

Declaration of Performance



Chemofast Injection System VECO, VECO Blue, VECO Tropical, VECO Express for concrete

DoP No. CF-00-011-02

- Unique identification code of the product-type: CF-00-011 - VECO, VECO Express, VECO Tropical
- Intended use/es: Bonded Fastener for use in concrete
- Manufacturer: Annex: B1 - B7
Chemofast Anchoring GmbH
Hanns-Martin-Schleyer-Str. 23
47877 Willich, Deutschland
Fon: +49 2154 81230
Fax: +49 2154 8123333
- Authorised representative: -
- AVCP System/s: 1
- European Assessment Document: EAD 330499-02-0601
European Technical Assessment: ETA-19/0402 issued on 20.11.2024
Technical Assessment Body: Technical and Test Institute for Construction Prague - TZUS
Notified body/ies: IFSW - TU Darmstadt NB 2873
- Declared performance/s:

Mechanical resistance and stability (BWR 1)	
Essential Characteristics	Performance
Characteristic resistance (static and quasi-static load)	
to tension load	Annex: C1, C2, C3, C5
to shear load	Annex: C1, C4, C6
Displacements	Annex: C7, C8
Characteristic resistance and displacements for seismic performance	
Category C1	Annex: C9 - C11
Category C2	Annex: C9 - C11
Safety in case of fire (BWR 2)	
Essential Characteristics	Performance
Reaction to fire	Fasterner satisfy requirements for Class A1
Resistance to fire	NPA

- Appropriate Technical Documentation and/or Specific Technical Documentation: Not relevant

The performance of the product specified above is in conformity with the declared performance. In accordance with Regulation (EU) No. 305/2011, this declaration of performance is issued under the sole responsibility of the manufacturer named above.

Signed for and on behalf of the manufacturer by:

i.V. Philipp Strater
Head of Applications Engineering and Technology

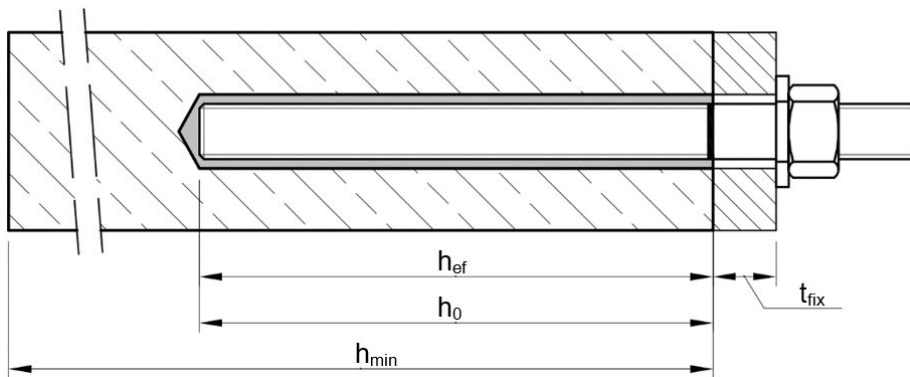
i.V. Dr. Sven Mronga
Head of Quality Management

Willich 26.11.2024

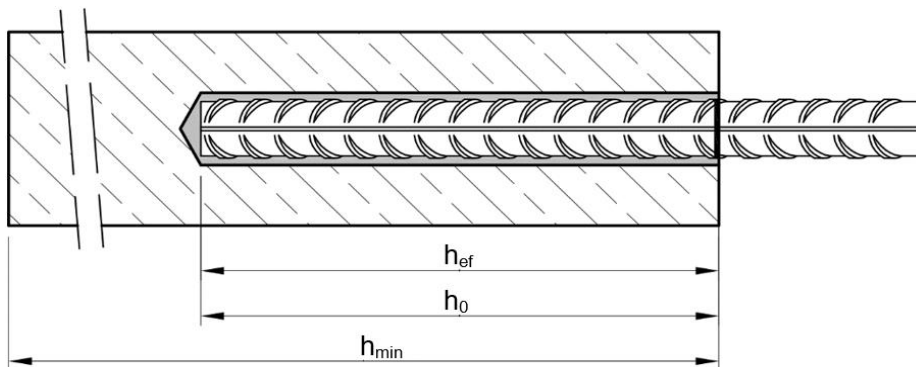
Rev. 08.00 - EN

Installation threaded rod M8 up to M24

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



Installation reinforcing bar Ø8 up to Ø25



- | | | | | | |
|-----------|---|-----------------------------|-------|---|---------------------|
| t_{fix} | = | thickness of fixture | h_0 | = | depth of drill hole |
| h_{ef} | = | effective embedment depth | | | |
| h_{min} | = | minimum thickness of member | | | |

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

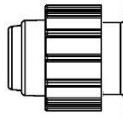
Product description
Installed conditions

Annex A 1

Cartridge system

Coaxial Cartridge:

150 ml, 160 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml

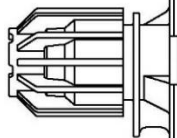


Imprint:

VECO, VECO Blue, VECO Express, VECO Tropical
Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

Side-by-Side Cartridge:

235 ml, 345 ml up to 360 ml and 825 ml

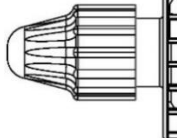


Imprint:

VECO, VECO Blue, VECO Express, VECO Tropical
Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

Foil Tube Cartridge:

165 ml and 300 ml



Imprint:

VECO, VECO Blue, VECO Express, VECO Tropical
Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

Static mixer SM-14W

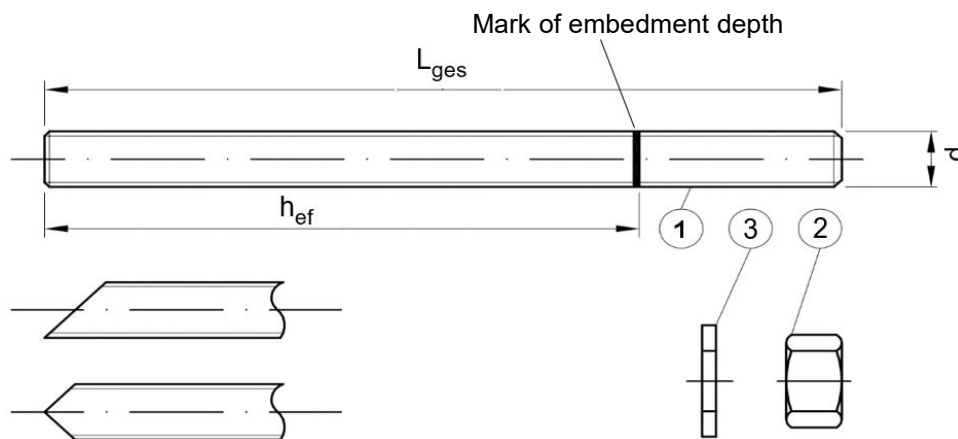


Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Product description
Injection system

Annex A 2

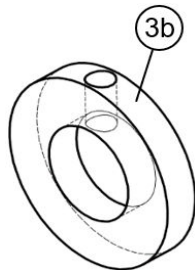
Threaded rod M8 up to M24 with washer and hexagon nut



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

Filling washer VFS



Mixer reduction nozzle MR



Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Product description

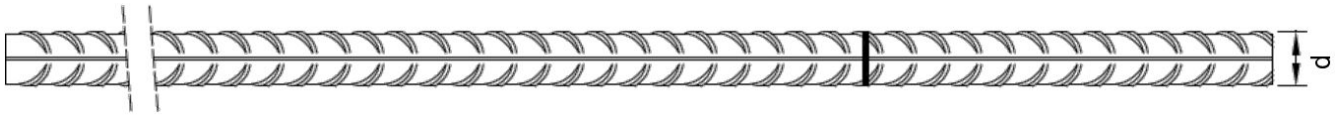
Threaded rod, filling washer and mixer reduction nozzle

Annex A 3

Table A1: Materials

Part	Designation	Material				
Steel, zinc plated (Steel acc. to EN ISO 683-4:2018 or EN 10263:2017) <ul style="list-style-type: none"> - zinc plated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042:2022 or - hot-dip galvanized $\geq 40 \mu\text{m}$ acc. to EN ISO 1461:2022 and EN ISO 10684:2004+AC:2009 or - sherardized $\geq 45 \mu\text{m}$ acc. to EN ISO 17668:2016 						
1	Anchor rod	Property class	Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture	
		acc. to EN ISO 898-1:2013	4.6	$f_{uk} = 400 \text{ N/mm}^2$	$f_{yk} = 240 \text{ N/mm}^2$	$A_5 > 8\%$
			4.8	$f_{uk} = 400 \text{ N/mm}^2$	$f_{yk} = 320 \text{ N/mm}^2$	$A_5 > 8\%$
			5.6	$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 300 \text{ N/mm}^2$	$A_5 > 8\%$
			5.8	$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 400 \text{ N/mm}^2$	$A_5 > 8\%$
8.8	$f_{uk} = 800 \text{ N/mm}^2$	$f_{yk} = 640 \text{ N/mm}^2$	$A_5 > 12\%^{1)}$			
2	Hexagon nut	acc. to EN ISO 898-2:2022	4	for anchor rod class 4.6 or 4.8		
			5	for anchor rod class 5.6 or 5.8		
			8	for anchor rod class 8.8		
3	Washer	Steel, zinc plated, hot-dip galvanized or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)				
3b	Filling washer	Steel, zinc plated, hot-dip galvanized or sherardized				
Stainless steel A2 (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014) Stainless steel A4 (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014) High corrosion resistance steel (Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014)						
1	Anchor rod ¹⁾	Property class	Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture	
		acc. to EN ISO 3506-1:2020	50	$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 210 \text{ N/mm}^2$	$A_5 > 8\%$
			70	$f_{uk} = 700 \text{ N/mm}^2$	$f_{yk} = 450 \text{ N/mm}^2$	$A_5 > 12\%^{1)}$
80	$f_{uk} = 800 \text{ N/mm}^2$	$f_{yk} = 600 \text{ N/mm}^2$	$A_5 > 12\%^{1)}$			
2	Hexagon nut ¹⁾	acc. to EN ISO 3506-1:2020	50	for anchor rod class 50		
			70	for anchor rod class 70		
			80	for anchor rod class 80		
3	Washer	A2: Material 1.4301, 1.4311 / 1.4307 / 1.4567 or 1.4541, EN 10088-1:2014 A4: Material 1.4401, 1.4404 / 1.4571 / 1.4362 or 1.4578, 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, High corrosion resistance steel				
1) $A_5 > 8\%$ fracture elongation if no use for seismic performance category C2 2) Property class 80 only for stainless steel A4 and high corrosion resistant steel HCR						
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete					Annex A 4	
Product description Materials						

Reinforcing bar: ø8 up to ø25



- Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range $0,05 \phi \leq h_{rib} \leq 0,07 \phi$
(d: nominal diameter of the bar; h_{rib} : Rib height of the bar)

Table A2: Materials Reinforcing bar

Part	Designation	Material
Rebar		
3	Reinforcing steel according to EN 1992-1-1:2004+AC:2018, Annex C	Bars and rebars from ring class B or C f_{yk} and k according to NDP or NCL according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Product description
Materials reinforcing bar

Annex A 5

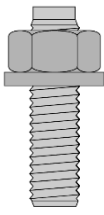



Specifications of the intended use				
Fasteners subject to (Static and quasi-static loads):				
	Working life 50 years		Working life 100 years	
Base material	uncracked concrete	cracked concrete	uncracked concrete	cracked concrete
HD: Hammer drilling CD: Compressed air drilling	M8 to M24	M8 to M16	No performance assessed	No performance assessed
Temperature Range:	I: -40°C to +40°C ¹⁾ II: -40°C to +80°C ²⁾		I: -40°C to +40°C ¹⁾ II: -40°C to +80°C ²⁾	
Fasteners subject to (seismic action):				
	Performance Category C1		Performance Category C2	
Base material	uncracked and cracked concrete		uncracked and cracked concrete	
HD: Hammer drilling CD: Compressed air drilling	M8 to M16		M12 to M16	
Temperature Range:	I: -40°C to +40°C ¹⁾ II: -40°C to +80°C ²⁾		I: -40°C to +40°C ¹⁾ II: -40°C to +80°C ²⁾	
<p>1) (max. long-term temperature +24°C and max. short-term temperature +40°C) 2) (max. long-term temperature +50°C and max. short-term temperature +80°C)</p> <p>Base materials:</p> <ul style="list-style-type: none"> - Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A2:2021. - Strength classes C20/25 to C50/60 according to EN 206:2013 + A2:2021 <p>Use conditions (Environmental conditions):</p> <ul style="list-style-type: none"> - Structures subject to dry internal conditions (all materials). - For all other conditions according to EN 1993-1-4:2006+A2:2020 corresponding to corrosion resistance classes to Table A1 (stainless steel and high corrosion resistant steel). <p>Design:</p> <ul style="list-style-type: none"> - 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 <p>Installation:</p> <ul style="list-style-type: none"> - Dry, wet concrete or flooded bore holes (not sea-water). - Hole drilling by hammer drill (HD) or compressed air drill mode (CD). - 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 VECO, VECO Blue, VECO Express, VECO Tropical for concrete				Annex B 1
Intended use Specifications				

Anchor size			M8	M10	M12	M16	M20	M24
Diameter of element	$d = d_{nom}$	[mm]	8	10	12	16	20	24
Nominal drill hole diameter	d_0	[mm]	10	12	14	18	24	28
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	80	90	96
	$h_{ef,max}$	[mm]	160	200	240	320	400	480
Diameter of clearance hole in the fixture	Prepositioned installation $d_f \leq$	[mm]	9	12	14	18	22	26
	Push through installation $d_f \leq$		12	14	16	20	24	30
Maximum torque moment	$\max T_{inst} \leq$	[Nm]	10	20	40	80	120	160
Minimum thickness of member	h_{min}	[mm]	$h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$			$h_{ef} + 2d_0$		
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120

Anchor size			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Diameter of element	$d = d_{nom}$	[mm]	8	10	12	14	16	20	25
Nominal drill hole diameter	d_0	[mm]	12	14	16	18	20	25	32
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	75	80	90	100
	$h_{ef,max}$	[mm]	160	200	240	280	320	400	500
Minimum thickness of member	h_{min}	[mm]	$h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$			$h_{ef} + 2d_0$			
Minimum spacing	s_{min}	[mm]	40	50	60	70	80	100	130
Minimum edge distance	c_{min}	[mm]	40	50	60	70	80	100	130

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete	Annex B 2
Intended use Installation parameters	

Table B3: Parameter cleaning and installation tools

					
Threaded rod	Reinforcing bar	d_0 Drill bit - \varnothing HD, CD	d_b Brush - \varnothing		$d_{b,min}$ min. Brush - \varnothing
[mm]	[mm]	[mm]		[mm]	[mm]
M8	-	10	RBT10	12	10,5
M10	8	12	RBT12	14	12,5
M12	10	14	RBT14	16	14,5
-	12	16	RBT16	18	16,5
M16	14	18	RBT18	20	18,5
-	16	20	RBT20	22	20,5
M20	-	24	RBT24	26	24,5
-	20	25	RBT25	27	25,5
M24	-	28	RBT28	30	28,5
-	25	32	RBT32	34	32,5

Cleaning and installation tools

Hand pump

(Volume 750 ml, $h_0 \geq 10 d_{nom}$, $d_0 \leq 20mm$)



Compressed air tool

(min 6 bar)



Brush RBT



Brush extension RBL



Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Intended use

IParameter anchor and drill sizes, brushes and piston plugs
Cleaning and Installation tools

Annex B 3

Table B4: Working and curing time VECO, VECO Blue¹⁾

Temperature in base material			Maximum working time	Minimum curing time
T			t_{work}	t_{cure}
- 5 °C	to	- 1 °C	90 min	6 h
+ 0 °C	to	+ 4 °C	45 min	3 h
+ 5 °C	to	+ 9 °C	25 min	2 h
+ 10 °C	to	+ 14 °C	20 min	100 min
+ 15 °C	to	+ 19 °C	15 min	80 min
+ 20 °C	to	+ 29 °C	6 min	45 min
+ 30 °C	to	+ 34 °C	4 min	25 min
+ 35 °C	to	+ 39 °C	2 min	20 min
Cartridge temperature			+5°C up to +40°C	

¹⁾ The VECO Blue injection mortar has a curing time proof by changing the color from blue to gray after curing minimum time. The curing time proof is only valid for the standard version of the mortar.

Table B5: Working and curing time VECO Express

Temperature in base material			Maximum working time	Minimum curing time
T			t_{work}	t_{cure}
- 10 °C	to	- 6 °C	60 min	4 h
- 5 °C	to	- 1 °C	45 min	2 h
+ 0 °C	to	+ 4 °C	25 min	80 min
+ 5 °C	to	+ 9 °C	10 min	45 min
+ 10 °C	to	+ 14 °C	4 min	25 min
+ 15 °C	to	+ 19 °C	3 min	20 min
+ 20 °C	to	+ 29 °C	2 min	15 min
Cartridge temperature			0°C up to +30°C	

Table B6: Working and curing time VECO Tropical

Temperature in base material			Maximum working time	Minimum curing time
T			t_{work}	t_{cure}
+ 10 °C	to	+ 14 °C	30 min	5 h
+ 15 °C	to	+ 19 °C	20 min	210 min
+ 20 °C	to	+ 29 °C	15 min	145 min
+ 30 °C	to	+ 34 °C	10 min	80 min
+ 35 °C	to	+ 39 °C	6 min	45 min
+ 40 °C	to	+ 44 °C	4 min	25 min
+45°C			2 min	20 min
Cartridge temperature			+5°C up to +45°C	

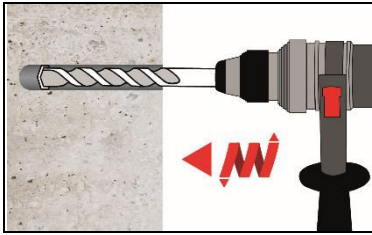
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Intended use
Working and curing time

Annex B 4

Installation instructions

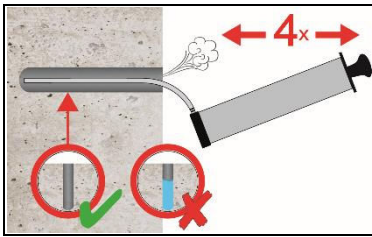
Drilling of the bore hole



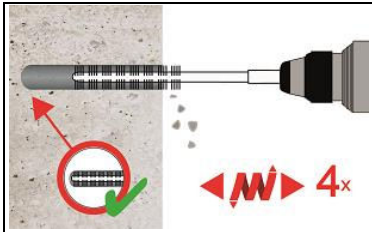
1. **Hammer drilling (HD) / Compressed air drilling (CD)**
 Drill a hole to the required embedment depth.
 Drill bit diameter according to Table B1 and B2.
 Aborted drill holes shall be filled with mortar.
 Proceed with Step 2 (MAC or CAC).

Manual Air Cleaning (MAC)

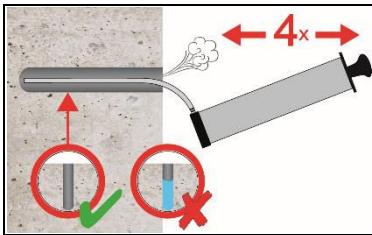
for drill hole diameter $d_0 \leq 20\text{mm}$ and drill hole depth $h_0 \leq 10d_{\text{nom}}$ with drilling method HD/CD



- 2a. **Attention! Remove standing water in the borehole before cleaning.**
 Blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 3).



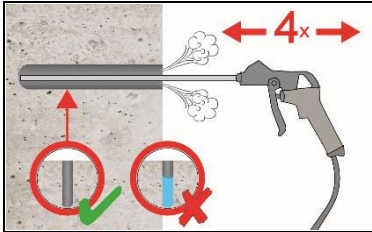
- 2b. Attach brush RBT according to Table B3 to a drilling machine or a cordless screwdriver. Brush the bore hole minimum 4x over the entire embedment depth in a twisting motion (if necessary, use a brush extension).



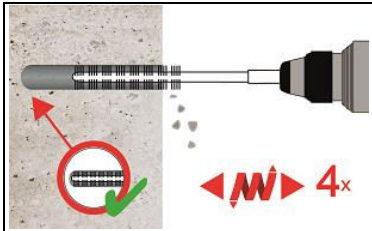
- 2c. Finally blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 3).

Compressed Air Cleaning (CAC):

All diameter with drilling method HD/CD



- Attention! Standing water in the bore hole must be removed before cleaning.**
 2a. Blow the bore hole clean minimum 4x with compressed air (min. 6 bar) (Annex B 3) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



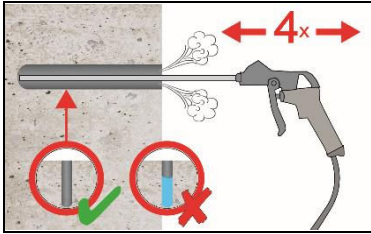
- 2b. Attach brush RBT according to Table B3 to a drilling machine or a cordless screwdriver. Brush the bore hole minimum 4x over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Intended use
 Installation instructions

Annex B 5

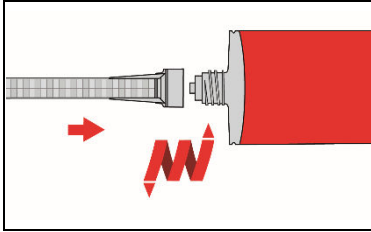
Installation instructions (continuation)



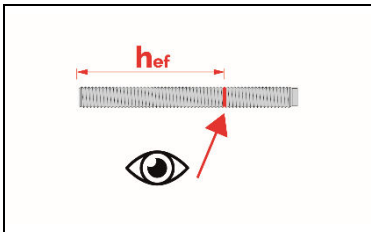
2c. Finally blow the bore hole clean minimum 4x with compressed air (min. 6 bar) (Annex B 3) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

Cleaned bore hole has to be protected against re-contamination in an appropriate way.

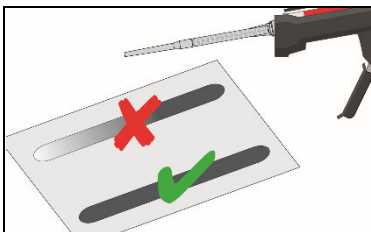
If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.



3. Screw on static-mixing nozzle SM-14W and load the cartridge into an appropriate dispensing tool. If necessary, cut off the foil tube clip before use. For every working interruption longer than the maximum working time t_{work} (Annex B 4) as well as for new cartridges, a new static-mixer shall be used.



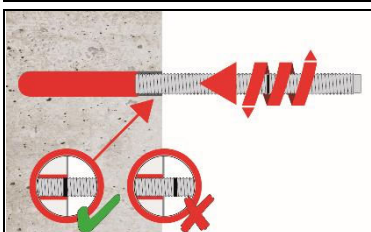
4. Mark embedment depth on the anchor rod. The anchor rod shall be free of dirt, grease, oil or other foreign material.



5. Not proper mixed mortar is not sufficient for fastening. Dispense and discard mortar until an uniform grey or blue (VECO Blue) colour is shown (at least 3 full strokes; for foil tube cartridges min. 6 strokes).



6. Starting at bottom of the hole and fill the hole up to approximately 2/3 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 4).



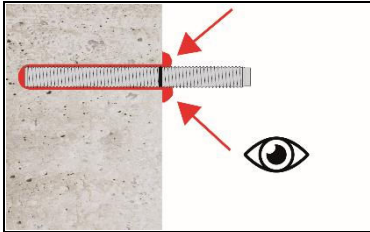
7. Insert the anchor rod while turning slightly up to the embedment mark.

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

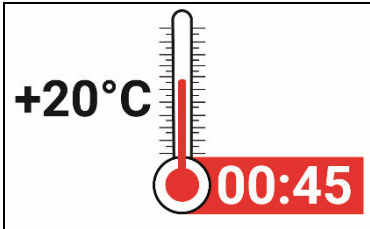
Intended use
Installation instructions (continuation)

Annex B 6

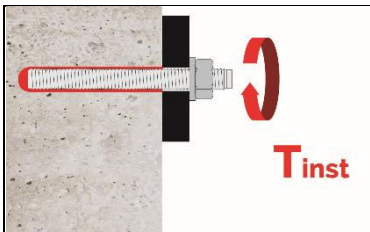
Installation instructions (continuation)



8. 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 6 before the maximum working time t_{work} has expired.



9. Temperature related curing time t_{cure} (Annex B 4) must be observed. Do not move or load the fastener during curing time.



10. Install the fixture by using a calibrated torque wrench. Observe maximum installation torque (Table B1). In case of static requirements (e.g. seismic), fill the annular gap in the fixture with mortar (Annex A 2). Therefore, replace the washer by the filling washer VFS and use the mixer reduction nozzle MR.

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Intended use
Installation instructions (continuation)

Annex B 7

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

Size			M8	M10	M12	M16	M20	M24	
Cross section area	A_s	[mm ²]	36,6	58	84,3	157	245	353	
Characteristic tension resistance, Steel failure ¹⁾									
Steel, Property class 4.6 and 4.8	$N_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	
Steel, Property class 5.6 and 5.8	$N_{Rk,s}$	[kN]	18 (17)	29 (27)	42	78	122	176	
Steel, Property class 8.8	$N_{Rk,s}$	[kN]	29 (27)	46 (43)	67	125	196	282	
Stainless steel A2, A4 and HCR, class 50	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	
Stainless steel A2, A4 and HCR, class 70	$N_{Rk,s}$	[kN]	26	41	59	110	171	247	
Stainless steel A4 and HCR, class 80	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	
Characteristic tension resistance, Partial safety factor ²⁾									
Steel, Property class 4.6 and 5.6	$\gamma_{Ms,N}$	[-]	2,0						
Steel, Property class 4.8, 5.8 and 8.8	$\gamma_{Ms,N}$	[-]	1,5						
Stainless steel A2, A4 and HCR, class 50	$\gamma_{Ms,N}$	[-]	2,86						
Stainless steel A2, A4 and HCR, class 70	$\gamma_{Ms,N}$	[-]	1,87						
Stainless steel A4 and HCR, class 80	$\gamma_{Ms,N}$	[-]	1,6						
Characteristic shear resistance, Steel failure ¹⁾									
Without lever arm	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9 (8)	14 (13)	20	38	59	85
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	21	39	61	88
	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141
	Stainless steel A2, A4 and HCR, class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88
	Stainless steel A2, A4 and HCR, class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124
	Stainless steel A4 and HCR, class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141
With lever arm	Steel, Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15 (13)	30 (27)	52	133	260	449
	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19 (16)	37 (33)	65	166	324	560
	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30 (26)	60 (53)	105	266	519	896
	Stainless steel A2, A4 and HCR, class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561
	Stainless steel A2, A4 and HCR, class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784
	Stainless steel A4 and HCR, class 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896
Characteristic shear resistance, Partial safety factor ²⁾									
Steel, Property class 4.6 and 5.6	$\gamma_{Ms,V}$	[-]	1,67						
Steel, Property class 4.8, 5.8 and 8.8	$\gamma_{Ms,V}$	[-]	1,25						
Stainless steel A2, A4 and HCR, class 50 50	$\gamma_{Ms,V}$	[-]	2,38						
Stainless steel A2, A4 and HCR, class 50 70	$\gamma_{Ms,V}$	[-]	1,56						
Stainless steel A4 and HCR, class 80	$\gamma_{Ms,V}$	[-]	1,33						
¹⁾ Values are only valid for the given stress area A_s . Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009. ²⁾ In absence of national regulation									
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete							Annex C 1		
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods									

Table C2: Characteristic values of tension loads under static and quasi-static action

Anchor size		All anchors types and sizes		
Concrete cone failure				
Uncracked concrete	$k_{ucr,N}$	[-]		11,0
Cracked concrete	$k_{cr,N}$	[-]		7,7
Edge distance	$c_{cr,N}$	[mm]		$1,5 h_{ef}$
Axial distance	$s_{cr,N}$	[mm]		$2 c_{cr,N}$
Splitting				
Edge distance	$h/h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	$1,0 h_{ef}$
	$2,0 > h/h_{ef} > 1,3$			$2 \cdot h_{ef} \left(2,5 - \frac{h}{h_{ef}} \right)$
	$h/h_{ef} \leq 1,3$			$2,4 h_{ef}$
Axial distance	$s_{cr,sp}$	[mm]		$2 c_{cr,sp}$
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete				Annex C 2
Performances Characteristic values of tension loads under static and quasi-static action				

Table C3: Characteristic values of tension loads under static and quasi-static action									
Anchor size threaded rod				M8	M10	M12	M16	M20	M24
Steel failure									
Characteristic tension resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ (or see Table C1)					
Partial factor		$\gamma_{Ms,N}$	[-]	See Table C1					
Combined pull-out and concrete failure									
Characteristic bond resistance in uncracked concrete C20/25									
Temperature range I: 40°C/24°C II: 80°C/50°C	Dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm ²]	8,5	8,0	8,0	8,0	8,0	8,0
				6,5	6,0	6,0	6,0	6,0	6,0
I: 40°C/24°C II: 80°C/50°C	Flooded bore hole			8,5	8,0	8,0	8,0	8,0	8,0
				6,5	6,0	6,0	6,0	6,0	6,0
Characteristic bond resistance in cracked concrete C20/25									
Temperature range I: 40°C/24°C II: 80°C/50°C	Dry and wet concrete	$\tau_{Rk,cr}$	[N/mm ²]	4,5	4,5	4,5	4,5	No performance assessed	
				3,5	3,5	3,5	3,5		
	I: 40°C/24°C II: 80°C/50°C			Flooded bore hole	4,5	4,5	4,5		4,5
					3,5	3,5	3,5		3,5
Increasing factor for uncracked concrete		ψ_c	[-]	$(f_{ck} / 20)^{0,2}$					
Increasing factor for cracked concrete		ψ_c	[-]	$(f_{ck} / 20)^{0,1}$					
Characteristic bond resistance depending on the concrete strength class		$\tau_{Rk,ucr} =$		$\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$					
		$\tau_{Rk,cr} =$		$\psi_c \cdot \tau_{Rk,cr,(C20/25)}$					
Temperature range I: 40°C/24°C	Factor for influence of sustained load for a working life 50 years	ψ_{sus}^0	[-]	0,60					
Temperature range II: 80°C/50°C				0,71					
Concrete cone failure									
Relevant parameter				See Table C2					
Splitting									
Relevant parameter				See Table C2					
Installation factor									
Dry and wet concrete		γ_{inst}	[-]	1,2					
Flooded bore hole				1,2					
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete								Annex C 3	
Performances Characteristic values of tension loads under static and quasi-static action									

Table C4: Characteristic values of shear loads under static and quasi-static action								
Anchor size threaded rod	M8	M10	M12	M16	M20	M24		
Steel failure without lever arm								
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	$V_{Rk,s}^0$	[kN]	$0,6 \cdot A_s \cdot f_{uk}$ (or see Table C1)					
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	$V_{Rk,s}^0$	[kN]	$0,5 \cdot A_s \cdot f_{uk}$ (or see Table C1)					
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1					
Ductility factor	k_7	[-]	1,0					
Steel failure with lever arm								
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$ (or see Table C1)					
Elastic section modulus	W_{el}	[mm ³]	31	62	109	277	541	935
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1					
Concrete pry-out failure								
Factor	k_8	[-]	2,0					
Installation factor	γ_{inst}	[-]	1,0					
Concrete edge failure								
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$					
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24
Installation factor	γ_{inst}	[-]	1,0					
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete							Annex C 4	
Performances Characteristic values of shear loads under static and quasi-static action								

Table C5: Characteristic values of tension loads under static and quasi-static action											
Anchor size reinforcing bar			$\varnothing 8$	$\varnothing 10$	$\varnothing 12$	$\varnothing 14$	$\varnothing 16$	$\varnothing 20$	$\varnothing 25$		
Steel failure											
Characteristic tension resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}^{1)}$								
Cross section area	A_s	[mm ²]	50	79	113	154	201	314	491		
Partial factor	$\gamma_{Ms,N}$	[-]	1,4 ²⁾								
Combined pull-out and concrete failure											
Characteristic bond resistance in uncracked concrete C20/25											
Temperature range	I: 40°C/24°C	Dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm ²]	7,0	7,0	7,0	7,0	6,5	6,5	6,5
	II: 80°C/50°C				5,5	5,5	5,5	5,5	5,5	5,0	5,0
	I: 40°C/24°C	Flooded bore hole			7,0	7,0	7,0	7,0	6,5	6,5	6,5
	II: 80°C/50°C				5,5	5,5	5,5	5,5	5,5	5,0	5,0
Increasing factor for uncracked concrete		ψ_c	[-]	$(f_{ck} / 20)^{0,1}$							
Characteristic bond resistance depending on the concrete strength class		$\tau_{Rk,ucr} =$		$\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$							
Temperature range I: 40°C/24°C	Factor for influence of sustained load for a working life 50 years	ψ_{sus}^0	[-]	0,60							
Temperature range II: 80°C/50°C				0,71							
Concrete cone failure											
Relevant parameter			See Table C2								
Splitting											
Relevant parameter			See Table C2								
Installation factor											
Dry and wet concrete		γ_{inst}	[-]	1,2							
Flooded bore hole				1,2							
¹⁾ f_{uk} shall be taken from the specifications of reinforcing bars ²⁾ in absence of national regulation											
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete									Annex C 5		
Performances Characteristic values of tension loads under static and quasi-static action											

Table C6: Characteristic values of shear loads under static and quasi-static action									
Anchor size reinforcing bar			$\varnothing 8$	$\varnothing 10$	$\varnothing 12$	$\varnothing 14$	$\varnothing 16$	$\varnothing 20$	$\varnothing 25$
Steel failure without lever arm									
Characteristic shear resistance	$V_{Rk,s}^0$	[kN]	$0,50 \cdot A_s \cdot f_{uk}^{1)}$						
Cross section area	A_s	[mm ²]	50	79	113	154	201	314	491
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 ²⁾						
Ductility factor	k_7	[-]	1,0						
Steel failure with lever arm									
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}^{1)}$						
Elastic section modulus	W_{el}	[mm ³]	50	98	170	269	402	785	1534
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 ²⁾						
Concrete pry-out failure									
Factor	k_8	[-]	2,0						
Installation factor	γ_{inst}	[-]	1,0						
Concrete edge failure									
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$						$\min(h_{ef}; 300\text{mm})$
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	14	16	20	25
Installation factor	γ_{inst}	[-]	1,0						
<p>¹⁾ f_{uk} shall be taken from the specifications of reinforcing bars</p> <p>²⁾ in absence of national regulation</p>									
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete								Annex C 6	
Performances Characteristic values of shear loads under static and quasi-static action									

Table C7: Displacement under tension load¹⁾								
Anchor size threaded rod			M8	M10	M12	M16	M20	M24
Uncracked concrete C20/25 under static and quasi-static action								
Temperature range I: 40°C/24°C	δ_{N0} -factor	[mm/(N/mm ²)]	0,03	0,04	0,05	0,07	0,08	0,10
	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,07	0,08	0,08	0,08	0,08	0,10
Temperature range II: 80°C/50°C	δ_{N0} -factor	[mm/(N/mm ²)]	0,02	0,03	0,03	0,04	0,04	0,05
	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,15	0,17	0,17	0,17	0,17	0,17
Cracked concrete C20/25 under static and quasi-static action								
Temperature range I: 40°C/24°C	δ_{N0} -factor	[mm/(N/mm ²)]	0,07	0,08	0,07	0,08	No performance assessed	
	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,13	0,11	0,11	0,10		
Temperature range II: 80°C/50°C	δ_{N0} -factor	[mm/(N/mm ²)]	0,09	0,08	0,07	0,09		
	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,17	0,14	0,14	0,13		
1) Calculation of the displacement $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau;$ τ : action bond stress for tension $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau;$								
Table C8: Displacement under shear load¹⁾								
Anchor size threaded rod			M8	M10	M12	M16	M20	M24
Uncracked concrete C20/25 under static and quasi-static action								
All temperature ranges	δ_{V0} -factor	[mm/kN]	0,02	0,02	0,01	0,01	0,01	0,01
	$\delta_{V\infty}$ -factor	[mm/kN]	0,03	0,02	0,02	0,01	0,01	0,01
Cracked concrete C20/25 under static and quasi-static action								
All temperature ranges	δ_{V0} -factor	[mm/kN]	0,05	0,04	0,03	0,01	No performance assessed	
	$\delta_{V\infty}$ -factor	[mm/kN]	0,07	0,06	0,04	0,02		
1) Calculation of the displacement $\delta_{V0} = \delta_{V0}\text{-factor} \cdot V;$ V : action shear load $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V;$								
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete							Annex C 7	
Performances Displacements under static and quasi-static action								

Table C9: Displacement under tension load¹⁾

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Uncracked concrete C20/25 under static and quasi-static action									
Temperature range I: 40°C/24°C	δ _{N0} -factor	[mm/(N/mm ²)]	0,03	0,06	0,02	0,03	0,05	0,06	0,06
	δ _{N∞} -factor	[mm/(N/mm ²)]	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Temperature range II: 80°C/50°C	δ _{N0} -factor	[mm/(N/mm ²)]	0,03	0,06	0,02	0,03	0,05	0,06	0,06
	δ _{N∞} -factor	[mm/(N/mm ²)]	0,15	0,15	0,15	0,15	0,16	0,16	0,16

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

Table C10: Displacement under shear load¹⁾

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Uncracked concrete C20/25 under static and quasi-static action									
All temperature ranges	δ _{V0} -factor	[mm/kN]	0,04	0,04	0,01	0,01	0,01	0,01	0,01
	δ _{V∞} -factor	[mm/kN]	0,05	0,06	0,02	0,02	0,02	0,02	0,02

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

Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete

Performances
 Displacements under static and quasi-static action

Annex C 8

Table C11: Characteristic values of tension loads under seismic action (Performance category C1)								
Anchor size threaded rod				M8	M10	M12	M16	
Steel failure								
Characteristic tension resistance		$N_{Rk,s,C1}$	[kN]	$1,0 \cdot N_{Rk,s}$				
Partial factor		$\gamma_{Ms,N}$	[-]	See Table C1				
Combined pull-out and concrete failure								
Characteristic bond resistance in cracked and uncracked concrete C20/25								
Temperature range	I: 40°C/24°C	Dry and wet concrete	$\tau_{Rk,C1}$	[N/mm ²]	2,30	2,25	2,30	2,20
	II: 80°C/50°C				1,85	1,80	1,80	1,75
	I: 40°C/24°C	Flooded bore hole			2,30	2,25	2,30	2,20
	II: 80°C/50°C				1,85	1,80	1,80	1,75
Increasing factor for concrete		ψ_c	[-]	1,0				
Characteristic bond resistance depending on the concrete strength class		$\tau_{Rk,C1} =$		$\psi_c \cdot \tau_{Rk,C1,(C20/25)}$				
Installation factor								
Dry and wet concrete		γ_{inst}	[-]	1,2				
Flooded bore hole				1,2				
Table C12: Characteristic values of tension loads under seismic action (Performance category C2)								
Anchor size threaded rod				M12		M16		
Steel failure								
Characteristic tension resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥ 70		$N_{Rk,s,C2}$	[kN]	$1,0 \cdot N_{Rk,s}$				
Partial factor		$\gamma_{Ms,N}$	[-]	See Table C1				
Combined pull-out and concrete failure								
Characteristic bond resistance in cracked and uncracked concrete C20/25								
Temperature range	I: 40°C/24°C	Dry and wet concrete	$\tau_{Rk,C2}$	[N/mm ²]	0,75		0,95	
	II: 80°C/50°C				0,60		0,75	
	I: 40°C/24°C	Flooded bore hole			0,75		0,95	
	II: 80°C/50°C				0,60		0,75	
Increasing factor for concrete		ψ_c	[-]	1,0				
Characteristic bond resistance depending on the concrete strength class		$\tau_{Rk,C2} =$		$\psi_c \cdot \tau_{Rk,C2,(C20/25)}$				
Installation factor								
Dry and wet concrete		γ_{inst}	[-]	1,2				
Flooded bore hole				1,2				
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete						Annex C 9		
Performances Characteristic values of tension loads under seismic action (Performance category C1 and C2)								

Table C13: Characteristic values of shear loads under seismic action (Performance category C1 and C2)					
Anchor size threaded rod		M8	M10	M12	M16
Steel failure without lever arm					
Characteristic shear resistance (Seismic C1)	$V_{Rk,s,C1}$	[kN]	$0,7 \cdot V^0_{Rk,s}$		
Characteristic shear resistance (Seismic C2) Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, Strength class ≥ 70	$V_{Rk,s,C2}$	[kN]	No performance assessed	$0,7 \cdot V^0_{Rk,s}$	
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1		
Factor for annular gap	α_{gap}	[-]	$0,5 (1,0)^1$		
1) Value in brackets valid for filled annular gap between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended					
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete				Annex C 10	
Performances Characteristic values of shear loads under seismic action (Performance category C1 and C2)					

Table C14: Displacement under tension load					
Anchor size threaded rod		M8	M10	M12	M16
Uncracked and cracked concrete under seismic action (performance category C2)					
Temperature range I: 40°C/24°C	$\delta_{N,C2(50\%)}$	[mm]	No performance assessed	0,23	0,29
	$\delta_{N,C2(100\%)}$	[mm]		0,43	0,55
Temperature range II: 80°C/50°C	$\delta_{N,C2(50\%)}$	[mm]		0,23	0,29
	$\delta_{N,C2(100\%)}$	[mm]		0,43	0,55
Table C15: Displacement under shear load					
Anchor size threaded rod		M8	M10	M12	M16
Uncracked and cracked concrete under seismic action (performance category C2)					
Temperature range I: 40°C/24°C	$\delta_{V,C2(50\%)}$	[mm]	No performance assessed	3,6	3,0
	$\delta_{V,C2(100\%)}$	[mm]		7,0	6,6
Temperature range II: 80°C/50°C	$\delta_{V,C2(50\%)}$	[mm]		3,6	3,0
	$\delta_{V,C2(100\%)}$	[mm]		7,0	6,6
Chemofast Injection System VECO, VECO Blue, VECO Express, VECO Tropical for concrete				Annex C 11	
Performances Displacement under seismic action (Performance category C2)					