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# PROHLÁŠENÍ O VLASTNOSTECH

DoP č. **MKT-1.1-901_cz**

- ✧ **Jedinečný identifikační kód typu výrobku:** **Klínová kotva BZ3 / BZ3 A4 / BZ3 HCR**
- ✧ **Zamýšlené/zamýšlená použití:** Mechanická hmoždinka pro použití v betonu, viz příloha / Annex B
- ✧ **Výrobce:** MKT Metall-Kunststoff-Technik GmbH & Co.KG
  Auf dem Immel 2
  67685 Weilerbach
- ✧ **Systém nebo systémy posuzování a ověřování stálosti vlastností stavebních výrobků:** 1
- ✧ **Evropský dokument pro posuzování:** **EAD 330232-01-0601**
  Evropské technické posouzení: **ETA-19/0619, 10.12.2021**
  Subjekt pro technické posuzování: DIBt, Berlin
  Oznámený subjekt/oznámené subjekty: NB 2873 – Technische Universität Darmstadt
- ✧ **Vlastnosti uvedené v prohlášení**

| Základní charakteristiky | Vlastnosti |
|---|---|
| **Mechanická odolnost a stabilita (BWR 1)** | |
| Minimální vzdálenost od okraje a středu | Příloha / Annex B3 |
| Charakteristická únosnost v tahu (statická a kvazistatická účinky) | Příloha / Annex C1, C2 |
| Charakteristická únosnost ve smyku (statická a kvazistatická účinky) | Příloha / Annex C3 |
| Charakteristická odolnost pro seismickou výkonnostní kategorii C1 + C2 | Příloha / Annex C4 |
| Posuny | Příloha / Annex C7, C8 |
| Trvanlivost | Příloha / Annex B1 |
| **Požární bezpečnost (BWR 2)** | |
| Chování při požáru | Třída A1 |
| Požární odolnost | Příloha / Annex C5, C6 |

Vlastnosti výše uvedeného výrobku jsou ve shodě se souborem deklarovaných vlastností. Toto prohlášení o vlastnostech se v souladu s nařízením (EU) č. 305/2011 vydává na výhradní odpovědnost výrobce uvedeného výše.

Podepsáno za výrobce a jeho jménem:

**Stefan Weustenhagen**
(Výkonný ředitel)
**Weilerbach, 10.12.2021**

p.p.
**Dipl.-Ing. Detlef Bigalke**
(Vedoucí vývoje produktu)

Originál tohoto prohlášení byl napsán v němčině. V případě odchylek v překladu platí německá verze.

## Specifications of intended use

| Wedge Anchor | BZ3 / BZ3 A4 / BZ3 HCR | | | |
|---|---|---|---|---|
| | M8 | M10 | M12 | M16 |
| Static or quasi-static action | ✓ | | | |
| Seismic performance categories C1 and C2 | ✓ | | | |
| Fire exposure | R30 / R60 / R90 / R120 | | | |
| Variable, effective anchorage depth | 35 mm to 90 mm | 40 mm to 100 mm | 50 mm to 125 mm | 65 mm to 160 mm |

**Base materials:**

- Cracked or uncracked concrete
- Reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016

**Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions: all materials
- For all other conditions according to EN 1993-1-2006 + A1:2015-10, corresponding to corrosion resistance classes CRC according to Annex A3, Table A2

**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.).
- Design method EN 1992-4:2018 and Technical Report TR 055:2018

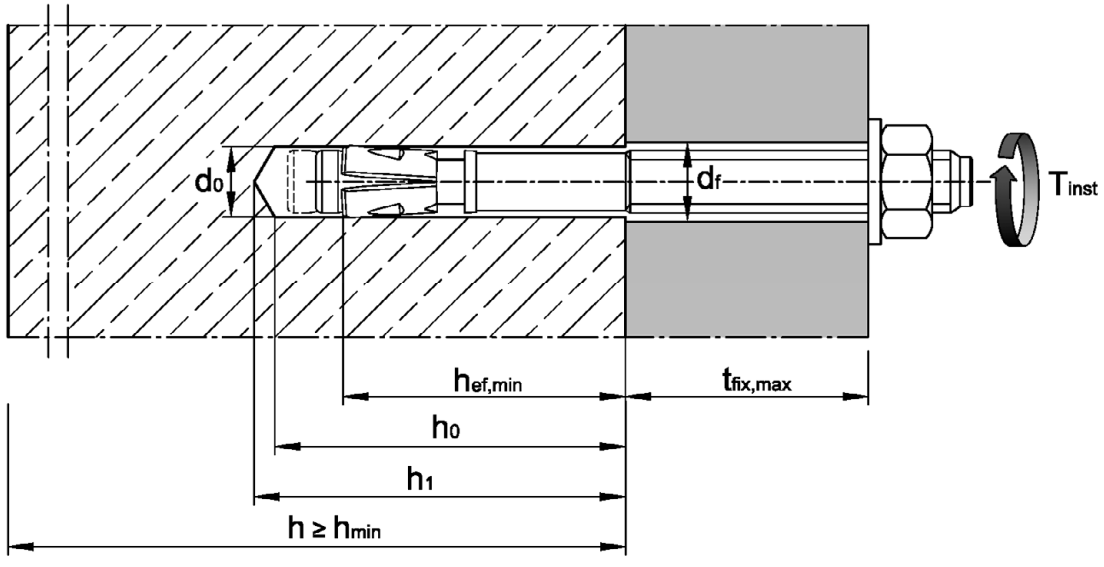
**Installation:**

- Hole drilling by hammer drill bit or vacuum drill bit
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener (exception: when using the cap nut HM)
- The anchor can be set in pre- or through-setting installation.
- Optionally, the annular gap between fixture and stud of BZ3 can be filled to reduce the hole clearance. For this purpose, the filling washer (Annex A3) must be used in addition to the supplied washer. For filling use MKT Injection Adhesive VMH, VMU plus, VMZ or other high-strength injection mortar with compressive strength ≥ 40N/mm².

## Table B1: Installation parameters

| Anchor size | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | |
|---|---|---|---|---|---|---|---|
| | | | | M8 | M10 | M12 | M16 |
| Nominal drill hole diameter | | $d_0$ | [mm] | 8 | 10 | 12 | 16 |
| Cutting diameter of drill bit | | $d_{cut} \leq$ | [mm] | 8,45 | 10,45 | 12,5 | 16,5 |
| Minimum effective anchorage depth | | $h_{ef,min}$ | [mm] | 35 | 40 | 50 | 65 |
| Maximum effective anchorage depth | | $h_{ef,max}$ | [mm] | 90 | 100 | 125 | 160 |
| Depth of drill hole | | $h_0 \geq$ | [mm] | $h_{ef}$ + 8 | $h_{ef}$ + 9 | $h_{ef}$ + 10 | $h_{ef}$ + 14 |
| | | $h_1 \geq$ | [mm] | $h_{ef}$ + 10 | $h_{ef}$ + 11 | $h_{ef}$ + 13 | $h_{ef}$ + 17 |
| Diameter of clearance hole in the fixture [1)] | | $d_f \leq$ | [mm] | 9 | 12 | 14 | 18 |
| Projection after anchor has been inserted for installing with cap nut HM (according to Annex B6, Figure 3) | | C | [mm] | 10,5 | 12,5 | 16,0 | 19,5 |
| Installation torque | BZ3 | $T_{inst}$ | [Nm] | 15 | 40 | 60 | 110 |
| | BZ3 A4 / HCR | $T_{inst}$ | [Nm] | 15 | 40 | 55 | 100 |

[1)] For larger diameters of clearance hole in the fixture, see EN 1992-4:2018, chapter 6.2.2.2



## Table B2: Minimum thickness of concrete member, minimum spacings, edge distances

| Anchor size | | | BZ3 / BZ3 A4 / BZ3 HCR | | | |
|---|---|---|---|---|---|---|
| | | | M8 | M10 | M12 | M16 |
| Minimum member thickness depending on $h_{ef}$ | $h_{min} \geq$ | [mm] | max ($1{,}5 \cdot h_{ef}$ ; 80) | | max ($1{,}5 \cdot h_{ef}$ ;100) | max ($1{,}5 \cdot h_{ef}$ ;120) |
| **Minimum edge distances and spacings** | | | | | | |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 55 | 65 |
| | for s ≥ | [mm] | see Table B4 | | | |
| Minimum spacings | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 |
| | for c ≥ | [mm] | see Table B4 | | | |

**The following equation must be fulfilled for the calculation of the minimum spacing and edge distance during installation in combination with variable anchorage depth and member thickness:**

$$A_{sp,req} \leq A_{sp,ef}$$

Required splitting area $A_{sp,req}$ and idealized splitting area $A_{sp,ef}$ according to Table B4.

## Table B3: Applicable concrete thickness $h_{sp}$ and area $A_{sp}$ to determine characteristic edge distance $c_{cr,sp}$

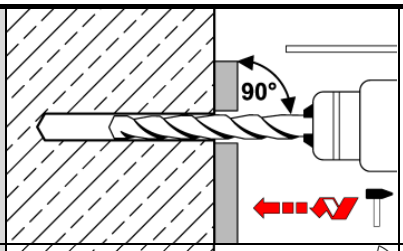
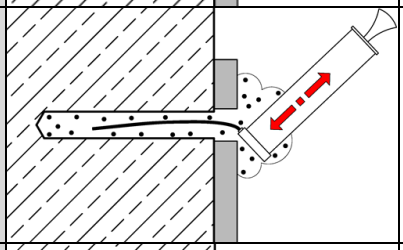
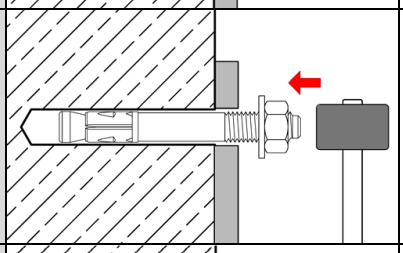
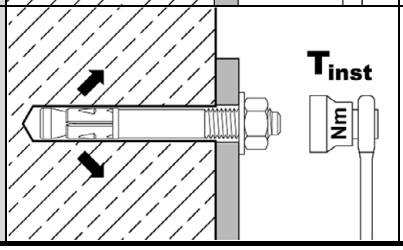
| Anchor size | | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|---|
| Applicable concrete thickness | BZ3<br>BZ3 A4<br>BZ3 HCR | $h_{sp}$ | [mm] | $\min(h\ ;\ h_{ef} + 1{,}5 \cdot c \cdot \sqrt{2})$ | | | |
| Area to determine $c_{cr,sp}$ [1)] | BZ3 | $A_{sp}$ | [mm²] | $\frac{N^0_{Rk,sp} - 2{,}573}{0{,}000436}$ | $\frac{N^0_{Rk,sp} + 2{,}040}{0{,}000693}$ | $\frac{N^0_{Rk,sp} + 3{,}685}{0{,}000692}$ | $\frac{N^0_{Rk,sp} + 3{,}738}{0{,}000875}$ |
| | BZ3 A4<br>BZ3 HCR | $A_{sp}$ | [mm²] | $\frac{N^0_{Rk,sp} + 4{,}177}{0{,}000862}$ | $\frac{N^0_{Rk,sp} + 7{,}235}{0{,}000967}$ | $\frac{N^0_{Rk,sp} + 7{,}847}{0{,}000951}$ | $\frac{N^0_{Rk,sp} + 11{,}415}{0{,}000742}$ |

[1)] with $N^0_{Rk,sp}$ in kN

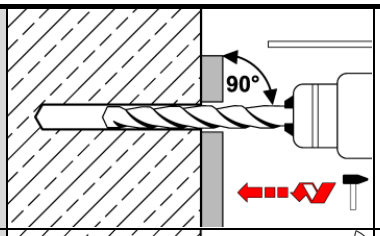
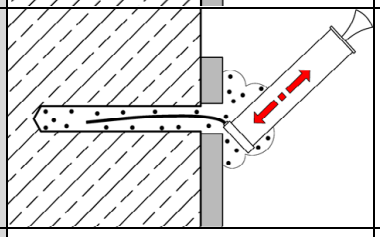
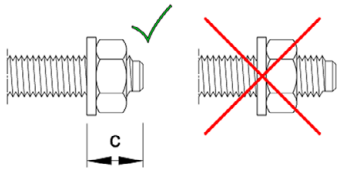
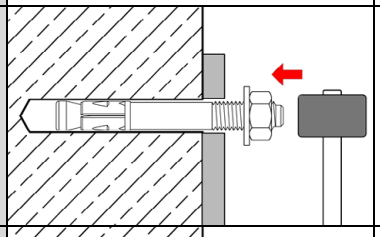
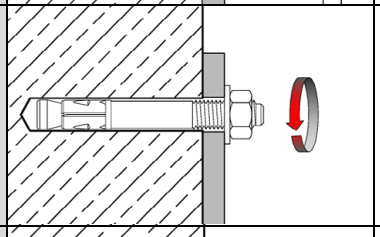
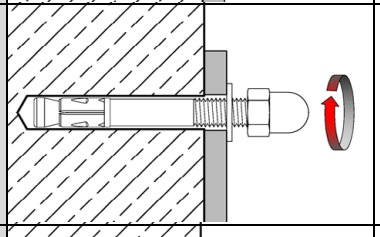
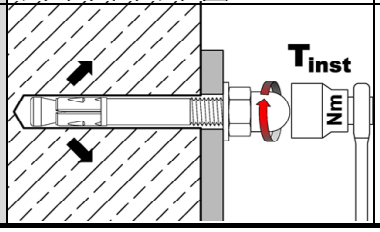
## Table B4: Areas to determine spacings and edge distances for installation

| Anchor size | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | |
|---|---|---|---|---|---|---|---|
| | | | | M8 | M10 | M12 | M16 |
| **The following equation must be fulfilled for the calculation of the minimum spacing and edge distance during installation in combination with variable anchorage depth and member thickness:** $A_{sp,req} \leq A_{sp,ef}$ | | | | | | | |
| **Idealized splitting area $A_{sp,ef}$** The edge distances and spacings shall be selected or rounded in steps of 5 mm. | | | | | | | |
| **Member thickness: $h > h_{ef} + 1{,}5 \cdot c$** | | | | | | | |
| Single anchor or anchor group with **$s \geq 3 \cdot c$** | | | | | | | |
| Effective anchorage depth **$h_{ef} < 1{,}5 \cdot c$** | | | $A_{sp,ef} = (6 \cdot c) \cdot (1{,}5 \cdot c + h_{ef})$ [mm²] | | | | |
| Effective anchorage depth **$h_{ef} \geq 1{,}5 \cdot c$** | | | $A_{sp,ef} = (6 \cdot c) \cdot (3 \cdot c)$ [mm²] | | | | |
| Anchor group ($s < 3 \cdot c$) | | | | | | | |
| Effective anchorage depth **$h_{ef} < 1{,}5 \cdot c$** | | | $A_{sp,ef} = (3 \cdot c + s) \cdot (1{,}5 \cdot c + h_{ef})$ [mm²] | | | | |
| Effective anchorage depth **$h_{ef} \geq 1{,}5 \cdot c$** | | | $A_{sp,ef} = (3 \cdot c + s) \cdot (3 \cdot c)$ [mm²] | | | | |
| **Member thickness**: **$h \leq h_{ef} + 1{,}5 \cdot c$** | | | | | | | |
| Single anchor or anchor group with **$s \geq 3 \cdot c$** | | | | | | | |
| Effective anchorage depth **$h_{ef} < 1{,}5 \cdot c$** | | | $A_{sp,ef} = (6 \cdot c) \cdot h$ [mm²] | | | | |
| Effective anchorage depth **$h_{ef} \geq 1{,}5 \cdot c$** | | | $A_{sp,ef} = (6 \cdot c) \cdot (h - h_{ef} + 1{,}5 \cdot c)$ [mm²] | | | | |
| Anchor group ($s < 3 \cdot c$) | | | | | | | |
| Effective anchorage depth **$h_{ef} < 1{,}5 \cdot c$** | | | $A_{sp,ef} = (3 \cdot c + s) \cdot h$ [mm²] | | | | |
| Effective anchorage depth **$h_{ef} \geq 1{,}5 \cdot c$** | | | $A_{sp,ef} = (3 \cdot c + s) \cdot (h - h_{ef} + 1{,}5 \cdot c)$ [mm²] | | | | |
| **Required splitting area $A_{sp,req}$** | | | | | | | |
| BZ3 | cracked concrete | $A_{sp,req}$ | [mm²] | 13 900 | 23 700 | 31 500 | 42 300 |
| | uncracked concrete | $A_{sp,req}$ | [mm²] | 22 500 | 34 700 | 41 300 | 50 200 |
| BZ3 A4 BZ3 HCR | cracked concrete | $A_{sp,req}$ | [mm²] | 16 900 | 25 900 | 29 800 | 44 300 |
| | uncracked concrete | $A_{sp,req}$ | [mm²] | 19 700 | 35 700 | 35 300 | 54 800 |

## Installation instructions

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

## Installation with cap nut HM

| | | |
|---|---|---|
| 1 |  | Drill hole perpendicular to concrete surface.<br>If using a vacuum drill bit, proceed with step 3. |
| 2 |  | Blow out dust. Alternatively vacuum clean down to the bottom of the hole. |
| 3 |  | Check position of nut. Projection C after anchor has been inserted see Annex B2, Table B1. |
| 4 |  | Drive in fastener. |
| 5 |  | Remove nut. |
| 6 |  | Screw on cap nut |
| 7 |  | Apply installation torque $T_{inst}$. |

**Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR**

**Intended use**
Installation instructions with cap nut

**Annex B6**

## Installation instructions with filling of annular gap

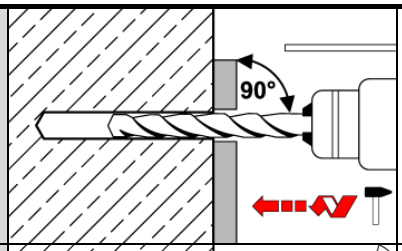
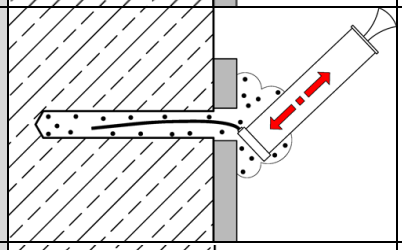
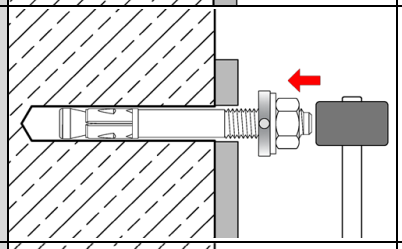
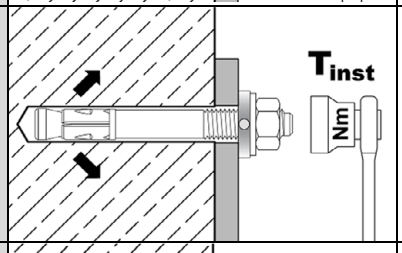
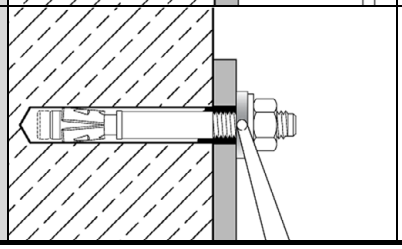
| | | |
|---|---|---|
| 1 |  | Drill hole perpendicular to concrete surface.<br>If using a vacuum drill bit, proceed with step 3. |
| 2 |  | Blow out dust. Alternatively vacuum clean down to the bottom of the hole. |
| 3 |  | Drive in fastener with additionally mounted filling washer. |
| 4 |  | Apply installation torque $T_{inst}$. |
| 5 |  | Fill the annular gap between anchor and fixture with injection adhesive (see Annex B1).<br>Use enclosed reducing adapter.<br>The annular gap is completely filled, when excess mortar seeps out. |

**Table C1:** Characteristic values for **tension loads** under static and quasi-static action, **BZ3** (steel, zinc plated)

| Fastener size | | | | BZ3 | | | |
|---|---|---|---|---|---|---|---|
| | | | | M8 | M10 | M12 | M16 |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | |
| **Steel failure** | | | | | | | |
| Characteristic resistance | | $N_{Rk,s}$ | [kN] | 19,8 | 30,4 | 44,9 | 79,3 |
| Partial factor [4] | | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| **Pull-out** | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | | $N_{Rk,p,cr}$ | [kN] | 9,5 | 15 | 22 | 30 |
| Increasing factor $N_{Rk,p,cr} = \psi_C \bullet N_{Rk,p,cr}$ (C20/25) | | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,439}$ | $\left(\frac{f_{ck}}{20}\right)^{0,265}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | $\left(\frac{f_{ck}}{20}\right)^{0,339}$ |
| Characteristic resistance in uncracked concrete C20/25 | | $N_{Rk,p,ucr}$ | [kN] | 14 | 24 | 30 | 50 |
| Increasing factor $N_{Rk,p,ucr} = \psi_C \bullet N_{Rk,p,ucr}$ (C20/25) | | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,489}$ | $\left(\frac{f_{ck}}{20}\right)^{0,448}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | $\left(\frac{f_{ck}}{20}\right)^{0,203}$ |
| **Splitting** | | | | | | | |
| Characteristic resistance | | $N^0_{Rk,sp}$ | [kN] | min ( $N_{Rk,p}$ ; $N^0_{Rk,c}$ [3] ) | | | |
| Characteristic edge distance [2] | | $c_{cr,sp}$ | [mm] | $\frac{A_{sp} + 0{,}8 \cdot (h_{sp} - h_{ef})^2}{(3{,}41 \cdot h_{sp} - 0{,}59 \cdot h_{ef})}$ | | | |
| Characteristic spacing | | $s_{cr,sp}$ | [mm] | $2 \cdot c_{cr,sp}$ | | | |
| **Concrete cone failure** | | | | | | | |
| Minimum, effective anchorage depth | | $h_{ef,min}$ | [mm] | 35 [1] | 40 | 50 | 65 |
| Maximum, effective anchorage depth | | $h_{ef,max}$ | [mm] | 90 | 100 | 125 | 160 |
| Characteristic edge distance | | $c_{cr,N}$ | [mm] | $1{,}5 \cdot h_{ef}$ | | | |
| Characteristic spacing | | $s_{cr,N}$ | [mm] | $2 \cdot c_{cr,N}$ | | | |
| Factor | cracked concrete | $k_{cr,N}$ | [-] | 7,7 | | | |
| | uncracked concrete | $k_{ucr,N}$ | [-] | 11,0 | | | |

[1] Fastenings with anchorage depth $h_{ef}$ < 40mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only.
[2] Applicable concrete thickness $h_{sp}$ and area $A_{sp}$ to determine characteristic edge distance $c_{cr,sp}$ according to Table B3
[3] $N^0_{Rk,c}$ according to EN 1992-4:2018
[4] In absence of other national regulations

**Table C2:** Characteristic values for **tension loads** under static or quasi-static action, **BZ3 A4** and **BZ3 HCR**

| **Fastener size** | | | **BZ3 A4 / BZ3 HCR** | | | |
|---|---|---|---|---|---|---|
| | | | **M8** | **M10** | **M12** | **M16** |
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | |
| **Steel failure** | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 19,8 | 30,4 | 44,9 | 74,6 |
| Partial factor [4] | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| **Pull-out** | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p,cr}$ | [kN] | 9,5 | 17 | 22 | 35 |
| Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25) | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,488}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | $\left(\frac{f_{ck}}{20}\right)^{0,435}$ | $\left(\frac{f_{ck}}{20}\right)^{0,350}$ |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p,ucr}$ | [kN] | 20 | 25 | 42 | 50 |
| Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25) | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,240}$ | $\left(\frac{f_{ck}}{20}\right)^{0,364}$ | $\left(\frac{f_{ck}}{20}\right)^{0,213}$ | $\left(\frac{f_{ck}}{20}\right)^{0,196}$ |
| **Splitting** | | | | | | |
| Characteristic resistance | $N^0_{Rk,sp}$ | [kN] | min ( $N_{Rk,p}$ ; $N^0_{Rk,c}$ [3] ) | | | |
| Characteristic edge distance [2] | $c_{cr,sp}$ | [mm] | $\frac{A_{sp} + 0,8 \cdot (h_{sp} - h_{ef})^2}{(3,41 \cdot h_{sp} - 0,59 \cdot h_{ef})}$ | | | |
| Characteristic spacing | $s_{cr,sp}$ | [mm] | $2 \cdot c_{cr,sp}$ | | | |
| **Concrete cone failure** | | | | | | |
| Minimum, effective anchorage depth | $h_{ef,min}$ | [mm] | 35 [1] | 40 | 50 | 65 |
| Maximum, effective anchorage depth | $h_{ef,max}$ | [mm] | 90 | 100 | 125 | 160 |
| Characteristic edge distance | $c_{cr,N}$ | [mm] | $1,5 \cdot h_{ef}$ | | | |
| Characteristic spacing | $s_{cr,N}$ | [mm] | $2 \cdot c_{cr,N}$ | | | |
| Factor — cracked concrete | $k_{cr,N}$ | [-] | 7,7 | | | |
| Factor — uncracked concrete | $k_{ucr,N}$ | [-] | 11,0 | | | |

[1] Fastenings with anchorage depth $h_{ef} < 40$ mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only

[2] Applicable concrete thickness $h_{sp}$ and area $A_{sp}$ according to Table B3 to determine characteristic edge distance $c_{cr,sp}$

[3] $N^0_{Rk,c}$ according to EN 1992-4:2018

[4] In absence of other national regulations

**Table C3:** Characteristic values for **shear loads** under static and quasi-static action

| Fastener size | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | |
|---|---|---|---|---|---|---|---|
| | | | | M8 | M10 | M12 | M16 |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | |
| **Steel failure <u>without</u> lever arm** | | | | | | | |
| Characteristic resistance | BZ3 | $V^0_{Rk,s}$ | [kN] | 15,7 | 26,8 | 38,3 | 60,0 |
| | BZ3 A4 / HCR | $V^0_{Rk,s}$ | [kN] | 16,8 | 27,8 | 39,8 | 69,5 |
| Partial factor 2) | | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Ductility factor | | $k_7$ | [-] | 1,0 | | | |
| **Steel failure <u>with</u> lever arm** | | | | | | | |
| Characteristic bending resistance | BZ3 | $M^0_{Rk,s}$ | [Nm] | 30 | 60 | 105 | 240 |
| | BZ3 A4 / HCR | $M^0_{Rk,s}$ | [Nm] | 27 | 55 | 99 | 223 |
| Partial factor 2) | | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| **Concrete pry-out failure** | | | | | | | |
| Pry-out factor | BZ3 | $k_8$ | [-] | 2,8 | 3,1 | 3,0 | 3,6 |
| | BZ3 A4 / HCR | $k_8$ | [-] | 2,7 | 2,8 | 3,3 | 3,4 |
| **Concrete edge failure** | | | | | | | |
| Effective length of fastener in shear loading | | $l_f$ | [mm] | $h_{ef}$ 1) | | | |
| Outside diameter of fastener | | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 |

1) Fastenings with anchorage depth $h_{ef} < 40$ mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only.

2) In absence of other national regulations

**Table C4:** Characteristic values for **seismic loading,** performance category **C1**

| Fastener size | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | M8 | | M10 | | M12 | | M16 | |
| Effective anchorage depth | | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 |
| **Tension load** | | | | | | | | | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | |
| **Steel failure** | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $N_{Rk,s,C1}$ | [kN] | 19,8 | | 30,4 | | 44,9 | | 79,3 | |
| | BZ3 A4 / HCR | $N_{Rk,s,C1}$ | [kN] | 19,8 | | 30,4 | | 44,9 | | 74,6 | |
| **Pull-out** | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $N_{Rk,p,C1}$ | [kN] | 9,1 | | 15,0 | | 22,0 | | 30,0 | |
| | BZ3 A4 / HCR | $N_{Rk,p,C1}$ | [kN] | 9,0 | | 17,0 | | 22,0 | | 35,0 | |
| **Shear load** | | | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $V_{Rk,s,C1}$ | [kN] | 11,7 | 13,4 | 22,5 | 24,4 | 30,0 | 33,8 | 48,8 | 52,3 |
| | BZ3 A4 / HCR | $V_{Rk,s,C1}$ | [kN] | 11,0 | 12,7 | 20,6 | 22,2 | 33,2 | 33,2 | 61,1 | 64,3 |
| Factor for anchorages | **with** annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | | | | |
| | **without** annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | | | | |

**Table C5:** Characteristic values for **seismic loading,** performance category **C2**

| Fastener size | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | M8 | | M10 | | M12 | | M16 | |
| Effective anchorage depth | | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 |
| **Tension load** | | | | | | | | | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | |
| **Steel failure** | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $N_{Rk,s,C2}$ | [kN] | 19,8 | | 30,4 | | 44,9 | | 79,3 | |
| | BZ3 A4 / HCR | $N_{Rk,s,C2}$ | [kN] | 19,8 | | 30,4 | | 44,9 | | 74,6 | |
| **Pull-out** | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $N_{Rk,p,C2}$ | [kN] | 2,8 | 3,6 | 7,3 | 12,5 | 10,7 | 19,0 | 19,8 | 35,2 |
| | BZ3 A4 / HCR | $N_{Rk,p,C2}$ | [kN] | 2,3 | 3,2 | 5,0 | 7,7 | 8,0 | 13,8 | 19,0 | 29,4 |
| **Shear load** | | | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $V_{Rk,s,C2}$ | [kN] | 7,3 | 11,3 | 15,4 | 19,0 | 18,3 | 28,0 | 39,4 | 43,3 |
| | BZ3 A4 / HCR | $V_{Rk,s,C2}$ | [kN] | 7,5 | 8,6 | 12,5 | 15,9 | 22,4 | 25,6 | 42,7 | 46,1 |
| Factor for anchorages | **with** annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | | | | |
| | **without** annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | | | | |

**Table C6:** Characteristic values **for tension and shear load** under **fire exposure, BZ3** (steel, zinc plated)

| **Fastener size** | | | | **BZ3** | | | |
|---|---|---|---|---|---|---|---|
| | | | | **M8** | **M10** | **M12** | **M16** |
| **Tension load** | | | | | | | |
| **Steel failure** | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 1,2 | 2,6 | 4,6 | 7,7 |
| | R60 | | | 1,0 | 1,9 | 3,3 | 5,6 |
| | R90 | | | 0,7 | 1,3 | 2,1 | 3,5 |
| | R120 | | | 0,6 | 1,0 | 1,5 | 2,5 |
| **Shear load** | | | | | | | |
| **Steel failure <u>without</u> lever arm** | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 4,0 | 7,5 | 12,3 | 20,7 |
| | R60 | | | 2,7 | 5,1 | 8,5 | 14,2 |
| | R90 | | | 1,4 | 2,7 | 4,6 | 7,7 |
| | R120 | | | 0,8 | 1,6 | 2,7 | 4,5 |
| **Steel failure <u>with</u> lever arm** | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 4,1 | 9,6 | 19,1 | 43,8 |
| | R60 | | | 2,8 | 6,6 | 13,1 | 30,1 |
| | R90 | | | 1,5 | 3,5 | 7,2 | 16,4 |
| | R120 | | | 0,8 | 2,0 | 4,2 | 9,6 |

$N_{Rk,p,fi}$ and $N_{Rk,c,fi}$ according to EN 1992-4:2018

**Table C7:** Characteristic values **for tension and shear load** under **fire exposure, BZ3 A4** and **BZ3 HCR**

| **Fastener size** | | | | **BZ3 A4 / BZ3 HCR** | | | |
|---|---|---|---|---|---|---|---|
| | | | | **M8** | **M10** | **M12** | **M16** |
| **Tension load** | | | | | | | |
| **Steel failure** | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 4,0 | 6,9 | 11,0 | 18,1 |
| | R60 | | | 2,9 | 5,0 | 8,0 | 13,1 |
| | R90 | | | 1,8 | 3,1 | 4,9 | 8,1 |
| | R120 | | | 1,2 | 2,1 | 3,4 | 5,6 |
| **Shear load** | | | | | | | |
| **Steel failure <u>without</u> lever arm** | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 8,5 | 17,6 | 32,0 | 52,6 |
| | R60 | | | 6,2 | 12,6 | 22,6 | 37,1 |
| | R90 | | | 3,9 | 7,5 | 13,1 | 21,5 |
| | R120 | | | 2,8 | 5,0 | 8,4 | 13,8 |
| **Steel failure <u>with</u> lever arm** | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 8,7 | 22,7 | 49,8 | 111,5 |
| | R60 | | | 6,3 | 16,2 | 35,1 | 78,6 |
| | R90 | | | 4,0 | 9,7 | 20,4 | 45,6 |
| | R120 | | | 2,8 | 6,5 | 13,0 | 29,2 |

$N_{Rk,p,fi}$ and $N_{Rk,c,fi}$ according to EN 1992-4:2018

**Table C8:** Displacements under **tension load, BZ3** (steel, zinc plated)

| Fastener size | | | BZ3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | M8 | | M10 | | M12 | | M16 | |
| **Displacements under static or quasi-static action** | | | | | | | | | | |
| $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load | | | | | | | | | | |
| $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$ | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 35 | | 40 | | 50 | | 65 | |
| **Cracked concrete** | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{-factor}}$ | [mm/kN] | 0,13 | | 0,05 | | 0,04 | | 0,03 | |
| | $\delta_{N\infty\text{-factor}}$ | [mm/kN] | 0,29 | | 0,20 | | 0,15 | | 0,11 | |
| **Uncracked concrete** | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{- factor}}$ | [mm/kN] | 0,03 | | 0,01 | | 0,004 | | 0,005 | |
| | $\delta_{N\infty\text{- factor}}$ | [mm/kN] | 0,03 | | 0,03 | | 0,03 | | 0,03 | |
| **Displacement under seismic action C2** | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 |
| Displacements for DLS | $\delta_{N, C2(DLS)}$ | [mm] | 3,9 | 4,9 | 2,8 | 4,7 | 2,4 | 4,2 | 2,5 | 4,5 |
| Displacements for ULS | $\delta_{N, C2(ULS)}$ | [mm] | 11,3 | 14,3 | 9,4 | 16,1 | 7,3 | 12,9 | 7,2 | 12,8 |

**Table C9:** Displacements under **tension load, BZ3 A4** and **BZ3 HCR**

| Fastener size | | | BZ3 A4 / BZ3 HCR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | M8 | | M10 | | M12 | | M16 | |
| **Displacements under static or quasi-static action** | | | | | | | | | | |
| $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load | | | | | | | | | | |
| $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$ | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 35 | | 40 | | 50 | | 65 | |
| **Cracked concrete** | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{-factor}}$ | [mm/kN] | 0,11 | | 0,06 | | 0,05 | | 0,02 | |
| | $\delta_{N\infty\text{-factor}}$ | [mm/kN] | 0,27 | | 0,17 | | 0,16 | | 0,08 | |
| **Uncracked concrete** | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{- factor}}$ | [mm/kN] | 0,02 | | 0,00 | | 0,001 | | 0,00 | |
| | $\delta_{N\infty\text{- factor}}$ | [mm/kN] | 0,05 | | 0,05 | | 0,05 | | 0,05 | |
| **Displacement under seismic action C2** | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 |
| Displacements for DLS | $\delta_{N, C2(DLS)}$ | [mm] | 2,0 | 2,9 | 2,6 | 4,1 | 3,3 | 5,7 | 3,3 | 5,1 |
| Displacements for ULS | $\delta_{N, C2(ULS)}$ | [mm] | 7,7 | 11,1 | 10,8 | 16,8 | 10,4 | 18,0 | 9,0 | 13,9 |

**Table C10:** Displacements under **shear load,** BZ3 (steel, zinc plated)

| **Fastener size** | | | **BZ3** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | | **M10** | | **M12** | | **M16** | |
| **Displacements under static or quasi-static action**<br>$\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load<br>$\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$ | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 35 | | 40 | | 50 | | 65 | |
| Factor for displacement | $\delta_{V0\text{- factor}}$ | [mm/kN] | 0,15 | | 0,09 | | 0,09 | | 0,07 | |
| | $\delta_{V\infty\text{- factor}}$ | [mm/kN] | 0,22 | | 0,13 | | 0,14 | | 0,11 | |
| **Displacement under seismic action C2** [1] | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 |
| Displacements for DLS | $\delta_{V,C2(DLS)}$ | [mm] | 2,8 | 2,7 | 3,0 | 3,1 | 3,4 | 3,7 | 3,4 | 3,8 |
| Displacements for ULS | $\delta_{V,C2(ULS)}$ | [mm] | 5,1 | 5,0 | 5,0 | 5,5 | 6,3 | 9,9 | 6,0 | 9,6 |

[1] For anchorages with clearance in the fixture the annular gap must also be taken into account.

**Table C11:** Displacements under **shear load,** BZ3 A4 and BZ3 HCR

| **Fastener size** | | | **BZ3 A4 / BZ3 HCR** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | | **M10** | | **M12** | | **M16** | |
| **Displacements under static or quasi-static action**<br>$\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load<br>$\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$ | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 35 | | 40 | | 50 | | 65 | |
| Factor for displacement | $\delta_{V0\text{- factor}}$ | [mm/kN] | 0,26 | | 0,14 | | 0,12 | | 0,09 | |
| | $\delta_{V\infty\text{- factor}}$ | [mm/kN] | 0,39 | | 0,20 | | 0,17 | | 0,14 | |
| **Displacement under seismic action C2** [1] | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 |
| Displacements for DLS | $\delta_{V,C2(DLS)}$ | [mm] | 2,8 | 3,0 | 3,4 | 3,5 | 3,5 | 4,2 | 3,8 | 4,4 |
| Displacements for ULS | $\delta_{V,C2(ULS)}$ | [mm] | 5,2 | 5,1 | 7,0 | 8,4 | 7,5 | 11,8 | 7,8 | 11,1 |

[1] For anchorages with clearance in the fixture the annular gap must also be taken into account