**RECA NORM**

RECA | HÄLT. WIRKT. BEWEGT.

# DÉCLARATION DES PERFORMANCES
# Nr. 0910000002-2015-05

1. Code d'identification unique du produit type: **Goujon à bague BZ plus et BZ-IG**

2. Numéro de type, de lot ou de série ou tout autre élément permettant l'identification du produit de construction, conformément à l'article 11, paragraphe 4:

**ETA-99/0010, Annex A3, A5**
**Numéro de lot: voir emballage**

3. Usage ou usages prévus du produit de construction, conformément à la spécification technique harmonisée applicable, comme prévu par le fabricant:

| | |
|---|---|
| **Type de produit** | Cheville d'ancrage à couple de serrage contrôlé (type boulon (avec taraudage)) |
| **Pour utilisation dans** | béton fissuré et non fissuré C20/25 – C50/60 (EN 206) |
| **Option** | 1 |
| **Charge** | statique ou quasi-statique,<br>sismique, catégorie C1+C2 (Dimensions comprises BZ plus M10, M12, M16, M20) |
| **Material** | Acier galvanisé:<br>Dans des locaux intérieurs secs uniquement<br>Dimensions comprises: BZ plus: M8, M10, 70M12, M16, M20, M24, M27<br>BZ-IG: M6, M8, M10, M12<br>Acier inoxydable (marquage A4):<br>A l'intérieur et à l'extérieur sans conditions particulièrement agressives<br>Dimensions comprises: BZ plus: M8, M10, 70M12, M16, M20, M24<br>BZ-IG: M6, M8, M10, M12<br>Acier hautement résistant à la corrosion (marquage HCR):<br>A l'intérieur et à l'extérieur dans des conditions particulièrement agressives<br>Dimensions comprises: BZ plus: M8, M10, 70M12, M16, M20, M24<br>BZ-IG: M6, M8, M10, M12 |
| **Plage de température** (éventuellement) | -- |

4. Nom, raison sociale ou marque déposée et adresse de contact du fabricant, conformément à l'article 11, paragraphe 5:

**RECA NORM GmbH**
**Am Wasserturm 4**
**74635 Kupferzell**

5. Le cas échéant, nom et adresse de contact du mandataire dont le mandat couvre les tâches visées à l'article 12, paragraphe 2: --

6. Le ou les systèmes d'évaluation et de vérification de la constance des performances du produit de construction, conformément à l'annexe V: **Système 1**

7. Dans le cas de la déclaration des performances concernant un produit de construction couvert par une norme harmonisée: --



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Geschäftsführer
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8. Dans le cas de la déclaration des performances concernant un produit de construction pour lequel une évaluation technique européenne a été délivrée:

**Deutsches Institut für Bautechnik, Berlin**

a délivré:

**ETA-99/0010**

sur la base de

**ETAG 001-2**

a réalisé 1343-CPR selon le système 1:

i) La détermination du produit type sur la base d'essais de type (y compris l'échantillonnage), de calculs relatifs au type, de valeurs issues de tableaux ou de la documentation descriptive du produit;

ii) Une inspection notifié de certification du contrôle de la production;

iii) Une surveillance, une évaluation et une appréciation permanentes du contrôle de la production en usine.

a délivré: Certificat de conformité 1343-CPR-M 550-1

9. Performances déclarées:

| **Caractéristiques essentielles** | **Méthode d'évaluation** | **Performances** | | **Spécifications techniques harmonisées** |
|---|---|---|---|---|
| | | **BZ plus** | **BZ-IG** | |
| Résistance caractéristiques en charge de traction | ETAG 001, Annex C CEN/TS 1992-4 | ETA-99/0010, Annex C1-C4 | ETA-99/0010, Annex C10-C11 | ETAG 001 |
| Résistance caractéristiques en charge transversale | ETAG 001, Annex C CEN/TS 1992-4 | ETA-99/0010, Annex C5 | ETA-99/0010, Annex C12 | |
| Résistance caractéristiques en sismique demande | TR 045 | ETA-99/0010, Annex C6 | NPD | |
| Maj en cours d'utilisation | ETAG 001, Annex C CEN/TS 1992-4 | ETA-99/0010, Annex C8-C9 | ETA-99/0010, Annex C14 | |
| Résistance caractéristiques entre influence de feu | TR 020 CEN/TS 1992-4 | ETA-99/0010, Annex C7 | ETA-99/0010, Annex C13 | |

Lorsque, conformément à l'article 37 ou 38, la documentation technique spécifique a été utilisée, les exigences remplies par le produit: --

10. Les performances du produit identifié aux points 1 et 2 sont conformes aux performances déclarées indiquées au point 9. La présente déclaration des performances est établie sous la seule responsabilité du fabricant identifié au point 4. Signée pour le fabricant et en son nom par:

ppa. Wolfgang Rau, Divisional director Product Management
(name and function)

Kupferzell, 2015-05-22
(place and date of issue)

.....
(signature)

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**Table C1:** Characteristic values for **tension loads,** BZ plus **zinc plated, cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure** | | | | | | | | | |
| Characteristic tension resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 60 | 86 | 126 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,53 | | 1,5 | | 1,6 | 1,5 | |
| **Pull-out** | | | | | | | | | |
| **Standard** anchorage depth | | | | | | | | | |
| Characteristic resistance in concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 9 | 16 | 25 | 1) | 1) | 1) |
| **Reduced** anchorage depth | | | | | | | | | |
| Characteristic resistance in concrete C20/25 | $N_{Rk,p,red}$ | [kN] | 5 | 7,5 | 1) | 1) | | | |
| Increasing factor for $N_{Rk,p}$ and $N_{Rk,p,red}$ | $\psi c$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | | | | | |
| **Concrete cone failure** | | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35 2) | 40 | 50 | 65 | | | |
| Factor for cracked concrete | $k_{cr}$ | [-] | 7,2 | | | | | | |

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

**Table C2:** Characteristic values for **tension loads,** BZ plus **A4 / HCR,**
**cracked concrete,** static and quasi-static action,
design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | | | |
| **Steel failure** | | | | | | | | |
| Characteristic tension resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 64 | 108 | 110 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | 1,68 | 1,5 |
| **Pull-out** | | | | | | | | |
| **Standard** anchorage depth | | | | | | | | |
| Characteristic resistance in concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 9 | 16 | 25 | 1) | 40 |
| **Reduced** anchorage depth | | | | | | | | |
| Characteristic resistance in concrete C20/25 | $N_{Rk,p,red}$ | [kN] | 5 | 7,5 | 1) | 1) | | |
| Increasing factor for $N_{Rk,p}$ and $N_{Rk,p,red}$ | $\psi c$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | | | | |
| **Concrete cone failure** | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35 2) | 40 | 50 | 65 | | |
| Factor for cracked concrete | $k_{cr}$ | [-] | 7,2 | | | | | |

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

**Table C3:** Characteristic values for **tension loads,** BZ plus **zinc plated, non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure** | | | | | | | | | |
| Characteristic tension resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 60 | 86 | 126 | 196 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,53 | | 1,5 | | 1,6 | 1,5 | |
| **Pull-out** | | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 12 | 16 | 25 | 35 | 1) | 1) | 1) |
| **Reduced anchorage depth** | | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N_{Rk,p,red}$ | [kN] | 7,5 | 9 | 1) | 1) | | | |
| **Splitting** For the proof against splitting failure $N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$ with consideration of the member thickness | | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | | |
| Splitting for **standard thickness of concrete member** (The higher resistance of case 1 and case 2 may be applied; the values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2); $\psi_{h,sp}$= 1,0) | | | | | | | | | |
| Standard thickness of concrete | $h_{min,1} \geq$ | [mm] | 100 | 120 | 140 | 170 | 200 | 230 | 250 |
| **Case 1** | | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 9 | 12 | 20 | 30 | 40 | 1) | 50 |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 3 $h_{ef}$ | | | | | | |
| **Case 2** | | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | 1) | 1) | 1) |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 4 $h_{ef}$ | | | | 4,4 $h_{ef}$ | 3 $h_{ef}$ | 5 $h_{ef}$ |
| Splitting for **minimum thickness of concrete member** | | | | | | | | | |
| Minimum thickness of concrete | $h_{min,2} \geq$ | [mm] | 80 | 100 | 120 | 140 | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | | | |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 5 $h_{ef}$ | | | | | | |
| **Reduced anchorage depth** | | | | | | | | | |
| Minimum thickness of concrete | $h_{min,3} \geq$ | [mm] | 80 | 80 | 100 | 140 | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 7,5 | 9 | 1) | 1) | | | |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 200 | 200 | 250 | 300 | | | |
| Increasing factor for $N_{Rk,p(red)}$ and $N^0_{Rk,sp}$ | $\psi c$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | | | | | |
| **Concrete cone failure** | | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35 2) | 40 | 50 | 65 | | | |
| Factor for non-cracked concrete | $k_{ucr}$ | [-] | 10,1 | | | | | | |

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

**Wedge Anchor BZ plus**

**Performance**
Characteristic values for **tension loads,** BZ plus **zinc plated, non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

**Annex C3**

**Table C4:** Characteristic values for **tension loads,** BZ plus **A4 / HCR, non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | | | |
| **Steel failure** | | | | | | | | |
| Characteristic tension resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 64 | 108 | 110 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | 1,68 | 1,5 |
| **Pull-out** | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 12 | 16 | 25 | 35 | 1) | 1) |
| **Reduced anchorage depth** | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N_{Rk,p,red}$ | [kN] | 7,5 | 9 | 1) | 1) | | |
| **Splitting** For the proof against splitting failure $N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$ with consideration of the member thickness | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | |
| Splitting for **standard thickness of concrete member** (The higher resistance of case 1 and case 2 may be applied; the values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2); $\psi_{h,sp}$= 1,0) | | | | | | | | |
| Standard thickness of concrete | $h_{min,1} \geq$ | [mm] | 100 | 120 | 140 | 160 | 200 | 250 |
| **Case 1** | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 9 | 12 | 20 | 30 | 40 | |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 3 $h_{ef}$ | | | | | |
| **Case 2** | | | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | 1) | 1) |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 230 | 250 | 280 | 400 | 440 | 500 |
| Splitting for **minimum thickness of concrete member** | | | | | | | | |
| Minimum thickness of concrete | $h_{min,2} \geq$ | [mm] | 80 | 100 | 120 | 140 | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | | |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 5 $h_{ef}$ | | | | | |
| **Reduced anchorage depth** | | | | | | | | |
| Minimum thickness of concrete | $h_{min,3} \geq$ | [mm] | 80 | 80 | 100 | 140 | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 7,5 | 9 | 1) | 1) | | |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 200 | 200 | 250 | 300 | | |
| Increasing factor for $N_{Rk,p(red)}$ and $N^0_{Rk,sp}$ | $\psi c$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | | | | |
| **Concrete cone failure** | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35 2) | 40 | 50 | 65 | | |
| Factor for non-cracked concrete | $k_{ucr}$ | [-] | 10,1 | | | | | |

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

**Table C5:** Characteristic values for **shear loads**, BZ plus, **cracked** and **non-cracked concrete,** static or quasi static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|---|
| Installation safety factor | | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure without lever arm, Steel zinc plated** | | | | | | | | | | |
| Characteristic shear resistance | | $V_{Rk,s}$ | [kN] | 12,2 | 20,1 | 30 | 55 | 69 | 114 | 169,4 |
| Factor for ductility | | $k_2$ | [-] | 1,0 | | | | | | |
| Partial safety factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,33 | 1,25 | 1,25 |
| **Steel failure without lever arm, Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic shear resistance | | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 123,6 | |
| Factor for ductility | | $k_2$ | [-] | 1,0 | | | | | | |
| Partial safety factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,4 | 1,25 | |
| **Steel failure with lever arm, Steel zinc plated** | | | | | | | | | | |
| Characteristic bending resistance | | $M^0_{Rk,s}$ | [Nm] | 23 | 47 | 82 | 216 | 363 | 898 | 1331,5 |
| Partial safety factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,33 | 1,25 | 1,25 |
| **Steel failure with lever arm, Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic bending resistance | | $M^0_{Rk,s}$ | [Nm] | 26 | 52 | 92 | 200 | 454 | 785,4 | |
| Partial safety factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,4 | 1,25 | |
| **Concrete pry-out failure** | | | | | | | | | | |
| k factor | | $k_{(3)}$ | [-] | 2,4 | | | | 2,8 | | |
| **Concrete edge failure** | | | | | | | | | | |
| Effective length of anchor in shear loading with $\mathbf{h_{ef}}$ | Steel zinc plated | $l_f$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| | Stainless steel A4, HCR | $l_f$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 | |
| Effective length of anchor in shear loading with $\mathbf{h_{ef,red}}$ | Steel zinc plated | $l_{f,red}$ | [mm] | 35 | 40 | 50 | 65 | | | |
| | Stainless steel A4, HCR | $l_{f,red}$ | [mm] | 35 | 40 | 50 | 65 | | | |
| Outside diameter of anchor | | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 | 20 | 24 | 27 |

**Wedge Anchor BZ plus**

**Performance**
Characteristic values for **shear loads**, BZ plus, **cracked** and **non-cracked concrete,** static or quasi static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

**Annex C5**

**Table C6:** Characteristic resistance for **seismic loading**, BZ plus, **standard anchorage depth,** performance category **C1** and **C2,** design according to TR045

| **Tension loads** | | | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | | | **M10** | **M12** | **M16** | **M20** |
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | |
| **Steel failure, steel zinc plated** | | | | | | |
| Characteristic resistance **C1** | $N_{Rk,s,seis,C1}$ | [kN] | 27 | 40 | 60 | 86 |
| Characteristic resistance **C2** | $N_{Rk,s,seis,C2}$ | [kN] | 27 | 40 | 60 | 86 |
| Partial safety factor | $\gamma_{Ms,seis}$ | [-] | 1,53 | 1,5 | | 1,6 |
| **Steel failure, stainless steel A4, HCR** | | | | | | |
| Characteristic resistance **C1** | $N_{Rk,s,seis,C1}$ | [kN] | 27 | 40 | 64 | 108 |
| Characteristic resistance **C2** | $N_{Rk,s,seis,C2}$ | [kN] | 27 | 40 | 64 | 108 |
| Partial safety factor | $\gamma_{Ms,seis}$ | [-] | 1,5 | | | 1,68 |
| **Pull-out** | | | | | | |
| Characteristic resistance **C1** | $N_{Rk,p,seis,C1}$ | [kN] | 9 | 16 | 25 | 36 |
| Characteristic resistance **C2** | $N_{Rk,p,seis,C2}$ | [kN] | 3,6 | 10,2 | 13,8 | 22,4 |

| **Shear loads** | | | | | | |
|---|---|---|---|---|---|---|
| **Steel failure without lever arm, Steel zinc plated** | | | | | | |
| Characteristic resistance **C1** | $V_{Rk,s,seis,C1}$ | [kN] | 20 | 27 | 44 | 69 |
| Characteristic resistance **C2** | $V_{Rk,s,seis,C2}$ | [kN] | 14 | 16,2 | 35,7 | 55,2 |
| Partial safety factor | $\gamma_{Ms,seis}$ | [-] | 1,25 | | | 1,33 |
| **Steel failure without lever arm, Stainless steel A4, HCR** | | | | | | |
| Characteristic resistance **C1** | $V_{Rk,s,seis,C1}$ | [kN] | 20 | 27 | 44 | 69 |
| Characteristic resistance **C2** | $V_{Rk,s,seis,C2}$ | [kN] | 14 | 16,2 | 35,7 | 55,2 |
| Partial safety factor | $\gamma_{Ms,seis}$ | [-] | 1,25 | | | 1,4 |

**Table C7:** Characteristic values **for tension and shear load** under **fire exposure,** BZ plus, **standard anchorage depth,** cracked and non-cracked concrete C20/25 to C50/60, design acc. to TR 020 or CEN/TS 1992-4, Annex D

| **Anchor size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Tension load** | | | | | | | | | | |
| **Steel failure** | | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 1,4 | 2,2 | 3,2 | 6,0 | 9,4 | 13,6 | 17,6 |
| | R60 | | | 1,1 | 1,8 | 2,8 | 5,2 | 8,2 | 11,8 | 15,3 |
| | R90 | | | 0,8 | 1,4 | 2,4 | 4,4 | 6,9 | 10,0 | 13,0 |
| | R120 | | | 0,7 | 1,2 | 2,2 | 4,0 | 6,3 | 9,1 | 11,8 |
| **Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 3,8 | 6,9 | 11,5 | 21,5 | 33,5 | 48,2 | |
| | R60 | | | 2,9 | 5,2 | 8,6 | 16 | 25,0 | 35,9 | |
| | R90 | | | 2,0 | 3,5 | 5,6 | 10,5 | 16,4 | 23,6 | |
| | R120 | | | 1,6 | 2,7 | 4,2 | 7,8 | 12,1 | 17,4 | |
| **Shear load** | | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 1,6 | 2,6 | 3,8 | 7,0 | 11 | 16 | 20,6 |
| | R60 | | | 1,5 | 2,5 | 3,6 | 6,8 | 11 | 15 | 19,8 |
| | R90 | | | 1,2 | 2,1 | 3,5 | 6,5 | 10 | 15 | 19,0 |
| | R120 | | | 1,0 | 2,0 | 3,4 | 6,4 | 10 | 14 | 18,6 |
| **Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 3,8 | 6,9 | 11,5 | 21,5 | 33,5 | 48,2 | |
| | R60 | | | 2,9 | 5,2 | 8,6 | 16 | 25,0 | 35,9 | |
| | R90 | | | 2,0 | 3,5 | 5,6 | 10,5 | 16,4 | 23,6 | |
| | R120 | | | 1,6 | 2,7 | 4,2 | 7,8 | 12,1 | 17,4 | |
| **Steel failure with lever arm** | | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 1,7 | 3,3 | 5,9 | 15 | 29 | 50 | 75 |
| | R60 | | | 1,6 | 3,2 | 5,6 | 14 | 28 | 48 | 72 |
| | R90 | | | 1,2 | 2,7 | 5,4 | 14 | 27 | 47 | 69 |
| | R120 | | | 1,1 | 2,5 | 5,3 | 13 | 26 | 46 | 68 |
| **Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 3,8 | 9,0 | 17,9 | 45,5 | 88,8 | 153,5 | |
| | R60 | | | 2,9 | 6,8 | 13,3 | 33,9 | 66,1 | 114,3 | |
| | R90 | | | 2,1 | 4,5 | 8,8 | 22,2 | 43,4 | 75,1 | |
| | R120 | | | 1,6 | 3,4 | 6,5 | 16,4 | 32,1 | 55,5 | |

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out and concrete edge failure can be calculated according to TR020 / CEN/TS 1992-4. If pull-out is not decisive $N_{Rk,p}$ in Eq. 2.4 and Eq. 2.5, TR 020 must be replaced by $N^0_{Rk,c}$.

## Table C8: Displacements under tension load, BZ plus

| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 |
|---|---|---|---|---|---|---|---|---|---|
| **Standard anchorage depth** | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | |
| Tension load in cracked concrete | N | [kN] | 2,4 | 4,3 | 7,6 | 11,9 | 17,1 | 21,1 | 24 |
| Displacement | $\delta_{N0}$ | [mm] | 0,6 | 1,0 | 0,4 | 1,0 | 0,9 | 0,7 | 0,9 |
| | $\delta_{N\infty}$ | [mm] | 1,4 | 1,2 | 1,4 | 1,3 | 1,0 | 1,2 | 1,4 |
| Tension load in non-cracked concrete | N | [kN] | 5,7 | 7,6 | 11,9 | 16,7 | 23,8 | 29,6 | 34 |
| Displacement | $\delta_{N0}$ | [mm] | 0,4 | 0,5 | 0,7 | 0,3 | 0,4 | 0,5 | 0,3 |
| | $\delta_{N\infty}$ | [mm] | 0,8 | | 1,4 | | 0,8 | | 1,4 |
| Displacements under seismic tension loads **C2** | | | | | | | | | |
| Displacements for DLS | $\delta_{N,seis,C2(DLS)}$ | [mm] | | 4,1 | 4,9 | 3,6 | 5,1 | | |
| Displacements for ULS | $\delta_{N,seis,C2(ULS)}$ | [mm] | | 13,8 | 15,7 | 9,5 | 15,2 | | |
| **Stainless steel A4, HCR** | | | | | | | | | |
| Tension load in cracked concrete | N | [kN] | 2,4 | 4,3 | 7,6 | 11,9 | 17,1 | 19,0 | |
| Displacement | $\delta_{N0}$ | [mm] | 0,7 | 1,8 | 0,4 | 0,7 | 0,9 | 0,5 | |
| | $\delta_{N\infty}$ | [mm] | 1,2 | 1,4 | 1,4 | 1,4 | 1,0 | 1,8 | |
| Tension load in non-cracked concrete | N | [kN] | 5,8 | 7,6 | 11,9 | 16,7 | 23,8 | 33,5 | |
| Displacement | $\delta_{N0}$ | [mm] | 0,6 | 0,5 | 0,7 | 0,2 | 0,4 | 0,5 | |
| | $\delta_{N\infty}$ | [mm] | 1,2 | 1,0 | 1,4 | 0,4 | 0,8 | 1,1 | |
| Displacements under seismic tension loads **C2** | | | | | | | | | |
| Displacements for DLS | $\delta_{N,seis,C2(DLS)}$ | [mm] | | 4,1 | 4,9 | 3,6 | 5,1 | | |
| Displacements for ULS | $\delta_{N,seis,C2(ULS)}$ | [mm] | | 13,8 | 15,7 | 9,5 | 15,2 | | |
| **Reduced anchorage depth** | | | | | | | | | |
| Tension load in cracked concrete | N | [kN] | 2,4 | 3,6 | 6,1 | 9,0 | | | |
| Displacement | $\delta_{N0}$ | [mm] | 0,8 | 0,7 | 0,5 | 1,0 | | | |
| | $\delta_{N\infty}$ | [mm] | 1,2 | 1,0 | 0,8 | 1,1 | | | |
| Tension load in non-cracked concrete | N | [kN] | 3,7 | 4,3 | 8,5 | 12,6 | | | |
| Displacement | $\delta_{N0}$ | [mm] | 0,1 | 0,2 | 0,2 | 0,2 | | | |
| | $\delta_{N\infty}$ | [mm] | 0,7 | 0,7 | 0,7 | 0,7 | | | |

## Table C9: Displacements under shear load, BZ plus

| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 |
|---|---|---|---|---|---|---|---|---|---|
| **Standard anchorage depth** | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | |
| Shear load in cracked and non-cracked concrete | V | [kN] | 6,9 | 11,4 | 17,1 | 31,4 | 36,8 | 64,9 | 96,8 |
| Displacement | $\delta_{V0}$ | [mm] | 2,0 | 3,2 | 3,6 | 3,5 | 1,8 | 3,5 | 3,6 |
| | $\delta_{V\infty}$ | [mm] | 3,0 | 4,7 | 5,5 | 5,3 | 2,7 | 5,3 | 5,4 |
| Displacements under seismic shear loads **C2** | | | | | | | | | |
| Displacements for DLS | $\delta_{V,seis,C2(DLS)}$ | [mm] | | 2,7 | 3,5 | 4,3 | 4,7 | | |
| Displacements for ULS | $\delta_{V,seis,C2(ULS)}$ | [mm] | | 5,3 | 9,5 | 9,6 | 10,1 | | |
| **Stainless steel A4, HCR** | | | | | | | | | |
| Shear load in cracked and non-cracked concrete | V | [kN] | 7,3 | 11,4 | 17,1 | 31,4 | 43,8 | 70,6 | |
| Displacement | $\delta_{V0}$ | [mm] | 1,9 | 2,4 | 4,0 | 4,3 | 2,9 | 2,8 | |
| | $\delta_{V\infty}$ | [mm] | 2,9 | 3,6 | 5,9 | 6,4 | 4,3 | 4,2 | |
| Displacements under seismic shear loads **C2** | | | | | | | | | |
| Displacements for DLS | $\delta_{V,seis,C2(DLS)}$ | [mm] | | 2,7 | 3,5 | 4,3 | 4,7 | | |
| Displacements for ULS | $\delta_{V,seis,C2(ULS)}$ | [mm] | | 5,3 | 9,5 | 9,6 | 10,1 | | |
| **Reduced anchorage depth** | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | |
| Shear load in cracked and non-cracked concrete | V | [kN] | 6,9 | 11,4 | 17,1 | 31,4 | | | |
| Displacement | $\delta_{V0}$ | [mm] | 2,0 | 3,2 | 3,6 | 3,5 | | | |
| | $\delta_{V\infty}$ | [mm] | 3,0 | 4,7 | 5,5 | 5,3 | | | |
| **Stainless steel A4, HCR** | | | | | | | | | |
| Shear load in cracked and non-cracked concrete | V | [kN] | 7,3 | 11,4 | 17,1 | 31,4 | | | |
| Displacement | $\delta_{V0}$ | [mm] | 1,9 | 2,4 | 4,0 | 4,3 | | | |
| | $\delta_{V\infty}$ | [mm] | 2,9 | 3,6 | 5,9 | 6,4 | | | |

**Table C10:** Characteristic values for **tension loads, BZ-IG, cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,2 | | | |
| **Steel failure** | | | | | | |
| Characteristic tension resistance, steel zinc plated | $N_{Rk,s}$ | [kN] | 16,1 | 22,6 | 26,0 | 56,6 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| Characteristic tension resistance, stainless steel A4, HCR | $N_{Rk,s}$ | [kN] | 14,1 | 25,6 | 35,8 | 59,0 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,87 | | | |
| **Pull-out failure** | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 9 | 12 | 20 |
| Increasing factor | $\psi c$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | | |
| **Concrete cone failure** | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 45 | 58 | 65 | 80 |
| Factor for cracked concrete | $k_{cr}$ | [-] | 7,2 | | | |

**Table C11:** Characteristic values for **tension loads, BZ-IG, non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,2 | | | |
| **Steel failure** | | | | | | |
| Characteristic tension resistance, steel zinc plated | $N_{Rk,s}$ | [kN] | 16,1 | 22,6 | 26,0 | 56,6 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| Characteristic tension resistance, stainless steel A4, HCR | $N_{Rk,s}$ | [kN] | 14,1 | 25,6 | 35,8 | 59,0 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,87 | | | |
| **Pull-out** | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 12 | 16 | 20 | 30 |
| **Splitting** ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$. The higher resistance of Case 1 and Case 2 may be applied.) | | | | | | |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 100 | 120 | 130 | 160 |
| **Case 1** | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 9 | 12 | 16 | 25 |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 3 $h_{ef}$ | | | |
| **Case 2** | | | | | | |
| Characteristic resistance in non-cracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 20 | 30 |
| Spacing (edge distance) | $s_{cr,sp}$ (= 2 $c_{cr,sp}$) | [mm] | 5 $h_{ef}$ | | | |
| Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$ | $\psi c$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | | |
| **Concrete cone failure** | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 45 | 58 | 65 | 80 |
| Factor for non-cracked concrete | $k_{ucr}$ | [-] | 10,1 | | | |

**Table C12:** Characteristic values for **shear loads, BZ-IG, cracked and non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

| **Anchor size** | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | | | |
| **BZ-IG, steel zinc plated** | | | | | | |
| **Steel failure without lever arm, Installation type V** | | | | | | |
| Characteristic shear resistance | $V_{Rk,s}$ | [kN] | 5,8 | 6,9 | 10,4 | 25,8 |
| **Steel failure without lever arm, Installation type D** | | | | | | |
| Characteristic shear resistance | $V_{Rk,s}$ | [kN] | 5,1 | 7,6 | 10,8 | 24,3 |
| **Steel failure with lever arm, Installation type V** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 12,2 | 30,0 | 59,8 | 104,6 |
| **Steel failure with lever arm, Installation type D** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 36,0 | 53,2 | 76,0 | 207 |
| Partial safety factor for $V_{Rk,s}$ and $M^0_{Rk,s}$ | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Factor of ductility | $k_2$ | [-] | 1,0 | | | |
| **BZ-IG, stainless steel A4, HCR** | | | | | | |
| **Steel failure without lever arm, Installation type V** | | | | | | |
| Characteristic shear resistance | $V_{Rk,s}$ | [kN] | 5,7 | 9,2 | 10,6 | 23,6 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| **Steel failure without lever arm, Installation type D** | | | | | | |
| Characteristic shear resistance | $V_{Rk,s}$ | [kN] | 7,3 | 7,6 | 9,7 | 29,6 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| **Steel failure with lever arm, Installation type V** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 10,7 | 26,2 | 52,3 | 91,6 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | |
| **Steel failure with lever arm, Installation type D** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 28,2 | 44,3 | 69,9 | 191,2 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Factor of ductility | $k_2$ | [-] | 1,0 | | | |
| **Concrete pry-out failure** | | | | | | |
| k factor | $k_{(3)}$ | [-] | 1,5 | 1,5 | 2,0 | 2,0 |
| **Concrete edge failure** | | | | | | |
| Effective length of anchor in shear loading | $l_f$ | [mm] | 45 | 58 | 65 | 80 |
| Effective diameter of anchor | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 |

**Table C13:** Characteristic values for **tension** and **shear load** under **fire exposure, BZ-IG**
cracked and non-cracked concrete C20/25 to C50/60,
design acc. to TR 020 or CEN/TS 1992-4, Annex D

| **Anchor size** | | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|---|
| **Tension load** | | | | | | | |
| **Steel failure** | | | | | | | |
| **Steel zinc plated** | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 0,7 | 1,4 | 2,5 | 3,7 |
| | R60 | | | 0,6 | 1,2 | 2,0 | 2,9 |
| | R90 | | | 0,5 | 0,9 | 1,5 | 2,2 |
| | R120 | | | 0,4 | 0,8 | 1,3 | 1,8 |
| **Stainless steel A4, HCR** | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 2,9 | 5,4 | 8,7 | 12,6 |
| | R60 | | | 1,9 | 3,8 | 6,3 | 9,2 |
| | R90 | | | 1,0 | 2,1 | 3,9 | 5,7 |
| | R120 | | | 0,5 | 1,3 | 2,7 | 4,0 |
| **Shear load** | | | | | | | |
| **Steel failure without lever arm** | | | | | | | |
| **Steel zinc plated** | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 0,7 | 1,4 | 2,5 | 3,7 |
| | R60 | | | 0,6 | 1,2 | 2,0 | 2,9 |
| | R90 | | | 0,5 | 0,9 | 1,5 | 2,2 |
| | R120 | | | 0,4 | 0,8 | 1,3 | 1,8 |
| **Stainless steel A4, HCR** | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 2,9 | 5,4 | 8,7 | 12,6 |
| | R60 | | | 1,9 | 3,8 | 6,3 | 9,2 |
| | R90 | | | 1,0 | 2,1 | 3,9 | 5,7 |
| | R120 | | | 0,5 | 1,3 | 2,7 | 4,0 |
| **Steel failure with lever arm** | | | | | | | |
| **Steel zinc plated** | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 0,5 | 1,4 | 3,3 | 5,7 |
| | R60 | | | 0,4 | 1,2 | 2,6 | 4,6 |
| | R90 | | | 0,4 | 0,9 | 2,0 | 3,4 |
| | R120 | | | 0,3 | 0,8 | 1,6 | 2,8 |
| **Stainless steel A4, HCR** | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 2,2 | 5,5 | 11,2 | 19,6 |
| | R60 | | | 1,5 | 3,9 | 8,1 | 14,3 |
| | R90 | | | 0,7 | 2,2 | 5,1 | 8,9 |
| | R120 | | | 0,4 | 1,3 | 3,5 | 6,2 |

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out failure and concrete edge failure can be designed according to TR020 / CEN/TS 1992-4.

## Table C14: Displacements under tension load, BZ-IG

| Anchor size | | | M6 | M8 | M10 | M12 |
|---|---|---|---|---|---|---|
| Tension load in cracked concrete | N | [kN] | 2,0 | 3,6 | 4,8 | 8,0 |
| Displacements | $\delta_{N0}$ | [mm] | 0,6 | 0,6 | 0,8 | 1,0 |
| | $\delta_{N\infty}$ | [mm] | 0,8 | 0,8 | 1,2 | 1,4 |
| Tension load in non-cracked concrete | N | [kN] | 4,8 | 6,4 | 8,0 | 12,0 |
| Displacements | $\delta_{N0}$ | [mm] | 0,4 | 0,5 | 0,7 | 0,8 |
| | $\delta_{N\infty}$ | [mm] | 0,8 | 0,8 | 1,2 | 1,4 |

## Table C15: Displacements under shear load, BZ-IG

| Anchor size | | | M6 | M8 | M10 | M12 |
|---|---|---|---|---|---|---|
| Shear load in cracked and non-cracked concrete | V | [kN] | 4,2 | 5,3 | 6,2 | 16,9 |
| Displacements | $\delta_{V0}$ | [mm] | 2,8 | 2,9 | 2,5 | 3,6 |
| | $\delta_{V\infty}$ | [mm] | 4,2 | 4,4 | 3,8 | 5,3 |