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Authorised and notified according  
to Article 29 of the Regulation (EU)  
No 305/2011 of the European  
Parliament and of the Council of 9  
March 2011

MEMBER OF EOTA



## European Technical Assessment ETA-19/0419 of 2019/06/19

### I General Part

**Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S**

**Trade name of the construction product:**

VT-HP injection system for concrete

**Product family to which the above construction product belongs:**

Bonded injection type anchor for use in non-cracked and cracked concrete including seismic area (C1 – C2) threaded rod M8-M30, rebar M8-M32

**Manufacturer:**

Simpson Strong-Tie®  
Rue du Camp  
Z.A.C. des Quatre Chemins  
F-85400 Sainte Gemme La Plaine  
Tel. +33 2 51 28 44 00  
Fax +33 2 51 28 44 01  
Internet [www.simpson.fr](http://www.simpson.fr)

**Manufacturing plant:**

Simpson Strong-Tie®  
Manufacturing facilities

**This European Technical Assessment contains:**

23 pages including 18 annexes which form an integral part of the document

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

EAD 330499-00-0601, “Bonded fasteners for use in concrete”

**This version replaces:**

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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## **II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT**

### **1 Technical description of product and intended use**

#### **Technical description of the product**

The VT-HP injection system for concrete is a bonded anchor consisting of a cartridge with VT-HP injection mortar and a steel element. The steel element consists of a commercial threaded rod with washer and hexagon nut in the range of M8 to M30 or a reinforcing bar in the range of diameter 8 to 32 mm.

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.

The characteristic material values, dimensions and tolerances of the anchors not indicated in Annexes shall correspond to the respective values laid down in the technical documentation<sup>1</sup> of this European Technical Assessment.

### **2 Specification of the intended use in accordance with the applicable EAD**

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 provisions made in this European Technical Assessment are based on an assumed intended working life of the anchor of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, 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.

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<sup>1</sup> The technical documentation of this European Technical Assessment is deposited at ETA-Danmark and, as far as relevant for the tasks of the Notified bodies involved in the attestation of conformity procedure, is handed over to the notified bodies.

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

#### **3.1 Characteristics of product**

##### **Mechanical resistance and stability (BWR 1):**

The essential characteristics are detailed in the Annex C.

##### **Safety in case of fire (BWR 2):**

Anchorage satisfy requirements for Class A1.

No performance is assessed for resistance to fire.

##### **Hygiene, health and the environment (BWR3):**

No performance assessed

##### **Safety in use (BWR4):**

For basic requirement Safety in use the same criteria are valid for Basic Requirement Mechanical resistance and stability (BWR1).

##### **Sustainable use of natural resources (BWR7)**

No performance assessed

Other Basic Requirements are not relevant.

#### **3.2 Methods of assessment**

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 has been made in accordance with EAD 330499-00-0601, "Bonded fasteners for use in concrete" and EOTA TR 049, "Post-installed fasteners in concrete under seismic action".

## **4 Assessment and verification of constancy of performance (AVCP)**

### **4.1 AVCP system**

According to the decision 96/582/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 1.

## **5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD**

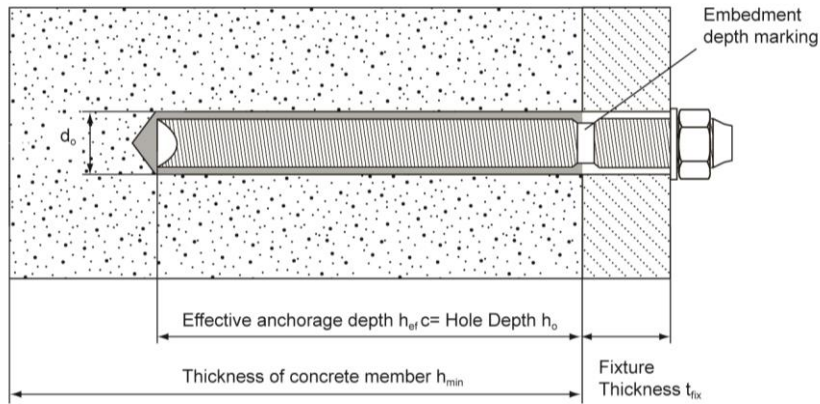
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking

Issued in Copenhagen on 2019-06-19 by

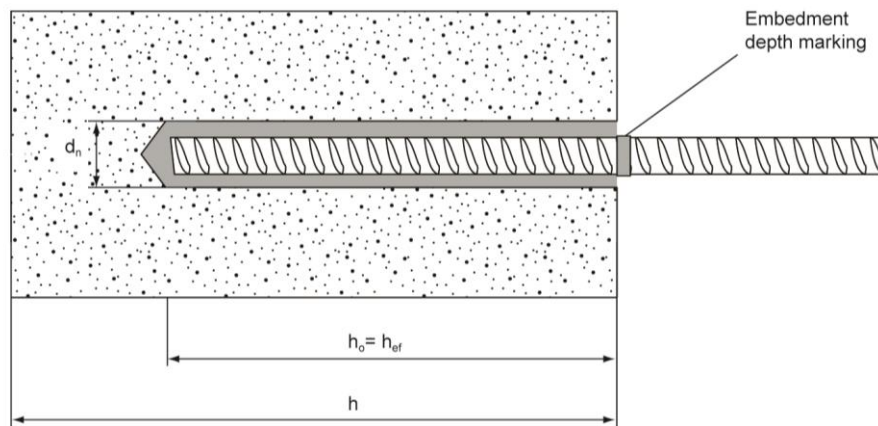


Thomas Bruun  
Managing Director, ETA-Danmark

**Installation threaded rod M8 up to M30**



**Installation reinforcing bar  $\varnothing 8$  up to  $\varnothing 32$**



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

**Injection System VT-HP for concrete**

**Product description**  
Installed condition

**Annex A1**

**Cartridge: VT-HP**

- A) Foil Bag Cartridge 165ml, 300ml.**
- B) Coaxial Cartridge 380ml / 400 ml / 410 ml / 420ml**
- C) Side by Side Cartridge 345ml, 825ml**

Cartridge Print : VT-HP

Including - Installation procedure, Production Batch code, Expiry Date, Storage conditions, Health & Safety warning, Gel & Cure time according to temperatures.

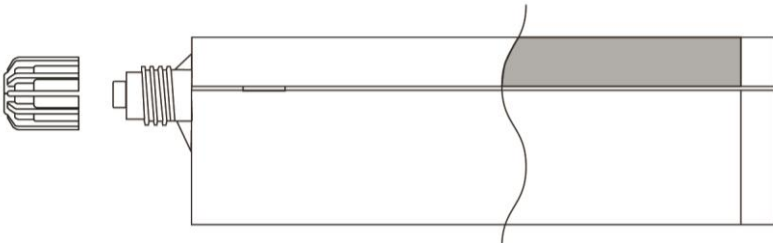
**A)**



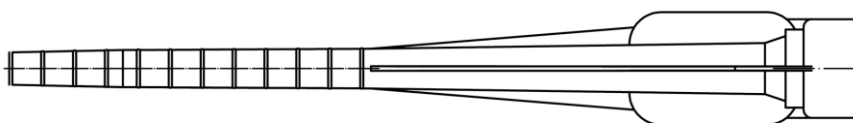
**B)**



**C)**



**Mixer**

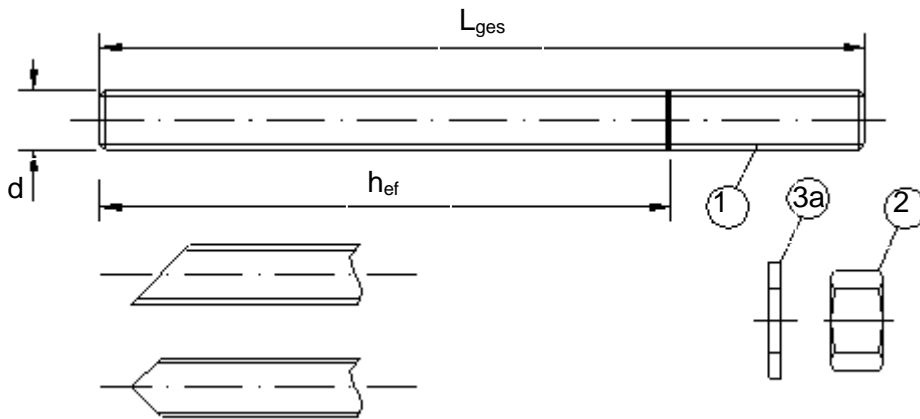


**Injection System VT-HP for concrete**

**Product description**  
Injection system

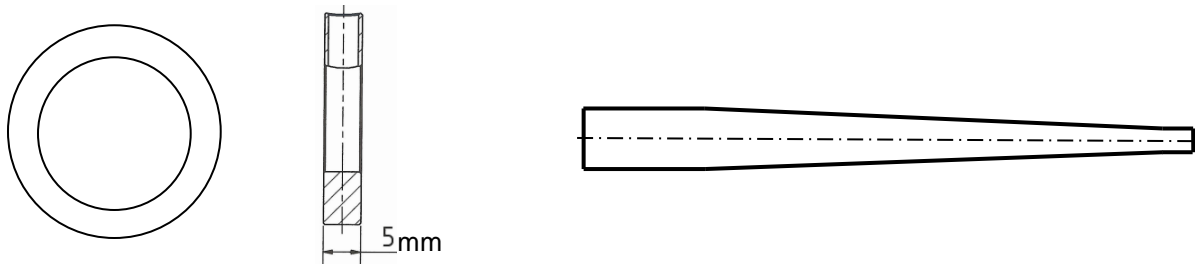
**Annex A2**

**Threaded rod M8, M10, M12, M16, M20, M24, M27, M30 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 and mixer reduction nozzle for filling the annular gap between anchor rod and fixture**



**Injection System VT-HP for concrete**

**Annex A3**

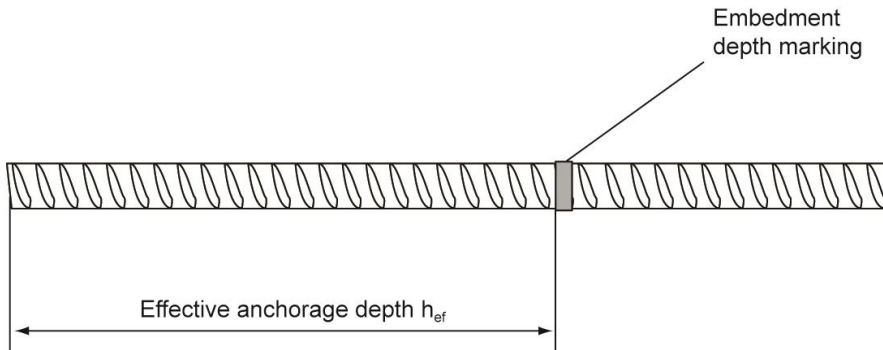
**Product description**

Threaded rod and filling washer



<b>Table A1: Materials</b>				
<b>Designation</b>		<b>Material</b>		
<b>Steel, zinc plated ( Steel acc. to EN 10087:1998 or EN 10263:2001)</b> zinc plated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042:1999 or hot-dip galvanised $\geq 40 \mu\text{m}$ acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or sherardized $\geq 40 \mu\text{m}$ acc. to DIN EN 17668:2016-06				
1	Anchor rod	Property class acc. to EN ISO 898-1:2013	4.6	$f_{uk}=400 \text{ N/mm}^2$ ; $f_{yk}=240 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			4.8	$f_{uk}=400 \text{ N/mm}^2$ ; $f_{yk}=320 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			5.6	$f_{uk}=500 \text{ N/mm}^2$ ; $f_{yk}=300 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			5.8	$f_{uk}=500 \text{ N/mm}^2$ ; $f_{yk}=400 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			8.8	$f_{uk}=800 \text{ N/mm}^2$ ; $f_{yk}=640 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			10.9	$f_{uk}=1000 \text{ N/mm}^2$ ; $f_{yk}=900 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
2	Hexagon nut	Property class acc. to EN ISO 898-2:2012	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
			10	for anchor rod class 10.9
3a	Washer, (z.B.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 oder EN ISO 7094:2000)	Steel, zinc plated, hot-dip galvanised or sherardized		
3b	Filling washer			
<b>Stainless steel A2 ( Material 1.4301 / 1.4303 / 1.4307 / 1.4567 oder 1.4541, acc. to EN 10088-1:2014)</b> <b>and Stainless steel A4 ( Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014)</b>				
1	Anchor rod <sup>1)2)</sup>	Property class acc. to EN ISO 3506-1:2009	50	$f_{uk}=500 \text{ N/mm}^2$ ; $f_{yk}=210 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			70	$f_{uk}=700 \text{ N/mm}^2$ ; $f_{yk}=450 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			80	$f_{uk}=800 \text{ N/mm}^2$ ; $f_{yk}=600 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
2	Hexagon nut <sup>1)2)</sup>	Property class acc. to EN ISO 3506-1:2009	50	for anchor rod class 50
			70	for anchor rod class 70
			80	for anchor rod class 80
3a	Washer, (z.B.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 oder EN ISO 7094:2000)	A2: Material 1.4301 / 1.4303 / 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		
3b	Filling washer <sup>3)</sup>			
<b>High corrosion resistance steel ( Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014)</b>				
1	Anchor rod <sup>1)</sup>	Property class acc. to EN ISO 3506-1:2009	50	$f_{uk}=500 \text{ N/mm}^2$ ; $f_{yk}=210 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			70	$f_{uk}=700 \text{ N/mm}^2$ ; $f_{yk}=450 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
			80	$f_{uk}=800 \text{ N/mm}^2$ ; $f_{yk}=600 \text{ N/mm}^2$ ; $A_5 > 8\%^{4)}$ fracture elongation
2	Hexagon nut <sup>1)</sup>	Property class acc. to EN ISO 3506-1:2009	50	for anchor rod class 50
			70	for anchor rod class 70
			80	for anchor rod class 80
3a	Washer, (z.B.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 oder EN ISO 7094:2000)	Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014		
3b	Filling washer			
<sup>1)</sup> Property class 70 for anchor rods up to M24 and <sup>2)</sup> Property class 70 only for stainless steel A4 <sup>3)</sup> Filling washer only with stainless steel A4 <sup>4)</sup> For seismic performance category C2, $A_5 > 19\%$ fracture elongation				
<b>Injection System VT-HP for concrete</b>			<b>Annex A4</b>	
<b>Product description</b> Materials threaded rod				

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



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

**Table A2: Materials**

Part	Designation	Material
<b>Reinforcing bars</b>		
1	Rebar EN 1992-1-1:2004+AC:2010, Annex C	Rebar class B or C $f_{yk}$ and k according to NDP or NCL of EN 1992-1-1/NA:2013 $f_{uk} = f_{tk} = k \cdot f_{yk}$

**Injection System VT-HP for concrete**

**Product description**  
Materials reinforcing bar

**Annex A5**

## Specifications of intended use

### Anchorage subject to:

- Static and quasi-static loads: M8 to M30, Rebar Ø8 to Ø32.
- Seismic action for Performance Category C1: M8 to M30 (except hot-dip galvanised rods), Rebar Ø8 to Ø32.
- Seismic action for Performance Category C2: M12, M16 and M20

### Base materials:

- Reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Non-cracked concrete: M8 to M30, Rebar Ø8 to Ø32.
- Cracked concrete: M8 to M30, Rebar Ø8 to Ø32.

### Temperature Range:

- I: - 40 °C to +40 °C (max long term temperature +24 °C and max short term temperature +40 °C)
- II: - 40 °C to +80 °C (max long term temperature +50 °C and max short term temperature +80 °C)
- III: - 40 °C to +120 °C (max long term temperature +72 °C and max short term temperature +120 °C)

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel A2 resp. A4 or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel A4 or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (high corrosion resistant steel).

Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

### Design:

- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- The Anchorages are designed in accordance to:
  - FprEN 1992-4:2017 and Technical Report TR055
  - Anchorages under seismic load are designed in accordance with EOTA Technical Report TR045

### Installation:

- Dry or wet concrete: M8 to M30, Rebar Ø8 to Ø32.
- Flooded holes (not sea water): M8 to M16, Rebar Ø8 to Ø16.
- Hole drilling by hammer (HD), hollow (HDB) or compressed air drill mode (CD).
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

**Injection System VT-HP for concrete**

**Intended Use**  
Specifications

**Annex B1**

**Table B1: Installation parameters for threaded rod**

Anchor size		M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30	
Outer diameter of anchor	$d_{nom}$ [mm] =	8	10	12	16	20	24	27	30	
Nominal drill hole diameter	$d_0$ [mm] =	10	12	14	18	24	28	32	35	
Effective anchorage depth	$h_{ef,min}$ [mm] =	60	60	70	80	90	96	108	120	
	$h_{ef,max}$ [mm] =	160	200	240	320	400	480	540	600	
Diameter of clearance hole in the fixture	$d_f$ [mm] ≤	9	12	14	18	22	26	30	33	
Diameter of steel brush	$d_b$ [mm] ≥	12	14	16	20	26	30	34	37	
Maximum torque moment	$T_{inst}$ [Nm] ≤	10	20	40	80	120	160	180	200	
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	135	150	
Minimum edge distance	$c_{min}$ [mm]	40	50	60	80	100	120	135	150	

**Table B2: Installation parameters for rebar**

Rebar size		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Outer diameter of anchor	$d_{nom}$ [mm] =	8	10	12	14	16	20	25	28	32
Nominal drill hole diameter	$d_0$ [mm] =	12	14	16	18	20	24	32	35	40
Effective anchorage depth	$h_{ef,min}$ [mm] =	60	60	70	75	80	90	100	112	128
	$h_{ef,max}$ [mm] =	160	200	240	280	320	400	500	580	640
Diameter of steel brush	$d_b$ [mm] ≥	14	16	18	20	22	26	34	37	41,5
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	125	140	160
Minimum edge distance	$c_{min}$ [mm]	40	50	60	70	80	100	125	140	160

Injection System VT-HP for concrete

Intended Use  
Installation parameters**Annex B2**

**Table B3: Parameter cleaning and setting tools**

Threaded Rod (mm)	Rebar (mm)	d <sub>0</sub> Drill bit - Ø HD, HDB, CA (mm)	d <sub>b</sub> Brush - Ø (mm)		d <sub>b,min</sub> min. Brush - Ø (mm)	Piston plug	Installation direction and use of piston plug		
							↓	⇨	↑
M8		10		12	10,5	-	-	-	-
M10	8	12		14	12,5	-	-	-	-
M12	10	14		16	14,5	-	-	-	-
	12	16		18	16,5	-	-	-	-
M16	14	18		20	18,5	PL18	h <sub>ef</sub> > 250 mm	h <sub>ef</sub> > 250 mm	all
		16	20		22	20,5			
	20	24		26	24,5	PL24			
M20	20	24		26	24,5	PL24			
M24		28		30	28,5	PL28			
M27	25	32		34	32,5	PL32			
M30	28	35		37	35,5	PL35			
	32	40		41,5	40,5	PL40			



**Push Pump**

Drill bit diameter (d<sub>0</sub>): 10 mm to 20 mm  
 Drill hole depth (h<sub>0</sub>): < 10 d<sub>nom</sub>  
 Only in non-cracked concrete



**CAC - Compressed air tool (min 6 bar)**

Drill bit diameter (d<sub>0</sub>): all diameters



**Piston plug for overhead or horizontal installation PL**

Drill bit diameter (d<sub>0</sub>): 18 mm to 40 mm



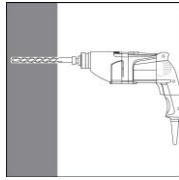
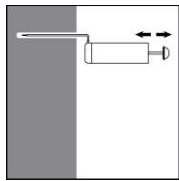
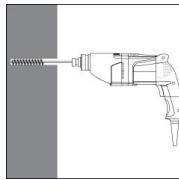
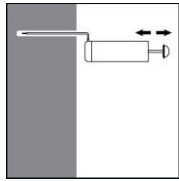
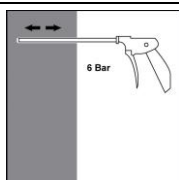
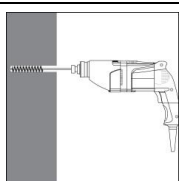
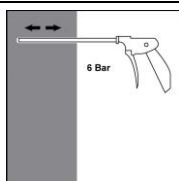
**Steel Brush**

Drill bit diameter (d<sub>0</sub>): all diameters

**Injection System VT-HP for concrete**

**Intended Use**  
 Cleaning and setting tools

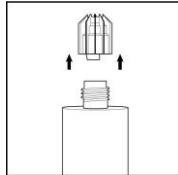
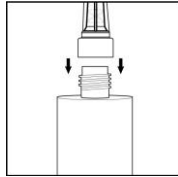
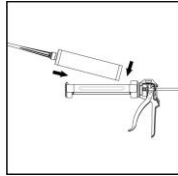
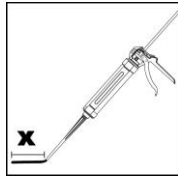
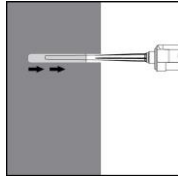
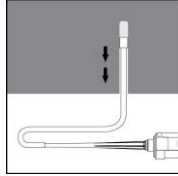
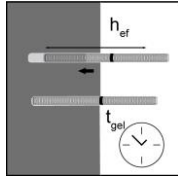
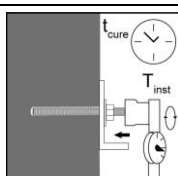
**Annex B3**

Instructions for use		
Bore hole drilling		
	<b>X 4</b>	<p>Drill with hammer drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1 or B2,) with hammer (HD), hollow (HDB) or compressed air (CD) drilling. The use of a hollow drill bit is only in combination with a sufficient vacuum permitted.</p> <p>In case of aborted drill hole: the drill hole shall be filled with mortar</p> <p><b>Attention! Standing water in the bore hole must be removed before cleaning.</b></p>
Bore hole cleaning		
Just before setting an anchor, the bore hole must be free of dust and debris.		
MAC: Cleaning for bore hole diameter $d_0 \leq 20\text{mm}$ and bore hole depth $h_0 \leq 10d_{\text{nom}}$ (uncracked concrete only!)		
	<b>X 4</b>	Starting from the bottom or back of the bore hole, blow the hole clean by a hand pump <sup>1)</sup> (Annex B3) a minimum of four times.
	<b>X 4</b>	Check brush diameter (Table B3). Brush the hole with an appropriate sized wire brush $> d_{b,\text{min}}$ (Table B3) a minimum of four times in a twisting motion. If the bore hole ground is not reached with the brush, a brush extension must be used.
	<b>X 4</b>	Finally blow the hole clean again with a hand pump (Annex B3) a minimum of four times.  <sup>1)</sup> It is permitted to blow bore holes with diameter between 14 mm and 20 mm and an embedment depth up to $10d_{\text{nom}}$ also in cracked concrete with hand-pump
CAC: Cleaning for all bore hole diameter in uncracked and cracked concrete		
	<b>X 4</b>	Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 3) a minimum of four times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.
	<b>X 4</b>	Check brush diameter (Table B3). Brush the hole with an appropriate sized wire brush $> d_{b,\text{min}}$ (Table B3) a minimum of four times. If the bore hole ground is not reached with the brush, a brush extension must be used.
	<b>X 4</b>	Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B3) a minimum of four times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used. <b>After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.</b>

**Injection System VT-HP for concrete**

**Intended Use**  
Installation instructions

**Annex B4**

Instructions for use	
	Remove the threaded cap from the cartridge.
	Attach the supplied mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. Cut off the foil tube clip before use if necessary. For every working interruption longer than the recommended working time (Table B4) as well as for new cartridges, a new mixer shall be used.
	Insert the cartridge into the dispenser. Press the release trigger to retract the plunger and insert the cartridge neatly into the cradle without any distortion. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
	Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour. For foil tube cartridges it must be discarded a minimum of six full strokes.
	Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets. For embedment larger than 190 mm an extension nozzle shall be used. Observe the gel-/ working times given in Table B4.
	Piston Plugs and mixer nozzle extensions shall be used according to Table B3 for the following applications: • Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-Ø d0 ≥ 18 mm and embedment depth hef > 250mm • Overhead assembly (vertical upwards direction): Drill bit-Ø d0 ≥ 18 mm
	Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.  The anchor shall be free of dirt, grease, oil or other foreign material.  Be sure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead application the anchor rod shall be fixed (e.g. wedges).
	Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B4). After full curing, the add-on part can be installed with up to the max. torque (Table B1) by using a calibrated torque wrench. It can be optional filled the annular gap between anchor and fixture with mortar. Therefor substitute the washer by the filling washer and connect the mixer reduction nozzle to the tip of the mixer. The annular gap is filled with mortar, when mortar oozes out of the washer.

**Injection System VT-HP for concrete**





**Intended Use**  
Installation instructions (continuation)

**Annex B5**

**Table B4: Maximum Working time and minimum curing time**

Concrete temperature	Gelling- / working time	Minimum curing time in dry concrete <sup>1)</sup>
0 °C to +4°C	45 min	7 h
+5 °C to +9°C	25 min	2 h
+ 10 °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
+ 40 °C	1,5 min	15 min
Cartridge temperature	+5°C to +40°C	

<sup>1)</sup> In wet concrete the curing time must be doubled.

Resin injection pump details		
Image	Size Cartridge / Code	Type
	165 / 300ml 165/300 ml 10:1	Manual
	345 / 380 / 400 / 410 / 420ml 420 ml 10:1 345 ml 10:1	Manual
	165 / 300 / 380 / 400 / 410 / 420ml 165/300 ml 380 / 400 / 410 / 420 ml 345 ml 7.4v Tool	Battery
	380 / 400 / 410 / 825ml 380 / 400 / 410 / 420 ml 825ml	Pneumatic

**Injection System VT-HP for concrete**

**Intended Use**  
Curing time

**Annex B6**



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

Size			M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30	
<b>Characteristic tension resistance, Steel failure</b>											
Steel, Property class 4.6 and 4.8	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224	
Steel, Property class 5.6 and 5.8	$N_{Rk,s}$	[kN]	18	29	42	78	122	176	230	280	
Steel, Property class 8.8	$N_{Rk,s}$	[kN]	29	46	67	125	196	282	368	449	
Steel, Property class 10.9	$N_{Rk,s}$	[kN]	38	60	87	163	255	367	477	583	
Stainless steel A2, A4 and HCR, Property class 50	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281	
Stainless steel A2, A4 and HCR, Property class 70	$N_{Rk,s}$	[kN]	26	41	59	110	171	247	-	-	
Stainless steel A4 and HCR, Property class 80	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	-	-	
<b>Characteristic tension resistance, Partial factor</b>											
Steel, Property class 4.6	$\gamma_{Ms,N}^{1)}$	[-]	2,0								
Steel, Property class 4.8	$\gamma_{Ms,N}^{1)}$	[-]	1,5								
Steel, Property class 5.6	$\gamma_{Ms,N}^{1)}$	[-]	2,0								
Steel, Property class 5.8, 8.8 and 10.9	$\gamma_{Ms,N}^{1)}$	[-]	1,5								
Stainless steel A2, A4 and HCR, Property class 50	$\gamma_{Ms,N}^{1)}$	[-]	2,86								
Stainless steel A2, A4 and HCR, Property class 70	$\gamma_{Ms,N}^{1)}$	[-]	1,87								
Stainless steel A4 and HCR, Property class 80	$\gamma_{Ms,N}^{1)}$	[-]	1,6								
<b>Characteristic shear resistance, Steel failure</b>											
Without lever arm	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9	14	20	38	59	85	110	135
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
	Steel, Property class 10.9	$V^0_{Rk,s}$	[kN]	19	30	43	81	127	183	238	224
	Stainless steel A2, A4 and HCR, Property class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
	Stainless steel A2, A4 and HCR, Property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	-	-
	Stainless steel A4 and HCR, Property 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	30	52	133	260	449	666	900
	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560	833	1123
	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	896	1333	1797
	Steel, Property class 10.9	$M^0_{Rk,s}$	[Nm]	37	75	131	333	649	1123	1664	2249
	Stainless steel A2, A4 and HCR, Property class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561	832	1125
	Stainless steel A2, A4 and HCR, Property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784	-	-
	Stainless steel A4 and HCR, Property class 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896	-	-
<b>Characteristic shear resistance, Partial factor</b>											
Steel, Property class 4.6	$\gamma_{Ms,V}^{1)}$	[-]	1,67								
Steel, Property class 4.8	$\gamma_{Ms,V}^{1)}$	[-]	1,25								
Steel, Property class 5.6	$\gamma_{Ms,V}^{1)}$	[-]	1,67								
Steel, Property class 5.8	$\gamma_{Ms,V}^{1)}$	[-]	1,25								
Steel, Property class 8.8	$\gamma_{Ms,V}^{1)}$	[-]	1,25								
Steel, Property class 10.9	$\gamma_{Ms,V}^{1)}$	[-]	1,50								
Stainless steel A2, A4 and HCR, Property class 50	$\gamma_{Ms,V}^{1)}$	[-]	2,38								
Stainless steel A2, A4 and HCR, Property class 70	$\gamma_{Ms,V}^{1)}$	[-]	1,56								
Stainless steel A4 and HCR, Property class 80	$\gamma_{Ms,V}^{1)}$	[-]	1,33								

<sup>1)</sup> in absence of national regulation

### Injection System VT-HP for concrete

#### Performances

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

## Annex C1

<b>Table C2: Characteristic values of tension loads under static, quasi-static action and seismic action (performance category C1 and C2)</b>											
<b>Anchor size threaded rod</b>				<b>M 8</b>	<b>M 10</b>	<b>M 12</b>	<b>M 16</b>	<b>M 20</b>	<b>M 24</b>	<b>M 27</b>	<b>M 30</b>
<b>Steel failure</b>											
Characteristic tension resistance		$N_{Rk,s}$	[kN]	see Table C1							
		$N_{Rk,s,C1} = N_{Rk,s,C2}$	[kN]	$1,0 \cdot N_{Rk,s}$							
Partial factor		$\gamma_{Ms,N}$	[-]	see Table C1							
<b>Combined pull-out and concrete failure</b>											
Characteristic bond resistance in non-cracked concrete C20/25											
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	10	12	12	12	12	11	10	9
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	7,5	8,5	8,5	8,5	No Performance assessed			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	7,5	9	9	9	9	8,5	7,5	6,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	5,5	6,5	6,5	6,5	No Performance assessed			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	4,0	5,0	5,0	5,0	No Performance assessed			
Characteristic bond resistance in cracked concrete C20/25											
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	4,0	5,0	5,5	5,5	5,5	5,5	6,5	6,5
		$\tau_{Rk,C1}$	[N/mm <sup>2</sup> ]	2,5	3,1	3,7	3,7	3,7	3,8	4,5	4,5
		$\tau_{Rk,C2}$	[N/mm <sup>2</sup> ]	-	-	2	2	2	-	-	-
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	4,0	4,0	5,5	5,5	No Performance assessed			
		$\tau_{Rk,C1}$	[N/mm <sup>2</sup> ]	2,5	2,5	3,7	3,7	No Performance assessed			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,5	3,5	4,0	4,0	4,0	4,0	4,5	4,5
		$\tau_{Rk,C1}$	[N/mm <sup>2</sup> ]	1,6	2,2	2,7	2,7	2,7	2,8	3,1	3,1
		$\tau_{Rk,C2}$	[N/mm <sup>2</sup> ]	-	-	1,4	1,4	1,4	-	-	-
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,5	3,0	4,0	4,0	No Performance assessed			
		$\tau_{Rk,C1}$	[N/mm <sup>2</sup> ]	1,6	1,9	2,7	2,7	No Performance assessed			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,0	2,5	3,0	3,0	3,0	3,0	3,5	3,5
		$\tau_{Rk,C1}$	[N/mm <sup>2</sup> ]	1,3	1,6	2,0	2,0	2,0	2,1	2,4	2,4
		$\tau_{Rk,C2}$	[N/mm <sup>2</sup> ]	-	-	1,1	1,1	1,1	-	-	-
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,0	2,5	3,0	3,0	No Performance assessed			
		$\tau_{Rk,C1}$	[N/mm <sup>2</sup> ]	1,3	1,6	2,0	2,0	No Performance assessed			
Increasing factors for concrete (only static or quasi-static actions) $\psi_c$		C25/30		1,02							
		C30/37		1,04							
		C35/45		1,07							
		C40/50		1,08							
		C45/55		1,09							
		C50/60		1,10							
<b>Concrete cone failure</b>											
Non-cracked 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 $c_{cr,N}$							
<b>Splitting</b>											
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 $c_{cr,sp}$							
Installation factor (dry and wet concrete)		$\gamma_{inst}$	[-]	1,0	1,2						
Installation factor (flooded bore hole)		$\gamma_{inst}$	[-]	1,4				No Performance assessed			
<b>Injection System VT-HP for concrete</b>										<b>Annex C2</b>	
<b>Performances</b> Characteristic values of tension loads under static, quasi-static action and seismic action (performance category C1 and C2)											

<b>Table C3: Characteristic values of shear loads under static, quasi-static action and seismic action (performance category C1 and C2)</b>										
Anchor size threaded rod			M 8	M 10	M 12	M 16	M 20	M24	M 27	M 30
<b>Steel failure without lever arm</b>										
Characteristic shear resistance	$V_{Rk,s}^0$	[kN]	see Table C1							
	$V_{Rk,s,C1}$	[kN]	$0,70 \cdot V_{Rk,s}^0$							
	$V_{Rk,s,C2}$	[kN]	-	-	$0,60 \cdot V_{Rk,s}^0$	$0,70 \cdot V_{Rk,s}^0$	$0,75 \cdot V_{Rk,s}^0$	-	-	-
Characteristic shear resistance for <b>hot-dip galvanized</b> commercial rods	$V_{Rk,s,C2}$	[kN]	-	-	$0,35 \cdot V_{Rk,s}^0$			-	-	-
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Ductility factor	$k_7$	[-]	1,0							
<b>Steel failure with lever arm</b>										
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	see Table C1							
	$M_{Rk,s,eq}^0$	[Nm]	No Performance Determined (NPD)							
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
<b>Concrete pry-out failure</b>										
Factor	$k_s$	[-]	2,0							
Installation factor	$\gamma_{inst}$	[-]	1,0							
<b>Concrete edge failure</b>										
Effective length of fastener	$l_f$	[mm]	$l_f = \min(h_{ef}; 8 d_{nom})$							
Outside diameter of fastener	$d_{nom}$	[mm]	8	10	12	16	20	24	27	30
Installation factor	$\gamma_{inst}$	[-]	1,0							
<b>Factor for annular gap</b>	$\alpha_{gap}$	[-]	$0,5 (1,0)^{1)}$							
<sup>1)</sup> Value in brackets valid for filled annular gap between anchor and clearance hole in the fixture. Use of special filling washer Annex A3 is required										
<b>Injection System VT-HP for concrete</b>									<b>Annex C3</b>	
<b>Performances</b> Characteristic values of shear loads under static, quasi-static action and seismic action (performance category C1 and C2)										

<b>Table C4: Characteristic values of tension loads under static, quasi-static action and seismic action (performance category C1)</b>													
<b>Anchor size reinforcing bar</b>				$\emptyset 8$	$\emptyset 10$	$\emptyset 12$	$\emptyset 14$	$\emptyset 16$	$\emptyset 20$	$\emptyset 25$	$\emptyset 28$	$\emptyset 32$	
<b>Steel failure</b>													
Characteristic tension resistance	$N_{Rk,s}$		[kN]	$A_s \cdot f_{uk}^{1)}$									
	$N_{Rk,s,eq}$		[kN]	$1,0 \cdot A_s \cdot f_{uk}^{1)}$									
Cross section area	$A_s$		[mm <sup>2</sup> ]	50	79	113	154	201	314	491	616	804	
Partial factor	$\gamma_{Ms,N}$		[-]	1,4 <sup>2)</sup>									
<b>Combined pull-out and concrete failure</b>													
Characteristic bond resistance in non-cracked concrete C20/25													
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	10	12	12	12	12	12	11	10	8,5	
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	7,5	8,5	8,5	8,5	8,5	No Performance Assessed				
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	7,5	9	9	9	9	9	8,0	7,0	6,0	
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	5,5	6,5	6,5	6,5	6,5	No Performance Assessed				
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5	
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	4,0	5,0	5,0	5,0	5,0	No Performance Assessed				
Characteristic bond resistance in cracked concrete C20/25													
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	4,0	5,0	5,5	5,5	5,5	5,5	5,5	6,5	6,5	
		$\tau_{Rk,eq}$	[N/mm <sup>2</sup> ]	2,5	3,1	3,7	3,7	3,7	3,7	3,8	4,5	4,5	
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	4,0	4,0	5,5	5,5	5,5	No Performance Assessed				
		$\tau_{Rk,eq}$	[N/mm <sup>2</sup> ]	2,5	2,5	3,7	3,7	3,7	No Performance Assessed				
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,5	3,5	4,0	4,0	4,0	4,0	4,0	4,5	4,5	
		$\tau_{Rk,eq}$	[N/mm <sup>2</sup> ]	1,6	2,2	2,7	2,7	2,7	2,7	2,8	3,1	3,1	
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,5	3,0	4,0	4,0	4,0	No Performance Determined (NPD)				
		$\tau_{Rk,eq}$	[N/mm <sup>2</sup> ]	1,6	1,9	2,7	2,7	2,7	No Performance Determined (NPD)				
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,0	2,5	3,0	3,0	3,0	3,0	3,0	3,5	3,5	
		$\tau_{Rk,eq}$	[N/mm <sup>2</sup> ]	1,3	1,6	2,0	2,0	2,0	2,0	2,1	2,4	2,4	
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	2,0	2,5	3,0	3,0	3,0	No Performance Determined (NPD)				
		$\tau_{Rk,eq}$	[N/mm <sup>2</sup> ]	1,3	1,6	2,0	2,0	2,0	No Performance Determined (NPD)				
Increasing factors for concrete (only static or quasi-static actions) $\psi_c$	C25/30			1,02									
	C30/37			1,04									
	C35/45			1,07									
	C40/50			1,08									
	C45/55			1,09									
	C50/60			1,10									
<b>Concrete cone failure</b>													
Non-cracked 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]	$2 c_{cr,N}$									
<b>Splitting</b>													
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]	$2 c_{cr,sp}$									
Installation factor (dry and wet concrete)	$\gamma_{inst}$		[-]	1,0	1,2								
Installation factor (flooded bore hole)	$\gamma_{inst}$		[-]	1,4						No Performance Determined (NPD)			
<sup>1)</sup> $f_{uk}$ shall be taken from the specifications of reinforcing bars <sup>2)</sup> in absence of national regulation													
<b>Injection System VT-HP for concrete</b>											<b>Annex C4</b>		
<b>Performances</b> Characteristic values of tension loads under static, quasi-static action and seismic action (performance category C1)													

<b>Table C5: Characteristic values of shear loads under static, quasi-static action and seismic action (performance category C1)</b>											
Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
<b>Steel failure without lever arm</b>											
Characteristic shear resistance	$V_{Rk,s}^0$	[kN]	$0,50 \cdot A_s \cdot f_{uk}^{(1)}$								
	$V_{Rk,s,eq}$	[kN]	$0,35 \cdot A_s \cdot f_{uk}^{(1)}$								
Cross section area	$A_s$	[mm <sup>2</sup> ]	50	79	113	154	201	314	491	616	804
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 <sup>2)</sup>								
Ductility factor	$k_7$	[-]	1,0								
<b>Steel failure with lever arm</b>											
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	$1.2 \cdot W_{el} \cdot f_{uk}^{(1)}$								
	$M_{Rk,s,eq}^0$	[Nm]	No Performance Determined (NPD)								
Elastic section modulus	$W_{el}$	[mm <sup>3</sup> ]	50	98	170	269	402	785	1534	2155	3217
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 <sup>2)</sup>								
<b>Concrete pry-out failure</b>											
Factor	$k_8$	[-]	2,0								
Installation factor	$\gamma_{inst}$	[-]	1,0								
<b>Concrete edge failure</b>											
Effective length of fastener	$l_f$	[mm]	$l_f = \min(h_{ef}, 8 d_{nom})$								
Outside diameter of fastener	$d_{nom}$	[mm]	8	10	12	14	16	20	25	28	32
Installation factor	$\gamma_{inst}$	[-]	1,0								
<b>Factor for annular gap</b>	$\alpha_{gap}$	[-]	0,5 (1,0) <sup>3)</sup>								
<sup>1)</sup> $f_{uk}$ shall be taken from the specifications of reinforcing bars <sup>2)</sup> in absence of national regulation <sup>3)</sup> Value in brackets valid for filled annular gap between anchor and clearance hole in the fixture. Use of special filling washer Annex A3 is required											
<b>Injection System VT-HP for concrete</b>										<b>Annex C5</b>	
<b>Performances</b> Characteristic values of shear loads under static, quasi-static action and seismic action (performance category C1)											

<b>Table C6: Displacements under tension load<sup>1)</sup> (threaded rod)</b>										
<b>Anchor size threaded rod</b>			<b>M 8</b>	<b>M 10</b>	<b>M 12</b>	<b>M 16</b>	<b>M 20</b>	<b>M24</b>	<b>M 27</b>	<b>M 30</b>
<b>Non-cracked concrete C20/25</b>										
Temperature range I: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,021	0,023	0,026	0,031	0,036	0,041	0,045	0,049
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,030	0,033	0,037	0,045	0,052	0,060	0,065	0,071
Temperature range II: 80°C/50°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
Temperature range III: 120°C/72°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
<b>Cracked concrete C20/25</b>										
Temperature range I: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,090			0,070				
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,105			0,105				
Temperature range II: 80°C/50°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,219			0,170				
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,255			0,245				
Temperature range III: 120°C/72°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,219			0,170				
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,255			0,245				
<b>Seismic Category C2</b>										
All temperature ranges	$\delta_{N,eq}$ (DLS)	[mm]	-	-	0,11	0,19	0,62	-	-	-
	$\delta_{N,eq}$ (ULS)	[mm]	-	-	0,29	0,62	0,94	-	-	-
<sup>1)</sup> Calculation of the displacement $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$ ; $\tau$ : action bond stress for tension $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ ;										
<b>Table C7: Displacements under shear load<sup>1)</sup> (threaded rod)</b>										
<b>Anchor size threaded rod</b>			<b>M 8</b>	<b>M 10</b>	<b>M 12</b>	<b>M 16</b>	<b>M 20</b>	<b>M24</b>	<b>M 27</b>	<b>M 30</b>
<b>For non-cracked concrete C20/25</b>										
All temperature ranges	$\delta_{V0}$ -factor	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$ -factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
<b>For cracked concrete C20/25</b>										
All temperature ranges	$\delta_{V0}$ -factor	[mm/(kN)]	0,12	0,12	0,11	0,10	0,09	0,08	0,08	0,07
	$\delta_{V\infty}$ -factor	[mm/(kN)]	0,18	0,18	0,17	0,15	0,14	0,13	0,12	0,10
<b>Seismic Category C2</b>										
All temperature ranges	$\delta_{V,eq}$ (DLS)	[mm]	-	-	2,99	3,76	5,19	-	-	-
	$\delta_{V,eq}$ (ULS)	[mm]	-	-	5,17	6,32	10,26	-	-	-
<sup>1)</sup> Calculation of the displacement $\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$ ; $V$ : action shear load $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$ ;										
<b>Injection System VT-HP for concrete</b>								<b>Annex C6</b>		
<b>Performances</b> Displacements (threaded rods)										

<b>Table C8: Displacements under tension load<sup>1)</sup> (rebar)</b>											
<b>Anchor size reinforcing bar</b>		$\varnothing 8$	$\varnothing 10$	$\varnothing 12$	$\varnothing 14$	$\varnothing 16$	$\varnothing 20$	$\varnothing 25$	$\varnothing 28$	$\varnothing 32$	
<b>Non-cracked concrete C20/25</b>											
Temperature range I: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,021	0,023	0,026	0,028	0,031	0,036	0,043	0,047	0,052
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,030	0,033	0,037	0,041	0,045	0,052	0,061	0,071	0,075
Temperature range II: 80°C/50°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
Temperature range III: 120°C/72°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
<b>Cracked concrete C20/25</b>											
Temperature range I: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,090			0,070					
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,105			0,105					
Temperature range II: 80°C/50°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,219			0,170					
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,255			0,245					
Temperature range III: 120°C/72°C	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,219			0,170					
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,255			0,245					
<sup>1)</sup> Calculation of the displacement $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$ ; $\tau$ : action bond stress for tension $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ ;											
<b>Table C9: Displacement under shear load<sup>1)</sup> (rebar)</b>											
<b>Anchor size reinforcing bar</b>		$\varnothing 8$	$\varnothing 10$	$\varnothing 12$	$\varnothing 14$	$\varnothing 16$	$\varnothing 20$	$\varnothing 25$	$\varnothing 28$	$\varnothing 32$	
<b>Non-cracked concrete C20/25</b>											
All temperature ranges	$\delta_{V0}$ -factor	[mm/(kN)]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$ -factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,04	0,04
<b>Cracked concrete C20/25</b>											
All temperature ranges	$\delta_{V0}$ -factor	[mm/(kN)]	0,12	0,12	0,11	0,11	0,10	0,09	0,08	0,07	0,06
	$\delta_{V\infty}$ -factor	[mm/(kN)]	0,18	0,18	0,17	0,16	0,15	0,14	0,12	0,11	0,10
<sup>1)</sup> Calculation of the displacement $\delta_{V0} = \delta_{V0}$ -factor $\cdot V$ ; $V$ : action shear load $\delta_{V\infty} = \delta_{V\infty}$ -factor $\cdot V$ ;											
<b>Injection System VT-HP for concrete</b>									<b>Annex C7</b>		
<b>Performances</b> Displacements (rebar)											