

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-18/0629**  
**of 4 September 2018**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

UCAS Undercut Anchor

Product family  
to which the construction product belongs

Mechanical fastener for use in concrete

Manufacturer

UCAS ENGINEERING CO., LTD.  
No. 2 Tongjiang Road  
Jianye District  
NANJING, JIANGSU, 210019  
VOLKSREPUBLIK CHINA

Manufacturing plant

UCAS Engineering Co., Ltd.

This European Technical Assessment  
contains

17 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 330232-00-0601

**European Technical Assessment**

**ETA-18/0629**

English translation prepared by DIBt

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## Specific Part

### 1 Technical description of the product

The UCAS Undercut anchor is an anchor made of galvanised steel which is placed in an undercut hole and anchored by mechanical interlock with displacement-controlled installation.

The product description is given in Annex A.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

### 3 Performance of the product and references to the methods used for its assessment

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 2
Displacements (static and quasi-static loading)	See Annex C 1 and C 2
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 3 and C 4

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

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

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

In accordance with EAD 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**

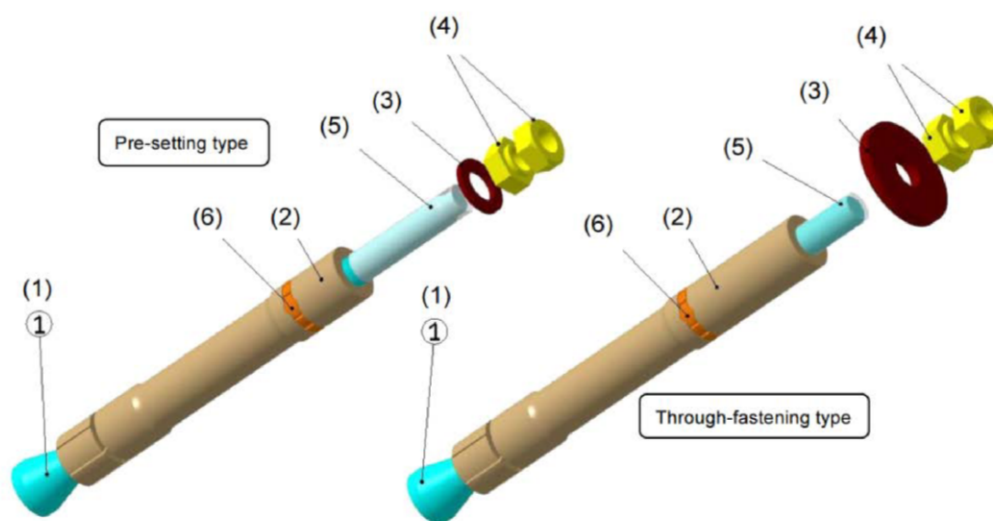
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 4 September 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Baderschneider

### Components of the undercut anchor (through-fastening and pre-setting type)



**Table A1: Components and materials of the undercut anchor**

No.	Component	Material specifications
(1)	Conical bolt	Strength Classification 8.8, SCM435 (thermally refined) or equivalent material, electroplated
(2)	Expander sleeve	SS400 (JIS G 3101-2010) or equivalent material, electroplated
(3)	Washer	JIS B 1256 Standard 300HV, electroplated
(4)	Nut	Hardlock Nut, Product name: HLN-R Class8 trivalent
(5)	Cap	Polyethylene
(6)	O-ring	Polypropylene

**Table A2: Material properties of steel components**

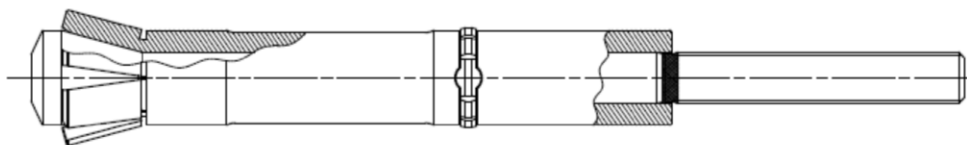
Part	Parameter		Unit	M16
Conical bolt with thread	ultimate steel strength	$f_{uk}$	[N/mm <sup>2</sup> ]	800
	yield steel strength	$f_{yk}$	[N/mm <sup>2</sup> ]	640
Expansion sleeve	ultimate steel strength	$f_{uk}$	[N/mm <sup>2</sup> ]	575
	yield steel strength	$f_{yk}$	[N/mm <sup>2</sup> ]	460

### UCAS UNDERCUT ANCHOR

**Product description**  
Anchor components and materials

**Annex A 1**

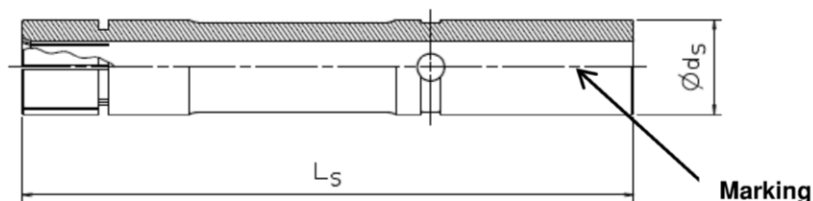
### Undercut anchor UCAS UNDERCUT ANCHOR (Pre-setting type)



### Conical bolt UCAS UNDERCUT ANCHOR (Pre-setting type)




### Expander sleeve UCAS UNDERCUT ANCHOR (Pre-setting type)



Marking: Company logo–UC (Under Cut) - Anchor size–Anchor type–  $h_{ef}$  (Effective anchorage depth)

- Coating (E = electroplated) -  $t_{fix,max}$  (Maximum thickness of fixture) - HD (Heavy Duty)

Through-fastening type:  UCM16T190E40HD

Pre-setting type:  UCM16P190E40HD

### Tabelle A3: Dimensions

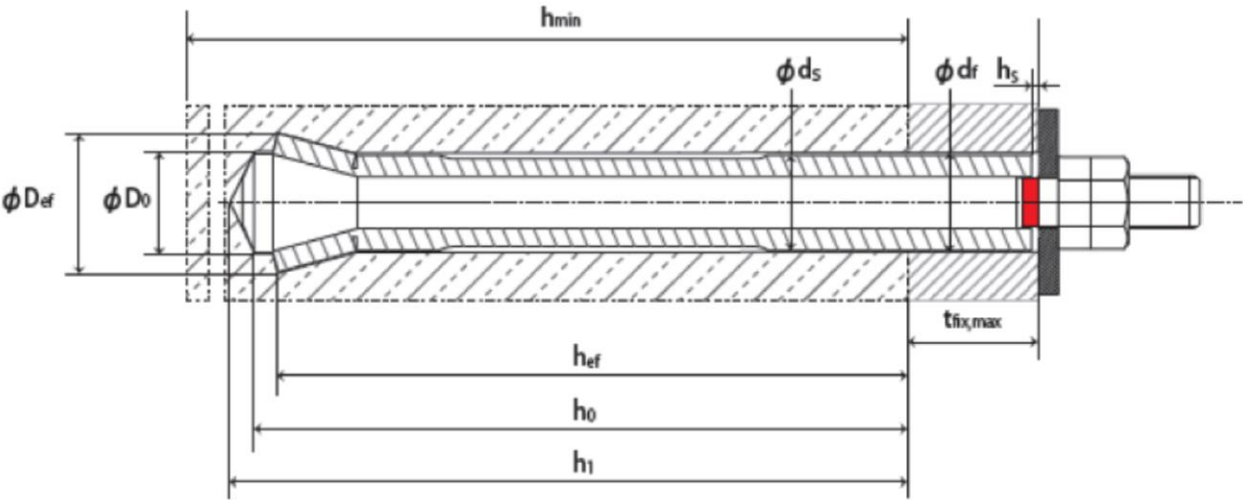
Anchor size			M16 T	M16 P
Anchor type		[-]	Through-fastening	Pre-setting
Length of anchor	L	[mm]	325	290
Length of sleeve	$L_s$	[mm]	230,4	190,4
Sleeve diameter	$d_s$	[mm]	29,5	29,5
Cone diameter	$d_c$	[mm]	29,5	29,5

### UCAS UNDERCUT ANCHOR

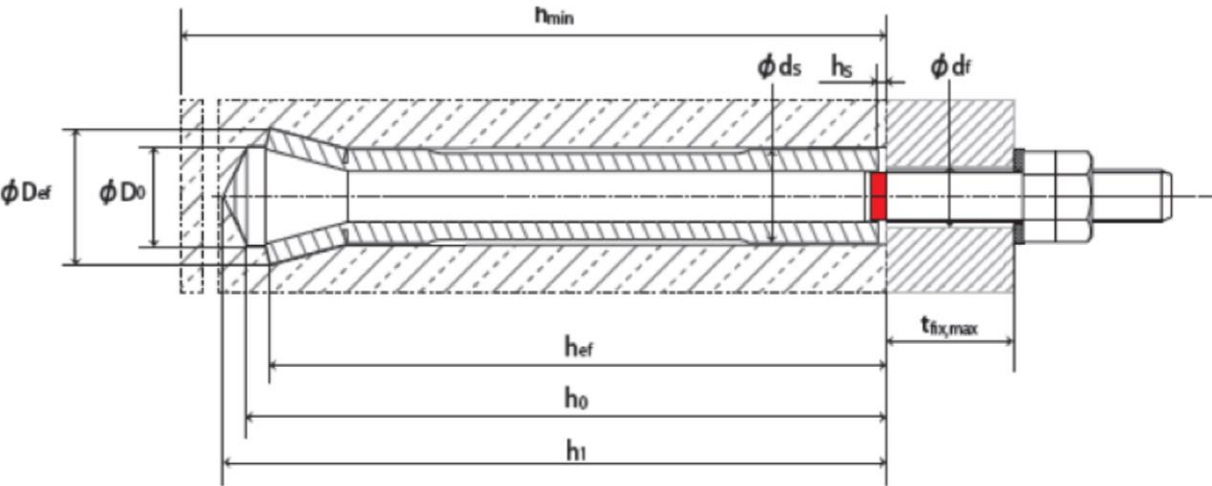
Product description  
Dimensions and marking

Annex A 2

Undercut anchor after installation (through-fastening type)



Undercut anchor after installation (pre-setting type)



UCAS UNDERCUT ANCHOR

Product description  
Anchor types

Annex A 3



## Specifications of Intended use

### Anchorage subject to:

- Static and quasi-static loads
- seismic loads of category C1 and C2

### Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013
- Strength classes C20/25 to C50/60 according to EN 206:2013
- Uncracked or cracked concrete

### Use conditions (environmental conditions)

- Structures subject to dry internal conditions

### Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are 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:

- Hammer drilling only
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without exchanging components of an anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings and using the appropriate tools listed in Table B3.
- Thickness of the fixture corresponding to Table B1
- The concrete shall be well compacted, e.g. without significant voids
- Cleaning the bore hole and installation of the anchor in accordance with Annex B4, B5 and B6
- Keeping of the minimum edge distance and spacing (Table B2)
- Positioning of the drill holes and the undercut without damaging the reinforcement
- In case of aborted hole, drilling of new hole at a minimum distance of twice the depth of the aborted hole, or smaller distance provided the aborted drill hole is filled with high strength mortar and no shear or oblique tension loads in the direction of aborted hole occur.
- The installation torque moment given in Table B1 to both nuts shall be applied using a calibrated torque wrench.
- Shear loading with lever arm and fastenings through a grout layer are not allowed under seismic loadings.
- For applications under seismic loading the fastening shall be placed outside of critical areas (e.g. plastic hinges of the concrete structure).

## UCAS UNDERCUT ANCHOR

### Intended Use Specifications

## Annex B 1



**Table B1: Installation parameters**

Anchor type			Through-fastening	Pre-setting
Thread Size			M16 T	M16 P
Nominal bore hole diameter	$D_0$	[mm]	30,5	
Drilled hole depth (at shoulder)	$h_0$	[mm]	198	
Deepest drilled hole depth (deepest point)	$h_1$	[mm]	204,5	
Expanded diameter	$D_{ef}$	[mm]	42,3	
Effective anchorage depth	$h_{ef}$	[mm]	190	
Required distance between concrete surface or surface of fixture and sleeve surface	$h_s$	[mm]	$\geq 2$	
Diameter of clearance hole in fixture	$d_f$	[mm]	32	18
Maximum thickness of fixture	$t_{fix,max}$	[mm]	40	
Installation torque	Convex nut	$T_{Inst}$	[Nm]	170
	Concave nut	$T_{Inst}$	[Nm]	70

**Table B2: Minimum thickness of member, minimum spacing and edge distance**

Thread Size			M16 T	M16 P
Minimum member thickness	$h_{min}$	[mm]	$290 + \alpha^{1)}$	290
<b>Uncracked and cracked concrete</b>				
Minimum edge distance	$c_{min}$	[mm]	152	
Minimum spacing	$s_{min}$	[mm]	190	

1)  $\alpha = t_{fix,max} - t_{fix}$

**UCAS UNDERCUT ANCHOR**

**Intended Use**  
Installation parameters

**Annex B 2**

**Table B3: Required setting tools**

Setting tool	Through-fastening	Pre-setting
	Part number	
Hammering drilling machine	Common tool	
Primary hole bit	PHG305245MAX (SDS-max) PHG305245HEX (Hexagonal)	PHG305205MAX (SDS-max) PHG305205HEX (Hexagonal)
Perpendicular guide	PG305V	
Depth and perpendicular gauge	VG88305T	VG88305
Vacuum cleaner	Common tool	
Undercutter	UC305MAX(SDS-max) UC305HEX(Hexagonal)	
Undercutter blade	BL305	
Undercut gauge	GE305	
Setting tool	STMAXM16 (SDS-max) STHEXM16 (Hexagonal)	
Calibrated torque wrench	Common tool	

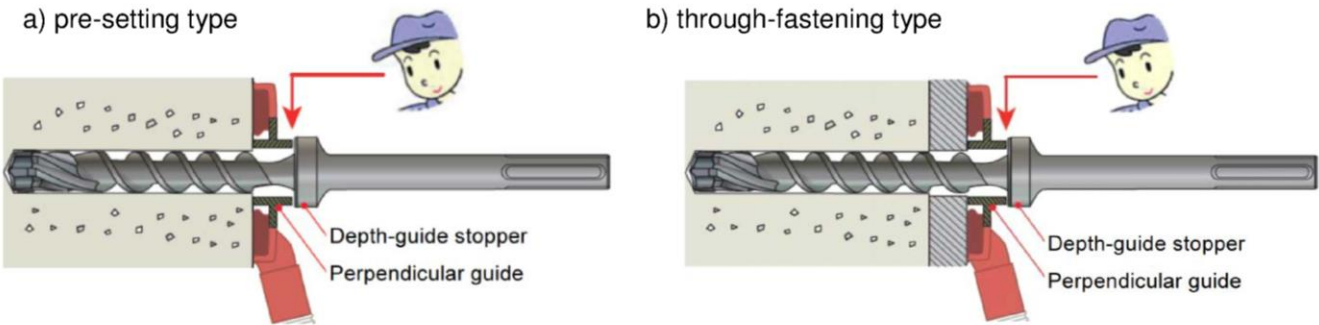
**UCAS UNDERCUT ANCHOR**

**Intended Use**  
Setting tools

**Annex B 3**

Installation instruction

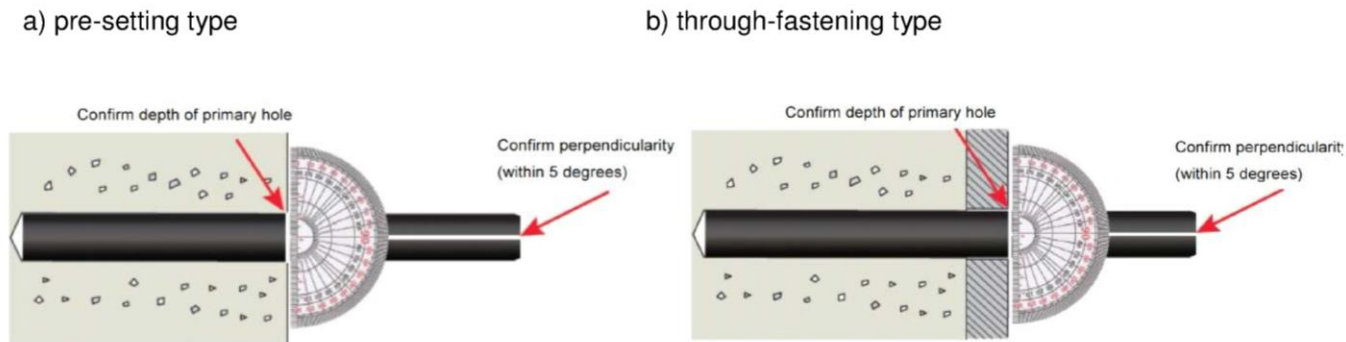
1) Drill the primary hole until its depth-guide stopper touches the perpendicular guide.



2) Clean the primary hole using a vacuum cleaner.



3) Confirm depth and perpendicularity of bore hole.

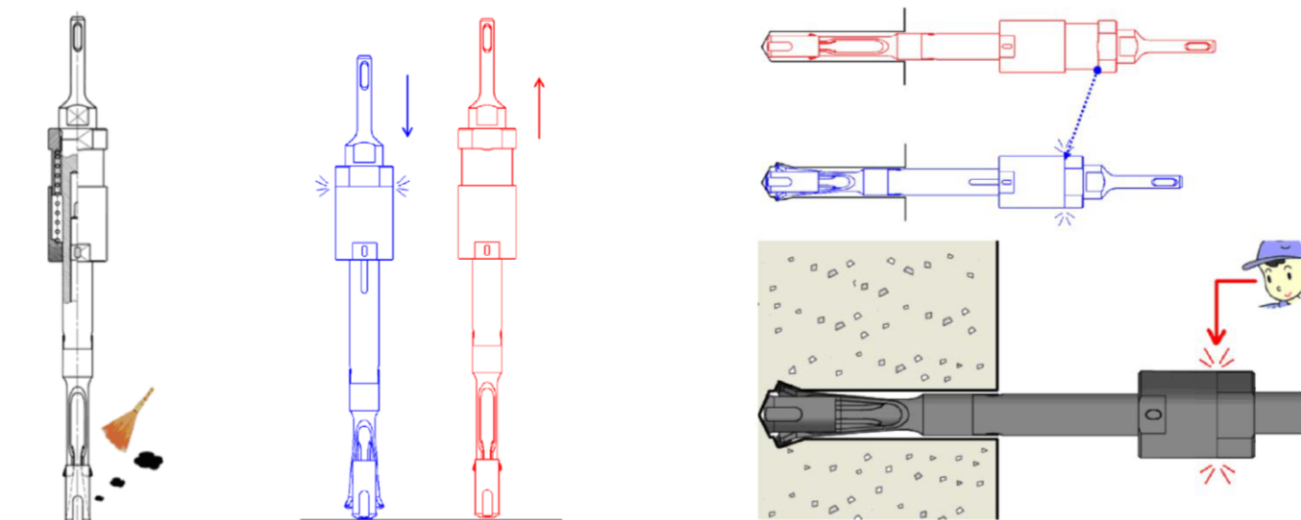


UCAS UNDERCUT ANCHOR

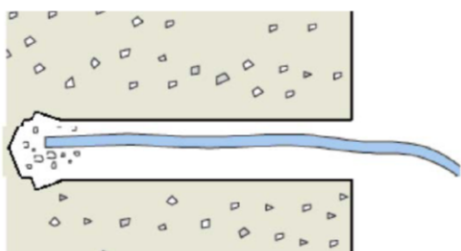
Intended Use  
Installation instruction

Annex B 4

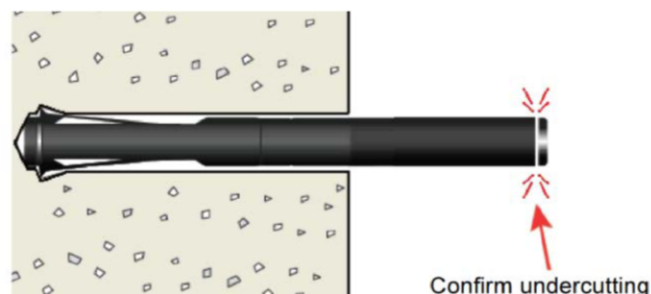
- 4) Clean around the cutter blade and the bow jaw of the undercutter with a brush. Then, hold and press the bow jaw against the ground, and confirm that the cutter blade opens and closes smoothly. Hold the tip of the undercutter bow jaw against the bottom of the hole. Turn on the hammer drill and press. The procedure is completed when the gap between the lock release screw and the stopper sleeve has closed.



- 5) Clean the undercut hole using a vacuum cleaner.



- 6) Confirm the undercutting with the undercut gauge.



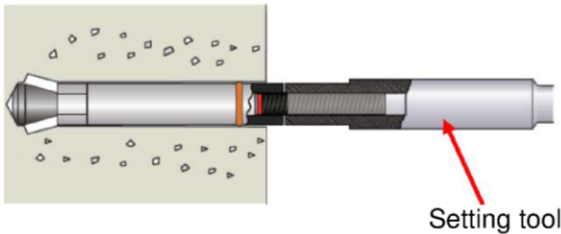
## UCAS UNDERCUT ANCHOR

**Intended Use**  
Installation instruction

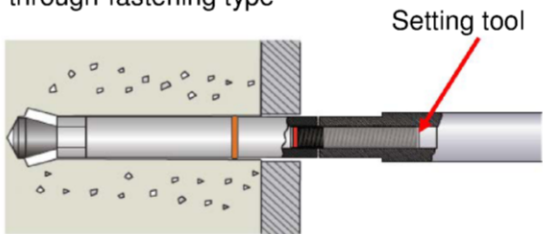
**Annex B 5**

7) Attach the setting tool to the electric drilling machine and insert the anchor bolt with screw protector into the setting tool. Install the anchor into the undercut hole and add hammering to open the expanding portion of the expander sleeve.

a) pre-setting type

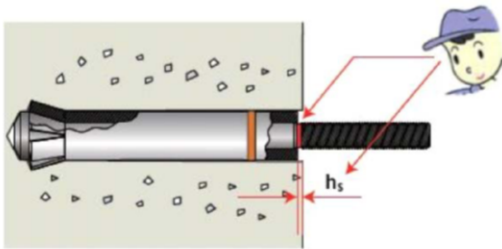


b) through-fastening type

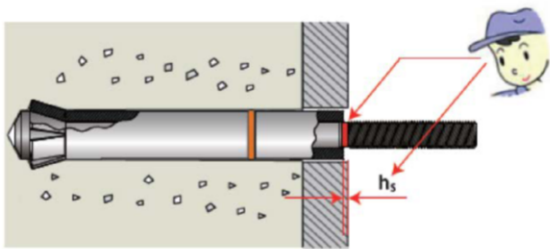


8) The setting is completed when the expander sleeve has been completely set inside the hole, the red line marked on the conical bolt is visible, and it is confirmed that the top surface of the expander sleeve is lower than the surface of the concrete by distance  $h_s \geq 2,0$  mm.

a) pre-setting type

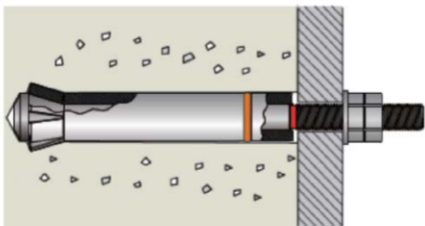


b) through-fastening type

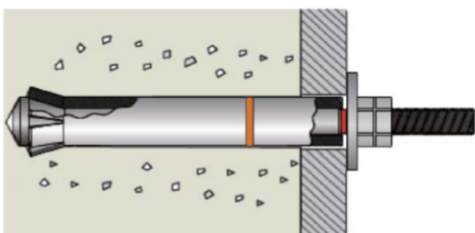


9) Use a set of nuts (Hardlock nut) to attach the fixture. Tighten the convex nut then the concave nut, each to its specified torque (Table B1), to complete installation.

a) pre-setting type



b) through-fastening type



UCAS UNDERCUT ANCHOR

Intended Use  
Installation instruction

Annex B 6

**Table C1: Characteristic resistances under tension loading**

Anchor type (Annex A3)			Through-fastening	Pre-setting
Size			M16 T	M16 P
Steel failure				
Characteristic resistance		$N_{Rk,s}$	[kN]	125,6
Partial factor		$\gamma_{Ms}^{1)}$	[-]	1,5
Pullout failure				
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p}$	[kN]	- <sup>2)</sup>
Characteristic resistance in uncracked concrete C20/25		$N_{Rk,p}$	[kN]	- <sup>2)</sup>
Partial factor		$\gamma_{Mp}^{1)}$	[-]	1,5
Increasing factor for $N_{Rk,p}$ for cracked and uncracked concrete	C20/25	$\Psi_c$	[-]	1,12
	C30/37		[-]	1,22
	C35/45		[-]	1,32
	C40/50		[-]	1,41
	C45/55		[-]	1,50
	C50/60		[-]	1,58
Concrete cone failure and splitting failure				
Effective embedment depth		$h_{ef}$	[mm]	190
Factor for uncracked concrete		$k_{ucr,N}$	[-]	11,0
Factor for cracked concrete		$k_{cr,N}$	[-]	7,7
Partial safety factor		$\gamma_{Mc}=\gamma_{Msp}^{1)}$	[-]	1,5
Characteristic spacing concrete cone failure		$s_{cr,N}$	[mm]	$3,0 \times h_{ef}$
Characteristic edge distance concrete cone failure		$c_{cr,N}$	[mm]	$1,5 \times h_{ef}$
Characteristic spacing splitting failure		$s_{cr,sp}$	[mm]	$3,0 \times h_{ef}$
Characteristic edge distance splitting failure		$c_{cr,sp}$	[mm]	$1,5 \times h_{ef}$
Installation factor		$\gamma_{inst}$	[-]	1,0

1) Parameters according to FprEN 1992-4:2016 in absence of other national regulations

2) Pull-out failure is not decisive

**Table C2: Displacements under tension loads for non-cracked and cracked concrete**

			M16T	M16P
Tension load $N^{1)}$ in cracked concrete C20/25			43,0	
Displacement	$\delta_{N0}$	[mm]	1,7	
	$\delta_{N\infty}$	[mm]	1,7	
Tension load $N^{1)}$ in uncracked concrete C20/25			61,3	
Displacement	$\delta_{N0}$	[mm]	0,8	
	$\delta_{N\infty}$	[mm]	1,3	

1)  $N = N_{Rk,c} / (1,4 \gamma_{Mc})$

## UCAS UNDERCUT ANCHOR

### Performances

Characteristic resistances and displacements  
under static and quasi static tension loading

## Annex C 1



**Table C3: Characteristic resistances under shear loading**

Anchor type (Annex A3)			Through-fastening	Pre-setting
Size			M16T	M16P
<b>Steel failure without lever arm</b>				
Characteristic resistance	$V_{Rk,s}$	[kN]	151,9	62,8
Ductility factor	$k_7^{(2)}$	[-]	0,8	0,8
Partial factor	$\gamma_{Ms}^{(1)}$	[-]	1,25	1,25
<b>Steel failure with lever arm</b>				
Characteristic bending resistance	$M_{Rk,s}^0$	[Nm]	250 <sup>(3)</sup>	250
Partial factor	$\gamma_{Ms}^{(1)}$	[-]	1,25 <sup>(3)</sup>	1,25
<b>Concrete pry-out failure</b>				
Factor for pry-out failure	$k_8^{(2)}$	[-]	2	2
Partial factor	$\gamma_{Mc}^{(1)}$	[-]	1,5	1,5
<b>Concrete edge failure</b>				
Effective length of anchor under shear loading	$l_{t,min}$	[mm]	74	74
Outside diameter of anchor	$d_{nom}$	[mm]	29,5	29,5
Partial factor	$\gamma_{Mc}^{(1)}$	-	1,5	1,5

<sup>1)</sup> Parameters according to FprEN 1992-4:2016 in absence of other national regulations

<sup>2)</sup> Parameters according to FprEN 1992-4:2016

<sup>3)</sup> According to FprEN 1992-4:2016, steel failure with lever arm must be considered only if  $t_{grout} \geq 0,5d$ .

**Table C4: Displacement under shear loads**

			M16 T	M16 P
Shear load $V^{(2)}$ in cracked and uncracked concrete C20/25 [kN]			86,8	35,9
Displacement <sup>(1)</sup>	$\delta_{V0}$	[mm]	4,1	2,9
	$\delta_{V\infty}$	[mm]	6,2	4,4

<sup>1)</sup> Additional displacements due to the annular gap of the clearance hole in the fixture is not considered.

<sup>2)</sup>  $V = V_{Rk,s} / (1,4 \cdot \gamma_{Ms})$

## UCAS UNDERCUT ANCHOR

### Performances

Characteristic resistances and displacements  
under static and quasi static shear loading

## Annex C 2



**Table C5: Characteristic resistances under seismic tension loading (category C1)**

Anchor type (Annex A3)			Through-fastening	Pre-setting
Size			M16 T	M16 P
Steel failure				
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	125,6	
Partial factor	$\gamma_{Ms}^{1)}$	[-]	1,5	
Pull-out failure				
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	90,2	
Partial factor	$\gamma_{Mp}^{1)}$	[-]	1,5	

<sup>1)</sup> Parameters according to FprEN 1992-4:2016 in absence of other national regulations

**Table C6: Characteristic resistances under seismic shear loading (category C1)**

Steel failure without lever arm			M16 T	M16 P
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	57,7	61,8
Partial factor	$\gamma_{Ms}^{1)}$	[-]	1,25	
Factor for annular gap	$\alpha_{gap}$	[-]	0,5	

<sup>1)</sup> Parameters according to FprEN 1992-4:2016 in absence of other national regulations

**Table C7: Characteristic resistances under seismic tension loading (category C2)**

Steel failure			M16 T	M16 P
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	125,6	
Partial factor	$\gamma_{Ms}^{1)}$	[-]	1,5	
Pull-out failure				
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	81,2	
Partial factor	$\gamma_{Mp}^{1)}$	[-]	1,5	

<sup>1)</sup> Parameters according to FprEN 1992-4:2016 in absence of other national regulations

**Table C8: Characteristic resistances under seismic shear loading (category C2)**

<b>Steel failure without lever arm</b>			M16 T	M16 P
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	57,7	61,8
Partial factor	$\gamma_{Ms}^{1)}$	[-]	1,25	1,25
Factor for annular gap	$\alpha_{gap}$	[-]	0,5	

<sup>1)</sup> Parameters according to FprEN 1992-4:2016 in absence of other national regulations

## UCAS UNDERCUT ANCHOR

### Performances

Characteristic resistances  
under seismic tension and shear loading of category C1 and C2

## Annex C 3

**Table C9: Characteristic displacements under seismic tension and shear loading  
(category C1 and C2)**

Anchor type (Annex A3)			Through-fastening	Pre-setting
Size			M16 T	M16 P
Seismic tension loading				
Displacements	$\delta_{N,seis}(DLS)$	[mm]	3,2	
	$\delta_{N,seis}(ULS)$	[mm]	12,5	
Seismic shear loading				
Displacements	$\delta_{V,seis}(DLS)$	[mm]	4,8	4,2
	$\delta_{V,seis}(ULS)$	[mm]	8,3	7,2

**UCAS UNDERCUT ANCHOR**

**Performances**  
Displacements  
under seismic tension and shear loading of category C1 and C2

**Annex C 4**