

## DÉCLARATION DES PERFORMANCES

### DoP 0299

pour le système d'injection UPAT UPM 55 (fixation à scellement pour utilisation dans le béton)

FR

1. Code d'identification unique du type de produit: **DoP 0299**
2. Usage(s) prévu(s): **Fixation dans du béton fissuré ou non fissuré, voir annexes, en particulier les annexes B1 - B11.**
3. Fabricant: **fischerwerke GmbH & Co. KG, Otto-Hahn-Straße 15, 79211 Denzlingen, Allemagne**
4. Mandataire: **-**
5. Système(s) d'évaluation et de vérification de la constance des performances: **1**
6. Document d'évaluation européen: **ETAG 001, Part 5, April 2013, utilisé en tant que DEE**  
 Evaluation Technique Européenne: **ETA-11/0418; 2016-09-30**  
 Organisme d'évaluation technique: **DIBt- Deutsches Institut für Bautechnik**  
 Organisme(s) notifié(s): **2873 TU Darmstadt**
7. Performance(s) déclarée(s):  
**Résistance mécanique et stabilité (BWR 1)**  
**Résistance caractéristique à la charge de traction (charge statique et quasi-statique):**  
 Résistance à la rupture de l'acier (charge de traction): Annexes C1-C3  
 Résistance à la rupture par extraction glissement: et rupture du cône béton: Annexes C5-C8  $\psi_{sus}^0 = \text{NPD}$   
 Résistance à la rupture du cône béton: Annexe C4  
 Distance au bord pour éviter la rupture par fendage sous charge: Annexe C4  
 Robustesse : Annexes C4-C8  
 Couple de serrage maxi.: Annexes B3, B4, B6  
 Distance au bord et entraxe mini.: Annexes B3-B6  
  
**Résistance caractéristique à la charge de cisaillement (charge statique et quasi-statique):**  
 Résistance à la rupture de l'acier: Annexes C1-C3  $(k_7=k_2)$   
 Résistance à la rupture par effet de levier: Annexe C4  $(k_8=k_3)$   
 Résistance à la rupture du béton en bord de dalle: Annexe C4  
  
**Déplacements sous charge à court et long terme :**  
 Déplacements sous charge à court et long terme : Annexes C9, C10  
  
**Résistance caractéristique et déplacements pour les catégories de performance sismique C1 et C2:**  
 Résistance à la charge de traction, catégorie C1: Annexes C11-C13  
 Résistance à la charge de traction, catégorie C2: Annexes C11, C14  
 Résistance à la charge de cisaillement, catégorie C1: Annexes C11, C12  
 Résistance à la charge de cisaillement, catégorie C2: Annexes C11, C14  
 Facteur espace annulaire: NPD  
  
**Hygiène, santé et environnement (BWR 3)**  
 Contenu, émission et/ou rejet de substances dangereuses: NPD
8. Documentation technique appropriée et/ou documentation technique spécifique: **-**

Les performances du produit identifié ci-dessus sont conformes aux performances déclarées. Conformément au règlement (UE) no 305/2011, la présente déclaration des performances est établie sous la seule responsabilité du fabricant mentionné ci-dessus.

Signé pour le fabricant et en son nom par:



Dr.-Ing. Oliver Geibig, Directeur Général Business Units & Ingénierie  
 Tumlingen, 2021-01-19



Jürgen Grün, Directeur Général Chimie & Qualité

Cette DoP a été préparée en plusieurs langues. En cas de différend relatif à l'interprétation, la version anglaise prévaudra.

L'annexe comprend des informations volontaires et complémentaires en langue anglaise dépassant les exigences légales (spécifiées de manière neutre).

## Specific Part

### 1 Technical description of the product

The UPAT injection system UPM 55 is a bonded anchor consisting of a cartridge with injection mortar UPM 55 and a steel element.

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 values under static and quasi-static action for design according to TR 029 or CEN/TS 1992-4:2009, Displacements	See Annex C 1 to C 10
Characteristic values for seismic performance categories C1 and C2 for design according to Technical Report TR 045, Displacements	See Annex C 11 to C 14

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

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1
Resistance to fire	No performance assessed

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

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply.

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

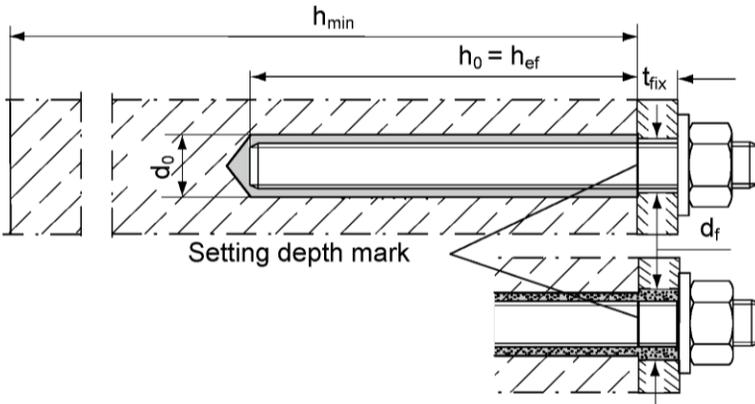
The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 the applicable European legal act is: [96/582/EC].

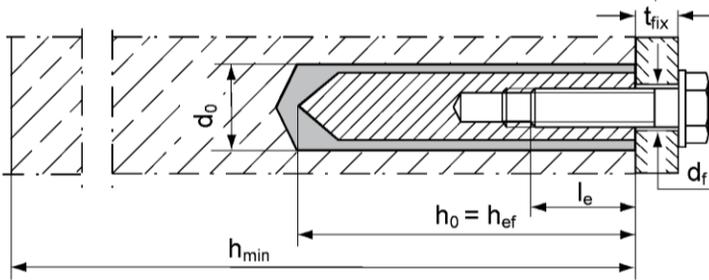
The system to be applied is: 1

# Installation conditions

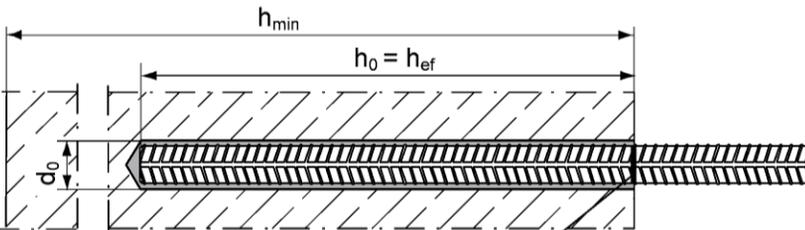


**Anchor rod**  
Pre-positioned anchor

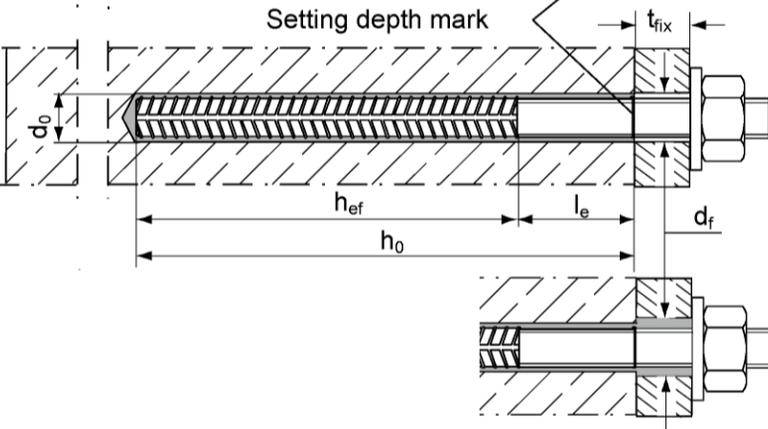
**Anchor rod**  
Push through anchor  
(annular gap filled with mortar)



**Internal threaded anchor IST**  
Pre-positioned anchor only



**Reinforcing bar**



**UPAT rebar anchor**  
Pre-positioned anchor

**UPAT rebar anchor**  
Push through anchor  
(annular gap filled with mortar)

UPAT injection system UPM 55

**Product description**  
Installation conditions

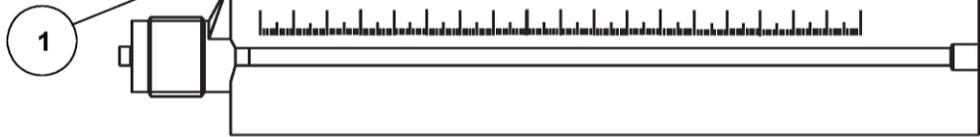
**Annex A 1**

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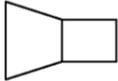
**Cartridge sizes (390 ml, 585 ml, 1100 ml, 1500 ml)**

**Imprint:** UPM 55, processing notes, shelf-life, piston travel scale, curing times and processing times (depending on temperature), hazard code, size, volume

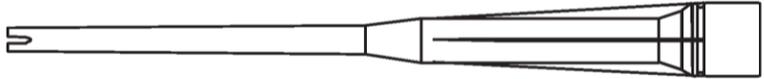
**Sealing cap**



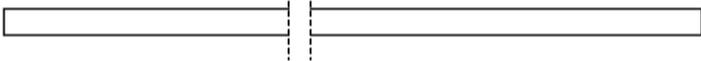
**Injection-adapter**



**Static mixer UPM**

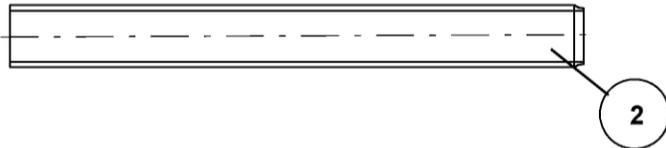


**Extension tube**

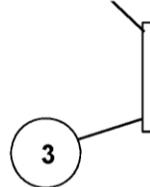


**Anchor rod**

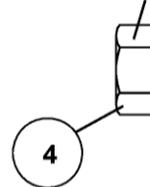
Size: M8, M10, M12, M14, M16, M20, M22, M24, M27, M30



**Washer**

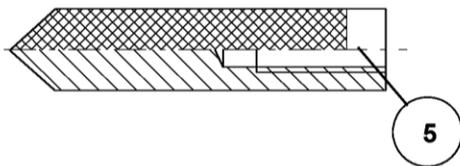


**Hexagon nut**

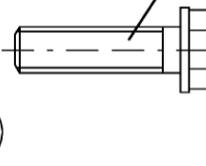


**Internal threaded anchor IST**

Size: M8, M10, M12, M16, M20



**Screw**



**Threaded rod**



**Washer**

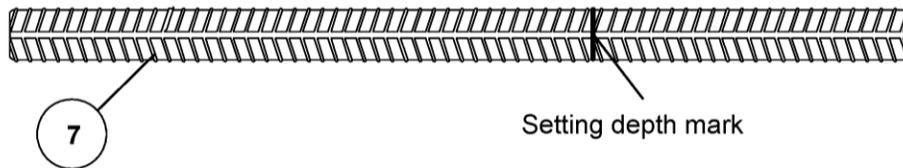


**Hexagon nut**



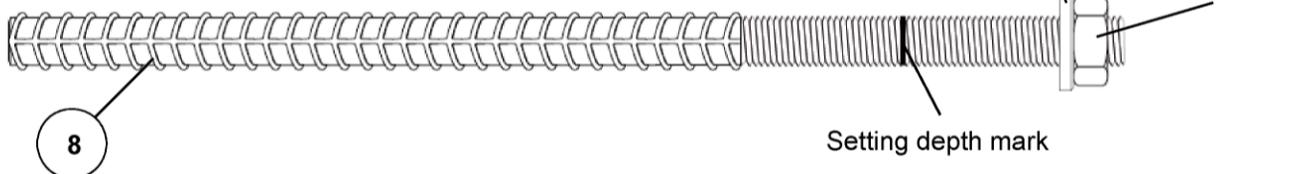
**Reinforcing bar**

Nominal diameter of the bar:  $\phi 8$ ,  $\phi 10$ ,  $\phi 12$ ,  $\phi 14$ ,  $\phi 16$ ,  $\phi 18$ ,  $\phi 20$ ,  $\phi 22$ ,  $\phi 24$ ,  $\phi 25$ ,  $\phi 26$ ,  $\phi 28$ ,  $\phi 30$ ,  $\phi 32$ ,  $\phi 34$ ,  $\phi 36$ ,  $\phi 40$



**UPAT rebar anchor**

Size: M12, M16, M20, M24



UPAT injection system UPM 55

**Product description**  
Cartridges / Static mixer / Steel elements

**Annex A 2**

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**Table A1: Materials**

Part	Designation	Material		
1	Mortar cartridge	Mortar, hardener, filler		
	Steel grade	Steel, zinc plated	Stainless steel A4	High corrosion resistant steel C
2	Anchor rod	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated $\geq 5 \mu\text{m}$ , EN ISO 4042:1999 A2K or hot-dip galvanised EN ISO 10684:2004 $f_{uk} \leq 1000 \text{ N/mm}^2$ $A_5 > 12 \%$ fracture elongation <sup>1)</sup>	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462 EN 10088-1:2014 $f_{uk} \leq 1000 \text{ N/mm}^2$ $A_5 > 12 \%$ fracture elongation <sup>1)</sup>	Property class 50 or 80 EN ISO 3506-1:2009 or property class 70 with $f_{yk} = 560 \text{ N/mm}^2$ 1.4565; 1.4529 EN 10088-1:2014 $f_{uk} \leq 1000 \text{ N/mm}^2$ $A_5 > 12 \%$ fracture elongation <sup>1)</sup>
3	Washer ISO 7089:2000	zinc plated $\geq 5 \mu\text{m}$ , EN ISO 4042:1999 A2K or hot-dip galvanised EN ISO 10684:2004	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	1.4565; 1.4529 EN 10088-1:2014
4	Hexagon nut	Property class 5 or 8; EN ISO 898-2:2012 zinc plated $\geq 5 \mu\text{m}$ , ISO 4042:1999 A2K or hot-dip galvanised EN ISO 10684:2004	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014
5	internal threaded anchor IST	Property class 5.8 ISO 898-1:2013 zinc plated $\geq 5 \mu\text{m}$ , ISO 4042:1999 A2K	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014
6	Screw or anchor / threaded rod for internal threaded anchor IST	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated $\geq 5 \mu\text{m}$ , ISO 4042:1999 A2K fracture elongation $A_5 > 8 \%$	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014 fracture elongation $A_5 > 8 \%$	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014 fracture elongation $A_5 > 8 \%$
7	Reinforcing bar EN 1992-1-1:2004 and AC:2010, Annex C	Bars and de-coiled rods, class B or C with $f_{yk}$ and $k$ according to NDP or NCL of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$		
8	UPAT rebar anchor	Rebar part: Bars and de-coiled rods class B or C with $f_{yk}$ and $k$ according to NDP or NCL of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$	Threaded part: Property class 70 or 80 EN ISO 3506-1:2009 1.4565; 1.4529, 1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 EN 10088-1:2014	

<sup>1)</sup> Fracture elongation  $A_5 > 8 \%$  for applications without requirements for seismic performance

UPAT injection system UPM 55

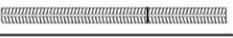
**Product description**  
Materials

**Annex A 3**

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# Specifications of intended use (part 1)

**Table B1:** Overview use and performance categories

Anchorages subject to		UPM 55 with ...							
		Anchor rod 	internal threaded anchor RG MI 	Reinforcing bar 	UPAT rebar anchor 				
Hammer drilling with standard drill bit 		all sizes							
Hammer drilling with hollow drill bit (Heller "Duster Expert" or Hilti "TE-CD, TE-YD") 		Nominal drill bit diameter ( $d_0$ ) 12 mm to 35 mm							
Diamond drilling 		all sizes							
Static and quasi static load, in	uncracked concrete	all sizes	Tables: C1, C5, C6, C10	all sizes	Tables: C2, C5, C7, C11	all sizes	Tables: C3, C5, C8, C12	all sizes	Tables: C4, C5, C9, C13
	cracked concrete								
Seismic performance category (only hammer drilling with Standard / hollow drill bits)	C1	M10 to M30	Tables: C14, C16, C17	---	$\phi 10$ to $\phi 32$	---	Tables: C15, C16, C18	---	
	C2	M12, M16, M20, M24	Tables: C14, C16, C19						
Use category	dry or wet concrete	all sizes							
	flooded hole	all sizes							
Installation temperature		+5 °C to +40 °C							
In-service temperature	Temperature range I	-40 °C to +60 °C (max. long term temperature +35 °C and max. short term temperature +60 °C)							
	Temperature range II	-40 °C to +72 °C (max. long term temperature +50 °C and max. short term temperature +72 °C)							

UPAT injection system UPM 55

**Intended Use**  
Specifications (part 1)

**Annex B 1**

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## Specifications of intended use (part 2)

### Base materials:

- Reinforced or unreinforced normal weight concrete Strength classes C20/25 to C50/60 according to EN 206-1:2000

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel or high corrosion resistant steel)
- Structures subject to external atmospheric exposure, to permanently damp internal conditions or in other particular aggressive conditions (high corrosion resistant steel)

Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used)

### Design:

- Anchorages have to be designed by a responsible engineer with experience of concrete anchor design
- Verifiable calculation notes and drawings are to be 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 under static or quasi-static actions are designed in accordance with EOTA Technical Report TR 029 "Design of bonded anchors" Edition September 2010 or CEN/TS 1992-4:2009
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with:
  - EOTA Technical Report TR 045 "Design of Metal Anchors under Seismic Action", Edition February 2013
  - Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure
  - Fastenings in stand-off installation or with a grout layer are not allowed

### Installation:

- Anchor installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- In case of aborted hole: The hole shall be filled with mortar
- Anchorage depth should be marked and adhered to on installation
- Overhead installation is allowed

UPAT injection system UPM 55

**Intended Use**  
Specifications (part 2)

**Annex B 2**

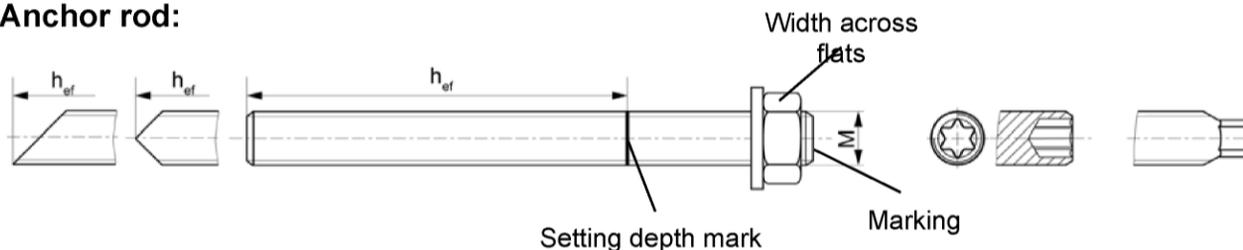
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**Table B2: Installation parameters for anchor rods**

Size		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Width across flats	SW	13	17	19	22	24	30	32	36	41	46
Nominal drill bit diameter	$d_0$	12	14	14	16	18	24	25	28	30	35
Drill hole depth	$h_0$	$h_0 = h_{ef}$									
Effective anchorage depth	$h_{ef,min}$	60	60	70	75	80	90	93	96	108	120
	$h_{ef,max}$	160	200	240	280	320	400	440	480	540	600
Minimum spacing and minimum edge distance	$s_{min}$ =	40	45	55	60	65	85	95	105	120	140
	$c_{min}$										
Diameter of clearance hole in the fixture <sup>1)</sup>	pre-positioned anchorage $d_f$	9	12	14	16	18	22	24	26	30	33
	push through anchorage $d_f$	14	16	16	18	20	26	28	30	33	40
Minimum thickness of concrete member	$h_{min}$	$h_{ef} + 30$ ( $\geq 100$ )			$h_{ef} + 2d_0$						
Maximum installation torque	$T_{inst,max}$ [Nm]	10	20	40	50	60	120	135	150	200	300

<sup>1)</sup> For larger clearance holes in the fixture see TR 029, 4.2.2.1 or CEN/TS 1992-4-1:2009, 5.2.3.1

**Anchor rod:**



**Marking (on random place):**

Property class 8.8, stainless steel, property class 80 or high corrosion resistant steel, property class 80: •  
 Stainless steel A4, property class 50 and high corrosion resistant steel, property class 50: ••  
 Or colour coding according to DIN 976-1

**Commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:**

- Materials, dimensions and mechanical properties according Annex A 3, Table A1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- Setting depth is marked

UPAT injection system UPM 55

**Intended Use**  
 Installation parameters anchor rods

**Annex B 3**

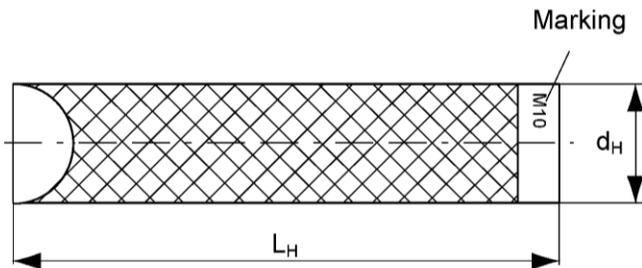
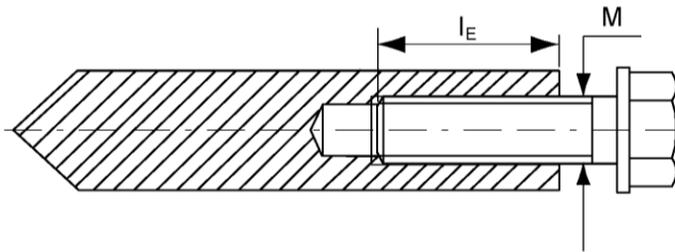
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**Table B3:** Installation parameters for internal threaded anchors IST

Size		M8	M10	M12	M16	M20
Diameter of anchor	$d_H$	12	16	18	22	28
Nominal drill bit diameter	$d_0$	14	18	20	24	32
Drill hole depth	$h_0$	$h_0 = h_{ef}$				
Effective anchorage depth ( $h_{ef} = L_H$ )	$h_{ef}$	90	90	125	160	200
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$	55	65	75	95	125
Diameter of clearance hole in the fixture <sup>1)</sup>	$d_f$	9	12	14	18	22
Minimum thickness of concrete member	$h_{min}$	120	125	165	205	260
Maximum screw-in depth	$l_{E,max}$	18	23	26	35	45
Minimum screw-in depth	$l_{E,min}$	8	10	12	16	20
Maximum installation torque	$T_{inst,max}$ [Nm]	10	20	40	80	120

<sup>1)</sup> For larger clearance holes in the fixture see TR 029, 4.2.2.1 or CEN/TS 1992-4-1:2009, 5.2.3.1

**Internal threaded anchor IST**



**Marking:** Anchor size

e.g.: **M10**

Stainless steel additional **A4**

e.g.: **M10 A4**

High corrosion resistant steel

additional **C**

e.g.: **M10 C**

Retaining bolt or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A 3, Table A1

UPAT injection system UPM 55

**Intended Use**  
Installation parameters internal threaded anchors IST

**Annex B 4**

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**Table B4:** Installation parameters for reinforcing bars

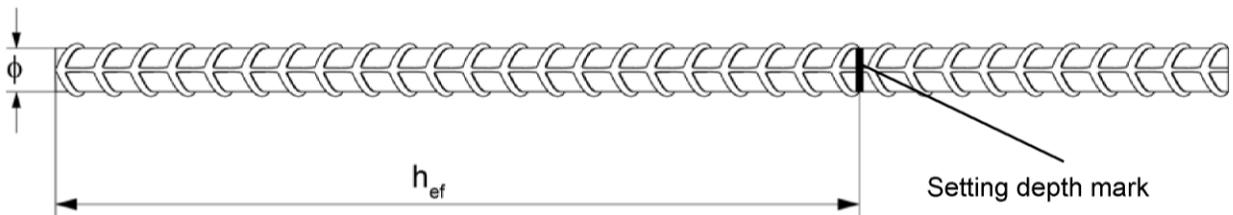
Nominal diameter of the bar		$\phi$	8 <sup>1)</sup>		10 <sup>1)</sup>		12 <sup>1)</sup>		14	16	18	20	22	24	
Nominal drill bit diameter	$d_0$	[mm]	10	12	12	14	14	16	18	20	25	25	30	30	
Drill hole depth	$h_0$		$h_0 = h_{ef}$												
Effective anchorage depth	$h_{ef,min}$		60	60	70	75	80	85	90	94	98				
	$h_{ef,max}$		160	200	240	280	320	360	400	440	480				
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		40	45	55	60	65	75	85	95	105				
Minimum thickness of concrete member	$h_{min}$	$h_{ef} + 30$ ( $\geq 100$ )					$h_{ef} + 2d_0$								

Nominal diameter of the bar		$\phi$	25	26	28	30	32	34	36	40	---	
Nominal drill bit diameter	$d_0$	[mm]	30	35	35	40	40	40	45	55	---	
Drill hole depth	$h_0$		$h_0 = h_{ef}$									
Effective anchorage depth	$h_{ef,min}$		100	104	112	120	128	136	144	160	---	
	$h_{ef,max}$		500	520	560	600	640	680	720	800	---	
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		110	120	130	140	160	170	180	200	---	
Minimum thickness of concrete member	$h_{min}$	$h_{ef} + 2d_0$										

<sup>1)</sup> Both drill bit diameters can be used

**Reinforcing bar**



- The minimum value of related rib area  $f_{R,min}$  must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range:  $0,05 \cdot \phi \leq h_{rib} \leq 0,07 \cdot \phi$   
( $\phi$  = Nominal diameter of the bar ,  $h_{rib}$  = rib height)

UPAT injection system UPM 55

**Intended Use**  
Installation parameters reinforcing bars

**Annex B 5**

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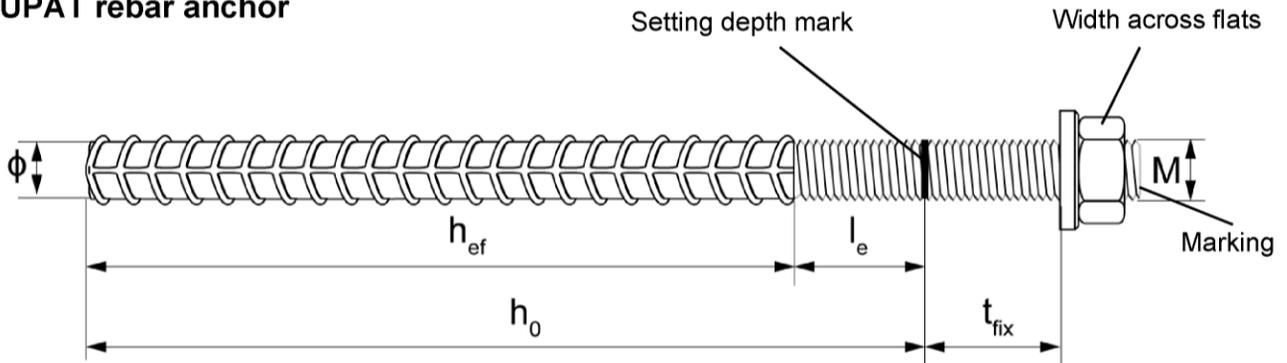
**Table B5: Installation parameters for UPAT rebar anchor**

Size		M12 <sup>1)</sup>	M16	M20	M24
Nominal diameter of the bar	$\phi$	12	16	20	25
Width across flats	SW	19	24	30	36
Nominal drill bit diameter	$d_0$	14	16	20	30
Drill hole depth	$h_0$	$h_{ef} + l_e$			
Effective anchorage depth	$h_{ef,min}$	70	80	90	96
	$h_{ef,max}$	140	220	300	380
Distance concrete surface to welded joint	$l_e$	100			
Minimum spacing and minimum edge distance	$s_{min}$	55	65	85	105
	$c_{min}$				
Diameter of clearance hole in the fixture <sup>2)</sup>	pre-positioned anchorage $\leq d_f$	14	18	22	26
	push through anchorage $\leq d_f$	18	22	26	32
Minimum thickness of concrete member	$h_{min}$	$h_0 + 30$ ( $\geq 100$ )	$h_0 + 2d_0$		
Maximum installation torque	$T_{inst,max}$	[Nm] 40	60	120	150

<sup>1)</sup> Both drill bit diameters can be used

<sup>2)</sup> For larger clearance holes in the fixture see TR 029, 4.2.2.1 or CEN/TS 1992-4-1:2009, 5.2.3.1

**UPAT rebar anchor**



Marking frontal e.g.: FRA (for stainless steel);  
FRA C (for high corrosion resistant steel)

UPAT injection system UPM 55

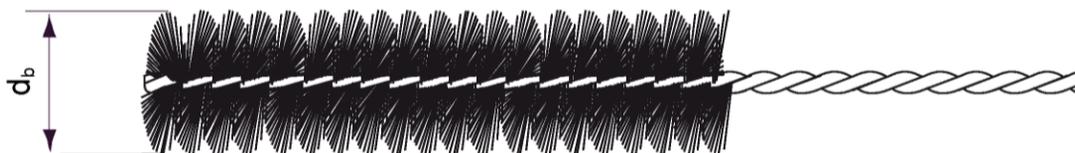
**Intended Use**  
Installation parameters UPAT rebar anchor

**Annex B 6**

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**Table B6: Parameters of steel brush BS / BSB Ø**

		BS											BSB			
Drill bit diameter	$d_0$	[mm]	12	14	16	18	20	24	25	28	30	32	35	40	45	55
Steel brush diameter	$d_b$		14	16	20		25	26	27	30	40		42	47	58	



**Table B7: Maximum processing time of the mortar and minimum curing time**  
 (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

System temperature [°C]	Maximum processing time $t_{work}$ [minutes]	Minimum curing time <sup>1)</sup> $t_{cure}$ [hours]
+5 to +10	120	40
≥ +10 to +20	30	18
≥ +20 to +30	14	10
≥ +30 to +40	7	5

<sup>1)</sup> In wet concrete or flooded holes the curing times must be doubled

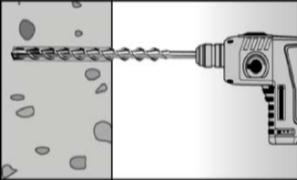
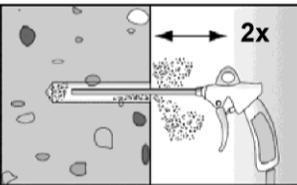
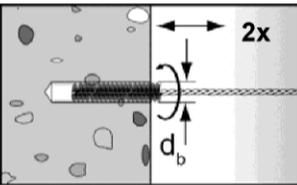
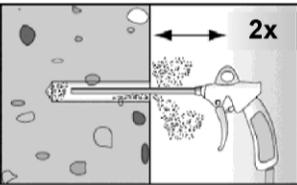
UPAT injection system UPM 55

**Intended Use**  
 Cleaning tools  
 Processing times and curing times

**Annex B 7**  
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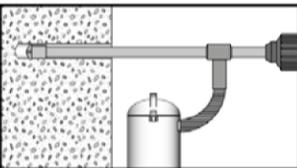
## Installation instructions part 1

### Drilling and cleaning the hole (hammer drilling with standard drill bit)

1		<p>Drill the hole. Drill hole diameter <math>d_0</math> and drill hole depth <math>h_0</math> see <b>Tables B2, B3, B4, B5</b></p>
2		<p>Blow out the drill hole twice, with oil-free compressed air (<math>p \geq 6</math> bar)</p> 
3		<p>Brush the drill hole twice. For drill hole diameter <math>\geq 30</math> mm use a power drill. For deep holes use an extension. Corresponding brushes see <b>Table B6</b></p>
4		<p>Blow out the drill hole twice, with oil-free compressed air (<math>p \geq 6</math> bar)</p> 

Go to step 6

### Drilling and cleaning the hole (hammer drilling with hollow drill bit)

1		<p>Check a suitable hollow drill (see <b>Table B1</b>) for correct operation of the dust extraction</p>
2		<p>Use a suitable dust extraction system, e.g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data</p> <p>Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process. Diameter of drill hole <math>d_0</math> and drill hole depth <math>h_0</math> see <b>Tables B2, B3, B4, B5</b></p>

Go to step 6

UPAT injection system UPM 55

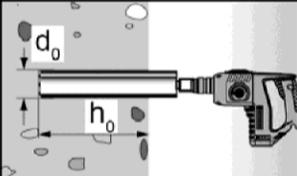
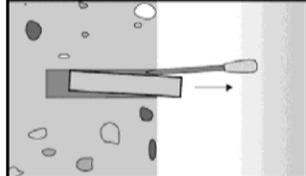
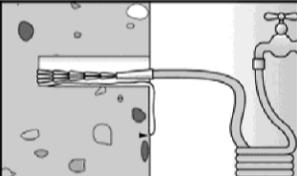
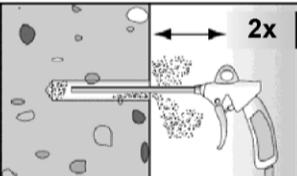
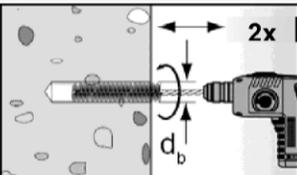
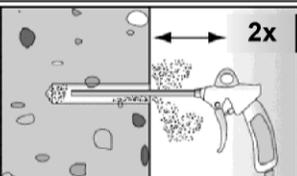
**Intended use**  
Installation instructions part 1

**Annex B 8**

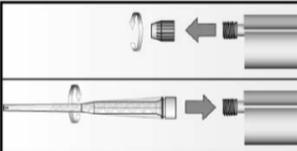
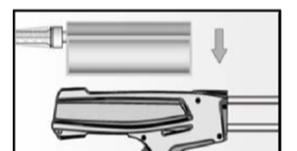
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## Installation instructions part 2

### Drilling and cleaning the hole (wet drilling with diamond drill bit)

1		<p>Drill the hole. Drill hole diameter <math>d_0</math> and drill hole depth <math>h_0</math> see <b>Tables B2, B3, B4, B5</b></p>	 <p>Break the drill core and draw it out</p>
2		<p>Flush the drill hole with clean water until it flows clear</p>	
3		<p>Blow out the drill hole twice, using oil-free compressed air (<math>p &gt; 6</math> bar)</p>	
4		<p>Brush the drill hole twice using a power drill. Corresponding brushes see <b>Table B6</b></p>	
5		<p>Blow out the drill hole twice, using oil-free compressed air (<math>p &gt; 6</math> bar)</p>	

### Preparing the cartridge

6		<p>Remove the sealing cap Screw on the static mixer (the spiral in the static mixer must be clearly visible)</p>	
7			<p>Place the cartridge into the dispenser</p>
8			<p>Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey</p>

UPAT injection system UPM 55

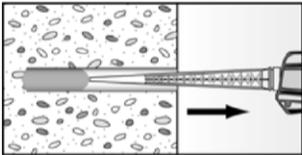
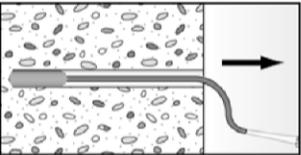
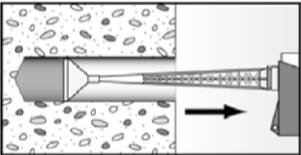
**Intended use**  
Installation instructions part 2

**Annex B 9**

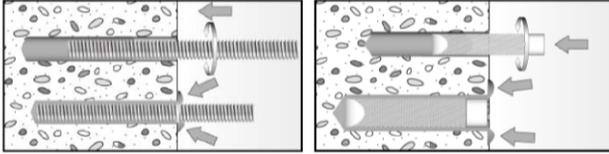
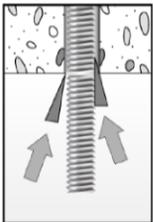
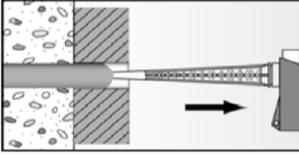
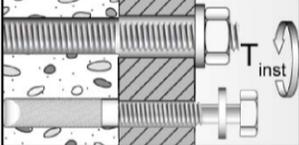
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# Installation instructions part 3

## Injection of the mortar

9	 <p>Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles</p>	 <p>For drill hole depth <math>\geq 150</math> mm use an extension tube</p>	 <p>For overhead installation, deep holes <math>h_0 &gt; 250</math> mm or drill hole diameter <math>d_0 \geq 40</math> mm use an injection-adapter</p>
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## Installation of anchor rods or internal threaded anchors IST

10		<p>Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. Press the threaded rod or internal threaded IST anchor down to the bottom of the hole, turning it slightly while doing so. After inserting the anchor element, excess mortar must be emerged around the anchor element</p>
	 <p>For overhead installations support the anchor rod with wedges</p>	 <p>For push through installation fill the annular gap with mortar</p>
11	 <p>Wait for the specified curing time <math>t_{cure}</math> see <b>Table B7</b></p>	<p>12</p>  <p>Mounting the fixture  <math>T_{inst,max}</math> see <b>Tables B2 and B3</b></p>

UPAT injection system UPM 55

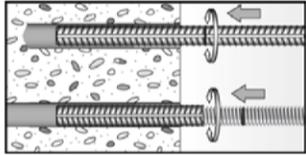
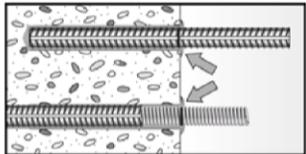
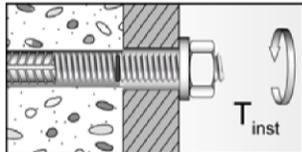
**Intended use**  
 Installation instructions part 3

**Annex B 10**

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## Installation instructions part 4

### Installation reinforcing bars and UPAT rebar anchor

10		Only use clean and oil-free reinforcing bars or UPAT rebar anchor. Mark the setting depth. Turn while using force to push the reinforcement bar or the UPAT rebar anchor into the filled hole up to the setting depth mark
		When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole
11	 <p>Wait for the specified curing time <math>t_{\text{cure}}</math> see <b>Table B7</b></p>	12  <p>Mounting the fixture <math>T_{\text{inst,max}}</math> see <b>Table B5</b></p>

UPAT injection system UPM 55

**Intended use**  
Installation instructions part 4

**Annex B 11**

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**Table C1: Characteristic values for the steel bearing capacity under tensile / shear load of UPAT anchor rods and standard threaded rods**

Size		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30			
<b>Bearing capacity under tensile load, steel failure</b>														
Charact. bearing capacity $N_{Rk}$	Steel zinc plated	5.8	Property class	[kN]	19	29	43	58	79	123	152	177	230	281
		8.8			29	47	68	92	126	196	243	282	368	449
	Stainless steel A4 and High corrosion resistant steel C	50			19	29	43	58	79	123	152	177	230	281
		70			26	41	59	81	110	172	212	247	322	393
		80			30	47	68	92	126	196	243	282	368	449
<b>Partial safety factors<sup>1)</sup></b>														
Partial safety factor $\gamma_{Ms,N}$	Steel zinc plated	5.8	Property class	[-]	1,50									
		8.8			1,50									
	Stainless steel A4 and High corrosion resistant steel C	50			2,86									
		70			1,50 <sup>2)</sup> / 1,87									
		80			1,60									
<b>Bearing capacity under shear load, steel failure</b>														
<b>without lever arm</b>														
Charact. bearing capacity $V_{Rk}$	Steel zinc plated	5.8	Property class	[kN]	9	15	21	29	39	61	76	89	115	141
		8.8			15	23	34	46	63	98	122	141	184	225
	Stainless steel A4 and High corrosion resistant steel C	50			9	15	21	29	39	61	76	89	115	141
		70			13	20	30	40	55	86	107	124	161	197
		80			15	23	34	46	63	98	122	141	184	225
Ductility factor acc. to CEN/TS 1992-4-5:2009 Section 6.3.2.1		$k_2$	[-]	1,0										
<b>with lever arm</b>														
Charact. bending moment $M_{Rk}$	Steel zinc plated	5.8	Property class	[Nm]	19	37	65	104	166	324	447	560	833	1123
		8.8			30	60	105	167	266	519	716	896	1333	1797
	Stainless steel A4 and High corrosion resistant steel C	50			19	37	65	104	166	324	447	560	833	1123
		70			26	52	92	146	232	454	626	784	1167	1573
		80			30	60	105	167	266	519	716	896	1333	1797
<b>Partial safety factors<sup>1)</sup></b>														
Partial safety factor $\gamma_{Ms,V}$	Steel zinc plated	5.8	Property class	[-]	1,25									
		8.8			1,25									
	Stainless steel A4 and High corrosion resistant steel C	50			2,38									
		70			1,25 <sup>2)</sup> / 1,56									
		80			1,33									

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> Only admissible for steel C, with  $f_{yk} / f_{uk} \geq 0,8$  and  $A_5 > 12 \%$  (e.g. UPAT anchor rods)

UPAT injection system UPM 55

**Performances**

Characteristic steel bearing capacity of UPAT anchor rods and standard threaded rods

**Annex C 1**

Appendix 17 / 30

**Table C2: Characteristic values for the steel bearing capacity under tensile / shear load of internal threaded anchors IST**

Size				M8	M10	M12	M16	M20	
<b>Bearing capacity under tensile load, steel failure</b>									
Characteristic bearing capacity with screw	$N_{Rk,s}$	Property class	5.8	[kN]	19	29	43	79	123
			8.8		29	47	68	108	179
		Property class 70	A4		26	41	59	110	172
			C		26	41	59	110	172
<b>Partial safety factors<sup>1)</sup></b>									
Partial safety factor	$\gamma_{Ms,N}$	Property class	5.8	[-]	1,50				
			8.8		1,50				
		Property class 70	A4		1,87				
			C		1,87				
<b>Bearing capacity under shear load, steel failure</b>									
<b>without lever arm</b>									
Characteristic bearing capacity with screw	$V_{Rk,s}$	Property class	5.8	[kN]	9,2	14,5	21,1	39,2	62,0
			8.8		14,6	23,2	33,7	54,0	90,0
		Property class 70	A4		12,8	20,3	29,5	54,8	86,0
			C		12,8	20,3	29,5	54,8	86,0
Ductility factor acc. to CEN/TS 1992-4-5:2009 Section 6.3.2.1			$k_2$	[-]	1,0				
<b>with lever arm</b>									
Characteristic bending moment with screw	$M^0_{Rk,s}$	Property class	5.8	[Nm]	20	39	68	173	337
			8.8		30	60	105	266	519
		Property class 70	A4		26	52	92	232	454
			C		26	52	92	232	454
<b>Partial safety factors<sup>1)</sup></b>									
Partial safety factor	$\gamma_{Ms,V}$	Property class	5.8	[-]	1,25				
			8.8		1,25				
		Property class 70	A4		1,56				
			C		1,56				

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> Only for steel failure without lever arm

UPAT injection system UPM 55

**Performances**

Characteristic steel bearing capacity of internal threaded anchors IST

**Annex C 2**

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**Table C3: Characteristic values for the steel bearing capacity under tensile / shear load of reinforcing bars**

Nominal diameter of the bar	$\phi$	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40	
<b>Bearing capacity under tensile load, steel failure</b>																			
Characteristic bearing capacity	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}^{1)}$																
<b>Bearing capacity under shear load, steel failure</b>																			
<b>without lever arm</b>																			
Characteristic bearing capacity	$V_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}^{1)}$																
Ductility factor acc. to CEN/TS 1992-4-5:2009 Section 6.3.2.1	$k_2$	[-]	0,8																
<b>with lever arm</b>																			
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}^{1)}$																

<sup>1)</sup>  $f_{uk}$  or  $f_{yk}$  respectively must be taken from the specifications of the reinforcing bar

**Table C4: Characteristic values for the steel bearing capacity under tensile / shear load of UPAT rebar anchors**

Size		M12	M16	M20	M24	
<b>Bearing capacity under tensile load, steel failure</b>						
Characteristic bearing capacity	$N_{Rk,s}$	[kN]	63	111	173	270
<b>Partial safety factors<sup>1)</sup></b>						
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,4			
<b>Bearing capacity under shear load, steel failure</b>						
<b>without lever arm</b>						
Characteristic bearing capacity	$V_{Rk,s}$	[kN]	30	55	86	124
Ductility factor acc. to CEN/TS 1992-4-5:2009 Section 6.3.2.1	$k_2$	[-]	1,0			
<b>with lever arm</b>						
Characteristic bearing capacity	$M_{Rk,s}^0$	[Nm]	92	233	454	785
<b>Partial safety factors<sup>1)</sup></b>						
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,56			

<sup>1)</sup> In absence of other national regulations

UPAT injection system UPM 55

**Performances**

Characteristic steel bearing capacity of reinforcing bars and UPAT rebar anchors

**Annex C 3**

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**Table C5: General design factors for the bearing capacity under tensile / shear load; uncracked or cracked concrete**

Size		All Sizes																		
<b>Bearing capacity under tensile load</b>																				
<b>Factors acc. to CEN/TS 1992-4:2009 Section 6.2.2.3</b>																				
Uncracked concrete	$k_{ucr}$	[-]	10,1																	
Cracked concrete	$k_{cr}$		7,2																	
<b>Factors for the compressive strength of concrete &gt; C20/25</b>																				
Increasing factor for $\tau_{Rk}$	C25/30	$\Psi_c$	[-]	1,02																
	C30/37			1,04																
	C35/45			1,06																
	C40/50			1,07																
	C45/55			1,08																
	C50/60			1,09																
<b>Splitting failure</b>																				
Edge distance	$h / h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	1,0 $h_{ef}$																
	$2,0 > h / h_{ef} > 1,3$			4,6 $h_{ef} - 1,8 h$																
	$h / h_{ef} \leq 1,3$			2,26 $h_{ef}$																
Spacing	$s_{cr,sp}$			2 $c_{cr,sp}$																
<b>Concrete cone failure acc. to CEN/TS 1992-4-5:2009 Section 6.2.3.2</b>																				
Edge distance	$c_{cr,N}$		[mm]	1,5 $h_{ef}$																
Spacing	$s_{cr,N}$			2 $c_{cr,N}$																
<b>Bearing capacity under shear load</b>																				
<b>Installation safety factors</b>																				
All installation conditions	$\gamma_2 = \gamma_{inst}$		[-]	1,0																
<b>Concrete pry-out failure</b>																				
Factor k acc. to TR029 Section 5.2.3.3 resp. $k_3$ acc. to CEN/TS 1992-4-5:2009 Section 6.3.3	$k_{(3)}$		[-]	2,0																
<b>Concrete edge failure</b>																				
The value of $h_{ef}$ (= $l_f$ ) under shear load			[mm]	min ( $h_{ef}$ , 8d)																
Calculation diameters																				
Size				M8	M10	M12	M14	M16	M20	M22	M24	M27	M30							
UPAT anchor rods and standard threaded rods	d	[mm]		8	10	12	14	16	20	22	24	27	30							
internal threaded anchors IST	d			12	16	18	-	22	28	-	-	-	-							
UPAT rebar anchors	d			-	-	12	-	16	20	-	25	-	-							
Nominal diameter of the bar	$\phi$			8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Reinforcing bar	d		[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40

UPAT injection system UPM 55

**Performances**

General design factors relating to the characteristic bearing capacity under tensile / shear load

**Annex C 4**

Appendix 20 / 30

**Table C6: Characteristic values of resistance for UPAT anchor rods and standard threaded rods in hammer or diamond drilled holes; uncracked or cracked concrete**

Size		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30			
<b>Combined pullout and concrete cone failure</b>														
Calculation diameter	d	[mm]	8	10	12	14	16	20	22	24	27	30		
<b>Uncracked concrete</b>														
<b>Characteristic bond resistance in uncracked concrete C20/25</b>														
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>														
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,ucr}$	[N/mm <sup>2</sup> ]	16	16	15	14	14	13	13	13	12	12
	II: 50 °C / 72 °C				15	14	14	13	13	12	12	12	12	11
<u>Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)</u>														
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,ucr}$	[N/mm <sup>2</sup> ]	16	16	15	13	13	11	11	10	10	9
	II: 50 °C / 72 °C				15	14	14	13	12	11	10	10	9	9
<u>Diamond-drilling (dry and wet concrete as well as flooded hole)</u>														
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,ucr}$	[N/mm <sup>2</sup> ]	16	15	13	12	12	10	10	10	9	9
	II: 50 °C / 72 °C				15	14	12	11	11	10	9	9	8	8
<b>Installation safety factors</b>														
Dry and wet concrete		$\gamma_2 = \gamma_{inst}$	[-]	1,0				1,2						
Flooded hole				1,4										
<b>Cracked concrete</b>														
<b>Characteristic bond resistance in cracked concrete C20/25</b>														
<u>Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry and wet concrete)</u>														
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,cr}$	[N/mm <sup>2</sup> ]	7	7	7	7	6	6	7	7	7	7
	II: 50 °C / 72 °C				7	7	7	7	6	6	7	7	7	7
<u>Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (flooded hole)</u>														
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,cr}$	[N/mm <sup>2</sup> ]	6	7,5	7,5	7	6	6	6	6	6	6
	II: 50 °C / 72 °C				6	7	7	7	6	6	6	6	6	6
<b>Installation safety factors</b>														
Dry and wet concrete		$\gamma_2 = \gamma_{inst}$	[-]	1,0				1,2						
Flooded hole				1,2				1,4						

UPAT injection system UPM 55

**Performances**

Characteristic values for static or quasi-static action under tensile load for UPAT anchor rods and standard threaded rods (uncracked or cracked concrete)

**Annex C 5**

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**Table C7: Characteristic values of resistance for internal threaded anchors IST in hammer or diamond drilled holes; uncracked or cracked concrete**

Size	M8	M10	M12	M16	M20		
<b>Combined pullout and concrete cone failure</b>							
Calculation diameter	d	[mm]	12	16	18	22	28
<b>Uncracked concrete</b>							
<b>Characteristic bond resistance in uncracked concrete C20/25</b>							
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>							
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,ucr}$ [N/mm <sup>2</sup> ]	15	14	14	13	12
	II: 50 °C / 72 °C		14	13	13	12	11
<u>Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)</u>							
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,ucr}$ [N/mm <sup>2</sup> ]	14	12	12	11	10
	II: 50 °C / 72 °C		13	12	11	10	9
<u>Diamond-drilling (dry and wet concrete as well as flooded hole)</u>							
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,ucr}$ [N/mm <sup>2</sup> ]	13	12	11	10	9
	II: 50 °C / 72 °C		12	11	10	9	8
<b>Installation safety factors</b>							
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0			1,2	
Flooded hole			1,4				
<b>Cracked concrete</b>							
<b>Characteristic bond resistance in cracked concrete C20/25</b>							
<u>Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry and wet concrete)</u>							
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,cr}$ [N/mm <sup>2</sup> ]	7	6	6	7	7
	II: 50 °C / 72 °C		7	6	6	7	7
<u>Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (flooded hole)</u>							
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,cr}$ [N/mm <sup>2</sup> ]	7	6,5	6	6	6
	II: 50 °C / 72 °C		7	6	6	6	6
<b>Installation safety factors</b>							
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0			1,2	
Flooded hole			1,2			1,4	

UPAT injection system UPM 55

**Performances**

Characteristic values for static or quasi-static action under tensile load for internal threaded anchors IST (uncracked or cracked concrete)

**Annex C 6**

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**Table C8: Characteristic values of resistance for reinforcing bars  
in hammer or diamond drilled holes; uncracked or cracked concrete**

Nominal diameter of the bar		$\phi$	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40		
<b>Combined pullout and concrete cone failure</b>																					
Calculation diameter		d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40	
<b>Uncracked concrete</b>																					
<b>Characteristic bond resistance in uncracked concrete C20/25</b>																					
Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)																					
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,ucr}$	[N/mm <sup>2</sup> ]	16	16	15	14	14	14	13	13	13	13	12	12	12	12	12	11	
	II: 50 °C / 72 °C				15	14	14	13	13	13	12	12	12	12	11	11	11	11	11	11	10
Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)																					
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,ucr}$	[N/mm <sup>2</sup> ]	16	16	14	13	12	12	11	11	10	10	10	10	9	9	9	8	8
	II: 50 °C / 72 °C				15	14	13	12	12	11	11	10	10	9	9	9	9	8	8	8	8
Diamond-drilling (dry and wet concrete as well as flooded hole)																					
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,ucr}$	[N/mm <sup>2</sup> ]	16	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
	II: 50 °C / 72 °C				15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
<b>Installation safety factors</b>																					
Dry and wet concrete		$\gamma_2 = \gamma_{inst}$	[-]	1,0						1,2											
Flooded hole				1,4																	
<b>Cracked concrete</b>																					
<b>Characteristic bond resistance in cracked concrete C20/25</b>																					
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry and wet concrete)																					
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,cr}$	[N/mm <sup>2</sup> ]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
	II: 50 °C / 72 °C				7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (flooded hole)																					
Tem- perature range	I: 35 °C / 60 °C		$\tau_{RK,cr}$	[N/mm <sup>2</sup> ]	6	7,5	6,5	6,5	6,5	6	6	6	6	6	6	6	6	5	5	5	5
	II: 50 °C / 72 °C				6	6,5	6,5	6	6	6	6	6	6	6	6	6	6	5	5	5	5
<b>Installation safety factors</b>																					
Dry and wet concrete		$\gamma_2 = \gamma_{inst}$	[-]	1,0						1,2											
Flooded hole				1,2						1,4											

UPAT injection system UPM 55

**Performances**

Characteristic values for static or quasi-static action under tensile load for reinforcing bars (uncracked or cracked concrete)

**Annex C 7**

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**Table C9: Characteristic values of resistance for UPAT rebar anchors  
in hammer or diamond drilled holes; uncracked or cracked concrete**

Size	M12	M16	M20	M24		
<b>Combined pullout and concrete cone failure</b>						
Calculation diameter	d	[mm]	12	16	20	25
<b>Uncracked concrete</b>						
<b>Characteristic bond resistance in uncracked concrete C20/25</b>						
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>						
Tem- perature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$ [N/mm <sup>2</sup> ]	15	14	13	13
	II: 50 °C / 72 °C		14	13	12	12
<u>Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)</u>						
Tem- perature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$ [N/mm <sup>2</sup> ]	14	12	11	10
	II: 50 °C / 72 °C		13	12	11	9
<u>Diamond-drilling (dry and wet concrete as well as flooded hole)</u>						
Tem- perature range	I: 35 °C / 60 °C	$\tau_{Rk,ucr}$ [N/mm <sup>2</sup> ]	13	12	10	9
	II: 50 °C / 72 °C		12	11	10	9
<b>Installation safety factors</b>						
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0		1,2	
Flooded hole			1,4			
<b>Cracked concrete</b>						
<b>Characteristic bond resistance in cracked concrete C20/25</b>						
<u>Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry and wet concrete)</u>						
Tem- perature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$ [N/mm <sup>2</sup> ]	7	6	6	7
	II: 50 °C / 72 °C		7	6	6	7
<u>Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (flooded hole)</u>						
Tem- perature range	I: 35 °C / 60 °C	$\tau_{Rk,cr}$ [N/mm <sup>2</sup> ]	7	6	6	6
	II: 50 °C / 72 °C		7	6	6	6
<b>Installation safety factors</b>						
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0		1,2	
Flooded hole			1,2	1,4		

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**Performances**

Characteristic values for static or quasi-static action under tensile load for UPAT rebar anchors (uncracked or cracked concrete)

**Annex C 8**

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**Table C10: Displacements for anchor rods**

Size		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
<b>Displacement-Factors for tensile load<sup>1)</sup></b>											
<b>Uncracked or cracked concrete; Temperature range I, II</b>											
$\delta_{N0}$ -Factor	[mm/(N/mm <sup>2</sup> )]	0,07	0,08	0,09	0,09	0,10	0,11	0,11	0,12	0,12	0,13
$\delta_{N\infty}$ -Factor		0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19
<b>Displacement-Factors for shear load<sup>2)</sup></b>											
<b>Uncracked or cracked concrete; Temperature range I, II</b>											
$\delta_{V0}$ -Factor	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05
$\delta_{V\infty}$ -Factor		0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07

<sup>1)</sup> Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau_{Ed}$$

$$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$$

( $\tau_{Ed}$ : Design value of the applied tensile stress)

<sup>2)</sup> Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V_{Ed}$$

$$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V_{Ed}$$

( $V_{Ed}$ : Design value of the applied shear force)

**Table C11: Displacements for internal threaded anchors IST**

Size		M8	M10	M12	M16	M20
<b>Displacement-Factors for tensile load<sup>1)</sup></b>						
<b>Uncracked or cracked concrete; Temperature range I, II</b>						
$\delta_{N0}$ -Factor	[mm/(N/mm <sup>2</sup> )]	0,09	0,10	0,10	0,11	0,13
$\delta_{N\infty}$ -Factor		0,13	0,15	0,16	0,17	0,19
<b>Displacement-Factors for shear load<sup>2)</sup></b>						
<b>Uncracked or cracked concrete; Temperature range I, II</b>						
$\delta_{V0}$ -Factor	[mm/kN]	0,12	0,09	0,08	0,07	0,05
$\delta_{V\infty}$ -Factor		0,18	0,14	0,12	0,10	0,08

<sup>1)</sup> Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau_{Ed}$$

$$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau_{Ed}$$

( $\tau_{Ed}$ : Design value of the applied tensile stress)

<sup>2)</sup> Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V_{Ed}$$

$$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V_{Ed}$$

( $V_{Ed}$ : Design value of the applied shear force)

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**Performances**

Displacements for anchor rods and internal threaded anchors IST

**Annex C 9**

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**Table C12: Displacements for reinforcing bars**

Nominal diameter of the bar $\phi$		8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
<b>Displacement-Factors for tensile load<sup>1)</sup></b>																		
<b>Uncracked or cracked concrete; Temperature range I, II</b>																		
$\delta_{N0}$ -Factor	[mm/(N/mm <sup>2</sup> )]	0,07	0,08	0,09	0,09	0,10	0,10	0,11	0,11	0,12	0,12	0,12	0,13	0,13	0,13	0,14	0,14	0,15
$\delta_{N\infty}$ -Factor		0,11	0,12	0,13	0,14	0,15	0,16	0,16	0,17	0,18	0,18	0,18	0,19	0,19	0,20	0,20	0,21	0,22
<b>Displacement-Factors for shear load<sup>2)</sup></b>																		
<b>Uncracked or cracked concrete; Temperature range I, II</b>																		
$\delta_{V0}$ -Factor	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,08	0,07	0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,04	0,04	0,04
$\delta_{V\infty}$ -Factor		0,27	0,22	0,18	0,16	0,14	0,12	0,11	0,10	0,09	0,09	0,08	0,08	0,07	0,07	0,06	0,06	0,05

1) Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0}\text{-Factor} \cdot \tau_{Ed}$$

$$\delta_{N\infty} = \delta_{N\infty}\text{-Factor} \cdot \tau_{Ed}$$

( $\tau_{Ed}$ : Design value of the applied tensile stress)

2) Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0}\text{-Factor} \cdot V_{Ed}$$

$$\delta_{V\infty} = \delta_{V\infty}\text{-Factor} \cdot V_{Ed}$$

( $V_{Ed}$ : Design value of the applied shear force)

**Table C13: Displacements for UPAT rebar anchors**

Size		M12	M16	M20	M24
<b>Displacement-Factors for tensile load<sup>1)</sup></b>					
<b>Uncracked or cracked concrete; Temperature range I, II</b>					
$\delta_{N0}$ -Factor	[mm/(N/mm <sup>2</sup> )]	0,09	0,10	0,11	0,12
$\delta_{N\infty}$ -Factor		0,13	0,15	0,16	0,18
<b>Displacement-Factors for shear load<sup>2)</sup></b>					
<b>Uncracked or cracked concrete; Temperature range I, II</b>					
$\delta_{V0}$ -Factor	[mm/kN]	0,12	0,09	0,07	0,06
$\delta_{V\infty}$ -Factor		0,18	0,14	0,11	0,09

1) Calculation of effective displacement:

$$\delta_{N0} = \delta_{N0}\text{-Factor} \cdot \tau_{Ed}$$

$$\delta_{N\infty} = \delta_{N\infty}\text{-Factor} \cdot \tau_{Ed}$$

( $\tau_{Ed}$ : Design value of the applied tensile stress)

2) Calculation of effective displacement:

$$\delta_{V0} = \delta_{V0}\text{-Factor} \cdot V_{Ed}$$

$$\delta_{V\infty} = \delta_{V\infty}\text{-Factor} \cdot V_{Ed}$$

( $V_{Ed}$ : Design value of the applied shear force)

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**Performances**

Displacements for reinforcing bars and UPAT rebar anchors

**Annex C 10**

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**Table C14: Characteristic values for the steel bearing capacity under tensile / shear load of UPAT anchor rods and standard threaded rods under seismic action performance category C1 or C2**

Size		M10	M12	M14	M16	M20	M22	M24	M27	M30			
<b>Bearing capacity under tensile load, steel failure<sup>1)</sup></b>													
<b>UPAT anchor rods and standard threaded rods, performance category C1</b>													
Charact. bearing capacity $N_{Rk,s,C1}$	Steel zinc plated	5.8	Property class	[kN]	29	43	58	79	123	152	177	230	281
		8.8			47	68	92	126	196	243	282	368	449
	Stainless steel A4 and High corrosion resistant steel C	50			29	43	58	79	123	152	177	230	281
		70			41	59	81	110	172	212	247	322	393
		80			47	68	92	126	196	243	282	368	449
					47	68	92	126	196	243	282	368	449
	<b>UPAT anchor rods and standard threaded rods, performance category C2</b>												
	Charact. bearing capacity $N_{Rk,s,C2}$	Steel zinc plated			5.8	Property class	[kN]	---	39	---	72	108	---
8.8			---	61	---			116	173	---	282	---	---
Stainless steel A4 and High corrosion resistant steel C		50	---	39	---			72	108	---	177	---	---
		70	---	53	---			101	152	---	247	---	---
		80	---	61	---			116	173	---	282	---	---
			---	61	---			116	173	---	282	---	---
<b>Bearing capacity under shear load, steel failure without lever arm<sup>1)</sup></b>													
<b>UPAT anchor rods, performance category C1</b>													
Charact. bearing capacity $V_{Rk,s,C1}$	Steel zinc plated	5.8	Property class	[kN]	15	21	29	39	61	76	89	115	141
		8.8			23	34	46	63	98	122	141	184	225
	Stainless steel A4 and High corrosion resistant steel C	50			15	21	29	39	61	76	89	115	141
		70			20	30	40	55	86	107	124	161	197
		80			23	34	46	63	98	122	141	184	225
					23	34	46	63	98	122	141	184	225
	<b>Standard threaded rods, performance category C1</b>												
	Charact. bearing capacity $V_{Rk,s,C1}$	Steel zinc plated			5.8	Property class	[kN]	11	15	20	27	43	53
8.8			16	24	32			44	69	85	99	129	158
Stainless steel A4 and High corrosion resistant steel C		50	11	15	20			27	43	53	62	81	99
		70	14	21	28			39	60	75	87	113	138
		80	16	24	32			44	69	85	99	129	158
			16	24	32			44	69	85	99	129	158
<b>UPAT anchor rods and standard threaded rods, performance category C2</b>													
Charact. bearing capacity $V_{Rk,s,C2}$		Steel zinc plated	5.8	Property class	[kN]			---	14	---	27	43	---
	8.8		---			22	---	44	69	---	99	---	---
	Stainless steel A4 and High corrosion resistant steel C	50	---			14	---	27	43	---	62	---	---
		70	---			20	---	39	60	---	87	---	---
		80	---			22	---	44	69	---	99	---	---
			---			22	---	44	69	---	99	---	---

<sup>1)</sup> Partial safety factors for performance category C1 or C2 see Table C16, for UPAT anchor rods the factor for steel ductility is 1,0

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**Performances**

Characteristic steel bearing capacity of UPAT anchor rods and standard threaded rods under seismic action (performance category C1 or C2)

**Annex C 11**

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**Table C15: Characteristic values for the steel bearing capacity under tensile / shear load of reinforcing bars (B500B) under seismic action performance category C1**

Nominal diameter of the bar		$\phi$	10	12	14	16	18	20	22	24	25	26	28	30	32
<b>Bearing capacity under tensile load, steel failure<sup>1)</sup></b>															
<b>Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1</b>															
Characteristic bearing capacity	$N_{Rk,s,C1}$	[kN]	44	63	85	111	140	173	209	249	270	292	339	389	443
<b>Bearing capacity under shear load, steel failure without lever arm<sup>1)</sup></b>															
<b>Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1</b>															
Characteristic bearing capacity	$V_{Rk,s,C1}$	[kN]	15	22	30	39	49	61	74	88	95	102	119	137	155

<sup>1)</sup> Partial safety factors for performance category C1 see Table C16

**Table C16: Partial safety factors of UPAT anchor rods, standard threaded rods and reinforcing bars (B500B) under seismic action performance category C1 or C2**

Size		M10	M12	M14	M16	M20	M22	M24	M27	M30					
Nominal diameter of the bar		$\phi$	10	12	14	16	18	20	22	24	25	26	28	30	32
<b>Bearing capacity under tensile load, steel failure<sup>1)</sup></b>															
Partial safety factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	5.8	[-]	1,50										
			8.8		1,50										
	Stainless steel A4 and High corrosion resistant steel C	50	2,86												
		70	1,50 <sup>2)</sup> / 1,87												
		80	1,60												
	Reinforcing bar	B500B	1,40												
<b>Bearing capacity under shear load, steel failure<sup>1)</sup></b>															
Partial safety factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	5.8	[-]	1,25										
			8.8		1,25										
	Stainless steel A4 and High corrosion resistant steel C		50		2,38										
			70		1,25 <sup>2)</sup> / 1,56										
			80		1,33										
	Reinforcing bar		B500B		1,50										

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> Only admissible for steel C, with  $f_{yk} / f_{uk} \geq 0,8$  and  $A_5 > 12\%$  (e.g. UPAT anchor rods)

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**Performances**

Characteristic steel bearing capacity of reinforcing bars under seismic action (performance category C1); partial safety factors (performance category C1 or C2)

**Annex C 12**

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**Table C17: Characteristic values of resistance for UPAT anchor rods and standard threaded rods in hammer drilled holes under seismic action performance category C1**

Size	M10	M12	M14	M16	M20	M22	M24	M27	M30	
<b>Characteristic bond resistance, combined pullout and concrete cone failure</b>										
<b>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</b>										
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,C1}$	[N/mm <sup>2</sup> ]	7,0	7,0	6,7	6,0	5,7	6,7	6,7
	II: 50 °C / 72 °C			7,0	7,0	6,7	5,7	5,7	6,7	6,7
<b>Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)</b>										
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,C1}$	[N/mm <sup>2</sup> ]	7,5	7,5	6,5	5,7	5,7	5,7	5,7
	II: 50 °C / 72 °C			6,8	6,8	6,5	5,7	5,7	5,7	5,7
<b>Installation safety factors</b>										
<b>Bearing capacity under tensile load</b>										
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0				1,2			
Flooded hole			1,2				1,4			
<b>Bearing capacity under shear load</b>										
All installation conditions	$\gamma_2 = \gamma_{inst}$	[-]	1,0							

**Table C18: Characteristic values of resistance for reinforcing bars in hammer drilled holes under seismic action performance category C1**

Nominal diameter of the bar	$\phi$	10	12	14	16	18	20	22	24	25	26	28	30	32
<b>Characteristic bond resistance, combined pullout and concrete cone failure</b>														
<b>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</b>														
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,C1}$	[N/mm <sup>2</sup> ]	7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	4,8
	II: 50 °C / 72 °C			7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	6,7
<b>Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)</b>														
Temperature range	I: 35 °C / 60 °C	$\tau_{RK,C1}$	[N/mm <sup>2</sup> ]	7,5	6,5	6,5	5,7	5,7	5,7	5,7	5,7	5,7	5,7	4,8
	II: 50 °C / 72 °C			6,5	6,5	5,8	5,8	5,7	5,7	5,7	5,7	5,7	5,7	5,7
<b>Installation safety factors</b>														
<b>Bearing capacity under tensile load</b>														
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0						1,2					
Flooded hole			1,2						1,4					
<b>Bearing capacity under shear load</b>														
All installation conditions	$\gamma_2 = \gamma_{inst}$	[-]	1,0											

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**Performances**

Characteristic values under seismic action (performance category C1) for UPAT anchor rods, standard threaded rods and reinforcing bars

**Annex C 13**

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**Table C19: Characteristic values of resistance for UPAT anchor rods and standard threaded rods in hammer drilled holes under seismic action performance category C2**

Size		M12	M16	M20	M24	
<b>Characteristic bond resistance, combined pullout and concrete cone failure</b>						
<b>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</b>						
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C2}$ [N/mm <sup>2</sup> ]	2,2	3,5	1,8	2,4
	II: 50 °C / 72 °C		2,2	3,5	1,8	2,4
<b>Hammer-drilling with standard drill bit or hollow drill bit (flooded hole)</b>						
Temperature range	I: 35 °C / 60 °C	$\tau_{Rk,C2}$ [N/mm <sup>2</sup> ]	2,3	3,5	1,8	2,1
	II: 50 °C / 72 °C		2,3	3,5	1,8	2,1
<b>Installation safety factors</b>						
<b>Bearing capacity under tensile load</b>						
Dry and wet concrete	$\gamma_2 = \gamma_{inst}$	[-]	1,0		1,2	
Flooded hole			1,2	1,4		
<b>Bearing capacity under shear load</b>						
All installation conditions	$\gamma_2 = \gamma_{inst}$	[-]	1,0			
<b>Displacement-Factors for tensile load<sup>1)</sup></b>						
$\delta_{N,(DLS)-Factor}$	[mm/(N/mm <sup>2</sup> )]	0,09	0,10	0,11	0,12	
$\delta_{N,(ULS)-Factor}$		0,15	0,17	0,17	0,18	
<b>Displacement-Factors for shear load<sup>2)</sup></b>						
$\delta_{V,(DLS)-Factor}$	[mm/kN]	0,18	0,10	0,07	0,06	
$\delta_{V,(ULS)-Factor}$		0,25	0,14	0,11	0,09	

1) Calculation of effective displacement:

$$\delta_{N,(DLS)} = \delta_{N,(DLS)-Factor} \cdot \tau_{Ed}$$

$$\delta_{N,(ULS)} = \delta_{N,(ULS)-Factor} \cdot \tau_{Ed}$$

( $\tau_{Ed}$ : Design value of the applied tensile stress)

2) Calculation of effective displacement:

$$\delta_{V,(DLS)} = \delta_{V,(DLS)-Factor} \cdot V_{Ed}$$

$$\delta_{V,(ULS)} = \delta_{V,(ULS)-Factor} \cdot V_{Ed}$$

( $V_{Ed}$ : Design value of the applied shear force)

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**Performances**

Characteristic values under seismic action (performance category C2) for UPAT anchor rods and standard threaded rods

**Annex C 14**

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