



Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products



European Technical Assessment

ETA-19/0542 of 30 January 2025

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

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

EAD 330499-02-0601, Edition 12/2023

ETA-19/0542 issued on 14 April 2022

Z009678.25

European Technical Assessment ETA-19/0542

English translation prepared by DIBt



Page 2 of 49 | 30 January 2025

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This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No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



Page 3 of 49 | 30 January 2025

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 mortar Injection mortar WIT-PE 1000 and a steel element according to Annex A 3 and Annex A 5.

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

The product description is given in Annex A.

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

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

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

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1 to C 6, C 8 to C 11, C 13 to C 16, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 7, C 12, C 17
Displacements under short-term and long-term loading	See Annex C 18 to C 20
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 21 to C 28

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 29 to C 31

3.3 Hygiene, health and the environment (BWR 3)

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

European Technical Assessment ETA-19/0542

English translation prepared by DIBt



Page 4 of 49 | 30 January 2025

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

In accordance with the European Assessment Document EAD 330499-02-0601 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.

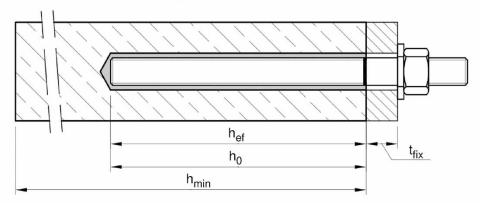
Issued in Berlin on 30 January 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock Head of Section beglaubigt: Baderschneider

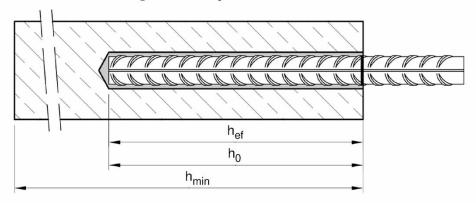


Installation threaded rod M8 up to M30

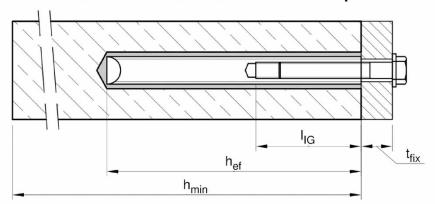
prepositioned installation or push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø40



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



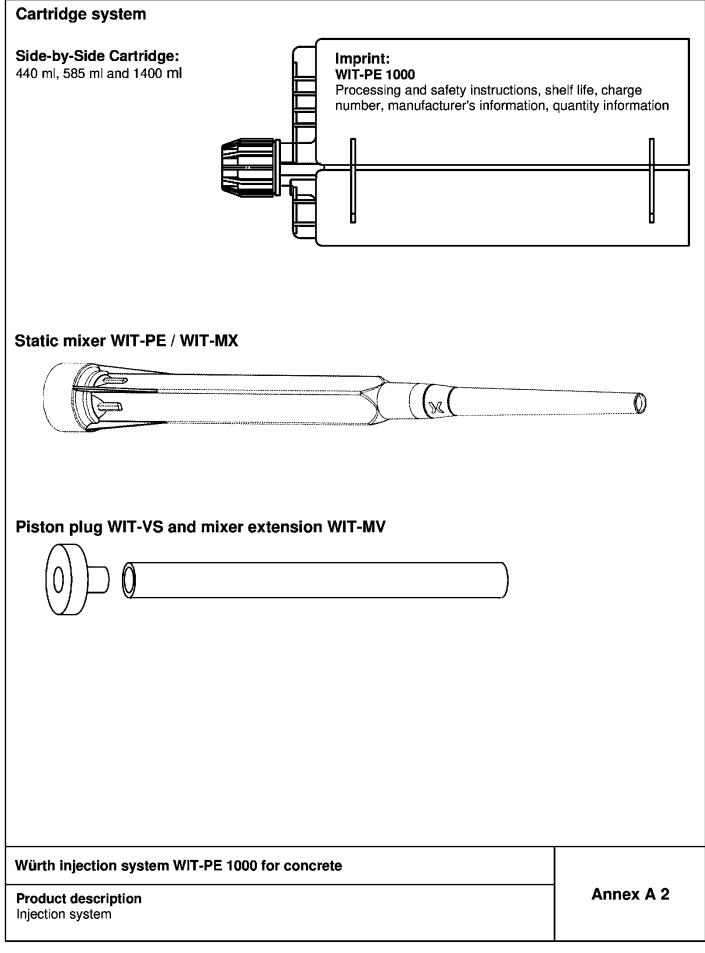
 t_{fix} = thickness of fixture h_0 = drill hole depth

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

h_{min} = minum thickness of member

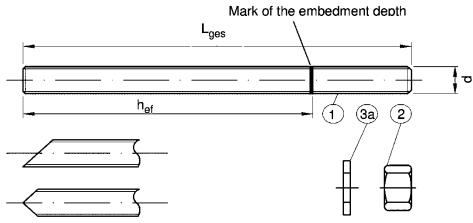
Würth injection system WIT-PE 1000 for concrete Product description Installed condition Annex A 1







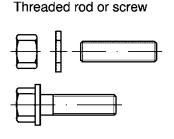
Threaded rod M8 up to M30 with washer and hexagon nut

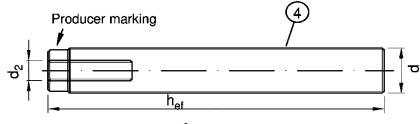


Commercial standard rod with:

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

Internal threaded rod IG-M6 to IG-M20





Marking Internal thread

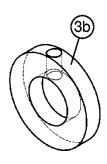
Mark

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

HCR additional mark for high-corrosion resistance steel

Filling washer WIT-SHB

Mixer reduction nozzle WIT-MR





Würth injection system WIT-PE 1000 for concrete

Product description

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

Annex A 3



	ble A1: Mate	riais				
Parl	Designation	Material				
- zi - h	inc plated ≥ 5 ot-dip galvanised ≥ 4	acc. to EN ISO 683-4:2 µm acc. to EN ISO 0 µm acc. to EN ISO 5 µm acc. to EN ISO	4042 1461	2:2022 or I :2022 and EN ISO 10684::	2004+AC:2009 or	
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
			4.6	f _{uk} = 400 N/mm ²	f _{vk} = 240 N/mm ²	A ₅ > 8%
1	Threaded rod			f _{uk} = 400 N/mm ²	f _{yk} = 320 N/mm ²	A ₅ > 8%
•	Timeaded fou	acc. to		f _{uk} = 500 N/mm²	f _{yk} = 300 N/mm ²	A ₅ > 8%
		EN ISO 898-1:2013		f _{uk} = 500 N/mm²	f _{vk} = 400 N/mm ²	A ₅ > 8%
				f _{uk} = 800 N/mm ²	f _{yk} = 640 N/mm ²	$A_5 \ge 12\%^{3}$
		acc. to	4	for anchor rod class 4.6 or	4.8	
2	Hexagon nut	EN ISO 898-2:2022	5	for anchor rod class 5.6 or	r 5.8	
			8	for anchor rod class 8.8		
3a	Washer	(e.g.: EN ISO 887:20	06, E	galvanised or sherardized :N ISO 7089:2000, EN ISO	7093:2000 or EN ISO 7	'094:2000)
3b	Filling washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized		Ter at a
	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
4	anchor rod acc. to			f _{uk} = 500 N/mm ²	f _{yk} = 400 N/mm ²	A ₅ > 8%
						1 ~
		EN ISO 898-1:2013	8.8	f _{uk} = 800 N/mm ²	f _{yk} = 640 N/mm ²	A ₅ > 8%
Stai	nless steel A4 (Mater	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1	.431 .457	f _{uk} = 800 N/mm ² I / 1.4567 or 1.4541, acc. to I / 1.4362 or 1.4578, acc. to I 1.4565, acc. to EN 10088	o EN 10088-1:2023) o EN 10088-1:2023)	
Stai	nless steel A4 (Mater	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1	.431 .457	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088 Characteristic steel	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023) Characteristic steel	
Stai Higl	nless steel A4 (Mater n corrosion resistand	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45	.431 .457	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023)	A ₅ > 8% Elongation at
Stai Higl	nless steel A4 (Mater	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class	.431 .457 .29 oi	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088-Characteristic steel ultimate tensile strength	DEN 10088-1:2023) DEN 10088-1:2023) DEN 10088-1:2023) DEN 10088-1:2023) Characteristic steel yield strength	A ₅ > 8% Elongation at fracture
Stai Higl	nless steel A4 (Mater n corrosion resistand	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class	.431 .457 29 oi	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088. Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$	$A_5 > 8\%$ Elongation at fracture $A_5 \ge 8\%$
Stai Higl	nless steel A4 (Mater n corrosion resistand	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020	.431 .457 29 oi	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088-Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	A ₅ > 8% Elongation at fracture A ₅ ≥ 8% A ₅ ≥ 12% ³⁾
Stai <u>Higl</u> 1	nless steel A4 (Mater n corrosion resistand	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 re steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 acc. to	.431 .457 .29 or .50 .70 .80 .50 .70	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088-Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	A ₅ > 8% Elongation at fracture A ₅ ≥ 8% A ₅ ≥ 12% ³⁾
Stai HigI	Threaded rod ¹⁾⁴⁾	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 re steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020	.431 .457 .29 or .70 .80 .70 .80	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088- Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80	b EN 10088-1:2023) c EN 10088-1:2023 c E	A ₅ > 8% Elongation at fracture A ₅ \geq 8% A ₅ \geq 12% ³⁾ A ₅ \geq 12% ³⁾
Stai Higl	Threaded rod ¹⁾⁴⁾	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 re steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529	.431 .457 .29 or .70 .80 .70 .80 .71 .43 .71 .44 .9 or 1	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088-Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023) 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 10088-1578, acc. to EN 10088-1:2023	Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$:2023
Stai High 1	Threaded rod ¹⁾⁴⁾ Hexagon nut ¹⁾⁴⁾	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 rial 1.4401 / 1.4404 / 1 rial 1.4401 / 1.4404 / 1 re steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452((e.g.: EN ISO 887:20	.431 .457 .29 or	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088. Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4.4565, acc. to EN 10088-1	o EN 10088-1:2023) o EN 10088-1:2023) -1: 2023) 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 10088-1578, acc. to EN 10088-1:2023	Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^3$ $A_5 \ge 12\%^3$:2023 :2023
Stai High 1	Threaded rod ¹⁾⁴⁾ Hexagon nut ¹⁾⁴⁾ Washer Filling washer	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 rial 1.4401 / 1.4404 / 1 rial 1.4401 / 1.4404 / 1 re steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452((e.g.: EN ISO 887:20	.431 .457 .29 or	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088-Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4404 / 1.4571 / 1.4362 or 1.4404 / 1.4571 / 1.4362 or 1.4505, acc. to EN 10088-15N ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel	b EN 10088-1:2023) c EN 10088-1:2023 c EN 10088-1:2023 c EN 10088-1 c EN	Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^3$ $A_5 \ge 12\%^3$ $A_5 \ge 12\%^3$:2023 :2023 :2023 :2094:2000)
Stai	Threaded rod ¹⁾⁴⁾ Hexagon nut ¹⁾⁴⁾ Washer	rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 rial 1.4401 / 1.4404 / 1 re steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4401 / HCR: Material 1.452! (e.g.: EN ISO 887:20 Stainless steel A4, H	.431 .457 .29 or	1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088-Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.44 04 / 1.4571 / 1.4362 or 1.45 04 / 1.4571 / 1.4362 or 1.45 01 ISO 7089:2000, EN ISO orrosion resistance steel	b EN 10088-1:2023) c EN 10088-1:2023 c EN 10088-1:2023 c EN 10088-1	Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^3$ $A_5 \ge 12\%^3$:2023 :2023 :2023

⁴⁾ Property class 80 only for stainless steel A4 and HCR

Würth injection system WIT-PE 1000 for concrete	
Product description Materials threaded rod, Internal threaded anchor rod and filling washer	Annex A 4

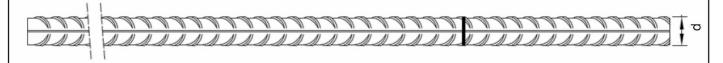
 ²⁾ for IG-M20 only property class 50
 3) A₅ > 8% fracture elongation if no use for seismic performance category C2

Page 9 of European Technical Assessment ETA-19/0542 of 30 January 2025

English translation prepared by DIBt



Reinforcing bar: ø8 up to ø40



Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010 Rib height of the bar shall be in the range $0.05d \le h_{rib} \le 0.07d$ (d: Nominal diameter of the bar; h_{rib} : Rib height of the bar)

Table A2: Materials Reinforcing bar

Part	Designation	Material
Reba	ar	
1	Reinforcing steel according to EN 1992 1 1:2004+AC:2010, Annex C	Bars and rebars from ring class B or C f_{yk} and k according to NDP or NCI according to 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



Specification of the intend										
Fasteners subject to (Static	<u> </u>	Working life 50 years Workin								
Base material	uncracked concrete	cracked concrete	uncracked concr	<u> </u>						
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M Ø8 to Ø IG-M6 to I	3 32,	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20							
HD: Hammer drilling CD: Compressed air drilling	Ø36 to Ø40	No performance assessed	Ø36 to Ø40	No performance assessed						
DD: Diamond drilling	M8 to M30, Ø8 to Ø40, IG-M6 to IG-M20	No performance assessed	M8 to M30, Ø8 to Ø40, IG-M6 to IG-M2	No performance assessed						
Temperature Range:	II: - 40 C 1	+40 C ¹⁾ to +72 C ²⁾ to +80 C ³⁾	l: - 40 ll: - 40 lll: - 40	C to +72 C ²⁾						
Fasteners subject to (seismi	c action):									
	Performance C	Category C1	Performan	ce Category C2						
Base material	Cracked and uncr	acked concrete	Cracked and u	nd uncracked concrete						
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M ⊘8 to 9	= -	M1:	112 to M30						
DD: Diamond drilling	No performand	e assessed	No perform	ormance assessed						
Temperature Range:	II: -40 C t	to +40 C ¹⁾ to +72 C ²⁾ to +80 C ³⁾	l: - 40 (ll: - 40 (lll: - 40 (C to +72 C ²⁾						
Fasteners subject to (fire exp	oosure):									
Base material		Cracked and unc	racked concrete							
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling		M8 to Ø8 to IG-M6 to	Ø32,							
DD: Diamond drilling		No performar	ice assessed							
Temperature Range:		I: - 40 C · II: - 40 C · III: - 40 C ·	to +72 C ²⁾							
1) (max. long-term temperature +24°0 2) (max. long-term temperature +50°0 3) (max. long-term temperature +60°0	C and max. short-term ter	mperature +72°C)								
Würth injection system WIT-P	E 1000 for concrete									
Intended use Specifications				Annex B 1						



Base materials:

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A2:2021.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A2:2021.

Use conditions (Environmental conditions):

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

Design:

- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.
 The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Fasteners are designed under the responsibility of an engineer experienced in fasteners and concrete work.
- The fasteners are designed in accordance to EN 1992-4:2018 and Technical Report TR 055, Edition February 2018
- The fasteners under fire exposure are designed in accordance to Technical Report TR 082, Edition June 2023.

Installation:

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

Würth injection system WIT-PE 1000 for concrete	
Intended use Specifications (Continued)	Annex B 2



Table B1: Installation parameters for threaded rod											
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of elemen	t	d = d _{nom}	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole di	ameter	d ₀	[mm]	10	12	14	18	22	28	30	35
Effective embedme	at donth	h _{ef,min}	[mm]	60	60	70	80	90	96	108	120
Enective embedmen	Effective embedment depth			160	200	240	320	400	480	540	600
Diameter of clearance hole in	Prepositioned ins	stallation d _f ≤	[mm]	9	12	14	18	22	26	30	33
the fixture	Push through i		[mm]	12	14	16	20	24	30	33	40
Maximum installatio	n torque	max T _{inst}	[Nm]	10	20	401)	60	100	170	250	300
Minimum thickness of member		h _{min}	[mm]	_ ~	_f + 30 m : 100 mr			ŀ	n _{ef} + 2do		
Minimum spacing		s _{min}	[mm]	40	50	60	75	95	115	125	140
Minimum edge dista	ınce	c _{min}	[mm]	35	40	45	50	60	65	75	80

¹⁾ Maximum installation torque for M12 with steel Grade 4.6 is 35 Nm

Table B2: Installation parameters for reinforcing bar

Reinforcing bar			Ø	8 ¹⁾	Ø 1	(0 ¹)	Ø 1	12 ¹⁾	Ø 14	Ø 16	Ø 20	Ø	24 ¹⁾	Ø	25 ¹⁾	Ø 28	Ø 32	Ø 36	Ø 40
Diameter of element	d = d _{nom}	[mm]		8	1	0	1	2	14	16	20	2	4	2	25	28	32	36	40
Nominal drill hole diameter	d ₀	[mm]	10	12	12	14	14	16	18	20	25	30	32	30	32	35	40	45	52/55
Effective embedment	h _{ef,min}	[mm]	6	0	6	0	7	0	75	80	90	9	6	1(00	112	128	144	160
depth	h _{ef,max}	[mm]		60	20		24	10	280	320	400	48	30	50	00	560	640	720	800
Minimum thickness of member	h _{min}	[mm]	h	ef ⁺ 10	30 r 0 m		≥					h	ef +	2d	0				
Minimum spacing	s _{min}	[mm]	4	0	5	0	6	0	70	75	95	12	20	12	20	130	150	180	200
Minimum edge distance	c _{min}	[mm]	3	5	4	0	4	5	50	50	60	7	0	7	0	75	85	180	200

¹⁾ both nominal drill hole diameter can be used

Table B3: Installation parameters for Internal threaded anchor rod

Internal threaded anchor rod			IG-M6	IG-M8	IG-M10 IG-M12 IG-M16 IG-M				
Internal diameter of anchor rod	d ₂	[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 ₀	[mm]	12	14	18	22	28	35	
Effective embedment depth	h _{ef,min}	[mm]	60	70	80	90	96	120	
Effective embedment depth	h _{ef,max}		200	240	320	400	480	600	
Diameter of clearance hole in the fixture	d _f ≤		7	9	12	14	18	22	
Maximum installation torque	max T _{inst}	[Nm]	10	10	20	40	60	100	
Thread engagement length min/max	l _{IG}	[mm]	8/20	8/20	10/25	12/30	16/32	20/40	
Minimum thickness of member	h _{min}	[mm]	0.	30 mm 0 mm		h _{ef} -	- 2d ₀		
Minimum spacing	s _{min}	[mm]	50	60	75	95	115	140	
Minimum edge distance	c _{min}	[mm]	40	45	50	60	65	80	
Park (Park St. 1977)	**			99		20	**	-	

¹⁾ With metric threads

Würth injection system WIT-PE 1000 for concrete

Intended use

Installation parameters

Annex B 3



Table B4: Parameter cleaning and installation tools															
					manu	Markey									
Threaded Rod	Re- inforcing bar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD	d _t Brush	5	d _{b,min} min. Brush - Ø	Piston plug Installation direction and us of piston plug								
[mm]	[mm]	[mm]	[mm]	WIT-	[mm]	[mm]	WIT-								
M8	8		10	RB10	11,5	10,5									
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		No plug required							
M12	10 / 12	IG-M8	14	RB14	15,5	14,5		No plug	required						
<i>i</i> =	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	T u	IG-M12	22	RB22	24,0	22,5	VS22								
<u>-</u>	20	-	25	RB25	27,0	25,5	VS25	h _{ef} >	h _{ef} >						
M24	u -	IG-M16	28	RB28	30,0	28,5	VS28	250 mm	250 mm	all					
M27	24 / 25	12	30	RB30	31,8	30,5	VS30	250 11111	250 111111						
-	24 / 25	-	32	RB32	34,0	32,5	VS32								
M30	28	IG-M20	35	RB35	37,0	35,5	VS35								
2=	32	8=	40	RB40	43,5	40,5	VS40								
en.	36	-	45	RB45	47,0	45,5	VS45								
ķ e r	40	/=	52 -	RB52	54,0	52,5	VS52	all	all	all					
-	40	?=	- 55	RB55	58,5	55,5	VS55								
_		allation to	ols												
	HDB – Hollow drill bit system The hollow drill system consists of Würth Extraction drill bit, MKT Extraction drill bit and a class M hoover with a minimum negative pressure of 253 hPa and a flow rate of minimum 150 m³/h (42 l/s).														

Compressed air tool

(min 6 bar)



Piston Plug WIT-VS



Brush WIT-RB



Brush extension



Würth injection system V	NIT-PE 1000 for concrete
--------------------------	--------------------------

Intended use

Cleaning and installation tools

Annex B 4



Table B5:	Worki	ng and curing	ı time	
Tempera	ture in bas	se material	Maximum working time	Minimum curing time ¹⁾
	Т		t _{work}	t _{cure}
+ 0°C	to	+ 4°C	90 min	144 h
+ 5°C	to	+ 9°C	80 min	48 h
+ 10°C	to	+ 14°C	60 min	28 h
+ 15°C	to	+ 19°C	40 min	18 h
+ 20 °C	to	+ 24 °C	30 min	12 h
+ 25 °C	to	+ 34 °C	12 min	9 h
+ 35 °C	to	+ 39 °C	8 min	6 h
	+ 40 °C		8 min	4 h
Cartr	idge tempe	erature	+5°C to	+40°C

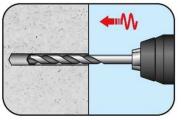
The minimum curing time is only valid for dry base material.
 In wet base material the curing time must be doubled.

Würth injection system WIT-PE 1000 for concrete	
Intended use Working time and curing time	Annex B 5



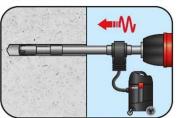
Installation instructions

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



1a. Hammer drilling (HD) / Compressed air drilling (CD)

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



1b. Hollow drill bit system (HDB) (see Annex B 4)

Drill a hole to the required embedment depth.

Drill bit diameter according to Table B1, B2 or B3.

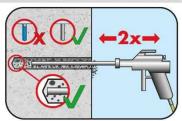
The hollow drilling system removes the dust and cleans the bore hole.

Proceed with Step 3.

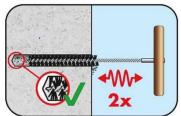
Attention! Standing water in the bore hole must be removed before cleaning.

Compressed Air Cleaning (CAC):

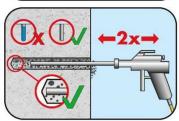
All diameter in cracked and uncracked concrete



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



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



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

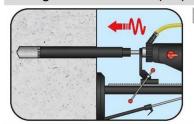
Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Würth injection system WIT-PE 1000 for concrete	
Intended use Installation instructions	Annex B 6



Installation instructions (continuation)

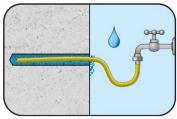
Drilling of the bore hole (DD)



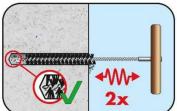
Diamond drilling (DD)
Drill a hole to the required embedment depth required Drill bit diameter according to Table B1, B2 or B3.
Aborted drill holes shall be filled with mortar.
Proceed with Step 2.

Flush & Compressed Air Cleaning (SPCAC):

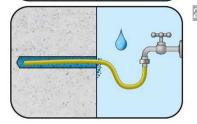
All diameter in uncracked concrete



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

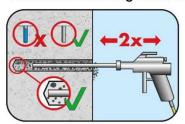


2b. Brush the bore hole minimum 2x with brush WIT-RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension shall be used.)

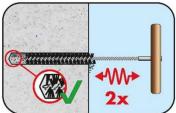


Flushing again with water until clear water comes out.

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



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



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

Würth injection system WIT-PE 1000 for concrete

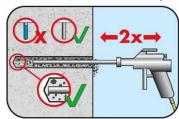
Intended use

Installation instructions (continuation)

Annex B 7



Installation instructions (continuation)



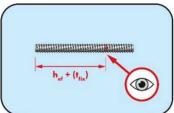
Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

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



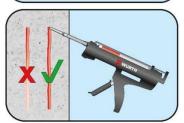
Screw on static-mixing nozzle WIT-PE / WIT-MX and load the cartridge into an appropriate dispensing tool.

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



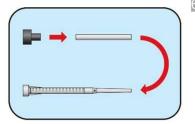
Mark embedment depth on the anchor rod.

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



Not proper mixed mortar is not sufficient for fastening.

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

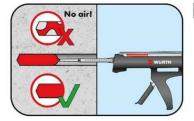


Piston plugs WIT-VS and mixer nozzle extensions WIT-MV shall be used according to

Table B4 for the following applications:

- Horizontal and vertical downwards direction: Drill bit-Ø d_0 ≥ 18 mm and embedment depth h_{ef} > 250mm
- Vertical upwards direction: Drill bit-Ø $d_0 \ge 18 \text{ mm}$

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



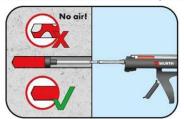
Injecting mortar without piston plug WIT-VS:

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

Würth injection system WIT-PE 1000 for concrete	
Intended use Installation instructions (continuation)	Annex B 8



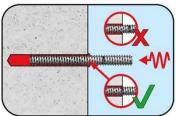
Installation instructions (continuation)



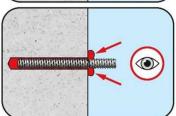


Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.) During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.

Observe the temperature related working time t_{work} (Annex B 5).

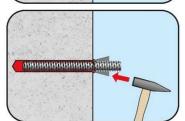


Insert the anchor rod while turning slightly up to the embedment mark.

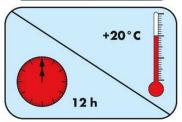


Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.

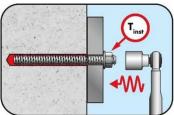
Otherwise, the installation must be repeated starting from step 7 before the maximum working time t_{work} has expired.



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



Temperature related curing time t_{cure} (Annex B 5) must be observed. Do not move or load the fastener during curing time.



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

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

Würth injection system WIT-PE 1000 for concrete

Intended use

Installation instructions (continuation)

Annex B 9



T	Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods												
Th	readed rod		M8	M10	M12	M16	M20	M24	M27	M30			
Cr	oss section area	A _s	[mm²]	36,6	58	84,3	157	245	353	459	561		
Cł	naracteristic tension resistance, Steel failu	re ¹⁾		•									
St	eel, Property class 4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224		
St	eel, Property class 5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280		
St	eel, Property class 8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449		
St	ainless steel A2, A4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281		
St	ainless steel A2, A4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)		
_	ainless steel A4 and HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)		
Cł	naracteristic tension resistance, Partial fac	tor ²⁾											
St	eel, Property class 4.6 and 5.6	γ _{Ms,N}	[-]				2,0	0					
St	eel, Property class 4.8, 5.8 and 8.8	γ _{Ms,N}	[-]				1,	5					
St	ainless steel A2, A4 and HCR, class 50	γ _{Ms,N}	[-]				2,8	6					
St	ainless steel A2, A4 and HCR, class 70	γ _{Ms,N}	[-]				1,8	7					
_	ainless steel A4 and HCR, class 80	γ _{Ms,N}	[-]		1,6								
Cł	naracteristic shear resistance, Steel failure	1)		,	1			r	ı	ı			
=	Steel, Property class 4.6 and 4.8	V ⁰ Rk,s	[kN]	9 (8)	14 (13)	20	38	59	85	110	135		
rarm	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	25	47	74	106	138	168		
eve	Steel, Property class 8.8	V ^u Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224		
Ĭ	Stainless steel A2, A4 and HCR, class 50	V ⁰ Rk,s	[kN]	9	15	21	39	61	88	115	140		
Without lever	Stainless steel A2, A4 and HCR, class 70	V ⁰ Rk,s	[kN]	13	20	30	55	86	124	_3)	_3)		
5	Stainless steel A4 and HCR, class 80	V ⁰ Rk,s	[kN]	15	23	34	63	98	141	_3)	_3)		
	Steel, Property class 4.6 and 4.8	М ⁰ Rk,s	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900		
arm	Steel, Property class 5.6 and 5.8	М ⁰ Rk,s	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123		
	Steel, Property class 8.8	М ⁰ _{Rk,s}	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797		
h lever	Stainless steel A2, A4 and HCR, class 50	М ⁰ _{Rk,s}	[Nm]	19	37	66	167	325	561	832	1125		
	Stainless steel A2, A4 and HCR, class 70	М ⁰ Rk,s	[Nm]	26	52	92	232	454	784	_3)	_3)		
			[Nm]	30	59	105	266	519	896	_3)	_3)		
Cł	naracteristic shear resistance, Partial facto	M ⁰ _{Rk,s}	•	•	•		•		•	•			
St	eel, Property class 4.6 and 5.6	γ _{Ms,V}	[-]				1,6	7					
St	eel, Property class 4.8, 5.8 and 8.8	γ _{Ms,V}	[-]				1,2	:5					
St	ainless steel A2, A4 and HCR, class 50	γ _{Ms,V}	[-]				2,3	8					
St	ainless steel A2, A4 and HCR, class 70	γ _{Ms,V}	[-]				1,5	6					
St	ainless steel A4 and HCR, class 80	γ _{Ms,V}	[-]				1,3	3					
4.	.												

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

³⁾ Fastener type not part of the ETA

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

²⁾ in absence of national regulation



Table C2:	Characteristic v for a working lif			ds under static and quasi-static action
Fastener				All Fastener type and sizes
Concrete cone fa	ailure			
Uncracked concre	ete	k _{ucr,N}	[-]	11,0
Cracked concrete	•	k _{cr,N}	[-]	7,7
Edge distance		c _{cr,N}	[mm]	1,5 h _{ef}
Axial distance		s _{cr,N}	[mm]	2 c _{cr,N}
Splitting				
	h/h _{ef} ≥ 2,0			1,0 h _{ef}
Edge distance	2,0 > h/h _{ef} > 1,3	C _{cr,sp}	[mm]	$2 \cdot h_{ef} \left(2,5 - \frac{h}{h_{ef}} \right)$
	h/h _{ef} ≤ 1,3			2,4 h _{ef}
Axial distance	-	S _{cr,sp}	[mm]	2 c _{cr,sp}

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years	Annex C 2



Thread	ded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel f			-									
Charac	teristic tension res	sistance	N _{Rk,s}	[kN]			$A_s \cdot f_l$	_{uk} (or s	ee Tab	le C1)		
Partial	factor		γ _{Ms,N}	[-]				see Ta	ble C1	! }		
-00754.24 mm r234245.0	ned pull-out and	Active to the experience of the contract of th	oth									
Charac (CD)	teristic bond resis	tance in uncracke	d concrete C	20/25 in hamr	ner dril	led hol	es (HD) and c	ompres	ssed ai	r drilled	holes
iture	I: 24°C/40°C	Dry, wet			20	20	19	19	18	17	16	16
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr	[N/mm ²]	15	15	15	14	13	13	12	12
<u> </u>	III:60°C/80°C	hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Charac	teristic bond resis	tance in uncracke	d concrete C	20/25 in hamr				hollow	drill bi	t (HDB))	
ge	I: 24°C/40°C	Dry west			17	16	16	16	15	14	14	13
ran	II: 50°C/72°C	Dry, wet concrete			14	14	14	13	13	12	12	11
ure	III:60°C/80°C		τ	[N/mm²]	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
erat	I: 24°C/40°C		^τ Rk,ucr	[18/111115]	16	16	16	15	15	14	14	13
Temperature range	II: 50°C/72°C	flooded bore hole			14	14	14	13	13	12	12	11
Te	III:60°C/80°C	Tiole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
	teristic bond resis hammer drilled ho)/25 in hamme	r drilled	holes	(HD) ,	compre	essed a	air drille	d holes	s (CD
<u>re</u>	I: 24°C/40°C	Dry wot			7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
Temperature range	II: 50°C/72°C	Dry, wet concrete and flooded bore	τ _{Rk,cr}	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Tem	III:60°C/80°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
	tion factor ψ ⁰ sus in CD) and in hamme				hamme	er drille	d holes	(HD),	compre	essed a	air drille	∌d
a_r	I: 24°C/40°C	Dry, wet	THOROW GITT	bit (FIDB)	0,80							
Temperatı range	II: 50°C/72°C	concrete and flooded bore	Ψ ⁰ sus	[-]	0,68							
Tem	III:60°C/80°C	hole			0,70							
Increas	sing factors for cor	ncrete	Ψς	[-]				(f _{ck} / 2	20) ^{0,1}			
	teristic bond resis		τ _{Rk,ucr} =				Ψο	• τ _{Rk,u}	cr,(C20/	(25)		
on the	concrete strength	class	τ _{Rk,cr} =				Ψ	c ^{• τ} Rk,	cr,(C20/2	25)		
Carlotte Contract	ete cone failure							2000				
	nt parameter							see Ta	ble C2			
Splittir Beleva	nt parameter							SPD To	ıble C2			
	ation factor							300 10	ibic O2	·		
for dry	and wet concrete	(HD; HDB, CD)	٧	r 1				1	,0			
for floo	ded bore hole (HD	; HDB, CD)	γinst	[-]				1	,2			
Würt	h injection syst	em WIT-PE 100	0 for conc	rete								
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (threaded rod)								Anne	x C 3	}		



Table		racteristic va working life			ls und	der st	atic a	nd q	uasi-	static	actio	n
Thread	led rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure			_								
Charac	teristic tension res	istance	N _{Rk,s}	[kN]			A _s · f	_{Jk} (or s	ee Tab	le C1)		
Partial t	factor		γ _{Ms,N}	[-]				see Ta	able C1			
	ned pull-out and											
Charac (CD)	teristic bond resist	ance in uncracke	d concrete C20)/25 in hamr 	ner dril	led hole	es (HD) and c	ompres	ssed ai	r drilled	holes
ature	I: 24°C/40°C	Dry, wet			20	20	19	19	18	17	16	16
Temperature range	II: 50°C/72°C	concrete and flooded bore hole	^τ Rk,ucr,100	[N/mm ²]	15	15	15	14	13	13	12	12
<u> </u>	III:60°C/80°C				6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Charac	teristic bond resist	ance in uncracke	d concrete C20)/25 in hamr	ner dril	led hol				t (HDB))	
ge	I: 24°C/40°C	Dry wet			17	16	16	16	15	14	14	13
Lau l	II: 50°C/72°C	Dry, wet concrete			14	14	14	13	13	12	12	11
Line I	III:60°C/80°C		7-,	[N/mm²]	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
eral	I: 24°C/40°C		^τ Rk,ucr,100	[[14/111111-]	16	16	16	15	15	14	14	13
Temperaturerange	II: 50°C/72°C	flooded bore hole			14	14	14	13	13	12	12	11
≝	III:60°C/80°C	11016			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
	teristic bond resist nammer drilled hol			5 in hamme	r drilled	holes	(HD) ,	compre	essed a	air drille	d hole:	s (CD)
<u>e</u>	I: 24°C/40°C	Dry, wet concrete and flooded bore	^τ Rk,cr,100		6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C			[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Tem)	III:60°C/80°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
	ion factor ψ ⁰ sus,10				5 in har	nmer d	rilled h	oles (H	D), cor	npress	ed air d	drilled
,	CD) and in hamme	er arillea noles witi	n nollow arill bi	t (HDB) T								
nperature range	I: 24°C/40°C	Dry, wet concrete and	0	.,	0,80							
Temperal	II: 50°C/72°C	flooded bore hole	Ψ^0 sus,100	[-]	0,68							
<u> </u>					0,70							
Increas	ing factors for con	crete	Ψc	[-]				(t _{ck} / 2	20) ^{0,1}			
	teristic bond resist		τ _{Rk,ucr,100} =				Ψς•	^τ Rk,ucr	,100,(C2	20/25)		
	concrete strength	ciass	τ _{Rk,cr,100} =				Ψ _C •	^τ Rk,cr,	100,(C2	0/25)		
	ete cone failure							see Ta	hla Co	1		
Splittin	nt parameter							see 18	ible C2			
	nt parameter							see Ta	able C2	1		
	ation factor											
for dry	1,0											
for floor	ded bore hole (HD	; HDB, CD)	γinst	[-]				1	,2			
Würtl	n injection syste	em WIT-PE 100	0 for concre	te						•	0 4	,
Chara	rmances acteristic values o working life of 100			d quasi-stat	ic actio	on				Anne	ex C 4	,



Table		racteristic val			s und	der st	atic a	nd q	uasi-	static	actio	on
Thread	led rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure											
Charac	teristic tension res	istance	N _{Rk,s}	[kN]			A _s · f	_{Jk} (or s	ee Tab	le C1)		
Partial t	factor		γ _{Ms,N}	[-]				see Ta	ıble C1			
	ned pull-out and											
Charac	teristic bond resist	ance in uncracked	d concrete C20	25 in diam	ond dri	led hol	es (DD)				
ture	I: 24°C/40°C	Dry, wet			15	14	14	13	12	12	11	11
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr	[N/mm²]	12	12	11	10	9,5	9,5	9,0	9,0
Ten	III:60°C/80°C	hole			5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0
Reducti	ion factor ψ ⁰ sus in	uncracked concre	ete C20/25 in di	amond drill	ed hole	s (DD)	ı					
ture	I: 24°C/40°C	Dry, wet		[-]	0,77							
Temperature range	II: 50°C/72°C	concrete and flooded bore	$\psi^0_{\sf sus}$		0,72							
Tem Tem	III:60°C/80°C	hole			0,72							
Increas	ing factors for con	crete	Ψc	[-]				(f _{ck} / 2	20) ^{0,2}			
	teristic bond resist		τ _{Rk,ucr} =				25)					
Concre	ete cone failure											
	nt parameter							see Ta	ble C2			
Splittin												
	Relevant parameter					see Table C2						
	ation factor	'DD)						4	^			
	and wet concrete (ded bore hole (DD)	•	γ _{inst}	[-]		1,2		ı	,0	1,4		

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



Table		racteristic va working life			s und	der st	atic a	nd q	uasi-:	static	actio	on .
Thread	ed rod			M8	M10	M12	M16	M20	M24	M27	M30	
Steel fa	ilure											
Charact	teristic tension res	istance	N _{Rk,s}	[kN]			A _s · f	_{ık} (or s	ee Tab	le C1)		
Partial fa	actor		γ _{Ms,N}	[-]				see Ta	ble C1			
	ned pull-out and											
Charact	teristic bond resist	ance in uncracke	d concrete C20	/25 in diam	ond dri	lled hol	es (DD)				
fure	일 I: 24°C/40°C Dry, wet				15	14	14	13	12	12	11	11
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	11	11	10	10	9,5	9,0	8,5	8,5
□ III:60°C/80°C hole					5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0
Reduction factor $\psi^0_{sus,100}$ in uncracked concrete C20/25 in diamond						holes (DD)					
ture	I: 24°C/40°C	Dry, wet			0,73							
Temperature range	II: 50°C/72°C	concrete and flooded bore	Ψ ⁰ sus,100	[-]	0,70							
Ten	III:60°C/80°C	hole			0,72							
Increasi	ing factors for con	crete	Ψc	[-]				(f _{ck} /	20) ^{0,2}			
	teristic bond resist concrete strength		τ _{Rk,ucr,100} =				Ψ _C •	^τ Rk,ucr	,100,(C2	(0/25)		
Concre	te cone failure											
Relevar	nt parameter							see Ta	ble C2			
Splitting												
	nt parameter							see Ta	ble C2			
	tion factor	(22)		1								
	and wet concrete ded bore hole (DD	· /	γ _{inst}	[-]	1,0							

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



Table C7: Characteristic for a working I					nder s	tatic a	nd qu	asi-st	atic acti	on
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 ⁰ Rk,s	[kN]			0,6 •	A _s • f _{uk}	(or see	Table C	1)	
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V ⁰ Rk,s	[kN]			0,5 •	A _s ∙ f _{uk}	(or see	Table C	1)	
Partial factor	γ _{Ms,V}	[-]	see Table C1							
Ductility factor	k ₇	[-]	1,0							
Steel failure with lever arm	1									
Characteristic bending moment	M ⁰ Rk,s	[Nm]			1,2 • 1	W _{el} • f _{uk}	(or see	Table C	21)	
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ _{Ms,V}	[-]				see	Table C	:1		
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γ _{inst}	[-]					1,0			
Concrete edge failure	_									
Effective length of fastener	I _f	[mm]		m	nin(h _{ef} ; 1	2 · d _{nor}	_n)		min(h _{ef} ;	300mm)
Outside diameter of fastener	d _{nom}	[mm]	n] 8 10 12 16 20 24 27 30							30
Installation factor	γ _{inst}	[-]					1,0			

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



Internal threa	ded anchor rod	 S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure ¹⁾		<u>-</u>					10 11110				
Characteristic	tension resistance	e, 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123	
Steel, strength		8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196	
Partial factor.	strength class 5.8		γMs,N	[-]	1,5						
	tension resistance										
	HCR, Strength cla	·	N _{Rk,s}	[kN]	14	26	41	59	110	124	
Partial factor			γMs,N	[-]		•	1,87			2,86	
Combined pu	ill-out and conci	ete cone failui		1							
Characteristic (CD)	bond resistance	in uncracked co	oncrete C	20/25 in h	ammer dr	illed holes	(HD) and	compress	sed air dril	led holes	
_	I: 24°C/40°C	Dry, wet			20	19	19	18	17	16	
Temperature	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr	[N/mm²]	15	15	14	13	13	12	
range	III:60°C/80°C		,		6,5	6,5	6,0	6,0	5,5	5,5	
Characteristic	bond resistance	hole in uncracked co	ncrete C	20/25 in h		· · · · · ·		· · · · · · · · · · · · · · · · · · ·		-	
	I: 24°C/40°C				16	16	16	15	14	13	
	II: 50°C/72°C	Dry, wet concrete			14	14	13	13	12	11	
	III:60°C/80°C	Concrete	τ _{Rk,ucr}	[N/mm²]	6,5	6,5	6,0	6,0	5,5	5,5	
range	I: 24°C/40°C	flooded bore	-nk,ucr	[]	16	16	15	15	14	13	
	II: 50°C/72°C	hole			14	14	13	13	12	11	
Characteristic	III:60°C/80°C bond resistance	in oracked cons	rata C20	/OF in hom	6,5	6,5	6,0	6,0	5,5	5,5	
	r drilled holes wit			/23 III IIaII	iiilei ailile	iu noies (r	1D), comp	resseu aii	armea no	ies (CD)	
	I: 24°C/40°C	Dry, wet			7,0	8,5	8,5	8,5	8,5	8,5	
Temperature	II: 50°C/72°C	concrete and	τ _{Rk,cr}	[N/mm²]	6,0	7,0	7,0	7,0	7,0	7,0	
range	III:60°C/80°C	flooded bore hole	TR,CI	[]	5,0	5,0	4,5	4,5	4,5	4,5	
Deduction foot		1	lead assau	roto COO/O	•						
	tor ${\psi^0}_{ extsf{SUS}}$ in crack				o in nami	ner unneu	noies (mi), compre	esseu an c	ııııea	
noies (CD) air	d in hammer drille I: 24°C/40°C	Dry, wet	Jilow ariii				0	90			
Temperature		concrete and	0	.,	0,80						
range	II: 50°C/72°C	flooded bore	Ψ ⁰ sus	[-]	0,68						
	III:60°C/80°C	hole						70			
Increasing fac	tors for concrete		Ψс	[-]			(f _{ck} / :	20) ^{0,1}			
Characteristic	bond resistance	depending on		τ _{Rk,ucr} =			Ψ c * ^τ Rk,ι	cr,(C20/25)			
the concrete s	trength class			τ _{Rk,cr} =			Ψc * ^τ Rk,	cr,(C20/25)			
Concrete con	e failure		•								
Relevant para	meter						see Ta	ble C2			
Splitting failu	re										
Relevant para							see Ta	ble C2			
Installation fa			1								
	t concrete (HD; H		γ _{inst}	[-]				,0			
	re hole (HD; HDE	• •						,2 			
	(incl. nut and was teristic tension res									a roa.	
	strength class 50										
Würth injed	tion system W	/IT-PE 1000 fo	or conci	ete							
	es ic values of tens g life of 50 years				static act	ion		1	Annex C	8 (



	eristic valuerking life of			ads und	der stat	ic and	quasi-s	tatic ac	tion	
Internal threaded anchor rod				IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure ¹⁾						1				
Characteristic tension resistant	ce. 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123	
Steel, strength class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196	
Partial factor, strength class 5.8	3 and 8.8	γMs,N	[-]		Į.	1	,5			
Characteristic tension resistant										
Steel A4 and HCR, Strength cla	·	N _{Rk,s}	[kN]	14	26	41	59	110	124	
Partial factor		γMs,N	[-]	1,87 2,8						
Combined pull-out and conc	rete cone failu					,			,	
Characteristic bond resistance (CD))/25 in ha	mmer dril	led holes	(HD) and	compress	ed air dri	led holes	
_ I: 24°C/40°C	Dry, wet			20	19	19	18	17	16	
Temperature II: 50°C/72°C	concrete and flooded bore	τ _{Rk,ucr,100}	[N/mm²]	15	15	14	13	13	12	
range III:60°C/80°C	hole			6,5	6,5	6,0	6,0	5,5	5,5	
Characteristic bond resistance		oncrete C20)/25 in hai			·			•	
I: 24°C/40°C				16	16	16	15	14	13	
II: 50°C/72°C	Dry, wet concrete			14	14	13	13	12	11	
Temperature III:60°C/80°C	Concrete	τ _{Rk,ucr,100}	[N/mm²]	6,5	6,5	6,0	6,0	5,5	5,5	
range <u>I: 24°C/40°C</u>	flooded bore	*HK,UCT, 100	[1.47,	16	16	15	15	14	13	
II: 50°C/72°C	hole			14	14	13	13	12	11	
III:60°C/80°C Characteristic bond resistance	in aracked son	 	E in home	6,5	6,5	6,0	6,0	5,5	5,5	
and in hammer drilled holes wit			э ш пашп	ner armeu	i noies (n	D), compr	esseu air	annea no	ies (CD)	
I: 24°C/40°C	Dry, wet			6,5	7,5	7,5	7,5	7,5	7,5	
Temperature II: 50°C/72°C	concrete and	τ _{Rk,cr,100}	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	
range III:60°C/80°C	flooded bore hole	TRK,CI, 100	[. •,]	5,0	5,0	4,5	4,5	4,5	4,5	
drilled holes (CD) and in hamm I: 24°C/40°C Temperature range II: 50°C/72°C	er drilled holes Dry, wet concrete and flooded bore			20/25 in hammer drilled holes (HD), compressed air HDB) 0,80 0,68					air	
III:60°C/80°C	hole			0,70						
Increasing factors for concrete		Ψc	[-]			(f _{ck} / :	20) ^{0,1}			
Characteristic bond resistance	depending on	τ _{Rk} ,	ucr,100 =		Ч	/c * ^τ Rk,ucr	,100,(C20/2	25)		
the concrete strength class		τ _{Rl}	k,cr,100 =			Ψc • ^τ Rk,cr,				
Concrete cone failure			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				,(
Relevant parameter						see Ta	able C2			
Splitting failure										
Relevant parameter						see Ta	able C2			
Installation factor			1							
for dry and wet concrete (HD; I		γ_{inst}	[-]				<u>,0</u>			
for flooded bore hole (HD; HDE	·			motorial	and area -		,2 f the intern	ol thross-	d red	
Fastenings (incl. nut and was The characteristic tension res For IG-M20 strength class 50	sistance for stee								a roa.	
Würth injection system W	/IT-PE 1000 f	or concre	te							
Performances Characteristic values of tens for a working life of 100 year				tatic actio	on			Annex (9	



1,0

1.4

Table C10		eristic value rking life of			ads und	ler stat	ic and	quasi-s	tatic ac	tion
	ded anchor rod	s			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure1)										
Characteristic	tension resistant	ce, <u>5.8</u>	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength	ı class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor,	strength class 5.	8 and 8.8	γ _{Ms,N}	[-]			1	,5		
	tension resistand HCR, Strength cl		N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor			γ _{Ms,N}	[-]			1,87			2,86
Combined pu	III-out and conc	rete cone failu	re							
Characteristic	bond resistance	in uncracked co	oncrete C2	0/25 in dia	mond dril	led holes	(DD)			
	I: 24°C/40°C	Dry, wet concrete and flooded bore			14	14	13	12	12	11
Temperature range	II: 50°C/72°C		^τ Rk,ucr	[N/mm ²]	12	11	10	9,5	9,5	9,0
	III:60°C/80°C	hole			5,5	5,0	4,5	4,5	4,5	4,0
Reduction fact	or ${\psi^0}_{ extsf{sus}}$ in uncr	acked concrete	C20/25 in	diamond d	Irilled hole	es (DD)				
	I: 24°C/40°C	Dry, wet			0,77					
Temperature range	II: 50°C/72°C	concrete and flooded bore	Ψ^0 sus	[-]			0,	72		
	III:60°C/80°C	hole					0,	72		
Increasing fact	tors for concrete		Ψ _C	[-]			(f _{ck} /)	20) ^{0,2}		
Characteristic the concrete st	bond resistance trength class		τ _{Rk,ucr} =			Ψ c ˙ τ _{Rk,ι}	ucr,(C20/25)		
Concrete con	CENTEL OF CONTROL CONT									
Relevant para	Mark Control of the C						see Ta	able C2		
Splitting failu										
Relevant para	meter		see Table C2							

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.

[-]

1,2

 γ_{inst}

Installation factor

for dry and wet concrete (DD)

for flooded bore hole (DD)

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

²⁾ For IG-M20 strength class 50 is valid



Table C11:	cteristic vorking li		loads	und	der	stat	ic a	and	qua	si-s	tati	ic ac	tio	n
	 -				T		T		T		T			

				22-TV								
Internal threa	ded anchor rod	s			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure1)	2			,								
Characteristic	tension resistance	ce, 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123		
Steel, strength	n class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196		
Partial factor,	strength class 5.8	8 and 8.8	γ _{Ms,N}	[-]			1	,5				
The production of the production of the same of the sa	tension resistand HCR, Strength cla		N _{Rk,s}	[kN]	14 26 41 59 110					124		
Partial factor			$\gamma_{Ms,N}$	[-]			1,87			2,86		
Combined pu	Ill-out and conci	rete cone failu	re									
Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)												
	I: 24°C/40°C	Dry, wet			14	14	13	12	12	11		
Temperature range	II: 50°C/72°C	concrete and flooded bore	τ _{Rk,ucr,100}	[N/mm ²]	11	10	10	9,5	9,0	8,5		
	III:60°C/80°C	hole			5,5	5,0	4,5	4,5	4,5	4,0		
Reduction fact	or ψ^0 sus, 100 in (uncracked cond	rete C20/2	5 in diamo	nd drilled	holes (D	D)					
	I: 24°C/40°C	Dry, wet			0,73							
Temperature range	II: 50°C/72°C	concrete and flooded bore	Ψ ⁰ sus,100	[-]	0,70							
	III:60°C/80°C	hole			0,72							
Increasing fact	tors for concrete		Ψс	[-]			(f _{ck} / :	20) ^{0,2}				
Characteristic the concrete st	bond resistance trength class	depending on	τ _{Rk,}	ucr,100 =		ψ	c • ^τ Rk,ucı	,100,(C20/2	25)			
Concrete con	ne failure		**									
Relevant parameter see Table C2												
Splitting failure												
Relevant para							see Ta	able C2				
Installation fa												
	et concrete (DD)		γinst	[-]	1,0							
for flooded bo	re hole (DD)		rinst	LJ	1,	2		1,	,4			

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

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

²⁾ For IG-M20 strength class 50 is valid



Table C12: Character for a work						static a	nd qua	si-stati	c action
Internal threaded anchor rods				IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm ¹)								
Characteristic shear resistance,	5.8	V ⁰ Rk,s	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V ⁰ Rk,s	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 and 8.8 $\gamma_{Ms,V}$ [-] 1,25									
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 ²⁾	V ⁰ _{Rk,s} [kN] 7 13 20 30 55					40			
Partial factor		γ _{Ms,V}	[-]			1,56			2,38
Ductility factor		k ₇	[-]				1,0		
Steel failure with lever arm ¹⁾		_							
Characteristic bending moment,	5.8	M ⁰ Rk,s	[Nm]	8	19	37	66	167	325
Steel, strength class	8.8	M ⁰ Rk,s	[Nm]	12	30	60	105	267	519
Partial factor, strength class 5.8 a	[-]		•	•	1,25				
Characteristic bending moment, Stainless Steel A4 and HCR,	м ⁰ _{Rk,s}	[Nm]	11	26	52	92	233	456	

Concrete edge failure										
Effective length of fastener	If	[mm]	[mm] $\min(h_{ef}; 12 \cdot d_{nom})$ $\min(h_{ef}; 30$							
Outside diameter of fastener	d _{nom}	[mm]	10 12 16 20 24 30							
Installation factor	γinst	[-]				1,0				

[-]

[-]

[-]

 $\gamma_{Ms,V}$

k₈

 γ_{inst}

1,56

2,0

1,0

2,38

Strength class 702)

Installation factor

Concrete pry-out failure

Partial factor

Factor

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

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

²⁾ For IG-M20 strength class 50 is valid



Table C13: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years														
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure														
Characteristic tension resistance	N _{Rk,s}	[kN]						A _s ·	fuk ¹⁾					
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor	γ _{Ms,N}	[-]						1,	4 2)					
Combined pull-out and conci	ete failure	•	•											
Characteristic bond resistance	in uncracked	d concret	e C20	/25 in	hamm	er (H	D) and	comp	resse	d air d	rilled h	noles ((CD)	
Use the second of the second o			16	16	16	16	16	16	15	15	15	15	15	15
ਲੂੰ ਜ਼ਿੰ II: 50°C/72°C and	^τ Rk,ucr	[N/mm²]	12	12	12	12	12	12	12	12	11	11	11	11
III:60°C/80°C flooded bore hole			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5
Characteristic bond resistance	in uncracked	concret	e C20	/25 in	hamm	er dri	led ho	les wi	th holl	ow dri	ll bit (F	HDB)		
I: 24°C/40°C _			14	14	13	13	13	13	13	13	13	13		
II: 50°C/72°C Dry, wet			12	12	12	11	11	11	11	11	11	11		
를 Bill: 60°C/80°C	π	[N/mm2]	5,5	5,5	5,5	5,5	5,5	5,5	+	5,0	5,0] ,	3)	
원 턴 I: 24°C/40°C	[™] Rk,ucr	[N /mm²]	13	13	13	13	13	13	13	13	13	13] `	")
II: 50°C/72°C bore hole			11	11	11	11	11	11	11	11	11	11		
III: 60°C/80°C			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0		
Characteristic bond resistance				5 in ha	ımmer	drilled	d holes	s (HD)	, comp	oresse	d air c	Irilled I	holes ((CD)
and in hammer drilled holes wit	<u>h hollow dril</u>	bit (HDI	B)	1		1		r	1			r		
i: 24°C/40°C Dry, wet concrete and flooded bore hole			7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5		
II: 50°C/72°C and flooded	^τ Rk,cr	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0] 3	3)
[년 III:60°C/80°C bore hole			4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5		
Reduction factor ψ^0_{SUS} in crack holes (CD) and in hammer drille						hamm	ner dril	led ho	les (H	D), co	mpres	sed ai	ir drille	d
E 1: 24°C/40°C Dry, wet				·				0,	80					
by b	Ψ ⁰ sus	[-]						0,	68					
ill:60°C/80°C bore hole								0,	70					
Increasing factors for concrete	Ψς	[-]						(f _{ck} / 2	20) 0,1					
Characteristic bond resistance		Rk,ucr =						• τ _{Rk,u}						
depending on the concrete strength class		τ _{Rk,cr} =						•τ _{Rk,}						
Concrete cone failure		TIN,OI	Į.				- ' '	1 111,1	51,(020	,23)				
Relevant parameter								see Ta	ble C	2				
Splitting			ı							_				
Relevant parameter							:	see Ta	ble C	2				
Installation factor (HD; HDB,	CD)													
for dry and wet concrete	T	.,					1	,0					1	,2
for flooded bore hole	γinst	[-]						<u>,</u> 2					1	3)
1) fuk shall be taken from the sp	ecifications o	of reinford	cing ba	ırs										
2) in absence of national regula	tion													
3) no performance assessed														
Würth injection system W	/IT-PE 100	0 for co	ncre	te										
Performances Characteristic values of tension loads under static afor a working life of 50 years (reinforcing bar)			tic and	d quas	si-stat	c acti	on				Ar	nex	C 13	3



Table C14: Characte for a wor					load	s un	der s	tatic	and	qua	si-st	atic a	actio	n
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure														
Characteristic tension resistance	N _{Rk,s}	[kN]						A _s ·	f _{uk} 1)					
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor	γ _{Ms,N}	[-]						1,4	42)					
Combined pull-out and concr			l											
Characteristic bond resistance i		concret	e C20	/25 in	hamm	ner (HI	D) and	comp	resse	d air d	rilled h	noles (CD)	
E I: 24°C/40°C Dry, wet			16	16	16	16	16	16	15	15	15	15	15	15
I ≒ o ————Iconcrete		[N I / 21								}				
in Signature of the state of th	τRk,ucr,100	[IN/MM²] 	12	12	12	12	12	12	12	12	11	11	11	11
कृ Ⅲ:60°C/80°C bore hole			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5
Characteristic bond resistance i	n uncracked	concret	e C20	/25 in	hamm	er dril	led ho	les wi	th holl	ow dri	ll bit (H	HDB)		
I: 24°C/40°C			14	14	13	13	13	13	13	13	13	13		
U: 50°C/72°C concrete			12	12	12	11	11	11	11	11	11	11		
E 24°C/40°C concrete	0°C TRk,ucr,100 [N	[N/mm²]	5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	3	3)
E				13	13	13	13	13	13	13	13	13		
II: 50°C/72°C bore hole			11 5,5	11 5,5	11 5,5	11 5,5	11 5,5	11 5,5	11 5,0	11 5,0	11 5,0	11 5,0		
Characteristic bond resistance i	n cracked c	oncrete (noles i	CD)
and in hammer drilled holes with				JIIIII	ıııııı c ı	unile	ı noice	, (ווט)	, comp	лсээс	u an c	ıı ın c u ı	IUICS ((CD)
		<u> </u>	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5		
transport of the state of the s	τ _{Rk,cr,100}	[N/mm²]		5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	3	s)
Entrangle 1: 24°C/40°C Dry, wet concrete and flooded bore hole			4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5		
Reduction factor $\psi^0_{sus,100}$ in odrilled holes (CD) and in hamme							amme			s (HD), com	presse	ed air	
II: 24°C/40°C Dry, wet concrete and flooded	Ψ ⁰ sus,100	 [-]						-	80 68					
III:60°C/80°C flooded bore hole	303,100								70					
Increasing factors for concrete	Ψc	[-]						(f _{ck} / 2	20) ^{0,1}					
Characteristic bond resistance	τ _{Rk I}	cr,100 =							,100,(C					
depending on the concrete strength class	·	cr,100 =							100,(C					
Concrete cone failure										•				
Relevant parameter								see Ta	able C	2				
Splitting														
Relevant parameter							:	see Ta	able C	2				
Installation factor (HD; HDB, (CD)	1	1				-							
for dry and wet concrete	γ _{inst}	[-]						,0						.2
for flooded bore hole			ine -	ro			1	,2					3	')
1) f _{uk} shall be taken from the sp		n reintord	ang ba	แร										
2) in absence of national regulat 3) no performance assessed	cion													
Würth injection system W	'IT-PE 100	0 for co	ncre	te										
Performances Characteristic values of tens for a working life of 100 year			tic and	d quas	si-stat	ic acti	on				Ar	nex	C 14	



Table C15:	Characte for a wor					load	s un	der s	tatio	and	qua	si-st	atic a	actio	n
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure															
Characteristic tens resistance	ion	N _{Rk,s}	[kN]						A _s ·	f _{uk} 1)					
Cross section area	l	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor		γ _{Ms,N}	[-]						1,	4 ²⁾					
Combined pull-ou	it and concre	ete failure													
Characteristic bond	d concret	te C20/25 in diamond drilled holes (DD)													
일 I: 24°C/40°C				14	13	13	13	12	12	11	11	11	11	11	10
III: 60°C/80°C	and	τ _{Rk,ucr}	[N/mm²]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0	8,5	8,5
	mooded			5,0	5,0	5,0	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0	4,0
Reduction factor ψ^0_{SUS} in uncracked concrete C20					diamor	nd drill	ed ho	es (DI))	•	•		•		
일 I: 24°C/40°C				0,77											
Section Sect		$\Psi^0_{ m sus}$	[-]	0,72											
	flooded bore hole								0,	72					
Increasing factors	for concrete	Ψc	[-]						(f _{ck} /	20) ^{0,2}	2				
Characteristic bond depending on the d strength class		τ	Rk,ucr =	Ψc * ^τ Rk,ucr,(C20/25)											
Concrete cone fai	ilure														
Relevant parameter								5	see Ta	able C	2				
Splitting															
Relevant paramete								5	see Ta	able C	2				
Installation factor	(DD)														
for dry and wet cor		γ _{inst}	[-]					1	,0						,2
for flooded bore ho	le	inst	ו־ז		1	,2				1	,4			3	3)

¹⁾ \mathbf{f}_{uk} shall be taken from the specifications of reinforcing bars

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

²⁾ in absence of national regulation

³⁾ no performance assessed



	teristic va orking life				load	s un	der s	tatio	and	qua	si-st	atic a	actio	n	
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40	
Steel failure															
Characteristic tension resistance	N _{Rk,s}	[kN]						A _s ·	f _{uk} 1)						
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	1018	1256	
Partial factor	γ _{Ms,N}	[-]						1,	4 ²⁾						
Combined pull-out and cond	rete failure	•	•												
Characteristic bond resistance	in uncracke	d concret	e C20	/25 in	diamo	ond dri	lled ho	oles (E	DD)						
E 24°C/40°C Dry, wet concrete			14	13	13	13	12	12	11	11	11	11	11	10	
II: 24°C/40°C Dry, wet concrete and flooded look bore hole	τRk,ucr,100	[N/mm²]	11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5	8,0	8,0	
III:60°C/80°C bore hole			5,0	5,0	5,0	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0	4,0	
Reduction factor ψ^0 sus,100 in	oncrete (020/25	in di	amono	drille	d hole:	s (DD))							
E I: 24°C/40°C Dry, wet			0,73												
II: 24°C/40°C Dry, wet concrete and flooded look bore hole	Ψ ⁰ sus,100	[-]	0,70												
III:60°C/80°C bore hole								0,	72						
Increasing factors for concrete	· Ψ _c	[-]						(f _{ck} / :	20) ^{0,2}	2					
Characteristic bond resistance depending on the concrete strength class	I	ucr,100 =													
Concrete cone failure															
Relevant parameter		see Table C2													
Splitting															
Relevant parameter					•	see Ta	able C	2							
Installation factor (DD)															
for dry and wet concrete	$-\gamma_{inst}$	[-]					1	,0						1,2	
for flooded bore hole	insi			1	,2				1	,4			3	3)	

 $^{^{\}rm 1)}\,{\rm f}_{\rm uk}$ shall be taken from the specifications of reinforcing bars

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

²⁾ in absence of national regulation

³⁾ no performance assessed



Table C17: Character a working						uno	der s	tatio	and	quas	si-sta	tic a	ction	for
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure without lever arm														
Characteristic shear resistance	V ⁰ Rk,s	[kN]						0,5	· A _s · f	: 1) uk				
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor	γ _{Ms,V}	[-]		1,5 ²⁾										
Ductility factor	k ₇	[-]		1,0										
Steel failure with lever arm	•		•											
Characteristic bending moment	M ⁰ Rk,s	[Nm]	1,2 • W _{el} • f _{uk} ¹⁾											
Elastic section modulus	W _{el}	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217	4580	6283
Partial factor	γ _{Ms,V}	[-]							1,5 ²⁾					
Concrete pry-out failure	•													
Factor	k ₈	[-]							2,0					
Installation factor	γ _{inst}	[-]							1,0					
Concrete edge failure	•	1												
Effective length of fastener	I _f	[mm]	n] min(h _{ef} ; 12 · d _{nom}) min(h _{ef} ; 300mm)											
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32	36	40
Installation factor	γ _{inst}	[-]		1,0										

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

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

²⁾ in absence of national regulation



Table C20:	Displacements under tension load ¹⁾ in hammer drilled holes (HD), comp. air
	drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

Threaded rod			М8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years										
Temperature range I: 24°C/40°C	δ_{N0} -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
Temperature range II: 50°C/72°C	δ_{N0} -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Temperature range III: 60°C/80°C	δ_{N0} -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Cracked concrete under static and quasi-static action for a working life of 50 and 100 years										
Temperature range I: 24°C/40°C	δ_{N0} -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,171
Temperature range II: 50°C/72°C	δ_{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)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229
Temperature range III: 60°C/80°C	$\delta_{\rm N0}$ -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)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229

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

Table C18: Displacements under tension load¹⁾ in diamond drilled holes (DD)

Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete under static and quasi-static action for a working life of 50 years										
Temperature range I: 24°C/40°C	$\delta_{\rm N0}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II: 50°C/72°C	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Temperature range III: 60°C/80°C	$\delta_{\rm N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Uncracked concrete under static and quasi-static action for a working life of 100 years										
Temperature range I: 24°C/40°C	δ_{N0} -factor	[mm/(N/mm ²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II: 50°C/72°C	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051
Temperature range III: 60°C/80°C	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051

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

Table C19: Displacements under shear load¹⁾ for all drilling methods

Threaded rod			М8	M10	M12	M16	M20	M24	M27	M30
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years										
All temperature ranges	δ_{V0} -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

¹⁾ Calculation of the displacement $\delta v_0 = \delta v_0$ -factor \cdot V; $\delta v_\infty = \delta v_\infty$ -factor \cdot V; V: action shear load

Würth injection system WIT-PE 1000 for concrete

Performances

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

Annex C 18



Table C21:	Displacements under tension load ¹⁾ in hammer drilled holes (HD), comp. air
	drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

QI III	d Holes (OD	, and in nam	iiiiçi aiii	ica iicic	• WILLII III	olion al	>:: /:::	JD,
Internal threaded ancho	r rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete und	Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years							
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Temperature range III:	δ _{N0} -factor	[mm/(N/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete under	static and qua	si-static action	for a worki	ing life of 8	50 and 100	years		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229
Temperature range III:	δ _{N0} -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,154	0,163	0,172	0,181	0,189	0,229

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

Table C22: Displacements under tension load¹⁾ in diamond drilled holes (DD)

Internal threaded anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete und	uasi-static actio	n for a wo	rking life o	of 50 years	3			
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,019	0,019	0,020	0,022	0,023	0,025
Temperature range II:	δ _{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Temperature range III:	δ _{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Uncracked concrete und	der static and q	uasi-static actio	n for a wo	rking life o	of 100 year	'S		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,021	0,021	0,023	0,024	0,025	0,027
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,039	0,040	0,043	0,045	0,047	0,051
Temperature range III:	δ_{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,039	0,040	0,043	0,045	0,047	0,051

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

Table C23: Displacements under shear load¹⁾ for all drilling methods

Internal threaded	l anchor rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Uncracked and c	Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years									
All temperature	δ_{V0} -factor	[mm/kN]	0,07	0,06	0,06	0,05	0,04	0,04		
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,10	0,09	0,08	0,08	0,06	0,06		

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

Würth injection system WIT-PE 1000 for concrete

Performances

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

Annex C 19



Table C24:		cements i													
Reinforcing bar	r		Q	Ø 8	Ø 10	Ø 12	Ø 14	Ø 10	6 Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Uncracked con	crete under	static and o	uasi-	stat	ic act	on for	a wo	rking	ife of 5	0 and	100 ye	ears			
Temp range	δ_{N0} -factor	[mm/(N/mm	ı²)] 0,	028	0,029	0,030	0,03	0,03	3 0,03	0,038	0,038	0,040	0,043	0,045	0,047
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	^{[2})] 0,	028	0,029	0,030	0,03	0,03	3 0,03	0,038	0,038	0,040	0,043	0,045	0,047
Temp range	δ_{N0} -factor	[mm/(N/mm	¹²)] 0,	038	0,039	0,040	0,042	0,04	4 0,047	0,051	0,051	0,054	0,058	0,060	0,063
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	^{[2})] 0,	047	0,049	0,051	0,053	0,05	5 0,059	0,065	0,065	0,068	0,072	0,074	0,079
Temp range	δ_{N0} -factor	[mm/(N/mm	¹²)] 0,	038	0,039	0,040	0,042	0,04	4 0,04	7 0,051	0,051	0,054	0,058	0,060	0,063
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	¹²)] 0,	047	0,049	0,051	0,053	0,05	5 0,059	0,065	0,065	0,068	0,072	0,074	0,079
Cracked concre	ete under st	atic and qua	si-st	atic	action	for a	worki	ng life	of 50	and 10	0 year	s			
Temp range	δ_{N0} -factor	[mm/(N/mm	²)] 0,	069	0,071	0,072	0,073	0,07	4 0,076	0,079	0,079	0,081	0,084		
I: 24°C/40°Č	$\delta_{N\infty}$ -factor	[mm/(N/mm	¹²)] 0,	115	0,122	0,128	0,135	0,14	2 0,15	0,171	0,171	0,181	0,194]	
Temp range	δ_{N0} -factor	[mm/(N/mm	¹²)] 0,	092	0,095	0,096	0,098	0,09	9 0,102	0,106	0,106	0,109	0,113] ,	••
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	¹²)] 0,	154	0,163	0,172	0,18	0,18	9 0,20	0,229	0,229	0,242	0,260	2	2)
Temp range	δ_{N0} -factor	[mm/(N/mm	¹²)] 0,	092	0,095	0,096	0,098	0,09	9 0,102	2 0,106	0,106	0,109	0,113	1	
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	^{[2})] 0,	154	0,163	0,172	0,18	0,18	9 0,20	0,229	0,229	0,242	0,260	1	
1) Calculation of 2) No performan Table C25:	Displac	cements i		er te	ensio	n loa		n dia	mono	l drill	ed ho	oles (, '		
Reinforcing bar						1						Ø 28	Ø 32	Ø 36	Ø 40
Uncracked con	r						_	, <u> </u>				1		П	
Temp range	δ_{N0} -factor	[mm/(N/mm		-			_	+	+		+	+	+		
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	/-				-	_		_		_			
Temp range	δ_{N0} -factor	[mm/(N/mm				_	_	_				_	_		
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm		-		-	_	+		+	+	+	+		
Temp range	δ_{N0} -factor	[mm/(N/mm				_	_	_				_	+		
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm									1	0,081	0,088	0,090	0,097
Uncracked con														1	
Temp range	δ_{N0} -factor		-			+	_					+			
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm													
Temp range	δ_{N0} -factor	[mm/(N/mm		_			_	_	_		+	+	+		
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm													
Temp range	δ_{N0} -factor	[mm/(N/mm		\rightarrow			-				-		<u> </u>		
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm	²)] 0,	035	0,037	0,040	0,042	0,04			1 -	1 -	<u> </u>		0,097
1) Calculation of Table C26:	·	ment: δ _{N0} = cements ι					δ _{N∞} -fac 1) for						tension		
Reinforcing bar			Ø8	т —									Ø 32	Ø 36	Ø 40
Uncracked and		ncrete unde													~ 40
	δ_{V0} -factor	[mm/kN]	0,06	_				0,04			0,03	0,03	0,03	0,03	0,03
All temperature ranges	$\delta_{V_{\infty}}$ -factor	[mm/kN]	0,00	0,0				0,06			0,05	0,04		0,04	0,04
1) Calculation of	V = -		δ_{V0} -fa	<u> </u>			δ _{ν∞} -fac	<u> </u>		action s	,		0,04	0,04	0,04
Würth injecti	· ·				-				,						
Performances Displacements for a working life	s under stati											,	Anne	c C 2	0



Table		acteristic val							on			
Thread	ded rod				М8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure											
Charac	teristic tension resis	tance	N _{Rk,s,eq,C1}	[kN]				۰ 1,0	$N_{Rk,s}$			
Partial	factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combi	Combined pull-out and concrete failure											
	cteristic bond resista holes (CD) and in ha				hamm	er drille	ed hole	s (HD)	, comp	ressed	air	
ture	I: 24°C/40°C	Dry, wet	τ _{Rk,eq,C1}	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Tem	III:60°C/80°C	hole	^τ Rk,eq,C1	[N/mm²]	5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
Increas	sing factors for conci	ete	Ψc	[-]	1,0							
Characteristic bond resistance depending on the concrete strength class			τ	τ _{Rk,eq,C1} =			Ψc * ^τ Rk,eq,C1,(C20/25)					
Installa	ation factor											
for dry and wet concrete (HD; HDB, CD)				ГЗ	1,0							
for floo	ded bore hole (HD; I	HDB, CD)	γ _{inst}	[-]				1	,2			

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (threaded rod)	Annex C 21



Tabl		acteristic va ormance cat										
Threac	ded rod				М8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure											
Charac	cteristic tension resi	stance	N _{Rk,s,eq,C1}	[kN]				1,0 •	$N_{Rk,s}$			
Partial	factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combi	ned pull-out and c	oncrete failure										
	cteristic bond resista holes (CD) and in h					hamm	er drille	ed hole	s (HD)	, comp	ressed	air
fure	I: 24°C/40°C	Dry, wet	τ _{Rk,eq,C1}	[N/mm ²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Tem	III:60°C/80°C	hole	^τ Rk,eq,C1	[N/mm²]	5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
Increas	sing factors for cond	rete	Ψς	[-]				1	,0			
Characteristic bond resistance depending on the concrete strength class		τ _{Rk,eq,C1} =		Ψc * ^τ Rk,eq,C1,(C20/25)								
Installa	ation factor											
for dry and wet concrete (HD; HDB, CD)		γ _{inst}	[-]					,0				
for floo	ded bore hole (HD;	HDB, CD)	inist	"				1	,2			

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (threaded rod)	Annex C 22



Table C29: Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years											
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure											
Characteristic shear (Seismic C1)	ar resistance	V _{Rk,s,eq,C1}	[kN]				0,70) • V ⁰ Rk	,s		
Partial factor $\gamma_{Ms,V}$ [-] see Table C1											
Factor for annula	r gap	$\alpha_{\sf gap}$	[-]				0,9	5 (1,0) ¹⁾			

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1)	Annex C 23
for a working life of 50 and 100 years (threaded rod)	

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



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

	(1-4-			 /			,		,					
Reinfo	orcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel f	ailure													
Characteristic tension resistance N _R			N _{Rk,s,eq,C1}	[kN]	$1,0 \cdot A_s \cdot f_{uk}^{1)}$									
Cross section area			A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor Y _{Ms,N} [-]									1,	42)				
Comb	Combined pull-out and concrete failure													
	cteristic bond resis holes (CD) and in						in har	nmer o	drilled	holes ((HD), c	compre	essed	air
ture	I: 24°C/40°C	concrete and flooded bore	^τ Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Temperature range	II: 50°C/72°C		^τ 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
Теп	III:60°C/80°C		^τ Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Increas	sing factors for co	ncrete	Ψc	[-]	1,0									
	cteristic bond resis ding on the concre		τ _H	Rk,eq,C1 =	Ψ _c • ^τ Rk,eq,C1,(C20/25)									
Install	ation factor													
for dry and wet concrete (HD; HDB, CD) $\gamma_{\rm inst}$			[-]					1	,0					
for floo	ded bore hole (HI	D; HDB, CD)						•	1	,2				
41 .	مرميك مرمرامة مما الممام													

¹⁾ f_{uk} shall be taken from the specifications of reinforcing bars

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (reinforcing bar)	Annex C 24

²⁾ in absence of national regulation



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

	`-		• •	•		•			•					
Reinfo	rcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel f	ailure									•	•			
Characteristic tension resistance N _{Rk,s,ee}			N _{Rk,s,eq,C1}	[kN]	1,0 • A _s • f _{uk} ¹⁾									
Cross section area			A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor Y _{Ms,N} [-]									1,	4 ²⁾				
Combi	ined pull-out and													
	cteristic bond resi holes (CD) and ir						in har	nmer o	drilled	holes ((HD), (compre	ssed	air
	I: 24°C/40°C	Dry, wet concrete and flooded bore	^τ Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C		^τ Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Terr	III:60°C/80°C	hole	^τ Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Increas	sing factors for co	oncrete	Ψс	[-]	1,0									
Characteristic bond resistance depending on the concrete strength class				Rk,eq,C1 =	Ψc * ^τ Rk,eq,C1,(C20/25)									
Install	ation factor													
for dry CD)	for dry and wet concrete (HD; HDB,			[-]					1	,0				
for floo	ded bore hole (H	D; HDB, CD)	γinst						1	,2				

 $^{^{1)}\,\}mathrm{f}_{\mathrm{uk}}\,\mathrm{shall}$ be taken from the specifications of reinforcing bars

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (reinforcing bar)	Annex C 25

²⁾ in absence of national regulation



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

¹⁾ f_{uk} shall be taken from the specifications of reinforcing bars

Würth injection system WIT-PE 1000 for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (reinforcing bar)	Annex C 26

²⁾ in absence of national regulation

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



Tabl		characteristic va performance ca							s			
Thread	led rod				M12	M16	M20	M24	M27	M30		
Steel fa	ailure											
Steel, s Stainle	eteristic tension strength class t ss Steel A4 an th class ≥70	8.8	N _{Rk,s,eq,C2}	[kN]	1,0 • N _{Rk,s}							
Partial	factor		γ _{Ms,N}	[-]	see Table C1							
Combi	ned pull-out a	and concrete failure))									
		esistance in cracked d in hammer drilled h				hammer (drilled hol	es (HD), d	compress	ed air		
ture	I: 24°C/40°C	Dry, wet	τRk,eq,C2	[N/mm²]	5,8	4,8	5,0	5,1	4,8	5,0		
Temperature range	II: 50°C/72°C	concrete and flooded bore	τ _{Rk,eq,C2}	[N/mm²]	5,0	4,1	4,3	4,4	4,1	4,3		
Ten	III:60°C/80°C	hole	τRk,eq,C2	[N/mm²]	1,9	1,6	1,6	1,7	1,5	1,6		
Increas	sing factors for	concrete	Ψς	[-]			1	,0	_			
Characteristic bond resistance depending on the concrete strength class			τ	Rk,eq,C2 =	Ψc * ^τ Rk,eq,C2,(C20/25)							
	ation factor											
	and wet concre	$\frac{1}{\gamma_{inst}}$	[-]				,0					
for flooded bore hole (HD; HDB, CD)			. 11191	"			1	,2				

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

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

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

Würth injection system WIT-PE 1000 for concrete	
Performances	Annex C 27
Characteristic values of tension and shear loads under seismic action	
(performance category C2) for a working life of 50 and 100 years (threaded rod)	



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

Table C36: Displacements under shear load (threaded rod)

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

Würth injection system WIT-PE 1000 for concrete	
Performances	Annex C 28
Displacements under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)	

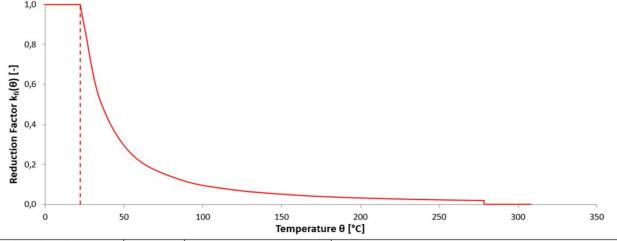


Table C37:	Characteristic values of tension and shear loads under fire exposure in
	hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer
	drilled holes with hollow drill bit (HDB)

Threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure												
Characteristic tension resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher			Fire	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
	No. a	[kN]	exposure	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
	Rk,s,fi	[KIN]	time	90	0,7	1,0	1,6	3,0 4,7	4,7	6,7	8,7	10,7
			[min]	120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9

Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature θ

			θ < 23°C	1,0
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	23°C ≤ θ ≤ 278°C	150,28 • θ ^{-1,598} ≤ 1,0
	1.69		θ > 278°C	0,0



				Temperatur	e θ [°C]							
Characteristic bond resistance for a given temperature (θ)	$\tau_{Rk,fi}(\theta)$		[N/mm²]			$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1)}$						
Steel failure without lever a	ırm				36							
Characteristic shear			Fire	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher	V _{Rk,s,fi}	[kN]	exposure time [min]	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
				90	0,7	1,0	1,6	3,0	4,7	6,7	8,7	10,7
				120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9
Steel failure with lever arm												
Characteristic bending			Fire	30	1,1	2,2	4,7	12,0	23,4	40,4	59,9	81,0
moment; Steel, Stainless	NAO	[Nm]	exposure	60	0,9	1,8	3,5	9,0	17,5	30,3	44,9	60,7
Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher	M ⁰ Rk,s,fi	[[ואוו]	time	90	0,7	1,3	2,5	6,3	12,3	21,3	,3 31,6	42,7
			[min]	120	0,5	1,0	1,8	4,7	9,1	15,7	23,3	31,5

¹⁾ $\tau_{Rk,cr,(C20/25)}$ characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range

Würth injection system WIT-PE 1000 for concrete Performances Characteristic values of tension and shear loads under fire exposure (threaded rod)	
Performances Characteristic values of tension and shear loads under fire exposure (threaded rod)	Annex C 29

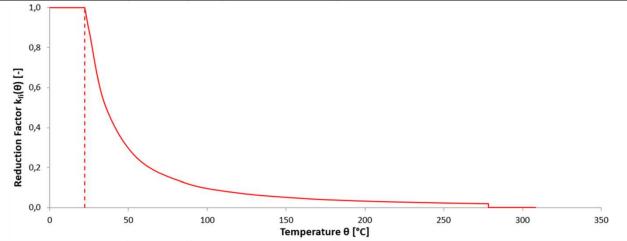


Table C38: Characteristic values of tension and shear loads under fire exposure in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

Internal threaded anchor rods					IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure											
Characteristic tension resistance; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70			Fire	30	0,3	1,1	1,7	3,0	5,7	8,8	
	N _{Rk,s,fi}	[kN]	exposure time [min]	60	0,2	0,9	1,4	2,3	4,2	6,6	
				90	0,2	0,7	1,0	1,6	3,0	4,7	
				120	0,1	0,5	0,8	1,2	2,2	3,4	

Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature θ

			θ < 23°C	1,0
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	23°C ≤ θ ≤ 278°C	$150,28 \cdot \theta^{-1,598} \le 1,0$
	1559		θ > 278°C	0,0



				Temperatur	eθ[°C]						
Characteristic bond resistance for a given temperature (<i>θ</i>)	$\tau_{Rk,fi}(\theta)$	[N/mm²]		$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1}$							
steel failure without lever arm											
Characteristic shear			Fire	30	0,3	1,1	1,7	3,0	5,7	8,8	
resistance; Steel, Stainless	V	ILAN 6	kN] exposure time [min]	ovnocuro	60	0,2	0,9	1,4	2,3	4,2	6,6
Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70	$V_{Rk,s,fi}$	[KIN]		90	0,2	0,7	1,0	1,6	3,0	4,7	
				120	0,1	0,5	0,8	1,2	2,2	3,4	
Steel failure with lever arm											
Characteristic bending			Fire	30	0,2	1,1	2,2	4,7	12,0	23,4	
moment; Steel, Stainless	MO	[Nm]	ovnoouro	60	0,2	0,9	1,8	3,5	9,0	17,5	
Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70	M ⁰ _{Rk,s,fi}	[INIII]	time [min]	90	0,1	0,7	1,3	2,5	6,3	12,3	
				120	0,1	0,5	1,0	1,8	4,7	9,1	

τ_{Rk,cr,(C20/25)} characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range

Characteristic values of tension and shear loads under fire exposure (internal threaded	
Performances Characteristic values of tension and shear loads under fire exposure (internal threaded anchor rod)	Annex C 30



drille	d holes v							lled	1010	3 (02	, uii		i di i i	
Reinforcing bar					Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure														
				30	0,5	1,2	2,3	3,1	4,0	6,3	9,0	9,8	12,3	16,1
Characteristic tension	N _{Rk,s,fi}	[kN]	Fire exposure	60	0,5	1,0	1,7	2,3	3,0	4,7	6,8	7,4	9,2	12,1
resistance; BSt 500	1 111,0,11		time [min]	90	0,4	0,8	1,5	2,0	2,6	4,1	5,9	6,4	8,0	10,5
Characteristic bond res	istance in a	racko	d and unc	120	0,3	0,6	1,1	1,5	2,0	3,1	4,5	4,9	6,2	8,0
given temperature θ	istance in t	JIACKE	a and unc	rackeu	Oncre	ele C2	U/25 U	p to C	,50/60	unae	i iire	conun	lons i	or a
			θ < 25	5°C					1	,0				
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	25°C ≤ θ :	≤ 278°C				176,	37 • θ	-1,598	≤ 1,0			
1,0			θ > 27	'8°C					0	,0				
Reduction Factor k _{ii} (θ) [-]	50	10	00	150		200		250		3	00		350	
Characteristic bond	τ (Δ)		[N]/mm2]	•	rature θ [°C]									
resistance for a given temperature (θ)	$\tau_{Rk,fi}(\theta)$		[N/mm²]		$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,t}$						C20/25) 17			
Steel failure without leve	er arm													
			Fire	30	0,5	1,2	2,3	3,1	4,0	6,3	9,0	9,8	12,3	16,1
Characteristic shear resistance; BSt 500	$V_{Rk,s,fi}$	[kN]	exposure	60	0,5	1,0	1,7	2,3	3,0	4,7	6,8	7,4	9,2	12,1
resistance, bot 500	8420 54		time [min]	90 120	0,4	0,8	1,5 1,1	2,0 1,5	2,6	4,1 3,1	5,9 4,5	6,4 4,9	8,0 6,2	10,5 8,0
Steel failure with lever a	rm	ļ.		120	0,3	0,0	1,1	1,5	2,0	3,1	4,5	4,9	0,2	0,0
Otoor landro With lover a				30	0,6	1,8	4,1	6,5	9,7	18,8	32,6	36,8	51,7	77,2
Characteristic bending	140		Fire	60	0,5	1,5	3,1	4,8	7,2	14,1			38,8	
moment; BSt 500	M ⁰ Rk,s,fi	[Nm]	exposure time [min]	90	0,4	1,2	2,6	4,2	6,3	12,3	21,2	23,9	33,6	50,2
				120	0,3	0,9	2,0	3,2	4,8	9,4	16,3	18,4	25,9	38,6
1) τ _{Rk,cr,(C20/25)} characte temperature range	ristic bond r	esistan	ce for crack	ed concre	ete for	concre	ete stre	ength c	lass C	20/25	for the	releva	nt	
Würth injection syste	em WIT-PI	E 100	0 for cond	crete									C 31	