DECLARATION of PERFORMANCE

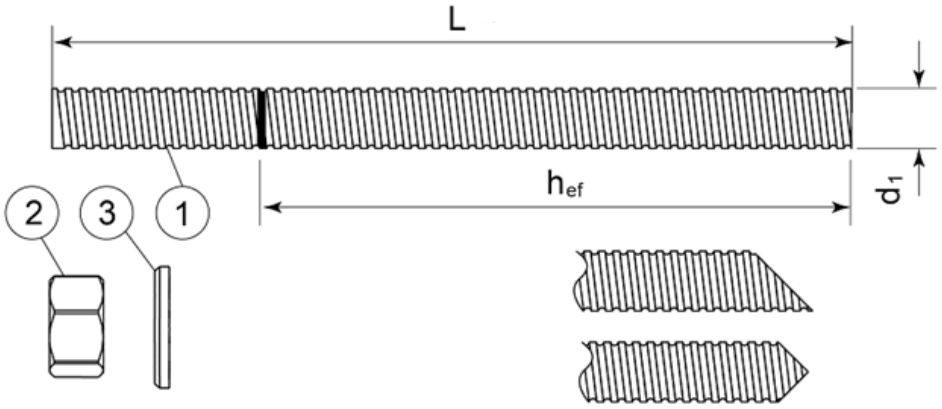
No 02/MKW/0873/2022

CE

1. *Unique identification code of the product-type*: **MKW Arctic**
2. *Intended use:* **Chemical anchor 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 A3, A4, B1, B3, B4 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: 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 18.08.2022**
   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 Mechanical resistance and stability			
3.1.1.	Characteristic resistance to tension load (static and quasi-static loading)	see Annex C1÷C4 below	ETA 20/0873
3.1.2.	Characteristic resistance to shear load (static and quasi-static loading)	see Annex C5,C6 below	ETA 20/0873
3.1.3	Displacements under short term and long term loading	see Annex C7 below	ETA 20/0873
3.1.4	Durability	see Annex B1 below	ETA 20/0873
3.2 Hygiene, health and the environment – NPD (No performance determined)			

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**

MKW Arctic	**Annex A3**
Product description: Threaded rod and materials	

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	

MKW Arctic
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:

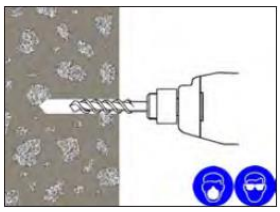
- **D3 – downward and horizontal and upwards (e.g. overhead) installation**

MKW Arctic	**Annex B1**
Intended use Specifications	

Installation instructions

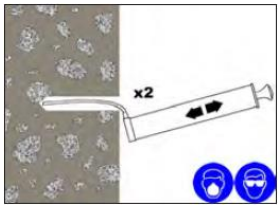
Before commencing installation ensure the operative is equipped with appropriate personal protection equipment, SDS Hammer Drill, Blow pump, Hole Cleaning Brush, good quality Dispensing Tool, Chemical cartridge with mixing nozzle and extension tube, if needed.

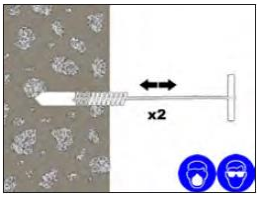
1. Drill the hole to the correct diameter and depth. This can be done with either a rotary percussion or rotary hammer drilling machine depending upon the substrate.

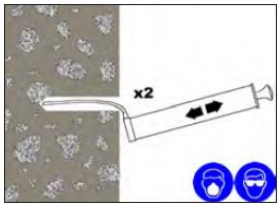


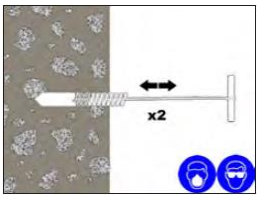
2. Thoroughly clean the hole in the following sequence using the brush with the required extensions and a blow pump.

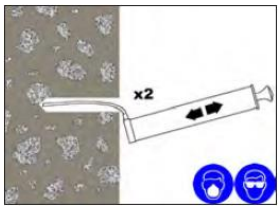
Blow Clean x2.
Brush Clean x2.
Blow Clean x2.
Brush Clean x2.
Blow Clean x2.





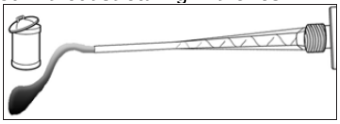






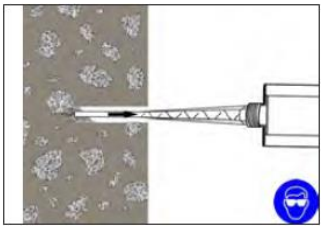
If the hole collects water after the initial cleaning this water must be removed before injecting the resin.

3. Select the appropriate static mixer nozzle for the installation, open the cartridge/foil and screw onto the mouth of the cartridge. Insert the cartridge into the correct applicator gun.
4. Extrude the first part of the cartridge to waste until an even colour has been achieved without streaking in the resin.

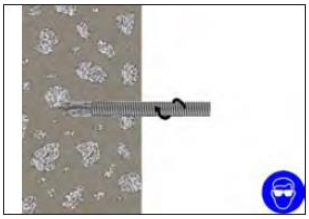


5. If necessary, cut the extension tube to the depth of the hole and push onto the end of the mixer nozzle, and (for threaded bar 16mm dia. or more) fit the correct resin stopper to the other end. Attach extension tubing and resin stopper.

6. Insert the mixer nozzle (resin stopper / extension tube if applicable) to the bottom of the hole. Begin to extrude the resin and slowly withdraw the mixer nozzle from the hole ensuring that there are no air voids as the mixer nozzle is withdrawn. Fill the hole to approximately ½ to ¾ full and remove the mixer nozzle completely.



7. Insert the clean threaded bar, free from oil or other release agents, to the bottom of the hole using a back and forth twisting motion ensuring all the threads are thoroughly coated. Adjust to the correct position within the stated working time.

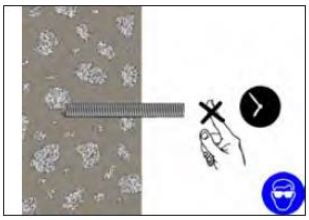


8. Any excess resin should be expelled from the hole evenly around the steel element showing that the hole is full.

   This excess resin should be removed from around the mouth of the hole before it sets.

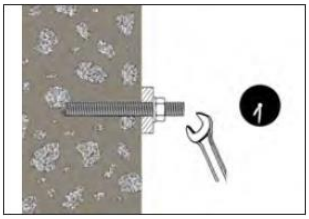
9. Leave the anchor to cure.

   Do not disturb the anchor until the appropriate loading/curing time has elapsed depending on the substrate conditions and ambient temperature.



10. Attach the fixture and tighten the nut to the recommended torque.

    Do not overtighten.



MKW Arctic	
Intended use Installation procedure	**Annex B3**

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 B3.1: Minimum curing time MKW

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

Table B3.2: Minimum curing time MKW Arctic

Resin cartridge temperature [°C]	T Work [mins]	Base material Temperature [°C]	T Load [mins]
+20	90	-20 to -15[1)]	110 hours
+20	35	-15 to -10[1)]	55 hours
+5	10	-10 to -5	30 hours
+5	3,5	-5 to 0	9 hours
+5	2	0 to +5	125
+5 to +10	2	+5 to +10	60
+10 to +20	2	+10 to +20	40
+20 to +25	1,5	+20 to +25	20
+25 to +30	1	+25 to +30	15
+30	1	+30	10

[1)] characteristic values of resistance see Annex C 2 and Annex C 4

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.

MKW Arctic

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 for a working life of 50 years and 100 years								
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					
Characteristic bond resistance in cracked concrete for a working life of 50 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	5	5	4,5	4	4	4
Characteristic bond resistance in cracked concrete for a working life of 100 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	4	4	3,5	3,5	3,5	3,5
Dry, wet concrete, flooded hole								
Partial safety factor	γ_{inst}	[-]	1,2					
Factor for influence of sustained load for a working life 50 years	ψ^0_{sus}	[-]	0,79					
Factor for concrete	C25/30 C30/37 C35/45 C40/50 C45/55 C50/60	ψ_c [-]	1,04 1,08 1,12 1,15 1,17 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 C1: Design method EN 1992-4
Characteristic values of resistance to tension load of threaded rod for MKW Arctic with installation temperature < -10°C

Steel failure – Characteristic resistance								
See Annex C 1								
Combined pullout and concrete cone failure in concrete C20/25								
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years								
Temperature: -40°C to +80°C	$\tau_{Rk,ucr}$	[N/mm²]	10	9,5	9,5	8,5	7	6,5
Dry, wet concrete, flooded hole								
Partial safety factor	γ_{inst}	[-]	1,2					
Characteristic bond resistance in cracked concrete for a working life of 50 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4	3,5	3,5	3,5
Characteristic bond resistance in cracked concrete for a working life of 100 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3	3	3	3
Dry, wet concrete, flooded hole								
Partial safety factor	γ_{inst}	[-]	1,2					
Factor for influence of sustained load for a working life 50 years	ψ^0_{sus}	[-]	0,79					
Factor for concrete	C25/30	[-]	1,04					
	C30/37		1,08					
	C35/45		1,12					
	C40/50		1,15					
	C45/55		1,17					
	C50/60		1,19					
	ψ_c							
Concrete cone failure								
See Annex C 1								
Splitting failure								
See Annex C 1								

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					

Combined pullout and concrete cone failure in concrete C20/25								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years								
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					
Characteristic bond resistance in cracked concrete for a working life of 50 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	4	3,5	3,5	3,5	3,5	2,5
Characteristic bond resistance in cracked concrete for a working life of 100 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	3	3	2,5	2,5	2,5	2
Dry, wet concrete, flooded hole								
Installation safety factor	γ_{inst}	[-]	1,2					
Factor for influence of sustained load for a working life 50 years	ψ^0_{sus}	[-]	0,79					
Factor for concrete: C25/30	ψ_c	[-]	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]	$2 \cdot c_{cr,sp}$					

MKW Arctic

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

Annex C3

Table C2: Design method EN 1992-4
Characteristic values of resistance to tension load of rebar
MKW Arctic with installation temperature < -10°C

Steel failure – Characteristic resistance							
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
See Annex C 3								

Combined pullout and concrete cone failure in concrete C20/25							
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**
Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years								
Temperature: -40°C to +80°C	$\tau_{Rk,ucr}$	[N/mm²]	8	7	7,5	6	6	5
Dry, wet concrete, flooded hole								
Installation safety factor	γ_{inst}	[-]	1,2					
Characteristic bond resistance in cracked concrete for a working life of 50 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3	3	3	2,5
Characteristic bond resistance in cracked concrete for a working life of 100 years								
Temperature: -40°C to +80°C	$\tau_{Rk,cr}$	[N/mm²]	2,5	2,5	2,5	2	2	2
Dry, wet concrete, flooded hole								
Installation safety factor	γ_{inst}	[-]	1,2					
Factor for influence of sustained load for a working life 50 years	ψ^0_{sus}	[-]	0,79					
Factor for 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
See Annex C 3

Splitting failure
See Annex C 3

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})					

MKW Arctic	
Performances Design according to EN 1992-4 Characteristic resistance for shear loads - threaded rod	**Annex C5**

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})					

MKW Arctic	
Performances Design according to EN 1992-4 Characteristic resistance for shear loads - rebar	**Annex C6**

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

MKW Arctic	
Performances Displacement for threaded rod and rebar	**Annex C7**

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, 06.10.2022

R&D Director

Janusz Kabała

Dyrektor Działu Rozwoju Produktów

Janusz Kabała