DECLARATION of PERFORMANCE
No 02/CA-H/X/0284/2021

CE

1. *Unique identification code of the product-type*: **CA-H/X**
2. *Intended use:* **Torgue controlled expansion wedge anchor CA-H/X are intended to be used for fastening construction structure to concrete**
3. *Name, registered trade name or registered trade mark and contact address of the manufacturer:* **Marcopol Sp. z o.o. Producer of Bolts str. Oliwska 100, 80-209 Chwaszczyno Poland**
4. *System or systems of assessment and verification of constancy of performance of the construction product:* **System "1" of assessment**
5. *European Technical Assessment:* **ETA 19/0284 issued 07.05.2019**

   Technical Assessment Body: **Instituto de Ciencias de la Construccion Eduardo Torroja**
   Notified Body: **Number: 1219 - Instituto de Ciencias de la Construccion Eduardo Torroja**
   Certificate of Constancy of Performance: **1219-CPR-0223**
6. *Declared performance:*

	Essential characteristic	Performance	Technical Specification
3.1 BWR 1: Mechanical resistance and stability			
3.1.1.	Characteristic values to tension loads	see table C2 below	ETA 19/0284
3.1.2.	Characteristic values to shear loads	see table C3 below	ETA 19/0284
3.1.3	Displacements under tension load	see table C4 below	ETA 19/0284
3.1.4	Dispalcements under shear load	see table C5 below	ETA 19/0284
3.1.5	Seismic performance C1	see table C6 below	ETA 19/0284
3.1.6	Seismic performanceC2	see table C7 below	ETA 19/0284
3.2 BWR 2: Safety in case of fire			
3.2.1.	Reaction to fire	Anchorages satisfy requirements for class A1	EN 13501-1
3.2.2	Resistance to fire	see table C8 below	ETA 19/0284

Table C2: Characteristic values to tension loads of design method A according to EN 1992-4 for CA-Z/X, CA-H/X, CA-Z/H anchor

Characteristic values of resistance to tension loads of design according to design method A				Performances					
				M8	M10	M12	M16	M20	M24
Tension loads: steel failure									
$N_{Rk,s}$	Characteristic resistance:		[kN]	18.1	31.4	40.4	72.7	116.6	179.2
γ_{Ms}	Partial safety factor:		[-]	1.5	1.5	1.5	1.5	1.5	1.5
Tension loads: pull-out failure in concrete									
CA-Z/X anchor									
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete:		[kN]	9	16	20	35	50	50
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete:		[kN]	5	9	12	25	30	30
CA-H/X anchor									
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete:		[kN]	9	16	30	35	50	--
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete:		[kN]	6	9	16	25	30	--
CA-Z/H anchor									
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete:		[kN]	9	16	25	35	50	--
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete:		[kN]	6	9	16	25	30	--
γ_{ins}	Installation safety factor:		[-]	1.2	1.0	1.0	1.0	1.0	1.2
ψ_c	Increasing factor for $N^0_{Rk,p}$:	C30/37	[-]	1.22	1.16	1.22	1.22	1.16	1.22
		C40/50	[-]	1.41	1.31	1.41	1.41	1.31	1.41
		C50/60	[-]	1.55	1.41	1.55	1.55	1.41	1.55
Tension loads: concrete cone and splitting failure									
h_{ef}	Effective embedment depth:		[mm]	48	60	70	85	100	125
$k_{ucr,N}$	Factor for uncracked concrete:		[-]	11.0					
$k_{cr,N}$	Factor for cracked concrete:		[-]	7,7					
γ_{ins}	Installation safety factor:		[-]	1.2	1.0	1.0	1.0	1.0	1.2
$s_{cr,N}$	Concrete cone failure:		[mm]	$3 \times h_{ef}$					
$c_{cr,N}$			[mm]	$1.5 \times h_{ef}$					
$s_{cr,sp}$	Splitting failure:		[mm]	288	300	350	425/510[1)]	500/600[1)]	560
$c_{cr,sp}$			[mm]	144	150	175	213/255[1)]	250/300[1)]	280

[1)] Respective values for anchors CA-Z/X / CA-H/X, CA-Z/H

Table C3: Characteristic values to shear loads of design method A according to EN1992-4 for CA-Z/X, CA-H/X, CA-Z/H anchor

Characteristic values of resistance to shear loads of design according to design method A			Performances					
			M8	M10	M12	M16	M20	M24
Shear loads: steel failure without lever arm								
$V_{Rk,s}$	Characteristic resistance:	[kN]	11.0	17.4	25.3	47.1	73.1	84.7
k_7	k_7 factor:	[-]	1.0					
γ_{Ms}	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	1.25
Shear loads: steel failure with lever arm								
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	22.5	44.8	78.6	199.8	389.4	673.5
γ_{Ms}	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	1.25
Shear loads: concrete pryout failure								
k_8	k factor:	[-]	1	2	2	2	2	2
γ_{ins}	Installation safety factor:	[-]	1.0					
Shear loads: concrete edge failure								
l_f	Effective length of anchor under shear loads:	[mm]	48	60	70	85	100	125
d_{nom}	Outside anchor diameter:	[mm]	8	10	12	16	20	24
γ_{ins}	Installation safety factor:	[-]	1.0					

Table C4: Displacements under tension load for CA-Z/X, CA-H/X, CA-Z/H anchor

Displacements under tension loads			Performances					
			M8	M10	M12	M16	M20	M24
CA-Z/X anchor								
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9	18.0
δ_{N0}	Short term displacement:	[mm]	1.1	0.7	1.0	0.4	1.6	0.4
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	2.0
CA-H/X anchor								
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9	--
δ_{N0}	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.2	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	--
CA-Z/H anchor								
N	Service tension load:	[kN]	2.5	4.3	7.6	11.9	14.3	--
δ_{N0}	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.3	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.6	1.6	1.6	1.6	1.6	--

Table C5: Displacements under shear load for CA-Z/X, CA-H/X, CA-Z/H anchor

Displacements under shear loads			Performances					
			M8	M10	M12	M16	M20	M24
CA-Z/X anchor								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	33.6
δ_{V0}	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	1.4
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	2.1
CA-H/X anchor								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	-
δ_{V0}	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	--
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	--
CA-Z/H anchor								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	--
δ_{V0}	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	--
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	--

Table C6: Design information for seismic performance C1 CA-Z/X, CA-Z/H anchor

Design information for seismic performance C1			Performances					
			M8	M10	M12	M16	M20	M24
Steel failure for tension and shear failure								
$N_{Rk,s,seis}$	Characteristic tension steel failure:	[kN]	--	31.4	40.4	72.7	116.6	--
$\gamma_{Ms,N}$	Partial safety factor:	[-]	--	1.5	1.5	1.5	1.5	--
$V_{Rk,p,seis}$	Characteristic shear steel failure:	[kN]	--	12.2	17.8	33.0	58.5	--
$\gamma_{Ms,V}$	Partial safety factor:	[-]	--	1.25	1.25	1.25	1.25	--
Pull out failure								
CA-Z/X anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	5.3	8.4	17.5	--	--
CA-Z/H anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	3.9	16.0	25.0	30.0	--
γ_{ins}	Installation safety factor:	[-]	--	1.0	1.0	1.0	1.0	--
Concrete cone failure								
h_{ef}	Effective embedment depth:	[mm]	--	60	70	85	100	--
$s_{cr,N}$	Spacing:	[mm]	--	$3 \times h_{ef}$				--
$c_{cr,N}$	Edge distance:	[mm]	--	$1.5 \times h_{ef}$				--
γ_{ins}	Installation safety factor:	[-]	--	1.0	1.0	1.0	1.0	--
Concrete pryout failure								
k_3	k_3 factor:	[-]	--	2	2	2	2	--
Concrete edge failure								
l_f	Effective length of anchor:	[mm]	--	60	70	85	100	--
d_{nom}	Outside anchor diameter:	[-]	--	10	12	16	20	--

Table C7: Design information for seismic performance C2 CA-Z/X, CA-Z/H anchor

Design information for seismic performance C2			Performances					
			M8	M10	M12	M16	M20	M24
Steel failure for tension and shear failure								
$N_{Rk,s,seis}$	Characteristic tension steel failure:	[kN]	--	--	40.4	72.7	116.6	--
$\gamma_{Ms,N}$	Partial safety factor:	[-]	--	--	1.5	1.5	1.5	--
$V_{Rk,p,seis}$	Characteristic shear steel failure:	[kN]	--	--	17.8	33.0	58.5	--
$\gamma_{Ms,V}$	Partial safety factor:	[-]	--	--	1.25	1.25	1.25	--
Pull out failure								
CA-Z/X anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	--	5.2	8.9	--	--
CA-Z/H anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	--	9.1	--	21.0	--
γ_{ins}	Installation safety factor:	[-]	--	--	1.0	1.0	1.0	--
Concrete cone failure								
h_{ef}	Effective embedment depth:	[mm]	--	--	70	85	100	--
$s_{cr,N}$	Spacing:	[mm]	--	--		$3 \times h_{ef}$		--
$c_{cr,N}$	Edge distance:	[mm]	--	--		$1.5 \times h_{ef}$		--
γ_{ins}	Installation safety factor:	[-]	--	--	1.0	1.0	1.0	--
Concrete pryout failure								
k_3	k_3 factor:	[-]	--	--	2	2	2	--
Concrete edge failure								
l_f	Effective length of anchor:	[mm]	--	--	70	85	100	--
d_{nom}	Outside anchor diameter:	[-]	--	--	12	16	20	--
Displacements								
CA-Z/X anchor								
$\delta_{N,seis\ (DLS)}$	Displacement Damage Limitation State:[1) 2)]	[mm]	--	--	2.34	3.99	--	--
$\delta_{V\ seis\ (DLS)}$		[mm]	--	--	5.53	5.96	--	--
$\delta_{N,seis\ (ULS)}$	Displacement Ultimate Limit State:[1)]	[mm]	--	--	9.54	10.17	--	--
$\delta_{V,seis\ (ULS)}$		[mm]	--	--	9.08	10.66	--	--
CA-Z/H anchor								
$\delta_{N,seis\ (DLS)}$	Displacement Damage Limitation State:[1) 2)]	[mm]	--	--	5.57	--	6.82	--
$\delta_{V\ seis\ (DLS)}$		[mm]	--	--	5.53	--	6.37	--
$\delta_{N,seis\ (ULS)}$	Displacement Ultimate Limit State:[1)]	[mm]	--	--	20.31	--	29.12	--
$\delta_{V,seis\ (ULS)}$		[mm]	--	--	9.08	--	12.32	--

[1)] The listed displacements represent mean values

[2)] A small displacement may be required in the design in the case of displacements sensitive fastening of "rigid" supports. The characteristics resistance associated with such small displacements may be determined by linear interpolation or proportional reduction.

Table C8: Characteristic values for resistance to fire CA-Z/X, CA-H/X, CA-Z/H anchor

Characteristic values for resistance to fire					Performances					
					M8	M10	M12	M16	M20	M24
Steel failure										
$N_{Rk,s,fi}$	Characteristic tension resistance:		R30	[kN]	0,4	0,9	1,7	3,1	4,9	7,1
			R60	[kN]	0,3	0,8	1,3	2,4	3,7	5,3
			R90	[kN]	0,3	0,6	1,1	2,0	3,2	4,6
			R120	[kN]	0,2	0,5	0,8	1,6	2,5	3,5
$V_{Rk,s,fi}$	Characteristic shear resistance:		R30	[kN]	0,4	0,9	1,7	3,1	4,9	7,1
			R60	[kN]	0,3	0,8	1,3	2,4	3,7	5,3
			R90	[kN]	0,3	0,6	1,1	2,0	3,2	4,5
			R120	[kN]	0,2	0,5	0,8	1,6	2,5	3,5
$M^0_{Rk,s,fi}$	Characteristic bending resistance:		R30	[kN]	0,4	1,1	2,6	6,7	13,0	22,5
			R60	[kN]	0,3	1,0	2,0	5,0	9,7	16,8
			R90	[kN]	0,3	0,7	1,7	4,3	8,4	14,6
			R120	[kN]	0,2	0,6	1,3	3,3	6,5	11,2
Pull out failure										
$N_{Rk,p,fi}$	Characteristic resistance:		R30 R60 R90	[kN]	1,3/1,5[1)]	2,3	3,0/4,0[1)]	6,3	7,5	7,5
			R120	[kN]	1,0/1,2[1)]	1,8	2,4/3,2[1)]	5,0	6,0	6,0
Concrete cone failure [2)]										
$N_{Rk,p,fi}$	Characteristic resistance:		R30 R60 R90	[kN]	2.9	5,0	7,4	12,0	18,0	31,4
			R120	[kN]	2,3	4,0	5,9	9,6	14,4	25,2
$S_{cr,N,fi}$	Critical spacing:	R30 to R120		[mm]	$4 \times h_{ef}$					
$S_{min,fi}$	Minimum spacing:	R30 to R120		[mm]	50	60	70	85/128[1)]	100/150[1)]	125
$c_{cr,N,fi}$	Critical edge distance:	R30 to R120		[mm]	$2 \times h_{ef}$					
$c_{min,fi}$	Minimum edge distance:	R30 to R120		[mm]	$c_{min} = 2 \times h_{ef}$; if fire attack comes from more than one side, the edge distance of the anchor has to be ≥ 300 mm and ≥ $2 \times h_{ef}$					
Concrete pry out failure										
k_3	k_3 factor:	R30 to R120		[-]	1	2	2	2	2	2

[1)] Respective values for anchors CA-Z/X / CA-H/X, CA-Z/H

[2)] As a rule, splitting failure can be neglected since cracked concrete and reinforcement is assumed.
In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{m,fi} = 1,0$ is recommended

7. **The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point *6***

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 3.

Signed by:

Chwaszczyno, 25.03.2021

R&D Director

Janusz Kabała

Dyrektor Działu Rozwoju Produktów

Janusz Kabała