BUILDING TRUST

# Sika AnchorFix®-1

## YTELSESERKLÆRING

## Nr. 97239786

| | | |
|---|---|---|
| **1** | **PRODUKTYPENS ENTYDIGE IDENTIFIKASJONSKODE:** | 97239786 |
| **2** | **TILSIKTET BRUKSOMRÅDE:** | ETA-13/0720 of 18/05/2018<br>Bonded injection type anchor for use in cracked and uncracked concrete |
| **3** | **FABRIKANT:** | Sika Services AG<br>Tüffenwies 16-22<br>8064 Zürich |
| **4** | **OPPNEVNT REPRESENTANT:** | |
| **5** | **SYSTEM FOR VURDERING OG KONTROLL AV YTEEVNE:** | System 1 |
| **6b** | EUROPEISK BEDØMMELSES DOKUMENT: | EAD 330499-00-0601 |
| | Europeisk Teknisk Bedømmelse: | ETA-13/0720 of 18/05/2018 |
| | Teknisk bedømmelsesorgan: | TECHNICKY A ZKUSEBNI USTAV STAVEBNI PRAHA s.p. |
| | Teknisk kontrollorgan (hEN) / vurderingsorgan (ETA): | 1020 |

## 7 ANGITT YTELSE

**Table B1**: Installation parameter

| 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 | $maxT_{fix}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 |
| Depth of drill hole for $h_{ef,min}$ | $h_0=h_{ef}$ | [mm] | 64 | 80 | 96 | 128 | 160 | 192 |
| Depth of drill hole for $h_{ef,max}$ | $h_0=h_{ef}$ | [mm] | 96 | 120 | 144 | 192 | 240 | 288 |
| Minimum edge distance | $c_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 |
| Minimum spacing | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 |
| Minimum thickness of member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | | $h_{ef}$ + $2d_0$ | |

**Table B2**: Cleaning

| All diameters |
|---|
| - 2 x blowing |
| - 2 x brushing |
| - 2 x blowing |
| - 2 x brushing |
| - 2 x blowing |

**Table B3**: Minimum curing time Sika AnchorFix-1

| 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 temperature  T load is set at the lowest temperature



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

| **Steel failure – Characteristic resistance** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Steel grade **8.8** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Steel grade **10.9** | $N_{Rk,s}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,4 | | | | | |
| Stainless steel grade **A2-70, A4-70** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,9 | | | | | |
| Stainless steel grade **A4-80** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,6 | | | | | |
| Stainless steel grade **1.4529** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Stainless steel grade **1.4565** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,9 | | | | | |

| **Combined pullout and concrete cone failure in uncracked concrete C20/25** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| **Characteristic bond resistance in non-cracked concrete** | | | | | | | | |
| **Dry/wet concrete and flooded hole** | $\tau_{Rk,ucr}$ | [N/mm²] | 9 | 8 | 9 | 9,5 | 8,5 | 8 |
| Installation safety factor | $\gamma_2$ [1] = $\gamma_{inst}$ [2] | [-] | 1,2 | | | | | |
| Factor for concrete | C30/37 | [-] | 1,12 | | | | | |
| | C35/45 $\psi_c$ | | 1,19 | | | | | |
| | C50/60 | | 1,30 | | | | | |

| **Concrete cone failure** | | | |
|---|---|---|---|
| Factor for concrete cone failure | $k_1$ [1] | [-] | 10,1 |
| | $k_{ucr,N}$ [2] | | 11 |
| Edge distance | $c_{cr,N}$ | [mm] | $1{,}5h_{ef}$ |

| **Splitting failure** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Size | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Edge distance | $c_{cr,sp}$ | [mm] | $2{,}0h_{ef}$ | | | $1{,}5h_{ef}$ | | |
| Spacing | $s_{cr,sp}$ | [mm] | $4{,}0h_{ef}$ | | | $3{,}0h_{ef}$ | | |
| Partial safety factor | $\gamma_{Msp}$ [1] | [-] | 1,8 | | | | | |

1) Design according EOTA Technical Report TR 055

2) Design according EN 1992-4:2016



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**Table C2:** Design method EN 1992-4
Characteristic values of resistance to shear load

| **Steel failure without lever arm** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $V_{Rk,s}$ | [kN] | 9 | 15 | 21 | 39 | 61 | 88 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **8.8** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **10.9** | $V_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Stainless steel grade **A2-70, A4-70** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | |
| Stainless steel grade **A4-80** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | |
| Stainless steel grade **1.4529** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Stainless steel grade **1.4565** | $N_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 **5.8** | $M^o_{Rk,s}$ | [N.m] | 19 | 37 | 66 | 166 | 325 | 561 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **8.8** | $M^o_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **10.9** | $M^o_{Rk,s}$ | [N.m] | 37 | 75 | 131 | 333 | 649 | 1123 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | |
| Stainless steel grade **A2-70, A4-70** | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | |
| Stainless steel grade **A4-80** | $M^o_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | |
| Stainless steel grade **1.4529** | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Stainless steel grade **1.4565** | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | |
| **Concrete pry-out 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 | $\ell_f$ | [mm] | min ($h_{ef}$, 8 $d_{nom}$) | | | | | |



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**Table C3:** Displacement under tension and shear load

| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Tension load | F | [kN] | 6,3 | 7,9 | 11,9 | 23,8 | 29,8 | 45,6 |
| Displacement | $\delta_{N0}$ | [mm] | 0,2 | 0,2 | 0,3 | 0,5 | 0,7 | 0,9 |
| | $\delta_{N\infty}$ | [mm] | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Shear load | F | [kN] | 5,2 | 8,3 | 12,0 | 22,4 | 35,0 | 50,4 |
| Displacement | $\delta_{V0}$ | [mm] | 0,1 | 0,1 | 0,2 | 0,4 | 0,8 | 1,5 |
| | $\delta_{V\infty}$ | [mm] | 0,2 | 0,2 | 0,3 | 0,6 | 1,2 | 2,3 |

## 8 RELEVANT TEKNISK DOKUMENTASJON OG/ELLER SPESIFIKK TEKNISK DOKUMENTASJON

Ytelsen for varen som angitt i pkt. 1 og 2, er i samsvar med ytelsen angitt i pkt. 7. Denne ytelseserklæringen er utstedt i samsvar med forskrift (EU) nr. 305/2011 på eget ansvar av produsenten, som angitt i pkt. 3.

Undertegnet for og på vegne av produsenten av:

Navn: Tomasz Gutowski
Funksjon: Corporate Standardization and Approvals
Warsawa, 19 June 2018

. . . . . .

Navn : Tatiana Ageyeva
Funksjon: Standardization and Approvals
Warsawa, 19 June 2019

. . . . . .

Ovenstående informasjon i samsvar med krav i EU-forordning nr. 305/2011

## RELATERT YTELSESERKLÆRING

| Produktnavn | Harmonisert teknisk spesifikasjon | DoP nummer |
|---|---|---|
| Sika AnchorFix®-1 Injection anchors for or use in masonry | ETA-17/0179 | 38701859 |
| Sika AnchorFix®-1 galvanized or stainless steel bonded anchor | ETA-13/0720 of 12/06/2013 | 68816162 |



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## FULL CE MERKING

| |
|---|
| CE<br>17 |
| Sika Services AG, Zurich, Switzerland |
| 97239786 |
| EAD 330499-00-0601 |
| Notified Body 1020 |
| Bonded injection type anchor for use in cracked and uncracked concrete |

**Reaction to fire -** Anchorages satisfy requirements for Class A1

**Resistance to fire** - No performance determined

**Anchorages 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).

**Ytelseserklæring**

97239786
2018.05 , ver. 1

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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 or flooded hole.
- 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 or EOTA Technical Report TR 055 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



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- **Table B1**: Installation parameters of threaded rod

| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $Ød_0$ | [mm] | 10 | 12 | 14 | 18 | 22 | 26 | 30 | 35 |
| Cleaning brush | | | S11HF | S14HF | S14/15HF | S22HF | S24HF | S31HF | S31HF | S38HF |
| Torque moment | max $T_{fixt}$ | [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 mm ≥ 100 mm | | | $h_{ef}$ + $2d_0$ | | | | |

- **Table B2**: Installation parameters of rebar

| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 |
|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $Ød_0$ | [mm] | 12 | 14 | 16 | 20 | 25 | 32 | 40 |
| Cleaning brush | | | S12/13HF | S14/15HF | S18HF | S22HF | S27HF | S35HF | S43HF |
| Torque moment | max $T_{fixt}$ | [Nm] | 10 | 20 | 40 | 80 | 120 | 180 | 200 |
| Min. embedment depth | | | | | | | | | |
| 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 mm ≥ 100 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 ≥ 10°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.



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**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 | $\gamma_{Ms}$ | [-] | 2,00 | | | | | | | |
| Steel grade **5.8** | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Steel grade **8.8** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Steel grade **10.9** | $N_{Rk,s}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 | 459 | 561 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | | | |
| Stainless steel grade **A2-70, A4-70** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,87 | | | | | | | |
| Stainless steel grade **A4-80** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,60 | | | | | | | |
| Stainless steel grade **1.4529** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Stainless steel grade **1.4565** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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/mm²] | 17 | 15 | 15 | 12 | 12 | 12 | 11 | 9,5 |
| **Dry, wet concrete, flooded hole** | | | | | | | | | |
| Partial safety factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | |
| Factor for uncracked concrete C25/30 | $\psi_c$ | [-] | 1,02 | | | | | | | |
| Factor for uncracked concrete C30/37 | $\psi_c$ | [-] | 1,04 | | | | | | | |
| Factor for uncracked concrete C35/45 | $\psi_c$ | [-] | 1,06 | | | | | | | |
| Factor for uncracked concrete C40/50 | $\psi_c$ | [-] | 1,07 | | | | | | | |
| Factor for uncracked concrete C45/55 | $\psi_c$ | [-] | 1,08 | | | | | | | |
| Factor for uncracked concrete C50/60 | $\psi_c$ | [-] | 1,09 | | | | | | | |
| **Characteristic bond resistance in cracked concrete** | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,cr}$ | [N/mm²] | 10 | 10 | 10 | 9,5 | 9 | 9 | 6 | 6 |
| **Dry, wet concrete, flooded hole** | | | | | | | | | |
| Partial safety factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | |
| Factor for cracked concrete C25/30 | $\psi_c$ | [-] | 1,02 | | | | | | | |
| Factor for cracked concrete C30/37 | $\psi_c$ | [-] | 1,04 | | | | | | | |
| Factor for cracked concrete C35/45 | $\psi_c$ | [-] | 1,06 | | | | | | | |
| Factor for cracked concrete C40/50 | $\psi_c$ | [-] | 1,07 | | | | | | | |
| Factor for cracked concrete C45/55 | $\psi_c$ | [-] | 1,08 | | | | | | | |
| Factor for cracked concrete C50/60 | $\psi_c$ | [-] | 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] | $1,5h_{ef}$ | | | | | | | |
| **Splitting failure** | | | | | | | | | |
| Size | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Edge distance | $c_{cr,sp}$ | [mm] | $2 \bullet h_{ef}$ | | | | | | | |
| Spacing | $s_{cr,sp}$ | [mm] | $2 \bullet c_{cr,sp}$ | | | | | | | |



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**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 | $\gamma_{Ms}$ | [-] | 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/mm²] | 13 | 13 | 13 | 12 | 12 | 12 | 8 |
| **Dry and wet concrete** | | | | | | | | |
| Installation safety factor | $\gamma_2$ [1] = $\gamma_{inst}$ [2] | [-] | 1,0 | | | | | | |
| **Flooded hole** | | | | | | | | |
| Installation safety factor | $\gamma_2$ [1] = $\gamma_{inst}$ [2] | [-] | 1,2 | | | | | | |
| Factor for uncracked concrete | C25/30 $\psi_c$ | [-] | 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/mm²] | 8 | 11 | 10 | 10 | 9 | 8,5 | 6 |
| **Dry and wet concrete** | | | | | | | | |
| Installation safety factor | $\gamma_2$ [1] = $\gamma_{inst}$ [2] | [-] | 1,0 | | | | | | |
| **Flooded hole** | | | | | | | | |
| Installation safety factor | $\gamma_2$ [1] = $\gamma_{inst}$ [2] | [-] | 1,2 | | | | | | |
| Factor for cracked concrete | C25/30 $\psi_c$ | [-] | 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 | $k_{ucr,N}$ [2] | [-] | 11 |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ [2] | | 7,7 |
| Edge distance | $c_{cr,N}$ | [mm] | $1,5h_{ef}$ |

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



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**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 | $\gamma_{Ms}$ | [-] | 1,67 | | | | | | | |
| Steel grade **5.8** | $V_{Rk,s}$ | [kN] | 9 | 15 | 21 | 39 | 61 | 88 | 115 | 140 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Steel grade **8.8** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Steel grade **10.9** | $V_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | | | |
| Stainless steel grade **A2-70, A4-70** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | | | |
| Stainless steel grade **A4-80** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | | | |
| Stainless steel grade **1.4529** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Stainless steel grade **1.4565** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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** | $M^0_{Rk,s}$ | [N.m] | 15 | 30 | 52 | 133 | 260 | 449 | 666 | 900 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,67 | | | | | | | |
| Steel grade **5.8** | $M^0_{Rk,s}$ | [N.m] | 19 | 37 | 66 | 166 | 325 | 561 | 832 | 1125 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Steel grade **8.8** | $M^0_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 | 1332 | 1799 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Steel grade **10.9** | $M^0_{Rk,s}$ | [N.m] | 37 | 75 | 131 | 333 | 649 | 1123 | 1664 | 2249 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Stainless steel grade **A2-70, A4-70** | $M^0_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | | | |
| Stainless steel grade **A4-80** | $M^0_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 | 1332 | 1799 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | | | |
| Stainless steel grade **1.4529** | $M^0_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Stainless steel grade **1.4565** | $M^0_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 | $\ell_f$ | [mm] | min ($h_{ef}$, 8 $d_{nom}$) | | | | | | | |



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**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 | $\gamma_{Ms}$ | [-] | 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 | $M^0_{Rk,s}$ | [N.m] | 33 | 65 | 112 | 265 | 518 | 1013 | 2122 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 | $\ell_f$ | [mm] | min ($h_{ef}$, 8 $d_{nom}$) | | | | | | |

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

| Size | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|---|---|---|---|---|---|---|---|---|---|
| Tension load | | | | | | | | | |
| Uncracked concrete | | | | | | | | | |
| F | [kN] | 11,9 | 14,3 | 19,0 | 23,8 | 35,7 | 35,7 | 45,2 | 45,2 |
| $\delta_{N0}$ | [mm] | 0,3 | 0,3 | 0,3 | 0,4 | 0,4 | 0,5 | 0,5 | 0,5 |
| $\delta_{N\infty}$ | [mm] | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 |
| Cracked concrete | | | | | | | | | |
| F | [kN] | 5,7 | 9,5 | 14,3 | 16,7 | 23,8 | 28,6 | 28,6 | 28,6 |
| $\delta_{N0}$ | [mm] | 0,3 | 0,4 | 0,4 | 0,5 | 0,5 | 0,6 | 0,6 | 0,7 |
| $\delta_{N\infty}$ | [mm] | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 |
| Shear load | | | | | | | | | |
| F | [kN] | 3,5 | 5,5 | 8,0 | 15,0 | 23,3 | 33,6 | 43,7 | 53,4 |
| $\delta_{V0}$ | [mm] | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 |
| $\delta_{V\infty}$ | [mm] | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 |

**Table C6:** Displacement of rebar under tension and shear load

| Size | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | Ø32 |
|---|---|---|---|---|---|---|---|---|
| Tension load | | | | | | | | |
| Uncracked concrete | | | | | | | | |
| F | [kN] | 7,6 | 11,9 | 16,7 | 28,6 | 35,7 | 45,2 | 66,7 |
| $\delta_{N0}$ | [mm] | 0,3 | 0,3 | 0,4 | 0,4 | 0,4 | 0,5 | 0,5 |
| $\delta_{N\infty}$ | [mm] | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 | 0,6 |
| Cracked concrete | | | | | | | | |
| F | [kN] | 5,7 | 9,5 | 11,9 | 19,0 | 23,8 | 28,6 | 35,7 |
| $\delta_{N0}$ | [mm] | 0,3 | 0,4 | 0,4 | 0,5 | 0,5 | 0,5 | 0,6 |
| $\delta_{N\infty}$ | [mm] | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 |
| Shear load | | | | | | | | |
| F | [kN] | 6,6 | 10,3 | 14,8 | 26,3 | 41,1 | 64,3 | 105,3 |
| $\delta_{V0}$ | [mm] | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 |
| $\delta_{V\infty}$ | [mm] | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 | 3,7 |



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**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 | $\gamma_{Ms}$ | [-] | 2,00 | | | | | | | |
| Characteristic resistance grade **5.8** | $N_{Rk,s,eq,C1}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Characteristic resistance grade **8.8** | $N_{Rk,s,eq,C1}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Characteristic resistance grade **10.9** | $N_{Rk,s,eq,C1}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 | 459 | 561 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 | $\gamma_{Ms}$ | [-] | 1,87 | | | | | | | |
| Characteristic resistance **A4-80** | $N_{Rk,s,eq,C1}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,60 | | | | | | | |
| Characteristic resistance **1.4529** | $N_{Rk,s,eq,C1}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | | | |
| Characteristic resistance **1.4565** | $N_{Rk,s,eq,C1}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,87 | | | | | | | |
| **Characteristic resistance to pull-out** | | | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,p,eq,C1}$ | [N/mm²] | 9,4 | 8,5 | 10,0 | 8,7 | 7,4 | 7,7 | 5,7 | 4,9 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 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 | $\gamma_{Ms}$ | [-] | 1,67 | | | | | | | |
| Characteristic resistance grade **5.8** | $V_{Rk,s,eq,C1}$ | [kN] | 7 | 11 | 16 | 26 | 40 | 35 | 46 | 56 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Characteristic resistance grade **8.8** | $V_{Rk,s,eq,C1}$ | [kN] | 11 | 17 | 25 | 41 | 64 | 56 | 73 | 90 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Characteristic resistance grade **10.9** | $V_{Rk,s,eq,C1}$ | [kN] | 14 | 22 | 32 | 51 | 80 | 71 | 92 | 112 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 | $\gamma_{Ms}$ | [-] | 1,56 | | | | | | | |
| Characteristic resistance **A4-80** | $V_{Rk,s,eq,C1}$ | [kN] | 11 | 17 | 25 | 41 | 64 | 56 | 73 | 90 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | | | |
| Characteristic resistance **1.4529** | $V_{Rk,s,eq,C1}$ | [kN] | 10 | 15 | 22 | 36 | 56 | 49 | 64 | 79 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | | | |
| Characteristic resistance **1.4565** | $V_{Rk,s,eq,C1}$ | [kN] | 10 | 15 | 22 | 36 | 56 | 49 | 64 | 79 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 | $\alpha_{v,h\text{-}dg,c1}$ | [-] | 0,47 | 0,47 | 0,47 | 0,54 | 0,54 | 0,88 | 0,88 | 0,88 |
| Factor for annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | | | | |

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



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**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 | $\gamma_{Ms}$ | [-] | 1,4 | | | | | |
| **Characteristic resistance to pull-out** | | | | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,p,eq,C1}$ | [N/mm$^2$] | 9,4 | 9,8 | 9,5 | 8,8 | 8,0 | 5,3 |
| **Dry and wet concrete** | | | | | | | | |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | |
| **Flooded hole** | | | | | | | | |
| Installation safety factor | $\gamma_{inst}$ | [-] | 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 | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Factor for annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | | |



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**Table C9:** Seismic performance category C2

| 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 | $\gamma_{Ms}$ | [-] | | 2,00 | |
| Characteristic resistance grade **5.8** | $N_{Rk,s,eq,C2}$ | [kN] | 42 | 79 | 123 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,50 | |
| Characteristic resistance grade **8.8** | $N_{Rk,s,eq,C2}$ | [kN] | 67 | 126 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,50 | |
| Characteristic resistance grade **10.9** | $N_{Rk,s,eq,C2}$ | [kN] | 84 | 157 | 245 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,33 | |
| Characteristic resistance **A2-70, A4-70** | $N_{Rk,s,eq,C2}$ | [kN] | 59 | 110 | 172 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,87 | |
| Characteristic resistance **A4-80** | $N_{Rk,s,eq,C2}$ | [kN] | 67 | 126 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,60 | |
| Characteristic resistance **1.4529** | $N_{Rk,s,eq,C2}$ | [kN] | 59 | 110 | 172 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,50 | |
| Characteristic resistance **1.4565** | $N_{Rk,s,eq,C2}$ | [kN] | 59 | 110 | 172 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,87 | |
| **Characteristic resistance to pull-out** | | | | | |
| Temperature T3: -40°C to +70°C | $\tau_{Rk,p,eq,C2}$ | [N/mm²] | 3,5 | 4,0 | 4,5 |
| Installation safety factor | $\gamma_2=\gamma_{inst}$ | [-] | | 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 | $\gamma_{Ms}$ | [-] | | 1,67 | |
| Characteristic resistance grade **5.8** | $V_{Rk,s,eq,C2}$ | [kN] | 16 | 22 | 35 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,25 | |
| Characteristic resistance grade **8.8** | $V_{Rk,s,eq,C2}$ | [kN] | 25 | 36 | 56 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,25 | |
| Characteristic resistance grade **10.9** | $V_{Rk,s,eq,C2}$ | [kN] | 32 | 45 | 70 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,50 | |
| Characteristic resistance **A2-70**, **A4-70** | $V_{Rk,s,eq,C2}$ | [kN] | 22 | 31 | 49 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,56 | |
| Characteristic resistance **A4-80** | $V_{Rk,s,eq,C2}$ | [kN] | 25 | 36 | 56 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,33 | |
| Characteristic resistance **1.4529** | $V_{Rk,s,eq,C2}$ | [kN] | 22 | 31 | 49 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,25 | |
| Characteristic resistance **1.4565** | $V_{Rk,s,eq,C2}$ | [kN] | 22 | 31 | 49 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | | 1,56 | |
| Characteristic shear load resistance $V_{Rk,s,eq}$ in the Table C8 shall be multiplied by following reduction factor for **hot-dip galvanized** commercial standard rods | | | | | |
| Reduction factor for hot-dip galvanized rods | $\alpha_{v,h\text{-}dg,c2}$ | [-] | 0,46 | 0,61 | 0,61 |
| Factor for annular gap | $\alpha_{gap}$ | [-] | | 0,5 | |

**Table C10:** Displacement under tensile and shear load - seismic category C2

| 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%.**



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## CE-ETIKETT

CE

13

Sika Services AG, Zurich, Switzerland

DoP No. 97239786

EAD 330499-00-0601

Notified Body 1020

Bonded injection type anchor for use in uncracked concrete

**Table B1**: Installation parameter

| **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 | $maxT_{fix}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 |
| Depth of drill hole for $h_{ef,min}$ | $h_0=h_{ef}$ | [mm] | 64 | 80 | 96 | 128 | 160 | 192 |
| Depth of drill hole for $h_{ef,max}$ | $h_0=h_{ef}$ | [mm] | 96 | 120 | 144 | 192 | 240 | 288 |
| Minimum edge distance | $c_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 |
| Minimum spacing | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 |
| Minimum thickness of member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | | $h_{ef}$ + $2d_0$ | |

**Table B2**: Cleaning

| **All diameters** |
|---|
| - 2 x blowing |
| - 2 x brushing |
| - 2 x blowing |
| - 2 x brushing |
| - 2 x blowing |

**Table B3**: Minimum curing time Sika AnchorFix-1

| **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 temperature  T load is set at the lowest temperature



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

| **Steel failure – Characteristic resistance** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Steel grade **8.8** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Steel grade **10.9** | $N_{Rk,s}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,4 | | | | | |
| Stainless steel grade **A2-70, A4-70** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,9 | | | | | |
| Stainless steel grade **A4-80** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,6 | | | | | |
| Stainless steel grade **1.4529** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Stainless steel grade **1.4565** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,9 | | | | | |

| **Combined pullout and concrete cone failure in uncracked concrete C20/25** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| **Characteristic bond resistance in non-cracked concrete** | | | | | | | | |
| **Dry/wet concrete and flooded hole** | $\tau_{Rk,ucr}$ | [N/mm²] | 9 | 8 | 9 | 9,5 | 8,5 | 8 |
| Installation safety factor | $\gamma_2$ [1] = $\gamma_{inst}$ [2] | [-] | 1,2 | | | | | |
| Factor for concrete C30/37 | $\psi_c$ | [-] | 1,12 | | | | | |
| Factor for concrete C35/45 | $\psi_c$ | [-] | 1,19 | | | | | |
| Factor for concrete C50/60 | $\psi_c$ | [-] | 1,30 | | | | | |

| **Concrete cone failure** | | | |
|---|---|---|---|
| Factor for concrete cone failure | $k_1$ [1] | [-] | 10,1 |
| | $k_{ucr,N}$ [2] | | 11 |
| Edge distance | $c_{cr,N}$ | [mm] | $1{,}5h_{ef}$ |

| **Splitting failure** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Size | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Edge distance | $c_{cr,sp}$ | [mm] | $2{,}0h_{ef}$ | | | $1{,}5h_{ef}$ | | |
| Spacing | $s_{cr,sp}$ | [mm] | $4{,}0h_{ef}$ | | | $3{,}0h_{ef}$ | | |
| Partial safety factor | $\gamma_{Msp}$ [1] | [-] | 1,8 | | | | | |

1) Design according EOTA Technical Report TR 055

2) Design according EN 1992-4:2016



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**Table C2:** Design method EN 1992-4
Characteristic values of resistance to shear load

| **Steel failure without lever arm** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $V_{Rk,s}$ | [kN] | 9 | 15 | 21 | 39 | 61 | 88 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **8.8** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **10.9** | $V_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | | |
| Stainless steel grade **A2-70, A4-70** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | |
| Stainless steel grade **A4-80** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | |
| Stainless steel grade **1.4529** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Stainless steel grade **1.4565** | $N_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 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 **5.8** | $M^o_{Rk,s}$ | [N.m] | 19 | 37 | 66 | 166 | 325 | 561 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **8.8** | $M^o_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Steel grade **10.9** | $M^o_{Rk,s}$ | [N.m] | 37 | 75 | 131 | 333 | 649 | 1123 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | | |
| Stainless steel grade **A2-70, A4-70** | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | |
| Stainless steel grade **A4-80** | $M^o_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | | |
| Stainless steel grade **1.4529** | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | | |
| Stainless steel grade **1.4565** | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | |
| **Concrete pry-out 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 | $\ell_f$ | [mm] | min ($h_{ef}$, 8 $d_{nom}$) | | | | | |



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**Table C3:** Displacement under tension and shear load

| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Tension load | F | [kN] | 6,3 | 7,9 | 11,9 | 23,8 | 29,8 | 45,6 |
| Displacement | $\delta_{N0}$ | [mm] | 0,2 | 0,2 | 0,3 | 0,5 | 0,7 | 0,9 |
| | $\delta_{N\infty}$ | [mm] | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Shear load | F | [kN] | 5,2 | 8,3 | 12,0 | 22,4 | 35,0 | 50,4 |
| Displacement | $\delta_{V0}$ | [mm] | 0,1 | 0,1 | 0,2 | 0,4 | 0,8 | 1,5 |
| | $\delta_{V\infty}$ | [mm] | 0,2 | 0,2 | 0,3 | 0,6 | 1,2 | 2,3 |

http://dop.sika.com

## CE-ETIKETT PÅ FORPAKNING

CE

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Sika Services AG, Zurich, Switzerland

DoP No. 97239786

EAD 330499-00-0601

Notified Body 1020

Bonded injection type anchor for use in uncracked concrete

For details see accompanying documents

http://dop.sika.com

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