DECLARATION of PERFORMANCE
No 03/MKW/0872/2023

1. *Unique identification code of the product-type*: **MKW, MKW Arctic**
2. *Intended use:* **Chemical anchor for fixing in cracked or uncracked concrete C12/15 ÷ C50/60 for rebar connection accordance with annexes A3 and B1÷B6 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 20/0872 issued of 20.11.2023**
   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-090-049716**
6. *Declared performance:*

	Essential characteristics	Performance	Technical specification
3.1 Mechanical resistance and stability – BRW 1			
3.1.1.	Bond strength of post-installed rebar	see Annex C1÷C2 below	ETA 20/0872
3.1.2.	Reduction factor	see Annex C1÷C2 below	ETA 20/0872
3.1.3	Amplification factor for minimum anchorage length	see Annex C1÷C2 below	ETA 20/0872
3.2 Safety in case of fire – BRW 2			
3.2.1	Reaction to fire	Class (A1) according to EN 13501-1	ETA 20/0872
3.2.2	Resistance to fire	See Annex C3	ETA 20/0872
3.3 General aspects related to fitness for use			
Durability and serviceability are only ensured if the specifications of intended use according to Annex B 1 are kept.			ETA 20/0872

Rebar Ø8, Ø10, Ø12, Ø14, Ø16, Ø18, Ø20, Ø22, Ø24, Ø25

Figure A6: Reinforcing bar

Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2004.

- The maximum outer rebar diameter over the ribs shall be:
  Nominal diameter of the rib d + 2 • h (h≤0,07 • d)
  (d: nominal diameter of the bar; h: rib height of the bar)

Table A1: Materials

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	

Specifications of intended use

Anchorages subject to:

- Static and quasi-static load
- Fire exposure

Base materials

- Reinforced or unreinforced normal weight concrete according to EN 206:2013
- Strength classes C12/15 to C50/60 according to EN 206:2013.
- Maximum chloride concrete of 0,40% (CL 0.40) related to the cement content according to EN 206:2013.
- Non-carbonated concrete.
  Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post installed rebar connection (with a diameter d_s + 60 mm) prior to the installation of the new rebar. The depth of concrete to be removed shall correspond to at least minimum concrete cover in accordance with EN 1992-1-1.
  The foregoing may be neglected if building components are new and not carbonated.

Temperature range:

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

Use conditions (Environmental conditions)

- The rebars may be used in dry or wet concrete.

Design:

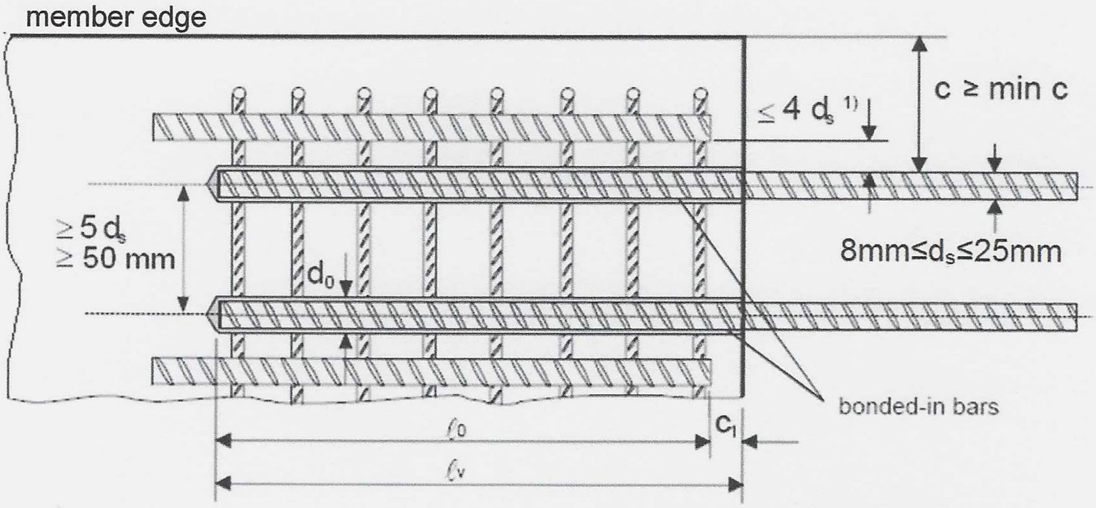
- The anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design according to EN 1992-1-1 and EN 1992-1-2.
- The position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

Installation:

- Dry or wet concrete.
- It must not be installed in flooded holes.
- Hole drilling by hammer drill, dustless drill, compressed air drill mode or diamond core drilling.
- The installation of post-installed rebars shall be done only by suitable trained installer and under supervision on site. The conditions under which an installer may be considered as suitable trained and the conditions for supervision on site are up to the Member States in which the installation is done.
- Check the position of the existing rebars (if the position is not known, it shall be determined using a rebar detector suitable for this purpose)

Figure B1: General design rules of construction for bonded-in rebars

- Only tension forces in the axis of the rebar may be transmitted
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1.
- The joints for concreting must be roughened to at least such an extent that aggregate protrude.



[1)] If the clear distance between lapped bars exceeds $4d_s$ then the lap length shall be increased by the difference between the clear bar distance and $4d_s$

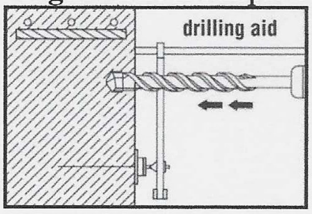
c	concrete cover of bonded-in bar
c_1	concrete cover at end-face of bonded-in bar
min c	minimum concrete cover acc. Table B1 of this assessment
d_s	diameter of bonded-in bar
ℓ_0	lap length acc. to EN 1992-1-1:2004
ℓ_v	effective embedment depth $\ge \ell_0 + c_1$
d_0	nominal drill bit diameter, see Table B2

Table B1: Minimum concrete cover c_{min} depending on drilling method

Drilling method	Bar diameter ϕ	Without drilling aid c_{min}	With drilling aid c_{min}
Hammer drilling or dustless drilling or diamond drilling	< 25 mm	30 mm + 0,06 $\ell_v \geq 2\ \phi$	30 mm + 0,02 $\ell_v \geq 2\ \phi$
	≥ 25 mm	40 mm + 0,06 $\ell_v \geq 2\ \phi$	40 mm + 0,02 $\ell_v \geq 2\ \phi$
Compressed air drilling	< 25 mm	50 mm + 0,08 ℓ_v	50 mm + 0,02 ℓ_v
	≥ 25 mm	60 mm + 0,08 $\ell_v \geq 2\ \phi$	60 mm + 0,02 $\ell_v \geq 2\ \phi$

The minimum concrete cover according to EN 1992-1-1 shall be observed.

Figure B2: Example of drilling aid



Minimum anchorage length $\ell_{bd,PIR}$ and minimum anchorage lap length $\ell_{0,PIR}$

Minimum anchorage length

$\ell_{b,PIR} = \alpha_{lb} \bullet \ell_{b,min}$

$\alpha_{lb} = \alpha_{lb,100y}$ = amplification factor for minimum anchorage length
(see Annex C 1, Table C2 for hammer or dustless drilling method)
(see Annex C 2, Table C4 for diamond core drilling method)

$\ell_{b,min}$ = minimum anchorage length of cast-in rebar according to EN 1992-1-1, eq. 8.6

Minimum lap length

$\ell_{0,PIR} = \alpha_{lb} \bullet \ell_{0,min}$

$\alpha_{lb} = \alpha_{lb,100y}$ = amplification factor for minimum anchorage length
(see Annex C 1, Table C2 for hammer or dustless drilling method)
(see Annex C 2, Table C4 for diamond core drilling method)

$\ell_{b,min}$ = minimum lap length of cast-in rebar according to EN 1992-1-1, eq. 8.11

Table B2: Drilling diameter and maximum embedment depth

Rebar diameter d_{nom} [1)	Nominal drilling diameter d_{cut}	Max permissible embedment depth $\ell_{v,max}$
[mm]	[mm]	[mm]
8	12	400
10	14	500
12	16	600
14	18	700
16	20	800
18	22	900
20	25	1000
22	28	1000
24	32	1000
25	32	1000

1) The maximum outer rebar diameter over the ribs shall be: nominal diameter of the bar d_{nom} + 0,20 d_{nom}

Table B3: Processing and Load 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

MKW Arctic

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

T work is typical gel time at highest temperature

T load is set at the lowest temperature

Table B5: Brush

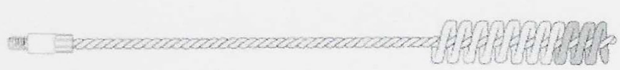
Sizes		Ø8	Ø10	Ø12	Ø14	Ø16	Ø18	Ø20	Ø22	Ø24	Ø25
Drill hole diameter d_0	[mm]	12	14	16	18	20	22	25	28	32	32
Brushes head diameter	[mm]	14	14	20	22	22	24	30	31	40	40
Brushes head length	[mm]	75									

If required use additional accessories and extension for air nozzle and brush to reach back of hole.

Max. hole depth	Brush / extension configuration	Part
280 mm	Standard brush	(a)
400 mm	Brush head unit + handle unit	(b)+(c)
700 mm	Brush head unit + extension piece + handle unit	(b)+(d)+(c)
1000 mm	Brush head unit + 2x extension piece + handle unit	(b)+(d)+(d)+(c)

Part (a)

Part (b)



Part (c)

Part (d)

Table B6: Extension hose for deep holes

Sizes		Ø8	Ø10	Ø12	Ø14	Ø16	Ø18	Ø20	Ø22	Ø24	Ø25
Hole diameter	[mm]	10	12	16	18	20	22	25	28	32	32
Extension hose	[mm]	9		14							
Resin stopper	[mm]	-	-	-	-	18		22		30	

Design bond strength of post-installed rebar $f_{bd,PIR}$ and $f_{bd,PIR,100y}$ for working life 50 and 100 years

$f_{bd,PIR} = k_b \cdot f_{bd}$

k_b = reduction factor

f_{bd} = design bond strength of cast-in rebar according to EN 1992-1-1

Table C1: Values of the design bond strength of post installed rebar $f_{bd,PIR} = f_{bd,PIR,100y}$ with reduction factor $k_b = k_{b,100y}$ for hammer drilling or dustless drilling methods for good bond conditions

Rebar Ø 8 to 12									
Concrete class	**C12/15**	**C16/20**	**C20/25**	**C25/30**	**C30/37**	**C35/45**	**C40/50**	**C45/55**	**C50/60**
k_b [-]	1,0	1,0	1,0	1,0	1,0	0,90	0,82	0,76	0,71
$f_{bd,PIR}$ [N/mm²]	**1,6**	**2,0**	**2,3**	**2,7**	**3,0**				
Rebar Ø 14 to 16									
Concrete class	**C12/15**	**C16/20**	**C20/25**	**C25/30**	**C30/37**	**C35/45**	**C40/50**	**C45/55**	**C50/60**
k_b [-]	1,0	1,0	1,0	1,0	0,89	0,90	0,82	0,76	0,71
$f_{bd,PIR}$ [N/mm²]	**1,6**	**2,0**	**2,3**	**2,7**		**3,0**			
Rebar Ø 18									
Concrete class	**C12/15**	**C16/20**	**C20/25**	**C25/30**	**C30/37**	**C35/45**	**C40/50**	**C45/55**	**C50/60**
k_b [-]	1,0	1,0	1,0	1,0	0,89	0,80	0,73	0,76	0,71
$f_{bd,PIR}$ [N/mm²]	**1,6**	**2,0**	**2,3**	**2,7**				**3,0**	
Rebar Ø 20 to 25									
Concrete class	**C12/15**	**C16/20**	**C20/25**	**C25/30**	**C30/37**	**C35/45**	**C40/50**	**C45/55**	**C50/60**
k_b [-]	1,0	1,0	1,0	1,0	0,89	0,80	0,73	0,67	0,63
$f_{bd,PIR}$ [N/mm²]	**1,6**	**2,0**	**2,3**	**2,7**					

Tabulated values are valid for good bond conditions according to EN 1992-1-1.
For all other bond conditions multiply the values by 0,7.

Table C2: Amplification factor for minimum anchorage length

Rebar	**Amplification factor**	**Concrete class**								
		C12/15	**C16/20**	**C20/25**	**C25/30**	**C30/37**	**C35/45**	**C40/50**	**C45/55**	**C50/60**
Ø 8	$\alpha_{lb} = \alpha_{lb,100y}$	1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,0	1,0
Ø 10		1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,0	1,0
Ø 12		1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0	1,0
Ø 14		1,0	1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,0
Ø 16		1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0
Ø 18		1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Ø 20		1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Ø 22		1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Ø 24		1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Ø 25		1,0	1,0	1,0	1,1	1,0	1,0	1,0	1,0	1,0

Design bond strength of post-installed rebar $f_{bd,PIR}$ and $f_{bd,PIR,100y}$ for working life 50 and 100 years

$f_{bd,PIR} = k_b \cdot f_{bd}$

k_b = reduction factor

f_{bd} = design bond strength of cast-in rebar according to EN 1992-1-1

Table C3: Values of the design bond strength of post installed rebar $f_{bd,PIR} = f_{bd,PIR,100y}$ with reduction factor $k_b = k_{b,100y}$ for diamond core drilling methods for good bond conditions

Concrete class	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Rebar Ø 8 to 10									
k_b [-]	1,0	1,0	1,0	1,0	1,0	1,0	0,91	0,84	0,79
$f_{bd,PIR}$ [N/mm²]	1,6	2,0	2,3	2,7	3,0	3,4			
Rebar Ø 12									
k_b [-]	1,0	1,0	1,0	1,0	1,0	0,90	0,82	0,76	0,71
$f_{bd,PIR}$ [N/mm²]	1,6	2,0	2,3	2,7	3,0				
Rebar Ø 14									
k_b [-]	1,0	1,0	1,0	1,0	0,89	0,90	0,82	0,76	0,71
$f_{bd,PIR}$ [N/mm²]	1,6	2,0	2,3	2,7		3,0			
Rebar Ø 16									
k_b [-]	1,0	1,0	1,0	1,0	0,89	0,80	0,73	0,67	0,63
$f_{bd,PIR}$ [N/mm²]	1,6	2,0	2,3	2,7					
Rebar Ø 18									
k_b [-]	1,0	1,0	1,0	0,86	0,89	0,80	0,73	0,67	0,63
$f_{bd,PIR}$ [N/mm²]	1,6	2,0	2,3		2,7				
Rebar Ø 20									
k_b [-]	1,0	1,0	1,0	0,86	0,76	0,69	0,63	0,58	0,54
$f_{bd,PIR}$ [N/mm²]	1,6	2,0	2,3						
Rebar Ø 22									
k_b [-]	1,0	1,0	0,86	0,86	0,76	0,69	0,63	0,58	0,54
$f_{bd,PIR}$ [N/mm²]	1,6	2,0		2,3					
Rebar Ø 24									
k_b [-]	1,0	1,0	0,86	0,74	0,66	0,59	0,54	0,58	0,54
$f_{bd,PIR}$ [N/mm²]	1,6	2,0						2,3	
Rebar Ø 25									
k_b [-]	1,0	1,0	0,86	0,74	0,66	0,59	0,54	0,50	0,47
$f_{bd,PIR}$ [N/mm²]	1,6	2,0							

Tabulated values are valid for good bond conditions according to EN 1992-1-1.
For all other bond conditions multiply the values by 0,7.

Table C4: Amplification factor for minimum anchorage length

Rebar	Amplification factor	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø 8 to 25	$\alpha_{lb} = \alpha_{lb,100y}$	1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,0	1,0

Design values of the bond strength $f_{bk,fi}$ and $f_{bk,fi,100y}$ under fire exposure for hammer or dustless drilling for working life 50 and 100 years

The design value of the bond strength $f_{bk,fi} = f_{bk,fi,100y}$ under fire exposure has to be calculated according the following equation:

$$f_{bk,fi}(\theta) = f_{bk,fi,100y}(\theta) = k_{fi}(\theta) \cdot f_{bd,PIR} \cdot \frac{\gamma_c}{\gamma_{M,fi}}$$

if: $20°C \leq \theta \leq 55{,}8°C$ — $k_{fi}(\theta) = 1$

$> 52{,}0°C \leq \theta \leq 308{,}9°C$ — $k_{fi}(\theta) = 31898 \cdot \theta^{-2{,}006} / (f_{bd,PIR} \cdot 4{,}3) \leq 1$

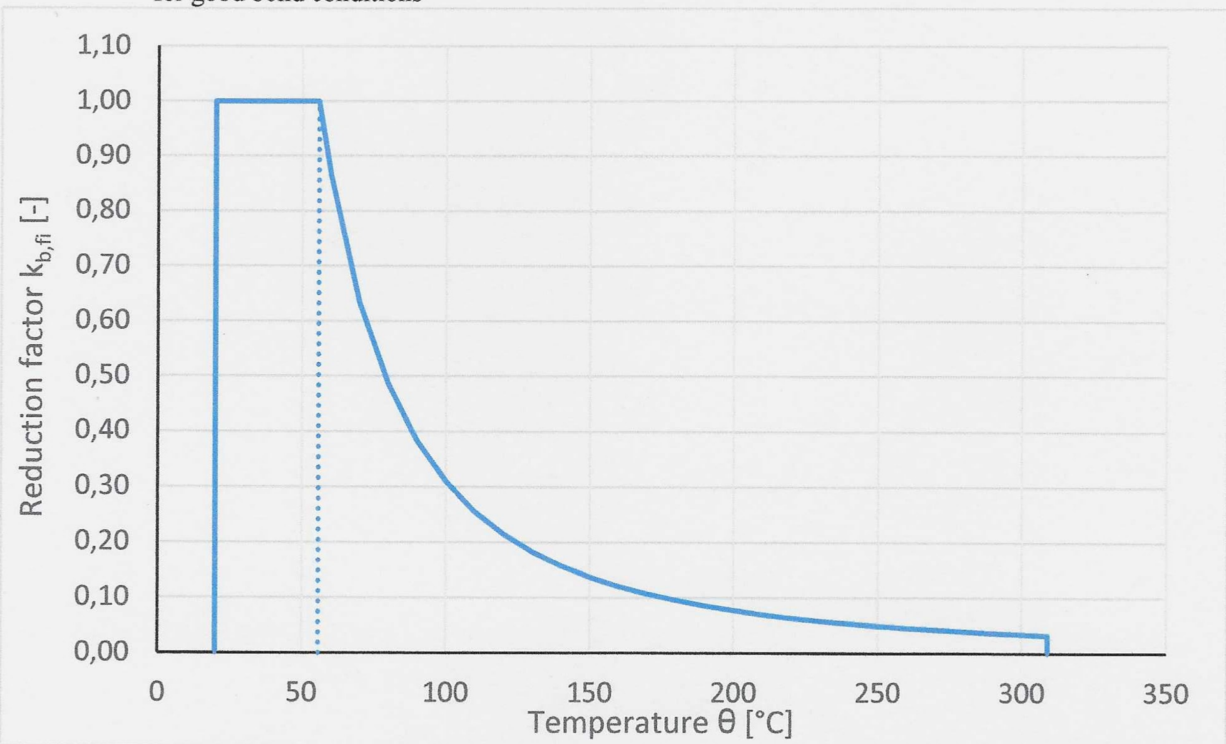
$\theta > 308{,}9°C$ — $k_{fi}(\theta) = 0$

with:

k_{fi}	temperature reduction factor
(θ)	temperature in °C
$f_{bd,PIR}$	design value of the bond strength in N/mm² according to Table C1 considering the concrete class, the rebar diameter and the bond conditions according to EN 1992-1-1
γ_c	partial safety factor according to EN 1992-1-1
$\gamma_{M,fi}$	partial safety factor according to EN 1992-1-1

The anchorage length shall be determined in accordance with EN 1992-1-1 equation (8.3) using the bond strength $f_{bk,fi}(\theta)$.

Figure C1: Example of the graph of reduction factor $k_{fi}(\theta)$ for concrete strength class C20/25 for good bond conditions



MKW, MKW Arctic for rebar connection	**Annex C3**
Performances Design values of the bond strength under fire exposure for hammer or dustless drilling	

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.

Chwaszczyno, 12.12.2023

Signed by:

Technical Support Business Partner

Janusz Kabała