



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 25 February 2022

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

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

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

ETA-19/0201 issued on 22 October 2020



# European Technical Assessment ETA-19/0201

Page 2 of 46 | 25 February 2022

English translation prepared by DIBt

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Z8861.22 8.06.01-375/21



# **European Technical Assessment ETA-19/0201**

Page 3 of 46 | 25 February 2022

English translation prepared by DIBt

#### **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 A 3.

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

The product description is given in Annex A.

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

The performances given in Section 3 are only valid if the 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 6, C 8 to C 11, C 13 to C 16, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 7, C 12, C 17
Displacements under short-term and long-term loading	See Annex C 18 to C 20
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 21 to C 28

#### 3.2 Hygiene, health and the environment (BWR 3)

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

Z8861.22 8.06.01-375/21



# European Technical Assessment ETA-19/0201

Page 4 of 46 | 25 February 2022

English translation prepared by DIBt

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 25 February 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock

Head of Section

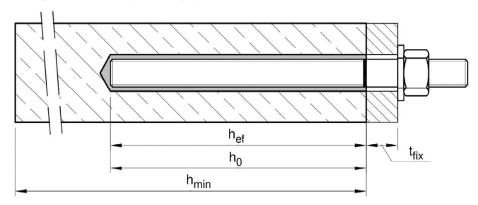
Stiller

Z8861.22 8.06.01-375/21

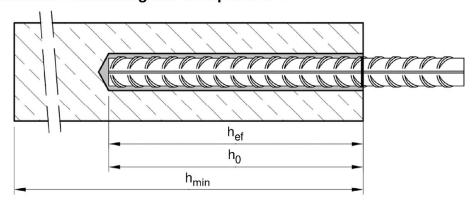


# Installation threaded rod M8 up to M30

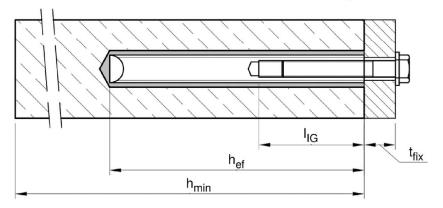
prepositioned installation or push through installation (annular gap filled with mortar)



# Installation reinforcing bar Ø8 up to Ø32



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



 $t_{fix}$  = thickness of fixture  $h_0$  = nominal drill hole diameter

 $h_{ef}$  = effective embedment depth  $I_{IG}$  = thread engagement length

 $h_{min}$  = minum thickness of member

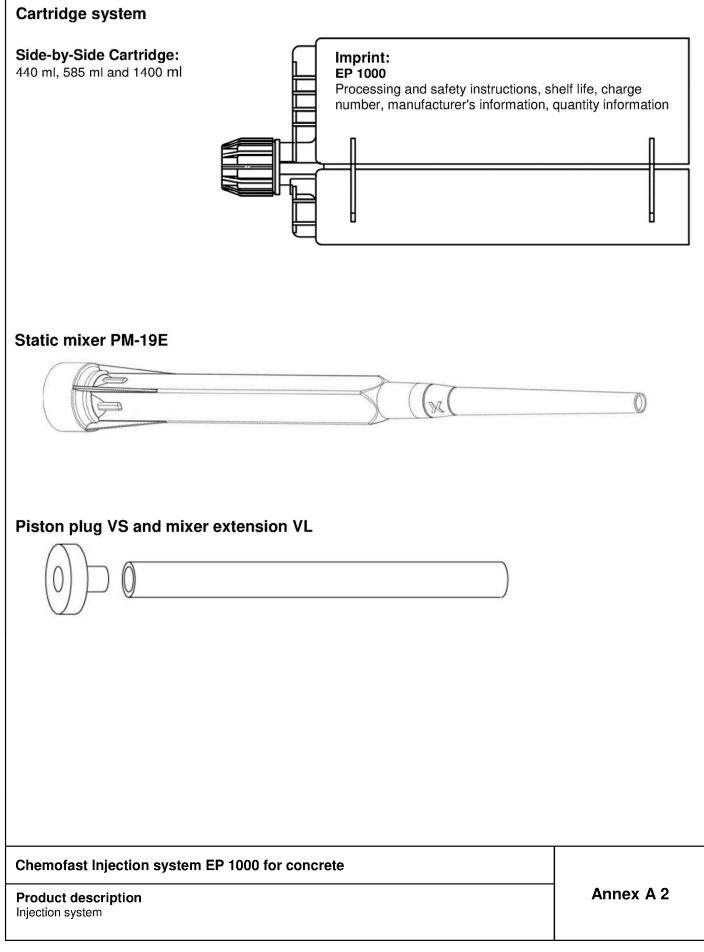
# Chemofast Injection system EP 1000 for concrete

# **Product description**

Installed condition

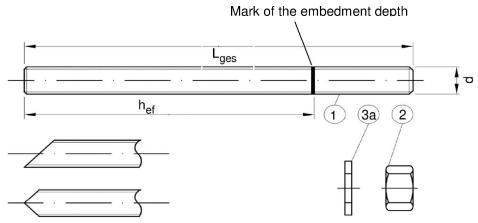
Annex A 1







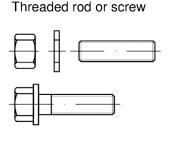
# Threaded rod M8 up to M30 with washer and hexagon nut

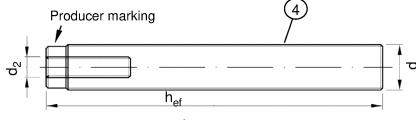


#### Commercial standard rod with:

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

#### Internal threaded rod IG-M6 to IG-M10



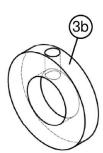


Marking Internal thread
Mark

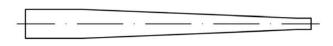
M8 Thread size (Internal thread)
A4 additional mark for stainless steel

HCR additional mark for high-corrosion resistance steel

# Filling washer VFS



### Mixer reduction nozzle MR



## Chemofast Injection system EP 1000 for concrete

#### **Product description**

Threaded rod; Internal threaded rod Filling washer; Mixer reduction nozzle

Annex A 3



Dar	able A1: Materi	T							
	t Designation	Material							
		acc. to EN ISO 683-4:2							
		i µm acc. to EN ISO		2:2018 or 1:2009 and EN ISO 10684	·2004+AC·2009 or				
		5 μm acc. to EN ISO			.2004+710.2000 01				
				Characteristic steel	Characteristic steel	Elongation at			
		Property class		ultimate tensile strength	yield strength	fracture			
			4.6	f <sub>uk</sub> = 400 N/mm <sup>2</sup>	f <sub>vk</sub> = 240 N/mm <sup>2</sup>	A <sub>5</sub> > 8%			
	Threaded rod			f <sub>uk</sub> = 400 N/mm <sup>2</sup>	f <sub>vk</sub> = 320 N/mm <sup>2</sup>	A <sub>5</sub> > 8%			
	Till eaded Tod	acc. to EN ISO 898-1:2013		f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>yk</sub> = 300 N/mm <sup>2</sup>	A <sub>5</sub> > 8%			
		EN 150 696-1.2013	5.8	f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>yk</sub> = 400 N/mm <sup>2</sup>	A <sub>5</sub> > 8%			
			8.8	f <sub>uk</sub> = 800 N/mm <sup>2</sup>	f <sub>yk</sub> = 640 N/mm <sup>2</sup>	$A_5 \ge 12\%^{(3)}$			
		acc. to	4	for anchor rod class 4.6 o					
2	Hexagon nut	acc. to EN ISO 898-2:2012	5	for anchor rod class 5.6 o	r 5.8				
		LIV 100 000 2:2012	8	for anchor rod class 8.8					
За	Washer			galvanised or sherardized EN ISO 7089:2000, EN ISC		7004:2000)			
3b	Filling washer			galvanised or sherardized		7034.2000)			
	T ming washer		t dip	Characteristic steel	Characteristic steel	Elongation at			
Internal threaded anchor rod	Property class		ultimate tensile strength	yield strength	fracture				
	acc. to	5.8	f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>yk</sub> = 400 N/mm <sup>2</sup>	A <sub>5</sub> > 8%				
		EN ISO 898-1:2013	8.8	f <sub>uk</sub> = 800 N/mm <sup>2</sup>	f <sub>vk</sub> = 640 N/mm <sup>2</sup>	A <sub>5</sub> > 8%			
Sta	inless steel A2 (Mate			1 / 1.4567 or 1.4541, acc. t	to EN 10088-1:2014)				
Sta	inless steel A4 (Mate	rial 1.4401 / 1.4404 / 1	.457	1 / 1.4362 or 1.4578, acc. t	o EN 10088-1:2014)				
Hig	h corrosion resistand	ce steel (Material 1.45	29 oı	1.4565, acc. to EN 10088					
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture			
	4)4)		50	f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>vk</sub> = 210 N/mm <sup>2</sup>	A <sub>5</sub> ≥ 8%			
1	Threaded rod <sup>1)4)</sup>	acc. to	70	f <sub>uk</sub> = 700 N/mm <sup>2</sup>	$f_{vk} = 450 \text{ N/mm}^2$	$A_5 \ge 12\%^{3}$			
		EN ISO 3506-1:2020	80	f <sub>uk</sub> = 800 N/mm <sup>2</sup>	$f_{vk} = 600 \text{ N/mm}^2$	$A_5 = 12\%$ $A_5 \ge 12\%$ $A_5 \ge 12\%$ $A_5 \ge 12\%$ $A_5 \ge 12\%$			
				art	19k = 000 14/111111-	A5 = 12% 3)			
	1)4)		50	for anchor rod class 50					
	Hexagon nut <sup>1)4)</sup>	lacc. to		70 for anchor rod class 70					
2	Troxagon nat	acc. to EN ISO 3506-1:2020							
2	Trexagerriat	EN ISO 3506-1:2020	80	for anchor rod class 80					
2	Troxagon nat	EN ISO 3506-1:2020 A2: Material 1.4301 /	80 1.43	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4					
	Washer	EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 /	80 1.43 1.44	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4	578, acc. to EN 10088-				
		EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529	80 1.43 1.44 9 or 1	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1	578, acc. to EN 10088- 1: 2014	1:2014			
3a	Washer	EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20	80 1.43 1.44 9 or 1 06, E	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISC	578, acc. to EN 10088- 1: 2014	1:2014			
3a		EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20 Stainless steel A4, H	80 1.43 1.44 9 or 1 06, E	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel	578, acc. to EN 10088- 1: 2014 0 7093:2000 or EN ISO	1:2014 7094:2000)			
3a	Washer Filling washer	EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20	80 1.43 1.44 9 or 1 06, E	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel	2578, acc. to EN 10088- 1: 2014 2: 7093:2000 or EN ISO Characteristic steel	1:2014 7094:2000) Elongation at			
22 33a 33b	Washer Filling washer Internal threaded	EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20 Stainless steel A4, H Property class	80 1.43 1.44 9 or 1 06, E	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel	578, acc. to EN 10088- 1: 2014 0 7093:2000 or EN ISO	1:2014			
3a 3b	Washer Filling washer	EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20 Stainless steel A4, H	80 1.43 1.44 9 or 1 06, E igh c	for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel ultimate tensile strength	2578, acc. to EN 10088- : 2014 D 7093:2000 or EN ISO Characteristic steel yield strength	1:2014 7094:2000) Elongation at fracture			

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

<sup>4)</sup> Property class 80 only for stainless steel A4 and HCR

Chemofast Injection system EP 1000 for concrete	
Product description  Materials threaded rod, Internal threaded anchor rod and filling washer	Annex A 4

<sup>2)</sup> for IG-M20 only property class 50

 $<sup>^{3)}</sup>$  A<sub>5</sub> > 8% fracture elongation if no use for seismic performance category C2







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  $\leq$   $h_{rib} \leq$  0,07d (d: Nominal diameter of the bar;  $h_{rib}$ : Rib height of the bar)

Table A2: Materials Reinforcing bar

Part	Designation	Material
Reba	ar	
1	Reinforcing steel according to EN 1992 1 1:2004+AC:2010, Annex C	Bars and rebars from ring class B or C $f_{yk}$ und k according to NDP or NCL according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

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



### Specification of the intended use

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

	Working life of	of 50 years	Working life of 100 years			
Base material	Uncracked concrete	cracked concrete	Uncracked concrete	cracked concrete		
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M Ø8 to Ø IG-M6 to I	<b>3</b> 32,	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20			
DD: Diamond drilling	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:	I: - 40 C 1		I: - 40 C t	55		

### Fasteners subject to (seismic action):

	Performance Category C1	Performance Category C2				
Base material	Cracked and uncracked concrete	Cracked and uncracked concrete				
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M30, ∅8 to ∅32	M12 to M30				
DD: Diamond drilling	No performance assessed	No performance assessed				
Temperature Range:	I: - 40 C to +40 C <sup>1)</sup> II: - 40 C to +72 C <sup>2)</sup>	I: - 40 C to +40 C <sup>1)</sup> II: - 40 C to +72 C <sup>2)</sup>				

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

#### **Base materials:**

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

#### Use conditions (Environmental conditions):

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

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

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

# Page 11 of European Technical Assessment ETA-19/0201 of 25 February 2022

English translation prepared by DIBt



#### Design:

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

#### Installation:

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

Chemofast Injection system EP 1000 for concrete	
Intended Use Specifications (Continued)	Annex B 2



Table B1: Installation parameters for threaded rod											
Threaded rod					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 <sub>0</sub>	[mm]	10	12	14	18	22	28	30	35
Effective embedme	Effective embedment depth		[mm]	60	60	70	80	90	96	108	120
Effective embedmen			[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in	Prepositioned ins	h <sub>ef,max</sub> stallation d <sub>f</sub> ≤	[mm]	9	12	14	18	22	26	30	33
the fixture	Push through installation d <sub>f</sub>		[mm]	12	14	16	20	24	30	33	40
Maximum installatio	n torque	max T <sub>inst</sub> ≤	[Nm]	10	20	40 <sup>1)</sup>	60	100	170	250	300
Minimum thickness of member h <sub>m</sub>		h <sub>min</sub>	[mm]		h <sub>ef</sub> + 30 mm ≥ 100 mm			n <sub>ef</sub> + 2do	)		
Minimum spacing		s <sub>min</sub>	[mm]	40	50	60	75	95	115	125	140
Minimum edge dista	ince	c <sub>min</sub>	[mm]	35	40	45	50	60	65	75	80

<sup>1)</sup> Maximum installation torque for M12 with steel Grade 4.6 is 35 Nm

# Table B2: Installation parameters for reinforcing bar

Reinforcing bar			Ø 8 <sup>1)</sup>	Ø 10 <sup>1)</sup>	Ø 121)	Ø 14	Ø 16	Ø 20	Ø 24 <sup>1)</sup>	Ø 25 <sup>1)</sup>	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 and administration	h <sub>ef,min</sub>	[mm]	60	60	70	75	80	90	96	100	112	128
Effective embedment depth	h <sub>ef,max</sub>	[mm]	160	200	240	280	320	400	480	500	560	640
Minimum thickness of member	h <sub>min</sub>	[mm]		30 mm 00 mm	2			h <sub>e</sub>	<sub>f</sub> + 2d <sub>0</sub>			
Minimum spacing	s <sub>min</sub>	[mm]	40	50	60	70	75	95	120	120	130	150
Minimum edge distance	C <sub>min</sub>	[mm]	35	40	45	50	50	60	70	70	75	85

<sup>1)</sup> both nominal drill hole diameter can be used

# Table B3: Installation parameters for Internal threaded anchor rod

Internal threaded anchor rod			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Internal diameter of anchor rod	$d_2$		6	8	10	12	16	20
Outer diameter of anchor rod1)	$d = d_{nom}$	[mm]	10	12	16	20	24	30
Nominal drill hole diameter	d <sub>0</sub>	[mm]	12	14	18	22	28	35
Effective embedment depth	h <sub>ef,min</sub>	[mm]	60	70	80	90	96	120
Effective embedment depth	h <sub>ef,max</sub>		200	240	320	400	480	600
Diameter of clearance hole in the fixture	d <sub>f</sub> ≤		7	9	12	14	18	22
Maximum installation torque	max T <sub>inst</sub> ≤	[Nm]	10	10	20	40	60	100
Thread engagement length min/max	l <sub>IG</sub>	[mm]	8/20	8/20	10/25	12/30	16/32	20/40
Minimum thickness of member	h <sub>min</sub>	[mm]	h <sub>ef</sub> + 3 ≥ 100			h <sub>ef</sub> -	- 2d <sub>0</sub>	
Minimum spacing	s <sub>min</sub>	[mm]	50	60	75	95	115	140
Minimum edge distance	c <sub>min</sub>	[mm]	40	45	50	60	65	80

<sup>1)</sup> 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	l: Parar	neter clea	ning and i	nstalla	ation	tools					
					mannil	Marketal					
Threaded Rod	Re- inforcing bar	Internal threaded anchor rod	d <sub>0</sub> Drill bit - Ø HD, HDB, CD, DD	d <sub>i</sub> Brusi	-	d <sub>b,min</sub> min. Brush - Ø	Piston plug		lation direction and use of piston plug		
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		1	$\rightarrow$	1	
M8	8		10	RB10	11,5	10,5					
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		No pluc	roquired		
M12	10 / 12	IG-M8	14	RB14	15,5	14,5	]	ινο ριαξ	required		
	12		16	RB16	17,5	16,5					
M16	14	IG-M10	18	RB18	20,0	18,5	VS18				
927 sociosos	16	States interested	20	RB20	22,0	20,5	VS20				
M20	200. 80	IG-M12	22	RB22	24,0	22,5	VS22	_			
	20		25	RB25	27,0	25,5	VS25	h <sub>ef</sub> >	h <sub>ef</sub> >		
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		
701 W-904	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				
HDB – Ho	llow drill bit	system				The hollow dril hollow drill bit a negative press 150 m³/h (42 l/	and a class ure of 253	s M hoover v	with a minim	um	
CAC - Cor (min 6 bar)	mpressed a	ir tool									
Brush RB						Pistole Plug	vs				
			W.								
Brush ext	ension RBL		mm	1999)	m		mm	mm			
Chemofas	st Injection	system EP	1000 for co	ncrete							



Table B5:	Workin	g and curing	time	
Tempera	ature in bas	se material	Maximum working time	Minimum curing time 1)
	Т		t <sub>work</sub>	t <sub>cure</sub>
+ 0 °C	to	+ 4 °C	90 min	144 h
+ 5°C	to	+ 9 °C	80 min	48 h
+ 10°C	to	+ 14°C	60 min	28 h
+ 15°C	to	+ 19°C	40 min	18 h
+ 20°C	to	+ 24 °C	30 min	12 h
+ 25°C	to	+ 34 °C	12 min	9 h
+ 35°C	to	+ 39 °C	8 min	6 h
	+ 40 °C		8 min	4 h
Cart	ridge tempe	erature	+5°C to	) +40°C

<sup>1)</sup> The minimum curing time is only valid for dry base material. In wet base material the curing time must be doubled.

Chemofast Injection system EP 1000 for concrete	
Intended Use Working time and curing time	Annex B 5

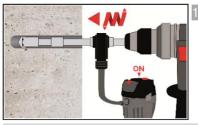


#### Installation instructions

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



Hammer drilling (HD) / Compressed air drilling (CD) Drill a hole to the required embedment depth. Drill bit diameter according to Table B1, B2 or B3. Aborted drill holes shall be filled with mortar. Proceed with Step 2.Proceed with Step 2.

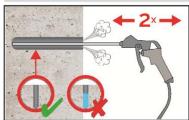


Hollow drill bit system (HDB) (see Annex B 4)
Drill a hole to the required embedment depth.
Drill bit diameter according to Table B1, B2 or B3.
The hollow drilling system removes the dust and cleans the bore hole.
Proceed with Step 3.

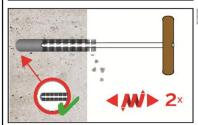
Attention! Standing water in the bore hole must be removed before cleaning.

#### Compressed Air Cleaning (CAC):

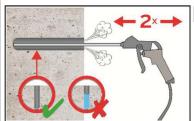
All diameter in cracked and uncracked concrete



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



Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)



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

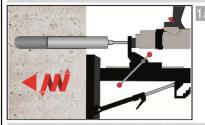
Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Chemofast Injection system EP 1000 for concrete	
Intended Use Installation instructions	Annex B 6



#### Installation instructions (continuation)

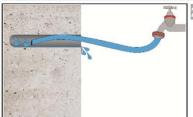
#### Drilling of the bore hole (DD)



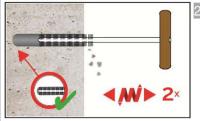
Diamond drilling (DD)
Drill a hole to the required embedment depth required
Drill bit diameter according to Table B1, B2 or B3.
Aborted drill holes shall be filled with mortar.
Proceed with Step 2.

#### Flush & Compressed Air Cleaning (SPCAC):

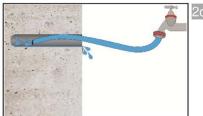
All diameter in uncracked concrete



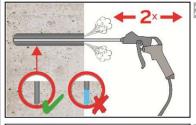
2a. Flushing with water until clear water comes out.



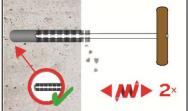
Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)



Flushing again with water until clear water comes out.



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



2e. Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)

#### Chemofast Injection system EP 1000 for concrete

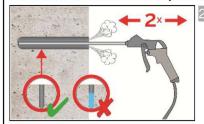
#### Intended Use

Installation instructions (continuation)

Annex B 7

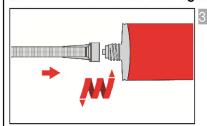


#### Installation instructions (continuation)



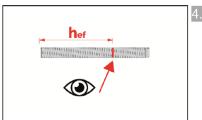
Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

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



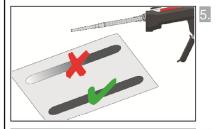
Screw on static-mixing nozzle PM-19E, and load the cartridge into an appropriate dispensing tool.

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



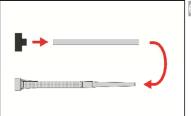
Mark embedment depth on the anchor rod.

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



Not proper mixed mortar is not sufficient for fastening.

Dispense and discard mortar until an uniform grey or red colour is shown (at least 3 full strokes).



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

- Horizontal and vertical downwards direction: Drill bit-Ø d<sub>0</sub> ≥ 18 mm and embedment depth h<sub>ef</sub> > 250mm
- Vertical upwards direction: Drill bit-Ø d<sub>0</sub> ≥ 18 mm

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



#### Injecting mortar without piston plug VS:

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

### Chemofast Injection system EP 1000 for concrete

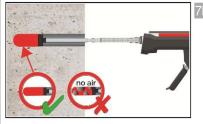
#### Intended Use

Installation instructions (continuation)

Annex B 8



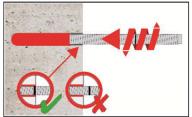
#### Installation instructions (continuation)



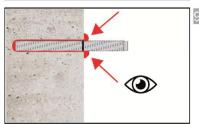
### 7b. Injecting mortar with piston plug VS:

Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.) During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.

Observe the temperature related working time t<sub>work</sub> (Annex B 5).



Insert the anchor rod while turning slightly up to the embedment mark.

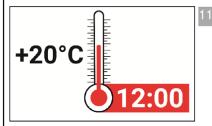


Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.

Otherwise, the installation must be repeated starting from step 7 before the maximum working time  $t_{work}$  has expired.



For application in vertical upwards direction the anchor rod shall be fixed (e.g. wedges).



Temperature related curing time t<sub>cure</sub> (Annex B 5) must be observed.

Do not move or load the fastener during curing time.



Install the fixture by using a calibrated torque wrench. Observe maximum installation torque (Table B1 or B3).

In case of static requirements (e.g. seismic), fill the annular gab in the fixture with mortar according to Annex 2. Therefore replace the washer by the filling washer VFS and use the mixer reduction nozzle MR.

#### Chemofast Injection system EP 1000 for concrete

#### **Intended Use**

Installation instructions (continuation)

Annex B 9



Th	readed rod				M8	M10	M12	M16	M20	M24	M27	M30
	oss section ar	ea	A <sub>s</sub>	[mm²]	36,6	58	84,3	157	245	353	459	561
		ension resistance, Steel failu		L J	00,0	00	0.,0			000		
		class 4.6 and 4.8	N <sub>Rk,s</sub>	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Ste	eel, Property of	class 5.6 and 5.8	N <sub>Rk,s</sub>	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
Ste	eel, Property of	class 8.8	N <sub>Rk,s</sub>	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
Sta	ainless steel A	A2, A4 and HCR, class 50	N <sub>Rk,s</sub>	[kN]	18	29	42	79	123	177	230	281
Sta	ainless steel A	A2, A4 and HCR, class 70	N <sub>Rk,s</sub>	[kN]	26	41	59	110	171	247	_3)	_3)
Sta	ainless steel A	4 and HCR, class 80	N <sub>Rk,s</sub>	[kN]	29	46	67	126	196	282	_3)	_3)
Cł	naracteristic t	ension resistance, Partial fac	tor <sup>2)</sup>									
St	eel, Property o	class 4.6 and 5.6	γ <sub>Ms,N</sub>	[-]				2,0	)			
St	eel, Property o	class 4.8, 5.8 and 8.8	γ <sub>Ms,N</sub>	[-]				1,5	5			
Sta	ainless steel A	A2, A4 and HCR, class 50	γ <sub>Ms,N</sub>	[-]				2,8	6			
Sta	ainless steel A	A2, A4 and HCR, class 70	γ <sub>Ms,N</sub>	[-]				1,8	7			
		4 and HCR, class 80	γMs,N	[-]				1,6	3			
Cł	aracteristic	shear resistance, Steel failure	1)									
Ε	Steel, Proper	ty class 4.6 and 4.8	V <sup>0</sup> Rk,s	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
rarm	Steel, Proper	ty class 5.6 and 5.8	V <sup>0</sup> Rk,s	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
eve	Steel, Proper	rty class 8.8	V <sup>0</sup> Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Ħ	Stainless ste	el A2, A4 and HCR, class 50	V <sup>0</sup> Rk,s	[kN]	9	15	21	39	61	88	115	140
Without lever	Stainless ste	el A2, A4 and HCR, class 70	V <sup>0</sup> Rk,s	[kN]	13	20	30	55	86	124	_3)	_3)
>	Stainless ste	el A4 and HCR, class 80	V <sup>0</sup> Rk,s	[kN]	15	23	34	63	98	141	_3)	_3)
	Steel, Proper	ty class 4.6 and 4.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900
ırm	Steel, Proper	ty class 5.6 and 5.8	M <sup>0</sup> Rk,s	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123
ever arm	Steel, Proper	ty class 8.8	M <sup>0</sup> Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
_	Stainless ste	el A2, A4 and HCR, class 50	M <sup>0</sup> Rk,s	[Nm]	19	37	66	167	325	561	832	1125
With	Stainless ste	el A2, A4 and HCR, class 70	M <sup>0</sup> Rk,s	[Nm]	26	52	92	232	454	784	_3)	_3)
	Stainless ste	el A4 and HCR, class 80	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	30	59	105	266	519	896	_3)	_3)
Ch	aracteristic s	shear resistance, Partial facto										
St	eel, Property o	class 4.6 and 5.6	γ <sub>Ms,V</sub>	[-]				1,6	7			
Ste	eel, Property o	class 4.8, 5.8 and 8.8	γ <sub>Ms,V</sub>	[-]				1,2	5			
Sta	ainless steel A	A2, A4 and HCR, class 50	γ <sub>Ms,V</sub>	[-]				2,3	8			
Sta	ainless steel A	A2, A4 and HCR, class 70	γ <sub>Ms,V</sub>	[-]				1,5	6			
Sta	ainless steel A	4 and HCR, class 80	γ <sub>Ms,V</sub>	[-]				1,3	3			

<sup>1)</sup> Values are only valid for the given stress area A<sub>s</sub>. Values in brackets are valid for undersized threaded rods with smaller stress area A<sub>s</sub> for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.

<sup>3)</sup> Fastener 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

<sup>2)</sup> in absence of national regulation



Table C2: Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years								
Fastener				All Fastener type and sizes				
Concrete cone failure								
Uncracked conc	rete	k <sub>ucr,N</sub>	[-]	11,0				
Cracked concret	te	k <sub>cr,N</sub>	[-]	7,7				
Edge distance		c <sub>cr,N</sub>	[mm]	1,5 h <sub>ef</sub>				
Axial distance		s <sub>cr,N</sub>	[mm]	2 c <sub>cr,N</sub>				
Splitting		•						
	h/h <sub>ef</sub> ≥ 2,0			1,0 h <sub>ef</sub>				
Edge distance	$2.0 > h/h_{ef} > 1.3$	c <sub>cr,sp</sub>	[mm]	$2 \cdot h_{ef} \left( 2,5 - \frac{h}{h_{ef}} \right)$				
	h/h <sub>ef</sub> ≤ 1,3			2,4 h <sub>ef</sub>				
Axial distance	•	s <sub>cr,sp</sub>	[mm]	2 c <sub>cr,sp</sub>				

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years	Annex C 2



	acteristic valu working life o			und	er sta	tic ar	nd qu	asi-si	tatic	actio	n
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure		W 20				-					
Characteristic tension res	sistance	N <sub>Rk,s</sub>	[kN]	4		A <sub>s</sub> • f	<sub>uk</sub> (or s	ee Tab	le C1)		
Partial factor		γMs,N	[-]				see Ta	able C1			
Combined pull-out and			MAZPORESCHOO 7/27 20	-10 104	ear a a na		927		10-20		Tarrene III
Characteristic bond resis (CD)	tance in uncracke	d concrete C2	0/25 in hamr	mer dri	lled hol	es (HD	) and c	ompre	ssed a	ir drilled	d hole
Temperature range II: 40°C\20°C \C	Dry, wet concrete and	<sup>τ</sup> Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16
он П: 72°С/50°С	flooded bore hole	T IK, uci	[,]	15	15	15	14	13	13	12	12
Characteristic bond resis	tance in uncracke	d concrete C2	0/25 in ham	mer dri	lled hol	es with	hollow	drill bi	t (HDB	5)	
<u>e</u> I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
II: 72°C/50°C	concrete	Τ	[N]/ma ma 21	14	14	14	13	13	12	12	11
H: 40°C/24°C   H: 72°C/50°C   H: 7	flooded bore	<sup>τ</sup> Rk,ucr	[N/mm²]	16	16	16	15	15	14	14	13
ਜ਼ਿ ਹਿ: 72°C/50°C	hole			14	14	14	13	13	12	12	11
Characteristic bond resis and in hammer drilled ho			25 in hamme	r drille	d holes	(HD) ,	compr	essed a	air drille	ed hole	s (CD
Temperature range II: 40°C/24°C	Dry, wet concrete and		[N]/2]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
Temper II: 72°C/50°C	flooded bore hole	l bore TRk,cr [IN/mm²] 6,0	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 in hamme				hamm	er drille	d hole:	s (HD),	compr	essed	air drille	ed
II: 72°C/50°C	Dry, wet concrete and	$\Psi^0$ sus [-]		0,80							
ਲ ਜ਼ II: 72°C/50°C	flooded bore hole	Ψ sus	[-]	0,68							
Increasing factors for cor	ncrete	Ψc	[-]				(f <sub>ck</sub> /	20) <sup>0,1</sup>			
Characteristic bond resis	tance depending	τ <sub>Rk,ucr</sub> =				Ψα	· τ <sub>Bk.ι</sub>	ucr,(C20/	/25)		
on the concrete strength		τ <sub>Rk,cr</sub> =						cr,(C20/			
Concrete cone failure		Titiyor					• • • • • • • • • • • • • • • • • • • •	01,(020/			
Relevant parameter							see Ta	able C2			
Splitting											
Relevant parameter				r			see Ta	able C2	!		
Installation factor	(HD, HDD, CD)	1						0			
for dry and wet concrete for flooded bore hole (HD		γ <sub>inst</sub>	[-]					,0 ,2			
Tot moded bare field (Fig.	,, 1100, 00)						,	,_			
Chemofast Injection	system EP 100	0 for concr	ete						Anne	ex C 3	3
Characteristic values of t for a working life of 50 ye		static and qua	si-static actic	on							



Steel failure Characteristic tension re Partial factor Combined pull-out and				M8	M10	M12	M16	M20	M24	M27	M30
Partial factor	•	I NI	FI N.D.	1		Λ . f	/or o	oo Tob	lo C1)		
	sistance	N <sub>Rk,s</sub>	[kN]			A <sub>S</sub> ·1		ee Tab	ie CT)		
complined pull-out and		γ <sub>Ms,N</sub>	[-]				see 1	able C1			
Characteristic bond resis		d concrete C20	)/25 in ham	mer dri	lled hol	es (HD	) and c	ompres	ssed ai	r drilled	d hole
II: 40°C/24°C	Dry, wet concrete and	<sup>τ</sup> Rk,ucr,100	[N/mm²]	20	20	19	19	18	17	16	16
E II: 72°C/50°C	flooded bore hole	*HK,UCI, 100	[14///////	15	15	15	14	13	13	12	12
Characteristic bond resis	stance in uncracke	d concrete C20	)/25 in ham	mer dri	lled hol	es with	hollow	drill bi	t (HDB	)	
<u>a</u> I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
1: 40°C/24°C   1: 40°C/24°C   1: 40°C/24°C   1: 72°C/50°C	concrete	π	[N/mm <sup>2</sup> ]	14	14	14	13	13	12	12	11
를 할 I: 40°C/24°C	flooded bore	<sup>τ</sup> Rk,ucr,100	[14/11111-]	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 and in hammer drilled ho			5 in hamme	r drille	d holes	(HD) ,	compre	essed a	air drille	ed hole	s (CE
I: 40°C/24°C  ange II: 72°C/50°C	Dry, wet concrete and	<sup>τ</sup> Rk,cr,100	.100 [N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
о е II: 72°С/50°С	flooded bore hole	11K,CI, 100		5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Reduction factor ${\psi^0}_{sus,1}$				5 in ha	mmer d	rilled h	oles (H	ID), cor	npress	ed air	drilled
I: 40°C/24°C II: 72°C/50°C	Dry, wet concrete and	Ψ <sup>0</sup> sus,100	sus.100 [-]		0,80						
II: 72°C/50°C	flooded bore hole	Y Sus,100		0,68							
ncreasing factors for co	ncrete	Ψc	[-]				(f <sub>ck</sub> / 2	20) <sup>0,1</sup>			
Characteristic bond resis	stance depending	τ <sub>Rk,ucr,100</sub> =				Ψ <b>c</b> •	<sup>τ</sup> Rk,ucr	,100,(C2	20/25)		
on the concrete strength	class	τ <sub>Rk,cr,100</sub> =				$\Psi_{C}$	τ <sub>Rk,cr,</sub>	100,(C2	0/25)		
Concrete cone failure											
Relevant parameter							see Ta	able C2			
Splitting Relevant parameter							soo Ta	able C2			
nstallation factor							See 16	ible 02			
or dry and wet concrete	(HD; HDB, CD)	1					1	,0			
or flooded bore hole (HE		<sup>γ</sup> inst	[-]					,2			
Chemofast Injection	system EP 100	0 for concre	te								



	racteristic valu working life o		on loads	und	er sta	atic a	nd qu	asi-s	tatic	actio	n
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure											
Characteristic tension re	esistance	N <sub>Rk,s</sub>	[kN]			$A_s \cdot f$	uk (or s	ee Tab	le C1)		
Partial factor		γ <sub>Ms,N</sub>	[-]				see Ta	able C1			
Combined pull-out and	d concrete failure										
Characteristic bond resi		d concrete C20	/25 in diam	ond dr	illed ho	les (DE	D)				
range range : I: 40°C/24°C	Dry, wet concrete and		FN1/	15	14	14	13	12	12	11	11
Temperature range II: 40°C/24°C	flooded bore hole	<sup>τ</sup> Rk,ucr [N/mm²] -		12	12	11	10	9,5	9,5	9,0	9,0
Reduction factor ψ <sup>0</sup> sus i	n uncracked concre	ete C20/25 in di	amond dril	led hol	es (DD	)					
II: 72°C/50°C	Dry, wet concrete and flooded bore	$\Psi^0$ sus	[-]	0,77							
E	hole			0,72							
Increasing factors for co	oncrete	Ψ <sub>c</sub>	[-]				(f <sub>ck</sub> /	20) 0,2			
Characteristic bond resi on the concrete strengtl		τ <sub>Rk,ucr</sub> =				Ψ	06. 10.97/0	ucr,(C20			
Concrete cone failure											
Relevant parameter						see Ta	able C2	2			
Splitting											
Relevant parameter							see Ta	able C2	2		
Installation factor											
for dry and wet concrete		Yingt	[-]		W 10-7-7		1	,0			
for flooded bore hole (DD)		γinst	[]	1,2 1,4							

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (threaded rod)	Annex C 5



	acteristic valu working life o			und	er sta	atic a	nd qu	ıasi-s	tatic	actio	n
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure							'				
Characteristic tension res	istance	N <sub>Rk,s</sub>	[kN]			$A_s \cdot f$	uk (or s	ee Tab	ole C1)		
Partial factor		γ <sub>Ms,N</sub>	[-]				see Ta	able C1			
Combined pull-out and	concrete failure	,									
Characteristic bond resist	ance in uncracked	d concrete C20	/25 in diam	ond dr	lled ho	les (DE	))	_			
II: 40°C/24°C	Dry, wet concrete and	T	[N]/22.22	15	14	14	13	12	12	11	11
Hermony II: 72°C/50°C	flooded bore hole	<sup>τ</sup> Rk,ucr,100	[N/mm <sup>2</sup> ]	11	11	10	10	9,5	9,0	8,5	8,5
Reduction factor ψ <sup>0</sup> sus,10	o in uncracked co	ncrete C20/25	in diamond	drilled	holes	(DD)	•				
II: 72°C/50°C	Dry, wet concrete and	$\Psi^0$ sus,100	[-]	0,73							
d II: 72°C/50°C	flooded bore hole	* Sus,100	1 1	0,70							
Increasing factors for con	crete	Ψc	[-]				(fck/	20) <sup>0,2</sup>			
Characteristic bond resist on the concrete strength		τ <sub>Rk,ucr,100</sub> =				Ψ <sub>C</sub> •	<sup>τ</sup> Rk,ucı	r,100,(C	20/25)		
Concrete cone failure											
Relevant parameter						see Ta	able C2	2			
Splitting											
Relevant parameter							see Ta	able C2	2		
Installation factor	<b>/</b>		1	_							
for dry and wet concrete		γ <sub>inst</sub>	[-]		4.6		1	,0			
for flooded bore hole (DD)		1		1,2 1,4							

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (threaded rod)	Annex C 6



Threaded rod			М8	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 <sup>0</sup> <sub>Rk,s</sub>	[kN]	0,6 ⋅ A <sub>s</sub> ⋅ f <sub>uk</sub> (or see Table C1)							
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	0,5 ⋅ A <sub>s</sub> ⋅ f <sub>uk</sub> (or see Table C1)							
Partial factor	γ <sub>Ms,V</sub>	[-]	see Table C1							
Ductility factor	k <sub>7</sub>	[-]	1,0							
Steel failure with lever arm		1								
Characteristic bending moment	M <sup>0</sup> Rk,s	[Nm]		-	1,2 • \	N <sub>el</sub> ∙ f <sub>uk</sub>	(or see	Table C	;1)	
Elastic section modulus	W <sub>el</sub>	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ <sub>Ms,V</sub>	[-]				see	Table C	:1		
Concrete pry-out failure										
Factor	k <sub>8</sub>	[-]					2,0			
Installation factor	γ <sub>inst</sub>	[-]	1,0							
Concrete edge failure										
Effective length of fastener	If	[mm]		m	iin(h <sub>ef</sub> ; 1	2 · d <sub>nor</sub>	n)		min(h <sub>ef</sub> ;	300mm)
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]	1,0							

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (threaded rod)	Annex C 7



	ristic values king life of 5			ads und	ler stati	c and q	uasi-sta	atic acti	on	
Internal threaded anchor rod	ls			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure <sup>1)</sup>										
Characteristic tension resistan	ce, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123	
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196	
Partial factor, strength class 5.	8 and 8.8	γMs,N	[-]			1	,5			
Characteristic tension resistan Steel A4 and HCR, Strength cl		N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Partial factor		γMs,N	[-]			1,87			2,86	
Combined pull-out and conc	rete cone failu					,			,	
Characteristic bond resistance (CD)			20/25 in h	ammer dr	illed holes	(HD) and	compress	sed air dril	led holes	
Temperature I: 40°C/24°C	Dry, wet			20	19	19	18	17	16	
range II: 72°C/50°C	flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm²]	15	15	14	13	13	12	
Characteristic bond resistance	in uncracked co	oncrete C	20/25 in h	ammer dr	illed holes	with hollo	w drill bit	(HDB)		
I: 40°C/24°C	Dry, wet			16	16	16	15	14	13	
Temperature II: 72°C/50°C	concrete	τ <sub>Rk,ucr</sub>	[N/mm²]	14	14	13	13	12	11	
range <u>I: 40°C/24°C</u>	flooded bore hole	T III, GOT	1	16 14	16 14	15 13	15 13	14 12	13	
II: 72°C/50°C Characteristic bond resistance		rote C20	/25 in ham	2. (1	3/2. 6	520 S.T.	2002	25.00-00	11 les (CD)	
and in hammer drilled holes wi					,					
Temperature I: 40°C/24°C	concrete and	<sup>τ</sup> Rk,ucr	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5	
range II: 72°C/50°C	flooded bore hole	T in Good		6,0	7,0	7,0	7,0	7,0	7,0	
Reduction factor $\psi^0_{SUS}$ in crac	ked and uncrac	ked conc	rete C20/2	25 in hamr	mer drilled	holes (H	D), compre	essed air d	drilled	
holes (CD) and in hammer dril		ollow drill	bit (HDB)							
Temperature I: 40°C/24°C	Dry, wet concrete and					0,	80			
Temperature II: 72°C/50°C	flooded bore hole	$\Psi^0$ sus	[-]	0,68						
Increasing factors for concrete		Ψс	[-]			(f <sub>ck</sub> / 2	20) <sup>0,1</sup>			
Characteristic bond resistance	depending on		τ <sub>Rk,ucr</sub> =			Ψ <b>c</b> • τ <sub>Rk,u</sub>	ıcr.(C20/25)	r (C20/25)		
the concrete strength class	asponanty on		τ <sub>Rk,cr</sub> =				cr,(C20/25)			
Concrete cone failure			Tik,OI			· O Tito,	or,(O20/20)			
Relevant parameter						see Ta	ble C2			
Splitting failure										
Relevant parameter						see Ta	ıble C2			
Installation factor										
for dry and wet concrete (HD;		γ <sub>inst</sub>	[-]				,0			
for flooded bore hole (HD; HDI							,2	71-P07-1 - 1		
1) Fastenings (incl. nut and was The characteristic tension re 2) For IG-M20 strength class 50	sistance for stee	ly with the I failure is	appropria valid for th	te material e internal i	and prope threaded r	erty class o od and the	f the intern fastening	nal threade element.	d rod.	
Chemofast Injection syst	em EP 1000 f	or conc	rete							
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod)  Annex C 8					8					



l .	ristic values king life of 1			ds unde	er statio	and q	uasi-sta	atic acti	on
Internal threaded anchor rod	s			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure <sup>1)</sup>									
Characteristic tension resistant	ce, <u>5.8</u>	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196
Partial factor, strength class 5.8	8 and 8.8	γMs,N	[-]	[-]					
Characteristic tension resistand Steel A4 and HCR, Strength cl.	The state of the s	N <sub>Rk,s</sub>	[kN]	[kN]	26	41	59	110	124
Partial factor		γMs,N	[-]			[-]			2,86
Combined pull-out and conc									
Characteristic bond resistance (CD)		oncrete C20	0/25 in ha	mmer dril	led holes	(HD) and	compress	sed air dril	led holes
Temperature I: 40°C/24°C	Dry, wet concrete and	τ <sub>Rk,ucr,100</sub>	[N/mm²]	20	19	19	18	17	16
range II: 72°C/50°C	flooded bore hole	,,		15	15	14	13	13	12
Characteristic bond resistance	1	oncrete C20	0/25 in hai	c-, and -o-were something				,	-
1: 40°C/24°C	Dry, wet			16	16	16	15	14	13
Temperature II: 72°C/50°C	concrete	τ <sub>Rk,ucr,100</sub>	[N/mm <sup>2</sup> ]	14	14	13	13	12	11
range <u>I: 40°C/24°C</u> II: 72°C/50°C	flooded bore hole	,,		16 14	16 14	15 13	15 13	14 12	13 11
Characteristic bond resistance		rete C20/2	⊥ 5 in hamn		100.00	0.00000	10000	1000000000	77. 500
and in hammer drilled holes wi	th hollow drill bi								(0-)
Temperature	Dry, wet concrete and	nd	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5
range II: 72°C/50°C	flooded bore hole	nk,uci,100	[]	5,5	6,5	6,5	6,5	6,5	6,5
Reduction factor $\psi^0_{sus,100}$ in drilled holes (CD) and in hamm					ammer dri	illed holes	(HD), coi	mpressed	air
_ I: 40°C/24°C	Dry, wet			,,		0	80		
range II: 72°C/50°C	concrete and flooded bore	Ψ <sup>0</sup> sus,100	[-]				68		
Increasing factors for concrete	hole	Ψς	[-]			(f <sub>ak</sub> / )	20) 0,1		
3 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -			ucr,100 =		W			)F)	
Characteristic bond resistance the concrete strength class	depending on		c,cr,100 =	Ψc * τRk,ucr,100,(C20/25) Ψc * τRk,cr,100,(C20/25)					
Concrete cone failure		*Ni	ζ, στ, του			rc Thk,cr,	100,(020/2	5)	
Relevant parameter						see Ta	able C2		
Splitting failure									
Relevant parameter						see Ta	able C2		
Installation factor									
for dry and wet concrete (HD; I		γ <sub>inst</sub>	[-]				,0		
for flooded bore hole (HD; HDB, CD)  Tinst  1,2  The property class of the internal threaded rod.						-11			
The characteristic tension res									a roa.
2) For IG-M20 strength class 50							9		
Chemofast Injection syst	em EP 1000 f	or concre	ete						
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (Internal threaded anchor rod)  Annex C 9				9					



Table C10:	Characteristic values of tension loads under static and quasi-static action
	for a working life of 50 years

				99	00			-	
Internal threaded anchor rod	ls			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure <sup>1)</sup>									
Characteristic tension resistan	ce, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196
Partial factor, strength class 5.	8 and 8.8	γ <sub>Ms,N</sub>	[-]			1	,5		
Characteristic tension resistant Steel A4 and HCR, Strength cl		N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124
Partial factor		γ <sub>Ms,N</sub>	[-]			1,87			2,86
Combined pull-out and conc	rete cone failu	re				,			
Characteristic bond resistance	in uncracked co	oncrete C20	0/25 in dia	mond dril	led holes	(DD)			
Temperature I: 40°C/24°C	Dry, wet concrete and	To	[N/mm²]	14	14	13	12	12	11
range II: 72°C/50°C	flooded bore hole	<sup>τ</sup> Rk,ucr		12	11	10	9,5	9,5	9,0
Reduction factor $\psi^0{}_{ t sus}$ in uncr	acked concrete	C20/25 in	diamond c	drilled hole	es (DD)				
Temperature I: 40°C/24°C	Dry, wet concrete and	00		0,77					
range II: 72°C/50°C	flooded bore hole	Ψ <sup>0</sup> sus	[-]	0,72					
Increasing factors for concrete		Ψc	[-]			(f <sub>ck</sub> / :	20) <sup>0,2</sup>		
Characteristic bond resistance the concrete strength class	depending on		τ <sub>Rk,ucr</sub> =	Ψ <b>c</b> * <sup>τ</sup> Rk,ucr,(C20/25)					
Concrete cone failure									
Relevant parameter					see Ta	able C2			
Splitting failure									
Relevant parameter						see Ta	able C2		
Installation factor		1							
for dry and wet concrete (DD)		γ <sub>inst</sub>	[-]	1,0					
for flooded bore hole (DD)	•	lide de e		1,	,2			,4	0.00

<sup>1)</sup> 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.

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod)	Annex C 10

<sup>2)</sup> For IG-M20 strength class 50 is valid



Table C11:	Characteristic values of tension loads under static and quasi-static action
	for a working life of 100 years

Internal threaded anchor roo	ds			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure <sup>1)</sup>										
Characteristic tension resistar	nce, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123	
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196	
Partial factor, strength class 5	.8 and 8.8	γ <sub>Ms,N</sub>	[-]			1	,5			
Characteristic tension resistar Steel A4 and HCR, Strength o		N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Partial factor		γ <sub>Ms,N</sub>	[-]			1,87			2,86	
Combined pull-out and cond	crete cone failu	re								
Characteristic bond resistance	e in uncracked c	oncrete C20	0/25 in dia	mond dril	led holes	(DD)				
Temperature I: 40°C/24°C	Dry, wet concrete and	TDI	[N/mm²]	14	14	13	12	12	11	
range II: 72°C/50°C	flooded bore hole	Rk,ucr,100	00 [N/mm²] 11 10 10					9,0	8,5	
Reduction factor $\psi^0_{ t sus,100}$ in	uncracked cond	rete C20/2	5 in diamo	nd drilled	holes (D	D)				
Temperature I: 40°C/24°C	Dry, wet concrete and		[-]				73			
range II: 72°C/50°C	flooded bore hole	$\Psi^0$ sus,100	[-]			0,	70			
Increasing factors for concrete	Y	Ψc	[-]			(f <sub>ck</sub> / :	20) <sup>0,2</sup>			
Characteristic bond resistance the concrete strength class	depending on	<sup>τ</sup> Rk,	ucr,100 =							
Concrete cone failure										
Relevant parameter				see Table C2						
Splitting failure										
Relevant parameter						see Ta	able C2			
Installation factor										
for dry and wet concrete (DD)	[-]	1,0								
for flooded bore hole (DD)		γinst	''	1,	2		1,	,4		

<sup>1)</sup> 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.

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (Internal threaded anchor rod)	Annex C 11

<sup>2)</sup> For IG-M20 strength class 50 is valid



1,0

Internal threaded anchor rods				IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm <sup>1</sup>	)								
Characteristic shear resistance,	5.8	V <sup>0</sup> Rk,s	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 a	and 8.8	γ <sub>Ms,V</sub>	[-]			•	1,25		
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>		V <sup>0</sup> <sub>Rk,s</sub>	[kN]	7	13	20	30	55	40
Partial factor		γ <sub>Ms,V</sub>	[-]			1,56			2,38
Ductility factor		k <sub>7</sub>	[-]				1,0		
Steel failure with lever arm1)									
Characteristic bending moment,	5.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	8	19	37	66	167	325
Steel, strength class	8.8	M <sup>0</sup> Rk,s	[Nm]	12	30	60	105	267	519
Partial factor, strength class 5.8 a	and 8.8	γ <sub>Ms,V</sub>	[-]				1,25		
Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>		M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	11	26	52	92	233	456
Partial factor		γ <sub>Ms,V</sub>	[-]			1,56			2,38
Concrete pry-out failure									
Factor		k <sub>8</sub>	[-]				2,0		
Installation factor		γ <sub>inst</sub>	[-]				1,0		
Concrete edge failure		71	d d						
Effective length of fastener		I <sub>f</sub>	[mm]		min(	h <sub>ef</sub> ; 12 • 0	d <sub>nom</sub> )		min(h <sub>ef</sub> ; 300m
Outside diameter of fastener		d <sub>nom</sub>	[mm]	10	12	16	20	24	30

<sup>1)</sup> 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.

[-]

 $\gamma_{inst}$ 

Installation factor

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)	Annex C 12

<sup>2)</sup> For IG-M20 strength class 50 is valid



Table C13: Cha	aracteristic v a working lif			load	s un	der s	tatic	and	quas	si-sta	tic a	ction		
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Steel failure			T						- 4\					
Characteristic tension	resistance	N <sub>Rk,s</sub>	[kN]						f <sub>uk</sub> 1)					
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804	
Partial factor Y <sub>Ms,N</sub> [-] 1,4														
Combined pull-out ar Characteristic bond res			to C20/25	in han	amor d	rillad k	nolog (	UD) 01	ad oor	nrocc	od oir	drillad	holor	
(CD)	sistance in uncra	Tree concre	T CZU/25	III IIaii	iiilei u	i illea i	loies (	п <i>D)</i> аі	ia con	ibiess	eu an	umeu	noies	
II: 40°C/24°C	Dry, wet concrete and flooded bore hole	<sup>₹</sup> Rk,ucr	[N/mm²]	16	16	16 12	16	16 12	16 12	15 12	15 12	15 11	15 11	
•					100-20-					22222				
Characteristic bond res		cked concre	te C20/25				T		l l	· `	,	10	10	
e ti 40°C/24°C	Dry, wet concrete			14 12	14 12	13 12	13 11	13	13 11	13	13	13 11	13 11	
II: 40°C/24°C II: 72°C/50°C II: 72°C/50°C	12.00.00 (D)((D)(1.00.00 (D)(D))	<sup>τ</sup> Rk,ucr	[N/mm <sup>2</sup> ]	13	13	13	13	13	13	13	13	13	13	
II: 72°C/50°C	flooded bore hole			11	11	11	11	11	11	11	11	11	11	
Characteristic bond res		ed concrete	C20/25 in											
and in hammer drilled				- I a i i i i i	Ci diiii	- TION	C5 (11E	,, 0011	ргозо	- CG GII	urmea	110103	(00)	
II: 40°C/24°C	Dry, wet concrete and	τ <sub>Rk,cr</sub>	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	
Te II: 72°C/50°C	flooded bore hole	*HK,Cr	[14/11111]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	
Reduction factor $\psi^0_{SU}$ holes (CD) and in ham					n ham	ımer d	rilled h	oles (	HD), c	ompre	ssed a	ir drille	ed	
II: 40°C/24°C	Dry, wet concrete and flooded bore	Ψ <sup>0</sup> sus	[-]	0,80										
Б II: 72°С/50°С	hole								68					
Increasing factors for c		Ψc	[-]					(f <sub>ck</sub> / 2	20) <sup>0,1</sup>					
Characteristic bond res			$\tau_{Rk,ucr} =$				$\Psi_{C}$	• τ <sub>Rk,ι</sub>	ıcr,(C20	)/25)				
depending on the cond class	rete strengtri		τ <sub>Rk,cr</sub> =				$\Psi_{C}$	• τ <sub>Rk,ι</sub>	ıcr,(C20	)/25)				
Concrete cone failure	•													
Relevant parameter								see Ta	able C2	2				
Splitting														
Relevant parameter								see Ta	able C2	2				
Installation factor	to (HD: HDB													
for dry and wet concret CD)	ie (חט, חטט,	γ <sub>inst</sub>	[-]					1	,0					
for flooded bore hole (I		900034,3009	9262 34					1	,2					
1) f <sub>uk</sub> shall be taken fro		ons of reinford	cing bars											
2) in absence of nation	al regulation													
Chemofast Injection	on system EP	1000 for c	oncrete											
Performances Characteristic values of for a working life of 50			nd quasi-sta	atic act	ion					A	nnex	C 13	3	



	a working lif	C 01 100 )	yeurs										
Reinforcing bar Steel failure				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3
Characteristic tension	rociotanao	No	[I/NI]					Δ.	f <sub>uk</sub> 1)				
	resistance	N <sub>Rk,s</sub>	[kN]	F0	70	110	454			450	404	010	00
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	. d	γMs,N	[-]					1,	42)				
Combined pull-out ar Characteristic bond res			to C20/25	in han	mer d	rillad k	nolos /	HD) ar	nd com	nrace	od air	drillad	holo
(CD)	sistance in uncra	The Concre	T 020/23	III IIaii	iiiiei u	illieu i	10163 (	i iD) ai	iu con	ipiess	eu aii	umeu	11016
II: 72°C/50°C	Dry, wet concrete and flooded bore	<sup>τ</sup> Rk,ucr,100	[N/mm²]	16	16	16	16	16	16	15	15	15	15
II: 72°C/50°C	hole			12	12	12	12	12	12	12	12	11	11
Characteristic bond res	sistance in uncra	cked concre	te C20/25	in han	nmer d	rilled h	oles v	vith ho	llow dr	ill bit (	HDB)		
<u>e</u> <u>I: 40°C/24°C</u>	Dry, wet			14	14	13	13	13	13	13	13	13	13
E 40°C/24°C    1: 40°C/24°C   1: 72°C/50°C   1: 72°C/50°C	concrete	TDI 100	[N/mm <sup>2</sup> ]	12	12	12	11	11	11	11	11	11	11
를 할 I: 40°C/24°C	flooded bore	<sup>τ</sup> Rk,ucr,100	[[14/11]]	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 and in hammer drilled				hamm	er drill	ed hol	es (HC	), com	press	ed air	drilled	holes	(CD)
	Dry, wet concrete and			6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range II: 40°C/24°C	flooded bore hole	<sup>τ</sup> Rk,ucr,100	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Reduction factor $\psi^0_{su}$	s.100 in cracked	and uncrack	ed concre	te C20	)/25 in	hamm	er dril	ed hol	es (H[	D), con	npress	ed air	
drilled holes (CD) and													
Temperature range II: 40°C/24°C	Dry, wet concrete and flooded bore	Ψ <sup>0</sup> sus,100	[-]					0,	80				
E II: 72°C/50°C	hole								68				
Increasing factors for o	concrete	Ψc	[-]					(f <sub>ck</sub> / 2	20) <sup>0,1</sup>				
Characteristic bond res		τ <sub>Rk</sub>	,ucr,100 =				Ψ <b>c</b> • ′		,100,(C				
depending on the conc class	crete strength		a,ucr,100 =						,100,(C				
Concrete cone failure		I TIN	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				- 0	i in,uci	, 100,(0	_0/20)			
Relevant parameter	-							see Ta	ble C2	2			
Splitting			<u> </u>	I									
Relevant parameter								see Ta	ble C2	2			
Installation factor			<u> </u>	I									
for dry and wet concre CD)	te (HD; HDB,	γ <sub>inst</sub>	[-]					1	,0				
for flooded bore hole (I	HD; HDB, CD)							1	,2				
1) f <sub>uk</sub> shall be taken fro	om the specification	ons of reinford	cing bars										
2) in absence of nation	al regulation												
Chemofast Injection	on system EP	1000 for co	oncrete										



Table C15: Cha for	aracteristic v a working lif			load	s un	der s	tatic	and	quas	i-sta	tic a	ction	
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure											7		
Characteristic tension resistance $N_{Rk,s}$ [kN] $A_s \cdot f_{uk}^{(1)}$													
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ <sub>Ms,N</sub>	[-]					1,	42)				
Combined pull-out ar	nd concrete failu	ire											
Characteristic bond res	sistance in uncra	cked concre	te C20/25	in dia	mond o	drilled l	holes	(DD)					
Dry, wet concrete and flooded bore τ <sub>Rk,ucr</sub> [N/mm²] 14 13 13 13 12 12 11 11 11 11													
T: 40°C/24°C	[N/mm²]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0		
Reduction factor ψ <sup>0</sup> su	s in uncracked co	oncrete C20/	25 in diam	nond d	rilled h	oles (I	DD)						
nperature range I: 40°C/24°C	Dry, wet concrete and	0	F 3					0,	77				
II: 72°C/50°C	flooded bore hole	Ψ <sup>0</sup> sus	[-]					0,	72				
Increasing factors for o	concrete	Ψс	[-]					(f <sub>ck</sub> / 2	20) <sup>0,2</sup>				
Characteristic bond residepending on the conclass	nd resistance												
Concrete cone failure	•												
Relevant parameter see Table C2													
Splitting													
Relevant parameter								see Ta	able C2	2			
Installation factor													
for dry and wet concre	te (DD)	γ	[_]					1	,0				
for flooded bore hole (I	DD)	γinst	[-]		1	,2				1	,4		
1) ful shall be taken from	om the specification	ons of reinford	cing bars										

 $<sup>^{1)}</sup>$   $f_{uk}$  shall be taken from the specifications of reinforcing bars

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (reinforcing bar)	Annex C 15

<sup>2)</sup> in absence of national regulation



1	aracteristic v a working lif			load	s un	der s	tatic	and	quas	si-sta	itic a	ction	Ì
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure								2	51				
Characteristic tension resistance $N_{Rk,s}$ [kN] $A_s \cdot f_{uk}^{(1)}$													
Cross section area		As	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ <sub>Ms,N</sub>	[-]					1,	42)				
Combined pull-out an	nd concrete failu												
Characteristic bond res	sistance in uncra	cked concret	te C20/25	in dia	mond c	drilled	holes (	(DD)			24-5		
## 1: 40°C/24°C   Dry, wet concrete and flooded bore   TRk,ucr,100   [N/mm²]   14   13   13   13   12   12   11   11   11													
T: 40°C/24°C	flooded bore hole	<sup>τ</sup> Rk,ucr,100	[N/mm <sup>2</sup> ]	11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5
Reduction factor $\psi^0_{sus}$	s,100 in uncracke	ed concrete (	C20/25 in	diamo	nd drill	ed ho	les (DI	D)					
range I: 40°C/24°C	Dry, wet concrete and	0						0,	73				
II: 72°C/50°C	flooded bore hole	Ψ <sup>0</sup> sus,100	[-]					0,	70				
Increasing factors for c	oncrete	Ψс	[-]					(f <sub>ck</sub> / 2	20) <sup>0,2</sup>	\$2 85			
Characteristic bond res depending on the conc class		<sup>τ</sup> Rk	ucr,100 =				ψ <b>c</b> • τ	Rk,ucı	r,100,(	C20/25)	)		
Concrete cone failure	)												
Relevant parameter								see Ta	able C	2			
Splitting													
Relevant parameter							)	see Ta	able C	2			
Installation factor													
for dry and wet concret	te (DD)	γ:	r_1					1	,0				
for flooded bore hole (DD) $\gamma_{\text{inst}}$ [-] 1,2													
1) f <sub>uk</sub> shall be taken fro	m the specificatio	ns of reinford	ing bars										

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (reinforcing bar)	Annex C 16

<sup>2)</sup> in absence of national regulation



Table C17: Characteristic a working life				ds ui	nder	stat	ic an	ıd qu	iasi-si	tatic a	ction	for
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 <sup>0</sup> Rk,s	[kN]					0,5	·As·	f <sub>uk</sub> 1)			
Cross section area	Ασ	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ <sub>Ms,V</sub>	[-]						1,52	)			
Ductility factor	k <sub>7</sub>	[-]						1,0				
Steel failure with lever arm												
Characteristic bending moment	М <sup>0</sup> <sub>Rk,s</sub>	[Nm]					1,2	· W <sub>el</sub>	• f <sub>uk</sub> 1)			
Elastic section modulus	W <sub>el</sub>	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γ <sub>Ms,V</sub>	[-]						1,52	)			
Concrete pry-out failure												
Factor	k <sub>8</sub>	[-]						2,0				
Installation factor	γinst	[-]						1,0				
Concrete edge failure	'	'										
Effective length of fastener	lf	[mm]			min(h	ef; 12	• d <sub>nor</sub>	m)		min(	h <sub>ef</sub> ; 300	mm)
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γ <sub>inst</sub>	[-]					•	1,0				

 $<sup>^{1)}\,</sup>f_{uk}$  shall be taken from the specifications of reinforcing bars

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (reinforcing bar)	Annex C 17

<sup>2)</sup> in absence of national regulation



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

Threaded rod						M16	M20	M24	M27	M30		
Uncracked concrete un	Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years											
Temperature range I:	$\delta_{N0}$ -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:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055		
72°C/50°C	$\delta_{N\infty}$ -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 q	uasi-static actior	n for a w	orking l	ife of 50	and 100	) years					
Temperature range I:	$\delta_{\text{N0}}$ -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:	$\delta_{N0}$ -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		

<sup>1)</sup> Calculation of the displacement

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

 $\tau$ : action bond stress for tension

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

Table C19: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Threaded rod						M16	M20	M24	M27	M30
Uncracked concrete un	der static and	d quasi-static act	ion for a	workin	g life of	50 years	S			
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II: 72°C/50°C	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Uncracked concrete un	der static and	d quasi-static act	ion for a	workin	g life of	100 yea	rs			
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051

<sup>1)</sup> Calculation of the displacement

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

 $\tau\textsc{:}$  action bond stress for tension

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

# Table C20: Displacements under shear load<sup>1)</sup> for all drilling methods

Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30	
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years											
All temperature	$\delta_{V0}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03	
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05	

<sup>1)</sup> Calculation of the displacement

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

V: action shear load

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

## Chemofast Injection system EP 1000 for concrete

#### **Performances**

Annex C 18

Displacements under static and quasi-static action for a working life of 50 and 100 years (threaded rod)



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

Internal threaded anchor	ernal threaded anchor rods				IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete und	ler static and q	uasi-static actio	n for a wo	rking life o	of 50 and 1	00 years		
Temperature range I:	$\delta_{N0}$ -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:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	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 under	static and qua	si-static action	for a work	ing life of 5	50 and 100	years		
Temperature range I:	$\delta_{N0}$ -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/mm <sup>2</sup> )]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,095	0,096	0,099	0,102	0,106	0,110
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,154	0,163	0,172	0,181	0,189	0,229

<sup>1)</sup> Calculation of the displacement

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

 $\tau$ : action bond stress for tension

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

Table C22: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Internal threaded ancho	r rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete und	ler static and q	uasi-static actio	n for a wo	rking life o	of 50 years			
Temperature range I:	δ <sub>N0</sub> -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:	$\delta_{N0}$ -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
Uncracked concrete und	ler static and q	uasi-static actio	n for a wo	rking life o	of 100 year	S		
Temperature range I:	$\delta_{N0}$ -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:	$\delta_{N0}$ -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)]	0,039	0,040	0,043	0,045	0,047	0,051

<sup>1)</sup> Calculation of the displacement

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

 $\tau$ : action bond stress for tension

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

# Table C23: Displacements under shear load<sup>1)</sup> for all drilling methods

Internal threaded	l anchor rods		IG-M6	IG-M8	IG-M10	IG-M12	-M12 IG-M16					
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years												
All temperature	δ <sub>V0</sub> -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				

<sup>1)</sup> Calculation of the displacement

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

V: action shear load

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

## Chemofast Injection system EP 1000 for concrete

#### **Performances**

Annex C 19

Displacements under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)



Table C24:	Displacements under tension load <sup>1)</sup>
	in hammer drilled holes (HD), compressed air drilled holes (CD) and in
	hammer drilled holes with hollow drill bit (HDB)

Reinforcing bar	Reinforcing bar				Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years												
Temp range I:	$\delta_{N0}$ -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:	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058
72°C/50°C	$\delta_{N\infty}$ -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:	$\delta_{\text{N0}}$ -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:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260

<sup>1)</sup> Calculation of the displacement

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

 $\tau$ : action bond stress for tension

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

# Table C25: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Uncracked concre	Uncracked concrete under static and quasi-static action for a working life of 50 years												
Temp range I:	$\delta_{N0}$ -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 <sub>N0</sub> -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	
Uncracked concre	ete under sta	tic and quasi-st	tatic ac	tion for	a work	ing life	of 100	years					
Temp range I:	$\delta_{N0}$ -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	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,018	0,020	0,021	0,022	0,024	0,026	0,029	0,029	0,031	0,034	
Temp range II:	$\delta_{N0}$ -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/mm <sup>2</sup> )]	0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,064	

<sup>1)</sup> Calculation of the displacement

δN0 = δN0-factor  $\cdot$  τ;

τ: action bond stress for tension

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

# Table C26: Displacements under shear load<sup>1)</sup> for all drilling methods

Reinforcing bar		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years												
All temperature	$\delta_{V0}$ -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

<sup>1)</sup> Calculation of the displacement

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

V: action shear load

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

## Chemofast Injection system EP 1000 for concrete

#### **Performances**

Annex C 20

Displacements under static and quasi-static action for a working life of 50 and 100 years (reinforcing bar)



Table	Table C27: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years												
Thread	Threaded rod M8 M10 M12 M16 M20 M24 M27 M3												
Steel fa	ailure												
Charac	teristic tension resist	ance	N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	$N_{Rk,s}$				
Partial '	factor		γ <sub>Ms,N</sub>	[-]				see Ta	ble C1				
Combi	ned pull-out and co	ncrete failure	•	•									
	teristic bond resistan noles (CD) and in hai					hamm	er drille	ed hole	s (HD)	, comp	ressed	air	
Temperature range	I: 40°C/24°C	Dry, wet concrete and	<sup>τ</sup> Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	
Tempe	II: 72°C/50°C	flooded bore hole	<sup>⊤</sup> Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	
Increas	sing factors for concre	ete	Ψс	[-]		1,0							
	teristic bond resistan concrete strength cla	τ	Rk,eq,C1 =	Ψc * <sup>τ</sup> Rk,eq,C1,(C20/25)									
Installa	ation factor												
for dry	and wet concrete (HI	γ <sub>inst</sub>	[-]	1,0									
for floor	ded bore hole (HD; H	IDB, CD)	rinst	[-]	1,2								

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (threaded rod)	Annex C 21



Table C28: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years												
Threaded rod M8 M10 M12 M16 M20 M24 M27 M30												
Steel failure	Steel failure											
Characteristic	tension resist	ance	N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	$N_{Rk,s}$			
Partial factor			γMs,N	[-]				see Ta	ble C1			
Combined pu	II-out and co	ncrete failure										
		nce in cracked a mmer drilled hol				hamm	er drill	ed hole	s (HD)	, comp	ressed	air
emperature range II: 72°	C/24°C	Dry, wet concrete and	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Temper II: 72°	C/50°C	flooded bore hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Increasing fact	tors for concre	ete	Ψc	[-]				1	,0			
Characteristic on the concrete		τ	Rk,eq,C1 =	Ψc • <sup>τ</sup> Rk,eq,C1,(C20/25)								
Installation factor												
for dry and we	γ <sub>inst</sub>	[-]	1,0									
for flooded bor	e hole (HD; H	IDB, CD)	rinst	[]				1	,2			

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (threaded rod)	Annex C 22



Table C29: Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years											
Threaded rod			М8	M10	M12	M16	M20	M24	M27	M30	
Steel failure											
Characteristic shear resistance (Seismic C1)	VDI 04										
Partial factor	γ <sub>Ms,V</sub>	[-]	see Table C1								
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0) <sup>1)</sup>								

<sup>1)</sup> Value in brackets valid for filled annular gab between fastener 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 shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (threaded rod)	Annex C 23



Table C30:	Characteristic values of tension loads under seismic action
	(performance category C1) for a working life of 50 years

6 Ø 20 Ø 24	24 Ø 25	Ø 28	Ø 32						
$A_s \cdot f_{uk}^{1)}$									
314 452	2 491	616	804						
, <b>4</b> <sup>2)</sup>									
l holes (HD),	), compre	ssed a	ir						
8,5 8,5	5 8,5	8,5	8,5						
7,0 7,0	0 7,0	7,0	7,0						
1,0									
Ψc • <sup>τ</sup> Rk,eq,C1,(C20/25)									
1,0									
1,2									

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (reinforcing bar)	Annex C 24

<sup>2)</sup> in absence of national regulation



Table C31:	Characteristic values of tension loads under seismic action
	(performance category C1) for a working life of 100 years

Dainta	roing bor				~ 0	C 10	C 10	C 11	C 1C	C 00	C 04	C 05	Ø 00	C 20
	rcing bar				98	Ø 10	0 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel fa	ailure													
Charac	teristic tension re	sistance	N <sub>Rk,s,eq,C1</sub>	[kN]				•	1,0 • A	s • f <sub>uk</sub>	1)			
Cross s	section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial	factor		γ <sub>Ms,N</sub>	[-]					1,	42)				
Combi	ned pull-out and	concrete failu	ire											
	teristic bond resis holes (CD) and in						in har	nmer c	drilled	holes (	(HD), c	compre	essed	air
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
	II: 72°C/50°C		<sup>τ</sup> Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Increas	sing factors for co	ncrete	Ψс	[-]	1,0									
Characteristic bond resistance depending on the concrete strength class			<sup>τ</sup> R	Ψc • τRk,eq,C1,(C20/25)										
Installa	ation factor													
for dry and wet concrete (HD; HDB, CD)			γ <sub>inst</sub>	st [-]				1,0						
for floo	ded bore hole (Hi	D; HDB, CD)		_		1,2								

<sup>1)</sup> f<sub>uk</sub> shall be taken from the specifications of reinforcing bars

Chemofast Injection system EP 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (reinforcing bar)	Annex C 25

<sup>2)</sup> in absence of national regulation



Table C32: Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years												
Reinforcing bar Ø 8 Ø 10 Ø 12 Ø 14 Ø 16 Ø 20 Ø 24 Ø 25 Ø 28 Ø 32												
Steel failure												
Characteristic shear resistance	V <sub>Rk,s,eq,C1</sub>	[kN]	0,35 · A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup>									
Cross section area	A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ <sub>Ms,V</sub>	[-]	1,5 <sup>2)</sup>									
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0) <sup>3)</sup>									

 $<sup>^{1)}</sup>$   $f_{uk}$  shall be taken from the specifications of reinforcing bars

Chemofast Injection system EP 1000 for concrete	
Performances	Annex C 26
Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (reinforcing bar)	

<sup>2)</sup> in absence of national regulation

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

for flooded bore hole (HD; HDB, CD)



1,2

Tabl	Table C33: Characteristic values of tension loads under seismic action (performance category C2) for a working life of 50 and 100 years											
Thread	ded rod				M12	M16	M20	M24	M27	M30		
Steel f	ailure											
Characteristic tension resistance, Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70  NRk,s,eq,C2 [kN]  1,0 • NRk,s												
Partial	factor	γ <sub>Ms,N</sub> [-] see Table C1										
Combined pull-out and concrete failure												
	cteristic bond resista holes (CD) and in ha					hammer (	drilled hol	es (HD), d	compress	ed air		
Femperature range	I: 40°C/24°C Dry wet		<sup>τ</sup> Rk,eq,C2	[N/mm²]	5,8	4,8	5,0	5,1	4,8	5,0		
Tempe	II: 72°C/50°C flooded bore hole	<sup>τ</sup> Rk,eq,C2	[N/mm²]	5,0	4,1	4,3	4,4	4,1	4,3			
Increas	sing factors for conc	rete	Ψς	[-]			1	,0		1		
Characteristic bond resistance depending on the concrete strength class				Rk,eq,C2 =	Ψc • <sup>τ</sup> Rk,eq,C2,(C20/25)							
Installa	ation factor											
	and wet concrete (H		γinst	[-]	1,0							
for flooded bore hole (HD: HDB, CD)		): HDB, CD)	rinst	[ ]	1.2							

# Table C34: Characteristic values of shear loads under seismic action (performance category C2) for a working life of 50 and 100 years

Threaded rod	M12	M16	M20	M24	M27	M30		
Steel failure						•	,	
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	V <sub>Rk,s,eq,C2</sub>	[kN]	0,70 • V <sup>0</sup> <sub>Rk,s</sub>					
Partial factor	γ <sub>Ms,V</sub>	[-]	see Table C1					
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0) <sup>1)</sup>					

<sup>1)</sup> Value in brackets valid for filled annular gab between fastener 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 C2) for a working life of 50 and 100 years (threaded rod)	Annex C 27



Table C35: Displacements under tension load (threaded rod)											
Threaded rod M12 M16 M20 M24 M27 M30											
Uncracked and cracked concrete under seismic action (performance category C2) for a working life of 50 and 100 years											
All tomperature ranges	$\delta_{N,eq,C2(DLS)}$	[mm]	0,21	0,24	0,27	0,36	0,92	0,70			
All temperature ranges	$\delta_{N,eq,C2(ULS)}$	[mm]	0,54	0,51	0,54	0,63	1,70	0,92			

# Table C36: Displacements under shear load (threaded rod)

Threaded rod			M12	M16	M20	M24	M27	M30
Uncracked and cracked concrete under for a working life of 50 and 100 years	d and cracked concrete under seismic action (performance category C2) ing life of 50 and 100 years							
	$\delta_{V,eq,C2(DLS)}$	[mm]	3,1	3,4	3,5	4,2	4,0	3,8
All temperature ranges	$\delta_{\text{V,eq,C2(ULS)}}$	[mm]	6,0	7,6	7,3	10,9	11,1	11,2

Chemofast Injection system EP 1000 for concrete

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

Annex C 28