DECLARATION of PERFORMANCE

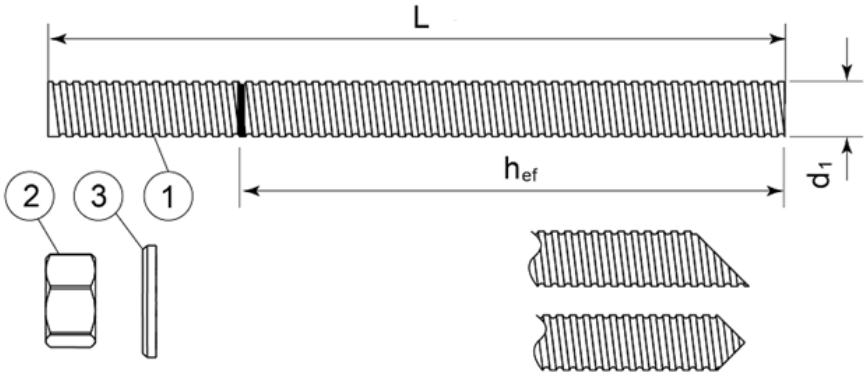
No 01/MKW/0873/2020

CE

1. *Unique identification code of the product-type*: **MKW**
2. *Intended use:* for fixing in cracked or uncracked concrete C20/25 ÷ C50/60 as a injection mortal together with threaded rod, hexagonal nut and washer or reinforcing bar – see annex B1 below
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 manufacturing plant 1**
4. *System of assessment verification of constancy of performance of the construction product:* **System "1" of assessment**
5. *European Technical Assessment:* **ETA 20/0873 issued 19.11.2020**
   Technical Assessment Body: **Technical and Test Institute for Construction Prague**
   Notified Body: **Number: 1020 - Technical and Test Institute for Construction Prague**
   Certificate number: **1020-CPR-090-050585**
6. *Declared performance:*

	Essential characteristics	Performance	Technical specification
3.1 BWR 1: Mechanical resistance and stability			
3.1.1.	Resistance to steel failure (tension)	see Annex C1, C2 below	ETA 20/0873
3.1.2.	Resistance to combined pull-out and concrete failure	see Annex C1,C2 below	ETA 20/0873
3.1.3	Resistance to concrete cone failure	see Annex C1, C2 below	ETA 20/0873
3.1.4	Edge distance to prevent splitting under load	see Annex C1,C2 below	ETA 20/0873
3.1.5	Robustness	see Annex C1, C2 below	ETA 20/0873
3.1.6	Maximum setting torgue moment	see Annex B4 below	ETA 20/0873
3.1.7	Minimum edge distance and spacing	see Annex B4 below	ETA 20/0873
3.1.8	Resistance to steel failure (shear)	see Annex C3, C4 below	ETA 20/0873
3.1.9	Resistance to pry-out failure	see Annex C3, C4 below	ETA 20/0873
3.1.10	Resistance to concrete edge failure	see Annex C2 below	ETA 20/0873
3.1.11	Displacements under short term and long term loading	see Annex C2 below	ETA 20/0873
3.1.12	Durability	see Annex B1 below	ETA 20/0873
3.3 BWR 3: Hygiene, health and the environment			
3.3.1.	Content, emission and/or release of dangerous substances	NPD	EU Regulation REACH 1907/2006

Threaded rod KGFIX M8, M10, M12, M16, M20, M24



Standard commercial threaded rod with marked embedment depth

Part	Designation	Material
Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042 or Steel, Hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461 and EN ISO 10684 or Steel, zinc diffusion coating ≥ 15 µm acc. to EN 13811		
1	Anchor rod	Steel, EN 10087 or EN 10263 Property class 4.6, 4.8, 5.6, 5.8, 8.8, 10.9* EN ISO 898-1
2	Hexagon nut EN ISO 4032	According to threaded rod, EN 20898-2
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod
Stainless steel		
1	Anchor rod	Material: A2-70, A4-70, A4-80, EN ISO 3506
2	Hexagon nut EN ISO 4032	According to threaded rod
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod
High corrosion resistant steel		
1	Anchor rod	Material: 1.4529, 1.4565, EN 10088-1
2	Hexagon nut EN ISO 4032	According to threaded rod
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod

*Galvanized rod of high strength are sensitive to hydrogen induced brittle failure

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Product description

Threaded rod and materials **Annex A3**

Rebar Ø8, Ø10, Ø12, Ø16, Ø20, Ø25

Standard commercial reinforcing bar with marked embedment depth

Product form		**Bars and de-coiled rods**	
Class		B	C
Characteristic yield strength f_{yk} or $f_{0,2k}$ (MPa)		400 to 600	
Minimum value of $k = (f_t/f_y)_k$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force ε_{uk} (%)		≥ 5,0	≥ 7,5
Bendability		Bend/Rebend test	
Maximum deviation from nominal mass (individual bar) (%)	Nominal bar size (mm) ≤ 8 > 8	±6,0 ±4,5	
Bond: Minimum relative rib area, $f_{R,min}$	Nominal bar size (mm) 8 to 12 > 12	0,040 0,056	

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Product description
Rebars and materials **Annex A4**

Specifications of intended use

Anchorages subject to: Static and quasi-static load

Base materials : Cracked and uncracked concrete

- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206

Temperature range:

- -40°C to +80°C (max. short. term temperature +80°C and max. long term temperature +50°C)

Use conditions (Environmental conditions)

- (X1) Structures subject to dry internal conditions (zinc coated steel, stainless steel, high corrosion resistance steel).
- (X2) Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel A4, high corrosion resistant steel).
- (X3) Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (high corrosion resistant steel).

Note: *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).*

Concrete conditions:

- I1 – installation in dry or wet (water saturated) concrete and use in service in dry or wet concrete.
- I2 – installation in water-filled (not sea water) and use in service in dry or wet concrete

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.

Installation:

- Hole drilling by hammer drill mode.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Installation direction:

- D3 – downward and horizontal and upwards (e.g. overhead) installation

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Intended use Specifications **Annex B 1**

Table B1: Installation parameters of threaded rod

Size			M8	M10	M12	M16	M20	M24
Nominal drill hole diameter	$Ød_0$	[mm]	10	12	14	18	22	26
Diameter of cleaning brush	d_b	[mm]	14	14	20	20	29	29
Torque moment	max T_{fix}	[Nm]	10	20	40	80	120	160
Depth of drill hole for $h_{ef,min}$	h_{ef}	[mm]	60	60	70	80	90	96
Depth of drill hole for $h_{ef,max}$	h_{ef}	[mm]	160	200	240	320	400	480
Depth of drill hole	h_0	[mm]	h_{ef}+5	h_{ef}+5	h_{ef}+5	h_{ef}+5	h_{ef}+5	h_{ef}+5
Minimum edge distance	c_{min}	[mm]	40	40	50	70	80	100
Minimum spacing	s_{min}	[mm]	40	40	50	70	80	100
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + $2d_0$		

Table B2: Installation parameters of rebar

Size			Ø8	Ø10	Ø12	Ø16	Ø20	Ø25
Nominal drill hole diameter	$Ød_0$	[mm]	12	14	16	20 | 22	25	30 | 32
Diameter of cleaning brush	d_b	[mm]	14	14	19	22	29	40
Depth of drill hole for $h_{ef,min}$	h_{ef}	[mm]	60	60	70	80	90	100
Depth of drill hole for $h_{ef,max}$	h_{ef}	[mm]	160	200	240	320	400	480
Depth of drill hole	h_0	[mm]	h_{ef}+5	h_{ef}+5	h_{ef}+5	h_{ef}+5	h_{ef}+5	h_{ef}+5
Minimum edge distance	c_{min}	[mm]	40	40	50	70	80	100
Minimum spacing	s_{min}	[mm]	40	40	50	70	80	100
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + $2d_0$		

Table B3: Minimum curing time

Resin cartridge temperature [°C]	T Work [mins]	Base material Temperature [°C]	T Load [mins]
min +5	18	min +5	145
+5 to +10	10	+5 to +10	
+10 to +20	6	+10 to +20	85
+20 to +25	5	+20 to +25	50
+25 to +30	4	+25 to +30	40
+30		+30	35

T Work is typical gel time at highest base material temperature in the range.
T Load is minimum set time required until load can be applied at the lowest temperature in the range.

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Intended use
Installation parameters
Curing time

Annex B4

Table C1: Design method EN 1992-4
Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor	γ_{Ms}	[-]	2,00					
Steel grade **4.8**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor	γ_{Ms}	[-]	1,50					
Steel grade **5.6**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177
Partial safety factor	γ_{Ms}	[-]	2,00					
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177
Partial safety factor	γ_{Ms}	[-]	1,50					
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Partial safety factor	γ_{Ms}	[-]	1,50					
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353
Partial safety factor	γ_{Ms}	[-]	1,33					
Stainless steel grade **A2-70, A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247
Partial safety factor	γ_{Ms}	[-]	1,87					
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Partial safety factor	γ_{Ms}	[-]	1,60					
High corrosion resistant steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247
Partial safety factor	γ_{Ms}	[-]	1,50					
High corrosion resistant steel grade **1.4565**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247
Partial safety factor	γ_{Ms}	[-]	1,87					

Combined pullout and concrete cone failure in concrete C20/25								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in uncracked concrete								
Temperature: -40°C to +80°C	$\tau_{Rk,ucr}$	[N/mm²]	11	10	10	9	7,5	7
Dry, wet concrete, flooded hole								
Partial safety factor	γ_{inst}	[-]	1,2					
Factor for uncracked concrete C25/30	ψ_c	[-]	1,04					
Factor for uncracked concrete C30/37	ψ_c	[-]	1,08					
Factor for uncracked concrete C35/45	ψ_c	[-]	1,12					
Factor for uncracked concrete C40/50	ψ_c	[-]	1,15					
Factor for uncracked concrete C45/55	ψ_c	[-]	1,17					
Factor for uncracked concrete C50/60	ψ_c	[-]	1,19					
Characteristic bond resistance in cracked concrete								
Temperature: -40°C to +80°C	$\tau_{Rk,ucr}$	[N/mm²]	5	5	4,5	4	4	4
Dry, wet concrete, flooded hole								
Partial safety factor	γ_{inst}	[-]	1,2					
Factor for cracked concrete C25/30	ψ_c	[-]	1,04					
Factor for cracked concrete C30/37	ψ_c	[-]	1,08					
Factor for cracked concrete C35/45	ψ_c	[-]	1,12					
Factor for cracked concrete C40/50	ψ_c	[-]	1,15					
Factor for cracked concrete C45/55	ψ_c	[-]	1,17					
Factor for cracked concrete C50/60	ψ_c	[-]	1,19					

Concrete cone failure			
Factor for concrete cone failure for uncracked concrete	$k_{ucr,N}$		11
Factor for concrete cone failure for cracked concrete	$k_{cr,N}$		7,7
Edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$

Splitting failure								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Edge distance	$c_{cr,sp}$	[mm]	$2 \cdot h_{ef}$					
Spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$					

Table C2: Design method EN 1992-4
Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance								
Size				**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]		28	43	62	111	173	270
Partial safety factor	γ_{Ms}	[-]		1,4					

Pullout failure in concrete C20/25								
Size				**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Characteristic bond resistance in uncracked concrete								
Temperature: -40°C to +80°C	$\tau_{Rk,ucr}$	[N/mm²]		8,5	8	8	7	7	5,5
Dry, wet concrete, flooded hole								
Installation safety factor	γ_{inst}	[-]		1,2					
Factor for uncracked concrete	ψ_c	[-]	C25/30	1,04					
			C30/37	1,08					
			C35/45	1,12					
			C40/50	1,15					
			C45/55	1,17					
			C50/60	1,19					
Characteristic bond resistance in cracked concrete								
Temperature: -40°C to +80°C	$\tau_{Rk,ucr}$	[N/mm²]		4	3,5	3,5	3,5	3,5	2,5
Dry, wet concrete, flooded hole								
Installation safety factor	γ_{inst}	[-]		1,2					
Factor for cracked concrete	ψ_c	[-]	C25/30	1,04					
			C30/37	1,08					
			C35/45	1,12					
			C40/50	1,15					
			C45/55	1,17					
			C50/60	1,19					

Concrete cone failure			
Factor for concrete cone failure for uncracked concrete	$k_{ucr,N}$	[-]	11
Factor for concrete cone failure for cracked concrete	$k_{cr,N}$		7,7
Edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$

Splitting failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Edge distance	$c_{cr,sp}$	[mm]	$2 \cdot h_{ef}$					
Spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$					

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Performances
Design according to EN 1992-4
Characteristic resistance for tension loads - rebar

Annex C 2

Table C3: Design method EN 1992-4
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel grade **4.6**	$V_{Rk,s}$	[kN]	7	12	17	31	49	71
Partial safety factor	γ_{Ms}	[-]	1,67					
Steel grade **4.8**	$V_{Rk,s}$	[kN]	7	12	17	31	49	71
Partial safety factor	γ_{Ms}	[-]	1,25					
Steel grade **5.6**	$V_{Rk,s}$	[kN]	9	15	21	39	61	88
Partial safety factor	γ_{Ms}	[-]	1,67					
Steel grade **5.8**	$V_{Rk,s}$	[kN]	9	15	21	39	61	88
Partial safety factor	γ_{Ms}	[-]	1,25					
Steel grade **8.8**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor	γ_{Ms}	[-]	1,25					
Steel grade **10.9**	$V_{Rk,s}$	[kN]	18	29	42	79	123	177
Partial safety factor	γ_{Ms}	[-]	1,5					
Stainless steel grade **A2-70, A4-70**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124
Partial safety factor	γ_{Ms}	[-]	1,56					
Stainless steel grade **A4-80**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor	γ_{Ms}	[-]	1,33					
High corrosion resistant steel grade **1.4529**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124
Partial safety factor	γ_{Ms}	[-]	1,25					
High corrosion resistant steel grade **1.4565**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124
Partial safety factor	γ_{Ms}	[-]	1,56					
Characteristic resistance of group of fasteners								
Ductility factor k_7 = 1,0 for steel with rupture elongation A_5 > 8%								

Steel failure with lever arm								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel grade **4.6**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449
Partial safety factor	γ_{Ms}	[-]	1,67					
Steel grade **4.8**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449
Partial safety factor	γ_{Ms}	[-]	1,25					
Steel grade **5.6**	$M^0_{Rk,s}$	[N.m]	19	37	66	166	325	561
Partial safety factor	γ_{Ms}	[-]	1,67					
Steel grade **5.8**	$M^0_{Rk,s}$	[N.m]	19	37	66	166	325	561
Partial safety factor	γ_{Ms}	[-]	1,25					
Steel grade **8.8**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898
Partial safety factor	γ_{Ms}	[-]	1,25					
Steel grade **10.9**	$M^0_{Rk,s}$	[N.m]	37	75	131	333	649	1123
Partial safety factor	γ_{Ms}	[-]	1,50					
Stainless steel grade **A2-70, A4-70**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786
Partial safety factor	γ_{Ms}	[-]	1,56					
Stainless steel grade **A4-80**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898
Partial safety factor	γ_{Ms}	[-]	1,33					
High corrosion resistant steel grade **1.4529**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786
Partial safety factor	γ_{Ms}	[-]	1,25					
High corrosion resistant steel grade **1.4565**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786
Partial safety factor	γ_{Ms}	[-]	1,56					
Concrete pryout failure								
Factor for resistance to pry-out failure	k_8	[-]	2					

Concrete edge failure								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24
Effective length of fastener	ℓ_f	[mm]	min (h_{ef}, 8 d_{nom})					

Table C4: Design method EN 1992-4
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135
Partial safety factor	γ_{Ms}	[-]	1,5					
Characteristic resistance of group of fasteners								
Ductility factor	k_7 = 1,0 for steel with rupture elongation A_5 > 8%							

Steel failure with lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Rebar BSt 500 S	$M^0_{Rk,s}$	[N.m]	33	65	112	265	518	1013
Partial safety factor	γ_{Ms}	[-]	1,5					
Concrete pryout failure								
Factor for resistance to pry-out failure	k_8	[-]	2					

Concrete edge failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	25
Effective length of fastener	ℓ_f	[mm]	min (h_{ef}, 8 d_{nom})					

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Performances
Design according to EN 1992-4
Characteristic resistance for shear loads - rebar

Annex C4

Table C5: Displacement of threaded rod under tension and shear load

Size		M8	M10	M12	M16	M20	M24
Tension load							
Uncracked concrete							
δ_{N0}	[mm/kN]	0,030	0,024	0,026	0,026	0,022	0,023
$\delta_{N\infty}$	[mm/kN]	0,103	0,083	0,059	0,045	0,038	0,032
Cracked concrete							
δ_{N0}	[mm/kN]	0,056	0,044	0,058	0,063	0,044	0,035
$\delta_{N\infty}$	[mm/kN]	0,694	0,556	0,577	0,469	0,278	0,217
Shear load							
δ_{V0}	[mm/kN]	0,021	0,016	0,013	0,010	0,008	0,007
$\delta_{V\infty}$	[mm/kN]	0,031	0,024	0,020	0,015	0,012	0,010

Table C6: Displacement of rebar under tension and shear load

Size		Ø8	Ø10	Ø12	Ø16	Ø20	Ø25
Tension load							
Uncracked concrete							
δ_{N0}	[mm/kN]	0,037	0,033	0,036	0,031	0,025	0,023
$\delta_{N\infty}$	[mm/kN]	0,126	0,113	0,081	0,053	0,043	0,031
Cracked concrete							
δ_{N0}	[mm/kN]	0,067	0,054	0,071	0,047	0,044	0,043
$\delta_{N\infty}$	[mm/kN]	0,820	0,630	0,660	0,372	0,272	0,266
Shear load							
δ_{V0}	[mm/kN]	0,020	0,016	0,013	0,010	0,008	0,006
$\delta_{V\infty}$	[mm/kN]	0,030	0,025	0,019	0,015	0,012	0,008

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Performances
Displacement for threaded rod and rebar

Annex C5

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, 05.02.2021

R&D Director

Janusz Kabała

Dyrektor Działu Rozwoju Produktów

Janusz Kabała