

DECLARATION of PERFORMANCE

No 01/MKE/0871/2020



1. *Unique identification code of the product-type:* **MKE**
2. *Intended use:* **for fixing in cracked or uncracked, reinforced or unreinforced normal weight concrete C20/25 ÷ C50/60 according EN 206:2013 dry or permanently damp (environmental conditions X1, X2, X3) as a injection mortal together with threaded rod, hexagonal nut and washer or rebar under static or quasi-static loads seismic action category C1, C2 – 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 20/0871 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-090-050587**
6. *Declared performance:*

| | Essential characteristics | Performance | Technical specification |
|---|--|----------------------------|-------------------------|
| 3.1 BWR 1: Mechanical resistance and stability | | | |
| Static and quasi-static loading | | | |
| 3.1.1. | Resistance to steel failure (tension) | see Annex C1, C2 below | ETA 20/0871 |
| 3.1.2. | Resistance to combined pull-out and concrete failure | see Annex C1,C2 below | ETA 20/0871 |
| 3.1.3 | Resistance to concrete cone failure | see Annex C1, C2 below | ETA 20/0871 |
| 3.1.4 | Edge distance to prevent splitting under load | see Annex C1,C2 below | ETA 20/0871 |
| 3.1.5 | Robustness | see Annex C1, C2 below | ETA 20/0871 |
| 3.1.6 | Maximum setting torque moment | see Annex B5 below | ETA 20/0871 |
| 3.1.7 | Minimum edge distance and spacing | see Annex B5 below | ETA 20/0871 |
| 3.1.8 | Resistance to steel failure (shear) | see Annex C3, C4 below | ETA 20/0871 |
| 3.1.9 | Resistance to pry-out failure | see Annex C3, C4 below | ETA 20/0871 |
| 3.1.10 | Resistance to concrete edge failure | see Annex C3, C4 below | ETA 20/0871 |
| 3.1.11 | Displacements under short term and long term loading | see Annex C5 below | ETA 20/0871 |
| 3.1.12 | Durability of metal parts | see Annex A3 and A4 below | ETA 20/0871 |
| Seismic performance C1 and C2 | | | |
| 3.1.13 | Resistance to steel failure | see Annex C6, C7, C8 below | ETA 20/0871 |

| | Essential characteristics | Performance | Technical specification |
|---|---------------------------|----------------------------|-------------------------|
| 3.1.14 | Resistance to pull-out | see Annex C6, C7, C8 below | ETA 20/0871 |
| 3.1.15 | Factor for annular gap | see Annex C6, C7, C8 below | ETA 20/0871 |
| 3.1.16 | Displacement | see Annex C8 below | ETA 20/0871 |
| 3.2 BWR 3: Hygiene, health and the environment | | | |
| | | NPD | |

Specifications of intended use

Anchorage subject to:

- Static and quasi-static load
- Seismic actions category C1 (max w = 0,5 mm):
 - threaded rod size M8, M10, M12, M16, M20, M24, M27, M30
 - rebar size Ø10, Ø12, Ø16, Ø20, Ø25, Ø32
 - Seismic actions category C2 (max w = 0,8 mm): threaded rod size M12, M16, M20

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 206:2013.

Temperature range:

- T3: -40°C to +70°C (max. short. term temperature +70°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.
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with EN 1992-4.

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

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 | M27 | M30 | |
| Steel grade 4.6 | $N_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 | |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | | | | |
| Steel grade 5.8 | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | | |
| Steel grade 8.8 | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | | |
| Steel grade 10.9 | $N_{Rk,s}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 | 459 | 561 | |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | | | | |
| Stainless steel grade A2-70, A4-70 | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 | |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | | | | |
| Stainless steel grade A4-80 | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 | |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | | | | | | | |
| Stainless steel grade 1.4529 | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | | |
| Stainless steel grade 1.4565 | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 | |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | | | | |
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 | |
| Characteristic bond resistance in uncracked concrete | | | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,ucr}$ | [N/mm ²] | 14 | 13 | 13 | 12 | 12 | 11 | 10 | 9 | |
| Dry, wet concrete, flooded hole | | | | | | | | | | | |
| Partial safety factor | γ_{inst} | [-] | 1,0 | | | | | | | | |
| Factor for uncracked concrete | C25/30 | ψ_c | [-] | 1,02 | | | | | | | |
| | C30/37 | | | 1,04 | | | | | | | |
| | C35/45 | | | 1,06 | | | | | | | |
| | C40/50 | | | 1,07 | | | | | | | |
| | C45/55 | | | 1,08 | | | | | | | |
| | C50/60 | | | 1,09 | | | | | | | |
| Characteristic bond resistance in cracked concrete | | | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,cr}$ | [N/mm ²] | 8 | 8 | 7,5 | 7,5 | 7 | 7 | 5 | 5 | |
| Dry, wet concrete, flooded hole | | | | | | | | | | | |
| Partial safety factor | γ_{inst} | [-] | 1,0 | | | | | | | | |
| Factor for cracked concrete | C25/30 | ψ_c | [-] | 1,02 | | | | | | | |
| | C30/37 | | | 1,04 | | | | | | | |
| | C35/45 | | | 1,06 | | | | | | | |
| | C40/50 | | | 1,07 | | | | | | | |
| | C45/55 | | | 1,08 | | | | | | | |
| | C50/60 | | | 1,09 | | | | | | | |
| 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] | 1,5 h_{ef} | | | | | | | |
| Splitting failure | | | | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 | |
| Edge distance | $c_{cr,sp}$ | [mm] | 2 • h_{ef} | | | | | | | | |
| Spacing | $s_{cr,sp}$ | [mm] | 2 • $c_{cr,sp}$ | | | | | | | | |

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Performances

Design according to EN 1992-4
 Characteristic resistance for tension loads - threaded rod

Annex C1

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 | Ø32 | |
| Rebar BSt 500 S | $N_{Rk,s}$ | [kN] | 28 | 43 | 62 | 111 | 173 | 270 | 442 | |
| Partial safety factor | γ_{Ms} | [-] | 1,4 | | | | | | | |

| Pullout failure in concrete C20/25 | | | | | | | | | | |
|--|-----------------|----------------------|-----|------|-----|-----|-----|-----|-----|--|
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 | |
| Characteristic bond resistance in uncracked concrete | | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,ucr}$ | [N/mm ²] | 12 | 12 | 12 | 11 | 11 | 11 | 7 | |
| Dry and wet concrete | | | | | | | | | | |
| Installation safety factor | γ_{inst} | [-] | 1,0 | | | | | | | |
| Flooded hole | | | | | | | | | | |
| Installation safety factor | γ_{inst} | [-] | 1,2 | | | | | | | |
| Factor for uncracked concrete | C25/30 | ψ_c | [-] | 1,02 | | | | | | |
| | C30/37 | | | 1,04 | | | | | | |
| | C35/45 | | | 1,06 | | | | | | |
| | C40/50 | | | 1,07 | | | | | | |
| | C45/55 | | | 1,08 | | | | | | |
| C50/60 | 1,09 | | | | | | | | | |
| Characteristic bond resistance in cracked concrete | | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,cr}$ | [N/mm ²] | 7 | 10 | 9 | 9 | 8 | 8 | 5 | |
| Dry and wet concrete | | | | | | | | | | |
| Installation safety factor | γ_{inst} | [-] | 1,0 | | | | | | | |
| Flooded hole | | | | | | | | | | |
| Installation safety factor | γ_{inst} | [-] | 1,2 | | | | | | | |
| Factor for cracked concrete | C25/30 | ψ_c | [-] | 1,02 | | | | | | |
| | C30/37 | | | 1,04 | | | | | | |
| | C35/45 | | | 1,06 | | | | | | |
| | C40/50 | | | 1,07 | | | | | | |
| | C45/55 | | | 1,08 | | | | | | |
| C50/60 | 1,09 | | | | | | | | | |

| 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] | 1,5 h_{ef} |

| Splitting failure | | | | | | | | | | |
|-------------------|-------------|------|-----------------|-----|-----|-----|-----|-----|-----|--|
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 | |
| Edge distance | $c_{cr,sp}$ | [mm] | 2 • h_{ef} | | | | | | | |
| Spacing | $s_{cr,sp}$ | [mm] | 2 • $c_{cr,sp}$ | | | | | | | |

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Performances

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

Annex C2

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 | M27 | M30 |
| Steel grade 4.6 | $V_{Rk,s}$ [kN] | 7 | 12 | 17 | 31 | 49 | 71 | 92 | 112 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | | | | | | | |
| Steel grade 5.8 | $V_{Rk,s}$ [kN] | 9 | 15 | 21 | 39 | 61 | 88 | 115 | 140 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | | | | |
| Steel grade 8.8 | $V_{Rk,s}$ [kN] | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | | | | |
| Steel grade 10.9 | $V_{Rk,s}$ [kN] | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial safety factor | γ_{Ms} [-] | 1,5 | | | | | | | |
| Stainless steel grade A2-70, A4-70 | $V_{Rk,s}$ [kN] | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | | | | | | | |
| Stainless steel grade A4-80 | $V_{Rk,s}$ [kN] | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial safety factor | γ_{Ms} [-] | 1,33 | | | | | | | |
| Stainless steel grade 1.4529 | $V_{Rk,s}$ [kN] | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | | | | |
| Stainless steel grade 1.4565 | $V_{Rk,s}$ [kN] | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| 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 | M27 | M30 |
| Steel grade 4.6 | $M^o_{Rk,s}$ [N.m] | 15 | 30 | 52 | 133 | 260 | 449 | 666 | 900 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | | | | | | | |
| Steel grade 5.8 | $M^o_{Rk,s}$ [N.m] | 19 | 37 | 66 | 166 | 325 | 561 | 832 | 1125 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | | | | |
| Steel grade 8.8 | $M^o_{Rk,s}$ [N.m] | 30 | 60 | 105 | 266 | 519 | 898 | 1332 | 1799 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | | | | |
| Steel grade 10.9 | $M^o_{Rk,s}$ [N.m] | 37 | 75 | 131 | 333 | 649 | 1123 | 1664 | 2249 |
| Partial safety factor | γ_{Ms} [-] | 1,50 | | | | | | | |
| Stainless steel grade A2-70, A4-70 | $M^o_{Rk,s}$ [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | | | | | | | |
| Stainless steel grade A4-80 | $M^o_{Rk,s}$ [N.m] | 30 | 60 | 105 | 266 | 519 | 898 | 1332 | 1799 |
| Partial safety factor | γ_{Ms} [-] | 1,33 | | | | | | | |
| Stainless steel grade 1.4529 | $M^o_{Rk,s}$ [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | | | | |
| Stainless steel grade 1.4565 | $M^o_{Rk,s}$ [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| 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 | M27 | M30 |
| Outside diameter of fastener | d_{nom} [mm] | 8 | 10 | 12 | 16 | 20 | 24 | 27 | 30 |
| Effective length of fastener | ℓ_f [mm] | min (ℓ_{ef} , $8 d_{nom}$) | | | | | | | |

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Performances

Design according to EN 1992-4
 Characteristic resistance for shear loads - threaded rod

Annex C3

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 | Ø32 | |
| Rebar BSt 500 S | $V_{Rk,s}$ | [kN] | 14 | 22 | 31 | 55 | 86 | 135 | 221 | |
| 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 | Ø32 | |
| Rebar BSt 500 S | $M^o_{Rk,s}$ | [N.m] | 33 | 65 | 112 | 265 | 518 | 1013 | 2122 | |
| 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 | Ø32 | |
| Outside diameter of fastener | d_{nom} | [mm] | 8 | 10 | 12 | 16 | 20 | 25 | 32 | |
| 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 | M27 | M30 |
|----------------------------------|------|------|------|------|------|------|------|------|
| Tension load | | | | | | | | |
| Uncracked concrete | | | | | | | | |
| $\bar{\delta}_{N0}$ [mm/kN] | 0,03 | 0,02 | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 |
| $\bar{\delta}_{N\infty}$ [mm/kN] | 0,05 | 0,04 | 0,03 | 0,03 | 0,02 | 0,02 | 0,01 | 0,01 |
| Cracked concrete | | | | | | | | |
| $\bar{\delta}_{N0}$ [mm/kN] | 0,05 | 0,04 | 0,03 | 0,03 | 0,02 | 0,02 | 0,02 | 0,02 |
| $\bar{\delta}_{N\infty}$ [mm/kN] | 0,35 | 0,21 | 0,14 | 0,12 | 0,08 | 0,07 | 0,07 | 0,07 |
| Shear load | | | | | | | | |
| $\bar{\delta}_{V0}$ [mm/kN] | 0,71 | 0,45 | 0,31 | 0,17 | 0,11 | 0,07 | 0,06 | 0,05 |
| $\bar{\delta}_{V\infty}$ [mm/kN] | 1,06 | 0,67 | 0,46 | 0,25 | 0,16 | 0,11 | 0,08 | 0,07 |

Table C6: Displacement of rebar under tension and shear load

| Size | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 |
|----------------------------------|------|------|------|------|------|------|------|
| Tension load | | | | | | | |
| Uncracked concrete | | | | | | | |
| $\bar{\delta}_{N0}$ [mm/kN] | 0,04 | 0,03 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 |
| $\bar{\delta}_{N\infty}$ [mm/kN] | 0,08 | 0,05 | 0,04 | 0,02 | 0,02 | 0,01 | 0,01 |
| Cracked concrete | | | | | | | |
| $\bar{\delta}_{N0}$ [mm/kN] | 0,05 | 0,04 | 0,03 | 0,03 | 0,02 | 0,02 | 0,02 |
| $\bar{\delta}_{N\infty}$ [mm/kN] | 0,35 | 0,21 | 0,17 | 0,11 | 0,08 | 0,07 | 0,06 |
| Shear load | | | | | | | |
| $\bar{\delta}_{V0}$ [mm/kN] | 0,38 | 0,24 | 0,17 | 0,10 | 0,06 | 0,04 | 0,02 |
| $\bar{\delta}_{V\infty}$ [mm/kN] | 0,56 | 0,36 | 0,25 | 0,14 | 0,09 | 0,06 | 0,04 |

MKE
Performances
 Displacement for threaded rod and rebar

Annex C5

Table C7: Seismic performance category C1 of threaded rod

| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|---|----------------------|----------------------|------|------|------|------|------|------|------|------|
| Tension load | | | | | | | | | | |
| Steel failure | | | | | | | | | | |
| Characteristic resistance grade 4.6 | $N_{Rk,s,eq,C1}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | | | |
| Characteristic resistance grade 5.8 | $N_{Rk,s,eq,C1}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | |
| Characteristic resistance grade 8.8 | $N_{Rk,s,eq,C1}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | |
| Characteristic resistance grade 10.9 | $N_{Rk,s,eq,C1}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 | 459 | 561 |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | | | |
| Characteristic resistance A2-70, A4-70 | $N_{Rk,s,eq,C1}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | | | |
| Characteristic resistance A4-80 | $N_{Rk,s,eq,C1}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | | | | | | |
| Characteristic resistance 1.4529 | $N_{Rk,s,eq,C1}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | |
| Characteristic resistance 1.4565 | $N_{Rk,s,eq,C1}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | | | |
| Characteristic resistance to pull-out | | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,p,eq,C1}$ | [N/mm ²] | 8,0 | 8,0 | 7,5 | 7,5 | 7,0 | 7,0 | 5,0 | 4,5 |
| Installation safety factor | γ_{inst} | [-] | 1,0 | | | | | | | |
| Shear load | | | | | | | | | | |
| Steel failure without lever arm | | | | | | | | | | |
| Characteristic resistance grade 4.6 | $V_{Rk,s,eq,C1}$ | [kN] | 5 | 9 | 13 | 20 | 32 | 28 | 37 | 45 |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | | | |
| Characteristic resistance grade 5.8 | $V_{Rk,s,eq,C1}$ | [kN] | 7 | 11 | 16 | 26 | 40 | 35 | 46 | 56 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | | |
| Characteristic resistance grade 8.8 | $V_{Rk,s,eq,C1}$ | [kN] | 11 | 17 | 25 | 41 | 64 | 56 | 73 | 90 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | | |
| Characteristic resistance grade 10.9 | $V_{Rk,s,eq,C1}$ | [kN] | 14 | 22 | 32 | 51 | 80 | 71 | 92 | 112 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | | |
| Characteristic resistance A2-70, A4-70 | $V_{Rk,s,eq,C1}$ | [kN] | 10 | 15 | 22 | 36 | 56 | 49 | 64 | 79 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | | | |
| Characteristic resistance A4-80 | $V_{Rk,s,eq,C1}$ | [kN] | 11 | 17 | 25 | 41 | 64 | 56 | 73 | 90 |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | | | |
| Characteristic resistance 1.4529 | $V_{Rk,s,eq,C1}$ | [kN] | 10 | 15 | 22 | 36 | 56 | 49 | 64 | 79 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | | |
| Characteristic resistance 1.4565 | $V_{Rk,s,eq,C1}$ | [kN] | 10 | 15 | 22 | 36 | 56 | 49 | 64 | 79 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | | | |
| Characteristic shear load resistance $V_{Rk,s,eq}$ in the Table C7 shall be multiplied by following reduction factor for hot-dip galvanized commercial standard rods | | | | | | | | | | |
| Reduction factor for hot-dip galvanized rods | $\alpha_{v,h-dg,c1}$ | [-] | 0,47 | 0,47 | 0,47 | 0,54 | 0,54 | 0,88 | 0,88 | 0,88 |
| Factor for annular gap | α_{gap} | [-] | 0,5 | | | | | | | |

The anchor shall be used with minimum rupture elongation after fracture A_s equal to 19%.

| | |
|---|-----------------|
| MKE | Annex C6 |
| Performances | |
| Seismic performance category C1 of threaded rod | |

Table C8: Seismic performance category C1 of rebar

| Size | | | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 |
|--|---------------------|----------------------|-----|-----|-----|-----|-----|-----|
| Tension load | | | | | | | | |
| Steel failure | | | | | | | | |
| Rebar BSt 500 S | $N_{Rk,s,eq,C1}$ | [kN] | 43 | 62 | 111 | 173 | 270 | 442 |
| Partial safety factor | γ_{Ms} | [-] | 1,4 | | | | | |
| Characteristic resistance to pull-out | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,p,eq,C1}$ | [N/mm ²] | 8,9 | 9,0 | 9,0 | 8,0 | 7,5 | 4,8 |
| Dry and wet concrete | | | | | | | | |
| Installation safety factor | γ_{inst} | [-] | 1,0 | | | | | |
| Flooded hole | | | | | | | | |
| Installation safety factor | γ_{inst} | [-] | 1,2 | | | | | |
| Shear load | | | | | | | | |
| Steel failure without lever arm | | | | | | | | |
| Rebar BSt 500 S | $V_{Rk,s,eq,C1}$ | [kN] | 16 | 23 | 41 | 69 | 67 | 111 |
| Partial safety factor | γ_{Ms} | [-] | 1,5 | | | | | |
| Factor for annular gap | α_{gap} | [-] | 0,5 | | | | | |

MKE

Performances
Seismic performance category C1 of rebar

Annex C7

Table C9: Seismic performance category C2 of threaded rod

| Size | | | M12 | M16 | M20 |
|---|----------------------|----------------------|------|------|------|
| Tension load | | | | | |
| Steel failure | | | | | |
| Characteristic resistance grade 4.6 | $N_{Rk,s,eq,C2}$ | [kN] | 34 | 63 | 98 |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | |
| Characteristic resistance grade 5.8 | $N_{Rk,s,eq,C2}$ | [kN] | 42 | 79 | 123 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | |
| Characteristic resistance grade 8.8 | $N_{Rk,s,eq,C2}$ | [kN] | 67 | 126 | 196 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | |
| Characteristic resistance grade 10.9 | $N_{Rk,s,eq,C2}$ | [kN] | 84 | 157 | 245 |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | |
| Characteristic resistance A2-70, A4-70 | $N_{Rk,s,eq,C2}$ | [kN] | 59 | 110 | 172 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | |
| Characteristic resistance A4-80 | $N_{Rk,s,eq,C2}$ | [kN] | 67 | 126 | 196 |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | |
| Characteristic resistance 1.4529 | $N_{Rk,s,eq,C2}$ | [kN] | 59 | 110 | 172 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | |
| Characteristic resistance 1.4565 | $N_{Rk,s,eq,C2}$ | [kN] | 59 | 110 | 172 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | |
| Characteristic resistance to pull-out | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,p,eq,C2}$ | [N/mm ²] | 3,2 | 3,7 | 4,2 |
| Installation safety factor | γ_{inst} | [-] | 1,0 | | |
| Shear load | | | | | |
| Steel failure without lever arm | | | | | |
| Characteristic resistance grade 4.6 | $V_{Rk,s,eq,C2}$ | [kN] | 13 | 18 | 28 |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | |
| Characteristic resistance grade 5.8 | $V_{Rk,s,eq,C2}$ | [kN] | 16 | 22 | 35 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | |
| Characteristic resistance grade 8.8 | $V_{Rk,s,eq,C2}$ | [kN] | 25 | 36 | 56 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | |
| Characteristic resistance grade 10.9 | $V_{Rk,s,eq,C2}$ | [kN] | 32 | 45 | 70 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | |
| Characteristic resistance A2-70, A4-70 | $V_{Rk,s,eq,C2}$ | [kN] | 22 | 31 | 49 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | |
| Characteristic resistance A4-80 | $V_{Rk,s,eq,C2}$ | [kN] | 25 | 36 | 56 |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | |
| Characteristic resistance 1.4529 | $V_{Rk,s,eq,C2}$ | [kN] | 22 | 31 | 49 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | |
| Characteristic resistance 1.4565 | $V_{Rk,s,eq,C2}$ | [kN] | 22 | 31 | 49 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | |
| Characteristic shear load resistance $V_{Rk,s,eq}$ in the Table C9 shall be multiplied by following reduction factor for hot-dip galvanized commercial standard rods | | | | | |
| Reduction factor for hot-dip galvanized rods | $\alpha_{v,h-dg,c2}$ | [-] | 0,46 | 0,61 | 0,61 |
| Factor for annular gap | α_{gap} | [-] | 0,5 | | |

Table C10: Displacement under tensile and shear load - seismic category C2 of threaded rod

| Size | | M12 | M16 | M20 |
|----------------------|------|-------|------|-------|
| $\delta_{N,eq}(DLS)$ | [mm] | 0,20 | 0,40 | 0,77 |
| $\delta_{N,eq}(ULS)$ | [mm] | 0,76 | 0,74 | 1,68 |
| $\delta_{V,eq}(DLS)$ | [mm] | 5,29 | 4,12 | 4,94 |
| $\delta_{V,eq}(ULS)$ | [mm] | 10,20 | 9,05 | 10,99 |

The anchor shall be used with minimum rupture elongation after fracture A_5 equal to 19%.

MKE Performances

Seismic performance category C2 of threaded rod

Annex C8

Table B1: Installation parameters of threaded rod

| Size | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|----------------------------------|------------------------|--|------------|------------|-----------------|------------|------------|------------|------------|
| Nominal drill hole diameter | $\varnothing d_0$ [mm] | 10 | 12 | 14 | 18 | 22 | 26 | 30 | 35 |
| Cleaning brush | | S11HF | S14HF | S14/15HF | S22HF | S24HF | S31HF | S31HF | S38HF |
| Torque moment | max T_{fix} [Nm] | 10 | 20 | 40 | 80 | 120 | 160 | 180 | 200 |
| Embedment depth for $h_{ef,min}$ | h_{ef} [mm] | 60 | 60 | 70 | 80 | 90 | 96 | 108 | 120 |
| Embedment depth for $h_{ef,max}$ | h_{ef} [mm] | 160 | 200 | 240 | 320 | 400 | 480 | 540 | 600 |
| Depth of drill hole | h_0 [mm] | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ |
| Minimum edge distance | C_{min} [mm] | 40 | 40 | 40 | 40 | 50 | 50 | 50 | 60 |
| Minimum spacing | S_{min} [mm] | 40 | 40 | 40 | 40 | 50 | 50 | 50 | 60 |
| Minimum thickness of member | h_{min} [mm] | $h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$ | | | $h_{ef} + 2d_0$ | | | | |

Table B2: Installation parameters of rebar

| Size | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 |
|----------------------------------|------------------------|--|------------|------------|-----------------|------------|------------|------------|
| Nominal drill hole diameter | $\varnothing d_0$ [mm] | 12 | 14 | 16 | 20 | 25 | 32 | 40 |
| Cleaning brush | | S12/13HF | S14/15HF | S18HF | S22HF | S27HF | S35HF | S43HF |
| Torque moment | max T_{fix} [Nm] | 10 | 20 | 40 | 80 | 120 | 180 | 200 |
| Embedment depth for $h_{ef,min}$ | h_{ef} [mm] | 60 | 60 | 70 | 80 | 90 | 100 | 128 |
| Embedment depth for $h_{ef,max}$ | h_{ef} [mm] | 160 | 200 | 240 | 320 | 400 | 500 | 640 |
| Depth of drill hole | h_0 [mm] | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ |
| Minimum edge distance | C_{min} [mm] | 40 | 40 | 40 | 40 | 50 | 50 | 70 |
| Minimum spacing | S_{min} [mm] | 40 | 40 | 40 | 40 | 50 | 50 | 70 |
| Minimum thickness of member | h_{min} [mm] | $h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$ | | | $h_{ef} + 2d_0$ | | | |

Table B3: Minimum curing time

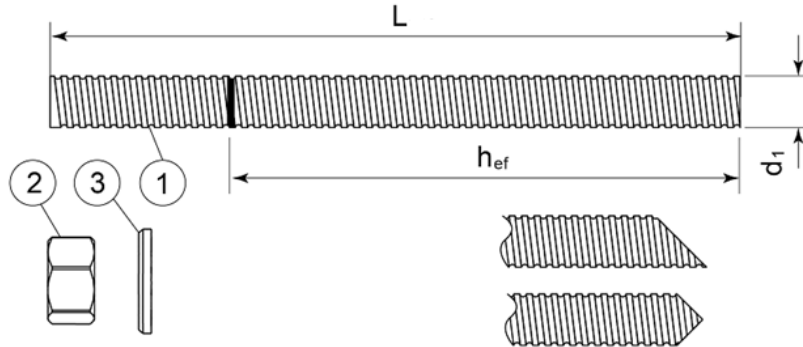
| Base Material Temperature [°C] | Cartridge Temperature [°C] | T Work [mins] | T Load [hrs] |
|---|----------------------------|---------------|--------------|
| +5 | Minimum +10 | 300 | 24 |
| +5°C to +10 | | 150 | |
| +10°C to +15 | +10°C to +15 | 40 | 18 |
| +15°C to +20 | +15°C to +20 | 25 | 12 |
| +20°C to +25 | +20°C to +25 | 18 | 8 |
| +25°C to +30 | +25°C to +30 | 12 | 6 |
| +30°C to +35 | +30°C to +35 | 8 | 4 |
| +35°C to +40 | +35°C to +40 | 6 | 2 |
| Ensure cartridge is $\geq 10^\circ\text{C}$ | | | |

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.

| | |
|--|-----------------|
| MKE | Annex B5 |
| Intended use | |
| Installation parameters Curing time | |

Threaded rod KGFIX M8, M10, M12, M16, M20, M24, M27, M30



Standard commercial threaded rod with marked embedment depth

| Part | Designation | Material |
|---|--|---|
| Steel, zinc plated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042 or Steel, Hot-dip galvanized $\geq 40 \mu\text{m}$ acc. to EN ISO 1461 and EN ISO 10684 or Steel, zinc diffusion coating $\geq 15 \mu\text{m}$ acc. to EN 13811 | | |
| 1 | Anchor rod | Steel, EN 10087 or EN 10263 Property class 4.6, 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

| | |
|--|-----------------|
| MKE | Annex A3 |
| Product description Threaded rod and materials | |

Rebar Ø8, Ø10, Ø12, Ø16, Ø20, Ø25, Ø32



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 $k = (f_t/f_y)_k$ | | $\geq 1,08$ | $\geq 1,15$ $< 1,35$ |
| Characteristic strain at maximum force ϵ_{uk} (%) | | $\geq 5,0$ | $\geq 7,5$ |
| Bendability | | Bend/Rebend test | |
| Maximum deviation from nominal mass (individual bar) (%) | Nominal bar size (mm) | $\pm 6,0$ $\pm 4,5$ | |
| | ≤ 8 | | |
| Bond: Minimum relative rib area, $f_{R,min}$ | Nominal bar size (mm) | 0,040 0,056 | |
| | 8 to 12 | | |
| | > 12 | | |

MKE

Product description

Rebars and materials

Annex A4

Values given in table C1÷C8 are valid only if were passing rules given in Annex B1 and B5

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, 05.02.2021

Signed by:

R&D Director

Janusz Kabała

Dyrektor Działu Rozwoju
Produktów



Janusz Kabała