Deutsches Institut für Bautechnik

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

European Technical Assessment Body for construction products

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European Technical Assessment ETA-24/0812 of 18 October 2024

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 Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR
Product family to which the construction product belongs	Post-installed fasteners in concrete under fatigue cyclic loading
Manufacturer	CHEMOFAST Anchoring GmbH Hanns-Martin-Schleyer-Straße 23 47877 Willich GERMANY
Manufacturing plant	Werk 2, Deutschland
This European Technical Assessment contains	20 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 330250-00-0601, Edition 06/2021

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Specific Part

1 Technical description of the product

The Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR is a fastener made of zinc plated steel or stainless steel (A4) or high corrosion resistant steel (HCR) 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 (static and quasi-static loading and seismic loading)	**Performance**
Characteristic resistance to tension load (static and quasi-static loading)	see Annex B3, C2, C3
Characteristic resistance to shear load (static and quasi-static loading)	see Annex C4
Displacements	see Annex C8, C9
Characteristic resistance and displacements for seismic performance categories C1 and C2	see Annex C5

Essential characteristic (fatigue loading, Assessment method B: Fatigue limit resistance)	**Performance**
Characteristic fatigue resistance under cyclic tension loading	
Characteristic steel fatigue resistance $\Delta N_{Rk,s,0,\infty}$	see Annex C1
Characteristic concrete cone, splitting and pull-out fatigue resistance $\Delta N_{Rk,c,0,\infty}$ $\Delta N_{Rk,sp,0,\infty}$ $\Delta N_{Rk,p,0,\infty}$	
Characteristic fatigue resistance under cyclic shear loading	
Characteristic steel fatigue resistance $\Delta V_{Rk,s,0,\infty}$	see Annex C1
Characteristic concrete edge and pry-out fatigue resistance $\Delta V_{Rk,c,0,\infty}$ $\Delta V_{Rk,cp,0,\infty}$	
Characteristic fatigue resistance under combined cyclic tension and shear loading	
Characteristic steel fatigue resistance a_s $(n = \infty)$	see Annex C1
Load transfer factor for cyclic tension, shear and combined tension and shear loading	
Load transfer factor ψ_{FN}, ψ_{FV}	see Annex C1

3.2 Safty 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 durabilty

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 330250-00-0601 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 18 October 2024 by Deutsches Institut für Bautechnik

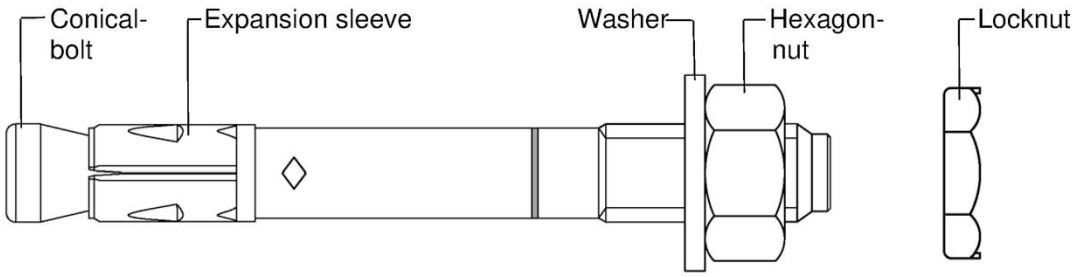
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

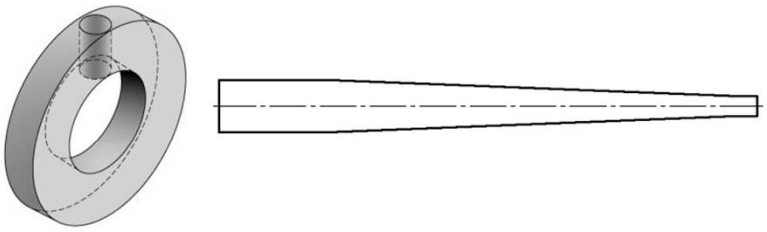
Deutsches Institut für Bautechnik DIBt

Wedge anchor BA3 dynamic, BA3 dynamic A4 und BA3 dynamic HCR

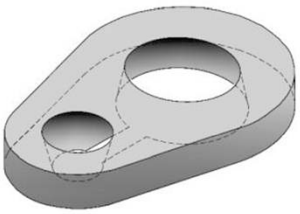
BA3 dyn. / BA3 dyn. A4 / BA3 dyn. HCR M10, M12, M16



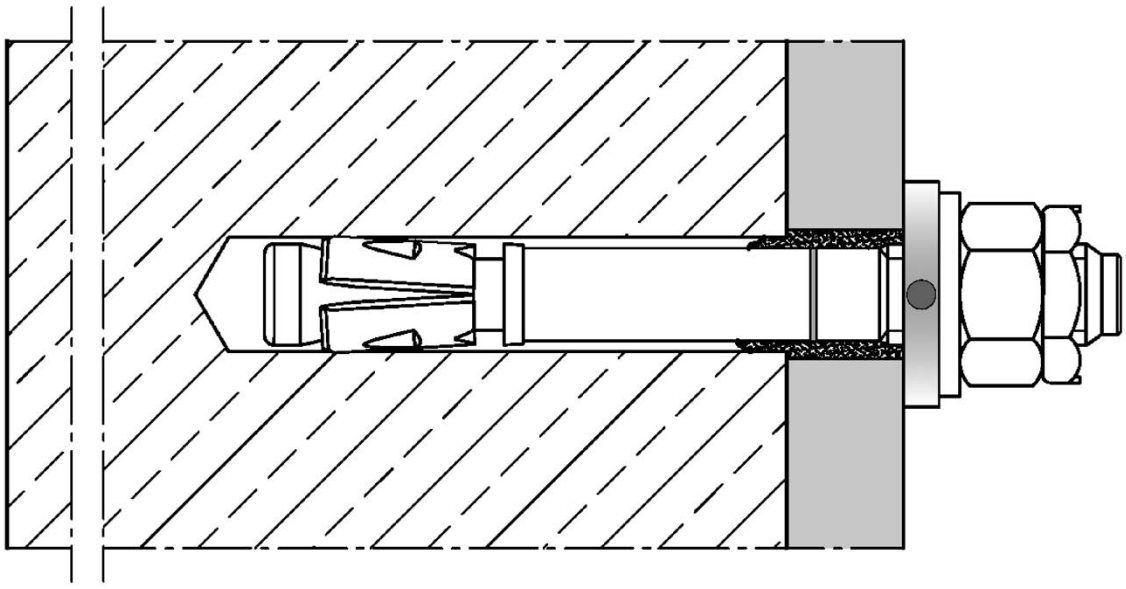
Filling washer VFS with reducing adapter



Filling washer (alternativ)



Installation situation



Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex A1**
Product description Product, installation situation	

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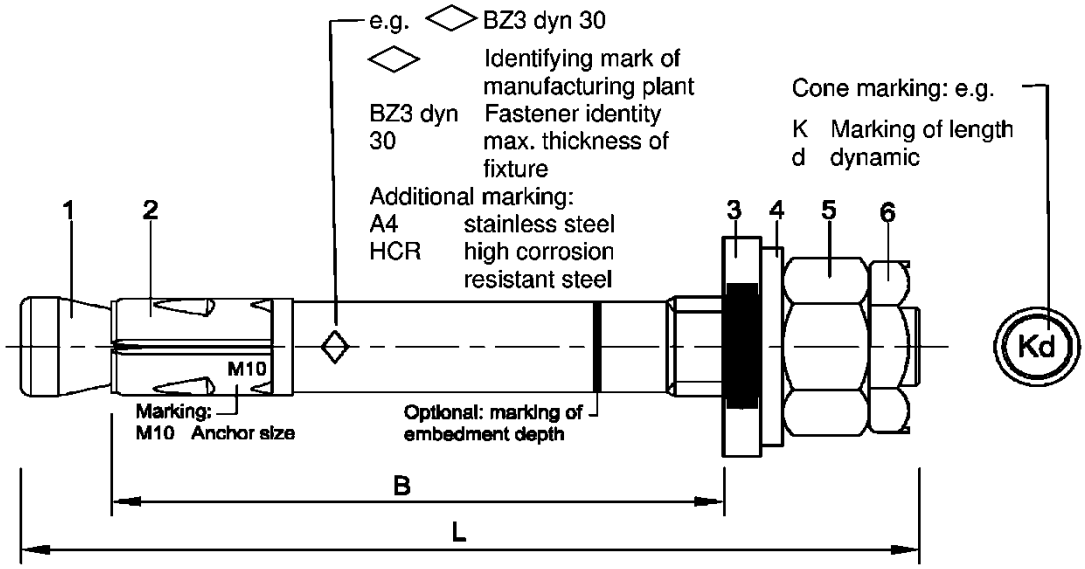
Marking



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

h_{ef}: (existing) effective anchorage depth

t_{fix}: fixture thickness

Table A1: Length identification

Length identifier		G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Usable length B	≥	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135

Length identifier		V	W	X	Y	Z
Usable length B	≥	140	145	150	160	170

Dimensions in mm

Table A2: Material

Part	Designation	Steel, zinc plated (BA3 dynamic)	Stainless steel (BA3 dynamic A4) CRC III	High corrosion resistant steel (BA3 dynamic HCR) CRC V
1	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%
2	Expansion sleeve	Stainless steel	Stainless steel	Stainless steel
3	Filling washer	Steel, galvanized ≥ 5 µm	Stainless steel	High corrosion resistant steel
4	Washer			
5	Hexagon nut			
6	Locknut			
7	Filling mortar	Chemofast Injection system (e.g. EP 1000, UM-H or VK)		

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR

Product description
Marking, length identification, material

Annex A2

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Specifications of intended use

Anchorages subject to:

- Fatigue cyclic loading
- Static and quasi-static action, fire exposure and seismic performance according to ETA-24/0686

Base materials:

- Cracked or uncracked concrete
- Compacted, 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
- For all other conditions according to EN 1993-1-4:2006+A1:2015, corresponding to corrosion resistance classes CRC according to Annex A2, 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, TR 055:2018 and TR 061:2020 (design method II)

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

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex B1**
Intended use Specifications of intended use	

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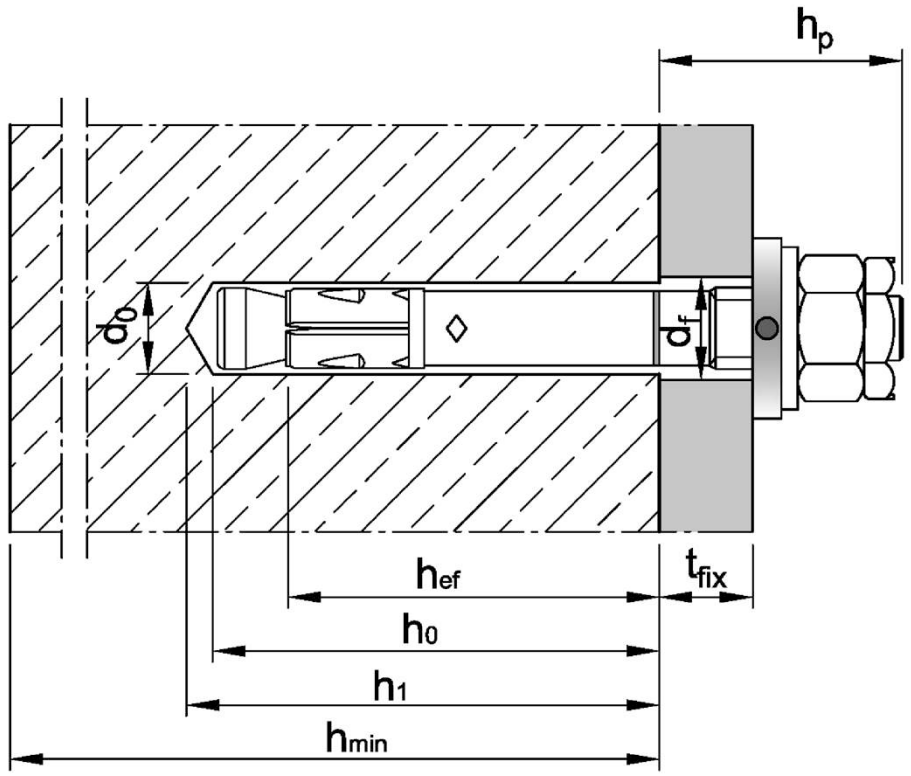
Table B1: Installation parameters

Anchor size				**M10**	**M12**	**M16**
Nominal drill hole diameter		d_0 =	[mm]	10	12	16
Cutting diameter of drill bit		$d_{cut} \leq$	[mm]	10,45	12,5	16,5
Effective anchorage depth[1)]		$h_{ef} \geq$	[mm]	60	70	85
Depth of drill hole		$h_0 \geq$	[mm]	h_{ef} + 9	h_{ef} + 10	h_{ef} + 14
		$h_1 \geq$	[mm]	h_{ef} + 11	h_{ef} + 13	h_{ef} + 17
Diameter of clearance hole in the fixture		d_f =	[mm]	12	14	18
Minimum fixture thickness		$t_{fix,min}$ =	[mm]	5	6	8
Installation torque	BA3 dyn.	T_{inst} =	[Nm]	40	60	110
	BA3 dyn. A4 BA3 dyn. HCR	T_{inst} =	[Nm]	40	55	100
Overstand		$h_p \leq$	[mm]	21,5 + t_{fix}	25,5 + t_{fix}	29,5 + t_{fix}
Length of fastener		L	[mm]	h_{ef} + t_{fix} + 30,5	h_{ef} + t_{fix} + 35,5	h_{ef} + t_{fix} + 43
Hexagon nut	width across nut		[mm]	17	19	24
Locknut	width across nut		[mm]	17	19	24

[1)] End of thread must be above the concrete surface



Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR

Intended use
Installation parameters

Annex B2

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

Anchor size				**M10**	**M12**	**M16**
Minimum member thickness depending on h_{ef}		$h_{min} \geq$	[mm]	$1{,}5 \cdot h_{ef}$		
Minimum edge distances and spacings						
Minimum edge distance		c_{min}	[mm]	45	55	65
		for s ≥	[mm]	see Table B4		
Minimum spacings		s_{min}	[mm]	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 connection with the anchorage depth and the member thickness:

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

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

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

Anchor size				**M10**	**M12**	**M16**
Applicable concrete thickness		h_{sp}	[mm]	$\min(h\,;\ h_{ef} + 1{,}5 \cdot c \cdot \sqrt{2})$		
Area to determine $c_{cr,sp}$	BA3 dyn.	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} + 2{,}040}{0{,}000693}$	$\frac{N^0_{Rk,sp} + 3{,}685}{0{,}000692}$	$\frac{N^0_{Rk,sp} + 3{,}738}{0{,}000875}$
	BA3 dyn. A4 BA3 dyn. HCR	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} + 7{,}235}{0{,}000967}$	$\frac{N^0_{Rk,sp} + 7{,}847}{0{,}000951}$	$\frac{N^0_{Rk,sp} + 11{,}415}{0{,}000742}$

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex B3**
Intended use Minimum spacings and edge distances Required area and applicable concrete thickness	

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

Anchor size				**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:						
$A_{sp,rqd} \leq A_{sp,ef}$						
Idealized splitting area $A_{sp,ef}$ The spacings and edge distances 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 $A_{sp,rqd}$						
BA3 dyn.	cracked concrete	$A_{sp,rqd}$	[mm²]	23 700	31 500	42 300
	uncracked concrete	$A_{sp,rqd}$	[mm²]	34 700	41 300	50 200
BA3 dyn. A4 BA3 dyn. HCR	cracked concrete	$A_{sp,rqd}$	[mm²]	25 900	29 800	44 300
	uncracked concrete	$A_{sp,rqd}$	[mm²]	35 700	35 300	54 800

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex B4**
Intended use Areas to determine spacings and edge distances	

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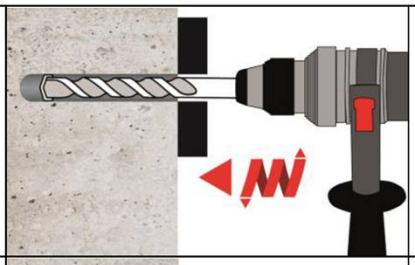
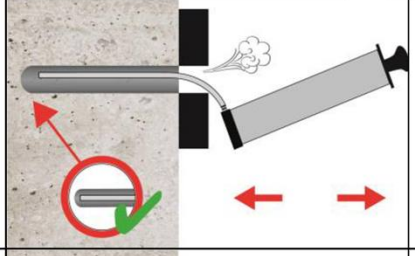
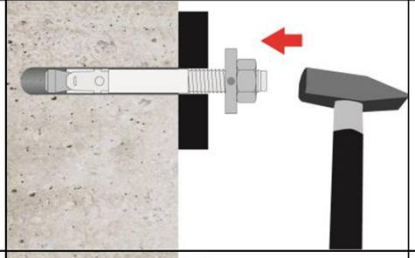
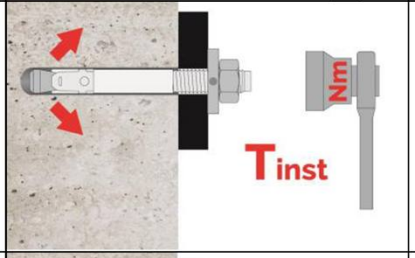
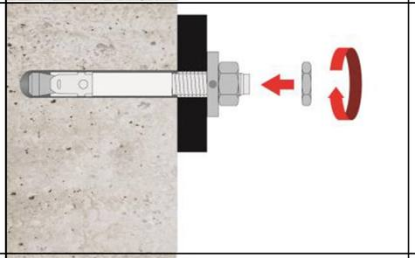
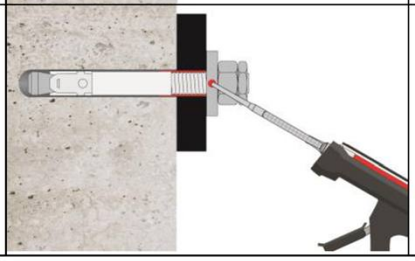
Installation instructions

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 with filling washer until effective anchorage depth is reached.
4		Apply installation torque T_{inst} according to Table B1 by using torque wrench.
5		Screw on locknut until hand tight then tighten ¼ to ½ turn.
6		Fill the annular gap between anchor and fixture with mortar (compressive strength ≥ 40 N/mm², e.g. Injection System EP 1000, UM-H oder VK). Use enclosed reducing adapter. Observe the processing information of the mortar! The annular gap is completely filled, when excess mortar seeps out.

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex B5**
Intended use Installation instructions	

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Table C1: Characteristic values of fatigue resistance

Anchor size				**M10**	**M12**	**M16**
Tension load						
Steel failure						
Characteristic fatigue resistance	BA3 dyn.	$\Delta N_{Rk,s,0,\infty}$	[kN]	4,6	6,2	9,7
	BA3 dyn. A4		[kN]	3,2	5,3	9,2
	BA3 dyn. HCR		[kN]	2,8	5,5	9,7
Load-transfer factor for fastener groups		ψ_{FN}	[-]	0,5		
Pull-out						
Characteristic fatigue resistance		$\Delta N_{Rk,p,0,\infty}$	[kN]	0,5 $N_{Rk,p}$		
Concrete cone and splitting failure						
Characteristic fatigue resistance		$\Delta N_{Rk,c,0,\infty}$	[kN]	0,5 $N_{Rk,c}$		
		$\Delta N_{Rk,sp,0,\infty}$	[kN]	0,5 $N_{Rk,sp}$		
Effective anchorage depth		h_{ef}	[mm]	60	70	85
Shear load						
Steel failure without lever arm						
Characteristic fatigue resistance	BA3 dyn.	$\Delta V_{Rk,s,0,\infty}$	[kN]	2,5	4,0	7,5
	BA3 dyn. A4		[kN]	1,5	2,8	6,0
	BA3 dyn. HCR		[kN]	2,3	2,8	5,0
Load-transfer factor for fastener groups		ψ_{FV}	[-]	0,5		
Concrete pry-out failure						
Characteristic fatigue resistance		$\Delta V_{Rk,cp,0,\infty}$	[kN]	0,5 $V_{Rk,cp}$		
Concrete edge failure						
Characteristic fatigue resistance		$\Delta V_{Rk,c,0,\infty}$	[kN]	0,5 $V_{Rk,c}$		
Effective length of anchor		l_f	[mm]	60	70	85
Diameter of anchor		d_{nom}	[mm]	10	12	16
Tension and shear load						
Partial factor [1)]		$\gamma_{Ms,fat}$	[-]	1,35		
		$\gamma_{Mc,fat}$	[-]	1,5		
		$\gamma_{Msp,fat}$	[-]	1,5		
		$\gamma_{Mp,fat}$	[-]	1,5		
Exponents for combined loading		α_s	[-]	0,5	0,5	0,7
		α_c	[-]	1,5		

[1)] In absence of other national regulations

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex C1**
Performance Characteristic values of fatigue resistance	

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Table C2: Characteristic values for **tension loads** under static and quasi-static action, **BA3 dynamic** (steel, zinc plated)

Anchor size				**M10**	**M12**	**M16**
Installation factor		γ_{inst}	[-]	1,0		
Steel failure						
Characteristic resistance		$N_{Rk,s}$	[kN]	30,4	44,9	79,3
Partial factor [1]		γ_{Ms}	[-]	1,5		
Pull-out						
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p,cr}$	[kN]	15	22	30
Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,265}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,339}$
Characteristic resistance in uncracked concrete C20/25		$N_{Rk,p,ucr}$	[kN]	24	30	50
Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,448}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,203}$
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						
Effective anchorage depth		h_{ef}	[mm]	60	70	85
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] In absence of other national regulations
[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

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex C2**
Performance Characteristic values for **tension loads, BA3 dynamic** (steel, zinc plated)	

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Table C3: Characteristic values for **tension loads** under static or quasi-static action, **BA3 dynamic A4** and **BA3 dynamic HCR**

Anchor size				**M10**	**M12**	**M16**
Installation factor		γ_{inst}	[-]	1,0		
Steel failure						
Characteristic resistance		$N_{Rk,s}$	[kN]	30,4	44,9	74,6
Partial factor [1]		γ_{Ms}	[-]	1,5		
Pull-out						
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p,cr}$	[kN]	17	22	35
Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,435}$	$\left(\frac{f_{ck}}{20}\right)^{0,350}$
Characteristic resistance in uncracked concrete C20/25		$N_{Rk,p,ucr}$	[kN]	25	42	50
Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,364}$	$\left(\frac{f_{ck}}{20}\right)^{0,213}$	$\left(\frac{f_{ck}}{20}\right)^{0,196}$
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						
Effective anchorage depth		h_{ef}	[mm]	60	70	85
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] In absence of other national regulations

[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

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex C3**
Performance Characteristic values for **tension loads, BA3 dynamic A4** and **BA3 dynamic HCR**	

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Table C4: Characteristic values for **shear loads** under static and quasi-static action

Anchor size				**M10**	**M12**	**M16**
Installation factor		γ_{inst}	[-]	1,0		
Steel failure without lever arm						
Characteristic resistance	BA3 dyn.	$V^0_{Rk,s}$	[kN]	26,8	38,3	60,0
	BA3 dyn. A4 BA3 dyn. HCR	$V^0_{Rk,s}$	[kN]	27,8	39,8	69,5
Partial factor [1]		γ_{Ms}	[-]	1,25		
Ductility factor		k_7	[-]	1,0		
Steel failure with lever arm						
Characteristic bending resistance	BA3 dyn.	$M^0_{Rk,s}$	[Nm]	60	105	240
	BA3 dyn. A4 BA3 dyn. HCR	$M^0_{Rk,s}$	[Nm]	55	99	223
Partial factor [1]		γ_{Ms}	[-]	1,25		
Concrete pry-out failure						
Pry-out factor	BA3 dyn.	k_8	[-]	3,1	3,0	3,6
	BA3 dyn. A4 BA3 dyn. HCR	k_8	[-]	2,8	3,3	3,4
Concrete edge failure						
Effective length of fastener in shear loading		l_f	[mm]	h_{ef}		
Outside diameter of fastener		d_{nom}	[mm]	10	12	16

[1] In absence of other national regulations

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR

Performance
Characteristic values for **shear loads**

Annex C4

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

Anchor size				**M10**	**M12**	**M16**
Effective anchorage depth		$h_{ef} \geq$	[mm]	60	70	85
Tension load						
Installation factor		γ_{inst}	[-]	1,0		
Steel failure						
Characteristic resistance	BA3 dyn.	$N_{Rk,s,C1}$	[kN]	30,4	44,9	79,3
	BA3 dyn. A4 BA3 dyn. HCR	$N_{Rk,s,C1}$	[kN]	30,4	44,9	74,6
Pull-out						
Characteristic resistance	BA3 dyn.	$N_{Rk,p,C1}$	[kN]	15,0	22,0	30,0
	BA3 dyn. A4 BA3 dyn. HCR	$N_{Rk,p,C1}$	[kN]	17,0	22,0	35,0
Shear load						
Steel failure without lever arm						
Characteristic resistance	BA3 dyn.	$V_{Rk,s,C1}$	[kN]	24,4	33,8	52,3
	BA3 dyn. A4 BA3 dyn. HCR	$V_{Rk,s,C1}$	[kN]	22,2	33,2	64,3
Factor for anchorages without annular gap		α_{gap}	[-]	1,0		

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

Anchor size				**M10**	**M12**	**M16**
Effective anchorage depth		$h_{ef} \geq$	[mm]	60	70	85
Tension load						
Installation factor		γ_{inst}	[-]	1,0		
Steel failure						
Characteristic resistance	BA3 dyn.	$N_{Rk,s,C2}$	[kN]	30,4	44,9	79,3
	BA3 dyn. A4 BA3 dyn. HCR	$N_{Rk,s,C2}$	[kN]	30,4	44,9	74,6
Pull-out						
Characteristic resistance	BA3 dyn.	$N_{Rk,p,C2}$	[kN]	12,5	19,0	35,2
	BA3 dyn. A4 BA3 dyn. HCR	$N_{Rk,p,C2}$	[kN]	7,7	13,8	29,4
Shear load						
Steel failure without lever arm						
Characteristic resistance	BA3 dyn.	$V_{Rk,s,C2}$	[kN]	19,0	28,0	43,3
	BA3 dyn. A4 BA3 dyn. HCR	$V_{Rk,s,C2}$	[kN]	15,9	25,6	46,1
Factor for anchorages without annular gap		α_{gap}	[-]	1,0		

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR

Performance
Characteristic resistance for **seismic loading**

Annex C5

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Table C7: Characteristic values **for tension and shear load** under **fire exposure, BA3 dynamic** (steel, zinc plated)

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

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

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Table C8: Characteristic values **for tension and shear load** under **fire exposure, BA3 dynamic A4** and **BA3 dynamic HCR**

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

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

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Table C9: Displacements under **tension load, BA3 dynamic** (steel, zinc plated)

Anchor size			**M10**	**M12**	**M16**
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$					
Cracked concrete					
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,05	0,04	0,03
	$\delta_{N\infty\text{-factor}}$	[mm/kN]	0,20	0,15	0,11
Uncracked concrete					
Factor for displacement	$\delta_{N0\text{- factor}}$	[mm/kN]	0,01	0,004	0,005
	$\delta_{N\infty\text{- factor}}$	[mm/kN]	0,03	0,03	0,03
Displacement under seismic action C2					
Displacements for DLS	$\delta_{N,C2(DLS)}$	[mm]	4,7	4,2	4,5
Displacements for ULS	$\delta_{N,C2(ULS)}$	[mm]	16,1	12,9	12,8

Table C10: Displacements under **tension load, BA3 dynamic A4** and **BA3 dynamic HCR**

Anchor size			**M10**	**M12**	**M16**
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$					
Cracked concrete					
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,06	0,05	0,02
	$\delta_{N\infty\text{-factor}}$	[mm/kN]	0,17	0,16	0,08
Uncracked concrete					
Factor for displacement	$\delta_{N0\text{- factor}}$	[mm/kN]	0,00	0,001	0,00
	$\delta_{N\infty\text{- factor}}$	[mm/kN]	0,05	0,05	0,05
Displacement under seismic action C2					
Displacements for DLS	$\delta_{N,C2(DLS)}$	[mm]	4,1	5,7	5,1
Displacements for ULS	$\delta_{N,C2(ULS)}$	[mm]	16,8	18,0	13,9

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR	**Annex C8**
Performance Displacements under tension load	

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Table C11: Displacements under **shear load, steel, zinc plated**

Anchor size			**M10**	**M12**	**M16**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$					
Factor for displacement	$\delta_{V0\text{- factor}}$	[mm/kN]	0,09	0,09	0,07
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,13	0,14	0,11
Displacement under seismic action C2					
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	3,1	3,7	3,8
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	5,5	9,9	9,6

Table C12: Displacements under **shear load, A4** and **HCR**

Anchor size			**M10**	**M12**	**M16**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$					
Factor for displacement	$\delta_{V0\text{- factor}}$	[mm/kN]	0,14	0,12	0,09
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,20	0,17	0,14
Displacement under seismic action C2					
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	3,5	4,2	4,4
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	8,4	11,8	11,1

Wedge Anchor Chemofast BA3 dynamic / BA3 dynamic A4 / BA3 dynamic HCR

Performance
Displacements under shear load

Annex C9