... eine starke Verbindung

PRESTANDADEKLARATION

DoP nr: **MKT-1.1-903_sv**

- ✧ **Produkttypens unika identifikationskod:** **Wedge ankare BZ3 / BZ3 A4 / BZ3 HCR**
- ✧ **Avsedd användning/avsedda användningar:** Mekanisk ankare för förankring i betong, se bilaga/Annex B
- ✧ **Tillverkare:** MKT Metall-Kunststoff-Technik GmbH & Co.KG
Auf dem Immel 2
67685 Weilerbach
- ✧ **Systemet eller systemen för bedömning och fortlöpande kontroll:** 1
- ✧ **Europeiskt bedömningsdokument:** **EAD 330232-02-0601**
  - Europeisk teknisk bedömning: **ETA-19/0619, 07.05.2026**
  - Tekniskt bedömningsorgan: DIBt, Berlin
  - Anmält/anmälda organ: NB 2873 – Technische Universität Darmstadt

✧ **Angiven prestanda:**

Väsentliga egenskaper	Prestanda
Bärförmåga, stadga och beständighet (BWR 1)	
Minsta kant- och mittavstånd	Bilaga / Annex B3
Karakteristiska motstånd under dragbelastning (statiska och kvasistatiska effekter)	Bilaga / Annex C1, C2
Karakteristiska motstånd under tvärspänning (statiska och kvasistatiska effekter)	Bilaga / Annex C3
Karakteristiska motstånd för de seismiska prestanda kategorierna C1 + C2	Bilaga / Annex C4, C5
Skift	Bilaga / Annex C8, C9, C10
Hållbarhet	Bilaga / Annex B1
Säkerhet vid brand (BWR 2)	
Brandegenskaper	Klass A1
Brandmotstånd	Bilaga / Annex C6, C7

Prestandan för ovanstående produkt överensstämmer med den angivna prestandan. Denna prestandadeklaration har utfärdats i enlighet med förordning (EU) nr 305/2011 på eget ansvar av den tillverkare som anges ovan.

Undertecknad på tillverkarens vägnar av:

Stefan Weustenhagen
(Verkställande direktör)

p.p.
Dipl.-Ing. Detlef Bigalke
(Produktutveckling direktör)

Weilerbach, 07.05.2026

Originalen av denna deklarationsförklaring skrevs på tyska. Vid avvikelser i översättningen gäller den tyska versionen.

Deutsches Institut für Bautechnik

DIBt

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European Technical Assessment Body for construction products

Designated in accordance with Article 39 of Regulation (EU) No 2024/3110 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-19/0619 of 7 May 2026

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	Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	MKT Metall-Kunststoff-Technik GmbH & Co. KG Auf dem Immel 2 67685 Weilerbach GERMANY
Manufacturing plant	MKT Metall-Kunststoff-Technik GmbH & Co. KG Auf dem Immel 2 67685 Weilerbach
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 Article 95(4) of Regulation (EU) 2024/3110, on the basis of	EAD 330232-02-0601
This version replaces	ETA-19/0619 issued on 12 June 2024

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Specific Part

1 Technical description of the product

The 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
Stiffness	No performance assessed

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 (BWR 2)

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 330232-02-0601 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 EAD

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 7 May 2026 by Deutsches Institut für Bautechnik

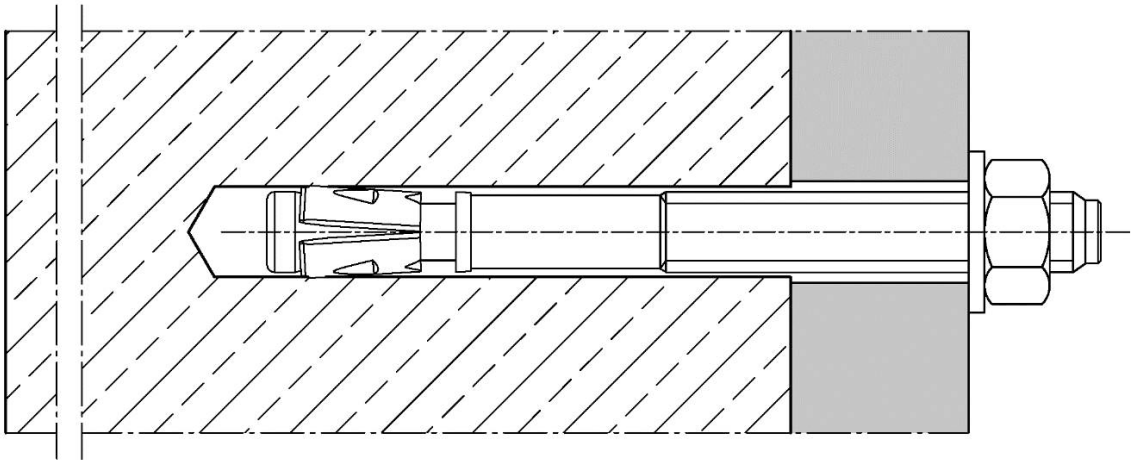
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Ziegler

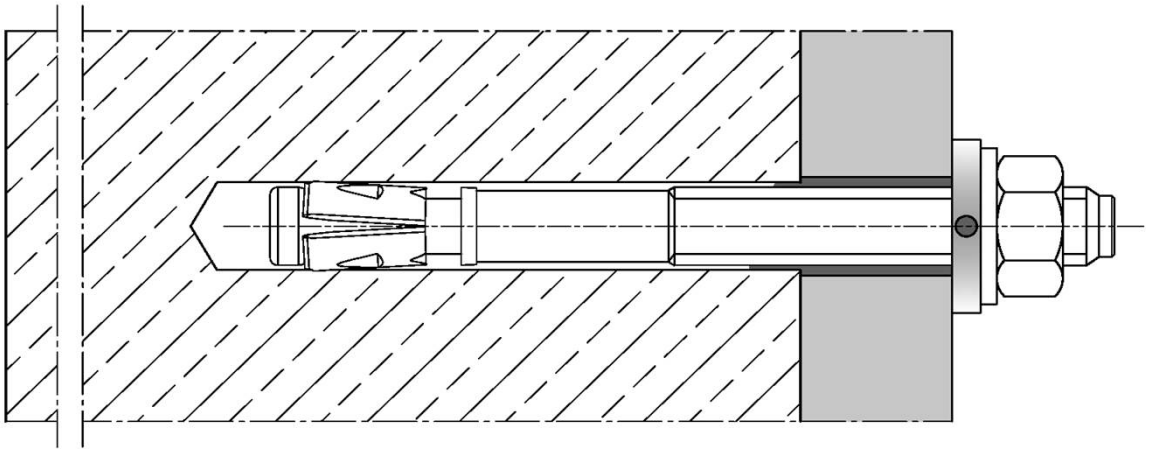
Deutsches Institut für Bautechnik DIBt

Wedge anchor BZ3, BZ3 A4 and BZ3 HCR

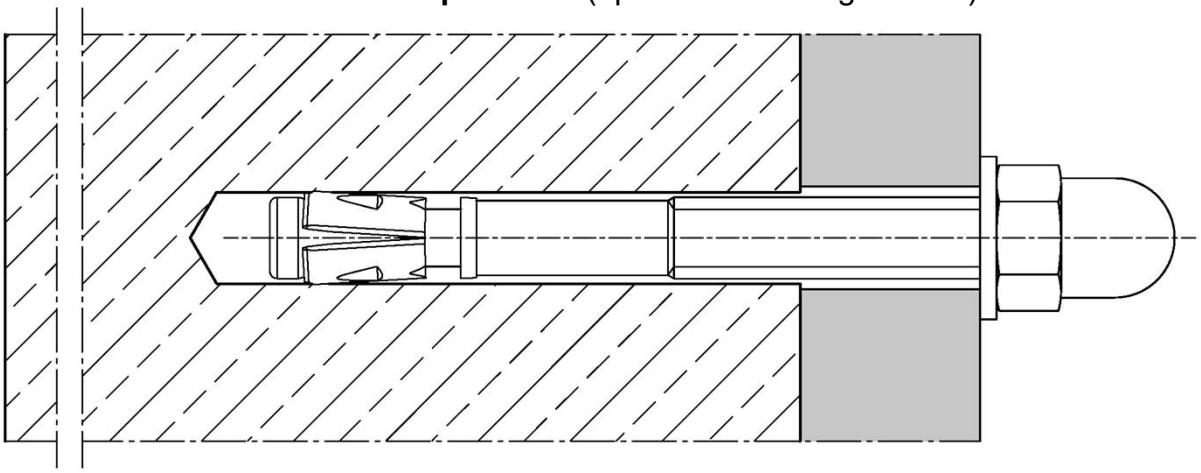
Installation condition



Installation condition with filling washer (optional with cap nut)

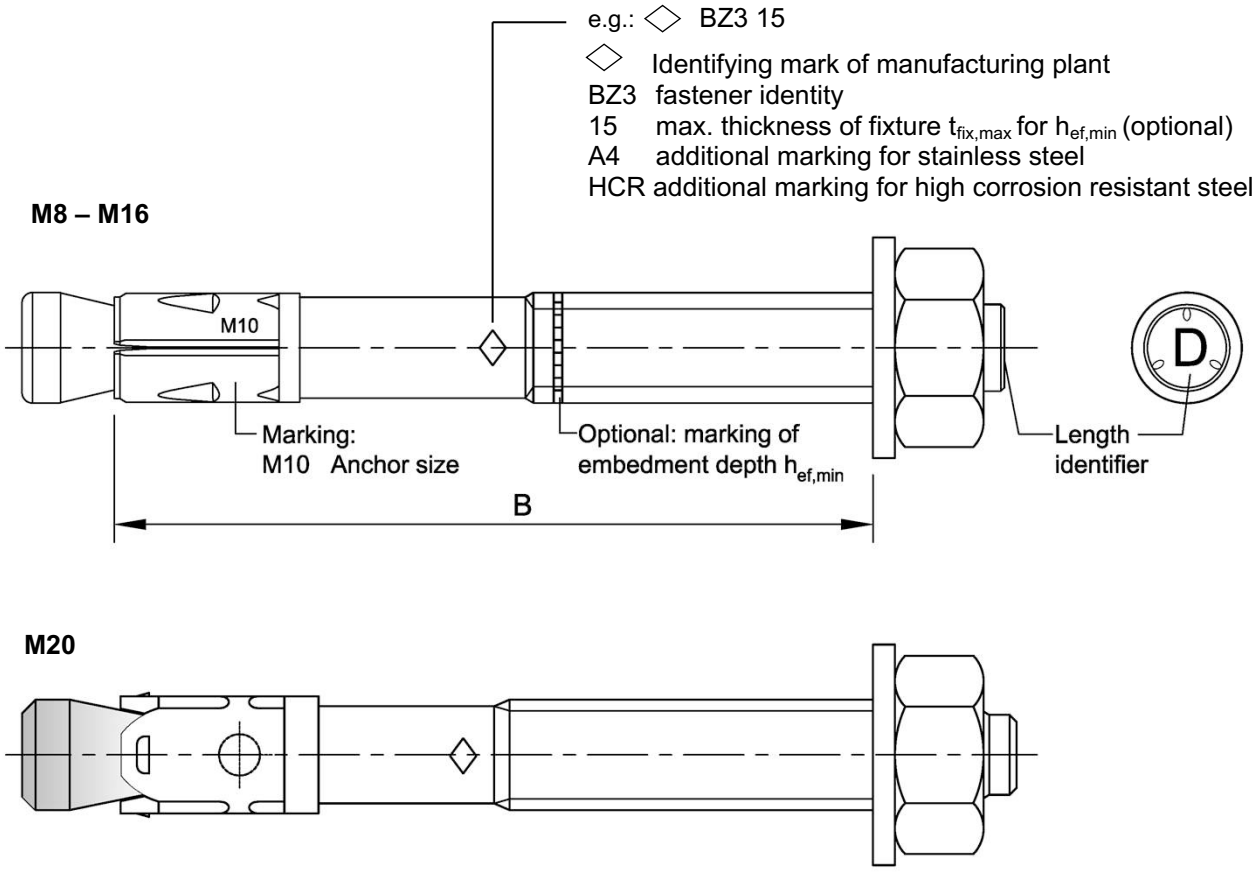


Installation condition with cap nut HM (optional with filling washer)



Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	
Product description Product types and installation conditions	**Annex A1**

Marking



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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Product description
Marking

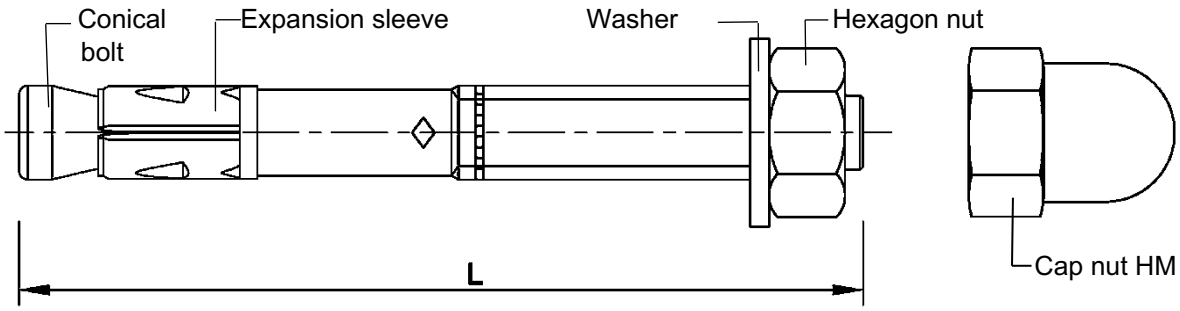
Annex A2

Table A2: Material

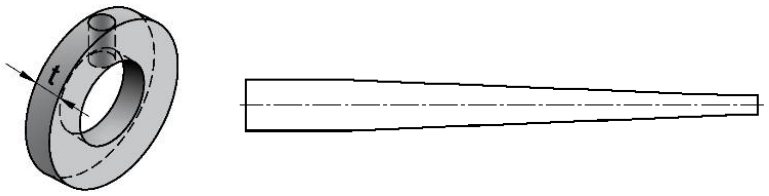
Part	BZ3	BZ3 A4	BZ3 HCR
	Steel, zinc plated	**Stainless steel CRC III**	**High corrosion resistant steel CRC V**
Conical bolt	Steel, galvanized ≥ 5 µm fracture elongation A_5 ≥ 8%	Stainless steel fracture elongation A_5 ≥ 8%	High corrosion resistant steel fracture elongation A_5 ≥ 8%
Expansion sleeve	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

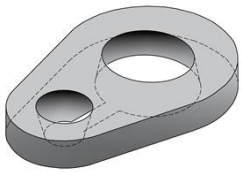
Fastener size			M8	M10	M12	M16	M20
Width across hexagon nut / cap nut HM	s	[mm]	13	17	19	24	30
Length of fastener	L	[mm]	h_{ef} + t_{fix} + 18,0	h_{ef} + t_{fix} + 21,5	h_{ef} + t_{fix} + 26,0	h_{ef} + t_{fix} + 33,0	h_{ef} + t_{fix} + 37,0
Thickness of filling washer VS	t	[mm]	5				



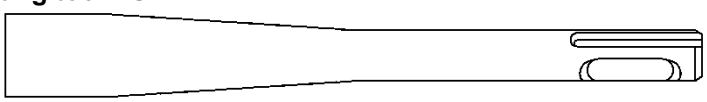
Filling washer VS with reducing adapter



alternate filling washer



Setting tool BSW



Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	**Annex A3**
Product description Material and dimensions	

Specifications of intended use

Wedge Anchor			M8	M10	M12	M16	M20
Anchorages subject to	Static or quasi-static action		✓				
	Seismic action performance categories	C1	✓				
		C2	✓				
	Fire exposure		R30 / R60 / R90 / R120				
Base materials	Normal weight concrete		compacted reinforced or unreinforced normal weight concrete according to EN 206:2013+A2:2021				
	Steel fibre reinforced concrete (SFRC)		according to EN 206:2013+A2:2021 including steel fibres according to EN 14889-1:2006, clause 5, group I; maximum content of steel fibres 80 kg/m³				
	Cracked or uncracked concrete		✓				
	Strength classes		C20/25 to C80/95[1)] according to EN 206:2013+A2:2021				
Drilling and cleaning	Hammer drilling (with cleaning)		✓				
	Hammer drilling (3x ventilate / without cleaning)		✓[2)]				
	Vacuum drilling (automatic cleaning)		✓				
h_{ef}	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

[1)] BZ3 M8 A4/HCR: C20/25 to C50/60
[2)] Except BZ3 M8 A4/HCR

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.

Installation:

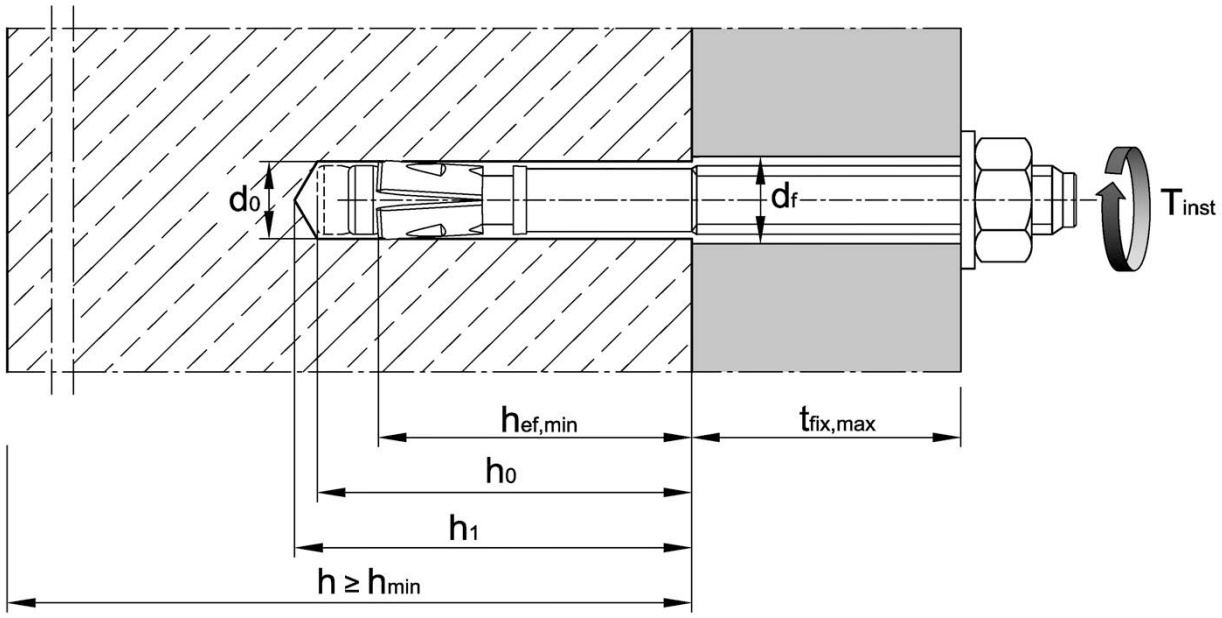
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener (exception: when using the cap nut HM)
- The anchor can be set in pre- or through-setting installation.
- Optionally, the annular gap between fixture and stud of BZ3 can be filled to reduce the 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 ≥ 40 N/mm².

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	**Annex B1**
Intended use Specifications	

Table B1: Installation parameters

Anchor size				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	Hammer drilling vacuum drilling	$h_0 \geq$	[mm]	h_{ef} + 8	h_{ef} + 9	h_{ef} + 10	h_{ef} + 14	h_{ef} + 14
		$h_1 \geq$	[mm]	h_{ef} + 10	h_{ef} + 11	h_{ef} + 13	h_{ef} + 17	h_{ef} + 17
	Hammer drilling without cleaning	$h_0 \geq$	[mm]	h_{ef} + 23	h_{ef} + 23	h_{ef} + 24	h_{ef} + 28	h_{ef} + 28
		$h_1 \geq$	[mm]	h_{ef} + 25	h_{ef} + 25	h_{ef} + 27	h_{ef} + 31	h_{ef} + 31
Diameter of clearance hole in the fixture [1)]		$d_f \leq$	[mm]	9	12	14	18	22
Projection after insertion of the anchor for mounting 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)] For larger diameters of clearance hole in the fixture, see EN 1992-4:2018, chapter 6.2.2.2



Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended use
Installation parameters

Annex B2

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

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Minimum member thickness depending on h_{ef}	$h_{min} \geq$	[mm]	max ($1{,}5 \cdot h_{ef}$; 80)		max ($1{,}5 \cdot h_{ef}$;100)	max ($1{,}5 \cdot h_{ef}$;120)	max ($1{,}5 \cdot h_{ef}$;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:							
$\mathbf{A_{sp,rqd} \leq A_{sp,ef}}$ 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				**M8**	**M10**	**M12**	**M16**	**M20**
Applicable concrete thickness	BZ3 BZ3 A4 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 BZ3 HCR	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} + 4{,}177}{0{,}000862}$	$\frac{N^0_{Rk,sp} + 7{,}235}{0{,}000967}$	$\frac{N^0_{Rk,sp} + 7{,}847}{0{,}000951}$	$\frac{N^0_{Rk,sp} + 11{,}415}{0{,}000742}$	$\frac{N^0_{Rk,sp} + 2{,}423}{0{,}000453}$

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	**Annex B3**
Intended use Minimum spacings and edge distances Required area and applicable concrete thickness	

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

Anchor size				**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

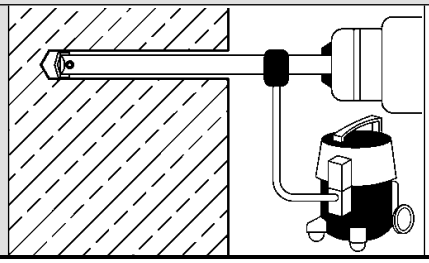
Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended use
Projected effective area to determine spacings and edge distances

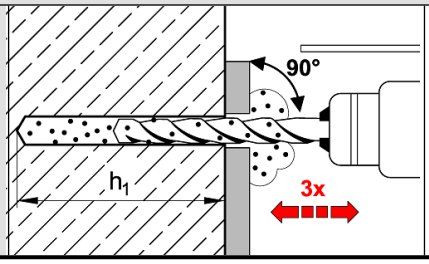
Annex B4

Installation instructions

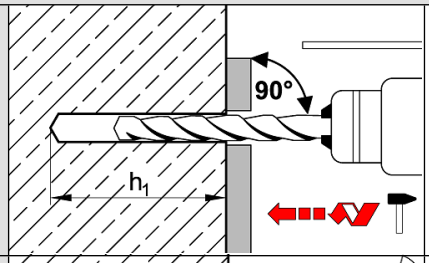
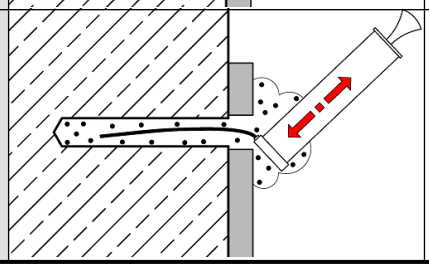
Hole drilling – Vacuum drilling

1		**Vacuum drilling:** Drill hole perpendicular to concrete surface. Proceed with step 3.

Hole drilling - Hammer drilling without cleaning

1		When the drill hole depth h_1 (see Annex B2, Table B1) 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.

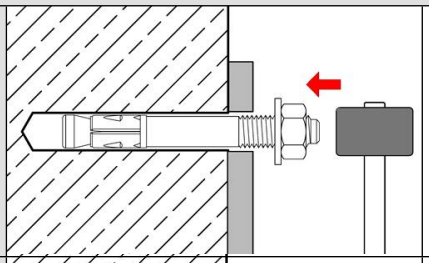
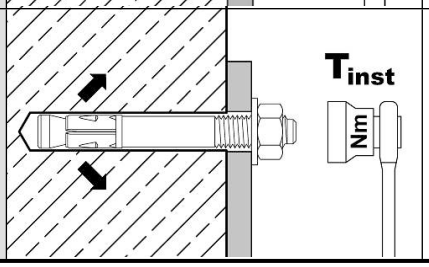
Hole drilling - Hammer drilling with cleaning

1		**Hammer drilling:** Drill hole perpendicular to concrete surface.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.

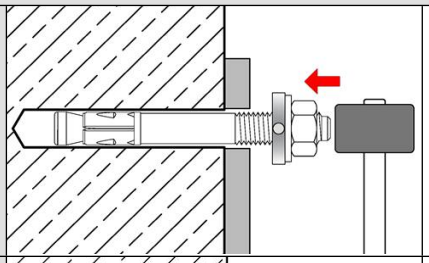
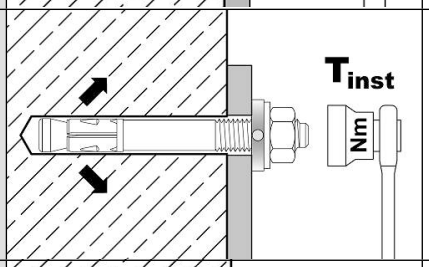
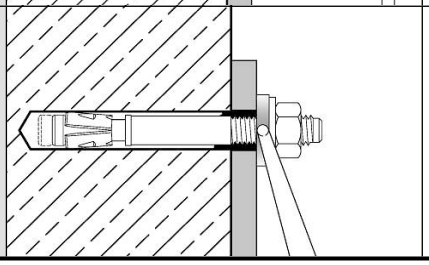
Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	**Annex B5**
Intended use Installation instructions – hole drilling and cleaning	

Installation instructions - continuation

Insert fastener

3		Drive in fastener (optionally use setting tool).
4		Apply installation torque T_{inst}.

Insert fastener with filling of annular gap

3		Drive in fastener with additionally mounted filling washer. (Optionally use setting tool).
4		Apply installation torque T_{inst}.
5		Fill the annular gap between anchor and fixture with injection adhesive (see Annex B1). Use enclosed reducing adapter. The annular gap is completely filled, when excess mortar seeps out.

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended Use
Installation instructions - set fastener

Annex B6

Installation instruction – continuation

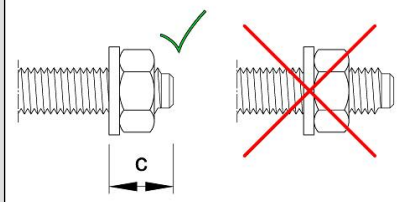
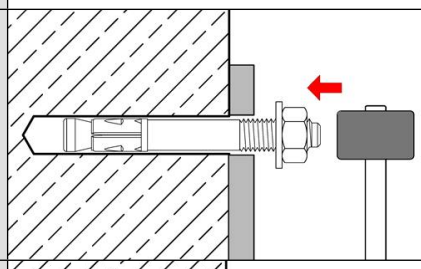
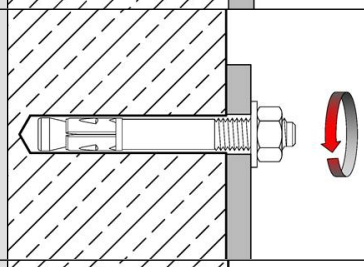
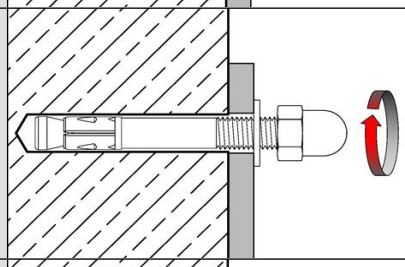
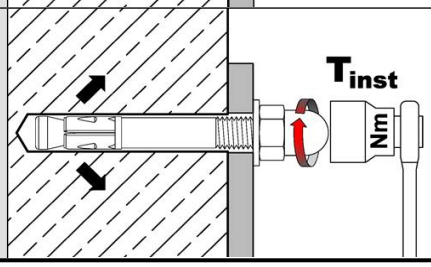
Install fastener with cap nut HM		
3		Check position of nut. Projection C after anchor has been inserted see Annex B2, Table B1.
4		Drive in fastener (optionally use setting tool).
5		Remove nut.
6		Screw on cap nut HM.
7		Apply installation torque T_{inst}.

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

Fastener size			**M8**	**M10**	**M12**	**M16**	**M20**
Installation factor	γ_{inst}	[-]	1,0				
Steel failure							
Characteristic resistance	$N_{Rk,s}$	[kN]	19,8	30,4	44,9	79,3	126,2
Partial factor [4]	γ_{Ms}	[-]	1,5				
Pull-out							
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,cr}$	[kN]	9,5	15,6	22,6	30,3	45,1
Increasing factor [5] $N_{Rk,p,cr} = \psi_{c,cr} \cdot N_{Rk,p,cr\ (C20/25)}$	$\psi_{c,cr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,439}$	$\left(\frac{f_{ck}}{20}\right)^{0,265}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,339}$	$\left(\frac{f_{ck}}{20}\right)^{0,338}$
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p,ucr}$	[kN]	14,0	23,9	31,4	53,7	59,1
Increasing factor [5] $N_{Rk,p,ucr} = \psi_{c,ucr} \cdot N_{Rk,p,ucr\ (C20/25)}$	$\psi_{c,ucr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,489}$	$\left(\frac{f_{ck}}{20}\right)^{0,448}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,203}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$
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]	$2 \cdot c_{cr,sp}$				
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]	$1{,}5 \cdot h_{ef}$				
Characteristic spacing	$s_{cr,N}$	[mm]	$2 \cdot c_{cr,N}$				
Factor — cracked concrete	$k_{cr,N}$	[-]	7,7	7,7	8,3	8,9	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} 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
[5] For concrete strength classes > C50/60: $f_{ck} = 50$ N/mm²

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

Fastener size				**M8**	**M10**	**M12**	**M16**	**M20**
Installation factor		γ_{inst}	[-]	1,0				
Steel failure								
Characteristic resistance		$N_{Rk,s}$	[kN]	19,8	30,4	44,9	74,6	126,2
Partial factor [4]		γ_{Ms}	[-]	1,5				
Pull-out								
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p,cr}$	[kN]	9,7	17,7	22,9	35,6	45,1
Increasing factor [5] $N_{Rk,p,cr} = \psi_{c,cr} \cdot N_{Rk,p,cr\ (C20/25)}$		$\psi_{c,cr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,488}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,435}$	$\left(\frac{f_{ck}}{20}\right)^{0,350}$	$\left(\frac{f_{ck}}{20}\right)^{0,338}$
Characteristic resistance in uncracked concrete C20/25		$N_{Rk,p,ucr}$	[kN]	19,9	25,2	42,5	51,9	59,1
Increasing factor [5] $N_{Rk,p,ucr} = \psi_{c,ucr} \cdot N_{Rk,p,ucr\ (C20/25)}$		$\psi_{c,ucr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,240}$	$\left(\frac{f_{ck}}{20}\right)^{0,364}$	$\left(\frac{f_{ck}}{20}\right)^{0,213}$	$\left(\frac{f_{ck}}{20}\right)^{0,196}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$
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]	$2 \cdot c_{cr,sp}$				
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]	$1{,}5 \cdot h_{ef}$				
Characteristic spacing		$s_{cr,N}$	[mm]	$2 \cdot c_{cr,N}$				
Factor	cracked concrete	$k_{cr,N}$	[-]	7,7	7,7	8,9	8,9	7,7
	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
[5] For concrete strength classes > C50/60: $f_{ck} = 50$ N/mm²

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

Fastener size				**M8**	**M10**	**M12**	**M16**	**M20**
Installation factor		γ_{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	$V^0_{Rk,s}$	[kN]	20,3	31,8	41,6	71,7	108,5
	BZ3 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	$V^0_{Rk,s}$	[kN]	18,6	27,0	44,9	80,1	108,5
	BZ3 HCR	$V^0_{Rk,s}$	[kN]	16,8	27,8	44,9	80,1	108,5
Partial factor [2]		γ_{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]		γ_{Ms}	[-]	1,25				
Concrete pry-out failure								
Pry-out factor	BZ3	$k_{8,cr}$	[-]	2,8	3,1	2,8	3,1	3,3
		$k_{8,ucr}$	[-]	2,8	3,1	3,0	3,6	3,3
	BZ3 A4 / HCR	$k_{8,cr}$	[-]	2,7	2,8	2,9	2,9	3,3
		$k_{8,ucr}$	[-]	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, tension load**

Fastener size				**M8**	**M10**	**M12**	**M16**	**M20**
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	40	50	65	90
Installation factor		γ_{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	15,3	22,6	30,3	45,1
	BZ3 A4 / HCR	$N_{Rk,p,C1}$	[kN]	9,4	17,7	22,8	35,6	45,1

Table C5: Characteristic values for **seismic loading,** performance category **C1, shear load**

Fastener size				**M8**	**M10**	**M12**	**M16**	**M20**
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	40	50	65	90
Steel failure without lever arm								
Characteristic resistance - **unfilled** annular gap	BZ3	$V_{Rk,s,C1}$	[kN]	Min ($0{,}346*h_{ef}$ -2,2;13,4)	Min ($0{,}094*h_{ef}$ +18,8;24,4)	Min ($0{,}188*h_{ef}$ +20,6;33,8)	Min ($0{,}176*h_{ef}$ +37,3;52,3)	83,8
	BZ3 A4	$V_{Rk,s,C1}$	[kN]	Min ($0{,}424*h_{ef}$ -3,7;15,4)	Min ($0{,}091*h_{ef}$ +19,9;25,3)	34,7	Min ($0{,}165*h_{ef}$ +52,4;66,4)	108,5
	BZ3 HCR	$V_{Rk,s,C1}$	[kN]	Min ($0{,}350*h_{ef}$ -3,0;12,7)	Min ($0{,}079*h_{ef}$ +17,4;22,2)	33,2	Min ($0{,}160*h_{ef}$ +50,7;64,3)	108,5
Characteristic resistance – **filled** annular gap	BZ3	$V_{Rk,s,C1}$	[kN]	Min ($0{,}148*h_{ef}$ +8,0;14,7)	24,1	Min ($0{,}082*h_{ef}$ +32,8;38,6)	60,2	86,1
	BZ3 A4	$V_{Rk,s,C1}$	[kN]	Min ($0{,}934*h_{ef}$ -23,4;18,6)	Min ($0{,}146*h_{ef}$ +17,9;26,6)	Min ($0{,}153*h_{ef}$ +29,1;39,8)	Min ($0{,}325*h_{ef}$ +46,6;74,2)	108,5
	BZ3 HCR	$V_{Rk,s,C1}$	[kN]	Min ($0{,}845*h_{ef}$ -21,2;16,8)	Min ($0{,}150*h_{ef}$ +18,5;27,5)	Min ($0{,}153*h_{ef}$ +29,1;39,8)	Min ($0{,}325*h_{ef}$ +46,6;74,2)	108,5
Factor for anchorages	**unfilled** annular gap	α_{gap}	[-]	0,5				
	filled annular gap	α_{gap}	[-]	1,0				

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Performance
Characteristic resistance for **seismic loading,** performance category **C1**

Annex C4

Table C6: Characteristic values for **seismic loading,** performance category **C2, tension load**

Fastener size				**M8**	**M10**	**M12**	**M16**	**M20**
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	40	50	65	90
Installation factor		γ_{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]	min ($0,150*h_{ef}$ -3,2; 3,6)	min ($0,262*h_{ef}$ -3,2; 12,5)	min ($0,415*h_{ef}$ -10,05; 19,0)	min ($0,77*h_{ef}$ -30,25; 35,2)	$90 \leq h_{ef} \leq 100$: min ($0,248*h_{ef}$ +12,8; 37,6)
	BZ3 A4 / HCR	$N_{Rk,p,C2}$	[kN]	min ($0,198*h_{ef}$ -5,7; 3,2)	min ($0,139*h_{ef}$ -0,6; 7,7)	min ($0,292*h_{ef}$ -6,6; 13,8)	min ($0,520*h_{ef}$ -14,8; 29,4)	$100 < h_{ef} \leq 140$: min ($0,134*h_{ef}$ +24,2; 42,9)

Table C7: Characteristic values for **seismic loading,** performance category **C2, shear load**

Fastener size				**M8**	**M10**	**M12**	**M16**	**M20**
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	40	50	65	90
Steel failure without lever arm								
Characteristic resistance - **unfilled** annular gap	BZ3	$V_{Rk,s,C2}$	[kN]	min ($0,818*h_{ef}$ -25,5;11,3)	min ($0,177*h_{ef}$ +8,3;19,0)	min ($0,487*h_{ef}$ -6,1;28,0)	min ($0,195*h_{ef}$ +26,7;43,3)	69,0
	BZ3 A4	$V_{Rk,s,C2}$	[kN]	min ($0,226*h_{ef}$ -1,6;10,4)	min ($0,193*h_{ef}$ +6,5;18,1)	min ($0,170*h_{ef}$ +14,9;26,8)	min ($0,174*h_{ef}$ +32,7;47,6)	88,9
	BZ3 HCR	$V_{Rk,s,C2}$	[kN]	min ($0,220*h_{ef}$ -1,3;8,6)	min ($0,169*h_{ef}$ +5,7;15,9)	min ($0,162*h_{ef}$ +14,2;25,6)	min ($0,169*h_{ef}$ +31,7;46,1)	88,9
Characteristic resistance – **filled** annular gap	BZ3	$V_{Rk,s,C2}$	[kN]	min ($0,206*h_{ef}$ +1,5;10,8)	min ($0,111*h_{ef}$ +13,3;19,9)	min ($0,068*h_{ef}$ +24,2;28,9)	min ($0,142*h_{ef}$ +36,7;48,8)	73,3
	BZ3 A4	$V_{Rk,s,C2}$	[kN]	min ($0,071*h_{ef}$ +7,5;10,7)	min ($0,031*h_{ef}$ +14,8;16,6)	min ($0,201*h_{ef}$ +14,4;28,5)	47,4	88,9
	BZ3 HCR	$V_{Rk,s,C2}$	[kN]	min ($0,064*h_{ef}$ +6,8;9,7)	min ($0,032*h_{ef}$ +15,2;17,1)	min ($0,201*h_{ef}$ +14,4;28,5)	47,4	88,9
Factor for anchorages	**unfilled** annular gap	α_{gap}	[-]	0,5				
	filled annular gap	α_{gap}	[-]	1,0				

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

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

Annex C5

Table C8: Characteristic values **for tension and shear load** under **fire exposure, BZ3** (steel, zinc plated)

Fastener size				**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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Performance
Characteristic values under **fire exposure, BZ3** (steel, zinc plated)

Annex C6

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Table C9: Characteristic values **for tension and shear load** under **fire exposure, BZ3 A4** and **BZ3 HCR**

Fastener size				**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

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

Fastener size			**M8**		**M10**		**M12**		**M16**		**M20**		
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$													
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		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 C11: Displacements under **tension load, BZ3 A4** and **BZ3 HCR**

Fastener size			**M8**		**M10**		**M12**		**M16**		**M20**		
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$													
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90		
Cracked concrete													
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,11		0,06		0,05		0,06		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

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Table C12: Displacements under **shear load, BZ3** (steel, zinc plated)

Fastener size			**M8**		**M10**		**M12**		**M16**		**M20**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$											
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90
Factor for displacement **unfilled** annular gap	$\delta_{V0\text{- factor}}$	[mm/kN]	0,157		0,081		0,086		0,080		0,067
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,235		0,121		0,129		0,120		0,100
Factor for displacement **filled** annular gap	$\delta_{V0\text{- factor}}$	[mm/kN]	0,002		0,039		0,047		0,038		0,016
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,004		0,059		0,070		0,057		0,024
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 considered.

Table C13: Displacements under **shear load, BZ3 A4**

Fastener size			**M8**		**M10**		**M12**		**M16**		**M20**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$											
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90
Factor for displacement **unfilled** annular gap	$\delta_{V0\text{- factor}}$	[mm/kN]	0,257		0,137		0,107		0,088		0,086
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,385		0,205		0,160		0,132		0,129
Factor for displacement **filled** annular gap	$\delta_{V0\text{- factor}}$	[mm/kN]	0,016		0,020		0,040		0,025		0,086
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,024		0,030		0,060		0,037		0,129
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 considered

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	**Annex C9**
Performance Displacements under shear load	

Table C14: Displacements under **shear load, BZ3 HCR**

Fastener size			**M8**		**M10**		**M12**		**M16**		**M20**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$		V: acting shear load									
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90
Factor for displacement **unfilled** annular gap	$\delta_{V0\text{- factor}}$	[mm/kN]	0,276		0,137		0,126		0,082		0,086
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,413		0,205		0,189		0,123		0,129
Factor for displacement **filled** annular gap	$\delta_{V0\text{- factor}}$	[mm/kN]	0,308		0,042		0,040		0,025		0,086
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,462		0,064		0,060		0,037		0,129
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 considered