Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

# European Technical Assessment

# ETA-07/0249 of 6 December 2021

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 | Halfen Wedge Anchor HB-BZ and HB-BZ-IG |
| Product family to which the construction product belongs | Mechanical fastener for use in concrete |
| Manufacturer | Leviat GmbH<br>Liebigstraße 14<br>40764 Langenfeld<br>DEUTSCHLAND |
| Manufacturing plant | Leviat Herstellwerk HB1 |
| This European Technical Assessment contains | 36 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 |
| This version replaces | ETA-07/0249 issued on 18 August 2016 |



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## Specific Part

### 1 Technical description of the product

The Halfen Wedge anchor HB-BZ and HB-BZ-IG 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 following fastener types are covered:

- Anchor type HB-BZ with external thread, washer and hexagon nut, sizes M8 to M27,
- Anchor type HB-BZ-IG S with internal thread, hexagon head nut and washer S-IG, sizes M6 to M12,
- Anchor type HB-BZ-IG SK with internal thread, countersunk head screw and countersunk washer SK-IG, sizes M6 to M12,
- Anchor type HB-BZ-IG B with internal thread, hexagon nut and washer MU-IG, sizes M6 to M12.

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) | HB-BZ see Annex B4, B5, C1 to C4<br>HB-BZ-IG see Annex B8, C11 and C12 |
| Characteristic resistance to shear load (static and quasi-static loading) | HB-BZ see Annex C5<br>HB-BZ-IG see Annex C13 |
| Displacements (static and quasi-static loading) | HB-BZ see Annex C9 and C10<br>HB-BZ-IG see Annex C15 |
| Characteristic resistance and displacements for seismic performance categories C1 and C2 | HB-BZ see Annex C6, C9 and C10<br>HB-BZ-IG No performance assessed |

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

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Class A1 |
| Resistance to fire | HB-BZ see Annex C7 and C8<br>HB-BZ-IG see Annex C14 |

### 3.3 Aspects of durability linked with the Basic Works Requirements

| 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: [96/582/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 6 December 2021 by Deutsches Institut für Bautechnik

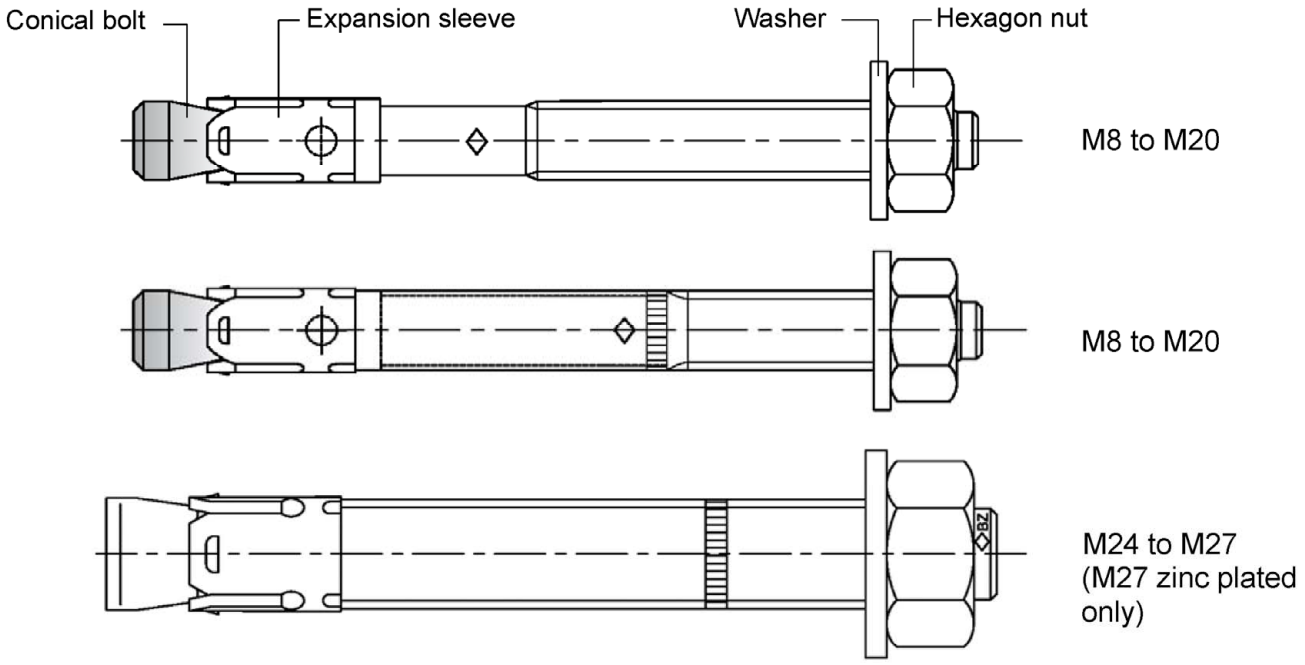
Dipl.-Ing. Beatrix Wittstock
Head of Section

*beglaubigt:*
Baderschneider

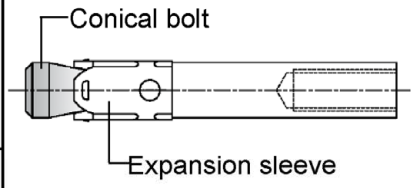
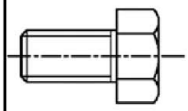
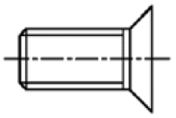
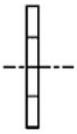
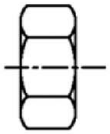
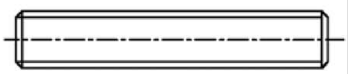
Deutsches Institut für Bautechnik DIBt

| Fastener version | Product description | Intended use | Performance |
|---|---|---|---|
| HB-BZ | Annex A1 - Annex A4 | Annex B1 – Annex B7 | Annex C1 – Annex C10 |
| HB-BZ-IG | Annex A1<br>Annex A5 – Annex A7 | Annex B1 – Annex B2<br>Annex B8 – Annex B10 | Annex C11 – Annex C15 |

## Wedge Anchor HB-BZ




## Wedge Anchor HB-BZ-IG M6 to M12

| Fastener system | | | |
|---|---|---|---|
| HB-BZ-IG S |  |  Washer |  Hexagon head screw |
| HB-BZ-IG SK | |  Countersunk washer |  Countersunk head screw |
| HB-BZ-IG B | | Washer  Hexagon nut  | Commerical standard rod  |

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| Wedge Anchor HB-BZ and HB-BZ-IG | |
|---|---|
| **Product description**<br>Fastener types | **Annex A1** |

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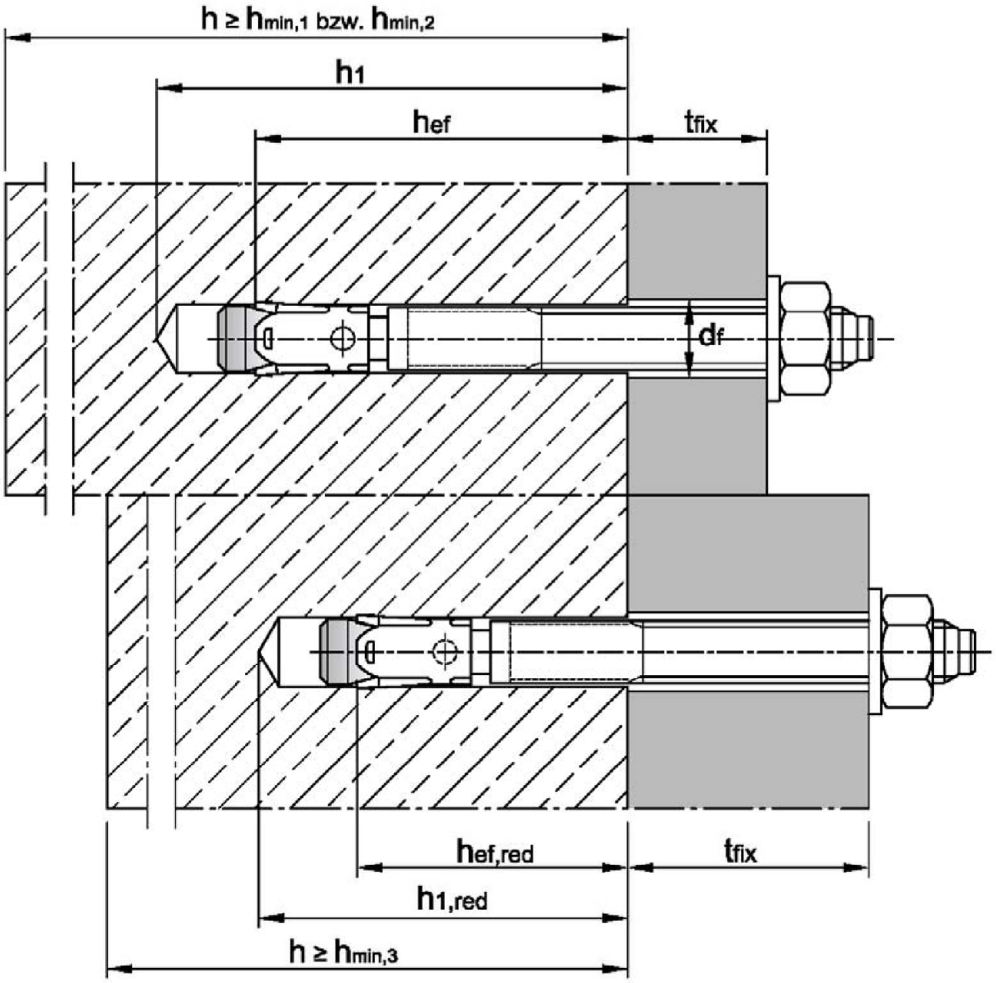
## Intended use Wedge Anchor HB-BZ




| Wedge Anchor HB-BZ | Annex A2 |
|---|---|
| **Product description**<br>Installation situation HB-BZ | |

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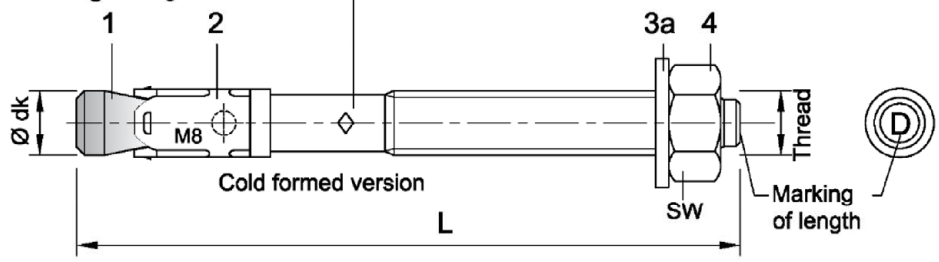
**Fastener size HB-BZ M8 to M20**:

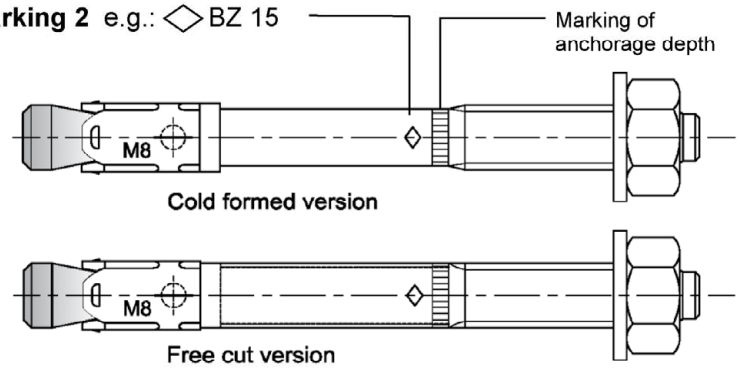
**Marking 1** e.g.: ◇ BZ 15/35




**Marking 1** e.g.: ◇ BZ 15/35

◇ identifying mark of manufacturing plant
BZ fastener identity
15 max. thickness of fixture for $h_{ef}$
35 max. thickness of fixture for $h_{ef,red}$
M8 thread diameter
Additional marking:
A4 stainless steel
HCR high corrosion resistant steel

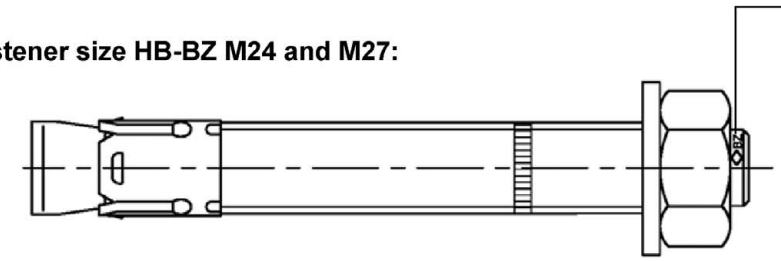
**Marking 2** e.g.: ◇ BZ 15




**Marking 2** e.g.: ◇ BZ 15

◇ identifying mark of manufacturing plant
BZ fastener identity
15 maximum thickness of fixture for $h_{ef}$
M8 thread diameter
Additional marking:
A4 stainless steel
HCR high corrosion resistant steel

**Fastener size HB-BZ M24 and M27:**



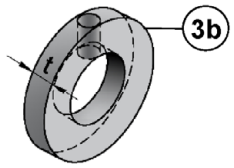
**Marking 3** e.g.: ◇ BZ M24-30

◇ identifying mark of manufacturing plant
BZ fastener identity
M24 thread diameter
30 maximum thickness of fixture
Additional marking:
A4 stainless steel
HCR high corrosion resistant steel

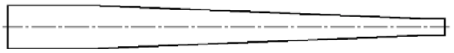
| Marking of length | C (c) | D (d) | E (e) | F (f) | G (g) | H (h) | I (i) | J (j) | K (k) | L (l) | M (m) | N (n) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length of fastener min ≥ | 63,5 | 76,2 | 88,9 | 101,6 | 114,3 | 127,0 | 139,7 | 152,4 | 165,1 | 177,8 | 190,5 | 203,2 |
| Length of fastener max < | 76,2 | 88,9 | 101,6 | 114,3 | 127,0 | 139,7 | 152,4 | 165,1 | 177,8 | 190,5 | 203,2 | 215,9 |

| Marking of length | O (o) | P (p) | Q (q) | R (r) | S (s) | T (t) | U (u) | V (v) | W (w) | X (x) | Y (y) | Z (z) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length of fastener min ≥ | 215,9 | 228,6 | 241,3 | 254,0 | 279,4 | 304,8 | 330,2 | 355,6 | 381,0 | 406,4 | 431,8 | 457,2 |
| Length of fastener max < | 228,6 | 241,3 | 254,0 | 279,4 | 304,8 | 330,2 | 355,6 | 381,0 | 406,4 | 431,8 | 457,2 | 483,0 |

**Filling washer and reducing adapter for filling the annular gap between fastener and fixture**




Thickness of washer for diameter
< M24: t = 5 mm
≥ M24: t = 6 mm



**Wedge Anchor HB-BZ**

**Product description**
Fastener sizes and marking

**Annex A3**

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## Table A1: Fastener dimensions HB-BZ

| Fastener size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 |
|---|---|---|---|---|---|---|---|---|---|
| Conical bolt | | Thread | M8 | M10 | M12 | M16 | M20 | M24 | M27 |
| | | ∅ $d_k$ = | 7,9 | 9,8 | 12,0 | 15,7 | 19,7 | 24 | 28 |
| Length of fastener[1)] | Steel, zinc plated | L | 65 + $t_{fix}$ | 80 + $t_{fix}$ | 96,5+$t_{fix}$ | 118+$t_{fix}$ | 137+$t_{fix}$ | 161+$t_{fix}$ | 178+$t_{fix}$ |
| | A4, HCR | L | 65 + $t_{fix}$ | 80 + $t_{fix}$ | 96,5+$t_{fix}$ | 118+$t_{fix}$ | 137+$t_{fix}$ | 168+$t_{fix}$ | - |
| | reduced anchorage depth | $L_{hef,red}$ | 54 + $t_{fix}$ | 60 + $t_{fix}$ | 76,5+$t_{fix}$ | 98+$t_{fix}$ | - | - | - |
| Thickness of filling washer | | t [mm] | 5 | 5 | 5 | 5 | 5 | 6 | 6 |
| Hexagon nut | | SW | 13 | 17 | 19 | 24 | 30 | 36 | 41 |

[1)] With additional use of filling washer 3b the usable thickness of fixture is reduced by the thickness of filling washer t [mm]

Dimensions in mm

## Table A2: Materials HB-BZ

| No. | Part | HB-BZ | | HB-BZ A4 | HB-BZ HCR |
|---|---|---|---|---|---|
| | | Steel, zinc plated | | Stainless steel A4 (CRC III) | High corrosion resistant steel HCR (CRC V) |
| | | **galvanized** ≥ 5µm | **sherardized** ≥ 45µm | | |
| 1 | Conical bolt | M8 to M20: Cold formed or machined steel, galvanized, cone plastic coated | M8 to M20: Cold formed or machined steel, sherardized, cone plastic coated | M8 to M20: Stainless steel (e.g. 1.4401, 1.4404, 1.4578, 1.4571) EN 10088:2014, cone plastic coated | M8 to M20: High corrosion resistant steel 1.4529 or 1.4565, EN 10088:2014, cone plastic coated |
| | Threaded bolt | M24 and M27: Steel, galvanized | M24 and M27: steel, sherardized | M24: Stainless steel (e.g. 1.4401, 1.4404) EN 10088:2014 | M24: High corrosion resistant steel 1.4529 or 1.4565, EN 10088:2014 |
| | Threaded cone | | M24 and M27: Steel, galvanized | | |
| 2 | Expansion sleeve | M8 to M20: Steel (e.g. 1.4301 or 1.4401) EN 10088:2014, M24 and M27: Steel, zinc plated | M8 to M20: Steel (e.g. 1.4301 or 1.4401) EN 10088:2014, M24 and M27: Steel, zinc plated | Stainless steel (e.g. 1.4401, 1.4404, 1.4571) EN 10088:2014 | Stainless steel (e.g. 1.4401, 1.4404, 1.4571) EN 10088:2014 |
| 3a | Washer | Steel, zinc plated | Steel, zinc plated | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014 | High corrosion resistant steel 1.4529 or 1.4565, EN 10088:2014 |
| 3b | Filling washer | | | | |
| 4 | Hexagon nut | Steel, galvanized, coated | Steel, zinc plated | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014, coated | High corrosion resistant steel 1.4529 or 1.4565, EN 10088:2014, coated |

**Wedge Anchor HB-BZ**

**Product description**
Dimensions and materials

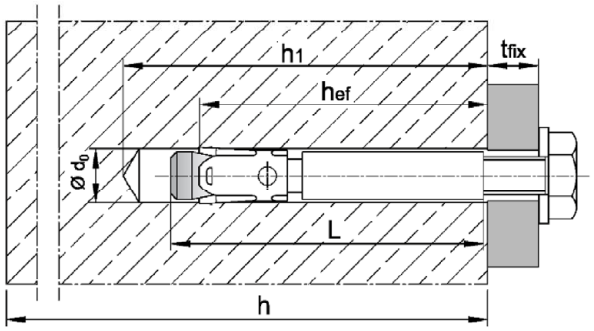
**Annex A4**

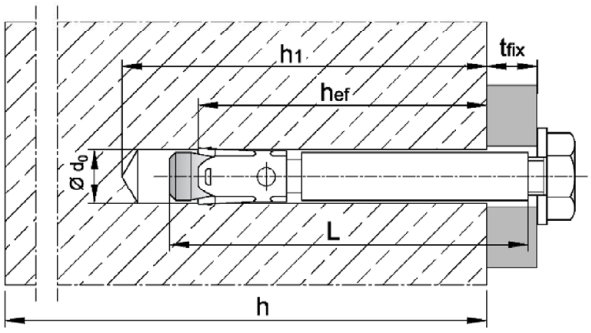
Deutsches Institut für Bautechnik DIBt

## Intended use Wedge Anchor HB-BZ-IG

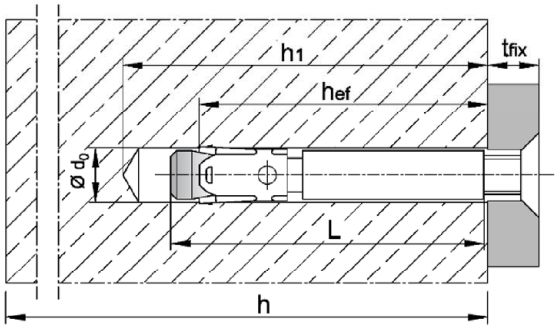
| Pre-setting installation (V) | Through-setting installation (D) |
|---|---|
| Pre-set fastener body, the fixture bears on the screw or thread rod only | The fastener is set through the fixture, the fixture bears on the conical bolt BZ-IG |

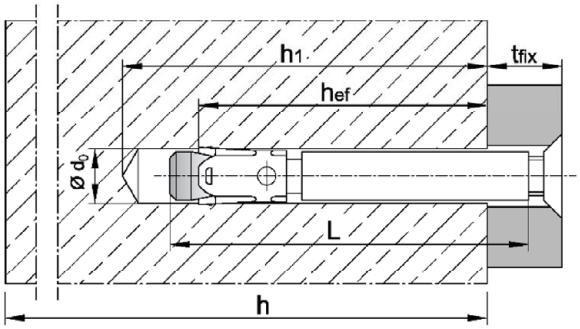
**HB-BZ-IG S** consisting of BZ-IG and S-IG



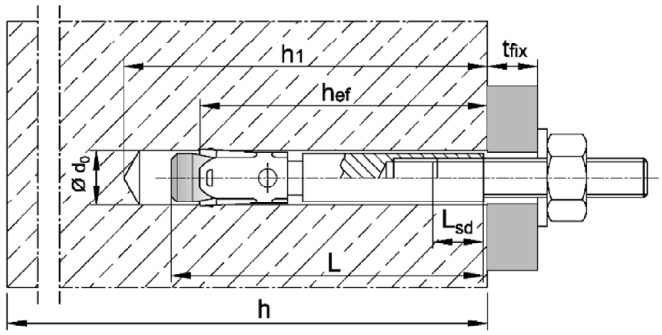



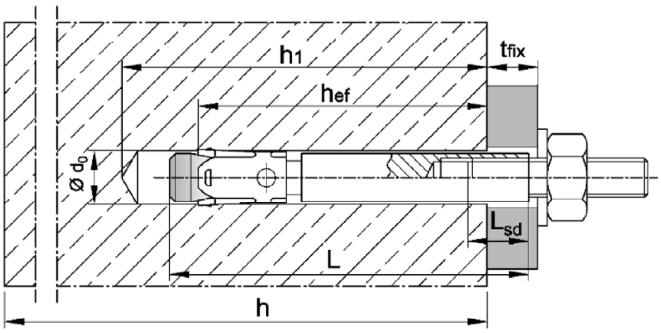

**HB-BZ-IG SK** consisting of BZ-IG and SK-IG



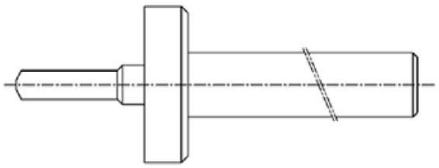




**HB-BZ-IG B** consisting of BZ-IG and MU-IG

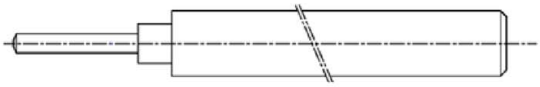



**Setting tool**



BZ-IGS M8 V, BZ-IGS M10 V, BZ-IGS M12 V or BZ-IGS M16 V



BZ-IGS M8 D, BZ-IGS M10 D, BZ-IGS M12 D or BZ-IGS M16 D

**Wedge Anchor HB-BZ-IG**

**Product description**
Installation situation **HB-BZ-IG**

**Annex A5**

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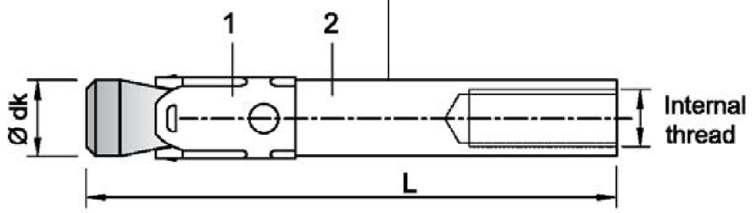
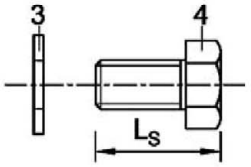
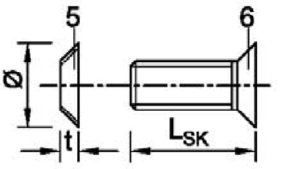
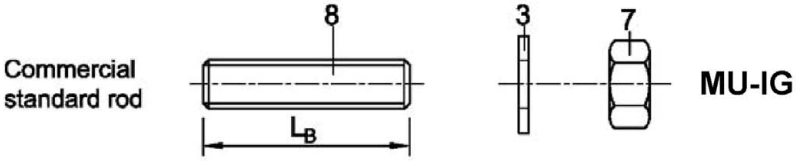
**Marking:** ◇ identifying mark of manufacturing plant
BZ fastener identity
M6 size of internal thread
10 max. thickness of fixture (only Through-setting installation)
Additional marking:
A4 stainless steel
HCR high corrosion resistant steel

e.g.: ◇ BZ M6-10 A4




## Table A3: Fastener dimensions HB-BZ-IG

| No. | Fastener size | | | M6 | M8 | M10 | M12 |
|---|---|---|---|---|---|---|---|
| 1 | Conical bolt with internal thread | | Ø $d_k$ | 7,9 | 9,8 | 11,8 | 15,7 |
| | Pre-setting installation | | L | 50 | 62 | 70 | 86 |
| | Through-setting installation | | L | 50 + $t_{fix}$ | 62 + $t_{fix}$ | 70 + $t_{fix}$ | 86 + $t_{fix}$ |
| 2 | Expansion sleeve | | | see table A4 | | | |
| 3 | Washer | | | see table A4 | | | |
| 4 | Hexagon head screw | width across flats | | 10 | 13 | 17 | 19 |
| | Pre-setting installation | | $L_S$ | $t_{fix}$ + (13 to 21) | $t_{fix}$ + (17 to 23) | $t_{fix}$ + (21 to 25) | $t_{fix}$ + (24 to 29) |
| | Through-setting installation | | $L_S$ | 14 to 20 | 18 to 22 | 20 to 22 | 25 to 28 |
| 5 | Countersunk washer | Ø countersunk | | 17,3 | 21,5 | 25,9 | 30,9 |
| | | | t | 3,9 | 5,0 | 5,7 | 6,7 |
| 6 | Countersunk head screw | | bit size | Torx T30 | Torx T45 (Steel, zinc plated) T40 (Stainless steel A4, HCR) | Hexagon socket 6 mm | Hexagon socket 8 mm |
| | Pre-setting installation | | $L_{SK}$ | $t_{fix}$ + (11 to 19) | $t_{fix}$ + (15 to 21) | $t_{fix}$ + (19 to 23) | $t_{fix}$ + (21 to 27) |
| | Through-setting installation | | $L_{SK}$ | 16 to 20 | 20 to 25 | 25 | 30 |
| 7 | Hexagon nut | width across flats | | 10 | 13 | 17 | 19 |
| 8 | Commercial standard rod[1)] | type V | $L_B \geq$ | $t_{fix}$ + 21 | $t_{fix}$ + 28 | $t_{fix}$ + 34 | $t_{fix}$ + 41 |
| | | type D | $L_B \geq$ | 21 | 28 | 34 | 41 |

[1)] acc. to specifications (Table A4)

Dimensions in mm

**Wedge Anchor HB-BZ-IG**

**Product description**
Fastener parts, marking and dimensions HB-BZ-IG

**Annex A6**

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## Table A4: Materials HB-BZ-IG

| No. | Part | HB-BZ-IG<br>Steel, galvanized ≥ 5 µm acc. to EN ISO 4042:1999 | HB-BZ-IG A4<br>Stainless steel A4 (CRC III) | HB-BZ-IG HCR<br>High corrosion resistant steel HCR (CRC V) |
|---|---|---|---|---|
| 1 | Conical bolt BZ-IG with internal thread | Machined steel, Cone plastic coated | Stainless steel (e.g. 1.4401, 1.4404, 1.4571) EN 10088:2014, Cone plastic coated | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014, Cone plastic coated |
| 2 | Expansion sleeve BZ-IG | Stainless steel (e.g. 1.4301, 1.4401) EN 10088:2014 | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014 | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014 |
| 3 | Washer S-IG / MU-IG | Steel, galvanized | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014 | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014 |
| 4 | Hexagon head screw S-IG | Steel, galvanized, coated | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014, coated | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014, coated |
| 5 | Countersunk washer SK-IG | Steel, galvanized | Stainless steel (e.g. 1.4401, 1.4404, 1.4571) EN 10088:2014, zinc plated, coated | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014, zinc plated, coated |
| 6 | Countersunk head screw SK-IG | Steel, galvanized coated | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014, coated | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014, coated |
| 7 | Hexagon nut MU-IG | Steel, galvanized coated | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014, coated | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014, coated |
| 8 | Commercial standard rod | Property class 8.8, EN ISO 898-1:2013 $A_5$ > 8 % ductile | Stainless steel (e.g. 1.4401, 1.4571) EN 10088:2014, property class 70, EN ISO 3506:2009 | High corrosion resistant steel, 1.4529, 1.4565, EN 10088:2014, property class 70, EN ISO 3506:2009 |



**Wedge Anchor HB-BZ-IG**

**Product description**
Materials HB-BZ-IG

**Annex A7**

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## Specifications of intended use

| **Wedge Anchor HB-BZ** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Standard anchorage depth | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
| Steel, galvanized | ✓ | | | | | | |
| Steel, sherardized | ✓ | | | | | | |
| Stainless steel A4 and high corrosion resistant steel HCR | ✓ | | | | | | - |
| Static or quasi-static action | ✓ | | | | | | |
| Fire exposure | ✓ | | | | | | |
| Seismic action (C1 and C2) [1)] | ✓ | | | | | - | - |

| Reduced anchorage depth [1)] | **M8** | **M10** | **M12** | **M16** |
|---|---|---|---|---|
| Steel, galvanized | ✓ | | | |
| Steel, sherardized | ✓ | | | |
| Stainless steel A4 and high corrosion resistant steel HCR | ✓ | | | |
| Static or quasi-static action | ✓ | | | |
| Fire exposure | ✓ | | | |
| Seismic action (C1 and C2) | - | | | |

[1)] only cold formed anchors acc. to Annex A3

| **Wedge Anchor HB-BZ-IG** | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|
| Steel, galvanized | ✓ | | | |
| Stainless steel A4 and high corrosion resistant steel HCR | ✓ | | | |
| Static or quasi-static action | ✓ | | | |
| Fire exposure | ✓ | | | |
| Seismic action (C1 and C2) | - | | | |

**Base materials:**

- Compacted, reinforced or unreinforced normal weight concrete (without fibers) according to EN 206:2013 + A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016
- Cracked or uncracked concrete

**Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions: all materials
- For all other conditions: Intended use of materials according to Annex A4, Table A2 or Annex A7, Table A4 corresponding corrosion resistance classes CRC according to EN 1993-1-4:2006+A1:2015

| **Wedge Anchor HB-BZ and HB-BZ-IG** | **Annex B1** |
|---|---|
| **Intended use**<br>Specifications | |

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## Specifications of intended use

**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.).
- Dimensioning of fasteners under static or quasi-static action, seismic action or fire exposure according to EN 1992-4:2018 in conjunction with Technical Report TR 055, Edition February 2018

**Installation:**

- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- 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
- Optionally, the annular gap between fixture and stud of the HB-BZ can be filled to reduce the clearance hole. For this purpose, the filling washer (3b) must be used in addition to the supplied washer (3a). For filling use high-strength mortar with compressive strength ≥ 40 N/mm² (e.g. Injection System HB-VMZ or Injection System HB-VMU plus for concrete)
- 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



| Wedge Anchor HB-BZ and HB-BZ-IG | |
|---|---|
| **Intended use**<br>Specifications | **Annex B2** |

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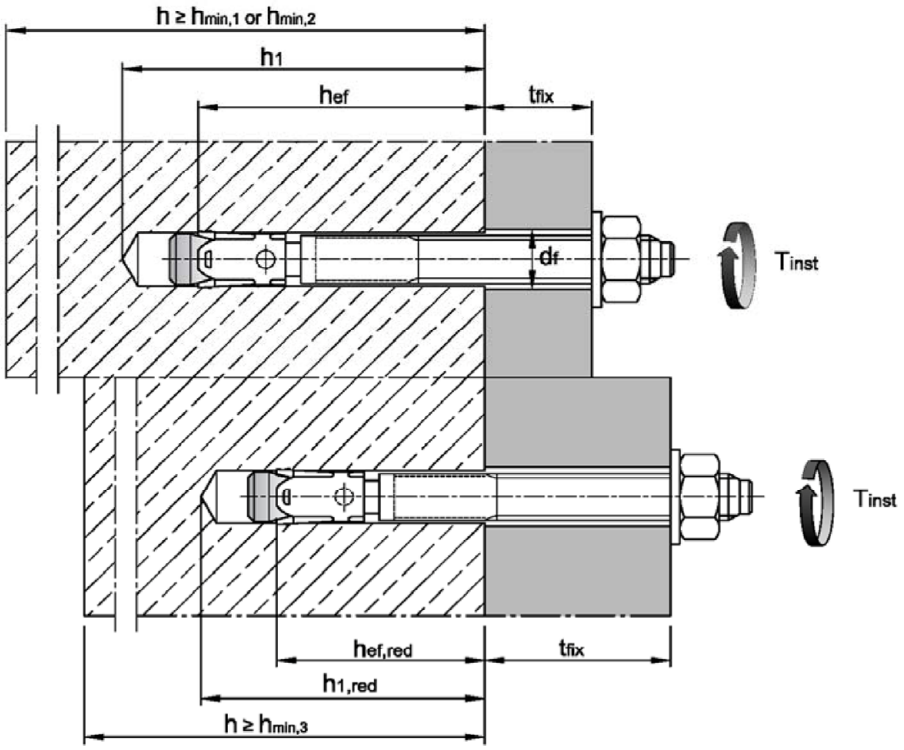
## Table B1: Installation parameters, HB-BZ

| Fastener size | | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | | $d_0$ | [mm] | 8 | 10 | 12 | 16 | 20 | 24 | 28 |
| Cutting diameter of drill bit | | $d_{cut} \leq$ | [mm] | 8,45 | 10,45 | 12,5 | 16,5 | 20,55 | 24,55 | 28,55 |
| Installation torque | Steel, galvanized | $T_{inst}$ | [Nm] | 20 | 25 | 45 | 90 | 160 | 200 | 300 |
| | Steel, sherardized | $T_{inst}$ | [Nm] | 16 | 22 | 40 | 90 | 160 | 260 | 300 |
| | Stainless steel A4, HCR | $T_{inst}$ | [Nm] | 20 | 35 | 50 | 110 | 200 | 290 | - |
| Diameter of clearance hole in the fixture | | $d_f \leq$ | [mm] | 9 | 12 | 14 | 18 | 22 | 26 | 30 |
| **Standard anchorage depth** | | | | | | | | | | |
| Depth of drill hole | Steel, zinc plated | $h_1 \geq$ | [mm] | 60 | 75 | 90 | 110 | 125 | 145 | 160 |
| | Stainless steel A4, HCR | $h_1 \geq$ | [mm] | 60 | 75 | 90 | 110 | 125 | 155 | - |
| Effective anchorage depth | Steel, zinc plated | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| | Stainless steel A4, HCR | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 | - |
| **Reduced anchorage depth** | | | | | | | | | | |
| Depth of drill hole | | $h_{1,red} \geq$ | [mm] | 49 | 55 | 70 | 90 | - | - | - |
| Reduced effective anchorage depth | | $h_{ef,red}$ | [mm] | 35 | 40 | 50 | 65 | | | |




**Wedge Anchor HB-BZ**

**Intended use**
Installation parameters

**Annex B3**

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## Table B2: Minimum **spacings** and **edge distances, standard anchorage depth**, HB-BZ

| **Fastener size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|
| **Standard thickness of concrete member** | | | | | | | | | |
| **Steel zinc plated** | | | | | | | | | |
| Standard thickness of member | $h_{min,1}$ | [mm] | 100 | 120 | 140 | 170 | 200 | 230 | 250 |
| **Cracked concrete** | | | | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 45 | 60 | 60 | 95 | 100 | 125 |
| | für c ≥ | [mm] | 70 | 70 | 100 | 100 | 150 | 180 | 300 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 60 | 60 | 95 | 100 | 180 |
| | für s ≥ | [mm] | 80 | 90 | 140 | 180 | 200 | 220 | 540 |
| **Uncracked concrete** | | | | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 45 | 60 | 65 | 90 | 100 | 125 |
| | für c ≥ | [mm] | 80 | 70 | 120 | 120 | 180 | 180 | 300 |
| Minimum edge distance | $c_{min}$ | [mm] | 50 | 50 | 75 | 80 | 130 | 100 | 180 |
| | für s ≥ | [mm] | 100 | 100 | 150 | 150 | 240 | 220 | 540 |
| **Stainless steel A4, HCR** | | | | | | | | | |
| Standard thickness of member | $h_{min,1}$ | [mm] | 100 | 120 | 140 | 160 | 200 | 250 | - |
| **Cracked concrete** | | | | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 50 | 60 | 60 | 95 | 125 | - |
| | für c ≥ | [mm] | 70 | 75 | 100 | 100 | 150 | 125 | |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 55 | 60 | 60 | 95 | 125 | |
| | für s ≥ | [mm] | 80 | 90 | 140 | 180 | 200 | 125 | |
| **Uncracked concrete** | | | | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 50 | 60 | 65 | 90 | 125 | - |
| | für c ≥ | [mm] | 80 | 75 | 120 | 120 | 180 | 125 | |
| Minimum edge distance | $c_{min}$ | [mm] | 50 | 60 | 75 | 80 | 130 | 125 | |
| | für s ≥ | [mm] | 100 | 120 | 150 | 150 | 240 | 125 | |
| **Minimum thickness of concrete member** | | | | | | | | | |
| **Steel zinc plated, stainless steel A4, HCR** | | | | | | | | | |
| Minimum thickness of member | $h_{min,2}$ | [mm] | 80 | 100 | 120 | 140 | - | - | - |
| **Cracked concrete** | | | | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 45 | 60 | 70 | - | - | - |
| | für c ≥ | [mm] | 70 | 90 | 100 | 160 | | | |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 50 | 60 | 80 | | | |
| | für s ≥ | [mm] | 80 | 115 | 140 | 180 | | | |
| **Uncracked concrete** | | | | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 60 | 60 | 80 | - | - | - |
| | für c ≥ | [mm] | 80 | 140 | 120 | 180 | | | |
| Minimum edge distance | $c_{min}$ | [mm] | 50 | 90 | 75 | 90 | | | |
| | für s ≥ | [mm] | 100 | 140 | 150 | 200 | | | |

| | | | |
|---|---|---|---|
| **Fire exposure from one side** | | | |
| Minimum spacing | $s_{min,fi}$ | [mm] | See normal ambient temperature |
| Minimum edge distance | $c_{min,fi}$ | [mm] | See normal ambient temperature |
| **Fire exposure from more than one side** | | | |
| Minimum spacing | $s_{min,fi}$ | [mm] | See normal ambient temperature |
| Minimum edge distance | $c_{min,fi}$ | [mm] | ≥ 300 mm |

Intermediate values by linear interpolation.

**Wedge Anchor HB-BZ**

**Intended use**
Minimum **spacings** and **edge distances** for **standard anchorage depth**

**Annex B4**

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## Table B3: Minimum **spacings** and **edge distances, reduced anchorage depth,** HB-BZ

| **Fastener size** | | | **M8** | **M10** | **M12** | **M16** |
|---|---|---|---|---|---|---|
| Minimum thickness of concrete member | $h_{min,3}$ | [mm] | 80 | 80 | 100 | 140 |
| **Cracked concrete** | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 50 | 50 | 50 | 65 |
| | für c ≥ | [mm] | 60 | 100 | 160 | 170 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 65 | 65 | 100 |
| | für s ≥ | [mm] | 185 | 180 | 250 | 250 |
| **Uncracked concrete** | | | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 50 | 50 | 50 | 65 |
| | für c ≥ | [mm] | 60 | 100 | 160 | 170 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 65 | 100 | 170 |
| | für s ≥ | [mm] | 185 | 180 | 185 | 65 |
| **Fire exposure from one side** | | | | | | |
| Minimum spacing | $s_{min,fi}$ | [mm] | See normal ambient temperature | | | |
| Minimum edge distance | $c_{min,fi}$ | [mm] | See normal ambient temperature | | | |
| **Fire exposure from more than one side** | | | | | | |
| Minimum spacing | $s_{min,fi}$ | [mm] | See normal ambient temperature | | | |
| Minimum edge distance | $c_{min,fi}$ | [mm] | ≥ 300 mm | | | |

Intermediate values by linear interpolation.



**Wedge Anchor HB-BZ**

**Intended use**
Minimum **spacings** and **edge distances** for **reduced anchorage depth**

**Annex B5**

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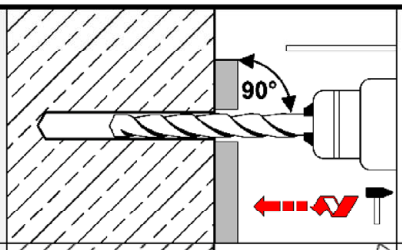
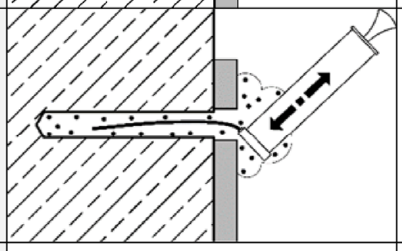
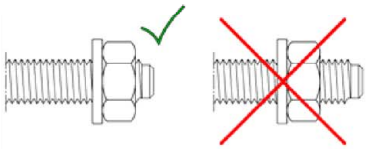
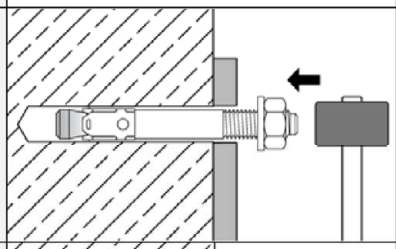
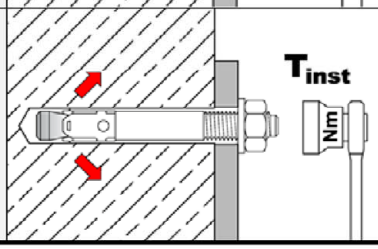
## Installation instructions HB-BZ

| | | |
|---|---|---|
| 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. |
| 4 |  | Drive in fastener, such that $h_{ef}$ or $h_{ef,red}$ depth is met. This compliance is ensured, if the thickness of fixture is not greater than the maximum thickness of fixture marked on the fastener in accordance with Annex A3. |
| 5 |  | Installation torque $T_{inst}$ shall be applied by using calibrated torque wrench. |



**Wedge Anchor HB-BZ**

**Intended use**
Installation instructions

**Annex B6**

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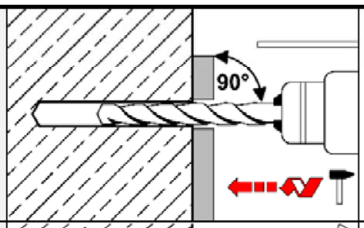
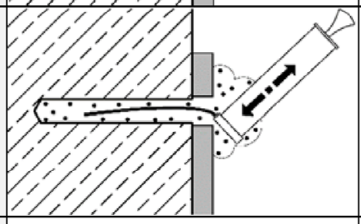
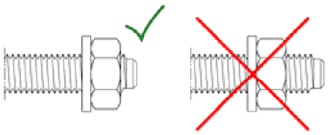
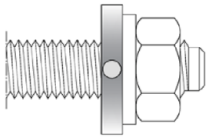
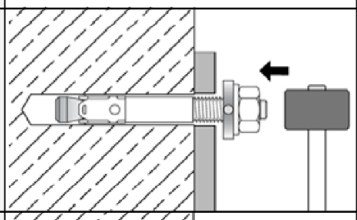
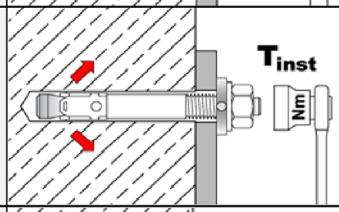
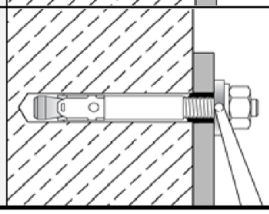
## Installation instructions HB-BZ with filling of annular gap

| | | |
|---|---|---|
| 1 |  | Drill hole perpendicular to concrete surface.<br>If using a vacuum drill bit, proceed with step 3a. |
| 2 |  | Blow out dust. Alternatively vacuum clean down to the bottom of the hole. |
| 3a |  | Check position of nut. |
| 3b |  | Fit the filling washer to the fastener.<br>The thickness of the filling washer must be taken into account with $t_{fix}$. |
| 4 |  | Drive in fastener with filling washer, such that $h_{ef}$ or $h_{ef,red}$ depth is met. This compliance is ensured, if the thickness of fixture is 5mm (or 6mm when ≥ M24) smaller than the maximum thickness of fixture marked on the fastener in accordance with Annex A3. |
| 5 |  | Installation torque $T_{inst}$ shall be applied by using calibrated torque wrench. |
| 6 |  | Fill the annular gap between stud and fixture with high strength mortar (compressive strength ≥ 40 N/mm² e.g. Injection system HB-VMZ or Injections System HB-VMU plus for concrete).<br>Use enclosed reducing adapter. Observe the processing information of the mortar!<br>The annular gap is completely filled, when excess mortar seeps out. |



| | |
|---|---|
| **Wedge Anchor HB-BZ** | **Annex B7** |
| **Intended Use**<br>Installation instructions with filling washer | |

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## Table B4: Installation parameters HB-BZ-IG

| Fastener size | | | | M6 | M8 | M10 | M12 |
|---|---|---|---|---|---|---|---|
| Effective anchorage depth | | $h_{ef}$ | [mm] | 45 | 58 | 65 | 80 |
| 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 |
| Depth of drill hole | | $h_1 \geq$ | [mm] | 60 | 75 | 90 | 105 |
| Screwing depth of threaded rod | | $L_{sd}$ [2] $\geq$ | [mm] | 9 | 12 | 15 | 18 |
| Installation torque, steel zinc plated | $T_{inst}$ | S | [Nm] | 10 | 30 | 30 | 55 |
| | | SK | [Nm] | 10 | 25 | 40 | 50 |
| | | B | [Nm] | 8 | 25 | 30 | 45 |
| Installation torque, stainless steel A4, HCR | $T_{inst}$ | S | [Nm] | 15 | 40 | 50 | 100 |
| | | SK | [Nm] | 12 | 25 | 45 | 60 |
| | | B | [Nm] | 8 | 25 | 40 | 80 |
| **Pre-setting installation** | | | | | | | |
| Diameter of clearance hole in the fixture | | $d_f \leq$ | [mm] | 7 | 9 | 12 | 14 |
| Minimum thickness of fixture | $t_{fix} \geq$ | S | [mm] | 1 | 1 | 1 | 1 |
| | | SK | [mm] | 5 | 7 | 8 | 9 |
| | | B | [mm] | 1 | 1 | 1 | 1 |
| **Through-setting installation** | | | | | | | |
| Diameter of clearance hole in the fixture | | $d_f \leq$ | [mm] | 9 | 12 | 14 | 18 |
| Minimum thickness of fixture [1] | $t_{fix} \geq$ | S | [mm | 5 | 7 | 8 | 9 |
| | | SK | [mm] | 9 | 12 | 14 | 16 |
| | | B | [mm] | 5 | 7 | 8 | 9 |

[1] The minimum thickness of fixture can be reduced to the value of Pre-setting installation, if the shear load at steel failure is designed with lever arm.
[2] see Annex A5

## Table B5: Minimum spacings and edge distances HB-BZ-IG

| Fastener size | | | | M6 | M8 | M10 | M12 |
|---|---|---|---|---|---|---|---|
| Minimum thickness of concrete member | | $h_{min}$ | [mm] | 100 | 120 | 130 | 160 |
| **Cracked concrete** | | | | | | | |
| Minimum spacing | | $s_{min}$ | [mm] | 50 | 60 | 70 | 80 |
| | | für c $\geq$ | [mm] | 60 | 80 | 100 | 120 |
| Minimum edge distance | | $c_{min}$ | [mm] | 50 | 60 | 70 | 80 |
| | | für s $\geq$ | [mm] | 75 | 100 | 100 | 120 |
| **Uncracked concrete** | | | | | | | |
| Minimum spacing | | $s_{min}$ | [mm] | 50 | 60 | 65 | 80 |
| | | für c $\geq$ | [mm] | 80 | 100 | 120 | 160 |
| Minimum edge distance | | $c_{min}$ | [mm] | 50 | 60 | 70 | 100 |
| | | für s $\geq$ | [mm] | 115 | 155 | 170 | 210 |
| **Fire exposure from one side** | | | | | | | |
| Minimum spacing | | $s_{min,fi}$ | [mm] | See normal temperature | | | |
| Minimum edge distance | | $c_{min,fi}$ | [mm] | See normal temperature | | | |
| **Fire exposure from more than one side** | | | | | | | |
| Minimum spacing | | $s_{min,fi}$ | [mm] | See normal temperature | | | |
| Minimum edge distance | | $c_{min,fi}$ | [mm] | ≥ 300 mm | | | |

Intermediate values by linear interpolation.

**Wedge Anchor HB-BZ-IG**

**Intended use**
Installation parameters, minimum spacings and edge distances HB-BZ-IG

**Annex B8**

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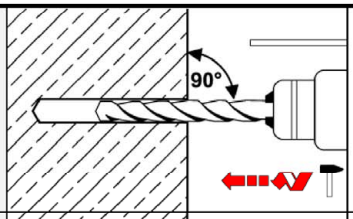
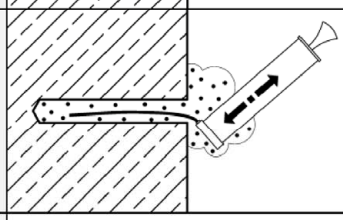
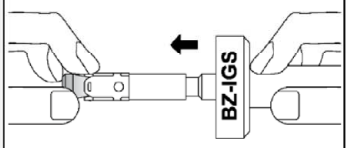
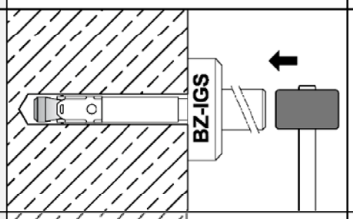
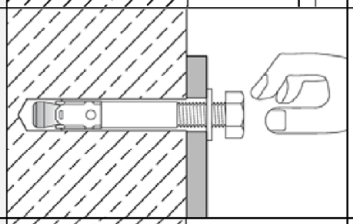
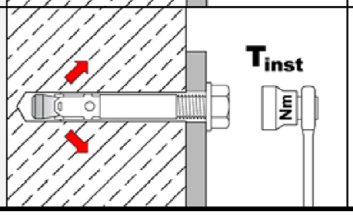
## Installation instructions HB-BZ-IG

### Pre-setting installation

| | | |
|---|---|---|
| 1 |  | Drill hole perpendicular to concrete surface.<br>If using vacuum drill bit, proceed with step 3. |
| 2 |  | Blow out dust. Alternatively vacuum clean down to the bottom of the hole. |
| 3 |  | Setting tool for **pre-setting installation** insert in fastener. |
| 4 |  | Drive in fastener with setting tool. |
| 5 |  | Drive in srew. |
| 6 |  | Installation torque $T_{inst}$ may be applied by using calibrated torque wrench. |

**Wedge Anchor HB-BZ-IG**

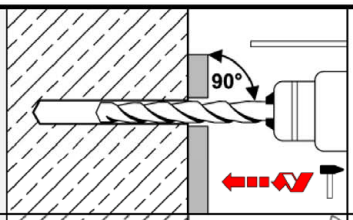
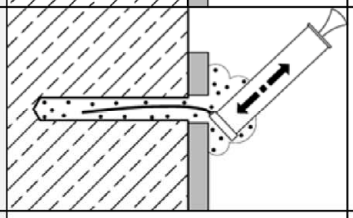
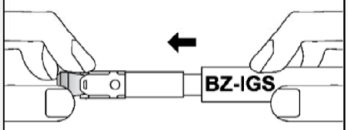
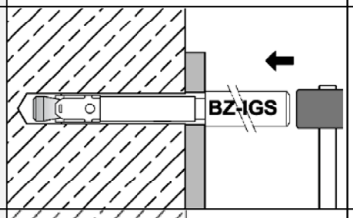
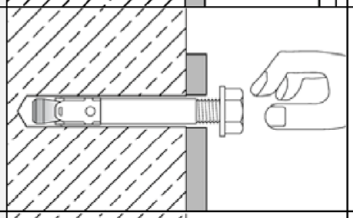
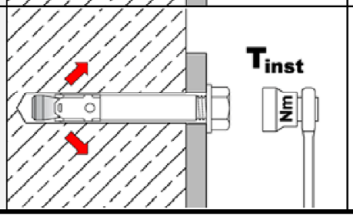
**Intended Use**
Installation instructions for pre-setting installation HB-BZ-IG

**Annex B9**

Deutsches Institut für Bautechnik DIBt

## Installation instructions HB-BZ-IG

### Through-setting installation

| | | |
|---|---|---|
| 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 |  | Setting tool for **through-setting installation** insert in fastener. |
| 4 |  | Drive in fastener with setting tool. |
| 5 |  | Drive in screw. |
| 6 |  | Installation torque $T_{inst}$ may be applied by using calibrated torque wrench. |



**Wedge Anchor HB-BZ-IG**

**Intended Use**
Installation instructions for through-setting installation HB-BZ-IG

**Annex B10**

Deutsches Institut für Bautechnik DIBt

**Table C1:** Characteristic values for **tension loads,** HB-BZ **zinc plated, cracked concrete,** static and quasi-static action

| **Fastener size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure** | | | | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 60 | 86 | 126 | 196 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,53 | | 1,5 | | 1,6 | 1,5 | |
| **Pull-out** | | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 9 | 16 | 25 | 36,0 | 44,4 | 50,3 |
| **Reduced anchorage depth** | | | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 7,5 | 12,7 | 18,9 | -[1] | -[1] | -[1] |
| Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25) | $\psi c$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | | | | | | |
| **Concrete cone failure** | | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35 [2] | 40 | 50 | 65 | -[1] | -[1] | -[1] |
| Factor for cracked concrete | $k_{cr,N}$ | [-] | 7,7 | | | | | | |

[1] No performance assessed
[2] Use restricted to anchoring of structural components statically indeterminate



**Wedge Anchor HB-BZ**

**Performance**
Characteristic values for **tension loads**, HB-BZ **zinc plated, cracked concrete**, static and quasi-static action

**Annex C1**

Deutsches Institut für Bautechnik DIBt

**Table C2:** Characteristic values for **tension loads,** HB-BZ **A4 / HCR, cracked concrete,** static and quasi-static action

| **Fastener size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | |
| **Steel failure** | | | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 64 | 108 | 110 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | 1,68 | 1,5 |
| **Pull-out** | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 9 | 16 | 25 | 36,0 | 40 |
| **Reduced anchorage depth** | | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 5 | 7,5 | 12,7 | 18,9 | -[1] | -[1] |
| Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25) | $\psi c$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | | | | | |
| **Concrete cone failure** | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35 [2] | 40 | 50 | 65 | -[1] | -[1] |
| Factor for cracked concrete | $k_{cr,N}$ | [-] | 7,7 | | | | | |

[1] No performance assessed
[2] Use restricted to anchoring of structural components statically indeterminate



**Wedge Anchor HB-BZ**

**Performance**
Characteristic values for **tension loads,** HB-BZ **A4 / HCR, cracked concrete,** static and quasi-static action

**Annex C2**

Deutsches Institut für Bautechnik DIBt

## Table C3: Characteristic values for **tension loads,** HB-BZ **zinc plated, uncracked concrete,** static and quasi-static action

| **Fastener size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure** | | | | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 60 | 86 | 126 | 196 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,53 | | 1,5 | | 1,6 | 1,5 | |
| **Pull-out** | | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 12 | 16 | 25 | 35 | 51,0 | 62,9 | 71,3 |
| **Reduced anchorage depth** | | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 7,5 | 9 | 18,0 | 26,7 | -[1] | -[1] | -[1] |
| **Splitting** | | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | | |
| Splitting for **standard thickness of concrete member** (The higher resistance of case 1 and case 2 may be applied; $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min,2} < h < h_{min,1}$ (Case 2); $\psi_{h,sp}$= 1,0)) | | | | | | | | | |
| Standard thickness of concrete | $h_{min,1} \geq$ | [mm] | 100 | 120 | 140 | 170 | 200 | 230 | 250 |
| **Case 1** | | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 9 | 12 | 20 | 30 | 40 | 62,3 | 50 |
| Edge distance | $c_{cr,sp}$ | [mm] | 1,5 $h_{ef}$ | | | | | | |
| **Case 2** | | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | 50,5 | 62,3 | 70,6 |
| Edge distance | $c_{cr,sp}$ | [mm] | 2$h_{ef}$ | | | | 2,2 $h_{ef}$ | 1,5 $h_{ef}$ | 2,5 $h_{ef}$ |
| Splitting for **minimum thickness of concrete member** | | | | | | | | | |
| Minimum thickness of concrete | $h_{min,2} \geq$ | [mm] | 80 | 100 | 120 | 140 | -[1] | -[1] | -[1] |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | | | |
| Edge distance | $c_{cr,sp}$ | [mm] | 2,5$h_{ef}$ | | | | | | |
| **Reduced anchorage depth** | | | | | | | | | |
| Minimum thickness of concrete | $h_{min,3} \geq$ | [mm] | 80 | 80 | 100 | 140 | -[1] | -[1] | -[1] |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 7,5 | 9 | 17,9 | 26,5 | | | |
| Edge distance | $c_{cr,sp}$ | [mm] | 100 | 100 | 125 | 150 | | | |
| Increasing factor for $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25) and for $N^0_{Rk,sp} = \psi_c \cdot N^0_{Rk,sp}$ (C20/25) | $\psi_c$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | | | | | | |
| **Concrete cone failure** | | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35[2] | 40 | 50 | 65 | -[1] | -[1] | -[1] |
| Factor for uncracked concrete | $k_{ucr,N}$ | [-] | 11,0 | | | | | | |

[1] No performance assessed
[2] Use restricted to anchoring of structural components statically indeterminate

**Wedge Anchor HB-BZ**

**Performance**
Characteristic values for **tension loads,** HB-BZ **zinc plated, uncracked concrete,** static and quasi-static action

**Annex C3**

Deutsches Institut für Bautechnik DIBt

## Table C4: Characteristic values for **tension loads,** HB-BZ **A4 / HCR, uncracked concrete,** static and quasi-static action

| **Fastener size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | |
| **Steel failure** | | | | | | | | |
| Characteristic resistance | $N_{Rk,s}$ | [kN] | 16 | 27 | 40 | 64 | 108 | 110 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,5 | | | | 1,68 | 1,5 |
| **Pull-out** | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 12 | 16 | 25 | 35 | 51 | 71,3 |
| **Reduced anchorage depth** | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 7,5 | 9 | 18,0 | 26,7 | -[1] | -[1] |
| **Splitting** | | | | | | | | |
| **Standard anchorage depth** | | | | | | | | |
| Splitting for **standard thickness of concrete member** (The higher resistance of case 1 and case 2 may be applied; $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min,2} < h < h_{min,1}$ (Case 2); $\psi_{h,sp}$= 1,0) | | | | | | | | |
| Standard thickness of concrete | $h_{min,1} \geq$ | [mm] | 100 | 120 | 140 | 160 | 200 | 250 |
| **Case 1** | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 9 | 12 | 20 | 30 | 40 | -[1] |
| Edge distance | $c_{cr,sp}$ | [mm] | 1,5 $h_{ef}$ | | | | | -[1] |
| **Case 2** | | | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | 50,5 | 70,6 |
| Edge distance | $c_{cr,sp}$ | [mm] | 115 | 125 | 140 | 200 | 220 | 250 |
| Splitting for **minimum thickness of concrete member** | | | | | | | | |
| Minimum thickness of concrete | $h_{min,2} \geq$ | [mm] | 80 | 100 | 120 | 140 | -[1] | -[1] |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 25 | 35 | | |
| Edge distance | $c_{cr,sp}$ | [mm] | 2,5 $h_{ef}$ | | | | | |
| **Reduced anchorage depth** | | | | | | | | |
| Minimum thickness of concrete | $h_{min,3} \geq$ | [mm] | 80 | 80 | 100 | 140 | -[1] | -[1] |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 7,5 | 9 | 17,9 | 26,5 | | |
| Edge distance | $c_{cr,sp}$ | [mm] | 100 | 100 | 125 | 150 | | |
| Increasing factor for $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25) and for $N^0_{Rk,sp} = \psi_c \cdot N^0_{Rk,sp}$ (C20/25) | $\psi_c$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | | | | | |
| **Concrete cone failure** | | | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 |
| Reduced anchorage depth | $h_{ef,red}$ | [mm] | 35[2] | 40 | 50 | 65 | -[1] | -[1] |
| Factor for uncracked concrete | $k_{ucr,N}$ | [-] | 11,0 | | | | | |

[1] No performance assessed.
[2] Use restricted to anchoring of structural components statically indeterminate.

**Wedge Anchor HB-BZ**

**Performance**
Characteristic values for **tension loads,** HB-BZ **A4 / HCR, uncracked concrete,** static and quasi-static action

**Annex C4**

Deutsches Institut für Bautechnik DIBt

**Table C5:** Characteristic values for **shear loads**, HB-BZ, **cracked** and **uncracked concrete,** static or quasi static action

| **Fastener size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|---|
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure without lever arm, Steel zinc plated** | | | | | | | | | | |
| Characteristic resistance | | $V^0_{Rk,s}$ | [kN] | 12,2 | 20,1 | 30 | 55 | 69 | 114 | 169,4 |
| Ductility factor | | $k_7$ | [-] | 1,0 | | | | | | |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,33 | 1,25 | 1,25 |
| **Steel failure without lever arm, Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | | $V^0_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 123,6 | -[1] |
| Ductility factor | | $k_7$ | [-] | 1,0 | | | | | | |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,4 | 1,25 | |
| **Steel failure with lever arm, Steel zinc plated** | | | | | | | | | | |
| Characteristic bending resistance | | $M^0_{Rk,s}$ | [Nm] | 23 | 47 | 82 | 216 | 363 | 898 | 1331,5 |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,33 | 1,25 | 1,25 |
| **Steel failure with lever arm, Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic bending resistance | | $M^0_{Rk,s}$ | [Nm] | 26 | 52 | 92 | 200 | 454 | 785,4 | -[1] |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,4 | 1,25 | |
| **Concrete pry-out failure** | | | | | | | | | | |
| Pry-out factor | | $k_8$ | [-] | 2,4 | | | | 2,8 | | |
| **Concrete edge failure** | | | | | | | | | | |
| Effective length of fastener in shear loading with $\mathbf{h_{ef}}$ | Steel zinc plated | $l_f$ | [mm] | 46 | 60 | 70 | 85 | 100 | 115 | 125 |
| | Stainless steel A4, HCR | $l_f$ | [mm] | 46 | 60 | 70 | 85 | 100 | 125 | -[1] |
| Effective length of fastener in shear loading with $\mathbf{h_{ef,red}}$ | Steel zinc plated | $l_{f,red}$ | [mm] | 35 [2] | 40 | 50 | 65 | -[1] | -[1] | -[1] |
| | Stainless steel A4, HCR | $l_{f,red}$ | [mm] | 35 [2] | 40 | 50 | 65 | | | |
| Outside diameter of fastener | | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 | 20 | 24 | 27 |

[1] No performance assessed.
[2] Use restricted to anchoring of structural components statically indeterminate.



**Wedge Anchor HB-BZ**

**Performance**
Characteristic values for **shear loads**, HB-BZ,
**cracked** and **uncracked concrete,** static or quasi static action

**Annex C5**

Deutsches Institut für Bautechnik DIBt

**Table C6:** Characteristic resistance for **seismic loading**, HB-BZ, **standard anchorage depth,** performance category **C1** and **C2**

| **Fastener size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|---|---|
| **Tension loads** | | | | | | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | |
| **Steel failure, Steel zinc plated** | | | | | | | | |
| Characteristic resistance **C1** | | $N_{Rk,s,C1}$ | [kN] | 16 | 27 | 40 | 60 | 86 |
| Characteristic resistance **C2** | | $N_{Rk,s,C2}$ | [kN] | 16 | 27 | 40 | 60 | 86 |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,53 | | 1,5 | | 1,6 |
| **Steel failure, Stainless steel A4, HCR** | | | | | | | | |
| Characteristic resistance **C1** | | $N_{Rk,s,C1}$ | [kN] | 16 | 27 | 40 | 64 | 108 |
| Characteristic resistance **C2** | | $N_{Rk,s,C2}$ | [kN] | 16 | 27 | 40 | 64 | 108 |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,5 | | | | 1,68 |
| **Pull-out** (steel zinc plated, stainless steel A4 and HCR) | | | | | | | | |
| Characteristic resistance **C1** | | $N_{Rk,p,C1}$ | [kN] | 5 | 9 | 16 | 25 | 36 |
| Characteristic resistance **C2** | | $N_{Rk,p,C2}$ | [kN] | 2,3 | 3,6 | 10,2 | 13,8 | 24,4 |
| **Shear loads** | | | | | | | | |
| **Steel failure without lever arm, Steel zinc plated** | | | | | | | | |
| Characteristic resistance **C1** | | $V_{Rk,s,C1}$ | [kN] | 9,3 | 20 | 27 | 44 | 69 |
| Characteristic resistance **C2** | | $V_{Rk,s,C2}$ | [kN] | 6,7 | 14 | 16,2 | 35,7 | 55,2 |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,33 |
| **Steel failure without lever arm, Stainless steel A4, HCR** | | | | | | | | |
| Characteristic resistance **C1** | | $V_{Rk,s,C1}$ | [kN] | 9,3 | 20 | 27 | 44 | 69 |
| Characteristic resistance **C2** | | $V_{Rk,s,C2}$ | [kN] | 6,7 | 14 | 16,2 | 35,7 | 55,2 |
| Partial factor | | $\gamma_{Ms}$ | [-] | 1,25 | | | | 1,4 |
| Factor for annular gap | **without** filling of annular gap | $\alpha_{gap}$ | [-] | 0,5 | | | | |
| | **with** filling of annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | |



**Wedge Anchor HB-BZ**

**Performance**
Characteristic resistance for **seismic loading**, HB-BZ, **standard anchorage depth,** performance category **C1** and **C2**

**Annex C6**

Deutsches Institut für Bautechnik DIBt

**Table C7:** Characteristic values **for tension and shear load** under **fire exposure,** HB-BZ, **standard anchorage depth,** cracked and uncracked concrete C20/25 to C50/60

| **Fastener size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Tension load** | | | | | | | | | | |
| **Steel failure** | | | | | | | | | | |
| **Steel, zinc plated** | | | | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 1,5 | 2,6 | 4,1 | 7,7 | 9,4 | 13,6 | 17,6 |
| | R60 | | | 1,1 | 1,9 | 3,0 | 5,6 | 8,2 | 11,8 | 15,3 |
| | R90 | | | 0,8 | 1,4 | 2,4 | 4,4 | 6,9 | 10,0 | 13,0 |
| | R120 | | | 0,7 | 1,2 | 2,2 | 4,0 | 6,3 | 9,1 | 11,8 |
| **Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 3,8 | 6,9 | 12,7 | 23,7 | 33,5 | 48,2 | -[1] |
| | R60 | | | 2,9 | 5,3 | 9,4 | 17,6 | 25,0 | 35,9 | |
| | R90 | | | 2,0 | 3,6 | 6,1 | 11,5 | 16,4 | 23,6 | |
| | R120 | | | 1,6 | 2,8 | 4,5 | 8,4 | 12,1 | 17,4 | |
| **Shear load** | | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | | |
| **Steel, zinc plated** | | | | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 1,6 | 2,6 | 4,1 | 7,7 | 11 | 16 | 20,6 |
| | R60 | | | 1,5 | 2,5 | 3,6 | 6,8 | 11 | 15 | 19,8 |
| | R90 | | | 1,2 | 2,1 | 3,5 | 6,5 | 10 | 15 | 19,0 |
| | R120 | | | 1,0 | 2,0 | 3,4 | 6,4 | 10 | 14 | 18,6 |
| **Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 3,8 | 6,9 | 12,7 | 23,7 | 33,5 | 48,2 | -[1] |
| | R60 | | | 2,9 | 5,3 | 9,4 | 17,6 | 25,0 | 35,9 | |
| | R90 | | | 2,0 | 3,6 | 6,1 | 11,5 | 16,4 | 23,6 | |
| | R120 | | | 1,6 | 2,8 | 4,5 | 8,4 | 12,1 | 17,4 | |
| **Steel failure with lever arm** | | | | | | | | | | |
| **Steel, zinc plated** | | | | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 1,7 | 3,3 | 6,4 | 16,3 | 29 | 50 | 75 |
| | R60 | | | 1,6 | 3,2 | 5,6 | 14 | 28 | 48 | 72 |
| | R90 | | | 1,2 | 2,7 | 5,4 | 14 | 27 | 47 | 69 |
| | R120 | | | 1,1 | 2,5 | 5,3 | 13 | 26 | 46 | 68 |
| **Stainless steel A4, HCR** | | | | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 3,8 | 9,0 | 19,7 | 50,1 | 88,8 | 153,5 | -[1] |
| | R60 | | | 2,9 | 6,8 | 14,6 | 37,2 | 66,1 | 114,3 | |
| | R90 | | | 2,1 | 4,7 | 9,5 | 24,2 | 43,4 | 75,1 | |
| | R120 | | | 1,6 | 3,6 | 7,0 | 17,8 | 32,1 | 55,5 | |

[1] No performance assessed

**Wedge Anchor HB-BZ**

**Performance**
Characteristic values **for tension and shear load** under **fire exposure,** HB-BZ, **standard anchorage depth**, cracked and uncracked concrete C20/25 to C50/60

**Annex C7**

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**Table C8:** Characteristic values **for tension and shear load** under **fire exposure,** HB-BZ, **reduced anchorage depth,** cracked and uncracked concrete C20/25 to C50/60

| **Fastener size** | | | | **M8** | **M10** | **M12** | **M16** |
|---|---|---|---|---|---|---|---|
| **Tension load** | | | | | | | |
| **Steel failure** | | | | | | | |
| **Steel, zinc plated** | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 1,5 | 2,6 | 4,1 | 7,7 |
| | R60 | | | 1,1 | 1,9 | 3,0 | 5,6 |
| | R90 | | | 0,8 | 1,3 | 1,9 | 3,5 |
| | R120 | | | 0,6 | 1,0 | 1,3 | 2,5 |
| **Stainless steel A4, HCR** | | | | | | | |
| Characteristic resistance | R30 | $N_{Rk,s,fi}$ | [kN] | 3,2 | 6,9 | 12,7 | 23,7 |
| | R60 | | | 2,5 | 5,3 | 9,4 | 17,6 |
| | R90 | | | 1,9 | 3,6 | 6,1 | 11,5 |
| | R120 | | | 1,6 | 2,8 | 4,5 | 8,4 |
| **Shear load** | | | | | | | |
| **Steel failure without lever arm** | | | | | | | |
| **Steel, zinc plated** | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 1,5 | 2,6 | 4,1 | 7,7 |
| | R60 | | | 1,1 | 1,9 | 3,0 | 5,6 |
| | R90 | | | 0,8 | 1,3 | 1,9 | 3,5 |
| | R120 | | | 0,6 | 1,0 | 1,3 | 2,5 |
| **Stainless steel A4, HCR** | | | | | | | |
| Characteristic resistance | R30 | $V_{Rk,s,fi}$ | [kN] | 3,2 | 6,9 | 12,7 | 23,7 |
| | R60 | | | 2,5 | 5,3 | 9,4 | 17,6 |
| | R90 | | | 1,9 | 3,6 | 6,1 | 11,5 |
| | R120 | | | 1,6 | 2,8 | 4,5 | 8,4 |
| **Steel failure with lever arm** | | | | | | | |
| **Steel, zinc plated** | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 1,5 | 3,3 | 6,4 | 16,3 |
| | R60 | | | 1,2 | 2,5 | 4,7 | 11,9 |
| | R90 | | | 0,8 | 1,7 | 3,0 | 7,5 |
| | R120 | | | 0,6 | 1,2 | 2,1 | 5,3 |
| **Stainless steel A4, HCR** | | | | | | | |
| Characteristic resistance | R30 | $M^0_{Rk,s,fi}$ | [Nm] | 3,2 | 8,9 | 19,7 | 50,1 |
| | R60 | | | 2,6 | 6,8 | 14,6 | 37,2 |
| | R90 | | | 2,0 | 4,7 | 9,5 | 24,2 |
| | R120 | | | 1,6 | 3,6 | 7,0 | 17,8 |



**Wedge Anchor HB-BZ**

**Performance**
Characteristic values **for tension and shear load** under **fire exposure,** HB-BZ, **reduced anchorage depth**, cracked and uncracked concrete C20/25 to C50/60

**Annex C8**

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## Table C9: Displacements under tension load, HB-BZ

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

[1] No performance assessed



**Wedge Anchor HB-BZ**

**Performance**
Displacements under tension load

**Annex C9**

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## Table C10: Displacements under shear load, HB-BZ

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

[1] No performance assessed



**Wedge Anchor HB-BZ**

**Performance**
Displacements under shear load

**Annex C10**

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**Table C11:** Characteristic values for **tension loads, HB-BZ-IG, cracked concrete,** static and quasi-static action

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

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## Table C12: Characteristic values for **tension loads, HB-BZ-IG uncracked concrete,** static and quasi-static action

| **Fastener size** | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,2 | | | |
| **Steel failure** | | | | | | |
| Characteristic resistance, **steel zinc plated** | $N_{Rk,s}$ | [kN] | 16,1 | 22,6 | 26,0 | 56,6 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| Characteristic resistance, **stainless steel A4, HCR** | $N_{Rk,s}$ | [kN] | 14,1 | 25,6 | 35,8 | 59,0 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,87 | | | |
| **Pull-out** | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 12 | 16 | 20 | 30 |
| **Splitting** (the higher resistance of Case 1 and Case 2 may be applied) | | | | | | |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 100 | 120 | 130 | 160 |
| **Case 1** | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 9 | 12 | 16 | 25 |
| Edge distance | $c_{cr,sp}$ | [mm] | 1,5 $h_{ef}$ | | | |
| **Case 2** | | | | | | |
| Characteristic resistance in uncracked concrete C20/25 | $N^0_{Rk,sp}$ | [kN] | 12 | 16 | 20 | 30 |
| Edge distance | $c_{cr,sp}$ | [mm] | 2,5 $h_{ef}$ | | | |
| Increasing factor for $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25) and for $N^0_{Rk,sp} = \psi_c \cdot N^0_{Rk,sp}$ | $\psi_c$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | | | |
| **Concrete cone failure** | | | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 45 | 58 | 65 | 80 |
| Factor for uncracked concrete | $k_{ucr,N}$ | [-] | 11,0 | | | |



**Wedge Anchor HB-BZ-IG**

**Performance**
Characteristic values for **tension loads, HB-BZ-IG, uncracked concrete,** static and quasi-static action

**Annex C12**

Deutsches Institut für Bautechnik DIBt

**Table C13:** Characteristic values for **shear loads, HB-BZ-IG, cracked and uncracked concrete,** static and quasi-static action

| **Fastener size** | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | |
| **HB-BZ-IG, steel zinc plated** | | | | | | |
| **Steel failure without lever arm, Pre-setting installation** | | | | | | |
| Characteristic resistance | $V^0_{Rk,s}$ | [kN] | 5,8 | 6,9 | 10,4 | 25,8 |
| **Steel failure without lever arm, Through-setting installation** | | | | | | |
| Characteristic resistance | $V^0_{Rk,s}$ | [kN] | 5,1 | 7,6 | 10,8 | 24,3 |
| **Steel failure with lever arm, Pre-setting installation** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 12,2 | 30,0 | 59,8 | 104,6 |
| **Steel failure with lever arm, Through-setting installation** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 36,0 | 53,2 | 76,0 | 207 |
| Partial factor for $V_{Rk,s}$ and $M^0_{Rk,s}$ | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Ductility factor | $k_7$ | [-] | 1,0 | | | |
| **HB-BZ-IG, stainless steel A4, HCR** | | | | | | |
| **Steel failure without lever arm, Pre-setting installation** | | | | | | |
| Characteristic resistance | $V^0_{Rk,s}$ | [kN] | 5,7 | 9,2 | 10,6 | 23,6 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| **Steel failure without lever arm, Through-setting installation** | | | | | | |
| Characteristic resistance | $V^0_{Rk,s}$ | [kN] | 7,3 | 7,6 | 9,7 | 29,6 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| **Steel failure with lever arm, Pre-setting installation** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 10,7 | 26,2 | 52,3 | 91,6 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,56 | | | |
| **Steel failure with lever arm, Through-setting installation** | | | | | | |
| Characteristic bending resistance | $M^0_{Rk,s}$ | [Nm] | 28,2 | 44,3 | 69,9 | 191,2 |
| Partial factor | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Ductility factor | $k_7$ | [-] | 1,0 | | | |
| **Concrete pry-out failure** | | | | | | |
| Pry-out factor | $k_8$ | [-] | 1,5 | 1,5 | 2,0 | 2,0 |
| **Concrete edge failure** | | | | | | |
| Effective length of fastener in shear loading | $l_f$ | [mm] | 45 | 58 | 65 | 80 |
| Effective diameter of fastener | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 |



**Wedge Anchor HB-BZ-IG**

**Performance**
Characteristic values for **shear loads, HB-BZ-IG, cracked and uncracked concrete,** static and quasi-static action

**Annex C13**

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**Table C14:** Characteristic values for **tension** and **shear load** under **fire exposure**, **HB-BZ-IG**, cracked and uncracked concrete C20/25 to C50/60

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



**Wedge Anchor HB-BZ-IG**

**Performance**
Characteristic values for **tension** and **shear loads** under **fire exposure, HB-BZ-IG** cracked and uncracked concrete C20/25 to C50/60

**Annex C14**

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## Table C15: Displacements under tension load, HB-BZ-IG

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

## Table C16: Displacements under shear load, HB-BZ-IG

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



**Wedge Anchor HB-BZ-IG**

**Performance**
Displacements under tension load and under shear load **HB-BZ-IG**

**Annex C15**