Einfach. Sicher. Upat

DÉCLARATION DES PERFORMANCES

DoP 0207

pour goujon d'ancrage Upat sleeve anchor UHS, UHS-I (fixation mécanique pour utilisation dans le béton) FR

1. Code d'identification unique du type de produit: **DoP 0207**

2. Usage(s) prévu(s): **Fixation dans du béton fissuré ou non fissuré.**
   Voir annexes, en particulier les annexes B1- B6

3. Fabricant: **Upat Vertriebs GmbH, Bebelstraße 11, 79108 Freiburg im Breisgau, Allemagne**

4. Mandataire: **–**

5. Système(s) d'évaluation et de vérification de la constance des performances: **1**

6. Document d'évaluation européen: **EAD 330232-00-0601 (Edition 10/ 2016)**
   Evaluation Technique Européenne: **ETA-17/0288; 2020-09-23**
   Organisme d'évaluation technique: **DIBt- Deutsches Institut für Bautechnik**
   Organisme(s) notifié(s): **1343 MPA Darmstadt / 2873 TU Darmstadt**

7. Performance(s) déclarée(s):

Résistance mécanique et stabilité (BWR 1)

Résistance caractéristique à la charge de traction (charge statique et quasi-statique):	Résistance à la rupture de l'acier (charge de	Annexes	C1, C2	E_S= 210 000 MPa
	Résistance à l'extraction glissement:	Annexes	C1, C2	
	Résistance à la rupture du cône béton:	Annexes	C1, C2	
	Robustesse:	Annexes	C1, C2	
	Distance au bord et entraxe mini.:	Annexe	C7	
	Distance au bord pour éviter la rupture par fendage sous charge:	Annexes	C1, C2	
	Déplacements sous charge statique et quasi-statique:	Annexes	C10, C11	
Résistance caractéristique à la charge de cisaillement (charge statique et quasi-statique):	Résistance à la rupture de l'acier:	Annexes	C3, C4	
	Résistance à la rupture par effet de levier:	Annexes	C3, C4	
	Résistance à la rupture du béton en bord de dalle:	Annexes	C3, C4	
	Déplacements sous charge statique et quasi-statique:	Annexes	C10, C11	
	Durabilité:	Annexes	A4, B1	
Résistance caractéristique et déplacements pour les catégories de performance sismique C1 et C2:	Résistance à la rupture de l'acier:	Annexes	C8, C9	
	Résistance à l'extraction glissement :	Annexes	C8, C9	
	0		>8%	
	Facteur espace annulaire :	Annexes	C8, C9	
	Déplacements:	Annexe	C11	

Sécurité en cas d'incendie (BWR 2)

Réaction au feu:	Classe (A1)		
Résistance au feu:	Résistance en cas d'incendie, rupture de l'acier	Annexe	C5
	Résistance en cas d'incendie, extraction glissement	Annexe	C5
	Résistance en cas d'incendie, rupture de l'acier	Annexe	C6

8. Documentation technique appropriée et/ou documentation technique spécifique: -

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

Signé pour le fabricant et en son nom par:

ppa. Thilo Pregartner, Dr.-Ing.

i.V. P. Schillinger, Dipl.-Ing.

Tumlingen, 2020-10-06

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

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

Specific Part

1 Technical description of the product

The Upat 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 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 C 1, C 2, C 7
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 3 and C 4
Displacements (static and quasi-static loading)	See Annex C 10, C 11
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 8, C 9, C 11
Durability	See Annex B 1

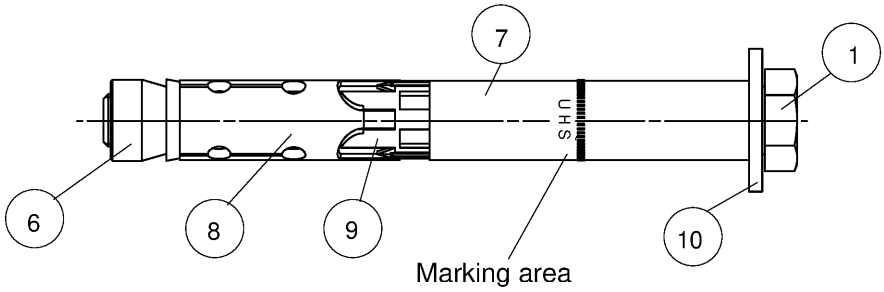
3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 5, C 6

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 330232-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1



Type hexagon screw **S**

UHS 10 - 32 S

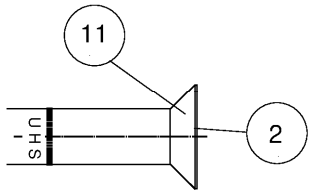
UHS 10 - 24 S R

Product label, example: UHS 15/25 R

Identification R

Type of fastener

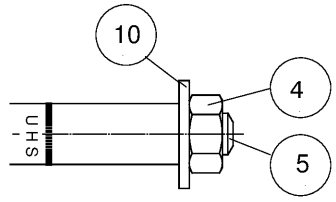
Nominal drill hole diameter/max. thickness of fixture (t_{fix})



Type countersunk screw **SK**

UHS 10 - 18 SK

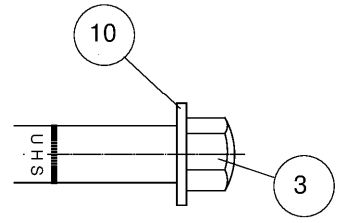
UHS 10 - 18 SK R



Type hexagon nut **B**

UHS 10 - 32 B

UHS 10 - 24 B R

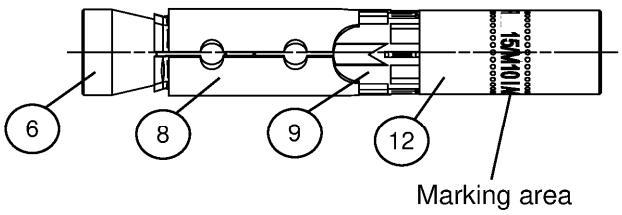


Type cap nut **H**

UHS 10 - 24 H

UHS 10 - 24 H R

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	12	Internal thread socket



Type internal threaded anchor I

UHS 12 M6-I or M8-I

UHS 15 M10-I or M12-I

Product label, example: UHS 12/M8-I R

Identification R

Type of fastener

Nominal drill hole diameter / size of internal thread

(Fig. not to scale)

Upat Sleeve Anchor UHS, UHS-I

Product description

Anchor types UHS, UHS R, UHS-I, UHS-I R

Annex A 1

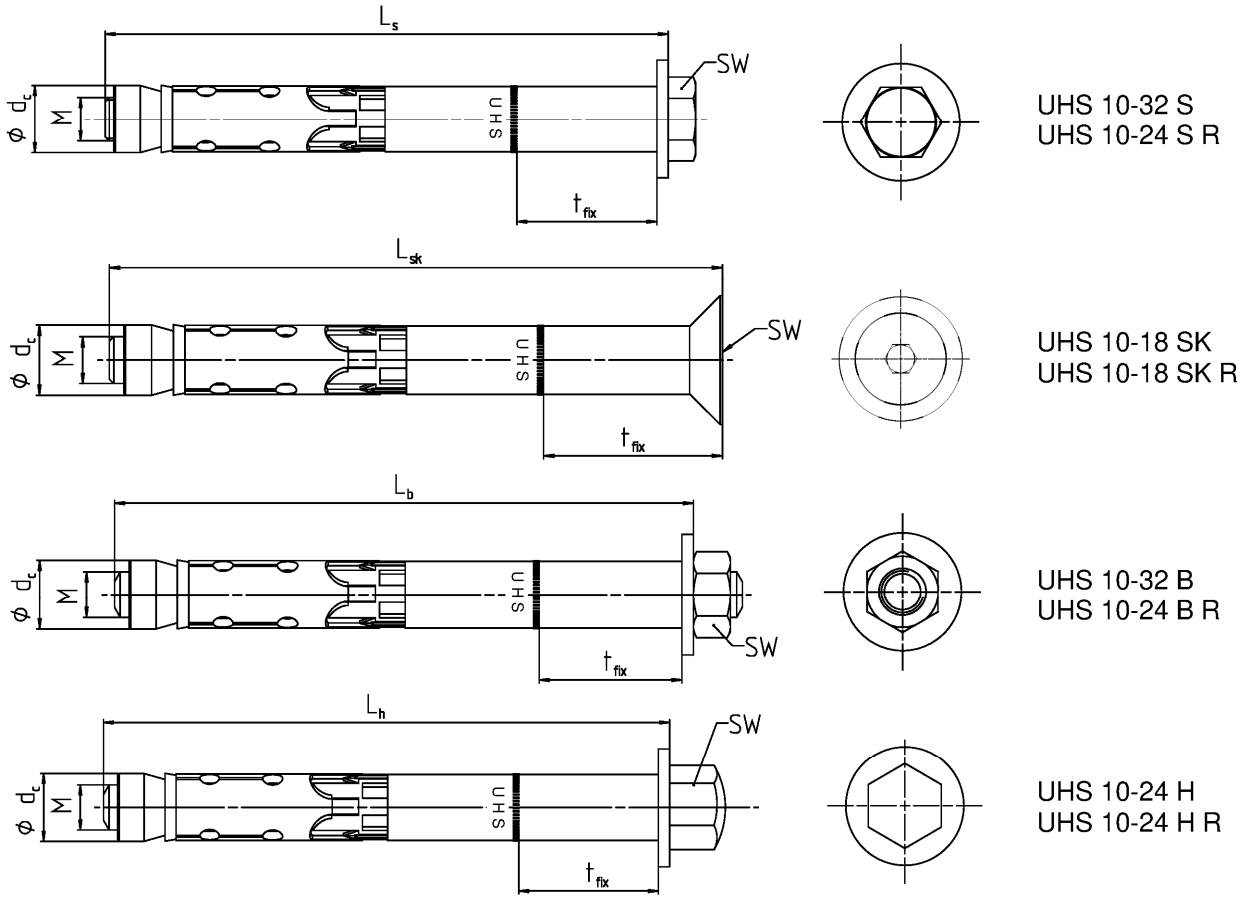


Table A2.1: Dimensions [mm] UHS and UHS R

Anchor type			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Thread		M	6	8	10	12	16	20	24
Diameter cone nut		d_c	10	12	14,8	17,8	23,7	27,5	31,5
Wrench size SW	UHS-S, -B		10	13	17	19	24	30	36
	UHS-SK[1]		4	5	6	8	[3]		
	UHS-H		13	17	17	19	24	[3]	
	UHS-S R, -B R, -H R		10	13	17	19	24	[3]	
	UHS-SK R[1]		4	5	6	8	[3]		
t_{fix} UHS-S, -B, -H + UHS-S R, -B R, -H R		min	0	0	0	0	0	0	0
t_{fix} UHS-SK + UHS-SK R [2]		min	5	6	6	8	[3]		
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	[3]		

[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 C3.1, C8.1 and C9.1
[3] Anchor type not part of assessment

(Fig. not to scale)

Upat Sleeve Anchor UHS, UHS-I

Product description
Anchor types and dimensions UHS, UHS R

Annex A 2

Table A3.1: Material UHS and UHS R

No.	Designation	Material	
		UHS	UHS R
	Steel grade	Steel	Stainless steel R
		Zinc plated ≥ 5 µm, ISO 4042:2018	Acc. to EN 10088:2014
1	Hexagon screw	Steel class 8.8; EN ISO 898-1:2013	Class 80 EN ISO 3506:2020
2	Countersunk screw		
3	Cap nut	Steel class 8	
4	Hexagon nut		
5	Threaded rod	Steel $f_{uk} \geq 800$ N/mm²; $f_{yk} \geq 640$ N/mm²	Stainless steel EN 10088:2014 $f_{uk} \geq 800$ N/mm²;$f_{yk} \geq 640$ N/mm²
6	Cone nut	Steel EN 10277:2018	Stainless steel EN 10088:2014
7	Distance sleeve	Steel EN 10305:2016	
8	Expansion sleeve	Steel EN 10139:2020/ EN 10277:2018	
9	Plastic sleeve	ABS (plastic)	
10	Washer	Steel EN 10139:2020	Stainless steel EN 10088:2014
11	Conical washer	Steel EN 10277:2018	

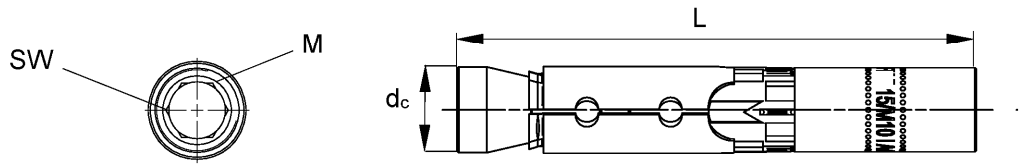


Table A4.1: Anchor Dimensions [mm] UHS-I and UHS-I R

Anchor type UHS-I, UHS-I R		**UHS 12/M6 I**	**UHS 12/M8 I**	**UHS 15/M10 I**	**UHS 15/M12 I**
Thread	M	6	8	10	12
Diameter cone nut	d_c	12	12	14,8	14,8
Wrench size internal hexagon	SW	6	8	6	8
Anchor length	L	77,5	77,5	90	90

Table A4.2: Material UHS-I and UHS-I R

No.	Designation	Material	
		UHS-I	UHS-I R
	Steel grade	Steel	Stainless steel R
		Zinc plated ≥ 5 µm, ISO 4042:2018	Acc. to EN 10088:2014
6	Cone nut	Steel EN 10277:2018	Stainless steel EN 10088:2014
8	Expansion sleeve	Steel EN 10139:2020 / EN 10277:2018	
9	Plastic sleeve	ABS (plastic)	
12	Internal thread bolt	Steel EN 10277:2018 $f_{uk} \geq 750$ N/mm², $f_{yk} \geq 600$ N/mm²	Stainless steel 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	Steel strength class A50, A70 or A80 EN ISO 3506:2010 1.4362, 1.4401, 1.4404, 1.4571, 1.4529

(Fig. not to scale)

Upat Sleeve Anchor UHS, UHS-I

Product description
Anchor types, dimensions and materials UHS-I, UHS I-R

Annex A 4

Specifications of intended use

Anchorages subject to:

Size		10	12	15	18	24	28	32
High Performance Anchor	UHS-S, -B				✓			
	UHS-H, -S R, -B R, -H R			✓			1)	
	UHS-SK, UHS-SK R			✓		1)		
High Performance Anchor UHS-I, UHS-I R		1)		✓		1)		
Hammer drilling with standard drill bit								
Hammer drilling with hollow drill bit with automatic cleaning					✓			
Static and quasi-static loads								
Cracked and uncracked concrete					✓			
Fire exposure								
Seismic performance category	C1 UHS	2)			✓			
	C1 UHS R				✓		1)	
	C2 UHS				✓			
	C2 UHS R				✓		1)	
	C1 UHS-I, UHS-I R	1)		2)		1)		
	C2 UHS-I, UHS-I R							

1) Anchor type not part of the assessment

2) No performance assessed

Base materials:

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

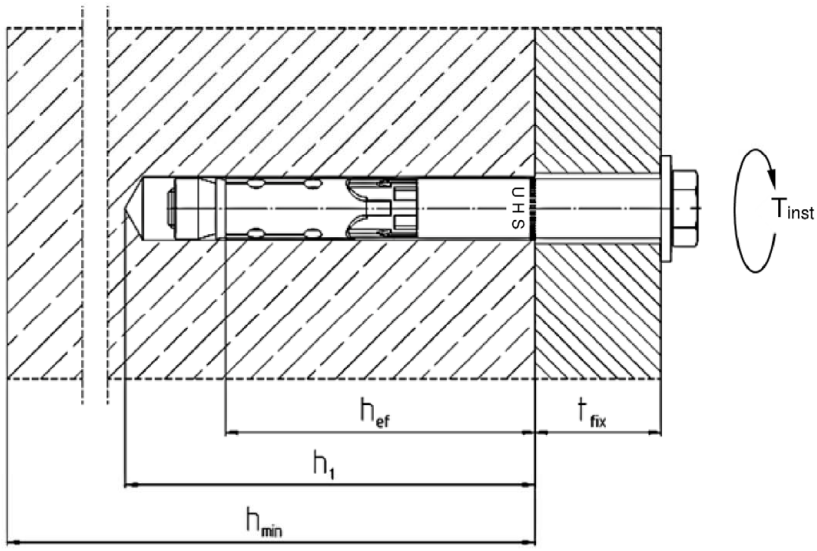
Use conditions (Environmental conditions):

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

  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 deicing 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 EN 1992-4:2018 and EOTA Technical Report TR 055, Edition February 2018



h_{ef} = Effective embedment depth
t_{fix} = Thickness of the fixture
h_1 = Depth of drill hole to deepest point
h_{min} = Minimum thickness of concrete member
T_{inst} = Required setting torque

Table B2.1: Installation parameters UHS and UHS R

Anchor type UHS S, -SK, -B, -H and UHS S R, -SK R, -B R, -H R			**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	$d_{cut} \leq$	[mm]	10,45	12,50	15,50	18,50	24,55	28,55	32,70
Depth of drill hole to deepest	$h_1 \geq$	[mm]	55	80	90	105	125	155	180
Diameter of clearance hole	$d_f \leq$	[mm]	12	14	17	20	26	31	35
Diameter of counter sunk	UHS SK	[mm]	18	22	25	32	[1]		
Depth of counter sunk, 90°	UHS SK R	[mm]	5,0	5,8	5,8	8,0			
Required setting torque	UHS S	T_{inst} [Nm]	10	22,5	40	80	160	180	200
	UHS B	T_{inst} [Nm]		17,5	38		120	180	200
	UHS H	T_{inst} [Nm]		22,5	40		90	[1]	
	UHS SK	T_{inst} [Nm]					[1]		
	UHS S R, UHS B R UHS H R	T_{inst} [Nm]	15	25	40	100	160	[1]	
	UHS SK R	T_{inst} [Nm]	10				[1]		

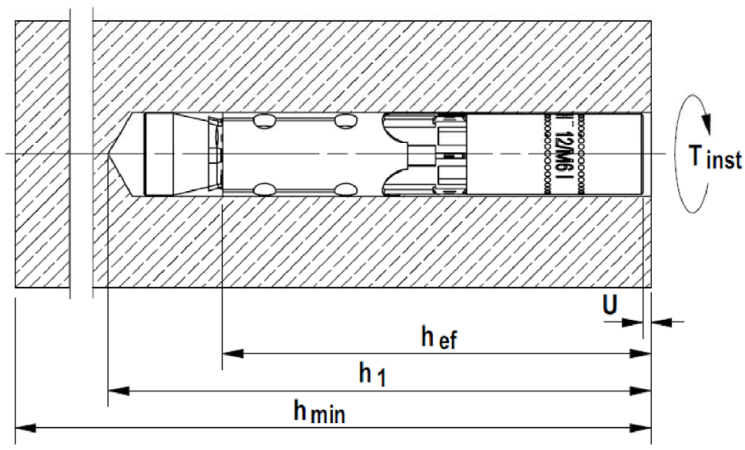
[1] Anchor type not part of assessment

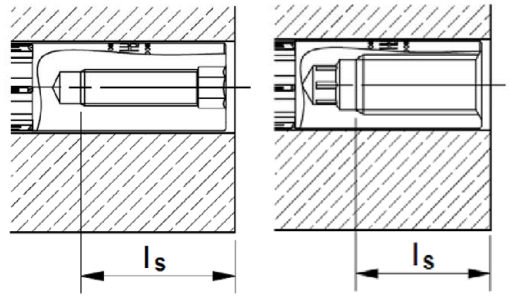
(Fig. not to scale)

Upat Sleeve Anchor UHS, UHS-I

Intended use
Installation parameters UHS, UHS R

Annex B 2





UHS 12/M6 I,
UHS 12/M8 I

UHS 15/M10 I,
UHS 15/M12 I

h_{ef} = Effective embedment depth
h_1 = Depth of drill hole to deepest point
h_{min} = Minimum thickness of conrete member
T_{inst} = Required setting torque
U = Required gap after torqueing
l_s = Screw-in depth

Table B3.1: Installation parameters UHS-I and UHS-I R

Anchor type UHS-I and UHS-I R				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 bit diameter	d_{cut}	≤		12,50		15,50	
Depth of drill hole	h_1	≥		85		95	
Diameter of clearance hole	d_f	≤		7	9	12	14
Required gap after torquing[1)]	U			3 - 5			
Required setting torque[1)]	T_{inst}		[Nm]	15		25	
Minimum screw-in depth	l_s	≥	[mm]	11 + U	13 + U	10 + U	12 + U
Maximum screw-in depth	l_s	≤		20 + U			
Maximum torque on fixture in combination with screws and threaded rods strength class ≥ 5.8 resp. ≥ A50	max T_{fix}		[Nm]	3	8	15	20

[1)] At least one of the requirements concerning the gap U or the required setting torque T_{inst} have to be fulfilled

(Fig. not to scale)

Upat Sleeve Anchor UHS, UHS-I

Intended use
Installation parameters UHS-I, UHS-I R

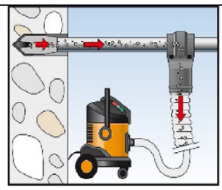
Annex B 3

Installation instructions:

- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener
- Checking before placing the fastener to ensure that the strength class of the concrete in which the fastener is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply
- Check of concrete being well compacted, e.g. without significant voids
- Hammer or hollow drilling according to Annex B5 and B6
- Drill hole created perpendicular +/- 5° to concrete surface, positioning without damaging the reinforcement
- In case of aborted hole: new drilling at a minimum distance twice the depth of the aborted drill hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application

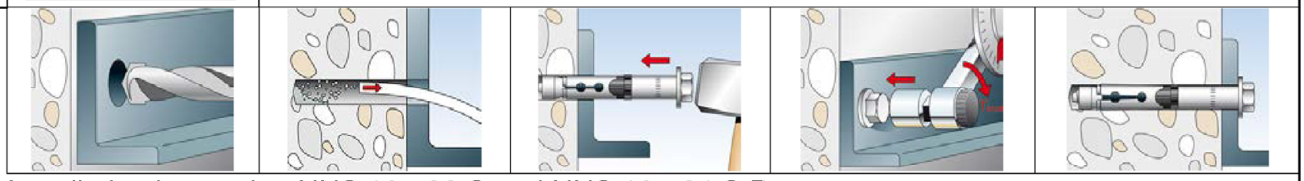
Installation instruction for the fischer High-Performance anchor
UHS 10 - UHS 32 and UHS 10 R - UHS 24 R

Hollow drilling

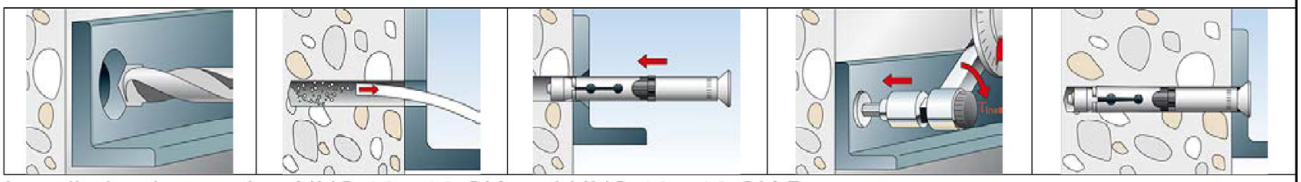


Continue with step 3, 4 and 5

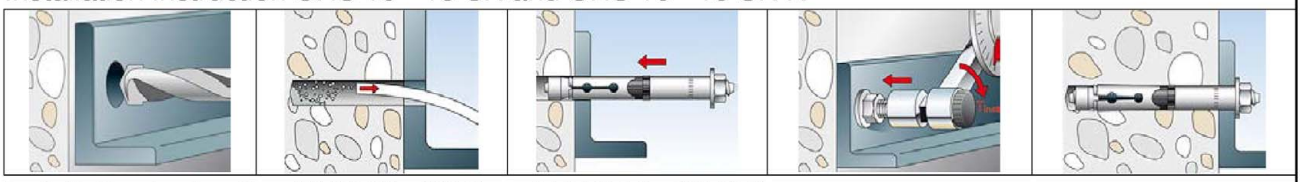
Hammer drilling



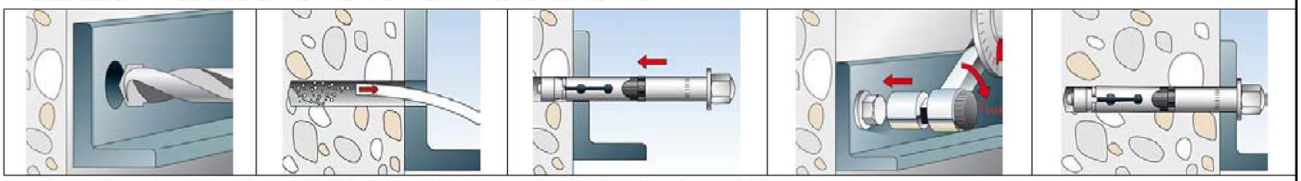
Installation instruction UHS 10 - 32 S and UHS 10 - 24 S R



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



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



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

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 the hole	-
3	Set the fastener	
4	Apply T_{inst}	
5	Installed fastener	

Types of drill bits

Hammer drill

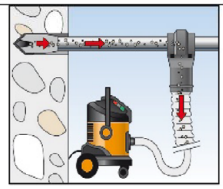
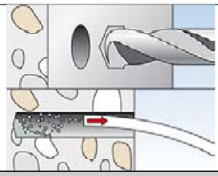
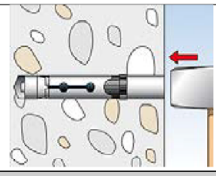
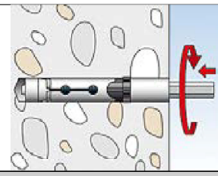
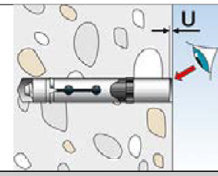
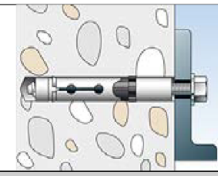
Hollow drill

Upat Sleeve Anchor UHS, UHS-I

Intended use
Installation instructions UHS, UHS R

Annex B 5

Installation instruction for the fischer High-Performance anchor internal thread
UHS-I and UHS-I R

Hollow drilling		Continue with step 2, 3, and 4			
Hammer drilling					
Step	**1**	**2**	**3**		**4**

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	Tighten the anchor. The included hexagon bit in the package should be used. Other tightening methods are allowed. Tighten the anchor in the concrete until the gap U is 3 - 5 mm or the required setting torque T_{inst} is reached. Only one of the above requirements has to be fulfilled.	
4	Attach the fixture and use a suitable screw or anchor rod. The length of the screw or anchor rod 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 gap U. Tighten the screw with the torque ≤ max T_{fix} (max T_{fix} see table B3.1)	

Types of drill bits	
Hammer drill	
Hollow drill	

Table C1.1: Performance characteristics of **tension resistance** under static and quasi-static loads **for UHS and UHS R**

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Steel failure									
UHS-S, -B,	$N_{Rk,s}$	[kN]	16,1	29,3	46,4	67,4	125,3	195,8	282,0
UHS-H, UHS-H R, -B R			16,1	29,3	46,4	67,4	125,3	2)	
UHS-SK			16,1	29,3	46,4	67,4	2)		
Partial factor	γ_{Ms} 1)	[-]	1,5						
UHS-S R	$N_{Rk,s}$	[kN]	16,1	29,3	46,4	67,4	125,3	2)	
UHS-SK R			16,1	29,3	46,4	67,4	2)		
Partial factor	γ_{Ms} 1)	[-]	1,6						
Pullout failure									
Characteristic resistance in cracked concrete C20/25 UHS and UHS R	$N_{Rk,p}$	[kN]	7,5	12,0	16,0	25,0	34,4	48,1	63,3
Characteristic resistance in uncracked concrete C20/25 UHS			12,5	22,9	28,8	35,2	49,2	68,8	90,4
Characteristic resistance in uncracked concrete C20/25 UHS R			12,5	20,0	28,8	35,2	49,2	2)	
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete	ψ_c	C25/30	1,12						
		C30/37	1,22						
		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 embedment depth	h_{ef}	[mm]	40	60	70	80	100	125	150
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7 3)						
Factor for uncracked concrete	$k_{ucr,N}$		11,0 3)						
Spacing	$s_{cr,N}$	[mm]	120	180	210	240	300	375	450
Edge distance	$c_{cr,N}$		60	90	105	120	150	187,5	225
Spacing (splitting)	$s_{cr,sp}$		190	300	320	340	380	480	570
Edge distance (splitting)	$c_{cr,sp}$		95	150	160	170	190	240	285
Characteristic resistance (splitting)	$N^0_{Rk,sp}$	[kN]	min $\{N^0_{Rk,c}; N_{Rk,p}\}$ 4)						

1) In absence of other national regulations
2) Anchor type no performance assessed
3) Based on concrete strength as cylinder strength
4) $N^0_{Rk,c}$ acc. EN 1992-4:2018

Table C2.1: Performance characteristics of **tension resistance** under static and quasi-static loads **for UHS-I and UHS-I R**

Anchor type UHS-I and UHS-I R				**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 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 A50	$N_{Rk,s}$	[kN]		10	19	29	43
Partial factor	γ_{Ms} [1)]	[-]		2,86			
Screw/thread strength class A70	$N_{Rk,s}$	[kN]		14	26	41	54
Partial factor	γ_{Ms} [1)]	[-]		1,87			
Screw/thread strength class A80	$N_{Rk,s}$	[kN]		16	29	46	46
Partial factor	γ_{Ms} [1)]	[-]		1,60			
Pullout failure							
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]		9,0		12,0	
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]		20,0		28,8	
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete	ψ_c		C25/30	1,12			
			C30/37	1,22			
			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 embedment depth	h_{ef}	[mm]		60		70	
Factor for cracked concrete	$k_{cr,N}$	[-]		7,7 [2)]			
Factor for uncracked concrete	$k_{ucr,N}$	[-]		11,0 [2)]			
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	
Characteristic resistance (splitting)	$N^0_{Rk,sp}$	[kN]		min $\{N^0_{Rk,c}; N_{Rk,p}\}$ [3)]			

[1)] In absence of other national regulations
[2)] Based on concrete strength as cylinder strength
[3)] $N^0_{Rk,c}$ acc. EN 1992-4:2018

Table C3.1: Performance characteristics of **shear resistance** for **UHS and UHS R** under static and quasi-static loads

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R			UHS 10	UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Installation factor	γ_{inst}	[-]	1,0						
Steel failure without lever arm									
UHS-S	$V^0_{Rk,s}$	[kN]	18,0	33,0	59,0	76,0	146,0	176,4	217,0
UHS-B	$V^0_{Rk,s}$	[kN]	16,0	27,2	42,8	61,9	119,0	148,8	169,0
UHS-H	$V^0_{Rk,s}$	[kN]	16,0	27,2	42,8	61,9	119,0	3)	
UHS-SK	t_{fix} 2)	[mm]	≥ 10		≥ 15		3)		
	$V^0_{Rk,s}$	[kN]	18,0	33,0	59,0	76,0			
	t_{fix} 2)	[mm]	< 10		< 15				
	$V^0_{Rk,s}$	[kN]	8,0	14,0	23,0	34,0			
Partial factor	γ_{Ms} 1)	[-]	1,25						
Factor for ductility	k_7		1,0						
UHS-S R	$V^0_{Rk,s}$	[kN]	18,0	33,0	59,0	76,0	146,0	3)	
Partial factor	γ_{Ms} 1)	[-]	1,33						
UHS-B R, -H R	$V^0_{Rk,s}$	[kN]	16,0	27,2	42,8	61,9	119,0	3)	
Partial factor	γ_{Ms} 1)	[-]	1,25						
UHS-SK R	t_{fix} 2)	[mm]	≥ 10		≥ 15		3)		
	$V^0_{Rk,s}$	[kN]	18,0	33,0	59,0	76,0			
	t_{fix} 2)	[mm]	< 10		< 15				
	$V^0_{Rk,s}$	[kN]	8,0	14,0	23,0	34,0			
Partial factor	γ_{Ms} 1)	[-]	1,33						
Factor for ductility	k_7		1,0						
Steel failure with lever arm and concrete pryout failure									
Characteristic bending resistance UHS-S, -SK, -B, -H	$M^0_{Rk,s}$	[Nm]	12	30	60	105	266	518	896
Partial factor	γ_{Ms} 1)	[-]	1,25						
Characteristic bending resistance UHS R	$M^0_{Rk,s}$	[Nm]	12	30	60	105	266	3)	
Partial factor UHS-B R, -H R	γ_{Ms} 1)	[-]	1,25						
Partial factor UHS-S R, -SK R	γ_{Ms} 1)	[-]	1,33						
Factor for pryout failure	k_8	[-]	1,0	2,0					
Concrete edge failure									
Effective embedment depth for calculation	l_f =	[mm]	h_{ef}						
Outside diameter of a fastener	d_{nom}		10	12	15	18	24	28	32

1) In absence of other national regulations
2) The thickness of the fixture has influence to the characteristic resistance for shear loads, steel failure without lever arm
3) No performance assessed

Table C4.1: Performance characteristics of **shear resistance** for **UHS-I and UHS-I R** under static and quasi-static loads

Anchor type UHS-I and UHS-I R			UHS 12/M6 I	UHS 12/M8 I	UHS 15/M10 I	UHS 15/M12 I
Installation factor	γ_{inst}	[-]	1,0			
Steel failure without lever arm						
Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898:2013						
Strength class 5.8	$V^0_{Rk,s}$	[kN]	5	9	15	21
Strength class 6.8	$V^0_{Rk,s}$	[kN]	6	11	18	24
Strength class 8.8	$V^0_{Rk,s}$	[kN]	8	14	23	24
Partial 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 3506:2010						
Strength class A50	$V^0_{Rk,s}$	[kN]	5	9	15	21
Partial factor	γ_{Ms} [1)]	[-]	2,38			
Strength class A70	$V^0_{Rk,s}$	[kN]	7	13	20	30
Partial factor	γ_{Ms} [1)]	[-]	1,56			
Strength class A80	$V^0_{Rk,s}$	[kN]	8	15	23	32
Partial factor	γ_{Ms} [1)]	[-]	1,33			
Factor for ductility	k_7	[-]	1,0			
Steel failure with lever arm and concrete pryout failure						
Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898:2013						
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 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 3506:2010						
Strength class A50	$M^0_{Rk,s}$	[Nm]	8	19	37	65
Partial factor	γ_{Ms} [1)]	[-]	2,38			
Strength class A70	$M^0_{Rk,s}$	[Nm]	11	26	52	92
Partial factor	γ_{Ms} [1)]	[-]	1,56			
Strength class A80	$M^0_{Rk,s}$	[Nm]	12	30	60	105
Partial factor	γ_{Ms} [1)]	[-]	1,33			
Factor for ductility	k_7	[-]	1,0			
Factor for pryout failure	k_8	[-]	2,0			
Concrete edge failure						
Effective embedment depth for calculation	$l_f =$	[mm]	h_{ef}			
Outside diameter of fastener	d_{nom}	[mm]	12		15	

[1)] In absence of other national regulations

Table C5.1: Performance characteristics of **tension resistance** under **fire exposure**

Anchor type		R30			R60		
		$N_{Rk,s,fi,30}$ [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, UHS 10 R		0,2	1,8	1,8	0,2	1,8	1,8
UHS 12, UHS 12 R		2,0	3,0	5,0	1,3	3,0	5,0
UHS 15, UHS 15 R		3,2	4,0	7,4	2,3	4,0	7,4
UHS 18, UHS 18 R		4,8	6,3	10,3	3,9	6,3	10,3
UHS 24, UHS 24 R		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,	5.8, A50[1]	0,1	2,3	5,0	0,1	2,3	5,0
UHS 12/M6-I R	8.8, A70, A80[1] [2]	0,2			0,2		
UHS 12/M8-I,	5.8, A50[1]	1,3			0,8		
UHS 12/M8-I R	8.8, A70, A80[1] [2]	2,0			1,3		
UHS 15/M10-I,	5.8, A50[1]	2,0	3,0	7,4	1,4	3,0	7,4
UHS 15/M10-I R	8.8, A70, A80[1] [2]	3,2			2,3		
UHS 15/M12-I,	5.8/A50[1]	3,0			2,4		
UHS 15/M12-I R	8.8, A70, A80[1] [2]	4,8			3,9		

Anchor type		R90			R120		
		$N_{Rk,s,fi,90}$ [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, UHS 10 R		0,1	1,8	1,8	0,1	1,5	1,5
UHS 12, UHS 12 R		0,6	3,0	5,0	0,2	2,4	4,0
UHS 15, UHS 15 R		1,4	4,0	7,4	1,0	3,2	5,9
UHS 18, UHS 18 R		3,0	6,3	10,3	2,6	5,0	8,2
UHS 24, UHS 24 R		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,	5.8, A50[1]	0,1	2,3	5,0	0,1	1,8	4,0
UHS 12/M6-I R	8.8, A70, A80[1] [2]	0,1			0,1		
UHS 12/M8-I,	5.8, A50[1]	0,4			0,1		
UHS 12/M8-I R	8.8, A70, A80[1] [2]	0,6			0,2		
UHS 15/M10-I,	5.8, A50[1]	0,9	3,0	7,4	0,6	2,4	5,9
UHS 15/M10-I R	8.8, A70, A80[1] [2]	1,4			1,0		
UHS 15/M12-I,	5.8/A50[1]	1,9			1,6		
UHS 15/M12-I R	8.8, A70, A80[1] [2]	3,0			2,6		

[1] Intermediate values by linear interpolation
[2] In combination with screw / threaded rod strength class 8.8, A70, A80

Table C6.1: Performance characteristics of **shear resistance** under **fire exposure**

Anchor type		R30		R60	
		$V_{Rk,s,fi,30}$ [kN]	$M^0_{Rk,s,fi,30}$ [Nm]	$V_{Rk,s,fi,60}$ [kN]	$M^0_{Rk,s,fi,60}$ [Nm]
UHS 10, UHS 10 R		0,3	0	0,3	0
UHS 12, UHS 12 R		2,0	2	1,3	1
UHS 15, UHS 15 R		3,2	4	2,3	3
UHS 18, UHS 18 R		4,8	7	3,9	6
UHS 24, UHS 24 R		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,	5.8, A50[1]	0,2	0	0,2	0
UHS 12/M6 I R	8.8, A70, A80[1) 2)]	0,3	0	0,3	0
UHS 12/M8 I,	5.8, A50[1]	1,3	1	0,8	1
UHS 12/M8-I R	8.8, A70, A80[1) 2)]	2,0	2	1,3	1
UHS 15/M10 I,	5.8, A50[1]	2,0	3	1,4	2
UHS 15/M10-I R	8.8, A70, A80[1) 2)]	3,2	4	2,3	3
UHS 15/M12-I,	5.8/A50[1]	3,0	4	2,4	4
UHS 15/M12-I R	8.8, A70, A80[1) 2)]	4,8	7	3,9	6

Anchor type		R90		R120	
		$V_{Rk,s,fi,90}$ [kN]	$M^0_{Rk,s,fi,90}$ [Nm]	$V_{Rk,s,fi,120}$ [kN]	$M^0_{Rk,s,fi,120}$ [Nm]
UHS 10, UHS 10 R		0,2	0	0,1	0
UHS 12, UHS 12 R		0,6	1	0,2	0
UHS 15, UHS 15 R		1,4	2	1,0	1
UHS 18, UHS 18 R		3,0	5	2,6	4
UHS 24, UHS 24 R		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,	5.8, A50[1]	0,1	0	0,1	0
UHS 12/M6-I R	8.8, A70, A80[1) 2)]	0,2	0	0,1	0
UHS 12/M8-I,	5.8, A50[1]	0,4	1	0,1	0
UHS 12/M8-I R	8.8, A70, A80[1) 2)]	0,6	1	0,2	0
UHS 15/M10 I,	5.8, A50[1]	0,9	2	0,6	1
UHS 15/M10-I R	8.8, A70, A80[1) 2)]	1,4	3	1,0	1
UHS 15/M12 I,	5.8/A50[1]	1,9	4	1,6	3
UHS 15/M12-I R	8.8, A70, A80[1) 2)]	3,0	6	2,6	4

[1] Intermediate values by linear interpolation
[2] In combination with screw / threaded rod strength class 8.8, A70, A80

Table C6.2: Minimum spacings and minimum edge distances of anchors under **fire exposure** for tension and shear loads

Anchor type		UHS 10	UHS 12 UHS 12-I	UHS 15 UHS 15-I	UHS 18	UHS 24	UHS 28	UHS 32
Spacing	$s_{cr,N,fi}$	$4 \times h_{ef}$						
	$s_{min,fi}$	40	50	60	70	80	100	120
Edge distance	$c_{cr,N,fi}$ [mm]	$2 \times h_{ef}$						
	$c_{min,fi}$	$c_{min,fi} = 2 \times h_{ef}$, for fire exposure from more than one side $c_{min,fi} \geq 300$ mm						

Upat Sleeve Anchor UHS, UHS-I

Perfomances
Performance characteristics of shear resistance under fire exposure
Minimum spacings and minimum edge distances of anchors under fire exposure

Annex C 6

Table C7.1: Minimum thickness of concrete member, minimum spacing and minimum edge distances **UHS, UHS R**

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R			**UHS 10**	**UHS 12**	**UHS 15**	**UHS 18**	**UHS 24**	**UHS 28**	**UHS 32**
Minimum thickness of concrete member	h_{min}	[mm]	80	120	140	160	200	250	300
Minimum spacing, cracked concrete	s_{min}	[mm]	40	50	60	70	80	100	120
	for c ≥		40	80	120	140	180	200	260
Minimum edge distance, cracked concrete	c_{min}		40	50	60	70	80	100	120
	for s ≥		40	80	120	160	200	220	280
Minimum spacing, uncracked concrete	s_{min}	[mm]	40	60	70	80	100	120	160
	for c ≥		70	100	100	160	200	220	360
Minimum edge distance, uncracked concrete	c_{min}		40	60	70	80	100	120	180
	for s ≥		70	100	140	200	220	240	380

Intermediate values may be calculated by linear interpolation

Table C7.2: Minimum thickness of concrete member, minimum spacing and minimum edge distances **UHS-I, UHS-I R**

Anchor type UHS-I and UHS-I R			**UHS 12/M6 I UHS 12/M8 I**	**UHS 15/M10 I UHS 15/M12 I**
Minimum thickness of concrete member	h_{min}	[mm]	125	150
Minimum spacing, cracked concrete	s_{min}	[mm]	50	60
	for c ≥		80	120
Minimum edge distance, cracked concrete	c_{min}		50	60
	for s ≥		80	120
Minimum spacing, uncracked concrete	s_{min}	[mm]	60	70
	for c ≥		100	100
Minimum edge distance, uncracked concrete	c_{min}		60	70
	for s ≥		100	140

Intermediate values may be calculated by linear interpolation.

Table C8.1: Performance characteristics of **tension and shear resistance** for **seismic performance category C1** for UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R				UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Steel failure									
Characteristic resistance of tension load **C1**	UHS-S, -B	$N_{Rk,s,C1}$	[kN]	29,3	46,4	67,4	125,3	195,8	282,0
	UHS-H, -H R, -B R			29,3	46,4	67,4	125,3	3)	
	UHS-SK			29,3	46,4	67,4	3)		
	Partial factor	$\gamma_{Ms,C1}$ 1)	[-]	1,5					
	UHS-S R	$N_{Rk,s,C1}$	[kN]	29,3	46,4	67,4	125,3	3)	
	UHS-SK R			29,3	46,4	67,4	3)		
	Partial factor	$\gamma_{Ms,C1}$ 1)	[-]	1,6					
Pullout failure									
Characteristic resistance of tension load in cracked concrete C1		$N_{Rk,p,C1}$	[kN]	12,0	16,0	25,0	36,0	50,3	66,1
		$\gamma_{Mp,C1}$ 1)	[-]	1,5					
Steel failure without lever arm									
Characteristic resistance of shear load C1									
UHS-S		$V_{Rk,s,C1}$	[kN]	25,0	41,0	60,0	123,0	141,0	200,0
UHS-B				17,0	30,0	46,0	103,0	117,0	169,0
UHS-H				17,0	30,0	46,0	103,0		
UHS-SK		t_{fix} 2)	[mm]	≥ 10	≥ 15		3)		
		$V_{Rk,s,C}$	[kN]	25,0	41,0	60,0			
		t_{fix} 2)	[mm]	< 10	< 15				
		$V_{Rk,s,C}$	[kN]	11,0	16,0	27,0			
Partial factor		$\gamma_{Ms,C1}$ 1)	[-]	1,25					
UHS-S R		$V_{Rk,s,C1}$	[kN]	25,0	41,0	60,0	123,0	-	
Partial factor		$\gamma_{Ms,C1}$ 1)	[-]	1,33					
UHS-B R, -H R		$V_{Rk,s,C1}$	[kN]	17,0	30,0	46,0	103,0	-	
Partial factor		$\gamma_{Ms,C1}$ 1)	[-]	1,25					
UHS-SK R		t_{fix} 2)	[mm]	≥ 10	≥ 15		3)		
		$V_{Rk,s,C1}$	[kN]	25,0	41,0	60,0			
		t_{fix} 2)	[mm]	< 10	< 15				
		$V_{Rk,s,C1}$	[kN]	11,0	16,0	27,0			
Partial factor		$\gamma_{Ms,C1}$ 1)	[-]	1,33					
Factor for annular gap		α_{gap}		0,50					

1) In absence of other national regulations
2) The thickness of the fixture has influence to the characteristic resistance for shear loads, steel failure without lever arm
3) No performance assessed

Table C9.1: Performance characteristics of **tension and shear resistance** for **seismic performance category C2** for UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R				UHS 12	UHS 15	UHS 18	UHS 24	UHS 28	UHS 32
Steel failure									
Characteristic resistance of tension load **C2**	UHS-S, -B	$N_{Rk,s,C2}$	[kN]	29,3	46,4	67,4	125,3	195,8	
	UHS-H, -H R, -B R			29,3	46,4	67,4	125,3	3)	
	UHS-SK			29,3	46,4	67,4	3)		
	Partial factor	$\gamma_{Ms,C2}$ 1)	[-]	1,5					
	UHS-S R	$N_{Rk,s,C2}$	[kN]	29,3	46,4	67,4	125,3	3)	
	UHS-SK R			29,3	46,4	67,4	3)		
	Partial factor	$\gamma_{Ms,C2}$ 1)	[-]	1,6					
Pullout failure									
Characteristic resistance of tension load in cracked concrete C2		$N_{Rk,p,C2}$	[kN]	6,2	11,3	21,8	43,0	65,9	
		$\gamma_{Mp,C2}$ 1)	[-]	1,5					
Steel failure without lever arm									
Characteristic resistance of shear load C2									
UHS-S		$V_{Rk,s,C2}$	[kN]	14,7	28,9	41,0	100,7		
UHS-B				9,8	20,9	34,1	61,9	67,2	
UHS-H				9,8	20,9	34,1	61,9	3)	
UHS-SK		t_{fix} 2)	[mm]	≥ 10	≥ 15		3)		
		$V_{Rk,s,C2}$	[kN]	14,8	23,3	33,8			
		t_{fix} 2)	[mm]	< 10	< 15				
		$V_{Rk,s,C2}$	[kN]	6,3	9,1	15,1			
Partial factor		$\gamma_{Ms,C2}$ 1)	[-]	1,25					
UHS-S R		$V_{Rk,s,C2}$	[kN]	14,7	28,9	41,0	100,7	3)	
Partial factor		$\gamma_{Ms,C2}$ 1)	[-]	1,33					
UHS-B R, -H R		$V_{Rk,s,C2}$	[kN]	9,8	20,9	34,1	61,9	3)	
Partial factor		$\gamma_{Ms,C2}$ 1)	[-]	1,25					
UHS-SK R		t_{fix} 2)	[mm]	≥ 10	≥ 15		3)		
		$V_{Rk,s,C2}$	[kN]	14,8	23,3	33,8			
		t_{fix} 2)	[mm]	< 10	< 15				
		$V_{Rk,s,C2}$	[kN]	6,3	9,1	15,1			
Partial factor		$\gamma_{Ms,C2}$ 1)	[-]	1,33					
Factor for annular gap		α_{gap}		0,50					

1) In absence of other national regulations
2) The thickness of the fixture has influence to the characteristic resistance for shear loads, steel failure without lever arm
3) No performance assessed

Table C10.1: Displacements under static and quasi static **tension loads** for UHS and UHS R

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R			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
	$\delta_{N\infty}$		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
	$\delta_{N\infty}$		1,7	1,6	1,6	1,6	1,8	1,3	1,1

Table C10.2: Displacements under static and quasi static **tension loads** for UHS-I and UHS-I R

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

Table C10.3: Displacements under static and quasi static **shear loads** for UHS-S and UHS-SK

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
	$\delta_{V\infty}$		3,6	4,1	6,6	7,5	10,5	9,0	12,0

Table C10.4: Displacements under static and quasi static **shear loads** for UHS-B and UHS-H

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
	$\delta_{V\infty}$		3,3	3,5	4,5	7,5	10,5	7,5	7,5

Table C11.1: Displacements under static and quasi static **shear loads** for UHS-S R, UHS-SK R, UHS-B R and UHS-H R

Anchor type UHS-S R, -SK R, -B R, -H R			**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

Table C11.2: Displacements under static and quasi static **shear loads** for UHS-I and UHS-I R

Anchor type: UHS-I and UHS-I R			**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

Table C11.3: Displacements under **tension loads** for **seismic performance category C2** for UHS and UHS R

Anchor type UHS-S, -SK, -B, -H and UHS-S R, -SK R, -B R, -H R			**UHS 12**	**UHS 15**	**UHS 18**	**UHS 24**	**UHS 28**	**UHS 32**
Displacement DLS	$\delta_{N,C2\ (DLS)}$	[mm]	1,55	2,63	2,04	4,26	3,06	
Displacement ULS	$\delta_{N,C2\ (ULS)}$		8,71	11,07	7,30	11,70	11,44	

Table C11.4: Displacements under **shear loads** for **seismic performance category C2** for UHS and UHS R

Anchor type UHS-S, -SK and UHS-S R, -SK R			**UHS 12**	**UHS 15**	**UHS 18**	**UHS 24**	**UHS 28**	**UHS 32**
Displacement DLS	$\delta_{V,C2\ (DLS)}$	[mm]	3,53	4,18	4,67	5,59	4,79	
Displacement ULS	$\delta_{V,C2\ (ULS)}$		6,62	7,38	9,03	14,09	9,95	

Anchor type UHS-B, -H and UHS-B R, -H R			**UHS 12**	**UHS 15**	**UHS 18**	**UHS 24**	**UHS 28**	**UHS 32**
Displacement DLS	$\delta_{V,C2\ (DLS)}$	[mm]	3,42	4,26	4,29	4,79		
Displacement ULS	$\delta_{V,C2\ (ULS)}$		5,26	6,66	7,95	7,69	9,95	