Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

Member of EOTA
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Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

# European Technical Assessment ETA-25/0098 of 10 June 2025

English translation prepared by DIBt - Original version in German language

**General Part**

| | |
|---|---|
| Technical Assessment Body issuing the European Technical Assessment: | Deutsches Institut für Bautechnik |
| Trade name of the construction product | TILCA Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR |
| Product family to which the construction product belongs | Mechanical fasteners for use in concrete |
| Manufacturer | EFCO Befestigungstechnik AG<br>Grabenstraße 1<br>8606 NÄNIKON<br>SCHWEIZ |
| Manufacturing plant | Werk 1, Deutschland |
| This European Technical Assessment contains | 24 pages including 3 annexes which form an integral part of this assessment |
| This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of | EAD 330232-01-0601, Edition 05/2021 |

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## Specific Part

### 1 Technical description of the product

The TILCA Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR is a fastener made of zinc plated steel, stainless steel or high corrosion resistant steel which is placed into a drilled hole and anchored by torque-controlled expansion.

The product description is given in Annex A.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the fastener is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the fastener of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

### 3 Performance of the product and references to the methods used for its assessment

#### 3.1 Mechanical resistance and stability (BWR 1)

| Essential characteristic | Performance |
|---|---|
| Characteristic resistance to tension load (static and quasi-static loading) | see Annex B3, C1, C2 |
| Characteristic resistance to shear load (static and quasi-static loading) | see Annex C3 |
| Characteristic resistance for seismic performance categories C1 and C2 | see Annex C4, C5 |
| Displacements | see Annex C8, C9, C10 |

#### 3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Class A1 |
| Resistance to fire | see Annex C6, C7 |

#### 3.3 Aspects of durability

| Essential characteristic | Performance |
|---|---|
| Durability | See Annex B1 |

### 4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD 330232-01-0601 the applicable European legal act is: 1996/582/EC.

The system to be applied is: 1

## 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 10 June 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

*beglaubigt:*
Baderschneider

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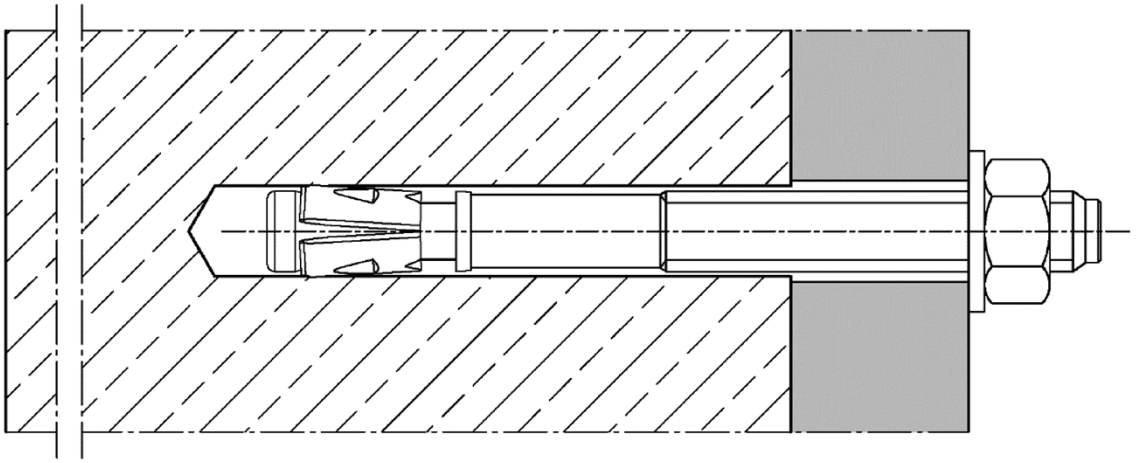
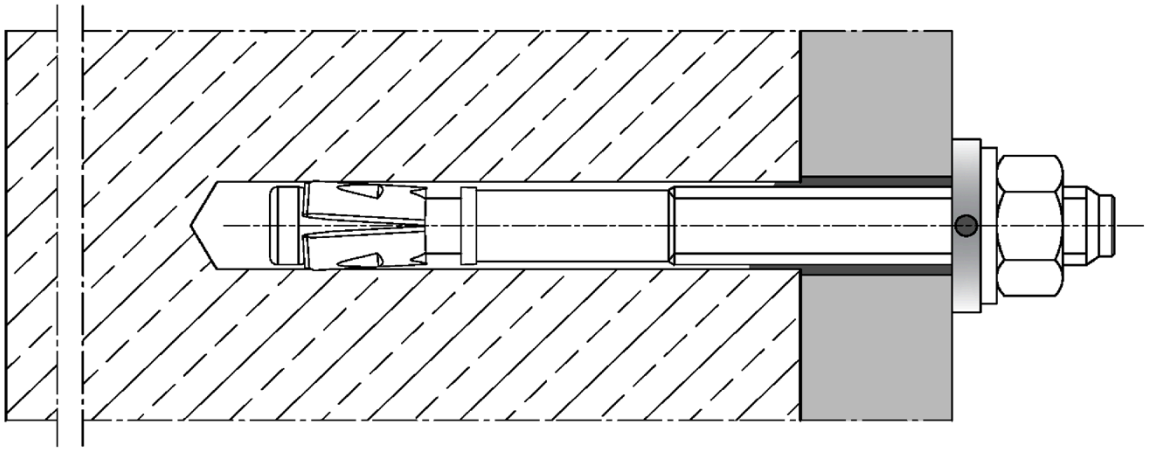
## TILCA Wedge Anchor BOA BZ3, BZ3 A4 and BZ3 HCR

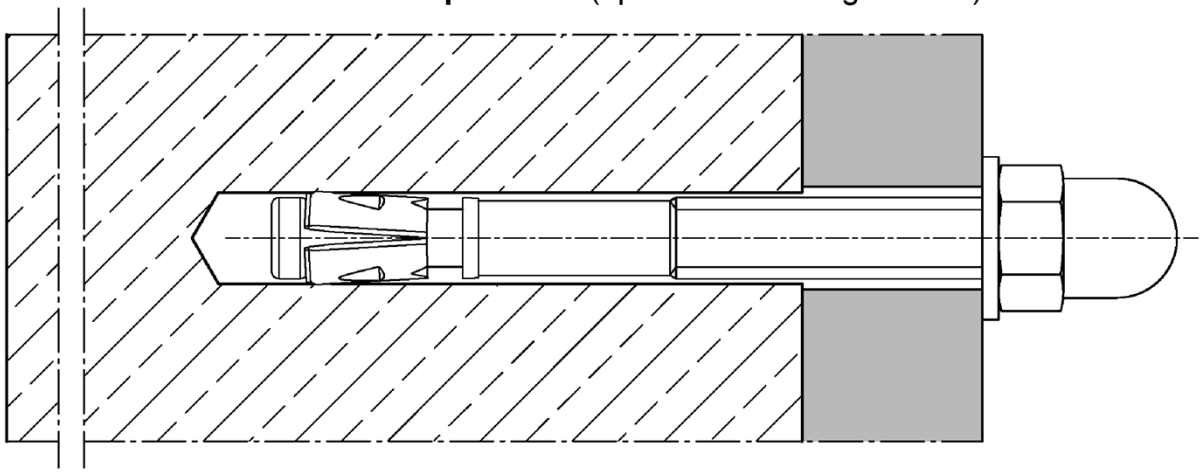
### Installation condition



### Installation condition with filling washer (optional with cap nut)

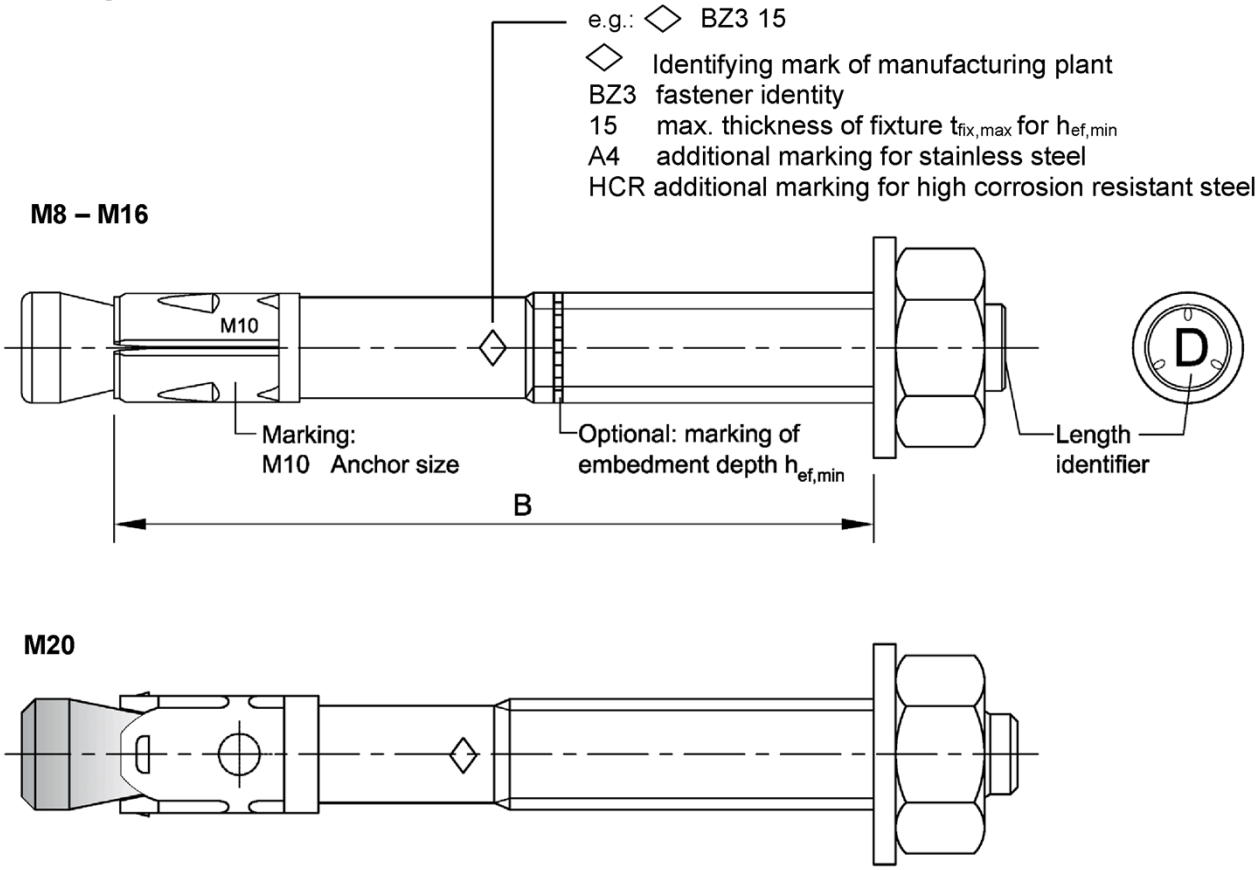


### Installation condition with cap nut HM (optional with filling washer)



| | |
|---|---|
| **TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR** | **Annex A1** |
| **Product description**<br>Product types and installation conditions | |

## Marking




Usable length: $B = h_{ef} + t_{fix}$

$h_{ef}$: (existing) effective anchorage depth

$t_{fix}$: fixture thickness (including e.g. levelling layers or other non-load-bearing layers or additional filling washer)

## Table A1: Length identification

| Length identifier | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Usable length B | ≥ | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 |

| Length identifier | | P | Q | R | S | T | U | V | W | X | Y | Z | AA | BB | CC | DD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Usable length B | ≥ | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 160 | 170 | 180 | 190 | 200 | 210 |

| Length identifier | | EE | FF | GG | HH | II | JJ | KK | LL |
|---|---|---|---|---|---|---|---|---|---|
| Usable length B | ≥ | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 |

Dimensions in mm

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Product description**
Marking

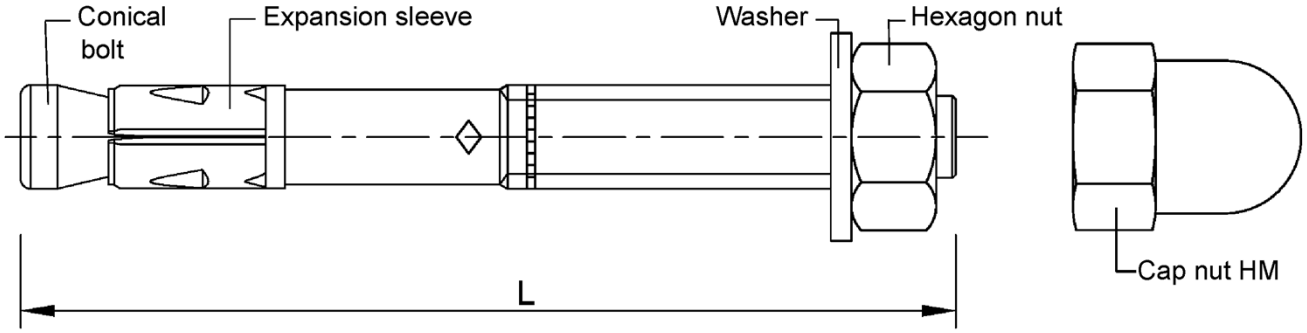
**Annex A2**

## Table A2: Material

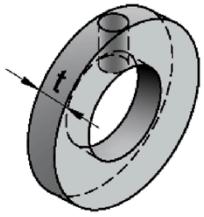
| Part | BZ3 | BZ3 A4 | BZ3 HCR |
|---|---|---|---|
| | **Steel, zinc plated** | **Stainless steel CRC III** | **High corrosion resistant steel CRC V** |
| Conical bolt | Steel, galvanized ≥ 5 µm fracture elongation $A_5$ ≥ 8% | Stainless steel fracture elongation $A_5$ ≥ 8% | High corrosion resistant steel fracture elongation $A_5$ ≥ 8% |
| Expansion sleeve | Stainless steel | Stainless steel | Stainless steel |
| Washer | Steel, galvanized ≥ 5 µm | Stainless steel | High corrosion resistant steel |
| Filling washer VS | | | |
| Hexagon nut | | | |
| Cap nut HM | | | |

## Table A3: Fastener dimensions

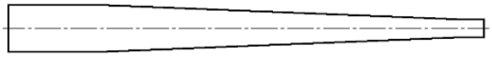
| Fastener size | | | BZ3 / BZ3 A4 / BZ3 HCR | | | | |
|---|---|---|---|---|---|---|---|
| | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Width across hexagon nut / cap nut HM | s | [mm] | 13 | 17 | 19 | 24 | 30 |
| Length of fastener | L | [mm] | $h_{ef}$ + $t_{fix}$ + 18,0 | $h_{ef}$ + $t_{fix}$ + 21,5 | $h_{ef}$ + $t_{fix}$ + 26,0 | $h_{ef}$ + $t_{fix}$ + 33,0 | $h_{ef}$ + $t_{fix}$ + 37,0 |
| Thickness of filling washer VS | t | [mm] | 5 | | | | |




**Filling washer VS**




**Reducing adapter**



**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Annex A3**

**Product description**
Material and dimensions

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## Specifications of intended use

| Wedge Anchor | BZ3 / BZ3 A4 / BZ3 HCR | | | | |
|---|---|---|---|---|---|
| | M8 | M10 | M12 | M16 | M20 |
| 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 | 90 mm to 140 mm |

**Base materials:**

- For all anchor sizes: compacted reinforced or unreinforced normal weight concrete, without fibres according to EN 206:2013+A2:2021
- Cracked or uncracked concrete
- Strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021

**Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions: all materials
- For all other conditions corresponding to corrosion resistance classes CRC according to EN 1993-1-4:2006 + A1:2015: stainless steel according to Annex A3, Table A2 of this ETA

**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.

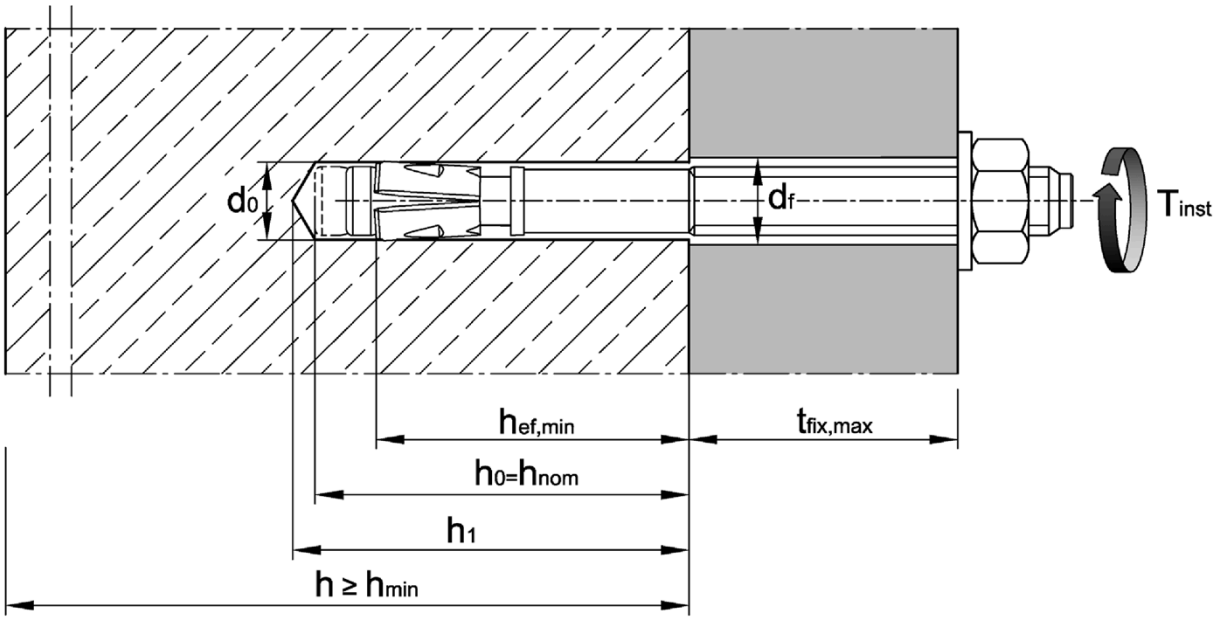
| TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR | Annex B1 |
|---|---|
| **Intended use**<br>Specifications | |

## Table B1: Installation parameters

| Anchor size | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | M8 | M10 | M12 | M16 | M20 |
| Nominal drill hole diameter | | $d_0$ | [mm] | 8 | 10 | 12 | 16 | 20 |
| Cutting diameter of drill bit | | $d_{cut} \leq$ | [mm] | 8,45 | 10,45 | 12,5 | 16,5 | 20,55 |
| Minimum effective anchorage depth | | $h_{ef,min}$ | [mm] | 35 | 40 | 50 | 65 | 90 |
| Maximum effective anchorage depth | | $h_{ef,max}$ | [mm] | 90 | 100 | 125 | 160 | 140 |
| Depth of drill hole | $h_{nom} = h_0 \geq$ | | [mm] | $h_{ef}$ + 8 | $h_{ef}$ + 9 | $h_{ef}$ + 10 | $h_{ef}$ + 14 | $h_{ef}$ + 14 ($h_{ef}$ + 28)[1] |
| | $h_1 \geq$ | | [mm] | $h_{ef}$ + 10 | $h_{ef}$ + 11 | $h_{ef}$ + 13 | $h_{ef}$ + 17 | $h_{ef}$ + 17 ($h_{ef}$ + 31)[1] |
| Diameter of clearance hole in the fixture [2] | | $d_f \leq$ | [mm] | 9 | 12 | 14 | 18 | 22 |
| Projection after anchor has been inserted for installing with cap nut HM (acc. to Annex B7, Figure 3) | | C | [mm] | 10,5 | 12,5 | 16,0 | 19,5 | 23,0 |
| Installation torque | BZ3 | $T_{inst}$ | [Nm] | 15 | 40 | 60 | 110 | 160 |
| | BZ3 A4 / HCR | $T_{inst}$ | [Nm] | 15 | 40 | 55 | 100 | 200 |

[1] Increased drill hole depth for hammer drilling without borehole cleaning.

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




**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Intended use**
Installation parameters

**Annex B2**

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

| Anchor size | | | BZ3 / BZ3 A4 / BZ3 HCR | | | | |
|---|---|---|---|---|---|---|---|
| | | | M8 | M10 | M12 | M16 | M20 |
| Minimum member thickness depending on $h_{ef}$ | $h_{min} \geq$ | [mm] | max (1,5·$h_{ef}$ ; 80) | | max (1,5·$h_{ef}$; 100) | max (1,5·$h_{ef}$; 120) | max (1,5·$h_{ef}$; 150) |
| **Minimum edge distances and spacings** | | | | | | | |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 55 | 65 | 90 |
| | for s ≥ | [mm] | see Table B4 | | | | |
| Minimum spacings | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 | 95 |
| | 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:** | | | | | | | |
| $A_{sp,rqd} \leq A_{sp,ef}$<br>Required splitting area $A_{sp,rqd}$ 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 | | | | BZ3 / BZ3 A4 / BZ3 HCR | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | M8 | M10 | M12 | M16 | M20 |
| 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] | $\frac{N^0_{Rk,sp} - 2{,}573}{0{,}000436}$ | $\frac{N^0_{Rk,sp} + 2{,}040}{0{,}000693}$ | $\frac{N^0_{Rk,sp} + 3{,}685}{0{,}000692}$ | $\frac{N^0_{Rk,sp} + 3{,}738}{0{,}000875}$ | $\frac{N^0_{Rk,sp} + 2{,}423}{0{,}000453}$ |
| | BZ3 A4<br>BZ3 HCR | $A_{sp}$ | [mm²] | $\frac{N^0_{Rk,sp} + 4{,}177}{0{,}000862}$ | $\frac{N^0_{Rk,sp} + 7{,}235}{0{,}000967}$ | $\frac{N^0_{Rk,sp} + 7{,}847}{0{,}000951}$ | $\frac{N^0_{Rk,sp} + 11{,}41}{0{,}000742}$ | $\frac{N^0_{Rk,sp} + 2{,}423}{0{,}000453}$ |

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

| | |
|---|---|
| **TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR** | **Annex B3** |
| **Intended use**<br>Minimum spacings and edge distances<br>Required area and applicable concrete thickness | |

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

| **Anchor size** | | | | **BZ3 / BZ3 A4 / BZ3 HCR** | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| **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:** $A_{sp,rqd} \leq A_{sp,ef}$ | | | | | | | | |
| **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 **$s \geq 3 \cdot c$** | | | | | | | | |
| Idealized splitting area | | $A_{sp,ef}$ | [mm²] | $(6 \cdot c) \cdot (1{,}5 \cdot c + h_{ef})$ | | | | |
| Anchor group ($s < 3 \cdot c$) | | | | | | | | |
| Idealized splitting area | | $A_{sp,ef}$ | [mm²] | $(3 \cdot c + s) \cdot (1{,}5 \cdot c + h_{ef})$ | | | | |
| **Member thickness: $h \leq h_{ef} + 1{,}5 \cdot c$** | | | | | | | | |
| Single anchor or anchor group with **$s \geq 3 \cdot c$** | | | | | | | | |
| Idealized splitting area | | $A_{sp,ef}$ | [mm²] | $(6 \cdot c) \cdot h$ | | | | |
| Anchor group ($s < 3 \cdot c$) | | | | | | | | |
| Idealized splitting area | | $A_{sp,ef}$ | [mm²] | $(3 \cdot c + s) \cdot h$ | | | | |
| **Required splitting area $A_{sp,rqd}$** | | | | | | | | |
| BZ3 | cracked concrete | $A_{sp,rqd}$ | [mm²] | 13 900 | 23 700 | 31 500 | 42 300 | 91 250 |
| | uncracked concrete | $A_{sp,rqd}$ | [mm²] | 22 500 | 34 700 | 41 300 | 50 200 | 110 000 |
| BZ3 A4 BZ3 HCR | cracked concrete | $A_{sp,rqd}$ | [mm²] | 16 900 | 25 900 | 29 800 | 44 300 | 91 250 |
| | uncracked concrete | $A_{sp,rqd}$ | [mm²] | 19 700 | 35 700 | 35 300 | 54 800 | 110 000 |

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Intended use**
Projected effective area to determine spacings and edge distances

**Annex B4**

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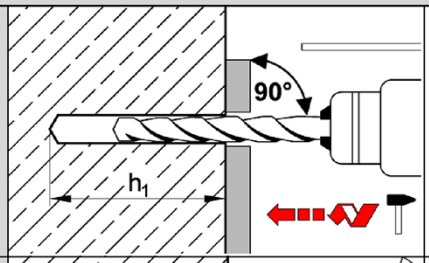
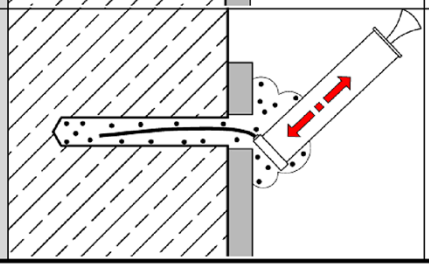
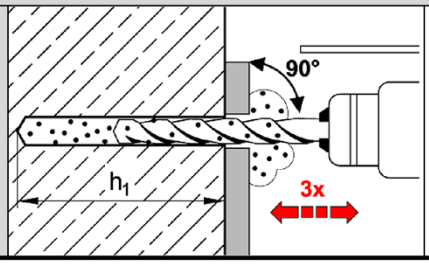
## Installation instructions

### Hole drilling with cleaning

| | | |
|---|---|---|
| 1 |  | **Hammer drilling or vacuum drilling:**<br>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. |

### Hammer drilling without cleaning (M20)

| | | |
|---|---|---|
| 1 |  | When the drill hole depth ($h_1$= $h_{ef}$ +31mm) is reached, move the drill back and forth at least three times with the machine switched on to remove the dust in the drill hole (venting the drill hole). Continue with step 3. |

| | |
|---|---|
| **TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR** | **Annex B5** |
| **Intended use**<br>Installation instructions – hole drilling and cleaning | |

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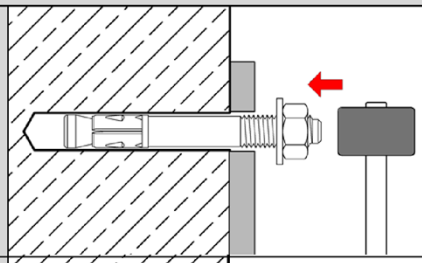
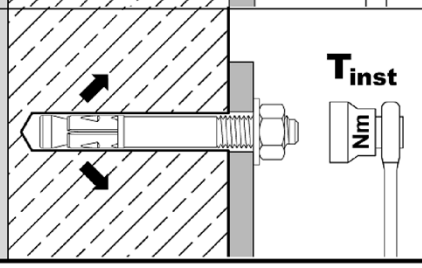
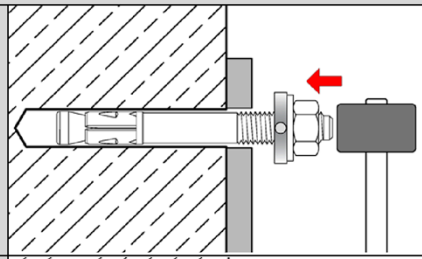
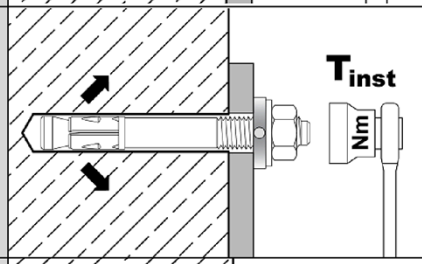
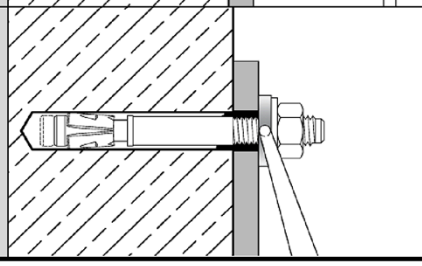
## Installation instructions - continuation

### Insert fastener

| | | |
|---|---|---|
| 3 |  | Drive in fastener. |
| 4 |   | Apply installation torque $T_{inst}$. |

### Insert fastener with filling of annular gap

| | | |
|---|---|---|
| 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. |

| | |
|---|---|
| **TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR** | **Annex B6** |
| **Intended Use**<br>Installation instructions - set fastener | |

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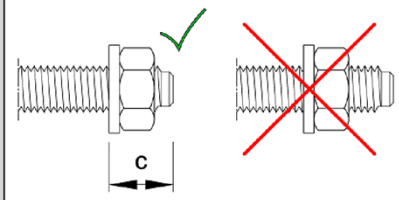
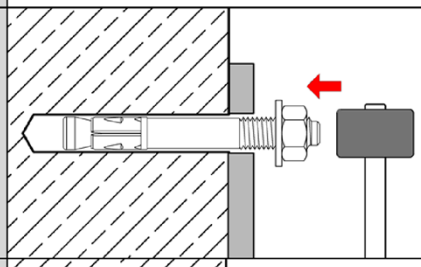
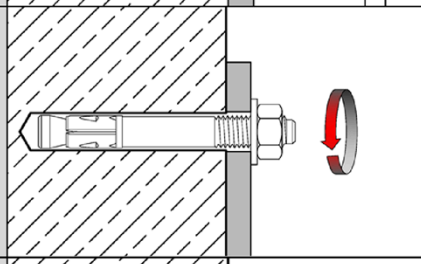
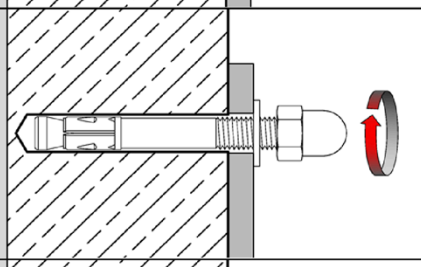
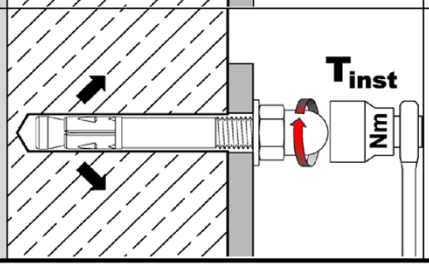
## **Installation instruction** – continuation

| **Install fastener with cap nut HM** | | |
|---|---|---|
| 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 HM. |
| 7 |  | Apply installation torque $T_{inst}$. |

| | |
|---|---|
| **TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR** | **Annex B7** |
| **Product description**<br>Installation instruction – set fastener with cap nut | |

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

| **Fastener size** | | | **BZ3** | | | | |
|---|---|---|---|---|---|---|---|
| | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | |
| **Steel failure** | | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 19,8 | 30,4 | 44,9 | 79,3 | 126,2 |
| 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 | 45 |
| Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25) | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,439}$ | $\left(\frac{f_{ck}}{20}\right)^{0,265}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | $\left(\frac{f_{ck}}{20}\right)^{0,339}$ | $\left(\frac{f_{ck}}{20}\right)^{0,338}$ |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p,ucr}$ | [kN] | 14 | 24 | 30 | 50 | 55 |
| Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25) | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,489}$ | $\left(\frac{f_{ck}}{20}\right)^{0,448}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | $\left(\frac{f_{ck}}{20}\right)^{0,203}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |
| **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] | $min\left(\frac{A_{sp}+0,8\cdot(h_{sp}-h_{ef})^2}{(3,41\cdot h_{sp}-0,59\cdot h_{ef})};\frac{A_{sp}}{h_{sp}\cdot\sqrt{8}}\right) \geq 1,5\cdot h_{ef}$ | | | | |
| Characteristic spacing | $s_{cr,sp}$ | [mm] | 2 · $c_{cr,sp}$ | | | | |
| Factor | $\psi_{h,sp}$ | [-] | 1,0 | | | | |
| **Concrete cone failure** | | | | | | | |
| Minimum, effective anchorage depth | $h_{ef,min}$ | [mm] | 35 [1] | 40 | 50 | 65 | 90 |
| Maximum, effective anchorage depth | $h_{ef,max}$ | [mm] | 90 | 100 | 125 | 160 | 140 |
| Characteristic edge distance | $c_{cr,N}$ | [mm] | 1,5 · $h_{ef}$ | | | | |
| Characteristic spacing | $s_{cr,N}$ | [mm] | 2 · $c_{cr,N}$ | | | | |
| Factor — cracked concrete | $k_{cr,N}$ | [-] | 7,7 | | | | |
| Factor — uncracked concrete | $k_{ucr,N}$ | [-] | 11,0 | | | | |

[1] Fastenings with anchorage depth $h_{ef}$ < 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

| **TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR** | **Annex C1** |
|---|---|
| **Performance**<br>Characteristic values for **tension loads, BZ3** (Steel, zinc plated) | |

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## 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** | **M20** |
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | |
| **Steel failure** | | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 19,8 | 30,4 | 44,9 | 74,6 | 126,2 |
| 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 | 45 |
| Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25) | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,488}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | $\left(\frac{f_{ck}}{20}\right)^{0,435}$ | $\left(\frac{f_{ck}}{20}\right)^{0,350}$ | $\left(\frac{f_{ck}}{20}\right)^{0,338}$ |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p,ucr}$ | [kN] | 20 | 25 | 42 | 50 | 55 |
| Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25) | $\psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,240}$ | $\left(\frac{f_{ck}}{20}\right)^{0,364}$ | $\left(\frac{f_{ck}}{20}\right)^{0,213}$ | $\left(\frac{f_{ck}}{20}\right)^{0,196}$ | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ |
| **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] | $min\left(\frac{A_{sp}+0,8\cdot(h_{sp}-h_{ef})^2}{(3,41\cdot h_{sp}-0,59\cdot h_{ef})};\frac{A_{sp}}{h_{sp}\cdot\sqrt{8}}\right) \geq 1,5\cdot h_{ef}$ | | | | |
| Characteristic spacing | $s_{cr,sp}$ | [mm] | 2 · $c_{cr,sp}$ | | | | |
| Factor | $\psi_{h,sp}$ | [-] | 1,0 | | | | |
| **Concrete cone failure** | | | | | | | |
| Minimum, effective anchorage depth | $h_{ef,min}$ | [mm] | 35 [1] | 40 | 50 | 65 | 90 |
| Maximum, effective anchorage depth | $h_{ef,max}$ | [mm] | 90 | 100 | 125 | 160 | 140 |
| Characteristic edge distance | $c_{cr,N}$ | [mm] | 1,5 · $h_{ef}$ | | | | |
| Characteristic spacing | $s_{cr,N}$ | [mm] | 2 · $c_{cr,N}$ | | | | |
| 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

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

| **Fastener size** | | | | **BZ3 / BZ3 A4 / BZ3 HCR** | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | |
| **Steel failure <u>without</u> lever arm** | | | | | | | | |
| Characteristic resistance – **<u>unfilled</u>** annular gap | BZ3 | $V^0_{Rk,s}$ | [kN] | 15,7 | 26,8 | 38,3 | 60,0 | 83,8 |
| | BZ3 A4 / HCR | $V^0_{Rk,s}$ | [kN] | 16,8 | 27,8 | 39,8 | 69,5 | 108,5 |
| Characteristic resistance – **<u>filled</u>** annular gap | BZ3 | $V^0_{Rk,s}$ | [kN] | 17,3 | 26,7 | 38,6 | 60,6 | 86,1 |
| | BZ3 A4 / HCR | $V^0_{Rk,s}$ | [kN] | 16,8 | 27,8 | 44,9 | 80,1 | 108,5 |
| 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 | 412 |
| | BZ3 A4 / HCR | $M^0_{Rk,s}$ | [Nm] | 27 | 55 | 99 | 223 | 390 |
| 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 | 3,3 |
| | BZ3 A4 / HCR | $k_8$ | [-] | 2,7 | 2,8 | 3,3 | 3,4 | 3,3 |
| **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 | 20 |

[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.

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

| **Fastener size** | | | | **BZ3 / BZ3 A4 / BZ3 HCR** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **M8** | | **M10** | | **M12** | | **M16** | | **M20** | |
| Effective anchorage depth | | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 | 100 |
| **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 | | 126,2 | |
| | BZ3 A4 / HCR | $N_{Rk,s,C1}$ | [kN] | 19,8 | | 30,4 | | 44,9 | | 74,6 | | 126,2 | |
| **Pull-out** | | | | | | | | | | | | | |
| Characteristic resistance | BZ3 | $N_{Rk,p,C1}$ | [kN] | 9,1 | | 15,0 | | 22,0 | | 30,0 | | 45,1 | |
| | BZ3 A4 / HCR | $N_{Rk,p,C1}$ | [kN] | 9,0 | | 17,0 | | 22,0 | | 35,0 | | 45,1 | |
| **Shear load** | | | | | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | | | | | |
| Characteristic resistance - **unfilled** annular gap | BZ3 | $V_{Rk,s,C1}$ | [kN] | 11,7 | 13,4 | 22,5 | 24,4 | 30,0 | 33,8 | 48,8 | 52,3 | 83,8 | |
| | BZ3 A4 / HCR | $V_{Rk,s,C1}$ | [kN] | 11,0 | 12,7 | 20,6 | 22,2 | 33,2 | 33,2 | 61,1 | 64,3 | 108,5 | |
| Characteristic resistance - **filled** annular gap | BZ3 | $V_{Rk,s,C1}$ | [kN] | 14,0 | 14,7 | 24,1 | 24,4 | 37,0 | 38,6 | 60,2 | 60,2 | 86,1 | |
| | BZ3 A4 / HCR | $V_{Rk,s,C1}$ | [kN] | 12,6 | 16,8 | 24,5 | 27,5 | 36,7 | 39,8 | 67,7 | 74,2 | 108,5 | |
| Factor for anchorages | **unfilled** annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | | | | | | |
| | **filled** annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | | | | | | |

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

| **Fastener size** | | | | **BZ3 / BZ3 A4 / BZ3 HCR** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **M8** | | **M10** | | **M12** | | **M16** | | **M20** | | |
| Effective anchorage depth | | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 | 100 | 140 |
| **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 | | 126,2 | | |
| | BZ3 A4 / HCR | $N_{Rk,s,C2}$ | [kN] | 19,8 | | 30,4 | | 44,9 | | 74,6 | | 126,2 | | |
| **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 | 35,1 | 37,6 | 42,9 |
| | BZ3 A4 / HCR | $N_{Rk,p,C2}$ | [kN] | 2,3 | 3,2 | 5,0 | 7,7 | 8,0 | 13,8 | 19,0 | 29,4 | 35,1 | 37,6 | 42,9 |
| **Shear load** | | | | | | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | | | | | | |
| Characteristic resistance - **unfilled** annular gap | BZ3 | $V_{Rk,s,C2}$ | [kN] | 7,3 | 11,3 | 15,4 | 19,0 | 18,3 | 28,0 | 39,4 | 43,3 | 69,0 | | |
| | BZ3 A4 / HCR | $V_{Rk,s,C2}$ | [kN] | 7,5 | 8,6 | 12,5 | 15,9 | 22,4 | 25,6 | 42,7 | 46,1 | 88,9 | | |
| Characteristic resistance - **filled** annular gap | BZ3 | $V_{Rk,s,C2}$ | [kN] | 9,7 | 10,8 | 17,7 | 19,9 | 27,6 | 28,9 | 46,0 | 48,8 | 73,3 | | |
| | BZ3 A4 / HCR | $V_{Rk,s,C2}$ | [kN] | 9,4 | 9,7 | 16,5 | 17,1 | 24,5 | 28,5 | 47,4 | 47,4 | 88,9 | | |
| Factor for anchorages | **unfilled** annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | | | | | | | |
| | **filled** annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | | | | | | | |

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Performance**
Characteristic resistance for **seismic loading,** performance category **C2**

**Annex C5**

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

| **Fastener size** | | | | **BZ3** | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| **Tension load** | | | | | | | | |
| **Steel failure** | | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 1,2 | 2,6 | 4,6 | 7,7 | 9,4 |
| | R60 | | | 1,0 | 1,9 | 3,3 | 5,6 | 8,2 |
| | R90 | | | 0,7 | 1,3 | 2,1 | 3,5 | 6,9 |
| | R120 | | | 0,6 | 1,0 | 1,5 | 2,5 | 6,3 |
| **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 | 11,0 |
| | R60 | | | 2,7 | 5,1 | 8,5 | 14,2 | 10,6 |
| | R90 | | | 1,4 | 2,7 | 4,6 | 7,7 | 10,2 |
| | R120 | | | 0,8 | 1,6 | 2,7 | 4,5 | 10,0 |
| **Steel failure <u>with</u> lever arm** | | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 4,1 | 9,6 | 19,1 | 43,8 | 29,1 |
| | R60 | | | 2,8 | 6,6 | 13,1 | 30,1 | 28,0 |
| | R90 | | | 1,5 | 3,5 | 7,2 | 16,4 | 26,9 |
| | R120 | | | 0,8 | 2,0 | 4,2 | 9,6 | 26,3 |

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

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**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** | **M20** |
| **Tension load** | | | | | | | | |
| **Steel failure** | | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 4,0 | 6,9 | 11,0 | 18,1 | 36,9 |
| | R60 | | | 2,9 | 5,0 | 8,0 | 13,1 | 27,4 |
| | R90 | | | 1,8 | 3,1 | 4,9 | 8,1 | 17,9 |
| | R120 | | | 1,2 | 2,1 | 3,4 | 5,6 | 13,1 |
| **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 | 73,5 |
| | R60 | | | 6,2 | 12,6 | 22,6 | 37,1 | 51,8 |
| | R90 | | | 3,9 | 7,5 | 13,1 | 21,5 | 30,1 |
| | R120 | | | 2,8 | 5,0 | 8,4 | 13,8 | 19,2 |
| **Steel failure <u>with</u> lever arm** | | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 8,7 | 22,7 | 49,8 | 111,5 | 194,7 |
| | R60 | | | 6,3 | 16,2 | 35,1 | 78,6 | 137,2 |
| | R90 | | | 4,0 | 9,7 | 20,4 | 45,6 | 79,7 |
| | R120 | | | 2,8 | 6,5 | 13,0 | 29,2 | 50,9 |

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

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Performance**
Characteristic values under **fire exposure, BZ3 A4** and **BZ3 HCR**

**Annex C7**

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

| **Fastener size** | | | **BZ3** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | | **M10** | | **M12** | | **M16** | | **M20** | | |
| **Displacements under static or quasi-static action**<br>$\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load<br>$\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$ | | | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 35 | | 40 | | 50 | | 65 | | 90 | | |
| **Cracked concrete** | | | | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{-factor}}$ | [mm/kN] | 0,13 | | 0,05 | | 0,04 | | 0,03 | | 0,04 | | |
| | $\delta_{N\infty\text{-factor}}$ | [mm/kN] | 0,29 | | 0,20 | | 0,15 | | 0,11 | | 0,05 | | |
| **Uncracked concrete** | | | | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{- factor}}$ | [mm/kN] | 0,03 | | 0,01 | | 0,004 | | 0,005 | | 0,02 | | |
| | $\delta_{N\infty\text{- factor}}$ | [mm/kN] | 0,03 | | 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 | 90 | 100 | 140 |
| Displacements for DLS | $\delta_{N, C2(DLS)}$ | [mm] | 3,9 | 4,9 | 2,8 | 4,7 | 2,4 | 4,2 | 2,5 | 4,5 | 4,2 | 4,5 | 5,1 |
| Displacements for ULS | $\delta_{N, C2(ULS)}$ | [mm] | 11,3 | 14,3 | 9,4 | 16,1 | 7,3 | 12,9 | 7,2 | 12,8 | 11,7 | 12,5 | 14,3 |

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

| **Fastener size** | | | **BZ3 A4 / BZ3 HCR** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | | **M10** | | **M12** | | **M16** | | **M20** | | |
| **Displacements under static or quasi-static action**<br>$\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load<br>$\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$ | | | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 35 | | 40 | | 50 | | 65 | | 90 | | |
| **Cracked concrete** | | | | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{-factor}}$ | [mm/kN] | 0,11 | | 0,06 | | 0,05 | | 0,02 | | 0,04 | | |
| | $\delta_{N\infty\text{-factor}}$ | [mm/kN] | 0,27 | | 0,17 | | 0,16 | | 0,08 | | 0,05 | | |
| **Uncracked concrete** | | | | | | | | | | | | | |
| Factor for displacement | $\delta_{N0\text{- factor}}$ | [mm/kN] | 0,02 | | 0,00 | | 0,001 | | 0,00 | | 0,02 | | |
| | $\delta_{N\infty\text{- factor}}$ | [mm/kN] | 0,05 | | 0,05 | | 0,05 | | 0,05 | | 0,03 | | |
| **Displacement under seismic action C2** | | | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 | 100 | 140 |
| Displacements for DLS | $\delta_{N, C2(DLS)}$ | [mm] | 2,0 | 2,9 | 2,6 | 4,1 | 3,3 | 5,7 | 3,3 | 5,1 | 4,2 | 4,5 | 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 | 11,7 | 12,5 | 14,3 |

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Performance**
Displacements under tension load

**Annex C8**

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

| **Fastener size** | | | **BZ3** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | | **M10** | | **M12** | | **M16** | | **M20** |
| **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 | | 90 |
| Factor for displacement **unfilled** annular gap | $\delta_{V0}$- factor | [mm/kN] | 0,15 | | 0,09 | | 0,09 | | 0,07 | | 0,06 |
| | $\delta_{V\infty}$- factor | [mm/kN] | 0,22 | | 0,13 | | 0,14 | | 0,11 | | 0,10 |
| Factor for displacement **filled** annular gap | $\delta_{V0}$- factor | [mm/kN] | 0,01 | | 0,04 | | 0,06 | | 0,04 | | 0,02 |
| | $\delta_{V\infty}$- factor | [mm/kN] | 0,015 | | 0,06 | | 0,09 | | 0,06 | | 0,03 |
| **Displacement under seismic action C2** [1] **unfilled** annular gap | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 |
| Displacements for DLS | $\delta_{V,C2(DLS)}$ | [mm] | 2,8 | 2,7 | 3,0 | 3,1 | 3,4 | 3,7 | 3,4 | 3,8 | 5,1 |
| Displacements for ULS | $\delta_{V,C2(ULS)}$ | [mm] | 5,1 | 5,0 | 5,0 | 5,5 | 6,3 | 9,9 | 6,0 | 9,6 | 9,4 |
| **Displacement under seismic action C2 filled** annular gap | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 |
| Displacements for DLS | $\delta_{V,C2(DLS)}$ | [mm] | 0,5 | 0,4 | 1,4 | 0,9 | 1,4 | 0,7 | 1,4 | 1,2 | 1,3 |
| Displacements for ULS | $\delta_{V,C2(ULS)}$ | [mm] | 1,7 | 1,9 | 5,8 | 4,5 | 4,5 | 3,1 | 5,0 | 3,9 | 5,2 |

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

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Performance**
Displacements under shear load

**Annex C9**

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

| **Fastener size** | | | **BZ3 A4 / BZ3 HCR** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | | **M10** | | **M12** | | **M16** | | **M20** |
| **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 | | 90 |
| Factor for displacement **unfilled** annular gap | $\delta_{V0}$- factor | [mm/kN] | 0,26 | | 0,14 | | 0,12 | | 0,09 | | 0,09 |
| | $\delta_{V\infty}$- factor | [mm/kN] | 0,39 | | 0,20 | | 0,17 | | 0,14 | | 0,13 |
| Factor for displacement **filled** annular gap | $\delta_{V0}$- factor | [mm/kN] | 0,16 | | 0,05 | | 0,05 | | 0,03 | | 0,09 |
| | $\delta_{V\infty}$- factor | [mm/kN] | 0,23 | | 0,08 | | 0,08 | | 0,05 | | 0,13 |
| **Displacement under seismic action C2** [1] **unfilled** annular gap | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 |
| Displacements for DLS | $\delta_{V,C2(DLS)}$ | [mm] | 2,8 | 3,0 | 3,4 | 3,5 | 3,5 | 4,2 | 3,8 | 4,4 | 5,1 |
| Displacements for ULS | $\delta_{V,C2(ULS)}$ | [mm] | 5,2 | 5,1 | 7,0 | 8,4 | 7,5 | 11,8 | 7,8 | 11,1 | 9,4 |
| **Displacement under seismic action C2 filled** annular gap | | | | | | | | | | | |
| Effective anchorage depth | $h_{ef} \geq$ | [mm] | 40 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 90 |
| Displacements for DLS | $\delta_{V,C2(DLS)}$ | [mm] | 0,9 | 0,6 | 1,2 | 0,5 | 1,5 | 1,5 | 1,6 | 1,6 | 4,1 |
| Displacements for ULS | $\delta_{V,C2(ULS)}$ | [mm] | 2,5 | 2,6 | 5,4 | 3,6 | 6,0 | 7,1 | 6,2 | 6,2 | 8,4 |

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

**TILCA Wedge Anchor BOA BZ3 / BZ3 A4 / BZ3 HCR**

**Performance**
Displacements under shear load

**Annex C10**