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European Technical Assessment

ETA-19/0280 of 15/05/2019

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	LC, LC-A4 and LCL Wedge Anchors
Product family to which the construction product belongs	Fasteners for use in concrete for redundant non-structural applications
Manufacturer	LINK YAPI SAN. VE TIC. AS GOSB 1000 CD. NO:1016 CAYIROVA - GEBZE, KOCAELI Turkey
Manufacturing plant(s)	Manufacturing Plants no. 6 and 7
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	European Assessment Document (EAD) 330747-00-0601 "Fasteners for use in concrete for redundant non-structural systems"

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Specific Part

1 Technical description of the product

The LC, LC-A4 and LCL Wedge Anchors are deformation-controlled expansion anchors in sizes of M6, M8, M10, M12, M16 and M20. The anchors LC and LCL are made of galvanized steel and LC-A4 are made of stainless steel.

The anchor is installed in a drilled hole and anchored by deformation-controlled expansion.

The description of the product is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document (EAD)

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

The performances given in this European Technical Assessment are based on an assumed 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 the Technical 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.

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

3.1 Performance of the product

3.1.1 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchors satisfy requirements for Class A1
Resistance to fire	See Annex C2

3.1.2 Safety and accessibility in use (BWR 4)

Essential characteristic	Performance
Characteristic resistance for all load directions	See Annex C1
Edge distances and spacing	See Annex C1

3.2 Methods used for the assessment

The assessment of the anchors has been made in accordance with the European Assessment Document (EAD) 330747-00-0601 "Fasteners for use in concrete for redundant non-structural systems".

The assessment of the anchor in relation to the requirements for resistance to fire has been made in accordance with the EOTA Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

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

According to Decision 97/161/EC of the European Commission the system 2+ of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) applies.

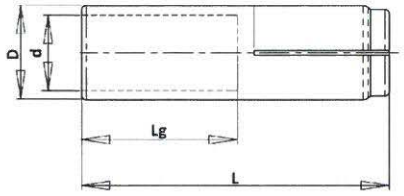
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document (EAD)

Technical details necessary for the implementation of the AVCP system are laid down in the control plan which is deposited at Instytut Techniki Budowlanej.

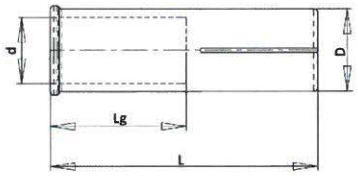
For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 15/05/2019 by Instytut Techniki Budowlanej

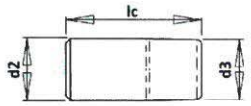
Anna Panek, MSc
Deputy Director of ITB



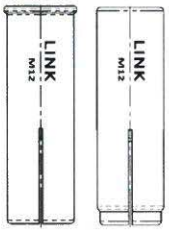
LC and LC-A4 sleeve



LCL sleeve



expansion plug



Marking:
Identifying mark – **LINK**
Size: Mxx (A4)
xx – thread size
A4 – for stainless steel

Table A1. Anchors LC – materials and dimensions

LC		**M6/25**	**M8/30**	**M10/40**	**M12/50**	**M16/65**	**M20/80**
Anchor length L	**[mm]**	25	30	40	50	65	80
Inner diameter d	**[mm]**	6	8	10	12	16	20
External diameter D	**[mm]**	8	10	12	15	20	25
Thread length Lg	**[mm]**	11	14	19	25	28	38
Anchor material	Steel in accordance with ASTM A510, SAE 1008 or SAE 1010; thickness of galvanizing > 5 μm $f_{uk} \geq 450$ N/mm² and $f_{yk} \geq 360$ N/mm²						
Fastening screw or threaded rod material	Steel, property class ≥ 4.8 according to EN-ISO 898-1; thickness of galvanizing > 5 μm						

Table A2. Anchor LC-A4 – materials and dimensions

LC-A4		**M6/25**	**M8/30**	**M10/40**	**M12/50**	**M16/65**
Anchor length L	**[mm]**	25	30	40	50	65
Inner diameter d	**[mm]**	6	8	10	12	16
External diameter D	**[mm]**	8	10	12	15	20
Thread length Lg	**[mm]**	11	14	19	25	28
Anchor material	Stainless steel 1.4401 according to EN 10088 (AISI 316) $f_{uk} \geq 500$ N/mm² and $f_{yk} \geq 210$ N/mm²					
Fastening screw or threaded rod material	Stainless steel 1.4401 in accordance with EN 10088; property class ≥ 70 according to EN ISO 3506					

LC, LC-A4 and LCL Wedge Anchors	**Annex A1** of European Technical Assessment ETA-19/0280
Product description Characteristic of the product	

Table A3. Anchors LCL – materials and dimensions

LCL		M6/25	M8/25	M8/30	M10/25	M10/40	M12/25	M12/50	M16/65	M20/80
Anchor length L	[mm]	25	25	30	25	40	25	50	65	80
Inner diameter d	[mm]	6	8	8	10	10	12	12	16	20
External diameter D	[mm]	8	10	10	12	12	15	15	20	25
Thread length Lg	[mm]	11	14	14	14	19	14	25	28	38
Anchor material	Steel in accordance with ASTM A510, SAE 1008 or SAE 1010; thickness of galvanizing > 5 µm $f_{uk} \geq 450$ N/mm^2 and $f_{yk} \geq 360$ N/mm^2									
Fastening screw or threaded rod material	Steel, property class ≥ 4.8 according to EN-ISO 898-1, thickness of galvanizing > 5 µm - for anchoring in solid concrete elements Steel, property class ≥ 4.6 according to EN-ISO 898-1, thickness of galvanizing > 5 µm - for anchoring in precast hollow core slabs									

Table A4. Expansion plug materials and dimensions

Expansion plug		M6	M8	M10	M12	M16	M20
Rear diameter d_2	[mm]	4,90	6,40	8,00	10,30	13,55	16,55
Front diameter d_3	[mm]	4,15	5,10	6,80	7,80	12,20	14,95
Length l_c	[mm]	9,40	11,40	16,00	20,75	25,40	30,00
Expansion plug material	Steel in accordance with JISG3505, SWRM8K or SWRM10K; thickness of galvanizing > 5 µm or stainless steel 1.4401 according to EN 10088 (AISI 316)						

SPECIFICATION OF INTENDED USE

Anchorages subject to:

- Multiple use for non-structural applications: sizes from M6 to M20 (LC and LCL) and sizes from M6 to M16 (LC-A4).
- Static and quasi-static loads: sizes from M6 to M20 (LC and LCL) and sizes from M6 to M16 (LC-A4).
- Anchorages with requirements related to resistance to fire: sizes from M8 to M20 (LC and LCL) and sizes from M8 to M16 (LC-A4).

Base material:

- Reinforced or unreinforced, cracked or non-cracked normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206.
- Solid concrete elements: sizes from M6 to M20 (LC, LCL) and M6 to M16 (LC-A4).
- Precast prestressed hollow core slabs (with w/e ≤ 4,2) strength class C40/50 to C50/60 according to EN 206: sizes from M6 to M12 (LCL).

Use conditions (environmental conditions):

- LC, LCL all sizes (galvanized steel) and LC-A4 size M6 (stainless steel): structures subject to dry internal conditions.
- LC-A4 sizes from M8 to M16 (stainless steel): 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).

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 transmitted. 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 and quasi-static loads are designed in accordance with EN 1992-4:2018; the anchors LC, LC-A4 and LCL anchored in solid concrete elements according to design method B, the anchors LCL anchored in precast, prestressed hollow core slabs according to design method A.
- The design of anchorages under fire exposure has to consider the conditions given in the EOTA Technical Report TR 020.
- Fasteners are only to be used for multiple use for non-structural applications acc. to EAD 330747-00-0601.

Installation:

- 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 any component of the anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings and using the appropriate tools.
- Check of concrete being well compacted, e.g. without significant voids.
- Positioning of the drill holes without damaging the reinforcement.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted 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.
- Anchor installation such that the effective anchorage depth is complied with.
- Anchor expansion by impact on the cone (expansion plug) of the anchor.

LC, LC-A4 and LCL Wedge Anchors	**Annex B1** of European Technical Assessment ETA-19/0280
Intended use Intended use	

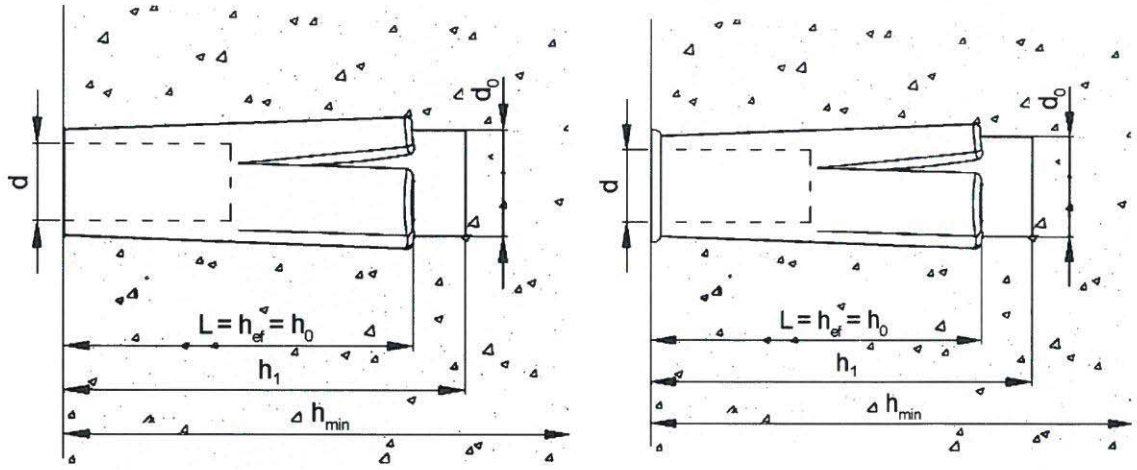
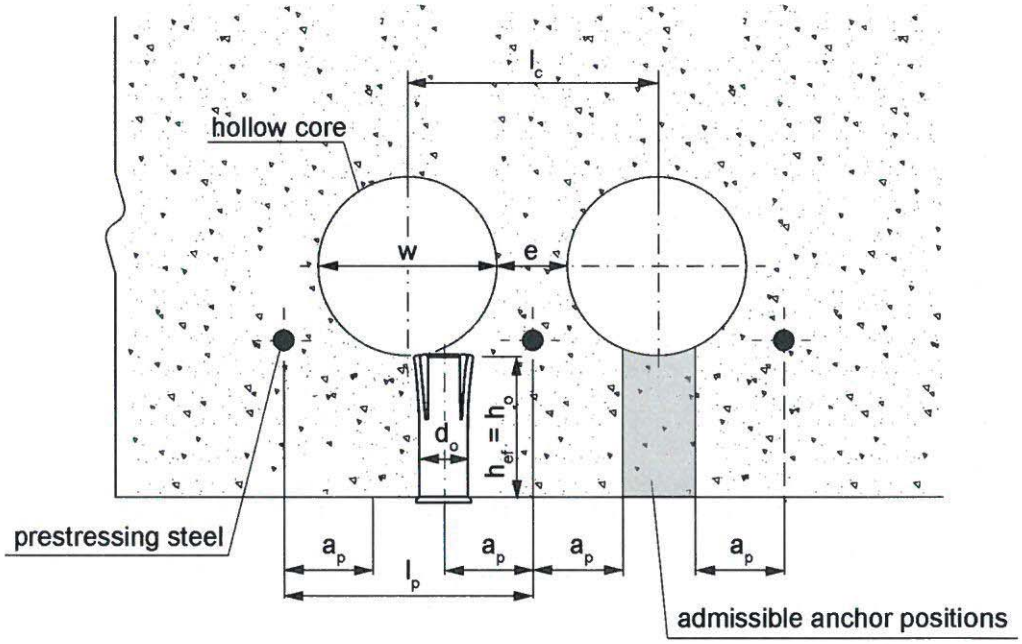


Table B1: Installation parameters of LC, LC-A4 and LCL anchors in solid concrete elements

Anchor size	Drill hole diameter	Drill hole depth	Effective anchorage depth	Installation torque (max)	Thickness of concrete member (min)	Screwing depth (min)	Screwing depth (max)	Diameter of clearance hole in the fixture
	[mm]	[mm]	[mm]	[Nm]	[mm]	[mm]	[mm]	[mm]
	d_0	h_1	$h_{ef} = h_o$	max T_{inst}	h_{min}	$l_{s,\,min}$	$l_{s,\,max}$	d_f
M6/25	8	27	25	4,5	80	6	11	7
M8/25	10	27	25	11	30	8	13	9
M8/30	10	32	30	11	80	8	13	9
M10/25	12	27	25	22	30	10	15	12
M10/40	12	42	40	22	80	10	15	12
M12/25	15	27	25	38	30	12	20	14
M12/50	15	52	50	38	100	12	20	14
M16/65	20	67	65	98	130	16	25	18
M20/80	25	82	80	130	160	20	35	22

LC, LC-A4 and LCL Wedge Anchors	**Annex B2** of European Technical Assessment ETA-19/0280
Intended use Installation parameters – solid concrete elements	

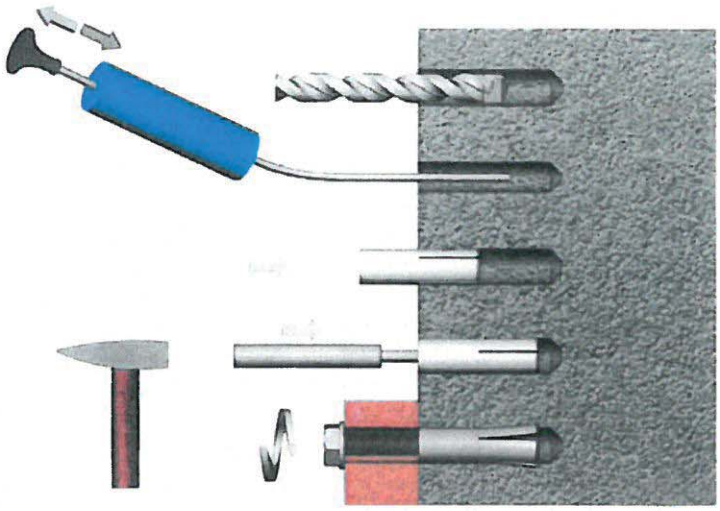


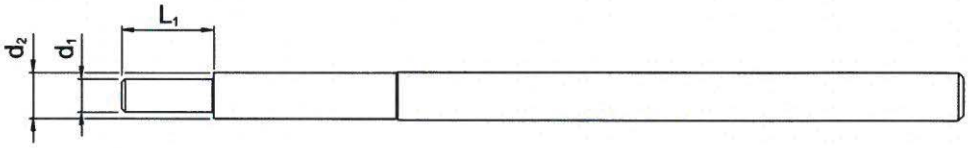
Core width / Web thickness; w / e	≤ 4,2
Core distance	$l_c \geq 100$ mm
Prestressing steel	$l_p \geq 100$ mm
Distance between anchor position and prestressing steel	$a_p \geq 50$ mm

Table B2: Installation parameters of LCL anchors in precast, prestressed hollow core slabs

Anchor size	Drill hole diameter	Drill hole depth	Effective anchorage depth	Installation torque (max)	Screwing depth (min)	Screwing depth (max)	Diameter of clearance hole in the fixture
	[mm]	[mm]	[mm]	[Nm]	[mm]	[mm]	[mm]
	d_0	h_0	h_{ef}	max T_{inst}	$l_{s,min}$	$l_{s,max}$	d_f
M6/25	8	25	25	4,5	6	11	7
M8/30	10	30	30	11	8	13	9
M10/40	12	40	40	22	10	15	12
M12/50	15	50	50	38	12	20	14

LC, LC-A4 and LCL Wedge Anchors	**Annex B3** of European Technical Assessment ETA-19/0280
Intended use Installation parameters – precast, prestressed hollow core slabs	





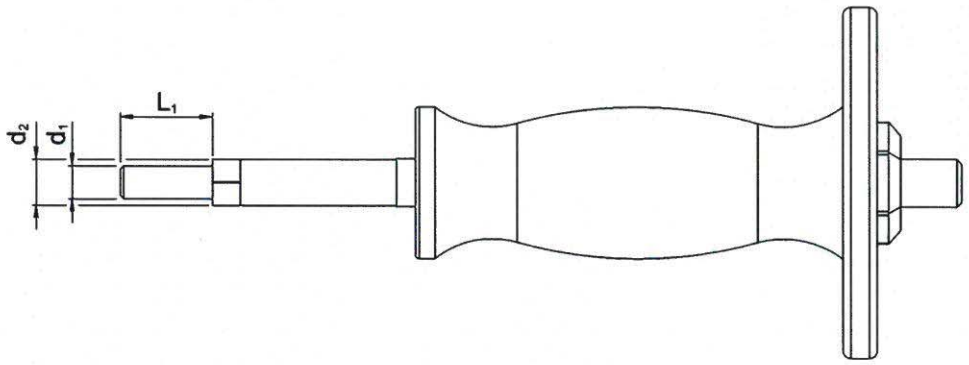
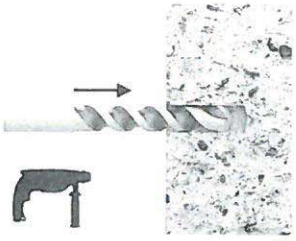


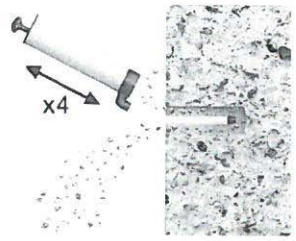
Table B3: Installation tools

Installation tools		M6/25	M8/25	M8/30	M10/25	M10/40	M12/25	M12/50	M16/65	M20/80
Diameter d_1	mm	5,0	6,6	6,6	8,3	8,3	10,2	10,2	13,5	16,8
Diameter d_2	mm	7,5	9,5	9,5	11,5	11,5	14,5	14,5	19,5	24,5
Length L_1	mm	14,8	17,0	18,0	17,0	23,0	17,0	28,0	33,0	47,0

LC, LC-A4 and LCL Wedge Anchors	**Annex B4** of European Technical Assessment ETA-19/0280
Intended use Installation instruction – general	

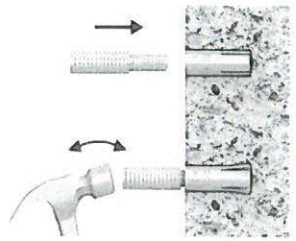


Drill a hole of required diameter and depth.

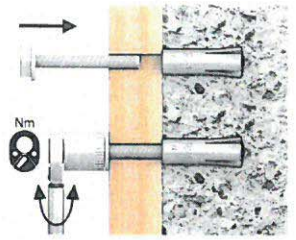


Clear the hole of drilling dust and debris (using blowpump).

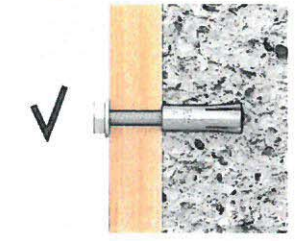
Insert wedge anchor, slotted end first.



Use the setting tool to drive the internal wedge into the anchor.

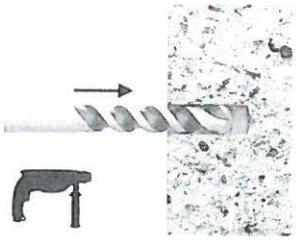


Insert bolt or stud through fixture and tighten to the recommended torque.

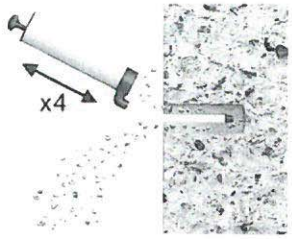


After installation.

LC, LC-A4 and LCL Wedge Anchors	**Annex B5**
Intended use Installation instruction – LC and LC-A4 anchor in solid concrete element	of European Technical Assessment ETA-19/0280

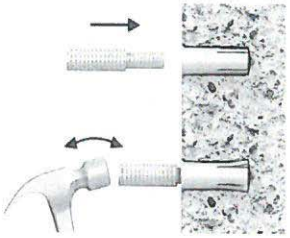


Drill a hole of required diameter and depth.

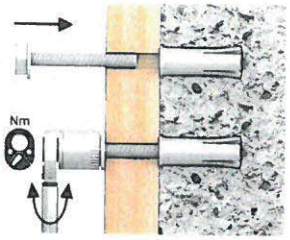


Clear the hole of drilling dust and debris (using blowpump).

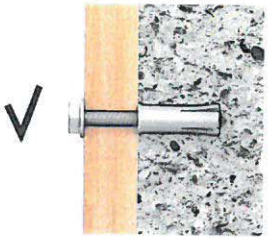
Insert wedge anchor, slotted end first.



Use the setting tool to drive the internal wedge into the anchor.

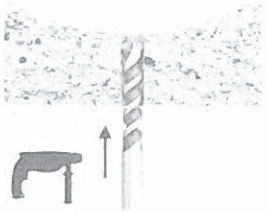


Insert bolt or stud through fixture and tighten to the recommended torque.

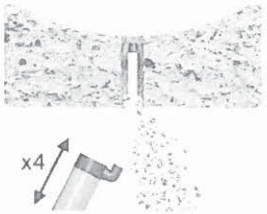


After Installation.

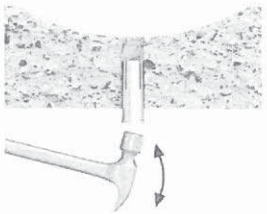
LC, LC-A4 and LCL Wedge Anchors	**Annex B6**
Intended use Installation instruction – LCL anchor in solid concrete element	of European Technical Assessment ETA-19/0280



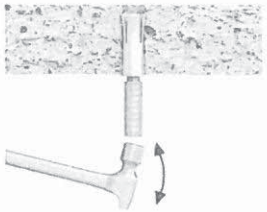
Drill a hole of required diameter and depth.



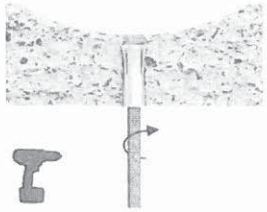
Clear the hole of drilling dust and debris (using blowpump).



Insert wedge anchor, slotted end first.



Use the setting tool to drive the internal wedge into the anchor.



Insert bolt or stud through fixture and tighten to the recommended torque.

After installation.

LC, LC-A4 and LCL Wedge Anchors	**Annex B7**
Intended use Installation instruction – LCL anchor in precast, prestressed hollow core slabs	of European Technical Assessment ETA-19/0280

Table C1: Characteristic resistance – LC – in solid concrete elements

LC			Property class	M6/25	M8/30	M10/40	M12/50	M16/65	M20/80
All load directions (fastening screw or threaded rod property class ≥ 4.8)									
Characteristic resistance in cracked and non-cracked concrete C20/25 to C50/60	F_{Rk}	[kN]	≥ 4.8	1,52	3,01	4,57	6,43	13,31	17,38
Partial safety factor	γ_2 (1)	[–]	–	1,2					
Spacing	s_{cr}	[mm]		200				260	320
Edge distance	c_{cr}	[mm]		150				195	240
Shear load with lever arm									
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	4.8	6	15	30	52	133	260
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	5.8	8	19	37	66	167	325
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	6.8	9	23	45	79	200	390
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	8.8	12	30	60	105	267	520
Partial safety factor	γ_{Ms} (1)	[–]	–	1,25					

(1) in the absence of other national regulations

Table C2: Characteristic resistance – LC-A4 – in solid concrete elements

LC-A4			Property class	M6/25	M8/30	M10/40	M12/50	M16/65
All load directions (fastening screw or threaded rod property class A4-70)								
Characteristic resistance in cracked and non-cracked concrete C20/25 to C50/60	F_{Rk}	[kN]	A4-70	1,00	2,01	3,20	4,59	8,27
Partial safety factor	γ_2 (1)	[–]	–	1,2				
Spacing	s_{cr}	[mm]		200				260
Edge distance	c_{cr}	[mm]		150				195
Shear load with lever arm								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	A4-70	11	26	52	92	233
Partial safety factor	γ_{Ms} (1)	[–]	–	1,25				

(1) in the absence of other national regulations

Table C3: Characteristic resistance – LCL – in solid concrete elements

LCL			Property class	M6/ 25	M8/ 25	M8/ 30	M10/ 25	M10/ 40	M12/ 25	M12/ 50	M16/ 65	M20/ 80
All load directions (fastening screw or threaded rod property class ≥ 4.8)												
Characteristic resistance in cracked and non-cracked concrete C20/25 to C50/60	F_{Rk}	[kN]	≥ 4.8	1,52	1,09	3,01	1,77	4,57	2,28	6,43	13,31	17,38
Partial safety factor	γ_2 (1)	[–]	–	1,2								
Spacing	s_{cr}	[mm]		200							260	320
Edge distance	c_{cr}	[mm]		150							195	240
Shear load with lever arm												
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	4.8	6	15	15	30	30	52	52	133	260
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	5.8	8	19	19	37	37	66	66	167	325
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	6.8	9	23	23	45	45	79	79	200	390
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	8.8	12	30	30	60	60	105	105	267	520
Partial safety factor	γ_{Ms} (1)	[–]	–	1,25								

(1) in the absence of other national regulations

Table C4: Characteristic resistance – LCL – in precast, prestressed hollow core slabs

LCL			M6/25	M8/30	M10/40	M12/50
Steel failure						
Partial safety factor	γ_{Ms} (1)	[–]	1,25	1,25	1,25	1,25
Pullout failure						
Characteristic resistance in precast prestressed hollow core slabs of strength class C40/50 to C50/60	$N^0_{Rk,p}$	[kN]	3,5	4,0	14,0	16,0
Partial safety factor	γ_2 2) = γ_{inst} (3)(4)	[–]	1,4	1,4	1,4	1,2
Concrete cone failure						
Factor for non-cracked concrete	k_1 2) = k_{ucr} (3)	[–]	10,1	10,1	10,1	10,1
Factor for non-cracked concrete	$k_{ucr,N}$ (4)	[–]	11,0	11,0	11,0	11,0
Installation safety factor	γ_2 2) = γ_{inst} (3)(4)	[–]	1,4	1,4	1,4	1,2
Characteristic spacing	$s_{cr,N}$	[mm]	200	200	200	200
Characteristic edge distance	$c_{cr,N}$	[mm]	100	100	100	100
Steel failure with lever arm						
Characteristic bending resistance for class ≥ 4.8	$M^0_{Rk,s}$	[Nm]	6	15	30	52
Characteristic bending resistance for class ≥ 5.8	$M^0_{Rk,s}$	[Nm]	8	19	37	66
Characteristic bending resistance for class ≥ 6.8	$M^0_{Rk,s}$	[Nm]	9	23	45	79
Characteristic bending resistance for class ≥ 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	105
Partial safety factor	γ_{Ms} (1)	[–]	1,25	1,25	1,25	1,25
Concrete edge failure						
Minimum member thickness	h_{min}	[mm]	30	30	30	30
Minimum edge distance	c_{min}	[mm]	35	40	55	70
Minimum spacing	s_{min}	[mm]	100	100	100	100

(1) in the absence of other national regulations
(2) parameter for design acc. ETAG 001 Annex C
(3) parameter for design acc. CEN/TS 1992-4-4:2009
(4) parameter for design acc. EN 1992-4:2018

Table C5: Characteristic resistance under fire exposure in solid concrete elements C20/25 to C50/60 – LC and LCL

Fire resistance class	LC and LCL		M8/25	M8/30	M10/25	M10/40	M12/25	M12/50	M16/65	M20/80
All load directions										
R30	Characteristic resistance $F_{Rk,fi}$ (1),(2)	[kN]	0,1	0,4	0,2	0,9	0,3	1,6	3,1	4,3
R60		[kN]	0,1	0,3	0,2	0,8	0,3	1,3	2,4	3,7
R90		[kN]	0,1	0,3	0,2	0,6	0,3	1,1	2,0	3,2
R120		[kN]	0,1	0,2	0,2	0,5	0,2	0,8	1,6	2,5
Spacing	$s_{cr,fi}$	[mm]	$4 \times h_{ef}$							
Edge distance	$c_{cr,fi}$	[mm]	$2 \times h_{ef}$							
The design method covers anchors with a fire attack from one side only. In case of fire attack from more than one side, the edge distance shall be ≥ 300 mm.										

(1) in the absence of other national regulations a partial safety factor $\gamma_{m,fi} = 1,0$ is recommended
(2) fastening screw or threaded rod property class no less than 4.8

Table C6: Characteristic resistance under fire exposure in solid concrete elements C20/25 to C50/60 – LC-A4

Fire resistance class	LC-A4		M8/30	M10/40	M12/50	M16/65
All load directions						
R30	Characteristic resistance $F_{Rk,fi}$ (1),(2)	[kN]	0,5	0,8	1,1	2,1
R60		[kN]	0,5	0,8	1,1	2,1
R90		[kN]	0,5	0,8	1,1	2,1
R120		[kN]	0,4	0,6	0,9	1,6
Spacing	$s_{cr,fi}$	[mm]	$4 \times h_{ef}$			
Edge distance	$c_{cr,fi}$	[mm]	$2 \times h_{ef}$			
The design method covers anchors with a fire attack from one side only. In case of fire attack from more than one side, the edge distance shall be ≥ 300 mm.						

(1) in the absence of other national regulations a partial safety factor $\gamma_{m,fi} = 1,0$ is recommended
(2) fastening screw or threaded rod property class no less than A4-70

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European Technical Assessment

ETA 18/0441 of 03/06/2018

Technical Assessment Body issuing the ETA: Technical and Test Institute for Construction Prague	
Trade name of the construction product	LT
Product family to which the construction product belongs	Product area code: 33 Torque controlled expansion anchor for use in uncracked concrete
Manufacturer	LINK YAPI SAN. VE TİC. AŞ. GOSB 1000 CD. NO:1016 ÇAYIROVA – GEBZE KOCAELİ TURKEY
Manufacturing plant	Manufacturing Plant No 2
This European Technical Assessment contains	10 pages including 8 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 Mechanical fasteners for use in concrete
This version is a corrigendum to	ETA 18/0441 of 03/06/2018

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1. Technical description of the product

The LT are through-fixing torque-controlled expansion anchors in sizes of M8, M10, M12, M16 and M20. Each type comprises a nut, bolt, washer and expansion sleeve. The anchors are made from zinc-plated and passivated steel.

The anchor is installed in a drilled hole; tightening the nut draws the cone into the sleeve. The expansion of this sleeve applies the anchorage.

The installed anchor is shown in Annex 1.

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 B.

The provisions made in this European Technical Assessment are based on an assumed 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, but are to be regarded only as a means for choosing the 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 (static and quasi-static loading)	See Annex C 1 and C 2
Displacement	See Annex C 1 and C 2

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1 according to EN 13501-1
Resistance to fire	No performance assessed

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

According to the Decision 97/463/EC of the European Commission[1], the system 1 of assessment verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) apply.

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Technical and Test Institute for Construction Prague.

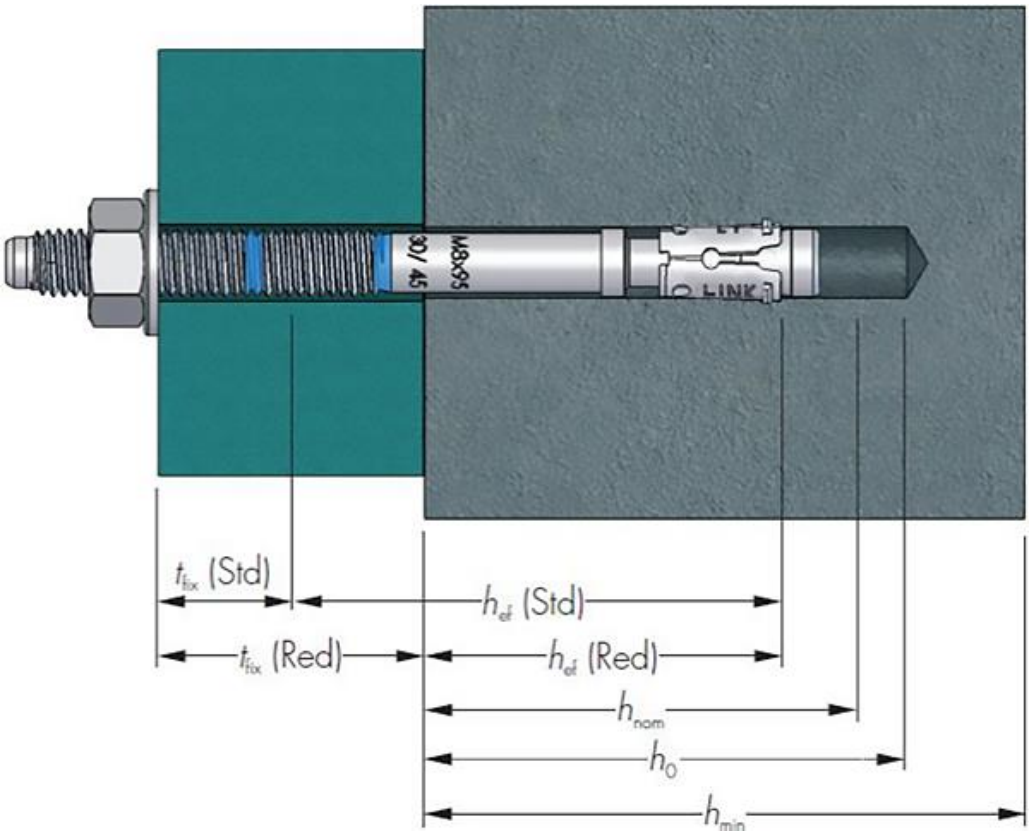
Issued in Prague on 03.06.2018

By

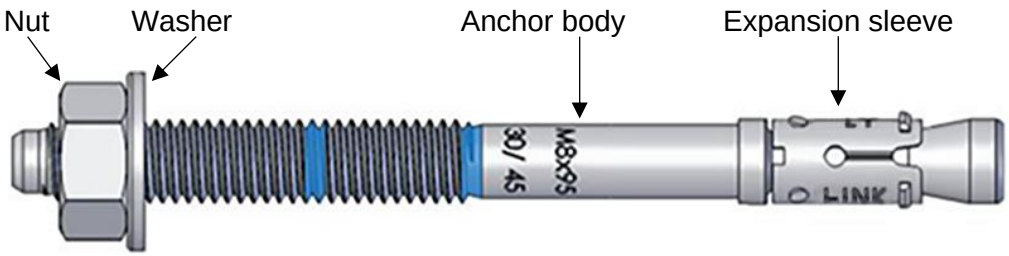
Ing. Mária Schaan
Head of the Technical Assessment Body

[1] Official Journal of the European Communities L 198/31 25.7.1997

LT - Installed anchor



LT - components



LT	**Annex A 1**
Product description Installed conditions and components	

Table A1 - Materials

Component	Material	Coating
Anchor body	Steel grade C17C, EN 10263-2	Electroplated ≥ 5 µm and clear chromate film Cr3
Expansion sleeve	Steel grade DC03, EN 10139 M8-M12 C590 M16-M20 C490	
Hexagonal nut	according DIN 934	
Washer	according DIN 125A or DIN 9021	

Table A2 – Material properties

Component		M8 – M16	M20
Anchor body – ultimate tensile strength	[N/mm²]	400 - 480	480 - 530
		M8 – M12	M16 – M20
Expansion sleeve – hardness	[HV]	185 - 215	155 - 185

Table A3 – Marking

M8														
Bolt length [mm]	60	65	75	80	85	90	95	100	105	115	120	140	150	160
Head marking	B	b	C	d	D	e	E	F	f	G	H	K	L	M
Bolt marking	-/10	-/15	10/25	15/30	20/35	25/40	30/45	35/50	40/55	50/65	55/70	75/90	85/100	95/110

M10											
Bolt length [mm]	65	80	85	90	95	115	120	130	140	150	180
Head marking	B	D	d	e	E	G	H	J	K	L	P
Bolt marking	-/5	10/20	15/25	20/30	25/35	45/55	50/60	60/70	70/80	80/90	110/120

M12																		
Bolt length [mm]	80	100	105	110	115	120	125	135	140	150	160	180	200	220	240	250	260	280
Head marking	D	F	f	G	g	h	H	J	K	L	M	P	R	S	T	U	V	X
Bolt marking	-/5	5/25	10/30	15/35	20/40	25/45	30/50	40/60	45/65	55/75	65/85	85/105	105/125	125/145	145/165	155/175	165/185	185/205

M16													
Bolt length [mm]	100	105	125	130	140	150	160	180	200	220	250	280	300
Head marking	F	f	H	J	K	L	M	P	R	S	U	X	Y
Bolt marking	-/5	-/10	5/25	10/30	20/40	30/50	40/60	60/80	80/100	100/120	130/150	160/180	180/200

M20							
Bolt length [mm]	125	140	160	165	180	200	250	300
Head marking	H	K	M	m	P	R	U	Y
Bolt marking	-/5	-/20	20/40	25/45	40/60	60/80	110/130	160/180

LT

Product description
Materials
Marking

Annex A 2

Specifications of intended use

Anchorages subject to:

- Static and quasi-static load.

Base materials

- Uncracked concrete.
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206-1:2000-12.

Use conditions (Environmental conditions)

- Structures subject to dry internal conditions.

Design:

- The anchorages are designed in accordance with the FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016 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.

Installation:

- 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 any components of the anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings using the appropriate tools.
- Effective anchoring depth, edge distance and spacing not less than the specified values without minus tolerance.
- In case of aborted drill hole: new drilling at a minimum distance away of twice the depth of the aborted 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.

LT	
Intended use Specifications	**Annex B 1**

Table B1 - Installation parameters

Size	Drill hole diameter	Bolt length	Thread length	Hole diameter in fixture	Standard embedment			Reduced embedment			Installation torque
					Min. hole depth	Effective embedment depth	Max. fixture thickness	Min. hole depth	Effective embedment depth	Max. fixture thickness	
	d_0 [mm]	l [mm]	l_G [mm]	d_f [mm]	h_0 [mm]	h_{ef} [mm]	t_{fix} [mm]	h_0 [mm]	h_{ef} [mm]	t_{fix} [mm]	T_{inst} [N.m]
M8	8	60	25	9	-	-	-	40	32	10	15
		65	30	9	-	-	-	40	32	15	
		75	35	9	55	47	10	40	32	25	
		80	40	9	55	47	15	40	32	30	
		85	45	9	55	47	20	40	32	35	
		90	50	9	55	47	25	40	32	40	
		95	55	9	55	47	30	40	32	45	
		100	60	9	55	47	35	40	32	50	
		105	65	9	55	47	40	40	32	55	
		115	75	9	55	47	50	40	32	65	
		120	80	9	55	47	55	40	32	70	
		140	100	9	55	47	75	40	32	90	
		150	100	9	55	47	85	40	32	100	
		160	100	9	55	47	95	40	32	110	
M10	10	65	21	11	-	-	-	49	39	5	30
		80	31	11	59	49	10	49	39	20	
		85	36	11	59	49	15	49	39	25	
		90	41	11	59	49	20	49	39	30	
		95	46	11	59	49	25	49	39	35	
		115	66	11	59	49	45	49	39	55	
		120	71	11	59	49	50	49	39	60	
		130	81	11	59	49	60	49	39	70	
		140	91	11	59	49	70	49	39	80	
		150	101	11	59	49	80	49	39	90	
		180	100	11	59	49	110	49	39	120	
M12	12	80	30	13	-	-	-	60	48	5	50
		100	40	13	80	68	5	60	48	25	
		105	45	13	80	68	10	60	48	30	
		110	50	13	80	68	15	60	48	35	
		115	55	13	80	68	20	60	48	40	
		120	60	13	80	68	25	60	48	45	
		125	65	13	80	68	30	60	48	50	
		135	75	13	80	68	40	60	48	60	
		140	80	13	80	68	45	60	48	65	
		150	90	13	80	68	55	60	48	75	
		160	100	13	80	68	65	60	48	85	
		180	100	13	80	68	85	60	48	105	
		200	100	13	80	68	105	60	48	125	
		220	100	13	80	68	125	60	48	145	
		240	100	13	80	68	145	60	48	165	
		250	100	13	80	68	155	60	48	175	
		260	100	13	80	68	165	60	48	185	
		280	100	13	80	68	185	60	48	205	
M16	16	100	30	18	-	-	-	80	65	5	100
		105	35	18	-	-	-	80	65	10	
		125	45	18	100	85	5	80	65	25	
		130	50	18	100	85	10	80	65	30	
		140	60	18	100	85	20	80	65	40	
		150	70	18	100	85	30	80	65	50	
		160	80	18	100	85	40	80	65	60	
		180	100	18	100	85	60	80	65	80	
		200	100	18	100	85	80	80	65	100	
		220	100	18	100	85	100	80	65	120	
		250	100	18	100	85	130	80	65	150	
		280	100	18	100	85	160	80	65	180	
		300	100	18	100	85	180	80	65	200	
M20	20	125	50	22	-	-	-	100	80	5	200
		140	50	22	-	-	-	100	80	20	
		160	61	22	119	99	20	100	80	40	
		165	66	22	119	99	25	100	80	45	
		180	81	22	119	99	40	100	80	60	
		200	100	22	119	99	60	100	80	80	
		250	100	22	119	99	110	100	80	130	
		300	100	22	119	99	160	100	80	180	

LT

Intended use
Installation parameters

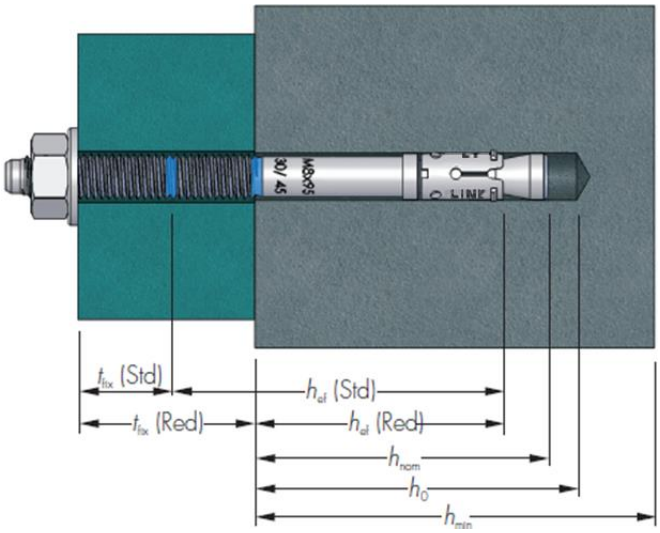
Annex B 2

Table B2 - Installation parameters – Minimum spacing and edge distance

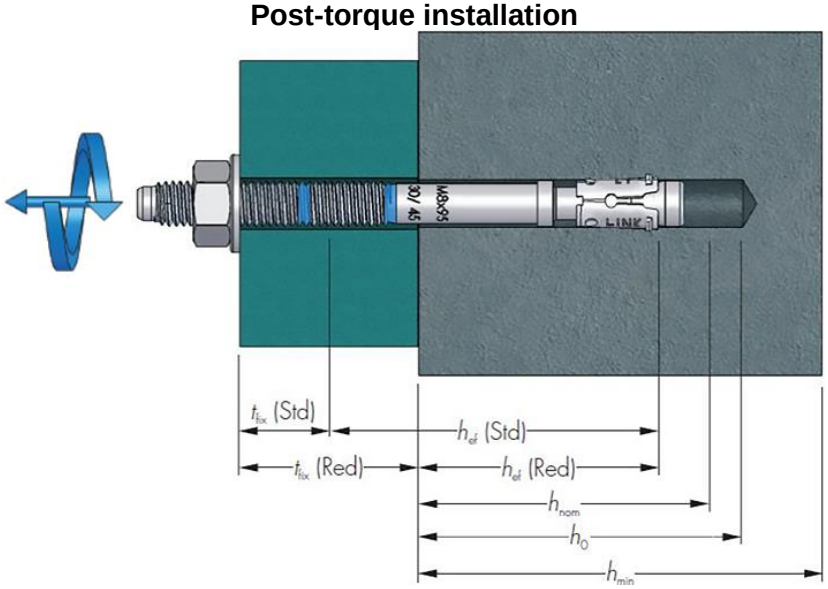
Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Minimum thickness of concrete member	h_{min}	[mm]	100	100	100	100	100	136	130	170	158	198
Minimum spacing	s_{min}	[mm]	45	50	55	55	100	75	100	90	125	140
for edge distance	$c \geq$	[mm]	50	55	65	65	100	90	100	105	125	160
Minimum edge distance	c_{min}	[mm]	40	40	65	50	100	65	100	80	125	100
for spacing	$s \geq$	[mm]	100	100	55	90	100	100	100	150	125	200

[1)] Use restricted to anchoring statically indeterminate structural components

Pre-torque installation



Post-torque installation

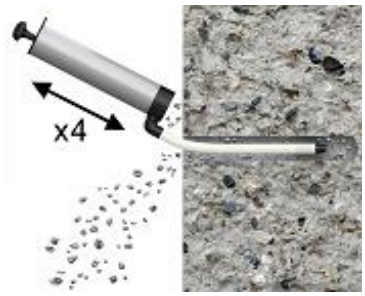


LT	
Intended use Installation parameters	**Annex B 3**

Installation instructions

1. 

Drill a hole of required diameter and depth

2. 

Clear the hole of drilling dust and debris
(using blowpump or equivalent method)

3. 

Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached

4. 

Tighten to the recommended torque

5. 

Assembled condition of anchor

LT	
Intended use Installation instructions	**Annex B 4**

Table C1 – Characteristic resistance under tension load

Steel failure												
Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Characteristic resistance	$N_{Rk,s}$	[kN]	15,8		25,2		37,3		66,1		101,0	
Partial safety factor	γ_{Ms}	[-]	1,4		1,4		1,4		1,4		1,4	

Pull-out failure												
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	9,0	12,0	9,0	12,0	16,0	25,0	30,0	40,0	35,0	40,0
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Increasing factor												
Uncracked concrete C30/37	ψ_c	[-]	1,25	1,10	1,36	1,37	1,20	1,16	1,12	1,17	1,18	1,30
Uncracked concrete C40/50	ψ_c	[-]	1,50	1,21	1,72	1,74	1,40	1,33	1,23	1,34	1,36	1,59
Uncracked concrete C50/60	ψ_c	[-]	1,76	1,32	2,08	2,10	1,60	1,49	1,34	1,50	1,54	1,89

Concrete cone failure												
Factor for concrete cone failure for uncracked concrete	$k_{ucr,N}$	[-]	11,0									
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Effective anchorage depth	h_{ef}	[mm]	32	47	39	49	48	68	65	85	79	99
Spacing	$s_{cr,N}$	[mm]	96	141	117	147	144	204	195	255	237	297
Edge distance	$c_{cr,N}$	[mm]	48	71	59	74	72	102	98	128	119	149

Splitting failure												
Spacing	$s_{cr,sp}$	[mm]	160	240	200	260	250	370	360	430	410	530
Edge distance	$c_{cr,sp}$	[mm]	80	120	100	130	125	185	180	215	205	265
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2

[1)] Use restricted to anchoring statically indeterminate structural components

Table C2 – Displacement under tension load

Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Tension load in uncracked concrete	N	[kN]	3,6	4,8	3,6	4,8	6,3	9,9	11,9	15,9	13,9	15,9
Displacement	δ_{N0}	[mm]	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
	$\delta_{N\infty}$	[mm]	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35

[1)] Use restricted to anchoring statically indeterminate structural components

LT

Performances
Characteristic resistance under tension load
Displacement under tension load

Annex C 1

Table C3 – Characteristic resistance under shear load

Steel failure without lever arm												
Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Characteristic resistance	$V^0_{Rk,s}$	[kN]	10,1		16,0		23,3		43,0		67,4	
Ductility factor	k_7	[-]	0,8		0,8		0,8		0,8		0,8	
Partial safety factor	γ_{Ms}	[-]	1,25		1,25		1,25		1,25		1,25	

Steel failure with lever arm												
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	17		35		61		154		301	
Partial safety factor	γ_{Ms}	[-]	1,25		1,25		1,25		1,25		1,25	

Concrete pry-out failure												
Characteristic resistance concrete C20/25	$V_{Rk,cp}$	[kN]	-	-	12,0	-	-	-	-	-	68,7	-
Factor	k_8	[-]	-	-	1,0	-	-	-	-	-	2,0	-
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2

Concrete edge failure												
Effective length of anchor	ℓ_f	[mm]	32	47	39	49	48	68	65	85	79	99
Anchor diameter	d_{nom}	[mm]	8		10		12		16		20	
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2

[1)] Use restricted to anchoring statically indeterminate structural components

Table C4 – Displacement under shear load

Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Tension load in uncracked concrete	V	[kN]	4,0	4,0	4,8	6,3	9,2	9,2	17,1	17,1	27,4	27,4
Displacement	δ_{V0}	[mm]	1,8	1,8	1,8	1,8	2,4	2,4	3,0	3,0	3,0	3,0
	$\delta_{V\infty}$	[mm]	2,7	2,7	2,7	2,7	3,6	3,6	4,5	4,5	4,5	4,5

[1)] Use restricted to anchoring statically indeterminate structural components

LT

Performances
Characteristic resistance under shear load
Displacement under shear load

Annex C 2

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European Technical Assessment

ETA 18/0483 of 13/09/2018

Technical Assessment Body issuing the ETA: Technical and Test Institute for Construction Prague	
Trade name of the construction product	LTS
Product family to which the construction product belongs	Product area code: 33 Torque controlled expansion anchor for use in cracked and uncracked concrete
Manufacturer	LINK YAPI SAN. VE TİC. AŞ. GOSB 1000 CD. NO:1016 ÇAYIROVA – GEBZE KOCAELİ TURKEY
Manufacturing plant	Manufacturing Plant No 2
This European Technical Assessment contains	12 pages including 10 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 Mechanical fasteners for use in concrete
This version replaces	ETA 18/0483 issued on 05/06/2018
This version is a corrigendum to	ETA 18/0483 of 05/06/2018

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1. Technical description of the product

The LTS are through-fixing torque-controlled expansion anchors in sizes of M8, M10, M12, M16 and M20. Each type comprises a special bolt with a taper, an expansion sleeve, a hexagonal nut and a washer. The anchors are made from carbon steel finished in zinc/aluminium coating.

The anchor is installed in a drilled hole; tightening the nut draws the cone into the sleeve. The expansion of this sleeve applies the anchorage.

The installed anchor is shown in Annex 1.

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 B.

The provisions made in this European Technical Assessment are based on an assumed 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, but are to be regarded only as a means for choosing the 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
Characteristic resistance and displacement for seismic performance category C2	See Annex C 4

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1 according to EN 13501-1
Resistance to fire	Seen Annex C 3

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

According to the Decision 97/463/EC of the European Commission[1], the system 1 of assessment verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) apply.

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Technical and Test Institute for Construction Prague.

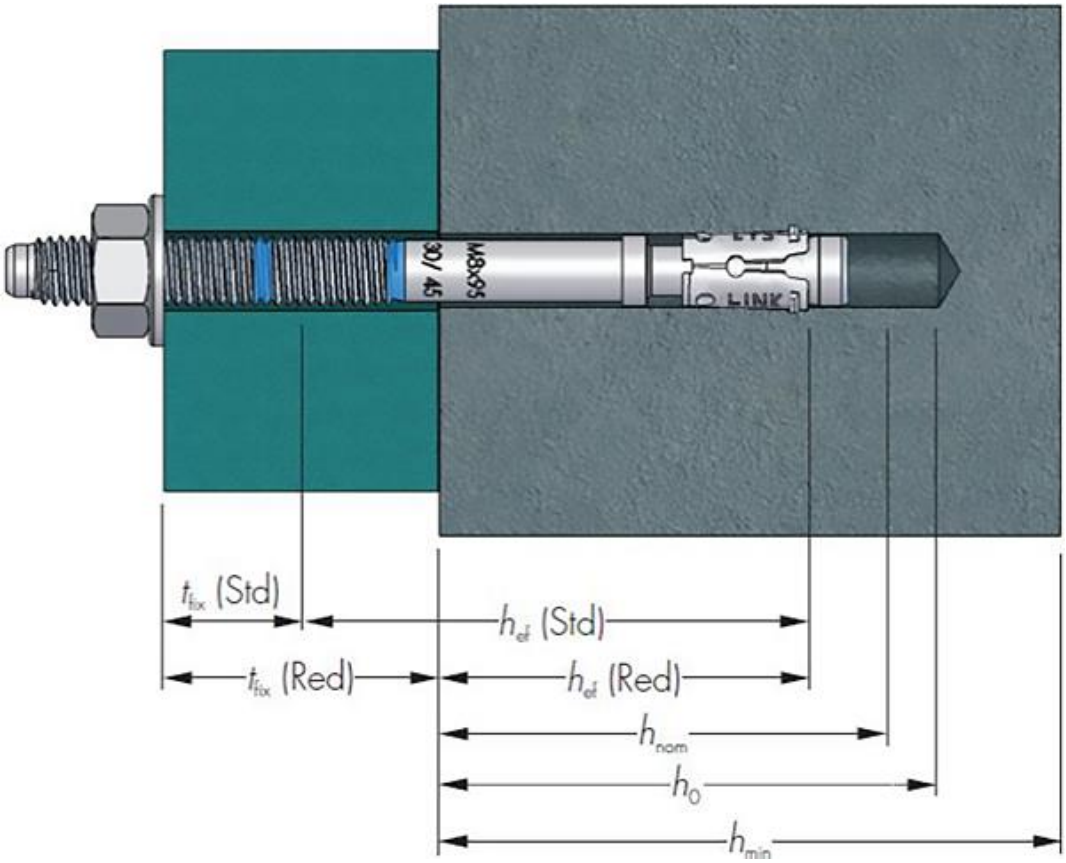
Issued in Prague on 13.09.2018

By

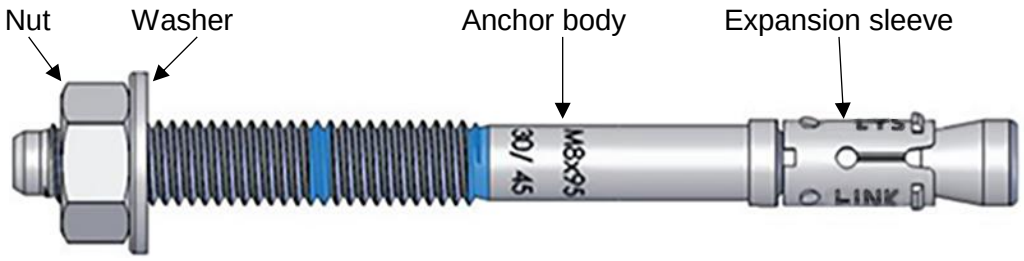
Ing. Mária Schaan
Head of the Technical Assessment Body

[1] Official Journal of the European Communities L 198/31 25.7.1997

LTS - Installed anchor



LTS - components



LTS	**Annex A 1**
Product description Installed conditions and components	

Table A1 - Materials

Component	Material
Anchor body	Steel rod on coil cold forged bolts
Expansion sleeve	Steel grade DC03, M8-M12 C590, M16-M20 C490, according EN 10139
Hexagonal nut	according DIN 934
Washer	according DIN 125A or DIN 9021

Table A2 – Material properties

		M8 - M12	M16 - M20
Expansion sleeve – hardness	[HV]	185 - 215	155 - 185

Table A3 – Marking

M8														
Bolt length [mm]	60	65	75	80	85	90	95	100	105	115	120	140	150	160
Head marking	B	b	C	d	D	e	E	F	f	G	H	K	L	M
Bolt marking	-/10	-/15	10/25	15/30	20/35	25/40	30/45	35/50	40/55	50/65	55/70	75/90	85/100	95/110

M10											
Bolt length [mm]	65	80	85	90	95	115	120	130	140	150	180
Head marking	B	D	d	e	E	G	H	J	K	L	P
Bolt marking	-/5	-/20	5/25	10/30	15/35	35/55	40/60	50/70	60/80	70/90	100/120

M12																		
Bolt length [mm]	80	100	105	110	115	120	125	135	140	150	160	180	200	220	240	250	260	280
Head marking	D	F	f	G	g	h	H	J	K	L	M	P	R	S	T	U	V	X
Bolt marking	-/5	5/25	10/30	15/35	20/40	25/45	30/50	40/60	45/65	55/75	65/85	85/105	105/125	125/145	145/165	155/175	165/185	185/205

M16													
Bolt length [mm]	100	105	125	130	140	150	160	180	200	220	250	280	300
Head marking	F	f	H	J	K	L	M	P	R	S	U	X	Y
Bolt marking	-/5	-/10	5/25	10/30	20/40	30/50	40/60	60/80	80/100	100/120	130/150	160/180	180/200

M20								
Bolt length [mm]	125	140	160	165	180	200	250	300
Head marking	H	K	M	m	P	R	U	Y
Bolt marking	-/5	-/20	20/40	24/45	40/60	60/80	110/130	160/180

LTS

Product description
Materials
Marking

Annex A 2

Specifications of intended use

Anchorages subject to:

- Static and quasi-static load
- Fire exposure
- Seismic actions category C2 (max w = 0,8 mm), size M10, M12, M16, only standard embedment

Base materials

- Cracked or uncracked concrete.
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206-1:2000-12.

Use conditions (Environmental conditions)

- Structures subject to dry internal conditions.

Design:

- The anchorages are designed in accordance with the FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016 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.
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016.
- Anchorages under fire exposure have to be designed in accordance with FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016.

Installation:

- 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 any components of the anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings using the appropriate tools.
- Effective anchoring depth, edge distance and spacing not less than the specified values without minus tolerance.
- In case of aborted drill hole: new drilling at a minimum distance away of twice the depth of the aborted 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.

LTS	**Annex B 1**
Intended use Specifications	

Table B1 - Installation parameters

Size	Drill hole diameter	Bolt length	Thread length	Hole diameter in fixture	Standard embedment				Reduced embedment				Installation torque
					Min. hole depth	Nominal embedment depth	Effective embedment depth	Max. fixture thickness	Min. hole depth	Nominal embedment depth	Effective embedment depth	Max. fixture thickness	
	d_0 [mm]	l [mm]	l_G [mm]	d_f [mm]	h_0 [mm]	h_{nom} [mm]	h_{ef} [mm]	t_{fix} [mm]	h_0 [mm]	h_{nom} [mm]	h_{ef} [mm]	t_{fix} [mm]	T_{inst} [N.m]
M8	8	60	25	9	-	-	-	-	50	40	32	10	10
		65	30	9	-	-	-	-	50	40	32	15	
		75	35	9	65	55	47	10	50	40	32	25	
		80	40	9	65	55	47	15	50	40	32	30	
		85	45	9	65	55	47	20	50	40	32	35	
		90	50	9	65	55	47	25	50	40	32	40	
		95	55	9	65	55	47	30	50	40	32	45	
		100	60	9	65	55	47	35	50	40	32	50	
		105	65	9	65	55	47	40	50	40	32	55	
		115	75	9	65	55	47	50	50	40	32	65	
		120	80	9	65	55	47	55	50	40	32	70	
		140	100	9	65	55	47	75	50	40	32	90	
		150	100	9	65	55	47	85	50	40	32	100	
		160	100	9	65	55	47	95	50	40	32	110	
M10	10	65	21	11	-	-	-	-	59	49	39	5	20
		80	31	11	-	-	-	-	59	49	39	20	
		85	36	11	79	69	59	5	59	49	39	25	
		90	41	11	79	69	59	10	59	49	39	30	
		95	46	11	79	69	59	15	59	49	39	35	
		115	66	11	79	69	59	35	59	49	39	55	
		120	71	11	79	69	59	40	59	49	39	60	
		130	81	11	79	69	59	50	59	49	39	70	
		140	91	11	79	69	59	60	59	49	39	80	
		150	101	11	79	69	59	70	59	49	39	90	
		180	100	11	79	69	59	100	59	49	39	120	
M12	12	80	30	13	-	-	-	-	70	60	48	5	40
		100	40	13	90	80	68	5	70	60	48	25	
		105	45	13	90	80	68	10	70	60	48	30	
		110	50	13	90	80	68	15	70	60	48	35	
		115	55	13	90	80	68	20	70	60	48	40	
		120	60	13	90	80	68	25	70	60	48	45	
		125	65	13	90	80	68	30	70	60	48	50	
		135	75	13	90	80	68	40	70	60	48	60	
		140	80	13	90	80	68	45	70	60	48	65	
		150	90	13	90	80	68	55	70	60	48	75	
		160	100	13	90	80	68	65	70	60	48	85	
		180	100	13	90	80	68	85	70	60	48	105	
		200	100	13	90	80	68	105	70	60	48	125	
		220	100	13	90	80	68	125	70	60	48	145	
		240	100	13	90	80	68	145	70	60	48	165	
		250	100	13	90	80	68	155	70	60	48	175	
		260	100	13	90	80	68	165	70	60	48	185	
		280	100	13	90	80	68	185	70	60	48	205	
M16	16	100	30	18	-	-	-	-	90	80	65	5	100
		105	35	18	-	-	-	-	90	80	65	10	
		125	45	18	110	100	85	5	90	80	65	25	
		130	50	18	110	100	85	10	90	80	65	30	
		140	60	18	110	100	85	20	90	80	65	40	
		150	70	18	110	100	85	30	90	80	65	50	
		160	80	18	110	100	85	40	90	80	65	60	
		180	100	18	110	100	85	60	90	80	65	80	
		200	100	18	110	100	85	80	90	80	65	100	
		220	100	18	110	100	85	100	90	80	65	120	
		250	100	18	110	100	85	130	90	80	65	150	
		280	100	18	110	100	85	160	90	80	65	180	
		300	100	18	110	100	85	180	90	80	65	200	
M20	20	125	50	22	-	-	-	-	110	100	80	5	180
		140	50	22	-	-	-	-	110	100	80	20	
		160	61	22	129	119	99	20	110	100	80	40	
		165	66	22	129	119	99	25	110	100	80	45	
		180	81	22	129	119	99	40	110	100	80	60	
		200	100	22	129	119	99	60	110	100	80	80	
		250	100	22	129	119	99	110	110	100	80	130	
		300	100	22	129	119	99	160	110	100	80	180	

LTS

Intended use
Installation parameters

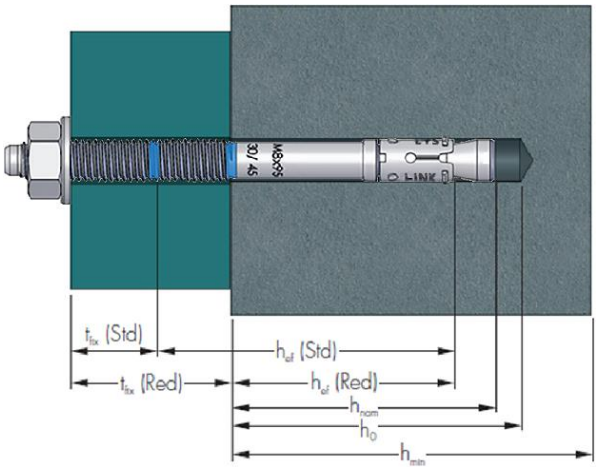
Annex B 2

Table B2 - Installation parameters – Minimum spacing and edge distance

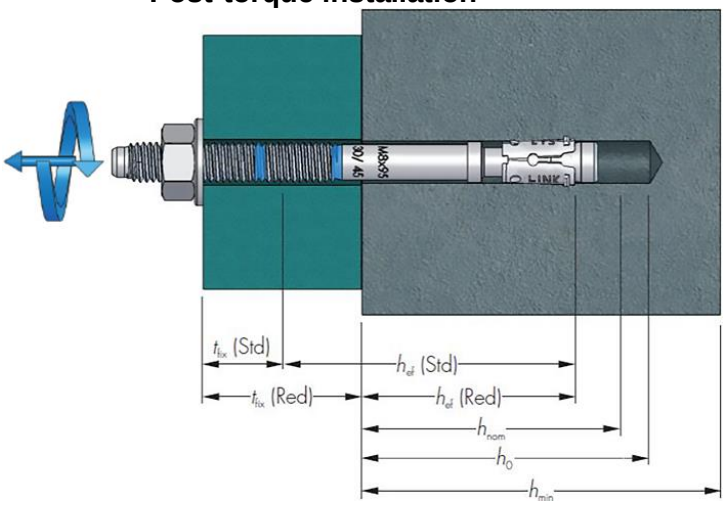
Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Minimum thickness of concrete member	h_{min}	[mm]	100	100	100	120	100	140	130	170	160	200
Minimum spacing and edge distance in cracked concrete												
Minimum spacing	s_{miin}	[mm]	55	50	75	70	150	90	190	160	300	180
for edge distance c ≥		[mm]	45	50	60	65	100	80	125	130	200	150
Minimum edge distance	c_{min}	[mm]	40	40	50	45	80	65	110	90	120	100
for spacing s ≥		[mm]	80	80	100	100	180	150	280	240	260	220
Minimum spacing and edge distance in uncracked concrete												
Minimum spacing	s_{min}	[mm]	55	50	75	70	150	90	190	160	300	180
for edge distance c ≥		[mm]	45	50	60	65	100	80	125	130	200	150
Minimum edge distance	c_{min}	[mm]	45	40	60	50	70	65	100	85	160	100
for spacing s ≥		[mm]	55	100	75	110	150	180	190	240	300	225

[1)] Use restricted to anchoring statically indeterminate structural components

Pre-torque installation



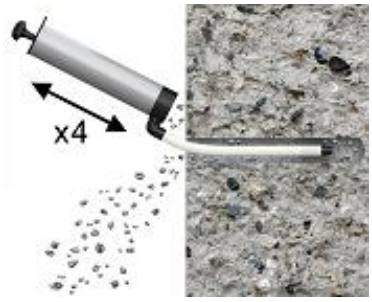
Post-torque installation



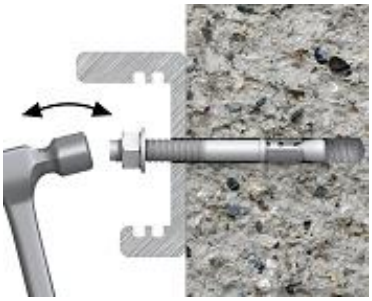
LTS	
Intended use Installation parameters	**Annex B 3**

Installation instructions

1.  Drill a hole of required diameter and depth

2. 

Clear the hole of drilling dust and debris
(using blowpump or equivalent method)

3.  Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached

4.  Tighten to the recommended torque

5.  Assembled condition of anchor

LTS	**Annex B 4**
Intended use Installation instructions	

Table C1 – Characteristic resistance under tension load

Steel failure												
Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Characteristic resistance	$N_{Rk,s}$	[kN]	11,0		17,5		25,8		45,8		70,0	
Partial safety factor	γ_{Ms}	[-]	1,4		1,4		1,4		1,4		1,4	

Pull-out failure												
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	3,0	5,0	6,0	9,0	9,0	12,0	16,0	20,0	-[2)]	30,0
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	7,5	9,0	9,0	12,0	12,0	20,0	-[2)]	35,0	-[2)]	-[2)]
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Increasing factor												
Cracked and uncracked concrete C30/37	ψ_c	[-]	1,20	1,12	1,16	1,22	1,22	1,00	1,11	1,14	1,12	1,07
Cracked and uncracked concrete C40/50	ψ_c	[-]	1,40	1,22	1,33	1,44	1,44	1,00	1,22	1,28	1,26	1,14
Cracked and uncracked concrete C50/60	ψ_c	[-]	1,60	1,33	1,50	1,67	1,67	1,00	1,33	1,43	1,39	1,21

Concrete cone failure												
Factor for concrete cone failure for cracked concrete	$k_{cr,N}$	[-]	7,7									
Factor for concrete cone failure for uncracked concrete	$k_{ucr,N}$	[-]	11,0									
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Effective anchorage depth	h_{ef}	[mm]	32	47	39	59	48	68	65	85	80	99
Spacing	$s_{cr,N}$	[mm]	96	141	117	177	144	204	195	255	240	297
Edge distance	$c_{cr,N}$	[mm]	48	71	59	89	72	102	98	128	120	149

Splitting failure												
Spacing	$s_{cr,sp}$	[mm]	170	220	200	300	250	340	320	430	410	530
Edge distance	$c_{cr,sp}$	[mm]	85	110	100	150	125	170	160	215	205	265
Installation safety factor	γ_{inst}	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0

[1)] Use restricted to anchoring statically indeterminate structural components
[2)] Pull-out failure mode is not decisive

Table C2 – Displacement under tension load

Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Tension load in cracked concrete	N	[kN]	1,2	2,0	2,4	4,3	4,3	5,7	7,6	9,5	12,3	14,3
Displacement	δ_{N0}	[mm]	0,6	0,8	0,3	1,0	0,5	0,7	0,3	0,4	0,4	0,4
	$\delta_{N\infty}$	[mm]	1,0	0,9	1,1	1,4	1,0	0,9	0,8	1,1	1,3	0,7
Tension load in uncracked concrete	N	[kN]	3,0	3,6	3,6	5,7	5,7	9,5	12,6	16,7	17,2	23,6
Displacement	δ_{N0}	[mm]	0,1	0,3	0,3	0,3	0,1	0,6	0,5	0,2	0,1	0,6
	$\delta_{N\infty}$	[mm]	1,0	0,9	1,1	1,4	1,0	0,9	0,8	1,1	1,3	0,7

[1)] Use restricted to anchoring statically indeterminate structural components

LTS

Performances
Characteristic resistance under tension load
Displacement under tension load

Annex C 1

Table C3 – Characteristic resistance under shear load

Steel failure without lever arm												
Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Characteristic resistance	$V^0_{Rk,s}$	[kN]	9,1		15,7		23,7		47,1		60,6	
Ductility factor	k_7	[-]	0,8		0,8		0,8		0,8		0,8	
Partial safety factor	γ_{Ms}	[-]	1,25		1,25		1,25		1,25		1,25	

Steel failure with lever arm												
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	22		45		79		200		389	
Partial safety factor	γ_{Ms}	[-]	1,25		1,25		1,25		1,25		1,25	

Concrete pry-out failure												
Factor	k_8	[-]	1,0	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0	2,0
Installation safety factor	γ_{inst}	[-]	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Concrete edge failure												
Effective length of anchor	ℓ_f	[mm]	32	47	39	59	48	68	65	85	80	99
Anchor diameter	d_{nom}	[mm]	8		10		12		16		20	
Installation safety factor	γ_{inst}	[-]	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

[1)] Use restricted to anchoring statically indeterminate structural components

Table C4 – Displacement under shear load

Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Shear load in cracked and uncracked concrete	V	[kN]	5,8	5,8	9,2	9,2	13,3	13,3	24,5	24,5	38,5	38,5
Displacement	δ_{V0}	[mm]	1,2	1,2	1,5	1,5	2,0	2,0	2,4	2,4	2,6	2,6
	$\delta_{V\infty}$	[mm]	1,8	1,8	2,3	2,3	3,0	3,0	3,6	3,6	3,9	3,9

[1)] Use restricted to anchoring statically indeterminate structural components

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Performances
Characteristic resistance under shear load
Displacement under shear load

Annex C 2

Table C5 – Characteristic values of resistance to tension load under fire exposure[1)]

Size			M8		M10		M12		M16		M20	
			Red[2)]	Std	Red[2)]	Std	Red	Std	Red	Std	Red	Std
Characteristic fire resistance duration at 30 minutes												
Steel failure	$N_{Rk,s,fi}$	[kN]	0,4		0,9		1,7		3,1		4,9	
Pull-out failure	$N_{Rk,p,fi}$	[kN]	0,8	1,3	1,5	2,3	2,3	3,0	4,0	5,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$	[kN]	1,0	2,7	1,7	4,8	2,9	6,9	6,1	12,0	10,3	17,6
Characteristic fire resistance duration at 60 minutes												
Steel failure	$N_{Rk,s,fi}$	[kN]	0,3		0,8		1,3		2,4		3,7	
Pull-out failure	$N_{Rk,p,fi}$	[kN]	0,8	1,3	1,5	2,3	2,3	3,0	4,0	5,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$	[kN]	1,0	2,7	1,7	4,8	2,9	6,9	6,1	12,0	10,3	17,6
Characteristic fire resistance duration at 90 minutes												
Steel failure	$N_{Rk,s,fi}$	[kN]	0,3		0,6		1,1		2,0		3,2	
Pull-out failure	$N_{Rk,p,fi}$	[kN]	0,8	1,3	1,5	2,3	2,3	3,0	4,0	5,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$	[kN]	1,0	2,7	1,7	4,8	2,9	6,9	6,1	12,0	10,3	17,6
Characteristic fire resistance duration at 120 minutes												
Steel failure	$N_{Rk,s,fi}$	[kN]	0,2		0,5		0,8		1,6		2,5	
Pull-out failure	$N_{Rk,p,fi}$	[kN]	0,6	1,0	1,2	1,8	1,8	2,4	3,2	4,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$	[kN]	0,8	2,2	1,4	3,9	2,3	5,5	4,9	9,6	8,2	14,0
Spacing	$s_{cr,N}$	[mm]	$4 \times h_{ef}$									
	s_{min}	[mm]	55	50	75	70	150	90	190	160	300	180
Edge distance	$c_{cr,N}$	[mm]	$2 \times h_{ef}$									
	c_{min}	[mm]	$c_{min} = 2 \times h_{ef}$ however if the fire attack is from more than one side, the edge distance of the anchor has to be ≥ 300 mm and ≥ $2 \times h_{ef}$									

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

[2)] Use restricted to anchoring statically indeterminate structural components

Table C6 – Characteristic values of resistance to shear load under fire exposure

Size			M8		M10		M12		M16		M20	
			Red[1)]	Std	Red[1)]	Std	Red	Std	Red	Std	Red	Std
Characteristic fire resistance duration at 30 minutes												
Steel failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,4		0,9		1,7		3,1		4,9	
Steel failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,4		1,1		2,6		6,7		13,0	
Characteristic fire resistance duration at 60 minutes												
Steel failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,3		0,8		1,3		2,4		3,7	
Steel failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,3		1,0		2,0		5,0		9,7	
Characteristic fire resistance duration at 90 minutes												
Steel failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,3		0,6		1,1		2,0		3,2	
Steel failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,3		0,7		1,7		4,3		8,4	
Characteristic fire resistance duration at 120 minutes												
Steel failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,2		0,5		0,8		1,6		2,5	
Steel failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,2		0,6		1,3		3,3		6,5	
Concrete pry-out failure												
Factor[2)]	k_8	[-]	1,0	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0	2,0
Concrete edge failure	The characteristic resistance $V^0_{Rk,c,fi}$ in concrete C20/25 to C50/60 is determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c(\leq 90)}$ and $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c(\leq 120)}$ with the initial value of the characteristic resistance $V^0_{Rk,c}$ in cracked concrete C20/25 under normal temperature											

[1)] Use restricted to anchoring statically indeterminate structural components

[2)] The values of factor k_8 and relevant values of $N_{Rk,c,fi}$ given in the Table C5 have to be considered in the design

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Performances
Characteristic values of resistance under fire exposure

Annex C 3

Table C7 – Characteristic values of resistance under seismic action category C2

Size			M10	M12	M16
			Standard		
Tension load					
Steel failure					
Characteristic resistance	$N_{Rk,s,eq,C2}$	[kN]	17,5	25,8	45,8
Partial safety factor	$\gamma_{Ms,eq}$	[-]	1,4	1,4	1,4
Pull-out failure					
Characteristic resistance in concrete C20/25	$N_{Rk,p,eq,C2}$	[kN]	3,4	7,0	10,9
Installation safety factor	$\gamma_{inst,eq}$	[-]	1,0	1,0	1,0
Shear load					
Steel failure without lever arm					
Characteristic resistance	$V_{Rk,s,eq,C2}$	[kN]	9,2	11,1	28,2
Partial safety factor	$\gamma_{Ms,eq}$	[-]	1,25	1,25	1,25
Factor for annular gap	α_{gap}	[-]		0,5	

Table C8 – Displacement under tensile and shear load - seismic category C2

Size		M10	M12	M16
$\delta_{N,eq(DLS)}$	[mm]	2,8	3,0	4,2
$\delta_{N,eq(ULS)}$	[mm]	9,3	12,2	13,0
$\delta_{V,eq(DLS)}$	[mm]	4,5	4,3	5,8
$\delta_{V,eq(ULS)}$	[mm]	7,0	7,0	10,2