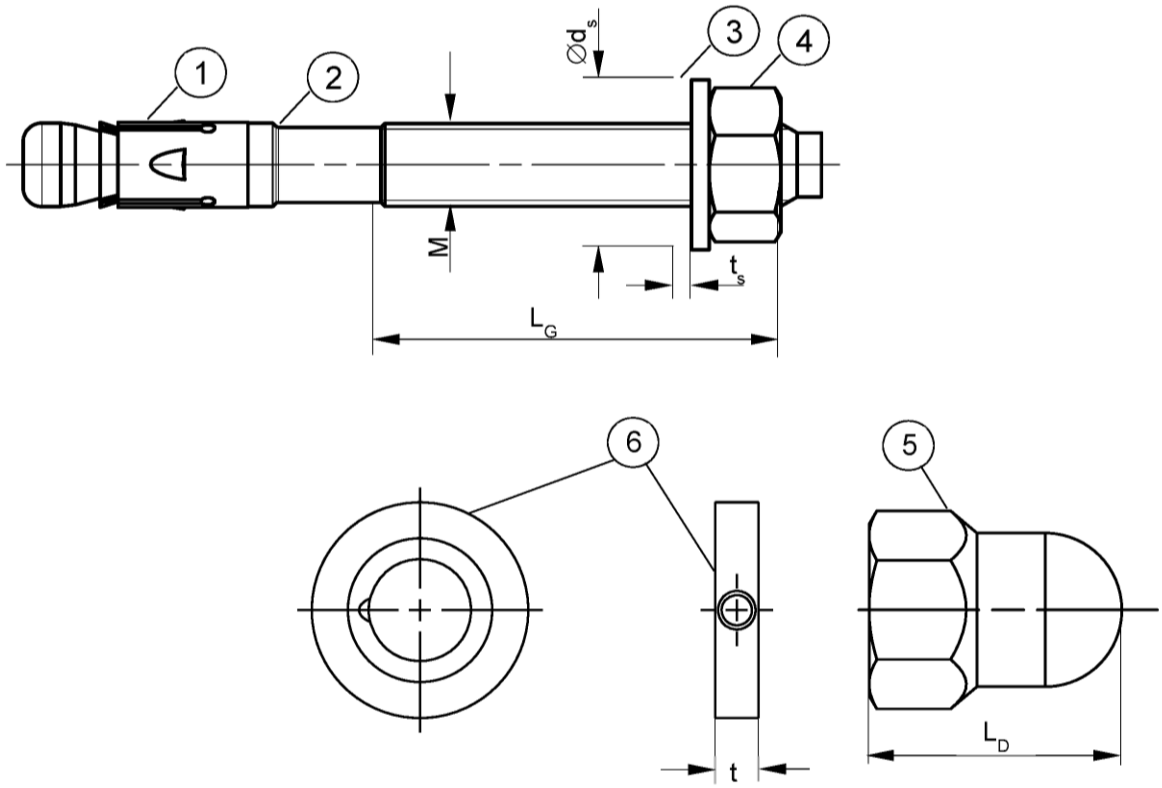


Table A3.1: Dimensions [mm]

Part	Designation			FAZ II, FAZ II A4, FAZ II C						
				M6	M8	M10	M12	M16	M20	M24
1	Expansion sleeve	Sheet thickness		0,8	1,3	1,4	1,6	2,4		3,0
2	Cone bolt	Thread size M		6	8	10	12	16	20	24
		L_G	≥	10	19	26	31	40	50	57
3	Washer	t_S	≥	1,4		1,8	2,3	2,7		3,7
		$\varnothing\ d_s$	≥	11	15	19	23	29	36	43
4 & 5	Hexagon nut / fischer FAZ II dome nut	Wrench size		10	13	17	19	24	30	36
5		L_D	≥	-		22	27	33	-	
6	fischer filling disc FFD	t	=	6				7	8	10

(Fig. not to scaled)

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C

Product description
Dimensions

Annex A 3

Specifications of intended use

Anchorages subject to:

<table>
<tr><th rowspan="2" colspan="2">Size</th><th colspan="7">FAZ II, FAZ II A4, FAZ II C</th></tr>
<tr><th>M6</th><th>M8</th><th>M10</th><th>M12</th><th>M16</th><th>M20</th><th>M24</th></tr>
<tr><td colspan="2">Static and quasi-static loads</td><td rowspan="3" colspan="7">✓</td></tr>
<tr><td colspan="2">Cracked and uncracked concrete</td></tr>
<tr><td colspan="2">Fire exposure</td></tr>
<tr><td rowspan="2">Seismic performance category</td><td>C1</td><td>-</td><td colspan="6">✓</td></tr>
<tr><td>C2[1)]</td><td colspan="2">-</td><td colspan="4">✓</td><td>-</td></tr>
</table>

[1)] FAZ II C: Only valid for cold-formed version (according to Annex A1)

Base materials:
- Reinforced and unreinforced normal weight concrete (cracked and uncracked) according to EN 206-1: 2000
- Strength classes C20/25 to C50/60 according to EN 206-1: 2000

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions (FAZ II, FAZ II A4, FAZ II C)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (FAZ II A4, FAZ II C)
- Structures subject to external atmospheric exposure and permanently damp internal condition, if other particular aggressive conditions exist
  (FAZ II C)

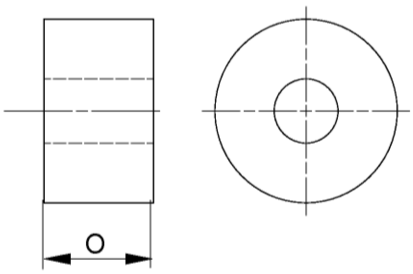
Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where deicing materials are used)

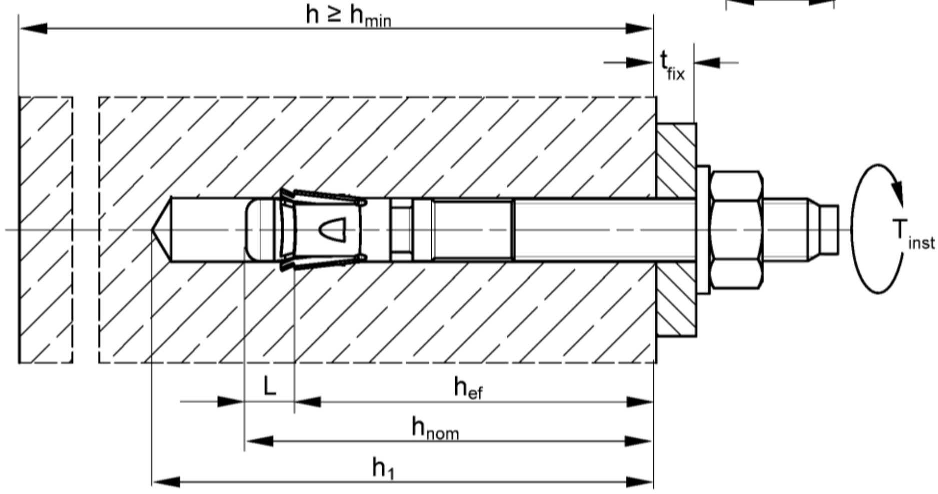
Design:
- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.)
- Design of fastenings according to FprEN 1992-4: 2016 and EOTA Technical Report TR 055
- For effective embedment depth h_{ef} < 40 mm and $h_{min} \geq$ 80 mm and < 100 mm only statically indeterminate fixings (e.g. light-weight suspended ceilings with internal exposure) are covered by the ETA

Table B2.1: Installation parameters

Size			FAZ II, FAZ II A4, FAZ II C						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Nominal drill hole diameter	d_0 =	[mm]	6	8	10	12	16	20	24
Maximum bit diameter with hammer or hollow drilling	$d_{cut,max}$	[mm]	6,40	8,45	10,45	12,5	16,5	20,55	24,55
Maximum bit diameter with diamond drilling	$d_{cut,max}$	[mm]	-	8,15	10,45	12,25	16,45	20,50	24,40
Overall fastener embedment depth in the concrete	$h_{nom} \geq$ (L)	[mm]	46,5 (6,5)	44,5 (9,5)	52,0 (12)	63,5 (13,5)	82,5 (17,5)	120 (20)	148,5 (23,5)
			Existing h_{ef} + L = h_{nom}						
Depth of drill hole to deepest point	$h_1 \geq$	[mm]	h_{nom} + 5					h_{nom} + 10	
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	14	18	22	26
Required setting torque	T_{inst} =	[Nm]	8	20	45	60	110	200	270
Excess length after hammering-in the cone bolt (for fischer dome nut applications according to Annex B6)	O =	[mm]	-		12	16	20	-	

Setting gauge FAZ II SL-H
for anchor with fischer FAZ II dome nut:





h_{ef} = Effective embedment depth
t_{fix} = Thickness of the fixture
h_1 = Depth of drill hole to deepest point
h = Thickness of the concrete member
h_{min} = Minimum thickness of concrete member
h_{nom} = Overall fastener embedment depth in the concrete
T_{inst} = Required setting torque

(Fig. not to scaled)

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Table B3.1: Minimum thickness of concrete members, minimum spacing and minimum edge distance

Size			FAZ II, FAZ II A4, FAZ II C						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Minimum edge distance									
Uncracked concrete	c_{min}	[mm]	45	40	45	55	65	95	135
Cracked concrete	c_{min}	[mm]	45	40	45	55	65	85	100
Minimum spacing	s_{min}	[mm]	according to Annex B4						
Minimum thickness of concrete member	h_{min}	[mm]	80			100	140	160	200
Thickness of concrete member	$h \geq$	[mm]	max. $\{h_{min}; h_1{}^{1)} + 30\}$				max. $\{h_{min}; h_1{}^{1)} + 2 \cdot d_o\}$		
Minimum spacing									
Uncracked concrete	s_{min}	[mm]	35	40	40	50	65	95	100
Cracked concrete	s_{min}	[mm]	35	35	40	50	65	95	100
Minimum edge distance	c_{min}	[mm]	according to Annex B4						
Minimum thickness of concrete member	h_{min}	[mm]	80			100	140	160	200
Thickness of concrete member	$h \geq$	[mm]	max. $\{h_{min}; h_1{}^{1)} + 30\}$				max. $\{h_{min}; h_1{}^{1)} + 2 \cdot d_o\}$		
Minimal splitting area									
Uncracked concrete	$A_{sp,req}$	[·1000 mm²]	5,1	18	37	54	67	100	117,5
Cracked concrete	$A_{sp,req}$	[·1000 mm²]	1,5	12	27	40	50	77	87,5

[1)] h_1 according to Annex B2

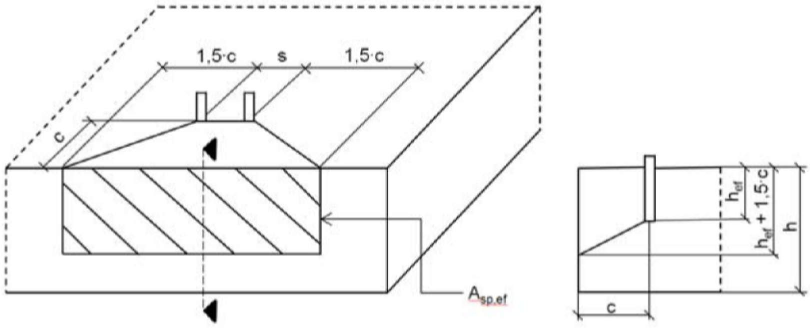
Splitting failure applied for minimum edge distance and spacing in dependence of the h_{ef}

For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

$$A_{sp,req} < A_{sp,ef}$$

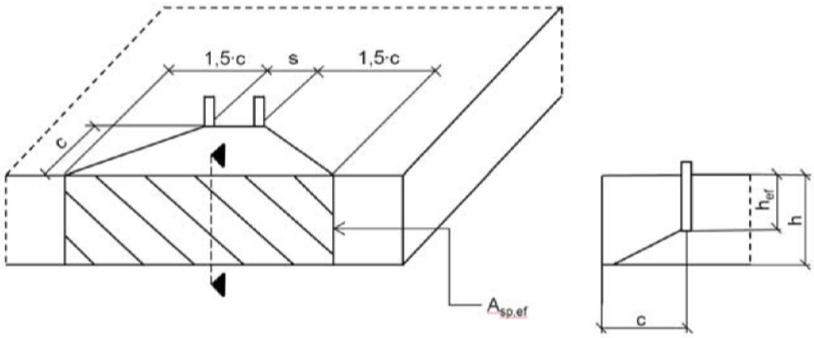
$A_{sp,req}$ = required splitting area
$A_{sp,ef}$ = effective splitting area (according to Annex B4)

Table B4.1: Effective splitting area $A_{sp,ef}$ with member thickness $h > h_{ef} + 1,5 \cdot c$ and $h \geq h_{min}$



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

Table B4.2: Effective splitting area $A_{sp,ef}$ with member thickness $h \leq h_{ef} + 1,5 \cdot c$ and $h \geq h_{min}$



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

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

(Fig. not to scaled)

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C

Intended Use
Minimum thickness of member, minimum spacings and edge distances

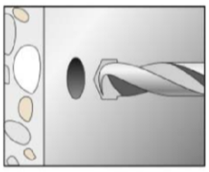
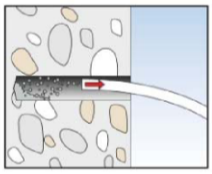
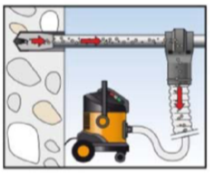
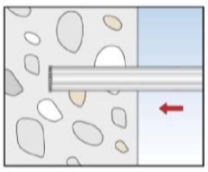
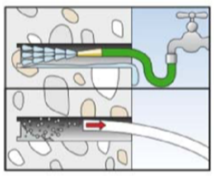
Annex B 4

Installation instructions:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Use of the anchor only as supplied by the manufacturer without exchanging the components of the anchor Exception: fischer FAZ II dome nut.
- Checking before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply
- Check of concrete being well compacted, e.g. without significant voids
- Hammer, hollow or diamond drilling according to Annex B5
- Drill hole created perpendicular +/- 5° to concrete surface, positioning without damaging the reinforcement
- In case of aborted hole: new drilling at a minimum distance twice the depth of the aborted drill hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application
- It must be ensured that in case of fire local spalling of the concrete cover does not occur
- Fastenings in stand-off installation or with a grout layer under seismic action are not covered
- In case of seismic applications the fastener shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure

Installation instructions: Drilling and cleaning the hole

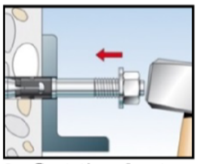
Types of drills and cleaning

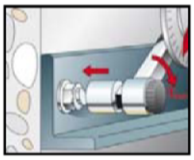
Hammer drill		 1: Drill the hole	 2: Clean the hole
Hollow drill		 1: Drill the hole with automatic cleaning	-
Diamond drill, for non seismic applications only and ≥ drill ∅ 8		 1: Drill the hole	 2: Clean the hole

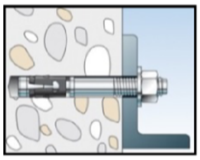
fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C	**Annex B 5**
Intended Use Installation instructions	

Installation instructions: Installation of the anchor

HEXAGON NUT:

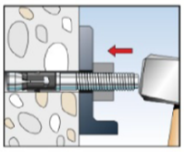

3: Set the fastener

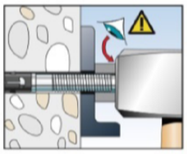

4: Apply T_{inst}

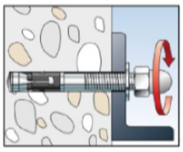

5: Installed fastener

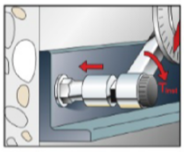
fischer FAZ II DOME NUT:

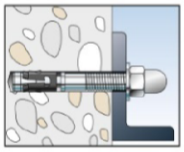
Option 1: Push through installation with setting gauge SL-H:


3: Set the fastener using setting gauge

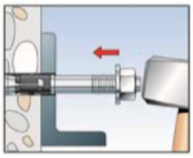

4: Check offset

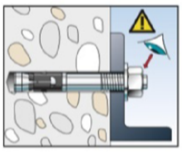

5: Turn on the washer and fischer FAZ II dome nut

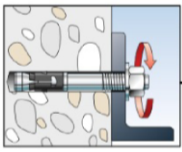

6: Apply T_{inst}


7: Installed fastener

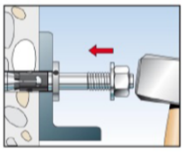
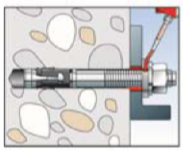
Option 2: Push through installation with hexagon nut:


3: Set the fastener


4: check setting position: Visible one turn of a thread


4.1: Remove nut

fischer FILLING DISC FFD optional for seismic C2 application or minimizing the annular gap:

Optional	The gap between bolt and fixture may be filled with mortar (compressive strength ≥ 50 N/mm² e.g. FIS SB) after step 7 (for eliminating the annular gap). The filling disc is additional to the standard washer. The thickness of the filling disc must be considered for definition of t_{fix} Countersunk of the filling disc in direction to the anchor plate.	 

Deutsches Institut für Bautechnik DIBt

Table C1.1: Characteristic **tension** resistance under static and quasi-static action

Size			FAZ II, FAZ II A4, FAZ II C M6	M8		M10	M12	M16	M20	M24
Steel failure										
Characteristic resistance FAZ II	$N_{Rk,s}$	[kN]	7,6	16,6		28,3	43,2	67,0	123,3	176,7
Characteristic resistance FAZ II A4/C	$N_{Rk,s}$	[kN]	11,4	17,0		29,0	44,3	70,6	124,9	183,6
Partial factor for steel failure	γ_{Ms} [1]	[-]	1,5							
Pullout failure										
Effective embedment depth for calculation	h_{ef}	[mm]	40	35 - < 45	45	40 - 60	50 - 70	65 - 85	100	125
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	1,5	5,5	8	13	20	- [2]		
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	10,5	14		20	22	- [2]		
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete	ψ_c	C25/30	1,12							
	ψ_c	C30/37	1,22							
	ψ_c	C35/45	1,32							
	ψ_c	C40/50	1,41							
	ψ_c	C45/55	1,50							
	ψ_c	C50/60	1,58							
Installation sensitivity factor	γ_{inst}	[-]	1,0							
Concrete cone and splitting failure										
Factor for uncracked concrete	$k_1 = k_{ucr,N}$	[-]	11,0 [3]							
Factor for cracked concrete	$k_1 = k_{cr,N}$	[-]	7,7 [3]							
Characteristic spacing	$s_{cr,N}$	[mm]	$3 \cdot h_{ef}$							
Characteristic edge distance	$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$							
Spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$							
Edge distance for h = 80	$c_{cr,sp}$	[mm]	40	$2,4 \cdot h_{ef}$		$2 \cdot h_{ef}$	-	-		
Edge distance for h = 100	$c_{cr,sp}$	[mm]		$2 \cdot h_{ef}$		$2,4 \cdot h_{ef}$	$2 \cdot h_{ef}$			
Edge distance for h = 120	$c_{cr,sp}$	[mm]				$1,9 \cdot h_{ef}$	$2,1 \cdot h_{ef}$			
Edge distance for h = 140	$c_{cr,sp}$	[mm]					$1,5 \cdot h_{ef}$	$2 \cdot h_{ef}$	-	
Edge distance for h = 160	$c_{cr,sp}$	[mm]							$2,4 \cdot h_{ef}$	-
Edge distance for h = 200	$c_{cr,sp}$	[mm]								$2,2 \cdot h_{ef}$

[1] In absence of other national regulations
[2] Pullout failure not relevant
[3] Based on concrete strength as cylinder strength

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C	**Annex C 1**
Performances Characteristic values of resistance under tension loads	

Table C2.1: Characteristic values of **shear** resistance under static and quasi-static action

Size				FAZ II, FAZ II A4, FAZ II C						
				M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure without lever arm										
Characteristic resistance	FAZ II	$V_{Rk,s}$	[kN]	5,9	13,6	21,4	30,6	55,0	81,4	110,1
	FAZ II A4/C			8,8	16,8	26,5	38,3	69,8	106,3	148,5
Partial factor for steel failure		γ_{Ms} 1)	[-]	1,25						
Factor for ductility		k_7		1,0						
Steel failure with lever arm and Concrete pryout failure										
Effective embedment depth for calculation		h_{ef}	[mm]	40	45	60	70	85	100	125
Characteristic bending resistance	FAZ II	$M^0_{Rk,s}$	[Nm]	11,4	26	52	92	233	513	865
	FAZ II A4/C			10,7	29	59	100	256	519	898
Factor for pryout failure		k_8	[-]	2,6	2,8	3,2		3,0	2,6	2,4
Effective embedment depth for calculation		h_{ef}	[mm]	-	35 - < 45	40 - < 60	50 - < 70	65 - < 85	-	
Characteristic bending resistance	FAZ II	$M^0_{Rk,s}$	[Nm]		20	44	92	184		
	FAZ II A4/C				21	45	100	193		
Factor for pryout failure		k_8	[-]		2,5	2,6	3,1	3,2		
Partial factor for steel failure		γ_{Ms} 1)	[-]	1,25						
Factor for ductility		k_7		1,0						
Concrete edge failure										
Effective embedment depth for calculation		l_f =	[mm]	h_{ef}						
Outside diameter of a fastener		d_{nom}		6	8	10	12	16	20	24

1) In absence of other national regulations

Table C3.1: Characteristic values of **tension** resistance under **fire exposure**

Size				FAZ II, FAZ II A4, FAZ II C						
				M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
		$h_{ef} \geq$	[mm]	40	35 / 45	40 / 60	50 / 70	65 / 85	100	125
Characteristic resistance **steel failure**	$N_{Rk,s,fi}$	R30	[kN]	0,6[1] / 0,9[2]	1,4	2,8	5,0	9,4	14,7	21,1
		R60		0,4[1] / 0,9[2]	1,2	2,3	4,1	7,7	12,0	17,3
		R90		0,3[1] / 0,9[2]	0,9	1,9	3,2	6,0	9,4	13,5
		R120		0,2[1] / 0,7[2]	0,8	1,6	2,8	5,2	8,1	11,6
Characteristic resistance **Concrete cone failure**	$N_{Rk,c,fi}$	R30 - R90		$7{,}7 \cdot h_{ef}^{1,5} \cdot (20)^{0,5} \cdot h_{ef} / 200 / 1000$						
		R120		$7{,}7 \cdot h_{ef}^{1,5} \cdot (20)^{0,5} \cdot h_{ef} / 200 / 1000 \cdot 0{,}8$						
Characteristic resistance **pullout failure**	$N_{Rk,p,fi}$	R30		0,4	0,9 / 2,0	2,2 / 3,3	3,0 / 5,0	4,5 / 6,8	8,6	12,0
		R60			0,8 / 2,0					
		R90			0,5 / 2,0					
		R120		0,3	0,3 / 1,6	1,7 / 2,6	2,4 / 4,0	3,6 / 5,4	6,9	9,6

Table C3.2: Characteristic values of **shear** resistance under **fire exposure**

Size **FAZ II, FAZ II A4, FAZ II C**			**R30**		**R60**	
			$V_{Rk,s,fi,30}$ [kN]	$M^0_{Rk,s,fi,30}$ [Nm]	$V_{Rk,s,fi,60}$ [kN]	$M^0_{Rk,s,fi,60}$ [Nm]
M6	$h_{ef} \geq$	40	0,6[1] / 0,9[2]	0,5[1] / 0,2[2]	0,4[1] / 0,9[2]	0,3[1] / 0,1[2]
M8		35	1,8	1,4	1,6	1,2
M10		40	3,6		2,9	3,0
M12		50	6,3	7,8	4,9	6,4
M16		65	11,7	19,9	9,1	16,3
M20		100	18,2	39,0	14,2	31,8
M24		125	26,3	67,3	20,5	55,0

Size **FAZ II, FAZ II A4, FAZ II C**			**R90**		**R120**	
			$V_{Rk,s,fi,90}$ [kN]	$M^0_{Rk,s,fi,90}$ [Nm]	$V_{Rk,s,fi,120}$ [kN]	$M^0_{Rk,s,fi,120}$ [Nm]
M6	$h_{ef} \geq$	40	0,3[1] / 0,9[2]	0,2[1] / 0,1[2]	0,2[1] / 0,7[2]	0,2[1] / 0,1[2]
M8		35	1,3	1,0	1,2	0,8
M10		40	2,2	2,4	1,9	2,1
M12		50	3,5	5,0	2,8	4,3
M16		65	6,6	12,6	5,3	11,0
M20		100	10,3	24,6	8,3	21,4
M24		125	14,8	42,6	11,9	37,0

Concrete pryout failure according to EN 1992-4

Table C3.3: Minimum spacings and minimum edge distances of anchors under **fire exposure** for **tension** and **shear** load

Size			FAZ II, FAZ II A4, FAZ II C						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Spacing	s_{min}	[mm]	Annex B3						
Edge distance	c_{min}		$c_{min} = 2 \cdot h_{ef}$, for fire exposure from more than one side $c_{min} \geq 300$ mm						

[1] FAZ II gvz
[2] FAZ II A4 / C

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C

Performances
Characteristic values of resistance under fire exposure

Annex C 3

Table C4.1: Characteristic values of **tension and shear** resistance under **seismic action category C1**

Size			FAZ II, FAZ II A4, FAZ II C						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Length of anchor	L_{max}	[mm]	-	167	186	221	285	394	477
Effective embedment depth	h_{ef}	[mm]	-	45	40 - 60	50 - 70	65 - 85	100	125
Steel failure									
Characteristic resistance tension load C1	$N_{Rk,s,C1}$	[kN]	-	16,0	27,0	41,0	66,0	111,0	150,0
Partial factor for steel failure	$\gamma_{Ms,C1}$ [1]	[-]	-	1,5					
Pullout failure									
Characteristic resistance tension load in cracked concrete C1	$N_{Rk,p,C1}$	[kN]	-	4,6	8,0	16,0	28,2	36,0	50,3
Installation sensitivity factor	γ_{inst}	[-]	-	1,0					
Steel failure without lever arm									
Characteristic resistance shear load C1	$V_{Rk,s,C1}$	[kN]	-	11	17	27	47	56	69
Partial factor for steel failure	$\gamma_{Ms,C1}$ [1]	[-]	-	1,25					

[1] In absence of other national regulations

$N_{Rks,eq} = N_{Rk,C1}$ for all failures

Table C4.2: Characteristic values of **tension and shear** resistance under **seismic action category C2**

Size			FAZ II, FAZ II A4, FAZ II C [1]						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Length of anchor	L_{max}	[mm]	-	-	186	221	285	394	-
Steel failure									
Characteristic resistance tension load C2	$N_{Rk,s,C2}$	[kN]	-	-	27	41	66	111	-
Partial factor for steel failure	$\gamma_{Ms,C2}$ [2]	[-]	-	-	1,5				-
Pullout failure									
Characteristic resistance tension load in cracked concrete C2	h_{ef}	[mm]	-	-	60	70	85	100	-
	$N_{Rk,p,C2}$	[kN]	-	-	5,1	7,4	21,5	30,7	-
	h_{ef}	[mm]	-	-	40-59	50-69	65-84	-	-
	$N_{Rk,p,C2}$	[kN]	-	-	2,7	4,4	16,4	-	-
Installation sensitivity factor	γ_{inst}	[-]	1,0						
Steel failure without lever arm									
Characteristic resistance shear load C2	h_{ef}	[mm]	-	-	60	70	85	100	-
	$V_{Rk,s,C2}$	[kN]	-	-	10,0	17,4	27,5	39,9	-
	h_{ef}	[mm]	-	-	40-59	50-69	65-84	-	-
	$V_{Rk,s,C2}$	[kN]	-	-	7,0	12,7	22,0	-	-
Partial factor for steel failure	$\gamma_{Ms,C2}$ [2]	[-]	1,25						

[1] FAZ II C: Only valid for cold-formed version (according to Annex A1)
[2] In absence of other national regulations

$N_{Rks,eq} = N_{Rk,C1}$ for all failures

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C	**Annex C 4**
Performances Characteristic values of resistance under tension and shear loads under seismic action	

Table C5.1: Displacements under static and quasi static **tension** loads

Size		FAZ II, FAZ II A4, FAZ II C						
		M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement – factor for tensile load[1)]								
δ_{N0} - factor	[mm/kN]	0,13	0,22	0,12	0,09	0,08	0,07	0,05
		1,00	0,78	0,40	0,19	0,09		0,07
$\delta_{N\infty}$ - factor	[mm/kN]	0,16	0,07	0,05	0,06		0,05	0,04
		0,24	0,29	0,21	0,14	0,10	0,06	0,05

Table C5.2: Displacements under static and quasi static **shear** loads

Size		FAZ II						
		M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement – factor for shear load[2)]								
δ_{V0} - factor	[mm/kN]	0,6	0,35	0,37	0,27	0,10	0,09	0,07
		0,9	0,52	0,55	0,40	0,14	0,15	0,11
		FAZ II A4, FAZ II C						
$\delta_{V\infty}$ - factor	[mm/kN]	0,6	0,23	0,19	0,18	0,10	0,11	0,07
		0,9	0,27	0,22	0,16	0,11	0,05	0,09

[1)] Calculation of effective displacement:
$\delta_{N0} = \delta_{N0}$ – factor · N_{ED}
$\delta_{N\infty} = \delta_{N\infty}$ – factor · N_{ED}
(N_{ED}: Design value of the applied tension force)

[2)] Calculation of effective displacement:
$\delta_{V0} = \delta_{V0}$ – factor · V_{ED}
$\delta_{V\infty} = \delta_{V\infty}$ – factor · V_{ED}
(V_{ED}: Design value of the applied shear force)

Table C5.3: Displacements under **tension** loads for **category C2** for all embedment depths

Size			FAZ II, FAZ II A4, FAZ II C						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement DLS	$\delta_{N,C2(DLS)}$	[mm]	-		2,7	4,4		5,6	-
Displacement ULS	$\delta_{N,C2\ (ULS)}$	[mm]			11,5	13,0	12,3	14,4	

Table C5.4: Displacements under **shear** loads for **category C2** for all embedment depths

Size			FAZ II, FAZ II A4, FAZ II C						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement DLS	$\delta_{V,C2\ (DLS)}$	[mm]	-		4,1	4,7	5,5	4,8	-
Displacement ULS	$\delta_{V,C2\ (ULS)}$	[mm]			6,2	7,8	10,1	11,2	

fischer Bolt Anchor FAZ II, FAZ II A4, FAZ II C

Performances
Displacements under tension and shear loads

Annex C 5