Deutsches Institut für Bautechnik DIBt

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment

ETA-17/0197 of 30 January 2023

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 UKA3 Plus
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	20 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601, Edition 04/2020
This version replaces	ETA-17/0197 issued on 3 April 2017

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Specific Part

1 Technical description of the product

The Upat UKA3 Plus is a bonded anchor for use in concrete consisting of a capsule Upat UKA3 Plus and a steel element according to Annex A2.

The capsule Upat UKA3 Plus is placed in the hole and the steel element is driven by machine with simultaneous hammering and turning.

The element is anchored via the bond between steel element, chemical 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 fastener 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 fastener 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 B 3 and B 4, C 1 to C 5
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 to C 3
Displacements under short-term and long-term loading	See Annex C 6
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 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

Issued in Berlin on 30 January 2023 by Deutsches Institut für Bautechnik

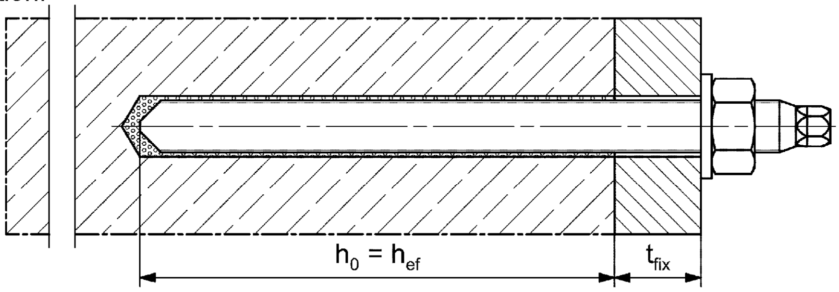
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

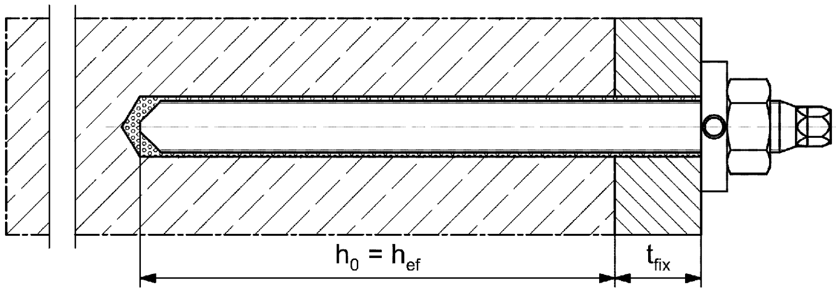
Installation conditions

Upat anchor rod ASTA; installation in concrete

Pre-positioned installation:

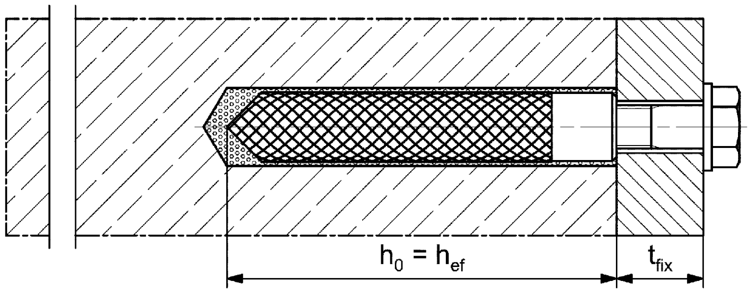


Pre-positioned installation with subsequently injected filling disc:

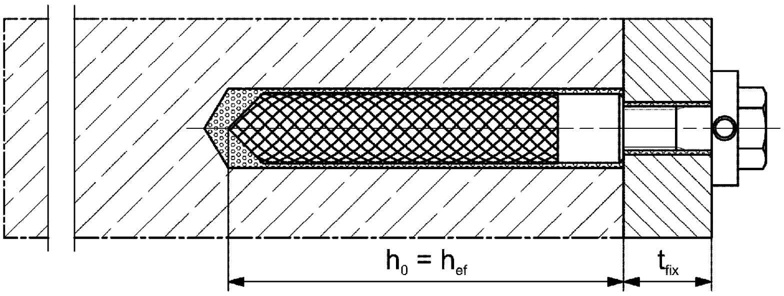


Upat internal threaded anchor IST; installation in concrete

Pre-positioned installation:



Pre-positioned installation with subsequently injected filling disc:



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

Upat UKA3 Plus	**Annex A 1**
Product description Installation conditions	

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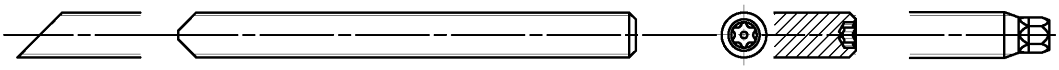
Overview product components

Capsule UKA3 Plus

Size: 8, 10, 12, 16, 16E, 20/22, 24

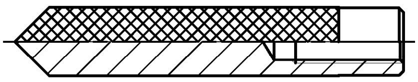
Upat Anchor rod ASTA

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

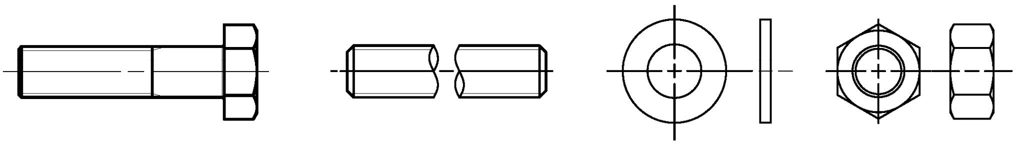


Upat internal threaded anchor IST

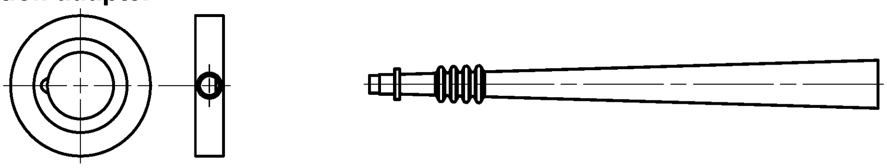
Size: M8, M10, M12, M16, M20



Screw / threaded rod / washer / hexagon nut



Filling disc with injection adapter



Figures not to scale

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Table A3.1: Materials

Part	Designation	Material		
1	Capsule UKA3 Plus	Mortar, hardener, filler		
	Steel grade	Steel zinc plated	Stainless steel R acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A1:2015	High corrosion resistant steel HCR acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015
2	Upat anchor rod ASTA	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009 f_{uk} ≤ 1000 N/mm^2	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462 EN 10088-1:2014 f_{uk} ≤ 1000 N/mm^2	Property class 50 or 80 EN ISO 3506-1:2020 or property class 70 with f_{yk}= 560 N/mm^2 1.4565; 1.4529 EN 10088-1:2014 f_{uk} ≤ 1000 N/mm^2
		Fracture elongation A_5 > 8 %,		
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanized ≥ 40 µm EN ISO10684:2004+AC:2009	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 4, 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised≥ 40 µm EN ISO10684:2004+AC:2009	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4565; 1.4529 EN 10088-1:2014
5	Upat internal threaded anchor IST	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K)	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529 EN 10088-1:2014
6	Commercial standard screw or threaded rod for internal threaded anchor IST	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) fracture elongation A_5 > 8 %	Property class 70 EN ISO 3506-1:2020 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 3506-1:2020 1.4565; 1.4529 EN 10088-1:2014 fracture elongation A_5 > 8 %
7	filling disc	zinc plated ≥ 5 µm, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised ≥ 40 µm EN ISO10684:2004+AC:2009	1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362 EN 10088-1:2014	1.4565;1.4529 EN 10088-1:2014

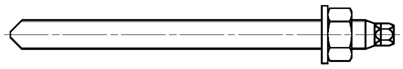
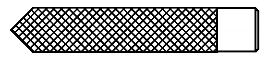
Upat UKA3 Plus

Product description
Materials

Annex A 3

Specifications of intended use part 1

Table B1.1: Overview use and performance categories

Fastenings subject to		**UKA3 Plus with …**			
		Upat anchor rod ASTA 		Upat internal threaded anchor IST 	
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", DreBo „D-Plus“, DreBo „D-Max“) 		Nominal drill bit diameter (d_0) 12 mm to 28 mm		all sizes	
Static and quasi static loading, in	uncracked concrete	all sizes	Tables: C1.1, C3.1, C4.1, C6.1	all sizes	Tables: C2.1, C3.1, C5.1, C6.2
	cracked concrete	M10, M12, M16, M20, M24			
Use category	I1 dry or wet concrete	all sizes		all sizes	
	I2 water filled hole	M12, M16, M20, M24		M8, M10, M16	
Seismic performance category	C1	-[1)]		-[1)]	
	C2				
Installation direction		D3 (downward and horizontal and upwards (e.g. overhead) installation)			
Installation temperature		$T_{i,min}$ =-15 °C to $T_{i,max}$ = +40 °C			
In-service temperature	Temperature range I	-40 °C to +40 °C	(max. short term temperature +40 °C and max. long term temperature +24 °C)		
	Temperature range II	-40 °C to +80 °C	(max. short term temperature +80 °C and max. long term temperature +50 °C)		
	Temperature range III	-40 °C to +120 °C	(max. short term temperature +120 °C and max. long term temperature +72 °C)		

[1)] No performance assessed

Upat UKA3 Plus	**Annex B 1**
Intended Use Specifications part 1	

Specifications of intended use part 2

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A 3 Table 3.1.

Design:

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

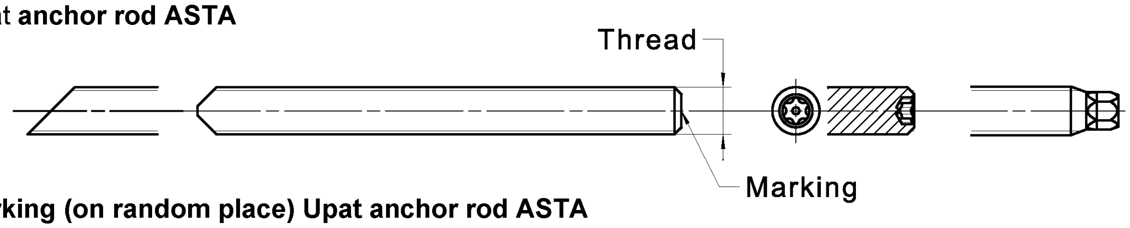
Installation:

- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Fastening depth should be marked and adhered to installation.
- Overhead installation is allowed (necessary equipment see installation instruction).

Upat UKA3 Plus	**Annex B 2**
Intended Use Specifications part 2	

Table B3.1: Installation parameters for **Upat anchor rods ASTA**									
Anchor rods ASTA			**thread**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Nominal drill bit diameter		d_0		10	12	14	18	25	28
Drill hole depth		h_0		$h_0 = h_{ef}$					
Effective embedment depth		h_{ef}		80	90	110	125	170	210
Minimum spacing and minimum edge distance		$s_{min} = c_{min}$		40	45	55	65	85	105
Diameter of clearance hole in the fixture	pre-positioned installation	d_f		9	12	14	18	22	26
Minimum thickness of concrete member		h_{min}		h_{ef} + 30 (≥ 100)			$h_{ef} + 2d_0$		
Maximum installation torque		max T_{inst}	[Nm]	10	20	40	60	120	150

Upat **anchor rod ASTA**

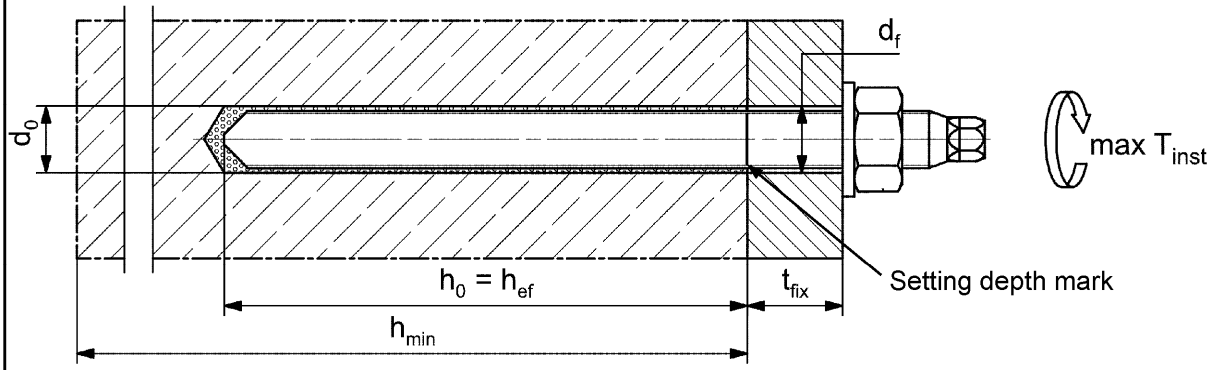


Marking (on random place) Upat anchor rod ASTA

Steel zinc plated PC[1] 8.8	● or **+**	Steel hot-dip PC[1] 8.8	●
High corrosion resistant steel HCR PC[1] 50	●	High corrosion resistant steel HCR PC[1] 70	-
High corrosion resistant steel HCR PC[1] 80	(	Stainless steel R property class 50	~
Stainless steel R property class 80	∗		
Alternatively: Colour coding according to DIN 976-1:2016			

[1] PC = property class

Installation conditions:



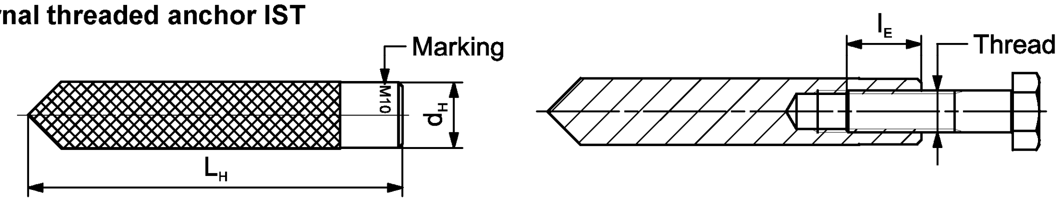
Figures not to scale

Upat UKA3 Plus	**Annex B 3**
Intended Use Installation parameters anchor rods ASTA	

Table B4.1: Installation parameters for **Upat internal threaded anchors IST**

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

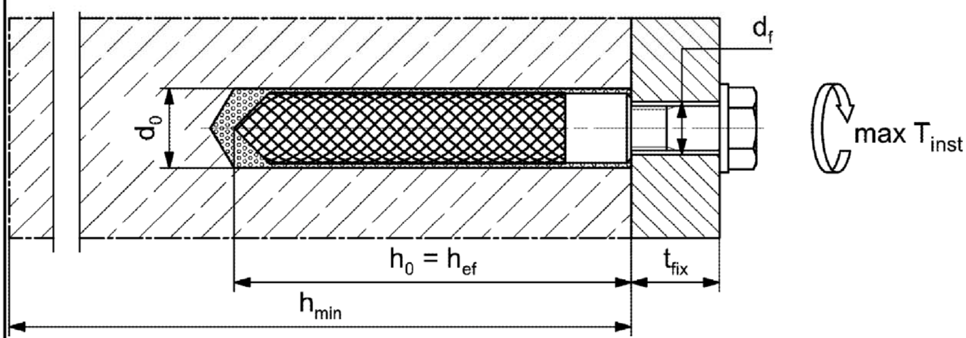
Upat **internal threaded anchor IST**



Marking: Anchor size e. g.: **M10**
Stainless steel → additional **R**; e.g.: **M10 R**
High corrosion resistant steel → additional **HCR**; e.g.: **M10 HCR**

Retaining bolt or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A 3, Table A3.1.

Installation conditions:



Figures not to scale

Upat UKA3 Plus	**Annex B 4**
Intended Use Installation parameters Upat internal threaded anchors IST	

Table B5.1: Dimensions of **resin capsule UKA3 Plus**

Capsule UKA3 Plus			**8**	**10**	**12**	**16**	**16 E**	**20/22**	**24**
Capsule diameter	d_P	[mm]	9,0	10,5	12,5	16,5		23,0	
Capsule length	L_P	[mm]	85	90	97	95	123	160	190

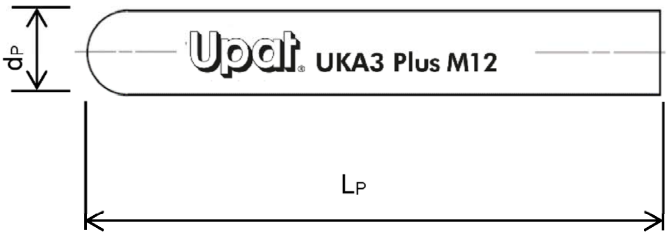


Table B5.2: Assignment of **resin capsule UKA3 Plus** to **Upat anchor rod ASTA**

Anchor rod ASTA			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Effective embedment depth	h_{ef}	[mm]	80	90	110	125	170	210
Related capsule UKA3 Plus		[-]	8	10	12	16	20/22	24

Table B5.3: Assignment of **resin capsule UKA3 Plus** to **the Upat internal threaded anchor IST**

Internal threaded anchor IST			**M8**	**M10**	**M12**	**M16**	**M20**
Effective embedment depth	h_{ef}	[mm]	90	90	125	160	200
Related capsule UKA3 Plus		[-]	10	12	16	16E	24

Table B5.4: Minimum curing time

(During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature; minimal capsule temperature -15 °C)

Concrete temperature [°C]	Minimum curing time t_{cure}
-15 to -10	30 h
> -10 to -5	16 h
> -5 to 0	10 h
> 0 to 5	45 min
> 5 to 10	30 min
> 10 to 20	20 min
> 20 to 30	5 min
> 30 to 40	3 min

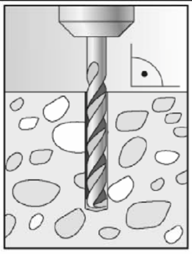
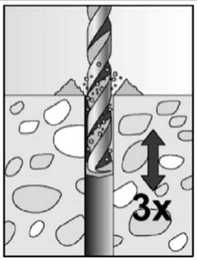
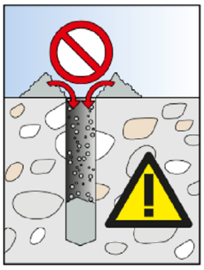
Upat UKA3 Plus

Intended Use
Dimensions of the capsules, Assignment of the capsule to the anchor rod and internal threaded anchor, Minimum curing time

Annex B 5

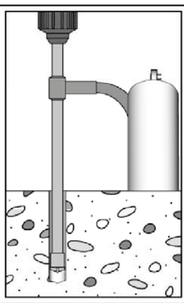
Installation instructions part 1

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

1		Specified drill hole depth **h_0** should be adhered to (e.g. mark on the drill bit). Drill the hole. Drill hole diameter **d_0** and drill hole depth **h_0** see **Tables B3.1, B4.1**
2		When reaching the drill hole depth **h_0** pull out the drill bit whilst power drill is switched on. To reduce the drill dust in the drill hole repeat this step minimum **three times**, beginning from the drill hole bottom (discharging the bore hole)
		Trickling of the bore dust into the drill hole has to be avoided. (e.g. with exhausting the drill dust) Blowing out or brushing the drill hole is not necessary

Go to step 3

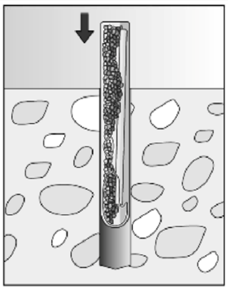
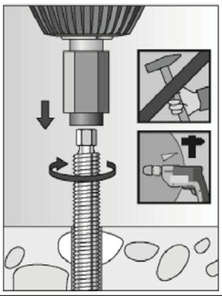
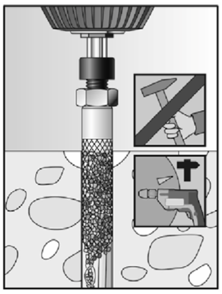
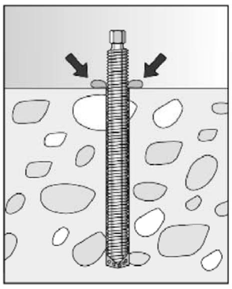
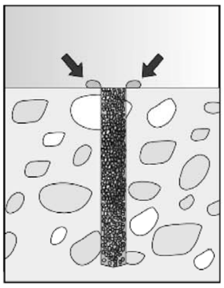
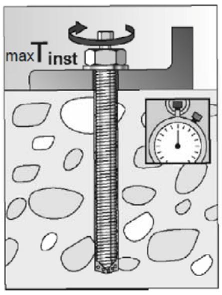
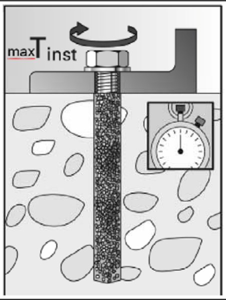
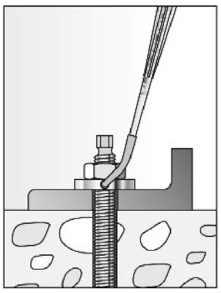
Drilling and cleaning the hole (hammer drilling with hollow drill bit)

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. fischer FVC 35 M 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. Diameter of drill hole **d_0** and drill hole depth **h_0** see **Tables B3.1, B4.1**

Go to step 3

Installation instructions part 2

Installation of capsule UKA3 Plus with Upat anchor rods ASTA or Upat internal threaded anchors IST

3		Push the capsule UKA3 Plus into the drill hole 	Depending on the anchor being installed, use a suitable setting tool (e.g. MW-SDS)
4			Only use clean and oil-free metal parts. Using a suitable adapter, drive the ASTA or internal threaded anchor IST into the capsule using a hammer drill set on rotary hammer action. Stop when the metal part reaches the bottom of the hole and is set to the correct embedment depth
5			When reaching the correct embedment depth, excess mortar must be emerged from the mouth of the drill hole
6			Wait for the specified curing time, t_{cure} see **Table B5.4** Mounting the fixture max T_{inst} see **Table B3.1, B4.1**
Option			After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the filling disc. compressive strength ≥ 50 N/mm^2 (e.g. Upat injection mortars UPM 33, UPM 44, UPM 55, UPM 66)

Upat UKA3 Plus	**Annex B 7**
Intended use Installation instructions part 2	

Deutsches Institut für Bautechnik

DIBt

Table C1.1: Characteristic resistance to **steel failure** under **tension / shear loading** of **Upat anchor rods ASTA**

Anchor rod ASTA					**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic resistance to steel failure under tension loading [2]										
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	[kN]	15(13)	23(21)	33	63	98	141
			5.8		19(17)	29(27)	43	79	123	177
			8.8		29(27)	47(43)	68	126	196	282
	Stainless steel R and high corrosion resistant steel HCR		50		19	29	43	79	123	177
			70		26	41	59	110	172	247
			80		30	47	68	126	196	282
Partial factors [1]										
Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	4.8	[-]	1,50					
			5.8		1,50					
			8.8		1,50					
	Stainless steel R and high corrosion resistant steel HCR		50		2,86					
			70		1,50[3] / 1,87					
			80		1,60					
Characteristic resistance to steel failure under shear loading [2]										
without lever arm										
Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	4.8	[kN]	9(8)	14(13)	20	38	59	85
			5.8		11(10)	17(16)	25	47	74	106
			8.8		15(13)	23(21)	34	63	98	141
	Stainless steel R and high corrosion resistant steel HCR		50		9	15	21	39	61	89
			70		13	20	30	55	86	124
			80		15	23	34	63	98	141
Ductility factor			k_7	[-]	1,0					
with lever arm										
Characteristic. resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	4.8	[Nm]	15(13)	30(27)	52	133	259	448
			5.8		19(16)	37(33)	65	166	324	560
			8.8		30(26)	60(53)	105	266	519	896
	Stainless steel R and high corrosion resistant steel HCR		50		19	37	65	166	324	560
			70		26	52	92	232	454	784
			80		30	60	105	266	519	896
Partial factors [1]										
Partial factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	4.8	[-]	1,25					
			5.8		1,25					
			8.8		1,25					
	Stainless steel R and high corrosion resistant steel HCR		50		2,38					
			70		1,25[3] / 1,56					
			80		1,33					

[1] In absence of other national regulations
[2] Values in brackets are valid for hot dip galvanised anchor rods
[3] Only for ASTA made of high corrosion-resistant steel HCR

Upat UKA3 Plus	**Annex C 1**
Performances Characteristic resistance to steel failure under tension / shear loading of Upat anchor rods ASTA	

Table C2.1: Characteristic resistance to **steel failure** under tension / shear loading of **Upat internal threaded anchors IST**

Internal threaded anchor IST					**M8**	**M10**	**M12**	**M16**	**M20**
Characteristic resistance to steel failure under tension loading									
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	R		26	41	59	110	172
			HCR		26	41	59	110	172
Partial factors[1)]									
Partial factor	$\gamma_{Ms,N}$	Property class	5.8	[-]	1,50				
			8.8		1,50				
		Property class 70	R		1,87				
			HCR		1,87				
Characteristic resistance to steel failure under shear loading									
without lever arm									
Characteristic bearing capacity with screw	$V^0_{Rk,s}$	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	R		12,8	20,3	29,5	54,8	86,0
			HCR		12,8	20,3	29,5	54,8	86,0
Ductility factor			k_7	[-]	1,0				
with lever arm									
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	R		26	52	92	232	454
			HCR		26	52	92	232	454
Partial factors[1)]									
Partial factor	$\gamma_{Ms,V}$	Property class	5.8	[-]	1,25				
			8.8		1,25				
		Property class 70	R		1,56				
			HCR		1,56				

[1)] In absence of other national regulations

Upat UKA3 Plus	**Annex C 2**
Performances Characteristic resistance to steel failure under tension / shear loading of Upat internal threaded anchor IST	

Table C3.1: Characteristic resistance to **concrete failure** under **tension / shear loading**

Size				**All sizes**					
Characteristic resistance to concrete failure under tension loading									
Installation factor		γ_{inst}	[-]	See annex C 4 to C 5					
Factors for the compressive strength of concrete > C20/25									
Increasing factor ψ_c for cracked or uncracked concrete $\tau_{Rk} = \psi_c \cdot \tau_{Rk}$ (C20/25)		C25/30	[-]	1,02					
		C30/37		1,04					
		C35/45		1,07					
		C40/50		1,08					
		C45/55		1,09					
		C50/60		1,10					
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									
Uncracked concrete		$k_{ucr,N}$	[-]	11,0					
Cracked concrete		$k_{cr,N}$		7,7					
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$					
Spacing		$s_{cr,N}$		$2\ c_{cr,N}$					
Factors for sustained tension loading									
Factor		ψ^0_{sus}	[-]	-[2]					
Characteristic resistance to concrete failure under shear loading									
All installation conditions		γ_{inst}	[-]	1,0					
Concrete pry-out failure									
Factor for pry-out failure		k_8	[-]	2,0					
Concrete edge failure									
Effective length of fastener in shear loading		l_f	[mm]	for $d_{nom} \leq 24$ mm: min (h_{ef}; $12\ d_{nom}$)					
Calculation diameters									
Size				M8	M10	M12	M16	M20	M24
Upat anchor rods		d	[mm]	8	10	12	16	20	24
Upat internal threaded anchors IST		d_{nom}		12	16	18	22	28	-[1]

[1] Anchor type not part of the assessment
[2] No performance assessed

Table C4.1: Characteristic resistance to **combined pull-out** and concrete failure for **Upat anchor rods ASTA** in hammer drilled holes; **uncracked or cracked concrete**

Anchor rod ASTA				**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 and wet concrete)									
Tem-perature range	I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	12,5	12,5	12,5	12,5	12,5	12,5
	II: 80 °C / 50 °C			12,0	12,0	12,0	12,0	12,0	12,0
	III: 120 °C / 72 °C			10,5	10,5	10,5	10,5	10,5	10,5
Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)									
Tem-perature range	I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	-[1)]	-[1)]	12,5	12,5	12,5	12,5
	II: 80 °C / 50 °C			-[1)]	-[1)]	12,0	12,0	12,0	12,0
	III: 120 °C / 72 °C			-[1)]	-[1)]	10,5	10,5	10,5	10,5
Installation factors									
Dry and wet concrete		γ_{inst}	[-]	1,2					
Water-filled hole				-[1)]	-[1)]	1,4			
Cracked concrete									
Characteristic bond resistance in cracked concrete C20/25									
Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)									
Tem-perature range	I: 40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1)]	4,5	4,5	4,5	4,5	4,5
	II: 80 °C / 50 °C			-[1)]	4,0	4,0	4,0	4,0	4,0
	III: 120 °C / 72 °C			-[1)]	3,5	3,5	3,5	3,5	3,5
Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)									
Tem-perature range	I: 40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1)]	-[1)]	4,5	4,5	4,5	4,5
	II: 80 °C / 50 °C			-[1)]	-[1)]	4,0	4,0	4,0	4,0
	III: 120 °C / 72 °C			-[1)]	-[1)]	3,5	3,5	3,5	3,5
Installation factors									
Dry and wet concrete		γ_{inst}	[-]	-[1)]	1,2				
Water-filled hole				-[1)]	-[1)]	1,4			

[1)] No performance assessed

Upat UKA3 Plus

Performances
Characteristic resistance to combined pull-out and concrete failure for Upat anchor rod ASTA

Annex C 4

Table C5.1: Characteristic resistance to **combined pull-out** and concrete failure for **Upat internal threaded anchors IST** in hammer drilled holes; **uncracked or cracked concrete**

Internal threaded anchors IST				**M8**	**M10**	**M12**	**M16**	**M20**
Combined pullout and concrete cone failure								
Calculation diameter		d	[mm]	12	16	18	22	28
Uncracked concrete								
Characteristic bond resistance in uncracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)								
Temperature range	I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	11	11	11	11	11
	II: 80 °C / 50 °C			10,5	10,5	10,5	10,5	10,5
	III: 120 °C / 72 °C			9,5	9,5	9,5	9,5	9,5
Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)								
Temperature range	I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	11	11	-[1)]	11	-[1)]
	II: 80 °C / 50 °C			10,5	10,5	-[1)]	10,5	-[1)]
	III: 120 °C / 72 °C			9,5	9,5	-[1)]	9,5	-[1)]
Installation factors								
Dry and wet concrete		γ_{inst}	[-]	1,2				
Water-filled hole				1,4		-[1)]	1,4	-[1)]
Cracked concrete								
Characteristic bond resistance in cracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)								
Temperature range	I: 40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	4,5	4,5
	II: 80 °C / 50 °C			4,0	4,0	4,0	4,0	4,0
	III: 120 °C / 72 °C			3,5	3,5	3,5	3,5	3,5
Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)								
Temperature range	I: 40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	-[1)]	4,5	-[1)]
	II: 80 °C / 50 °C			4,0	4,0	-[1)]	4,0	-[1)]
	III: 120 °C / 72 °C			3,5	3,5	-[1)]	3,5	-[1)]
Installation factors								
Dry and wet concrete		γ_{inst}	[-]	1,2				
Water-filled hole				1,4		-[1)]	1,4	-[1)]

[1)] No performance assessed

Table C6.1: Displacements for Upat anchor rods ASTA

Anchor rod ASTA		M8	M10	M12	M16	M20	M24
Displacement-Factors for tension loading[1)]							
Uncracked or cracked concrete; Temperature range I, II, III							
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,07	0,08	0,09	0,10	0,11	0,12
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	0,13	0,14	0,15	0,17	0,17	0,18
Displacement-Factors for shear loading[2)]							
Uncracked or cracked concrete; Temperature range I, II, III							
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,18	0,15	0,12	0,09	0,07	0,06
$\delta_{V\infty\text{-Factor}}$	[mm/kN]	0,27	0,22	0,18	0,14	0,11	0,09

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

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

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

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

V = acting shear loading

Table C6.2: Displacements for Upat internal threaded anchors IST

Internal threaded anchor IST		M8	M10	M12	M16	M20
Displacement-Factors for tension loading[1)]						
Uncracked or cracked concrete; Temperature range I, II, III						
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,09	0,10	0,10	0,11	0,19
$\delta_{N\infty\text{-Factor}}$	[mm/(N/mm²)]	0,13	0,15	0,15	0,17	0,19
Displacement-Factors for shear loading[2)]						
Uncracked or cracked concrete; Temperature range I, II, III						
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,12	0,09	0,08	0,07	0,05
$\delta_{V\infty\text{-Factor}}$	[mm/kN]	0,18	0,14	0,12	0,10	0,08

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

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

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

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

V = acting shear loading

Upat UKA3 Plus	**Annex C 6**
Performances Displacements for anchor rods ASTA and Upat internal threaded anchors IST	