

# Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-22/6262 of 25/11/2022
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	VJ Technology Injection system XPE440 for concrete
Product family to which the construction product belongs:	Product code 33 - Fixings
Manufacturer:	VJ Technology Ltd. Brunswick Road Cobbs Wood Ind. Estate ASHFORD KENT TN23 1EN UK
Manufacturing plant(s):	VJ Technology Plant 1
This UK Technical Assessment contains:	42 pages including 3 annexes which form an integral part of this assessment
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	EAD 330499-01-0601, Edition 04/2020

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#### 1 Technical description of the product

The VJ Technology Injection System XPE440 for concrete is a bonded anchor consisting of a cartridge with injection XPE440 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 reinforcing bar in the range of  $\emptyset$  8 to  $\emptyset$  32 mm or an internal threaded anchor rod IT-M6 to IT-M20.

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(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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 UK Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex B2, C1 to C5, C7 to C9, C11 to C13
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1, C6, C10, C14
Displacements under short-term and long-term loading	See Annex C15 to C17
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C18 to C23

#### 3.2 Safety in case of fire (BWR 2)

Not relevant.

#### 3.3 Health, hygiene, and the environment (BWR 3)

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

#### 3.4 Safety and accessibility in use (BWR 4)

Not relevant.

#### 3.5 Protection against noise (BWR 5)

Not relevant.

#### 3.6 Energy economy and heat retention (BWR 6)

Not relevant.

#### 3.7 Sustainable use of natural resources (BWR 7)

No performance assessed.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied

#### 4.1 System of assessment and verification of constancy of performance

According to UKAD No. 330499-01-0601 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011 as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

# 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

#### 5.1 UKCA marking for the product/system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance
- UKTA number.

On behalf of the British Board of Agrément

2.1

Date of Issue: 25 November 2022

Hardy Giesler Chief Executive Officer



British Board of Agrément, 1<sup>st</sup> Floor Building 3 Hatters Lane **Croxley Park** Watford WD18 8YG

#### ANNEXES

- Annex A1 Product description Installed condition
- Annex A2 Product description Injection system
- Annex A3 Product description Threaded rod, internal threaded rod, and filling washer
- Annex A4 Product description Materials threaded rod and internal threaded rod
- Annex A5 Product description Materials reinforcing bar
- Annex B1 Intended use Specifications
- Annex B2 Intended use Specifications
- Annex B3 Intended use Installation parameters
- Annex B4 Intended use Cleaning and setting tools
- Annex B5 Intended use Installation instructions
- Annex B6 Intended use Installation instructions (continuation)
- Annex B7 Intended use Installation instructions (continuation)
- Annex B8 Intended use Curing time
- Annex C1 Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods
- Annex C2 Characteristic values for Concrete cone failure and Splitting with all kind of action
- Annex C3 Characteristic values of tension loads under static and quasi-static action
- Annex C4 Characteristic values of tension loads under static and quasi-static action
- Annex C5 Characteristic values of tension loads under static and quasi-static action
- Annex C6 Characteristic values of shear loads under static and quasi-static action
- Annex C7 Characteristic values of tension loads under static and quasi-static action
- Annex C8 Characteristic values of tension loads under static and quasi-static action
- Annex C9 Characteristic values of tension loads under static and guasi-static action
- Annex C10 Characteristic values of shear loads under static and quasi-static action
- Annex C11 Characteristic values of tension loads under static and guasi-static action
- Annex C12 Characteristic values of tension loads under static and quasi-static action
- Annex C13 Characteristic values of tension loads under static and quasi-static action
- Annex C14 Characteristic values of shear loads under static and quasi-static action
- Annex C15 Displacement under static and quasi-static action (threaded rods)
- Annex C16 Displacements under static and quasi-static action (internal threaded anchor rod)
- Annex C17 Displacements under static and quasi-static action (rebar)
- Annex C18 Characteristic values of tension loads under seismic action (performance category C1 + C2)
- Annex C19 Characteristic values of shear loads under seismic action (performance category C1 + C2)
- Annex C20 Characteristic values of tension loads under seismic action (performance category C1)
- Annex C21 Characteristic values of shear loads under seismic action (performance category C1)
- Annex C22 Displacements under seismic C1 action (threaded rods and rebar)
- Annex C23 Displacements under seismic C2 action (threaded rods)







Та	ble A1: Mate	rials						
Part	Designation	Material						
Ste	Steel, zinc plated (Steel acc. to BS EN ISO 683-4: 2018 or BS EN 10263: 2017           -         Zinc plated         ≥ 5 μm         acc. to BS EN ISO 4042: 2018           -         Hot-dip galvanized         ≥ 40 μm         acc. to BS EN 1461: 2009 and BS EN ISO 10684: 2004 + AC: 2009           -         Sherardized         ≥ 45 μm         acc. to BS EN 15O 17668: 2016							
		Property class		Characteristic steel ultimate tensile strength	Characteristic ste yield strength	eel Elongation at fracture		
			4.6	f <sub>uk</sub> = 400 N/mm <sup>2</sup>	f <sub>yk</sub> = 240 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
1	Threaded rod	acc to	4.8	f <sub>uk</sub> = 400 N/mm²	f <sub>vk</sub> = 320 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
		BS EN ISO 898-1:	5.6	f <sub>uk</sub> = 500 N/mm²	f <sub>vk</sub> = 300 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
		2013	5.8	f <sub>uk</sub> = 500 N/mm²	f <sub>vk</sub> = 400 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
			8.8	f <sub>uk</sub> = 800 N/mm <sup>2</sup>	$f_{vk} = 640 \text{ N/mm}^2$	A <sub>5</sub> ≥ 12% <sup>3)</sup>		
		acc. to	4	for anchor rod class 4.6 o	r 4.8			
2	Hexagon nut	BS EN ISO 898-2:	5	for anchor rod class 5.6 o	r 5.8			
		2012	8	for anchor rod class 8.8				
За	Washer	(e.g.: BS EN ISO 70	ot-dip ( 89: 20	galvanized or sherardized 00, BS EN ISO 7093: 2000 d	or BS EN ISO 7094	I: 2000		
3b	Filling washer	Steel, zinc plated, h	ot-dip	galvanised or sherardized				
	Internal threaded	Property class		ultimate tensile strength	yield strength	eel Elongation at fracture		
4	anchor rod	acc. to	5.8	f <sub>uk</sub> = 500 N/mm²	$f_{yk} = 400 \text{ N/mm}^2$	A <sub>5</sub> > 8%		
		BS EN ISO 898-1: 2013	8.8	f <sub>uk</sub> = 800 N/mm²	f <sub>yk</sub> = 640 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
Staiı Staiı High	Stainless steel A2 (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to BS EN 10088-1: 2014 Stainless steel A4 (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to BS EN 10088-1: 2014 High corrosion resistance steel (Material 1.4529 or 1.4565, acc. to BS EN 10088-1: 2014							
		Property class		Characteristic steel	Characteristic ste	eel Elongation at		
				ultimate tensile strength	yield strength			
1	Threaded rod <sup>1)4)</sup>	acc. to	50	$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 210 \text{ N/mm}^2$	$A_5 < 8\%$		
		BS EN ISO 3506-	70	$f_{uk} = 700 \text{ N/mm}^2$	$f_{yk} = 450 \text{ N/mm}^2$	$A_5 \ge 12\%^{3}$		
		1. 2020	80	f <sub>uk</sub> = 800 N/mm <sup>2</sup>	$f_{yk} = 600 \text{ N/mm}^2$	A <sub>5</sub> ≥ 12% <sup>3</sup>		
	Heyeren nut 1)4)	acc. to	50	for anchor rod class 50				
2		1: 2020	80	for anchor rod class 70				
3a         Washer         A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to BS EN 10088-1: 2014 A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to BS EN 10088-1: 2014 HCR: Material 1.4529 or 1.4565, acc. to BS EN 10088-1: 2014 (e.g.: BS EN ISO 7089: 2000, BS EN ISO 7093: 2000 or BS EN ISO 7094: 2000)								
3b	Filling washer	Stainless steel A4, H	High c	orrosion resistance steel				
		Property class		Characteristic steel ultimate tensile strength	Characteristic ste yield strength	eel Elongation at fracture		
	Internal threaded	acc. to	50	f <sub>uk</sub> = 500 N/mm²	$f_{yk} = 210 \text{ N/mm}^2$	A <sub>5</sub> > 8%		
4	anchor rod <sup>1)2)</sup>	1: 2020	70	f <sub>uk</sub> = 700 N/mm²	f <sub>yk</sub> = 450 N/mm²	A <sub>5</sub> > 8%		
1) 2) 3) 4)	Property class 70 or for IT-M20 only prope A₅ > 8% fracture elor Property class 80 onl	80 for anchor rods up to erty class 50 ligation if <u>no</u> requirement ly for stainless steel A4 a	M24 a t for pe and H0	and Internal threaded anchor erformance category C2 exis CR	r rods up to IT-M16 ts	S,		
VJ Technology Injection System XPE440 for concrete         Product description         Materials threaded rod and internal threaded rod				Annex A 4				
						l		

# Reinforcing bar Ø 8, Ø 10, Ø 12, Ø 14, Ø 16, Ø 20, Ø 24, Ø 25, Ø 28, Ø 32 h<sub>ef</sub> Minimum value of related rip area $f_{R,min}$ according to BS EN 1992-1-1: 2004 + A1: 2014 Rib height of the bar shall be in the range $0,05d \le h \le 0,07d$ (d: Nominal diameter of the bar; h: Rip height of the bar) Table A2: **Materials** Part | Designation Material **Reinforcing bars** Bars and de-coiled rods class B or C Rebar $f_{\nu k}$ and k according to NDP or NCL of BS EN 1992-1-1: 2004 1 BS EN 1992-1-1: 2004 + A1: 2014 Annex C + A1: 2014; f<sub>uk</sub> = f<sub>tk</sub> = k · f<sub>yk</sub>

#### VJ Technology Injection System XPE440 for concrete

# **Product description**

Annex A 5

Materials reinforcing bar

Specifications of intended use						
Anchorages subject to (for a s	ervice life of 50 ye	ars):				
	Static and qua	si-static loads	Seismic action for Performance Category C1	Seismic action for Performance Category C2		
Base material	Non-cracked concrete	cracked concrete	Cracked and no	n-cracked concrete		
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to Ø8 to IT-M6 to	M30, Ø32, IT-M20	M8 to M30, Ø8 to Ø32	M12 to M24		
Diamond drilling (DD)	M8 to M30, Ø8 to Ø32, IT-M6 to IT-M20	No performance assessed	No performance assessed	No performance assessed		
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 +72 °C (max long term temperature +50 °C and max short term temperature +72 °C)					
Anchorages subject to (for a s	ervice life of 100 y	ears):		,,		
	Static and qua	Seismic action for Performance Category C1	Seismic action for Performance Category C2			
Base material	Non-cracked concrete	Cracked and no	on-cracked concrete			
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to M30, Ø8 to Ø32, IT-M6 to IT-M20		M8 to M30, Ø8 to Ø32	M12 to M24		
Diamond drilling (DD)	No performance assessed	No performance assessed No performance		No performance assessed		
Temperature Range:	I: - 40 °C to +40 °C (max long term temperature +24 °C and max short term temperature +40 °C)					
<ul> <li>Base materials:</li> <li>Compacted, reinforced or unreinforced normal weight concrete without fibres according to BS EN 206: 2013 + A2: 2021</li> <li>Strength classes C20/25 to C50/60 according to BS EN 206: 2013 + A2: 2021</li> </ul>						
<ul> <li>Use conditions (Environmental conditions):</li> <li>Structures subject to dry internal conditions (all materials).</li> <li>For all other conditions according to BS EN 1993-1-4: 2006 + A2: 2020 corresponding to corrosion resistance class</li> <li>Stainless steel Stahl A2 according to Annex A 4, Table A1: CRC II</li> <li>Stainless steel Stahl A4 according to Annex A 4, Table A1: CRC III</li> <li>High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V</li> </ul>						
VJ Technology Injection System	XPE440 for conc	rete				
Intended Use Specifications				Annex B 1		

#### 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 BS EN 1992-4: 2018 and Technical Report TR055, Edition February 2018

#### Installation:

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

#### VJ Technology Injection System XPE440 for concrete

Intended Use Specifications

Table B1:         Installation parameters for threaded rod											
Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of elemen	t	d = d <sub>nom</sub>	[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 embedment depth		h <sub>ef,min</sub>	[mm]	60	60	70	80	90	96	108	120
		h <sub>ef,max</sub>	[mm]	160	200	240	320	400	480	540	600
Diameter of	Prepositioned installation 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 torque mo	noment T <sub>inst</sub> ≤		[Nm]	10	20	<b>40</b> <sup>1)</sup>	60	100	170	250	300
Minimum thickness of member h		h <sub>min</sub>	[mm]	h₀ ≥	h <sub>ef</sub> + 30 mm ≥ 100 mm		h <sub>ef</sub> + 2d <sub>0</sub>				
Minimum spacing s <sub>min</sub>		[mm]	40	50	60	75	95	115	125	140	
Minimum edge distance c <sub>min</sub>		[mm]	35	40	45	50	60	65	75	80	
<sup>1)</sup> Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm											

## Table B2: Installation parameters for rebar

Anchor size			Ø 81)	Ø 10 <sup>1)</sup>	Ø 121)	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Diameter of element	d = d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32
Nominal drill hole diameter	d <sub>0</sub>	[mm]	10 12	12 14	14 16	18	20	25	32	32	35	40
Effective embedment depth	h <sub>ef,min</sub>	[mm]	60	60	70	75	80	90	96	100	112	128
	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]	h <sub>ef</sub> + 30 mm ≥ 100 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

Anchor size			IT-M6	IT-M8	IT-M10	IT-M12	IT-M16	IT-M20
Internal diameter of anchor rod	d <sub>2</sub>	[mm]	6	8	10	12	16	20
Outer diameter of anchor rod <sup>1)</sup>	d = d <sub>nom</sub>	[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
Enective embedment depth	h <sub>ef,max</sub>	[mm]	200	240	320	400	480	600
Diameter of clearance hole in the fixture	d <sub>f</sub> ≤	[mm]	7	9	12	14	18	22
Maximum torque moment	T <sub>inst</sub> ≤	[Nm]	10	10	20	40	60	100
Thread engagement length min/max	I <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> + 30 mm ≥ 100 mm		h <sub>ef</sub> + 30 mm ≥ 100 mm h <sub>ef</sub>		- 2d₀	
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
$\frac{1}{10}$ With matrix threads according to BS EN 1002 1 9: 2005 + AC: 2010								

<sup>1)</sup> With metric threads according to BS EN 1993-1-8: 2005 + AC: 2010

### VJ Technology Injection System XPE440 for concrete

Intended Use

Installation parameters

Image: Second	n Installati					
Threaded Rod         Rebar         Internal threaded anchor rod         do Drill bit - Ø HD, HDB, CD, DD         db Brush - Ø         db,min min. Brush - Ø         Pisto plug           [mm]         [mm]         [mm]         [mm]         [mm]         [mm]         Pill bit - Ø Brush - Ø         Pisto min. Brush - Ø         Pisto min. Brush - Ø           [mm]         [mm]         [mm]         [mm]         [mm]         [mm]         Pill bit - Ø Brush - Ø         Pill bit diameters         Pill bit diameters         Pill bit diameters         Pill bit diameter (d): all diameters         Pill bit diameter	n Installati					
[mm]         [mm]         [mm]         [mm]         [mm]         [mm]           M8         8         10         PP10         11,5         10,5           M10         8 / 10         IT-M6         12         PP12         13,5         12,5           M12         10 / 12         IT-M8         14         PP14         15,5         14,5           12         16         PP16         17,5         16,5         16,5           M16         14         IT-M10         18         PP18         20,0         18,5         BR10           16         20         PP20         22,0         20,5         BR22           M20         IT-M12         22         PP22         24,0         22,5         BR23           M24         IT-M16         28         PP28         30,0         28,5         BR33           M27         30         PP30         31,8         30,5         BR33           M30         28         IT-M20         35         PP35         37,0         35,5         BR44           M30         28         IT-M20         35         PP35         37,0         35,5         BR44           M30 <t< th=""><th></th><th>ion directio of piston pl</th><th>n and use ug</th></t<>		ion directio of piston pl	n and use ug			
M8         8         10         PP10         11,5         10,5           M10         8 / 10         IT-M6         12         PP12         13,5         12,5           M12         10 / 12         IT-M8         14         PP14         15,5         14,5           12         16         PP16         17,5         16,5         14,5           M16         14         IT-M10         18         PP18         20,0         18,5         BR18           16         20         PP20         22,0         20,5         BR29           M20         IT-M12         22         PP22         24,0         22,5         BR29           M24         IT-M12         22         PP25         27,0         25,5         BR29           M27         30         PP30         31,8         30,5         BR39           M30         28         IT-M20         35         PP35         37,0         35,5         BR39           32         40         PP40         43,5         40,5         BR40	<b>↓</b>					
M10       8 / 10       IT-M6       12       PP12       13,5       12,5         M12       10 / 12       IT-M8       14       PP14       15,5       14,5         12       16       PP16       17,5       16,5         M16       14       IT-M10       18       PP18       20,0       18,5       BR10         16       20       PP20       22,0       20,5       BR22         M20       IT-M12       22       PP22       24,0       22,5       BR22         M24       IT-M16       28       PP28       30,0       28,5       BR33         M30       28       IT-M20       35       PP32       34,0       32,5       BR33         M30       28       IT-M20       35       PP35       37,0       35,5       BR33         M30       28       IT-M20       35       PP40       43,5       40,5       BR40         M40       IP40       43,5       40,5       BR40         Drill bit diameter (d_a); all diameters       Idiameters       Image: state stat						
M12       10 / 12       IT-M8       14       PP14       15,5       14,5         12       16       PP16       17,5       16,5         M16       14       IT-M10       18       PP18       20,0       18,5       BR13         16       20       PP20       22,0       20,5       BR24         M20       IT-M12       22       PP22       24,0       22,5       BR25         20       25       PP25       27,0       25,5       BR26         M24       IT-M16       28       PP28       30,0       28,5       BR36         M30       28       IT-M20       35       PP35       37,0       35,5       BR36         M30       28       IT-M20       35       PP35       37,0       35,5       BR36         M30       28       IT-M20       35       PP35       37,0       35,5       BR46         M30       28       IT-M20       35       PP40       43,5       40,5       BR46         Drill bit diameter (d_a): all diameters       40       PP40       43,5       40,5       BR46	N.a. alu					
12       16       PP16       17,5       16,5         M16       14       IT-M10       18       PP18       20,0       18,5       BR14         16       20       PP20       22,0       20,5       BR24         M20       IT-M12       22       PP22       24,0       22,5       BR25         M24       IT-M16       28       PP28       30,0       28,5       BR36         M27       30       PP30       31,8       30,5       BR36         M30       28       IT-M20       35       PP35       37,0       35,5       BR36         M30       28       IT-M20       35       PP40       43,5       40,5       BR46	No plu	ig required				
M16       14       IT-M10       18       PP18       20,0       18,5       BR18         16       20       PP20       22,0       20,5       BR20         M20       IT-M12       22       PP22       24,0       22,5       BR20         20       25       PP25       27,0       25,5       BR20         M24       IT-M16       28       PP28       30,0       28,5       BR30         M27       30       PP30       31,8       30,5       BR30         M30       28       IT-M20       35       PP35       37,0       35,5       BR30         32       40       PP40       43,5       40,5       BR40						
16       20       PP20       22,0       20,5       BR20         20       25       PP25       27,0       25,5       BR20         M24       IT-M16       28       PP28       30,0       28,5       BR30         M27       30       PP30       31,8       30,5       BR30         M26       1T-M20       35       PP35       37,0       35,5       BR30         M30       28       IT-M20       35       PP35       37,0       35,5       BR30         32       40       PP40       43,5       40,5       BR40						
M20       IT-M12       22       PP22       24,0       22,5       BR23         20       25       PP25       27,0       25,5       BR23         M24       IT-M16       28       PP28       30,0       28,5       BR23         M27       30       PP30       31,8       30,5       BR33         M27       32       PP32       34,0       32,5       BR33         M30       28       IT-M20       35       PP35       37,0       35,5       BR33         M30       28       IT-M20       35       PP40       43,5       40,5       BR40						
20       25       PP25       27,0       25,5       BR24         M24       IT-M16       28       PP28       30,0       28,5       BR34         M27       30       PP30       31,8       30,5       BR34         24 / 25       32       PP32       34,0       32,5       BR35         M30       28       IT-M20       35       PP35       37,0       35,5       BR35         32       40       PP40       43,5       40,5       BR46         CAC - Rec. compressed air tool (min 6 bar)         Drill bit diameter (d_a): all diameters       all diameters						
M24       IT-M16       28       PP28       30,0       28,5       BR24         M27       30       PP30       31,8       30,5       BR30         24 / 25       32       PP32       34,0       32,5       BR30         M30       28       IT-M20       35       PP35       37,0       35,5       BR30         32       40       PP40       43,5       40,5       BR40         CAC - Rec. compressed air tool (min 6 bar)         Drill bit diameter (d_a): all diameters       all diameters	h_>	h.>				
M27       30       PP30       31,8       30,5       BR30         24 / 25       32       PP32       34,0       32,5       BR33         M30       28       IT-M20       35       PP35       37,0       35,5       BR33         32       40       PP40       43,5       40,5       BR40         CAC - Rec. compressed air tool (min 6 bar)         Drill bit diameter (d_a): all diameters			all			
24 / 25       32       PP32       34,0       32,5       BR33         M30       28       IT-M20       35       PP35       37,0       35,5       BR33         32       40       PP40       43,5       40,5       BR40         CAC - Rec. compressed air tool (min 6 bar)         Drill bit diameters	250 mm	1   250 mm				
M30         28         IT-M20         35         PP35         37,0         35,5         BR33           32         40         PP40         43,5         40,5         BR40						
32     40     PP40     43,5     40,5     BR40       CAC - Rec. compressed air tool (min 6 bar)       Drill bit diameter (d_): all diameters						
CAC - Rec. compressed air tool (min 6 bar)         Drill bit diameter (d_0): all diameters         Image: Complex c						
VJ Technology Injection System XPE440 for concrete       Annex B 4         Intended Use       Cleaning and setting tools						

Installation instruct	ons	
Drilling of the bore	hole (HD, HDB, CD)	
	<ul> <li>1a. Hammer (HD) or compressed air drilling (CD)</li> <li>Drill a hole into the base material to the size and embedment de selected anchor (Table B1, B2, or B3). Proceed with Step 2. In case of aborted drill hole, the drill hole shall be filled with mort</li> </ul>	pth required by the ar.
	<b>1b.</b> Hollow drill bit system (HDB) (see Annex B 3) Drill a hole into the base material to the size and embedment de selected anchor (Table B1, B2, or B3). This drilling system remo the bore hole during drilling (all conditions). Proceed with Step 3 In case of aborted drill hole, the drill hole shall be filled with mort	pth required by the ves the dust and cleans ar.
	Attention! Standing water in the bore hole must be removed before	ore cleaning.
CAC: Cleaning for d	ry, wet and water-filled bore holes with all diameter in uncracked a	and cracked concrete
2x	2a. Starting from the bottom or back of the bore hole, blow the hole c compressed air (min. 6 bar) (Annex B 4) a minimum of two times stream is free of noticeable dust. If the bore hole ground is not real extension must be used.	lean with until return air ached an
	<ul> <li>Check brush diameter (Table B4). Brush the hole with an appropr</li> <li>d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.</li> <li>If the bore hole ground is not reached with the brush, a brush external</li> </ul>	iate sized wire brush ension must be used.
2x	2c. Finally blow the hole clean again with compressed air (min. 6 bar minimum of two times until return air stream is free of noticeable of ground is not reached an extension must be used.	) (Annex B 4) a dust. If the bore hole
	After cleaning, the bore hole has to be protected against re-ca an appropriate way, until dispensing the mortar in the bore ho the cleaning has to be repeated directly before dispensing the In-flowing water must not contaminate the bore hole again.	ontamination in ole. If necessary, e mortar.
VJ Technology Inje	ction System XPE440 for concrete	
Intended Use Installation instructior	ıs	Annex B 5

Installation instruct	ions	
Drilling of the bore	hole (DD)	
	<b>1a. Diamond drilling (DD)</b> Drill with diamond drill a hole into the base material to the size and required by the selected anchor (Table B1, B2, or B3). Proceed with In case of aborted drill hole, the drill hole shall be filled with mort	nd embedment depth with Step 2. ar.
SPCAC: Cleaning fo	r dry, wet and water-filled bore holes with all diameter in uncracke	ed concrete
	Attention! Standing water in the bore hole must be removed before	ore cleaning.
	2a. Rinsing with water until clear water comes out.	
	<ul> <li>2b. Check brush diameter (Table B4). Brush the hole with an appropr</li> <li>&gt; d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.</li> <li>If the bore hole ground is not reached with the brush, a brush external</li> </ul>	iate sized wire brush ension must be used.
	<b>2c.</b> Rinsing again with water until clear water comes out.	
2x	2d. Starting from the bottom or back of the bore hole, blow the hole of compressed air (min. 6 bar) (Annex B 4) a minimum of two times stream is free of noticeable dust. If the bore hole ground is not real extension must be used.	lean with until return air ached an
	<ul> <li>2e. Check brush diameter (Table B4). Brush the hole with an appropr</li> <li>&gt; d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.</li> <li>If the bore hole ground is not reached with the brush, a brush external</li> </ul>	iate sized wire brush ension must be used.
2x	2f. Finally blow the hole clean again with compressed air (min. 6 bar) minimum of two times until return air stream is free of noticeable of ground is not reached an extension must be used.	) (Annex B 4) a dust. If the bore hole
	After cleaning, the bore hole has to be protected against re-co an appropriate way, until dispensing the mortar in the bore ho the cleaning has to be repeated directly before dispensing the In-flowing water must not contaminate the bore hole again.	ontamination in ole. If necessary, e mortar.
VJ Technology Inje	ction System XPE440 for concrete	
Intended Use Installation instruction	ns	Annex B 6

Installation instruc	Installation instructions (continuation)				
	<ol> <li>Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.</li> <li>For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.</li> </ol>				
+ hef →	4. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.				
min. 3 full stroke	5. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey or red colour.				
	<b>6</b> Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used. Observe the gel-/ working times given in Table B5.				
	<ul> <li>7. Piston plugs and mixer nozzle extensions shall be used according to Table B4 for the following applications:         <ul> <li>Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-Ø d<sub>0</sub> ≥ 18 mm and embedment depth h<sub>ef</sub> &gt; 250mm</li> <li>Overhead assembly (vertical upwards direction): Drill bit-Ø d<sub>0</sub> ≥ 18 mm</li> </ul> </li> </ul>				
	8. 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.				
	9. After inserting the anchor, the annular gab between anchor rod and concrete, in case of a push through installation additionally also the fixture, must be complete filled with mortar. If excess mortar is not visible at the top of the hole, the requirement is not fulfilled and the application has to be renewed. For overhead application the anchor rod shall be fixed (e.g. wedges).				
20°C e.g.	10. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B5).				
Tinst	11. After full curing, the add-on part can be installed with up to the max. torque (Table B1 or B3) by using a calibrated torque wrench. In case of prepositioned installation the annular gab between anchor and fixture can be optional filled with mortar. Therefor substitute the washer by the filling washer and connect the mixer reduction nozzle to the tip of the mixer. The annular gap is filled with mortar, when mortar oozes out of the washer.				
VJ Technology Inje	ection System XPE440 for concrete				

#### Intended Use

Installation instructions (continuation)

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

### VJ Technology Injection System XPE440 for concrete

Intended Use Curing time

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

Siz	20			M8	M10	M12	M16	M20	M24	M27	M30				
Cro	oss section area	As	[mm²]	36,6	58	84,3	157	245	353	459	561				
Ch	aracteristic tension resistance, Steel failu	re <sup>1)</sup>													
Ste	eel, Property 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 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 class 8.8	N <sub>Rk,s</sub>	[kN]	29 (27)	46 (43)	67	125	196	282	368	449				
Sta	ainless steel A2, A4 and HCR, class 50	N <sub>Rk,s</sub>	[kN]	18	29	42	79	123	177	230	281				
Sta	ainless steel A2, A4 and HCR, class 70	N <sub>Rk,s</sub>	[kN]	26	41	59	110	171	247	-	-				
Sta	ainless steel A4 and HCR, class 80	N <sub>Rk,s</sub>	[kN]	29	46	67	126	196	282	-	-				
Ch	aracteristic tension resistance, Partial fac	tor <sup>2)</sup>													
Ste	eel, Property class 4.6 and 5.6	$\gamma_{Ms,N}$	[-]				2,0	)							
Ste	eel, Property class 4.8, 5.8 and 8.8	8 γ <sub>Ms,N</sub> [-] 1,5													
Sta	ainless steel A2, A4 and HCR, class 50	$\gamma_{Ms,N}$	[-]				2,8	6							
Sta	ainless steel A2, A4 and HCR, class 70	γMs,N	[-]				1,8	7							
Sta	ainless steel A4 and HCR, class 80	$\gamma_{Ms,N}$	[-]				1,6	6							
Ch	aracteristic shear resistance, Steel failure	1)													
u	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9 (8)	14 (13)	20	38	59	85	110	135				
r arr	Steel, Property class 5.6 and 5.8	V⁰ <sub>Rk,s</sub>	[kN]	11 (10)	17 (16)	25	47	74	106	138	168				
evei	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224				
out l	Stainless steel A2, A4 and HCR, class 50	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	9	15	21	39	61	88	115	140				
Nith	Stainless steel A2, A4 and HCR, class 70	V <sup>0</sup> Rk,s	[kN]	13	20	30	55	86	124	-	-				
	Stainless steel A4 and HCR, class 80	V <sup>0</sup> Rk,s	[kN]	15	23	34	63	98	141	-	-				
	Steel, Property class 4.6 and 4.8	M <sup>0</sup> Rk,s	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900				
arm	Steel, Property class 5.6 and 5.8	M <sup>0</sup> Rk,s	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123				
ver	Steel, Property class 8.8	M <sup>0</sup> Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797				
h le	Stainless steel A2, A4 and HCR, class 50	M <sup>0</sup> Rk,s	[Nm]	19	37	66	167	325	561	832	1125				
Wit	Stainless steel A2, A4 and HCR, class 70	M <sup>0</sup> Rk,s	[Nm]	26	52	92	232	454	784	-	-				
	Stainless steel A4 and HCR, class 80	M <sup>0</sup> Rk,s	[Nm]	30	59	105	266	519	896	-	-				
Ch	aracteristic shear resistance, Partial facto	r <sup>2)</sup>													
Ste	eel, Property class 4.6 and 5.6	γMs,V	[-]	[-] 1,67											
Ste	eel, Property class 4.8, 5.8 and 8.8	γMs,∨	[-]				1,2	5							
Sta	ainless steel A2, A4 and HCR, class 50	γMs,V	[-]				2,3	8							
Sta	ainless steel A2, A4 and HCR, class 70	γ <mark>Ms</mark> ,V	[-]				1,5	6							
Sta	ainless steel A4 and HCR, class 80	γMs,V	[-]				1,3	3							
1)	Values are only valid for the given stress area A	Values	s in brad	-kets are	valid for	undersiz	red thre	aded ro	ds with	smaller					

<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 BS EN ISO 10684: 2004 + AC: 2009
 <sup>2)</sup> in absence of national regulation

#### VJ Technology Injection System XPE440 for concrete

#### Performances

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

# Table C2: Characteristic values for Concrete cone failure and Splitting with all kind of action

Anchor				All Anchor type and sizes
Concrete cone fa	ailure			
Non-cracked con	crete	k <sub>ucr,N</sub>	[-]	11,0
Cracked concrete		k <sub>cr,N</sub>	[-]	7,7
Edge distance	dge distance		[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	Edge distance $2,0 > h/h_{ef} > 1,3$		[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>

#### VJ Technology Injection System XPE440 for concrete

#### Performances

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

# Table C3:Characteristic values of tension loads under static and quasi-static action<br/>for a service life of 50 years

		140	1440	1440	1440	1400	1404	1407			
Anchor size threaded ro	a			MIS	M10	M12	M16	M20	M24	M27	M30
Characteristic tension resi	intanco	N	[LN]			Δ • f		ee Tab			
	Islance	l'™Rk,s				∕rs 't					
Partial factor		<sup>γ</sup> Ms,Ν	[-]				see la	able C1			
Combined pull-out and o	concrete failure					-1 (1)				- 1 - 1 - 20	1
holes (CD)			20/25 in nar	nmer d	iriliea n	oles (H	D) and	compr	ressea	air drill	ea
ا عناق ا: 40°C/24°C ا عناق ا: 40°C/24°C	Dry, wet concrete and		[N/mm²]	20	20	19	19	18	17	16	16
ଇ ଅ ା: 72°C/50°C	flooded bore hole		[]	15	15	15	14	13	13	12	12
Characteristic bond resista	ance in non-crack	ed concrete C2	20/25 in har	nmer d	Irilled h	oles wi	th hollo	w drill	bit (HD	B)	
୍ରକ୍ର l: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
ਸ਼ੁੱ ਗੁ ∐: 72°C/50°C	concrete		FN 1 / 27	14	14	14	13	13	12	12	11
ାର୍ଥ୍ୟ°C/24°C	flooded bore	<sup>T</sup> Rk,ucr	[ [N/mm²]	16	16	16	15	15	14	14	13
Historica Historica Hole				14	14	14	13	13	12	12	11
Characteristic bond resistance in cracked concrete C20/25 in hamme				r drilled	holes	(HD)	compre	essed a	air drille	d holes	• · · · •
and with hollow drill bit (H	DB)					(	p				- ()
l: 40°C/24°C	Dry, wet concrete and	T.	[NI/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
u u u u u u u u u u u u u u	flooded bore hole	'Rk,cr		6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor $\psi^0_{sus}$ in (	cracked and non-	cracked concre	te C20/25 i	in hamı	mer dril	led hol	es (HD	), com	oressed	l air dri	lled
holes (CD) and with hollow	v drill bit (HDB)			1							
eration in the second s	Dry, wet concrete and	)// <sup>0</sup>	r_1	0,80							
und term term transformed to the second sec	flooded bore hole	+ sus					0,	68			
		C25/30					1,	02			
		C30/37					1,	04			
Increasing factors for cond	crete	C35/45					1,	07			
Ψc		C40/50					1,	08			
		C45/55					1,	10			
Concrete cone failure		1050/60					Ι,	10			
Relevant parameter							see Ta	ble C2			
Splitting											
Relevant parameter							see Ta	ble C2			
Installation factor											
for dry and wet concrete (	HD; HDB, CD)		r 1				1	,0			
for flooded bore hole (HD;	HDB, CD)	rinst	[-]				1	,2			
VJ Technology Injection System XPE440 for concrete         Performances         Characteristic values of tension loads under static and quasi-static action									Anne	x C 3	

# Table C4:Characteristic values of tension loads under static and quasi-static action<br/>for a service life of 100 years

Anchor size threaded ro	Ichor size threaded rod						M16	M20	M24	M27	M30	
Steel failure						• r						
Characteristic tension resi	stance	N <sub>Rk,s</sub>	[kN]			As·f	ık (or s	ee lab	le C1)			
Partial factor		γMs,N	[-]				see Ta	ble C1				
Combined pull-out and c	concrete failure											
Characteristic bond resista holes (CD)	ance in non-crack	ed concrete C2	20/25 in har	nmer d	Irilled h	oles (H	D) and	compr	essed	air drill	ed	
Temperature range I: A0,5/7,0,05 I: C/5/2,05	Dry, wet concrete and flooded bore hole	<sup>T</sup> Rk,ucr,100	[N/mm²]	20	20	19	19	18	17	16	16	
Characteristic bond resista	ance in non-crack	ed concrete C2	20/25 in har	nmer d	Irilled h	oles wi	th hollc	w drill	bit (HD	B)		
de la construction de la constru	Dry, wet concrete	T	[N]/mm2]	17	16	16	16	15	14	14	13	
⊌ ⊑ □ □ □ □ □ □ □ □ □ □ □ □ □	I:     40°C/24°C     flooded bore hole     *Rk,ucr,100     [10/11/11]			16	16	16	15	15	14	14	13	
Characteristic bond resista and with hollow drill bit (HI	ance in cracked c DB)	oncrete C20/25	in hamme	r drillec	holes	(HD) ,	compre	essed a	ir drille	d holes	s (CD)	
Temperature Tange I: 40°C/24°C	Dry, wet concrete and flooded bore hole	<sup>T</sup> Rk,cr,100	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	
· ·		C25/30			11		1,	02				
		C30/37					1,0	04				
Increasing factors for cond	crete	C35/45					1,0	07				
$\Psi_{c}$		C40/50	C40/50 1,									
		C45/55		1,09								
		C50/60		1,10								
Concrete cone failure												
Relevant parameter							see Ta	ble C2				
Splitting												
Relevant parameter							see la	ble C2				
Installation factor		1						0				
for flooded bore hole (HD)		γ <sub>inst</sub>	[-]				<u>ا</u> 1	2				
or flooded bore hole (HD; HDB, CD) <sup>7</sup> inst [-] 1,2												
VJ Technology Injectio	on System XPE	440 for concre	ete									
Performances Characteristic values of ter	Performances Characteristic values of tension loads under static and quasi-static action								Anne	x C 4		

# Table C5:Characteristic values of tension loads under static and quasi-static action<br/>for a service life of 50 years

Awahayaina thusadad ya			MO	8440	8440	MAC	1400	1404	1407	1420				
Anchor size threaded roo	u			δIVI		W1Z	W116	IVI20	IVI24	IVIZ/	IVI JU			
	-1	N	FL.N.17			۸ . ۴	. (or a	oo Tah						
Unaracteristic tension resi	stance	l'™Rk,s				<sup>γ</sup> s <sup>•</sup> ι								
Partial factor		<sup>γ</sup> Ms,N	[-]				see Ta	able C1						
Combined pull-out and c	concrete failure													
Characteristic bond resista	ance in non-crack	ed concrete C2	20/25 in dia	mond o	drilled h	oles (E	D)							
l: 40°C/24°C aude : 	Dry, wet concrete and flooded bore	<sup>7</sup> Rk,ucr	[N/mm²]	15	14	14	13	12	12	11	11			
ال: 72°C/50°C	hole			12	12	11	10	9,5	9,5	9,0	9,0			
Reduction factor $\psi^0_{sus}$ in r	non-cracked conc	rete C20/25 in	diamond dı	rilled ho	oles (Dl	D)								
L: 40°C/24°C	Dry, wet concrete and flooded bore	$\Psi^0$ sus	[-]				0,	77						
⊑	hole						0,	72						
		C25/30		1,04										
		C30/37					1,	08						
Increasing factors for conc					1,	12								
Ψc					1,	15								
C45/55							1,	17						
		1,19												
Concrete cone failure				1										
Relevant parameter							see Ta	able C2						
Splitting														
Relevant parameter				see Table C2										
Installation factor		1		1.0										
for flooded bore bole (DD)	וטכ	γ <sub>inst</sub>	[-]	1,0										
					1,2				1,4					
VJ Technology Injectio	VJ Technology Injection System XPE440 for concrete													
Performances Characteristic values of ter	erformances haracteristic values of tension loads under static and quasi-static act								Anne	x C 5				

Table C6:         Characteristic values of shear loads under static and quasi-static action												
Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30		
Steel failure without lever arm						•						
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	V <sup>0</sup> Rk,s	[kN]			0,6 •	A <sub>s</sub> ∙f <sub>uk</sub>	(or see	Table C	1)			
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 C	1)			
Partial factor	<sup>γ</sup> Ms,∨	[-]				see	Table C	1				
Ductility factor	<b>k</b> 7	[-]					1,0					
Steel failure with lever arm												
Characteristic bending moment	M <sup>0</sup> Rk,s	[Nm]			1,2 •	W <sub>el</sub> ∙ f <sub>uk</sub>	、(or see	Table C	21)			
Elastic section modulus         W <sub>el</sub> [mm³]         31         62         109         277         541         935         1387         1874												
Partial factor	γMs,∨	[-]				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	۱ <sub>f</sub>	[mm]		n	nin(h <sub>ef</sub> ; ^	12 • 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					
nstallation factor												
VJ Technology Injection System X Performances Characteristic values of shear loads under	VJ Technology Injection System XPE440 for concrete Performances Characteristic values of shear loads under static and quasi-static action											

#### Table C7: Characteristic values of tension loads under static and guasi-static action for a service life of 50 years Anchor size internal threaded anchor rods IT-M6 IT-M8 IT-M10 IT-M12 IT-M16 IT-M20 Steel failure<sup>1)</sup> N<sub>Rk.s</sub> [kN] 10 17 29 42 76 123 Characteristic tension resistance. 5.8 Steel, strength class 8.8 [kN] 16 27 46 67 121 196 N<sub>Rk.s</sub> Partial factor, strength class 5.8 and 8.8 1.5 [-] γMs,N Characteristic tension resistance, Stainless N<sub>Rk.s</sub> 14 26 59 110 124 [kN] 41 Steel A4 and HCR, Strength class 70<sup>2)</sup> Partial factor [-] 1,87 2,86 γMs,N Combined pull-out and concrete cone failure Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drilled holes (CD) Dry, wet I: 40°C/24°C 20 19 18 17 19 16 concrete and Temperature [N/mm<sup>2</sup>] <sup>τ</sup>Rk.ucr flooded bore range II: 72°C/50°C 15 15 14 13 13 12 hole Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB) I: 40°C/24°C Dry, wet 16 16 16 15 14 13 Temperature II: 72°C/50°C concrete 14 14 13 13 12 11 [N/mm<sup>2</sup>] <sup>τ</sup>Rk,ucr range I: 40°C/24°C flooded bore 16 16 15 15 14 13 II: 72°C/50°C hole 14 14 13 13 12 11 Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) Dry, wet 1: 40°C/24°C 7.0 8.5 8.5 8.5 8.5 8.5 concrete and Temperature [N/mm<sup>2</sup>] <sup>τ</sup>Rk.cr range flooded bore II: 72°C/50°C 6.0 7.0 7.0 7.0 7.0 7.0 hole Reduction factor $\psi^0_{sus}$ in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) Dry, wet I: 40°C/24°C 0.80 Temperature concrete and $\Psi^0$ sus [-] flooded bore range II: 72°C/50°C 0.68 hole C25/30 1.02 C30/37 1,04 Increasing factors for concrete C35/45 1,07 C40/50 1,08 Ψc C45/55 1,09 C50/60 1,10 Concrete cone failure Relevant parameter see Table C2 Splitting failure Relevant parameter see Table C2 Installation factor for dry and wet concrete (HD; HDB, CD) 1.0 [-] γinst for flooded bore hole (HD; HDB, CD) 1.2 <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. 2) For IT-M20 strength class 50 is valid VJ Technology Injection System XPE440 for concrete Annex C 7 Performances Characteristic values of tension loads under static and quasi-static action

Table C8:Characteristic values of tension loads under static and quasi-static action for a service life of 100 years											
Anchor size internal thread	ed anchor rods	<u> </u>		IT-M6	IT-M8	IT-M10	IT-M12	IT-M16	IT-M20		
Steel failure <sup>1)</sup>											
Characteristic tension resistar	nce, <u>5</u> .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	5.8 and 8.8	γMs,N	[-]			1	5				
Characteristic tension resistar Steel A4 and HCR, Strength of	nce, Stainless class 70 <sup>2)</sup>	N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124		
Partial factor		γMs,N	[-]			1,87			2,86		
Combined pull-out and con	crete cone fail	ure									
Characteristic bond resistan holes (CD)	ce in non-crac	ked concre	te C20/2	5 in hamm	ner drilled	holes (HD	) and com	pressed a	air drilled		
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	<sup>7</sup> Rk,ucr,100	[N/mm²]	20	19	19	18	17	16		
Characteristic bond resistance	e in non-cracke	d concrete	C20/25 in	hammer	drilled hole	es with ho	llow drill b	it (HDB)			
Temperature	Dry, wet concrete	Tol 400	[N/mm²]	16	16	16	15	14	13		
range I: 40°C/24°C	flooded bore hole	*RK,ucr,100		16	16	15	15	14	13		
Characteristic bond resistance	e in cracked co	ncrete C20/	25 in ham	nmer drille	d holes (⊦	ID), comp	ressed air	drilled ho	les (CD)		
	Dry wet										
Temperature I: 40°C/24°C range	concrete and flooded bore hole	<sup>τ</sup> Rk,cr,100	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5		
		C25	/30			1,	02				
		C30	/37			1,1	04				
Increasing factors for concrete	e	C35	/45			1,1	07				
Ψc		C40	/50			1,0	08				
		C50	/60			1,	10				
Concrete cone failure						- ,					
Relevant parameter						see Ta	ble C2				
Splitting failure											
Relevant parameter						see Ta	ble C2				
Installation factor											
for dry and wet concrete (HD;	HDB, CD)	Yinst	[ [-] ]			1,	0				
for flooded bore hole (HD; HD	B, CD)	' III St				1,	2				
<ol> <li>Fastenings (incl. nut and rod. The characteristic te</li> <li>For IT-M20 strength clas</li> </ol>	washer) must c ension resistance s 50 is valid	omply with t	he approp ilure is vali	riate mate	rial and pro	operty clas	s of the int	ernal threa	ıded ment.		
VJ Technology Injection \$	System XPE44	40 for con	crete								
Performances Characteristic values of tensio	n loads under st	atic and qua	asi-static a	ction				Annex C	8		

Table C9:Characteristic values of tension loads under static and quasi-static action for a service life of 50 years												
Anchor size internal threaded	l anchor rods			IT-M6	IT-M8	IT-M10	IT-M12	IT-M16	IT-M20			
Steel failure <sup>1)</sup>												
Characteristic tension resistanc	e, 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 resistanc Steel A4 and HCR, Strength cla	e, Stainless ass 70 <sup>2)</sup>	N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124			
Partial factor		γMs,N	[-]			1,87			2,86			
Combined pull-out and concr	ete cone failu	e	L1									
Characteristic bond resistance	e in non-cracke	ed concre	ete C20/2	5 in diamo	ond drilled	holes (DD	))					
Temperature _: 40°C/24°C	Dry, wet concrete and	TPL	[N/mm²]	14	14	13	12	12	11			
range II: 72°C/50°C	flooded bore hole	*Rk,ucr	[14/11111]	12	11	10	9,5	9,5	9,0			
Reduction factor $\psi^0_{sus}$ in non-	cracked concr	ete C20/2	25 in diam	ond drille	d holes (E	DD)						
Temperature _: 40°C/24°C	Dry, wet concrete and	0				0,	77					
range II: 72°C/50°C	flooded bore hole	Ψ <sup>°</sup> sus	[-]			0,	72					
		C2	5/30			1,	04					
		C30	0/37			1,	08					
Increasing factors for concrete		C3	5/45			1,	12					
Ψc			J/50	1,15								
		C45/55 1,1/ C50/60 111						)				
Concrete cone failure		1,13										
Relevant parameter						see Ta	ble C2					
Splitting failure												
Relevant parameter						see Ta	ble C2					
Installation factor			- <u> </u>									
for dry and wet concrete (DD)		γ <sub>inst</sub>	[-]			1	,0	4				
				1	, <b>Z</b>		1	,4				
<ul> <li>Pastenings (incl. nut and w rod. The characteristic tens</li> <li><sup>2)</sup> For IT-M20 strength class</li> </ul>	Or flooded bore hole (DD)       Yinst       [-]       1,2       1,4         1       Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.         2)       For IT-M20 strength class 50 is valid											
VJ Technology Injection Sy	/stem XPE44(	) for con	crete					_				
Performances Characteristic values of tension	loads under stat	ic and qua	asi-static a	ction				Annex C	;9			

Table C10: Characteristic values of shear loads under static and quasi-static action										
IT-Me	6 IT-M8	IT-M10	IT-M12	IT-M16	IT-M20					
] 5	9	15	21	38	61					
] 8	14	23	34	60	98					
			1,25		1					
] 7	13	20	30	55	40					
		1,56			2,38					
			1,0							
] 8	19	37	66	167	325					
] 12	30	60	105	267	519					
		_	1,25		-					
] 11	26	52	92	233	456					
		1,56			2,38					
			2,0							
			1,0							
]	min(	[h <sub>ef</sub> ; 12 ⋅ c	a <sub>nom</sub> )		min(h <sub>ef</sub> ; 300mm)					
] 10	12	16	20	24	30					
			1,0							
propriate d for the i	material and	d property aded rod a	class of th	ie internal stening ele	threaded rod. ement.					
VJ Technology Injection System XPE440 for concrete Performances Characteristic values of shear loads under static and quasi-static action										
	<b>ete</b> tatic actic	<b>ete</b> tatic action	<b>ete</b> tatic action	<b>ete</b> tatic action	ete tatic action					

Table C11: Characteristic values of tension loads under static and quasi-static action         for a service life of 50 years													
IOF a	ng bar	or so yea	15	a	Ø 10	Q 12	(X 14	Ø 16	<i>a</i> 20	(X 24	(X 25	a 28	a 22
Steel failure	ng bar			00		12	14	010	w 20	W 24	Ø 25	Ø 20	Ø 32
Characteristic tension	resistance	Noka	[kN]					Α. •	f <sup>1)</sup>				
Cross section area		A A		50	70	113	154	201	-uk 314	452	101	616	804
Dortial factor		/`s		50	79	113	154	201	(J) (12)	452	491	010	004
		<sup>γ</sup> Ms,N	[ [-]					1,	4 <sup>2</sup> /				
Combined pull-out an	nd concrete failt	ire areakad aa	noroto CC	0/05 :			بالممالة						اء ما
holes (CD)				1	n nam	mer ar			10) an		presse		rillea
C/24°C :: 40°C/24°C	Dry, wet concrete and		[N/mm²]	16	16	16	16	16	16	15	15	15	15
ີ້ <sup>ຫຼ</sup> ິຍ ຍິ່ງ II: 72°C/50°C	hole			12	12	12	12	12	12	12	12	11	11
Characteristic bond res	sistance in non-c	racked conc	rete C20/2	25 in h	amme	r drilleo	d holes	s with I	hollow	drill bi	t (HDE	3)	
<u>ଥ</u> <u>l:</u> 40°C/24°C	Dry, wet			14	14	13	13	13	13	13	13	13	13
ਸ਼ੁੱਲੂ <u>II:</u> 72°C/50°C	concrete		1.1.1	12	12	12	11	11	11	11	11	11	11
କୁହୁଁ <u> </u> : 40°C/24°C	flooded bore	<sup>1</sup> Rk,ucr	[[N/mm²]	13	13	13	13	13	13	13	13	13	13
⊢ II: 72°C/50°C	hole			11	11	11	11	11	11	11	11	11	11
Characteristic bond resistance in cracked concrete C20/25					er drill	ed hol	es (HE	D), con	npress	ed air	drilled	holes	(CD)
e			1	1	ł								
C/24°C I: 40°C/24°C	Dry, wet concrete and	<sup>7</sup> Rk,cr	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
E U: 72°C/50°C	hole	,		6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor $\psi^0_{su}$	<sub>s</sub> in cracked and	l non-cracke	ed concre	te C20	)/25 in	hamm	ner dril	led ho	les (H	D), cor	npress	ed air	
drilled holes (CD) and	with hollow drill	bit (HDB)	1										
l: 40°C/24°C	Dry, wet concrete and	0110						0,	80				
ق تق ق اا: 2°C/50°C	flooded bore hole	Ψ sus						0,	68				
		C25,	/30					1,	02				
		C30,	/37					1,	04				
Increasing factors for c	concrete	C35,	/45					1,	07				
Ψc		C40/	/50					1,	08				
		C45,	/55					1,	09				
		C50,	/60					1,	10				
Concrete cone failure								T		<u> </u>			
Splitting								see 12	able C.	2			
Polovant parameter										<u>ີ</u>			
										2			
for dry and wet concret								1	0				
for flooded bore hole (		γinst	[-]					1	,0 2				
<sup>1)</sup> f <sub>uk</sub> shall be taken from <sup>2)</sup> in absence of nationa	n the specificatior al regulation	ns of reinforci	ng bars	I					,_				
VJ Technology Inje	ction System X	(PE440 for	concrete										
Performances Characteristic values of tension loads under static and quasi-static action													

Table C12: Characteristic values of tension loads under static and quasi-static action         for a service life of 100 years												
Anchor size 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 tension resistance	N <sub>Rks</sub>	[kN]					A <sub>s</sub> ·	f <sub>uk</sub> <sup>1)</sup>				
Cross section area	A <sub>s</sub>	[mm <sup>2</sup> ]	50	79	113	154	201	314	452	491	616	804
Partial factor	YMe N	[-1					1	Δ <sup>2)</sup>				
Combined pull-out and concrete	failure						•,	•				
Characteristic bond resistance in holes (CD)	non-cracked co	oncrete C2	:0/25 i	n ham	mer dr	illed h	oles (ŀ	HD) an	d com	presse	ed air c	rilled
Dry, wet be a difference be l: 40°C/24°C flooded bo hole	nd re <sup>T</sup> Rk,ucr,100	[N/mm²]	16	16	16	16	16	16	15	15	15	15
Characteristic bond resistance in r	non-cracked conc	rete C20/2	5 in ha	ammei	r drilleo	d holes	s with	hollow	drill bi	t (HDE	3)	
L: 40°C/24°C Dry, wet concrete	τ	[NI/mm2]	14	14	13	13	13	13	13	13	13	13
E l: 40°C/24°C flooded bo ⊢ l: 40°C/24°C hole		13	13	13	13	13	13	13	13	13	13	
Characteristic bond resistance in c and with hollow drill bit (HDB)	C20/25 in	hamm	er drill	ed hol	es (HE	), con	npress	ed air	drilled	holes	(CD)	
Dry, wet concrete a flooded bo hole	nd re <sup>T</sup> Rk,cr,100	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
	C25	/30					1,	02				
	C30	/37					1,	04				
Increasing factors for concrete	C35	/45	1,07									
$\Psi_{c}$	C40	/50					1,	08				
	C45	/55					1,	09				
Concrete cone failure	050	/60					Ι,	10				
Relevant parameter							see Ta	able Cí	2			
Splitting							000 10		_			
Relevant parameter							see Ta	able C	2			
Installation factor												
for dry and wet concrete (HD; HDB	5, CD)						1	,0				
for flooded bore hole (HD; HDB, CI	D) <sup>Y</sup> inst	[ [-]					1	,2				
<sup>1)</sup> f <sub>uk</sub> shall be taken from the specifi <sup>2)</sup> in absence of national regulation	cations of reinforci	ng bars										
VJ Technology Injection Syst	em XPE440 for	concrete									_	
<b>Performances</b> Characteristic values of tension loads under static and quasi-static action									A	nnex	C 12	2

Table C13: Char for a	Table C13: Characteristic values of tension loads under static and quasi-static action           for a service life of 50 years												
Anchor size reinforci	ng bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure						1							
Characteristic tension r	resistance	N <sub>Rk.s</sub>	[kN]					As	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 N</sub>	[-]			1		1.	4 <sup>2)</sup>				
Combined pull-out an	d concrete failu	Ire						,					
Characteristic bond re	sistance in non	-cracked co	ncrete C2	0/25 i	n diam	nond d	rilled h	oles (l	DD)				
berature ber	Dry, wet concrete and flooded bore	<sup>7</sup> Rk,ucr	[N/mm²]	14	13	13	13	12	12	11	11	11	11
Ē <sup>≌</sup> Ⅱ: 72°C/50°C	hole			11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor $\psi^0_{sus}$	<sub>s</sub> in non-cracked	l concrete C	20/25 in c	diamor	nd drill	ed hol	es (DD	)					
l: 40°C/24°C	Dry, wet concrete and flooded bore	$\Psi^0$ sus	[-]					0,	77				
ଞ୍ଚି <sup>22</sup> II: 72°C/50°C	hole							0,	72				
		C25,	/30					1,	04				
		C30,	/37					1,	08				
Increasing factors for c	oncrete	C35,	/45					1,	12				
ΨC		C40/	/55					1, 1	17				
	/60					1, 1.	19						
Concrete cone failure	)							.,					
Relevant parameter							:	see Ta	able C2	2			
Splitting													
Relevant parameter							:	see Ta	able C2	2			
Installation factor													
for dry and wet concret	e (DD)	Yinst	[-]					1	,0				
for flooded bore hole (	DD)	, mor			1	,2				1	,4		
for dry and wet concrete (DD) for flooded bore hole (DD) <sup>1</sup> f <sub>uk</sub> shall be taken from the specifications of reinforcing bars <sup>2</sup> in absence of national regulation													
VJ Technology Injer	VJ Technology Injection System XPE440 for concrete Performances Characteristic values of tension loads under static and quasi-static action										nnex	C 13	3
	haracteristic values of tension loads under static and quasi-static action												

Table C14: Characteristic va	alues of	shear	load	s un	der s	stati	c and	d qua	asi-sta	atic ac	ction	
Anchor size reinforcing bar			Ø 8	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	• A <sub>s</sub> •	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	γMs,V	[-]		•			•	1,5 <sup>2)</sup>				
Ductility factor	k <sub>7</sub>	[-]						1,0				
Steel failure with lever arm												
Characteristic bending moment	M <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	γMs,V	[-]	1,5 <sup>2)</sup>									
Concrete pry-out failure												
Factor	k <sub>8</sub>	[-]						2,0				
Installation factor	$\gamma$ inst	[-]						1,0				
Concrete edge failure												
Effective length of fastener	lf	[mm]			min(h	<sub>ef</sub> ; 12	• d <sub>nor</sub>	n)		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	$\gamma_{inst}$	[-]						1,0				
Outside diameter of fastener         d <sub>nom</sub> [mm]         8         10         12         14         16         20         24         25         28         32           Installation factor $\gamma_{inst}$ [-]												
VJ Technology Injection System XPE440 for concrete Performances Characteristic values of shear loads under static and quasi-static action										Ann	ex C 1	4

### Table C17: Displacements under tension load<sup>1)</sup> in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)

Anchor size threaded ro	bd		M8	M10	M12	M16	M20	M24	M27	M30		
Non-cracked concrete C	220/25 under	static and quasi-	static ac	tion for	a servio	ce life of	50 year	rs				
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 C20/25 under static and quasi-static action for a service life of 50 years												
Temperature range l: 40°C/24°C	δ <sub>N0</sub> -factor	[mm/(N/mm <sup>2</sup> )]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082		
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171		
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	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)]	0,259	0,154	0,163	0,172	0,181	0,189	0,207	0,229		
Non-cracked concrete (	220/25 under	static and quasi-	static ac	tion for	a servio	e life of	100 yea	ars				
Temperature range I:	δ <sub>N0</sub> -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/mm <sup>2</sup> )]	0,028	0,030	0,031	0,033	0,036	0,038	0,040	0,042		
Cracked concrete C20/2	25 under stati	ic and quasi-stati	c action	for a se	rvice lif	e of 100	years					
Temperature range I:         δ           40°C/24°C         δ	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082		
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171		
		-										

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

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

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

### Table C15: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Anchor size threaded ro	Anchor size threaded rod					M16	M20	M24	M27	M30
Non-cracked concrete C	20/25 under	static and quasi-	static ac	tion for	a servio	ce life of	f 50 year	ſS		
Temperature range l: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
	$\delta_{N\infty}$ -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	$\delta_{N0}$ -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

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

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

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

### Table C16: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size threa	ded rod	M8	M10	M12	M16	M20	M24	M27	M30	
Non-cracked and	cracked concret	e C20/25 under st	atic and q	uasi-sta	tic actio	n				
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>2)</sup> Calculation of $\delta_{V0} = \delta_{V0}$ -facto $\delta_{V\infty} = \delta_{V\infty}$ -facto	the displacement r → V; r → V;	ear load								
VJ Technology I Performances		Anr	nex C <sup>/</sup>	15						

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

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

Anchor size Inter	mal thre	adad anak	orrad				10	IT M10					
Anchor size inter	nai unre	20/25 und	r statio and			n for a	00				11-11/20		
		20/25 unue					sen			<b>s</b>	0.044		
I emperature rar	nge I:	Su factor	[]//////	N/IIII-)]	0,029	0,03	20	0,033	0,035	0,030	0,041		
+0 0/24 0		N∞-lactor	[[[[[[]]/([	N/IIII <sup>-</sup> )]	0,029	0,03	10	0,033	0,035	0,030	0,041		
Temperature ran	nge II:	NO-lactor	[mm/()	v/mm²)]	0,039	0,04	+U = 4	0,044	0,047	0,051	0,055		
rz crockod concrete	0.00/21	<sup>0</sup> N∞ <sup>-lactol</sup>	[mm/()	v/mm²)]	0,049			0,055	0,059	0,064	0,070		
		Suc-factor					72			0.070	0.082		
1 emperature rar 40°C/24°C	nge I:	δ <sub>N</sub> -factor	[[[[]]/(]	1/mm <sup>2</sup> )]	0,071	0,07	י <u>ב</u> ייב	0,074	0,070	0,079	0,002		
		δ <sub>N∞</sub> factor	[mm//]	1/mm <sup>2</sup> )]	0,115	0,12	22	0,120	0,100	0,142	0,171		
72°C/50°C	ige II:	δN -factor	[[[[[]]/(]	$\sqrt{(mm^2)}$	0,095	0,0	30	0,099	0,102	0,100	0,110		
Non-cracked con	crete C	20/25 unde	r static and		tatic acti	on for a	son	10,172	f 100 voa	re	0,223		
		δNo-factor		$1/mm^2$			301			0.038	0.041		
40°C/24°C	nge I:	δ <sub>N</sub> -factor	· [mm/()	$\frac{1}{mm^2}$	0,023	0,00	30	0,000	0,000	0,030	0.042		
Gracked concrete	C20/2	under st	tic and qua	viiiiii)j	action fo		vice	0,033  ife of 100	Vears	0,038	0,042		
		δυο-factor		131-3tatic			72			0.079	0.082		
40°C/24°C	ige i.	δ <sub>Nu</sub> -factor	· [mm/()	V/mm <sup>2</sup> )]	0,071	0,07	2	0,074	0,070	0,073	0.171		
		0,100	0,142	0,171									
Table C19: D	δN0 = δN0-factor · τ; τ: action bond stress for tension δN∞ = δN∞-factor · τ;  Table C19: Displacements under tension load <sup>1)</sup> in diamond drilled holes (DD)												
Anchor size Inter	nal thre	aded ancl	or rod		IT-M6	IT-N	/18	IT-M10	IT-M12	2 IT-M16	IT-M20		
Non-cracked con	crete C	20/25 unde	er static and	l quasi-s	tatic acti	on for a	ser	vice life o	f 50 years	S	1		
Temperature rar	nge I:	$\delta_{N0}$ -factor	[mm/(l	V/mm²)]	0,012	0,01	12	0,013	0,014	0,014	0,015		
40°C/24°C	-	$\delta_{N\infty}$ -factor	[mm/(l	N/mm²)]	0,019	0,01	19	0,020	0,022	0,023	0,025		
Temperature rar	nge II:	$\delta_{N0}$ -factor	[mm/(l	N/mm²)]	0,014	0,01	14	0,015	0,016	0,016	0,018		
72°C/50°C		$\delta_{N\infty}$ -factor	[mm/(l	V/mm²)]	0,053	0,05	55	0,058	0,062	0,065	0,070		
<sup>1)</sup> Calculation of $\delta_{N0} = \delta_{N0}$ -facto $\delta_{N\infty} = \delta_{N\infty}$ -facto <b>Table C20: D</b>	the disp or · τ; or · τ; <b>)isplac</b>	lacement	τ: action under sh	on bond s lear loa	tress for te ad <sup>2)</sup> for	ension all dril	llinç	g metho	ds				
Anchor size Inter	mal thre	eaded anch	or rod	IT-	M6 I	T-M8	IT	-M10	IT-M12	IT-M16	IT-M20		
Non-cracked and	cracke	d concrete	e C20/25 un	der stati	c and qua	isi-stati	c act	tion					
All temperature	δ <sub>V0</sub> -fa	ctor	[mm/kN]	0,0	07	0,06	(	0,06	0,05	0,04	0,04		
ranges	$\delta_{V\infty}$ -fa	actor	[mm/kN]	0,	10	0,09	(	0,08	0,08	0,06	0,06		
<sup>2)</sup> Calculation of $\delta_{V0} = \delta_{V0}$ -facto $\delta_{V\infty} = \delta_{V\infty}$ -facto	the disp or →V; or →V;	lacement V:	action shear	load									
VJ Technology Injection System XPE440 for concrete         Performances         Displacements under static and quasi-static action (Internal threaded anchor rod)											C 16		

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

Anchor size reinfo	orcing bar		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked conc	rete C20/25	under static an	d quasi	-static	action f	or a se	rvice li	fe of 50	years			
Temp range l:	$\delta_{N0}$ -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:	$\delta_{N0}$ -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 C20/25 under static and quasi-static action for a service life of 50 years												
Temp range l:	$\delta_{N0}$ -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
Non-cracked conc	rete C20/25	under static an	d quasi	-static	action f	or a se	rvice li	fe of 10	0 years	i		
Temp range l:	$\delta_{N0}$ -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	0,030	0,031	0,032	0,033	0,036	0,039	0,039	0,041	0,043
Cracked concrete	C20/25 und	er static and qu	asi-stat	ic actio	n for a	service	e life of	100 ye	ars			
Temp range I:         δ           40°C/24°C         δ	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194

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

Anchor size reinfo	orcing bar		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked conc	under static and	d quasi	-static a	action f	<sup>i</sup> or a se	rvice lit	fe of 50	years				
Temp range l:	$\delta_{\text{N0}}$ -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: د 72°C/50°C د	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088

<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  $\cdot \tau$ ;

### Table C23: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
For concrete C20/25 under static and quasi-static action												
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>2)</sup> Calculation of the displacement

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

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

### VJ Technology Injection System XPE440 for concrete

#### Performances

Displacements under static and quasi-static action (rebar)

# Table C24: Characteristic values of tension loads under seismic action (performance category C1+C2

Anchor size threaded	rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure		1		1							
(Seismic C1)	esistance	N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	N <sub>Rk,s</sub>			
Characteristic tension re (Seismic C2) Steel, strength class 8.8 Stainless Steel A4 and Strength class ≥70	esistance, 3 HCR,	N <sub>Rk,s,eq,C2</sub>	[kN]	۲ perfor assa	lo mance assed		1,0 •	N <sub>Rk,s</sub>		N perfor assa	lo mance issed
Partial factor		γMs N	[-]				see Ta	able C1		I	
Combined pull-out and	d concrete failure	1013,11									
Characteristic bond residual drilled holes (CD) and	istance in cracked a with hollow drill bit (I	nd non-cracked HDB)	d concrete	C20/25	in ham	nmer dr	illed ho	oles (H	D), con	npresse	ed air
( <u>)</u>		<sup>T</sup> Rk.eg.C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
an l: 40°C/24°C	Dry, wet	<sup>τ</sup> Rk,eq,C2	[N/mm²]	NF	PA <sup>1)</sup>	5,8	4,8	5,0	5,1	NF	PA <sup>1)</sup>
mper ranç	flooded bore	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
⊔ <u>e</u> II: 72°C/50°C	noie	<sup>τ</sup> Rk,eq,C2	[N/mm²]	NF	PA <sup>1)</sup>	5,0	4,1	4,3	4,4	NF	PA <sup>1)</sup>
Reduction factor $\psi^0$	, in cracked and r	hon-cracked c	oncrete C	20/25	in ham	mer dr	illed h	oles (⊦	ID), co	mpress	sed air
drilled holes (CD) and	with hollow drill bit (H					V.	,				
l: 40°C/24°C	Dry, wet concrete and						0,	80			
ال: 72°C/50°C	flooded bore hole	Ψ <sup>°</sup> sus					0,	68			
Increasing factors for co	oncrete $\psi_{c}$	C25/30 to	C50/60				1	,0			
Concrete cone failure											
Relevant parameter							see Ta	able C2			
Splitting											
Relevant parameter							see Ta	able C2			
for day and wet concrete							1	0			
for flooded bore hole (H		γinst	[-]				1	,0 2			
<sup>1)</sup> No performance assa	assed							,∠			
VJ Technology Injec	VJ Technology Injection System XPE440 for concrete										
Performances Characteristic values of	tension loads under	seismic action (	performanc	e categ	ory C1+	-C2)		'	Anne	x C 1	8

# Table C25: Characteristic values of shear loads under seismic action(performance category C1+C2)

(performance)	salegory C	+62)									
Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30	
Steel failure											
Characteristic shear resistance (Seismic C1)	V <sub>Rk,s,eq,C1</sub>	[kN]				0,70	)∙V <sup>0</sup> Rk	, <b>S</b>			
Characteristic shear resistance (Seismic C2), Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	V <sub>Rk,s,eq,C2</sub>	[kN]	N perfor assa	lo mance assed		0,70 •	V <sup>0</sup> Rk,s		No perfo assa	ormance ssed	
Partial factor	γ <sub>Ms,</sub> ∨	[-]	see Table C1								
Ductility factor	k <sub>7</sub>	[-]	1,0								
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	۱ <sub>f</sub>	[mm]	m] min(h <sub>ef</sub> ; 12 · d <sub>nom</sub> ) min(h <sub>ef</sub> ; 300mm							300mm)	
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	16	20	24	27	30	
Installation factor	γ <sub>inst</sub>	[-]					1,0				
Factor for annular gap	$lpha_{\sf gap}$	[-]	[-] 0,5 (1,0) <sup>1)</sup>								

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

#### VJ Technology Injection System XPE440 for concrete

#### Performances

Characteristic values of shear loads under seismic action (performance category C1+C2)

Table C26: Characteristic values of tension loads under seismic action(performance category C1)													
Anchor size 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 tension resistance		N <sub>Rk,s,eq,C1</sub>	[kN]					1,0 • A	s • f <sub>uk</sub>	1)			
Cross section area		As	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor			[-]					1	<b>⊿</b> 2)				
Combined pull-out and concret	te failu	re	[]					• ,	•				
Characteristic bond resistance in drilled holes (CD) and with hollow	cracke w drill b	ed and non-co bit (HDB)	cracked co	oncrete	e C20/2	25 in h	amme	r drille	d hole	s (HD)	, comp	resse	d air
e I: 40°C/24°C Dry, we	t e and	<sup>⊤</sup> Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
E II: 72°C/50°C hole	bore	<sup>7</sup> Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor $\psi^0_{sus}$ in cracke	ed and	non-cracke	ed concret	te C20	)/25 in	hamm	ner dril	led ho	les (Hl	D), cor	npress	ed air	
drilled holes (CD) and with hollow	w drill b	oit (HDB)											
ຍ ກຸ່ມີ I: 40°C/24°C Dry, we concret	t e and	<u>م</u> ارد	<b>[_]</b>					0,	80				
ັດ. ຫຼື flooded ອີ II: 72°C/50°C hole ⊢	LJ					0,	68						
Increasing factors for concrete $\psi_0$	с	C25/30 to	C50/60					1	,0				
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 (HD; HD	B, CD)	<u>.</u>	<b>F</b> 1					1	,0				
for flooded bore hole (HD; HDB, C	CD)	rinst	[-]					1	,2				
for dry and wet concrete (HD; HDB, CD)       Yinst       [-]       1,0         for flooded bore hole (HD; HDB, CD)       Yinst       [-]       1,2 <sup>1)</sup> f <sub>uk</sub> shall be taken from the specifications of reinforcing bars       2) in absence of national regulation       1													
VJ Technology Injection Sys	stem X	PE440 for	concrete							-		• • •	
Performances Characteristic values of tension lo	ads une	der seismic a	action (perf	orman	ce cate	egory (	21)			A	nnex	C 2(	)

Table C27: Characteristic values of shear loads under seismic action         (performance category C1)													
Anchor size 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> 1)				
Cross section area	A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804	
Partial factor	γMs,∨	[-]						1,5 <sup>2)</sup>					
Ductility factor	k <sub>7</sub>	[-]						1,0					
Concrete pry-out failure													
Factor	k <sub>8</sub>	[-]						2,0					
Installation factor	$\gamma_{inst}$	[-]						1,0					
Concrete edge failure													
Effective length of fastener	l <sub>f</sub>	[mm]			min(h <sub>e</sub>	<sub>ef</sub> ; 12 •	d <sub>nom</sub>	)		min(	h <sub>ef</sub> ; 300	)0mm)	
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32	
Installation factor	$\gamma_{inst}$	[-]						1,0					
Factor for annular gap	$lpha_{\sf gap}$	[-]					0	5 (1,0	) <sup>3)</sup>				
<ol> <li><sup>1)</sup> f<sub>uk</sub> shall be taken from the specificatio</li> <li><sup>2)</sup> in absence of national regulation</li> <li><sup>3)</sup> Value in brackets valid for filled annu Annex A 3 is recommended.</li> </ol>	ons of reinford	sing bars	r and d	cleara	nce ho	ole in th	ne fixtu	ıre. Us	e of sp	oecial fill	ing wash	ne r	

### VJ Technology Injection System XPE440 for concrete

#### Performances

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

Table C28: Displacement under tension load <sup>1)</sup> (threaded rod)												
Anchor size threaded rod				M10	M12	M16	M20	M24	M27	M30		
Non-cracked and cracked concrete C20/25 under seismic C1 action												
Temperature range l: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082		
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171		
Temperature range II: 72°C/50°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110		
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,259	0,154	0,163	0,172	0,181	0,189	0,207	0,229		

### Table C29: Displacements under tension load<sup>1)</sup> (rebar)

Anchor size reinforcing bar				Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked and cracked concrete C20/25 under seismic C1 action												
Temperature	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
range I: 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
Temperature	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
range II: 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

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

 $\delta_{N\infty} = \delta_{N\infty}$ -factor  $\cdot \tau$ ; ( $\tau$ : action bond stress for tension)

## Table C30: Displacements under shear load<sup>2)</sup> (threaded rod)

Anchor size threaded rod				M10	M12	M16	M20	M24	M27	M30
Non-cracked and cr	acked concrete C2	0/25 under seis	mic C1 a	action						
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

## Table C31: Displacements under shear load<sup>2)</sup> (rebar)

Anchor size reinforcing bar	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32

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>2)</sup> Calculation of the displacement

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

 $\delta_{V\infty}$  =  $\delta_{V\infty}\text{-factor}~\cdot~V;~~(V\text{: action shear load})$ 

#### VJ Technology Injection System XPE440 for concrete

#### Performances

Displacements under seismic C1 action (threaded rods and rebar)

Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Non-cracked and cracked concrete C20/25 under seismic C2 action         Imm]         No         0.21         0.24         0.27         0.36         No           All temperature         Sk.C2(0L5)         Imm]         Performance         0.54         0.51         0.54         0.63         performance           assassed         Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Anchor size threaded rod         M8	Table C32: Displacements under tension load (threaded rod)											
Non-cracked and cracked concrete C20/25 under seismic C2 action         No         Oc.21         0.24         0.27         0.36         performance           All temperature ranges         \$N_C2(ULS)         [mm]         performance         0.54         0.51         0.54         0.63         performance           Anchor size threaded rod         M8         M10         M12         M16         M20         M24         M27           Non-cracked and cracked concrete C20/25 under seismic C2 action         Anther size threaded rod         M8         M10         M12         M16         M20         M24         M27           Non-cracked and cracked concrete C20/25 under seismic C2 action         3.1         3.4         3.5         4.2         p.           All temperature ranges         \$V_C2(ULS)         [mm]         performance assassed         6.0         7.6         7.3         10.9         passes	Anchor size threade	ed rod		M8 N	110	M12	M16	M20	M24	M27	M30	
All temperature ranges $\frac{\delta_{N,C2(DLS)}}{\delta_{N,C2(ULS)}}$ [mm]       performance performance assassed       0.21       0.24       0.27       0.36       perform assassed         Table C33: Displacements under shear load (threaded rod)         Anthor size threaded rod       M8       M10       M12       M16       M20       M24       M27         Non-cracked and cracked concrete C20/25 under seismic C2 action         All temperature $\delta_{V,C2(ULS)}$ [mm]       performance       3.1       3.4       3.5       4.2       No         No         assassed       6.0       7.6       7.3       10.9       perform asses         VJ Technology Injection System XPE440 for concrete         Performances         Displacements under seismic C2 action (threaded rods)	Non-cracked and cr	acked concrete C2	0/25 under seis	smic C2 act	ion							
rangesi       Structure       Imm       performance assassed       0.54       0.51       0.54       0.63       performance assassed         Table C33: Displacements under shear load (threaded rod)         Anchor size threaded rod         Mite M10       M12       M16       M20       M24       M27         Non-cracked and cracked concrete C20/25 under seismic C2 action         All temperature $\frac{3}{\sqrt{C2}(U,S)}$ Imm       performance assassed $\frac{3}{6}$ .0       7.6       7.3       10.9       perform asses         VJ C2(U.S)       Imm       performance assassed $\frac{3}{6}$ .0       7.6       7.3       10.9       asses         VJ Technology Injection System XPE440 for concrete         Performance Displacements under seismic C2 action (threaded rods)	All temperature	$\delta_{N,C2(DLS)}$	[mm]	No		0,21	0,24	0,27	0,36	N	lo	
Table C33: Displacements under shear load (threaded rod)         Anchor size threaded rod       M8       M10       M12       M16       M20       M24       M27         Non-cracked and cracked concrete C20/25 under seismic C2 action       All temperature $\frac{5}{V}$ (C2(ULS)       Imm]       performance $3.1$ $3.4$ $3.5$ $4.2$ pM0         All temperature $\frac{5}{V}$ (C2(ULS)       Imm]       performance $6.0$ $7.6$ $7.3$ $10.9$ assessed         VJ Technology Injection System XPE440 for concrete       Performances       Displacements under seismic C2 action (threaded rods)       Annex C 2	ranges	δ <sub>N,C2(ULS)</sub>	[mm]	assasse	nce   ed	0,54	0,51	0,54	0,63	asse	mance ssed	
VJ Technology Injection System XPE440 for concrete         Porformances         Displacements under seismic C2 action (threaded rods)	Table C33: Dis	placements un	der shear lo	oad (threa	aded	rod)	M16	M20	M24	M27	M20	
WJ Technology Injection System XPE440 for concrete         VJ Technology Injection System XPE440 for concrete	Anchor size threade	a rou	0/2E under eeir	ivio in	ion			10120	11/24		IVISU	
All temperature ranges       0V_C2(DLS)       [Imm]       performance assassed       3,1       3,4       3,5       4,2       performance performance assassed         6,0       7,6       7,3       10,9       asses         VJ Technology Injection System XPE440 for concrete         Performances       Displacements under seismic C2 action (threaded rods)	Non-cracked and cr		U/25 under seis		ion	2.4	2.4	25	4.0		lo	
VJ Technology Injection System XPE440 for concrete         Performances         Displacements under seismic C2 action (threaded rods)	All temperature	<sup>o</sup> V,C2(DLS)		performa	nce	3,1	3,4	3,5	4,2	perfor	mance	
VJ Technology Injection System XPE440 for concrete         Performances         Displacements under seismic C2 action (threaded rods)	ranges	<sup>8</sup> V,C2(ULS)	[mm]	assasse	ed	6,0	7,6	7,3	10,9	asse	ssed	
VJ Technology Injection System XPE440 for concrete       Annex C 2         Performances       Annex C 2         Displacements under seismic C2 action (threaded rods)       Annex C 2												
	VJ Technology Injection System XPE440 for concrete         Performances         Displacements under seismic C2 action (threaded rods)								Annex C 23			



### British Board of Agrément, 1<sup>st</sup> Floor Building 3

1<sup>st</sup> Floor Building 3 Hatters Lane Croxley Park Watford WD18 8YG