...eine starke Verbindung

DECLARAȚIA DE PERFORMANȚĂ

DoP Nr.: **MKT-1.1-901**_ro

✧ **Cod unic de identificare al produsului-tip:** **Bolțuri ancore BZ3 / BZ3 A4 / BZ3 HCR**

✧ **Utilizare (utilizări) preconizată (preconizate):** Ancora mecanică pentru ancorare în beton, a se vedea anexa / Annex B

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

✧ **Sistem sau sisteme de evaluare și verificare a constanței performanței:** 1

✧ **Documentul de evaluare european:** **EAD 330232-01-0601**
Evaluarea tehnică europeană: **ETA-19/0619, 10.12.2021**
Organismul de evaluare tehnică: DIBt, Berlin
Organism (organisme) notificat(e): NB 2873 – Technische Universität Darmstadt

✧ **Performanța (performanțe) declarată (declarate):**

Caracteristici esențiale	Performanță
Rezistență mecanică și stabilitate (BWR 1)	
Distanțele minime de margine și centru	Anexa / Annex B3
Rezistențe caracteristice sub sarcină la tracțiune (efecte statice și cvasistatice)	Anexa / Annex C1, C2
Rezistențe caracteristice sub stres transversal (efecte statice și cvasistatice)	Anexa / Annex C3
Rezistențe caracteristice pentru categoriile de performanță seismică C1 + C2	Anexa / Annex C4
Schimbări	Anexa / Annex C7, C8
Durabilitate	Anexa / Annex B1
Securitatea la incendiu (BWR 2)	
Comportamentul la foc	Clasa A1
Rezistență la foc	Anexa / Annex C5, C6

Performanța produsului de mai sus este performanța / performanța declarată. Producătorul de mai sus este singurul responsabil de întocmirea declarației de performanță în conformitate cu Regulamentul (EU) nr. 305/2011.

Semnată pentru și în numele fabricantului de către:

Stefan Weustenhagen
(Director general)

p.p.
Dipl.-Ing. Detlef Bigalke
(Sef de dezvoltare a produselor)

Weilerbach, 10.12.2021

Originalul acestei declarații de performanță a fost scris în limba germană. În cazul abaterilor în traducere, versiunea germană este validă.

Specifications of intended use

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

Base materials:

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

Use conditions (Environmental conditions):

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

Design:

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

Installation:

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

Table B1: Installation parameters

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

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

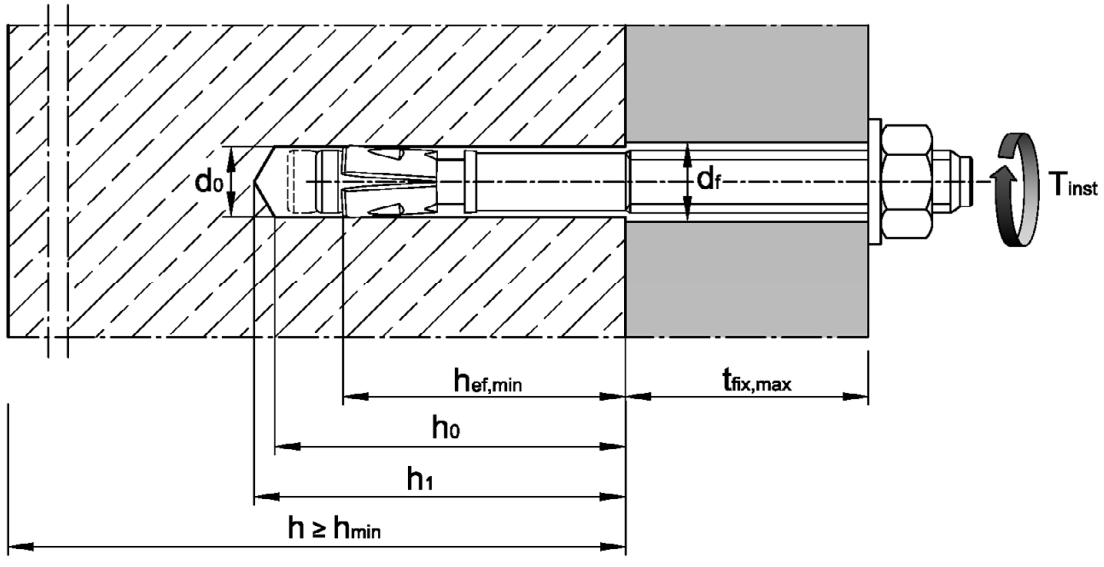


Table B2: Minimum thickness of concrete member, minimum spacings, edge distances

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

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

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

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

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

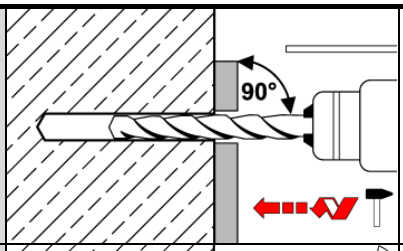
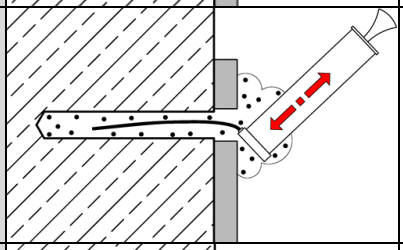
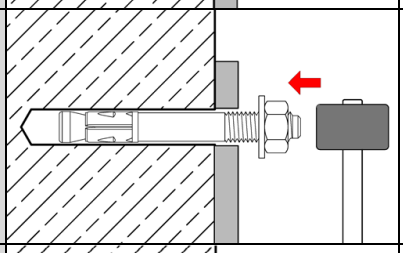
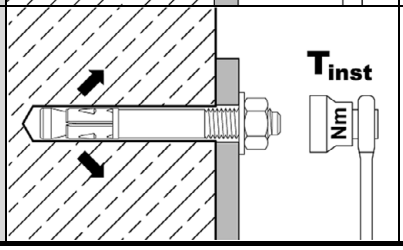
Anchor size				M8	M10	M12	M16
Applicable concrete thickness	BZ3 BZ3 A4 BZ3 HCR	h_{sp}	[mm]	$\min(h\ ;\ h_{ef} + 1{,}5 \cdot c \cdot \sqrt{2})$			
Area to determine $c_{cr,sp}$ [1)]	BZ3	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} - 2{,}573}{0{,}000436}$	$\frac{N^0_{Rk,sp} + 2{,}040}{0{,}000693}$	$\frac{N^0_{Rk,sp}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

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

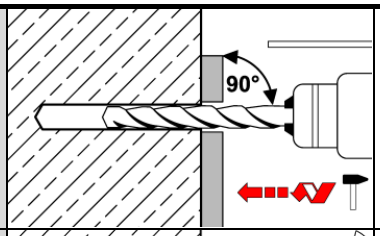
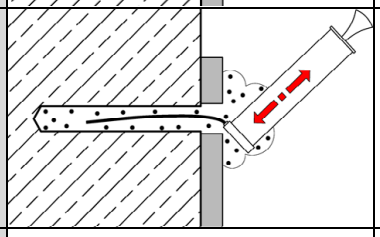
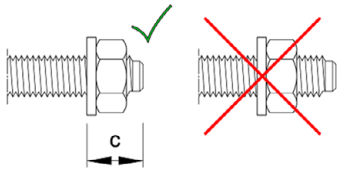
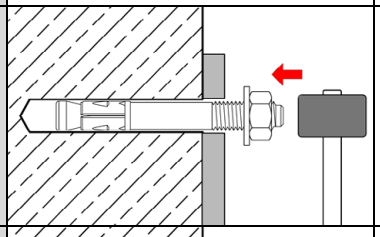
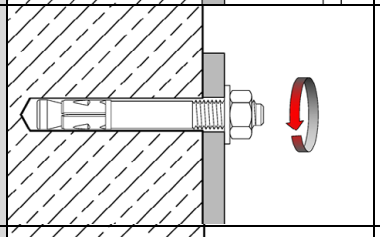
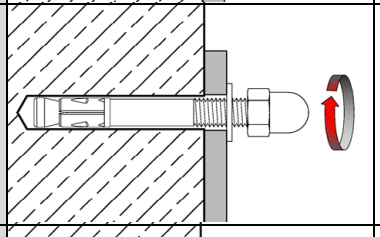
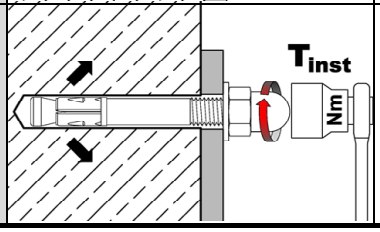
Table B4: Areas to determine spacings and edge distances for installation

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

Installation instructions

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

Installation with cap nut HM

1		Drill hole perpendicular to concrete surface. 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

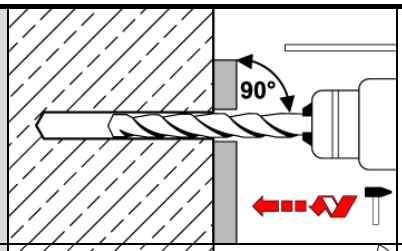
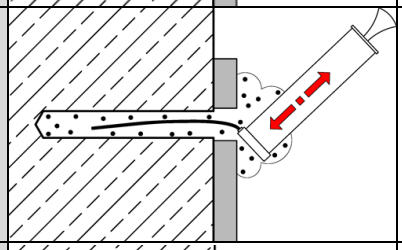
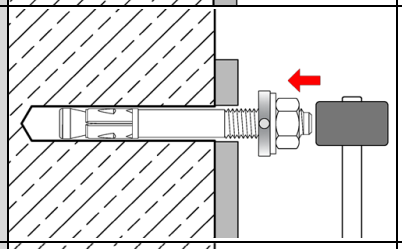
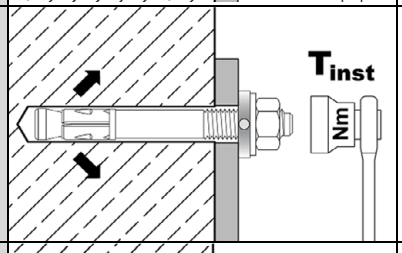
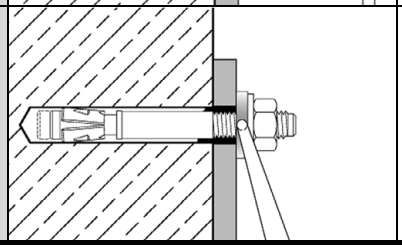
1		Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.
3		Drive in fastener with additionally mounted filling washer.
4		Apply installation torque T_{inst}.
5		Fill the annular gap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

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

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

Fastener size			**BZ3 A4 / BZ3 HCR**			
			M8	**M10**	**M12**	**M16**
Installation factor	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			
Factor — uncracked concrete	$k_{ucr,N}$	[-]	11,0			

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

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

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

[4] In absence of other national regulations

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

Fastener size				BZ3 / BZ3 A4 / BZ3 HCR			
				M8	M10	M12	M16
Installation factor		γ_{inst}	[-]	1,0			
Steel failure <u>without</u> lever arm							
Characteristic resistance	BZ3	$V^0_{Rk,s}$	[kN]	15,7	26,8	38,3	60,0
	BZ3 A4 / HCR	$V^0_{Rk,s}$	[kN]	16,8	27,8	39,8	69,5
Partial factor 2)		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
	BZ3 A4 / HCR	$M^0_{Rk,s}$	[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

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							

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

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

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

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

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

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

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

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

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

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

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

Fastener size			**BZ3**							
			M8		**M10**		**M12**		**M16**	
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$										
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65	
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 $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$										
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65	
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