



Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments



European Technical Assessment

ETA-19/0201 of 22 October 2020

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

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

This version replaces

Deutsches Institut für Bautechnik

Chemofast Injection System EP 1000 for concrete

Bonded fastener for use in concrete

CHEMOFAST Anchoring GmbH Hanns-Martin-Schleyer-Straße 23 47877 Willich DEUTSCHLAND

CHEMOFAST Anchoring GmbH Hanns-Martin-Schleyer-Straße 23 47877 Willich DEUTSCHLAND

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

EAD 330499-01-0601 Edition 04/2020

ETA-19/0201 issued on 17 December 2019



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Z69579.20 8.06.01-639/20



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Specific Part

1 Technical description of the product

The "Chemofast Injection system EP 1000 for concrete" is a bonded anchor consisting of a cartridge with injection mortar Chemofast Injection mortar EP 1000 and a steel element according to Annex A3.

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 quasistatic loading)	See Annex C 1 to C 5, C 7 to C 9, C 11 to C13, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 6, C 10, C 14
Displacements under short-term and long-term loading	See Annex C 15 to C 17
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 18 to C 21

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 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 22 October 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow beglaubigt:
Head of Department Lange

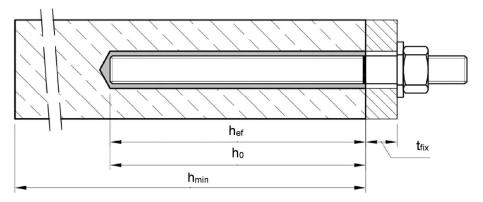
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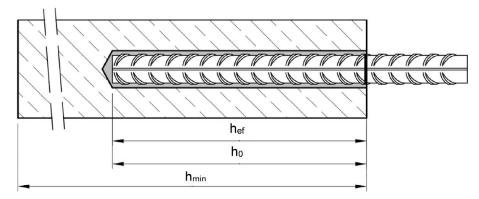
Installation threaded rod M8 up to M30

prepositioned installation or

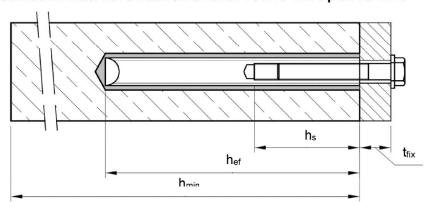
push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø32



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



 t_{fix} = thickness of fixture

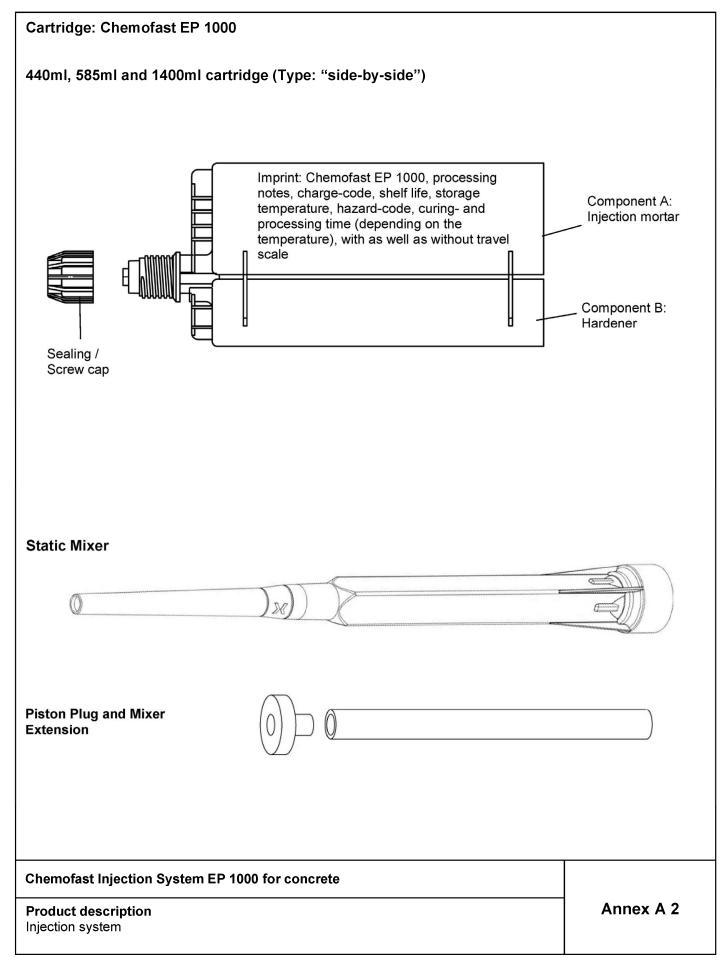
h_{ef} = effective anchorage depth

 $h_0 = depth of drill hole$

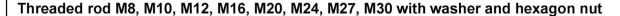
 h_{min} = minimum thickness of member

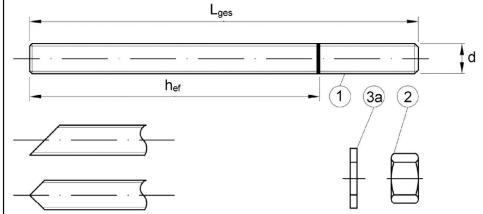
Chemofast Injection System EP 1000 for concrete	
Product description Installed condition	Annex A 1







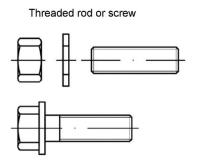


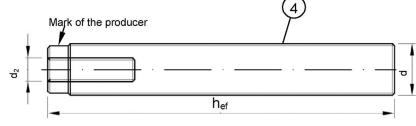


Commercial standard threaded rod with:

- Materials, dimensions and mechanical properties acc. Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004
- Marking of embedment depth







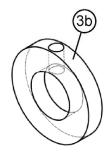
Marking: e.g.

Marking Internal thread Mark

Thread size (Internal thread) M8 additional mark for stainless steel Α4

additional mark for high-corrosion resistance steel HCR

Filling washer and mixer reduction nozzle for filling the annular gap between anchor rod and fixture





Chemofast Injection System EP 1000 for concrete

Product description

Threaded rod, internal threaded rod and filling washer

Annex A 3

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Table A1: Materials										
Part	Designation	Material								
Stee zi ho	ll, zinc plated (Steel one plated ≥ 5 ot-dip galvanised ≥ 4	acc. to EN 10087:1998 5 µm acc. to EN ISO 10 µm acc. to EN ISO 15 µm acc. to EN ISO	404 146	2:1999 or 1:2009 and EN ISO 10684:	2004+AC:2009 or					
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture				
			4.6	f _{uk} = 400 N/mm ²	f _{vk} = 240 N/mm²	A ₅ > 8%				
1	Threaded rod		4.8	f _{uk} = 400 N/mm²	f _{vk} = 320 N/mm²	A ₅ > 8%				
	Thicaded rod	acc. to		f _{uk} = 500 N/mm²	f _{vk} = 300 N/mm²	A ₅ > 8%				
		EN ISO 898-1:2013		f _{uk} = 500 N/mm²	f _{vk} = 400 N/mm²	A ₅ > 8%				
				f _{uk} = 800 N/mm²	f _{vk} = 640 N/mm²	A ₅ ≥ 12% ³⁾				
			4	for anchor rod class 4.6 o	1 7					
2 Hexagon nut acc. to 5 for anchor rod class 5.6 or 5.8 5 for anchor rod class 5.6 or 5.8										
8 for anchor rod class 8.8										
3a	Washer	(e.g.: EN ISO 887:20	06, E	galvanised or sherardized EN ISO 7089:2000, EN ISC	7093:2000 or EN ISO 7	094:2000)				
3b	Filling washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized	T -					
	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture				
4	anchor rod	acc. to	5.8	f _{uk} = 500 N/mm²	f _{yk} = 400 N/mm²	A ₅ > 8%				
EN ISO 898-1:2013			8.8	f _{uk} = 800 N/mm²	f _{yk} = 640 N/mm²	A ₅ > 8%				
tai	nless steel A4 (Mate	rial 1.4401 / 1.4404 / 1	.457	1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088	o EN 10088-1:2014)					
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture				
1	Threaded rod ¹⁾⁴⁾	led rod ¹⁾⁴⁾		f _{uk} = 500 N/mm ²	f _{yk} = 210 N/mm ²	A ₅ ≥ 8%				
•	Timodada rod	acc. to EN ISO 3506-1:2009	70 f _{uk} = 700 N/mm ²		f _{vk} = 450 N/mm²	A ₅ ≥ 12% ³⁾				
		EN 130 3306-1.2009	80	f _{uk} = 800 N/mm²	f _{vk} = 600 N/mm ²	A ₅ ≥ 12% ³⁾				
		and to	50	for anchor rod class 50						
2	Hexagon nut 1)4)	acc. to EN ISO 3506-1:2009	70	for anchor rod class 70						
			80	for anchor rod class 80						
A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014 A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014 HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014 (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)										
3b	Filling washer	Stainless steel A4, H	igh c	orrosion resistance steel						
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture				
4	Internal threaded	acc. to	50	f _{uk} = 500 N/mm²	f _{yk} = 210 N/mm²	A ₅ > 8%				
-	anchor rod ¹⁾²⁾	EN ISO 3506-1:2009	70	f _{uk} = 700 N/mm ²	f _{yk} = 450 N/mm²	A ₅ > 8%				

¹⁾ Property class 70 or 80 for anchor rods and hexagon nuts up to M24 and Internal threaded anchor rods up to IG-M16

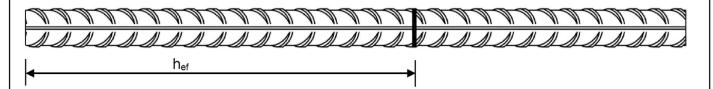
⁴⁾ Property class 80 only for stainless steel A4 and HCR

Chemofast Injection System EP 1000 for concrete	
Product description Materials threaded rod and internal threaded rod	Annex A 4

²⁾ for IG-M20 only property class 50

 $^{^{3)}}$ A₅ > 8% fracture elongation if \underline{no} use for seismic performance category C2

Reinforcing bar \varnothing 8, \varnothing 10, \varnothing 12, \varnothing 14, \varnothing 16, \varnothing 20, \varnothing 24, \varnothing 25, \varnothing 28, \varnothing 32



- Minimum value of related rip area f_{R,min} according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range 0,05d ≤ h ≤ 0,07d
 (d: Nominal diameter of the bar; h: Rip height of the bar)

Table A2: Materials

F	Part	Designation	Material
F	Reinf	orcing bars	
	1	I ENI 1992-1-1-2004+40-2010 Annev 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 $f_{uk} = f_{tk} = k \cdot f_{yk}$

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Chemofast Injection System EP 1000 for concrete	
Product description Materials reinforcing bar	Annex A 5



Anchorages subject to (Static and quasi-static loads):											
	for a working l	ife of 50 years	for a working life of 100 years								
Base material	Non-cracked concrete	cracked concrete	Non-cracked concrete	cracked concrete							
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	Ø8 to	M30, Ø32, o IG-M20	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20								
Diamond drilling (DD)	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20	No performance assessed	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20	No performance assessed							
Temperature Range:		to +40 °C¹) to +72 °C²)	I: - 40 °C to +40 °C ¹⁾ II: - 40 °C to +72 °C ²⁾								
Anchorages subject to (Seism	ic action):										
	for Performar	nce Category C1	for Performar	nce Category C2							
Base material		Cracked and no	n-cracked concrete								
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)		o M30, to Ø32	M12 to M24								
Diamond drilling (DD)	No performance assessed No performance assessed										
Temperature Range:		I: -40 °C to +40 °C ¹⁾ I: -40 °C to +40 °C ¹⁾									

Specifications of intended use

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

Chemofast Injection System EP 1000 for concrete	
Intended Use Specifications	Annex B 1

^{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)

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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 by hammer (HD), hollow (HDB), compressed air (CD) or diamond drill mode (DD).
- 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.

Chemofast Injection System EP 1000 for concrete	
Intended Use Specifications	Annex B 2



Table B1: Installation parameters for threaded rod											
Anchor size		M8	M10	M12	M16	M20	M24	M27	M30		
Diameter of elemen	t	d = d _{nom}	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole di	ameter	d _o	[mm]	10	12	14	18	22	28	30	35
Effective coolerators at death		h _{ef,min}	[mm]	60	60	70	80	90	96	108	120
Ellective ellibedillei	Effective embedment depth		[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in	Prepositioned ins	tallation d _f ≤	[mm]	9	12	14	18	22	26	30	33
the fixture	Push through installation d _f		[mm]	12	14	16	20	24	30	33	40
Maximum torque mo	oment	max T _{inst} ≤	[Nm]	10	20	40 ¹⁾	60	100	170	250	300
Minimum thickness of member		h _{min}	[mm]	h _{ef} + 30 mm ≥ 100 mm			h _{ef} + 2d ₀	2d ₀			
Minimum spacing		s _{min}	[mm]	40	50	60	75	95	115	125	140
Minimum edge dista	ince	c _{min}	[mm]	35	40	45	50	60	65	75	80

¹⁾ Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm

Table B2: Installation parameters for rebar

Anchor size				Ø 10 ¹⁾	Ø 12 ¹	Ø 14	Ø 16	Ø 20	Ø 24 ¹⁾	Ø 25 ¹⁾	Ø 28	Ø 32
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
Ellective ellibedilletit deptil	$h_{ef,max}$	[mm]	160	200	240	280	320	400	480	500	560	640
Minimum thickness of member	h _{min}	[mm]	h _{ef} + 30 mm 100 mm		2			h _e	_f + 2d ₀			
Minimum spacing	s _{min}	[mm]	40	40 50		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

Table B3: Installation parameters for Internal threaded anchor rod

Anchor size			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-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 death	h _{ef,min}	[mm]	60	70	80	90	96	120
Effective embedment depth	h _{ef,max}		200	240	320	400	480	600
Diameter of clearance hole in the fixture	d _f ≤	[mm]	7	9	12	14	18	22
Maximum torque moment	max T _{inst} ≤	[Nm]	10	10	20	40	60	100
Thread engagement length min/max	I _{IG}	[mm]	8/20	8/20	10/25	12/30	16/32	20/40
Minimum thickness of member	h _{min}	[mm]		30 mm 0 mm		h _{ef} +	- 2d₀	
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 1993-1-8:2005+AC:2009

Chemofast Injection System EP 1000 for concrete

Intended Use

Installation parameters

Annex B 3

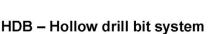


Table B4	: Paran	neter clea	ning and s	etting	g tool	S				
				The state of the s	mannik	Man Mark				
Threaded Rod	Rebar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD, DD	d Brus	l _b h - Ø	d _{b,min} min. Brush - Ø	Piston plug	Installatio of	n directio piston plu	
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		1	1	1
M8	8		10	RB10	11,5	10,5				
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		No plua	required	
M12	10 / 12	IG-M8	14	RB14	15,5	14,5		No plug	required	
	12		16	RB16	17,5	16,5				
M16	14	IG-M10	18	RB18	20,0	18,5	VS18			
	16		20	RB20	22,0	20,5	VS20			
M20		IG-M12	22	RB22	24,0	22,5	VS22			
	20		25	RB25	27,0	25,5	VS25	h _{ef} >	h _{ef} >	
M24		IG-M16	28	RB28	30,0	28,5	VS28	250 mm	250 mm	all
M27	24 / 25		30	RB30	31,8	30,5	VS30	230 11111	230 111111	
	24 / 25		32	RB32	34,0	32,5	VS32			
M30	28	IG-M20	35	RB35	37,0	35,5	VS35]		
	32		40	RB40	43,5	40,5	VS40			

CAC - Rec. compressed air tool (min 6 bar)

Drill bit diameter (d₀): all diameters





Drill bit diameter (d₀): all diameters

The hollow drill bit system contains the Heller Duster Expert hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa <u>and</u> flow rate of minimum 150 m³/h (42 l/s).



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Installation instructions

Drilling of the bore hole (HD, HDB, CD)

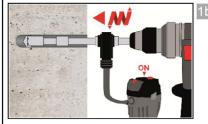


Hammer (HD) or compressed air drilling (CD)

Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2 or B3).

Proceed with Step 2.

In case of aborted drill hole, the drill hole shall be filled with mortar.



Hollow drill bit system (HDB) (see Annex B 3)

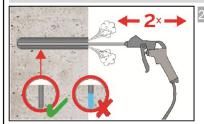
Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2 or B3). This drilling system removes the dust and cleans the bore hole during drilling (all conditions).

Proceed with Step 3.

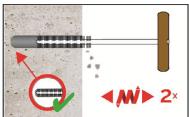
In case of aborted drill hole, the drill hole shall be filled with mortar.

Attention! Standing water in the bore hole must be removed before cleaning.

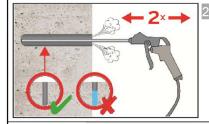
CAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete



Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used



Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension must be used.



Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

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

Chemofast Injection System EP 1000 for concrete

Intended Use
Installation instructions

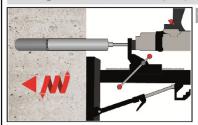
Annex B 5

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Installation instructions (continuation)

Drilling of the bore hole (DD)



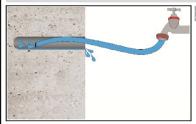
Diamond drilling (DD)

Drill with diamond drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). Proceed with Step 2.

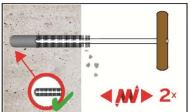
In case of aborted drill hole, the drill hole shall be filled with mortar.

Attention! Standing water in the bore hole must be removed before cleaning.

SPCAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete

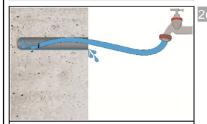


2a. Rinsing with water until clear water comes out.

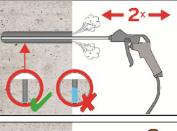


Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times.

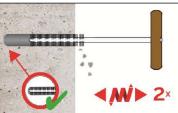
If the bore hole ground is not reached with the brush, a brush extension must be used.



Rinsing again with water until clear water comes out.



Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used



Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times.

If the bore hole ground is not reached with the brush, a brush extension must be used.

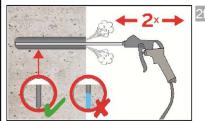
Chemofast Injection System EP 1000 for concrete

Intended Use

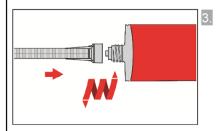
Installation instructions (continuation)

Annex B 6

Installation instructions (continuation)

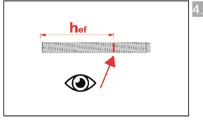


Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

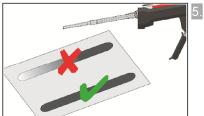


Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.

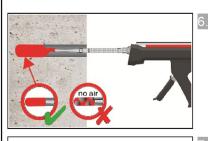
For every working interruption longer than the recommended working time (Table B5 as well as for new cartridges, a new static-mixer shall be used.



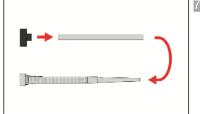
Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.



Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey or red colour.



Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used. Observe the gel-/ working times given in Table B5.



Piston plugs shall be used according to Table B4 for the following applications:

- Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-Ø d₀ ≥ 18 mm and embedment depth h_{ef} > 250mm
- Overhead assembly (vertical upwards direction): Drill bit-Ø d₀ ≥ 18 mm
 Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.

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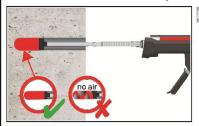
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Installation instructions (continuation)

Annex B 7

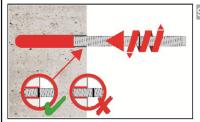


Installation instructions (continuation)



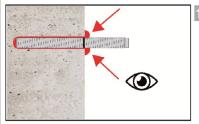
Insert piston plug to back of the hole and inject adhesive. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used.

During injection the piston plug is naturally pushed out of the borehole by the back pressure of the mortar. Observe the gel-/ working times given in Table B5.



Push the fixing element into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment mark has reached the surface level.

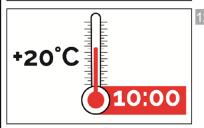
The anchor shall be free of dirt, grease, oil or other foreign material.



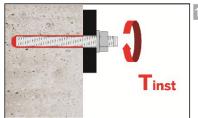
10. After inserting the anchor, the annular gab between anchor rod and concrete, in case of a push through installation additionally also the fixture, must be complete filled with mortar. If excess mortar is not visible at the top of the hole, the requirement is not fulfilled and the application has to be renewed.



For overhead application the anchor rod shall be fixed (e.g. wedges) until the mortar has started to harden.



12. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B5).



After full curing, the add-on part can be installed with up to the max. torque (Table B1 or B3) by using a calibrated torque wrench. In case of prepositioned installation the annular gab between anchor and fixture can be optional filled with mortar. Therefor substitute the washer by the filling washer and connect the mixer reduction nozzle to the tip of the mixer. The annular gap is filled with mortar, when mortar oozes out of the washer.

Chemofast Injection System EP 1000 for concrete

Intended Use
Installation instructions (continuation)

Annex B 8



Table B5: Maximum working time and minimum curing time Gelling Minimum curing time in Minimum curing time in Concrete temperature working time dry concrete wet concrete 0°C + 4 °C 90 min 144 h 288 h to + 5 °C + 9 °C 80 min 48 h 96 h to + 10 °C + 14 °C 60 min 28 h 56 h to + 15 °C + 19 °C 40 min 18 h 36 h to + 20 °C + 24 °C 30 min 12 h 24 h to + 25 °C + 34 °C 12 min 9 h 18 h to + 35 °C + 39 °C 6 h 12 h to 8 min +40 °C 8 min 4 h 8 h Cartridge temperature +5°C to +40°C

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Intended Use
Curing time

Annex B 9

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Т	able C1: Characteristic values resistance of threads			ension	resista	ance a	and st	teel sl	hear				
Si	ze			M8	M10	M12	M16	M20	M24	M27	M30		
Cr	oss section area	A _s	[mm²]	36,6	58	84,3	157	245	353	459	561		
Cr	naracteristic tension resistance, Steel failu	re 1)		•					•	•			
St	eel, Property class 4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224		
St	eel, Property class 5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280		
St	eel, Property class 8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449		
St	ainless steel A2, A4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281		
St	ainless steel A2, A4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)		
St	ainless steel A4 and HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)		
Cł	naracteristic tension resistance, Partial fac	tor ²⁾											
St	eel, Property class 4.6 and 5.6	γ _{Ms,N}	[-]				2,0	0					
St	eel, Property class 4.8, 5.8 and 8.8	γ _{Ms,N}	[-]				1,	5					
St	ainless steel A2, A4 and HCR, class 50	$\gamma_{Ms,N}$	[-]				2,8	6					
St	ainless steel A2, A4 and HCR, class 70	γ _{Ms,N}	[-]		1,87								
	ainless steel A4 and HCR, class 80	γ _{Ms,N}	[-]				1,6	3					
Cr	naracteristic shear resistance, Steel failure	1)	T				Γ	ı	1	ı	I		
ے	Steel, Property class 4.6 and 4.8	V ⁰ Rk,s	[kN]	9 (8)	14 (13)	20	38	59	85	110	135		
r arm	Steel, Property class 5.6 and 5.8	V ⁰ Rk,s	[kN]	11 (10)	17 (16)	25	47	74	106	138	168		
eve	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 ^U 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 ^U 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		
arm	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		
With lever	Stainless steel A2, A4 and HCR, class 50	M ⁰ Rk,s	[Nm]	19	37	66	167	325	561	832	1125		
Wit	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)		
Cł	naracteristic shear resistance, Partial facto	r ²⁾											
St	eel, Property class 4.6 and 5.6	$\gamma_{Ms,V}$	[-]				1,6	7					
St	eel, Property class 4.8, 5.8 and 8.8	γ _{Ms,V}	[-]				1,2	25					
Stainless steel A2, A4 and HCR, class 50 $\gamma_{Ms,V}$ [-] 2,38													
St	ainless steel A2, A4 and HCR, class 70	$\gamma_{Ms,V}$	[-]				1,5	6					
St	ainless steel A4 and HCR, class 80	γ _{Ms,V}	[-]				1,3	3					

¹⁾ Values are only valid for the given stress area As. 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

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³⁾ Anchor type not part of the ETA

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods	Annex C 1



Table C2:	Characteristic v of action	alues for C	oncrete co	one failure and Splitting with all kind
Anchor				All Anchor type and sizes
Concrete cone f	ailure			
Non-cracked con	crete	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}

Chemofast Injection System EP 1000 for concrete

Performances
Characteristic values for Concrete cone failure and Splitting with all kind of action

Annex C 2



			50 years	_							
Anchor size threaded re Steel failure	od			M8	M10	M12	M16	M20	M24	M27	M30
Steel fallure Characteristic tension res	sistance	N _D .	[FN]]			A • f	_{ık} (or se	ee Tah	le (:1)		
	SISIANCE	N _{Rk,s}	[kN]								
Partial factor		γMs,N	[-]				see Ta	ible C1			
Combined pull-out and		lead assausts	C20/25 in har		مالم مالئما	alaa /II	D\ a = d			النمام منا	a al
Characteristic bond resis holes (CD)	tance in non-crac		C20/25 In har	nmer d	irillea n	oles (n	ال and	compr	essea	air driii	ea
I: 40°C/24°C	Dry, wet concrete and	TDI	[N/mm²]	20	20	19	19	18	17	16	16
ص اا: 72°C/50°C	flooded bore hole	[⊤] Rk,ucr	[147111111]	15	15	15	14	13	13	12	12
Characteristic bond resis	tance in non-crac	ked concrete	C20/25 in har	nmer d	Irilled h	oles wi	th hollo	w drill	bit (HD	B)	
<u></u> I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
型 g ll: 72°C/50°C	concrete			14	14	14	13	13	12	12	11
1: 40°C/24°C 1: 72°C/50°C 1: 40°C/24°C 1: 72°C/50°C 1: 7	flooded bore	^τ Rk,ucr	[N/mm²]	16	16	16	15	15	14	14	13
II: 72°C/50°C	hole			14	14	14	13	13	12	12	11
Characteristic bond resis	 tance in cracked (concrete C20.	/25 in hamme								
and with hollow drill bit (F			720 III Hallille		110100	(115),	oompre				
Temperature II: 40°C/24°C II: 72°C/50°C	Dry, wet concrete and	TDI	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
G is II: 72°C/50°C	flooded bore hole	[⊤] Rk,cr	[147111111]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ${\psi^0}_{sus}$ in holes (CD) and with hollo		-cracked cond	crete C20/25 i	n hamı	mer dril	led hol	es (HD), comp	ressec	l air dri	illed
I: 40°C/24°C and de la compensation de la compensa	Dry, wet concrete and	Ψ ⁰ sus	[-]				0,8	80			
ق اا: 72°C/50°C	flooded bore hole	₩ sus	1.1				0,0	68			
		C25/30						02			
		C30/37						04			
Increasing factors for cor	ncrete	C35/45						07			
Ψс		C40/50						08 00			
		C45/55 C50/60						09 10			
Concrete cone failure		1030/00		<u> </u>			Ι,	10			
Relevant parameter							see Ta	ble C2			
Splitting				I .			,				
Relevant parameter							see Ta	ble C2			
Installation factor				•							
for dry and wet concrete	(HD; HDB, CD)		r 1				1,	,0			
for flooded bore hole (HD); HDB, CD)	γinst	[-]				1,	,2			
								Ι			
Chemofast Injection	System EP 1000	for concret	te								

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Table		racteristic va on for a work			s und	der st	atic a	nd q	uasi-	static	;	
Ancho	r size threaded re	od			M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure											
Charac	teristic tension re	sistance	N _{Rk,s}	[kN]			A _s · f	_{uk} (or s	ee Tab	le C1)		
Partial ·	factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combi	ned pull-out and	concrete failure	1									
	teristic bond resis		ked concrete C	20/25 in har	nmer o	Irilled h	oles (H	ID) and	compr	essed	air drill	ed
Temperature range	l: 40°C/24°C	Dry, wet concrete and	T=	[N/mm²]	20	20	19	19	18	17	16	16
Tempe	II: 72°C/50°C	flooded bore hole	^T Rk,ucr,100	[14/111111-]	15	15	15	14	13	13	12	12
Charac	teristic bond resis	tance in non-crac	ked concrete C	20/25 in har	nmer d	Irilled h	oles wi	th hollo	w drill	bit (HD	B)	
<u>ந</u>	I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
atu Je	II: 72°C/50°C	concrete			14	14	14	13	13	12	12	11
Temperature range	I: 40°C/24°C	flooded bore	TRk,ucr,100	[N/mm²]	16	16	16	15	15	14	14	13
	II: 72°C/50°C	hole			14	14	14	13	13	12	12	11
	teristic bond resis	tance in cracked	Concrete C20/2	5 in hamme								
	th hollow drill bit (F		concrete G20/2	.5 III Hallille	i dilliet	1110163	(110),	compre	sseu c	an arme	o noice	3 (CD)
Temperature range	l: 40°C/24°C	Dry, wet concrete and	TD1 100	[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	^τ Rk,cr,100	[14/11111]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
			C25/30					1,	02			
			C30/37					1,	04			
Increas	sing factors for cor	ncrete	C35/45					1,	07			
Ψ_{c}			C40/50					1,	80			
			C45/55					1,	09			
			C50/60					1,	10			
	ete cone failure											
	nt parameter							see Ta	ble C2			
Splittin									11 66			
	nt parameter							see l'a	ble C2			
	ation factor	(UD UDE CE)		1					•			
	and wet concrete	·	γ_{inst}	[-]					,0			
for floo	ded bore hole (HD	o; HDB, CD)		1				1	,2			

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 4



Ancho	r size threaded ro	nd			M8	M10	M12	M16	M20	M24	M27	M30
Steel fa		ou .			IVIO	IVITO	IVIIZ	IVIIO	IVIZU	IVIZ4	IVIZI	IVISU
	teristic tension res	istance	N _{Rk,s}	[kN]			A. • f.	_{uk} (or s	ee Tab	le C1)		
		istarioc						see Ta				
Partial f			γMs,N	[-]				see 12	ible C i			
	ned pull-out and teristic bond resist					الممالية	oloo /F	\D\				
	tensuc bond resist	ance in non-crac	Ted concrete C	20/25 In dia	mona d	inied i	loies (L	(U)				
Temperature range	I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr}	[N/mm²]	15	14	14	13	12	12	11	11
Temp	II: 72°C/50°C	flooded bore hole	TAX,GOI		12	12	11	10	9,5	9,5	9,0	9,0
Reducti	ion factor ψ ⁰ sus in	non-cracked con	crete C20/25 in	diamond di	rilled ho	oles (D	D)					
rature ge	l: 40°C/24°C	Dry, wet	0					0,	77			
Temperature range	II: 72°C/50°C	flooded bore hole	Ψ^0 sus	[-]				0,	72			
<u>'</u>			C25/30					1.	04			
			C30/37						08			
Increas	ing factors for con	crete	C35/45						12			
$\Psi_{\textbf{C}}$			C40/50					1,	15			
			C45/55					1,	17			
			C50/60					1,	19			
	ned pull-out and											
	teristic bond resist	ance in non-crac	ked concrete C	20/25 in dia □	mond o	drilled h	noles (D	DD)				I
Temperature range	l: 40°C/24°C	Dry, wet concrete and	^τ Rk,ucr,100	[N/mm²]	15	14	14	13	12	12	11	11
Temp	II: 72°C/50°C	flooded bore hole	TRK,UCI, 100	[]	11	11	10	10	9,5	9,0	8,5	8,5
			C25/30					1,	04			
			C30/37						80			
	ing factors for con	crete	C35/45						12			
Ψ_{C}			C40/50						15			
			C45/55 C50/60						17 10			
Concre	ete cone failure		030/60					Ι,	19			
	nt parameter							see Ta	ble C2			
Splittin	•				1			220 10	02			
	nt parameter							see Ta	ble C2			
Installa	ation factor											
for dry a	and wet concrete ((DD)		r 1				1	,0			
for floor	ded bore hole (DD))	γinst	[-]		1,2				1,4		

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Table C6: Characteristic	values	of sh	ear lo	ads u	nder s	tatic a	nd qu	asi-sta	atic acti	on
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 •	A _s ·f _{uk}	(or see	Table C	1)	
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 C	1)	
Partial factor	γ _{Ms,V}	[-]				see	Table C	:1		
Ductility factor	k ₇	[-]					1,0			
Steel failure with lever arm	1									
Characteristic bending moment	M ⁰ _{Rk,s}	[Nm]			1,2 • \	W _{el} • f _{uk}	(or see	Table C	:1)	
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	$\gamma_{Ms,V}$	[-]				see	Table C	1		
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γ_{inst}	[-]					1,0			
Concrete edge failure										
Effective length of fastener	I _f	[mm]		n	nin(h _{ef} ; 1	l2 • d _{nor}	_m)		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			

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 6



Anchor size internal threaded	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure ¹⁾						1			
Characteristic tension resistance	ce. 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		γ _{Ms,N}	[-]				,5		
Characteristic tension resistant Steel A4 and HCR, Strength cla	ce, Stainless	N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor		γ _{Ms,N}	[-]			1,87			2,86
Combined pull-out and conc	rete cone failu								
Characteristic bond resistance holes (CD)	e in non-crack	ed concre	ete C20/2	5 in hamn	ner drilled	holes (HD) and con	npressed a	air drilled
_ l: 40°C/24°C	Dry, wet			20	19	19	18	17	16
Temperature range II: 72°C/50°C	flooded bore hole	^τ Rk,ucr	[N/mm²]	15	15	14	13	13	12
Characteristic bond resistance	1	concrete	C20/25 in	hammer	drilled hol	es with ho	llow drill b	oit (HDB)	
l: 40°C/24°C	Dry, wet			16	16	16	15	14	13
Temperature II: 72°C/50°C	concrete		[N]/na na 21	14	14	13	13	12	11
range I: 40°C/24°C	flooded bore	^τ Rk,ucr	[N/mm²]	16	16	15	15	14	13
II: 72°C/50°C	hole			14	14	13	13	12	11
	eristic bond resistance in cracked cond			nmer drille	d holes (l	HD), comp	ressed air	drilled ho	les (CD)
and with hollow drill bit (HDB)	Dry, wet					Π			
Temperature I: 40°C/24°C range	concrete and flooded bore	^τ Rk,cr	[N/mm²]		8,5	8,5	8,5	8,5	8,5
II: 72°C/50°C	hole			6,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ^0_{sus} in crac drilled holes (CD) and with hol	low drill bit (HD		oncrete C	20/25 in I	hammer d	rilled hole	s (HD), co	mpressed	l air
Temperature L: 40°C/24°C	Dry, wet concrete and	Ψ ⁰ sus	[-]			0,	80		
range II: 72°C/50°C	flooded bore hole	Ψ sus	[-]			0,	68		
			5/30			1,	02		
			0/37			<u> </u>	04		
Increasing factors for concrete			5/45				07		
Ψ_{C}			0/50 5/55				08 09		
			0/60				10		
Concrete cone failure									
Relevant parameter						see Ta	able C2		
Splitting failure									
Relevant parameter						see Ta	able C2		
Installation factor									
for dry and wet concrete (HD; H		γ _{inst}	[-]				,0		
for flooded bore hole (HD; HDB, CD)							,2		

The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element. ²⁾ For IG-M20 strength class 50 is valid

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 7

I: 40°C/24°C

English translation prepared by DIBt

Deutsches Institut für **Bautechnik**

action for a	el failure ¹⁾ racteristic tension resistance, 5.8 N _{Rk,s} [kN] 10 17 29 42 76 123 el, strength class 8.8 N _{Rk,s} [kN] 16 27 46 67 121 196 tial factor, strength class 5.8 and 8.8 γ _{Ms,N} [-] 1,5 racteristic tension resistance, Stainless el A4 and HCR, Strength class 70 2) N _{Rk,s} [kN] 14 26 41 59 110 124 tial factor γ _{Ms,N} [-] 1,87 2,86								
Anchor size internal threaded and	hor rod	s		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-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 and	l 8.8	γ _{Ms,N}	[-]			1	,5		
Characteristic tension resistance, S Steel A4 and HCR, Strength class 7		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 fail	ure							

Characteristic values of tension loads under static and quasi-static

Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drilled holes (CD)

20

19

19

18

17

16

Dry, wet

Temperature	1. 40 0/24 0	concrete and				13	13	10	17	2
range	II: 72°C/50°C	flooded bore hole	^τ Rk,ucr,100	[N/mm²]	15	15	14	13	13	12
Characteristic	bond resistance	in non-cracked	concrete C	20/25 in h	nammer d	rilled hole	s with hol	low drill b	it (HDB)	
	I: 40°C/24°C	Dry, wet			16	16	16	15	14	13
Temperature	II: 72°C/50°C	concrete	σ	[N]/mm21	14	14	13	13	12	11
range	I: 40°C/24°C	flooded bore	τRk,ucr,100	[[N/]]]	16	16	15	15	14	13
	II: 72°C/50°C	hole			14	14	13	13	12	11

Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)

Temperature	l: 40°C/24°C	Dry, wet concrete and		[N]/21	6,5	7,5	7,5	7,5	7,5	7,5	
rongo	II: 72°C/50°C	flooded bore hole	^T Rk,ucr,100	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	
			C25	/30			1,	02			
			C30.	/37			1,	04			
Increasing fact	ors for concrete		C35/45		1,07						
Ψc			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

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for dry and wet concrete (HD; HDB, CD)	2/.	r 1	1,0
for flooded bore hole (HD; HDB, CD)	rinst	[-]	1,2

³⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

4) For IG-M20 strength class 50 is valid

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 8

Table C9:



action f	or a working	g life of 5	0 years	<u>; </u>						
Anchor size internal threade	ed anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure ¹⁾										
Characteristic tension resistan	ice, 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 and 8.8	γ _{Ms,N}	[-]		l	1	,5			
Characteristic tension resistan	ice, Stainless	N _{Rk,s}	[kN]	14	26	41	59	110	124	
Steel A4 and HCR, Strength c	iass 70 -7	<u> </u>				4.07			2.00	
Partial factor		γMs,N	[-]	- (= 0		1,87			2,86	
Combined pull-out and cond						h-l (DD				
Characteristic bond resistant		ea concrete	E C20/25	in diamor	ia arillea i	noies (טט	') 			
Temperature I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr}	 [N/mm²]	14	14	13	12	12	11	
range II: 72°C/50°C	flooded bore hole	- KK,uCi	[10/11]	12	11	10	9,5	9,5	9,0	
Reduction factor ${\psi^0}_{ t sus}$ in nor	-cracked concr	ete C20/25	in diamo	nd drilled	holes (Di	D)				
Temperature I: 40°C/24°C	Dry, wet concrete and	Ψ ⁰ sus				0,	77			
range II: 72°C/50°C	ange flooded here		[-]			0,	72			
	C25	/30			1,	04				
	C30	/37			1,	08				
Increasing factors for concrete		C35	/45			1,	12			
$\Psi_{\mathbf{c}}$		C40	/50	1,15						
		C45	/55	1,17						
		C50	/60	1,17						
Combined pull-out and conc	rete cone failui	re for a wo	rking life	of 100 ye	ears					
Characteristic bond resistand	e in non-cracke	ed concrete	C20/25	in diamon	d drilled h	noles (DD)			
Temperature I: 40°C/24°C	Dry, wet concrete and	T	[N]/m=m=21	14	14	13	12	12	11	
range II: 72°C/50°C	flooded bore hole	Rk,ucr,100	[N/mm²]	11	10	10	9,5	9,0	8,5	
	-	C25	/30			1,	04			
		C30	/37			1,	08			
Increasing factors for concrete	•	C35	/45			1,	12			
Ψ_{C}		C40	/50			1,	15			
		C45					17			
		C50	/60			1,	19			
Concrete cone failure										
Relevant parameter						see 1	able C2			
Splitting failure						000 T	able C2			
Relevant parameter Installation factor						see 18	able C2			
		Τ				1	0			
for dry and wet concrete (DD) for flooded bore hole (DD)		γ _{inst}	[-]	1,	2	l	,0 1,	1		
Fastenings (incl. nut and rod. The characteristic te For IG-M20 strength clas	nsion resistance			ate materi	al and pro		of the int	ernal threa		
Chemofast Injection Syste	em EP 1000 fo	r concrete								
Performances Characteristic values of tension	n loads under sta	tic and quas	si-static ac	tion			A	Annex C	9	

Characteristic values of tension loads under static and quasi-static



Anchor size for internal thread	ed anch	or rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm ¹⁾)			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 a	γ _{Ms,V}	[-]				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 a	ınd 8.8	γMs,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		γMs,V	[-]			1,56			2,38
Concrete pry-out failure									
Factor		k ₈	[-]				2,0		
Installation factor		γinst	[-]				1,0		
Concrete edge failure									
Effective length of fastener		I _f	[mm]		min(h _{ef} ; 12 • 0	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		•

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

2) For IG-M20 strength class 50 is valid

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 10



Anchor size reinforci	tion for a wo				Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3
Steel failure									- 4\				
Characteristic tension	resistance	N _{Rk,s}	[kN]					1	f _{uk} 1)	ı			
Cross section area		A _s	[mm²]	50	79	113	154	201		452	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]					1,	4 ²⁾				
Combined pull-out a										_			
Characteristic bond re	esistance in nor	n-cracked co	oncrete C2	0/25 ii	n ham	mer dr	illed h	oles (⊦	ID) an	d com	presse	ed air c	Irilled
E 40°C/24°C II: 72°C/50°C	Dry, wet concrete and	^τ Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15
	flooded bore hole			12	12	12	12	12	12	12	12	11	11
Characteristic bond re		cracked cond	rete C20/2		amme						t (HDE	ŕ	
စ္ <u></u> l: 40°C/24°C	J 2.,,			14	14	13	13	13	13	13	13	13	13
II: 72°C/50°C	concrete	τ _{Rk,ucr}	[N/mm²]	12	12	12	11	11	11	11	11	11	11
1: 40°C/24°C 1: 72°C/50°C 1: 40°C/24°C 1: 72°C/50°C	flooded bore	*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 re and with hollow drill bi		ed concrete	C20/25 in	hamm	er drill	ed hol	es (HE), con	npress	ed air	drilled	holes	(CD
I: 40°C/24°C	Dry, wet concrete and	τ	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,
9 E	flooded bore	^τ Rk,cr	[N/mm²]			7.0	7.0	7.0	7.0	7,0	7,0	7,0	7,
II: 72°C/50°C	hole			6,0	6,0	7,0	7,0	7,0	7,0	7,0	,,0	',0	,,,
ह्य थि ।।: 72°C/50°C Reduction factor ψ ⁰ su	hole	d non-crack	ed concre	,	·	·		·		ĺ	,	ĺ	· ·
Reduction factor $\psi^0_{{ m su}}$	hole _s in cracked and		ed concre	,	·	·		·		ĺ	,	ĺ	·
Reduction factor $\psi^0_{{ m su}}$	hole in cracked and with hollow drill Dry, wet concrete and	bit (HDB)		,	·	·		led ho		ĺ	,	ĺ	·
Reduction factor ψ ⁰ sudrilled holes (CD) and	hole is in cracked and with hollow drill Dry, wet		ed concre	,	·	·		led ho	les (HI	ĺ	,	ĺ	· ·
Reduction factor $\psi^0_{{ m su}}$	hole is in cracked and with hollow drill Dry, wet concrete and flooded bore	bit (HDB)	[-]	,	·	·		led ho 0,	les (HI	ĺ	,	ĺ	
Reduction factor ψ^0_{sL} drilled holes (CD) and ψ^0_{sL} drilled hole	hole is in cracked and with hollow drill Dry, wet concrete and flooded bore hole	bit (HDB) Ψ ⁰ sus C25 C30	[-] //30 //37	,	·	·		0, 0,	80 68 02	ĺ	,	ĺ	·
Reduction factor ψ^0_{sl} drilled holes (CD) and $\frac{d}{d}$ \frac{d}	hole is in cracked and with hollow drill Dry, wet concrete and flooded bore hole	bit (HDB) Ψ ⁰ sus C25 C30 C35	[-] 5/30 5/37 5/45	,	·	·		0, 0, 1,	80 68 02 04 07	ĺ	,	ĺ	· ·
Reduction factor ψ^0_{sL} drilled holes (CD) and ψ^0_{sL} drilled hole	hole is in cracked and with hollow drill Dry, wet concrete and flooded bore hole	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40	[-] 5/30 5/37 5/45 5/50	,	·	·		0, 0, 1, 1, 1, 1,	80 68 02 04 07	ĺ	,	ĺ	· ·
Reduction factor ψ^0_{sl} drilled holes (CD) and $\frac{d}{d}$ \frac{d}	hole is in cracked and with hollow drill Dry, wet concrete and flooded bore hole	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40 C45	[-] 5/30 5/37 5/45 5/50	,	·	·		0, 0, 1, 1, 1, 1,	80 68 02 04 07 08	ĺ	,	ĺ	
Reduction factor ψ^0_{sL} drilled holes (CD) and ψ^0_{sL} ψ^0	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40	[-] 5/30 5/37 5/45 5/50	,	·	·		0, 0, 1, 1, 1, 1,	80 68 02 04 07	ĺ	,	ĺ	
Reduction factor ψ^0_{sl} drilled holes (CD) and $\frac{d}{d}$ \frac{d}	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40 C45	[-] 5/30 5/37 5/45 5/50	,	·	·	ner dril	0, 0, 1, 1, 1, 1, 1,	80 68 02 04 07 08	D), cor	,	ĺ	
Reduction factor ψ^0_{sl} drilled holes (CD) and ψ^0_{sl} ψ^0	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40 C45	[-] 5/30 5/37 5/45 5/50	,	·	·	ner dril	0, 0, 1, 1, 1, 1, 1,	80 68 02 04 07 08 09	D), cor	,	ĺ	
Reduction factor ψ^0_{sl} drilled holes (CD) and ψ^0_{sl} ψ^0	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40 C45	[-] 5/30 5/37 5/45 5/50	,	·	·	ner dril	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09	D), cor	,	ĺ	
Reduction factor ψ^0_{st} drilled holes (CD) and ψ^0_{st} drilled holes (CD) and ψ^0_{st} $\psi^$	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40 C45	[-] 5/30 5/37 5/45 5/50	,	·	·	ner dril	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10	D), cor	,	ĺ	
Reduction factor ψ^0_{sl} drilled holes (CD) and ψ^0_{sl} ψ^0	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete	U (HDB) Ψ ⁰ sus C25 C30 C35 C45 C50	[-] 5/30 5/45 5/45 5/55 5/60	,	·	·	ner dril	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10	D), cor	,	ĺ	
Reduction factor ψ^0_{st} drilled holes (CD) and ψ^0_{st} drilled holes (CD) and ψ^0_{st} $\psi^$	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole te (HD; HDB, CD)	bit (HDB) Ψ ⁰ sus C25 C30 C45 C45 C50	[-] 3/30 3/37 3/45 3/50 3/55 3/60	,	·	·	ner dril	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10	D), cor	,	ĺ	
Reduction factor ψ^0_{st} drilled holes (CD) and ψ^0_{st} drilled holes (CD) and ψ^0_{st} $\psi^$	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete te (HD; HDB, CD) m the specificatio	bit (HDB) Ψ ⁰ sus C25 C30 C45 C45 C50	[-] 3/30 3/37 3/45 3/50 3/55 3/60	,	·	·	ner dril	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10 able C2	D), cor	,	ĺ	
Reduction factor \$\psi^0_{SL}\$ drilled holes (CD) and \$\frac{9}{2}\$ \\ \text{production} \\ \text{li: } 40^\circ C/24^\circ C \\ \text{li: } 72^\circ C/50^\circ C \\ \text{Increasing factors for } \\ \text{Vc} \\ \text{Concrete cone failure} \\ \text{Relevant parameter} \\ \text{Splitting} \\ \text{Relevant parameter} \\ \text{Installation factor} \\ \text{for dry and wet concrefor flooded bore hole (} \\ \text{1} \) fuk shall be taken from	hole s in cracked and with hollow drill Dry, wet concrete and flooded bore hole concrete te (HD; HDB, CD) m the specificatio al regulation	bit (HDB) Ψ ⁰ sus C25 C30 C35 C40 C45 C50) γinst ns of reinforce	[-] 5/30 5/45 5/45 5/55 5/60	,	·	·	ner dril	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10 able C2	D), cor	,	ĺ	· ·

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	naracteristic tion for a wo					nder	stati	c and	d qua	asi-st	tatic		
Anchor size reinforci		Jiking inc	01 100	-		Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure										1			
Characteristic tension i	resistance	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		γ _{Ms,N}	[-]	1,42)									
Combined pull-out ar	nd concrete fail			<u> </u>				<u> </u>					
Characteristic bond re holes (CD)	esistance in non	-cracked co	ncrete C2	20/25 i	n ham	mer dr	illed h	oles (F	HD) an	d com	presse	ed air d	Irilled
His 40°C/24°C His 72°C/50°C His 72°C/50°	Dry, wet concrete and	-	FN1/21	16	16	16	16	16	16	15	15	15	15
Hermonia History 11: 72°C/50°C	flooded bore hole	^T Rk,ucr,100	[N/mm²]	12	12	12	12	12	12	12	12	11	11
Characteristic bond res	sistance in non-c	racked conc	rete C20/2	5 in h	ammei	r drille	holes	with	hollow	drill bi	it (HDE	3)	
<u>υ</u> Ι: 40°C/24°C	Dry, wet			14	14	13	13	13	13	13	13	13	13
東 g II: 72°C/50°C	concrete		FN1/ 27	12	12	12	11	11	11	11	11	11	11
E	flooded bore	^τ Rk,ucr,100	[N/mm²]	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 res	sistance in crack	ed concrete	C20/25 in	hamm	er drill	ed hol	es (H[D), con	npress	ed air	drilled	holes	(CD)
and with hollow drill bit	(HDB)									ı		,	
Temperature range :: 40°C/24°C :: 40°C/20°C	Dry, wet concrete and	T	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
อน อน เมื่อ	flooded bore hole	^τ Rk,cr,100	[[[]]]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
		C25	/30					1,	02		•	•	
		C30	/37					1,	04				
Increasing factors for c	oncrete	C35							07				
$\Psi_{\mathbf{c}}$		C40							80				
		C45							09				
Concrete cone failure		C50	/60					1,	10				
Relevant parameter	;							SOO T	able C	2			
Splitting				<u> </u>				300 16	ADIC U	<u>-</u>			
Relevant parameter								see Ta	able C	2			
Installation factor				<u> </u>						_			
for dry and wet concret	te (HD; HDB, CD)						1	,0				
for flooded bore hole (H		γ _{inst}	[-]						,2				
1) 6 1 11 1 1 6	. 41 161 41												

 $^{^{1)}}$ f_{uk} shall be taken from the specifications of reinforcing bars $^{2)}$ in absence of national regulation

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 12



Anchor size reinforcii	ng bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø3
Steel failure													
Characteristic tension r	resistance	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		γMs,N	[-]					1,	4 ²⁾				
Combined pull-out an													
Characteristic bond re	sistance in non	-cracked co	ncrete C2	0/25 i	n diam	ond d	rilled h	oles ([DD)	1			
Temperature II: 40°C/24°C II: 72°C/50°C	Dry, wet concrete and flooded bore hole	[₹] Rk,ucr	[N/mm²]	14	13 11	13 10	13 10	12 10	12 9,5	11 9,5	9,5	9,0	9,0
·											-,-		
Reduction factor ψ ⁰ _{sus}	_s in non-cracked	concrete C	20/25 in (diamor	nd drill	ed hol	es (DL))					
Dry, wet concrete and flooded bore hole								0,	77 72				
		C25	/30					1,	04				
		C30	/37					1,	80				
Increasing factors for concrete C35/45					1,12								
$\Psi_{\mathbf{C}}$	/50						15						
C45/55 C50/60									17 10				
Combined pull-out an	nd concrete fail			of 100	Voars	•		Ι,	19				
Characteristic bond re							rilled h	oles ([ומס				
L: 40°C/24°C Dry, wet concrete and flooded bore hole		^τ Rk,ucr,100	[N/mm²]	14	13	13	13	12	12	11	11	11	11
ਜ਼ਿੰ Ⅱ: 72°C/50°C	hole			11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,
		C25	/30	1,04									
		C30		1,08									
Increasing factors for c	oncrete	C35		1,12									
$\Psi_{\mathbf{c}}$		C40.							15 17				
		C45							17 19				
Concrete cone failure	<u> </u>	1 030	, 50	<u> </u>				Ι,					
Relevant parameter								see Ta	ble C	2			
Splitting													
Relevant parameter								see Ta	ble C	2			
Installation factor													
for dry and wet concret		γ _{inst}	[-]					1	,0			_	
for flooded bore hole (E			1		1	,2				1	,4		
1) f _{uk} shall be taken fron 2) in absence of nationa	al regulation												
Chemofast Injection Performances	n System EP 10	000 for con	crete							A	nnex	C 13	3



Table C14: Characteris	tic values	of she	ar lo	ads ı	unde	r sta	itic a	nd q	uasi-	static	actio	า
Anchor size 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}	[-]	1,52)									
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}	[-]		,		•	•	1,5 ²⁾		•	•	
Concrete pry-out failure		•										
Factor	k ₈	[-]						2,0				
Installation factor	γinst	[-]						1,0				
Concrete edge failure	•	•	•									
Effective length of fastener	If	[mm]	min(h _{ef} ; 12 • d _{nom}) min(h _{ef} ; 300mm)						mm)			
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γinst	[-]		•	•			1,0		-		

 $^{^{1)}\,}f_{uk}$ shall be taken from the specifications of reinforcing bars $^{2)}$ in absence of national regulation

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 14



Table C15:	Displacements under tension load ¹⁾ in hammer drilled holes (HD),
	compressed air drilled holes (CD) and with hollow drill bit (HDB)

Anchor size threaded re	od		M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete i	acked concrete under static and quasi-static action for a working life of 50 and 100 years									
Temperature range I:	$\delta_{ extsf{N0}} extsf{-factor}$	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
Temperature range II:	δ _{N0} -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Cracked concrete unde	r static and	quasi-static actio	n for a w	orking l	ife of 50	and 10	0 years			
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,171
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110
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	0,229

¹⁾ Calculation of the displacement

 $\delta_{\text{N0}} = \delta_{\text{N0}}\text{-factor} \cdot \tau;$

 τ : action bond stress for tension

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

Displacements under tension load¹⁾ in diamond drilled holes (DD) Table C16:

Anchor size threaded re	Anchor size threaded rod				M12	M16	M20	M24	M27	M30
Non-cracked concrete	ınder static a	ınd quasi-static a	ction fo	r a work	ing life	of 50 yea	ars			
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Non-cracked concrete u	ınder static a	nd quasi-static a	ction for	a worki	ing life c	of 100 ye	ars			
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051

¹⁾ Calculation of the displacement

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

Displacements under shear load¹⁾ for all drilling methods Table C17:

Anchor size thread	M8	M10	M12	M16	M20	M24	M27	M30		
Non-cracked and c	racked concrete un	ncrete under static and quasi-static action								
All temperature	$\delta_{ extsf{V0}}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
ranges	$\delta_{ m V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

¹⁾ Calculation of the displacement

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

 $\delta_{V\infty} = \delta_{V\infty}$ -factor · V;

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Performances

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

Annex C 15



Table C18:	Displacements under tension load ¹⁾ in hammer drilled holes (HD),
	compressed air drilled holes (CD) and with hollow drill bit (HDB)

Anchor size Internal thr	eaded anchor	rod	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Non-cracked concrete ι	ınder static and	d quasi-static ac	tion for a v	vorking lif	e of 50 and	100 years	,	
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete unde	r static and qua	asi-static action	for a work	ing life of	50 and 100	years		
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	δ _{N0} -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229

¹⁾ Calculation of the displacement

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

Table C19: Displacements under tension load¹⁾ in diamond drilled holes (DD)

Anchor size Internal thr	eaded anchor	rod	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Non-cracked concrete ι	ınder static and	d quasi-static ac	tion for a v	vorking life	e of 50 yea	rs		
Temperature range l:	δ_{N0} -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,019	0,019	0,020	0,022	0,023	0,025
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Non-cracked concrete ι	ınder static an	d quasi-static ac	tion for a v	vorking life	e of 100 ye	ars		
Temperature range l:	δ_{N0} -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,021	0,021	0,023	0,024	0,025	0,027
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,039	0,040	0,043	0,045	0,047	0,051

¹⁾ Calculation of the displacement

$$\begin{split} \delta_{\text{N0}} &= \delta_{\text{N0}}\text{-factor} \ \cdot \tau; \\ \delta_{\text{N}\infty} &= \delta_{\text{N}\infty}\text{-factor} \ \cdot \tau; \end{split}$$

 τ : action bond stress for tension

Table C20: Displacements under shear load¹⁾ for all drilling methods

Anchor size Internal threaded anchor rod			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Non-cracked and	d and cracked concrete under static and quasi-static action							
All temperature	δ_{V0} -factor	[mm/kN]	0,07	0,06	0,06	0,05	0,04	0,04
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,10	0,09	0,08	0,08	0,06	0,06

¹⁾ Calculation of the displacement

 $\delta_{V0} = \delta_{V0}$ -factor · V;

V: action shear load

 $\delta_{V\infty} = \delta_{V\infty}$ -factor · V;

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Table C21:	Displacements under tension load ¹⁾ in hammer drilled holes (HD),
	compressed air drilled holes (CD) and with hollow drill bit (HDB)

Anchor size reinfo	orcing bar		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked cond	rete under s	static and quasi	-static a	action f	or a wo	rking l	ife of 50	and 10	00 year	S		
Temp range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
Temp range II: 72°C/50°C	δ_{N0} -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,072
Cracked concrete	under statio	and quasi-stat	ic actio	n for a	workin	g life of	50 and	l 100 ye	ears			
Temp range I:	$\delta_{ extsf{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194
Temp range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260

¹⁾ Calculation of the displacement

 $\delta_{\text{N0}} = \delta_{\text{N0}}\text{-factor} \quad \tau, \qquad \qquad \tau. \text{ action bond stress for tension}$

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

Table C22: Displacements under tension load¹⁾ in diamond drilled holes (DD)

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked concrete under static and quasi-static action for a working life of 50 years												
Temp range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,01	0,011	0,012	0,013	0,013	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,018	0,019	0,020	0,021	0,024	0,027	0,027	0,028	0,031
Temp range II:	δ _{N0} -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088
Non-cracked cond	crete under s	static and quasi	-static a	action f	or a wo	rking li	ife of 10	00 years	3			
Temp range l:	δ_{N0} -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,010	0,011	0,012	0,013	0,013	0,014	0,015
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,018	0,020	0,021	0,022	0,024	0,026	0,029	0,029	0,031	0,034
Temp range II:	$\delta_{ extsf{N0}} extsf{-factor}$	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,064

¹⁾ Calculation of the displacement

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

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

Table C23: Displacements under shear load¹⁾ for all drilling methods

Anchor size rein	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Non-cracked and cracked concrete under static and quasi-static action												
All temperature	$\delta_{ m V0}$ -factor	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	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	0,04	0,04

¹⁾ Calculation of the displacement

 $\delta_{V0} = \delta_{V0}$ -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 (rebar)

Annex C 17



Table C24:	Characteristic values of tension load (performance category C1) for a work			ırs

<u> </u>									
		M8	M10	M12	M16	M20	M24	M27	M30
N _{Rk,s,eq,C1}	[kN]	1,0 • N _{Rk,s}							
$\gamma_{Ms,N}$	[-]				see Ta	ble C1			
Combined pull-out and concrete failure									
	d concrete (C20/25	in han	nmer dr	illed ho	oles (HI	D), com	npresse	ed air
^τ Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
^τ Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
C25/30 to	C50/60				1	,0			
•									
for dry and wet concrete (HD; HDB, CD)						,0			
γinst	[-]				1	,2			
	γMs,N and non-cracke (HDB) τRk,eq,C1 τRk,eq,C1	γ _{Ms,N} [-] and non-cracked concrete (HDB) τ _{Rk,eq,C1} [N/mm²] τ _{Rk,eq,C1} [N/mm²] C25/30 to C50/60	N _{Rk,s,eq,C1}	N _{Rk,s,eq,C1}	N _{Rk,s,eq,C1}	N _{Rk,s,eq,C1}	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

Table C25: 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 (Seismic C1)	V _{Rk,s,eq,C1}	[kN]	0,70 ⋅ V ⁰ _{Rk,s}												
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							[-] see Table C1					
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0)1)												

¹⁾ Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended.

Chemofast Injection System EP 1000 for concrete	
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)	Annex C 18



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Table C26: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 and 100 years

				-							_			
Ancho	r size reinforcin	g bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel f	ailure					•								•
Charac	cteristic tension re	esistance	N _{Rk,s,eq,C1}	[kN]					1,0 • 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,N}	[-]		•	•	•	1,	4 ²⁾	•	•	•	•
Combi	ined pull-out and	d concrete failu	ire	•										
1	cteristic bond resi holes (CD) and v			cracked co	ncrete	€ C20/2	25 in h	amme	r drille	d hole	s (HD)), com	oresse	d air
nperature 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	8,5	8,5
Temperature range	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
Increas	sing factors for co	oncrete ψ _C	C25/30 to	C50/60	1,0									
Installa	ation factor													
for dry	and wet concrete	(HD: HDB, CD)							1	.0				

[-]

for flooded bore hole (HD; HDB, CD)

Table C27: Characteristic values of shear loads under seismic action (performance category C1)

Anchor size 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	·As	f _{uk} 1)			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,V}	[-]		1,52)								
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0) ³⁾									

¹⁾ fuk shall be taken from the specifications of reinforcing bars

Chemofast Injection System EP 1000 for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (rebar)	Annex C 19

¹⁾ fuk shall be taken from the specifications of reinforcing bars

²⁾ in absence of national regulation

²⁾ in absence of national regulation

³⁾ Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended.

for flooded bore hole (HD; HDB, CD)



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Table C29: 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 Steel, strength class 8. Stainless Steel A4 and Strength class ≥70	8	N _{Rk,s,eq,C2}	[kN]		1,0 •	$N_{Rk,s}$	
Partial factor		$\gamma_{Ms,N}$	[-]		see Ta	ble C1	
Combined pull-out ar	nd concrete failure	•					
Characteristic bond res drilled holes (CD) and			ed concrete C	20/25 in han	nmer drilled ho	les (HD), con	npressed air
Temperat ure range II: 72°C/50°C	Dry, wet concrete and	^τ Rk,eq,C2	[N/mm²]	5,8	4,8	5,0	5,1
ед II: 72°С/50°С	flooded bore hole	^τ Rk,eq,C2	[N/mm²]	5,0	4,1	4,3	4,4
Increasing factors for o	concrete $\psi_{\mathbf{C}}$	C25/30 to	C50/60		1	0	
Installation factor		•	·				
for dry and wet concre-	te (HD: HDB_CD)			-	1	0	-

Table C28: 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 • V ⁰ _{Rk,s}			
Partial factor	γ _{Ms,V}	[-]	see Table C1			
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0)1)			

¹⁾ Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended.

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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)	Annex C 20



Table C30: Displacements under tension load (threaded rod)							
Anchor size thread	led rod		M12	M16	M20	M24	
Non-cracked and cracked concrete under seismic action (performance category C2)							
All temperature ranges	δ N,eq,C2(DLS)	[mm]	0,21	0,24	0,27	0,36	
	δ N,eq,C2(ULS)	[mm]	0,54	0,51	0,54	0,63	

Table C31: Displacements under shear load (threaded rod)

Anchor size threaded rod			M12	M16	M20	M24	
Non-cracked and cracked concrete under seismic action (performance category C2)							
All temperature ranges	$\delta_{ m V,eq,C2(DLS)}$	[mm]	3,1	3,4	3,5	4,2	
	$\delta_{V,eq,C2(ULS)}$	[mm]	6,0	7,6	7,3	10,9	

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

Annex C 21