

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-19/0542**  
**of 13 September 2019**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

Würth Injection system WIT-PE 1000 for concrete

Product family  
to which the construction product belongs

Bonded fastener for use in concrete

Manufacturer

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

Manufacturing plant

Werk 3

This European Technical Assessment  
contains

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

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

EAD 330499-01-0601

**European Technical Assessment**

**ETA-19/0542**

English translation prepared by DIBt

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## 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. The steel element consist of a threaded rod with washer and hexagon nut in the range of M8 to M30, reinforcing bar in the range of diameter Ø8 to Ø32 mm or internal threaded rod W-VI-IG-M6 to W-VI-IG-M20.

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

The product description is given in Annex A.

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

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. 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<br>(static and quasi-static loading)            | See Annex<br>C 1, C 2, C 3, C 4, C 5, C 7 |
| Characteristic resistance to shear load<br>(static and quasi-static loading)              | See Annex<br>C 1, C 2, C 4, C 6, C 8      |
| Displacements<br>(static and quasi-static loading)                                        | See Annex<br>C 9 to C 11                  |
| Characteristic resistance for seismic performance category<br>C1 and C2 and displacements | See Annex<br>C 12 to C 17                 |
| Durability                                                                                | See Annex B 1                             |

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

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

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

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

The system to be applied is: 1

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

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

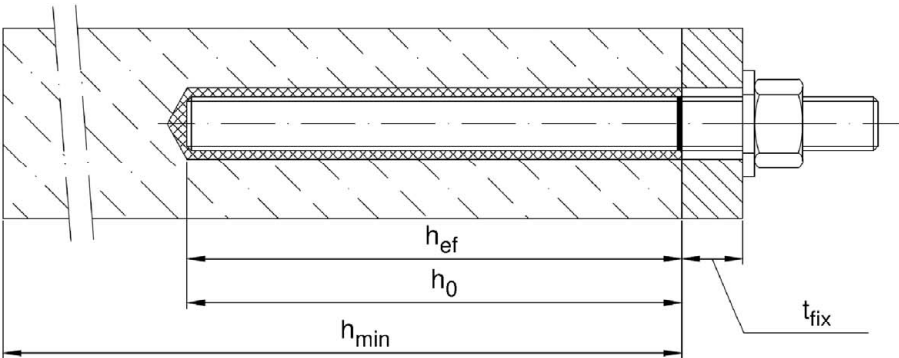
Issued in Berlin on 13 September 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

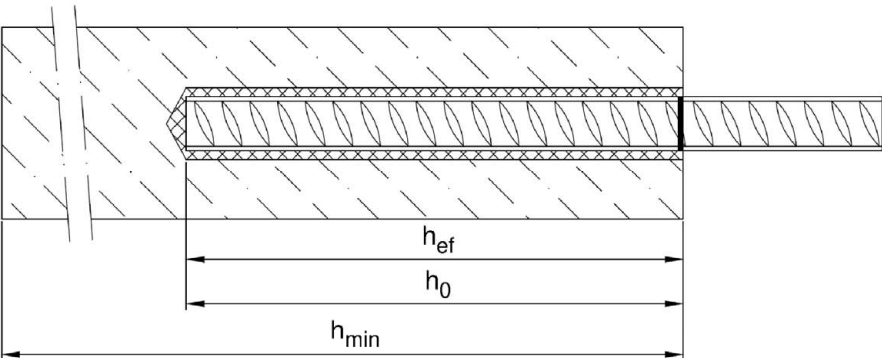
*beglaubigt:*  
Baderschneider

**Installation threaded rod M8 up to M30**

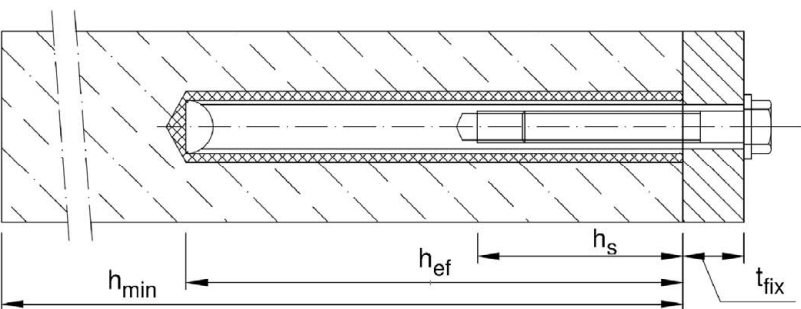
prepositioned installation or  
push through installation (annular gap filled with mortar)



**Installation reinforcing bar Ø8 up to Ø32**



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



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

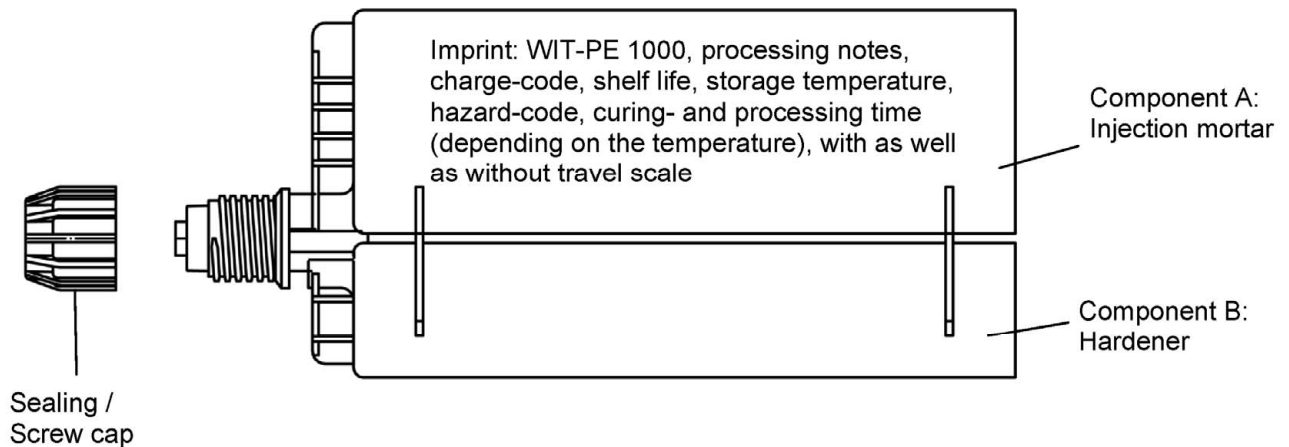
**Würth Injection System WIT-PE 1000 for concrete**

**Product description**  
Installed condition

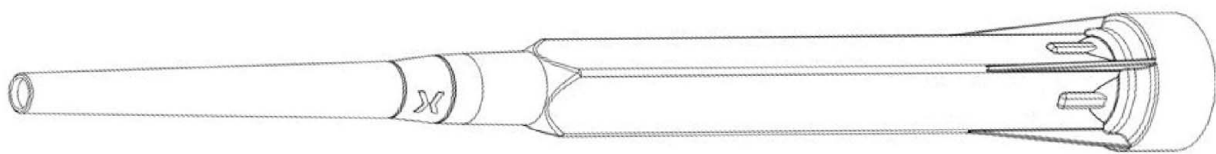
**Annex A 1**

## Cartridge: WIT-PE 1000

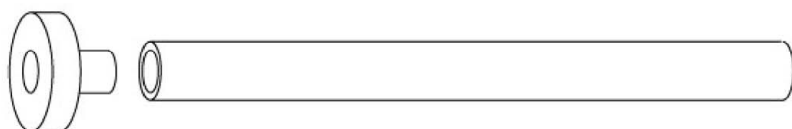
440ml, 585ml and 1400ml cartridge (Type: "side-by-side")



## Static Mixer WIT-PE



## Piston Plug WIT-VS and Mixer Extension

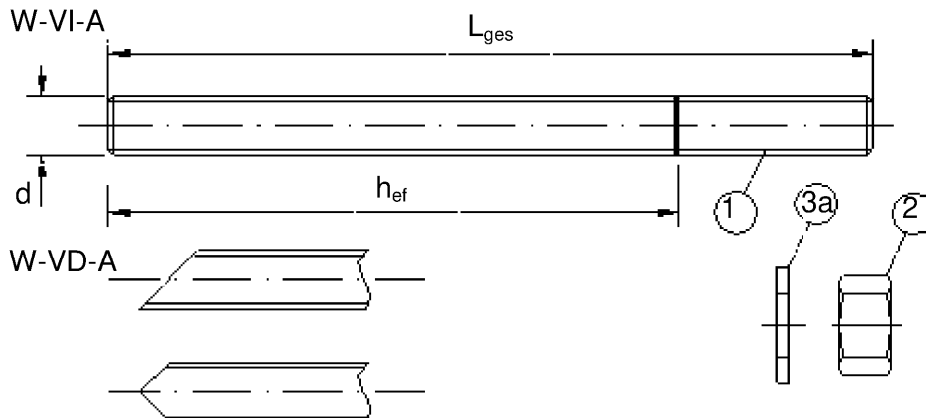


Würth Injection System WIT-PE 1000 for concrete

Product description  
Injection system

Annex A 2

### Threaded rod M8, M10, M12, M16, M20, M24, M27, M30 with washer and hexagon nut

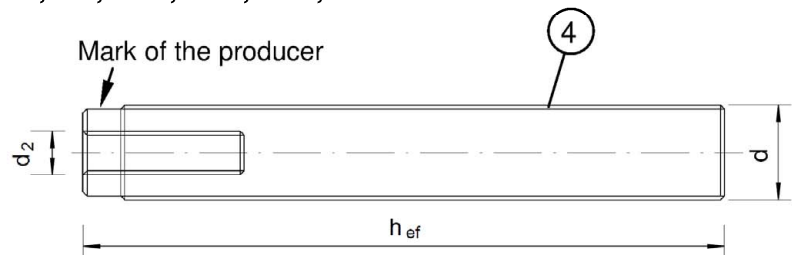
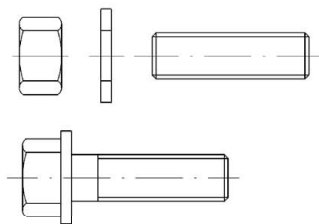


Commercial standard threaded rod with:

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

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

Threaded rod or screw



Marking: e.g.



M8



Marking Internal thread



Mark

M8

Thread size (Internal thread)

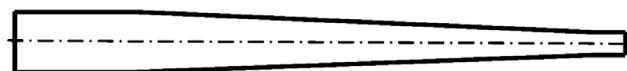
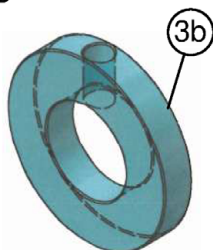
A4

additional mark for stainless steel

HCR

additional mark for high-corrosion resistance steel

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



Würth Injection System WIT-PE 1000 for concrete

#### Product description

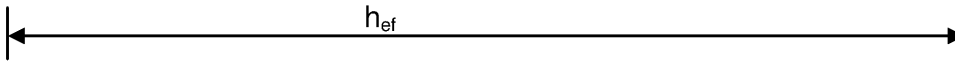
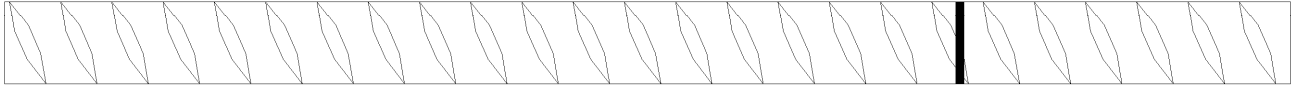
Threaded rod, internal threaded rod and filling washer

Annex A 3

**Table A1: Materials**

| Part                                                                                                                                                                                                                                                                                                                                                           | Designation                                  | Material                                                                                                                                                                                                                                                                                                              |                                                |                                              |                                         |                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------|-----------------------------------------|------------------------------------|
| <b>Steel, zinc plated</b> (Steel acc. to EN 10087:1998 or EN 10263:2001)                                                                                                                                                                                                                                                                                       |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| - zinc plated ≥ 5 µm acc. to EN ISO 4042:1999 or                                                                                                                                                                                                                                                                                                               |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| - hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or                                                                                                                                                                                                                                                                         |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| - sherardized ≥ 45 µm acc. to EN ISO 17668:2016                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| 1                                                                                                                                                                                                                                                                                                                                                              | Threaded rod                                 | Property class                                                                                                                                                                                                                                                                                                        | Characteristic steel ultimate tensile strength | Characteristic steel yield strength          | Elongation at fracture                  |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              | acc. to EN ISO 898-1:2013                                                                                                                                                                                                                                                                                             | 4.6                                            | f <sub>uk</sub> = 400 N/mm <sup>2</sup>      | f <sub>yk</sub> = 240 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 4.8                                            | f <sub>uk</sub> = 400 N/mm <sup>2</sup>      | f <sub>yk</sub> = 320 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 5.6                                            | f <sub>uk</sub> = 500 N/mm <sup>2</sup>      | f <sub>yk</sub> = 300 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 5.8                                            | f <sub>uk</sub> = 500 N/mm <sup>2</sup>      | f <sub>yk</sub> = 400 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 8.8                                            | f <sub>uk</sub> = 800 N/mm <sup>2</sup>      | f <sub>yk</sub> = 640 N/mm <sup>2</sup> | A <sub>5</sub> ≥ 12% <sup>3)</sup> |
| 2                                                                                                                                                                                                                                                                                                                                                              | Hexagon nut                                  | acc. to EN ISO 898-2:2012                                                                                                                                                                                                                                                                                             | 4                                              | for anchor rod class 4.6, 4.8                |                                         |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 5                                              | for anchor rod class 4.6, 4.8, 5.6, 5.8      |                                         |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 8                                              | for anchor rod class 4.6, 4.8, 5.6, 5.8, 8.8 |                                         |                                    |
| 3a                                                                                                                                                                                                                                                                                                                                                             | Washer                                       | Steel, zinc plated, hot-dip galvanised or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)                                                                                                                                                                                 |                                                |                                              |                                         |                                    |
| 3b                                                                                                                                                                                                                                                                                                                                                             | Filling washer                               | Steel, zinc plated, hot-dip galvanised or sherardized                                                                                                                                                                                                                                                                 |                                                |                                              |                                         |                                    |
| 4                                                                                                                                                                                                                                                                                                                                                              | Internal threaded anchor rod                 | Property class                                                                                                                                                                                                                                                                                                        | Characteristic steel ultimate tensile strength | Characteristic steel yield strength          | Elongation at fracture                  |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              | acc. to EN ISO 898-1:2013                                                                                                                                                                                                                                                                                             | 5.8                                            | f <sub>uk</sub> = 500 N/mm <sup>2</sup>      | f <sub>yk</sub> = 400 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 8.8                                            | f <sub>uk</sub> = 800 N/mm <sup>2</sup>      | f <sub>yk</sub> = 640 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
| <b>Stainless steel A2</b> (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014)                                                                                                                                                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| <b>Stainless steel A4</b> (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014)                                                                                                                                                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| <b>High corrosion resistance steel</b> (Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014)                                                                                                                                                                                                                                                                   |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| 1                                                                                                                                                                                                                                                                                                                                                              | Threaded rod <sup>1)4)</sup>                 | Property class                                                                                                                                                                                                                                                                                                        | Characteristic steel ultimate tensile strength | Characteristic steel yield strength          | Elongation at fracture                  |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              | acc. to EN ISO 3506-1:2009                                                                                                                                                                                                                                                                                            | 50                                             | f <sub>uk</sub> = 500 N/mm <sup>2</sup>      | f <sub>yk</sub> = 210 N/mm <sup>2</sup> | A <sub>5</sub> ≥ 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 70                                             | f <sub>uk</sub> = 700 N/mm <sup>2</sup>      | f <sub>yk</sub> = 450 N/mm <sup>2</sup> | A <sub>5</sub> ≥ 12% <sup>3)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 80                                             | f <sub>uk</sub> = 800 N/mm <sup>2</sup>      | f <sub>yk</sub> = 600 N/mm <sup>2</sup> | A <sub>5</sub> ≥ 12% <sup>3)</sup> |
| 2                                                                                                                                                                                                                                                                                                                                                              | Hexagon nut <sup>1)4)</sup>                  | acc. to EN ISO 3506-1:2009                                                                                                                                                                                                                                                                                            | 50                                             | for anchor rod class 50                      |                                         |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 70                                             | for anchor rod class 50, 70                  |                                         |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 80                                             | for anchor rod class 50, 70, 80              |                                         |                                    |
| 3a                                                                                                                                                                                                                                                                                                                                                             | Washer                                       | A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014<br>A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014<br>HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014<br>(e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000) |                                                |                                              |                                         |                                    |
| 3b                                                                                                                                                                                                                                                                                                                                                             | Filling washer                               | Stainless steel A4, High corrosion resistance steel                                                                                                                                                                                                                                                                   |                                                |                                              |                                         |                                    |
|                                                                                                                                                                                                                                                                                                                                                                |                                              | Property class                                                                                                                                                                                                                                                                                                        | Characteristic steel ultimate tensile strength | Characteristic steel yield strength          | Elongation at fracture                  |                                    |
| 4                                                                                                                                                                                                                                                                                                                                                              | Internal threaded anchor rod <sup>1)2)</sup> | acc. to EN ISO 3506-1:2009                                                                                                                                                                                                                                                                                            | 50                                             | f <sub>uk</sub> = 500 N/mm <sup>2</sup>      | f <sub>yk</sub> = 210 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
|                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       | 70                                             | f <sub>uk</sub> = 700 N/mm <sup>2</sup>      | f <sub>yk</sub> = 450 N/mm <sup>2</sup> | A <sub>5</sub> > 8%                |
| <sup>1)</sup> Property class 70 or 80 for anchor rods up to M24 and Internal threaded anchor rods up to IG-M16,<br><sup>2)</sup> for IG-M20 only property class 50<br><sup>3)</sup> A <sub>5</sub> > 8% fracture elongation if <u>no</u> requirement for performance category C2 exists<br><sup>4)</sup> Property class 80 only for stainless steel A4 and HCR |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              | Annex A 4                               |                                    |
| Product description<br>Materials threaded rod and internal threaded rod                                                                                                                                                                                                                                                                                        |                                              |                                                                                                                                                                                                                                                                                                                       |                                                |                                              |                                         |                                    |

## Reinforcing bar Ø 8, Ø 10, Ø 12, Ø 14, Ø 16, Ø 20, Ø 24, Ø 25, Ø 28, Ø 32



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

**Table A2: Materials**

| Part                    | Designation                                | Material                                                                                                                                 |
|-------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reinforcing bars</b> |                                            |                                                                                                                                          |
| 5                       | Rebar<br>EN 1992-1-1:2004+AC:2010, Annex C | Bars and de-coiled rods class B or C<br>$f_{yk}$ and $k$ according to NDP or NCL of EN 1992-1-1/NA<br>$f_{uk} = f_{tk} = k \cdot f_{yk}$ |

**Würth Injection System WIT-PE 1000 for concrete**

**Product description**  
Materials reinforcing bar

**Annex A 5**

### Specifications of intended use

#### Anchorage subject to:

- Static and quasi-static loads: M8 to M30, Rebar Ø8 to Ø32, IG-M6 to IG-M20.
- Seismic action for Performance Category C1: M8 to M30 (except hot-dip galvanised rods), Rebar Ø8 to Ø32.
- Seismic action for Performance Category C2: M12 to M24 (except hot-dip galvanised rods).

#### Base materials:

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.
- Non-cracked concrete: M8 to M30, Rebar Ø8 to Ø32, IG-M6 to IG-M20.
- Cracked concrete: M8 to M30, Rebar Ø8 to Ø32, IG-M6 to IG-M20.

#### Temperature Range:

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

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

#### Installation:

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

Würth Injection System WIT-PE 1000 for concrete

Intended Use  
Specifications

Annex B 1

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

| Anchor size                               |                                  |      | M8                                           | M10 | M12              | M16             | M20 | M24 | M27 | M30 |
|-------------------------------------------|----------------------------------|------|----------------------------------------------|-----|------------------|-----------------|-----|-----|-----|-----|
| Diameter of element                       | $d = d_{nom}$                    | [mm] | 8                                            | 10  | 12               | 16              | 20  | 24  | 27  | 30  |
| Nominal drill hole diameter               | $d_0$                            | [mm] | 10                                           | 12  | 14               | 18              | 22  | 28  | 30  | 35  |
| Effective embedment depth                 | $h_{ef,min}$                     | [mm] | 60                                           | 60  | 70               | 80              | 90  | 96  | 108 | 120 |
|                                           | $h_{ef,max}$                     | [mm] | 160                                          | 200 | 240              | 320             | 400 | 480 | 540 | 600 |
| Diameter of clearance hole in the fixture | Prepositioned installation $d_f$ | [mm] | 9                                            | 12  | 14               | 18              | 22  | 26  | 30  | 33  |
|                                           | Push through installation $d_f$  | [mm] | 12                                           | 14  | 16               | 20              | 24  | 30  | 33  | 40  |
| Maximum torque moment                     | $T_{inst} \leq$                  | [Nm] | 10                                           | 20  | 40 <sup>1)</sup> | 60              | 100 | 170 | 250 | 300 |
| Minimum thickness of member               | $h_{min}$                        | [mm] | $h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$ |     |                  | $h_{ef} + 2d_0$ |     |     |     |     |
| Minimum spacing                           | $s_{min}$                        | [mm] | 40                                           | 50  | 60               | 75              | 95  | 115 | 125 | 140 |
| Minimum edge distance                     | $c_{min}$                        | [mm] | 35                                           | 40  | 45               | 50              | 60  | 65  | 75  | 80  |

<sup>1)</sup> Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm

**Table B2: Installation parameters for rebar**

| Anchor size                 |               |      | Ø 8 <sup>1)</sup>                            | Ø 10 <sup>1)</sup> | Ø 12 <sup>1)</sup> | Ø 14            | Ø 16 | Ø 20 | Ø 24 | Ø 25 | Ø 28 | Ø 32 |
|-----------------------------|---------------|------|----------------------------------------------|--------------------|--------------------|-----------------|------|------|------|------|------|------|
| Diameter of element         | $d = d_{nom}$ | [mm] | 8                                            | 10                 | 12                 | 14              | 16   | 20   | 24   | 25   | 28   | 32   |
| Nominal drill hole diameter | $d_0$         | [mm] | 10                                           | 12                 | 12                 | 14              | 14   | 16   | 18   | 20   | 25   | 32   |
| Effective embedment depth   | $h_{ef,min}$  | [mm] | 60                                           | 60                 | 70                 | 75              | 80   | 90   | 96   | 100  | 112  | 128  |
|                             | $h_{ef,max}$  | [mm] | 160                                          | 200                | 240                | 280             | 320  | 400  | 480  | 500  | 560  | 640  |
| Minimum thickness of member | $h_{min}$     | [mm] | $h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$ |                    |                    | $h_{ef} + 2d_0$ |      |      |      |      |      |      |
| Minimum spacing             | $s_{min}$     | [mm] | 40                                           | 50                 | 60                 | 70              | 75   | 95   | 120  | 120  | 130  | 150  |
| Minimum edge distance       | $c_{min}$     | [mm] | 35                                           | 40                 | 45                 | 50              | 50   | 60   | 70   | 70   | 75   | 85   |

<sup>1)</sup> both nominal drill hole diameter can be used

**Table B3: Installation parameters for Internal threaded anchor rod**

| Anchor size                                |                 |      | IG-M6                                        | IG-M8 | IG-M10 | IG-M12          | IG-M16 | IG-M20 |
|--------------------------------------------|-----------------|------|----------------------------------------------|-------|--------|-----------------|--------|--------|
| Internal diameter of anchor rod            | $d_2$           | [mm] | 6                                            | 8     | 10     | 12              | 16     | 20     |
| Outer diameter of anchor rod <sup>1)</sup> | $d = d_{nom}$   | [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    |
|                                            | $h_{ef,max}$    | [mm] | 200                                          | 240   | 320    | 400             | 480    | 600    |
| Diameter of clearance hole in the fixture  | $d_f$           | [mm] | 7                                            | 9     | 12     | 14              | 18     | 22     |
| Maximum torque moment                      | $T_{inst} \leq$ | [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] | $h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$ |       |        | $h_{ef} + 2d_0$ |        |        |
| Minimum spacing                            | $s_{min}$       | [mm] | 50                                           | 60    | 75     | 95              | 115    | 140    |
| Minimum edge distance                      | $c_{min}$       | [mm] | 40                                           | 45    | 50     | 60              | 65     | 80     |

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

**Würth Injection System WIT-PE 1000 for concrete**

**Intended Use**  
Installation parameters

**Annex B 2**

**Table B4: Parameter cleaning and setting tools**

|  |  |  |  |  |      |  |                  |                                                                                     |                                                                                     |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Threaded Rod                                                                      | Rebar                                                                             | Internal threaded anchor rod                                                      | d <sub>0</sub><br>Drill bit - Ø<br>HD, HDB, CD                                    | d <sub>b</sub><br>Brush - Ø                                                       |      | d <sub>b,min</sub><br>min.<br>Brush - Ø                                             | Piston plug      | Installation direction and use of piston plug                                       |                                                                                     |                                                                                     |
| [mm]                                                                              | [mm]                                                                              | W-VI-IG                                                                           | [mm]                                                                              | WIT-                                                                              | [mm] | [mm]                                                                                | WIT-             |  |  |  |
| M8                                                                                | 8                                                                                 |                                                                                   | 10                                                                                | RB10                                                                              | 11,5 | 10,5                                                                                | No plug required |                                                                                     |                                                                                     |                                                                                     |
| M10                                                                               | 8 / 10                                                                            | IG-M6                                                                             | 12                                                                                | RB12                                                                              | 13,5 | 12,5                                                                                |                  |                                                                                     |                                                                                     |                                                                                     |
| M12                                                                               | 10 / 12                                                                           | IG-M8                                                                             | 14                                                                                | RB14                                                                              | 15,5 | 14,5                                                                                |                  |                                                                                     |                                                                                     |                                                                                     |
|                                                                                   | 12                                                                                |                                                                                   | 16                                                                                | RB16                                                                              | 17,5 | 16,5                                                                                |                  |                                                                                     |                                                                                     |                                                                                     |
| M16                                                                               | 14                                                                                | IG-M10                                                                            | 18                                                                                | RB18                                                                              | 20,0 | 18,5                                                                                | VS18             | h <sub>ef</sub> ><br>250 mm                                                         | h <sub>ef</sub> ><br>250 mm                                                         | all                                                                                 |
|                                                                                   | 16                                                                                |                                                                                   | 20                                                                                | RB20                                                                              | 22,0 | 20,5                                                                                | VS20             |                                                                                     |                                                                                     |                                                                                     |
| M20                                                                               |                                                                                   | IG-M12                                                                            | 22                                                                                | RB22                                                                              | 24,0 | 22,5                                                                                | VS22             |                                                                                     |                                                                                     |                                                                                     |
|                                                                                   | 20                                                                                |                                                                                   | 25                                                                                | RB25                                                                              | 27,0 | 25,5                                                                                | VS25             |                                                                                     |                                                                                     |                                                                                     |
| M24                                                                               |                                                                                   | IG-M16                                                                            | 28                                                                                | RB28                                                                              | 30,0 | 28,5                                                                                | VS28             |                                                                                     |                                                                                     |                                                                                     |
| M27                                                                               |                                                                                   |                                                                                   | 30                                                                                | RB30                                                                              | 31,8 | 30,5                                                                                | VS30             |                                                                                     |                                                                                     |                                                                                     |
|                                                                                   | 24 / 25                                                                           |                                                                                   | 32                                                                                | RB32                                                                              | 34,0 | 32,5                                                                                | VS32             |                                                                                     |                                                                                     |                                                                                     |
| M30                                                                               | 28                                                                                | IG-M20                                                                            | 35                                                                                | RB35                                                                              | 37,0 | 35,5                                                                                | VS35             |                                                                                     |                                                                                     |                                                                                     |
|                                                                                   | 32                                                                                |                                                                                   | 40                                                                                | RB40                                                                              | 43,5 | 40,5                                                                                | VS40             |                                                                                     |                                                                                     |                                                                                     |

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

Drill bit diameter ( $d_0$ ): all diameters



#### HDB – Hollow drill bit system

Drill bit diameter ( $d_0$ ): all diameters

The hollow drill bit system contains the Würth Extraction Drill Bit, MKT Extraction Drill Bit or Heller Duster Expert hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa and flow rate of minimum 150 m³/h (42 l/s).

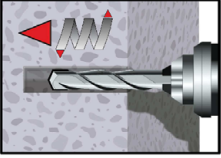
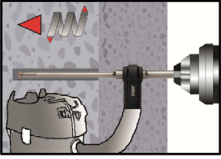
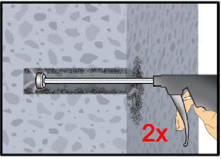
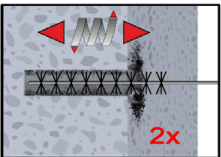
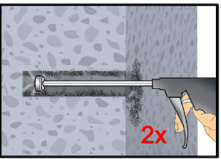


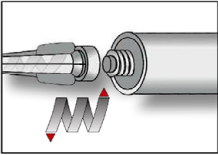
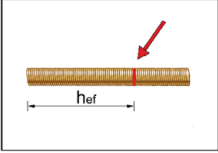
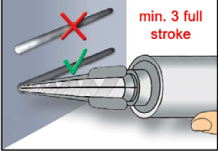
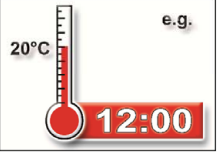
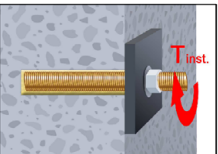
**Würth Injection System WIT-PE 1000 for concrete**

#### Intended Use

Cleaning and setting tools

**Annex B 3**

| Installation instructions                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drilling of the bore hole                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                           | <p><b>1a. Hammer (HD) or compressed air drilling (CD)</b><br/>Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). Proceed with Step 2.<br/>In case of aborted drill hole, the drill hole shall be filled with mortar.</p> <p><b>1b. Hollow drill bit system (HDB) (see Annex B 3)</b><br/>Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). This drilling system removes the dust and cleans the bore hole during drilling (all conditions). Proceed with Step 3.<br/>In case of aborted drill hole, the drill hole shall be filled with mortar.</p>                                                                                                                   |
|                                                                                                                                                                                                                                                             | <p><b>Attention! Standing water in the bore hole must be removed before cleaning.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| CAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|    | <p><b>2a.</b> Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 3) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.</p> <p><b>2b.</b> Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush <math>&gt; d_{b,min}</math> (Table B4) a minimum of two times in a twisting motion.<br/>If the bore hole ground is not reached with the brush, a brush extension must be used.</p> <p><b>2c.</b> Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 3) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.</p> |
|                                                                                                                                                                                                                                                             | <p><b>After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p><b>Würth Injection System WIT-PE 1000 for concrete</b></p>                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>Intended Use</b><br/>Installation instructions</p>                                                                                                                                                                                                    | <p><b>Annex B 4</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Installation instructions (continuation)                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>3. Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.<br/>For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.</p> <p>4. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.</p> <p>5. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey or red colour.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                       | <p>6. Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used. Observe the gel-/ working times given in Table B5.</p> <p>7. Piston plugs and mixer nozzle extensions shall be used according to Table B4 for the following applications:</p> <ul style="list-style-type: none"> <li>Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-<math>\varnothing d_0 \geq 18</math> mm and embedment depth <math>h_{ef} &gt; 250</math>mm</li> <li>Overhead assembly (vertical upwards direction): Drill bit-<math>\varnothing d_0 \geq 18</math> mm</li> </ul> <p>8. Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.</p> <p>The anchor shall be free of dirt, grease, oil or other foreign material.</p> <p>9. After inserting the anchor, the annular gap between anchor rod and concrete, in case of a push through installation additionally also the fixture, must be complete filled with mortar. If excess mortar is not visible at the top of the hole, the requirement is not fulfilled and the application has to be renewed. For overhead application the anchor rod shall be fixed (e.g. wedges).</p> |
|                                                                                                                                                                                                                                                       | <p>10. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B5).</p> <p>11. After full curing, the add-on part can be installed with up to the max. torque (Table B1 or B3) by using a calibrated torque wrench. In case of prepositioned installation the annular gap between anchor and fixture can be optional filled with mortar. Therefor substitute the washer by the filling washer and connect the mixer reduction nozzle to the tip of the mixer. The annular gap is filled with mortar, when mortar oozes out of the washer.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><b>Würth Injection System WIT-PE 1000 for concrete</b></p>                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><b>Intended Use</b><br/>Installation instructions (continuation)</p>                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><b>Annex B 5</b></p>                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Table B5: Maximum working time and minimum curing time**

| Concrete temperature                            | Gelling working time | Minimum curing time in dry concrete | Minimum curing time in wet concrete |
|-------------------------------------------------|----------------------|-------------------------------------|-------------------------------------|
| + 5 °C    to    + 9 °C                          | 80 min               | 48 h                                | 96 h                                |
| + 10 °C    to    + 14 °C                        | 60 min               | 28 h                                | 56 h                                |
| + 15 °C    to    + 19 °C                        | 40 min               | 18 h                                | 36 h                                |
| + 20 °C    to    + 24 °C                        | 30 min               | 12 h                                | 24 h                                |
| + 25 °C    to    + 34 °C                        | 12 min               | 9 h                                 | 18 h                                |
| + 35 °C    to    + 39 °C                        | 8 min                | 6 h                                 | 12 h                                |
| +40 °C                                          | 8 min                | 4 h                                 | 8 h                                 |
| Cartridge temperature                           | +5°C to +40°C        |                                     |                                     |
|                                                 |                      |                                     |                                     |
|                                                 |                      |                                     |                                     |
| Würth Injection System WIT-PE 1000 for concrete |                      |                                     | Annex B 6                           |
| Intended Use<br>Curing time                     |                      |                                     |                                     |

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

| Size                                                                                                                                                                                                                                                                                                             |                                          |                                | M8    | M10     | M12     | M16  | M20 | M24       | M27 | M30  |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------|-------|---------|---------|------|-----|-----------|-----|------|------|
| Cross section area                                                                                                                                                                                                                                                                                               |                                          | A <sub>S</sub>                 | [mm²] | 36,6    | 58      | 84,3 | 157 | 245       | 353 | 459  | 561  |
| Characteristic tension resistance, Steel failure <sup>1)</sup>                                                                                                                                                                                                                                                   |                                          |                                |       |         |         |      |     |           |     |      |      |
| Steel, Property class 4.6 and 4.8                                                                                                                                                                                                                                                                                |                                          | N <sub>Rk,s</sub>              | [kN]  | 15 (13) | 23 (21) | 34   | 63  | 98        | 141 | 184  | 224  |
| Steel, Property class 5.6 and 5.8                                                                                                                                                                                                                                                                                |                                          | N <sub>Rk,s</sub>              | [kN]  | 18 (17) | 29 (27) | 42   | 78  | 122       | 176 | 230  | 280  |
| Steel, Property class 8.8                                                                                                                                                                                                                                                                                        |                                          | N <sub>Rk,s</sub>              | [kN]  | 29 (27) | 46 (43) | 67   | 125 | 196       | 282 | 368  | 449  |
| Stainless steel A2, A4 and HCR, class 50                                                                                                                                                                                                                                                                         |                                          | N <sub>Rk,s</sub>              | [kN]  | 18      | 29      | 42   | 79  | 123       | 177 | 230  | 281  |
| Stainless steel A2, A4 and HCR, class 70                                                                                                                                                                                                                                                                         |                                          | N <sub>Rk,s</sub>              | [kN]  | 26      | 41      | 59   | 110 | 171       | 247 | -    | -    |
| Stainless steel A4 and HCR, class 80                                                                                                                                                                                                                                                                             |                                          | N <sub>Rk,s</sub>              | [kN]  | 29      | 46      | 67   | 126 | 196       | 282 | -    | -    |
| Characteristic tension resistance, Partial factor <sup>2)</sup>                                                                                                                                                                                                                                                  |                                          |                                |       |         |         |      |     |           |     |      |      |
| Steel, Property class 4.6 and 5.6                                                                                                                                                                                                                                                                                |                                          | γ <sub>Ms,N</sub>              | [-]   | 2,0     |         |      |     |           |     |      |      |
| Steel, Property class 4.8, 5.8 and 8.8                                                                                                                                                                                                                                                                           |                                          | γ <sub>Ms,N</sub>              | [-]   | 1,5     |         |      |     |           |     |      |      |
| Stainless steel A2, A4 and HCR, class 50                                                                                                                                                                                                                                                                         |                                          | γ <sub>Ms,N</sub>              | [-]   | 2,86    |         |      |     |           |     |      |      |
| Stainless steel A2, A4 and HCR, class 70                                                                                                                                                                                                                                                                         |                                          | γ <sub>Ms,N</sub>              | [-]   | 1,87    |         |      |     |           |     |      |      |
| Stainless steel A4 and HCR, class 80                                                                                                                                                                                                                                                                             |                                          | γ <sub>Ms,N</sub>              | [-]   | 1,6     |         |      |     |           |     |      |      |
| Characteristic shear resistance, Steel failure <sup>1)</sup>                                                                                                                                                                                                                                                     |                                          |                                |       |         |         |      |     |           |     |      |      |
| Without lever arm                                                                                                                                                                                                                                                                                                | Steel, Property class 4.6 and 4.8        | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 9 (8)   | 14 (13) | 20   | 38  | 59        | 85  | 110  | 135  |
|                                                                                                                                                                                                                                                                                                                  | Steel, Property class 5.6 and 5.8        | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 11 (10) | 17 (16) | 25   | 47  | 74        | 106 | 138  | 168  |
|                                                                                                                                                                                                                                                                                                                  | Steel, Property class 8.8                | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 15 (13) | 23 (21) | 34   | 63  | 98        | 141 | 184  | 224  |
|                                                                                                                                                                                                                                                                                                                  | Stainless steel A2, A4 and HCR, class 50 | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 9       | 15      | 21   | 39  | 61        | 88  | 115  | 140  |
|                                                                                                                                                                                                                                                                                                                  | Stainless steel A2, A4 and HCR, class 70 | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 13      | 20      | 30   | 55  | 86        | 124 | -    | -    |
|                                                                                                                                                                                                                                                                                                                  | Stainless steel A4 and HCR, class 80     | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 15      | 23      | 34   | 63  | 98        | 141 | -    | -    |
| With lever arm                                                                                                                                                                                                                                                                                                   | Steel, Property class 4.6 and 4.8        | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 15 (13) | 30 (27) | 52   | 133 | 260       | 449 | 666  | 900  |
|                                                                                                                                                                                                                                                                                                                  | Steel, Property class 5.6 and 5.8        | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 19 (16) | 37 (33) | 65   | 166 | 324       | 560 | 833  | 1123 |
|                                                                                                                                                                                                                                                                                                                  | Steel, Property class 8.8                | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 30 (26) | 60 (53) | 105  | 266 | 519       | 896 | 1333 | 1797 |
|                                                                                                                                                                                                                                                                                                                  | Stainless steel A2, A4 and HCR, class 50 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 19      | 37      | 66   | 167 | 325       | 561 | 832  | 1125 |
|                                                                                                                                                                                                                                                                                                                  | Stainless steel A2, A4 and HCR, class 70 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 26      | 52      | 92   | 232 | 454       | 784 | -    | -    |
|                                                                                                                                                                                                                                                                                                                  | Stainless steel A4 and HCR, class 80     | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 30      | 59      | 105  | 266 | 519       | 896 | -    | -    |
| Characteristic shear resistance, Partial factor <sup>2)</sup>                                                                                                                                                                                                                                                    |                                          |                                |       |         |         |      |     |           |     |      |      |
| Steel, Property class 4.6 and 5.6                                                                                                                                                                                                                                                                                |                                          | γ <sub>Ms,V</sub>              | [-]   | 1,67    |         |      |     |           |     |      |      |
| Steel, Property class 4.8, 5.8 and 8.8                                                                                                                                                                                                                                                                           |                                          | γ <sub>Ms,V</sub>              | [-]   | 1,25    |         |      |     |           |     |      |      |
| Stainless steel A2, A4 and HCR, class 50                                                                                                                                                                                                                                                                         |                                          | γ <sub>Ms,V</sub>              | [-]   | 2,38    |         |      |     |           |     |      |      |
| Stainless steel A2, A4 and HCR, class 70                                                                                                                                                                                                                                                                         |                                          | γ <sub>Ms,V</sub>              | [-]   | 1,56    |         |      |     |           |     |      |      |
| Stainless steel A4 and HCR, class 80                                                                                                                                                                                                                                                                             |                                          | γ <sub>Ms,V</sub>              | [-]   | 1,33    |         |      |     |           |     |      |      |
| <sup>1)</sup> Values are only valid for the given stress area A <sub>s</sub> . Values in brackets are valid for undersized threaded rods with smaller stress area A <sub>s</sub> for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.<br><sup>2)</sup> in absence of national regulation |                                          |                                |       |         |         |      |     |           |     |      |      |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                                                                                                                                                  |                                          |                                |       |         |         |      |     | Annex C 1 |     |      |      |
| Performances<br>Characteristic values for steel tension resistance and steel shear resistance of threaded rods                                                                                                                                                                                                   |                                          |                                |       |         |         |      |     |           |     |      |      |

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

| Anchor                |                        |             | All Anchor type and sizes |                                                        |
|-----------------------|------------------------|-------------|---------------------------|--------------------------------------------------------|
| Concrete cone failure |                        |             |                           |                                                        |
| Non-cracked concrete  |                        | $k_{ucr,N}$ | [-]                       | 11,0                                                   |
| Cracked concrete      |                        | $k_{cr,N}$  | [-]                       | 7,7                                                    |
| Edge distance         |                        | $c_{cr,N}$  | [mm]                      | 1,5 $h_{ef}$                                           |
| Axial distance        |                        | $s_{cr,N}$  | [mm]                      | 2 $c_{cr,N}$                                           |
| Splitting             |                        |             |                           |                                                        |
| Edge distance         | $h/h_{ef} \geq 2,0$    | $c_{cr,sp}$ | [mm]                      | 1,0 $h_{ef}$                                           |
|                       | $2,0 > h/h_{ef} > 1,3$ |             |                           | $2 \cdot h_{ef} \left( 2,5 - \frac{h}{h_{ef}} \right)$ |
|                       | $h/h_{ef} \leq 1,3$    |             |                           | 2,4 $h_{ef}$                                           |
| Axial distance        |                        | $s_{cr,sp}$ | [mm]                      | 2 $c_{cr,sp}$                                          |
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**Annex C 2**

| Table C3: Characteristic values of tension loads under static and quasi-static action                                                                                      |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------|-----------------|--------------------------------------|------|-----|-----|-----|-----------|-----|-----|-----|
| Anchor size threaded rod                                                                                                                                                   |               |                                         |                 |                                      | M8   | M10 | M12 | M16 | M20       | M24 | M27 | M30 |
| Steel failure                                                                                                                                                              |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Characteristic tension resistance                                                                                                                                          |               | $N_{Rk,s}$                              | [kN]            | $A_s \cdot f_{uk}$ (or see Table C1) |      |     |     |     |           |     |     |     |
| Partial factor                                                                                                                                                             |               | $\gamma_{Ms,N}$                         | [-]             | see Table C1                         |      |     |     |     |           |     |     |     |
| Combined pull-out and concrete failure                                                                                                                                     |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drilled holes (CD)                                           |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Temperature range                                                                                                                                                          | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | $\tau_{Rk,ucr}$ | [N/mm²]                              | 20   | 20  | 19  | 19  | 18        | 17  | 16  | 16  |
|                                                                                                                                                                            | II: 72°C/50°C |                                         |                 |                                      | 15   | 15  | 15  | 14  | 13        | 13  | 12  | 12  |
| Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                          |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Temperature range                                                                                                                                                          | I: 40°C/24°C  | Dry, wet concrete                       | $\tau_{Rk,ucr}$ | [N/mm²]                              | 17   | 16  | 16  | 16  | 15        | 14  | 14  | 13  |
|                                                                                                                                                                            | II: 72°C/50°C |                                         |                 |                                      | 14   | 14  | 14  | 13  | 13        | 12  | 12  | 11  |
|                                                                                                                                                                            | I: 40°C/24°C  | flooded bore hole                       |                 |                                      | 16   | 16  | 16  | 15  | 15        | 14  | 14  | 13  |
|                                                                                                                                                                            | II: 72°C/50°C |                                         |                 |                                      | 14   | 14  | 14  | 13  | 13        | 12  | 12  | 11  |
| Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD) , compressed air drilled holes (CD) and with hollow drill bit (HDB)                 |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Temperature range                                                                                                                                                          | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | $\tau_{Rk,cr}$  | [N/mm²]                              | 7,0  | 7,0 | 8,5 | 8,5 | 8,5       | 8,5 | 8,5 | 8,5 |
|                                                                                                                                                                            | II: 72°C/50°C |                                         |                 |                                      | 6,0  | 6,0 | 7,0 | 7,0 | 7,0       | 7,0 | 7,0 | 7,0 |
| Reduktion factor $\psi^0_{sus}$ in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Temperature range                                                                                                                                                          | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | $\psi^0_{sus}$  | [-]                                  | 0,75 |     |     |     |           |     |     |     |
|                                                                                                                                                                            | II: 72°C/50°C |                                         |                 |                                      | 0,68 |     |     |     |           |     |     |     |
| Increasing factors for concrete $\psi_c$                                                                                                                                   |               |                                         | C25/30          |                                      | 1,02 |     |     |     |           |     |     |     |
|                                                                                                                                                                            |               |                                         | C30/37          |                                      | 1,04 |     |     |     |           |     |     |     |
|                                                                                                                                                                            |               |                                         | C35/45          |                                      | 1,07 |     |     |     |           |     |     |     |
|                                                                                                                                                                            |               |                                         | C40/50          |                                      | 1,08 |     |     |     |           |     |     |     |
|                                                                                                                                                                            |               |                                         | C45/55          |                                      | 1,09 |     |     |     |           |     |     |     |
|                                                                                                                                                                            |               |                                         | C50/60          |                                      | 1,10 |     |     |     |           |     |     |     |
| Concrete cone failure                                                                                                                                                      |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Relevant parameter                                                                                                                                                         |               |                                         |                 | see Table C2                         |      |     |     |     |           |     |     |     |
| Splitting                                                                                                                                                                  |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Relevant parameter                                                                                                                                                         |               |                                         |                 | see Table C2                         |      |     |     |     |           |     |     |     |
| Installation factor                                                                                                                                                        |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| for dry and wet concrete (all drilling methods)                                                                                                                            |               | $\gamma_{inst}$                         | [-]             | 1,0                                  |      |     |     |     |           |     |     |     |
| for flooded bore hole (all drilling methods)                                                                                                                               |               |                                         |                 | 1,2                                  |      |     |     |     |           |     |     |     |
|                                                                                                                                                                            |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                            |               |                                         |                 |                                      |      |     |     |     | Annex C 3 |     |     |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action                                                                                |               |                                         |                 |                                      |      |     |     |     |           |     |     |     |

**Table C4: Characteristic values of shear loads under static and quasi-static action**

| Anchor size threaded rod                                                                                             |                 |       |                                                   | M8 | M10 | M12 | M16 | M20       | M24  | M27                          | M30 |
|----------------------------------------------------------------------------------------------------------------------|-----------------|-------|---------------------------------------------------|----|-----|-----|-----|-----------|------|------------------------------|-----|
| Steel failure without lever arm                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
| Characteristic shear resistance<br>Steel, strength class 4.6, 4.8 and 5.6, 5.8                                       | $V_{Rk,s}^0$    | [kN]  | $0,6 \cdot A_s \cdot f_{uk}$ (or see Table C1)    |    |     |     |     |           |      |                              |     |
| Characteristic shear resistance<br>Steel, strength class 8.8<br>Stainless Steel A2, A4 and HCR, all strength classes | $V_{Rk,s}^0$    | [kN]  | $0,5 \cdot A_s \cdot f_{uk}$ (or see Table C1)    |    |     |     |     |           |      |                              |     |
| Partial factor                                                                                                       | $\gamma_{Ms,V}$ | [-]   | see Table C1                                      |    |     |     |     |           |      |                              |     |
| Ductility factor                                                                                                     | $k_7$           | [-]   | 1,0                                               |    |     |     |     |           |      |                              |     |
| Steel failure with lever arm                                                                                         |                 |       |                                                   |    |     |     |     |           |      |                              |     |
| Characteristic bending moment                                                                                        | $M_{Rk,s}^0$    | [Nm]  | $1,2 \cdot W_{el} \cdot f_{uk}$ (or see Table C1) |    |     |     |     |           |      |                              |     |
| Elastic section modulus                                                                                              | $W_{el}$        | [mm³] | 31                                                | 62 | 109 | 277 | 541 | 935       | 1387 | 1874                         |     |
| Partial factor                                                                                                       | $\gamma_{Ms,V}$ | [-]   | see Table C1                                      |    |     |     |     |           |      |                              |     |
| Concrete pry-out failure                                                                                             |                 |       |                                                   |    |     |     |     |           |      |                              |     |
| Factor                                                                                                               | $k_8$           | [-]   | 2,0                                               |    |     |     |     |           |      |                              |     |
| Installation factor                                                                                                  | $\gamma_{inst}$ | [-]   | 1,0                                               |    |     |     |     |           |      |                              |     |
| Concrete edge failure                                                                                                |                 |       |                                                   |    |     |     |     |           |      |                              |     |
| Effective length of fastener                                                                                         | $l_f$           | [mm]  | $\min(h_{ef}; 12 \cdot d_{nom})$                  |    |     |     |     |           |      | $\min(h_{ef}; 300\text{mm})$ |     |
| Outside diameter of fastener                                                                                         | $d_{nom}$       | [mm]  | 8                                                 | 10 | 12  | 16  | 20  | 24        | 27   | 30                           |     |
| Installation factor                                                                                                  | $\gamma_{inst}$ | [-]   | 1,0                                               |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
|                                                                                                                      |                 |       |                                                   |    |     |     |     |           |      |                              |     |
| Würth Injection System WIT-PE 1000 for concrete                                                                      |                 |       |                                                   |    |     |     |     | Annex C 4 |      |                              |     |
| Performances<br>Characteristic values of shear loads under static and quasi-static action                            |                 |       |                                                   |    |     |     |     |           |      |                              |     |

**Table C5: Characteristic values of tension loads under static and quasi-static action**

| Anchor size internal threaded anchor rods                                                                                                                                                                                                                            |               |                                         |                               | IG-M6        | IG-M8 | IG-M10 | IG-M12    | IG-M16 | IG-M20 |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------|-------------------------------|--------------|-------|--------|-----------|--------|--------|-----|
| Steel failure <sup>1)</sup>                                                                                                                                                                                                                                          |               |                                         |                               |              |       |        |           |        |        |     |
| Characteristic tension resistance,                                                                                                                                                                                                                                   | 5.8           | N <sub>Rk,s</sub>                       | [kN]                          | 10           | 17    | 29     | 42        | 76     | 123    |     |
| Steel, strength class                                                                                                                                                                                                                                                | 8.8           | N <sub>Rk,s</sub>                       | [kN]                          | 16           | 27    | 46     | 67        | 121    | 196    |     |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                           |               | γ <sub>Ms,N</sub>                       | [-]                           | 1,5          |       |        |           |        |        |     |
| Characteristic tension resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>                                                                                                                                                                       |               | N <sub>Rk,s</sub>                       | [kN]                          | 14           | 26    | 41     | 59        | 110    | 124    |     |
| Partial factor                                                                                                                                                                                                                                                       |               | γ <sub>Ms,N</sub>                       | [-]                           | 1,87         |       |        |           |        | 2,86   |     |
| Combined pull-out and concrete cone failure                                                                                                                                                                                                                          |               |                                         |                               |              |       |        |           |        |        |     |
| Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drilled holes (CD)                                                                                                                                     |               |                                         |                               |              |       |        |           |        |        |     |
| Temperature range                                                                                                                                                                                                                                                    | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | τ <sub>Rk,ucr</sub>           | [N/mm²]      | 20    | 19     | 19        | 18     | 17     | 16  |
|                                                                                                                                                                                                                                                                      | II: 72°C/50°C |                                         |                               |              | 15    | 15     | 14        | 13     | 13     | 12  |
| Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                                                                                                    |               |                                         |                               |              |       |        |           |        |        |     |
| Temperature range                                                                                                                                                                                                                                                    | I: 40°C/24°C  | Dry, wet concrete                       | τ <sub>Rk,ucr</sub>           | [N/mm²]      | 16    | 16     | 16        | 15     | 14     | 13  |
|                                                                                                                                                                                                                                                                      | II: 72°C/50°C |                                         |                               |              | 14    | 14     | 13        | 13     | 12     | 11  |
|                                                                                                                                                                                                                                                                      | I: 40°C/24°C  | flooded bore hole                       |                               |              | 16    | 16     | 15        | 15     | 14     | 13  |
|                                                                                                                                                                                                                                                                      | II: 72°C/50°C |                                         |                               |              | 14    | 14     | 13        | 13     | 12     | 11  |
| Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)                                                                                                            |               |                                         |                               |              |       |        |           |        |        |     |
| Temperature range                                                                                                                                                                                                                                                    | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | τ <sub>Rk,cr</sub>            | [N/mm²]      | 7,0   | 8,5    | 8,5       | 8,5    | 8,5    | 8,5 |
|                                                                                                                                                                                                                                                                      | II: 72°C/50°C |                                         |                               |              | 6,0   | 7,0    | 7,0       | 7,0    | 7,0    | 7,0 |
| Reduktion factor ψ <sup>0</sup> <sub>sus</sub> in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)                                                                            |               |                                         |                               |              |       |        |           |        |        |     |
| Temperature range                                                                                                                                                                                                                                                    | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | ψ <sup>0</sup> <sub>sus</sub> | [-]          | 0,75  |        |           |        |        |     |
|                                                                                                                                                                                                                                                                      | II: 72°C/50°C |                                         |                               |              | 0,68  |        |           |        |        |     |
| Increasing factors for concrete ψ <sub>c</sub>                                                                                                                                                                                                                       |               |                                         | C25/30                        |              | 1,02  |        |           |        |        |     |
|                                                                                                                                                                                                                                                                      |               |                                         | C30/37                        |              | 1,04  |        |           |        |        |     |
|                                                                                                                                                                                                                                                                      |               |                                         | C35/45                        |              | 1,07  |        |           |        |        |     |
|                                                                                                                                                                                                                                                                      |               |                                         | C40/50                        |              | 1,08  |        |           |        |        |     |
|                                                                                                                                                                                                                                                                      |               |                                         | C45/55                        |              | 1,09  |        |           |        |        |     |
|                                                                                                                                                                                                                                                                      |               |                                         | C50/60                        |              | 1,10  |        |           |        |        |     |
| Concrete cone failure                                                                                                                                                                                                                                                |               |                                         |                               |              |       |        |           |        |        |     |
| Relevant parameter                                                                                                                                                                                                                                                   |               |                                         |                               | see Table C2 |       |        |           |        |        |     |
| Splitting failure                                                                                                                                                                                                                                                    |               |                                         |                               |              |       |        |           |        |        |     |
| Relevant parameter                                                                                                                                                                                                                                                   |               |                                         |                               | see Table C2 |       |        |           |        |        |     |
| Installation factor                                                                                                                                                                                                                                                  |               |                                         |                               |              |       |        |           |        |        |     |
| for dry and wet concrete (all drilling methods)                                                                                                                                                                                                                      |               |                                         | γ <sub>inst</sub>             | [-]          | 1,0   |        |           |        |        |     |
| for flooded bore hole (all drilling methods)                                                                                                                                                                                                                         |               |                                         |                               |              | 1,2   |        |           |        |        |     |
| <sup>1)</sup> Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element. |               |                                         |                               |              |       |        |           |        |        |     |
| <sup>2)</sup> For IG-M20 strength class 50 is valid                                                                                                                                                                                                                  |               |                                         |                               |              |       |        |           |        |        |     |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                                                                                                      |               |                                         |                               |              |       |        | Annex C 5 |        |        |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action                                                                                                                                                                          |               |                                         |                               |              |       |        |           |        |        |     |

**Table C6: Characteristic values of shear loads under static and quasi-static action**

| Anchor size for internal threaded anchor rods                                                                                                                                                                                                                                                                                                                |     |                                |      | IG-M6                                         | IG-M8 | IG-M10 | IG-M12 | IG-M16    | IG-M20                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------|------|-----------------------------------------------|-------|--------|--------|-----------|------------------------------|
| Steel failure without lever arm <sup>1)</sup>                                                                                                                                                                                                                                                                                                                |     |                                |      |                                               |       |        |        |           |                              |
| Characteristic shear resistance,<br>Steel, strength class                                                                                                                                                                                                                                                                                                    | 5.8 | V <sup>0</sup> <sub>Rk,s</sub> | [kN] | 5                                             | 9     | 15     | 21     | 38        | 61                           |
|                                                                                                                                                                                                                                                                                                                                                              | 8.8 | V <sup>0</sup> <sub>Rk,s</sub> | [kN] | 8                                             | 14    | 23     | 34     | 60        | 98                           |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                                                                                                                   |     | γ <sub>Ms,V</sub>              | [-]  | 1,25                                          |       |        |        |           |                              |
| Characteristic shear resistance,<br>Stainless Steel A4 and HCR,<br>Strength class 70 <sup>2)</sup>                                                                                                                                                                                                                                                           |     | V <sup>0</sup> <sub>Rk,s</sub> | [kN] | 7                                             | 13    | 20     | 30     | 55        | 40                           |
| Partial factor                                                                                                                                                                                                                                                                                                                                               |     | γ <sub>Ms,V</sub>              | [-]  | 1,56                                          |       |        |        |           | 2,38                         |
| Ductility factor                                                                                                                                                                                                                                                                                                                                             |     | k <sub>7</sub>                 | [-]  | 1,0                                           |       |        |        |           |                              |
| Steel failure with lever arm <sup>1)</sup>                                                                                                                                                                                                                                                                                                                   |     |                                |      |                                               |       |        |        |           |                              |
| Characteristic bending moment,<br>Steel, strength class                                                                                                                                                                                                                                                                                                      | 5.8 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm] | 8                                             | 19    | 37     | 66     | 167       | 325                          |
|                                                                                                                                                                                                                                                                                                                                                              | 8.8 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm] | 12                                            | 30    | 60     | 105    | 267       | 519                          |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                                                                                                                   |     | γ <sub>Ms,V</sub>              | [-]  | 1,25                                          |       |        |        |           |                              |
| Characteristic bending moment,<br>Stainless Steel A4 and HCR,<br>Strength class 70 <sup>2)</sup>                                                                                                                                                                                                                                                             |     | M <sup>0</sup> <sub>Rk,s</sub> | [Nm] | 11                                            | 26    | 52     | 92     | 233       | 456                          |
| Partial factor                                                                                                                                                                                                                                                                                                                                               |     | γ <sub>Ms,V</sub>              | [-]  | 1,56                                          |       |        |        |           | 2,38                         |
| Concrete pry-out failure                                                                                                                                                                                                                                                                                                                                     |     |                                |      |                                               |       |        |        |           |                              |
| Factor                                                                                                                                                                                                                                                                                                                                                       |     | k <sub>8</sub>                 | [-]  | 2,0                                           |       |        |        |           |                              |
| Installation factor                                                                                                                                                                                                                                                                                                                                          |     | γ <sub>inst</sub>              | [-]  | 1,0                                           |       |        |        |           |                              |
| Concrete edge failure                                                                                                                                                                                                                                                                                                                                        |     |                                |      |                                               |       |        |        |           |                              |
| Effective length of fastener                                                                                                                                                                                                                                                                                                                                 |     | l <sub>f</sub>                 | [mm] | min(h <sub>ef</sub> ; 12 • d <sub>nom</sub> ) |       |        |        |           | min(h <sub>ef</sub> ; 300mm) |
| Outside diameter of fastener                                                                                                                                                                                                                                                                                                                                 |     | d <sub>nom</sub>               | [mm] | 10                                            | 12    | 16     | 20     | 24        | 30                           |
| Installation factor                                                                                                                                                                                                                                                                                                                                          |     | γ <sub>inst</sub>              | [-]  | 1,0                                           |       |        |        |           |                              |
| <div><div><sup>1)</sup> Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod.<br/>The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.</div><div><sup>2)</sup> For IG-M20 strength class 50 is valid</div></div> |     |                                |      |                                               |       |        |        |           |                              |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                                                                                                                                                                                              |     |                                |      |                                               |       |        |        | Annex C 6 |                              |
| <div>Performances</div> <div>Characteristic values of shear loads under static and quasi-static action</div>                                                                                                                                                                                                                                                 |     |                                |      |                                               |       |        |        |           |                              |

**Table C7: Characteristic values of tension loads under static and quasi-static action**

| Anchor size reinforcing bar                                                                                                                                                               |               |                                         |                               | Ø 8                                            | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24      | Ø 25 | Ø 28 | Ø 32 |     |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------|-------------------------------|------------------------------------------------|------|------|------|------|------|-----------|------|------|------|-----|----|
| Steel failure                                                                                                                                                                             |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Characteristic tension resistance                                                                                                                                                         |               | N <sub>Rk,s</sub>                       | [kN]                          | A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup> |      |      |      |      |      |           |      |      |      |     |    |
| Cross section area                                                                                                                                                                        |               | A <sub>s</sub>                          | [mm²]                         | 50                                             | 79   | 113  | 154  | 201  | 314  | 452       | 491  | 616  | 804  |     |    |
| Partial factor                                                                                                                                                                            |               | γ <sub>Ms,N</sub>                       | [-]                           | 1,4 <sup>2)</sup>                              |      |      |      |      |      |           |      |      |      |     |    |
| Combined pull-out and concrete failure                                                                                                                                                    |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes (HD) and compressed air drilled holes (CD)                                                          |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Temperature range                                                                                                                                                                         | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | τ <sub>Rk,ucr</sub>           | [N/mm²]                                        | 16   | 16   | 16   | 16   | 16   | 16        | 15   | 15   | 15   | 15  |    |
|                                                                                                                                                                                           | II: 72°C/50°C |                                         |                               |                                                | 12   | 12   | 12   | 12   | 12   | 12        | 12   | 12   | 11   | 11  |    |
| Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                         |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Temperature range                                                                                                                                                                         | I: 40°C/24°C  | Dry, wet concrete                       | τ <sub>Rk,ucr</sub>           | [N/mm²]                                        | 14   | 14   | 13   | 13   | 13   | 13        | 13   | 13   | 13   | 13  |    |
|                                                                                                                                                                                           | II: 72°C/50°C |                                         |                               |                                                | 12   | 12   | 12   | 11   | 11   | 11        | 11   | 11   | 11   | 11  |    |
|                                                                                                                                                                                           | I: 40°C/24°C  | flooded bore hole                       |                               |                                                | 13   | 13   | 13   | 13   | 13   | 13        | 13   | 13   | 13   | 13  | 13 |
|                                                                                                                                                                                           | II: 72°C/50°C |                                         |                               |                                                | 11   | 11   | 11   | 11   | 11   | 11        | 11   | 11   | 11   | 11  |    |
| Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)                                 |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Temperature range                                                                                                                                                                         | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | τ <sub>Rk,cr</sub>            | [N/mm²]                                        | 7,0  | 7,0  | 8,5  | 8,5  | 8,5  | 8,5       | 8,5  | 8,5  | 8,5  | 8,5 |    |
|                                                                                                                                                                                           | II: 72°C/50°C |                                         |                               |                                                | 6,0  | 6,0  | 7,0  | 7,0  | 7,0  | 7,0       | 7,0  | 7,0  | 7,0  | 7,0 |    |
| Reduktion factor ψ <sup>0</sup> <sub>sus</sub> in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Temperature range                                                                                                                                                                         | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | ψ <sup>0</sup> <sub>sus</sub> | [-]                                            | 0,75 |      |      |      |      |           |      |      |      |     |    |
|                                                                                                                                                                                           | II: 72°C/50°C |                                         |                               |                                                | 0,68 |      |      |      |      |           |      |      |      |     |    |
| Increasing factors for concrete ψ <sub>c</sub>                                                                                                                                            |               | C25/30                                  |                               | 1,02                                           |      |      |      |      |      |           |      |      |      |     |    |
|                                                                                                                                                                                           |               | C30/37                                  |                               | 1,04                                           |      |      |      |      |      |           |      |      |      |     |    |
|                                                                                                                                                                                           |               | C35/45                                  |                               | 1,07                                           |      |      |      |      |      |           |      |      |      |     |    |
|                                                                                                                                                                                           |               | C40/50                                  |                               | 1,08                                           |      |      |      |      |      |           |      |      |      |     |    |
|                                                                                                                                                                                           |               | C45/55                                  |                               | 1,09                                           |      |      |      |      |      |           |      |      |      |     |    |
|                                                                                                                                                                                           |               | C50/60                                  |                               | 1,10                                           |      |      |      |      |      |           |      |      |      |     |    |
| Concrete cone failure                                                                                                                                                                     |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Relevant parameter                                                                                                                                                                        |               |                                         |                               | see Table C2                                   |      |      |      |      |      |           |      |      |      |     |    |
| Splitting                                                                                                                                                                                 |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Relevant parameter                                                                                                                                                                        |               |                                         |                               | see Table C2                                   |      |      |      |      |      |           |      |      |      |     |    |
| Installation factor                                                                                                                                                                       |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| for dry and wet concrete (all drilling methods)                                                                                                                                           |               | γ <sub>inst</sub>                       | [-]                           | 1,0                                            |      |      |      |      |      |           |      |      |      |     |    |
| for flooded bore hole (all drilling methods)                                                                                                                                              |               |                                         |                               | 1,2                                            |      |      |      |      |      |           |      |      |      |     |    |
| 1) f <sub>uk</sub> shall be taken from the specifications of reinforcing bars                                                                                                             |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| 2) in absence of national regulation                                                                                                                                                      |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                           |               |                                         |                               |                                                |      |      |      |      |      | Annex C 7 |      |      |      |     |    |
| Performances<br>Characteristic values of tension loads under static and quasi-static action                                                                                               |               |                                         |                               |                                                |      |      |      |      |      |           |      |      |      |     |    |

**Table C8: Characteristic values of shear loads under static and quasi-static action**

| Anchor size reinforcing bar                                                                                                                                   |                                |       | Ø 8                                                   | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24      | Ø 25                         | Ø 28 | Ø 32 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------|-------------------------------------------------------|------|------|------|------|------|-----------|------------------------------|------|------|
| Steel failure without lever arm                                                                                                                               |                                |       |                                                       |      |      |      |      |      |           |                              |      |      |
| Characteristic shear resistance                                                                                                                               | V <sup>0</sup> <sub>Rk,s</sub> | [kN]  | 0,5 • A <sub>s</sub> • f <sub>uk</sub> <sup>1)</sup>  |      |      |      |      |      |           |                              |      |      |
| Cross section area                                                                                                                                            | A <sub>s</sub>                 | [mm²] | 50                                                    | 79   | 113  | 154  | 201  | 314  | 452       | 491                          | 616  | 804  |
| Partial factor                                                                                                                                                | γ <sub>Ms,V</sub>              | [-]   | 1,5 <sup>2)</sup>                                     |      |      |      |      |      |           |                              |      |      |
| Ductility factor                                                                                                                                              | k <sub>7</sub>                 | [-]   | 1,0                                                   |      |      |      |      |      |           |                              |      |      |
| Steel failure with lever arm                                                                                                                                  |                                |       |                                                       |      |      |      |      |      |           |                              |      |      |
| Characteristic bending moment                                                                                                                                 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]  | 1.2 • W <sub>el</sub> • f <sub>uk</sub> <sup>1)</sup> |      |      |      |      |      |           |                              |      |      |
| Elastic section modulus                                                                                                                                       | W <sub>el</sub>                | [mm³] | 50                                                    | 98   | 170  | 269  | 402  | 785  | 896       | 1534                         | 2155 | 3217 |
| Partial factor                                                                                                                                                | γ <sub>Ms,V</sub>              | [-]   | 1,5 <sup>2)</sup>                                     |      |      |      |      |      |           |                              |      |      |
| Concrete pry-out failure                                                                                                                                      |                                |       |                                                       |      |      |      |      |      |           |                              |      |      |
| Factor                                                                                                                                                        | k <sub>8</sub>                 | [-]   | 2,0                                                   |      |      |      |      |      |           |                              |      |      |
| Installation factor                                                                                                                                           | γ <sub>inst</sub>              | [-]   | 1,0                                                   |      |      |      |      |      |           |                              |      |      |
| Concrete edge failure                                                                                                                                         |                                |       |                                                       |      |      |      |      |      |           |                              |      |      |
| Effective length of fastener                                                                                                                                  | l <sub>f</sub>                 | [mm]  | min(h <sub>ef</sub> ; 12 • d <sub>nom</sub> )         |      |      |      |      |      |           | min(h <sub>ef</sub> ; 300mm) |      |      |
| Outside diameter of fastener                                                                                                                                  | d <sub>nom</sub>               | [mm]  | 8                                                     | 10   | 12   | 14   | 16   | 20   | 24        | 25                           | 28   | 32   |
| Installation factor                                                                                                                                           | γ <sub>inst</sub>              | [-]   | 1,0                                                   |      |      |      |      |      |           |                              |      |      |
| <div><sup>1)</sup> f<sub>uk</sub> shall be taken from the specifications of reinforcing bars</div> <div><sup>2)</sup> in absence of national regulation</div> |                                |       |                                                       |      |      |      |      |      |           |                              |      |      |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                               |                                |       |                                                       |      |      |      |      |      | Annex C 8 |                              |      |      |
| Performances<br>Characteristic values of shear loads under static and quasi-static action                                                                     |                                |       |                                                       |      |      |      |      |      |           |                              |      |      |

**Table C9: Displacements under tension load<sup>1)</sup> (threaded rod)**

| Anchor size threaded rod                                                |                            |                           | M8    | M10   | M12   | M16   | M20   | M24   | M27   | M30   |
|-------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Non-cracked concrete C20/25 under static and quasi-static action</b> |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>40°C/24°C                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,033 | 0,035 | 0,038 | 0,039 | 0,041 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,033 | 0,035 | 0,038 | 0,039 | 0,041 |
| Temperature range II:<br>72°C/50°C                                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,044 | 0,047 | 0,051 | 0,052 | 0,055 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,047 | 0,049 | 0,051 | 0,055 | 0,059 | 0,064 | 0,067 | 0,070 |
| <b>Cracked concrete C20/25 under static and quasi-static action</b>     |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>40°C/24°C                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,069 | 0,071 | 0,072 | 0,074 | 0,076 | 0,079 | 0,081 | 0,082 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,193 | 0,115 | 0,122 | 0,128 | 0,135 | 0,142 | 0,155 | 0,171 |
| Temperature range II:<br>72°C/50°C                                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,099 | 0,102 | 0,106 | 0,109 | 0,110 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,259 | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 |

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

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

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

**Table C10: Displacements under shear load<sup>2)</sup> (threaded rod)**

| Anchor size threaded rod                                                            |                            |         | M8   | M10  | M12  | M16  | M20  | M24  | M27  | M30  |
|-------------------------------------------------------------------------------------|----------------------------|---------|------|------|------|------|------|------|------|------|
| <b>Non-cracked and cracked concrete C20/25 under static and quasi-static action</b> |                            |         |      |      |      |      |      |      |      |      |
| All temperature ranges                                                              | $\delta_{V0}$ -factor      | [mm/kN] | 0,06 | 0,06 | 0,05 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 |
|                                                                                     | $\delta_{V\infty}$ -factor | [mm/kN] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 |

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

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

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

**Würth Injection System WIT-PE 1000 for concrete**

**Performances**

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

**Annex C 9**

**Table C11: Displacements under tension load<sup>1)</sup> (Internal threaded rod)**

| Anchor size Internal threaded anchor rod                                |                            |                           | IG-M6 | IG-M8 | IG-M10 | IG-M12 | IG-M16 | IG-M20 |
|-------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|--------|--------|--------|--------|
| <b>Non-cracked concrete C20/25 under static and quasi-static action</b> |                            |                           |       |       |        |        |        |        |
| Temperature range I:<br>40°C/24°C                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,029 | 0,030 | 0,033  | 0,035  | 0,038  | 0,041  |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,029 | 0,030 | 0,033  | 0,035  | 0,038  | 0,041  |
| Temperature range II:<br>72°C/50°C                                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,039 | 0,040 | 0,044  | 0,047  | 0,051  | 0,055  |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,049 | 0,051 | 0,055  | 0,059  | 0,064  | 0,070  |
| <b>Cracked concrete C20/25 under static and quasi-static action</b>     |                            |                           |       |       |        |        |        |        |
| Temperature range I:<br>40°C/24°C                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,071 | 0,072 | 0,074  | 0,076  | 0,079  | 0,082  |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,115 | 0,122 | 0,128  | 0,135  | 0,142  | 0,171  |
| Temperature range II:<br>72°C/50°C                                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,095 | 0,096 | 0,099  | 0,102  | 0,106  | 0,110  |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,154 | 0,163 | 0,172  | 0,181  | 0,189  | 0,229  |

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

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

$\tau$ : action bond stress for tension

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

**Table C12: Displacements under shear load<sup>2)</sup> (Internal threaded rod)**

| Anchor size Internal threaded anchor rod                                            |                            |         | IG-M6 | IG-M8 | IG-M10 | IG-M12 | IG-M16 | IG-M20 |
|-------------------------------------------------------------------------------------|----------------------------|---------|-------|-------|--------|--------|--------|--------|
| <b>Non-cracked and cracked concrete C20/25 under static and quasi-static action</b> |                            |         |       |       |        |        |        |        |
| All temperature<br>ranges                                                           | $\delta_{V0}$ -factor      | [mm/kN] | 0,07  | 0,06  | 0,06   | 0,05   | 0,04   | 0,04   |
|                                                                                     | $\delta_{V\infty}$ -factor | [mm/kN] | 0,10  | 0,09  | 0,08   | 0,08   | 0,06   | 0,06   |

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

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

V: action shear load

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

**Würth Injection System WIT-PE 1000 for concrete**

**Performances**

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

**Annex C 10**

**Table C13: Displacements under tension load<sup>1)</sup> (rebar)**

| Anchor size reinforcing bar                                             |                            |                           | Ø 8   | Ø 10  | Ø 12  | Ø 14  | Ø 16  | Ø 20  | Ø 24  | Ø 25  | Ø 28  | Ø 32  |
|-------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Non-cracked concrete C20/25 under static and quasi-static action</b> |                            |                           |       |       |       |       |       |       |       |       |       |       |
| Temperature range I:<br>40°C/24°C                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,031 | 0,033 | 0,035 | 0,038 | 0,038 | 0,040 | 0,043 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,015 | 0,015 | 0,016 | 0,017 | 0,017 | 0,019 | 0,020 | 0,020 | 0,021 | 0,023 |
| Temperature range II:<br>72°C/50°C                                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,042 | 0,044 | 0,047 | 0,051 | 0,051 | 0,054 | 0,058 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,047 | 0,049 | 0,051 | 0,053 | 0,055 | 0,059 | 0,065 | 0,065 | 0,068 | 0,072 |
| <b>Cracked concrete C20/25 under static and quasi-static action</b>     |                            |                           |       |       |       |       |       |       |       |       |       |       |
| Temperature range I:<br>40°C/24°C                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,069 | 0,071 | 0,072 | 0,073 | 0,074 | 0,076 | 0,079 | 0,079 | 0,081 | 0,084 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,115 | 0,122 | 0,128 | 0,135 | 0,142 | 0,155 | 0,171 | 0,171 | 0,181 | 0,194 |
| Temperature range II:<br>72°C/50°C                                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,098 | 0,099 | 0,102 | 0,106 | 0,106 | 0,109 | 0,113 |
|                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 | 0,229 | 0,242 | 0,260 |

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

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

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

**Table C14: Displacements under shear load<sup>2)</sup> (rebar)**

| Anchor size reinforcing bar                                     |                            |         | Ø 8  | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25 | Ø 28 | Ø 32 |
|-----------------------------------------------------------------|----------------------------|---------|------|------|------|------|------|------|------|------|------|------|
| <b>For concrete C20/25 under static and quasi-static action</b> |                            |         |      |      |      |      |      |      |      |      |      |      |
| All temperature ranges                                          | $\delta_{V0}$ -factor      | [mm/kN] | 0,06 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 | 0,03 |
|                                                                 | $\delta_{V\infty}$ -factor | [mm/kN] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 | 0,04 | 0,04 |

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

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

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

**Würth Injection System WIT-PE 1000 for concrete**

**Performances**

Displacements under static and quasi-static action (rebar)

**Annex C 11**

**Table C15: Characteristic values of tension loads under seismic action  
(performance category C1+C2)**

| Anchor size threaded rod                                                                                                                                                                  |                                                  |                               |         | M8                      | M10 | M12                     | M16 | M20 | M24 | M27 | M30 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------|---------|-------------------------|-----|-------------------------|-----|-----|-----|-----|-----|
| Steel failure                                                                                                                                                                             |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| Characteristic tension resistance<br>(Seismic C1)                                                                                                                                         |                                                  | N <sub>Rk,s,eq,C1</sub>       | [kN]    | 1,0 • N <sub>Rk,s</sub> |     |                         |     |     |     |     |     |
| Characteristic tension resistance,<br>(Seismic C2)<br>Steel, strength class 8.8<br>Stainless Steel A4 and HCR,<br>Strength class ≥70                                                      |                                                  | N <sub>Rk,s,eq,C2</sub>       | [kN]    | NPA                     |     | 1,0 • N <sub>Rk,s</sub> |     |     |     | NPA |     |
| Partial factor                                                                                                                                                                            |                                                  | γ <sub>Ms,N</sub>             | [-]     | see Table C1            |     |                         |     |     |     |     |     |
| Combined pull-out and concrete failure                                                                                                                                                    |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| Characteristic bond resistance in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)                 |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| Temperature<br>range<br>I: 40°C/24°C<br><br>I: 72°C/50°C                                                                                                                                  | Dry, wet<br>concrete and<br>flooded bore<br>hole | τ <sub>Rk,eq,C1</sub>         | [N/mm²] | 7,0                     | 7,0 | 8,5                     | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 |
|                                                                                                                                                                                           |                                                  | τ <sub>Rk,eq,C2</sub>         | [N/mm²] | NPA                     |     | 5,8                     | 4,8 | 5,0 | 5,1 | NPA |     |
|                                                                                                                                                                                           |                                                  | τ <sub>Rk,eq,C1</sub>         | [N/mm²] | 6,0                     | 6,0 | 7,0                     | 7,0 | 7,0 | 7,0 | 7,0 | 7,0 |
|                                                                                                                                                                                           |                                                  | τ <sub>Rk,eq,C2</sub>         | [N/mm²] | NPA                     |     | 5,0                     | 4,1 | 4,3 | 4,4 | NPA |     |
| Reduktion factor ψ <sup>0</sup> <sub>sus</sub> in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| Temperature<br>range<br>I: 40°C/24°C<br><br>II: 72°C/50°C                                                                                                                                 | Dry, wet<br>concrete and<br>flooded bore<br>hole | ψ <sup>0</sup> <sub>sus</sub> | [-]     | 0,75                    |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         | 0,68                    |     |                         |     |     |     |     |     |
| Increasing factors for concrete ψ <sub>C</sub>                                                                                                                                            |                                                  | C25/30 to C50/60              |         | 1,0                     |     |                         |     |     |     |     |     |
| Concrete cone failure                                                                                                                                                                     |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| Relevant parameter                                                                                                                                                                        |                                                  |                               |         | see Table C2            |     |                         |     |     |     |     |     |
| Splitting                                                                                                                                                                                 |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| Relevant parameter                                                                                                                                                                        |                                                  |                               |         | see Table C2            |     |                         |     |     |     |     |     |
| Installation factor                                                                                                                                                                       |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
| for dry and wet concrete<br>(all drilling methods)                                                                                                                                        |                                                  | γ <sub>inst</sub>             | [-]     | 1,0                     |     |                         |     |     |     |     |     |
| for flooded bore hole<br>(all drilling methods)                                                                                                                                           |                                                  |                               |         | 1,2                     |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
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|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
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|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
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|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |
|                                                                                                                                                                                           |                                                  |                               |         |                         |     |                         |     |     |     |     |     |

| Table C16: Characteristic values of shear loads under seismic action<br>(performance category C1+C2)                                                               |                    |      |                                  |     |                         |     |     |     |                              |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|----------------------------------|-----|-------------------------|-----|-----|-----|------------------------------|-----|
| Anchor size threaded rod                                                                                                                                           |                    |      | M8                               | M10 | M12                     | M16 | M20 | M24 | M27                          | M30 |
| Steel failure without lever arm                                                                                                                                    |                    |      |                                  |     |                         |     |     |     |                              |     |
| Characteristic shear resistance<br>(Seismic C1)                                                                                                                    | $V_{Rk,s,eq,C1}$   | [kN] | $0,70 \cdot V^0_{Rk,s}$          |     |                         |     |     |     |                              |     |
| Characteristic shear resistance<br>(Seismic C2),<br>Steel, strength class 8.8<br>Stainless Steel A4 and HCR,<br>Strength class $\geq 70$                           | $V_{Rk,s,eq,C2}$   | [kN] | NPA                              |     | $0,70 \cdot V^0_{Rk,s}$ |     |     |     | NPA                          |     |
| Partial factor                                                                                                                                                     | $\gamma_{Ms,V}$    | [-]  | see Table C1                     |     |                         |     |     |     |                              |     |
| Ductility factor                                                                                                                                                   | $k_7$              | [-]  | 1,0                              |     |                         |     |     |     |                              |     |
| Steel failure with lever arm                                                                                                                                       |                    |      |                                  |     |                         |     |     |     |                              |     |
| Characteristic bending moment                                                                                                                                      | $M^0_{Rk,s,eq,C1}$ | [Nm] | No Performance Assessed (NPA)    |     |                         |     |     |     |                              |     |
|                                                                                                                                                                    | $M^0_{Rk,s,eq,C2}$ | [Nm] | No Performance Assessed (NPA)    |     |                         |     |     |     |                              |     |
| Concrete pry-out failure                                                                                                                                           |                    |      |                                  |     |                         |     |     |     |                              |     |
| Factor                                                                                                                                                             | $k_8$              | [-]  | 2,0                              |     |                         |     |     |     |                              |     |
| Installation factor                                                                                                                                                | $\gamma_{inst}$    | [-]  | 1,0                              |     |                         |     |     |     |                              |     |
| Concrete edge failure                                                                                                                                              |                    |      |                                  |     |                         |     |     |     |                              |     |
| Effective length of fastener                                                                                                                                       | $l_f$              | [mm] | $\min(h_{ef}; 12 \cdot d_{nom})$ |     |                         |     |     |     | $\min(h_{ef}; 300\text{mm})$ |     |
| Outside diameter of fastener                                                                                                                                       | $d_{nom}$          | [mm] | 8                                | 10  | 12                      | 16  | 20  | 24  | 27                           | 30  |
| Installation factor                                                                                                                                                | $\gamma_{inst}$    | [-]  | 1,0                              |     |                         |     |     |     |                              |     |
| Factor for annular gap                                                                                                                                             | $\alpha_{gap}$     | [-]  | $0,5 (1,0)^{1)}$                 |     |                         |     |     |     |                              |     |
| <sup>1)</sup> Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is required |                    |      |                                  |     |                         |     |     |     |                              |     |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                    |                    |      |                                  |     |                         |     |     |     | Annex C 13                   |     |
| Performances<br>Characteristic values of shear loads under seismic action (performance category C1+C2)                                                             |                    |      |                                  |     |                         |     |     |     |                              |     |

**Table C17: Characteristic values of tension loads under seismic action  
(performance category C1)**

| Anchor size reinforcing bar                                                                                                                                                               |               |                                         |                               | Ø 8                                                  | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24       | Ø 25 | Ø 28 | Ø 32 |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------|-------------------------------|------------------------------------------------------|------|------|------|------|------|------------|------|------|------|-----|
| Steel failure                                                                                                                                                                             |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Characteristic tension resistance                                                                                                                                                         |               | N <sub>Rk,s,eq</sub>                    | [kN]                          | 1,0 · A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup> |      |      |      |      |      |            |      |      |      |     |
| Cross section area                                                                                                                                                                        |               | A <sub>s</sub>                          | [mm²]                         | 50                                                   | 79   | 113  | 154  | 201  | 314  | 452        | 491  | 616  | 804  |     |
| Partial factor                                                                                                                                                                            |               | γ <sub>Ms,N</sub>                       | [-]                           | 1,4 <sup>2)</sup>                                    |      |      |      |      |      |            |      |      |      |     |
| Combined pull-out and concrete failure                                                                                                                                                    |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Characteristic bond resistance in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)                 |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Temperature range                                                                                                                                                                         | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | τ <sub>Rk,eq</sub>            | [N/mm²]                                              | 7,0  | 7,0  | 8,5  | 8,5  | 8,5  | 8,5        | 8,5  | 8,5  | 8,5  | 8,5 |
|                                                                                                                                                                                           | II: 72°C/50°C |                                         | τ <sub>Rk,eq</sub>            | [N/mm²]                                              | 6,0  | 6,0  | 7,0  | 7,0  | 7,0  | 7,0        | 7,0  | 7,0  | 7,0  | 7,0 |
| Reduktion factor ψ <sup>0</sup> <sub>sus</sub> in cracked and non-cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Temperature range                                                                                                                                                                         | I: 40°C/24°C  | Dry, wet concrete and flooded bore hole | ψ <sup>0</sup> <sub>sus</sub> | [-]                                                  | 0,75 |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                                                           | 0,68          |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Increasing factors for concrete ψ <sub>C</sub>                                                                                                                                            |               | C25/30 to C50/60                        |                               | 1,0                                                  |      |      |      |      |      |            |      |      |      |     |
| Concrete cone failure                                                                                                                                                                     |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Relevant parameter                                                                                                                                                                        |               |                                         |                               | see Table C2                                         |      |      |      |      |      |            |      |      |      |     |
| Splitting                                                                                                                                                                                 |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Relevant parameter                                                                                                                                                                        |               |                                         |                               | see Table C2                                         |      |      |      |      |      |            |      |      |      |     |
| Installation factor                                                                                                                                                                       |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| for dry and wet concrete (all drilling methods)                                                                                                                                           |               | γ <sub>inst</sub>                       | [-]                           | 1,0                                                  |      |      |      |      |      |            |      |      |      |     |
| for flooded bore hole (all drilling methods)                                                                                                                                              |               |                                         |                               | 1,2                                                  |      |      |      |      |      |            |      |      |      |     |
| <div>1) f<sub>uk</sub> shall be taken from the specifications of reinforcing bars</div> <div>2) in absence of national regulation</div>                                                   |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                           |               |                                         |                               |                                                      |      |      |      |      |      | Annex C 14 |      |      |      |     |
| Performances<br>Characteristic values of tension loads under seismic action (performance category C1)                                                                                     |               |                                         |                               |                                                      |      |      |      |      |      |            |      |      |      |     |

**Table C18: Characteristic values of shear loads under seismic action  
(performance category C1)**

| Anchor size reinforcing bar                                                                                                                                                                                                                                                                                |                                   |       | Ø 8                                                   | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24       | Ø 25                         | Ø 28 | Ø 32 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------|-------------------------------------------------------|------|------|------|------|------|------------|------------------------------|------|------|
| Steel failure without lever arm                                                                                                                                                                                                                                                                            |                                   |       |                                                       |      |      |      |      |      |            |                              |      |      |
| Characteristic shear resistance                                                                                                                                                                                                                                                                            | V <sub>Rk,s,eq</sub>              | [kN]  | 0,35 · A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup> |      |      |      |      |      |            |                              |      |      |
| Cross section area                                                                                                                                                                                                                                                                                         | A <sub>s</sub>                    | [mm²] | 50                                                    | 79   | 113  | 154  | 201  | 314  | 452        | 491                          | 616  | 804  |
| Partial factor                                                                                                                                                                                                                                                                                             | γ <sub>Ms,V</sub>                 | [-]   | 1,5 <sup>2)</sup>                                     |      |      |      |      |      |            |                              |      |      |
| Ductility factor                                                                                                                                                                                                                                                                                           | k <sub>7</sub>                    | [-]   | 1,0                                                   |      |      |      |      |      |            |                              |      |      |
| Steel failure with lever arm                                                                                                                                                                                                                                                                               |                                   |       |                                                       |      |      |      |      |      |            |                              |      |      |
| Characteristic bending moment                                                                                                                                                                                                                                                                              | M <sup>0</sup> <sub>Rk,s,eq</sub> | [Nm]  | No Performance Assessed (NPA)                         |      |      |      |      |      |            |                              |      |      |
| Concrete pry-out failure                                                                                                                                                                                                                                                                                   |                                   |       |                                                       |      |      |      |      |      |            |                              |      |      |
| Factor                                                                                                                                                                                                                                                                                                     | k <sub>8</sub>                    | [-]   | 2,0                                                   |      |      |      |      |      |            |                              |      |      |
| Installation factor                                                                                                                                                                                                                                                                                        | γ <sub>inst</sub>                 | [-]   | 1,0                                                   |      |      |      |      |      |            |                              |      |      |
| Concrete edge failure                                                                                                                                                                                                                                                                                      |                                   |       |                                                       |      |      |      |      |      |            |                              |      |      |
| Effective length of fastener                                                                                                                                                                                                                                                                               | l <sub>f</sub>                    | [mm]  | min(h <sub>ef</sub> ; 12 · d <sub>nom</sub> )         |      |      |      |      |      |            | min(h <sub>ef</sub> ; 300mm) |      |      |
| Outside diameter of fastener                                                                                                                                                                                                                                                                               | d <sub>nom</sub>                  | [mm]  | 8                                                     | 10   | 12   | 14   | 16   | 20   | 24         | 25                           | 28   | 32   |
| Installation factor                                                                                                                                                                                                                                                                                        | γ <sub>inst</sub>                 | [-]   | 1,0                                                   |      |      |      |      |      |            |                              |      |      |
| Factor for annular gap                                                                                                                                                                                                                                                                                     | α <sub>gap</sub>                  | [-]   | 0,5 (1,0) <sup>3)</sup>                               |      |      |      |      |      |            |                              |      |      |
| <div>1) f<sub>uk</sub> shall be taken from the specifications of reinforcing bars</div> <div>2) in absence of national regulation</div> <div>3) Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is required</div> |                                   |       |                                                       |      |      |      |      |      |            |                              |      |      |
| Würth Injection System WIT-PE 1000 for concrete                                                                                                                                                                                                                                                            |                                   |       |                                                       |      |      |      |      |      | Annex C 15 |                              |      |      |
| Performances<br>Characteristic values of shear loads under seismic action (performance category C1)                                                                                                                                                                                                        |                                   |       |                                                       |      |      |      |      |      |            |                              |      |      |

**Table C19: Displacements under tension load<sup>1)</sup> (threaded rod)**

| Anchor size threaded rod                               |                            |                           | M8    | M10   | M12   | M16   | M20   | M24   | M27   | M30   |
|--------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Cracked concrete C20/25 under seismic C1 action</b> |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>40°C/24°C                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,069 | 0,071 | 0,072 | 0,074 | 0,076 | 0,079 | 0,081 | 0,082 |
|                                                        | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,193 | 0,115 | 0,122 | 0,128 | 0,135 | 0,142 | 0,155 | 0,171 |
| Temperature range II:<br>72°C/50°C                     | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,099 | 0,102 | 0,106 | 0,109 | 0,110 |
|                                                        | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,259 | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 |

**Table C20: Displacements under tension load<sup>1)</sup> (rebar)**

| Anchor size reinforcing bar                            |                            |                           | Ø 8   | Ø 10  | Ø 12  | Ø 14  | Ø 16  | Ø 20  | Ø 24  | Ø 25  | Ø 28  | Ø 32  |
|--------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Cracked concrete C20/25 under seismic C1 action</b> |                            |                           |       |       |       |       |       |       |       |       |       |       |
| Temperature range I:<br>40°C/24°C                      | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,069 | 0,071 | 0,072 | 0,073 | 0,074 | 0,076 | 0,079 | 0,079 | 0,081 | 0,084 |
|                                                        | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,115 | 0,122 | 0,128 | 0,135 | 0,142 | 0,155 | 0,171 | 0,171 | 0,181 | 0,194 |
| Temperature range II:<br>72°C/50°C                     | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,098 | 0,099 | 0,102 | 0,106 | 0,106 | 0,109 | 0,113 |
|                                                        | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 | 0,229 | 0,242 | 0,260 |

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

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

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

**Table C21: Displacements under shear load<sup>2)</sup> (threaded rod)**

| Anchor size threaded rod                                               |                            |         | M8   | M10  | M12  | M16  | M20  | M24  | M27  | M30  |
|------------------------------------------------------------------------|----------------------------|---------|------|------|------|------|------|------|------|------|
| <b>Non-cracked and cracked concrete C20/25 under seismic C1 action</b> |                            |         |      |      |      |      |      |      |      |      |
| All temperature ranges                                                 | $\delta_{V0}$ -factor      | [mm/kN] | 0,06 | 0,06 | 0,05 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 |
|                                                                        | $\delta_{V\infty}$ -factor | [mm/kN] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 |

**Table C22: Displacement under shear load<sup>1)</sup> (rebar)**

| Anchor size reinforcing bar                        |                            |         | Ø 8  | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25 | Ø 28 | Ø 32 |
|----------------------------------------------------|----------------------------|---------|------|------|------|------|------|------|------|------|------|------|
| <b>For concrete C20/25 under seismic C1 action</b> |                            |         |      |      |      |      |      |      |      |      |      |      |
| All temperature ranges                             | $\delta_{V0}$ -factor      | [mm/kN] | 0,06 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 | 0,03 |
|                                                    | $\delta_{V\infty}$ -factor | [mm/kN] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 | 0,04 | 0,04 |

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

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

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

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**Performances**

Displacements under seismic C1 action (threaded rods and rebar)

**Annex C 16**

**Table C23: Displacements under tension load<sup>1)</sup> (threaded rod)**

| Anchor size threaded rod                        |                      |      | M8  | M10 | M12  | M16  | M20  | M24  | M27 | M30 |
|-------------------------------------------------|----------------------|------|-----|-----|------|------|------|------|-----|-----|
| Cracked concrete C20/25 under seismic C2 action |                      |      |     |     |      |      |      |      |     |     |
| All temperature ranges                          | $\delta_{N,eq}(DLS)$ | [mm] | NPA |     | 0,21 | 0,24 | 0,27 | 0,36 | NPA |     |
|                                                 | $\delta_{N,eq}(ULS)$ | [mm] |     |     | 0,54 | 0,51 | 0,54 | 0,63 |     |     |

**Table C24: Displacements under shear load (threaded rod)**

| Anchor size threaded rod                        |                      |      | M8  | M10 | M12 | M16 | M20 | M24  | M27 | M30 |
|-------------------------------------------------|----------------------|------|-----|-----|-----|-----|-----|------|-----|-----|
| Cracked concrete C20/25 under seismic C2 action |                      |      |     |     |     |     |     |      |     |     |
| All temperature ranges                          | $\delta_{V,eq}(DLS)$ | [mm] | NPA |     | 3,1 | 3,4 | 3,5 | 4,2  | NPA |     |
|                                                 | $\delta_{V,ep}(ULS)$ | [mm] |     |     | 6,0 | 7,6 | 7,3 | 10,9 |     |     |

Würth Injection System WIT-PE 1000 for concrete

**Performances**

Displacements under seismic C2 action (threaded rods)

**Annex C 17**