

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-19/0619
of 10 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

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
DEUTSCHLAND

Manufacturing plant

MKT Metall-Kunststoff-Technik GmbH & Co. KG
Auf dem Immel 2
67685 Weilerbach

This European Technical Assessment
contains

22 pages including 3 annexes which form an integral part
of this assessment

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

EAD 330232-01-0601 Edition 05/2021

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Specific Part

1 Technical description of the product

The 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
Displacements	see Annex C7, C8
Durability	see Annex B1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	see Annex C5, C6

English translation prepared by DIBt

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

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

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

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

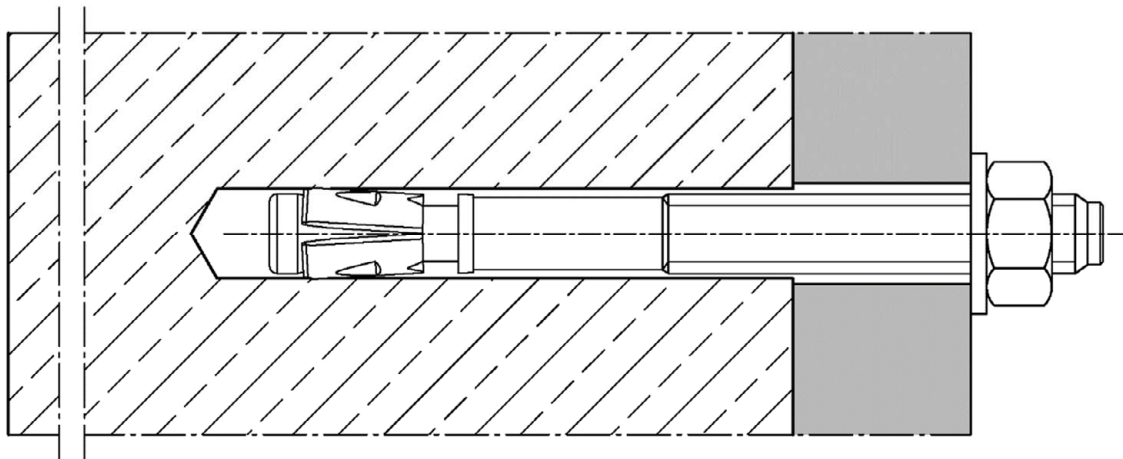
Issued in Berlin on 10 December 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

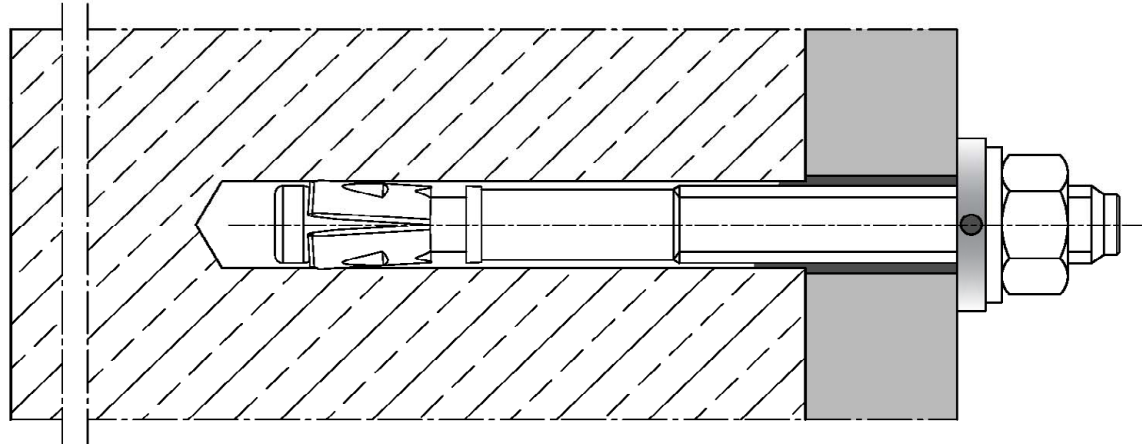
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Wedge anchor BZ3, BZ3 A4 and BZ3 HCR

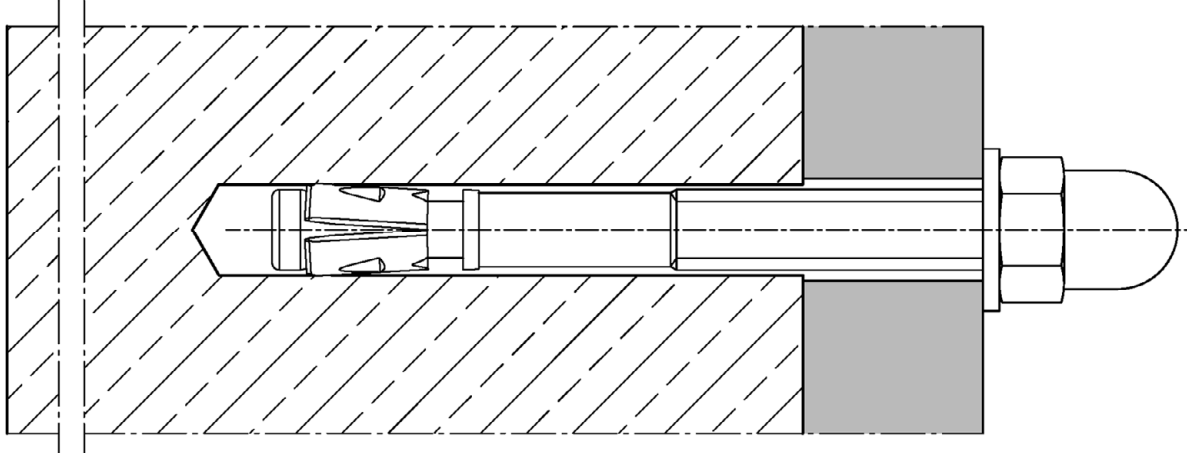
Installation condition



Installation condition with filling washer (optional with cap nut)



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

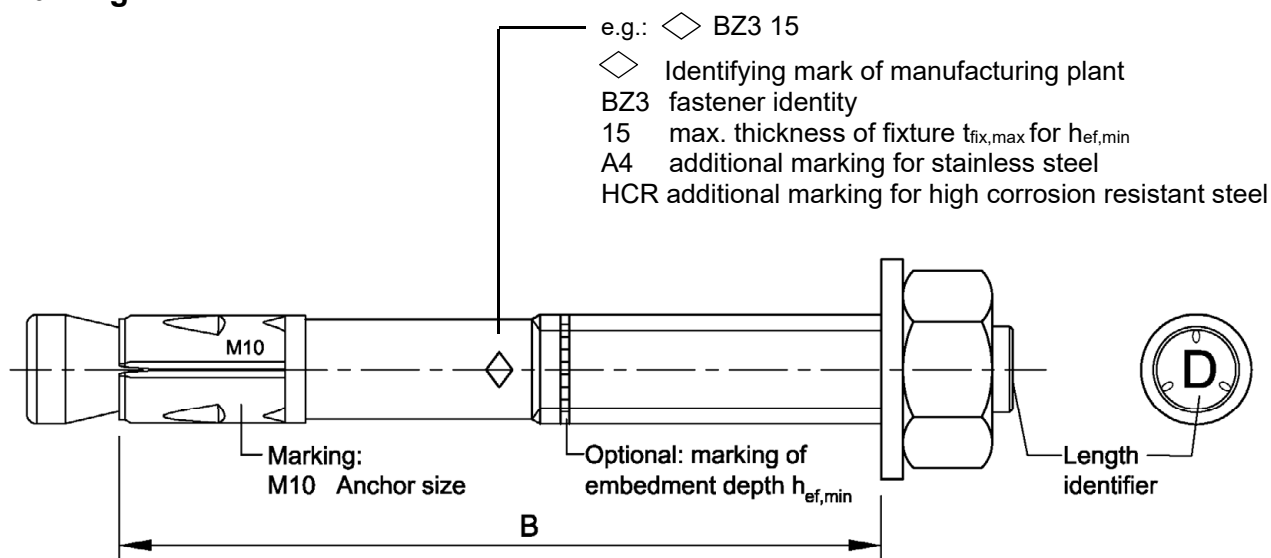


Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Product description
Product types and installation conditions

Annex A1

Marking



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

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 \geq	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 \geq	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 \geq	220	230	240	250	260	270	280	290

Dimensions in mm

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Annex A2

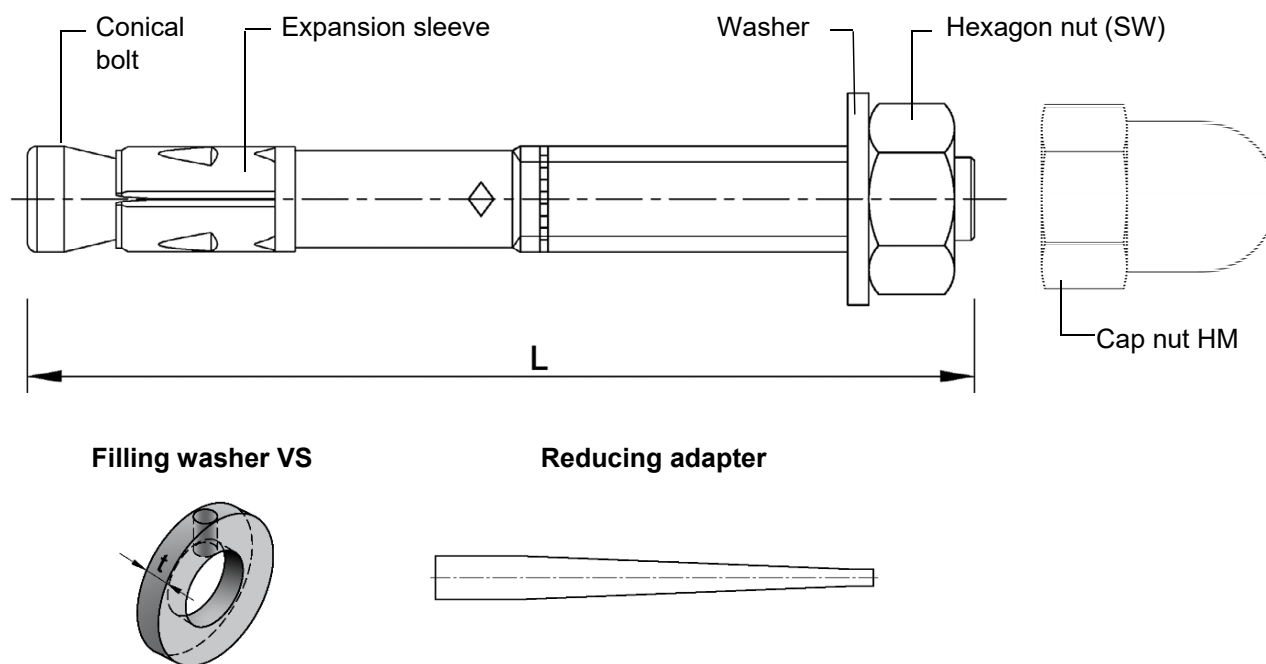
Product description
Marking

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			
Hexagon nut			
Cap nut			

Table A3: Fastener dimensions

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



Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Product description
Material and dimensions

Annex A3

Specifications of intended use

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

Base materials:

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

Use conditions (Environmental conditions):

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

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.
- The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Design method EN 1992-4:2018 and Technical Report TR 055:2018

Installation:

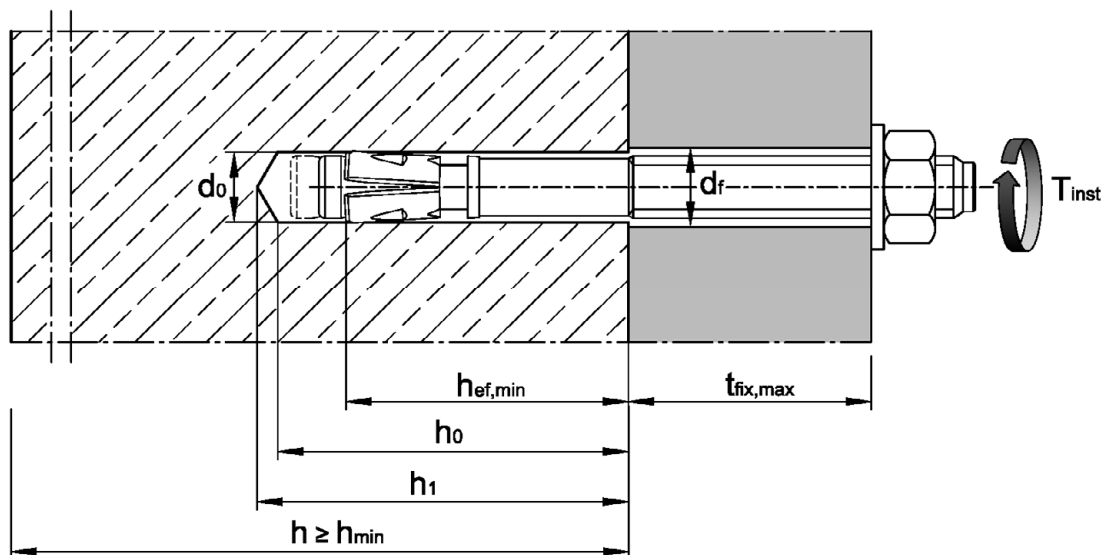
- Hole drilling by hammer drill bit or vacuum drill bit
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener (exception: when using the cap nut HM)
- The anchor can be set in pre- or through-setting installation.
- Optionally, the annular gap between fixture and stud of BZ3 can be filled to reduce the hole clearance. For this purpose, the filling washer (Annex A3) must be used in addition to the supplied washer. For filling use MKT Injection Adhesive VMH, VMU plus, VMZ or other high-strength injection mortar with compressive strength $\geq 40\text{N/mm}^2$.

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

Table B1: Installation parameters

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

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



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		BZ3 / BZ3 A4 / BZ3 HCR			
		M8	M10	M12	M16
Minimum member thickness depending on h_{ef}	$h_{min} \geq$ [mm]	max (1,5 · h_{ef} ; 80)		max (1,5 · h_{ef} ; 100)	max (1,5 · h_{ef} ; 120)
Minimum edge distances and spacings					
Minimum edge distance	c_{min} [mm]	40	45	55	65
	for $s \geq$ [mm]	see Table B4			
Minimum spacings	s_{min} [mm]	35	40	50	65
	for $c \geq$ [mm]	see Table B4			
<p>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:</p> $A_{sp,req} \leq A_{sp,ef}$ <p>Required splitting area $A_{sp,req}$ and idealized splitting area $A_{sp,ef}$ according to Table B4.</p>					

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

Anchor size		M8	M10	M12	M16	
Applicable concrete thickness	BZ3 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} [mm ²]	$\frac{N_{Rk,sp}^0 - 2,573}{0,000436}$	$\frac{N_{Rk,sp}^0 + 2,040}{0,000693}$	$\frac{N_{Rk,sp}^0 + 3,685}{0,000692}$	$\frac{N_{Rk,sp}^0 + 3,738}{0,000875}$
	BZ3 A4 BZ3 HCR	A_{sp} [mm ²]	$\frac{N_{Rk,sp}^0 + 4,177}{0,000862}$	$\frac{N_{Rk,sp}^0 + 7,235}{0,000967}$	$\frac{N_{Rk,sp}^0 + 7,847}{0,000951}$	$\frac{N_{Rk,sp}^0 + 11,415}{0,000742}$

¹⁾ with $N_{Rk,sp}^0$ in kN

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended use
Minimum spacings and edge distances
Required area and applicable concrete thickness

Annex B3

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

Anchor size	BZ3 / BZ3 A4 / BZ3 HCR						
	M8	M10	M12	M16			
<p>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:</p> $A_{sp,req} \leq A_{sp,ef}$							
<p>Idealized splitting area $A_{sp,ef}$ The edge distances and spacings shall be selected or rounded in steps of 5 mm.</p>							
<p>Member thickness: $h > h_{ef} + 1,5 \cdot c$</p>							
<p>Single anchor or anchor group with $s \geq 3 \cdot c$</p>							
Effective anchorage depth	$h_{ef} < 1,5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (1,5 \cdot c + h_{ef})$		[mm ²]			
Effective anchorage depth	$h_{ef} \geq 1,5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (3 \cdot c)$		[mm ²]			
<p>Anchor group ($s < 3 \cdot c$)</p>							
Effective anchorage depth	$h_{ef} < 1,5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (1,5 \cdot c + h_{ef})$		[mm ²]			
Effective anchorage depth	$h_{ef} \geq 1,5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (3 \cdot c)$		[mm ²]			
<p>Member thickness: $h \leq h_{ef} + 1,5 \cdot c$</p>							
<p>Single anchor or anchor group with $s \geq 3 \cdot c$</p>							
Effective anchorage depth	$h_{ef} < 1,5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot h$		[mm ²]			
Effective anchorage depth	$h_{ef} \geq 1,5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (h - h_{ef} + 1,5 \cdot c)$		[mm ²]			
<p>Anchor group ($s < 3 \cdot c$)</p>							
Effective anchorage depth	$h_{ef} < 1,5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot h$		[mm ²]			
Effective anchorage depth	$h_{ef} \geq 1,5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (h - h_{ef} + 1,5 \cdot c)$		[mm ²]			
<p>Required splitting area $A_{sp,req}$</p>							
BZ3	cracked concrete	$A_{sp,req}$	[mm ²]	13 900	23 700	31 500	42 300
	uncracked concrete	$A_{sp,req}$	[mm ²]	22 500	34 700	41 300	50 200
BZ3 A4	cracked concrete	$A_{sp,req}$	[mm ²]	16 900	25 900	29 800	44 300
BZ3 HCR	uncracked concrete	$A_{sp,req}$	[mm ²]	19 700	35 700	35 300	54 800

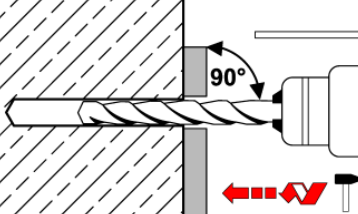
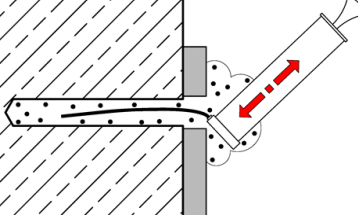
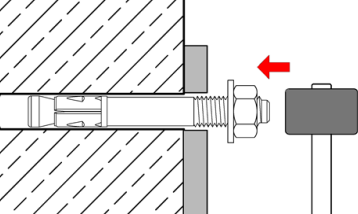
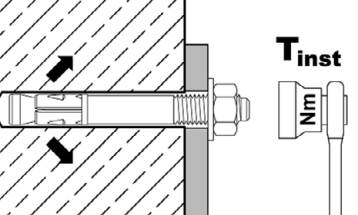
Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended use

Projected effective area to determine spacings and edge distances

Annex B4

Installation instructions

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended use
Installation instructions

Annex B5

Installation with cap nut HM

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Intended use
Installation instructions with cap nut

Annex B6

Installation instructions with filling of annular gap

1		Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.
3		Drive in fastener with additionally mounted filling washer.
4		Apply installation torque T_{inst} .
5		Fill the annular gap between anchor and fixture with injection adhesive (see Annex B1). 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 with filling of annular gap

Annex B7

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

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

¹⁾ Fastenings with anchorage depth $h_{ef} < 40$ 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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Annex C1

Performance

Characteristic values for **tension loads, BZ3** (Steel, zinc plated)

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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Performance
Characteristic values for **tension loads, BZ3 A4** and **BZ3 HCR**

Annex C2

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

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

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

²⁾ In absence of other national regulations

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Performance
Characteristic values for **shear loads**

Annex C3

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

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

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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Performance
Characteristic resistance for seismic loading

Annex C4

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

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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

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

Annex C5

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

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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

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

Annex C6

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

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

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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR

Performance
Displacements under tension load

Annex C7

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

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

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

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

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

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

Wedge Anchor BZ3 / BZ3 A4 / BZ3 HCR	Annex C8
Performance Displacements under tension load	