

## TELJESÍTMÉNYNYILATKOZAT

DoP Száma: **MKT-124 - hu**


- ✧ **A terméktípus egyedi azonosító kódja:** **Nagy teherbírású horgony SZ**
- ✧ **Felhasználás célja(i):** Mechanikus horgony a repedt és nem krakkolt beton rögzítésére, lásd a B. Mellékletet / Annex B
- ✧ **Gyártó:** MKT Metall-Kunststoff-Technik GmbH & Co.KG  
Auf dem Immel 2  
67685 Weilerbach
- ✧ **Az AVCP-rendszer(ek):** 1
- ✧ **Az európai értékelési dokumentum:** **EAD 330232-00-0601**  
Európai műszaki értékelés: **ETA-02/0030, 10.07.2018**  
A műszaki értékelést végző szerv: DIBt, Berlin  
Bejelentett szerv(ek): NB 1343 – MPA, Darmstadt

✧ **A nyilatkozatban szereplő teljesítmény(ek):**

| Alapvető tulajdonságok   | Teljesítmény              |
|--|---------------------------|
| <b>Mechanikai szilárdság és állékonyság (BWR1)</b>               |                           |
| Jellemző ellenállások statikus és kvázi-statisz terhelésekhez    | Melléklet/Annex C1 – C6   |
| A C1 + C2 szeizmikus teljesítménykategóriák jellemző ellenállása | Melléklet/Annex C7 – C8   |
| Eltolódásokat  | Melléklet/Annex C10 – C11 |
| <b>Tűzbiztonság (BWR2)</b>                                       |                           |
| Tűz viselkedést  | Osztály A1                |
| Tűz ellenállás   | Melléklet/Annex C9        |

A fent azonosított termék teljesítménye megfelel a bejelentett teljesítmény(ek)nek. A 305/2011/EU rendeletnek megfelelően e teljesítménynyilatkozat kiadásáért kizárólag a fent meghatározott gyártó a felelős.

A gyártó nevében és részéről aláíró személy:

  
**Stefan Weustenhagen**  
(Vezérigazgató)  
**Weilerbach, 10.07.2018**

p.p.   
**Dipl.-Ing. Detlef Bigalke**  
(A termékfejlesztés vezetője)



A teljesítménynyilatkozat eredeti példányát németül írták. A fordítás eltérése esetén a német változat érvényes.

## Specification of intended use

| Highload Anchor SZ,<br>steel zinc plated  | 10/M6          | 12/M8   | 15/M10 | 18/M12 | 24/M16 | 24/<br>M16L | 28/M20 | 32/M24 |
|---|----------------|---------|--------|--------|--------|-------------|--------|--------|
| Static or quasi-static action             | ✓              |         |        |        |        |             |        |        |
| Seismic action (SZ-B and SZ-S)            | -              | C1 + C2 |        |        |        |             |        |        |
| Seismic action (SZ-SK)                    | -              | C1 + C2 |        |        |        | -           |        |        |
| Fire exposure                             | R 30 ... R 120 |         |        |        |        |             |        |        |
| Highload Anchor SZ,<br>stainless steel A4 | 12/M8          | 15/M10  | 18/M12 | 24/M16 |        |             |        |        |
| Static or quasi-static action             | ✓              |         |        |        |        |             |        |        |
| Seismic action (SZ-B and SZ-S)            | C1 + C2        |         |        |        |        |             |        |        |
| Seismic action (SZ-SK)                    | C1 + C2        |         |        |        | -      |             |        |        |
| Fire exposure                             | R30 ... R120   |         |        |        |        |             |        |        |

### Base materials:

- Cracked and uncracked concrete
- Compacted, reinforced or unreinforced normal weight concrete (without fibers) according to EN 206:2013
- Strength classes C20/25 to C50/60 according to EN 206:2013

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc plated steel or stainless steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal conditions, if no particular aggressive conditions exist (stainless steel).

Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used.)

### Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static actions, seismic actions and under fire exposure are designed in accordance with FprEN 1992-4:2016 and TR 055.

### Installation:

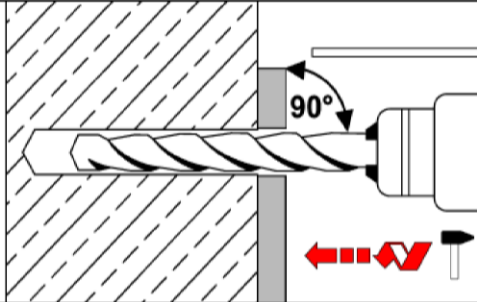
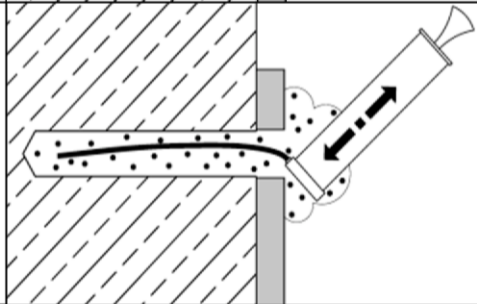
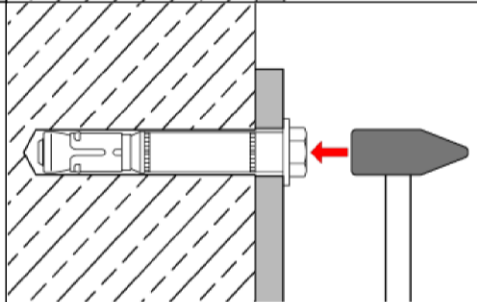
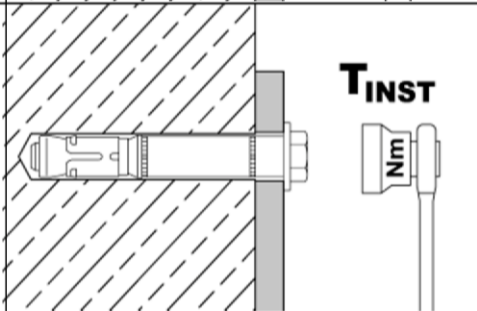
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application.
- Compliance with the effective anchorage depth. For fastenings with anchorage depths  $h_{ef} > h_{ef,min}$  the usable thickness of fixture is reduced by  $h_{ef} - h_{ef,min}$ .
- Use as supplied by the manufacturer without replacing individual parts.
- Drilling of hole only by hammer drilling (use of vacuum drill bits is admissible)

## Highload Anchor SZ

**Intended use**  
Specification of intended use

**Annex B1**

# Installation instructions

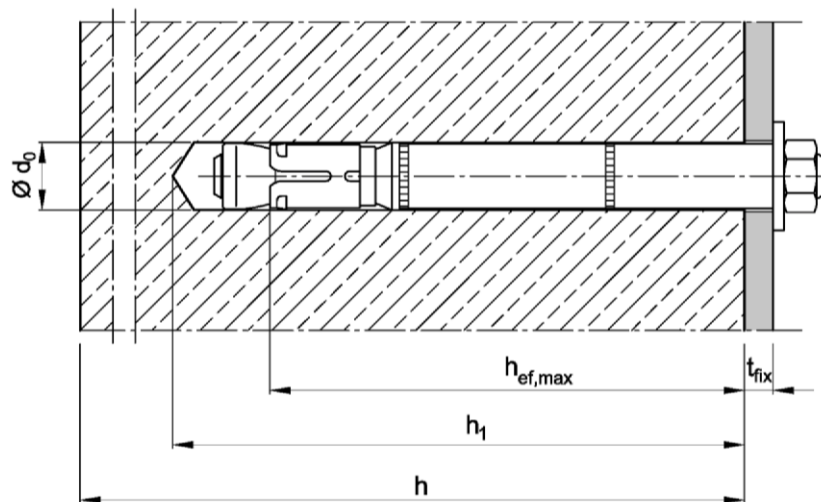
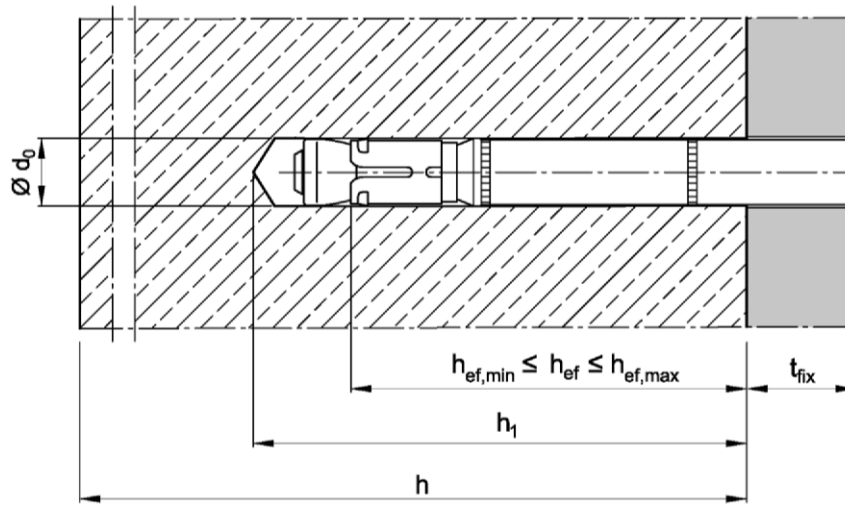
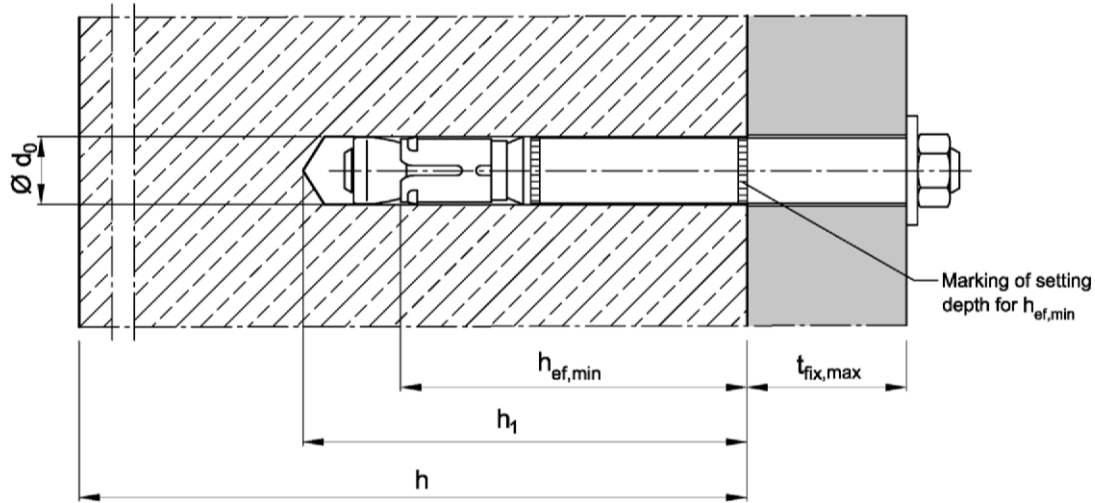
|   |   |  |
|---|---|--|
| 1 |    | <p>Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.</p> |
| 2 |    | <p>Blow out dust. Alternatively vacuum clean down to the bottom of the hole.</p>                       |
| 3 |   | <p>Drive in fastener.</p>  |
| 4 |  | <p>Apply installation torque <math>T_{inst}</math> by using calibrated torque wrench.</p>              |

## Highload Anchor SZ

Intended use  
Installation instructions

Annex B2

# Installation situation



## Highload Anchor SZ

Intended use  
Installation situation

Annex B3

**Table B1: Installation parameters, steel zinc plated**

| Fastener size   |                              | 10/M6         | 12/M8         | 15/M10        | 18/M12        | 24/M16         | 24/<br>M16L    | 28/M20         | 32/M24         |
|---|------------------------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|
| Size of thread  | [-]                          | M6            | M8            | M10           | M12           | M16            | M16            | M20            | M24            |
| Minimum effective anchorage depth                         | $h_{ef,min}$ [mm]            | 50            | 60            | 71            | 80            | 100            | 115            | 125            | 150            |
| Maximum effective anchorage depth                         | $h_{ef,max}$ [mm]            | 76            | 100           | 110           | 130           | 114            | 150            | 185            | 210            |
| Nominal diameter of drill bit                             | $d_0 =$ [mm]                 | 10            | 12            | 15            | 18            | 24             | 24             | 28             | 32             |
| Cutting diameter of drill bit                             | $d_{cut} \leq$ [mm]          | 10,45         | 12,5          | 15,5          | 18,5          | 24,55          | 24,55          | 28,55          | 32,7           |
| Depth of drill hole                                       | $h_1 \geq$ [mm]              | $h_{ef} + 15$ | $h_{ef} + 20$ | $h_{ef} + 25$ | $h_{ef} + 25$ | $h_{ef} + 30$  | $h_{ef} + 30$  | $h_{ef} + 35$  | $h_{ef} + 30$  |
| Diameter of clearance hole in the fixture                 | $d_f \leq$ [mm]              | 12            | 14            | 17            | 20            | 26             | 26             | 31             | 35             |
| Thickness of countersunk washer SZ-SK                     | $t_{sk}$ [mm]                | 4             | 5             | 6             | 7             | -              | -              | -              | -              |
| Minimum thickness of fixture SZ-SK                        | $t_{fix min}^{2)}$ [mm]      | 8             | 10            | 14            | 18            | -              | -              | -              | -              |
| Installation torque                                       | $T_{inst}$ (SZ-B, SZ-S) [Nm] | 15            | 30            | 50            | 80            | 160            | 160            | 280            | 280            |
|   | $T_{inst}$ (SZ-SK) [Nm]      | 10            | 25            | 55            | 70            | -              | -              | -              | -              |
| Minimum thickness of member                               | $h_{min}$ [mm]               | $h_{ef} + 50$ | $h_{ef} + 60$ | $h_{ef} + 69$ | $h_{ef} + 80$ | $h_{ef} + 100$ | $h_{ef} + 115$ | $h_{ef} + 125$ | $h_{ef} + 150$ |
| Minimum spacing <sup>1) 3)</sup> cracked concrete         | $s_{min}$ [mm]               | 50            | 50            | 60            | 70            | 100            | 100            | 125            | 150            |
|   | for $c \geq$ [mm]            | 50            | 80            | 120           | 140           | 180            | 180            | 300            | 300            |
| Minimum edge distance <sup>1) 3)</sup> cracked concrete   | $c_{min}$ [mm]               | 50            | 55            | 60            | 70            | 100            | 100            | 180            | 150            |
|   | for $s \geq$ [mm]            | 50            | 100           | 120           | 160           | 220            | 220            | 540            | 300            |
| Minimum spacing <sup>1) 3)</sup> uncracked concrete       | $s_{min}$ [mm]               | 50            | 60            | 60            | 70            | 100            | 100            | 125            | 150            |
|   | for $c \geq$ [mm]            | 80            | 100           | 120           | 140           | 180            | 180            | 300            | 300            |
| Minimum edge distance <sup>1) 3)</sup> uncracked concrete | $c_{min}$ [mm]               | 50            | 60            | 60            | 70            | 100            | 100            | 180            | 150            |
|   | for $s \geq$ [mm]            | 100           | 120           | 120           | 160           | 220            | 220            | 540            | 300            |

<sup>1)</sup> Intermediate values by linear interpolation

<sup>2)</sup> Depending on the existing shear load, the thickness of the fixture may be reduced to the thickness of the countersunk washer  $t_{sk}$  (see Annex A2). It must be verified that the present shear load can be transferred completely into the distance sleeve (bearing of hole).

<sup>3)</sup> For fire exposure from more than one side  $c \geq 300$  mm or  $c_{min} \geq 300$  mm applies.

**Highload Anchor SZ**

**Intended use**  
Installation parameters, **steel zinc plated**

**Annex B4**

**Table B2: Installation parameters, stainless steel A4**

| Fastener size  |                         | 12/M8         | 15/M10        | 18/M12        | 24/M16         |
|--|-------------------------|---------------|---------------|---------------|----------------|
| Size of thread   | [-]                     | M8            | M10           | M12           | M16            |
| Minimum effective anchorage depth                            | $h_{ef,min}$ [mm]       | 60            | 71            | 80            | 100            |
| Maximum effective anchorage depth                            | $h_{ef,max}$ [mm]       | 100           | 110           | 130           | 150            |
| Nominal diameter of drill bit                                | $d_0 =$ [mm]            | 12            | 15            | 18            | 24             |
| Cutting diameter of drill bit                                | $d_{cut} \leq$ [mm]     | 12,5          | 15,5          | 18,5          | 24,55          |
| Depth of drill hole  | $h_1 \geq$ [mm]         | $h_{ef} + 20$ | $h_{ef} + 25$ | $h_{ef} + 25$ | $h_{ef} + 30$  |
| Diameter of clearance hole in the fixture                    | $d_f \leq$ [mm]         | 14            | 17            | 20            | 26             |
| Thickness of countersunk washer SZ-SK                        | $t_{sk}$ [mm]           | 5             | 6             | 7             | -              |
| Minimum thickness of fixture SZ-SK                           | $t_{fix min}^{2)}$ [mm] | 10            | 14            | 18            | -              |
| Installation torque  | $T_{inst}$ (SZ-B) [Nm]  | 35            | 55            | 90            | 170            |
|  | $T_{inst}$ (SZ-S) [Nm]  | 30            | 50            | 80            | 170            |
|  | $T_{inst}$ (SZ-SK) [Nm] | 17,5          | 42,5          | 50            | -              |
| Minimum thickness of member                                  | $h_{min}$ [mm]          | $h_{ef} + 60$ | $h_{ef} + 69$ | $h_{ef} + 80$ | $h_{ef} + 100$ |
| Minimum spacing <sup>1) 3)</sup><br>cracked concrete         | $s_{min}$ [mm]          | 50            | 60            | 70            | 80             |
|  | for $c \geq$ [mm]       | 80            | 120           | 140           | 180            |
| Minimum edge distance <sup>1) 3)</sup><br>cracked concrete   | $c_{min}$ [mm]          | 50            | 60            | 70            | 80             |
|  | for $s \geq$ [mm]       | 80            | 120           | 160           | 200            |
| Minimum spacing <sup>1) 3)</sup><br>uncracked concrete       | $s_{min}$ [mm]          | 50            | 60            | 70            | 80             |
|  | for $c \geq$ [mm]       | 80            | 120           | 140           | 180            |
| Minimum edge distance <sup>1) 3)</sup><br>uncracked concrete | $c_{min}$ [mm]          | 50            | 85            | 70            | 180            |
|  | for $s \geq$ [mm]       | 80            | 185           | 160           | 80             |

<sup>1)</sup> Intermediate values by linear interpolation

<sup>2)</sup> Depending on the existing shear load, the thickness of the fixture may be reduced to the thickness of the countersunk washer  $t_{sk}$  (see Annex A2). It must be verified that the present shear load can be transferred completely into the distance sleeve (bearing of hole).

<sup>3)</sup> For fire exposure from more than one side  $c \geq 300$  mm or  $c_{min} \geq 300$  mm applies.

**Highload Anchor SZ**

**Intended use**  
Installation parameters, **stainless steel A4**

**Annex B5**

**Table C1:** Characteristic values for **tension load, cracked concrete**, static or quasi-static action, **steel zinc plated**

| Fastener size  |                  |      | 10/M6                                  | 12/M8 | 15/M10 | 18/M12 | 24/M16 | 24/<br>M16L | 28/M20 | 32/M24 |
|--|------------------|------|--|-------|--------|--------|--------|-------------|--------|--------|
| Installation factor                                  | $\gamma_{inst}$  | [-]  | 1,0                                    |       |        |        |        |             |        |        |
| <b>Steel failure</b>                                 |                  |      |  |       |        |        |        |             |        |        |
| Characteristic resistance                            | $N_{Rk,s}$       | [kN] | 16                                     | 29    | 46     | 67     | 126    | 126         | 196    | 282    |
| Partial factor                                       | $\gamma_{Ms}$    | [-]  | 1,5                                    |       |        |        |        |             |        |        |
| <b>Pull-out failure</b>                              |                  |      |  |       |        |        |        |             |        |        |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$       | [kN] | 5                                      | 12    | 16     | 25     | 36     | 44          | 50     | 65     |
| Increasing factor for $N_{Rk,p}$                     | $\psi_C$         | [-]  | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |       |        |        |        |             |        |        |
| <b>Concrete cone failure</b>                         |                  |      |  |       |        |        |        |             |        |        |
| Minimum effective anchorage depth                    | $h_{ef,min}$     | [mm] | 50                                     | 60    | 71     | 80     | 100    | 115         | 125    | 150    |
| Maximum effective anchorage depth                    | $h_{ef,max}$     | [mm] | 76                                     | 100   | 110    | 130    | 114    | 150         | 185    | 210    |
| Factor for cracked concrete                          | $k_1 = k_{cr,N}$ | [-]  | 7,7                                    |       |        |        |        |             |        |        |

**Highload Anchor SZ**

**Performance**

Characteristic values for **tension load, cracked concrete**, static or quasi-static action, **steel zinc plated**

**Annex C1**

**Table C2:** Characteristic values for **tension load, cracked concrete**, static or quasi-static action, **stainless steel A4**

| Fastener size  |                  |      | 12/M8                                  | 15/M10 | 18/M12 | 24/M16 |
|--|------------------|------|--|--------|--------|--------|
| Installation factor                                  | $\gamma_{inst}$  | [-]  | 1,0                                    |        |        |        |
| <b>Steel failure</b>                                 |                  |      |  |        |        |        |
| <b>SZ-B</b>  |                  |      |  |        |        |        |
| Characteristic resistance                            | $N_{Rk,s}$       | [kN] | 26                                     | 41     | 60     | 110    |
| Partial factor                                       | $\gamma_{Ms}$    | [-]  | 1,5                                    |        |        |        |
| <b>SZ-S and SZ-SK</b>                                |                  |      |  |        |        |        |
| Characteristic resistance                            | $N_{Rk,s}$       | [kN] | 26                                     | 41     | 60     | 110    |
| Partial factor                                       | $\gamma_{Ms}$    | [-]  | 1,87                                   |        |        |        |
| <b>Pull-out failure</b>                              |                  |      |  |        |        |        |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$       | [kN] | 9                                      | 16     | 25     | 36     |
| Increasing factor for $N_{Rk,p}$                     | $\psi_C$         | [-]  | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |        |        |        |
| <b>Concrete cone failure</b>                         |                  |      |  |        |        |        |
| Minimum effective anchorage depth                    | $h_{ef,min}$     | [mm] | 60                                     | 71     | 80     | 100    |
| Maximum effective anchorage depth                    | $h_{ef,max}$     | [mm] | 100                                    | 110    | 130    | 150    |
| Factor for cracked concrete                          | $k_1 = k_{cr,N}$ | [-]  | 7,7                                    |        |        |        |

**Highload Anchor SZ**

**Performance**

Characteristic values for **tension load, cracked concrete**, static or quasi-static action, **stainless steel A4**

**Annex C2**



**Table C3: Characteristic values for tension load, uncracked concrete, static or quasi-static action, steel zinc plated**

| Fastener size  |                   |      | 10/M6                                  | 12/M8 | 15/M10 | 18/M12 | 24/M16       | 24/<br>M16L  | 28/M20                                 | 32/M24 |   |
|--|-------------------|------|--|-------|--------|--------|--------------|--------------|--|--------|---|
| Installation factor  | $\gamma_{inst}$   | [-]  | 1,0                                    |       |        |        |              |              |  |        |   |
| <b>Steel failure</b>   |                   |      |  |       |        |        |              |              |  |        |   |
| Characteristic resistance  | $N_{Rk,s}$        | [kN] | 16                                     | 29    | 46     | 67     | 126          | 126          | 196                                    | 282    |   |
| Partial factor   | $\gamma_{Ms}$     | [-]  | 1,5                                    |       |        |        |              |              |  |        |   |
| <b>Pull-out failure</b>  |                   |      |  |       |        |        |              |              |  |        |   |
| Characteristic resistance in uncracked concrete C20/25                               | $N_{Rk,p}$        | [kN] | 17                                     | 20    | 30     | 36     | 50           | 1)           | 70                                     | 1)     |   |
| Increasing factor for $N_{Rk,p}$   | $\psi_C$          | [-]  | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |       |        |        |              | -            | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |        | - |
| <b>Splitting failure</b> (The higher resistance of case 1 and case 2 may be applied) |                   |      |  |       |        |        |              |              |  |        |   |
| Case 1   |                   |      |  |       |        |        |              |              |  |        |   |
| Characteristic resistance in uncracked concrete C20/25                               | $N^0_{Rk,sp}$     | [kN] | 12                                     | 16    | 25     | 30     | 40           | 70           | 50                                     | 70     |   |
| Edge distance  | $C_{cr,sp}$       | [mm] | 1,5 $h_{ef}$                           |       |        |        |              |              |  |        |   |
| Increasing factor for $N^0_{Rk,sp}$  | $\psi_C$          | [-]  | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |       |        |        |              |              |  |        |   |
| Case 2   |                   |      |  |       |        |        |              |              |  |        |   |
| Characteristic resistance in uncracked concrete                                      | $N^0_{Rk,sp}$     | [kN] | $\min(N_{Rk,p}; N^0_{Rk,c})$           |       |        |        |              |              |  |        |   |
| Edge distance  | $C_{cr,sp}$       | [mm] | 2,5 $h_{ef}$                           |       |        |        | 1,5 $h_{ef}$ | 2,5 $h_{ef}$ | 2 $h_{ef}$                             |        |   |
| <b>Concrete cone failure</b>   |                   |      |  |       |        |        |              |              |  |        |   |
| Minimum effective anchorage depth  | $h_{ef,min}$      | [mm] | 50                                     | 60    | 71     | 80     | 100          | 115          | 125                                    | 150    |   |
| Maximum effective anchorage depth  | $h_{ef,max}$      | [mm] | 76                                     | 100   | 110    | 130    | 114          | 150          | 185                                    | 210    |   |
| Edge distance  | $C_{cr,N}$        | [mm] | 1,5 $h_{ef}$                           |       |        |        |              |              |  |        |   |
| Factor for uncracked concrete  | $k_1 = k_{ucr,N}$ | [-]  | 11,0                                   |       |        |        |              |              |  |        |   |

1)  $N_{Rk,p} = N^0_{Rk,c}$  calculated with  $h_{ef,min}$

### Highload Anchor SZ

#### Performance

Characteristic values for **tension load, uncracked concrete**, static or quasi-static action, **steel zinc plated**

**Annex C3**

**Table C4:** Characteristic values for **tension load, uncracked concrete**, static or quasi-static action, **stainless steel A4**

| Fastener size  |                   |      | 12/M8                                  | 15/M10 | 18/M12 | 24/M16 |
|--|-------------------|------|--|--------|--------|--------|
| Installation factor                                    | $\gamma_{inst}$   | [-]  | 1,0                                    |        |        |        |
| <b>Steel failure</b>                                   |                   |      |  |        |        |        |
| <b>SZ-B</b>  |                   |      |  |        |        |        |
| Characteristic resistance                              | $N_{Rk,s}$        | [kN] | 26                                     | 41     | 60     | 110    |
| Partial factor   | $\gamma_{Ms}$     | [-]  | 1,5                                    |        |        |        |
| <b>SZ-S and SZ-SK</b>                                  |                   |      |  |        |        |        |
| Characteristic resistance                              | $N_{Rk,s}$        | [kN] | 26                                     | 41     | 60     | 110    |
| Partial factor   | $\gamma_{Ms}$     | [-]  | 1,87                                   |        |        |        |
| <b>Pull-out failure</b>                                |                   |      |  |        |        |        |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$        | [kN] | 16                                     | 25     | 35     | 50     |
| Increasing factor for $N_{Rk,p}$                       | $\psi_c$          | [-]  | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |        |        |        |
| <b>Splitting failure</b>                               |                   |      |  |        |        |        |
| Edge distance  | $c_{cr,sp}$       | [mm] | 180                                    | 235    | 265    | 300    |
| <b>Concrete cone failure</b>                           |                   |      |  |        |        |        |
| Minimum effective anchorage depth                      | $h_{ef,min}$      | [mm] | 60                                     | 71     | 80     | 100    |
| Maximum effective anchorage depth                      | $h_{ef,max}$      | [mm] | 100                                    | 110    | 130    | 150    |
| Edge distance  | $c_{cr,N}$        | [mm] | 1,5 $h_{ef}$                           |        |        |        |
| Factor for uncracked concrete                          | $k_1 = k_{Ucr,N}$ | [-]  | 11,0                                   |        |        |        |

**Highload Anchor SZ**

**Performance**

Characteristic values for **tension loads, uncracked concrete**, static or quasi-static action, **stainless steel A4**

**Annex C4**

**Table C5:** Characteristic values of **shear load**, static or quasi-static action, **steel zinc plated**

| Fastener size                                 |                |      | 10/M6             | 12/M8 | 15/M10 | 18/M12 | 24/M16 | 24/<br>M16L | 28/M20 | 32/M24 |
|---|----------------|------|-------------------|-------|--------|--------|--------|-------------|--------|--------|
| <b>Steel failure without lever arm</b>        |                |      |                   |       |        |        |        |             |        |        |
| <b>SZ-B</b>                                   |                |      |                   |       |        |        |        |             |        |        |
| Characteristic resistance                     | $V^{0}_{Rk,s}$ | [kN] | 16                | 25    | 36     | 63     | 91     | 91          | 122    | 200    |
| Ductility factor                              | $k_7$          | [-]  | 1,0               |       |        |        |        |             |        |        |
| <b>SZ-S and SZ-SK</b>                         |                |      |                   |       |        |        |        |             |        |        |
| Characteristic resistance                     | $V^{0}_{Rk,s}$ | [kN] | 18                | 30    | 48     | 73     | 126    | 126         | 150    | 200    |
| Ductility factor                              | $k_7$          | [-]  | 1,0               |       |        |        |        |             |        |        |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,25              |       |        |        |        |             |        |        |
| <b>Steel failure with lever arm</b>           |                |      |                   |       |        |        |        |             |        |        |
| Characteristic resistance                     | $M^{0}_{Rk,s}$ | [Nm] | 12                | 30    | 60     | 105    | 266    | 266         | 519    | 898    |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,25              |       |        |        |        |             |        |        |
| <b>Concrete pry-out failure</b>               |                |      |                   |       |        |        |        |             |        |        |
| Pry-out factor                                | $k_8$          | [-]  | 1,8 <sup>1)</sup> | 2,0   |        |        |        |             |        |        |
| <b>Concrete edge failure</b>                  |                |      |                   |       |        |        |        |             |        |        |
| Effective length of fastener in shear loading | $l_f$          | [mm] | $h_{ef}$          |       |        |        |        |             |        |        |
| Outside diameter of fastener                  | $d_{nom}$      | [mm] | 10                | 12    | 15     | 18     | 24     | 24          | 28     | 32     |

<sup>1)</sup>  $k_8 = 2,0$  for  $h_{ef} \geq 60$  mm

**Highload Anchor SZ**

**Performance**  
Characteristic values for **shear load**, static or quasi-static action, **steel zinc plated**

**Annex C5**

**Table C6:** Characteristic values for **shear load**, static or quasi-static action, **stainless steel A4**

| Fastener size                                 |                |      | 12/M8    | 15/M10 | 18/M12 | 24/M16 |
|---|----------------|------|----------|--------|--------|--------|
| <b>Steel failure without lever arm</b>        |                |      |          |        |        |        |
| Characteristic resistance                     | $V^{0}_{Rk,s}$ | [kN] | 24       | 37     | 62     | 92     |
| <b>SZ-B</b>                                   |                |      |          |        |        |        |
| Ductility factor                              | $k_7$          | [-]  | 1,0      |        |        |        |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,25     |        |        |        |
| <b>SZ-S</b>                                   |                |      |          |        |        |        |
| Ductility factor                              | $k_7$          | [-]  | 1,0      |        |        |        |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,36     |        |        |        |
| <b>SZ-SK</b>                                  |                |      |          |        |        |        |
| Ductility factor                              | $k_7$          | [-]  | 0,8      |        |        | -      |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,36     |        |        | -      |
| <b>Steel failure with lever arm</b>           |                |      |          |        |        |        |
| Characteristic bending resistance             | $M^{0}_{Rk,s}$ | [Nm] | 26       | 52     | 92     | 232    |
| <b>SZ-B</b>                                   |                |      |          |        |        |        |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,25     |        |        |        |
| <b>SZ-S and SZ-SK</b>                         |                |      |          |        |        |        |
| Partial factor                                | $\gamma_{Ms}$  | [-]  | 1,56     |        |        |        |
| <b>Concrete pry-out failure</b>               |                |      |          |        |        |        |
| Pry-out factor                                | $k_8$          | [-]  | 2,0      |        |        |        |
| <b>Concrete edge failure</b>                  |                |      |          |        |        |        |
| Effective length of fastener in shear loading | $l_f$          | [mm] | $h_{ef}$ |        |        |        |
| Outside diameter of fastener                  | $d_{nom}$      | [mm] | 12       | 15     | 18     | 24     |

**Highload Anchor SZ**

**Performance**  
 Characteristic values for **shear load**, static or quasi-static action, **stainless steel A4**

**Annex C6**

**Table C7:** Characteristic values for **seismic action, Category C1 and C2, steel zinc plated**

| Fastener size                                |                  |      | 12/M8 | 15/M10 | 18/M12 | 24/M16 | 24/M16L | 28/M20 | 32/M24 |
|--|------------------|------|-------|--------|--------|--------|---------|--------|--------|
| Tension load                                 |                  |      |       |        |        |        |         |        |        |
| Installation factor                          | $\gamma_{inst}$  | [-]  | 1,0   |        |        |        |         |        |        |
| <b>Steel failure</b>                         |                  |      |       |        |        |        |         |        |        |
| Characteristic resistance category <b>C1</b> | $N_{Rk,s,eq,C1}$ | [kN] | 29    | 46     | 67     | 126    | 126     | 196    | 280    |
| Characteristic resistance category <b>C2</b> | $N_{Rk,s,eq,C2}$ | [kN] | 29    | 46     | 67     | 126    | 126     | 196    | 280    |
| Partial factor                               | $\gamma_{Ms}$    | [-]  | 1,5   |        |        |        |         |        |        |
| <b>Pull-out failure</b>                      |                  |      |       |        |        |        |         |        |        |
| Characteristic resistance category <b>C1</b> | $N_{Rk,p,eq,C1}$ | [kN] | 12    | 16     | 25     | 36     | 44,4    | 50,3   | 63,3   |
| Characteristic resistance category <b>C2</b> | $N_{Rk,p,eq,C2}$ | [kN] | 5,4   | 16,4   | 22,6   | 29,0   | 41,2    | 43,6   | 63,3   |
| <b>Shear load</b>                            |                  |      |       |        |        |        |         |        |        |
| <b>Steel failure without lever arm</b>       |                  |      |       |        |        |        |         |        |        |
| <b>SZ-B</b>                                  |                  |      |       |        |        |        |         |        |        |
| Characteristic resistance category <b>C1</b> | $V_{Rk,s,eq,C1}$ | [kN] | 18,0  | 27,1   | 43,4   | 51,9   | 51,9    | 96,4   | 160,1  |
| Characteristic resistance category <b>C2</b> | $V_{Rk,s,eq,C2}$ | [kN] | 12,7  | 20,5   | 31,5   | 50,1   | 50,1    | 67,1   | 108,1  |
| <b>SZ-S</b>                                  |                  |      |       |        |        |        |         |        |        |
| Characteristic resistance category <b>C1</b> | $V_{Rk,s,eq,C1}$ | [kN] | 18,0  | 27,1   | 43,4   | 51,9   | 51,9    | 96,4   | 160,1  |
| Characteristic resistance category <b>C2</b> | $V_{Rk,s,eq,C2}$ | [kN] | 12,7  | 20,5   | 31,5   | 69,3   | 69,3    | 67,1   | 108,1  |
| <b>SZ-SK</b>                                 |                  |      |       |        |        |        |         |        |        |
| Characteristic resistance category <b>C1</b> | $V_{Rk,s,eq,C1}$ | [kN] | 25,2  | 36,5   | 50,4   | -      | -       | -      | -      |
| Characteristic resistance category <b>C2</b> | $V_{Rk,s,eq,C2}$ | [kN] | 19,2  | 29,3   | 39,4   | -      | -       | -      | -      |
| Factor for annular gap                       | $\alpha_{gap}$   | [-]  | 0,5   |        |        |        |         |        |        |
| Partial factor                               | $\gamma_{Ms}$    | [-]  | 1,25  |        |        |        |         |        |        |

**Highload Anchor SZ**

**Performance**  
Characteristic values for **seismic action, steel zinc plated**

**Annex C7**

**Table C8: Characteristic values for seismic action, Category C1 and C2, stainless steel A4**

| Fastener size                                 |                  |      | 12/M8 | 15/M10 | 18/M12 | 24/M16 |
|---|------------------|------|-------|--------|--------|--------|
| <b>Tension load</b>                           |                  |      |       |        |        |        |
| Installation factor                           | $\gamma_{inst}$  | [-]  | 1,0   |        |        |        |
| <b>Steel failure</b>                          |                  |      |       |        |        |        |
| Characteristic resistance, category <b>C1</b> | $N_{Rk,s,eq,C1}$ | [kN] | 26    | 41     | 60     | 110    |
| Characteristic resistance, category <b>C2</b> | $N_{Rk,s,eq,C2}$ | [kN] | 26    | 41     | 60     | 110    |
| Partial factor <b>SZ-B</b>                    | $\gamma_{Ms}$    | [-]  | 1,5   |        |        |        |
| Partial factor <b>SZ-S and SZ-SK</b>          | $\gamma_{Ms}$    | [-]  | 1,87  |        |        |        |
| <b>Pull-out failure</b>                       |                  |      |       |        |        |        |
| Characteristic resistance, category <b>C1</b> | $N_{Rk,p,eq,C1}$ | [kN] | 9     | 16     | 26     | 36     |
| Characteristic resistance, category <b>C2</b> | $N_{Rk,p,eq,C2}$ | [kN] | 4,8   | 16,5   | 24,8   | 44,5   |
| <b>Shear load</b>                             |                  |      |       |        |        |        |
| <b>Steel failure without lever arm</b>        |                  |      |       |        |        |        |
| <b>SZ-B</b>                                   |                  |      |       |        |        |        |
| Characteristic resistance, category <b>C1</b> | $V_{Rk,s,eq,C1}$ | [kN] | 9,6   | 13,3   | 25,4   | 75,4   |
| Characteristic resistance, category <b>C2</b> | $V_{Rk,s,eq,C2}$ | [kN] | 9,7   | 14,0   | 18,0   | 32,2   |
| Partial factor                                | $\gamma_{Ms}$    | [-]  | 1,25  |        |        |        |
| <b>SZ-S</b>                                   |                  |      |       |        |        |        |
| Characteristic resistance, category <b>C1</b> | $V_{Rk,s,eq,C1}$ | [kN] | 9,6   | 13,3   | 25,4   | 75,4   |
| Characteristic resistance, category <b>C2</b> | $V_{Rk,s,eq,C2}$ | [kN] | 9,7   | 14,0   | 18,0   | 32,2   |
| Partial factor                                | $\gamma_{Ms}$    | [-]  | 1,36  |        |        |        |
| <b>SZ-SK</b>                                  |                  |      |       |        |        |        |
| Characteristic resistance, category <b>C1</b> | $V_{Rk,s,eq,C1}$ | [kN] | 11,5  | 23,3   | 31,6   | -      |
| Characteristic resistance, category <b>C2</b> | $V_{Rk,s,eq,C2}$ | [kN] | 10,8  | 17,4   | 15,4   | -      |
| Partial factor                                | $\gamma_{Ms}$    | [-]  | 1,36  |        |        |        |

**Highload Anchor SZ**

**Performance**  
Characteristic values for seismic action, stainless steel A4

**Annex C8**

**Table C9:** Characteristic values under **fire exposure** in cracked and uncracked concrete C20/25 to C50/60

| Fastener size                          |      | 10/M6                | 12/M8 | 15/M10 | 18/M12 | 24/M16 | 24/<br>M16L | 28/M20 | 32/M24 |   |
|--|------|----------------------|-------|--------|--------|--------|-------------|--------|--------|---|
| <b>Tension load</b>                    |      |                      |       |        |        |        |             |        |        |   |
| <b>Steel failure</b>                   |      |                      |       |        |        |        |             |        |        |   |
| <b>Steel zinc plated</b>               |      |                      |       |        |        |        |             |        |        |   |
| Characteristic resistance              | R30  | $N_{Rk,s,fi}$ [kN]   | 1,0   | 1,9    | 4,3    | 6,3    | 11,6        | 18,3   | 26,3   |   |
|  | R60  |                      | 0,8   | 1,5    | 3,2    | 4,6    | 8,6         | 13,5   | 19,5   |   |
|  | R90  |                      | 0,6   | 1,0    | 2,1    | 3,0    | 5,0         | 7,7    | 12,6   |   |
|  | R120 |                      | 0,4   | 0,8    | 1,5    | 2,0    | 3,1         | 4,9    | 9,2    |   |
| <b>Stainless steel A4</b>              |      |                      |       |        |        |        |             |        |        |   |
| Characteristic resistance              | R30  | $N_{Rk,s,fi}$ [kN]   | -     | 6,1    | 10,2   | 15,7   | 29,2        | -      | -      | - |
|  | R60  |                      | -     | 4,4    | 7,3    | 11,1   | 20,6        | -      | -      | - |
|  | R90  |                      | -     | 2,6    | 4,3    | 6,4    | 12,0        | -      | -      | - |
|  | R120 |                      | -     | 1,8    | 2,8    | 4,1    | 7,7         | -      | -      | - |
| <b>Shear load</b>                      |      |                      |       |        |        |        |             |        |        |   |
| <b>Steel failure without lever arm</b> |      |                      |       |        |        |        |             |        |        |   |
| <b>Steel zinc plated</b>               |      |                      |       |        |        |        |             |        |        |   |
| Characteristic resistance              | R30  | $V_{Rk,s,fi}$ [kN]   | 1,0   | 1,9    | 4,3    | 6,3    | 11,6        | 18,3   | 26,3   |   |
|  | R60  |                      | 0,8   | 1,5    | 3,2    | 4,6    | 8,6         | 13,5   | 19,5   |   |
|  | R90  |                      | 0,6   | 1,0    | 2,1    | 3,0    | 5,0         | 7,7    | 12,6   |   |
|  | R120 |                      | 0,4   | 0,8    | 1,5    | 2,0    | 3,1         | 4,9    | 9,2    |   |
| <b>Stainless steel A4</b>              |      |                      |       |        |        |        |             |        |        |   |
| Characteristic resistance              | R30  | $V_{Rk,s,fi}$ [kN]   | -     | 14,3   | 22,7   | 32,8   | 61,0        | -      | -      | - |
|  | R60  |                      | -     | 11,1   | 17,6   | 25,5   | 47,5        | -      | -      | - |
|  | R90  |                      | -     | 7,9    | 12,6   | 18,3   | 34,0        | -      | -      | - |
|  | R120 |                      | -     | 6,3    | 10,0   | 14,6   | 27,2        | -      | -      | - |
| <b>Steel failure with lever arm</b>    |      |                      |       |        |        |        |             |        |        |   |
| <b>Steel zinc plated</b>               |      |                      |       |        |        |        |             |        |        |   |
| Characteristic bending resistance      | R30  | $M^0_{Rk,s,fi}$ [Nm] | 0,8   | 2,0    | 5,6    | 9,7    | 24,8        | 42,4   | 83,6   |   |
|  | R60  |                      | 0,6   | 1,5    | 4,1    | 7,2    | 18,3        | 29,8   | 61,9   |   |
|  | R90  |                      | 0,4   | 1,0    | 2,7    | 4,7    | 11,9        | 17,1   | 40,1   |   |
|  | R120 |                      | 0,3   | 0,8    | 1,9    | 3,1    | 6,6         | 10,7   | 29,2   |   |
| <b>Stainless steel A4</b>              |      |                      |       |        |        |        |             |        |        |   |
| Characteristic bending resistance      | R30  | $M^0_{Rk,s,fi}$ [Nm] | -     | 6,2    | 13,2   | 24,4   | 61,8        | -      | -      | - |
|  | R60  |                      | -     | 4,5    | 9,4    | 17,2   | 43,6        | -      | -      | - |
|  | R90  |                      | -     | 2,7    | 5,6    | 10,0   | 25,3        | -      | -      | - |
|  | R120 |                      | -     | 1,8    | 3,6    | 6,4    | 16,2        | -      | -      | - |

If pull-out is not decisive in equation D.4 and D.5, FprEN 1992-4:2016  $N_{Rk,p}$  must be replaced by  $N^0_{Rk,c}$ .

**Highload Anchor SZ**

**Performance**  
Characteristic values under **fire exposure**

**Annex C9**

**Table C10: Displacements under tension and shear load, steel zinc plated**

| Fastener size                                |                       |      | 10/<br>M6 | 12/<br>M8 | 15/<br>M10 | 18/<br>M12 | 24/<br>M16 | 24<br>/M16L | 28/<br>M20 | 32/<br>M24 |
|--|-----------------------|------|-----------|-----------|------------|------------|------------|-------------|------------|------------|
| <b>Tension load</b>                          |                       |      |           |           |            |            |            |             |            |            |
| Tension load in cracked concrete             | N                     | [kN] | 2,4       | 5,7       | 7,6        | 12,3       | 17,1       | 21,1        | 24         | 26,2       |
| Displacement                                 | $\delta_{N0}$         | [mm] | 0,5       | 0,5       | 0,5        | 0,7        | 0,8        | 0,7         | 0,9        | 1,4        |
|  | $\delta_{N\infty}$    | [mm] | 2,0       | 2,0       | 1,3        | 1,3        | 1,3        | 1,3         | 1,4        | 1,9        |
| Tension load in uncracked concrete           | N                     | [kN] | 8,5       | 9,5       | 14,3       | 17,2       | 24         | 29,6        | 34         | 43         |
| Displacement                                 | $\delta_{N0}$         | [mm] | 0,8       | 1,0       |            | 1,1        |            | 1,3         | 0,3        | 0,7        |
|  | $\delta_{N\infty}$    | [mm] | 3,4       |           |            | 1,7        |            | 2,3         | 1,4        | 0,7        |
| <b>Seismic action C2</b>                     |                       |      |           |           |            |            |            |             |            |            |
| Displacement for DLS                         | $\delta_{N,eq}$ (DLS) | [mm] | -         | 3,3       | 3,0        | 5,0        | 3,0        | 3,0         | 4,0        | 5,3        |
| Displacement for ULS                         | $\delta_{N,eq}$ (ULS) | [mm] | -         | 12,2      | 11,3       | 16,0       | 9,2        | 9,2         | 13,8       | 12,4       |
| <b>Shear load</b>                            |                       |      |           |           |            |            |            |             |            |            |
| <b>SZ-B</b>                                  |                       |      |           |           |            |            |            |             |            |            |
| Shear load in cracked and uncracked concrete | V                     | [kN] | 9,1       | 14        | 20,7       | 35,1       | 52,1       | 52,1        | 77         | 86,6       |
| Displacement                                 | $\delta_{V0}$         | [mm] | 2,5       | 2,1       | 2,7        | 3,0        | 5,1        | 5,1         | 4,3        | 10,5       |
|  | $\delta_{V\infty}$    | [mm] | 3,8       | 3,1       | 4,1        | 4,5        | 7,6        | 7,6         | 6,5        | 15,8       |
| <b>Seismic action C2</b>                     |                       |      |           |           |            |            |            |             |            |            |
| Displacement for DLS                         | $\delta_{V,eq}$ (DLS) | [mm] | -         | 2,3       | 3,1        | 3,0        | 2,6        | 2,6         | 1,6        | 6,1        |
| Displacement for ULS                         | $\delta_{V,eq}$ (ULS) | [mm] | -         | 4,8       | 6,4        | 6,1        | 6,6        | 6,6         | 4,8        | 9,5        |
| <b>SZ-S</b>                                  |                       |      |           |           |            |            |            |             |            |            |
| Shear load in cracked and uncracked concrete | V                     | [kN] | 10,1      | 17,1      | 27,5       | 41,5       | 72         | 72          | 77         | 86,6       |
| Displacement                                 | $\delta_{V0}$         | [mm] | 2,9       | 2,5       | 3,6        | 3,5        | 7,0        | 7,0         | 4,3        | 10,5       |
|  | $\delta_{V\infty}$    | [mm] | 4,4       | 3,8       | 5,4        | 5,3        | 10,5       | 10,5        | 6,5        | 15,8       |
| <b>Seismic action C2</b>                     |                       |      |           |           |            |            |            |             |            |            |
| Displacement for DLS                         | $\delta_{V,eq}$ (DLS) | [mm] | -         | 2,3       | 3,1        | 3,0        | 3,3        | 3,3         | 1,6        | 6,1        |
| Displacement for ULS                         | $\delta_{V,eq}$ (ULS) | [mm] | -         | 4,8       | 6,4        | 6,1        | 8,2        | 8,2         | 4,8        | 9,5        |
| <b>SZ-SK</b>                                 |                       |      |           |           |            |            |            |             |            |            |
| Shear load in cracked and uncracked concrete | V                     | [kN] | 10,1      | 17,1      | 27,5       | 41,5       | -          | -           | -          | -          |
| Displacement                                 | $\delta_{V0}$         | [mm] | 2,9       | 2,5       | 3,6        | 3,5        | -          | -           | -          | -          |
|  | $\delta_{V\infty}$    | [mm] | 4,4       | 3,8       | 5,4        | 5,3        | -          | -           | -          | -          |
| <b>Seismic action C2</b>                     |                       |      |           |           |            |            |            |             |            |            |
| Displacement for DLS                         | $\delta_{V,eq}$ (DLS) | [mm] | -         | 3,1       | 3,9        | 3,9        | -          | -           | -          | -          |
| Displacement for ULS                         | $\delta_{V,eq}$ (ULS) | [mm] | -         | 10,2      | 11,8       | 13,0       | -          | -           | -          | -          |

**Highload Anchor SZ**

**Performance**  
Displacements under tension and shear load, steel zinc plated

**Annex C10**



**Table C11: Displacements under tension and shear load, stainless steel A4**

| Fastener size                      |                       | 12/M8 | 15/M10 | 18/M12 | 24/M16 |      |
|------------------------------------|-----------------------|-------|--------|--------|--------|------|
| <b>Tension load</b>                |                       |       |        |        |        |      |
| Tension load in cracked concrete   | N                     | [kN]  | 4,3    | 7,6    | 12,1   | 17,0 |
| Displacement                       | $\delta_{N0}$         | [mm]  | 0,5    | 0,5    | 1,3    | 0,5  |
|                                    | $\delta_{N\infty}$    | [mm]  | 1,2    | 1,6    | 1,8    | 1,6  |
| Tension load in uncracked concrete | N                     | [kN]  | 7,6    | 11,9   | 16,7   | 24,1 |
| Displacement                       | $\delta_{N0}$         | [mm]  | 0,2    | 0,3    | 1,2    | 1,5  |
|                                    | $\delta_{N\infty}$    | [mm]  | 1,1    | 1,1    | 1,1    | 1,1  |
| Seismic action C2                  |                       |       |        |        |        |      |
| Displacement for DLS               | $\delta_{N,eq (DLS)}$ | [mm]  | 4,7    | 4,5    | 4,3    | 4,9  |
| Displacement for ULS               | $\delta_{N,eq (ULS)}$ | [mm]  | 13,3   | 12,7   | 9,7    | 10,1 |
| <b>Shear load</b>                  |                       |       |        |        |        |      |
| Shear load in cracked concrete     | V                     | [kN]  | 13,9   | 21,1   | 34,7   | 50,8 |
| Displacement                       | $\delta_{V0}$         | [mm]  | 3,4    | 4,9    | 4,8    | 6,7  |
|                                    | $\delta_{V\infty}$    | [mm]  | 5,1    | 7,4    | 7,1    | 10,1 |
| Seismic action C2                  |                       |       |        |        |        |      |
| <b>SZ-B, SZ-S</b>                  |                       |       |        |        |        |      |
| Displacement for DLS               | $\delta_{V,eq (DLS)}$ | [mm]  | 2,8    | 3,1    | 2,6    | 3,3  |
| Displacement for ULS               | $\delta_{V,eq (ULS)}$ | [mm]  | 5,6    | 5,8    | 5,0    | 6,9  |
| <b>SZ-SK</b>                       |                       |       |        |        |        |      |
| Displacement for DLS               | $\delta_{V,eq (DLS)}$ | [mm]  | 2,5    | 2,8    | 2,9    | -    |
| Displacement for ULS               | $\delta_{V,eq (ULS)}$ | [mm]  | 5,8    | 5,9    | 6,9    | -    |

**Highload Anchor SZ**

**Performance**  
Displacements under tension and shear load, stainless steel A4

**Annex C11**