Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment ETA-16/0905 of 11 May 2021

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection system AC200+ for concrete
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	Stanley Black & Decker Deutschland GmbH Richard-Klinger-Straße 11 65510 Idstein DEUTSCHLAND
Manufacturing plant	Plant 1
This European Technical Assessment contains	29 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601, Edition 04/2020
This version replaces	ETA-16/0905 issued on 20 February 2017

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Specific Part

1 Technical description of the product

The "Injection system AC200+ for concrete" is a bonded anchor consisting of a cartridge with injection mortar Injection mortar AC200+ and a steel element according to Annex A3 and A4.

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

The product description is given in Annex A.

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

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 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 B 3, C 1 to C 4, C 6, C 7
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 5, C 8
Displacements under short-term and long-term loading	See Annex C 9 and C10
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 11 to C 14

3.2 Hygiene, health and the environment (BWR 3)

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

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

In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 11 May 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

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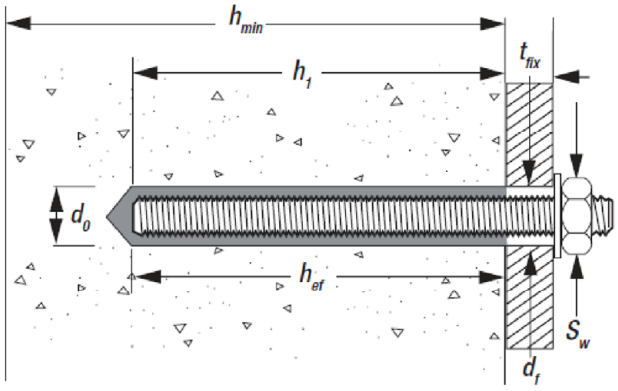
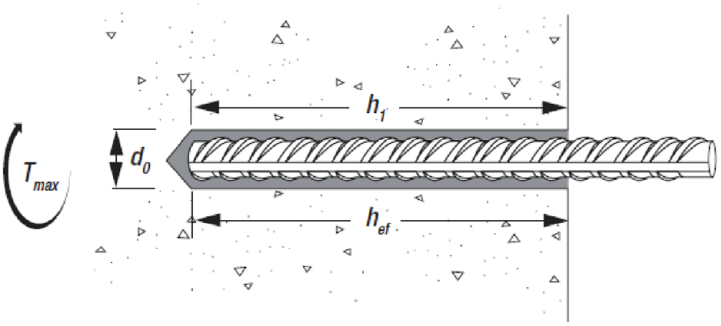
Threaded rod M8, M10, M12, M16, M20, M24, M27, M30 with washer and hexagon nut

Reinforcing bar Ø8, Ø10, Ø12, Ø14, Ø16, Ø20, Ø25, Ø25, Ø28, Ø32

Installation threaded rod M8 to M30



Installation reinforcing bar Ø8 to Ø32



t_{fix} = thickness of fixture
h_{ef} = effective anchorage depth
h_1 = depth of drill hole
h_{min} = minimum thickness of member

Injection system AC200+ for concrete	**Annex A1**
Product description Installed condition	

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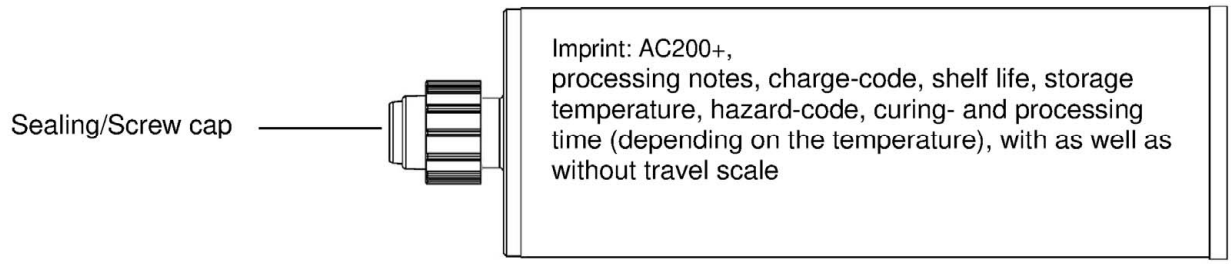
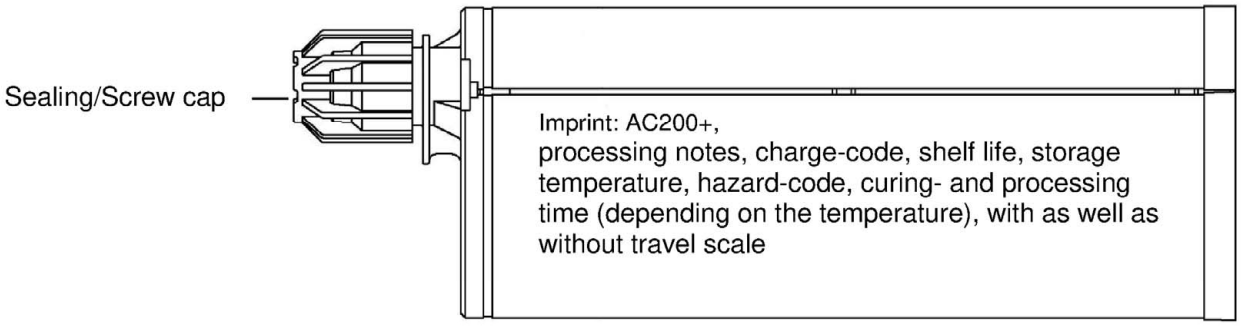
Cartridge: AC200+

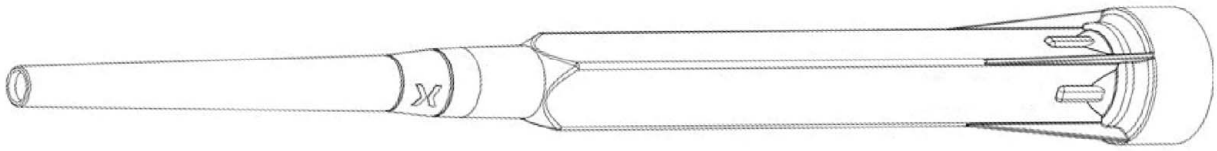
150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml cartridge (Type: coaxial)



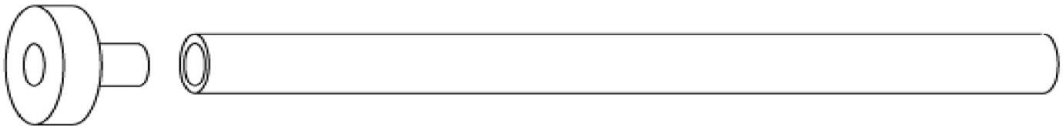
235 ml, 345 ml up to 360 ml and 825 ml cartridge (Type: side-by-side)



Static Mixer «Mischer»



Piston Plug and Mixer Extension



Injection system AC200+ for concrete	**Annex A2**
Product description Injection system	

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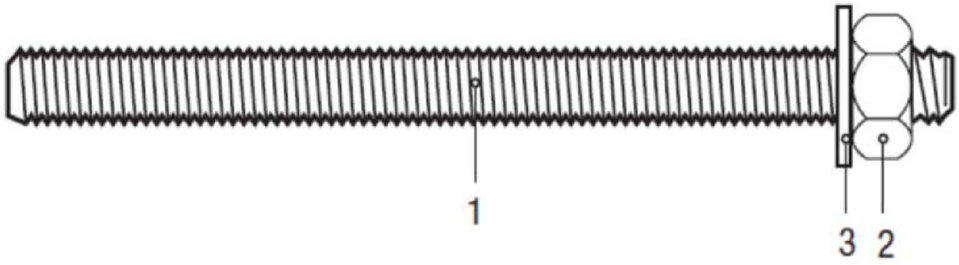
Table A1: Materials (Threaded rod)



Part	Designation	Material			
Zinc plated steel: Material acc. to EN ISO 683-4:2018 or EN 10263:2017; electro plated ≥ 5 µm acc. to EN ISO 4042:2018 or hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or sherardized ≥ 45 µm acc. to EN ISO 17688:2016					
1	Threaded rod	Property class acc. to EN ISO 898-1:2013	Characteristic ultimate strength f_{uk}	Characteristic yield strength f_{yk}	Fracture elongation A_5
		4.6	400 N/mm²	240 N/mm²	> 8%
		4.8	400 N/mm²	320 N/mm²	> 8%
		5.6	500 N/mm²	300 N/mm²	> 8%
		5.8	500 N/mm²	400 N/mm²	> 8%
		8.8	800 N/mm²	640 N/mm²	> 12%[3)]
2	Hexagon nut	Property class acc. to EN ISO 898-2:2012	for threaded rod class		
		4	4.6 & 4.8		
		5	5.6 & 5.8		
		8	8.8		
3	Washer	EN ISO 887:2006; EN ISO 7089:2000; EN ISO 7093:2000; EN ISO 7094:2000			
Stainless steel A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014 Stainless steel A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014 High corrosion resistance steel HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014					
1	Threaded rod	Property class acc. to EN ISO 3506-1:2020	Characteristic ultimate strength f_{uk}	Characteristic yield strength f_{yk}	Fracture elongation A_5
		50	500 N/mm²	210 N/mm²	> 8%
		70[1)]	700 N/mm²	450 N/mm²	> 12%[3)]
		80[1)2)]	800 N/mm²	600 N/mm²	> 12%[3)]
2	Hexagon nut	Property class acc. to EN ISO 3506-1:2020	for threaded rod class		
		50	50		
		70[1)]	70		
		80[1)2)]	80		
3	Washer	EN ISO 887:2006; EN ISO 7089:2000; EN ISO 7093:2000; EN ISO 7094:2000			

[1)] Property class 70 or 80 for threaded rods and hexagon nuts up to M24
[2)] Property class 80 only for stainless steel A4 and high corrosion resistance steel HCR
[3)] A_5 > 8% fracture elongation if no use for seismic performance category C2

Injection system AC200+ for concrete	**Annex A3**
Product description Materials threaded rod	

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Table A2: Materials (Reinforcing bar)

- Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2009+AC:2010
- Rib height of the bar shall be in the range $0{,}05d \le h \le 0{,}07d$
  (d: Nominal diameter of the rebar, h: Rib height of the bar)

Part	Designation	Material
1	Rebar according EN 1992-1-1:2009+AC:2010, Annex C	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

Injection system AC200+ for concrete	**Annex A4**
Product description Materials reinforcing bar	

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Specifications of intended use

Anchorages subject to static and quasi-static loads:

Working life	**50 years**	**100 years**
Base material	Uncracked and cracked concrete	Uncracked and cracked concrete
Hammer drilling (HD) Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to M30; ∅8 to ∅32	M8 to M30; ∅8 to ∅32
Temperature range	I: - 40 °C to +40 °C[1)] II: - 40 °C to +80 °C[2)] III: - 40 °C to +120 °C[3)] IV: - 40 °C to +160 °C[4)]	I: - 40 °C to +40 °C[1)] II: - 40 °C to +80 °C[2)]

Anchorages subject to seismic action:

Performance category	**C1**	**C2**
Base material	Uncracked and cracked concrete	Uncracked and cracked concrete
Hammer drilling (HD) Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to M30; ∅8 to ∅32	M12 to M24
Temperature range	I: - 40 °C to +40 °C[1)] II: - 40 °C to +80 °C[2)] III: - 40 °C to +120 °C[3)] IV: - 40 °C to +160 °C[4)]	I: - 40 °C to +40 °C[1)] II: - 40 °C to +80 °C[2)] III: - 40 °C to +120 °C[3)] IV: - 40 °C to +160 °C[4)]

[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 +80 °C)
[3)] (max long-term temperature +72 °C and max short-term temperature +120 °C)
[4)] (max long-term temperature +100 °C and max short-term temperature +160 °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 A3, Table A1: CRC II
  - Stainless steel Stahl A4 according to Annex A3, Table A1: CRC III
  - High corrosion resistance steel HCR according to Annex A3, Table A1: CRC V

Injection system AC200+ for concrete	**Annex B1**
Intended use Specifications	

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Design:

- Verifiable calculation notes and drawings are 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.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- The anchorages 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 in hammer drill mode with standard drill bit (HD) or with hollow drill bit (HDB), or in compressed air drill mode (CD).
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- The injection mortar is assessed for installation at minimum concrete temperature of -5°C, where subsequently the temperature in the concrete does not rise at a rapid rate, i.e. from the minimum installation temperature to 24°C within a 12-hour period.

Injection system AC200+ for concrete	**Annex B2**
Intended use Specifications	

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Table B1: Installation parameters for threaded rod

Size of threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element		$d = d_{nom}$	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole diameter		d_0	[mm]	10	12	14	18	22	28	30	35
Effective embedment depth		$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120
		$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in the fixture[1]	Preset installation	$d_f \leq$	[mm]	9	12	14	18	22	26	30	33
	Through installation	d_f	[mm]	12	14	16	20	24	30	33	40
Maximum torque moment		max $T_{inst} \leq$	[Nm]	10	20	40[2]	60	100	170	250	300
Minimum thickness of member		h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2d_0$				
Minimum spacing		s_{min}	[mm]	40	50	60	75	95	115	125	140
Minimum edge distance		c_{min}	[mm]	35	40	45	50	60	65	75	80

[1] For application under seismic loading the diameter of clearance hole in the fixture shall be at maximum d_1 + 1mm or alternatively the annular gap between fixture and threaded rod shall be filled force-fit with mortar.
[2] Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm

Table B2: Installation parameters for reinforcing bar

Size of reinforcing bar			Ø8[1]	Ø10[1]	Ø12[1]	Ø14	Ø16	Ø20	Ø24[1]	Ø25[1]	Ø28	Ø32
Diameter of element	$d = d_{nom}$	[mm]	8	10	12	14	16	20	24	25	28	32
Nominal drill hole diameter	d_0	[mm]	10 | 12	12 | 14	14 | 16	18	20	25	30 | 32	30 | 32	35	40
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	75	80	90	96	100	112	128
	$h_{ef,max}$	[mm]	160	200	240	280	320	400	480	500	560	640
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2d_0$						
Minimum spacing	s_{min}	[mm]	40	50	60	70	75	95	120	120	130	150
Minimum edge distance	c_{min}	[mm]	35	40	45	50	50	60	70	70	75	85

[1] Both nominal drill hole diameter can be used

Injection system AC200+ for concrete

Intended use
Installation parameters

Annex B3

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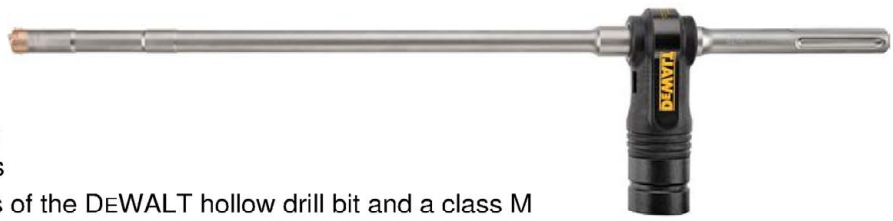
Table B3: Parameter cleaning and setting tools

Threaded rod	Reinforcing bar	Drill bit diameter d_0	Brush diameter nominal d_b	Brush diameter minimum $d_{b,min}$	Piston plug	Installation direction and use of piston plug		
[mm]	[mm]	[mm]	[mm]	[mm]	[No.]	Vertical (down)	Horizontal	Overhead
M8	8	10	11,5	10,5	-	-	-	-
M10	8 / 10	12	13,5	12,5	-	-	-	-
M12	10 / 12	14	15,5	14,5	-	-	-	-
-	12	16	17,5	16,5	-	-	-	-
M16	14	18	20,0	18,5	#18	h_{ef} > 250 mm	h_{ef} > 250 mm	all
-	16	20	22,0	20,5	#20			
M20	-	22	24,0	22,5	#22			
-	20	25	27,0	25,5	#25			
M24	-	28	30,0	28,5	#28			
M27	24 / 25	30	31,8	30,5	#30			
-	24 / 25	32	34,0	32,5	#32			
M30	28	35	37,0	35,5	#35			
-	32	40	43,5	40,5	#40			

MAC - Hand pump (volume 750 ml)
Drill bit diameter (d_0): 10 mm to 20 mm
Drill hole depth (h_0): < 10 d_s
Only in uncracked concrete

CAC - Rec. compressed air tool (min 6 bar)
Drill bit diameter (d_0): all diameters



HDB – Hollow drill bit system
Drill bit diameter (d_0): all diameters
The hollow drill bit system consists of the DEWALT hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa and flow rate of minimum 150 m³/h (42 l/s).

Injection system AC200+ for concrete	Annex B4
Intended use Cleaning and setting tools	

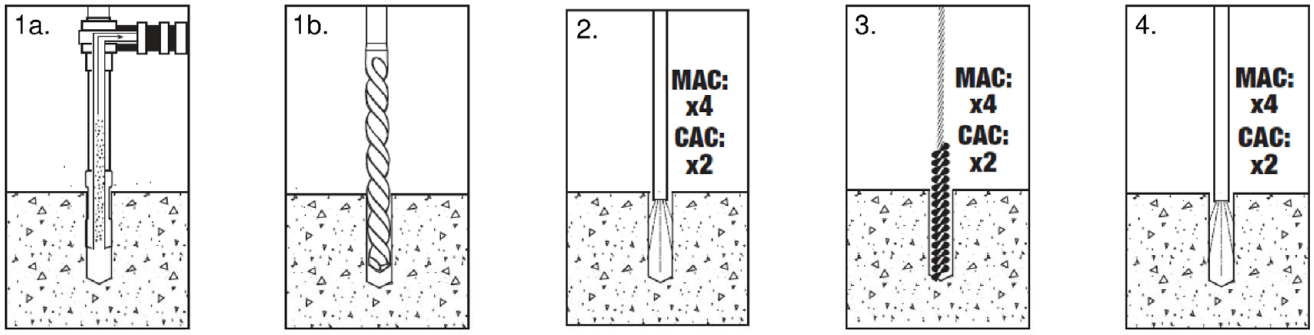
Deutsches Institut für Bautechnik DIBt

Installation instructions

Manual Air Cleaning (MAC)
Cleaning for dry and wet bore hole with diameter $d_0 \leq 20$mm and bore hole depth $h_0 \leq 10d_{nom}$, uncracked concrete only

Compressed Air Cleaning (CAC)
Cleaning for dry, wet and water filled bore hole with all diameter and hole depth, uncracked and cracked concrete

Hollow Drill Bit (HDB) **Standard Drill Bit, hammer drill mode (HD) or compressed air drill mode (CD)**



1a.) Connect the hollow drill bit of proper size to the vacuum and drill a hole into the base material to the required depth while the vac is running. The drill dust is removed during the drilling process. Proceed with Step 5.
1b.) Using the proper drill bit size, drill a hole into the base material to the required depth. Proceed with Step 2.
2.) Before cleaning, remove any standing water out of the drilled hole. Starting from the bottom of the hole, blow the hole clean with a hand pump minimum of 4 times (MAC) or with compressed air (min. 6 bar) minimum of 2 times (CAC). If the hole ground cannot be reached, an extension must be used.
3.) Select a brush of the correct diameter. Starting from the hole ground, brush the hole a minimum of 4 times (MAC) or 2 times (CAC), respectively. If the hole ground is not reached, a brush extension must be used.
4.) Finally, blow the hole clean again with a hand pump minimum of 4 times (MAC) or with compressed air (min. 6 bar) minimum of 2 times (CAC). If the hole ground cannot be reached, an extension must be used.

After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the adhesive in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the adhesive. In-flowing water must not contaminate the bore hole.

Injection system AC200+ for concrete	**Annex B5**
Intended use Installation instructions	

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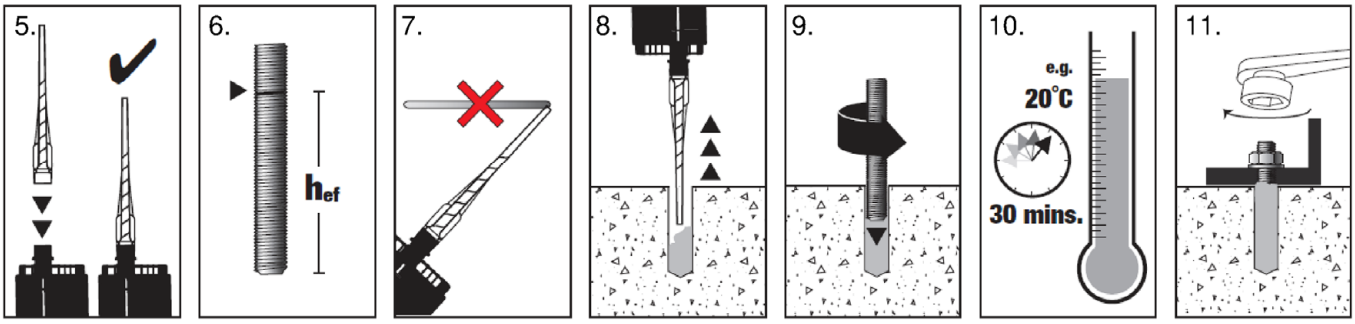
Installation instructions (continued)



5.) Attach a supplied static mixing nozzle to the cartridge and load the cartidge into the correct dispensing tool. For foil tube type cartridges, cut off the foil clip before use. For every working interruption longer than the recommneded working time as well as for new cartridges, a new mixer nozzle must be used.
6.) Mark the required embedment depth on the anchor rod.
7.) Squeeze out a minimum of 3 full strokes and discard non-balanced adhesive until the adhesive shows a consistent colour.
8.) Starting from the back of the cleaned hole, fill the hole approximately two thirds with adhesive. Slowly withdraw the nozzle as the hole fills to avoid creating air pockets. For holes with embedment depths greater than 190 mm, a proper extension nozzle must be used. For vertical down installations and horizontal installations in holes deeper than 250 mm, and for overhead installation always, use a piston plug if the hole is 18 mm or larger.
9.) Push the threaded rod or reinforcing bar into the hole while turning slightly to properly distribute the adhesive. The anchor should be clean and free of dirt, grease or oil. Be sure that the gap is completedly filled with adhesive. Excess adhesive must be visible at the top of the hole. For overhead application, the threaded rod or reinforcing bar must be fixed (e.g. wedges) until the mortar has started to harden.
10.) Allow the adhesive to cure for the specified time prior to applying any load. Do not load the anchor until it is fully cured.
11.) After full curing, the fixture can be installed. Make sure the maximum torque is not exceeded.

Injection system AC200+ for concrete	**Annex B6**
Intended use Installation instructions	

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Table B4: Maximum working time and minimum curing time

Concrete temperature	Gelling working time	Minimum curing time in dry concrete	Minimum curing time in wet concrete
- 5 °C to - 1 °C	50 min	5 h	10 h
0 °C to + 4 °C	25 min	3,5 h	7 h
+ 5 °C to + 9 °C	15 min	2 h	4 h
+ 10 °C to + 14 °C	10 min	1 h	2 h
+ 15 °C to + 19 °C	6 min	40 min	80 min
+ 20 °C to + 29 °C	3 min	30 min	60 min
+ 30 °C to + 40 °C	2 min	30 min	60 min
Cartridge temperature	+5 °C to +40 °C		

Injection system AC200+ for concrete

Intended use
Curing time

Annex B7

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Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Anchor size				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Cross section area		A_s	[mm²]	36,6	58	84,3	157	245	353	459	561
Characteristic tension resistance, Steel failure[1)]											
Steel, Property class 4.6 and 4.8		$N_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Steel, Property class 5.6 and 5.8		$N_{Rk,s}$	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
Steel, Property class 8.8		$N_{Rk,s}$	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
Stainless steel A2, A4 and HCR, class 50		$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Stainless steel A2, A4 and HCR, class 70		$N_{Rk,s}$	[kN]	26	41	59	110	171	247	-[3)]	-[3)]
Stainless steel A4 and HCR, class 80		$N_{Rk,s}$	[kN]	29	46	67	126	196	282	-[3)]	-[3)]
Characteristic tension resistance, Partial factor[2)]											
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,N}$	[-]	2,0							
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,N}$	[-]	1,5							
Stainless steel A2, A4 and HCR, class 50		$\gamma_{Ms,N}$	[-]	2,86							
Stainless steel A2, A4 and HCR, class 70		$\gamma_{Ms,N}$	[-]	1,87							
Stainless steel A4 and HCR, class 80		$\gamma_{Ms,N}$	[-]	1,6							
Characteristic shear resistance, Steel failure[1)]											
Without lever arm	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
	Stainless steel A2, A4 and HCR, class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
	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)]
With lever arm	Steel, Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900
	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123
	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
	Stainless steel A2, A4 and HCR, class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561	832	1125
	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)]
Characteristic shear resistance, Partial factor[2)]											
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,V}$	[-]	1,67							
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,V}$	[-]	1,25							
Stainless steel A2, A4 and HCR, class 50		$\gamma_{Ms,V}$	[-]	2,38							
Stainless steel A2, A4 and HCR, class 70		$\gamma_{Ms,V}$	[-]	1,56							
Stainless steel A4 and HCR, class 80		$\gamma_{Ms,V}$	[-]	1,33							

[1)] Values are only valid for the given stress area A_s. Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.
[2)] In absence of national regulation
[3)] Anchor type not part of the ETA

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

Annex C1

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Table C2: Characteristic values for concrete cone failure and splitting failure

Anchor size				**All anchor types and sizes**
Concrete cone failure				
Uncracked concrete		$k_{ucr,N}$	[-]	11,0
Cracked concrete		$k_{cr,N}$	[-]	7,7
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$
Axial distance		$s_{cr,N}$	[mm]	$2\ c_{cr,N}$
Splitting failure				
Edge distance	$h/h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	$1,0\ h_{ef}$
	$2,0 > h/h_{ef} > 1,3$			$2 \cdot h_{ef}\left(2,5 - \frac{h}{h_{ef}}\right)$
	$h/h_{ef} \leq 1,3$			$2,4\ h_{ef}$
Axial distance		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$

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Performances Characteristic values for concrete cone failure and splitting failure	

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Table C3: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years

Anchor size threaded rod					**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure												
Characteristic tension resistance			$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ (or see Table C1)							
Partial factor			$\gamma_{Ms,N}$	[-]	See Table C1							
Combined pull-out and concrete failure												
Characteristic bond resistance in uncracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	17	17	16	15	14	13	13	13
	II: 80°C/50°C		$\tau_{Rk,ucr}$	[N/mm²]	17	17	16	15	14	13	13	13
	III: 120°C/72°C		$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	12	12	11	11
	IV: 160°C/100°C		$\tau_{Rk,ucr}$	[N/mm²]	12	11	11	10	9,5	9,0	9,0	9,0
Characteristic bond resistance in cracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
	II: 80°C/50°C		$\tau_{Rk,cr}$	[N/mm²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
	III: 120°C/72°C		$\tau_{Rk,cr}$	[N/mm²]	6,0	6,5	7,0	7,5	7,0	6,0	6,0	6,0
	IV: 160°C/100°C		$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	6,0	6,5	6,0	5,5	5,5	5,5
Reduction factor ψ^0_{sus} in cracked and uncracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,90							
	II: 80°C/50°C				0,87							
	III: 120°C/72°C				0,75							
	IV: 160°C/100°C				0,66							
Increasing factors for concrete ψ_c			C25/30		1,02							
			C30/37		1,04							
			C35/45		1,07							
			C40/50		1,08							
			C45/55		1,09							
			C50/60		1,10							
Concrete cone failure												
Relevant parameter					See Table C2							
Splitting failure												
Relevant parameter					See Table C2							
Installation factor												
For dry and wet concrete		MAC	γ_{inst}	[-]	1,2					No Performance Assessed		
		CAC			1,0							
		HDB			1,2							
For flooded bore hole		CAC			1,4							

Injection system AC200+ for concrete

Performances
Characteristic values of tension loads under static and quasi-static action

Annex C3

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Table C4: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years

Anchor size threaded rod					**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure												
Characteristic tension resistance			$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ (or see Table C1)							
Partial factor			$\gamma_{Ms,N}$	[-]	See Table C1							
Combined pull-out and concrete failure												
Characteristic bond resistance in uncracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,100}$	[N/mm²]	17	17	16	15	14	13	13	13
Temperature range	II: 80°C/50°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,100}$	[N/mm²]	17	17	16	15	14	13	13	13
Characteristic bond resistance in cracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,cr,100}$	[N/mm²]	5,5	6,0	6,5	6,5	6,5	6,5	6,5	6,5
Temperature range	II: 80°C/50°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,cr,100}$	[N/mm²]	5,5	6,0	6,5	6,5	6,5	6,5	6,5	6,5
Increasing factors for concrete ψ_c			C25/30		1,02							
			C30/37		1,04							
			C35/45		1,07							
			C40/50		1,08							
			C45/55		1,09							
			C50/60		1,10							
Concrete cone failure												
Relevant parameter					See Table C2							
Splitting failure												
Relevant parameter					See Table C2							
Installation factor												
For dry and wet concrete		MAC	γ_{inst}	[-]	1,2					No Performance Assessed		
		CAC			1,0							
		HDB			1,2							
For flooded bore hole		CAC			1,4							

Injection system AC200+ for concrete

Performances
Characteristic values of tension loads under static and quasi-static action

Annex C4

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Table C5: Characteristic values of shear loads under static and quasi-static action

Anchor size 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]	$0,6 \cdot A_s \cdot f_{uk}$ (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]	$0,5 \cdot A_s \cdot f_{uk}$ (or see Table C1)							
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1							
Ductility factor	k_7	[-]	1,0							
Steel failure with lever arm										
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$ (or see Table C1)							
Elastic section modulus	W_{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1							
Concrete pry-out failure										
Factor	k_8	[-]	2,0							
Installation factor	γ_{inst}	[-]	1,0							
Concrete edge failure										
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$						$\min(h_{ef}; 300mm)$	
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γ_{inst}	[-]	1,0							

Injection system AC200+ for concrete

Performances
Characteristic values of shear loads under static and quasi-static action

Annex C5

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Table C6: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years

Anchor size reinforcing bar					**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø24**	**Ø25**	**Ø28**	**Ø32**
Steel failure														
Characteristic tension resistance			$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1]									
Cross section area			A_s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor			$\gamma_{Ms,N}$	[-]	1,4 [2]									
Combined pull-out and concrete failure														
Characteristic bond resistance in uncracked concrete C20/25														
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	14	14	14	14	13	13	13	13	13	13
	II: 80°C/50°C		$\tau_{Rk,ucr}$	[N/mm²]	14	14	14	14	13	13	13	13	13	13
	III: 120°C/72°C		$\tau_{Rk,ucr}$	[N/mm²]	13	12	12	12	12	11	11	11	11	11
	IV: 160°C/100°C		$\tau_{Rk,ucr}$	[N/mm²]	9,5	9,5	9,5	9,0	9,0	9,0	9,0	9,0	8,5	8,5
Characteristic bond resistance in cracked concrete C20/25														
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
	II: 80°C/50°C		$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
	III: 120°C/72°C		$\tau_{Rk,cr}$	[N/mm²]	4,5	5,0	5,0	5,5	5,5	5,5	5,5	6,0	6,0	6,0
	IV: 160°C/100°C		$\tau_{Rk,cr}$	[N/mm²]	4,0	4,5	4,5	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Reduction factor ψ^0_{sus} in cracked and uncracked concrete C20/25														
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,90									
	II: 80°C/50°C				0,87									
	III: 120°C/72°C				0,75									
	IV: 160°C/100°C				0,66									
Increasing factors for concrete ψ_c			C25/30		1,02									
			C30/37		1,04									
			C35/45		1,07									
			C40/50		1,08									
			C45/55		1,09									
			C50/60		1,10									
Concrete cone failure														
Relevant parameter					See Table C2									
Splitting failure														
Relevant parameter					See Table C2									
Installation factor														
For dry and wet concrete	MAC		γ_{inst}	[-]	1,2					No Performance Assessed				
	CAC				1,0									
	HDB				1,2									
For flooded bore hole	CAC				1,4									

[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] In absence of national regulation

Injection system AC200+ for concrete

Performances
Characteristic values of tension loads under static and quasi-static action

Annex C6

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Table C7: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years

Anchor size reinforcing bar				**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø24**	**Ø25**	**Ø28**	**Ø32**
Steel failure													
Characteristic tension resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1]									
Cross section area		A_s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]	1,4 [2]									
Combined pull-out and concrete failure													
Characteristic bond resistance in uncracked concrete C20/25													
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,100}$	[N/mm²]	14	14	14	14	13	13	13	13	13	13
Temperature range II: 80°C/50°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,100}$	[N/mm²]	14	14	14	14	13	13	13	13	13	13
Characteristic bond resistance in cracked concrete C20/25													
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,cr,100}$	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0
Temperature range II: 80°C/50°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,cr,100}$	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0
Increasing factors for concrete ψ_c		C25/30		1,02									
		C30/37		1,04									
		C35/45		1,07									
		C40/50		1,08									
		C45/55		1,09									
		C50/60		1,10									
Concrete cone failure													
Relevant parameter				See Table C2									
Splitting failure													
Relevant parameter				See Table C2									
Installation factor													
For dry and wet concrete	MAC	γ_{inst}	[-]	1,2					No Performance Assessed				
	CAC			1,0									
	HDB			1,2									
For flooded bore hole	CAC			1,4									

[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] In absence of national regulation

Injection system AC200+ for concrete

Performances
Characteristic values of tension loads under static and quasi-static action

Annex C7

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Table C8: Characteristic values of shear loads under static and quasi-static action

Anchor size reinforcing bar			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø24**	**Ø25**	**Ø28**	**Ø32**
Steel failure without lever arm												
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]	$0{,}50 \cdot A_s \cdot f_{uk}$ [1)]									
Cross section area	A_s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 [2)]									
Ductility factor	k_7	[-]	1,0									
Steel failure with lever arm												
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1.2 \cdot W_{el} \cdot f_{uk}$ [1)]									
Elastic section modulus	W_{el}	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 [2)]									
Concrete pry-out failure												
Factor	k_8	[-]	2,0									
Installation factor	γ_{inst}	[-]	1,0									
Concrete edge failure												
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$							$\min(h_{ef}; 300mm)$		
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γ_{inst}	[-]	1,0									

[1)] f_{uk} shall be taken from the specifications of reinforcing bars
[2)] In absence of national regulation

Injection system AC200+ for concrete

Performances
Characteristic values of shear loads under static and quasi-static action

Annex C8

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Table C9: Displacements under tension load[1] (threaded rod)

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete C20/25 under static and quasi-static action for a working life of 50 and 100 years										
Temperature range I: 40°C/24°C II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,031	0,032	0,034	0,037	0,039	0,042	0,044	0,046
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,040	0,042	0,044	0,047	0,051	0,054	0,057	0,060
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,032	0,034	0,035	0,038	0,041	0,044	0,046	0,048
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,042	0,044	0,045	0,049	0,053	0,056	0,059	0,062
Temperature range IV: 160°C/100°C	δ_{N0}-factor	[mm/(N/mm²)]	0,121	0,126	0,131	0,142	0,153	0,163	0,171	0,179
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,124	0,129	0,135	0,146	0,157	0,168	0,176	0,184
Cracked concrete under static and quasi-static action for a working life of 50 and 100 years										
Temperature range I: 40°C/24°C II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,081	0,083	0,085	0,090	0,095	0,099	0,103	0,106
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,104	0,107	0,110	0,116	0,122	0,128	0,133	0,137
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,084	0,086	0,088	0,093	0,098	0,103	0,107	0,110
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,108	0,111	0,114	0,121	0,127	0,133	0,138	0,143
Temperature range IV: 160°C/100°C	δ_{N0}-factor	[mm/(N/mm²)]	0,312	0,321	0,330	0,349	0,367	0,385	0,399	0,412
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,321	0,330	0,340	0,358	0,377	0,396	0,410	0,424

[1] Calculation of the displacement

$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension

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

Table C10: Displacements under shear load[2] (threaded rod)

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked and cracked concrete under static and quasi-static action										
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

[2] Calculation of the displacement

$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load

$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

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Performances
Displacements under static and quasi-static action (threaded rods)

Annex C9

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Table C11: Displacements under tension load[1] (reinforcing bar)

Anchor size reinforcing bar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø24	Ø25	Ø28	Ø32
Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years												
Temperature range I: 40°C/24°C II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,031	0,032	0,034	0,035	0,037	0,039	0,042	0,043	0,045	0,048
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,040	0,042	0,044	0,045	0,047	0,051	0,054	0,055	0,058	0,063
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,032	0,034	0,035	0,036	0,038	0,041	0,044	0,045	0,047	0,050
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,042	0,044	0,045	0,047	0,049	0,053	0,056	0,057	0,060	0,065
Temperature range IV: 160°C/100°C	δ_{N0}-factor	[mm/(N/mm²)]	0,121	0,126	0,131	0,137	0,142	0,153	0,163	0,164	0,172	0,186
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,124	0,129	0,135	0,141	0,146	0,157	0,168	0,169	0,177	0,192
Cracked concrete under static and quasi-static action for a working life of 50 and 100 years												
Temperature range I: 40°C/24°C II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,081	0,083	0,085	0,087	0,090	0,095	0,099	0,099	0,103	0,108
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,104	0,107	0,110	0,113	0,116	0,122	0,128	0,128	0,133	0,141
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,084	0,086	0,088	0,090	0,093	0,098	0,103	0,103	0,107	0,113
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,108	0,111	0,114	0,118	0,121	0,127	0,133	0,133	0,138	0,148
Temperature range IV: 160°C/100°C	δ_{N0}-factor	[mm/(N/mm²)]	0,312	0,321	0,330	0,340	0,349	0,367	0,385	0,385	0,399	0,425
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,321	0,330	0,340	0,349	0,358	0,377	0,396	0,396	0,410	0,449

[1] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C12: Displacements under shear load[2] (reinforcing bar)

Anchor size reinforcing bar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø24	Ø25	Ø28	Ø32
Uncracked and cracked concrete under static and quasi-static action												
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05	0,04	0,04

[2] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

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Performances Displacements under static and quasi-static action (reinforcing bar)	

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Table C13: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 and 100 years

Anchor size threaded rod					**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure												
Characteristic tension resistance			$N_{Rk,s,eq,C1}$	[kN]	$1,0 \cdot N_{Rk,s}$							
Partial factor			$\gamma_{Ms,N}$	[-]	See Table C1							
Combined pull-out and concrete failure												
Characteristic bond resistance in cracked and uncracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,eq,C1}$	[N/mm²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
	II: 80°C/50°C		$\tau_{Rk,eq,C1}$	[N/mm²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
	III: 120°C/72°C		$\tau_{Rk,eq,C1}$	[N/mm²]	6,0	6,5	7,0	7,5	7,0	6,0	6,0	6,0
	IV: 160°C/100°C		$\tau_{Rk,eq,C1}$	[N/mm²]	5,5	5,5	6,0	6,5	6,0	5,5	5,5	5,5
Increasing factors for concrete ψ_c			C25/30 to C50/60		1,0							
Installation factor												
For dry and wet concrete		CAC	γ_{inst}	[-]	1,0							
		HDB			1,2							
For flooded bore hole		CAC			1,4							

Table C14: Characteristic values of shear loads under seismic action (performance category C1)

Anchor size threaded rod			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure										
Characteristic shear resistance	$V_{Rk,s,eq,C1}$	[kN]	$0,70 \cdot V^0_{Rk,s}$							
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1							
Factor for annular gap	α_{gap}	[-]	0,5							

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

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Table C15: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 and 100 years

Anchor size reinforcing bar				**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø24**	**Ø25**	**Ø28**	**Ø32**
Steel failure													
Characteristic tension resistance		$N_{Rk,s,eq,C1}$	[kN]	$1,0 \cdot A_s \cdot f_{uk}$ [1]									
Cross section area		A_s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]	1,4 [2]									
Combined pull-out and concrete failure													
Characteristic bond resistance in cracked and uncracked concrete C20/25													
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,eq,C1}$	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
Temperature range II: 80°C/50°C		$\tau_{Rk,eq,C1}$	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
Temperature range III: 120°C/72°C		$\tau_{Rk,eq,C1}$	[N/mm²]	4,5	5,0	5,0	5,5	5,5	5,5	5,5	6,0	6,0	6,0
Temperature range IV: 160°C/100°C		$\tau_{Rk,eq,C1}$	[N/mm²]	4,0	4,5	4,5	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Increasing factors for concrete ψ_C		C25/30 to C50/60		1,0									
Installation factor													
For dry and wet concrete	CAC	γ_{inst}	[-]	1,0									
For dry and wet concrete	HDB	γ_{inst}	[-]	1,2									
For flooded bore hole	CAC	γ_{inst}	[-]	1,4									

[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] In absence of national regulation

Table C16: Characteristic values of shear loads under seismic action (performance category C1)

Anchor size reinforcing bar			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø24**	**Ø25**	**Ø28**	**Ø32**
Steel failure												
Characteristic shear resistance	$V_{Rk,s,eq}$	[kN]	$0,35 \cdot A_s \cdot f_{uk}$ [1]									
Cross section area	A_s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 [2]									
Factor for annular gap	α_{gap}	[-]	0,5									

[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] In absence of national regulation

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

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Table C17: Characteristic values of tension loads under seismic action (performance category C2) for a working life of 50 and 100 years

Anchor size threaded rod					**M12**	**M16**	**M20**	**M24**
Steel failure								
Characteristic tension resistance, Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70			$N_{Rk,s,eq,C2}$	[kN]	$1,0 \cdot N_{Rk,s}$			
Partial factor			$\gamma_{Ms,N}$	[-]	See Table C1			
Combined pull-out and concrete failure								
Characteristic bond resistance in cracked and uncracked concrete C20/25								
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,eq,C2}$	[N/mm²]	3,6	3,5	3,3	2,3
	II: 80°C/50°C		$\tau_{Rk,eq,C2}$	[N/mm²]	3,6	3,5	3,3	2,3
	III: 120°C/72°C		$\tau_{Rk,eq,C2}$	[N/mm²]	3,1	3,0	2,8	2,0
	IV: 160°C/100°C		$\tau_{Rk,eq,C2}$	[N/mm²]	2,5	2,7	2,5	1,8
Increasing factors for concrete ψ_c			C25/30 to C50/60		1,0			
Installation factor								
For dry and wet concrete		CAC	γ_{inst}	[-]	1,0			
		HDB			1,2			
For flooded bore hole		CAC			1,4			

Table C18: Characteristic values of shear loads under seismic action (performance category C2)

Anchor size threaded rod			**M12**	**M16**	**M20**	**M24**
Steel failure						
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	$V_{Rk,s,eq,C2}$	[kN]	$0,70 \cdot V^0_{Rk,s}$			
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1			
Factor for annular gap	α_{gap}	[-]	0,5			

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Performances
Characteristic values of tension and shear loads under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)

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Table C19: Displacements under tension load (threaded rod)

Anchor size threaded rod			M12	M16	M20	M24
Uncracked and cracked concrete under seismic action (performance category C2)						
All temperature ranges	$\delta_{N,eq,C2(DLS)}$	[mm]	0,24	0,27	0,29	0,27
	$\delta_{N,eq,C2(ULS)}$	[mm]	0,55	0,51	0,50	0,58

Table C20: Displacements under shear load (threaded rod)

Anchor size threaded rod			M12	M16	M20	M24
Uncracked and cracked concrete under seismic action (performance category C2)						
All temperature ranges	$\delta_{V,eq,C2(DLS)}$	[mm]	3,6	3,0	3,1	3,5
	$\delta_{V,eq,C2(ULS)}$	[mm]	7,0	6,6	7,0	9,3

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Performances
Displacements under seismic action (performance category C2) (threaded rods)

Annex C14