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Designated according to Article 29 of Regulation (EU) No 305/2011

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# European Technical Assessment

# ETA 12/0569 of 07/12/2022

(English language translation, the original version in Czech language)

**Technical Assessment Body issuing the ETA:** Technical and Test Institute for Construction Prague

| | |
|---|---|
| **Trade name of the construction product** | Würth WIT-PM 200<br>Würth WIT-PM 200 express<br>Würth WIT-PM 200 tropical |
| **Product family to which the construction product belongs** | Product area code: 33<br>Bonded injection type anchor for use in uncracked concrete |
| **Manufacturer** | Adolf Würth GmbH & Co. KG<br>Reinhold-Würth-Straße 12-17<br>74653 Künzelsau<br>Germany |
| **Manufacturing plant(s)** | Plant 3, Germany |
| **This European Technical Assessment contains** | 18 pages including 15 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<br>Bonded fasteners for use in concrete |
| **This version replaces** | ETA 12/0569 issued on 25/01/2016 |

## 1. Technical description of the product

The Würth Injection System WIT-PM 200, WIT-PM 200 tropical and WIT-PM 200 express for uncracked concrete is a bonded anchor consisting of a cartridge with injection mortar and a steel element. The steel elements consists of a commercial threaded rods, a hexagon nut and a washer. The steel elements are made of galvanized steel or stainless steel.

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 illustration and the description of the product are given in Annex A.

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

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

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the products in relation to the expected economically reasonable working life of the works.

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

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

| Essential characteristic | Performance |
|---|---|
| Characteristic resistance to tension load (static and quasi-static loading) | Annex C 1, C 2, C 3 |
| Characteristic resistance to shear load (static and quasi-static loading) | Annex C 1, C 4 |
| Displacements under short term and long term loading | Annex C 5 |
| Durability | Annex B 1 |
| Characteristic resistance and displacements for seismic performance categories C1 and C2 | NPA |

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

No performance determined.

### 3.3 General aspects relating to fitness for use

Durability and serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

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

According to the Decision 96/582/EC of the European Commission[1] the system of assessment verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table applies.

| Product | Intended use | Level or class | System |
|---|---|---|---|
| Metal anchors for use in concrete | For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the construction works) or heavy units | - | 1 |

[1] Official Journal of the European Communities L 254 of 08.10.1996

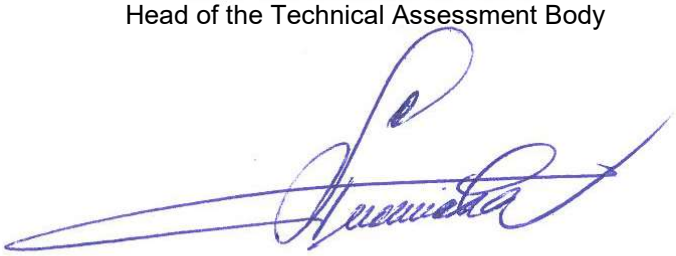
## 5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable EAD

The factory production control shall be in accordance with the control plan which is a part of the technical documentation of this European Technical Assessment. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Technický a zkušební ústav stavební Praha, s.p.[2] The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

Issued in Prague on 07.12.2022

By

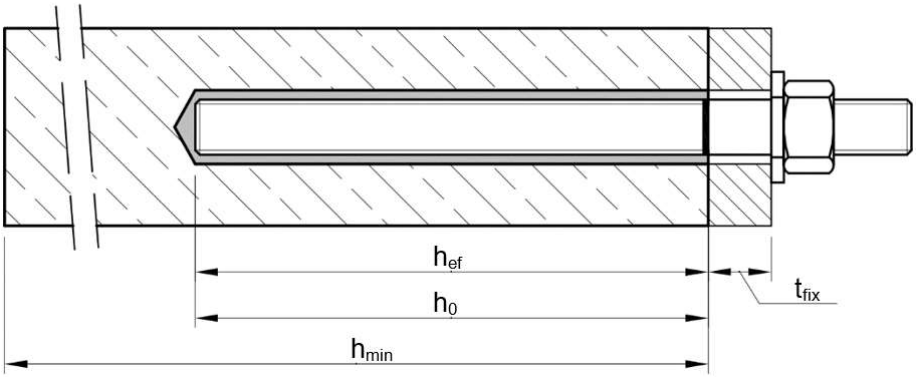
**Ing. Jiří Studnička, Ph.D.**
Head of the Technical Assessment Body




[2] The control plan is a confidential part of the documentation of the European Technical Assessment, but not published together with the ETA and only handed over to the approved body involved in the procedure of AVCP.

## Installation threaded rod M8 up to M24

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

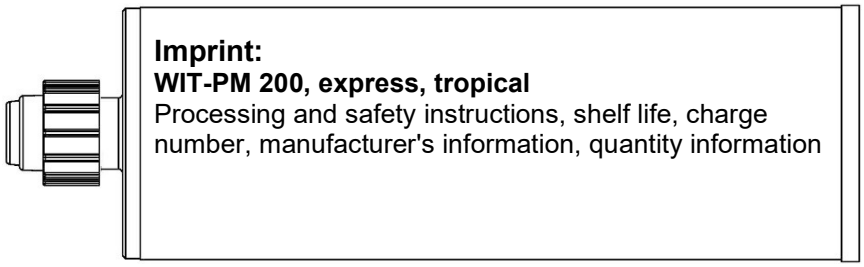



$t_{fix}$ = thickness of fixture
$h_{ef}$ = effective embedment depth
$h_{min}$ = minimum thickness of member
$h_0$ = depth of drill hole

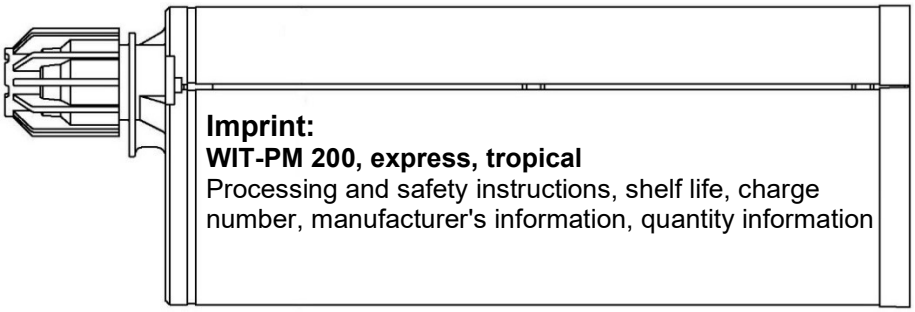
| | |
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | |
| **Product description**<br>Installed conditions | **Annex A 1** |

**Cartridge system**

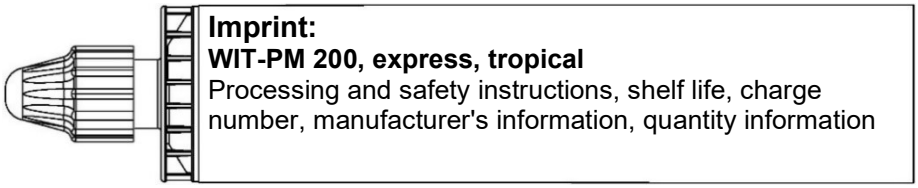
**Coaxial Cartridge:**
150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml



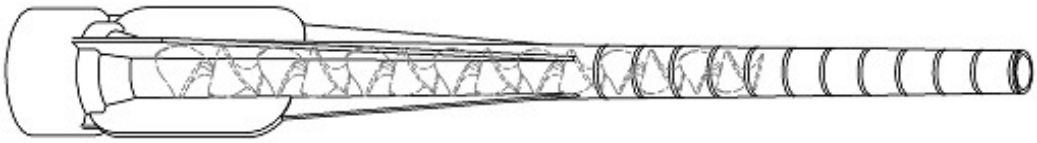

**Side-by-Side Cartridge:**
235 ml, 345 ml up to 360 ml and 825 ml




**Foil Tube Cartridge:**
165 ml and 300 ml




**Static mixer CRW 14W, Fill & Clean**



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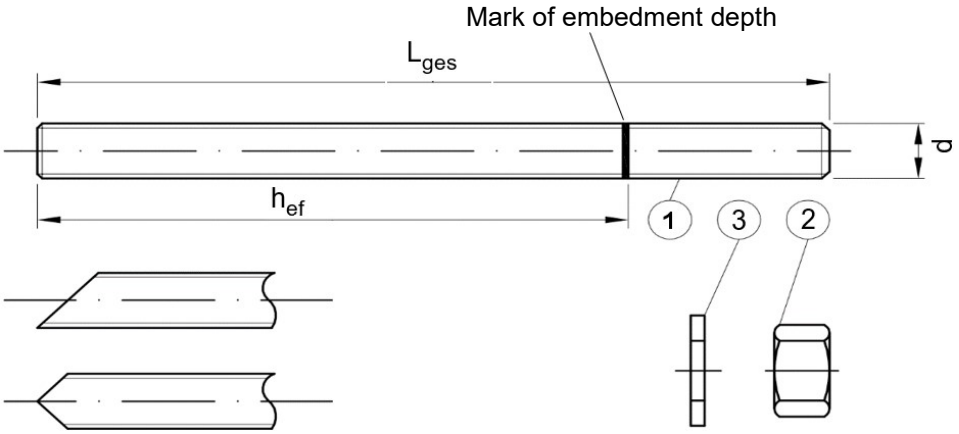
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | |
| **Product description**<br>Injection system | **Annex A 2** |

## Threaded rod M8 up to M24 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

| | |
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | **Annex A 3** |
| **Product description**<br>Threaded rod | |

## Table A1: Materials

| Part | Designation | Material | | | | |
|---|---|---|---|---|---|---|
| **Steel, zinc plated** (Steel acc. to EN ISO 683-4:2018 or EN 10263:2001)<br>- zinc plated ≥ 5 µm acc. to EN ISO 4042:2018 or<br>- hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or<br>- sherardized ≥ 45 µm acc. to EN ISO 17668:2016 | | | | | | |
| 1 | Anchor rod | Property class | | Characteristic steel ultimate tensile strength | Characteristic steel yield strength | Elongation at fracture |
| | | acc. to EN ISO 898-1:2013 | 4.6 | $f_{uk}$ = 400 N/mm² | $f_{yk}$ = 240 N/mm² | $A_5$ > 8% |
| | | | 4.8 | $f_{uk}$ = 400 N/mm² | $f_{yk}$ = 320 N/mm² | $A_5$ > 8% |
| | | | 5.6 | $f_{uk}$ = 500 N/mm² | $f_{yk}$ = 300 N/mm² | $A_5$ > 8% |
| | | | 5.8 | $f_{uk}$ = 500 N/mm² | $f_{yk}$ = 400 N/mm² | $A_5$ > 8% |
| | | | 8.8 | $f_{uk}$ = 800 N/mm² | $f_{yk}$ = 640 N/mm² | $A_5$ > 8% |
| 2 | Hexagon nut | acc. to EN ISO 898-2:2012 | 4 | for anchor rod class 4.6 or 4.8 | | |
| | | | 5 | for anchor rod class 5.6 or 5.8 | | |
| | | | 8 | for anchor rod class 8.8 | | |
| 3 | Washer | Steel, zinc plated, hot-dip galvanized or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000) | | | | |
| **Stainless steel A2** (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014)<br>**Stainless steel A4** (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014)<br>**High corrosion resistance steel** (Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014) | | | | | | |
| 1 | Anchor rod[1)] | Property class | | Characteristic steel ultimate tensile strength | Characteristic steel yield strength | Elongation at fracture |
| | | acc. to EN ISO 3506-1:2009 | 50 | $f_{uk}$ = 500 N/mm² | $f_{yk}$ = 210 N/mm² | $A_5$ > 8% |
| | | | 70 | $f_{uk}$ = 700 N/mm² | $f_{yk}$ = 450 N/mm² | $A_5$ > 8% |
| | | | 80 | $f_{uk}$ = 800 N/mm² | $f_{yk}$ = 600 N/mm² | $A_5$ > 8% |
| 2 | Hexagon nut[1)] | acc. to EN ISO 3506-1:2009 | 50 | for anchor rod class 50 | | |
| | | | 70 | for anchor rod class 70 | | |
| | | | 80 | for anchor rod class 80 | | |
| 3 | Washer | A2: Material 1.4301, 1.4311 / 1.4307 / 1.4567 or 1.4541, EN 10088-1:2014<br>A4: Material 1.4401, 1.4404 / 1.4571 / 1.4362 or 1.4578, 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) | | | | |

[1)] Property class 80 only for stainless steel A4 and high corrosion resistant steel HCR

| | |
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | **Annex A 4** |
| **Product description**<br>Materials | |

## Specifications of intended use

### Fasteners subject to (Static and quasi-static loads):

| | Working life 50 years | | Working life 100 years | |
|---|---|---|---|---|
| Base material | uncracked concrete | cracked concrete | uncracked concrete | cracked concrete |
| HD: Hammer drilling<br>CD: Compressed air drilling | M8 to M24 | No performance assessed | No performance assessed | No performance assessed |
| Temperature Range: | I: -40°C to +40°C[1)]<br>II: -40°C to +80°C[2)] | | I: -40°C to +40°C[1)]<br>II: -40°C to +80°C[2)] | |

[1)] (max. long-term temperature +24°C and max. short-term temperature +40°C)

[2)] (max. long-term temperature +50°C and max. short-term temperature +80°C)

**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

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

**Design:**

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

**Installation:**

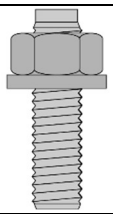
- Dry, wet concrete or flooded bore holes (not sea-water).
- Hole drilling by hammer drill (HD) or compressed air drill mode (CD).
- Overhead installation allowed.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical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

| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | |
|---|---|
| **Intended use**<br>Specifications | **Annex B 1** |

## Table B1: Installation parameters for threaded rod

| Anchor size | | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|---|
| Diameter of element | | $d = d_{nom}$ | [mm] | 8 | 10 | 12 | 16 | 20 | 24 |
| Nominal drill hole diameter | | $d_0$ | [mm] | 10 | 12 | 14 | 18 | 24 | 28 |
| Effective embedment depth | | $h_{ef,min}$ | [mm] | 60 | 60 | 70 | 80 | 90 | 96 |
| | | $h_{ef,max}$ | [mm] | 160 | 200 | 240 | 320 | 400 | 480 |
| Diameter of clearance hole in the fixture | Prepositioned installation | $d_f \leq$ | [mm] | 9 | 12 | 14 | 18 | 22 | 26 |
| | Push through installation | $d_f$ | | 12 | 14 | 16 | 20 | 24 | 30 |
| Maximum torque moment | | max $T_{inst} \leq$ | [Nm] | 10 | 20 | 40 | 80 | 120 | 160 |
| Minimum thickness of member | | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | $h_{ef}$ + $2d_0$ | | |
| Minimum spacing | | $s_{min}$ | [mm] | 40 | 50 | 60 | 80 | 100 | 120 |
| Minimum edge distance | | $c_{min}$ | [mm] | 40 | 50 | 60 | 80 | 100 | 120 |

## Table B2: Parameter cleaning and installation tools



| Threaded rod | $d_0$ Drill bit - ∅ | $d_b$ Brush - ∅ | | $d_{b,min}$ min. Brush - ∅ |
|---|---|---|---|---|
| [mm] | [mm] | [mm] | | [mm] |
| M8 | 10 | WIT-RMB10 | 12 | 10,5 |
| M10 | 12 | WIT-RMB12 | 14 | 12,5 |
| M12 | 14 | WIT-RMB14 | 16 | 14,5 |
| M16 | 18 | WIT-RMB18 | 20 | 18,5 |
| M20 | 24 | WIT-RMB24 | 26 | 24,5 |
| M24 | 28 | WIT-RMB28 | 30 | 28,5 |

## Cleaning and installation tools

**Hand pump**
(Volume 750 ml, $h_0 \geq 10\ d_{nom}$, $d_0 \leq 20$mm)


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

**Brush WIT-RMB**

**Brush extension WIT-RMB-L**

**Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete**

**Intended use**
Installation parameters
Parameter anchor and drill sizes, brushes, Cleaning and Installation tools

**Annex B 2**

## Table B3: Working and curing time WIT-PM 200

| Temperature in base material | | | Maximum working time | Minimum curing time |
|---|---|---|---|---|
| T | | | $t_{work}$ | $t_{cure}$ |
| - 5 °C | to | - 1 °C | 90 min | 6 h |
| + 0 °C | to | + 4 °C | 45 min | 3 h |
| + 5 °C | to | + 9 °C | 25 min | 2 h |
| + 10 °C | to | + 14 °C | 20 min | 100 min |
| + 15 °C | to | + 19 °C | 15 min | 80 min |
| + 20 °C | to | + 29 °C | 6 min | 45 min |
| + 30 °C | to | + 34 °C | 4 min | 25 min |
| + 35 °C | to | + 39 °C | 2 min | 20 min |
| Cartridge temperature | | | +5°C up to +40°C | |

## Table B4: Working and curing time WIT-PM 200 express

| Temperature in base material | | | Maximum working time | Minimum curing time |
|---|---|---|---|---|
| T | | | $t_{work}$ | $t_{cure}$ |
| - 10 °C | to | - 6 °C | 60 min | 4 h |
| - 5 °C | to | - 1 °C | 45 min | 2 h |
| + 0 °C | to | + 4 °C | 25 min | 80 min |
| + 5 °C | to | + 9 °C | 10 min | 45 min |
| + 10 °C | to | + 14 °C | 4 min | 25 min |
| + 15 °C | to | + 19 °C | 3 min | 20 min |
| + 20 °C | to | + 29 °C | 2 min | 15 min |
| Cartridge temperature | | | 0°C up to +30°C | |

## Table B5: Working and curing time WIT-PM 200 tropical

| Temperature in base material | | | Maximum working time | Minimum curing time |
|---|---|---|---|---|
| T | | | $t_{work}$ | $t_{cure}$ |
| + 10 °C | to | + 14 °C | 30 min | 5 h |
| + 15 °C | to | + 19 °C | 20 min | 210 min |
| + 20 °C | to | + 29 °C | 15 min | 145 min |
| + 30 °C | to | + 34 °C | 10 min | 80 min |
| + 35 °C | to | + 39 °C | 6 min | 45 min |
| + 40 °C | to | + 44 °C | 4 min | 25 min |
| +45°C | | | 2 min | 20 min |
| Cartridge temperature | | | +5°C up to +45°C | |

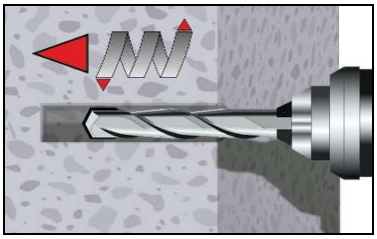
**Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete**

**Intended use**
Working and curing time

**Annex B 3**

## Installation instructions

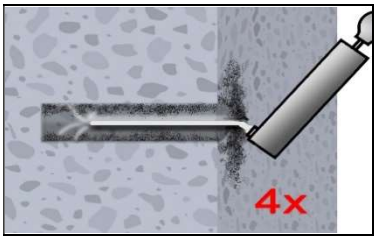
### Drilling of the bore hole



1. **Hammer drilling (HD) / Compressed air drilling (CD)**
Drill a hole to the required embedment depth.
Drill bit diameter according to Table B1.
Aborted drill holes shall be filled with mortar.
Proceed with Step 2 (MAC or CAC).

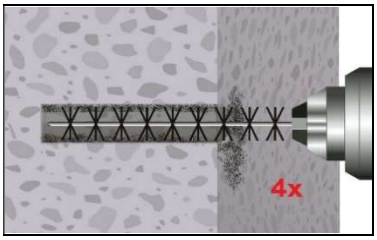
### Manual Air Cleaning (MAC)

for drill hole diameter $d_0 \leq 20$mm and drill hole depth $h_0 \leq 10d_{nom}$ with drilling method HD/CD

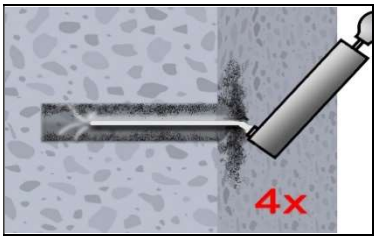



**Attention! Remove standing water in the borehole before cleaning.**

2a. Blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 2).



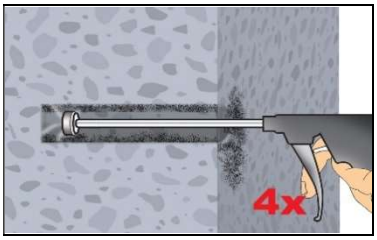

2b. Attach brush WIT-RMB according to Table B2 to a drilling machine or a cordless screwdriver. Brush the bore hole minimum 4x over the entire embedment depth in a twisting motion (if necessary, use a brush extension WIT-RMB-L).




2c. Finally blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 2).

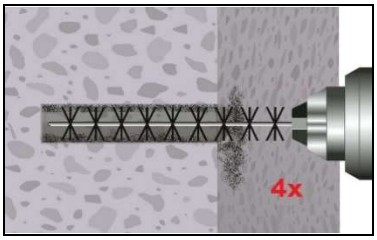
### Compressed Air Cleaning (CAC):

All diameter with drilling method HD/CD




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

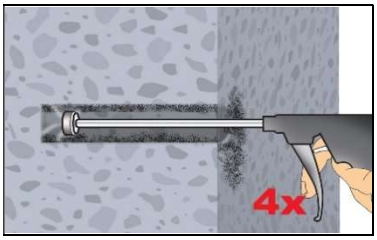
2a. Blow the bore hole clean minimum 4x with compressed air (min. 6 bar) (Annex B 2) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)




2b. Attach brush WIT-RMB according to Table B3 to a drilling machine or a cordless screwdriver. Brush the bore hole minimum 4x over the entire embedment depth in a twisting motion. (If necessary, a brush extension WIT-RMB-L shall be used.)

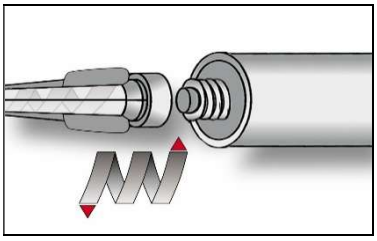
| | |
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | **Annex B 4** |
| **Intended use**<br>Installation instructions | |

**Installation instructions (continuation)**

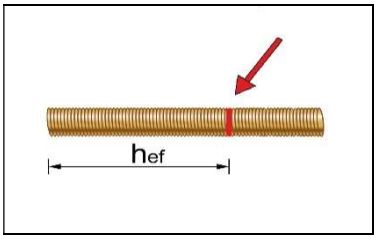



2c. Finally blow the bore hole clean minimum 4x with compressed air (min. 6 bar) (Annex B 2) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

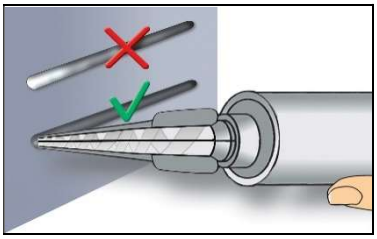
**Cleaned bore hole has to be protected against re-contamination in an appropriate way.**
**If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.**



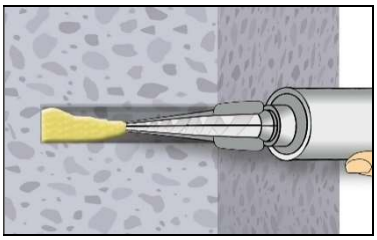
3. Screw on static-mixing nozzle CRW 14W, Fill & Clean and load the cartridge into an appropriate dispensing tool.
For every working interruption longer than the maximum working time $t_{work}$ (Annex B 3) as well as for new cartridges, a new static-mixer shall be used.



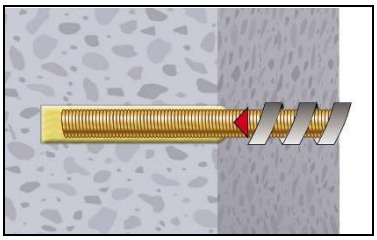

4. Mark embedment depth on the anchor rod.
The anchor rod shall be free of dirt, grease, oil or other foreign material.



5. Not proper mixed mortar is not sufficient for fastening.
Dispense and discard mortar until an uniform grey colour is shown (at least 3 full strokes; for foil tube cartridges min. 6 strokes).



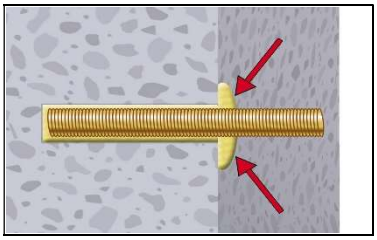
6. Starting at bottom of the hole and fill the hole up to approximately 2/3 with adhesive (If necessary, a mixer nozzle extension shall be used.)
Slowly withdraw of the static mixing nozzle avoid creating air pockets
Observe the temperature related working time $t_{work}$ (Annex B 3).



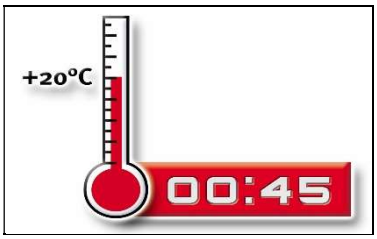
7. Insert the anchor rod while turning slightly up to the embedment mark.

| | |
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | **Annex B 5** |
| **Intended use**<br>Installation instructions (continuation) | |

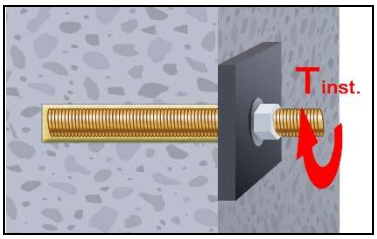
**Installation instructions (continuation)**



8. Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.
Otherwise, the installation must be repeated starting from step 6 before the maximum working time $t_{work}$ has expired.




9. Temperature related curing time $t_{cure}$ (Annex B 3) must be observed.
Do not move or load the fastener during curing time.




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

| | |
|---|---|
| **Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete** | **Annex B 6** |
| **Intended use**<br>Installation instructions (continuation) | |

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

| **Size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|---|---|
| Cross section area | | $A_s$ | [mm²] | 36,6 | 58 | 84,3 | 157 | 245 | 353 |
| **Characteristic tension resistance, Steel failure [1)]** | | | | | | | | | |
| Steel, Property class 4.6 and 4.8 | | $N_{Rk,s}$ | [kN] | 15 (13) | 23 (21) | 34 | 63 | 98 | 141 |
| Steel, Property class 5.6 and 5.8 | | $N_{Rk,s}$ | [kN] | 18 (17) | 29 (27) | 42 | 78 | 122 | 176 |
| Steel, Property class 8.8 | | $N_{Rk,s}$ | [kN] | 29 (27) | 46 (43) | 67 | 125 | 196 | 282 |
| Stainless steel A2, A4 and HCR, class 50 | | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Stainless steel A2, A4 and HCR, class 70 | | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 171 | 247 |
| Stainless steel A4 and HCR, class 80 | | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| **Characteristic tension resistance, Partial safety factor [2)]** | | | | | | | | | |
| Steel, Property class 4.6 and 5.6 | | $\gamma_{Ms,N}$ | [-] | 2,0 | | | | | |
| Steel, Property class 4.8, 5.8 and 8.8 | | $\gamma_{Ms,N}$ | [-] | 1,5 | | | | | |
| Stainless steel A2, A4 and HCR, class 50 | | $\gamma_{Ms,N}$ | [-] | 2,86 | | | | | |
| Stainless steel A2, A4 and HCR, class 70 | | $\gamma_{Ms,N}$ | [-] | 1,87 | | | | | |
| Stainless steel A4 and HCR, class 80 | | $\gamma_{Ms,N}$ | [-] | 1,6 | | | | | |
| **Characteristic shear resistance, Steel failure [1)]** | | | | | | | | | |
| Without lever arm | Steel, Property class 4.6 and 4.8 | $V^0_{Rk,s}$ | [kN] | 9 (8) | 14 (13) | 20 | 38 | 59 | 85 |
| | Steel, Property class 5.6 and 5.8 | $V^0_{Rk,s}$ | [kN] | 9 (8) | 15 (13) | 21 | 39 | 61 | 88 |
| | Steel, Property class 8.8 | $V^0_{Rk,s}$ | [kN] | 15 (13) | 23 (21) | 34 | 63 | 98 | 141 |
| | Stainless steel A2, A4 and HCR, class 50 | $V^0_{Rk,s}$ | [kN] | 9 | 15 | 21 | 39 | 61 | 88 |
| | Stainless steel A2, A4 and HCR, class 70 | $V^0_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| | Stainless steel A4 and HCR, class 80 | $V^0_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| With lever arm | Steel, Property class 4.6 and 4.8 | $M^0_{Rk,s}$ | [Nm] | 15 (13) | 30 (27) | 52 | 133 | 260 | 449 |
| | Steel, Property class 5.6 and 5.8 | $M^0_{Rk,s}$ | [Nm] | 19 (16) | 37 (33) | 65 | 166 | 324 | 560 |
| | Steel, Property class 8.8 | $M^0_{Rk,s}$ | [Nm] | 30 (26) | 60 (53) | 105 | 266 | 519 | 896 |
| | Stainless steel A2, A4 and HCR, class 50 | $M^0_{Rk,s}$ | [Nm] | 19 | 37 | 66 | 167 | 325 | 561 |
| | Stainless steel A2, A4 and HCR, class 70 | $M^0_{Rk,s}$ | [Nm] | 26 | 52 | 92 | 232 | 454 | 784 |
| | Stainless steel A4 and HCR, class 80 | $M^0_{Rk,s}$ | [Nm] | 30 | 59 | 105 | 266 | 519 | 896 |
| **Characteristic shear resistance, Partial safety factor [2)]** | | | | | | | | | |
| Steel, Property class 4.6 and 5.6 | | $\gamma_{Ms,V}$ | [-] | 1,67 | | | | | |
| Steel, Property class 4.8, 5.8 and 8.8 | | $\gamma_{Ms,V}$ | [-] | 1,25 | | | | | |
| Stainless steel A2, A4 and HCR, class 50 50 | | $\gamma_{Ms,V}$ | [-] | 2,38 | | | | | |
| Stainless steel A2, A4 and HCR, class 50 70 | | $\gamma_{Ms,V}$ | [-] | 1,56 | | | | | |
| Stainless steel A4 and HCR, class 80 | | $\gamma_{Ms,V}$ | [-] | 1,33 | | | | | |

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

2) In absence of national regulation

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

**Annex C 1**

## Table C2: Characteristic values of tension loads under static and quasi-static action

| Anchor size | | | | All anchors types and sizes |
|---|---|---|---|---|
| **Concrete cone failure** | | | | |
| Uncracked concrete | | $k_{ucr,N}$ | [-] | 11,0 |
| 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 $c_{cr,sp}$ |

**Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete**

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

**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 |
|---|---|---|---|---|---|---|---|---|---|---|
| **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 uncracked concrete C20/25 | | | | | | | | | | |
| Temperature range | I: | 40°C/24°C | $\tau_{Rk,ucr}$ | [N/mm²] | 8,5 | 8,0 | 8,0 | 8,0 | 8,0 | 8,0 |
| | II: | 80°C/50°C | | | 6,5 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 |
| | I: | 40°C/24°C | | | 8,5 | 8,0 | 8,0 | 8,0 | 8,0 | 8,0 |
| | II: | 80°C/50°C | | | 6,5 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 |
| Dry and wet concrete | | | | | | | | | | |
| Flooded bore hole | | | | | | | | | | |
| Increasing factor for concrete | | | $\psi_c$ | [-] | $(f_{ck} / 20)^{0,2}$ | | | | | |
| Characteristic bond resistance depending on the concrete strength class | | | $\tau_{Rk,ucr}$ = | | $\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$ | | | | | |
| **Concrete cone failure** | | | | | | | | | | |
| Relevant parameter | | | | | See Table C2 | | | | | |
| **Splitting** | | | | | | | | | | |
| Relevant parameter | | | | | See Table C2 | | | | | |
| **Installation factor** | | | | | | | | | | |
| Dry and wet concrete | | | $\gamma_{inst}$ | [-] | 1,2 | | | | | |
| Flooded bore hole | | | | | 1,2 | | | | | |

**Würth Injection system WIT-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete**

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

**Annex C 3**

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

| Anchor size threaded rod | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **Steel failure without lever arm** | | | | | | | | |
| Characteristic shear resistance Steel, strength class 4.6 and 4.8 | $V^0_{Rk,s}$ | [kN] | $0,6 \cdot A_s \cdot f_{uk}$ (or see Table C1) | | | | | |
| Characteristic shear resistance Steel, strength class 5.6, 5.8 and 8.8 Stainless Steel A2, A4 and HCR, all classes | $V^0_{Rk,s}$ | [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 | $M^0_{Rk,s}$ | [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 |
| 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] | $\min(h_{ef}; 12 \cdot d_{nom})$ | | | | | |
| Outside diameter of fastener | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 | 20 | 24 |
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | |

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**Performances**
Characteristic values of shear loads under static and quasi-static action

**Annex C 4**

## Table C5: Displacement under tension load[1)]

| Anchor size threaded rod | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **Uncracked concrete C20/25 under static and quasi-static action** | | | | | | | | |
| Temperature range I: 40°C/24°C | $\delta_{N0}$-factor | [mm/(N/mm²)] | 0,03 | 0,04 | 0,05 | 0,07 | 0,08 | 0,10 |
| | $\delta_{N\infty}$-factor | [mm/(N/mm²)] | 0,07 | 0,08 | 0,08 | 0,08 | 0,08 | 0,10 |
| Temperature range II: 80°C/50°C | $\delta_{N0}$-factor | [mm/(N/mm²)] | 0,02 | 0,03 | 0,03 | 0,04 | 0,04 | 0,05 |
| | $\delta_{N\infty}$-factor | [mm/(N/mm²)] | 0,15 | 0,17 | 0,17 | 0,17 | 0,17 | 0,17 |

1) 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 C6: Displacement under shear load[1)]

| Anchor size threaded rod | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **For uncracked concrete C20/25** | | | | | | | | |
| All temperature ranges | $\delta_{V0}$-factor | [mm/kN] | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 |
| | $\delta_{V\infty}$-factor | [mm/kN] | 0,03 | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 |

1) 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-PM 200, WIT-PM 200 express, WIT-PM 200 tropical for concrete**

**Performances**
Displacements under static and quasi-static action

**Annex C 5**