Deutsches Institut für Bautechnik

Member of EOTA
www.eota.eu

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-18/0385 of 6 November 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Upat Injection system UPM 22
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	Upat Vertriebs GmbH Bebelstraße 11 79108 Freiburg im Breisgau DEUTSCHLAND
Manufacturing plant	Upat
This European Technical Assessment contains	18 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-00-0601

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

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

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No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

Specific Part

1 Technical description of the product

The Upat injection system UPM 22 is a bonded anchor consisting of a cartridge with injection mortar Upat UPM 22, Upat UPM 22 Relax or Upat UPM 22 Express 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 resistance to tension load (static and quasi-static loading)	See Annex C 1 to C 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 to C 2
Displacements (static and quasi-static loading)	See Annex C 3
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Hygiene, health and the environment (BWR 3)

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

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

In accordance with the European Assessment Document EAD 330499-00-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

Issued in Berlin on 6 November 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

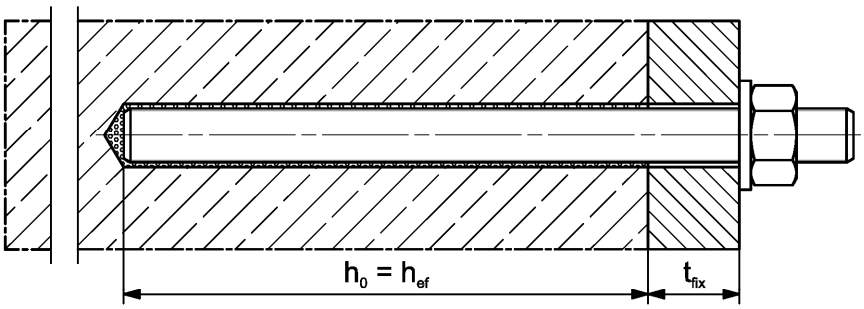
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

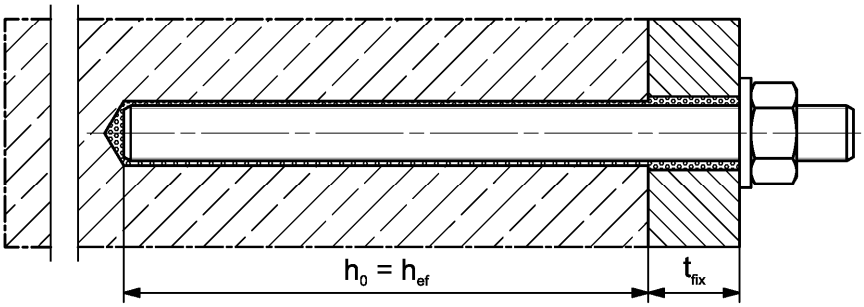
Installation conditions part 1

Upat anchor rod

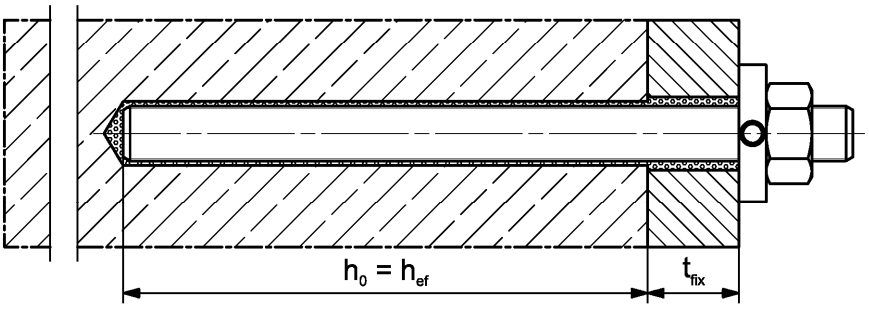
Pre positioned installation



Push through installation (annular gap filled with mortar)



Pre-positioned or push through installation with subsequently pressed filling disk
(annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

Upat injection system UPM 22

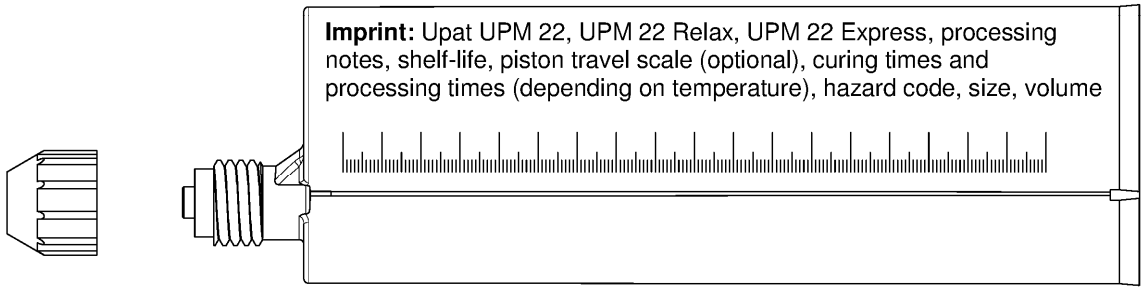
Product description
Installation conditions part 1

Annex A 1

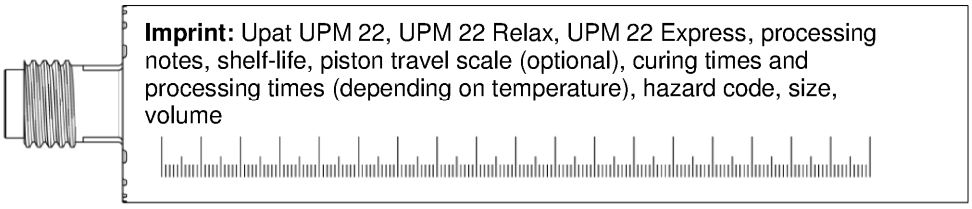
Deutsches Institut für Bautechnik DIBt

Overview system components part 1

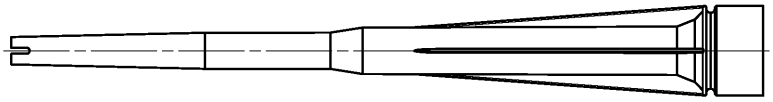
Injection cartridge (shuttle cartridge) with sealing cap; Size: 345 ml, 360 ml, 390 ml, 550 ml, 950 ml, 1500 ml



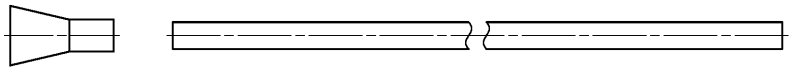
Injection cartridge (coaxial cartridge) with sealing cap; Size: 100 ml, 150 ml, 300 ml, 380 ml, 400 ml, 410 ml



Static mixer Upat MR Plus



Injection adapter and Extension tube for static mixer



Cleaning brush BS / BSB

Blow-out pump

Figures not to scale

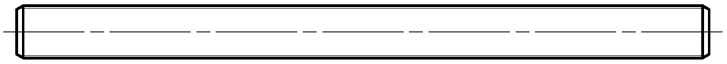
Upat injection system UPM 22	**Annex A 2**
System description Overview system components part 1; cartridges / static mixer / accessories	

Deutsches Institut für Bautechnik DIBt

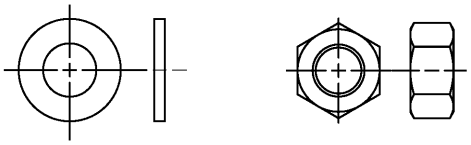
Overview system components part 2

Upat anchor rod

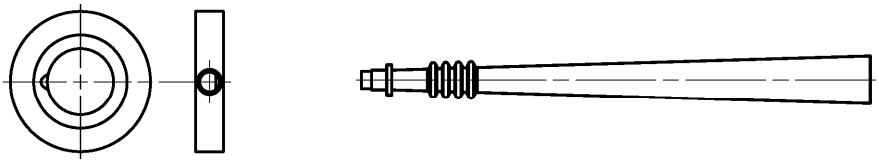
Size: M8, M10, M12, M16, M20 ,M24



washer / hexagon nut



filling disk with injection adapter



Figures not to scale

Upat injection system UPM 22	**Annex A 3**
System description Overview system components part 2; steel components	

Deutsches Institut für Bautechnik DIBt

Table A4.1: Materials

Part	Designation	Material		
1	Injection 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 ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanized ≥ 40 µm EN ISO 10684:2004 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation	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 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation	Property class 50 or 80 EN ISO 3506-1:2009 or property class 70 with f_{yk}= 560 N/mm² 1.4565; 1.4529; EN 10088-1:2014 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 µm 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 ≥ 5 µm, ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 µm 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	filling disk similar to DIN 6319-G	zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 µm 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

Upat injection system UPM 22

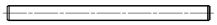
Product description
Materials

Annex A 4

Deutsches Institut für Bautechnik DIBt

Specifications of intended use (part 1)

Table B1.1: Overview use and performance categories

Anchorages subject to			**Upat UPM 22, UPM 22 Relax, UPM 22 Express with …**	
			Anchor rod 	
Hammer drilling with standard drill bit			all sizes	
Hammer drilling with hollow drill bit (fischer FHD Heller "Duster Expert"; Bosch „Speed Clean“; Hilti "TE-CD, TE-YD") 			Nominal drill bit diameter (d_0) 12 mm to 28 mm	
Static and quasi static load, in		uncracked concrete	all sizes	Tables: C1.1 C2.1 C3.1 C3.2
Use category	I1	dry or wet concrete	all sizes	
	I2	Flooded hole	M12 to M24 [1)]	
Installation direction			D3 (downward and horizontal and upwards (e.g. overhead) installation)	
Installation temperature			$T_{i,min}$ = 0 °C to $T_{i,max}$ = +40 °C	
In-service temperature		Temperature range I	-40 °C to +80 °C	(max. short term temperature +80 °C ; max. long term temperature +50 °C)

[1)] Only with coaxial cartridge: 380 ml, 400 ml, 410 ml

Upat injection system UPM 22	**Annex B 1**
Intended use Specifications (part 1)	

Deutsches Institut für Bautechnik DIBt

Specifications of intended use (part 2)

Base materials:

- Reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013

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 are designed in accordance with FprEN 1992-4:2017 and EOTA Technical Report TR 055

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

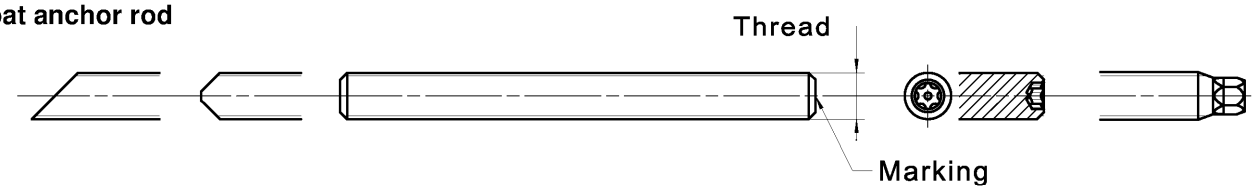
Upat injection system UPM 22	**Annex B 2**
Intended use Specifications (part 2)	

Deutsches Institut für Bautechnik DIBt

Table B3.1: Installation parameters plus minimum spacing and minimum edge distance for anchor rods

Anchor rods			**Thread**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Width across flats		SW		13	17	19	24	30	36
Nominal drill hole diameter		d_0		10	12	14	18	24	28
Drill hole depth		h_0		$h_0 = h_{ef}$					
Effective embedment depth		$h_{ef,\,min}$		60	60	70	80	90	96
		$h_{ef,\,max}$		160	200	240	320	400	480
Minimum spacing and minimum edge distance		s_{min} = c_{min}	[mm]	40	45	55	65	85	105
Diameter of the clearance hole of the fixture	pre positioned installation	d_f		9	12	14	18	22	26
	push through installation	d_f		11	14	16	20	26	30
Minimum thickness of concrete member		h_{min}		h_{ef} + 30 (≥ 100)			h_{ef} + $2d_0$		
Maximum torque moment for attachment of the fixture		max T_{fix}	[Nm]	10	20	40	60	120	150

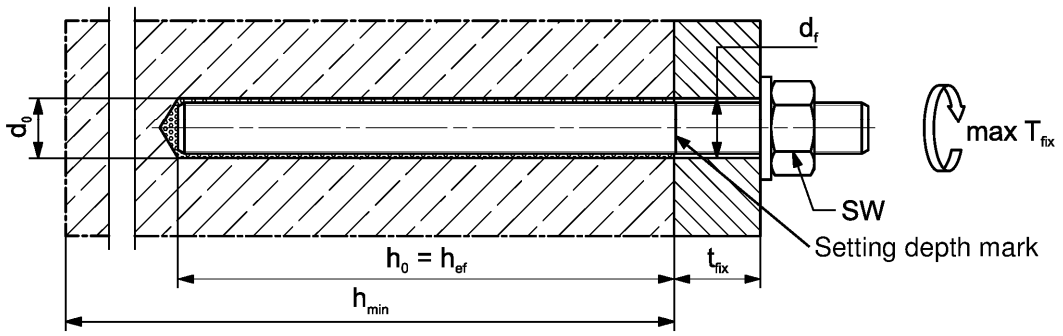
Upat anchor rod



Marking (on random place) Upat anchor rod:

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

Installation conditions:



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

- Materials, dimensions and mechanical properties according to Annex A 4, Table A4.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- Setting depth is marked

Figures not to scale

Upat injection system UPM 22

Intended use
Installation parameters anchor rods

Annex B 3

Deutsches Institut für Bautechnik DIBt

Table B4.1: Parameters of the cleaning brush BS (steel brush)

The size of the cleaning brush refers to the drill hole diameter

Nominal drill hole diameter	d_0	[mm]	10	12	14	18	24	28
Steel brush diameter	d_b		11	14	16	20	26	30

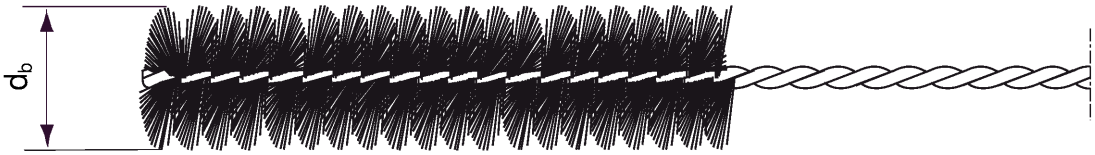


Table B4.2 Maximum processing time of the mortar and minimum curing time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]			Maximum processing time t_{work}			Minimum curing time [1] t_{cure}		
			UPM 22 Express	UPM 22	UPM 22 Relax	UPM 22 Express	UPM 22	UPM 22 Relax
>±0	to	+5	5 min	13 min	---	3 h	3 h	6 h
>+5	to	+10	3 min	9 min	20 min	50 min	90 min	3 h
>+10	to	+20	1 min	5 min	10 min	30 min	60 min	2 h
>+20	to	+30	---	4 min	6 min	---	45 min	60 min
>+30	to	+40	---	2 min	4 min	---	35 min	30 min

[1] In wet concrete or water filled holes the curing times must be doubled

Upat injection system UPM 22

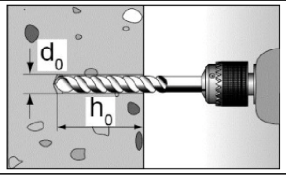
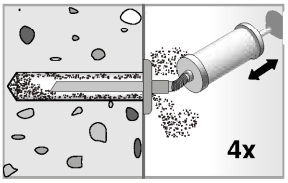
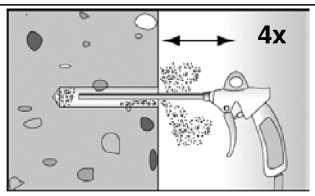
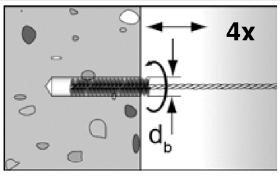
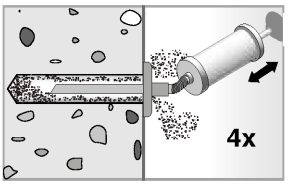
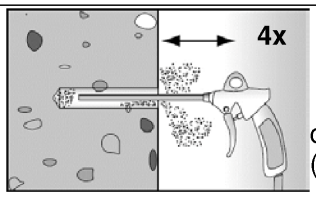
Intended use
Cleaning brush (steel brush)
Processing time and curing time

Annex B 4

Deutsches Institut für Bautechnik DIBt

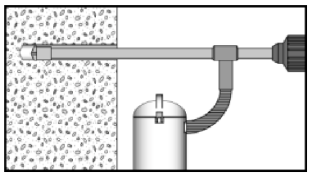
Installation instructions part 1

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

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **tables B3.1**
2		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand  For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar)
3		Brush the drill hole four times. For deep holes use an extension. Corresponding brushes see **table B4.1**
4		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand  For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar)

Go to step 5

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

1		Check a suitable hollow drill (see **table B1.1**) for correct operation of the dust extraction
2		Use a suitable dust extraction system, e. g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **table B3.1**

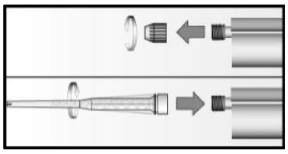
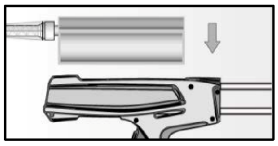
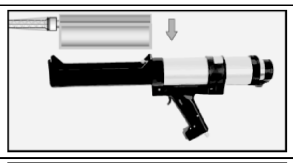
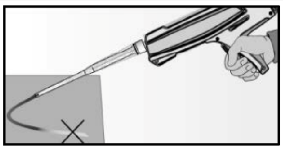
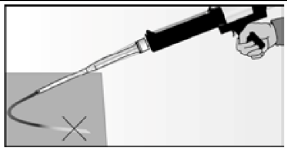
Go to step 5

Upat injection system UPM 22	**Annex B 5**
Intended use Installation instructions part 1	

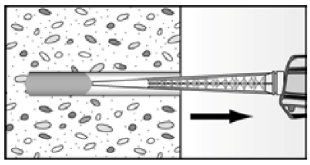
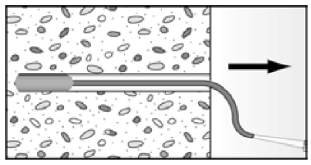
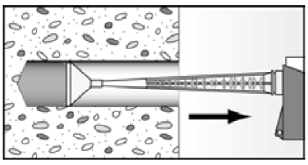
Deutsches Institut für Bautechnik DIBt

Installation instructions part 2

Preparing the cartridge

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

Injection of the mortar

8			
	Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles	For drill hole depth ≥ 150 mm use an extension tube	For overhead installation, deep holes (h_0 > 250 mm) use an injection-adapter

Upat injection system UPM 22

Intended use
Installation instructions part 2

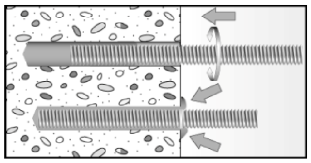
Annex B 6

Deutsches Institut für Bautechnik DIBt

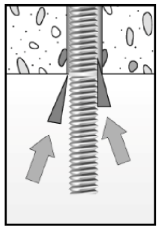
Installation instructions part 3

Installation of anchor rods

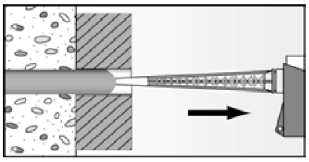
9



Only use clean and oil-free anchor elements.
Mark the setting depth of the anchor. Push the anchor rod 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.



For overhead installations support the anchor rod with wedges.
(e. g. centering wedges)

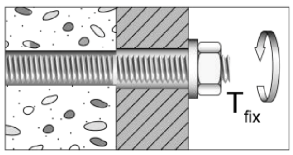


For push through installation fill the annular gap with mortar

10

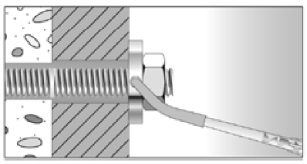
Wait for the specified curing time t_{cure} see **table B4.2**

11



Mounting the fixture
max T_{fix} see **tables B3.1**

Option



After the minimum curing time is reached, the gap between anchor and fixture (annular clearance) may be filled with mortar via the filling disc.
Compressive strength ≥ 50 N/mm² (e.g. Upat injection mortars UPM 44, UPM 33, UPM 22)
ATTENTION: Using filling disk reduces t_{fix} (usable length of the anchor)

Upat injection system UPM 22

Intended use
Installation instructions part 3

Annex B 7

Deutsches Institut für Bautechnik DIBt

Table C1.1: Essential characteristic for the **steel bearing capacity** under tensile / shear load of **Upat anchor rods** and **standard threaded rods**

Anchor rod / standard threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Bearing capacity under tensile load, steel failure									
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	5.8	19 (17)	29 (27)	43	79	123	177
			8.8	29 (27)	47 (43)	68	126	196	282
	Stainless steel A4 and high corrosion resistant steel C		50	19	29	43	79	123	177
			70	26	41	59	110	172	247
			80	30	47	68	126	196	282
			[kN]						
Partial factors[1]									
Partial 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[2] / 1,87					
			80	1,60					
			[-]						
Bearing capacity under shear load, steel failure									
without lever arm									
Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	5.8	9 (8)	15 (13)	21	39	61	89
			8.8	15 (13)	23 (21)	34	63	98	141
	Stainless steel A4 and high corrosion resistant steel C		50	9	15	21	39	61	89
			70	13	20	30	55	86	124
			80	15	23	34	63	98	141
			[kN]						
Ductility factor			k_7	[-]	1,0				
with lever arm									
Charact. resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	5.8	19 (16)	37 (33)	65	166	324	560
			8.8	30 (26)	60 (53)	105	266	519	896
	Stainless steel A4 and high corrosion resistant steel C		50	19	37	65	166	324	560
			70	26	52	92	232	454	784
			80	30	60	105	266	519	896
			[Nm]						
Partial factors[1]									
Partial 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[2] / 1,56					
			80	1,33					
			[-]						

[1] In absence of other national regulations
[2] Only admissible for steel C, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. Upat anchor rods)
[3] Values in brackets are valid for undersized threaded rods with smaller stress area As for hotdip galvanized standard threaded rods according to EN ISO 10684:2004+AC:2009

Upat injection system UPM 22

Performances
Essential characteristics for the steel bearing capacity of Upat anchor rods and standard threaded rods

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C2.1: Essential characteristics under tensile / shear load

Size				**All sizes**					
Tensile load									
Uncracked concrete	$k_{ucr,N}$	[-]		11,0					
Factors for the compressive strength of concrete > C20/25									
Increasing factor for τ_{Rk}	C25/30	Ψ_c	[-]	1,05					
	C30/37			1,10					
	C35/45			1,15					
	C40/50			1,19					
	C45/55			1,22					
	C50/60			1,26					
Splitting failure									
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		$s_{cr,sp}$		$2\ c_{cr,sp}$					
Concrete cone failure									
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$					
Spacing		$s_{cr,N}$		$2\ c_{cr,N}$					
Shear load									
Robustness factors		γ_{inst}	[-]	1,0					
Concrete pry-out failure									
Factor for pry-out failure		k_8	[-]	2,0					
Concrete edge failure									
The value of $h_{ef}(=l_f)$ under shear load			[mm]	$\min(h_{ef}, 8d)$					
Calculation diameters									
Size				M8	M10	M12	M16	M20	M24
Upat anchor rods and standard threaded rods		d_{nom}	[mm]	8	10	12	16	20	24

Upat injection system UPM 22

Performances
Essential characteristics under tensile / shear load

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3.1: Essential characteristics of **tensile resistance** for **Upat anchor rods** and **standard threaded rods** in hammer drilled holes; **uncracked concrete**

Anchor rod / standard threaded rod			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Combined pullout and concrete cone failure								
Calculation diameter	d	[mm]	8	10	12	16	20	24
Uncracked concrete								
Characteristic bond resistance in uncracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)								
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,0	9,0	9,0	8,5	8,5
Hammer-drilling with standard drill bit or hollow drill bit (flooded hole) [1]								
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	---	---	8,0	8,0	8,0	7,5
Robustness factors								
Dry or wet concrete	γ_{inst}	[-]	1,2					
Flooded hole[1]			---		1,4			

[1] Only with coaxial cartridge: 380 ml, 400 ml, 410 ml

Table C3.2: **Displacements** for **anchor rods**

Anchor rod		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement-Factors for tensile load[1]							
Uncracked concrete; Temperature range I							
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,09	0,09	0,10	0,10	0,10	0,10
$\delta_{N\infty\text{-Factor}}$		0,10	0,10	0,12	0,12	0,12	0,13
Displacement-Factors for shear load[2]							
Uncracked concrete; Temperature range I							
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,11	0,11	0,10	0,10	0,09	0,09
$\delta_{V\infty\text{-Factor}}$		0,12	0,12	0,11	0,11	0,10	0,10

[1] Calculation of effective displacement:

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

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

(τ_{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)

Upat injection system UPM 22

Performances
Essential characteristics of tensile resistance for Upat anchor rod, standard threaded rods (uncracked concrete), Displacement for anchor rods

Annex C 3