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-17/0690 of 13 November 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	Miyanaga ANZEX Undercut Anchor
Product family to which the construction product belongs	Undercut anchor for use in concrete
Manufacturer	MIYANAGA CO., LTD 2393 Fukui MIKI, HYOGO 673-0433 JAPAN
Manufacturing plant	
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

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Specific Part

1 Technical description of the product

The Miyanaga ANZEX 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 for static and quasi static action, displacements	See Annex C 1 and C 2
Characteristic resistance for seismic performance categories C1 and C2, displacements	See Annex C 3 and C 4

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Characteristic resistance under fire exposure	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 13 November 2017 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Lange

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

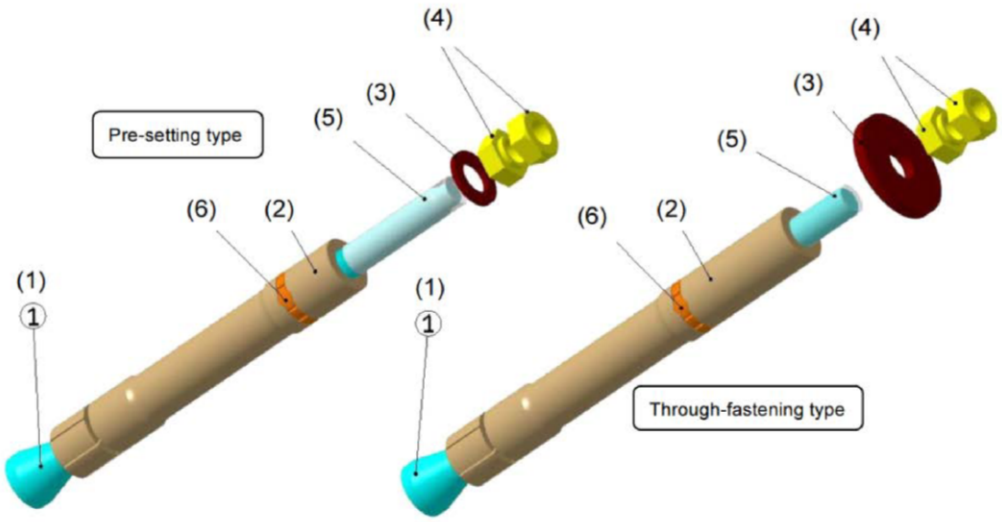

Table A1: Components and materials of the undercut anchor

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/mm²]	800
	yield steel strength	f_{yk}	[N/mm²]	640
Expansion sleeve	ultimate steel strength	f_{uk}	[N/mm²]	575
	yield steel strength	f_{yk}	[N/mm²]	460

Miyanaga ANZEX undercut anchor	Annex A 1
Product description Anchor components and materials	

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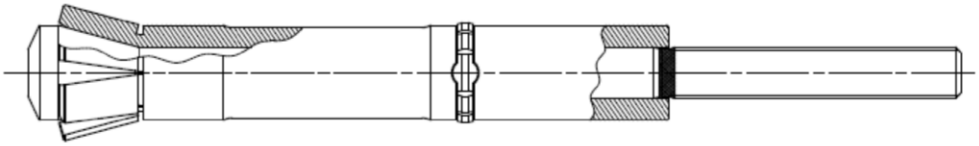
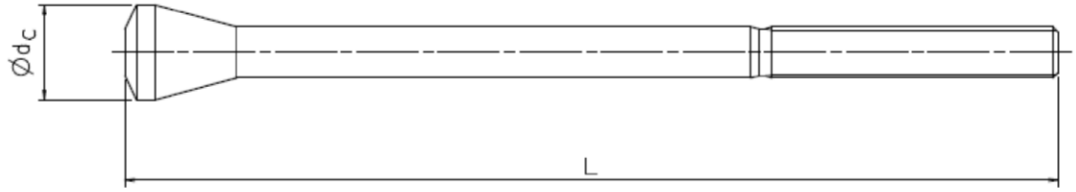
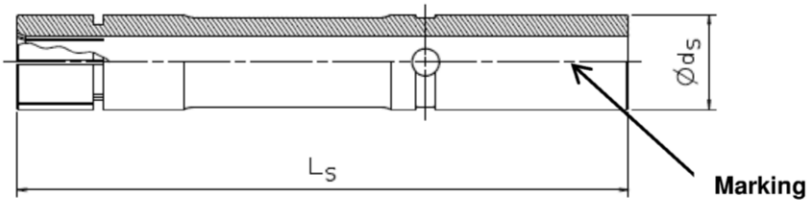
Undercut anchor Miyanaga ANZEX (Pre-setting type)



Conical bolt Miyanaga ANZEX (Pre-setting type)



Expander sleeve Miyanaga ANZEX (Pre-setting type)



Marking: Company logo–ANZEX–Anchor size–Anchor type–Strength class–Coating (E = electroplated)–Bore hole diameter

Through-fastening type: ANZEX AZM16T88E305

Pre-setting type: ANZEX AZM16P88E305

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

Miyanaga ANZEX undercut anchor	Annex A 2
Product description Dimensions and marking	

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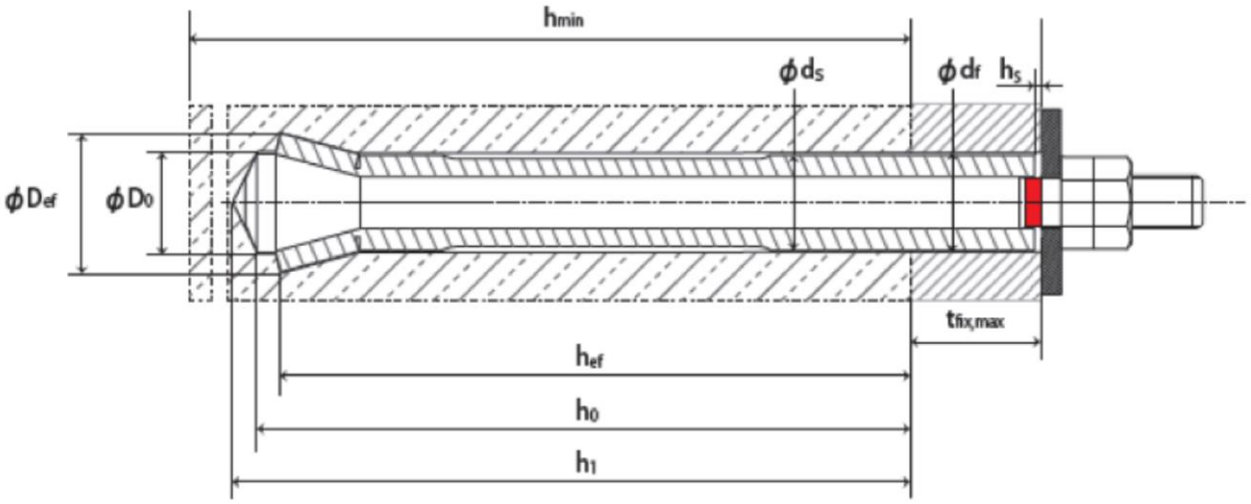
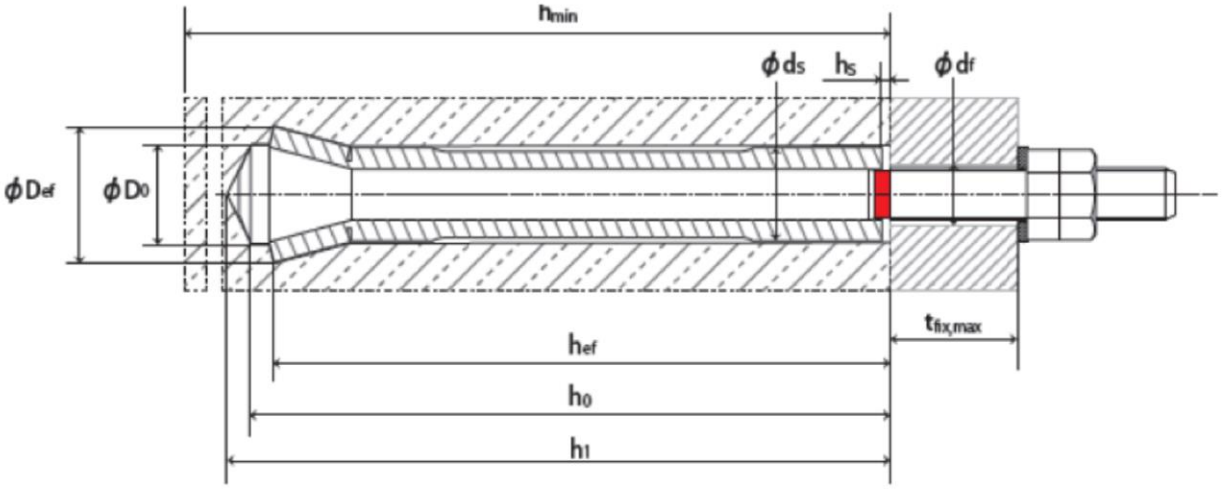
Undercut anchor after installation (through-fastening type)



Undercut anchor after installation (pre-setting type)



Miyanaga ANZEX undercut anchor	
Product description Anchor types	**Annex A 3**

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Intended use

Anchorages subject to:

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

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000
- Strength classes C20/25 to C50/60 according to EN 206-1:2000
- Uncracked or cracked concrete

Use conditions (environmental conditions)

- Anchorages 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.).
- Anchorages under static or quasi-static actions are designed for design method A in accordance with 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 B5, B6 and B7
- 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).

Miyanaga ANZEX undercut anchor	**Annex B 1**
Intended Use Specifications	

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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]	≥ 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
Uncracked and cracked concrete				
Minimum edge distance	c_{min}	[mm]	152	
Minimum spacing	s_{min}	[mm]	190	

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

Miyanaga ANZEX undercut anchor

Intended Use
Installation parameters

Annex B 2

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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	
Undercutt gauge	GE305	
Setting tool	STMAXM16 (SDS-max) STHEXM16 (Hexagonal)	
Calibrated torque wrench	Common tool	

Miyanaga ANZEX undercut anchor	Annex B 3
Intended Use Setting tools	

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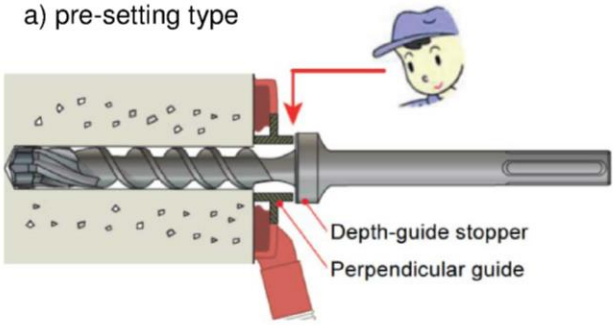
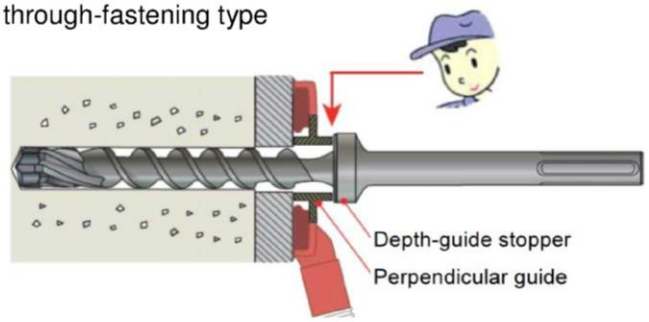
Installation instruction

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

a) pre-setting type

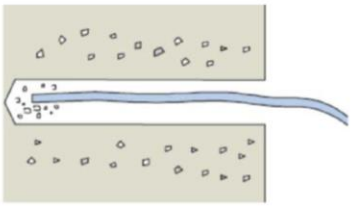


b) through-fastening type

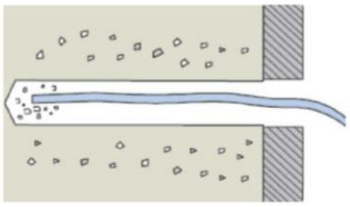


2) Clean the primary hole using a vacuum cleaner.

a) pre-setting type

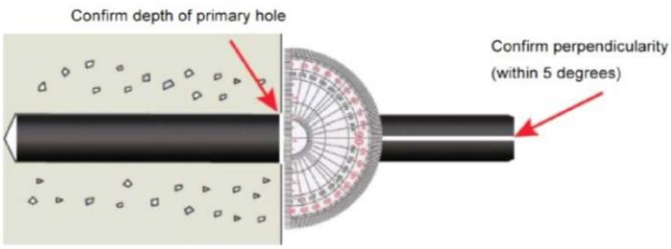


b) through-fastening type

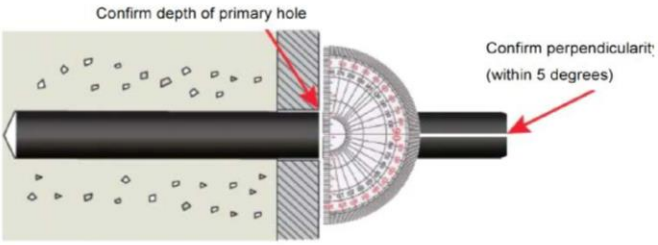


3) Confirm depth and perpendicularity of bore hole.

a) pre-setting type



b) through-fastening type



Miyanaga ANZEX undercut anchor	
Intended Use Installation instruction	**Annex B 4**

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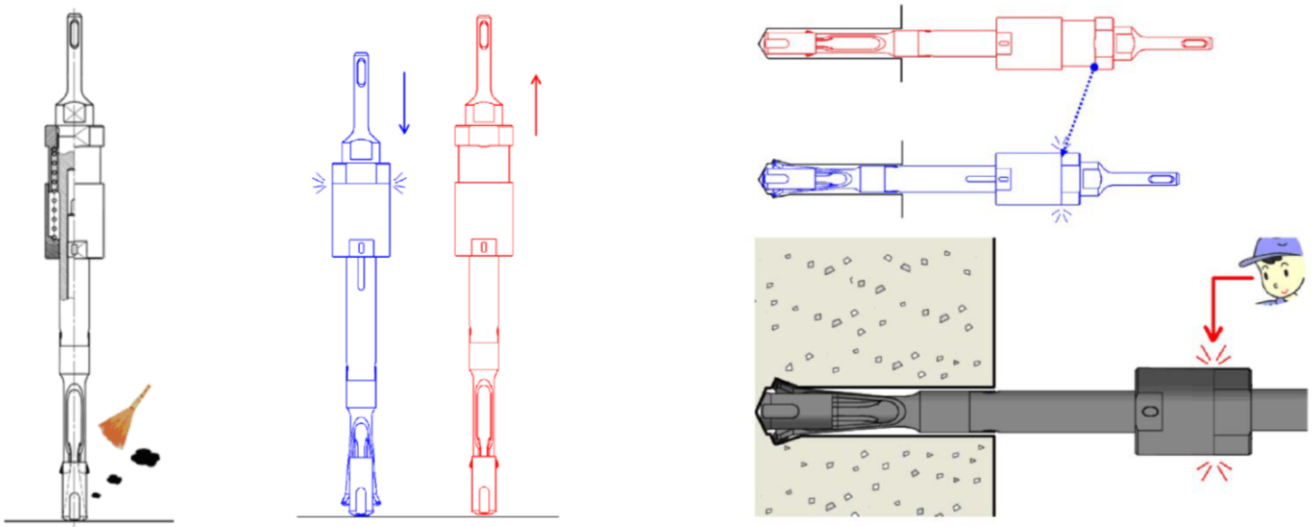
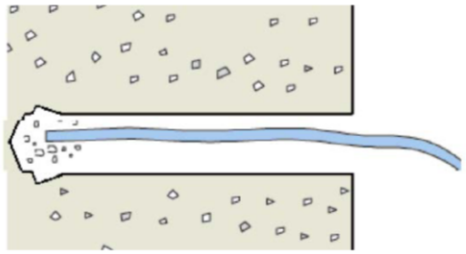
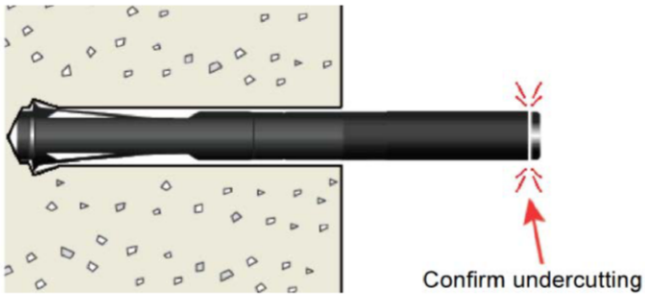
4) Clean around the cutter blade and the bow jaw of the undercutter with a brush. Then, hold and press the bow jaw against the ground, and confirm that the cutter blade opens and closes smoothly.
Hold the tip of the undercutter bow jaw against the bottom of the hole. Turn on the hammer drill and press. 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.

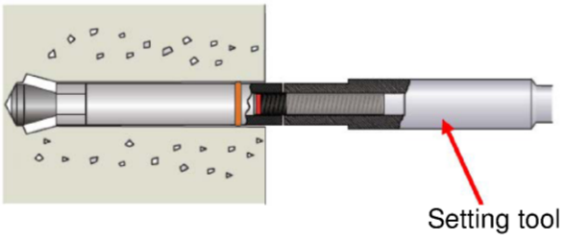


Miyanaga ANZEX undercut anchor	**Annex B 5**
Intended Use Installation instruction	

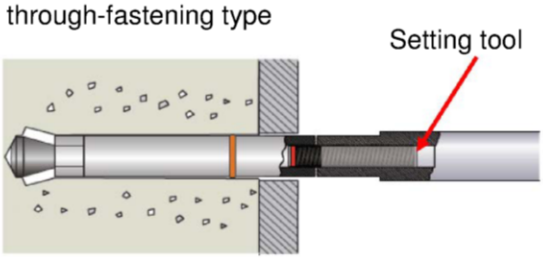
Deutsches Institut für Bautechnik DIBt

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

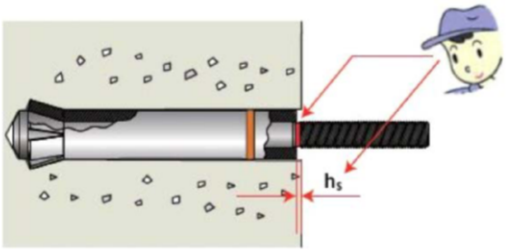


b) through-fastening type

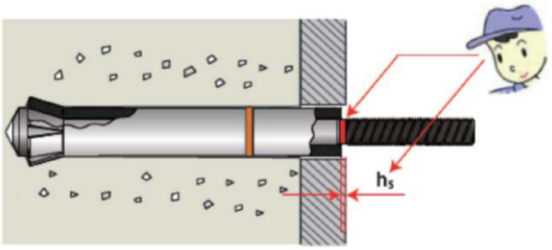


8) The setting is completed when the expander sleeve has been completely set inside the hole, the red line marked on the conical bolt is visible, and it is confirmed that the top surface of the expander sleeve is lower than the surface of the concrete by distance $h_s \geq 2.0$ mm.

a) pre-setting type

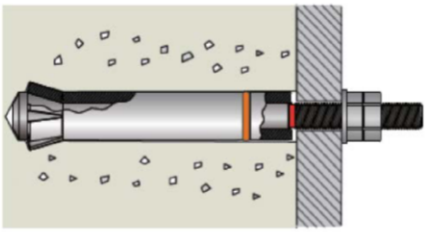


b) through-fastening type

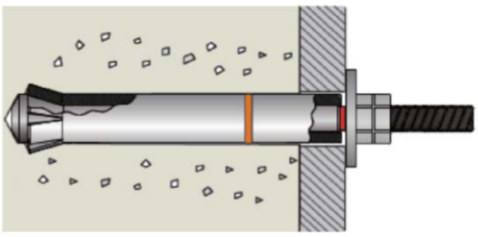


9) Use a set of nuts (Hardlock nut) to attach the fixture. Tighten the convex nut then the concave nut, each to its specified torque (Table B1), to complete installation.

a) pre-setting type



b) through-fastening type



Miyanaga ANZEX undercut anchor	
Intended Use Installation instruction	**Annex B 6**

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Table C1: Characteristic resistances under tension loading, Design method A

Anchor type (Annex B2)				Through-fastening	Pre-setting
Size				M16 T	M16 P
Steel failure					
Characteristic resistance		$N_{Rk,s}$	[kN]	125.6	125.6
Partial safety factor		γ_{Ms} 1)	[-]	1.5	1.5
Pullout failure					
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p}$	[kN]	- 2)	
Characteristic resistance in uncracked concrete C20/25		$N_{Rk,p}$	[kN]	- 2)	
Partial safety factor concrete		γ_{Mp} 1)	[-]	1.5	
Increasing factor for $N_{RK,p}$ for cracked and uncracked concrete	C20/25	Ψ_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 x h_{ef}	
Characteristic edge distance concrete cone failure		$c_{cr,N}$	[mm]	1.5 x h_{ef}	
Characteristic spacing splitting failure		$s_{cr,sp}$	[mm]	3.0 x h_{ef}	
Characteristic edge distance splitting failure		$c_{cr,sp}$	[mm]	1.5 x h_{ef}	
Installation safety factor		γ_{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		[kN]	43.0	
Displacement	δ_{N0}	[mm]	1.7	
	$\delta_{N\infty}$	[mm]	1.7	
Tension load N[1] in uncracked concrete C20/25		[kN]	61.3	
Displacement	δ_{N0}	[mm]	0.8	
	$\delta_{N\infty}$	[mm]	1.3	

1) $N = N_{RK,c} / (1.4\ \gamma_{Mc})$

Miyanaga ANZEX undercut anchor

Design method A,
Characteristic resistances and displacements
under static and quasi static tension loading

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic resistances under shear loading, Design method A

Anchor type (Annex B2)			Through-fastening	Pre-setting
Size			**M16T**	**M16P**
Steel failure without lever arm				
Characteristic resistance	$V_{Rk,s}$	[kN]	151.9	62.8
Factor for groups	k_7 [2)]	[-]	0.8	0.8
Partial safety factor	γ_{Ms} [1)]	[-]	1.25	1.25
Steel failure with lever arm				
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	250 [3)]	250
Partial safety factor	γ_{Ms} [1)]	[-]	1.25 [3)]	1.25
Concrete pry-out failure				
Factor for pry-out failure	k_8 [2)]	[-]	2	2
Partial safety factor	γ_{Mc} [1)]	[-]	1.5	1.5
Concrete edge failure				
Effective length of anchor under shear loading	$l_{f,min}$	[mm]	74	74
Outside diameter of anchor	d_{nom}	[mm]	29.5	29.5
Partial safety factor	γ_{Mc} [1)]	-	1.5	1.5

1) Parameters according to FprEN 1992-4:2016 in absence of other national regulations
2) Parameters according to FprEN 1992-4:2016
3) 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 [1)]	δ_{V0}	[mm]	4.1	2.9
	$\delta_{V\infty}$	[mm]	6.2	4.4

1) Additional displacements due to the annular gap of the clearance hole in the fixture is not considered.
2) $V = V_{RK,s} / (1.4 \cdot \gamma_{Ms})$

Miyanaga ANZEX undercut anchor

Design method A,
Characteristic resistances and displacements
under static and quasi static shear loading

Annex C 2

Deutsches Institut für Bautechnik DIBt

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

Anchor type (Annex B2)			Through-fastening	Pre-setting
Size			M16 T	M16 P
Steel failure				
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	125.6	
Partial safety factor	γ_{Ms} [1)]	[-]	1.5	
Pull-out failure				
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	90.2	
Partial safety factor	γ_{Mp} [1)]	[-]	1.5	

1) 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 safety factor	γ_{Ms} [1)]	[-]	1.25	

1) 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 safety factor	γ_{Ms} [1)]	[-]	1.5	
Pull-out failure				
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	81.2	
Partial safety factor	γ_{Mp} [1)]	[-]	1.5	

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

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

Steel failure without lever arm			**M16 T**	**M16 P**
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	57.7	61.8
Partial safety factor	γ_{Ms} [1)]	[-]	1.25	1.25

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

Miyanaga ANZEX undercut anchor

Design method A,
Characteristic resistances
under seismic tension and shear loading of category C1 and C2

Annex C 3

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

Anchor type (Annex B2)			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

Miyanaga ANZEX undercut anchor	**Annex C 4**
Design method A, Displacements under seismic tension and shear loading of category C1 and C2	