



PRESTATIEVERKLARING



DoP: 0122

voor fischer Bolt Anchor FBZ, FBZ A4 (Metalen ankers voor gebruik in beton (zware lasten)) – NL

1. Unieke identificatiecode van het producttype: **DoP: 0122**
2. Beoogd(e) gebruik(en): **Bevestiging achteraf in gescheurd of ongescheurd beton, zie bijlage, in het bijzonder bijlagen B 1 tot en met B 4**
3. Fabrikant: **fischerwerke GmbH & Co. KG, Klaus-Fischer-Straße 1, 72178 Waldachtal, Duitsland**
4. Gemachtigde: --
5. Het systeem of de systemen voor de beoordeling en verificatie van de prestatiebestendigheid: **1**
6. Europees beoordelingsdocument: **EAD 330232-00-0601**

Europese technische beoordeling: **ETA-17/0624; 2017-09-08**

Technische beoordelingsinstantie: **DIBt**

Aangemelde instantie(s): **1343 – MPA Darmstadt**

7. Aangegeven prestatie(s):

Mechanische weerstand en stabiliteit (BWR 1)

- **Karakteristieke weerstand tegen statische en quasi-statische belasting: Zie bijlage, in het bijzonder bijlagen C 1 tot en met C 4**
- **Verplaatsingen: Zie bijlage, in het bijzonder bijlage C 5**

Veiligheid bij brand (BWR 2)

- **Brandgedrag: Verankeringen voldoen aan de vereisten voor klasse A1**
- **Karakteristieke weerstand onder brand belasting: Zie bijlage, in het bijzonder bijlage C 4**

8. Geëigende technische documentatie en/of specifieke technische documentatie: ---

De prestaties van het hierboven omschreven product zijn conform de aangegeven prestaties. Deze prestatieverklaring wordt in overeenstemming met Verordening (EU) nr. 305/2011 onder de exclusieve verantwoordelijkheid van de hierboven vermelde fabrikant verstrekt.

Ondertekend voor en namens de fabrikant door:

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Tumlingen, 2017-09-15

- Deze prestatieverklaring is opgesteld in verschillende talen. Bij een geschil over de interpretatie prevaleert de engelse versie.
- De bijlage bevat vrijwillige en aanvullende informatie in de Engelse taal boven op de (taal-neutraal gespecificeerde) wettelijke voorschriften.

Specific Part**1 Technical description of the product**

The fischer Bolt Anchor FBZ is an anchor made of galvanised steel (FBZ) or made of stainless steel (FBZ A4) 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 to C 4
Displacements	See Annex C 5

3.2 Safety in case of fire (BWR 2)

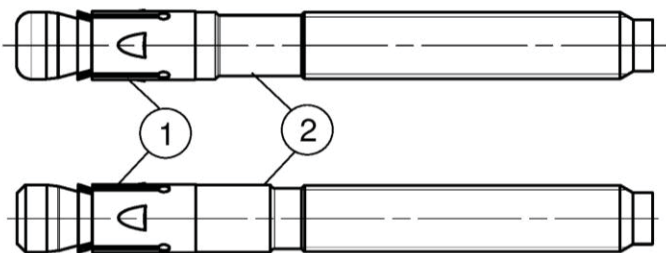
Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1
Characteristic resistance under fire exposure	See Annex C 4

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

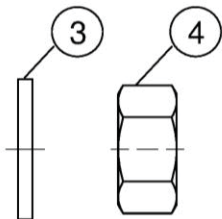
In accordance with the European Assessment Document EAD Nr. 330232-00-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

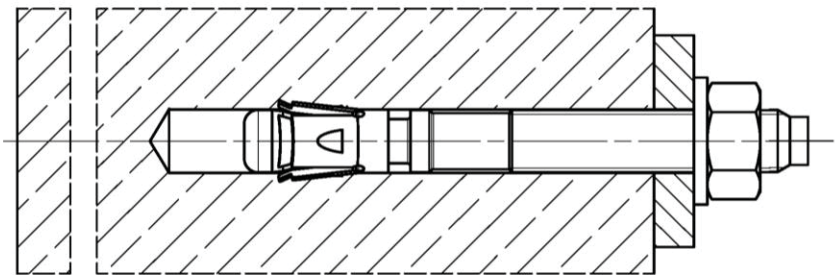
Cone bolt manufactured by cold - forming:



Cone bolt manufactured by turning:



- ① Expansion sleeve
- ② Cone bolt (cold – formed or turned)
- ③ Washer
- ④ Hexagon nut

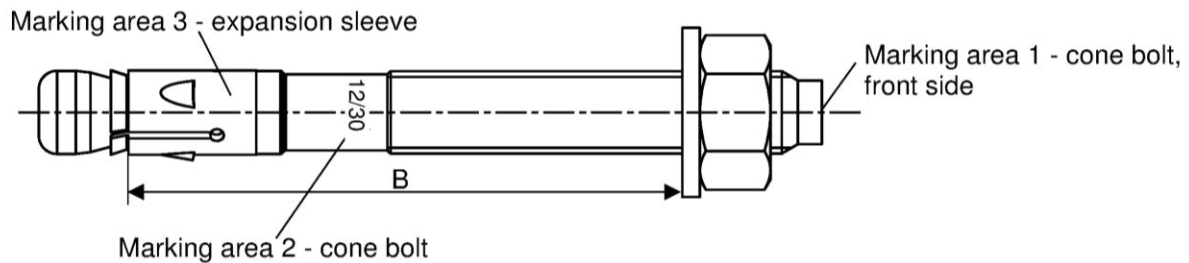


(Fig. not to scaled)

fischer Bolt Anchor FBZ, FBZ A4

Product description
Installed condition

Annex A 1

Product marking and letter-code:

Product marking, example:

 **FBZ 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 placed at marking area 2

FBZ: carbon steel, galvanized

FBZ A4: stainless 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
$B \geq [\text{mm}]$	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
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
$B \geq [\text{mm}]$	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

Calculation existing h_{ef} for installed fasteners:

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

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 FBZ, FBZ A4

Product description
Product marking and letter code

Annex A 2

Product dimensions

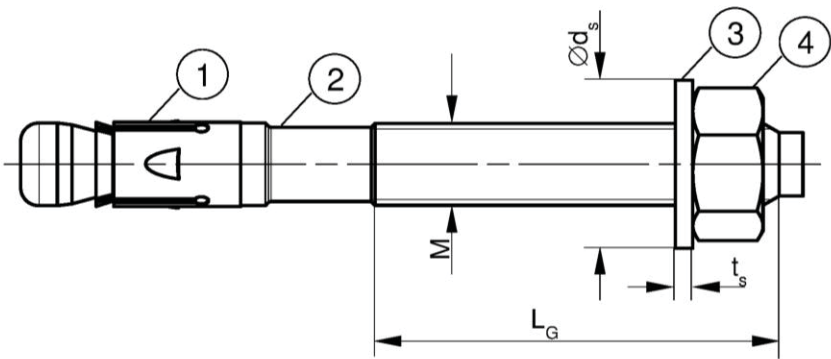


Table A3.1: Dimensions [mm]

Part	Designation		FBZ, FBZ A4				
			M8	M10	M12	M16	M20
1	Expansion sleeve	Sheet thickness	1,3	1,4	1,6	2,4	
2	Cone bolt	Thread size M	8	10	12	16	20
		L _G	19	26	31	40	50
3	Washer	t _s	1,4	1,8	2,3	2,7	
		Ø d _s					
4	Hexagon nut	Wrench size	13	17	19	24	30

(Fig. not to scaled)

fischer Bolt Anchor FBZ, FBZ A4

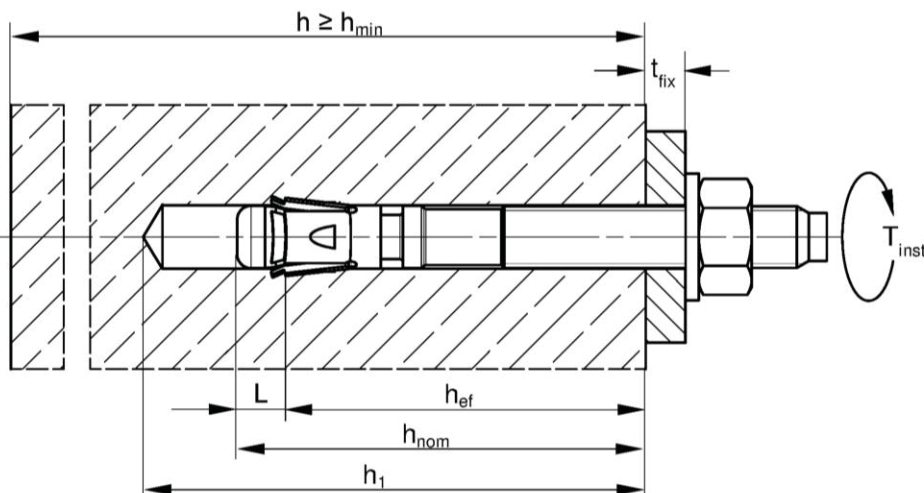
Product description
Dimensions

Annex A 3

Specifications of intended use					
Anchorage subject to:					
Size	FBZ, FBZ A4				
	M8	M10	M12	M16	M20
Static and quasi-static loads	✓				
Cracked and uncracked concrete					
Fire exposure					
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 (FBZ, FBZ A4) - Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (FBZ A4) Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used) Design: - Anchorage 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 / or < 100 mm only statically indeterminate fixings (e.g. lightweight suspended ceilings with internal exposure) are covered by the ETA					
fischer Bolt Anchor FBZ, FBZ A4					Annex B 1
Intended use Specifications					

Table B2.1: Installation parameters

Size	FBZ, FBZ A4				
	M8	M10	M12	M16	M20
Nominal drill hole diameter $d_0 =$	8	10	12	16	20
Maximum bit diameter with hammer or hollow drilling $d_{cut,max}$ [mm]	8,45	10,45	12,5	16,5	20,55
Maximum bit diameter with diamond drilling	8,15		12,25	16,45	20,50
Overall fastener embedment depth in the concrete $h_{nom} \geq (L)$ [mm]	44,5 (9,5)	52,0 (12)	63,5 (13,5)	82,5 (17,5)	120 (20)
Depth of drill hole to deepest point $h_1 \geq$	Existing $h_{ef} + L = h_{nom}$ $h_{nom} + 5$				$h_{nom} + 10$
Diameter of clearance hole in the fixture $d_f \leq$ [mm]	9	12	14	18	22
Required setting torque $T_{inst} =$ [Nm]	20	45	60	110	200



- 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)

fischer Bolt Anchor FBZ, FBZ A4

Intended use
Installation parameters

Annex B 2

Table B3.1: Minimum thickness of concrete members, minimum spacings and minimum edge distances of anchors for **standard anchorage depth** ($h_{ef, sta}$)

Size		FBZ, FBZ A4				
		M8	M10	M12	M16	M20
Standard anchorage depth $h_{ef, sta} \geq$		45	60	70	85	100
Concrete members with thickness $\geq 2 \times h_{ef, sta}$	Minimum thickness of concrete member $h_{min, 1}$ [mm]	100	120	140	170	200
	Uncracked concrete					
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	40		50	65	95
		50	60	70	95	180
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$	40	45	55	65	95
		100	80	110	150	190
	Cracked concrete					
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	35	40	50	65	95
Concrete members with thickness $< 2 \times h_{ef, sta}$		50	55	70	95	140
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$	40	45	55	65	85
		70	80	110	150	190
	Minimum thickness of concrete member $h_{min, 2}$ [mm]	80	100	120	140	160
	Cracked and uncracked concrete					
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	35	40	50	80	125
		70	100	90	130	220
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$	40	60		65	125
		100	90	120	180	230

Intermediate values for s_{min} and c_{min} inside of the same thickness of concrete member by linear interpolation**Table B3.2:** Minimum thickness of concrete members, minimum spacings and minimum edge distances of anchors for **reduced anchorage depth** ($h_{ef, red}$)

Size		FBZ, FBZ A4			
		M8	M10	M12	M16
Reduced anchorage depth $h_{ef,red} \geq$		35 ¹⁾	40	50	65
Concrete members with thickness $\geq 2 \times h_{ef,red}$	Minimum thickness of concrete member $h_{min, 3}$ [mm]	80		100	140
	Uncracked concrete				
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	40		50	65
		100		110	130
		45		55	65
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$	180		220	250
		Cracked concrete			
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	40		50	65
		90		110	130
45		55	65		
Minimum edge distance $\frac{c_{min}}{\text{for } s >}$	180		220	250	

Intermediate values for s_{min} and c_{min} by linear interpolation¹⁾ Only in anchoring structural components which are statically indeterminate

fischer Bolt Anchor FBZ, FBZ A4

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

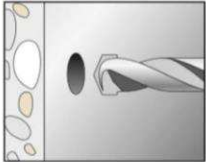
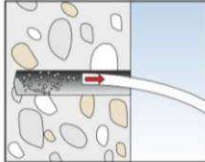
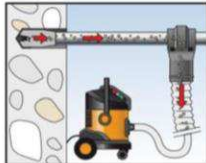
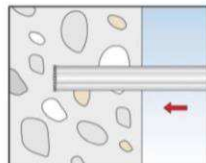
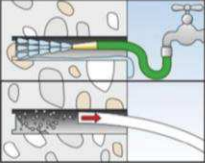
Annex B 3

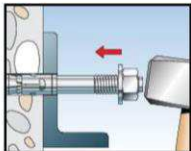
Installation instructions:

- 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
- 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 B4
- Drill hole created perpendicular $\pm 5^\circ$ 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

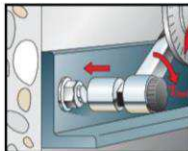
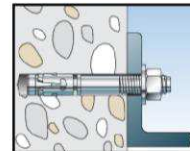
Installation instructions: Drilling and cleaning the hole

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			
		1: Drill the hole	2: Clean the hole

Installation instructions: Installation of the anchor

3: Set the fastener

4: Apply T_{inst} 

5: Installed fastener

fischer Bolt Anchor FBZ, FBZ A4

Intended use
Installation instructions

Annex B 4

Table C1.1: Characteristic values of **tension** resistance for **standard anchorage depth**

Size				FBZ, FBZ A4					
				M8	M10	M12	M16	M20	
Steel failure for standard anchorage depth									
Characteristic resistance	FBZ	$N_{Rk,s}$	[kN]	16,6	28,3	43,2	67,0	123,3	
	FBZ A4	$N_{Rk,s}$		17,0	29,0	44,3	70,6	124,9	
Partial factor for steel failure			$\gamma_{Ms}^{3)}$	1,5					
Pullout failure for standard anchorage depth									
Effective anchorage depth for calculation			$h_{ef,sta} \geq$	[mm]	45	60	70	85	100
Characteristic resistance in cracked concrete C20/25			$N_{Rk,p}$	[kN]	6	10	16	26	30
Characteristic resistance in uncracked concrete C20/25			$N_{Rk,p}$		11	16	17	34	42
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete			ψ_c	C25/30	1,12				
				C30/37	1,22				
				C35/45	1,32				
				C40/50	1,41				
				C45/55	1,50				
				C50/60	1,58				
Installation sensitivity factor			γ_{inst}	[-]	1,0				
Concrete cone and splitting failure for standard anchorage depth in applications with concrete members of thickness $\geq 2x h_{ef,sta}$									
Effective anchorage depth			h_{ef}	[mm]	45	60	70	85	100
Factor for uncracked concrete			$k_1 = k_{ucr,N}$	[-]	11,0 ²⁾				
Factor for cracked concrete			$k_1 = k_{cr,N}$		7,7 ²⁾				
Minimum thickness of concrete member			$h_{min,1}$	[mm]	100	120	140	170	200
Characteristic spacing			$s_{cr,N}$		3 h_{ef}				
Characteristic edge distance			$c_{cr,N}$		1,5 h_{ef}				
Spacing (splitting failure) ¹⁾			$s_{cr,sp}$		140	180	210	260	370
Edge distance (splitting failure) ¹⁾			$c_{cr,sp}$		70	90	105	130	185
Concrete cone and splitting failure for standard anchorage depth in applications with concrete members of thickness $< 2x h_{ef,sta}$									
Effective anchorage depth			h_{ef}	[mm]	45	60	70	85	100
Factor for uncracked concrete			$k_1 = k_{ucr,N}$	[-]	11,0 ²⁾				
Factor for cracked concrete			$k_1 = k_{cr,N}$		7,7 ²⁾				
Minimum thickness of concrete member			$h_{min,2}$	[mm]	80	100	120	140	160
Characteristic spacing			$s_{cr,N}$		3 h_{ef}				
Characteristic edge distance			$c_{cr,N}$		1,5 h_{ef}				
Spacing (splitting failure) ¹⁾			$s_{cr,sp}$		180	240	280	340	480
Edge distance (splitting failure) ¹⁾			$c_{cr,sp}$		90	120	140	170	240
1) Intermediate values for $s_{cr,sp}$ and $c_{cr,sp}$ between concrete thickness $h_{min,2}$ and $h_{min,1}$ by linear interpolation 2) Based on concrete strength as cylinder strength 3) In absence of other national regulations									
fischer Bolt Anchor FBZ, FBZ A4								Annex C 1	
Performances Characteristic values of resistance under tension loads									

Table C2.1: Characteristic values of tension resistance for reduced anchorage depth

Size		FBZ, FBZ A4						
		M8	M10	M12	M16			
Steel failure for reduced anchorage depth								
Characteristic resistance	FBZ	$N_{Rk,s}$	[kN]	16,6	28,3	43,2	67,0	
	FBZ A4	$N_{Rk,s}$		17,0	29,0	44,3	70,6	
Partial factor for steel failure			$\gamma_{Ms}^{3)}$	[-]	1,5			
Pullout failure for reduced anchorage depth								
Effective anchorage depth for calculation			$h_{ef,red} \geq$	[mm]	35 ¹⁾	40	50	65
Characteristic resistance in cracked concrete C20/25			$N_{Rk,p}$	[kN]	4	7	10	15
Characteristic resistance in uncracked concrete 20/25			$N_{Rk,p}$		8	10	15	22
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete			ψ_c	C25/30	1,12			
				C30/37	1,22			
				C35/45	1,32			
				C40/50	1,41			
				C45/55	1,50			
				C50/60	1,58			
Installation sensitivity factor			γ_{inst}	[-]	1,0			
Concrete cone and splitting failure for reduced anchorage depth								
Effective anchorage depth			h_{ef}	[mm]	35 ¹⁾	40	50	65
Factor for uncracked concrete			$k_1 = k_{ucr,N}$	[-]	11 ²⁾			
Factor for cracked concrete			$k_1 = k_{cr,N}$		7,7 ²⁾			
Min. thickness of concrete member			$h_{min,3}$		80	100	140	
Characteristic spacing			$s_{cr,N}$		3 h_{ef}			
Characteristic edge distance			$c_{cr,N}$	[mm]	1,5 h_{ef}			
Spacing (splitting failure)			$s_{cr,sp}$		140	160	200	260
Edge distance (splitting failure)			$c_{cr,sp}$		70	80	100	130
¹⁾ Use restricted to anchoring of structural components which are statically indeterminate								
²⁾ Based on concrete strength as cylinder strength								
³⁾ In absence of other national regulations								
fischer Bolt Anchor FBZ, FBZ A4								Annex C 2
Performances Characteristic values of resistance under tension loads								

Table C3.1: Characteristic values of **shear** resistance for **standard and reduced anchorage depth**

Size				FBZ, FBZ A4				
				M8	M10	M12	M16	M20
Steel failure without lever arm for standard and reduced anchorage depth								
Characteristic resistance	FBZ	$V_{Rk,s}$	[kN]	12,0	21,4	30,6	55,0	70,0
	FBZ A4	$V_{Rk,s}$		16,1	26,5	37,4	57,2	
Partial factor for steel failure		$\gamma_{Ms}^{1)}$	[-]	1,25				
Factor for ductility		k_7		1,0				
Standard anchorage depth								
Steel failure with lever arm								
Characteristic bending resistance	FBZ	$M_{Rk,s}^0$	[Nm]	26	52	92	233	513
	FBZ A4	$M_{Rk,s}^0$		29	59	100	256	519
Partial factor for steel failure		$\gamma_{Ms}^{1)}$	[-]	1,25				
Factor for ductility		k_7		1,0				
Concrete pryout failure								
Factor for pryout failure		k_8	[-]	2,8	3,2		3,0	2,6
Concrete edge failure								
Effective embedment depth for calculation		l_f	[mm]	45	60	70	85	100
Outside diameter of a fastener		d_{nom}		8	10	12	16	20
Installation sensitivity factor		γ_{Inst}	[-]	1,0				
Reduced anchorage depth								
Steel failure with lever arm								
Characteristic bending resistance	FBZ	$M_{Rk,s}^0$	[Nm]	20	44	92	184	-
	FBZ A4	$M_{Rk,s}^0$		21	45	100	193	-
Partial factor for steel failure		$\gamma_{Ms}^{1)}$	[-]	1,25				
Factor for ductility		k_2		1,0				
Concrete pryout failure								
Factor for pryout failure		k_8	[-]	2,5	2,6	3,1	3,2	-
Concrete edge failure								
Effective embedment depth for calculation		l_f	[mm]	35	40	50	65	-
Outside diameter of a fastener		d_{nom}		8	10	12	16	-
1) In absence of other national regulations								
fischer Bolt Anchor FBZ, FBZ A4							Annex C 3	
Performances Characteristic values of resistance under shear loads								

Table C4.1: Characteristic values of **tension** resistance under **fire exposure**

Size		FBZ, FBZ A4				
		M8	M10	M12	M16	M20
$h_{ef} \geq$ [mm]		35 / 45	40 / 60	50 / 70	65 / 85	100
Characteristic resistance steel failure	R30	1,4	2,8	5,0	9,4	14,7
	R60	1,2	2,3	4,1	7,7	12,0
	R90	0,9	1,9	3,2	6,0	9,4
	R120	0,8	1,6	2,8	5,2	8,1
Characteristic resistance Concrete cone failure	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	R30	0,9 / 2,0	2,2 / 3,3	3,0 / 5,0	4,5 / 6,8	8,6
	R60	0,8 / 2,0				
	R90	0,5 / 2,0				
	R120	0,3 / 1,6	1,7 / 2,6	2,4 / 4,0	3,6 / 5,4	6,9

Table C4.2: Characteristic values of **shear** resistance under **fire exposure**

Size FBZ, FBZ A4			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]
M8	$h_{ef} \geq$	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
Size FBZ, FBZ A4			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]
M8	$h_{ef} \geq$	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

Table C4.3: Minimum spacings and minimum edge distances of anchors under **fire exposure** for **tension** and **shear** load

Size	FBZ, FBZ A4				
	M8	M10	M12	M16	M20
Spacing	Annex B3				
Edge distance	$c_{min} = 2 \cdot h_{ef}$, for fire exposure from more than one side $c_{min} \geq 300 \text{ mm}$				

fischer Bolt Anchor FBZ, FBZ A4	Annex C 4
Performances Characteristic values of resistance under fire exposure	

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

Size	FBZ, FBZ A4				
	M8	M10	M12	M16	M20
Displacement – factor for tensile load¹⁾					
δ_{N0} - factor in cracked concrete	0,22	0,12	0,09	0,08	0,07
$\delta_{N\infty}$ - factor [mm/kN]	0,78	0,40	0,19	0,09	
δ_{N0} - factor in uncracked concrete	0,07	0,05	0,06		0,05
$\delta_{N\infty}$ - factor	0,29	0,21	0,14	0,10	0,06

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

Size	FBZ				
	M8	M10	M12	M16	M20
Displacement – factor for shear load²⁾					
δ_{V0} - factor in cracked concrete [mm/kN]	0,35	0,37	0,27	0,10	0,09
$\delta_{V\infty}$ - factor	0,52	0,55	0,40	0,14	0,15
δ_{V0} - factor in uncracked concrete [mm/kN]	FBZ A4				
	0,23	0,19	0,18	0,10	0,11
	0,27	0,22	0,16	0,11	0,05

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 tension 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)

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Performances

Displacements under tension and shear loads

Annex C 5