Deutsches Institut für Bautechnik

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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-17/0288 of 22 August 2017

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 Sleeve Anchor UHS, UHS-I
Product family to which the construction product belongs	Torque-controlled expansion anchor for use in concrete
Manufacturer	Upat Vertriebs GmbH Bebelstraße 11 79108 Freiburg im Breisgau DEUTSCHLAND
Manufacturing plant	Upat
This European Technical Assessment contains	22 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	European Assessment Document (EAD) 330232-00-0601

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Specific Part

1 Technical description of the product

The Upat Sleeve Anchor UHS, UHS-I is an anchor made of galvanised steel (sizes with external diameter 10, 12, 15, 18, 24, 28 and 32, sizes with internal thread 12/M6 I, 12/M8 I, 15/M10 I and 15/M12 I) or stainless steel (sizes with external diameter 10, 12, 15, 18 and 24, sizes with internal thread 12/M6 I, 12/M8 I, 15/M10 I and 15/M12 I) which is placed into a drilled hole and anchored by torque-controlled expansion.

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 for static and quasi static	See Annex C 1 to C 4
Characteristic resistance for seismic performance categories C1	See Annex C 7
Displacements under tension and shear loads	See Annex C 7 and C 8

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	See Annex C 5 and C 6

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

In accordance with European Assessment Documents EAD No. 330232-00-0601 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

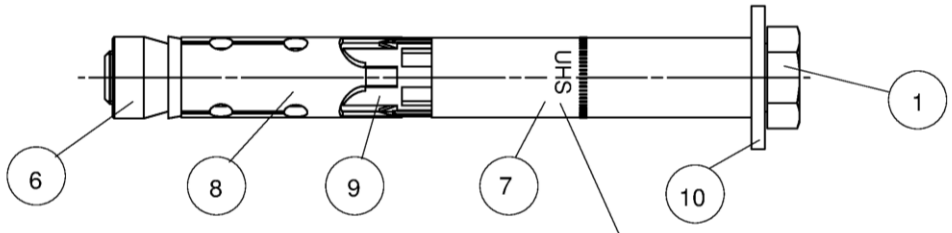
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 22 August 2017 by Deutsches Institut für Bautechnik

Lars Eckfeldt
p.p. Head of Department

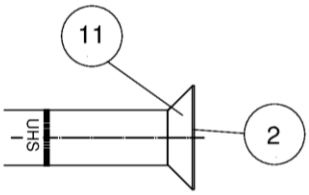
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

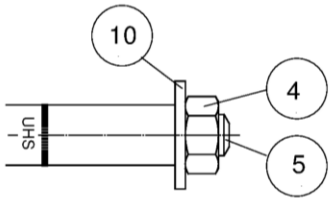


Type hexagon screw S
UHS 10 - 32 S
UHS 10 - 24 S A4

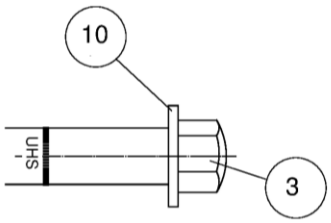
Marking: Identifying mark of the producer, anchor identity
nominal drill hole diameter / max. thickness of fixture
e. g. UHS 15/25 A4



Type countersunk screw **SK**
UHS 10 - 18 SK
UHS 10 - 18 SK A4

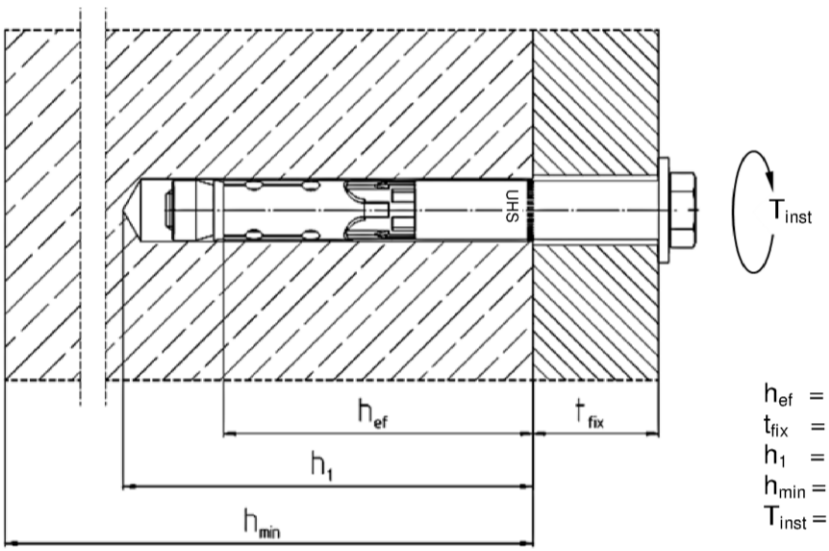


Type hexagon nut **B**
UHS 10 - 32 B
UHS 10 - 24 B A4



Type cap nut **H**
UHS 10 - 24 H
UHS 10 - 24 H A4

1	Hexagon screw	5	Threaded rod	9	Plastic sleeve
2	Countersunk screw	6	Cone nut	10	Washer
3	Cap nut	7	Distance sleeve	11	Conical washer
4	Hexagon nut	8	Expansion sleeve		



h_{ef} = Effective anchorage depth
t_{fix} = Thickness of fixture
h_1 = Drill hole depth
h_{min} = Minimal member thickness
T_{inst} = Installation torque

Upat Sleeve Anchor UHS, UHS-I

Product description
Installed condition and Anchor types UHS, UHS A4

Annex A 1

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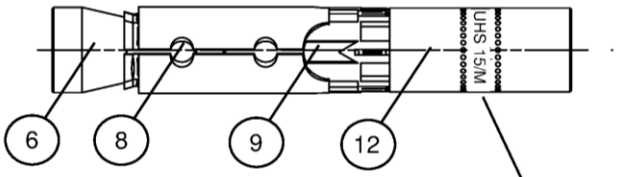
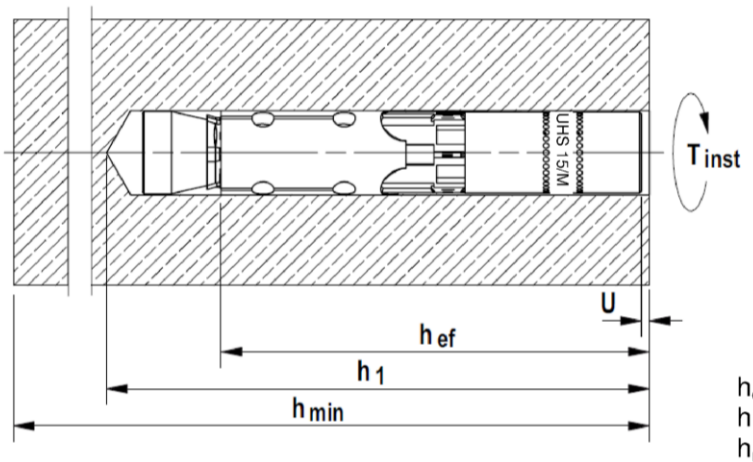
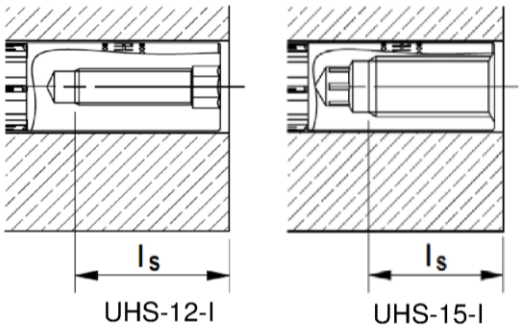
UHS 12 M6 I (A4)
UHS 12 M8 I (A4)
UHS 15 M10 I (A4)
UHS 15 M12 I (A4)



6 Cone nut
8 Expansion sleeve
9 Plastic sleeve
12 Internal thread bolt

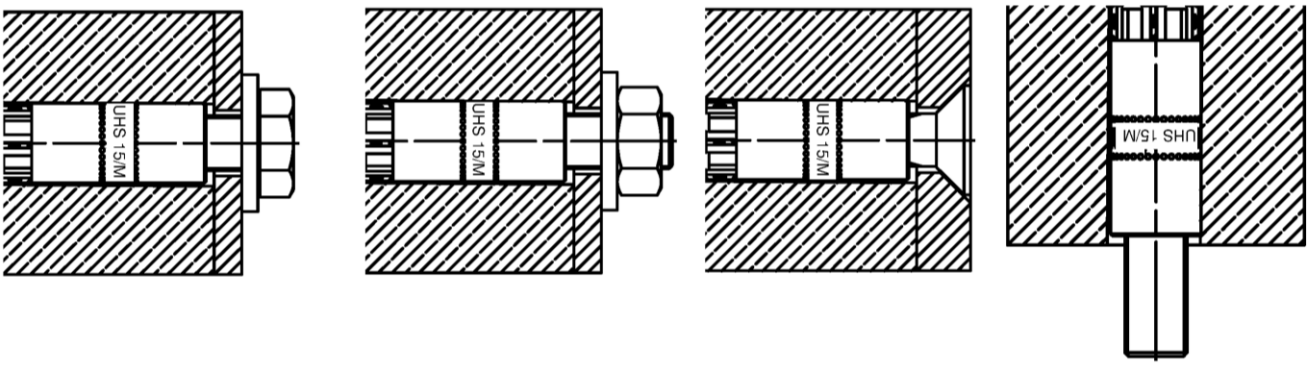
Marking: Identifying mark of the producer, anchor identity
nominal drill hole diameter / size of internal thread
e. g. UHS 15/M12 I A4





h_{ef} = Effective anchorage depth
h_1 = Drill hole depth
h_{min} = Minimal member thickness
T_{inst} = Installation torque
l_s = Screw in depth
U = Gab to concrete surface

Example of possible Applications UHS-I and UHS-I A4



Upat Sleeve Anchor UHS, UHS-I

Product description
Installed condition and Anchor types UHS-I, UHS-I A4

Annex A 2

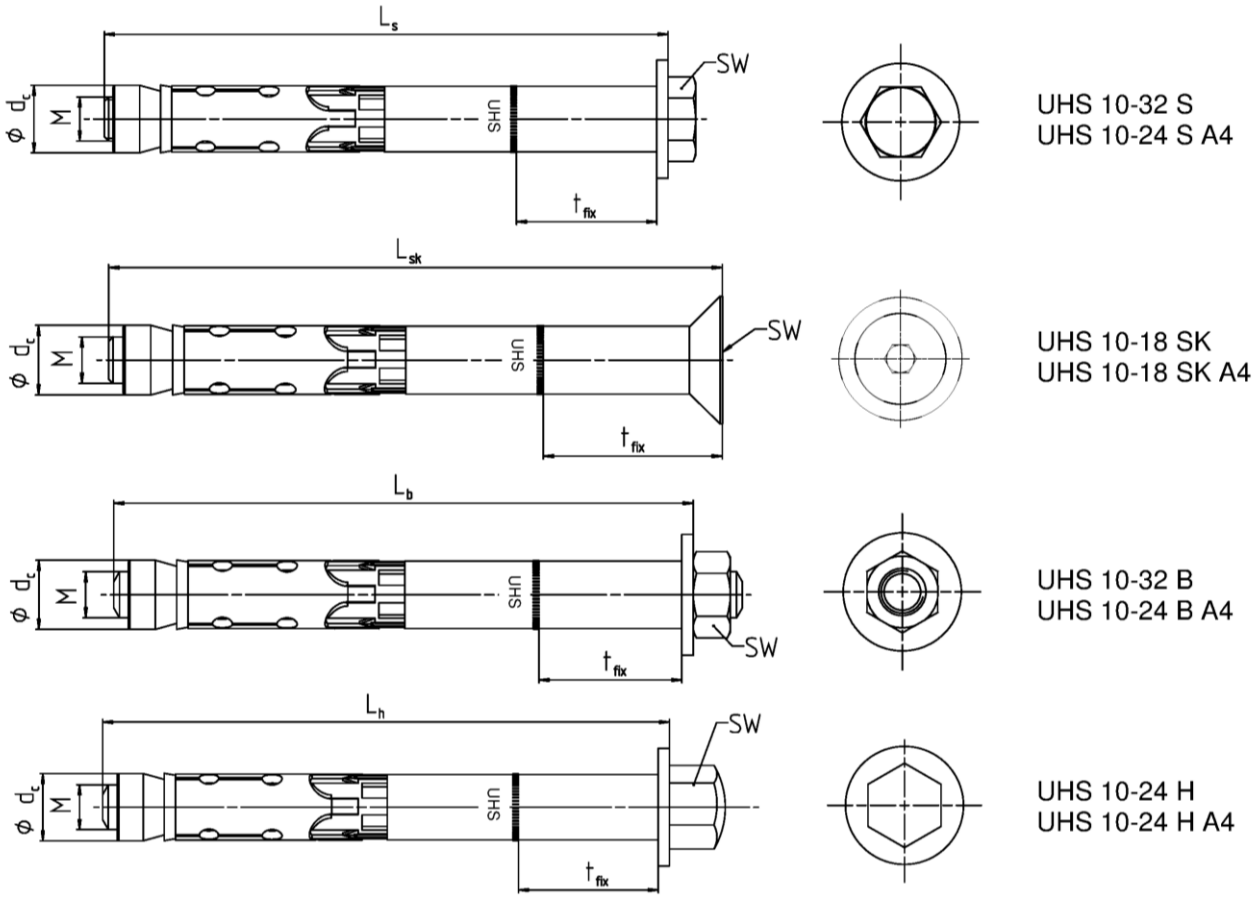


Table A1: Anchor Dimensions [mm] UHS and UHS A4

Anchor type UHS S, SK, B, H and UHS S, SK, B, H A4			**UHS 10**	**UHS 12**	**UHS 15**	**UHS 18**	**UHS 24**	**UHS 28**	**UHS 32**
Thread	M	=	6	8	10	12	16	20	24
Diameter conical nut	d_c	=	10	12	14,8	17,8	23,7	27,5	31,5
Wrench size SW UHS	UHS S, B	=	10	13	17	19	24	30	36
	UHS SK [1]		4	5	6	8	-	-	-
	UHS H		13	17	17	19	24	-	-
Wrench size SW UHS A4	UHS S, B, H A4		10	13	17	19	24	-	-
	UHS SK A4 [1]		4	5	6	8	-	-	-
t_{fix} UHS + UHS A4 S, B, H	min	≥	0	0	0	0	0	0	0
$t_{fix, red}$ UHS SK + UHS SK A4 [2]	min	≥	5	6	6	8	-	-	-
t_{fix} UHS + UHS A4	max	≤	250	250	300	350	400	500	500
Length of screw / bolt	L_s, L_h, L_b (- t_{fix})	≥	49	74	89	99	124	149	174
Length of countersunk screw	L_{sk} (- t_{fix})	≥	54	79	95	107	-	-	-

[1] Internal hexagon
[2] The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is taken into account, see tables C3 and C4

Upat Sleeve Anchor UHS, UHS-I

Product description
Anchor types and dimensions UHS, UHS A4

Annex A 3

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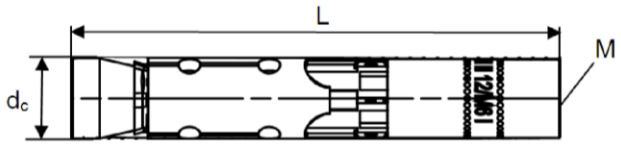

Table A2: Anchor Dimensions [mm] UHS-I and UHS-I A4

Anchor type UHS-I and UHS-I A4			UHS 12/M6 I	UHS 12/M8 I	UHS 15/M10 I	UHS 15/M12 I
Thread	M	=	6	8	10	12
Diameter conical nut	d_c	=	12	12	14,8	14,8
Wrench size internal hexagon		=	6	8	6	8
Anchor length	L	=	77,5	77,5	90	90

Table A3: Material UHS and UHS A4

Nb.	Designation	UHS	UHS A4
1	Hexagon screw	Steel class 8.8; EN ISO 898-1:2013 [1)]	Strength class ≥ 70 EN ISO 3506:2010
2	Countersunk screw	Steel class 8.8; EN ISO 898-1:2013 [1)]	
3	Cap nut	Steel class 8 [1)]	
4	Hexagon nut	Steel class 8 [1)]	
5	Threaded rod	Steel $f_{uk} \geq 800$ N/mm²; $f_{yk} \geq 640$ N/mm² [1)]	
6	Cone nut	Steel EN 10277:2008 [1)]	
7	Distance sleeve	Steel EN 10305:2016 [1)]	EN 10088:2014
8	Expansion sleeve	Steel EN 10139:2016/ EN 10277:2008 [1)]	EN 10088:2014
9	Plastic sleeve	ABS (plastic)	
10	Washer	Steel EN 10139:2016 [1)]	EN 10088:2014
11	Conical washer	Steel EN 10277:2008 [1)]	EN 10088:2014

[1)] Galvanised according to EN ISO 4042:2001, ≥ 5 µm

Table A4: Material UHS-I and UHS-I A4

Nb.	Designation	UHS	UHS A4
6	Cone nut	Steel EN 10277:2008 [1)]	Strength class ≥ 70 EN ISO 3506:2010
8	Expansion sleeve	Steel EN 10139:2016 / EN 10277:2008 [1)]	EN 10088:2014
9	Plastic sleeve	ABS (plastic)	
12	Internal thread bolt	Steel EN 10277:2008 [1)] $f_{uk} \geq 750$ N/mm², $f_{yk} \geq 600$ N/mm²	EN 10088:2014 $f_{uk} \geq 750$ N/mm², $f_{yk} \geq 600$ N/mm²
Requirements for fixing elements		Steel strength class 5.8, 6.8 or 8.8 EN ISO 898-1:2013 [1)]	Steel strength class 50, 70 or 80 EN ISO 3506:2010 1.4362, 1.4401, 1.4404, 1.4571, 1.4529

[1)] Galvanised according to EN ISO 4042:2001, ≥ 5 µm

Upat Sleeve Anchor UHS, UHS-I	**Annex A 4**
Product description Anchor types and dimensions UHS-I, UHS I-A4 Materials	

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Specifications of intended use

Anchorages subject to:

Upat Sleeve Anchor UHS, UHS A4	10	12	15	18	24	28	32
Upat Sleeve Anchor UHS-I, UHS-I A4	-	12	15	-			
Standard anchorage depth	✓						
Static and quasi-static action load	✓						
Cracked and uncracked concrete	✓						
Fire exposure	✓						
Seismic action for Performance Category C1	-	S, B, H, SK	S, B, H, SK	S, B, H, SK	S, B, H	S, B	S, B

Base materials:

- Reinforced and unreinforced normal weight concrete (cracked and uncracked) according to EN 206-1:2000
- Strength classes C20/25 to C50/60 according to EN 206-1:2000

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (UHS, UHS A4, UHS-I, UHS-I A4)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (UHS A4, UHS-I A4)

  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 are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- 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.)
- Design of fastenings according to FprEN 1992-4: 2016 and EOTA Technical Report TR 055

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Hammer or hollow drilling according to Annex B5 and B6
- Drill hole create perpendicular +/- 5° to concrete surface, positioning without damaging the reinforcement

Upat Sleeve Anchor UHS, UHS-I	**Annex B 1**
Intended use Specifications	

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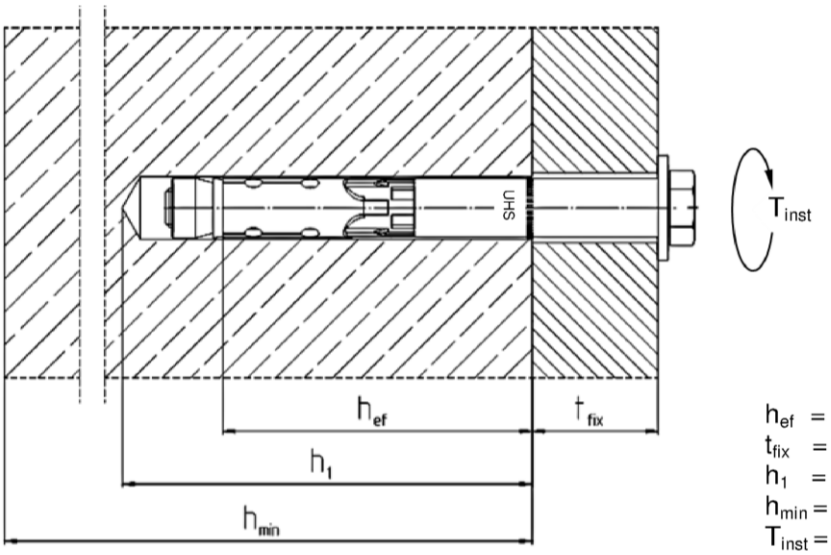

h_{ef} = Effective anchorage depth
t_{fix} = Thickness of fixture
h_1 = Drill hole depth
h_{min} = Minimal member thickness
T_{inst} = Installation torque

Table B1: Installation parameters UHS and UHS A4

Anchor type UHS S, SK, B, H and UHS S, SK, B, H A4			**UHS 10**	**UHS 12**	**UHS 15**	**UHS 18**	**UHS 24**	**UHS 28**	**UHS 32**
Nominal drill hole Diameter	d_0 =	[mm]	10	12	15	18	24	28	32
Maximum diameter of drill bit	d_{cut} ≤	[mm]	10,45	12,50	15,50	18,50	24,55	28,55	32,70
Depth of drill hole	h_1 ≥	[mm]	55	80	90	105	125	155	180
Diameter of clearance hole	d_f ≤	[mm]	12	14	17	20	26	31	35
Diameter of counter sunk	UHS SK UHS SK A4		18	22	25	32	-	-	-
Depth of counter sunk, 90°	UHS SK UHS SK A4		5,0	5,8	5,8	8,0	-	-	-
Required installation torque	UHS S	T_{inst} = [Nm]	10	22,5	40	80	160	180	200
	UHS B	T_{inst} = [Nm]	10	17,5	38	80	120	180	200
	UHS H	T_{inst} = [Nm]	10	22,5	40	80	90	-	-
	UHS SK	T_{inst} = [Nm]	10	22,5	40	80	-	-	-
	UHS S, B, H A4	T_{inst} = [Nm]	15	25	40	100	160	-	-
	UHS SK A4	T_{inst} = [Nm]	10	25	40	100	-	-	-

Upat Sleeve Anchor UHS, UHS-I

Intended Use
Installation instructions UHS, UHS A4

Annex B 2

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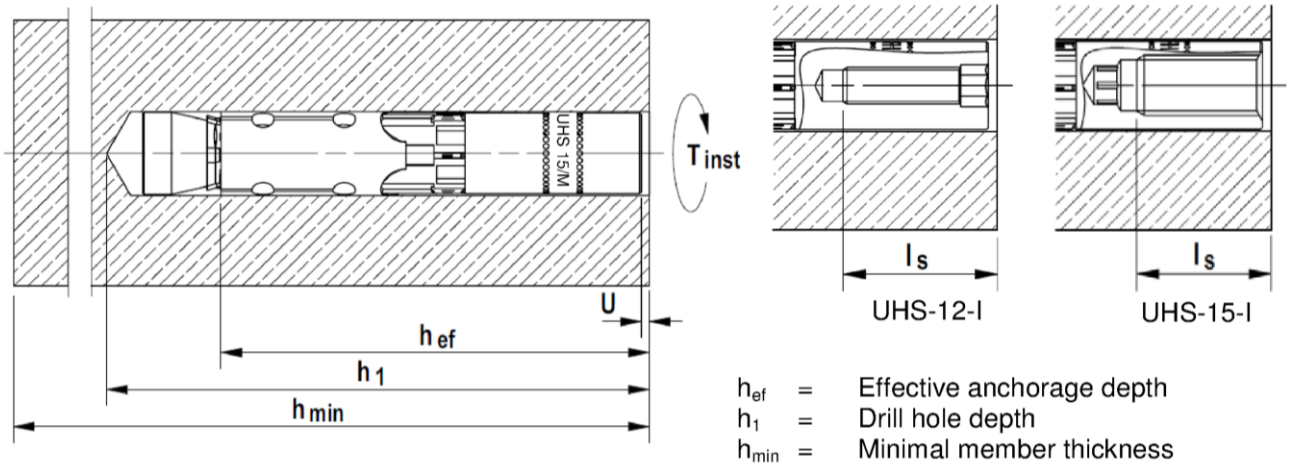

h_{ef} = Effective anchorage depth
h_1 = Drill hole depth
h_{min} = Minimal member thickness
T_{inst} = Installation torque
l_s = Screw in depth
U = Gab to concrete surface

Table B2: Installation parameters UHS-I and UHS-I A4

Anchor type UHS-I and UHS-I A4				UHS 12/M6 I	UHS 12/M8 I	UHS 15/M10 I	UHS 15/M12 I
Nominal drill hole diameter	d_0	=	[mm]	12		15	
Maximum diameter of drill bit	d_{cut}	≤	[mm]	12,50		15,50	
Depth of drill hole	h_1	≥	[mm]	85		95	
Diameter of clearance hole	d_f	≤	[mm]	7	9	12	14
Required gap after torquing[1)]	U	=	[mm]	3-5 mm			
Required installation torque[1)]	T_{inst}	=	[Nm]	15		25	
Minimum screw in length	l_s	≥	[mm]	11+U	13+U	10+U	12+U
Maximum screw in length	l_s	≤	[mm]	20+U			
Maximum torque on fixture in combination with screws and threaded rods strength class ≥ 5.8 and ≥ 50	T_{max}	≤	[Nm]	3	8	15	20

[1)] Only one of both requirements has to be fulfilled

Upat Sleeve Anchor UHS, UHS-I

Intended Use
Installation instructions UHS-I, UHS-I A4

Annex B 3

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Table B3: Minimum thickness of concrete member, minimum spacing and minimum edge distances UHS, UHS A4

Anchor type UHS S, SK, B, H and UHS S, SK, B, H A4		UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Min. member thickness	h_{min} [mm]	80	120	140	160	200	250	300
Minimum spacing, cracked concrete	s_{min} [mm]	50	60	70	80	100	125	150
	for c ≥ [mm]	50	80	120	140	180	200	260
Minimum edge distance, cracked concrete	c_{min} [mm]	50	60	70	80	100	150	150
	for s ≥ [mm]	50	80	120	160	200	220	280
Minimum spacing, uncracked concrete	s_{min} [mm]	50	70	80	90	125	150	175
	for c ≥ [mm]	70	100	100	160	200	220	360
Minimum edge distance, uncracked concrete	c_{min} [mm]	50	70	80	90	125	150	200
	for s ≥ [mm]	70	100	140	200	220	240	380

Intermediate values may be calculated by linear interpolation.

Table B4: Minimum thickness of concrete member, min. spacing and min. edge distances UHS-I, UHS-I A4

Anchor type UHS-I and UHS-I A4		UHS 12/M6 I UHS 12/M8 I	UHS 15/M10 I UHS 15/M12 I
Min. member thickness	h_{min} [mm]	125	150
Minimum spacing, cracked concrete	s_{min} [mm]	60	70
	for c ≥ [mm]	80	120
Minimum edge distance, cracked concrete	c_{min} [mm]	60	70
	for s ≥ [mm]	80	120
Minimum spacing, uncracked concrete	s_{min} [mm]	70	80
	for c ≥ [mm]	100	100
Minimum edge distance, uncracked concrete	c_{min} [mm]	70	80
	for s ≥ [mm]	100	140

Intermediate values may be calculated by linear interpolation.

Table B5: Minimum spacing and minimum edge distances of anchors under **fire exposure**

Anchor type		UHS 10	UHS 12 UHS 12-I	UHS 15 UHS 15-I	UHS 18	UHS 24	UHS 28	UHS 32
Spacing	$\frac{s_{cr,N}}{s_{min}}$ [mm]	4x h_{ef}						
		50	60	70	80	100	125	150
Edge distance	$\frac{c_{cr,n}}{c_{min}}$ [mm]	2 x h_{ef}						
		c_{min} = 2 x h_{ef} , for fire exposure from more than one side $c_{min} \geq$ 300 mm						

Upat Sleeve Anchor UHS, UHS-I

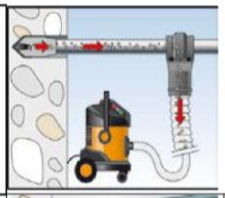
Intended Use
Minimum thickness of member, minimum spacings and edge distances
Minimum spacing and minimum edge distances of anchors under fire exposure

Annex B 4

Deutsches Institut für Bautechnik DIBt

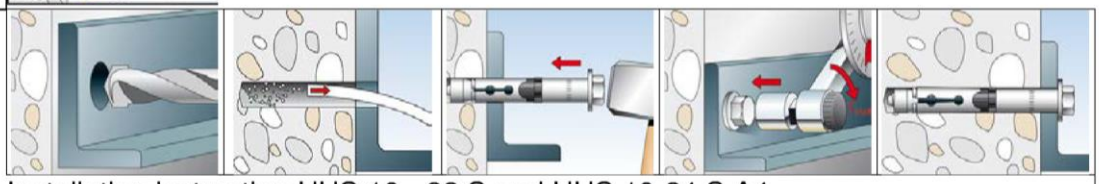
Installation instruction for the Upat Sleeve Anchor
UHS 10 - UHS 32 and UHS 10 A4 - UHS 24 A4

Hollow drilling

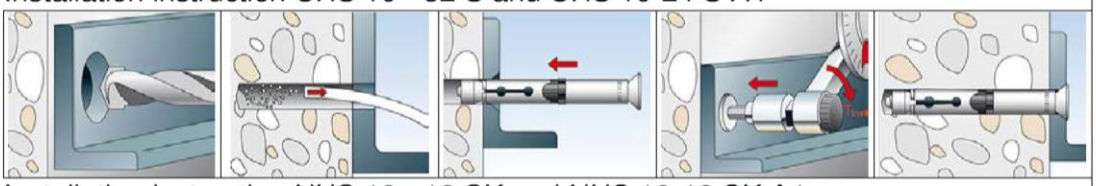


Continue with step 3, 4 and 5

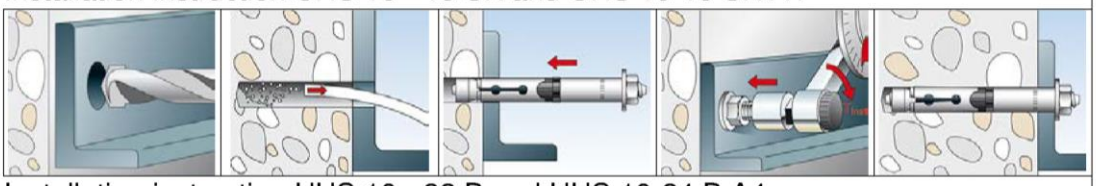
Hammer drilling



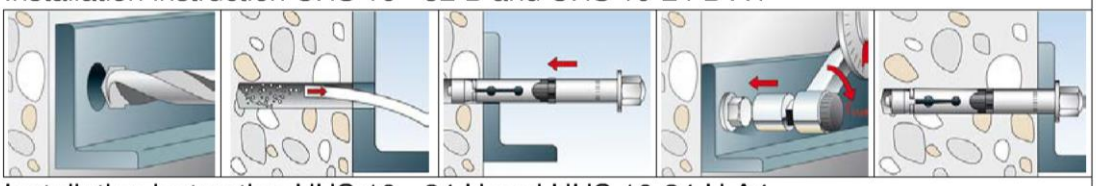
Installation instruction UHS 10 - 32 S and UHS 10-24 S A4



Installation instruction UHS 10 - 18 SK and UHS 10-18 SK A4



Installation instruction UHS 10 - 32 B and UHS 10-24 B A4



Installation instruction UHS 10 - 24 H and UHS 10-24 H A4

Step	1	2	3	4	5

Step	Description	
1	Create drill hole with hammer drill	Create drill hole with hollow drill and vacuum cleaner
2	Clean bore hole	-
3	Set anchor	
4	Expand anchor with prescribed installation torque T_{inst}	
5	Finished installation	

Types of drills	
Hammer drill	
Hollow drill	

Upat Sleeve Anchor UHS, UHS-I

Intended Use
Installation instructions UHS, UHS A4

Annex B 5

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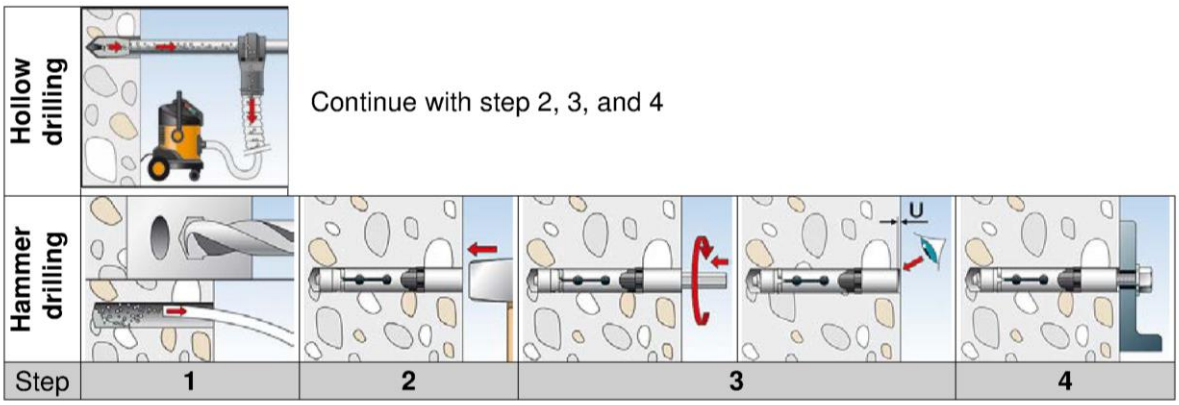
Installation instruction for the Upat Sleeve Anchor internal thread **UHS-I and UHS-I A4**



Step	Description	
1	Create drill hole with hammer drill Clean drill hole	Create drill hole with hollow drill and vacuum cleaner
2	Hammering in the anchor flushed with the surface of the concrete	
3	Tightening the anchor. Tightening with the included hexagon in the package is preferred. Other tightening methods are allowed. Tighten the anchor into the concrete until the gap U is 3-5 mm or the installation torque is reached. Only one requirement has to be fulfilled.	
4	Connecting the fixing and the anchor with a fitting fastener. The length of the fastener should be determined depending on the thickness of fixture t_{fix}, admissible tolerances, and available thread length $l_{s,max}$ and $l_{s,min}$ including the gab U. Tightening the screw with the torque ≤ T_{max}.	

Types of drills	
Hammer drill	
Hollow drill	

Upat Sleeve Anchor UHS, UHS-I	**Annex B 6**
Intended Use Installation instructions UHS-I, UHS I A4	

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Table C1: Characteristic values of **tension** resistance under static and quasi-static action **for UHS and UHS A4**

Anchor type UHS S, SK, B, H and UHS S, SK, B, H A4				UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Steel failure										
UHS	$N_{Rk,s}$		[kN]	16,1	29,3	46,4	67,4	125,3	195,8	282,0
UHS A4	$N_{Rk,s}$		[kN]	14,1	25,6	40,6	59,0	109,7	-	-
Partial sensitivity factor	γ_{Ms} [1]		[-]	1,5						
Pullout failure										
cracked concrete UHS and UHS A4	$N_{Rk,p}$	[kN]	C20/25	6	11	16	25	[2]		
uncracked concrete UHS	$N_{Rk,p}$	[kN]	C20/25	[2]						
uncracked concrete UHS A4	$N_{Rk,p}$	[kN]	C20/25	[2]	18	[2]			–	
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete	ψ_c		C25/30	1,12						
			C30/37	1,23						
			C35/45	1,32						
			C40/50	1,41						
			C45/55	1,50						
			C50/60	1,58						
Installation factor	γ_{inst}		[-]	1,0						
Concrete cone failure and splitting failure										
Effective anchorage depth	h_{ef}		[mm]	40	60	70	80	100	125	150
Factor k_1 for uncracked concrete	$k_{uc,N}$		[-]	11,0						
Factor k_1 for cracked concrete	$k_{cr,N}$		[-]	7,7						
Spacing	$s_{cr,N}$		[mm]	120	180	210	240	300	375	450
Edge distance	$c_{cr,N}$		[mm]	60	90	105	120	150	187,5	225
Spacing (splitting)	$s_{cr,sp}$		[mm]	190	300	320	340	380	480	570
Edge distance (splitting)	$c_{cr,sp}$		[mm]	95	150	160	170	190	240	285
Installation factor	γ_{inst}		[-]	1,0						

[1] In absence of other national regulations
[2] Pullout failure not relevant

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values of resistance under tension loads for UHS and UHS A4

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic values of **tension** resistance under static and quasi-static action **for UHS-I and UHS-I A4**

Anchor type UHS-I and UHS-I A4				UHS 12/M6 I	UHS 12/M8 I	UHS 15/M10 I	UHS 15/M12 I
Steel failure							
Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898							
Strength class 5.8	$N_{Rk,s}$	[kN]		10	19	29	43
Strength class 6.8	$N_{Rk,s}$	[kN]		12	23	35	44
Strength class 8.8	$N_{Rk,s}$	[kN]		16	27	44	44
Partial sensitivity factor	γ_{Ms} [1]	[-]		1,5			
Anchor in combination with screw / threaded rod of stainless steel complying with DIN EN ISO 3506							
Screw/thread strength class 50	$N_{Rk,s}$	[kN]		10	19	29	43
Partial sensitivity factor	γ_{Ms} [1]	[-]		2,86			
Screw/thread strength class 70	$N_{Rk,s}$	[kN]		14	26	41	54
Partial sensitivity factor	γ_{Ms} [1]	[-]		1,87			
Screw/thread strength class 80	$N_{Rk,s}$	[kN]		16	29	46	46
Partial sensitivity factor	γ_{Ms} [1]	[-]		1,60			
Pullout failure							
cracked concrete	$N_{Rk,p}$	[kN]	C20/25	9		12	
uncracked concrete	$N_{Rk,p}$	[kN]	C20/25	18		[2]	
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete	ψ_c		C25/30	1,12			
			C30/37	1,23			
			C35/45	1,32			
			C40/50	1,41			
			C45/55	1,50			
			C50/60	1,58			
Installation factor	γ_{inst}	[-]		1,0			
Concrete cone failure and splitting failure							
Effective anchorage depth	h_{ef}	[mm]		60		70	
Factor k_1 for uncracked concrete	$k_{ucr,N}$	[-]		11,0			
Factor k_1 for cracked concrete	$k_{cr,N}$	[-]		7,7			
Spacing	$s_{cr,N}$	[mm]		180		210	
Edge distance	$c_{cr,N}$	[mm]		90		105	
Spacing (splitting)	$s_{cr,sp}$	[mm]		300		320	
Edge distance (splitting)	$c_{cr,sp}$	[mm]		150		160	
Installation factor	γ_{inst}	[-]		1,0			

[1] In absence of other national regulations
[2] Pullout failure is not decisive

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values of resistance under tension loads for UHS-I and UHS-I A4

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values of **shear** resistance for **UHS and UHS A4** under static and quasi-static action

Anchor type UHS S, SK, B, H and UHS S, SK, B, H A4			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Steel failure without lever arm									
UHS S	$V_{Rk,s}$	[kN]	18	33	59	76	146	174	217
UHS B + UHS H	$V_{Rk,s}$	[kN]	16	27	41	62	119	146	169
UHS S A4, UHS B A4, UHS H A4	$V_{Rk,s}$	[kN]	18	28	43	66	119	-	-
UHS SK for t_{fix} standard	$V_{Rk,s}$	[kN]	18	33	59	76	-	-	-
UHS SK A4 for t_{fix} standard	$V_{Rk,s}$	[kN]	18	28	43	66	-	-	-
t_{fix} standard for UHS SK	t_{fix}	[mm]	≥10	≥10	≥15	≥15	-		-
UHS SK for t_{fix} reduced	$V_{Rk,s}$	[kN]	8	14	23	34	-	-	-
UHS SK A4 for t_{fix} reduced	$V_{Rk,s}$	[kN]	7	13	20	30	-	-	-
t_{fix} reduced for UHS SK	t_{fix}	[mm]	<10	<10	<15	<15	-	-	-
Partial sensitivity factor	γ_{Ms} [1]	[-]	1,25						
Factor for ductility	k_7	[-]	1,0						
Steel failure with lever arm									
Bending UHS	$M^0_{Rk,s}$	[Nm]	12	30	60	105	266	518	896
Bending UHS A4	$M^0_{Rk,s}$	[Nm]	11	26	52	92	232	-	-
Partial sensitivity factor	γ_{Ms} [1]	[-]	1,25						
Concrete pryout failure									
Factor for pry-out	k_8	[-]	1,0	2,0					
Concrete edge failure									
Effective length of anchor	l_f	[mm]	40	60	70	80	100	125	150
Effective diameter of anchor	d_{nom}	[mm]	10	12	15	18	24	28	32
Installation factor	γ_{inst}	[-]	1,0						

[1] In absence of other national regulations

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values of resistance under **shear** loads for UHS and UHS A4

Annex C 3

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic values of **shear** resistance for **UHS-I and UHS-I A4** under static and quasi-static action

Anchor type UHS-I and UHS-I A4			UHS 12/M6 I	UHS 12/M8 I	UHS 15/M10 I	UHS 15/M12 I
Steel failure without lever arm						
Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898						
Strength class 5.8	$V_{Rk,s}$	[kN]	5	9	15	21
Strength class 6.8	$V_{Rk,s}$	[kN]	6	11	18	24
Strength class 8.8	$V_{Rk,s}$	[kN]	8	14	23	24
Partial sensitivity factor	γ_{Ms} [1)]	[-]	1,25			
Factor for ductility	k_7	[-]	1,0			
Anchor in combination with screw / threaded rod of stainless steel complying with DIN EN ISO 3506						
Strength class 50	$V_{Rk,s}$	[kN]	5	9	15	21
Partial sensitivity factor	γ_{Ms} [1)]	[-]	2,38			
Strength class 70	$V_{Rk,s}$	[kN]	7	13	20	30
Partial sensitivity factor	γ_{Ms} [1)]	[-]	1,56			
Strength class 80	$V_{Rk,s}$	[kN]	8	15	23	32
Partial sensitivity factor	γ_{Ms} [1)]	[-]	1,33			
Factor for ductility	k_7	[-]	1,0			
Steel failure with lever arm						
Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898						
Strength class 5.8	$M^0_{Rk,s}$	[Nm]	8	19	37	65
Strength class 6.8	$M^0_{Rk,s}$	[Nm]	9	23	44	78
Strength class 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	105
Partial sensitivity factor	γ_{Ms} [1)]	[-]	1,25			
Factor for ductility	k_7	[-]	1,0			
Anchor in combination with screw / threaded rod of stainless steel complying with DIN EN ISO 3506						
Strength class 50	$M^0_{Rk,s}$	[Nm]	8	19	37	65
Partial sensitivity factor	γ_{Ms} [1)]	[-]	2,38			
Strength class 70	$M^0_{Rk,s}$	[Nm]	11	26	52	92
Partial sensitivity factor			1,56			
Strength class 80	$M^0_{Rk,s}$	[Nm]	12	30	60	105
Partial sensitivity factor	γ_{Ms} [1)]	[-]	1,33			
Factor for ductility	k_7	[-]	1,0			
Concrete pryout failure						
Factor for pry-out	k_8	[-]	2,0			
Concrete edge failure						
Effective length of anchor under	l_f	[mm]	60		70	
Effective diameter of anchor	d_{nom}	[mm]	12		15	
Installation factor	γ_{inst}	[-]	1,0			

[1)] In absence of other national regulations

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values of resistance under **shear** loads for UHS-I and UHS-I A4

Annex C 4

Deutsches Institut für Bautechnik DIBt

Table C5: Characteristic values of **tension** resistance under **fire exposure**

Anchor type	R30 Fire resistance 30 minutes			R60 Fire resistance 60 minutes		
	$N_{Rk,s,fi,30}$ [kN]	$N_{Rk,p,fi,30}$ [kN]	$N^0_{Rk,c,fi,30}$ [kN]	$N_{Rk,s,fi,60}$ [kN]	$N_{Rk,p,fi,60}$ [kN]	$N^0_{Rk,c,fi,60}$ [kN]
UHS 10 (A4)	0,2	1,8	1,8	0,2	1,8	1,8
UHS 12 (A4)	2,0	3,0	5,0	1,3	3,0	5,0
UHS 15 (A4)	3,2	4,0	7,4	2,3	4,0	7,4
UHS 18 (A4)	4,8	6,3	10,3	3,9	6,3	10,3
UHS 24 (A4)	8,9	9,0	18,0	7,3	9,0	18,0
UHS 28	13,9	12,6	31,4	11,3	12,6	31,4
UHS 32	20,0	16,5	49,6	16,3	16,5	49,6
UHS 12/M6 I (A4) 5.8/50[1)]	0,1	2,3	5,0	0,1	2,3	5,0
8.8, 70, 80[1) 2)]	0,2			0,2		
UHS 12/M8 I (A4) 5.8/50[1)]	1,3			0,8		
8.8, 70, 80[1) 2)]	2,0			1,3		
UHS 15/M10 I (A4)5.8/50[1)]	2,0	3,0	7,4	1,4	3,0	7,4
8.8, 70, 80[1) 2)]	3,2			2,3		
UHS 15/M12 I (A4) 5.8/50[1)]	3,0			2,4		
8.8, 70, 80[1) 2)]	4,8			3,9		
	R90 Fire resistance 90 minutes			R120 Fire resistance 120 minutes		
	$N_{Rk,s,fi,90}$ [kN]	$N_{Rk,p,fi,90}$ [kN]	$N^0_{Rk,c,fi,90}$ [kN]	$N_{Rk,s,fi,120}$ [kN]	$N_{Rk,p,fi,120}$ [kN]	$N^0_{Rk,c,fi,120}$ [kN]
UHS 10 (A4)	0,1	1,8	1,8	0,1	1,5	1,5
UHS 12 (A4)	0,6	3,0	5,0	0,2	2,4	4,0
UHS 15 (A4)	1,4	4,0	7,4	1,0	3,2	5,9
UHS 18 (A4)	3,0	6,3	10,3	2,6	5,0	8,2
UHS 24 (A4)	5,6	9,0	18,0	4,8	7,2	14,4
UHS 28	8,8	12,6	31,4	7,5	10,1	25,2
UHS 32	12,6	16,5	49,6	10,8	13,2	39,7
UHS 12/M6 I (A4) 5.8/50[1)]	0,1	2,3	5,0	0,1	1,8	4,0
8.8, 70, 80[1) 2)]	0,1			0,1		
UHS 12/M8 I (A4) 5.8/50[1)]	0,4			0,1		
8.8, 70, 80[1) 2)]	0,6			0,2		
UHS 15/M10 I (A4) 5.8/50[1)]	0,9	3,0	7,4	0,6	2,4	5,9
8.8, 70, 80[1) 2)]	1,4			1,0		
UHS 15/M12 I (A4) 5.8/50[1)]	1,9			1,6		
8.8, 70, 80[1) 2)]	3,0			2,6		

[1)] Intermediate values by linear interpolation
[2)] In combination with screw / threaded rod **s**trength class 8.8, 70, 80

In absence of other national regulations the partial sensitivity factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended.

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values of **tension** resistance under **fire exposure** in cracked and uncracked concrete

Annex C 5

Deutsches Institut für Bautechnik DIBt

Table C6: Characteristic values of **shear** resistance under **fire exposure**

Anchor type	R30 Fire resistance 30 minutes		R60 Fire resistance 60 minutes	
	$V_{Rk,s,fi,30}$ [kN]	$M^0_{Rk,s,fi,30}$ [Nm]	$V_{Rk,s,fi,60}$ [kN]	$M^0_{Rk,s,fi,60}$ [Nm]
UHS 10 (A4)	0,3	0	0,3	0
UHS 12 (A4)	2,0	2	1,3	1
UHS 15 (A4)	3,2	4	2,3	3
UHS 18 (A4)	4,8	7	3,9	6
UHS 24 (A4)	8,9	19	7,3	15
UHS 28	13,9	37	11,3	30
UHS 32	20,0	64	16,3	52
UHS 12/M6 I (A4) 5.8/50	0,2	0	0,2	0
8.8, 70, 80 [1)]	0,3	0	0,3	0
UHS 12/M8 I (A4) 5.8/50	1,3	1	0,8	1
8.8, 70, 80 [1)]	2,0	2	1,3	1
UHS 15/M10 I (A4) 5.8/50	2,0	3	1,4	2
8.8, 70, 80 [1)]	3,2	4	2,3	3
UHS 15/M12 I (A4) 5.8/50	3,0	4	2,4	4
8.8, 70, 80 [1)]	4,8	7	3,9	6
	R90 Fire resistance 90 minutes		R120 Fire resistance 120 minutes	
	$V_{Rk,s,fi,90}$ [kN]	$M^0_{Rk,s,fi,90}$ [Nm]	$V_{Rk,s,fi,120}$ [kN]	$M^0_{Rk,s,fi,120}$ [Nm]
UHS 10 (A4)	0,2	0	0,1	0
UHS 12 (A4)	0,6	1	0,2	0
UHS 15 (A4)	1,4	2	1,0	1
UHS 18 (A4)	3,0	5	2,6	4
UHS 24 (A4)	5,6	12	4,8	10
UHS 28	8,8	23	7,5	20
UHS 32	12,6	40	10,8	34
UHS 12/M6 I (A4) 5.8/50	0,1	0	0,1	0
8.8, 70, 80 [1)]	0,2	0	0,1	0
UHS 12/M8 I (A4) 5.8/50	0,4	1	0,1	0
8.8, 70, 80 [1)]	0,6	1	0,2	0
UHS 15/M10 I (A4) 5.8/50	0,9	2	0,6	1
8.8, 70, 80 [1)]	1,4	3	1,0	1
UHS 15/M12 I (A4) 5.8/50	1,9	4	1,6	3
8.8, 70, 80 [1)]	3,0	6	2,6	4

[1)] In combination with screw / threaded rod **s**trength class 8.8, 70, 80

In absence of other national regulations the partial sensitivity factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended.

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values of shear resistance under **fire exposure**

Annex C 6

Deutsches Institut für Bautechnik DIBt

Table C7: Characteristic values for seismic action valid for performance category C1 for UHS

		UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Steel failure							
Anchor type UHS S, SK, B, H	$N^0_{Rk,s,eq}$ [kN]	29,3	46,4	67,4	125,3	195,8	282,0
Anchor type UHS S, SK, B, H	γ_{Ms} [1] [-]	1,5					
Pullout failure							
Anchor type UHS S, SK, B, H	$N^0_{Rk,p,eq}$ [kN]	12,0	16,0	25,0	36,0	50,3	66,1
Anchor type UHS S, SK, B, H	γ_{Mp} [1] [-]	1,5					
Steel failure without lever arm							
Anchor type UHS S, SK	$V^0_{Rk,s,eq}$ [kN]	25	41	60	123	141	200
Anchor type UHS B, H	$V^0_{Rk,s,eq}$ [kN]	17	30	46	103	117	169
Anchor type UHS S, SK, B, H	γ_{Ms} [1] [-]	1,25					

[1] In absence of other national regulations

Table C8: Displacements due to tension loads for UHS and UHS A4

Anchor type UHS S, SK, B, H and UHS S, SK, B, H A4			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Tension load cracked concrete	N	[kN]	3,6	5,7	7,6	11,9	17,1	24,0	31,5
Corresponding displacements	δ_{N0}	[mm]	1,0	1,0	1,0	1,0	1,0	0,7	0,7
	$\delta_{N\infty}$	[mm]	1,7	1,6	1,6	1,6	1,8	1,3	1,1
Tension load uncracked concrete	N	[kN]	6,0	11,2	14,1	17,2	24,0	33,6	44,2
Corresponding displacements	δ_{N0}	[mm]	0,6	1,0	1,0	1,0	1,0	0,3	0,3
	$\delta_{N\infty}$	[mm]	1,7	1,6	1,6	1,6	1,8	1,3	1,1

Table C9: Displacements due to tension loads for UHS-I and UHS-I A4

Anchor type UHS-I and UHS-I A4		UHS 12/M6 I UHS 12/M8 I	UHS 15/M10 I UHS 15/M12 I
Tension load cracked concrete Tension load uncracked concrete	N [kN]	4,3 9,5	5,7 14,1
Corresponding displacements	δ_{N0} [mm]	1,7	1,9
	$\delta_{N\infty}$ [mm]	2,2	2,9

Upat Sleeve Anchor UHS, UHS-I

Performances
Characteristic values for seismic action valid for performance category C1
Displacements under tension loads

Annex C 7

Deutsches Institut für Bautechnik DIBt

Table C10: Displacements due to shear loads for UHS S and SK [1)]

Anchor type UHS S and UHS SK			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Shear load in cracked and uncracked concrete	V	[kN]	10,3	18,9	33,7	43,4	83,4	99,4	124,0
Corresponding displacements	δ_{V0}	[mm]	2,4	2,7	4,4	5,0	7,0	6,0	8,0
	$\delta_{V\infty}$	[mm]	3,6	4,1	6,6	7,5	10,5	9,0	12,0

[1)] Tolerance of clearance hole not included in the displacements

Table C11: Displacements due to shear loads for UHS B and H [1)]

Anchor type: UHS B and UHS H			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Shear load in cracked and uncracked concrete	V	[kN]	8,9	15,4	23,4	35,4	68,0	83,4	96,6
Corresponding displacements	δ_{V0}	[mm]	2,2	2,3	3,0	5,0	7,0	5,0	5,0
	$\delta_{V\infty}$	[mm]	3,3	3,5	4,5	7,5	10,5	7,5	7,5

[1)] Tolerance of clearance hole not included in the displacements

Table C12: Displacements due to shear loads for UHS S A4, UHS SK A4, UHS B A4 and UHS H A4 [1)]

Anchor type: UHS S A4, UHS SK A4, UHS B A4, UHS H A4			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24
Shear load in cracked and uncracked concrete	V	[kN]	10,3	16,0	24,6	37,7	68,0
Corresponding displacements	δ_{V0}	[mm]	3,5	3,5	3,7	5,7	9,0
	$\delta_{V\infty}$		5,3	5,3	5,6	8,6	13,5

[1)] Tolerance of clearance hole not included in the displacements

Table C13: Displacements due to shear loads for UHS-I and UHS-I A4[1)]

Anchor type UHS-I and UHS-I A4			UHS 12/M6 I	UHS 12/M8 I	UHS 15/M10 I	UHS 15/M12 I
Shear load in cracked and uncracked concrete	V	[kN]	4,6	8,3	13,3	13,7
Corresponding displacements	δ_{V0}	[mm]	2,6	2,6	2,2	2,2
	$\delta_{V\infty}$		3,9	3,9	3,3	3,3

[1)] Tolerance of clearance hole not included in the displacements

Upat Sleeve Anchor UHS, UHS-I

Performances
Displacements under shear loads

Annex C 8