

DÉCLARATION DES PERFORMANCES

DoP 0187

pour goujon d'ancrage fischer FBZ, FBZ R (fixation mécanique pour utilisation dans le béton)

FR

1. <u>Code d'identification unique du type de produit:</u>	DoP 0187		
2. <u>Usage(s) prévu(s):</u>	Fixation dans du béton fissuré ou non fissuré. Voir annexes, en particulier les annexes B1- B4		
3. <u>Fabricant:</u>	fischerwerke GmbH & Co. KG, Klaus-Fischer-Str. 1, 72178 Waldachtal, Allemagne		
4. <u>Mandataire:</u>	-		
5. <u>Système(s) d'évaluation et de vérification de la constance des performances:</u>	1		
6. <u>Document d'évaluation européen:</u>	EAD 330232-00-0601		
Evaluation Technique Européenne:	ETA-17/0624; 2020-04-28		
Organisme d'évaluation technique:	DIBt- Deutsches Institut für Bautechnik		
Organisme(s) notifié(s):	1343 MPA Darmstadt / 2873 TU Darmstadt		
7. <u>Performance(s) déclarée(s):</u>			
Résistance mécanique et stabilité (BWR 1)			
Résistance caractéristique à la charge de traction (charge statique et quasi-statique):	Résistance à la rupture de l'acier (charge de	Annexes C1, C2	E _s = 210 000 MPa
	Résistance à l'extraction glissement:	Annexes C1, C2	
	Résistance à la rupture du cône béton:	Annexes C1, C2	
	Robustesse:	Annexes C1, C2	
	Distance au bord et entraxe mini.:	Annexe B3	
	Distance au bord pour éviter la rupture par fendage sous charge:	Annexes C1, C2	
	Déplacements sous charge statique et quasi-statique:	Annexe C5	
	Résistance à la rupture de l'acier:	Annexe C3	
	Résistance à la rupture par effet de levier:	Annexe C3	
	Résistance à la rupture du béton en bord de dalle:	Annexe C3	
Résistance caractéristique à la charge de cisaillement (charge statique et quasi-statique):	Déplacements sous charge statique et quasi-statique:	Annexe C5	
	Durabilité:	Annexes A4, B1	
Résistance caractéristique et déplacements pour les catégories de performance sismique C1 et C2:	Résistance à la rupture de l'acier:	NPD	
	Résistance à l'extraction glissement :	NPD	
	0	NPD	
	Facteur espace annulaire :	NPD	
	Déplacements:	NPD	
Sécurité en cas d'incendie (BWR 2)			
Réaction au feu:	Classe (A1)		
Résistance au feu:	Résistance en cas d'incendie, rupture de l'acier	Annexe C4	
	Résistance en cas d'incendie, extraction glissement	Annexe C4	
	Résistance en cas d'incendie, rupture de l'acier	Annexe C4	



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

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

Signé pour le fabricant et en son nom par:

ppa. Thilo Prg

Thilo Pregartner, Dr.-Ing.
Tumlingen, 2020-05-12

i.V. P. Sch

Peter Schillinger, Dipl.-Ing.

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

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

Specific Part

1 Technical description of the product

The fischer Bolt Anchor FBZ is an anchor made of galvanised steel (FBZ) or made of stainless steel (FBZ R) 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 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, C 1 and C 2
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 3
Displacements (static and quasi-static loading)	See Annex C 5
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed
Durability	See Annex B 1

3.2 Safety in case of fire (BWR 2)

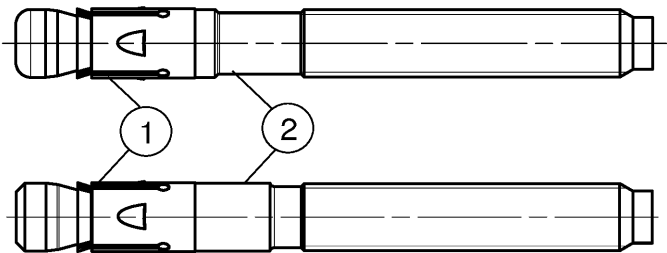
Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 4

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

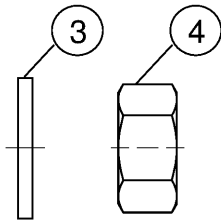
In accordance with the European Assessment Document EAD 330232-00-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

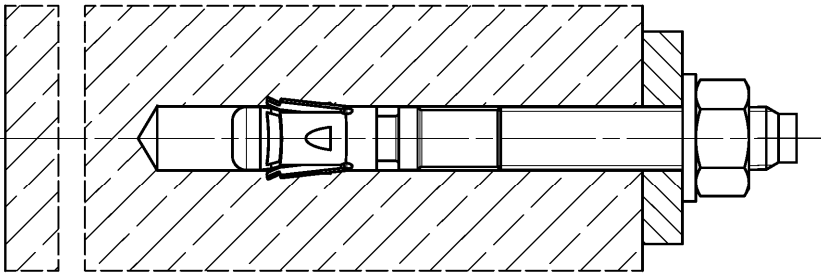
Cone bolt manufactured by cold - forming:



Cone bolt manufactured by turning:



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



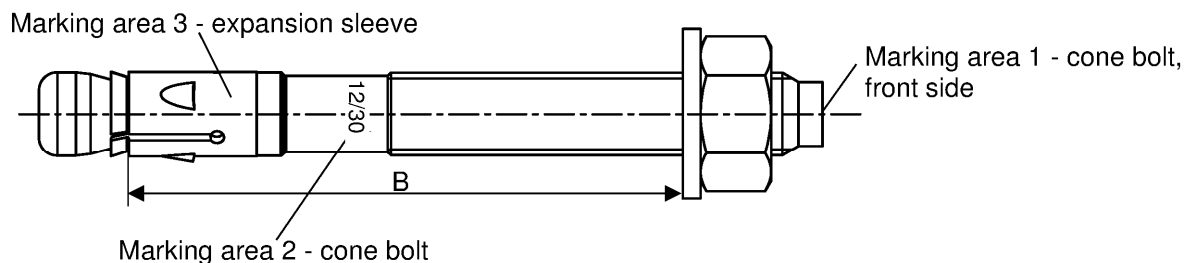
(Fig. not to scale)

fischer Bolt Anchor FBZ, FBZ R

Product description
Installed condition

Annex A 1

Product label and letter-code:



Product label, example:

 FBZ 12/30 R

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

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

FBZ: carbon steel, galvanized
FBZ R: 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 ≥ [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 ≥ [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 scale)

fischer Bolt Anchor FBZ, FBZ R

Product description
Product label and letter code

Annex A 2

Appendix 3/ 14

Product dimensions

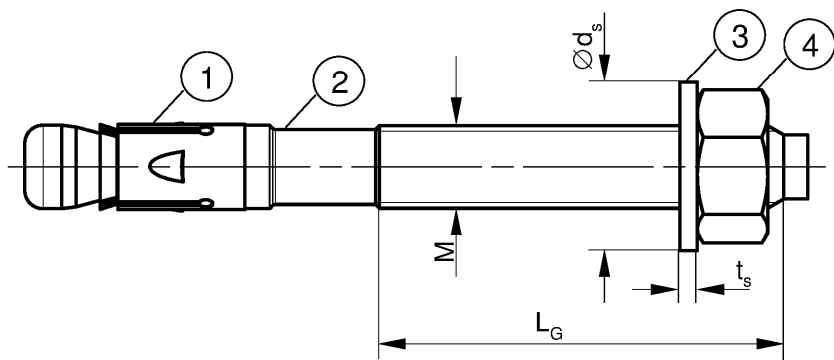


Table A3.1: Dimensions [mm]

Part	Designation		FBZ, FBZ R				
			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	
		$\varnothing d_s$					
		$\geq$	15	19	23	29	36
4	Hexagon nut	Wrench size	13	17	19	24	30

(Fig. not to scale)

fischer Bolt Anchor FBZ, FBZ R

Product description
Dimensions

Annex A 3

Table A4.1: Materials FBZ (ISO 4042:2018/Zn5/An(A2K))															
Part	Designation	Material													
1	Expansion sleeve	Cold strip, EN 10139:2016 or stainless steel EN 10088:2014													
2	Cone bolt	Cold form steel or free cutting steel													
3	Washer	Cold strip, EN 10139:2016													
4	Hexagon nut	Steel, property class min. 8, EN ISO 898-2:2012													
Table A4.2: Materials FBZ R <table> <tr> <th>Part</th><th>Designation</th><th>Material</th></tr> <tr> <td>1</td><td>Expansion sleeve</td><td rowspan="3">Stainless steel EN 10088:2014</td></tr> <tr> <td>2</td><td>Cone bolt</td></tr> <tr> <td>3</td><td>Washer</td></tr> <tr> <td>4</td><td>Hexagon nut</td><td>Stainless steel EN 10088:2014; ISO 3506-2:2018; property class – min. 70</td></tr> </table>			Part	Designation	Material	1	Expansion sleeve	Stainless steel EN 10088:2014	2	Cone bolt	3	Washer	4	Hexagon nut	Stainless steel EN 10088:2014; ISO 3506-2:2018; property class – min. 70
Part	Designation	Material													
1	Expansion sleeve	Stainless steel EN 10088:2014													
2	Cone bolt														
3	Washer														
4	Hexagon nut	Stainless steel EN 10088:2014; ISO 3506-2:2018; property class – min. 70													
fischer Bolt Anchor FBZ, FBZ R Product description Materials															
		Annex A 4 Appendix 5/ 14													

Specifications of intended use

Anchorage subject to:

Size	FBZ, FBZ R				
	M8	M10	M12	M16	M20
Static and quasi-static loads	✓				
Cracked and uncracked concrete					
Fire exposure					

Base materials:

- Compacted reinforced and unreinforced normal weight concrete without fibres (cracked and uncracked) according to EN 206-1:2013+A1:2016
- Strength classes C20/25 to C50/60 according to EN 206-1:2013+A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (FBZ, FBZ R)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (FBZ R)
 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 EN 1992-4:2018 and EOTA Technical Report TR 055
- For effective embedment depth $h_{ef} < 40$ mm only statically indeterminate fixings (e.g. light-weight suspended ceilings with internal exposure) are covered by the ETA

fischer Bolt Anchor FBZ, FBZ R

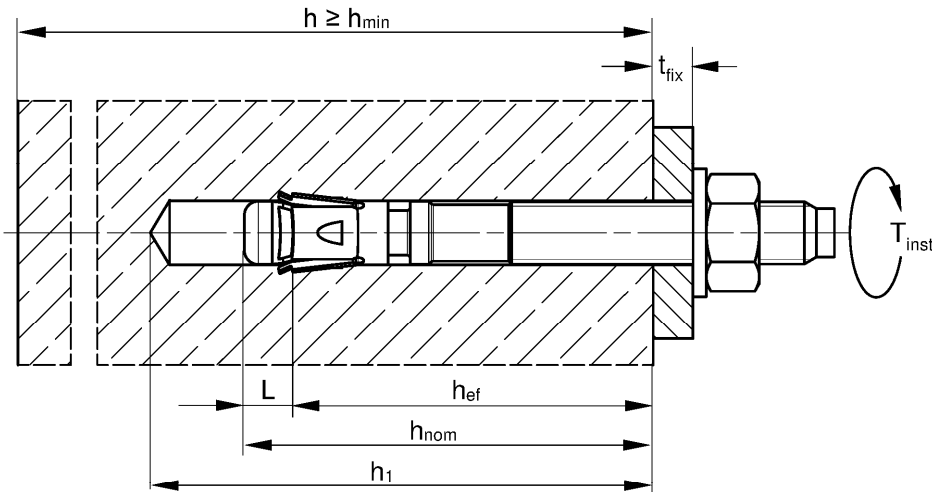
Intended Use
Specifications

Annex B 1

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Table B2.1: Installation parameters

Size	FBZ, FBZ R				
	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)
Existing $h_{ef} + L = h_{nom}$					
Depth of drill hole to deepest point $h_1 \geq$	$h_{nom} + 5$				$h_{nom} + 10$
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 scale)

fischer Bolt Anchor FBZ, FBZ R

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 R				
		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
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$ [mm]	50	60	70	95	180
		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 $\frac{c_{min}}{\text{for } s \geq}$ [mm]	40	45	55	65	85
		70	80	110	150	190
	Cracked and uncracked concrete					
	Minimum thickness of concrete member $h_{min,2}$ [mm]	80	100	120	140	160
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	35	40	50	80	125
		70	100	90	130	220
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$ [mm]	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 R			
		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
	Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$	45		55	65
		180		220	250
	Cracked concrete				
	Minimum spacing $\frac{s_{min}}{\text{for } c \geq}$ [mm]	40		50	65
	90		110	130	
Minimum edge distance $\frac{c_{min}}{\text{for } s \geq}$	45		55	65	
	180		220	250	

Intermediate values for s_{min} and c_{min} by linear interpolation

¹⁾ Only in anchoring structural components which are statically indeterminate

fischer Bolt Anchor FBZ, FBZ R

Intended Use

Minimum thickness of member, minimum spacing and edge distance

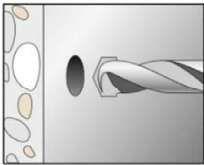
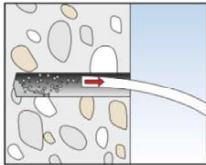
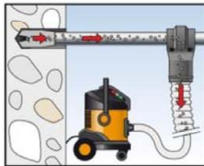
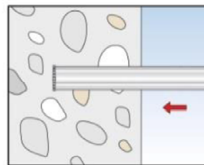
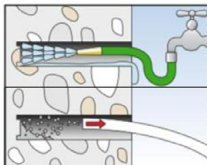
Annex B 3

Installation instructions:

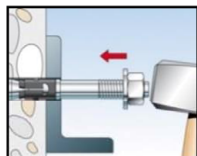
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Use of the anchor only as supplied by the manufacturer without exchanging the components of the anchor
- Checking before placing the anchor to 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
- 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

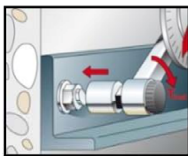
Types of drills and cleaning

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 $\geq$ drill $\varnothing 8$			
		1: Drill the hole	2: Clean the hole

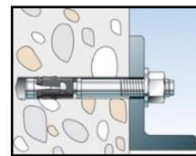
Installation instructions: Installation of the anchor



3: Set the fastener



4: Apply T_{inst}



5: Installed fastener

fischer Bolt Anchor FBZ, FBZ R

Intended Use

Installation instructions

Annex B 4

Table C1.1: Characteristic tension resistance for standard anchorage depth								
Size		FBZ, FBZ R						
		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 R			17,0	29,0	44,3	70,6	124,9
Partial factor for steel failure			γ _{Ms} ¹⁾	[-]				1,5
Pullout failure for standard anchorage depth								
Effective embedment depth for calculation		h _{ef,sta}	[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				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 factor			γ _{inst}	[-]				1,0
Concrete cone and splitting failure for standard anchorage depth in applications with concrete members of thickness ≥ 2x h _{ef,sta}								
Effective embedment depth		h _{ef,sta}	[mm]	45	60	70	85	100
Factor for uncracked concrete		k _{ucr,N}	[-]	11,0 ²⁾				
Factor for cracked concrete		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) ⁴⁾		s _{cr,sp}		140	180	210	260	370
Edge distance (splitting failure) ⁴⁾		c _{cr,sp}		70	90	105	130	185
Characteristic resistance to splitting		N ⁰ _{Rk,sp}		[kN]	min {N ⁰ _{Rk,c} ; N _{Rk,p} } ³⁾			
Concrete cone and splitting failure for standard anchorage depth in applications with concrete members of thickness ≥ 2x h _{ef,sta}								
Effective embedment depth		h _{ef,sta}	[mm]	45	60	70	85	100
Factor for uncracked concrete		k _{ucr,N}	[-]	11,0 ²⁾				
Factor for cracked concrete		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) ⁴⁾		s _{cr,sp}		180	240	280	340	480
Edge distance (splitting failure) ⁴⁾		c _{cr,sp}		90	120	140	170	240
Characteristic resistance to splitting		N ⁰ _{Rk,sp}		[kN]	min {N ⁰ _{Rk,c} ; N _{Rk,p} } ³⁾			
1) In absence of other national regulations								
2) Based on concrete strength as cylinder strength								
3) N ⁰ _{Rk,c} according to EN 1992-4:2018								
4) Intermediate values for s _{cr,sp} and c _{cr,sp} between concrete thickness h _{min,2} and h _{min,1} by linear interpolation								
fischer Bolt Anchor FBZ, FBZ R							Annex C 1	
Performances Characteristic values of resistance under tension loads								
							Appendix 10/ 14	

Table C2.1: Characteristic tension resistance for reduced anchorage depth							
Size		FBZ, FBZ R					
		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 R	$N_{Rk,s}$		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	C25/30		1,12				
	C30/37		1,22				
	C35/45		1,32				
	C40/50	ψ_c	1,41				
	C45/55		1,50				
	C50/60		1,58				
Installation factor			γ_{inst}	[-]			1,0
Concrete cone and splitting failure for reduced anchorage depth							
Effective anchorage depth	$h_{ef,red}$	[mm]	35 ¹⁾	40	50	65	
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11 ²⁾				
Factor for cracked concrete	$k_{cr,N}$		7,7 ²⁾				
Min. thickness of concrete member	$h_{min,3}$	[mm]	80		100	140	
Characteristic spacing	$s_{cr,N}$		3 h_{ef}				
Characteristic edge distance	$c_{cr,N}$		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	
Characteristic resistance to splitting			$N^0_{Rk,sp}$	[kN]			$\min \{N^0_{Rk,c}; N_{Rk,p}\}^{4)}$
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							
⁴⁾ $N^0_{Rk,c}$ according to EN 1992-4:2018							
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Table C3.1: Characteristic values of shear resistance for standard and reduced anchorage depth								
Size				FBZ, FBZ R				
				M8	M10	M12	M16	M20
Steel failure without lever arm for standard and reduced anchorage depth								
Characteristic resistance	FBZ	$V_{Rk,s}^0$	[kN]	12,0	21,4	30,6	55,0	70,0
	FBZ R	$V_{Rk,s}^0$		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 R	$M_{Rk,s}^0$		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
Reduced anchorage depth								
Steel failure with lever arm								
Characteristic bending resistance	FBZ	$M_{Rk,s}^0$	[Nm]	20	44	92	184	-
	FBZ R	$M_{Rk,s}^0$		21	45	100	193	-
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	[-]	2,5	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								
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Table C4.1: Characteristic values of tension resistance under fire exposure							
Size			FBZ, FBZ R				
			M8	M10	M12	M16	M20
h _{ef} ≥ [mm]			35 / 45	40 / 60	50 / 70	65 / 85	100
Characteristic resistance steel failure	N _{Rk,s,fi}	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	N _{Rk,c,fi}	R30 - R90	7,7 · h _{ef} ^{1,5} · (20) ^{0,5} · h _{ef} / 200 / 1000				
		R120	7,7 · h _{ef} ^{1,5} · (20) ^{0,5} · h _{ef} / 200 / 1000 · 0,8				
Characteristic resistance pullout failure	N _{Rk,p,fi}	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

Size FBZ, FBZ R		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} ≥	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 R		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} ≥	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

Concrete pryout failure according to EN 1992-4:2018

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

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

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Table C5.1: Displacements under static and quasi static tension loads					
Size	FBZ, FBZ R				
	M8	M10	M12	M16	M20
Displacement – factor for tensile load ¹⁾					
δ_{N0} - factor	0,22	0,12	0,09	0,08	0,07
$\delta_{N\infty}$ - factor	0,78	0,40	0,19	0,09	
δ_{N0} - factor	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 load ²⁾					
δ_{V0} - factor	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	0,23	0,19	0,18	0,10	0,11
$\delta_{V\infty}$ - factor	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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