



Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments



European Technical Assessment

ETA-23/0696 of 8 November 2023

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Deutsches Institut für Bautechnik

Injection system XWE for concrete

Bonded fastener for use in concrete

Tecfi S.p.A Strada Statale Appia, Km. 193 81050 PASTORANO (CE) ITALIEN

Manufacturing plant

This European Technical Assessment contains

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of Tecfi Plant 4

46 pages including 3 annexes which form an integral part of this assessment

330499-01-0601-v01, Edition 11/2020



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Specific Part

1 Technical description of the product

The "Injection system XWE for concrete" is a bonded anchor consisting of a mortar cartridge with injection mortar XWE and a steel element according to Annex A 3.

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 and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi- static loading)	See Annex C 1 to C 6, C 8 to C 11, C 13 to C 16, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 7, C 12, C 17
Displacements under short-term and long-term loading	See Annex C 18 to C 20
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 21 to C 28

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed



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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-v01 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 8 November 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock Head of Section

beglaubigt: Baderschneider

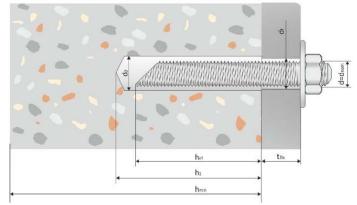
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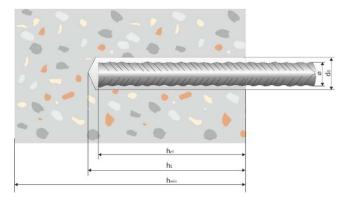


Installation threaded rod M8 up to M30

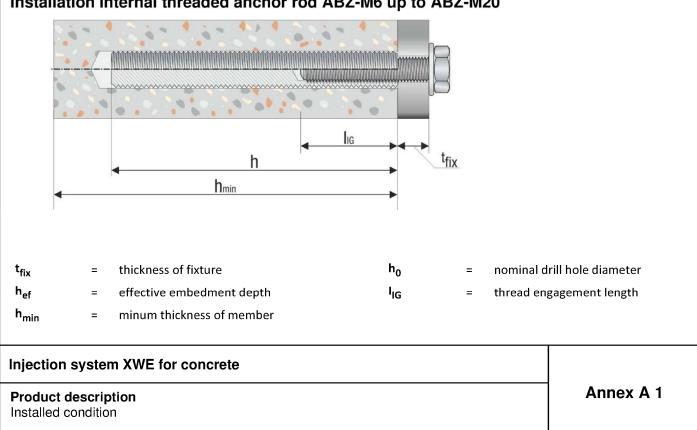
prepositioned installation or push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø32



Installation internal threaded anchor rod ABZ-M6 up to ABZ-M20

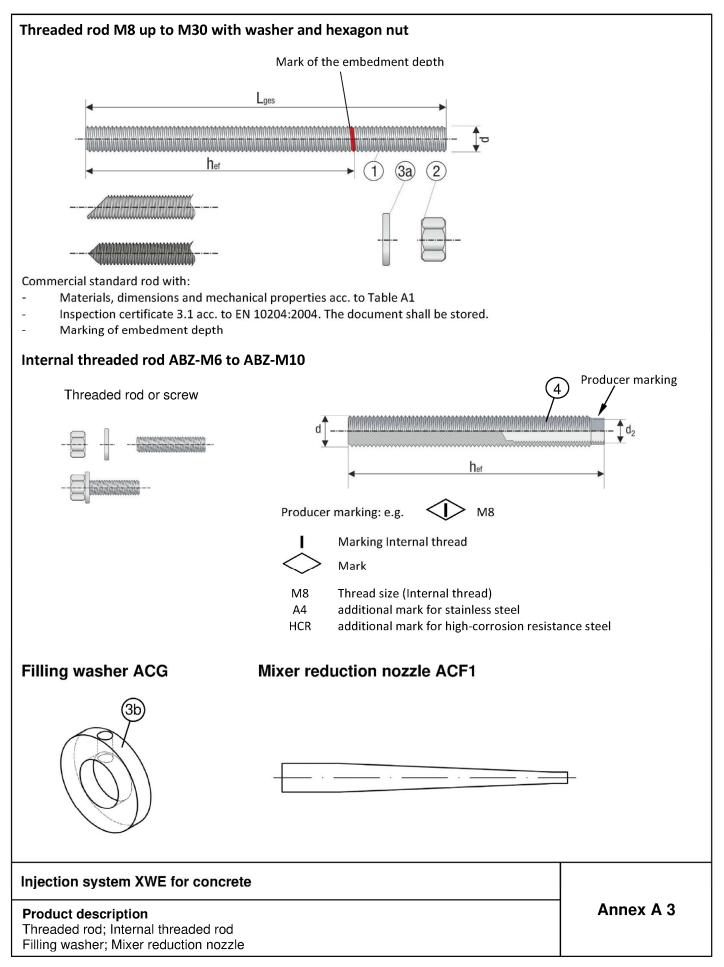


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Cartridge system	
Side-by-Side Cartridge: 440 ml, 585 ml and 1400 ml	
Static mixer DI03	
Static mixer Dios	
Piston plug ACE and mixer extension ACF	
Injection system XWE for concrete	
Product description Injection system	Annex A 2







<u></u>	ble A1: Mate	Material							
tee	l, zinc plated (Steel acc.		or EN 1	10263:2001)					
		μm acc. to EN ISO 4		-					
	10	•		009 and EN ISO 10684:2004+	AC:2009 or				
S	nerardized ≥ 4	5 μm acc. to EN ISO 1	7668:						
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture			
			16	$f_{uk} = 400 \text{ N/mm}^2$	f _{vk} = 240 N/mm ²	A ₅ > 8%			
				$f_{uk} = 400 \text{ N/mm}^2$	$f_{vk} = 320 \text{ N/mm}^2$	A ₅ > 8%			
L	Threaded rod	acc. to		$f_{uk} = 500 \text{ N/mm}^2$	$f_{vk} = 300 \text{ N/mm}^2$	A ₅ > 8%			
		EN ISO 898-1:2013		$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 400 \text{ N/mm}^2$	A ₅ > 8%			
				$f_{uk} = 800 \text{ N/mm}^2$	$f_{yk} = 640 \text{ N/mm}^2$				
					1	A ₅ ≥ 12% ³⁾			
		acc. to	4	for anchor rod class 4.6 or 4					
2	Hexagon nut	EN ISO 898-2:2012	5 8	for anchor rod class 5.6 or 5.8 for anchor rod class 8.8					
		Steel zinc plated bot		alvanised or sherardized					
3a	Washer		. –	SO 7089:2000, EN ISO 7093:2	2000 or EN ISO 7094:2000)				
ßb	Filling washer			alvanised or sherardized	,				
		Property class		Characteristic steel	Characteristic steel yield	Elongation at			
4	Internal threaded			ultimate tensile strength	strength	fracture			
+	anchor rod	acc. to		f _{uk} = 500 N/mm ²	$f_{yk} = 400 \text{ N/mm}^2$	A ₅ > 8%			
		EN ISO 898-1:2013	8.8	f _{uk} = 800 N/mm ²	f _{yk} = 640 N/mm²	A ₅ > 8%			
Stai	nless steel A4 (Material	1.4401 / 1.4404 / 1.457	1/1.4	4567 or 1.4541, acc. to EN 10 4362 or 1.4578, acc. to EN 10 5, acc. to EN 10088-1: 2014)					
ligi			1.450	Characteristic steel					
					I Characteristic steel vield	Elongation at			
		Property class		ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture			
1	Threaded rod ¹⁾⁴	Property class	50			-			
1	Threaded rod ¹⁾⁴⁾	acc. to		ultimate tensile strength	strength f _{yk} = 210 N/mm ²	fracture A ₅ ≥ 8%			
1	Threaded rod ¹⁾⁴⁾		70	ultimate tensile strength f _{uk} = 500 N/mm ² f _{uk} = 700 N/mm ²	strength f_{yk} = 210 N/mm ² f_{yk} = 450 N/mm ²	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$			
L	Threaded rod ¹⁾⁴⁾	acc. to	70 80	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$	strength f _{yk} = 210 N/mm ²	fracture A ₅ ≥ 8%			
		acc. to EN ISO 3506-1:2020 acc. to	70 80 50	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50	strength f_{yk} = 210 N/mm ² f_{yk} = 450 N/mm ²	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$			
	Threaded rod ¹⁾⁴⁾ Hexagon nut ¹⁾⁴⁾	acc. to EN ISO 3506-1:2020	70 80 50	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$	strength f_{yk} = 210 N/mm ² f_{yk} = 450 N/mm ²	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$			
2		acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529	70 80 50 70 80 1.430 1.440 or 1.4	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$, acc. to EN 10088-1:2014 a, acc. to EN 10088-1:2014 4	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$			
2 3a	Hexagon nut ¹⁾⁴⁾ Washer	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 50 7089:2000, EN ISO 7093:2	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$, acc. to EN 10088-1:2014 a, acc. to EN 10088-1:2014 4	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$			
2 3a	Hexagon nut ¹⁾⁴⁾	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006 Stainless steel A4, Hig	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 50 7089:2000, EN ISO 7093:2	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$, acc. to EN 10088-1:2014 a, acc. to EN 10088-1:2014 4	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$			
2 3a 3b	Hexagon nut ¹⁾⁴⁾ Washer	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 S0 7089:2000, EN ISO 7093:2 osion resistance steel Characteristic steel ultimate tensile strength	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ Elongation at fracture			
2 3a 3b	Hexagon nut ¹⁾⁴⁾ Washer Filling washer	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006 Stainless steel A4, Hig Property class acc. to	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS h corr	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 50 7089:2000, EN ISO 7093:2 osion resistance steel Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$	strength f_{yk} = 210 N/mm² f_{yk} = 450 N/mm² f_{yk} = 600 N/mm² .	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ Elongation at			
a Ba	Hexagon nut ¹⁾⁴⁾ Washer Filling washer Internal threaded	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006 Stainless steel A4, Hig Property class	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS h corr	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 S0 7089:2000, EN ISO 7093:2 osion resistance steel Characteristic steel ultimate tensile strength	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ Elongation at fracture			
2 3a 3b 1)P 2)fc 3)A	Hexagon nut ¹⁾⁴⁾ Washer Filling washer Internal threaded anchor rod ¹⁾²⁾	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006 Stainless steel A4, Hig Property class acc. to EN ISO 3506-1:2020 anchor rods and hexago class 50 n if no use for seismic pe	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS h corr 50 70 n nuts	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 SO 7089:2000, EN ISO 7093:2 osion resistance steel Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ up to M24 and Internal thread	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ Image: Second se			
2)fo 3)A 4)P	Hexagon nut ¹⁾⁴⁾ Washer Filling washer Internal threaded anchor rod ¹⁾²⁾ roperty class 70 or 80 for or ABZ-M20 only property 5 > 8% fracture elongation	acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:2006 Stainless steel A4, Hig Property class acc. to EN ISO 3506-1:2020 anchor rods and hexago class 50 n if no use for seismic pertainless steel A4 and HCl	70 80 50 70 80 1.430 1.440 or 1.4 5, EN IS h corr 50 70 n nuts	ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 70 for anchor rod class 80 7 / 1.4311 / 1.4567 or 1.4541 4 / 1.4571 / 1.4362 or 1.4578 565, acc. to EN 10088-1: 201 SO 7089:2000, EN ISO 7093:2 osion resistance steel Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ up to M24 and Internal thread	strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 1, acc. to EN 10088-1:2014 2, acc. to EN 10088-1:2014 4, acc. to EN 10088-1:2014 2000 or EN ISO 7094:2000) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ Ied anchor rods up to ABZ-M	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ Image: Second se			

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Rei	inforcing bar: ø8 up to ø32		
			, ¢
Min	imum value of related rip area f _{R,min} accordir	ng to EN 1992-1-1:2004+AC:2010	
Rib	height of the bar shall be in the range 0,05d \leq	≤ h _{rib} ≤ 0,07d	
(d:	Nominal diameter of the bar; h _{rib} : Rib height o	of the bar)	
Tal	ole A2: Materials Reinforcing ba	ar	
Part		Material	
Reba			
1	Reinforcing steel according to EN 1992 1 1:2004+AC:2010, Annex C	Bars and rebars from ring class B or C f_{yk} and k according to NDP or NCI according to E $f_{uk} = f_{tk} = k \cdot f_{yk}$	N 1992-1-1/NA
		- ·	
Inje	ection system XWE for concrete		
	oduct description terials reinforcing bar		Annex A 5



Specification of the intended use

Fasteners subject to (Static and quasi-static loads):

		Working life	50 years	Working life	100 years	
	Base material	uncracked concrete	cracked concrete	uncracked concrete	cracked concrete	
HDB: H	Hammer drilling Hammer drilling with nollow drill bit Compressed air drilling	M8 to M Ø8 to Ø ABZ -M6 to Ø	ð 32,	M8 to M30, Ø8 to Ø32, ABZ -M6 to ABZ -M20		
DD: D	Diamond drilling	M8 to M30, Ø8 to Ø32, ABZ -M6 to ABZ -M20	No performance assessed	M8 to M30, Ø8 to Ø32, ABZ -M6 to ABZ -M20	No performance assessed	
Temper	rature Range:	l: - 40 C 1 ll: - 40 C 1		l: - 40 C t ll: - 40 C t		

Fasteners subject to (seismic action):

		Performance Category C1	Performance Category C2
	Base material	Cracked and uncracked concrete	Cracked and uncracked concrete
HD: HDB: CD:	Hammer drilling Hammer drilling with hollow drill bit Compressed air drilling	M8 to M30, Ø8 to Ø32	M12 to M24
DD:	Diamond drilling	No performance assessed	No performance assessed
Temp	erature Range:	I: -40 C to $+40 \text{ C}^{1)}$ II: -40 C to $+72 \text{ C}^{2)}$	I: -40 C to $+40 \text{ C}^{1)}$ II: -40 C to $+72 \text{ C}^{2)}$

1) (max. long-term temperature +24°C and max. short-term temperature +40°C)

²⁾ (max. long-term temperature +50°C and max. short-term temperature +72°C)

Base materials:

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:
 - Stainless steel Stahl A2 according to Annex A 4, Table A1: CRC II
 - Stainless steel Stahl A4 according to Annex A 4, Table A1: CRC III
 - High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

Injection system XWE for concrete

Intended Use Specifications



Design:

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

Installation:

- Dry, wet concrete or flooded bore holes (not sea-water).
- Hole drilling by hammer (HD), hollow (HDB), compressed air (CD) or diamond drill mode (DD).
- Overhead installation allowed.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Injection system XWE for concrete

Intended Use Specifications (Continued)

Deutsches Institut für Bautechnik

	nstallatio	on parame	eters fo	or thre	aded			_				-			
Threaded rod						M8	M10		V12	M16	M20		M24	M27	M30
Diameter of element d = d			d = d _{nor}		n]	8	10		12	16	20	8	24	27	30
Nominal drill hole diar	meter		d	0 [mr	n]	10	12		14	18	22		28	30	35
Effective embedment	donth		h _{ef,mi}	n [mr	n]	60	60		70	80	90		96	108	120
Effective embedment	ueptii		h _{ef,ma}	ıx [mr	n]	160	200		240	320	400)	480	540	600
Diameter of	Prepositi	oned install	ation d _f	≤ [mr	n]	9	12		14	18	22		26	30	33
clearance hole in the fixture	Push t	hrough insta	llation o	l _f [mr	n]	12	14		16	20	24	8	30	33	40
Maximum installation	torque		max T _{in:}	st [Nr	n]	10	20	4	40 ¹⁾	60	100)	170	250	300
Minimum thickness of member			h _{mi}	n [mr	n]	h _{ef} + 30 mm ≥ 100 mm						h	_{⊇f} + 2d₀		
Minimum spacing			s _{mi}	n [mr	n]	40	50		60	75	95	8	115	125	140
Minimum edge distance			c _m i	n [mr	n]	35	40		45	50	60	2	65	75	80
1)Maximum installatio	on torque for	M12 with st	eel Grad	e 4.6 is 3	5 Nm										
Table B2:	Installatio	on parame	eters f	or rein	forcir	ng ba	r								
Reinforcing bar		-		Ø 81)	Ø 101)Ø1	2 ¹⁾ Ø	14	Ø 16	Ø 20	Ø	24 1)	Ø 251)	Ø 28	Ø 32
Diameter of element		d = d _{nom}	[mm]	8	10	12	2 1	L4	16	20	2	24	25	28	32
Nominal drill hole diar	neter	d _C	[mm]	10 12	12 14	4 14	16 :	18	20	25	30	32	30 32	35	40
	1	h _{ef,min}	[mm]	60	60	70) 7	75	80	90	9	96	100	112	128
Effective embedment	deptn	h _{ef,max}		160	200	24	0 2	80	320	400	4	80	500	560	640
Minimum thickness of	member	h _{mir}	[mm]	h _{ef} + 3	0 mm ≥ mm	: 100				h	ef + 2	2d ₀			•
Minimum spacing		S _{min}	[mm]	40	50	60) 7	70	75	95	1	20	120	130	150
Minimum edge distan	ce	c _{min}	[mm]	35	40	45	5 5	50	50	60	7	70	70	75	85
¹⁾ both nominal drill h	ole diameter	can be used													
Table B3:	Installati	on para	meter	s for l	nterr	nal tl	nread	ded	ancl	hor ro	d				
		-													

Internal threaded anchor rod			ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ -M16	ABZ -M20
Internal diameter of anchor rod	d ₂	[mm]	6	8	10	12	16	20
Outer diameter of anchor rod ¹⁾	d = d _{nom}	[mm]	10	12	16	20	24	30
Nominal drill hole diameter	d ₀	[mm]	12	14	18	22	28	35
Effective embedment denth	h _{ef,min}	[mm]	60	70	80	90	96	120
Effective embedment depth	h _{ef,max}	[mm]	200	240	320	400	480	600
Diameter of clearance hole in the fixture	d _f ≤	[mm]	7	9	12	14	18	22
Maximum installation torque	max T _{inst}	[Nm]	10	10	20	40	60	100
Thread engagement length min/max	l _{IG}	[mm]	8/20	8/20	10/25	12/30	16/32	20/40
Minimum thickness of member	h _{min}	[mm]	h _{ef} + 3 ≥ 100	80 mm) mm		h _{ef} + 2d ₀		
Minimum spacing	s _{min}	[mm]	50	60	75	95	115	140
Minimum edge distance	c _{min}	[mm]	40	45	50	60	65	80
¹⁾ With metric threads according to EN	¹)With metric threads according to EN 1993-1-8:2005+AC:2009							

Injection system XWE for concrete

Intended Use

Installation parameters



					ramun	HARABLE		0	D	
Threaded Rod	Reinforcing bar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD, DD	d _t Brush		d _{b,min} min. Brush - Ø	Piston plug	Installatio	n direction a piston plug	and use o
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		Ļ	\rightarrow	1
M8	8		10	ACD10	11,5	10,5			11	
M10	8 / 10	ABZ-M6	12	ACD12	13,5	12,5		NI		
M12	10 / 12	ABZ -M8	14	ACD14	15,5	14,5		No plug	required	
	12		16	ACD16	17,5	16,5				
M16	14	ABZ -M10	18	ACD18	20,0	18,5	ACE18			
	16		20	ACD20	22,0	20,5	ACE20			
M20		ABZ -M12	22	ACD22	24,0	22,5	ACE22			
	20		25	ACD25	27,0	25,5	ACE25	h _{ef} >	h _{ef} > 250 mm	
M24		ABZ -M16	28	ACD28	30,0	28,5	ACE28			all
M27	24 / 25		30	ACD30	31,8	30,5	ACE30	250 mm		
	24 / 25		32	ACD32	34,0	32,5	ACE32			
M30	28	ABZ -M20	35	ACD35	37,0	35,5	ACE35			
	32		40	ACD40	43,5	40,5	ACE40			
	low drill bit sys	stem		9	(The hollow drill drill bit and a cla of 253 hPa and a	iss M hoove	er with a mini	mum negative	e pressure
(min 6 bar)	<i>*</i>									
	www.	mm	nn.		I	Piston Plug AC	E			
(min 6 bar)	manned and the second sec		DH.		I	Piston Plug AC	E			

Injection system XWE for concrete

Intended Use Cleaning and installation tools

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English translation prepared by DIBt



Table B5:	Workin	g and curing ti	me	
Temper	ature in base	ematerial	Maximum working time	Minimum curing time ¹⁾
	Т		t _{work}	t _{cure}
+ 0 °C	to	+ 4 °C	90 min	144 h
+ 5 °C	to	+ 9 °C	80 min	48 h
+ 10 °C	to	+ 14 °C	60 min	28 h
+ 15 °C	to	+ 19 °C	40 min	18 h
+ 20 °C	to	+ 24 °C	30 min	12 h
+ 25 °C	to	+ 34 °C	12 min	9 h
+ 35 °C	to	+ 39 °C	8 min	6 h
	+ 40 °C		8 min	4 h
Cart	ridge temper	ature	+5°C to	р +40°С

 The minimum curing time is only valid for dry base material. In wet base material the curing time must be doubled.

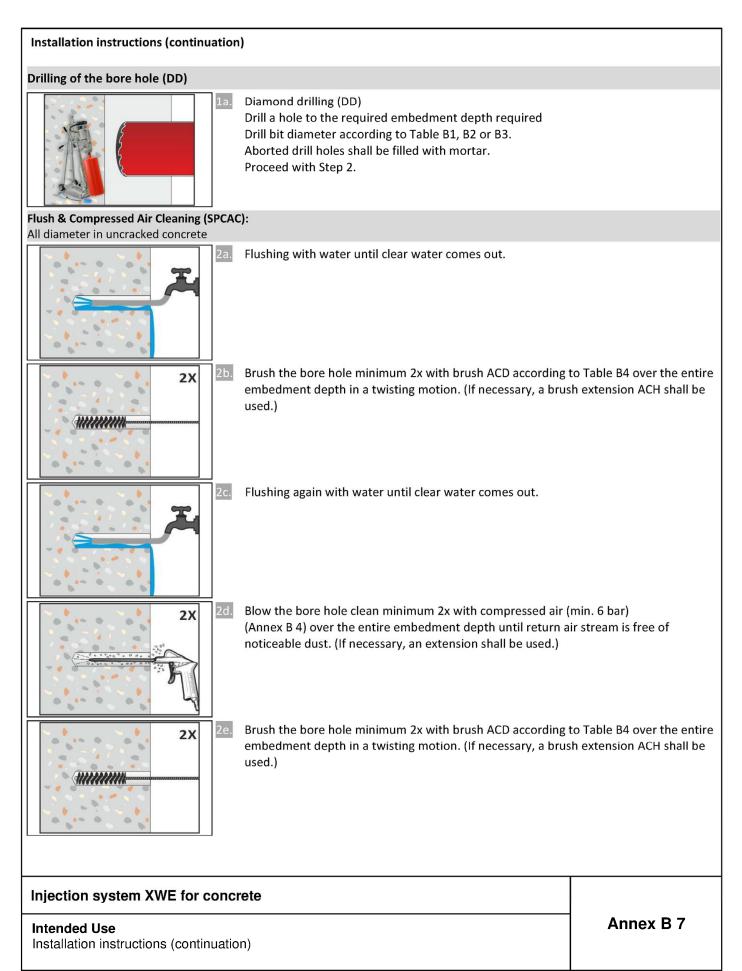
Injection system XWE for concrete

Intended Use Working time and curing time



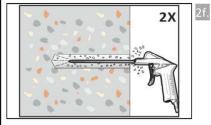
Drilling of the bore hole (HD, HDE	3, CD)		
•	1a.	Hammer drilling (HD) / Compressed air drilling (CD) Drill a hole to the required embedment depth. Drill bit diameter according to Table B1, B2 or B3. Aborted drill holes shall be filled with mortar. Proceed with Step 2.Proceed with Step 2.	
	1b.	Hollow drill bit system (HDB) (see Annex B 4) Drill a hole to the required embedment depth. Drill bit diameter according to Table B1, B2 or B3. The hollow drilling system removes the dust and cleans the B Proceed with Step 3. tention! Standing water in the bore hole must be rem	
Compressed Air Cleaning (CAC):	ماره ما		
All diameter in cracked and uncrace	2a.	concrete Blow the bore hole clean minimum 2x with compressed air ((Annex B 4) over the entire embedment depth until return a noticeable dust. (If necessary, an extension shall be used.)	-
2X	2b.	Brush the bore hole minimum 2x with brush ACD according tembedment depth in a twisting motion. (If necessary, a brust used.)	
2X	2c.	Finally blow the bore hole clean minimum 2x with compress B 4) over the entire embedment depth until return air strear dust. (If necessary, an extension shall be used.)	
		against re-contamination in an appropriate way, lirectly before dispensing the mortar. In-flowing water must	not contaminate the bore





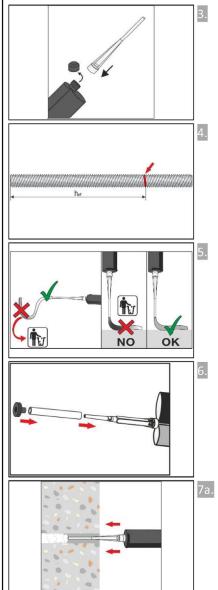


Installation instructions (continuation)



Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.



Screw on static-mixing nozzle and load the cartridge into an appropriate dispensing tool.

For every working interruption longer than the maximum working time t_{work} (Annex B 5) as well as for new cartridges, a new static-mixer shall be used.

Mark embedment depth on the anchor rod. The anchor rod shall be free of dirt, grease, oil or other foreign material.

Not proper mixed mortar is not sufficient for fastening. Dispense and discard mortar until an uniform grey or red colour is shown (at least 3 full strokes).

Piston plugs ACE and mixer nozzle extensions ACF shall be used according to Table B4 for the following applications:

- Horizontal and vertical downwards direction: Drill bit-Ø $d_0 \ge 18$ mm and embedment depth $h_{ef} > 250$ mm
- Vertical upwards direction: Drill bit- $\emptyset d_0 \ge 18 \text{ mm}$

Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.

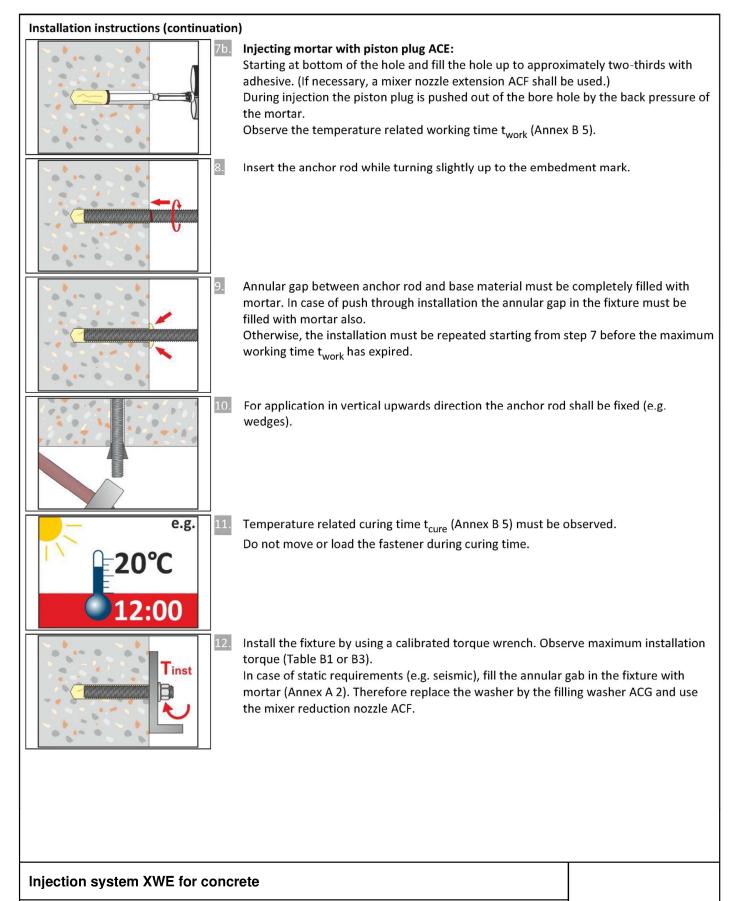
Injecting mortar without piston plug ACE:

Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.) Slowly withdraw of the static mixing nozzle avoid creating air pockets Observe the temperature related working time t_{work} (Annex B 5).

Injection system XWE for concrete

Intended Use Installation instructions (continuation)





Intended Use Installation instructions (continuation)



Th	readed rod			M8	M10	M12	M16	M20	M24	M27	M30
Cr	oss section area	A _s	[mm ²]	36,6	58	84,3	157	245	353	459	561
Ch	aracteristic tension resistance, Steel failure ¹⁾	201									
Ste	el, Property class 4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Ste	el, Property class 5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
Ste	el, Property class 8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
Sta	inless steel A2, A4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281
Sta	inless steel A2, A4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)
Sta	inless steel A4 and HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)
Ch	aracteristic tension resistance, Partial factor ²	2)									
Ste	el, Property class 4.6 and 5.6	γ _{Ms,N}	[-]				2,0)			
Ste	el, Property class 4.8, 5.8 and 8.8	γ _{Ms,N}	[-]				1,5	5			
Sta	inless steel A2, A4 and HCR, class 50	γ _{Ms,N}	[-]				2,8	6			
Sta	inless steel A2, A4 and HCR, class 70	γ _{Ms,N}	[-]				1,8	7			
Sta	inless steel A4 and HCR, class 80	γ _{Ms,N}	[-]				1,6	5			
Ch	aracteristic shear resistance, Steel failure ¹⁾		L							I	
~	Steel, Property class 4.6 and 4.8	V ⁰ _{Rk,s}	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
arm	Steel, Property class 5.6 and 5.8	V ⁰ _{Rk,s}	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
ever	Steel, Property class 8.8	V ⁰ _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
out	Stainless steel A2, A4 and HCR, class 50	V ⁰ _{Rk,s}	[kN]	9	15	21	39	61	88	115	140
Without lever	Stainless steel A2, A4 and HCR, class 70	V ⁰ _{Rk,s}	[kN]	13	20	30	55	86	124	_3)	_3)
>	Stainless steel A4 and HCR, class 80	V ⁰ _{Rk,s}	[kN]	15	23	34	63	98	141	_3)	_3)
	Steel, Property class 4.6 and 4.8	M ⁰ _{Rk,s}	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900
E	Steel, Property class 5.6 and 5.8	M ⁰ _{Rk,s}	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123
er arm	Steel, Property class 8.8	M ⁰ _{Rk,s}	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
lever	Stainlass staal A2 A4 and HCB class E0	M ⁰ _{Rk,s}	[Nm]	19	37	66	167	325	561	832	1125
With	Stainless steel A2, A4 and HCR, class 50 Stainless steel A2, A4 and HCR, class 70	M ⁰ _{Rk,s}	[Nm]	26	52	92	232	454	784	_3)	_3)
	Stainless steel A4 and HCR, class 80	M ⁰ _{Rk,s}	[Nm]	30	59	105	266	519	896	_3)	_3)
C L		Rk,s		50	55	105	200	515	850	/	/
	aracteristic shear resistance, Partial factor ²⁾ eel, Property class 4.6 and 5.6	Vacad	[]				1.6	7			
	el, Property class 4.8, 5.8 and 8.8	Y _{Ms,V}	[-]				1,6 1,2				
	inless steel A2, A4 and HCR, class 50	Y _{Ms,V}	[-]				2,3				
	inless steel A2, A4 and HCR, class 30	Y _{Ms,V}	[-]				1,5				
_	inless steel A2, A4 and HCR, class 70	γ _{Ms,V} γ _{Ms,V}	[-]				1,3				
	Values are only valid for the given stress area A _s . hot-dip galvanised threaded rods according to E in absence of national regulation	Values in bra	ackets a		r undersiz	ed threa			aller stre	ess area	A _s for

Characteristic values for steel tension resistance and steel shear resistance of threaded rods



Table C2:Characteristic values of tension loads under static and quasi-static actionfor a working life of 50 and 100 years

E				All Factors and stars
Fastener				All Fastener type and sizes
Concrete cone fail	ure			
Uncracked concret	e	k _{ucr,N}	[-]	11,0
Cracked concrete		k _{cr,N}	[-]	7,7
Edge distance		c _{cr,N}	[mm]	1,5 h _{ef}
Axial distance		s _{cr,N}	[mm]	2 c _{cr,N}
Splitting				
	h/h _{ef} ≥2,0			1,0 h _{ef}
Edge distance	2,0 > h/h _{ef} > 1,3	C _{cr,sp}	[mm]	$2 \cdot h_{ef} \left(2.5 - \frac{h}{h_{ef}} \right)$
	h/h _{ef} ≤ 1,3			2,4 h _{ef}
Axial distance		s _{cr,sp}	[mm]	2 c _{cr,sp}

Injection system XWE for concrete

Performances

Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years

Annex C 2



	Characteristic value life of 50 years	s of tension l	oads und	er stat	tic and	l quas	i-stati	c actio	on for	a wor	king
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure			1								
Characteristic tension	resistance	N _{Rk,s}	[kN]			A _s •	f _{uk} (or s	ee Tabl	e C1)		
Partial factor		γ _{Ms,N}	[-]				see Ta	ble C1			
Combined pull-out an	d concrete failure										
Characteristic bond re	esistance in uncracked cor	ncrete C20/25 in	hammer dri	lled hol	es (HD)	and cor	npresse	ed air dr	illed ho	les (CD)	
I: 40°C/24°C	and	τ _{Rk,ucr}	[N/mm²]	20	20	19	19	18	17	16	16
u: 72°C/50°C	flooded bore hole			15	15	15	14	13	13	12	12
Characteristic bond re	sistance in uncracked cor	ncrete C20/25 in	hammer dri	lled hol	es with	hollow	drill bit	(HDB)			
ຸຍ I: 40°C/24°C	2			17	16	16	16	15	14	14	13
5	Drv. wet concrete			14	14	14	13	13	12	12	11
II: 72°C/50°C		^τ Rk,ucr	[N/mm ²]	16	16	16	15	15	14	14	13
II: 72°C/50°C				14	14	14	13	13	12	12	11
11. 72 6,50 6	esistance in cracked concr	 	mmer drille								
Contraction of the second se	with hollow drill bit (HDB			unoies	(110), 0	ompres	seu all	urmeur		b) and i	
	_		[N] /2]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
I: 40°C/24°C	flooded bore hole	^T Rk,cr	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
	_s in cracked and uncracke es with hollow drill bit (HI		25 in hamm	er drille	d holes	(HD), co	ompres	sed air o	drilled h	oles (CI	D) and
I: 40°C/24°C	Dry, wet concrete	Ψ ⁰ sus	[-]				0,	80			
₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩	flooded bore hole	Ψ sus	[-]				0,	68			
Increasing factors for	concrete	Ψc	[-]				$(f_{ck}/)$	20) ^{0,1}			
Characteristic bond re	esistance depending on	τ _{Rk,ucr} =				ψ	c ^{•τ} Rk,u	lcr,(C20/2	25)		
the concrete strength		τ _{Rk,cr} =				ų	$\tau_c \cdot \tau_{Rk,i}$	cr,(C20/2	5)		
Concrete cone failure		,							- /		
Relevant parameter							see Ta	ble C2			
Splitting											
Relevant parameter							see Ta	ble C2			
Installation factor	 Permana acutorez concorte. 	1	T	1							
for dry and wet concre		- Y _{inst}	[-]					,0			
for flooded bore hole	(HD; HDB, CD)						1	,2			
Injection system	NXWE for concrete										
	ues of tension loads u of 50 years (threaded r		l quasi-stat	tic actio	on				Anne	ex C 3	}



Table C4:		cteristic values 100 years	s of tension l	oads und	er stat	tic and	quas	i-stati	c actio	on for	a wor	king
Threaded roo	d				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure			37.50						2014 C 1 1 1			
Characteristic	c tension resista	ince	N _{Rk,s}	[kN]			A _s •	f _{uk} (or s	ee Tabl	e C1)		
Partial factor			Y _{Ms,N}	[-]				see Ta	able C1			
	ull-out and conc			A. 12		2				10.00 10 00 0		
	c bond resistanc	e in uncracked con	crete C20/25 in	hammer dri	lled hol	es (HD)	and co	npresse	ed air dr	illed ho	les (CD)	
Temperature Temperature 1 :1 2 :1	10°C/24°C	Dry, wet concrete and flooded bore	τ _{Rk,ucr,100}	[N/mm²]	20	20	19	19	18	17	16	16
	′2°C/50°C	hole			15	15	15	14	13	13	12	12
Characteristic	c bond resistanc	e in uncracked con	crete C20/25 in	hammer dri	lled hol	es with	hollow	drill bit	(HDB)			
დ I: 4	10°C/24°C				17	16	16	16	15	14	14	13
Temperature range 7 :: 7 :: 7 ::	2°C/50°C	Dry, wet concrete			14	14	14	13	13	12	12	11
range ::	10°C/24°C	flooded bore	τ _{Rk,ucr,100}	[N/mm ²]	16	16	16	15	15	14	14	13
	/2°C/50°C	hole			14	14	14	13	13	12	12	11
	1.5	e in cracked concre	ete C20/25 in ha	mmer drille								
		ollow drill bit (HDB)			u norco	(51110100	o c u un	unneur		, and 1	
Temperature range 2.:II 2	10°C/24°C	Dry, wet concrete and		[N] /21	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Tempe I: 1	72°C/50°C	flooded bore hole	^T Rk,cr,100	[N/mm ²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
	/	cracked and uncra with hollow drill bi		20/25 in hai	mmer d	rilled hc	les (HD), comp	oressed	air drille	ed holes	(CD)
Temperature range 2. :II	10°C/24°C	Dry, wet concrete and		1				0,	80			
Tempe II: 7	72°C/50°C	flooded bore hole	$\Psi^0_{sus,100}$	[-]				0,	68			
Increasing fac	ctors for concre	te	Ψc	[-]				(f $_{\rm ck}$ /	20) ^{0,1}			
Characteristic	c bond resistand	e depending on	τ _{Rk,ucr,100} =				Ψ_{c}	• τ _{Rk,ucr}	,100,(C20)/25)		
	strength class	, 0	$\tau_{\rm Rk,cr,100} =$						100,(C20			
Concrete con	ne failure		111,01,1200						100)(020	/ /		
Relevant para	ameter							see Ta	able C2			
Splitting												
Relevant para								see Ta	able C2			
Installation fa			I		ſ							
	vet concrete (HD		γ _{inst}	[-]				0	.,0			
for flooded b	ore hole (HD; HI	DB, CD)						1	,2			
Injection	system XWE	for concrete										
Performa	nces								1	Anne	ex C 4	
		tension loads un years (threaded		quasi-stat	ic actio	on						



Table C5:Characteristilife of 50 yea		ension lo	oads und	er stat	ic and	l quas	i-stati	c actio	on for	a wor	king		
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30		
Steel failure													
Characteristic tension resistance	N _{Rk,s}		[kN]	-		A _s • 1	f _{uk} (or s		e C1)				
Partial factor	Y _{Ms,N}		[-]				see Ta	ble C1					
Combined pull-out and concrete failu													
Characteristic bond resistance in uncra	acked concrete (C20/25 in	diamond dri	illed hol	es (DD)								
L: 40°C/24°C Dry, wet and E L: 40°C/24°C II: 72°C/50°C flooded hole	concrete bore	r	[N/mm²]	15 12	14	14	13 10	12 9,5	12 9,5	11 9,0	11 9,0		
Reduction factor ψ^0_{sus} in uncracked co	oncrete C20/25	in diamon	d drilled hol	holes (DD)									
a)	concrete		[-]				0, 0,	77 72					
Increasing factors for concrete	Ψc		[-]	(f _{ck} / 20) ^{0,2}									
Characteristic bond resistance depend the concrete strength class	ling on _{T_{Rk,uc}}	.r =				ψ	c•τ _{Rk,u}		25)				
Concrete cone failure													
Relevant parameter				5			see Ta	ble C2					
Splitting													
Relevant parameter							see Ta	ble C2					
Installation factor													
for dry and wet concrete (DD)	γ _{inst}		[-]		1.2		1	,0					
for flooded bore hole (DD)					1,2				1,4				
Injection system XWE for co Performances Characteristic values of tension for a working life of 50 years (the	loads under s	tatic and	quasi-stat	ic actic	on				Anne	ex C 5			



	acteristic values f 100 years	s of tension l	oads und	er stat	ic and	l quas	i-stati	c actio	on for	a wor	king
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure		200									
Characteristic tension resista	ance	N _{Rk,s}	[kN]			A _s • 1	f _{uk} (or s	ee Tabl	e C1)		
Partial factor		γ _{Ms,N}	[-]				see Ta	ble C1			
Combined pull-out and cond					<i></i>						
Characteristic bond resistand	ce in uncracked con	crete C20/25 in	diamond dri	lled ho	es (DD)						
l: 40°C/24°C i: 40°C/24°C i: 40°C/24°C i: 72°C/50°C i: 72°C/50°C	Dry, wet concrete and flooded bore hole	τ _{Rk,ucr,100}	[N/mm²]	15	14	14	13 10	12 9,5	12 9,0	11 8,5	11 8,5
	-				01102-00			- / -		-/-	-/-
Reduction factor $\psi^0_{sus,100}$ in	uncracked concret	te C20/25 in diar	nond drilled	holes (DD)						
E I: 40°C/24°C H: 72°C/50°C	Dry, wet concrete and flooded bore hole	$\psi^0_{sus,100}$	[-]					73			
Increasing factors for concre		Ψc	[-]				(f _{ck} /	20) ^{0,2}			
Characteristic bond resistand the concrete strength class	ce depending on	τ _{Rk,ucr,100} =				Ψ_{c}	τ _{Rk,ucr}	,100,(C20)/25)		
Concrete cone failure		1									
Relevant parameter							see Ta	ble C2			
Splitting											
Relevant parameter							see Ta	ble C2			
Installation factor for dry and wet concrete (DD	ນ						1	,0			
for flooded bore hole (DD)		Yinst	[-]		1,2			,0	1,4		
Injection system XWI	E for concrete										
Performances Characteristic values of for a working life of 100			quasi-stat	ic actio	on				Anne	ex C 6	



Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm										
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	V ⁰ _{Rk,s}	[kN]			0,6	• A _s • f _{uk}	(or see ⁻	Table C1)		
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V ⁰ _{Rk,s}	[kN]			0,5	• A _s • f _{uk}	(or see ⁻	Table C1)		
Partial factor	γ _{Ms,V}	[-]				see	Table C1			
Ductility factor	k ₇	[-]					1,0			
Steel failure with lever arm										
Characteristic bending moment	M ⁰ _{Rk,s}	[Nm]			1,2 •	W _{el} • f _u	k (or see	Table C1)	
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ _{Ms,V}	[-]				see	Table C1			
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γ _{inst}	[-]					1,0			
Concrete edge failure	1									
Effective length of fastener	۱ _f	[mm]		r	min(h _{ef} ; 1	.2 • d _{nom})		min(h _{ef} ;	300mm
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γ _{inst}	[-]					1,0			

Performances

Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (threaded rod)

Annex C 7



Table C8:	Characteri life of 50 y	istic values o /ears	f tensio	n loads u	under sta	itic and o	quasi-sta	tic actio	n for a w	vorking
Internal threaded	anchor rods				ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ-M16	ABZ-M20
Steel failure ¹⁾										
Characteristic tens	ion resistance,	5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength clas	SS	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor, stren	ngth class 5.8 an	id 8.8	۲Ms,N	[-]			1	,5		
Characteristic tens A4 and HCR, Streng		Stainless Steel	N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor			YMs,N	[-]			1,87			2,86
Combined pull-out	t and concrete o	one failure	•	•	•					
Characteristic bond	d resistance in u	ncracked concre	te C20/25	in hamme	r drilled ho	oles (HD) ar	nd compres	sed air dri	led holes (CD)
	40°C/24°C	Dry, wet			20	19	19	18	17	16
Temperature — range II:	72°C/50°C	concrete and flooded bore hole	τ _{Rk,ucr}	[N/mm²]	15	15	14	13	13	12
Characteristic bond	d resistance in u	ncracked concre	te C20/25	in hamme	r drilled ho	les with h	ollow drill b	it (HDB)		
	40°C/24°C	Dry, wet			16	16	16	15	14	13
Temperature <u>II:</u>		concrete	τ _{Rk,ucr}	[N/mm ²]	14	14	13	13	12	11
	40°C/24°C	flooded bore	, uci	1	16	16	15	15	14	13
	72°C/50°C	hole	C20 /25 in		14	14	13	13	12	11
Characteristic bond hammer drilled ho		drill bit (HDB)	C20/25 In	nammer d		s (HD), com	ipressed al	r arillea no	nes (CD) ar	na in
Temperature	40°C/24°C	Dry, wet concrete and	τ _{Rk,cr}	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5
range II:	72°C/50°C	flooded bore hole			6,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ in hammer drilled ${\rm I}$	000		concrete C	20/25 in h	ammer dril	led holes (HD), compr	essed air c	Irilled holes	s (CD) and
l:	40°C/24°C	Dry, wet					0,	80		
Temperature range II:	72°C/50°C	concrete and flooded bore hole	Ψ ⁰ sus	[-]			0,	68		
Increasing factors f	for concrete		Ψc	[-]			(f _{ck} /	20) ^{0,1}		
Characteristic bond	d resistance den	ending on the		τ _{Rk,ucr} =			Ψ c •τ _{Rk.u}	cr,(C20/25)		
concrete strength o				τ _{Rk,cr} =				cr,(C20/25)		
Concrete cone fail	ure							,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
Relevant paramete	er						see Ta	ble C2		
Splitting failure										
Relevant paramete							see Ta	ble C2		
Installation factor	Normal State	2.14			r					
for dry and wet con			γ _{inst}	[-]				,0		
for flooded bore ho				opproprio	to motorial	and prop		,2 f the interr	al throada	drad
 Fastenings (inc The characteri For IG-M20 str 	istic tension res	istance for steel	failure is	appropria valid for th	te material le internal	threaded r	od and the	fastening	element.	a roa.
Injection system	em XWE for	concrete								
Performances Characteristic v for a working lif	alues of tensi				static act	ion		/	Annex (28



Table C9:	Character life of 100	ristic values o) years	of tension	loads ur	nder stat	ic and q	uasi-sta	tic actio	n for a w	orking
Internal thread	led anchor rods				ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ-M16	ABZ-M20
Steel failure ¹⁾			-	-						
Characteristic t	ension resistance,	5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength	class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor, s	trength class 5.8 ai	nd 8.8	۲Ms,N	[-]			1	,5		
PORTON CONTRACTOR CONTRACTOR PROVIDENT TO CONTRACTOR CONTRACTOR	ension resistance, rength class 70 ²⁾	Stainless Steel	N _{Rk,s}	[kN]	[kN]	26	41	59	110	124
Partial factor			۲ _{Ms} ,N	[-]			1,87			2,86
Combined pull-	out and concrete	cone failure								
Characteristic b	ond resistance in u	uncracked concre	ete C20/25 ir	hammer	drilled hole	es (HD) an	d compres	sed air dril	led holes (CD)
Temperature	I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr,100}	[N/mm²]	20	19	19	18	17	16
range	II: 72°C/50°C	flooded bore hole			15	15	14	13	13	12
Characteristic b	ond resistance in u	1	ete C20/25 ir	n hammer						40
-	I: 40°C/24°C	Dry, wet			16	16	16	15	14	13
	II: 72°C/50°C I: 40°C/24°C	concrete	τ _{Rk,ucr,100}	[N/mm ²]	14	14	13	13	12	11
range	II: 72°C/50°C	flooded bore hole			16 14	16 14	15 13	15 13	14 12	13 11
Characteristic h	ond resistance in o		C20/25 in h	ammer dri						
10 DOI: 1000000000000000000000000000000000000	holes with hollow	drill bit (HDB)						unneu no		
Temperature	I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,cr,100}	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5
range	II: 72°C/50°C	flooded bore hole			5,5	6,5	6,5	6,5	6,5	6,5
Reduction facto	or $\psi^0_{sus,100}$ in cra	cked and uncrac	ked concrete	e C20/25 ir	hammer	drilled hole	es (HD), co	mpressed	air drilled ł	noles (CD)
	drilled holes with									
	I: 40°C/24°C	Dry, wet					0,	80		
Temperature	89. 	concrete and flooded bore	$\Psi^0_{sus,100}$	[-]						
range	II: 72°C/50°C	hole					0,	68		
Increasing facto	ors for concrete		Ψc	[-]			(f _{ck} /	20) ^{0,1}		
Characteristic b	ond resistance de	pending on the	τ _R	k,ucr,100 =		1	Ψc ^{•τ} Rk,ucr	,100,(C20/2	5)	
concrete streng	gth class		τ	Rk,cr,100 =			Ψc ^{•τ} Rk,cr,	100,(C20/25	5)	
Concrete cone	failure									
Relevant param	neter						see Ta	able C2		
Splitting failure	•									
Relevant param							see Ta	able C2		
Installation fac			1							
	concrete (HD; HD		Yinst	[-]				,0		
	e hole (HD; HDB, C							,2		
The charac	(incl. nut and was steristic tension res 20 strength class	sistance for stee								d rod.
Injection sy	ystem XWE for	concrete								
	ces ic values of tens g life of 100 year				tatic actic	n			Annex C	9



Table C10: Characte life of 50		ues o	f tension	loads un	der stat	ic and q	uasi-stat	tic action	n for a w	orking
Internal threaded anchor rods					ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ-M16	ABZ-M20
Steel failure ¹⁾										
Characteristic tension resistance,	5.	8	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength class	8.	8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor, strength class 5.8 a		-	Y _{Ms,N}	[-]				,5		
Characteristic tension resistance,		tool		ĽJ			-	,		
A4 and HCR, Strength class 70 ²⁾	Stanness S		N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor			γ _{Ms,N}	[-]			1,87			2,86
Combined pull-out and concrete										
Characteristic bond resistance in	1	concre	te C20/25 ir	n diamond	drilled hol	es (DD)				
Temperature I: 40°C/24°C	Dry, wet concrete flooded b		^τ Rk,ucr	[N/mm²]	14	14	13	12	12	11
range II: 72°C/50°C	hole				12	11	10	9,5	9,5	9,0
Reduction factor $\psi^0{}_{sus}$ in uncrac	ked concret	te C20,	25 in diamo	ond drilled	holes (DD)					
Temperature I: 40°C/24°C	Dry, wet concrete	and	ψ ⁰ sus	[-]			0,	77		
range II: 72°C/50°C	flooded b hole	oore	Ψsus	[-]				72		
Increasing factors for concrete			Ψ_{c}	[-]			(f _{ck} /)	20) ^{0,2}		
Characteristic bond resistance de concrete strength class	pending on	the		τ _{Rk,ucr} =			Ψ c * ^τ Rk,ι	ıcr,(C20/25)		
Concrete cone failure										
Relevant parameter							see Ta	ble C2		
Splitting failure										
Relevant parameter							see Ta	ble C2		
Installation factor										
for dry and wet concrete (DD)			ν.	[]			1	,0		
for flooded bore hole (DD)			γ _{inst}	[-]	1,	2		1,	,4	
 Fastenings (incl. nut and wa The characteristic tension re For ABZ-M20 strength class 	sistance fo	r steel								d rod.
Injection system XWE for Performances			r statio and					A	nnex C	10
Characteristic values of tens for a working life of 50 years						лт 				



Table C11: Character life of 100	istic values o) years	f tension	loads un	der stat	ic and q	uasi-stat	ic action	n for a w	orking
Internal threaded anchor rods				ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ-M16	ABZ-M20
Steel failure ¹⁾									
Characteristic tension resistance,	5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor, strength class 5.8 ar			[-]	10	27		,5	121	190
Characteristic tension resistance,		γ _{Ms,N}	[-]		<u>.</u>		,J		
A4 and HCR, Strength class 70 ²⁾	Stanness Steer	N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor		γ _{Ms,N}	[-]			1,87			2,86
Combined pull-out and concrete	cone failure								
Characteristic bond resistance in u	uncracked concre	ete C20/25 ir	n diamond	drilled hol	es (DD)				
Temperature I: 40°C/24°C	Dry, wet concrete and flooded bore	τ _{Rk,ucr,100}	[N/mm²]	14	14	13	12	12	11
II: 72 C/50 C	hole			11	10	10	9,5	9,0	8,5
Reduction factor $\psi^0{}_{sus,100}$ in unc	racked concrete	C20/25 in di	amond dri	lled holes	(DD)				
I: 40°C/24°C	Dry, wet concrete and	0	1 1			0,	73		
range II: 72°C/50°C	flooded bore hole	Ψ ⁰ sus,100	[-]			0,	70		
Increasing factors for concrete		Ψc	[-]			(f _{ck} /)	20) ^{0,2}		
Characteristic bond resistance dep concrete strength class	ending on the	τ _{Rk}	,ucr,100 =		ίη.	Ψ c • ^τ Rk,ucr		5)	
Concrete cone failure									
Relevant parameter						see Ta	ble C2		
Splitting failure						marreson n ar			
Relevant parameter						see Ta	ble C2		
Installation factor		~	7						
for dry and wet concrete (DD)			[-]			1	,0		
for flooded bore hole (DD)		γ _{inst}	[-]	1,	2		1,	4	
 Fastenings (incl. nut and was The characteristic tension res For ABZ-M20 strength class s 	sistance for stee								a rod.
Injection system XWE for Performances Characteristic values of tens for a working life of 100 year	ion loads unde			atic actio	n		A	nnex C	11



Internal threaded anchor rods				ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ-M16	ABZ-M20
Steel failure without lever arm ¹⁾				•		, .			
Characteristic shear resistance,	5.8	V ⁰ _{Rk,s}	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V ⁰ _{Rk,s}	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 and	8.8 b	γ _{Ms,V}	[-]		1	.	1,25		
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 ²⁾		V ⁰ _{Rk,s}	[kN]	7	13	20	30	55	40
Partial factor		γ _{Ms,V}	[-]			1,56			2,38
Ductility factor		k ₇	[-]				1,0		
Steel failure with lever arm ¹⁾									
Characteristic bending moment,	5.8	M ⁰ _{Rk,s}	[Nm]	8	19	37	66	167	325
Steel, strength class	8.8	M ⁰ _{Rk,s}	[Nm]	12	30	60	105	267	519
Partial factor, strength class 5.8 and	8.8 t	γ _{Ms,V}	[-]				1,25		
Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70 ²⁾		M ⁰ _{Rk,s}	[Nm]	11	26	52	92	233	456
Partial factor		γ _{Ms,V}	[-]			1,56			2,38
Concrete pry-out failure									
Factor		k ₈	[-]				2,0		
Installation factor		γ _{inst}	[-]				1,0		
Concrete edge failure				1					
Effective length of fastener		l _f	[mm]		min	(h _{ef} ; 12 • d	_{nom})		min(h _{ef} ; 300mm
Outside diameter of fastener		d _{nom}	[mm]	10	12	16	20	24	30
Installation factor		γ _{inst}	[-]				1,0		
 Fastenings (incl. nut and washer) in characteristic tension resistance f For ABZ-M20 strength class 50 is v 	for steel fa								d rod. The



	aracteristic va orking life of 50		sion load	ds un	der st	atic a	ınd qı	lasi-si	tatic a	actior	n for a	1	
Reinforcing bar		-		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure				4						1			
Characteristic tension res	sistance	N _{Rk,s}	[kN]					A _s •	f _{uk} 1)				
Cross section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		Y _{Ms,N}	[-]					1,4	42)				
Combined pull-out and c	concrete failure		•										
Characteristic bond resist	tance in uncracked	concrete C2	0/25 in han	nmer d	rilled h	oles (H	ID) and	compr	essed a	air drill	ed hole	es (CD)	
L: 40°C/24°C	Dry, wet concrete and flooded bore	τ _{Rk,ucr}	[N/mm²]	16	16	16	16	16	16	15	15	15	15
ຮຼັ II: 72°C/50°C	hole			12	12	12	12	12	12	12	12	11	11
Characteristic bond resist	tance in uncracked	d concrete C2	0/25 in har	nmer d	rilled h	oles w	ith holl	ow dril	l bit (H	DB)			
<u>ب</u> I: 40°C/24°C	Dry, wet			14	14	13	13	13	13	13	13	13	13
and the second	concrete	τ	[N/mm²]	12	12	12	11	11	11	11	11	11	11
E I: 40°C/24°C	flooded bore	τ _{Rk,ucr}		13	13	13	13	13	13	13	13	13	13
[⊕] II: 72°C/50°C	hole			11	11	11	11	11	11	11	11	11	11
	Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)												
l: 40°C/24°C	Dry, wet concrete and flooded bore	τ _{Rk,cr}	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
ul: 72°C/50°C ⊢	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0					
Reduction factor ψ^0_{sus} in hammer drilled holes v			ete C20/25	in ham	mer dr	illed ho	oles (HI	0), com	presse	d air dr	rilled ho	oles (CI	D) and
emperating between the second	Dry, wet concrete and flooded bore	ψ^0_{sus}	[-]					0,	80				
ll: 72°C/50°C	hole							0,					
Increasing factors for cor	ncrete	Ψc	[-]					(f _{ck} / 2	20) ^{0,1}				
Characteristic bond resist			τ _{Rk,ucr} =				Ψα	· ^τ Rk,u	cr,(C20/	′25)			
on the concrete strength	class		τ _{Rk,cr} =				Ψα	• ^τ Rk,u	cr,(C20/	′25)			
Concrete cone failure													
Relevant parameter								see Ta	ble C2				
Splitting								T-	hla 62				
Relevant parameter								see Ta	ble C2				
Installation factor for dry and wet concrete								1	,0				
for flooded bore hole (HI		γ _{inst}	[-]						,0 ,2				
¹⁾ f _{uk} shall be taken from		f reinforcing t	bars						/-				
²⁾ in absence of national i													
Injection system X	WE for concre	ete											
Performances Characteristic values for a working life of 5			tic and qu	asi-st	atic ac	tion				Α	nnex	C 13	3



Table C14: Characterist life of 100 y	tic values of ter ears	nsion load	ds un	der st	atic a	nd qu	uasi-s	tatica	actior	n for a	worl	king
Reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure		1	1					4)				
Characteristic tension resistance	N _{Rk,s}	[kN]						f _{uk} 1)				
Cross section area	A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,N}	[-]					1,	4 ²⁾				
Combined pull-out and concrete fail		0/2E in har	more	Irillad b	oloc /L		comp	accod	oir drill			
Characteristic bond resistance in und			nmer d	iniied n	ioles (F	iD) and	compr	essea	air arill			
L: 40°C/24°C Dry, wet concrete a flooded bo hole	100	[N/mm²]	16	16	16	16	16	16	15	15	15	15
II: 72°C/50°C hole			12	12	12	12	12	12	12	12	11	11
Characteristic bond resistance in uno	racked concrete C2	0/25 in har	nmer c	Irilled h	oles w	ith holl	ow dril	l bit (H	DB)			
린 I: 40°C/24°C Dry, wet			14	14	13	13	13	13	13	13	13	13
te the the term of term o	τ _{Rk,ucr,100}	[N/mm ²]	12	12	12	11	11	11	11	11	11	11
	re		13	13	13	13	13	13	13	13	13	13
		25 : 1	11	11	11	11	11	11	11	11	11	11
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)												
L: 40°C/24°C Dry, wet concrete a flooded bo hole	[N] /ma ma 2]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	
8. b E E H: 72°C/50°C flooded bo hole	re ^T Rk,cr,100	[N/mm ²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Reduction factor $\psi^0_{sus,100}$ in cracke and in hammer drilled holes with ho		oncrete C20)/25 in	hamm	er drille	ed hole	s (HD),	compr	essed a	air drille	ed hole	s (CD)
	nd						0,	80				
L: 40°C/24°C Dry, wet concrete a flooded bo hole	110 100	[-]					0,	68				
Increasing factors for concrete	Ψc	[-]					(f_{ck})	20) ^{0,1}				
Characteristic bond resistance deper	nding ^τ _F	k,ucr,100 =				ψ_{c} .	$\tau_{\rm Rk,ucr}$,100,(C2	:0/25)			
on the concrete strength class	τ	; Rk,cr,100 =				ψ_{c}	^τ Rk,cr,	100,(C2	0/25)			
Concrete cone failure												
Relevant parameter							see Ta	able C2				
Splitting			I				T-					
Relevant parameter Installation factor							see la	able C2				
for dry and wet concrete (HD; HDB, G	20)	1					1	,0				
for flooded bore hole (HD; HDB, CD)	Y _{inst}	[-]						,2				
¹⁾ f _{uk} shall be taken from the specifica	tions of reinforcing	bars										
²⁾ in absence of national regulation												
Injection system XWE for c	oncrete											
Performances Characteristic values of tension for a working life of 100 years		tic and qu	iasi-st	atic ac	tion				A	nnex	C 14	l



	naracteristic r a working l			n Ioa	ds u	nder	stati	c and	d qua	asi-si	atic	actio	n
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure		1											4
Characteristic tension res	sistance	N _{Rk,s}	[kN]					A _s •	f _{uk} 1)				
Cross section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		Y _{Ms,N}	[-]					1,4	4 ²⁾				
Combined pull-out and o	oncrete failure												
Characteristic bond resis	tance in uncracked	d concrete C2	0/25 in diar	mond o	drilled b	noles (E	DD)						
L: 40°C/24°C	Dry, wet concrete and flooded bore	τ _{Rk,ucr}	[N/mm²]	14	13	13	13	12	12	11	11	11	11
ll: 72°C/50°C	hole			11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor ψ^0_{SUS} i	n uncracked concr	ete C20/25 in	diamond c	drilled b	noles ([DD)							
I: 40°C/24°C	Dry, wet concrete and flooded bore	ψ^0_{sus}	[-]					0,	77				
ll: 72°C/50°C	hole							0,	72				
Increasing factors for cor	ncrete	Ψc	[-]					(f _{ck} / 1	20) ^{0,2}				
Characteristic bond resis on the concrete strength	τ _{Rk,ucr} =				Ψα	: ^{• τ} Rk,u	ıcr,(C20/	/25)					
Concrete cone failure													
Relevant parameter								see Ta	ble C2				
Splitting													
								see Ta	ble C2				
	(22)	1											
		Yinst	[-]		1	2		1	,0	1	Λ		
	-	ns of reinford	ing bars			,2					,-		
Relevant parameter see Table C2 Installation factor 1.0													
Injection system X	WE for concre	ete								_			_
Performances Characteristic values for a working life of 5			tic and qu	asi-sta	atic ac	tion				A	nnex	C 15	D



	racteristic va of 100 years	lues of ten	ision load	ds un	der st	atic a	nd qu	iasi-s	tatic a	action	for a	wor	king
Reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic tension resi	stance	N _{Rk,s}	[kN]					A _s •	f _{uk} 1)				
Cross section area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor		Y _{Ms,N}	[-]					1,	42)				
Combined pull-out and co	oncrete failure												
Characteristic bond resista	ance in uncracked	concrete C2	0/25 in diar	mond o	drilled b	noles (E	DD)		1				
n nperat	Dry, wet concrete and flooded bore hole	^T Rk,ucr,100	[N/mm²]	14 11	13 10	13 10	13 10	12 9,5	12 9,0	11 9,0	11 9,0	11 8,5	11 8,5
Reduction factor $\psi^0_{sus,10}$	00 in uncracked co	oncrete C20/2	25 in diamo	ond dri	lled hol	es (DD)						
e l: 40°C/24°C	Dry, wet concrete and	$\psi^0_{sus,100}$	[-]					0,	73				
و و ۳ II: 72°C/50°C	flooded bore hole	· SUS,100	.,					0,	70				
Increasing factors for cond		Ψc	[-]					(f $_{\rm ck}$ /	20) ^{0,2}				
Characteristic bond resista on the concrete strength of	k,ucr,100 =				Ψ c •1	^t Rk,ucr	-,100,(c	20/25)					
Concrete cone failure													
Relevant parameter								see Ta	able C2				
Splitting				ſ									
								see Ta	able C2				
		1	1						-				
		γ _{inst}	[-]		1	2		1	,0	1	1		
	•	ns of reinford	ing bars		1	,2				1	,4		
Splitting Relevant parameter see Table C2 Installation factor 1.0													
Injection system XV	WE for concre	ete								_			_
Performances Characteristic values for a working life of 10			tic and qu	asi-st	atic ac	tion				A	nnex	C 16	0



Table C17:Characteristic valuelife of 50 and 10		near loa	ıds u	nder	statio	and	quas	i-stat	ic acti	on for a	a work	ing
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure without lever arm												
Characteristic shear resistance	V ⁰ _{Rk,s}	[kN]					0,5	· A _s ·	f _{uk} 1)			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,V}	[-]						1,5 ²⁾				
Ductility factor	k ₇	[-]						1,0				
Steel failure with lever arm												
Characteristic bending moment	M ⁰ _{Rk,s}	[Nm]		_	_		1,2	• w _{el} •	f _{uk} 1)			
Elastic section modulus	W _{el}	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γ _{Ms,V}	[-]						1,52)				
Concrete pry-out failure												
Factor k ₈ [-] 2,0												
Installation factor	[-]						1,0					
Concrete edge failure												
Effective length of fastener	۱ _f	[mm]			min(ł	ո _{ef} ; 12	• d _{nom}	₁)		min	h _{ef} ; 300	mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γ _{inst}	[-]						1,0				
 f_{uk} shall be taken from the specification in absence of national regulation 	ons of reinfo	orcing bar	S									
Injection system XWE for concr	ete											
Performances Characteristic values of shear loads for a working life of 50 and 100 year			uasi-	static	actior	1				Ann	ex C 1	7



iı	Displacements un hammer drille holes with hollow	d holes (HD), c	ompres	sed air	drilled	holes (CD) and	l in han	nmer di	rilled
Threaded rod	ioles with hollow		/ 	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete u	nder static and quas	i-static action for a					11120	10124	10127	10150
	S fastar	[mm/(N/mm ²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
Temperature range 40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]		0,029	0,030	0,033	0,035	0,038	0,039	0,04
· ·	S fastau	[mm/(N/mm ²)]	0,028							,
Temperature range 72°C/50°C	II: δ_{N0} -factor $\delta_{N\infty}$ -factor		0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,05
-		[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Cracked concrete und	S 6						0.070	0.070	0.001	0.00
Temperature range 40°C/24°C		[mm/(N/mm ²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,08
40 C/24 C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,17
Temperature range		[mm/(N/mm ²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,11
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,22
) Displacements u			ension						
ii ii	n diamond drille	d holes (DD)								
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete u	nder static and quas	i-static action for a	working	life of 50	years					
Temperature range	l: δ _{N0} -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,01
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,02
Temperature range	ll: δ _{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,01
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,07
Uncracked concrete u							,	-,	_,	, ,
Temperature range	S fastan	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,01
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,02
Temperature range	S factor	[mm/(N/mm ²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,01
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,05
¹⁾ Calculation of the dis $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$;	placement	τ: action bond s					-,	-,	-,	
f	Displacements u or all drilling me		d ¹⁾							
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked and cracke		-			1		1	1	1	1
All temperature	δ_{V0} -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
¹⁾ Calculation of the dis $\delta_{V0} = \delta_{V0}$ -factor · V; $\delta_{V\infty} = \delta_{V\infty}$ -factor · V;		V: action shear	load							
Performances Displacements und for a working life of	der static and qua	si-static action						Anı	nex C	18



Internal threaded a			ed holes wit		ABZ-M6	ABZ-M8		ABZ-M12	ABZ-M16	ABZ-M20
Uncracked concrete		10070	asi-static action	for a v	0.0000000000000000000000000000000000000			ADZ-IVI12	ADZ-IVI10	ADZ-IVIZU
		δ_{NO} -factor	[mm/(N/		0,029	0,030	0,033	0,035	0,038	0,041
Temperature rar 40°C/24°C	nge I:	δ_{N0} -factor	[mm/(N/		0,029					
		δ_{N0} -factor	[mm/(N/	A	. <i></i>	0,030	0,033	0,035	0,038	0,041
Temperature ran 72°C/50°C	ige II:	δ_{N0} -factor			0,039	0,040	0,044	0,047		0,055
Cracked concrete u			[mm/(N/		0,049	0,051	0,055	0,059	0,064	0,070
		δ _{NO} -factor			0,071	0,072	0,074	0,076	0,079	0.092
Temperature rar 40°C/24°C	nge I:	δ_{N0} -factor	[mm/(N/ [mm/(N/							0,082
		δ_{N0} -factor			0,115	0,122	0,128	0,135	0,142	0,171
Temperature ran 72°C/50°C	ige II:		[mm/(N/		0,095	0,096	0,099	0,102	0,106	0,110
	diantara	$\delta_{N\infty}$ -factor	[mm/(N/	mm-)]	0,154	0,163	0,172	0,181	0,189	0,229
¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor ·	τ;	nent	τ : action b	oond str	ess for tensi	on				
$\delta_{N^{\infty}} = \delta_{N^{\infty}} \text{-} factor$					<i></i>					
Table C22:	Displa	acements	under tensio	on loa	d1)					
	in dia	mond dril	led holes (D	D)						
Internal threaded a	nchor ro	ds			ABZ-M6	ABZ-M8	ABZ-M10	ABZ-M12	ABZ-M16	ABZ-M2
Uncracked concrete	e under s	tatic and qu	asi-static action	for a w						
Temperature rar		δ_{N0} -factor	[mm/(N/		0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	.80	$\delta_{N\infty}$ -factor	[mm/(N/		0,019	0,019	0,020	0,022	0,023	0,025
Temperature ran	ge II:	δ_{N0} -factor	[mm/(N/		0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	.Be	$\delta_{N\infty}$ -factor	[mm/(N/		0,053	0,055	0,058	0,062	0,065	0,070
Uncracked concrete	e under s				vorking life	of 100 yea	rs			1 -
Temperature rar	nge I:	δ_{N0} -factor	[mm/(N/	mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	0	$\delta_{N\infty}$ -factor	[mm/(N/	mm²)]	0,021	0,021	0,023	0,024	0,025	0,027
Temperature ran	ge II:	δ_{N0} -factor	[mm/(N/	mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	0	$\delta_{N\infty}$ -factor	[mm/(N/	mm²)]	0,039	0,040	0,043	0,045	0,047	0,051
1) Calculation of th $\delta_{N0} = \delta_{N0}$ -factor $\delta_{N\infty} = \delta_{N\infty}$ -factor	· τ;	cement	τ: action	bond st	ress for ter	ision				
Table C23:		acements drilling n	under shear nethods	load ¹)					
Internal threaded a	nchor ro	ds		ABZ-	M6 AB	Z-M8 A	BZ-M10	ABZ-M12	ABZ-M16	ABZ-M20
Uncracked and crac	ked cond	rete under s	static and quasi	-static a	action for a	working li	fe of 50 and	100 years		
All temperature	δ _{V0} -fac	tor	[mm/kN]	0,0	07 0	,06	0,06	0,05	0,04	0,04
ranges	$\delta_{V\infty}$ -fac	tor	[mm/kN]	0,1	.0 0	,09	0,08	0,08	0,06	0,06
¹⁾ Calculation of the	displacer	nent								
δ_{V0} = $\delta_{\text{V0}}\text{-}\text{factor}$ \cdot	V;		V: action s	shear lo	ad					
$\delta_{V^{\infty}} = \delta_{V^{\infty}}$ -factor	· V;									
		E for conc	rata							



Table C24:	in hamme	ents under te r drilled holes hollow drill b	(HD), d	compre	essed a	ir drill	ed hol	es (CD)) and i	n ham	mer dr	illed
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø3
Uncracked concret	e under static a	nd quasi-static ad	tion for	a workir	ng life of	50 and	100 yeai	rs				
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,04
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,04
Temp range II:	δ_{NO} -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,05
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,07
Cracked concrete u	100000	quasi-static actio	on for a v	vorking l	life of 50	and 10	0 years		180			
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,08
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,19
Temp range II:	δ_{NO} -factor	[mm/(N/mm ²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,11
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,26
$\begin{array}{c} \delta_{N\circ} = \delta_{N\circ} \text{-factor} \cdot \tau; & \tau: \text{ action bond stress for tension} \\ \delta_{N\circ} = \delta_{N\circ} \text{-factor} \cdot \tau; & \\ \textbf{Table C25: Displacements under tension load}^{1)} \\ \textbf{in diamond drilled holes (DD)} \\ \hline \end{array}$												
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3
Uncracked concret	e under static a	nd quasi-static ad	tion for	a workir	ng life of	50 year	s					
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,008	0,009	0,009	0,01	0,011	0,012	0,013	0,013	0,014	0,01
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,018	0,018	0,019	0,020	0,021	0,024	0,027	0,027	0,028	0,03
Temp range II:	δ_{N0} -factor	[mm/(N/mm ²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,01
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,08
Uncracked concret	e under static a	nd quasi-static ad	tion for	a workir	ng life of	100 yea	rs					
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,008	0,009	0,009	0,010	0,011	0,012	0,013	0,013	0,014	0,01
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,018	0,020	0,021	0,022	0,024	0,026	0,029	0,029	0,031	0,03
Temp range II:	δ_{N0} -factor	[mm/(N/mm ²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,01
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,06
¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\delta_{N\infty} = \delta_{N\infty}$ -factor Table C26:	τ; τ; Displacem	τ: act ents under sh ing methods	ion bond ear loa		r tension							
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Uncracked and cra	cked concrete i	under static and o	2.2000 Yest			10.0% (C. 2007)	Solder an Annald			~ -5	~ 10	2.5
All temperature	δ _{V0} -factor	[mm/kN]		1	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
ranges	$\delta_{V\infty}$ -factor	[mm/kN]			0,08	0,06	0,04	0,05	0,05	0,05	0,04	0,04
¹⁾ Calculation of the $\delta_{V0} = \delta_{V0}$ -factor $\delta_{V\infty} = \delta_{V\infty}$ -factor	e displacement · V;		ion shear		0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,0
Injection system Performances Displacements for a working life	under static a									Anne	ex C 2	20



Table		teristic value mance categ										
Threade	ed rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel fai	ilure											
Characte	eristic tension resistan	ce	N _{Rk,s,eq,C1}	[kN]				1,0 •	N _{Rk,s}			
Partial f	actor		γ _{Ms,N}	[-]				see Ta	ble C1			
Combin	ed pull-out and concre	ete failure										
	eristic bond resistance d in hammer drilled ho			ete C20/25 in	ı hamm	er drille	d holes	(HD), co	ompres	sed air d	drilled h	oles
Temperature range	I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,eq,C1}	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
Tempe ran	II: 72°C/50°C	flooded bore hole	$\tau_{\rm Rk,eq,C1}$	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Increasi	ng factors for concrete	2	Ψc	[-]				1	,0			
	eristic bond resistance crete strength class	depending on		τ _{Rk,eq,C1} =			Ψ_{c}	• ^τ Rk,eq	,C1,(C20,	/25)		
Installat	tion factor											
for dry a	and wet concrete (HD;	HDB, CD)	V	[-]				1	,0			
for flood	ded bore hole (HD; HD	B, CD)	rinst					1	,2			
for flooded bore hole (HD; HDB, CD) γ _{inst} [-]												

Injection system XWE for concrete

Performances

Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (threaded rod)

Annex C 21



Table		teristic value rmance categ										
Thread	ed rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ilure						ю					
Charact	eristic tension resistan	ce	N _{Rk,s,eq,C1}	[kN]				1,0 •	N _{Rk,s}			
Partial	factor		Y _{Ms,N}	[-]				see Ta	ble C1			
Combin	ned pull-out and concre	ete failure										
Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)												
Temperature range	l: 40°C/24°C	Dry, wet concrete and	τ _{Rk,eq,C1}	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Tempe	II: 72°C/50°C	flooded bore hole	$\tau_{\rm Rk,eq,C1}$	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Increas	ing factors for concrete	2	Ψc	[-]				1	,0			
	ceristic bond resistance crete strength class	depending on		τ _{Rk,eq,C1} =			Ψc	• τ _{Rk,ec}	,C1,(C20,	/25)		
Installa	tion factor											
for dry	and wet concrete (HD;	HDB, CD)	- γ _{inst}	[-]				1	,0			
for floo	ded bore hole (HD; HD	B, CD)	rinst	[[]				1	,2			

Injection system XWE for concrete

Performances

Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (threaded rod)

Annex C 22



Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure			La realit.							200.002.000
Characteristic shear resistance (Seismic C1)	V _{Rk,s,eq,C1}	[kN]				0,7	0 • V ⁰ _{Rk,}	s		
Partial factor	γ _{Ms,V}	[-]				see	Table C	1		
Factor for annular gap	α _{gap}	[-]				0,	5 (1,0) ¹⁾			
Injection system XWE for conc	rete									
Performances								1 A	nnex C	23

Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (threaded rod)



Table		racteristic val formance cat							on					
Reinford	ing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel fai	lure								÷		•			
Characte	eristic tension resis	tance	N _{Rk,s,eq,C1}	[kN]					1,0 • A	s•f _{uk} 1)			
Cross se	ction area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial fa	actor		γ _{Ms,N}	[-]					1,	4 ²⁾				
	ed pull-out and co		•	•										
	eristic bond resista I in hammer drillec				20/25	in ham	mer dr	illed ho	bles (Hl	D), com	presse	d air dı	rilled ho	oles
Temperature range	l: 40°C/24°C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Temperal	II: 72°C/50°C	flooded bore hole	τ _{Rk,eq,C1}	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Increasir	ng factors for conc	rete	Ψc	[-]					1	,0				
	Characteristic bond resistance depending on the concrete strength class $\tau_{Rk,eq,C1} =$ $\psi_c \cdot \tau_{Rk,eq,C1}$ Installation factor													
Installation factor														
	for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD) γ _{inst} [-] 1,0 1,2													
	hall be taken from													
Inject	ion system XV	/E for concre	ete											
	rmances cteristic values o	of tension load	s under sei:	smic actio	n (per	forma	nce ca	ategor	y C1)		Α	nnex	C 24	ŀ

for a working life of 50 years (reinforcing bar)



Table		racteristic va												
		formance ca	tegory CI)	tor a wo				5				1.000		
Reinfor Steel fa					Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
	eristic tension resis	tanco	Net	[kN]					10•4	• f _{uk} ¹)			
		stance	N _{Rk,s,eq,C1}		50	70	110			1		401	C1C	804
	ction area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial f	ed pull-out and co	ncrete failure	γ _{Ms,N}	[-]					1,	4 ²⁾				
Charact	eristic bond resista	nce in cracked a			20/25	in ham	mer dr	illed ho	oles (HI	D), com	presse	d air dr	illed ho	oles
(CD) and	d in hammer drilled	holes with holld	ow drill bit (H	DB)										
Temperature range	l: 40°C/24°C	Dry, wet concrete and	τ _{Rk,eq,C1}	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperat	ll: 72°C/50°C	flooded bore hole	τ _{Rk,eq,C1}	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Increasi	ng factors for conc	rete	Ψc	[-]					1	.,0				
	eristic bond resista oncrete strength c		1	τ _{Rk,eq,C1} =				ψ_{c}	• τ _{Rk,ec}	q,C1,(C20)/25)			
	tion factor		1											
<u> </u>	and wet concrete (I		γ _{inst}	[-]						.,0				
	ded bore hole (HD; shall be taken from								1	,2				
Inject	ion system XV	VE for concre	ete											
	rmances acteristic values (of tension load	s under sei	smic actio	n (per	forma	nce ca	ategor	y C1)		Α	nnex	C 25	5

for a working life of 100 years (reinforcing bar)



Table C32: Characteristic v (performance c			100			10 10 10 10 10 10 10 10 10 10 10 10 10 1		year	s			
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure												
Characteristic shear resistance	V _{Rk,s,eq,C1}	[kN]					0,35	• A _s •	f _{uk} 1)			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,V}	[-]						1,5 ²⁾				
Factor for annular gap	α_{gap}	[-]					0	,5 (1,0) ³⁾			
¹⁾ f _{uk} shall be taken from the specifications	s of reinforcing	bars										
 ²) in absence of national regulation ³) Value in brackets valid for filled annular recommended. 	gab between fa	astener an	d cleai	rance h	ole in t	he fixt	ure. Us	e of spe	ecial fill	ing wash	er Annex	A 3 is

Injection system XWE for concrete

Performances

Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (reinforcing bar)

Annex C 26



	teristic value				action nd 100 years		
Threaded rod				M12	M16	M20	M24
Steel failure						•	
Characteristic tension resistan Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	ice,	N _{Rk,s,eq,C2}	[kN]		1,0•	N _{Rk,s}	
Partial factor		γ _{Ms,N}	[-]		see Ta	ble C1	
Combined pull-out and concre	ete failure	004000					
Characteristic bond resistance (CD) and in hammer drilled ho			crete C20/25	in hammer dril	led holes (HD), o	compressed air	drilled holes
	Dry, wet concrete and	^τ Rk,eq,C2	[N/mm²]	5,8	4,8	5,0	5,1
und re	flooded bore hole	τ _{Rk,eq,C2}	[N/mm²]	5,0	4,1	4,3	4,4
Increasing factors for concrete	e	Ψc	[-]		1,	.0	
Characteristic bond resistance the concrete strength class	e depending on		τ _{Rk,eq,C2} =		Ψc • ^τ Rk,eq	,C2,(C20/25)	
Installation factor		1	, ,				
for dry and wet concrete (HD;	-	γ _{inst}	[-]		1,		
for flooded bore hole (HD; HD	B, CD)				1,	.2	
(perfor	teristic value rmance cate			life of 50 ai	nd 100 years		
Threaded rod				M12	M16	M20	M24
Steel failure			-				
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	2	V _{Rk,s,eq,C2}	[kN]		0,70 •	V ⁰ _{Rk,s}	
Partial factor		γ _{Ms,V}	[-]		see Ta	ble C1	
Factor for annular gap		α_{gap}	[-]		0,5 (2	1,0) ¹⁾	
¹⁾ Value in brackets valid for Annex A 3 is recommended		jab between fa	stener and c	learance hole	in the fixture. Us	se of special fill	ing washer
Injection system XWE	for concrete						
Performances Characteristic values of te category C2) for a workin					rmance		x C 27



Threaded rod			M12	M16	M20	M24
Uncracked and cracked concrete un	der seismic action (perfo	rmance cate	gory C2) for a	working life of !	50 and 100 year	s
All to man to man and a second	$\delta_{N,eq,C2(DLS)}$	[mm]	0,21	0,24	0,27	0,36
All temperature ranges	$\delta_{N,eq,C2(ULS)}$	[mm]	0,54	0,51	0,54	0,63
Table C36: Displaceme	nts under shear load	d (threade	d rod)			
Threaded rod			M12	M16	M20	M24
Jncracked and cracked concrete un	der seismic action (perfo	rmance cate	gory C2) for a	working life of !	50 and 100 year	s
	$\delta_{V,eq,C2(DLS)}$	[mm]	3,1	3,4	3,5	4,2
All temperature ranges	$\delta_{V,eq,C2(ULS)}$	[mm]	6,0	7,6	7,3	10,9

Injection system XWE for concrete

Performances

Displacements under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)

Annex C 28