DECLARATION OF PERFORMANCE No LE-ZNA4/21

1. Unique identification code of the product-type: **LE-ZNA4**
2. Intended use/es: **Torque controlled expansion anchor for use in cracked and uncracked concrete**
3. Manufacturer: **Klimas Sp. z o.o.**
   ul. Wincentego Witosa 135/137
   Kuźnica Kiedrzyńska 42-233 Mykanów
4. Authorised representative: **not applicable**
5. System/s of AVCP: **system 2+**
6. **European Assessment Document:** **EAD 330232-01-0601**
   European Technical Assessment: **ETA-20/0641 28/12/2023**
   Technical Assessment Body: **Instytut Techniki Budowlanej**
   Notified body/ies: **1488**
7. Declared performance/s:

Characteristic resistance (static and quasi-static loading)

Table C1 – Characteristic resistance under tension load

Size			M8	M10	M12	M16
STEEL FAILURE - LE-ZNA4, LE-DA4						
Characteristic resistance – reduced part	$N_{Rk,s}$	[kN]	16,2	27,7	38,6	71,9
Partial safety factor class:	$\gamma_{M,s}$	[-]	1,57			
STEEL FAILURE - LE-A4						
Characteristic resistance – reduced part	$N_{Rk,s}$	[kN]	16,7	28,5	39,7	74,0
Partial safety factor class:	$\gamma_{M,s}$	[-]	1,62			
PULL OUT FAILURE						
Characteristic resistance in uncracked concrete C20/25:	$N_{Rk,p}$	[kN]	1)	1)	1)	1)
Characteristic resistance in cracked concrete C20/25:	$N_{Rk,p}$	[kN]	1)	1)	1)	1)
Installation safety factor:	γ_{inst}	[-]	1,0			1,2
Increasing factors for $N^0_{Rk,c}$:	Ψ_c	C30/37	1,04			
		C40/50	1,06			
		C50/60	1,08			
CONCRETE CONE FAILURE AND SPLITTING FAILURE						
Factor for uncracked concrete:	$k_{ucr,N}$	[-]	11,0			
Factor for cracked concrete:	$k_{cr,N}$	[-]	7,7			
Installation safety factor:	γ_{inst}	[-]	1,0			1,2
Concrete cone failure:	$s_{cr,N}$	[mm]	$3 \times h_{ef}$			
	$c_{cr,N}$	[mm]	$1.5 \times h_{ef}$			

Standard embedment						
Effective anchorage depth:	h_{ef}	[mm]	40	60	70	85
Splitting failure:	$s_{cr,sp}$	[mm]	2 x $c_{cr,sp}$			
LE-A4						
Splitting failure:	$c_{cr,sp}$	[mm]	72	90	105	127,5
LE-ZNA4						
Splitting failure:	$c_{cr,sp}$	[mm]	72	96	105	127,5
LE-DA4						
Splitting failure:	$c_{cr,sp}$	[mm]	100	150	200	215
Reduced embedment						
Effective anchorage depth:	h_{ef}	[mm]	-	40	50	65
Splitting failure:	$s_{cr,sp}$	[mm]	2 x $c_{cr,sp}$			
LE-A4						
Splitting failure:	$c_{cr,sp}$	[mm]	-	100	100	165
LE-ZNA4						
Splitting failure:	$c_{cr,sp}$	[mm]	-	80	100	130
LE-DA4						
Splitting failure:	$c_{cr,sp}$	[mm]	-	100	125	165

1) The pull-out failure mode is not decisive

Table C3 – Characteristic resistance under shear load

Size LE-ZNA4, LE-DA4			M8	M10	M12	M16
STEEL FAILURE WITHOUT LEVER ARM						
Characteristic resistance	$V_{Rk,s}$	[kN]	12,4	19,7	26,6	49,6
Partial safety factor class:	$\gamma_{M,s}$	[-]	1,31			
STEEL FAILURE WITH LEVER ARM						
Characteristic bending moment	$M_{Rk,s}$	[Nm]	25,5	50,8	89,1	226,4
Partial safety factor:	$\gamma_{M,s}$	[-]	1,31			
CONCRETE PRYOUT FAILURE						
Standard embedment						
Pryout factor:	k_8	[-]	1,0	2,0	2,0	2,0
Reduced embedment						
Pryout factor:	k_8	[-]	1,0	1,0	1,0	2,0
Installation safety factor:	γ_{inst}	[-]	1,0			
CONCRETE EDGE FAILURE						
Effective length of anchor:	l_f	[mm]	40	40 / 60	50 / 70	65 / 85
Outside diameter of anchor:	d_{nom}	[mm]	8	10	12	16
Installation safety factor:	γ_{inst}	[-]	1,0			

Size LE-A4			M8	M10	M12	M16
STEEL FAILURE WITHOUT LEVER ARM						
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	20,3	25,9	48,6
Partial safety factor class:	$\gamma_{M,s}$	[-]	1,35			
STEEL FAILURE WITH LEVER ARM						
Characteristic bending moment	$M_{Rk,s}$	[Nm]	26,2	52,3	91,7	233,1
Partial safety factor:	$\gamma_{M,s}$	[-]	1,35			
CONCRETE PRYOUT FAILURE						
Standard embedment						
Pryout factor:	k_8	[-]	1,0	2,0	2,0	2,0
Reduced embedment						
Pryout factor:	k_8	[-]	1,0	1,0	1,0	2,0
Installation safety factor:	γ_{ins}	[-]	1,0			
CONCRETE EDGE FAILURE						
Effective length of anchor:	l_f	[mm]	40	40 / 60	50 / 70	65 / 85
Outside diameter of anchor:	d_{nom}	[mm]	8	10	12	16
Installation safety factor:	γ_{ins}	[-]	1,0			

Displacement

Table C2 – Displacement under tension load

Size LE-ZNA4, LE-DA4			M8	M10	M12	M16
Tension service load in concrete:	N	[kN]	4,1	4,1	5,8	7,2
Displacement:	δ_{N0}	[mm]	1,4	1,4	1,4	1,4
	$\delta_{N\infty}$	[mm]	0,6			
Size LE-A4			M8	M10	M12	M16
Tension service load in concrete:	N	[kN]	4,1	4,1	5,8	7,2
Displacement:	δ_{N0}	[mm]	1,0	1,1	1,4	1,4
	$\delta_{N\infty}$	[mm]	0,5			

Table C4 – Displacement under shear load

Size LE-ZNA4, LE-DA4			M8	M10	M12	M16
Tension service load in concrete:	V	[kN]	6,1	9,6	12,7	19,7
Displacement:	δ_{V0}	[mm]	1,9	2,1	2,2	2,2
	$\delta_{V\infty}$	[mm]	2,9	3,1	3,2	3,2
Size LE-A4			M8	M10	M12	M16
Tension service load in concrete:	V	[kN]	6,6	10,7	12,3	19,3
Displacement:	δ_{V0}	[mm]	1,2	1,7	2,0	2,0
	$\delta_{V\infty}$	[mm]	1,8	2,6	2,9	2,9

Characteristic resistance (seismic performance category C1)

Table C5 – Characteristic resistances loads - seismic performance category C1

Size LE-ZNA4, LE-DA4			M8	M10	M12	M16
TENSION LOAD STEEL FAILURE						
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	16,2	27,7	38,6	71,9
Partial safety factor	$\gamma_{Ms,s,C1}$	[-]	1,57			
TENSION LOAD PULLOUT FAILURE						
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	8,5	8,5	12,0	18,0
Installation safety factor	γ_{inst}	[-]	1,0	1,0	1,0	1,2
SHEAR LOAD STEEL FAILURE WITHOUT LEVER ARM						
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	8,2	13,6	20,7	39,7
Partial safety factor	$\gamma_{Ms,C1}$	[-]	1,31			
Size LE-A4			**M8**	**M10**	**M12**	**M16**
TENSION LOAD STEEL FAILURE						
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	16,7	28,5	39,7	74,0
Partial safety factor	$\gamma_{Ms,s,C1}$	[-]	1,62			
TENSION LOAD PULLOUT FAILURE						
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	8,5	8,5	12,0	18,0
Installation safety factor	γ_{inst}	[-]	1,0	1,0	1,0	1,2
SHEAR LOAD STEEL FAILURE WITHOUT LEVER ARM						
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	7,2	11,0	17,1	33,0
Partial safety factor	$\gamma_{Ms,C1}$	[-]	1,35			

Reaction to fire - Class A1 according to EN 13501-1

Resistance to fire

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

Size LE-ZNA4, LE-DA4			M8	M10	M12	M16
Min. Effective anchorage depth:	h_{ef}	[mm]	40	40	50	65
Characteristic fire resistance duration at 30 minutes						
Steel failure	$N_{Rk,s,fi(30)}$	[kN]	0,4	0,9	1,7	3,1
Pull-Out Failure	$N_{Rk,p,fi(30)}$	[kN]	2,2	2,2	3,1	4,5
Concrete Cone Failure	$N_{Rk,c,fi(30)}$	[kN]	1,9	1,9	3,4	6,6
Characteristic fire resistance duration at 60 minutes						
Steel failure	$N_{Rk,s,fi(60)}$	[kN]	0,3	0,8	1,3	2,4
Pull-Out Failure	$N_{Rk,p,fi(60)}$	[kN]	2,2	2,2	3,1	4,5
Concrete Cone Failure	$N_{Rk,c,fi(60)}$	[kN]	1,9	1,9	3,4	6,6
Characteristic fire resistance duration at 90 minutes						
Steel failure	$N_{Rk,s,fi(90)}$	[kN]	0,3	0,6	1,1	2,0
Pull-Out Failure	$N_{Rk,p,fi(90)}$	[kN]	2,2	2,2	3,1	4,5
Concrete Cone Failure	$N_{Rk,c,fi(90)}$	[kN]	1,9	1,9	3,4	6,6
Characteristic fire resistance duration at 120 minutes						
Steel failure	$N_{Rk,s,fi(120)}$	[kN]	0,2	0,5	0,8	1,6
Pull-Out Failure	$N_{Rk,p,fi(120)}$	[kN]	1,7	1,7	2,4	3,6
Concrete Cone Failure	$N_{Rk,c,fi(120)}$	[kN]	1,6	1,6	2,7	5,2
Spacing						
Spacing	$s_{cr,N}$	[mm]	$4 \times h_{ef}$			
	s_{min}	[mm]	54	54	68	88
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 C7 – Characteristic values of resistance to shear load under fire exposure

Size LE-ZNA4, LE-DA4			M8	M10	M12	M16
Characteristic fire resistance duration at 30 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(30)}$	[kN]	0,4	0,9	1,7	3,1
Steel Failure with lever arm	$M_{Rk,s,fi(30)}$	[Nm]	0,4	1,1	2,6	6,7
Characteristic fire resistance duration at 60 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(60)}$	[kN]	0,3	0,8	1,3	2,4
Steel Failure with lever arm	$M_{Rk,s,fi(60)}$	[Nm]	0,3	1,0	2,0	5,0
Characteristic fire resistance duration at 90 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(90)}$	[kN]	0,3	0,6	1,1	2,0
Steel Failure with lever arm	$M_{Rk,s,fi(90)}$	[Nm]	0,3	0,7	1,7	4,3
Characteristic fire resistance duration at 120 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(120)}$	[kN]	0,2	0,5	0,8	1,6
Steel Failure with lever arm	$M_{Rk,s,fi(120)}$	[Nm]	0,2	0,6	1,3	3,3
Concrete pryout failure R30-R120						
Characteristic resistance	$V_{Rk,cp,fi}$	[kN]	Concrete pryout failure according to EN 1992-4			
Spacing	s_{min}	[mm]	54	54	68	88
Edge distance	c_{min}	[mm]	54	54	68	88

Table C8 – Characteristic values of resistance to tension load under fire exposure

Size LE-A4			M8	M10	M12	M16
Min. Effective anchorage depth:	h_{ef}	[mm]	40	40	50	65
Characteristic fire resistance duration at 30 minutes						
Steel failure	$N_{Rk,s,fi(30)}$	[kN]	0,7	1,5	2,5	4,7
Pull-Out Failure	$N_{Rk,p,fi(30)}$	[kN]	2,2	2,2	3,1	4,5
Concrete Cone Failure	$N_{Rk,c,fi(30)}$	[kN]	1,9	1,9	3,4	6,6
Characteristic fire resistance duration at 60 minutes						
Steel failure	$N_{Rk,s,fi(60)}$	[kN]	0,6	1,2	2,1	3,9
Pull-Out Failure	$N_{Rk,p,fi(60)}$	[kN]	2,2	2,2	3,1	4,5
Concrete Cone Failure	$N_{Rk,c,fi(60)}$	[kN]	1,9	1,9	3,4	6,6
Characteristic fire resistance duration at 90 minutes						
Steel failure	$N_{Rk,s,fi(90)}$	[kN]	0,4	0,9	1,7	3,1
Pull-Out Failure	$N_{Rk,p,fi(90)}$	[kN]	2,2	2,2	3,1	4,5
Concrete Cone Failure	$N_{Rk,c,fi(90)}$	[kN]	1,9	1,9	3,4	6,6
Characteristic fire resistance duration at 120 minutes						
Steel failure	$N_{Rk,s,fi(120)}$	[kN]	0,4	0,8	1,3	2,5
Pull-Out Failure	$N_{Rk,p,fi(120)}$	[kN]	1,7	1,7	2,4	3,6
Concrete Cone Failure	$N_{Rk,c,fi(120)}$	[kN]	1,6	1,6	2,7	5,2
Spacing						
Spacing	$s_{cr,N}$	[mm]	$4 \times h_{ef}$			
	s_{min}	[mm]	54	54	68	88
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 C9 – Characteristic values of resistance to shear load under fire exposure

Size LE-A4			M8	M10	M12	M16
Characteristic fire resistance duration at 30 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(30)}$	[kN]	0,7	1,5	2,5	4,7
Steel Failure with lever arm	$M_{Rk,s,fi(30)}$	[Nm]	0,7	1,9	3,9	10,0
Characteristic fire resistance duration at 60 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(60)}$	[kN]	0,6	1,2	2,1	3,9
Steel Failure with lever arm	$M_{Rk,s,fi(60)}$	[Nm]	0,6	1,5	3,3	8,3
Characteristic fire resistance duration at 90 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(90)}$	[kN]	0,4	0,9	1,7	3,1
Steel Failure with lever arm	$M_{Rk,s,fi(90)}$	[Nm]	0,4	1,2	2,6	6,7
Characteristic fire resistance duration at 120 minutes						
Steel Failure without lever arm	$V_{Rk,s,fi(120)}$	[kN]	0,4	0,8	1,3	2,5
Steel Failure with lever arm	$M_{Rk,s,fi(120)}$	[Nm]	0,4	1,0	2,1	5,3
Concrete pryout failure R30-R120						
Characteristic resistance	$V_{Rk,cp,fi}$	[kN]	Concrete pryout failure according to EN 1992-4			
Spacing	s_{min}	[mm]	54	54	68	88
Edge distance	c_{min}	[mm]	54	54	68	88

8. Appropriate Technical Documentation and/or Specific Technical Documentation: not applicable

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Kuźnica Kiedrzyńska
07-11-2024

[place]
[date of issue]

Kierownik działu technicznego
Adam Szczepanowski
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