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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

European Technical Assessment ETA-19/0819 of 2019/12/13

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	EXTREME GRIP EPOXY Bonded anchor
Product family to which the above construction product belongs:	Bonded anchor with anchor rod for use in concrete under static, quasi-static or seismic action (performance category C2)
Manufacturer:	Torggler Chimica S.p.A Via Prati Nuovi, 9 IT-39020 Marlegno (BZ) Tel. +39 0473 282400 Internet www.torggler.com
Manufacturing plant:	Torggler Chimica S.p.A Manufacturing plant II
This European Technical Assessment contains:	23 pages including 18 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	European Assessment Document (EAD) no 330499-00-0601 Bonded fasteners for use in concrete.
This version replaces:	-

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
The EXTREME GRIP EPOXY Bonded anchor is a bonded anchor (injection type) consisting of an injection mortar cartridge equipped with a special mixing nozzle and threaded anchor rod of the sizes M8 to M30 made of:

- galvanized carbon steel
- stainless steel A4-70, A4-80 or high corrosion resistant stainless steel with hexagon nut and washer.

The threaded rod is placed into a drilled hole previously injected (using an applicator gun) with a mortar with a slow and slight twisting motion. The anchor rod is anchored by the bond between rod, mortar and concrete.

The threaded rod is available for all diameters with three type of tip end a one side 45° chamfer, a two sided 45° chamfer or a flat. The threaded rods are either delivered with the mortar cartridges or commercial standard threaded rods purchased separately. Each mortar cartridge is marked with the identifying mark of the producer and with the trade name. The mortar cartridges are available in different sizes.

The anchor in the range of M8 to M30 and the mortar cartridges corresponds to the drawings given in the Annex A1 to A4.

The characteristic material values, dimensions and tolerances of the anchors not indicated in Annexes shall correspond to the respective values laid down in the technical documentation[1] of this European Technical Assessment.

The anchors are intended to be used with embedment depth given in Annex A2, Table A1. For the installed anchor see Figure given in Annex A1. The intended use specifications of the product are detailed in the Annex B1.

2 Specification of the intended use in accordance with the applicable EAD

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B1 to B9

The provisions made in this European Technical Assessment are based on an assumed intended working life of the anchor of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, 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.

1 The technical documentation of this European Technical Assessment is deposited at ETA-Danmark and, as far as relevant for the tasks of the Notified bodies involved in the attestation of conformity procedure, is handed over to the notified bodies.

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

3.1 Characteristics of product

Mechanical resistance and stability (BWR1):
The essential characteristics are detailed in the Annex from C1 to C3.

Safety in case of fire (BWR2):
The essential characteristics are detailed in the Annex from C4.

Hygiene, health and the environment (BWR3):
No performance assessed

Safety in use (BWR4):
For basic requirement Safety in use the same criteria are valid for Basic Requirement Mechanical resistance and stability (BWR1).

Sustainable use of natural resources (BWR7)
No performance determined

Other Basic Requirements are not relevant.

3.2 Methods of assessment

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 has been made in accordance European Assessment Document (EAD) no 330499-00-0601 Bonded fasteners for use in concrete.

4 Attestation and verification of constancy of performance (AVCP)

4.1 AVCP system

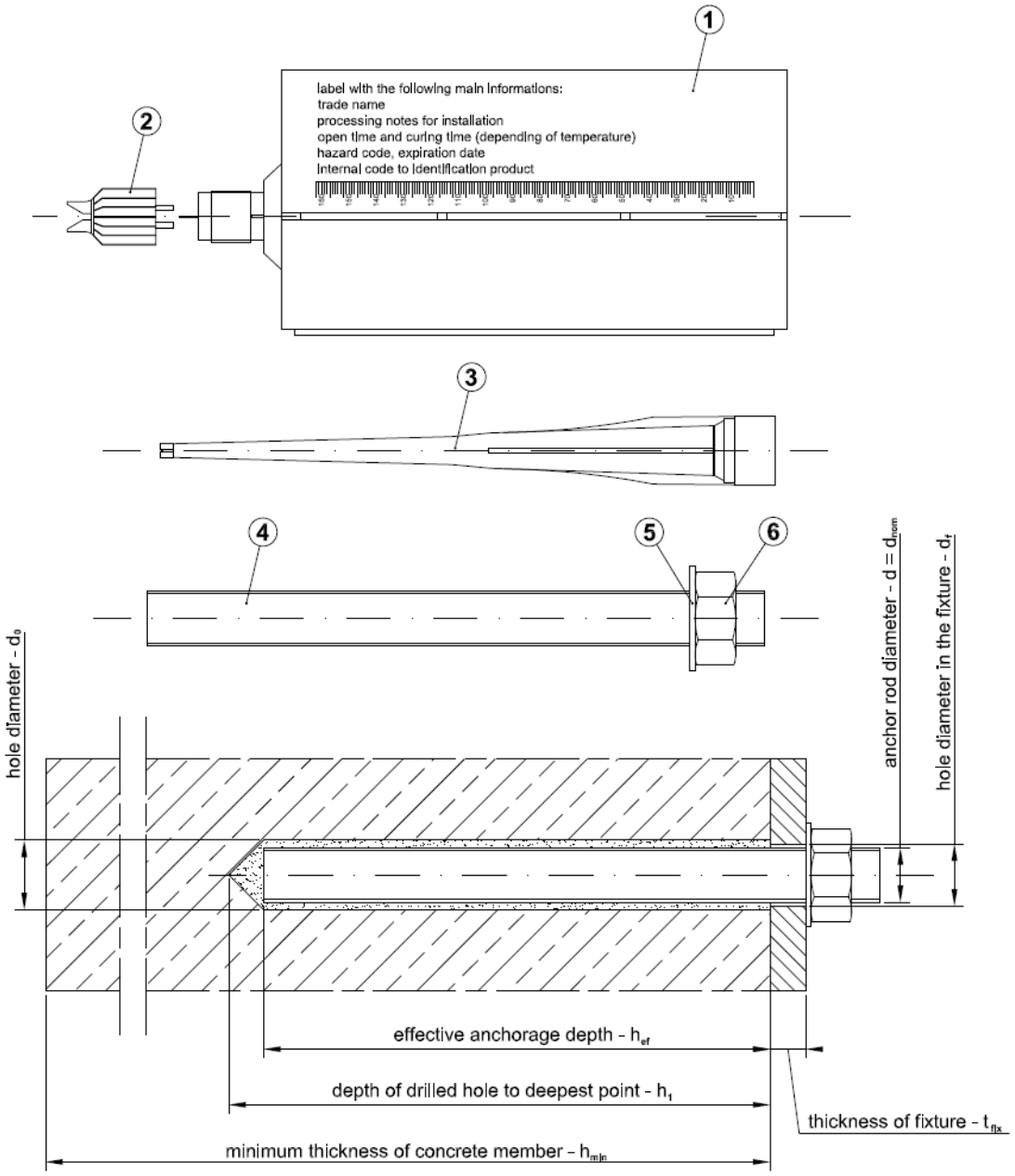
According to the decision 96/582/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 1.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking

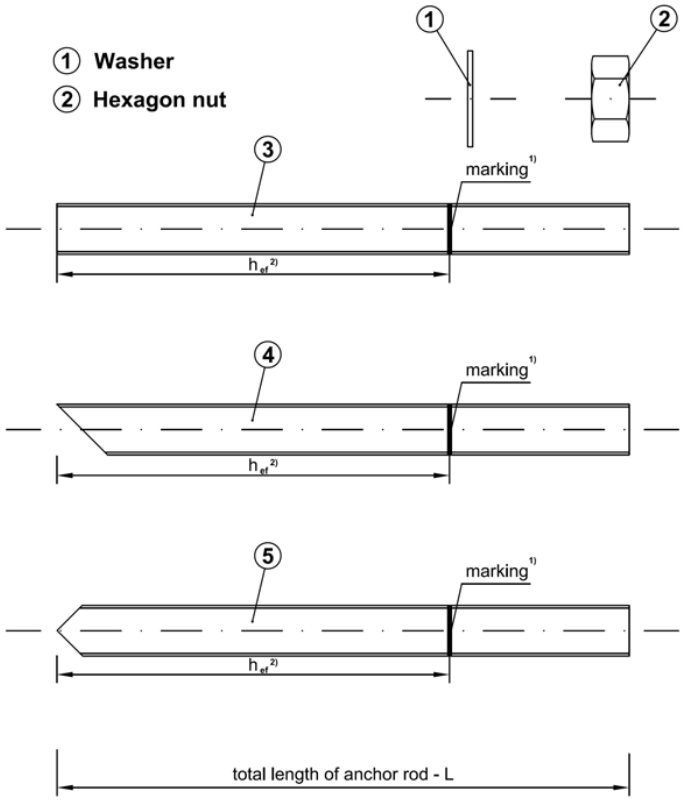
Issued in Copenhagen on 2019-12-13 by

Thomas Bruun
Manager, ETA-Danmark



① Cartridge
② Sealing cap
③ Mixer
④ Anchor threaded rod
⑤ Washer
⑥ Hexagon nut

EXTREME GRIP EPOXY Bonded anchor	**Annex A1** of European Technical Assessment ETA-19/0819
Product and intended use	



③ Version 1 - rod with flat end with marking on h_{ef}
④ Version 2 - rod with 45° cutted end with marking on h_{ef}
⑤ Version 3 - rod with V shape end with marking on h_{ef}

Table A1: Threaded rod dimensions

Size	d [mm]	$h_{ef,min}$ [mm]	$h_{ef,max}$ [mm]
M8	8	60	160
M10	10	60	200
M12	12	70	240
M16	16	80	320
M20	20	90	400
M24	24	96	480
M27	27	110	540
M30	30	120	600

1) Marking according to point 1.1 of EAD 330499-00-0601

2) Effective anchorage depths according to the range specified in Table A1.

EXTREME GRIP EPOXY Bonded anchor	**Annex A2** of European Technical Assessment ETA-19/0819
Threaded rod types and dimensions	

Table A2: Threaded rod materials

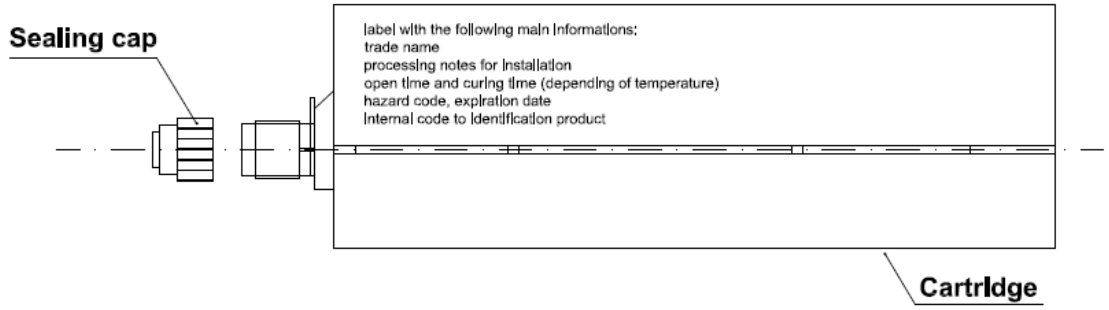
Part	Designation		
	Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042	**Stainless steel**	**High corrosion resistance stainless steel (HCR)**
Threaded rod	Steel, property class 5.8, 8.8, acc. to EN ISO 898-1	Material 1.4401 / 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529 / 1.4565/1.4547, acc. to EN 10088; property class 70 acc. to EN ISO 3506
Hexagon nut	Steel, property class 5, 8 acc. to EN 20898-2; corresponding to threaded rod material	Material 1.4401 / 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529 / 1.4565/1.4547, acc. to EN 10088; property class 70 acc. to EN ISO 3506
Washer	Steel, acc. to EN ISO 7089; corresponding to threaded rod material	Material 1.4401 / 1.4571 acc. to EN 10088; corresponding to threaded rod material	Material 1.4529 / 1.4565/1.4547, acc. to EN 10088; corresponding to threaded rod material

Commercial standard threaded rods with:
- material and mechanical properties according to Table A2,
- confirmation of material and mechanical properties by inspection certificate 3.1 according to EN-10204:2004,
- marking of the threaded rod with the embedment depth.
- Minimum rupture elongation, A_1, equal to 12% according to EN ISO 898 for use under seismic action

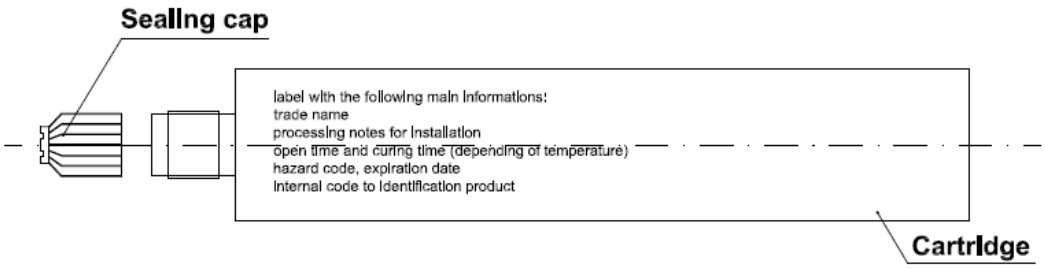
Table A3: Injection mortar

Product	Composition
EXTREME GRIP EPOXY Bonded anchor two components injection mortar)	Additive: quartz Bonding agent: epoxy resin

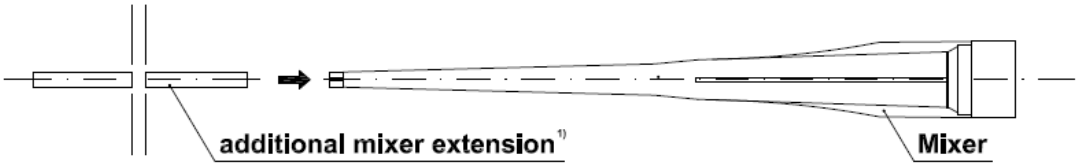
Cartridge from 400 to 900 ml - syde by syde cartridge



Cartridge 265 ml - peeler cartridge



MIXER - the mixer is suitable for each type of cartridge



1) Variable length from 380 mm up to 1000 mm

EXTREME GRIP EPOXY Bonded anchor	**Annex A4**
Cartridge types and sizes	of European Technical Assessment ETA-19/0819

Use:
The anchors are intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation 305/2011 (EU) shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences.

Anchors subject to:
- Static and quasi-static loads: sizes from M8 to M30.
- Seismic loads performance category C2: sizes from M16 to M24.

Base materials:
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206-1.
- Non cracked concrete: sizes from M8 to M30.
- Cracked concrete: sizes from M12 to M24.

Temperature range:
The anchors may be used in the following temperature range:
a) -40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C).
b) -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C).

Use conditions (Environmental conditions):
- Elements made of galvanized steel may be used in structures subject to dry internal conditions only.
- Elements made of stainless steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions exist. Such 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).
- Elements made of high corrosion resistant steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure or exposure in permanently damp internal conditions or in other particular aggressive conditions. Such 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 chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Installation:
The anchors may be installed in:
- Dry or wet concrete (use category I1): sizes from M8 to M30.
- Flooded holes with the exception of seawater (use category I2): sizes from M8 to M30.
- Installation direction D3 (downward and horizontal and upwards installation).
- The anchor is suitable for hammer drilled holes: sizes from M8 to M30.

Proposed design methods:
- Static and quasi-static load: EN 1992-4.
- Seismic load: EOTA Technical Report TR045 (February 2013).

EXTREME GRIP EPOXY Bonded anchor	**Annex B1** of European Technical Assessment ETA-19/0819
Intended use - Specification	

Table B1: Installation data

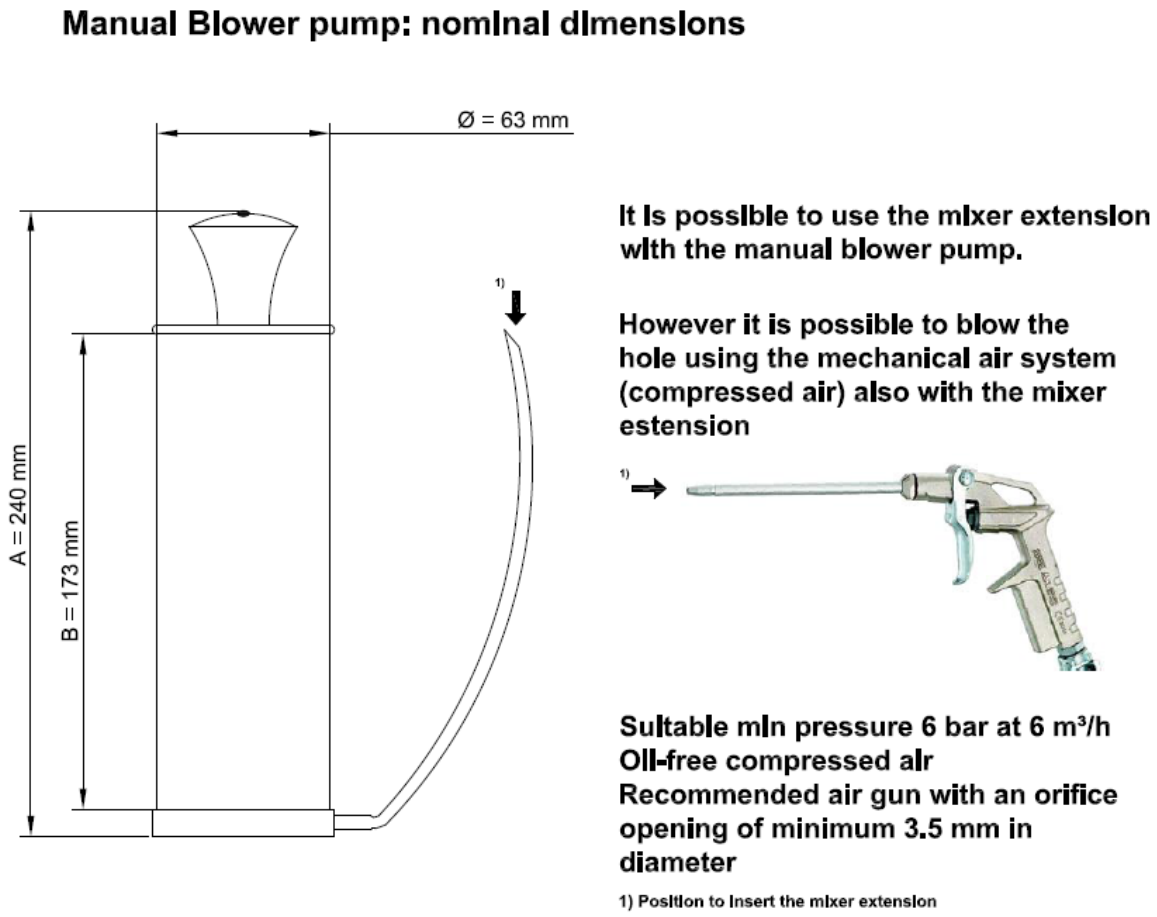
Size		M8	M10	M12	M16	M20	M24	M27	M30
Nominal drilling diameter	d_0 [mm]	10	12	14	18	24	28	30	35
Maximum diameter hole in the fixture	d_{fix} [mm]	9	12	14	18	22	26	29	33
Embedment depth	$h_{ef,min}$ [mm]	60	60	70	80	90	96	110	120
	$h_{ef,max}$ [mm]	160	200	240	320	400	480	540	600
Depth of the drilling hole	h_1 [mm]	h_{ef} + 5 mm							
Minimum thickness of the slab	h_{min} [mm]	h_{ef} + 30 mm; ≥ 100 mm			h_{ef} + $2d_0$				
Torque moment	T_{inst} [Nm]	10	20	40	80	130	200	270	300
Thickness to be fixed	$t_{fix,min}$ [mm]	> 0							
	$t_{fix,max}$ [mm]	< 1500							
Minimum spacing	S_{min} [mm]	40	50	60	80	100	120	135	150
Minimum edge distance	C_{min} [mm]	40	50	60	80	100	120	135	150

Table B2: Minimum curing time[1)]

Concrete temperature	Processing time	Minimum curing time[3)]
0°C[2)]	3 h 20 min	54 h
5°C[2)]	2 h 30 min	41 h
10°C	1 h 40 min	28 h
15°C	1 h 10 min	22 h
20°C	50 min	16 h
25°C	30 min	14 h
30°C	20 min	12 h

1) the minimum time from the end of the mixing to the time when the anchor may be torque or loaded (whichever is longer).
2) minimum resin temperature recommended, for injection between 5°C and 0°C, equal to 10°C.
3) minimum curing time for dry, wet and flooded hole conditions.

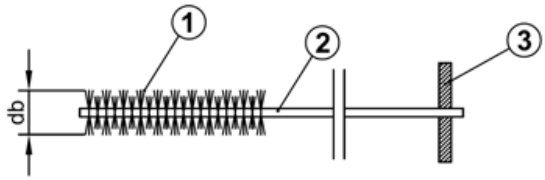
Manual blower pump: nominal dimensions



Mixer extension (from 380 mm to 1000 mm) with nominal diameter equal to 8 mm

EXTREME GRIP EPOXY Bonded anchor	**Annex B3**
Cleaning tools (1)	of European Technical Assessment ETA-19/0819

Standard brush

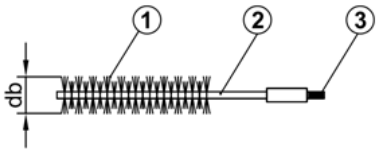


① Steel bristles
② Steel stem
③ Wood handle

Table B3: Standard brush diameter

Threaded rod diameter - d			M8	M10	M12	M16	M20	M24	M27	M30
d_0	Nominal drill hole	[mm]	10	12	14	18	24	28	30	35
d_b	Brush diameter	[mm]	12	14	16	20	26	30	32	37

Special brush



① Steel bristles
② Steel stem
③ Threaded connection for drilling tool extension
④ Extension special brush
⑤ Drilling tool connection (SDS connection)

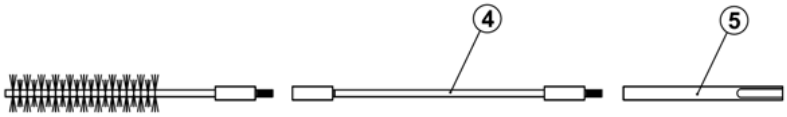
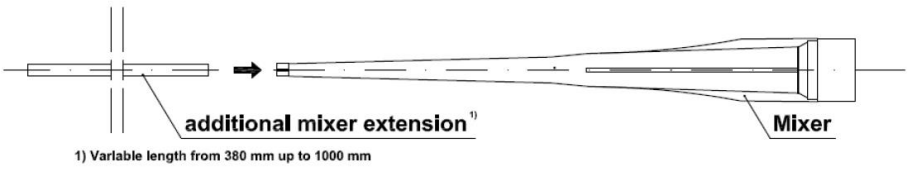


Table B4: Special brush diameter (mechanical brush)

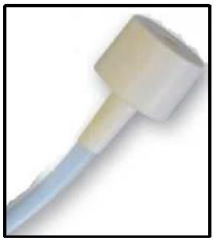
Threaded rod diameter - d			M16	M20	M24	M27	M30
d_0	Nominal drill hole	[mm]	18	24	28	30	35
d_b	Brush diameter	[mm]	20	26	30	32	37

EXTREME GRIP EPOXY Bonded anchor	Annex B4 of European Technical Assessment ETA-19/0819
Cleaning tools (2)	

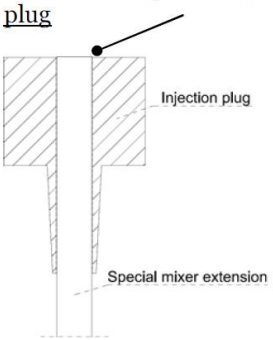
Use the mixer extension (assembled on the standard mixer) for the injection up to 300 mm if necessary.



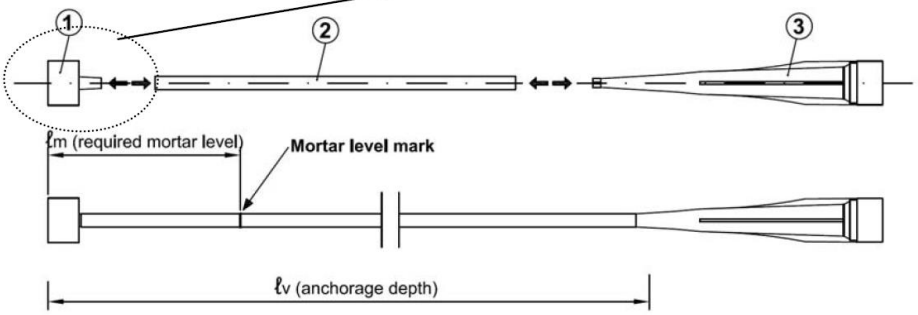
Use this system for special conditions:



Insert the special mixer extension in the inner diameter of the injection plug up to reach the top of the plug



Tools for installation in special condition



① **Injection plug (nominal diameter according to the nominal diameter of drilled hole)**

② **Special mixer extension (variable length with nominal diameter 10 mm)**

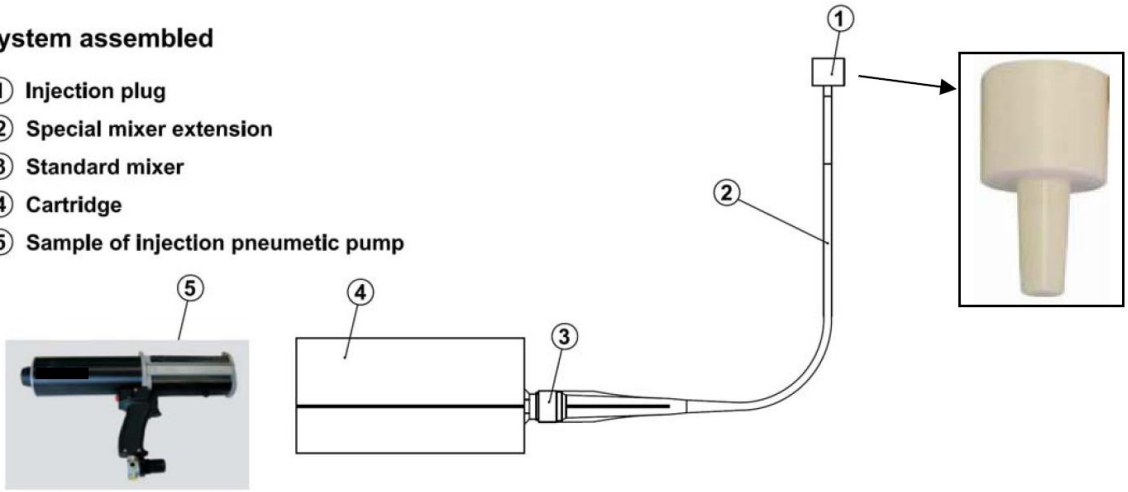
Mark the required mortar level ℓ_m and embedment depth ℓ_v with tape or marker on the injection extension. Quick estimation: $\ell_m = 1/3 \cdot \ell_v$
Continue injection until the mortar level mark ℓ_m becomes visible.

③ **Standard mixer (suitable for all size of cartirge)**

These tools allow the application in special conditions:
- installation with anchorage depth greater than 300 mm
- overhead installation.
For these applications is recommanded the use of the injection pneumatic pump.

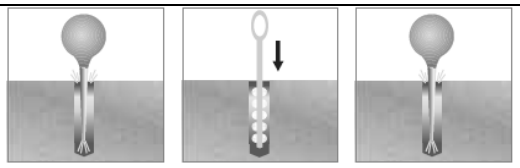
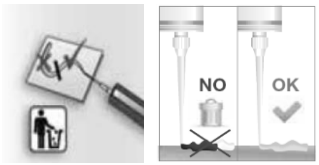
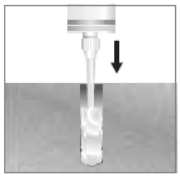
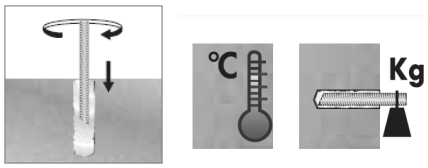
System assembled

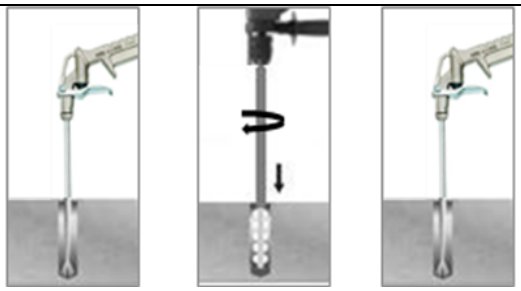
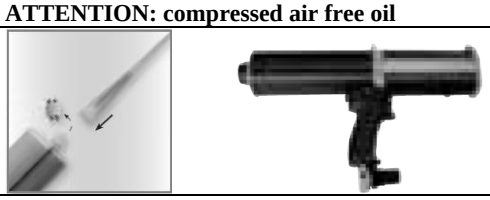
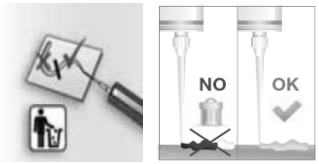
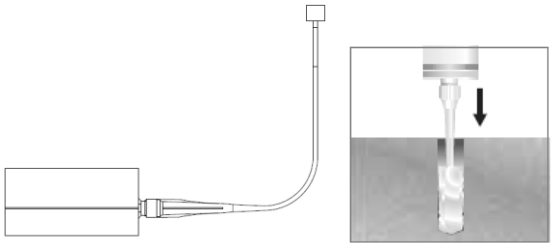
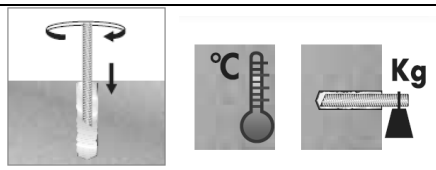
① **Injection plug**
② **Special mixer extension**
③ **Standard mixer**
④ **Cartridge**
⑤ **Sample of injection pneumetic pump**



EXTREME GRIP EPOXY Bonded anchor	**Annex B5** of European Technical Assessment ETA-19/0819
Tools for injection (1)	

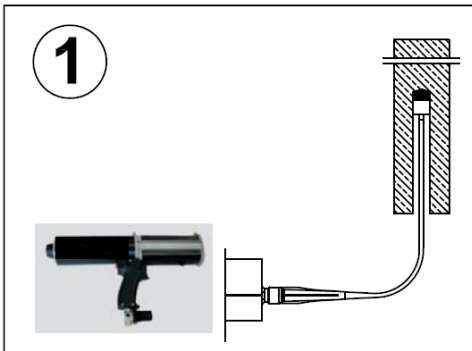
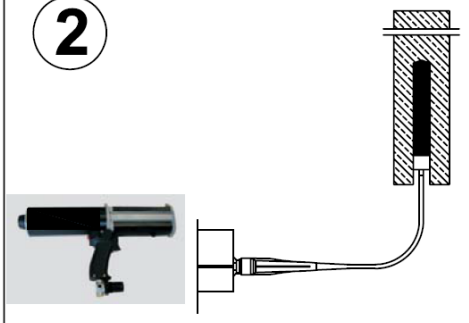
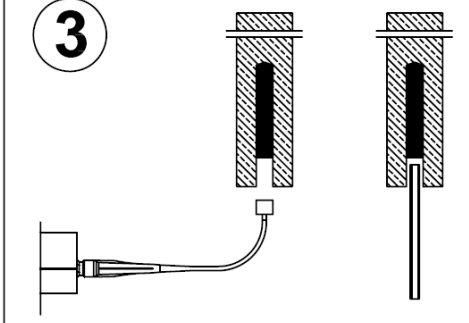
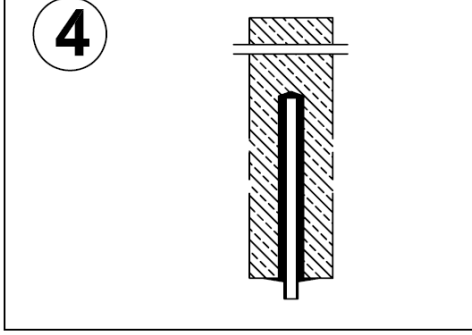
Resin injection pump details		
Pump example	**Size cartridge**	**Type**
	900 ml	Pneumatic
	from 450 ml to 480 ml	Pneumatic
	400 ml	Pneumatic
	from 450 ml to 480 ml	Manual (up to 300 mm anchorage depth)
	400 ml	Manual (up to 300 mm anchorage depth)
	265 ml	Manual (up to 300 mm anchorage depth)

1		Drill the hole with the correct diameter and depth using a rotary percussive machine. Check the perpendicularity of the hole during the drilling operation.
2	 **4x Blower Manual Pump** **4x Standard Brush** **4x Blower Manual Pump** **if necessary use a mixer extension for the blower operation (see Annex B3)**	Clean the hole from drilling dust: the hole shall be cleaned by at least 4 blowing operations, by at least 4 brushing operations followed again by at least 4 blowing operations; before brushing clean the brush and check (see Annex B4, standard brush) if the brush diameter is sufficient. For the blower tools see Annex B3.
3		Unscrew the front cup, screw on the mixer and insert the cartridge in the gun.
4		Before starting to use the cartridge, eject a first part of the product, being sure that the two components are completely mixed. The complete mixing is reached only after that the product, obtained by mixing the two components, comes out from the mixer with an uniform color.
5	 **if necessary use a mixer extension for the injection (see Annex B5)**	Fill the drilled hole uniformly starting from the drilled hole bottom, in order to avoid entrapment of the air; remove the mixer slowly bit by bit during pressing-out; filling the drill hole with a quantity of the injection mortar corresponding to 2/3 of the drill hole depth.
6	 **ATTENTION: Use the rods dry and free oil and other contaminants**	Insert immediately the rod, marked according to the proper anchorage depth, slowly and with a slight twisting motion, removing excess of injection mortar around the rod. Observe the processing time according Annex B2. Wait the curing time according Annex B2.

1		Drill the hole with the correct diameter and depth using a rotary percussive machine. Check the perpendicularity of the hole during the drilling operation.
2	 **4 x 5 seconds** **4x** **4 x 5 seconds** **ATTENTION: compressed air free oil**	Clean the hole from drilling dust: the hole shall be cleaned by at least 4 blowing operations (5 seconds for single operation) with compressed air, by at least 4 brushing operations with special brush followed again by at least 4 blowing operations (5 seconds for single operation) with compressed air. Before brushing clean the brush and check (see Annex B4, special brush) if the brush diameter is sufficient. For the blower tools see the Annex B3.
3		Unscrew the front cup of the cartridges, screw on the mixer and insert the cartridge in the proper pneumatic-pump.
4		Before starting to use the cartridge, eject a first part of the product, being sure that the two components are completely mixed. The complete mixing is reached only after that the product, obtained by mixing the two components, comes out from the mixer with an uniform color.
5		Before starting the injection, assemble the system according to Annex B5. After that, fill the drilled hole uniformly from the drilled hole bottom, in order to avoid entrapment of the air; remove the special mixer extension with injection plug slowly bit by bit during pressing-out; filling the drill hole with a quantity of the injection mortar corresponding to 2/3 of the drill hole depth. Procedure for overhead application is detailed in Annex B9.
6	 **ATTENTION: Use the rods dry and free oil and other contaminants**	Insert immediately the rod, marked according to the proper anchorage depth, slowly and with a slight twisting motion, removing excess of injection mortar around the rod. Observe the processing time according Annex B2. Wait the curing time according Annex B2.

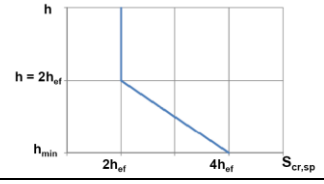
EXTREME GRIP EPOXY Bonded anchor	**Annex B8** of European Technical Assessment ETA-19/0819
Procedure up to 600 mm depth	

In addition to standard procedure, for overhead installation, following the below procedure

	**1 - Start injection** **Inject from the bottom of the hole. Maintain this position during the injection phase.**
	**2 - Injection phase** **Inject the product about 2/3 of the hole depth.** **During the injection maintain this position to assure the correct installation**
	**3 - End injection** **Remove the injection plug.** **Insert immediately the rod (turn the rod during the insertion).**
	**4 - End installation** **To avoid the slipping of the rod during the open time of the product (due to the rod own weigth) use a temporary interlocking element (for ex. wedge of wood)**

EXTREME GRIP EPOXY Bonded anchor	**Annex B9** of European Technical Assessment ETA-19/0819
Overhead application	

Table C1: Characteristic values for tension and shear load in cracked and non cracked concrete.

HARMONIZED TECHNICAL SPECIFICATION: EAD 330499-00-0601									
ESSENTIAL CHARACTERISTICS		**PERFORMANCE**							
Installation parameters		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
d [mm]		8	10	12	16	20	24	27	30
d_0 [mm]		10	12	14	18	24	28	30	35
d_{fix} [mm]		9	12	14	18	22	26	29	33
h_1 [mm]		h_{ef} + 5 mm							
h_{min} [mm]		h_{ef} + 30 mm; ≥ 100 mm			h_{ef} + $2d_0$				
T_{inst} [Nm]		10	20	40	80	130	200	270	300
t_{fix} [mm]	Min	> 0							
	Max	≤ 1500 mm							
S_{min} [mm]		40	50	60	80	100	120	135	150
C_{min} [mm]		40	50	60	80	100	120	135	150
γ_2 [-] Category I1		1,00							
γ_2 [-] Category I2		1,20							
Resistance for concrete cone failure		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$N_{Rk,c}$ [kN]		Characteristic resistance according to the design method specified in Annex B1							
$s_{cr,N}$ [mm]		$3h_{ef}$							
$c_{cr,N}$ [mm]		$1.5h_{ef}$							
$k_{urcr,N}$ [-]		Parameter according to the design method specified in Annex B1							
$k_{cr,N}$ [-]		Parameter according to the design method specified in Annex B1							
Resistance for combined pullout and concrete cone failure		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$\tau_{Rk,ucr}$ [N/mm²] concrete C20/25 Temperature range -40°C/+40°C (T_{mlp} = 24°C)		12,0	11,0	11,0	11,0	10,0	10,0	10,0	10,0
$\tau_{Rk,ucr}$ [N/mm²] concrete C20/25 Temperature range -40°C/+80°C (T_{mlp} = 50°C)		9,0	8,5	8,5	8,5	7,0	7,0	7,0	7,0
$\psi_{c,ucr}$ C30/37 [-]		1,08							
$\psi_{c,ucr}$ C40/50 [-]		1,15							
$\psi_{c,ucr}$ C50/60 [-]		1,19							
$\tau_{Rk,cr}$ [N/mm²] concrete C20/25 Temperature range -40°C/+40°C (T_{mlp} = 24°C)		-	-	7,0	7,0	7,0	7,0	-	-
$\tau_{Rk,cr}$ [N/mm²] concrete C20/25 Temperature range -40°C/+80°C (T_{mlp} = 50°C)		-	-	5,5	5,5	5,5	5,5	-	-
$\psi_{c,cr}$ C30/37 [-]		1,00							
$\psi_{c,cr}$ C40/50 [-]		1,00							
$\psi_{c,cr}$ C50/60 [-]		1,00							
Resistance for tensile load Resistance for splitting failure		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$S_{cr,sp}$ [mm]						if h = h_{min} - $S_{cr,sp}$ = 4 h_{ef} if h_{min} ≤ h < 2 h_{ef} - $S_{cr,sp}$ = interpolate value if h ≥ 2 h_{ef} - $S_{cr,sp}$ = 2 h_{ef}			
$C_{cr,sp}$ [mm]		0,50 $S_{cr,sp}$							

Note: Characteristic resistance for steel failure (standard threaded rods) according to the design method. Steel property class according to Annex A3 Table A2. Design method according to Annex B1.

EXTREME GRIP EPOXY Bonded anchor	**Annex C1** of European Technical Assessment ETA-19/0819
Performance for static and quasi-static loads: Resistances	

HARMONIZED TECHNICAL SPECIFICATION: EAD 330499-00-0601								
ESSENTIAL CHARACTERISTICS	**PERFORMANCE**							
Resistance for shear load **Resistance for concrete pry-out failure**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$k = k_3 = k_8$ [-]	2,0							
Steel failure without lever arm [1)]								
$V_{Rk,s}$ [kN]	Characteristic resistance according to the design method specified in Annex B1							
k_7 [-]	1							
Steel failure with lever arm [1)]								
$M^0_{Rk,s}$ [kN]	Characteristic resistance according to the design method specified in Annex B1							
Concrete edge failure								
$V_{Rk,c}$ [kN]	Characteristic resistance according to the design method specified in Annex B1							
d_{nom} [mm]	8	10	12	16	20	24	27	30
l_f [mm]	h_{ef}							

Note: Characteristic resistance for steel failure (standard threaded rods) according to the design method. Steel property class according to Annex A3 Table A2. Design method according to Annex B1.

Table C2: Characteristic values for tension and shear for seismic category C2

HARMONIZED TECHNICAL SPECIFICATION: TR049			
ESSENTIAL CHARACTERISTICS	**PERFORMANCE**		
Resistance for tensile load **Resistance for steel failure** **(standard threaded rod class 8.8 with A≥12%)**	**M16**	**M20**	**M24**
$N_{Rk,seis}$ [kN]	126	196	282
$\gamma_{M,seis}$ [-]	1,50		
Resistance for tensile load **Resistance for combined pullout and concrete cone failure**	**M16**	**M20**	**M24**
$\tau_{Rk,seis}$ [N/mm²] concrete C20/25 Temperature range -40°C/+40°C (T_{mlp} = 24°C)	2,9	2,8	2,6
$\tau_{Rk,seis}$ [N/mm²] concrete C20/25 Temperature range -40°C/+80°C (T_{mlp} = 50°C)	2,2	2,1	2,0
$\psi_{c,cr}$ C30/37 [-]	1,00		
$\psi_{c,cr}$ C40/50 [-]	1,00		
$\psi_{c,cr}$ C50/60 [-]	1,00		
Resistance for shear load **Resistance for steel failure without lever-arm** **(standard threaded rod class 8.8 with A≥12%)**	**M16**	**M20**	**M24**
$V_{Rk,seis}$ [kN]	25	39	56
$\gamma_{M,seis}$ [-]	1,25		

Table C3: Displacements under service loads (static and quasi static) in cracked and non cracked concrete.

HARMONIZED TECHNICAL SPECIFICATION: EAD 330499-00-0601								
ESSENTIAL CHARACTERISTICS	**PERFORMANCE**							
Displacement under service load Tensile and Shear load	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
F_{unc} [kN] for concrete from C20/25 to C50/60	7,6	9,5	14,3	19,0	23,8	35,7	45,2	54,8
$\delta_{0,unc}$ [mm]	0,29	0,31	0,36	0,37	0,38	0,54	0,67	0,80
$\delta_{\infty,unc}$ [mm]	0,80							
F_{cr} [kN] for concrete from C20/25 to C50/60	-	-	9,5	14,3	19,0	23,8	-	-
$\delta_{0,cr}$ [mm]	-	-	0,36	0,36	0,36	0,36	-	-
$\delta_{\infty,cr}$ [mm]	-	-	1,85				-	-

Note: Design method according to Annex B1.

Table C4: Displacement under tensile and shear load in case of performance category C2

HARMONIZED TECHNICAL SPECIFICATION: TR049					
ESSENTIAL CHARACTERISTICS			**PERFORMANCE**		
Displacement under tensile load			**M16**	**M20**	**M24**
Displacement DLS	$\delta_{N,seis(DLS)}$	[mm]	0,26	0,25	0,34
Displacement ULS	$\delta_{N,seis(ULS)}$	[mm]	0,37	0,45	0,56
Displacement under shear load			**M16**	**M20**	**M24**
Displacement DLS	$\delta_{V,seis(DLS)}$	[mm]	2,41	2,39	2,21
Displacement ULS	$\delta_{V,seis(ULS)}$	[mm]	8,30	7,29	7,42

Note: Design method according to Annex B1.

Table C5: Resistance to fire

HARMONIZED TECHNICAL SPECIFICATION: EAD 330499-00-0601	
ESSENTIAL CHARACTERISTICS	**PERFORMANCE**
Resistance to fire	No performance assessed

Table C6: Reaction to fire

HARMONIZED TECHNICAL SPECIFICATION: EAD 330499-00-0601	
ESSENTIAL CHARACTERISTICS	**PERFORMANCE**
Reaction to fire	In the final application the thickness of the mortar layer is about 1 to 2 mm and most of the mortar is material classified class A1 according to EC Decision 96/603/EC. Therefore it may be assumed that the bonding material (synthetic mortar or a mixture of synthetic mortar and cementitious mortar) in connection with the metal anchor in the end use application do not make any contribution to fire growth or to the fully developed fire and they have no influence to the smoke hazard.

Table C6: Terminology and symbols

TERMINOLOGY AND SYMBOLS	
d	Diameter of anchor bolt or thread diameter
d_0	Drill hole diameter
d_{fix}	Diameter of clearance hole in the fixture
h_{ef}	Effective anchorage depth
h_1	Depth of the drilling hole
h_{min}	Minimum thickness of concrete member
T_{inst}	Torque moment to installation
t_{fix}	Thickness to be fixed
S_{min}	Minimum allowable spacing
C_{min}	Minimum allowable edge distance
$S_{cr,sp}$	Spacing for ensuring the transmission of the characteristic tensile resistance of a single anchor without spacing and edge effects in case of splitting failure
$C_{cr,sp}$	Edge distance for ensuring the transmission of the characteristic tensile resistance of a single anchor without spacing and edge effects in case of splitting failure
$\tau_{Rk,ucr}$	Characteristic bond resistance in un-cracked concrete class C20/25
$\tau_{Rk,cr}$	Characteristic bond resistance in cracked concrete class C20/25
γ_2	Partial safety factors for installation
$\psi_{c,ucr}$	Increasing factor for un-cracked concrete
$\psi_{c,cr}$	Increasing factor for cracked concrete
k	Factor for concrete edge failure
F	Service load in un-cracked (ucr) or cracked concrete (cr)
δ_0	Short term displacement under service load in un-cracked (uncr) or cracked concrete (cr)
δ_∞	Long term displacement under service load in un-cracked (uncr) or cracked concrete (cr)
seis	Seismic action
NPD	No declared performance