



Approval body for construction products and types of construction

**Bautechnisches Prüfamt** 

An institution established by the Federal and Laender Governments



# **European Technical Assessment**

ETA-19/0542 of 28 April 2020

English translation prepared by DIBt - Original version in German language

#### **General Part**

Technical Assessment Body issuing the European Technical Assessment:

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

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

This version replaces

Deutsches Institut für Bautechnik

Würth Injection system WIT-PE 1000 for concrete

Bonded fastener for use in concrete

Adolf Würth GmbH & Co. KG Reinhold-Würth-Straße 12-17 74653 Künzelsau DEUTSCHLAND

Werk 3

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

EAD 330499-01-0601

ETA-19/0542 issued on 13 September 2019



# European Technical Assessment ETA-19/0542

Page 2 of 40 | 28 April 2020

English translation prepared by DIBt

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

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

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No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



# **European Technical Assessment** ETA-19/0542

Page 3 of 40 | 28 April 2020

English translation prepared by DIBt

#### **Specific Part**

#### 1 Technical description of the product

The "Würth Injection System WIT-PE 1000 for concrete" is a bonded anchor consisting of a cartridge with injection WIT-PE 1000 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 IG-M6 to IG-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 in accordance with the applicable European **Assessment Document**

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 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	See Annex				
(static and quasi-static loading)	B2, C 1 to C 5, C 7 to C 9, C 11 to C 13				
Characteristic resistance to shear load	See Annex				
(static and quasi-static loading)	C 1, C 6, C 10, C 14				
Displacements under short-term and long-term loading	See Annex				
	C 15 to C 17				
Characteristic resistance and displacements for seismic	See Annex				
performance categories C1 and C2	C 18 to C 23				

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

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

Z30636.20 8.06.01-69/20



# European Technical Assessment ETA-19/0542

Page 4 of 40 | 28 April 2020

English translation prepared by DIBt

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 28 April 2020 by Deutsches Institut für Bautechnik

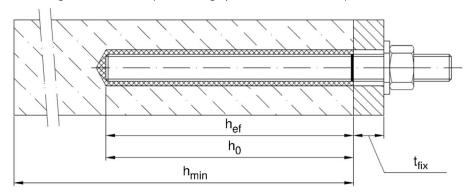
BD Dipl.-Ing. Andreas Kummerow Head of Department

beglaubigt: Baderschneider

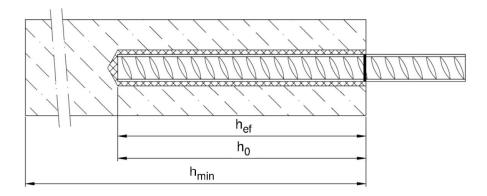


# Installation threaded rod M8 up to M30

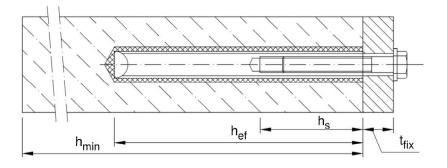
prepositioned installation or push through installation (annular gap filled with mortar)



# Installation reinforcing bar Ø8 up to Ø32



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



 $t_{fix}$  = thickness of fixture

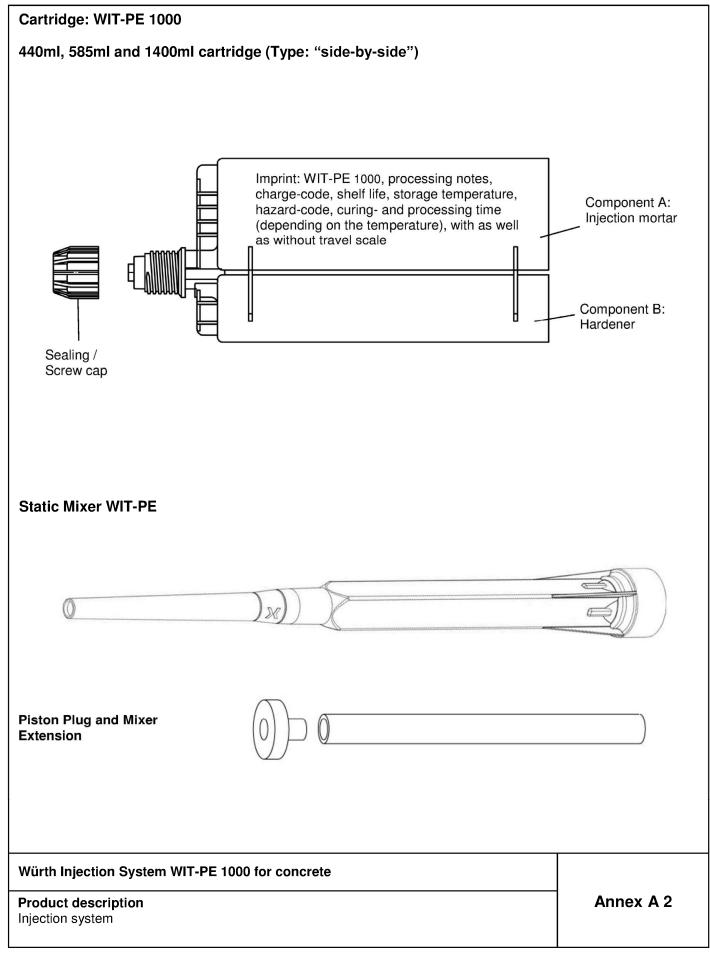
h<sub>ef</sub> = effective anchorage depth

 $h_0$  = depth of drill hole

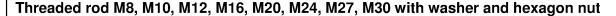
 $h_{min}$  = minimum thickness of member

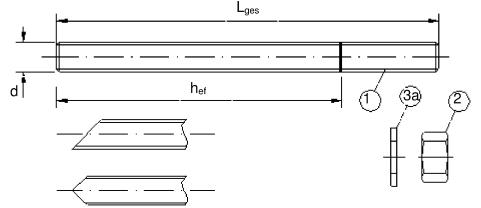
Würth Injection System WIT-PE 1000 for concrete	
Product description Installed condition	Annex A 1







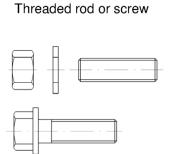


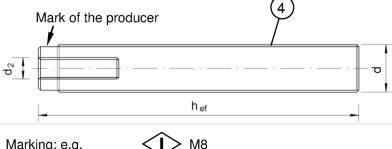


Commercial standard threaded rod with:

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

# Internal threaded anchor rod IG-M6, IG-M8, IG-M10, IG-M12, IG-M16, IG-M20





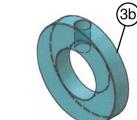
Marking: e.g.

Marking Internal thread Mark

8M Thread size (Internal thread) Α4 additional mark for stainless steel

HCR additional mark for high-corrosion resistance steel

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





# Würth Injection System WIT-PE 1000 for concrete

# **Product description**

Threaded rod, internal threaded rod and filling washer

Annex A 3



	ble A1: Mater	rials						
Part	Designation	Material						
zi h	nc plated ≥ sot-dip galvanised ≥ 4		) 4042 ) 146	2:1999 or 1:2009 and EN ISO 10684:	2004+AC:2009 or			
· SI	nerardized ≥ 4	45 μm acc. to EN ISC Property class	1/6	Characteristic steel	Characteristic steel	Elongation at		
		' '	16	ultimate tensile strength  f <sub>uk</sub> = 400 N/mm <sup>2</sup>	yield strength  f <sub>vk</sub> = 240 N/mm <sup>2</sup>	fracture A <sub>5</sub> > 8%		
_	Thus a dead we d			f <sub>uk</sub> = 400 N/mm <sup>2</sup>	$f_{VK} = 320 \text{ N/mm}^2$	A <sub>5</sub> > 8%		
1	Threaded rod	acc. to		f <sub>uk</sub> = 500 N/mm <sup>2</sup>	$f_{VK} = 300 \text{ N/mm}^2$	A <sub>5</sub> > 8%		
		EN ISO 898-1:2013		f <sub>uk</sub> = 500 N/mm <sup>2</sup>	$f_{vk} = 400 \text{ N/mm}^2$	A <sub>5</sub> > 8%		
				f <sub>uk</sub> = 800 N/mm <sup>2</sup>	$f_{yk} = 640 \text{ N/mm}^2$	$A_5 \ge 12\%^{(3)}$		
_		<u> </u>	4	for anchor rod class 4.6 o	· ·			
2	Hexagon nut	acc. to EN ISO 898-2:2012	5	for anchor rod class 5.6 o	r 5.8			
		EN 130 696-2.2012	8	for anchor rod class 8.8				
3a	Washer			galvanised or sherardized EN ISO 7089:2000, EN ISC	7093:2000 or EN ISO	7094:2000)		
3b	Filling washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized				
Proper		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture		
4	Internal threaded anchor rod	acc. to		f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>vk</sub> = 400 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
anonor rod		Tacc. to	5.0			0		
	anonor rod	EN ISO 898-1:2013			f <sub>yk</sub> = 640 N/mm <sup>2</sup>	A <sub>5</sub> > 8%		
Stai	nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 erial 1.4301 / 1.4307 / 1 erial 1.4401 / 1.4404 / 1	8.8  .431  .457	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)	A <sub>5</sub> > 8%		
itai	nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 erial 1.4301 / 1.4307 / 1 erial 1.4401 / 1.4404 / 1	8.8   .431   .457   529 o	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength			
itai ligl	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistan	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  ace steel (Material 1.45  Property class	8.8   .431   .457   529 o	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)   Characteristic steel	A <sub>5</sub> > 8%		
tai ligl	nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 erial 1.4301 / 1.4307 / 1 erial 1.4401 / 1.4404 / 1 ice steel (Material 1.45	8.8  .431  .457  529 or	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength	A <sub>5</sub> > 8%  Elongation at fracture		
tai	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistan	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  ace steel (Material 1.45  Property class  acc. to	8.8 1.431 1.457 529 or 50 70	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup>	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$	$A_5 > 8\%$ Elongation at fracture $A_5 \ge 8\%$		
itai ligi	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistan	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  ace steel (Material 1.45  Property class  acc. to  EN ISO 3506-	8.8 1.431 1.457 529 or 50 70 80	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t 1 / 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup>	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)  Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%$ $A_5 \ge 12\%$		
itai ligi	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistan	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  erial 1.4401 / 1.4404 / 1  erial 1.450  Property class  acc. to  EN ISO 3506-  1:2009  acc. to  EN ISO 3506-	8.8 1.431 1.457 529 of 50 70 80 50	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)  Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%$ $A_5 \ge 12\%$		
Stai High	nless steel A2 (Materials steel A4 (Materials	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  ice steel (Material 1.45  Property class  acc. to  EN ISO 3506- 1:2009  acc. to  EN ISO 3506- 1:2009	8.8 1.431 1.457 529 or 50 70 80 50 70 80	$f_{uk} = 800 \text{ N/mm}^2$ $1 / 1.4567 \text{ or } 1.4541, \text{ acc. t}$ $1 / 1.4362 \text{ or } 1.4578, \text{ acc. t}$ $1 / 1.4365, \text{ acc. to EN } 10088$ $Characteristic steel$ $ultimate tensile strength$ $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ $f_{or anchor rod class } 50$ $for anchor rod class } 50$ $for anchor rod class } 80$	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$	A <sub>5</sub> > 8%  Elongation at fracture  A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12% 3)  A <sub>5</sub> $\geq$ 12% 3)		
1 2	nless steel A2 (Materials steel A4 (Materials	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  ere steel (Material 1.45  Property class  acc. to  EN ISO 3506- 1:2009  acc. to  EN ISO 3506- 1:2009  A2: Material 1.4301 /  A4: Material 1.4401 /  HCR: Material 1.452	8.8 1.431 1.457 529 or 70 80 50 70 80 7 1.43 7 1.44 9 or 1	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50 for anchor rod class 70 for anchor rod class 80  107 / 1.4311 / 1.4567 or 1.4 1.4565, acc. to EN 10088-1	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)  Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-578, acc. to EN 10088-: 2014	A <sub>5</sub> > 8%  Elongation at fracture  A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12% 3)  A <sub>5</sub> $\geq$ 12% 3)		
1 2 3a	Threaded rod <sup>1)4)</sup>	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  erial 1.4401 / 1.4404 / 1  erial 1.450  Property class  acc. to  EN ISO 3506- 1:2009  acc. to  EN ISO 3506- 1:2009  A2: Material 1.4301 /  A4: Material 1.4401 /  HCR: Material 1.452 (e.g.: EN ISO 887:20	8.8 1.431 1.457 529 or 50 70 80 70 80 7 1.43 7 1.44 9 or 1	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  07 / 1.4311 / 1.4567 or 1.4  04 / 1.4571 / 1.4362 or 1.4	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)  Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-578, acc. to EN 10088-: 2014	A <sub>5</sub> > 8%  Elongation at fracture  A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12% 3)  A <sub>5</sub> $\geq$ 12% 3)		
Stai High	Threaded rod <sup>1)4)</sup> Hexagon nut <sup>1)4)</sup> Washer	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  erial 1.4401 / 1.4404 / 1  erial 1.450  Property class  acc. to  EN ISO 3506- 1:2009  acc. to  EN ISO 3506- 1:2009  A2: Material 1.4301 /  A4: Material 1.4401 /  HCR: Material 1.452 (e.g.: EN ISO 887:20	8.8 1.431 1.457 529 or 50 70 80 70 80 7 1.43 7 1.44 9 or 1	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 70  for anchor rod class 80  107 / 1.4311 / 1.4567 or 1.4  1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISC orrosion resistance steel  Characteristic steel	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)  Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-578, acc. to EN 10088-: 2014 o 7093:2000 or EN ISO  Characteristic steel	A <sub>5</sub> > 8%   Elongation at fracture   A <sub>5</sub> $\geq$ 8%   A <sub>5</sub> $\geq$ 12% 3)   A <sub>5</sub> $\geq$ 12% 3)   1:2014   1:2014   7094:2000)		
1 2 3a	Threaded rod <sup>1)4)</sup> Hexagon nut <sup>1)4)</sup> Washer	EN ISO 898-1:2013  erial 1.4301 / 1.4307 / 1  erial 1.4401 / 1.4404 / 1  erial 1.4401 / 1.4404 / 1  erial 1.450  Property class  acc. to  EN ISO 3506- 1:2009  Acc. to  EN ISO 3506- 1:2009  A2: Material 1.4301 /  A4: Material 1.4401 /  HCR: Material 1.452  (e.g.: EN ISO 887:20  Stainless steel A4, H	8.8 1.431 1.457 529 or 50 70 80 70 80 7 1.43 7 1.44 9 or 1	f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> for anchor rod class 50 for anchor rod class 70 for anchor rod class 80  107 / 1.4311 / 1.4567 or 1.4 1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISC orrosion resistance steel	o EN 10088-1:2014) o EN 10088-1:2014) -1: 2014)  Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-578, acc. to EN 10088-: 2014 0 7093:2000 or EN ISO	A <sub>5</sub> > 8%  Elongation at fracture  A <sub>5</sub> ≥ 8%  A <sub>5</sub> ≥ 12% <sup>3)</sup> A <sub>5</sub> ≥ 12% <sup>3)</sup> 1:2014  1:2014  7094:2000)		

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

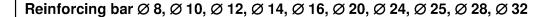
<sup>&</sup>lt;sup>4)</sup> Property class 80 only for stainless steel A4 and HCR

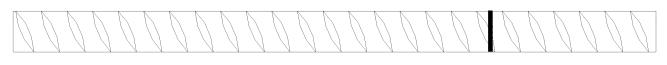
Würth Injection System WIT-PE 1000 for concrete	
Product description Materials threaded rod and internal threaded rod	Annex A 4

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

 $<sup>^{3)}</sup>$  A<sub>5</sub> > 8% fracture elongation if  $\underline{no}$  requirement for performance category C2 exists









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

# **Table A2: Materials**

Part	Designation	Material					
Reinf	orcing bars						
1	FN  1992-1-1-2004-401-2011   Annov (	Bars and de-coiled rods class B or C $f_{yk}$ and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$					

Würth Injection System WIT-PE 1000 for concrete	
Product description Materials reinforcing bar	Annex A 5



Specifications of intended use										
Anchorages subject to (for a s	ervice life of 50 year	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 non-cracked concrete							
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to Ø8 to IG-M6 to	Ø32,	M8 to M30, Ø8 to Ø32	M12 to M24						
Diamond drilling (DD)	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20	No performance assessed	No performance assessed	No performance assessed						
Temperature Range:		emperature +24 °C II: -40	°C to +40 °C and max short term te °C to +72 °C and max short term te	,						
Anchorages subject to (for a s	ervice life of 100 ye	ears):								
	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 non-	-cracked concrete						
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to Ø8 to IG-M6 to	Ø32,	M8 to M30, Ø8 to Ø32	M12 to M24						
Diamond drilling (DD)	No performance assessed	No performance assessed	No performance assessed	No performance assessed						

#### Base materials:

Temperature Range:

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

# Use conditions (Environmental conditions):

- · Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:

I: -40 °C to +40 °C

(max long term temperature +24 °C and max short term temperature +40 °C)

- Stainless steel Stahl A2 according to Annex A 4, Table A1: CRC II
- Stainless steel Stahl A4 according to Annex A 4, Table A1: CRC III
- High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

Würth Injection System WIT-PE 1000 for concrete	
Intended Use Specifications	Annex B 1

# Page 11 of European Technical Assessment ETA-19/0542 of 28 April 2020

English translation prepared by DIBt



# Design:

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

#### Installation:

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

Würth Injection System WIT-PE 1000 for concrete	
Intended Use Specifications	Annex B 2



Table B1: Installation parameters for threaded rod											
Anchor size					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 embedmen	Effective and advanta		[mm]	60	60	70	80	90	96	108	120
Ellective embedmer	Effective embedment depth			160	200	240	320	400	480	540	600
Diameter of clearance hole in	Prepositioned ins	stallation d <sub>f</sub> ≤	[mm]	9	12	14	18	22	26	30	33
the fixture	Push through i	nstallation d <sub>f</sub>	[mm]	12	14	16	20	24	30	33	40
Maximum torque mo	oment	T <sub>inst</sub> ≤	[Nm]	10	20	40 <sup>1)</sup>	60	100	170	250	300
Minimum thickness of member		h <sub>min</sub>	[mm]		<sub>f</sub> + 30 m : 100 mr				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 dista	ınce	c <sub>min</sub>	[mm]	35	40	45	50	60	65	75	80

 $<sup>^{\</sup>rm 1)}$  Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm

# Table B2: Installation parameters for rebar

Anchor size	Ø 8 <sup>1)</sup>	Ø 10 <sup>1)</sup>	Ø 12 <sup>1)</sup>	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	$d_0$	[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
Effective embedment depth	h <sub>ef,max</sub>	[mm]	160	200	240	280	320	400	480	500	560	640
Minimum thickness of member	h <sub>min</sub>	[mm]		30 mm )0 mm	≥			h <sub>e</sub>	f + 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			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Internal diameter of anchor rod	d <sub>2</sub>	[mm]	6	8	10	12	16	20
Outer diameter of anchor rod1)	$d = d_{nom}$	[mm]	10	12	16	20	24	30
Nominal drill hole diameter	d <sub>0</sub>	[mm]	12	14	18	22	28	35
Effective embedment depth	h <sub>ef,min</sub>	[mm]	60	70	80	90	96	120
Effective embedment depth	h <sub>ef,max</sub>	[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	l <sub>IG</sub>	[mm]	8/20	8/20	10/25	12/30	16/32	20/40
Minimum thickness of member	h <sub>min</sub>	[mm]		h <sub>ef</sub> + 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

<sup>1)</sup> With metric threads according to EN 1993-1-8:2005+AC:2009

Würth Injection System WIT-PE 1000 for concrete	
Intended Use Installation parameters	Annex B 3

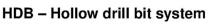


Table B4	: Paran	neter clea	ning and s	etting	g tool:	s						
Z	Tettersterreedth											
Threaded Rod	Rebar	Internal threaded anchor rod	d <sub>0</sub> Drill bit - Ø HD, HDB, CD, DD	ı	ь <b>h - Ø</b>	d <sub>b,min</sub> min. Brush - Ø	Piston plug	Installatio of	n directio piston plu			
[mm]	[mm]	[mm]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

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

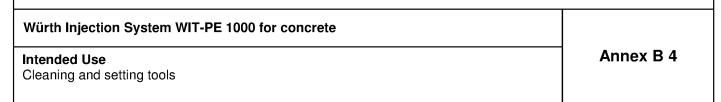
Drill bit diameter (d<sub>0</sub>): all diameters





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

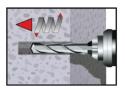
The hollow drill bit system contains the Würth Saugbohrer, MKT Saugbohrer hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa <u>and</u> flow rate of minimum 150 m $^3$ /h (42 l/s).





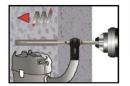
#### Installation instructions

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



1a. Hammer (HD) or compressed air drilling (CD)

Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). Proceed with Step 2. In case of aborted drill hole, the drill hole shall be filled with mortar.



1b. Hollow drill bit system (HDB) (see Annex B 3)

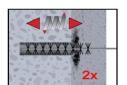
Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). This drilling system removes the dust and cleans the bore hole during drilling (all conditions). Proceed with Step 3. In case of aborted drill hole, the drill hole shall be filled with mortar.

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

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



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.



2b. Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.

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



2c. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.

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

Würth Injection System WIT-PE 1000 for concrete

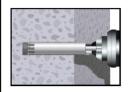
Intended Use
Installation instructions

Annex B 5



#### Installation instructions

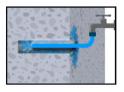
#### Drilling of the bore hole (DD)



# 1a. Diamond drilling (DD)

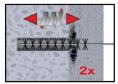
Drill with diamond drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). Proceed with Step 2. In case of aborted drill hole, the drill hole shall be filled with mortar.

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



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

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



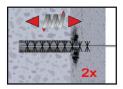
Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.
 If the bore hole ground is not reached with the brush, a brush extension must be used.



2c. Rinsing again with water until clear water comes out.



2d. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.



2e. Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.
If the bore hole ground is not reached with the brush, a brush extension must be used.



2f. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.

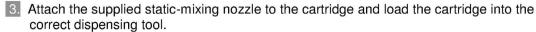
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Würth Injection System WIT-PE 1000 for concrete	
Intended Use Installation instructions	Annex B 6

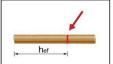


#### Installation instructions (continuation)

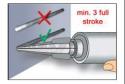




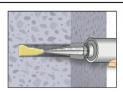
For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.



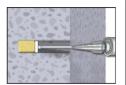
4. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.



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.



6. 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.

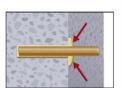


- 7. Piston plugs and mixer nozzle extensions shall be used according to Table B4 for the following applications:
  - Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit- $\emptyset$  d<sub>0</sub>  $\ge$  18 mm and embedment depth h<sub>ef</sub> > 250mm
  - Overhead assembly (vertical upwards direction): Drill bit-Ø d<sub>0</sub> ≥ 18 mm

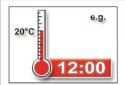


8. Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

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).



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).



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.

# Würth Injection System WIT-PE 1000 for concrete Intended Use Installation instructions (continuation) Annex B 7



Table B5:	Ma	aximum w	orking time and minin	num curing time	
Concrete temperature		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 temperature				+5°C to +40°C	

Würth Injection System WIT-PE 1000 for concrete	
Intended Use Curing time	Annex B 8



T	able C1: Characteristic values for resistance of threaded		l tens	sion re	sistan	ce an	d stee	el she	ar		
Si	ze			M8	M10	M12	M16	M20	M24	M27	M30
Cr	oss section area	A <sub>s</sub>	[mm²]	36,6	58	84,3	157	245	353	459	561
Cr	naracteristic tension resistance, Steel failu	re 1)		•	•						
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	1	-
Sta	ainless steel A4 and HCR, class 80	N <sub>Rk,s</sub>	[kN]	29	46	67	126	196	282	ı	-
Cr	naracteristic 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	$\gamma_{Ms,N}$	[-]				1,5	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	γ <sub>Ms,N</sub>	[-]				1,8	7			
Sta	ainless steel A4 and HCR, class 80	γ <sub>Ms,N</sub>	[-]				1,6	3			
Cr	naracteristic shear resistance, Steel failure										
_	Steel, Property class 4.6 and 4.8	V <sup>0</sup> Rk,s	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
arm	Steel, Property class 5.6 and 5.8	V <sup>0</sup> Rk,s	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
ever	Steel, Property class 8.8	V <sup>0</sup> Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
) ti	Stainless steel A2, A4 and HCR, class 50	V <sup>0</sup> Rk,s	[kN]	9	15	21	39	61	88	115	140
Without lever	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> <sub>Rk,s</sub>	[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
	Steel, Property class 8.8	М <sup>0</sup> <sub>Rk,s</sub>	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
Vith lever	Stainless steel A2, A4 and HCR, class 50	M <sup>0</sup> Rk,s	[Nm]	19	37	66	167	325	561	832	1125
\ X	Stainless steel A2, A4 and HCR, class 70	M <sup>0</sup> <sub>Rk,s</sub>	[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	1	-
Cr	naracteristic shear resistance, Partial facto	r <sup>2)</sup>									
Ste	eel, Property class 4.6 and 5.6	γ <sub>Ms,V</sub>	[-]				1,6	7			
Ste	eel, Property class 4.8, 5.8 and 8.8	γ <sub>Ms,V</sub>	[-]				1,2	5			
Sta	ainless steel A2, A4 and HCR, class 50	$\gamma_{Ms,V}$	[-]				2,3	8			
Sta	ainless steel A2, A4 and HCR, class 70	γ <sub>Ms,V</sub>	[-]				1,5	6			
Sta	ainless steel A4 and HCR, class 80	γ <sub>Ms,V</sub>	[-]				1,3	3			

<sup>1)</sup> Values are only valid for the given stress area A<sub>s</sub>. Values in brackets are valid for undersized threaded rods with smaller stress area  $A_s$  for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009. <sup>2)</sup> in absence of national regulation

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods	Annex C 1

8.06.01-69/20 Z30641.20



	Characteristic val	ues for Co	ncrete cone f	ailure and Splitting with all kind of
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		c <sub>cr,N</sub>	[mm]	1,5 h <sub>ef</sub>
Axial distance		s <sub>cr,N</sub>	[mm]	2 c <sub>cr,N</sub>
Splitting		·	•	
	h/h <sub>ef</sub> ≥ 2,0			1,0 h <sub>ef</sub>
Edge distance	$2.0 > h/h_{ef} > 1.3$	c <sub>cr,sp</sub>	[mm]	$2 \cdot h_{ef} \left( 2,5 - \frac{h}{h_{ef}} \right)$
	h/h <sub>ef</sub> ≤ 1,3			2,4 h <sub>ef</sub>
Axial distance	•	S <sub>cr.sp</sub>	[mm]	2 c <sub>cr.sp</sub>

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values for Concrete cone failure and Splitting with all kind of action	Annex C 2



I .	cteristic value ervice life of		n loads	unde	r stat	ic an	d qua	si-sta	atic a	ction	
Anchor size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure			ı	1							
Characteristic tension resi	stance	N <sub>Rk,s</sub>	[kN]			$A_{s} \cdot f_{l}$	<sub>Jk</sub> (or s	ee Tab	le C1)		
Partial factor		γ <sub>Ms,N</sub>	[-]	see Table C1							
Combined pull-out and o											
Characteristic bond resista holes (CD)	ance in non-cracl	ked concrete C2	20/25 in har	mmer o	Irilled h	oles (⊦	ID) and	compr	essed	air drill	ed
II: 72°C/50°C	Dry, wet concrete and	<sup>τ</sup> Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	flooded bore hole	Titi,doi		15	15	15	14	13	13	12	12
Characteristic bond resista	ance in non-crack	ked concrete C2	20/25 in har	mmer d	Irilled h	oles w	th hollo	w drill	bit (HD	B)	
º I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
1: 40°C/24°C	concrete		FN 1 / 01	14	14	14	13	13	12	12	11
ta eg   II: 72°C/50°C   ta eg   II: 72°C/50°C	flooded bore	<sup>τ</sup> Rk,ucr	[N/mm²]	16	16	16	15	15	14	14	13
Ⅱ: 72°C/50°C	hole			14	14	14	13	13	12	12	11
Characteristic bond resista		oncrete C20/25	in hamme	r drilled	holes	(HD) ,	compre	essed a	ir drille	d holes	s (CD)
and with hollow drill bit (H	DB) Dry, wet			7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
pera ange	concrete and flooded bore	<sup>τ</sup> Rk,cr	[N/mm²]					,			
ਜ਼ਿੰ Ⅱ: 72°C/50°C	hole			6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor $\psi^0_{sus}$ in holes (CD) and with hollow		cracked concre	te C20/25 i	in hamı	mer dril	led hol	es (HD	), comp	oressec	d air dri	lled
II: 40°C/24°C	Dry, wet concrete and flooded bore	Ψ <sup>0</sup> sus [-]		0,80							
	hole			0,68							
		C25/30					1,	02			
		C30/37						04			
Increasing factors for cond	crete	C35/45						07			
$\Psi_{\mathbf{c}}$		C40/50 C45/55						08 09			
		C50/60		1,09 1,10							
Concrete cone failure		1000,00					.,,				
Relevant parameter							see Ta	ıble C2			
Splitting				_							
Relevant parameter							see Ta	ble C2			
Installation factor	HD. HDB. CD)	1					- 1	^			
for dry and wet concrete () for flooded bore hole (HD;	•	γ <sub>inst</sub>	[-]					,0 ,2			
To moded sere here (FIE),	1100, 00)						<u>'</u>	, <b>-</b>			
Würth Injection System	m WIT-PE 1000	for concrete									
Performances Characteristic values of te	nsion loads under	static and quasi	-static actio	n					Anne	x C 3	}



Anchor size threaded ro	od			М8	M10	M12	M16	M20	M24	M27	M30
Steel failure		TNI	FL-N 17			Λ . f	· /or c	oo Tob	lo C1)		
Characteristic tension res	sistance	N <sub>Rk,s</sub>	[kN]				ık (or s		ie CT)		
Partial factor		γ <sub>Ms,N</sub>	[-]				see Ta	ıble C1			
Combined pull-out and			20/05: 1				<b></b>				
Characteristic bond resist holes (CD)	tance in non-crack	ked concrete C	20/25 in har	nmer d	Irilled h	oles (H	D) and	compr	essed	air drill	ed
Temperature range :I :C\O.000000000000000000000000000000000000	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 resist	tance in non-crack	ked concrete C	20/25 in har	nmer d	rilled h	oles wi	th hollo	w drill	bit (HD	B)	
I: 40°C/24°C	Dry, wet concrete	Tou	[N/mm²]	17	16	16	16	15	14	14	13
ਰੂ ਜੂ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ ਹਿਲ	flooded bore hole	TRk,ucr,100	[[N/]]	16	16	16	15	15	14	14	13
Characteristic bond resist and with hollow drill bit (H		concrete C20/2	5 in hamme	r drilled	holes	(HD) ,	compre	essed a	ir drille	d hole:	s (CD)
Temperature range I: C>0.00000000000000000000000000000000000	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,cr,100	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
	1	C25/30	1				1,	02			
		C30/37						04			
Increasing factors for con	ıcrete	C35/45						07			
$\Psi_{\mathbf{C}}$		C40/50 C45/55						08 00			
		C50/60		1,09 1,10							
Concrete cone failure		1030/00						10			
Relevant parameter							see Ta	ıble C2			
Splitting											
Relevant parameter							see Ta	ıble C2			
Installation factor		_									
for dry and wet concrete		$\gamma_{inst}$	[-]	1,0							
for flooded bore hole (HD	; HDB, CD)	riist	''				1	,2			
Würth Injection Syste	m WIT-PE 1000	for concrete							Anne	x C 4	ļ

for flooded bore hole (DD)



Table C5: Chara	cteristic value	es of tensio	n loads	unde	r stat	ic and	d qua	si-sta	atic a	 ction	
for a s	ervice life of	50 years									
Anchor size threaded ro		M8	M10	M12	M16	M20	M24	M27	M30		
Steel failure											
Characteristic tension res	sistance	N <sub>Rk,s</sub>	[kN]			$A_{s} \cdot f_{l}$	<sub>Jk</sub> (or s	ee Tab	le C1)		
Partial factor		γ <sub>Ms,N</sub>	[-]				see Ta	ıble C1			
Combined pull-out and	concrete failure										
Characteristic bond resist	tance in non-crack	ked concrete C2	20/25 in dia	mond o	drilled h	oles (E	DD)				
ge I: 40°C/24°C	Dry, wet concrete and	<sup>τ</sup> Rk,ucr	[N]/2]	15	14	14	13	12	12	11	11
Temperature range II: 40°C/24°C	UI: 72°C/50°C    Sty, Wet concrete and flooded bore hole		[N/mm²] -	12	12	11	10	9,5	9,5	9,0	9,0
Reduction factor ψ <sup>0</sup> sus in	non-cracked cond	crete C20/25 in	diamond dr	illed ho	oles (DI	D)					
		$\Psi^0$ sus		0,77							
Temperature range II: 72°C/50°C	flooded bore hole	Ψ sus	[-]	0,72							
		C25/30	25/30 1,04								
		C30/37		1,08							
Increasing factors for con	crete	C35/45		1,12							
$\Psi_{C}$		C40/50		1,15							
		C45/55		1,17							
C50/60							1,	19			
Concrete cone failure							Ta	bla CO			
Relevant parameter  Splitting							see 12	ble C2			
Relevant parameter							SEE TE	hle C2			
Installation factor				see Table C2							
for dry and wet concrete	(DD)		_				1	,0			
for flooded bore hole (DD	. ,	γ <sub>inst</sub>	[-]		1,2			, -	1,4		

1,2

1,4

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 5



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 C1)							
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V <sup>0</sup> <sub>Rk,s</sub>	[kN]			0,5 •	A <sub>s</sub> ∙ f <sub>uk</sub>	(or see	Table C	1)	
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Ductility factor	k <sub>7</sub>	[-]	1,0							
Steel failure with lever arm										
Characteristic bending moment	М <sup>0</sup> <sub>Rk,s</sub>	[Nm]			1,2 • \	W <sub>el</sub> • f <sub>uk</sub>	(or see	Table C	21)	
Elastic section modulus	W <sub>el</sub>	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ <sub>Ms,V</sub>	[-]				see	Table C	:1		
Concrete pry-out failure										
Factor	k <sub>8</sub>	[-]					2,0			
Installation factor	$\gamma_{inst}$	[-]	1,0							
Concrete edge failure										
Effective length of fastener	I <sub>f</sub>	[mm]	$\min(h_{ef}; 12 \cdot d_{nom}) \qquad \qquad \min(h_{ef}; 300mm)$							
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]					1,0			

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

**Performances** 



Anchor size internal threaded	l anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure <sup>1)</sup>										
Characteristic tension resistand	e, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123	
Steel, strength class	el, strength class 8.8		[kN]	16	27	46	67	121	196	
Partial factor, strength class 5.8	3 and 8 8	$N_{Rk,s}$ $\gamma_{Ms,N}$	[-]			1	,5			
Characteristic tension resistand Steel A4 and HCR, Strength cla	e, Stainless	N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Partial factor		γ <sub>Ms,N</sub>	[-]		1	1,87			2,86	
Combined pull-out and concr	ete cone failui								,	
Characteristic bond resistance holes (CD)			ete C20/2	5 in hamr	ner drilled	holes (HD	) and con	npressed a	air drilled	
_ I: 40°C/24°C	Dry, wet			20	19	19	18	17	16	
Temperature II: 72°C/50°C	concrete and flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm²]	15	15	14	13	13	12	
Characteristic bond resistance	l .	concrete	C20/25 in	hammer	drilled ho	les with ho	l llow drill b	it (HDB)		
1: 40°C/24°C	Dry, wet		1	16	16	16	15	14	13	
Temperature II: 72°C/50°C	concrete			14	14	13	13	12	11	
range I: 40°C/24°C	flooded bore	<sup>τ</sup> Rk,ucr	[N/mm <sup>2</sup> ]	16	16	15	15	14	13	
II: 72°C/50°C	hole			14	14	13	13	12	11	
Characteristic bond resistance and with hollow drill bit (HDB)	in cracked cond	crete C20	/25 in ham	nmer drille	ed holes (I	HD), comp	ressed air	drilled ho	les (CD)	
· · · · · · · · · · · · · · · · · · ·	concrete and	τ <sub>Rk,cr</sub> [N/mm	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5	
range II: 72°C/50°C	flooded bore hole		[]	6,0	7,0	7,0	7,0	7,0	7,0	
Reduction factor $\psi^0_{_{{f SUS}}}$ in crac		racked c	oncrete C	:20/25 in	hammer c	I Irilled hole:	s (HD) co	mpressed	air	
drilled holes (CD) and with holl							- ( ),		-	
Temperature	Dry, wet concrete and	$\Psi^0$ sus	[-]	0,80						
range II: 72°C/50°C	flooded bore hole			0,68						
			5/30				02			
Increasing factors for concrete			0/37 5/45				04 07			
Ψc			0/50	1,07 1,08						
			5/55				09			
		C5	0/60			1,	10			
Concrete cone failure										
Relevant parameter						see Ta	ble C2			
Splitting failure							00			
Relevant parameter						see Ta	ble C2			
nstallation factor	DR CD)		1				^			
for dry and wet concrete (HD; H for flooded bore hole (HD; HDB,		γ <sub>inst</sub>	[-]				<u>,0</u> ,2			
Fastenings (incl. nut and wash The characteristic tension resi     For IG-M20 strength class 50	ner) must comply stance for steel					erty class of	the intern		d rod.	

Z30642.20 8.06.01-69/20

Characteristic values of tension loads under static and quasi-static action

Annex C 7



Steel failure   1		ristic values			ds unde	er statio	and qu	ıasi-sta	tic actio	n	
Characteristic tension resistance,   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   N <sub>Rk,s</sub>   [kN]   16   27   46   67   121   196     Partial factor   1,5     Characteristic tension resistance, Stainless steel A4 and HCR, Strength class 570   2   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   59   110   122     Partial factor   7   N <sub>Rk,s</sub>   [kN]   14   26   41   41   41     Partial factor   7   N <sub>Rk,s</sub>   14   12   12     Partial factor   7   N <sub>Rk,s</sub>   16   16   16   16   16   15   14   13     Partial factor   7   N <sub>Rk,s</sub>   18   N <sub>Rk,s</sub>	Anchor size internal thread	ed anchor rod	 S		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel, strength class   8.8   N <sub>Rik,s</sub>   [kN]   16   27   46   67   121   196     Partial factor, strength class 5.8 and 8.8   Y <sub>Ms,N</sub>   F.]   1.5     Characteristic tension resistance, Stainless 5 teel A4 and HCR, Strength class 70 <sup>20</sup>   N <sub>Rik,s</sub>   [kN]   14   26   41   59   110   122     Partial factor	Steel failure <sup>1)</sup>										
Steel, strength class   8.8   N <sub>Rik,s</sub>   [kN]   16   27   46   67   121   196     Partial factor, strength class 5.8 and 8.8   Y <sub>Ms,N</sub>   F.]   1.5     Characteristic tension resistance, Stainless 5 teel A4 and HCR, Strength class 70 <sup>20</sup>   N <sub>Rik,s</sub>   [kN]   14   26   41   59   110   122     Partial factor	Characteristic tension resista	nce, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123	
Partial factor, strength class 5.8 and 8.8   Y <sub>Ms,N</sub>   [-]   1,5	Steel, strength class	Steel, strength class 8.8		[kN]	16	27	46	67	121	196	
Characteristic tension resistance, Stainless Steel A4 and HCR, Strength class 70 2  VMs,N [-] 1,87 2,8 2,8   Combined pull-out and concrete cone failure   Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drill holes (CD)   Temperature range   1: 40°C/24°C   Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drill holes (CD)   Temperature range   1: 40°C/24°C   Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)   Temperature range   1: 40°C/24°C   Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)   Temperature range   1: 40°C/24°C   Temperature range range   1: 40°C/24°C   Temperature range rang	Partial factor, strength class 5	5.8 and 8.8	· ·	[-]			1	,5			
Combined pull-out and concrete cone failure   Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drill holes (CD)   Temperature range   I: 40°C/24°C   Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)   Temperature range   I: 40°C/24°C   I:					14	26	41	59	110	124	
Combined pull-out and concrete cone failure           Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drill holes (CD)           Temperature range         I: 40°C/24°C         Dry, wet concrete and flooded bore hole         TRk,ucr,100 [N/mm²]         20         19         19         18         17         16           Characteristic bond resistance in non-cracked concrete card range         I: 40°C/24°C         Dry, wet concrete concre			γ <sub>Ms.N</sub>	[-]			1,87			2,86	
Temperature range   I: 40°C/24°C   Concrete and flooded bore hole   TRK, ucr, 100   [N/mm²]   20   19   19   18   17   16   16   16   16   15   14   13   13   16   16   16   15   14   13   16   16   16   15   14   13   16   16   16   16   15   14   13   16   16   16   16   15   14   13   16   16   16   16   16   15   14   13   16   16   16   16   16   16   16	Combined pull-out and con	crete cone fail									
Temperature range			ked concre	ete C20/2	5 in hamn	ner drilled	holes (HC	) and con	npressed a	air drilled	
Temperature range   I: 40°C/24°C   Concrete   Tak,ucr,100   [N/mm²]   16   16   15   15   14   13   13   16   16   16   15   15   14   13   13   16   16   16   15   15   14   13   13   16   16   16   15   15   14   13   13   16   16   16   15   15   14   13   13   16   16   16   15   15   14   13   13   16   16   16   16   15   15   14   13   13   16   16   16   15   15   14   13   15   15   14   13   15   15   14   13   15   15   15   15   15   15   15	1 40 ( ) / 4 ( ,	concrete and flooded bore	<sup>τ</sup> Rk,ucr,100	[N/mm²]	20	19	19	18	17	16	
Temperature range   1. 40°C/24°C   concrete   flooded bore hole   Tek,ucr,100   Tek,uc	Characteristic bond resistanc	e in non-cracke	d concrete	C20/25 in	hammer	drilled hol	es with ho	llow drill b	oit (HDB)		
1: 40°C/24°C   1: 4	Temperature I: 40°C/24°C		TDI 100	[N]/mm <sup>2</sup> ]	16	16	16	15	14	13	
## Temperature range   1: 40°C/24°C   Dry, wet concrete and flooded bore hole   TRK,cr,100   [N/mm²]   6,5   7,5	range I: 40°C/24°C	1	Rk,ucr,100	[[14/11111-]	16	16	15	15	14	13	
Temperature range I: 40°C/24°C concrete and flooded bore hole			ncrete C20/	/25 in ham	nmer drille	ed holes (F	HD), comp	ressed air	drilled ho	les (CD)	
Increasing factors for concrete	1 40 0/24 0	concrete and flooded bore	<sup>τ</sup> Rk,cr,100	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$											
Ψ <sub>C</sub>	I	_									
C45/55   1,09     C50/60   1,10     Concrete cone failure   Relevant parameter   See Table C2   Splitting failure   See Table C2   Installation factor	<u> </u>	e									
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)  Vine [1]  1,10	Ψс					· · · · · · · · · · · · · · · · · · ·					
Relevant parameter see Table C2  Splitting failure  Relevant parameter see Table C2  Installation factor  for dry and wet concrete (HD; HDB, CD)  Vinet  [1]  1,0											
Splitting failure Relevant parameter see Table C2 Installation factor for dry and wet concrete (HD; HDB, CD)  Vinet  [1]  1,0	Concrete cone failure						<u> </u>				
Relevant parameter see Table C2  Installation factor  for dry and wet concrete (HD; HDB, CD)  Vine [1]  1,0	Relevant parameter						see Ta	able C2			
Installation factor for dry and wet concrete (HD; HDB, CD)  Vines  [1]  1,0	Splitting failure										
for dry and wet concrete (HD; HDB, CD)	Relevant parameter						see Ta	able C2			
Vinet   I-	Installation factor										
for flooded bore hole (HD; HDB, CD)			Yinet	[-]				-			
	for flooded bore hole (HD; HD	B, CD)	'11151	[ [ ]			1	,2			

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.

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

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



	istic values ce life of 50				. • • • • • • • • • • • • • • • • • • •	<b>q</b> t				
Anchor size internal threade		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure <sup>1)</sup>					•	•		·	l	
Characteristic tension resistance, 5.8			[kN]	10	17	29	42	76	123	
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196	
Partial factor, strength class 5.	8 and 8.8	γ <sub>Ms,N</sub>	[-]		•	1	,5			
Characteristic tension resistan Steel A4 and HCR, Strength cl		N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Partial factor		γ <sub>Ms,N</sub>	[-]			1,87			2,86	
Combined pull-out and conc	rete cone failu	re								
Characteristic bond resistance	e in non-cracke	ed concre	te C20/2	5 in diamo	nd drilled	holes (DI	D)			
Temperature I: 40°C/24°C	Dry, wet concrete and	τ <sub>Rk,ucr</sub>	[N/mm²]	14	14	13	12	12	11	
range II: 72°C/50°C flooded bore hole		*HK,ucr	[,,,,,,,,,]	12	11	10	9,5	9,5	9,0	
Reduction factor $\psi^0_{sus}$ in non	ı-cracked concr	ete C20/2	25 in diam	nond drille	d holes ([	DD)				
Temperature I: 40°C/24°C	Dry, wet concrete and	Ψ <sup>0</sup> sus	[-]	0,77						
range II: 72°C/50°C	flooded bore hole	Ψ sus	[-]	0,72						
			5/30	1,04						
			0/37	1,08						
Increasing factors for concrete			5/45	1,12						
$\Psi_{C}$			0/50				15			
			5/55 0/60	1,17 1,19						
Concrete cone failure		1 00.	0/00			٠,	10			
Relevant parameter						see Ta	able C2			
Splitting failure										
Relevant parameter						see Ta	able C2			
Installation factor										
for dry and wet concrete (DD)			[]			1	,0			
for flooded bore hole (DD)		γinst	[-]	1,2 1,4						

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.

For IG-M20 strength class 50 is valid

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 9



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

<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 IG-M20 strength class 50 is valid

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



Table C11: Cha	racteristic va			oads	und	er st	atic	and c	quasi	i-stat	ic ac	tion		
Anchor size reinforci		, Ju	<del></del>	Ø8	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</sub>	[kN]					A <sub>s</sub> ·	$f_{uk}^{1)}$					
Cross section area		As	[mm²]	50	79	113	154	201	314	452	491	616	804	
Partial factor		γ <sub>Ms,N</sub>	[-]		•			1,	<b>4</b> <sup>2)</sup>					
Combined pull-out ar	nd concrete failu													
Characteristic bond re holes (CD)	esistance in non	-cracked co	ncrete C2	20/25 i	n ham	mer dr	illed h	oles (F	ID) an	d com	presse	ed air c	rilled	
II: 40°C/24°C  II: 72°C/50°C	Dry, wet concrete and	<sup>7</sup> Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15	
II: 72°C/50°C	flooded bore hole	i in,uoi		12	12	12	12	12	12	12	12	11	11	
Characteristic bond res	rete C20/2	5 in h	ammei	drilled	holes	with I	nollow	drill bi	t (HDE	3)				
စ္ <u></u> I: 40°C/24°C	Dry, wet			14	14	13	13	13	13	13	13	13	13	
11: 72°C/50°C	concrete	Ι	[N]/m/==23	12	12	12	11	11	11	11	11	11	11	
H: 40°C/24°C   H: 72°C/50°C   H: 72°C/50°C   H: 40°C/24°C   H: 72°C/50°C   H: 40°C/24°C   H: 4	flooded bore	<sup>τ</sup> Rk,ucr	[N/mm²]	13	13	13	13	13	13	13	13	13	13	
ਸ਼ਿ: 72°C/50°C	hole			11	11	11	11	11	11	11	11	11	11	
Characteristic bond res	C20/25 in	hamm	er drill	ed hol	es (HD	D), con	npress	ed air	drilled	holes	(CD)			
and with hollow drill bit	(HDB)	1		1	ı	Г		,			1			
I: 40°C/24°C	concrete and	TDI	   [N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	
ਜੂ ਸ਼   ਸ਼ੂ ਸ਼   ਸ਼ੂ ਸ਼ੂ ਸ਼ਿ: 72°C/50°C	flooded bore hole	,	[[4/]]]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	
Reduction factor $\psi^0_{su}$ drilled holes (CD) and	~		ed concre	te C20	)/25 in	hamm	ner dril	led ho	les (H	D), cor	mpress	sed air		
` ′	Dry, wet concrete and			0,80										
II: 40°C/24°C  an a	flooded bore hole	Ψ <sup>0</sup> sus	[-]	0,68										
	1	C25	/30					1.	02					
		C30.							04					
Increasing factors for o	concrete	C35	/45	1,07										
Ψс		C40		1,08										
		C45		1,09										
Concrete cone failure		C50	/60					1,	10					
Relevant parameter	<del>-</del>							see Ta	able C	2				
Splitting				l						_				
Relevant parameter								see Ta	able C	2				
Installation factor				<u> </u>						•				
	or dry and wet concrete (HD: HDB, CD)						1,0							
for flooded bore hole (I	HD; HDB, CD)	γinst	[-]					1	,2					
1) f <sub>uk</sub> shall be taken from 2) in absence of national		ns of reinforci	ng bars											
Würth Injection Sys	stem WIT-PE 10	000 for con	crete											
Performances Characteristic values o	f tension loads ur	ider static an	d quasi-sta	itic acti	on					A	nnex	C 11		



Anchor size reinforci	ing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic tension	resistance	$N_{Rk,s}$	[kN]					$A_s$ .	$f_{uk}^{1)}$				
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γMs,N	[-]	1,42)									•
Combined pull-out a	nd concrete fail	ure	•										
Characteristic bond re holes (CD)	esistance in non	-cracked co	ncrete C2	20/25 i	n ham	mer dr	illed h	oles (F	HD) an	d com	presse	ed air c	drilled
Temperature range :I: 0.05/57.00 C.05/57.00	Dry, wet concrete and flooded bore hole	<sup>T</sup> Rk,ucr,100	[N/mm²]	16	16	16	16	16	16	15	15	15	15
Characteristic bond re	sistance in non-c	racked conc	rete C20/2	25 in h	ammer	drilled	holes	with	hollow	drill bi	t (HDE	3)	
nperature range :	Dry, wet concrete	T	[N]/ma ma 2]	14	14	13	13	13	13	13	13	13	13
T: 40°C/24°C  I: 40°C/24°C	flooded bore hole	<sup>τ</sup> Rk,ucr,100	[N/mm²]	13	13	13	13	13	13	13	13	13	13
Characteristic bond resistance in cracked concrete C20/25 in and with hollow drill bit (HDB)					er drill	ed hol	es (HD	)), con	npress	ed air	drilled	holes	(CD)
Temperature range :I :: O.575/O.00	Dry, wet concrete and flooded bore hole	<sup>†</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
	1	C25.	/30					1,	02				
		C30							04				
Increasing factors for o	concrete	C35							07				
$\Psi_{\mathbf{C}}$		C40							80				
		C45.							09 10				
Concrete cone failure	<u> </u>	030.	700					١,	10				
Relevant parameter								see Ta	able C	2			
Splitting				l .									
Relevant parameter							;	see Ta	able C	2			
Installation factor													
for dry and wet concre	te (HD; HDB, CD	)	[ ]					1	,0				
for flooded bore hole (	HD; HDB, CD)	γinst	[-]					1	,2				
1) fuk shall be taken from 2) in absence of nation		ns of reinforci	ng bars										

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



Table C13: Characteristic values of tension loads under static and quasi-static action for a service life of 50 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>Rk,s</sub>	[kN]	$A_s \cdot f_{uk}^{1)}$									
Cross section area	A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γMs,N	[-]					1,	<b>4</b> <sup>2)</sup>				
Combined pull-out and concrete fail												
Characteristic bond resistance in non	ncrete C2	0/25 i	n diam	ond d	rilled h	oles (I	DD)	,	ı			
I: 40°C/24°C Dry, wet concrete and flooded bore hole	To	[N/mm²]	14	13	13	13	12	12	11	11	11	11
ଞ୍ଚି ଆ: 72°C/50°C flooded bore hole	<sup>τ</sup> Rk,ucr	[[14/11111]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor ψ <sup>0</sup> sus in non-cracked	Reduction factor $\psi^0_{ ext{ sus}}$ in non-cracked concrete C20/25 i											
Dry, wet concrete and flooded bore	0	0,77										
I: 40°C/24°C Dry, wet concrete and flooded bore hole	$\Psi^0$ sus	γ <sup>0</sup> sus [-]		0,72								
	C25/	/30	1,04									
	C30/		1,08									
Increasing factors for concrete	C35/		1,12									
$\Psi_{c}$	C40/							15				
	C45/		1,17									
Concrete cone failure	C50/	/60					١,	19				
Relevant parameter							500 Ta	able C	2			
Splitting						300 16	ibic O	_				
Relevant parameter						see Ta	able C	2				
Installation factor												
for dry and wet concrete (DD)	26	r 1	1,0									
for flooded bore hole (DD)	γinst	[-]		1	,2				1	,4		

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

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 13



Table C14: Characteristic	values o	f shear	load	ls un	der	stati	c and	d qua	asi-st	atic ad	ction	
Anchor size reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure without lever arm				•		•				•	•	
Characteristic shear resistance	V <sup>0</sup> Rk,s	[kN]					0,5	·As·	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	γ <sub>Ms,V</sub>	[-]			•			1,5 <sup>2)</sup>	ı			
Ductility factor	k <sub>7</sub>	[-]						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> 1)			
Elastic section modulus	W <sub>el</sub>	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γ <sub>Ms,V</sub>	[-]		•	•	•	•	1,5 <sup>2)</sup>	ı			
Concrete pry-out failure		•										
Factor	k <sub>8</sub>	[-]						2,0				
Installation factor	γinst	[-]						1,0				
Concrete edge failure		•	•									
Effective length of fastener	If	[mm]			min(h	n <sub>ef</sub> ; 12	• d <sub>nor</sub>	<sub>n</sub> )		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	γinst	[-]		•	•	•	•	1,0			•	

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

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



Table C15:	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	nchor size threaded rod				M12	M16	M20	M24	M27	M30	
Non-cracked concrete ι	ınder static a	and quasi-static a	ction fo	r a servi	ce life o	f 50 yea	rs	1			
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	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070	
Cracked concrete under static and quasi-static action for a service life of 50 years											
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082	
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171	
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110	
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,259	0,154	0,163	0,172	0,181	0,189	0,207	0,229	
Non-cracked concrete ι	ınder static a	and quasi-static a	ction fo	r a servi	ce life o	f 100 ye	ars				
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	0,030	0,031	0,033	0,036	0,038	0,040	0,042	
Cracked concrete unde	r static and c	uasi-static action	for a se	ervice li	fe of 100	years					
	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082	
	$\delta_{ extsf{N}\infty}$ -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

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

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

# Table C16: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Anchor size threaded rod				M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete under static and quasi-static action for a service life of 50 years										
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070

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

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

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

# Table C17: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size thread	M8	M10	M12	M16	M20	M24	M27	M30		
Non-cracked and c	itic actio	on								
All temperature	$\delta_{ m V0}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
ranges	$\delta_{ m V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

<sup>&</sup>lt;sup>2)</sup> Calculation of the displacement

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

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

# Würth Injection System WIT-PE 1000 for concrete

## **Performances**

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

Annex C 15



Table C18: 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 Internal thre	eaded anchor	rod	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Non-cracked concrete C	20/25 under s	tatic and quasi-s	tatic actio	n for a ser	vice life of	50 years		
Temperature range I:	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete C20/2	5 under static	and quasi-static	action for	a service	life of 50 y	ears	•	
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229
Non-cracked concrete C	20/25 under s	tatic and quasi-s	tatic actio	n for a ser	vice life of	100 years		
Temperature range I:	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,030	0,031	0,033	0,036	0,038	0,042
Cracked concrete C20/2	5 under static	and quasi-static	action for	a service	life of 100	years		
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
	•	-						

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

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

τ: action bond stress for tension

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

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

Anchor size Internal thre	eaded anchor r	od	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Non-cracked concrete C	20/25 under st	atic and quasi-s	tatic action	n for a ser	vice life of	50 years		
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,019	0,019	0,020	0,022	0,023	0,025
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070

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

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

# Table C20: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size Inter	Anchor size Internal threaded anchor rod			IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Non-cracked and cracked concrete C20/25 und			r static and	quasi-stati	c action			
All temperature	$\delta_{V0}$ -factor	[mm/kN]	0,07	0,06	0,06	0,05	0,04	0,04
ranges	inperature 10 1 1		0,10	0,09	0,08	0,08	0,06	0,06

<sup>2)</sup> Calculation of the displacement

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

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

V: action shear load

# Würth Injection System WIT-PE 1000 for concrete

## **Performances**

Displacements under static and quasi-static action (Internal threaded anchor rod)

Annex C 16



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

Anchor size reinfo	orcing bar		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked cond	rete C20/25	under static an	d quasi	-static	action	for a se	rvice li	fe of 50	years			
Temp range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
Temp range II:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	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/mm <sup>2</sup> )]	0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,072
Cracked concrete	C20/25 unde	er static and qu	asi-stat	ic actio	n for a	service	e life of	50 yea	rs			
Temp range I:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	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/mm <sup>2</sup> )]	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 cond	rete C20/25	under static an	d quasi	-static	action	for a se	rvice li	fe of 10	0 years	<b>3</b>		
Temp range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,030	0,031	0,032	0,033	0,036	0,039	0,039	0,041	0,043
Cracked concrete	e C20/25 under static and quasi-static action for a service life of 100 years											
Temp range I:	$\delta_{N0}$ -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

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

Anchor size reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked concrete C20/25 under static ar				-static	action 1	or a se	rvice li	fe of 50	years			
Temp range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,01	0,011	0,012	0,013	0,013	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,018	0,019	0,020	0,021	0,024	0,027	0,027	0,028	0,031
Temp range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/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

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

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

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

	<u>-</u>											
Anchor size rein	Ø8	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>&</sup>lt;sup>2)</sup> Calculation of the displacement

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

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

Würth Injection System WIT-PE 1000 for concrete	
Performances Displacements under static and quasi-static action (rebar)	Annex C 17



Steel failure Characteristic tensic Seismic C1)					M8	M10	M12	M16	M20	M24	M27	M30	
						•							
,	n resist	ance	N <sub>Rk,s,eq,C1</sub>	[kN]	1,0 • N <sub>Rk,s</sub>								
Characteristic tensic Seismic C2) Steel, strength class Stainless Steel A4 a Strength class ≥70	8.8	·	N <sub>Rk,s,eq,C2</sub>	[kN]	performance 1,0 · N <sub>Rk,s</sub> performance					perfor	lo mance ssed		
Partial factor	artial factor Y <sub>Ms,N</sub> [-]								able C1		•		
Combined pull-out	and co	ncrete failure	•	•									
Characteristic bond drilled holes (CD) a				d concrete	C20/25	in ham	nmer dr	illed ho	oles (Hi	D), con	npresse	d air	
<u>e</u> 1, 40°C/04°C	,		<sup>τ</sup> Rk,eq,C1	[N/mm <sup>2</sup> ]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	
range	,	Dry, wet concrete and	τ <sub>Rk,eq,C2</sub>	[N/mm²]	NF	NPA <sup>1)</sup>		4,8	5,0	5,1	NF	PA <sup>1)</sup>	
_	^	flooded bore hole	<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>ō</u> II: 72°C/50°	C	Hole	τ <sub>Rk,eq,C2</sub>	[N/mm²]	NF	PA <sup>1)</sup>	5,0	4,1	4,3	4,4	NPA <sup>1)</sup>		
Reduction factor $\psi$ drilled holes (CD) a				concrete C	C20/25 in hammer drilled holes (HD), compressed								
II: 40°C/24°C	)	Dry, wet concrete and	$\Psi^0$ sus	[-]				0,	80				
e	С	flooded bore hole	Ψ sus	[-]				0,	68				
ncreasing factors fo	r concre	ete ψ <sub>C</sub>	C25/30 to	C50/60				1	,0				
Concrete cone failu	ıre												
Relevant parameter								see Ta	able C2				
Splitting					ı								
Relevant parameter								see Ta	able C2				
nstallation factor			T										
or dry and wet cond or flooded bore hole			ļ γ <sub>inst</sub>	[-]	1,0								

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1+C2)	Annex C 18



Anchor size threaded rod			М8	M10	M12	M16	M20	M24	M27	M30
Steel failure				•		•				•
Characteristic shear resistance (Seismic C1)	V <sub>Rk,s,eq,C1</sub>	[kN]				0,70	o∙v <sup>0</sup> Rk	,s		
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]	perfor	lo mance issed		0,70 •	V <sup>0</sup> Rk,s			ormance assed
Partial factor   YMs,V [-]   see Table						Table C	1			
Ductility factor	k <sub>7</sub>	[-]					1,0			
Concrete pry-out failure	<b>-</b>									
Factor	k <sub>8</sub>	[-]					2,0			
Installation factor	γ <sub>inst</sub>	[-]					1,0			
Concrete edge failure	·									
Effective length of fastener	I <sub>f</sub>	[mm]		m	nin(h <sub>ef</sub> ; <sup>-</sup>	12 · d <sub>no</sub>	m)		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	γ <sub>inst</sub>	[-]		•		•	1,0			•
Factor for annular gap $\alpha_{\text{gap}}$ [-] 0,5 (1,0) <sup>1)</sup>										

<sup>&</sup>lt;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.

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1+C2)	Annex C 19



Table C26: Characteristic va (performance cat			oads	und	er se	eismi	c act	tion				
Anchor size reinforcing bar	-9,	,	Ø8	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	A <sub>s</sub>	[mm²]	50 79 113 154 201 314 452 491 616 80								804	
Partial factor	γ <sub>Ms,N</sub>	[-]	1,42)									
Combined pull-out and concrete failu	re											
Characteristic bond resistance in cracked drilled holes (CD) and with hollow drill be		cracked co	ncrete	C20/2	25 in h	amme	r drille	d hole	s (HD)	, comp	oresse	d air
The part of the												
ପ୍ରିଞ୍ଜ II: 72°C/50°C hole	<sup>₹</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 cracked and drilled holes (CD) and with hollow drill by		ed concret	te C20	)/25 in	hamn	ner dril	led ho	les (H	D), cor	npress	ed air	
I: 40°C/24°C Dry, wet concrete and flooded bore hole	\u0	<b>.</b> 1					0,	80				
ਰੀ ਦੂ ਜ਼ਿਲ੍ਹਾ II: 72°C/50°C hole	Ψ <sup>0</sup> sus	[-]					0,	68				
Increasing factors for concrete ψ <sub>C</sub>	C25/30 to	C50/60					1	,0				
Concrete cone failure	l											
Relevant parameter						;	see Ta	able C	2			
Splitting	Splitting											
Relevant parameter							see Ta	able C	2			
Installation factor												
for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)	γinst	[-]						,0 ,2				

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

Würth Injection System WIT-PE 1000 for concrete  Performances Characteristic values of tension loads under seismic action (performance category C1)	
Performances Characteristic values of tension loads under seismic action (performance category C1)	Annex C 20



Table C27: Characteristic values of shear loads under seismic action (performance category C1)													
Anchor size reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Steel failure			•		•	•	•	•					
Characteristic shear resistance	V <sub>Rk,s,eq,C1</sub>	[kN]					0,35	·As	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	γ <sub>Ms,V</sub>	[-]	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	γ <sub>inst</sub>	[-]						1,0					
Concrete edge failure	<u>,                                      </u>	•	•										
Effective length of fastener	I <sub>f</sub>	[mm]		ı	min(h <sub>e</sub>	<sub>ef</sub> ; 12 •	d <sub>nom</sub>	)		min(	h <sub>ef</sub> ; 300	mm)	
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32	
Installation factor	γ <sub>inst</sub>	[-]	1,0										
Factor for annular gap	$\alpha_{\sf gap}$	[-]		-	-	-	0,	5 (1,0	)3)	-		_	

Würth Injection System WIT-PE 1000 for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1)	Annex C 21

 <sup>1)</sup> f<sub>uk</sub> shall be taken from the specifications of reinforcing bars
 2) in absence of national regulation
 3) Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended.



Table C28: Displa	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 under seismic C1 action														
Temperature range I:	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082				
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171				
Temperature range II: 72°C/50°C	$\delta_{\text{N0}}$ -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			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Non-cracked and cracked concrete under 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 l: 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

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

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

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

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30		
Non-cracked and cracked concrete under seismic C1 action												
All temperature ranges	$\delta_{ m V0}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03		
	$\delta_{ m V\infty}$ -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 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked and cracked concrete under seismic C1 action												
1, an temperature	$\delta_{ m V0}$ -factor	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
	$\delta_{V\infty}$ -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  $\cdot V$ ;

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

Würth Injection System WIT-PE 1000 for concrete	
Performances Displacements under seismic C1 action (threaded rods and rebar)	Annex C 22



Table C32: Di	Table C32: Displacements under tension load (threaded rod)												
Anchor size threa	M8	M10	M12	M16	M20	M24	M27	M30					
Non-cracked and cracked concrete under seismic C2 action													
All temperature	δ <sub>N,C2(DLS)</sub>	[mm]		lo	0,21	0,24	0,27	0,36					
ranges	$\delta_{\text{N,C2(ULS)}}$	[mm]	ļ !	performance assassed		0,51	0,54	0,63	perforr assa				

# Table C33: Displacements under shear load (threaded rod)

Anchor size threa		M8 M10	M12	M16	M20	M24	M27	M30				
Non-cracked and cracked concrete under seismic C2 action												
All temperature	$\delta_{V,C2(DLS)}$	[mm]	No	3,1	3,4	3,5	4,2	_	lo			
ranges	$\delta_{V,C2(ULS)}$	[mm]	performance assassed	6,0	7,6	7,3	10,9	репоп assa	mance ssed			

Würth Injection System WIT-PE 1000 for concrete

Performances
Displacements under seismic C2 action (threaded rods)

Annex C 23