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European Technical Assessment

ETA 20/0640
of 27/07/2023

Technical Assessment Body issuing the ETA: Technical and Test Institute for Construction Prague	
Trade name of the construction product	LE-ZN LE-DZN
Product family to which the construction product belongs	Product area code: 33 Torque controlled expansion anchor for use in uncracked concrete
Manufacturer	Klimas Sp. z o.o. Kuźnica Kiedrzyńska, Ul. Wincentego Witosa 135/137, 42-233 Mykanów, Poland
Manufacturing plant	PLANT1, PLANT2, POLAND
This European Technical Assessment contains	15 pages including 13 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 330232-01-0601 Mechanical fasteners for use in concrete
This version replaces	ETA 20/0640 issued on 01/09/2022

1. Technical description of the product

The LE-ZN, LE-DZN are through-fixing torque-controlled expansion anchors in sizes of M6, M8, M10, M12, M16 and M20. Each type comprises a nut, bolt, washer and expansion sleeve. The anchors are made from steel with zinc 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 A 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	See Annex C3

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

According to the Decision 96/582/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.

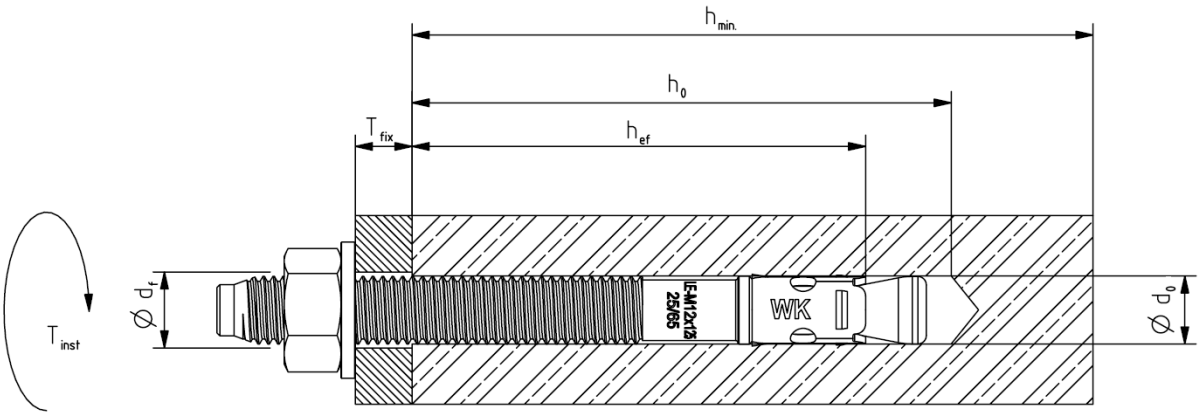
Issued in Prague on 27.07.2023

By

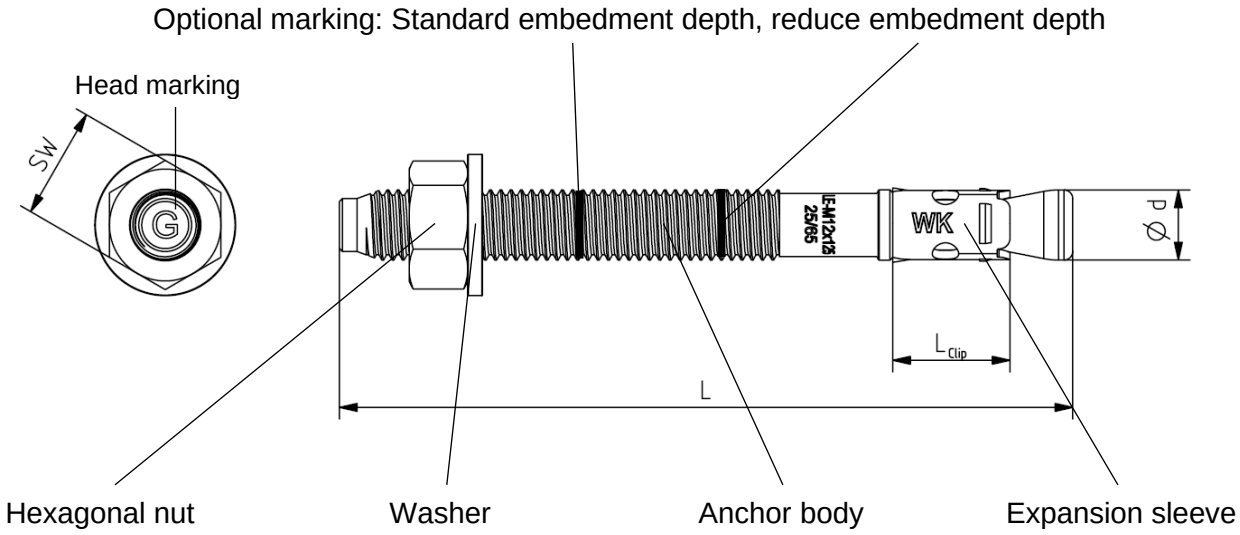
Ing. Jiří Studnička, Ph.D.
Head of the Technical Assessment Body

[1] Official Journal of the European Communities L 254 of 08.10.1996

Installed anchor



Components



LE-ZN, LE-DZN	**Annex A 1**
Product description Installed conditions and components	

Table A1 - Materials

Component	Material
Anchor body	Carbon steel
Expansion sleeve	Carbon steel
Hexagonal nut	Steel class 8 DIN 934 / EN ISO 898-2
Washer	Steel DIN 125 or EN ISO 7089 / DIN 9021A or EN ISO 7093
Protection	LE-ZN - Zinc coating (≥ 5µm); electroplated acc. to EN ISO 4042, all parts LE-DZN - flake zinc (≥ 8µm) acc. to ISO 2178:2016 for body, nut and washer

Table A2 – Marking

Parameters			**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Bolt length:	L	[mm]	50÷160	60÷255	85÷255	85÷305	105÷345	160÷400
Width torque wrench:	SW	[mm]	10	13	17	19	24	30

Head Bolt Marking

Bolt length [mm] L ≥	20	65	77	90	103	115	128	141	153
Head marking	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Bolt length [mm] L ≥	166	178	191	204	217	230	242	255	281
Head marking	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**

LE-ZN, LE-DZN	
Product description Materials Marking	**Annex A 2**

Specifications of intended use

Anchorages subject to:

- Static and quasi-static load
- Fire exposure

Base materials

- Uncracked concrete.
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206:2013+A1:2016

Use conditions (Environmental conditions)

- Structures subject to dry internal conditions.
- M6 is only for anchoring structural components which are statically indeterminate and subject to internal conditions.

Design:

- The anchorages are designed in accordance with the EN 1992-4 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 fire exposure have to be designed in accordance with EN 1992-4.

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.

LE-ZN, LE-DZN	**Annex B 1**
Intended use Specifications	

Table B1 - Installation parameters

Installation parameters			M6 [1)]	M8	M10	M12	M16	M20
drill diameter:	d_o	[mm]	6	8	10	12	16	20
Fixture clearance hole diameter:	d_f	[mm]	8	10	12	14	18	22
nominal torque:	T_{inst}	[Nm]	5	20	30	50	100	160
Width torque wrench:	SW	[mm]	10	13	17	19	24	30
Standard embedment								
drill depth:	h_1	[mm]	43	52	74	88	106	145
embedment depth:	h_{nom}	[mm]	38	47	69	80	98	130
effective depth:	h_{ef}	[mm]	35	40	60	70	85	115
Reduced embedment								
drill depth:	h_1	[mm]	-	-	54	68	86	125
embedment depth:	h_{nom}	[mm]	-	-	49	60	78	110
effective depth:	h_{ef}	[mm]	-	-	40	50	65	95

1) anchoring structural components which are statically indeterminate and subject to internal conditions.

LE-ZN, LE-DZN

Intended use
Installation parameters

Annex B 2

Table B2 - Installation parameters – Minimum spacing and edge distance – LE-ZN

Installation parameters			M6	M8	M10	M12	M16	M20
Standard embedment								
effective depth:	h_{ef}	[mm]	35	40	60	70	85	115
Minimum thickness of concrete member:	h_{min}	[mm]	100	According to table B3				230
Minimum allowable spacing:	s_{min}	[mm]	47					156
Minimum allowable edge distance:	c_{min}	[mm]	47					156
Reduced embedment								
effective depth:	h_{ef}	[mm]	-	-	40	50	65	95
Minimum thickness of concrete member:	h_{min}	[mm]	-	-	According to table B3			190
Minimum allowable spacing:	s_{min}	[mm]	-	-				128
Minimum allowable edge distance:	c_{min}	[mm]	-	-				128

LE-ZN

Intended use
Installation parameters

Annex B 3

Table B3 - Installation parameters – Minimum spacing and edge distance – LE-ZN

Installation parameters			M6	M8	M10	M12	M16	M20
Standard embedment								
effective depth:	h_{ef}	[mm]	35	40	60	70	85	115
Minimum thickness of concrete member:	h_{min}	[mm]	According to table B2	100	120	160	170	According to table B2
Minimum allowable spacing:	s_{min}	[mm]		35	40	50	65	
	for c ≥	[mm]		According to Annex B6				
Minimum allowable edge distance:	c_{min}	[mm]		40	45	55	65	
	for s ≥	[mm]		According to Annex B6				
Minimum splitting area (uncracked concrete)	$A_{sp,req}$	[mm²]		24799	28712	37843	54150	
Reduced embedment								
effective depth:	h_{ef}	[mm]	-	-	40	50	65	95
Minimum thickness of concrete member:	h_{min}	[mm]	-	-	100	100	130	According to table B2
Minimum allowable spacing:	s_{min}	[mm]	-	-	40	50	65	
	for c ≥	[mm]	-	-	According to Annex B6			
Minimum allowable edge distance:	c_{min}	[mm]	-	-	45	55	65	
	for s ≥	[mm]	-	-	According to Annex B6			
Minimum splitting area (uncracked concrete)	$A_{sp,req}$	[mm²]	-	-	28712	37843	54150	

For the calculation of minimum spacing and minimum edge distance of anchors in combination with standard or reduced embedment depth and with different thicknesses of concrete members the following equation shall be fulfilled:

$$\mathbf{A_{sp,req} < A_{sp,ef}}$$

$A_{sp,req}$ = required splitting area
$A_{sp,ef}$ = effective splitting area (according to Annex B6)

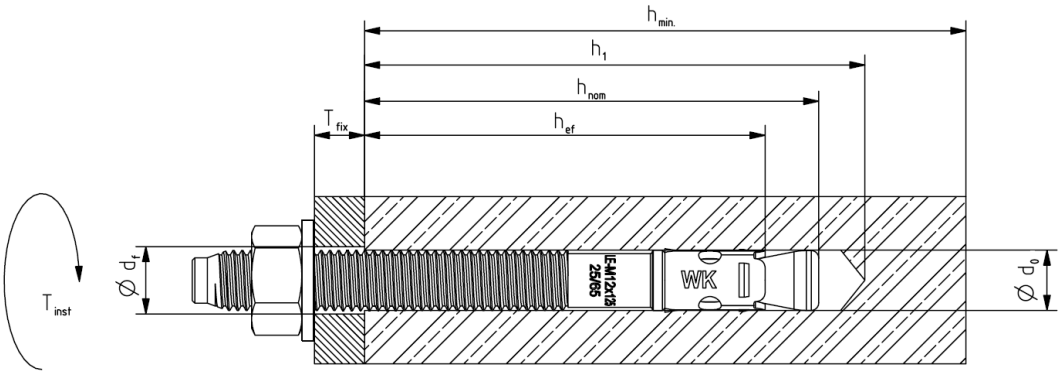
LE-ZN

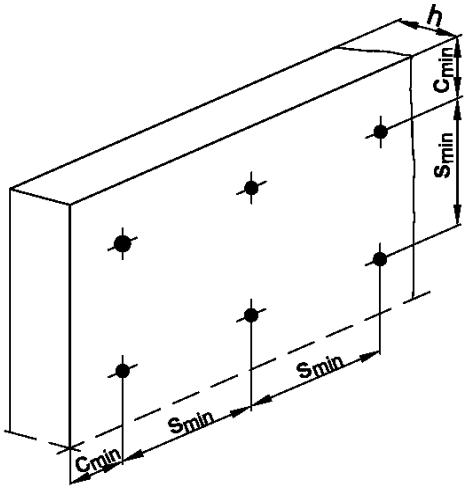
Intended use
Installation parameters

Annex B 4

Table B4 - Installation parameters – Minimum spacing and edge distance – LE-DZN

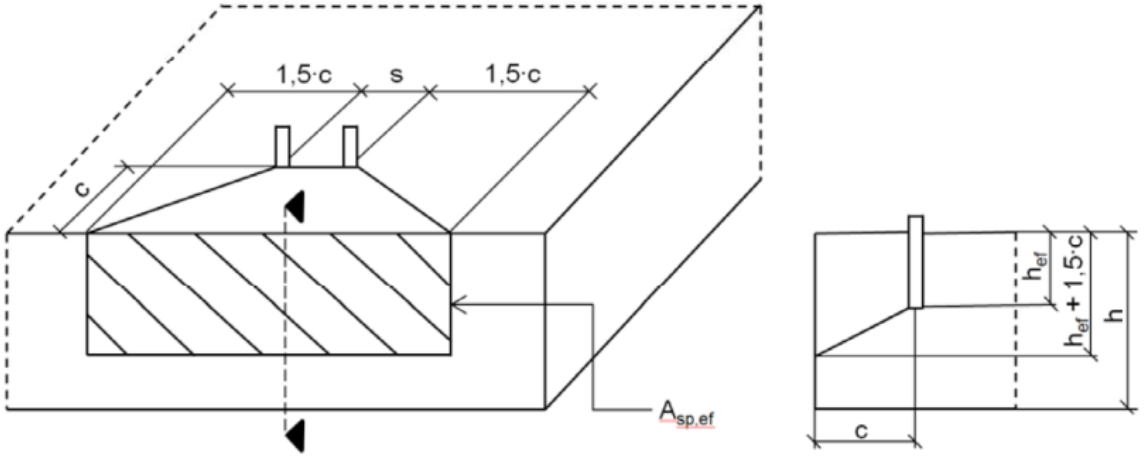
Installation parameters			M6	M8	M10	M12	M16	M20
Standard embedment								
effective depth:	h_{ef}	[mm]	35	40	60	70	85	115
Minimum thickness of concrete member:	h_{min}	[mm]	100	100	120	160	170	230
Minimum allowable spacing:	s_{min}	[mm]	47	54	82	109	116	156
Minimum allowable edge distance:	c_{min}	[mm]	47	54	82	109	116	156
Reduced embedment								
effective depth:	h_{ef}	[mm]	-	-	40	50	65	95
Minimum thickness of concrete member:	h_{min}	[mm]	-	-	100	100	130	190
Minimum allowable spacing:	s_{min}	[mm]	-	-	54	68	88	128
Minimum allowable edge distance:	c_{min}	[mm]	-	-	54	68	88	128





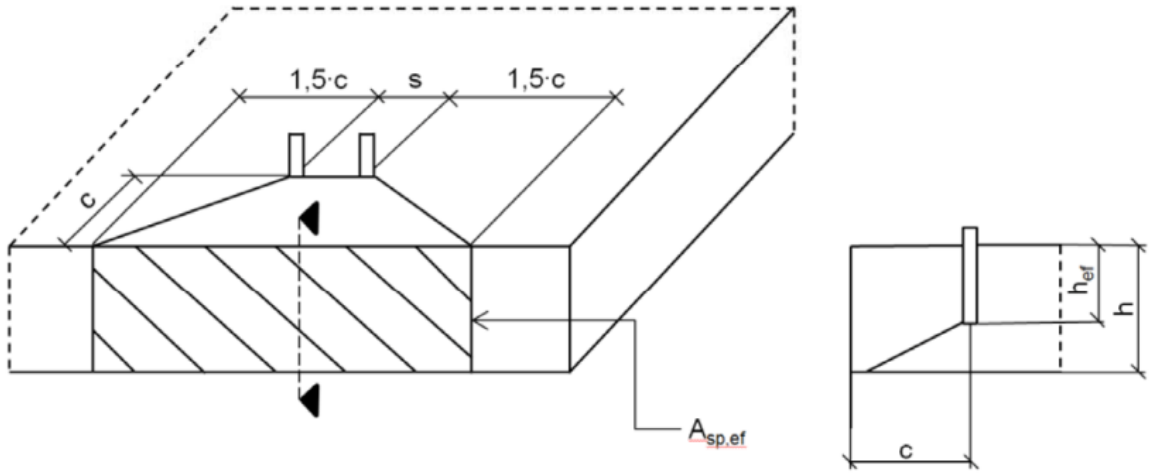
LE-DZN	Annex B 5
Intended use Installation parameters	

Table B5 - Effective splitting area $A_{sp,ef}$ with member thickness $h > h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$



Single anchor and group of anchors with $s > 3 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$ [mm²]	with $c \geq c_{min}$
Group of anchors with $s \leq 3 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (h_{ef} + 1{,}5 \cdot c)$ [mm²]	with $c \geq c_{min}$ and $s \geq s_{min}$

Table B6 – Effective splitting area $A_{sp,ef}$ with member thickness $h \leq h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$



Single anchor and group of anchors with $s > 3 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot$ existing h [mm²]	with $c \geq c_{min}$
Group of anchors with $s \leq 3 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot$ existing h [mm²]	with $c \geq c_{min}$ and $s \geq s_{min}$

Edge distance and axial spacing shall be rounded to at least 5 mm (Fig. not to scale)

LE-ZN	**Annex B 6**
Intended use Installation parameters	

Table B7 – Example of the calculated minimum edge distance and spacing for the specific member thicknesses – LE-ZN – standard embedment depth

Installation parameters			M8			M10					M12		M16	
Splitting area	$A_{sp,req.}$	[mm²]	24799			28712					37844		54150	
Embedment depth	h_{ef}	[mm]	40			60					70		85	
Minimum thickness of concrete member	h_{min}	[mm]	100			120					160		170	
Actual concrete member thickness	$h_{act.}$[1]	[mm]	100[1]		115[1]	120[1]		150[1]			160[1]		170[1]	190[1]
Minimum allowable spacing:	s_{min}	[mm]	35		35	40		40			50		65	65
	for c ≥	[mm]	75		65	70		55			65		85	75
Minimum allowable edge distance:	c_{min}	[mm]	40	50	50	45	50	45	50	55	55	65	65	75
	for s ≥	[mm]	130	100	70	105	90	95	65	40	85	50	125	65

[1] For other base material thicknesses $h \geq h_{act}$, same edge distance and spacing values are allowed

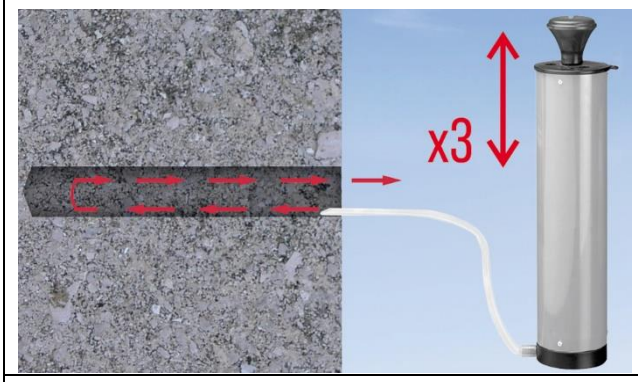
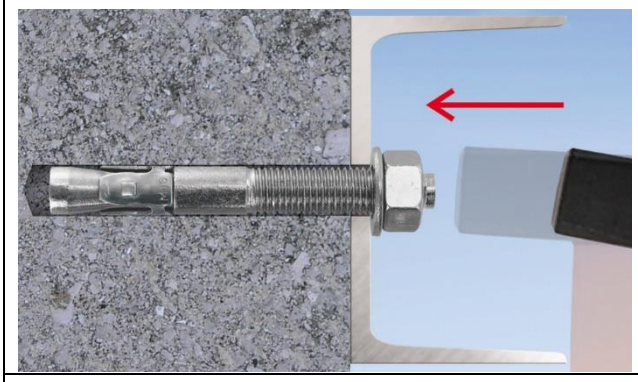
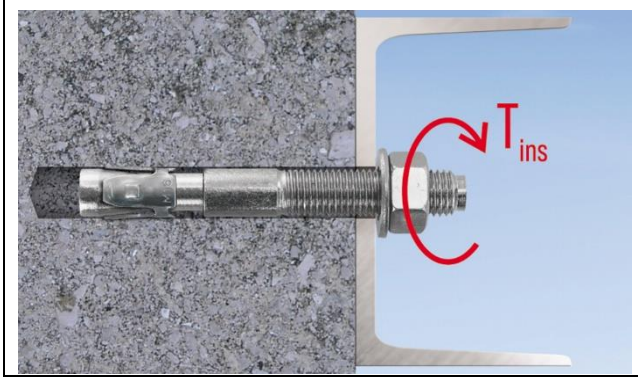
Table B8 – Example of the calculated minimum edge distance and spacing for the specific member thicknesses – LE-ZN – reduced embedment depth

Installation parameters			M8	M10					M12			M16	
Splitting area	$A_{sp,req.}$	[mm²]	-	28712					37844			54150	
Embedment depth	h_{ef}	[mm]	-	40					50			65	
Minimum thickness of concrete member	h_{min}	[mm]	-	100					100			130	
Actual concrete member thickness	$h_{act.}$[1]	[mm]	-	100[1]	130[1]				100[1]	150[1]		130[1]	160[1]
Minimum allowable spacing:	s_{min}	[mm]	-	40	40				50	50		65	65
	for c ≥	[mm]	-	85	65				110	70		120	95
Minimum allowable edge distance:	c_{min}	[mm]	-	45	45	50	55	60	95	55	60	70	100	80
	for s ≥	[mm]	-	155	135	100	70	45	95	125	95	50	120	100

[1] For other base material thicknesses $h \geq h_{act}$, same edge distance and spacing values are allowed

LE-ZN	**Annex B 7**
Intended use Installation parameters	

Installation instructions

	Drill a hole of required diameter and depth
	Clear the hole of drilling dust and debris (using blowpump or equivalent method)
	Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached
	Tighten to the recommended torque

LE-ZN, LE-DZN	**Annex B 8**
Intended use Installation instructions	

Table C1 – Characteristic resistance under tension load

Size			M6	M8	M10	M12	M16	M20
STEEL FAILURE								
Characteristic resistance – reduced part	$N_{Rk.s}$	[kN]	9,9	16,2	27,7	38,6	71,9	126,7
Partial safety factor class:	$\gamma_{M,s}$	[-]	1,81					
PULL OUT FAILURE								
Characteristic resistance in C20/25 uncracked concrete:	$N_{Rk,p}$	[kN]	1)	1)	1)	1)	1)	1)
Installation safety factor:	γ_{ins}	[-]	1,0	1,0	1,0	1,0	1,0	1,0
Increasing factors for $N^0_{Rk,c}$:	Ψ_c	C30/37	1,00	1,06				
		C40/50	1,00	1,11				
		C50/60	1,00	1,16				
CONCRETE CONE FAILURE AND SPLITTING FAILURE								
Factor for uncracked concrete:	$k_{ucr,N}$	[-]	11,0					
Installation safety factor:	γ_{ins}	[-]	1,0					
Concrete cone failure:	$s_{cr,N}$	[mm]	3 x h_{ef}					
	$c_{cr,N}$	[mm]	1.5 x h_{ef}					
Standard embedment								
Effective anchorage depth:	h_{ef}	[mm]	35	40	60	70	85	115
Splitting failure:	$s_{cr,sp}$	[mm]	175	200	300	400	425	575
	$c_{cr,sp}$	[mm]	90	100	150	200	215	290
Reduced embedment								
Effective anchorage depth:	h_{ef}	[mm]	-	-	40	50	65	95
Splitting failure:	$s_{cr,sp}$	[mm]	-	-	200	250	325	475
	$c_{cr,sp}$	[mm]	-	-	100	125	165	240

1) The pull-out failure mode is not decisive

Table C2 – Displacement under tension load

Size			M6	M8	M10	M12	M16	M20
Tension service load in uncracked concrete:	N	[kN]	5,0	6,0	6,3	8,8	14,0	25,7
Displacement:	δ_{N0}	[mm]	1,5	1,5	1,5	1,6	1,7	1,8
	$\delta_{N\infty}$	[mm]	2,4					

LE-ZN, LE-DZN

Performances
Characteristic resistance under tension load
Displacement under tension load

Annex C 1

Table C3 – Characteristic resistance under shear load

Size			M6	M8	M10	M12	M16	M20
STEEL FAILURE WITHOUT LEVER ARM								
Characteristic resistance	$V_{Rk.s}$	[kN]	6,8	12,4	19,7	28,7	53,4	83,3
Partial safety factor class:	$\gamma_{M,s}$	[-]	1,51					
STEEL FAILURE WITHOUT LEVER ARM								
Characteristic bending moment	$M_{Rk.s}$	[Nm]	15,6	38,0	75,4	131,6	316,0	621,8
Partial safety factor:	$\gamma_{M,s}$	[-]	1,51					
CONCRETE PRYOUT FAILURE								
Pryout factor:	k_8	[-]	1,0	1,0	1,0	1,0	2,0	2,0
Installation safety factor:	γ_{ins}	[-]	1,0					
CONCRETE EDGE FAILURE								
Effective length of anchor:	l_f	[mm]	35	40	40 / 60	50 / 70	65 / 85	95 / 115
Outside diameter of anchor:	d_{nom}	[mm]	6	8	10	12	16	20
Installation safety factor:	γ_{ins}	[-]	1,0					

Table C4 – Displacement under shear load

Size			M6	M8	M10	M12	M16	M20
Tension service load in uncracked concrete:	V	[kN]	6,1	6,0	9,6	12,7	23,6	34,6
Displacement:	δ_{V0}	[mm]	1,2	1,3	1,6	1,8	1,8	3,0
	$\delta_{V\infty}$	[mm]	1,8	2,0	2,4	2,7	2,7	4,5

LE-ZN, LE-DZN

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

Size			M6	M8	M10	M12	M16	M20
Min. Effective anchorage depth:	h_{ef}	[mm]	35	40	40	50	65	95
Characteristic fire resistance duration at 30 minutes								
Steel failure	$N_{Rk,s,fi}$	[kN]	0,2	0,4	0,9	1,7	3,1	4,9
Pull-Out Failure	$N_{Rk,p,fi}$	[kN]	2,5	3,0	3,3	4,5	7,0	12,5
Concrete Cone Failure	$N_{Rk,c,fi}$	[kN]	1,8	2,6	2,6	4,5	8,6	22,2
Characteristic fire resistance duration at 60 minutes								
Steel failure	$N_{Rk,s,fi}$	[kN]	0,2	0,3	0,8	1,3	2,4	3,7
Pull-Out Failure	$N_{Rk,p,fi}$	[kN]	2,5	3,0	3,3	4,5	7,0	12,5
Concrete Cone Failure	$N_{Rk,c,fi}$	[kN]	1,8	2,6	2,6	4,5	8,6	22,2
Characteristic fire resistance duration at 90 minutes								
Steel failure	$N_{Rk,s,fi}$	[kN]	0,1	0,3	0,6	1,1	2,0	3,2
Pull-Out Failure	$N_{Rk,p,fi}$	[kN]	2,5	3,0	3,3	4,5	7,0	12,5
Concrete Cone Failure	$N_{Rk,c,fi}$	[kN]	1,8	2,6	2,6	4,5	8,6	22,2
Characteristic fire resistance duration at 120 minutes								
Steel failure	$N_{Rk,s,fi}$	[kN]	0,1	0,2	0,5	0,8	1,6	2,5
Pull-Out Failure	$N_{Rk,p,fi}$	[kN]	2,0	2,4	2,6	3,6	5,6	10,0
Concrete Cone Failure	$N_{Rk,c,fi}$	[kN]	1,5	2,0	2,0	3,6	6,9	17,8
Spacing								
Spacing	$s_{cr,N}$	[mm]	$4 \times h_{ef}$					
	s_{min}	[mm]	47	54	54	68	88	128
Edge distance	$c_{cr,N}$	[mm]	$2 \times h_{ef}$					
	c_{min}	[mm]	$2 \times h_{ef}$, however if the fire attack is from more than one side, the edge distance of the anchor has to be ≥ 300 mm and ≥ $2 \times h_{ef}$					

$\gamma_{M,fi}$ - partial safety factor for resistance under fire exposure (usually $\gamma_{M,fi}$ =1.0)

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

Size			M6	M8	M10	M12	M16	M20
Characteristic fire resistance duration at 30 minutes								
Steel Failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,2	0,4	0,9	1,7	3,1	4,9
Steel Failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,1	0,4	1,7	3,9	9,3	18,3
Characteristic fire resistance duration at 60 minutes								
Steel Failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,2	0,3	0,8	1,3	2,4	3,7
Steel Failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,1	0,3	1,4	2,9	7,0	13,7
Characteristic fire resistance duration at 90 minutes								
Steel Failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,1	0,3	0,6	1,1	2,0	3,2
Steel Failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,1	0,3	1,1	2,5	6,0	11,9
Characteristic fire resistance duration at 120 minutes								
Steel Failure without lever arm	$V_{Rk,s,fi}$	[kN]	0,1	0,2	0,5	0,8	1,6	2,5
Steel Failure with lever arm	$M_{Rk,s,fi}$	[Nm]	0,1	0,2	0,9	1,9	4,6	9,1

LE-ZN, LE-DZN

Performances
Characteristic values of resistance under fire exposure

Annex C 3