

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-17/0198
of 30 January 2023

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

Berner chemical anchor BCA II

Product family
to which the construction product belongs

Bonded fastener for use in concrete

Manufacturer

Berner Omnichannel Trading
Holding SE
Bernerstraße 6
74653 Künzelsau
DEUTSCHLAND

Manufacturing plant

Berner Herstellwerk 6

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 330499-01-0601, Edition 04/2020

This version replaces

ETA-17/0198 issued on 10 August 2017

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Specific Part

1 Technical description of the product

The Berner chemical anchor BCA II is a bonded anchor for use in concrete consisting of a capsule Berner BCA II and a steel element according to Annex A2.

The capsule Berner BCA II is placed in the hole and the steel element is driven by machine with simultaneous hammering and turning.

The element is anchored via the bond between steel element, chemical mortar and concrete.

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 B 3 and B 4, C 1 to C 5
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 to C 3
Displacements under short-term and long-term loading	See Annex C 6
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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

Issued in Berlin on 30 January 2023 by Deutsches Institut für Bautechnik

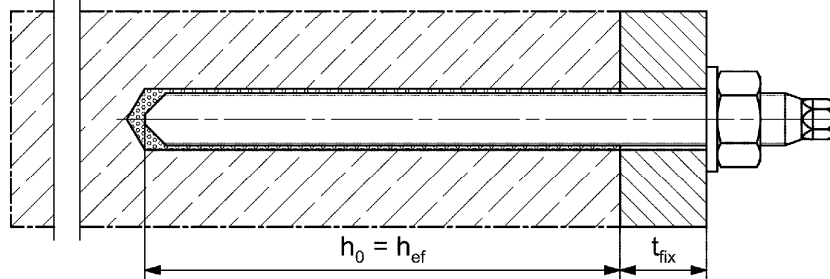
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

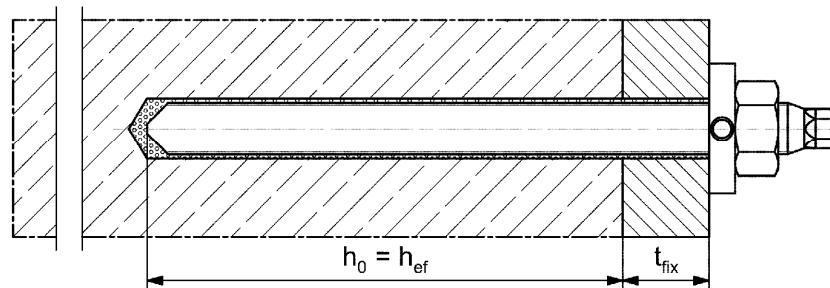
Installation conditions

Berner anchor rod BCA M; installation in concrete

Pre-positioned installation:

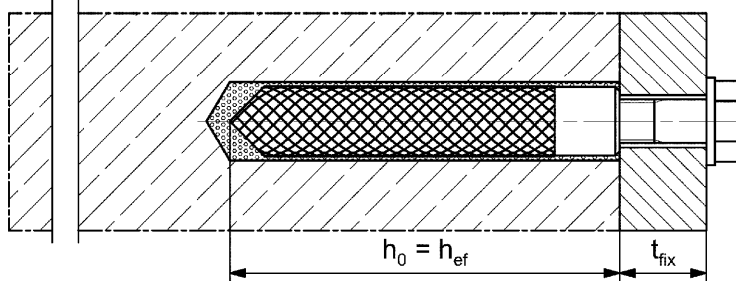


Pre-positioned installation with subsequently injected filling disc:

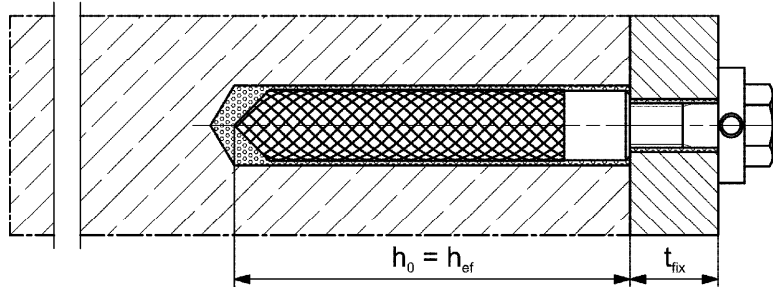


internal threaded anchor MCS Plus I; installation in concrete

Pre-positioned installation:



Pre-positioned installation with subsequently injected filling disc:



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

Berner chemical anchor BCA II

Product description
Installation conditions

Annex A 1

Overview product components

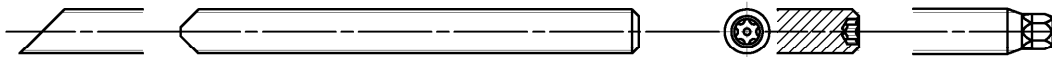
Capsule BCA II

Size: 8, 10, 12, 16, 16E, 20/22, 24



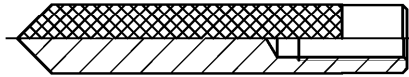
Anchor rod BCA M

Size: M8, M10, M12, M16, M20, M24

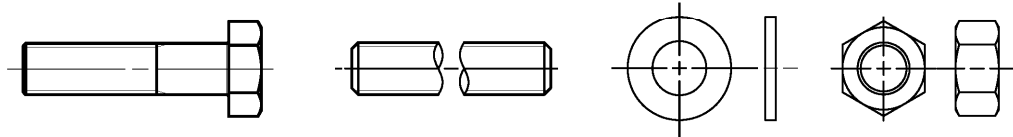


Berner internal threaded anchor MCS Plus I

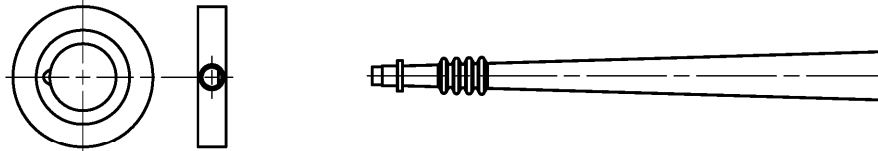
Size: M8, M10, M12, M16, M20



Screw / threaded rod / washer / hexagon nut



Filling disc with injection adapter



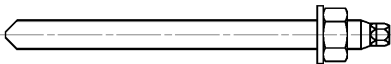
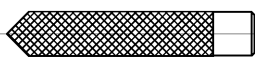


Figures not to scale

Berner chemical anchor BCA II

Product description
Overview product components

Annex A 2

Table A3.1: Materials				
Part	Designation	Material		
1	Capsule BCA II	Mortar, hardener, filler		
	Steel grade	Steel zinc plated	Stainless steel R acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A1:2015	High corrosion resistant steel HCR acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015
2	Anchor rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 zinc plated $\geq 5 \mu\text{m}$, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ EN ISO 10684:2004+AC:2009 $f_{uk} \leq 1000 \text{ N/mm}^2$	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462 EN 10088-1:2014 $f_{uk} \leq 1000 \text{ N/mm}^2$	Property class 50 or 80 EN ISO 3506-1:2020 or property class 70 with $f_{yk} = 560 \text{ N/mm}^2$ 1.4565; 1.4529 EN 10088-1:2014 $f_{uk} \leq 1000 \text{ N/mm}^2$
Fracture elongation $A_5 > 8 \%$,				
3	Washer ISO 7089:2000	zinc plated $\geq 5 \mu\text{m}$, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised \geq 40 μm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	1.4565; 1.4529 EN 10088-1:2014
4	Hexagon nut	Property class 4, 5 or 8; EN ISO 898-2:2012 zinc plated $\geq 5 \mu\text{m}$, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ EN ISO 10684:2004+AC:2009	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4565; 1.4529 EN 10088-1:2014
5	Berner internal threaded anchor MCS Plus I	Property class 5.8 ISO 898-1:2013 zinc plated $\geq 5 \mu\text{m}$, ISO 4042:2018/Zn5/An(A2K)	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529 EN 10088-1:2014
6	Commercial standard screw or threaded rod for internal threaded anchor MCS Plus I	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated $\geq 5 \mu\text{m}$, ISO 4042:2018/Zn5/An(A2K) fracture elongation $A_5 > 8 \%$	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014 fracture elongation $A_5 > 8 \%$	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529 EN 10088-1:2014 fracture elongation $A_5 > 8 \%$
7	filling disc	zinc plated $\geq 5 \mu\text{m}$, ISO 4042:2018/Zn5/An(A2K) or hot dip galvanised $\geq 40 \mu\text{m}$ EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	1.4565; 1.4529 EN 10088-1:2014
Berner chemical anchor BCA II				
Product description Materials				Annex A 3

Specifications of intended use part 1					
Table B1.1: Overview use and performance categories					
Fastenings subject to		BCA II with ...			
		Berner anchor rod BCA M 	Berner internal threaded anchor MCS Plus I 		
Hammer drilling with standard drill bit 	all sizes				
Hammer drilling with hollow drill bit (BERNER Cleandrift dustless; fischer „FHD“, Heller "Duster Expert"; Bosch „Speed Clean“; Hilti "TE-CD, TE-YD", DreBo „D-Plus“, DreBo „D-Max“) 	Nominal drill bit diameter (d ₀) 12 mm to 28 mm		all sizes		
Static and quasi static loading, in	uncracked concrete	all sizes	Tables: C1.1, C3.1, C4.1, C6.1	Tables: C2.1, C3.1, C5.1, C6.2	
	cracked concrete	M10, M12, M16, M20, M24			
Use category	I1 dry or wet concrete	all sizes			all sizes
	I2 water filled hole	M12, M16, M20, M24			M8, M10, M16
Seismic performance category	C1	_1)		_1)	
	C2	_1)		_1)	
Installation direction	D3 (downward and horizontal and upwards (e.g. overhead) installation)				
Installation temperature	T _{i,min} = -15 °C to T _{i,max} = +40 °C				
In-service temperature	Temperature range I	-40 °C to +40 °C	(max. short term temperature +40 °C and max. long term temperature +24 °C)		
	Temperature range II	-40 °C to +80 °C	(max. short term temperature +80 °C and max. long term temperature +50 °C)		
	Temperature range III	-40 °C to +120 °C	(max. short term temperature +120 °C and max. long term temperature +72 °C)		
1) No performance assessed					
Berner chemical anchor BCA II				Annex B 1	
Intended Use Specifications part 1					

Specifications of intended use part 2

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A 3 Table 3.1.

Design:

- Fastenings are designed under the responsibility of an engineer experienced in fastenings and concrete work.
- Verifiable calculation notes and drawings are to be 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.).
- Fastenings are designed in accordance with:
EN 1992-4:2018 and EOTA Technical Report TR 055, Edition February 2018.

Installation:

- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Fastening depth should be marked and adhered to installation.
- Overhead installation is allowed (necessary equipment see installation instruction).

Berner chemical anchor BCA II

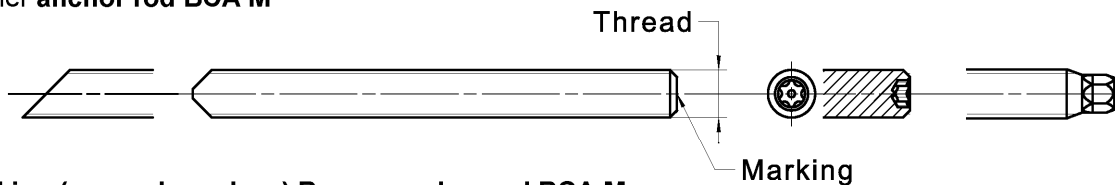
Intended Use
Specifications part 2

Annex B 2

Table B3.1: Installation parameters for anchor rods BCA M

Anchor rods BCA M		thread	M8	M10	M12	M16	M20	M24
Nominal drill bit diameter	d_0		10	12	14	18	25	28
Drill hole depth	h_0		$h_0 = h_{ef}$					
Effective embedment depth	h_{ef}		80	90	110	125	170	210
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		40	45	55	65	85	105
Diameter of pre-clearance hole in the positioned fixture	d_f		9	12	14	18	22	26
Minimum thickness of concrete member	h_{min}		$h_{ef} + 30$ (≥ 100)			$h_{ef} + 2d_0$		
Maximum installation torque	$\max T_{inst}$	[Nm]	10	20	40	60	120	150

Berner anchor rod BCA M



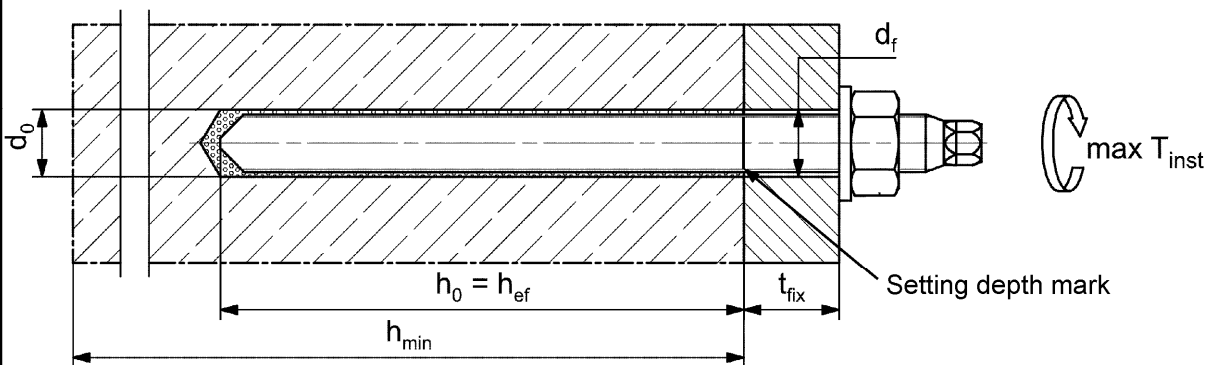
Marking (on random place) Berner anchor rod BCA M

Steel zinc plated PC ¹⁾ 8.8	• or +	Steel hot-dip PC ¹⁾ 8.8	•
High corrosion resistant steel HCR PC ¹⁾ 50	•	High corrosion resistant steel HCR PC ¹⁾ 70	-
High corrosion resistant steel HCR PC ¹⁾ 80	(Stainless steel R property class 50	~
Stainless steel R property class 80	*		

Alternatively: Colour coding according to DIN 976-1:2016

¹⁾ PC = property class

Installation conditions:



Figures not to scale

Berner chemical anchor BCA II

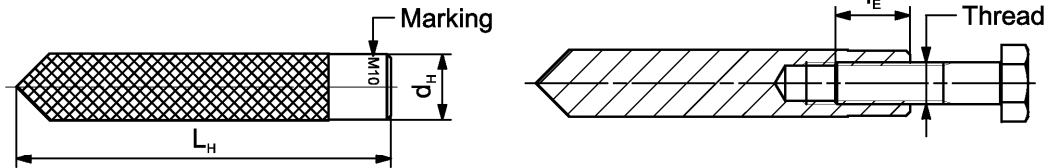
Intended Use
Installation parameters anchor rods BCA M

Annex B 3

Table B4.1: Installation parameters for Berner internal threaded anchors MCS Plus I

Internal threaded anchors MCS Plus I		thread	M8	M10	M12	M16	M20
Diameter of anchor	$d = d_H$	[mm]	12	16	18	22	28
Nominal drill bit diameter	d_0		14	18	20	24	32
Drill hole depth	h_0		$h_0 = h_{ef} = L_H$				
Effective embedment depth ($h_{ef} = L_H$)	h_{ef}		90	90	125	160	200
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		55	65	75	95	125
Diameter of clearance hole in the fixture	d_f		9	12	14	18	22
Minimum thickness of concrete member	h_{min}		120	125	165	205	260
Maximum screw-in depth	$l_{E,max}$		18	23	26	35	45
Minimum screw-in depth	$l_{E,min}$		8	10	12	16	20
Maximum installation torque	$\max T_{inst}$		[Nm]	10	20	40	80

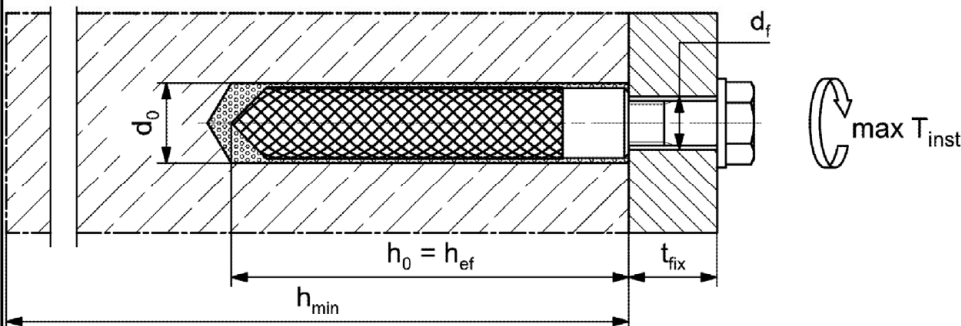
Berner internal threaded anchor MCS Plus I



Marking: Anchor size e. g.: **M10**
Stainless steel → additional **R**; e.g.: **M10 R**
High corrosion resistant steel → additional **HCR**; e.g.: **M10 HCR**

Retaining bolt or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A 3, Table A3.1.

Installation conditions:



Figures not to scale

Berner chemical anchor BCA II

Intended Use
Installation parameters Berner internal threaded anchors MCS Plus I

Annex B 4

Table B5.1: Dimensions of resin capsule BCA II

Capsule BCA II		8	10	12	16	16 E	20/22	24
Capsule diameter	d_P	9,0	10,5	12,5	16,5		23,0	
Capsule length	L_P	85	90	97	95	123	160	190

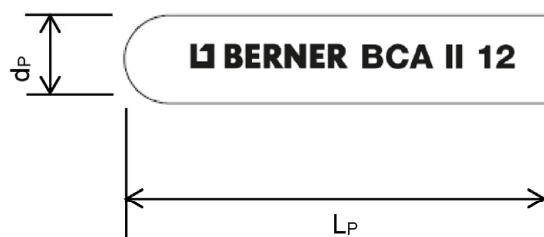


Table B5.2: Assignment of resin capsule BCA II to Berner anchor rod BCA M

Anchor rod BCA M		M8	M10	M12	M16	M20	M24
Effective embedment depth	h_{ef} [mm]	80	90	110	125	170	210
Related capsule BCA II	[-]	8	10	12	16	20/22	24

Table B5.3: Assignment of resin capsule BCA II to the Berner internal threaded anchor MCS Plus I

Internal threaded anchor MCS Plus I		M8	M10	M12	M16	M20
Effective embedment depth	h_{ef} [mm]	90	90	125	160	200
Related capsule BCA II	[-]	10	12	16	16E	24

Table B5.4: Minimum curing time

(During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature; minimal capsule temperature -15 °C)

Concrete temperature [°C]	Minimum curing time t_{cure}
-15 to -10	30 h
> -10 to -5	16 h
> -5 to 0	10 h
> 0 to 5	45 min
> 5 to 10	30 min
> 10 to 20	20 min
> 20 to 30	5 min
> 30 to 40	3 min

Berner chemical anchor BCA II

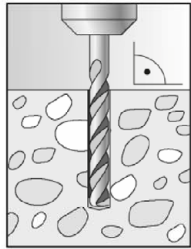
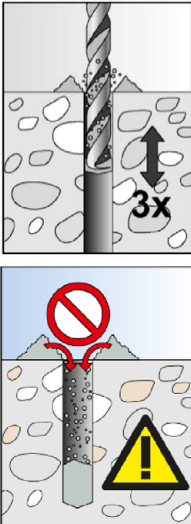
Intended Use

Dimensions of the capsules, Assignment of the capsule to the anchor rod and internal threaded anchor, Minimum curing time

Annex B 5


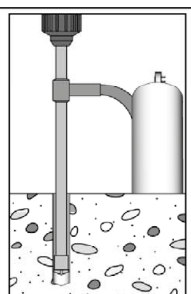
Installation instructions part 1

Drilling and cleaning the hole (hammer drilling with standard drill bit)

1		<p>Specified drill hole depth h_0 should be adhered to (e.g. mark on the drill bit). Drill the hole. Drill hole diameter d_0 and drill hole depth h_0 see Tables B3.1, B4.1</p>
2		<p>When reaching the drill hole depth h_0 pull out the drill bit whilst power drill is switched on. To reduce the drill dust in the drill hole repeat this step minimum three times, beginning from the drill hole bottom (discharging the bore hole)</p> <p>Trickling of the bore dust into the drill hole has to be avoided. (e.g. with exhausting the drill dust) Blowing out or brushing the drill hole is not necessary</p>

Go to step 3

Drilling and cleaning the hole (hammer drilling with hollow drill bit)

1		<p>Check a suitable hollow drill (see Table B1.1) for correct operation of the dust extraction</p>
2		<p>Use a suitable dust extraction system, e.g. BWDVC PERM M-1 or a comparable dust extraction system with equivalent performance data</p> <p>Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Diameter of drill hole d_0 and drill hole depth h_0 see Tables B3.1, B4.1</p>

Go to step 3

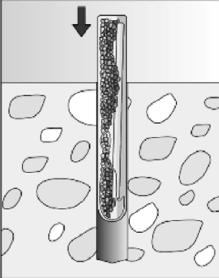

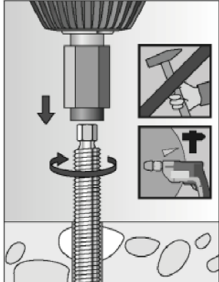
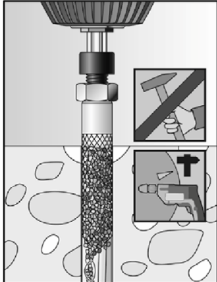
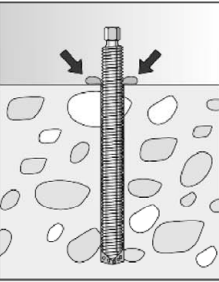
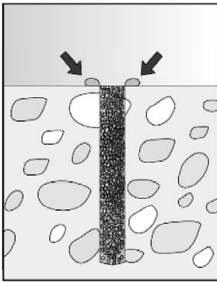
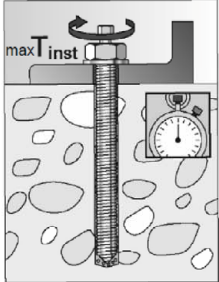
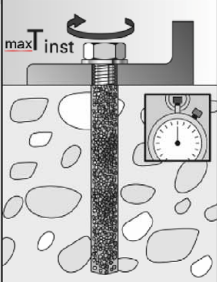
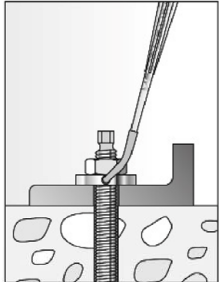
Berner chemical anchor BCA II

Intended use
Installation instructions part 1

Annex B 6

Installation instructions part 2

Installation of capsule BCA II with Berner anchor rods BCA M or Berner internal threaded anchors MCS Plus I

3		<p>Push the capsule BCA II into the drill hole</p>		<p>Depending on the anchor being installed, use a suitable setting tool (e.g. RA-SDS)</p>
4			<p>Only use clean and oil-free metal parts. Using a suitable adapter, drive the BCA M or internal threaded anchor MCS Plus I into the capsule using a hammer drill set on rotary hammer action. Stop when the metal part reaches the bottom of the hole and is set to the correct embedment depth</p>	
5			<p>When reaching the correct embedment depth, excess mortar must be emerged from the mouth of the drill hole</p>	
6			<p>Wait for the specified curing time, t_{cure} see Table B5.4</p> <p>Mounting the fixture $max T_{inst}$ see Table B3.1, B4.1</p>	
Option		<p>After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the filling disc. compressive strength $\geq 50 \text{ N/mm}^2$ (e.g. Berner injection mortars MCS Uni Plus, MCS Diamond)</p>		

Berner chemical anchor BCA II

Intended use
Installation instructions part 2

Annex B 7

Table C1.1: Characteristic resistance to steel failure under tension / shear loading of Berner anchor rods BCA M									
Anchor rod BCA M			M8	M10	M12	M16	M20	M24	
Characteristic resistance to steel failure under tension loading ²⁾									
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	15(13)	23(21)	33	63	98	141
			5.8	19(17)	29(27)	43	79	123	177
			8.8	29(27)	47(43)	68	126	196	282
	Stainless steel R and high corrosion resistant steel HCR	Property class	50	19	29	43	79	123	177
			70	26	41	59	110	172	247
			80	30	47	68	126	196	282
Partial factors ¹⁾									
Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	4.8	1,50					
			5.8	1,50					
			8.8	1,50					
	Stainless steel R and high corrosion resistant steel HCR	Property class	50	2,86					
			70	1,50 ³⁾ / 1,87					
			80	1,60					
Characteristic resistance to steel failure under shear loading ²⁾									
without lever arm									
Characteristic resistance $V_{Rk,s}$	Steel zinc plated	Property class	4.8	9(8)	14(13)	20	38	59	85
			5.8	11(10)	17(16)	25	47	74	106
			8.8	15(13)	23(21)	34	63	98	141
	Stainless steel R and high corrosion resistant steel HCR	Property class	50	9	15	21	39	61	89
			70	13	20	30	55	86	124
			80	15	23	34	63	98	141
Ductility factor		k ₇	[-] 1,0						
with lever arm									
Characteristic resistance $M_{Rk,s}^0$	Steel zinc plated	Property class	4.8	15(13)	30(27)	52	133	259	448
			5.8	19(16)	37(33)	65	166	324	560
			8.8	30(26)	60(53)	105	266	519	896
	Stainless steel R and high corrosion resistant steel HCR	Property class	50	19	37	65	166	324	560
			70	26	52	92	232	454	784
			80	30	60	105	266	519	896
Partial factors ¹⁾									
Partial factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	4.8	1,25					
			5.8	1,25					
			8.8	1,25					
	Stainless steel R and high corrosion resistant steel HCR	Property class	50	2,38					
			70	1,25 ³⁾ / 1,56					
			80	1,33					
¹⁾ In absence of other national regulations ²⁾ Values in brackets are valid for hot dip galvanised anchor rods ³⁾ Only for BCA M made of high corrosion-resistant steel HCR									
Berner chemical anchor BCA II							Annex C 1		
Performances Characteristic resistance to steel failure under tension / shear loading of Berner anchor rods BCA M									

Table C2.1: Characteristic resistance to steel failure under tension / shear loading of Berner internal threaded anchors MCS Plus I								
Internal threaded anchor MCS Plus I			M8	M10	M12	M16	M20	
Characteristic resistance to steel failure under tension loading								
Characteristic bearing capacity with screw	$N_{Rk,s}$	Property class 5.8	[kN]	19	29	43	79	123
		Property class 8.8		29	47	68	108	179
		Property class 70 R		26	41	59	110	172
		Property class 70 HCR		26	41	59	110	172
Partial factors¹⁾								
Partial factor	$\gamma_{Ms,N}$	Property class 5.8	[-]	1,50				
		Property class 8.8		1,50				
		Property class 70 R		1,87				
		Property class 70 HCR		1,87				
Characteristic resistance to steel failure under shear loading								
without lever arm								
Characteristic bearing capacity with screw	$V^0_{Rk,s}$	Property class 5.8	[kN]	9,2	14,5	21,1	39,2	62,0
		Property class 8.8		14,6	23,2	33,7	54,0	90,0
		Property class 70 R		12,8	20,3	29,5	54,8	86,0
		Property class 70 HCR		12,8	20,3	29,5	54,8	86,0
Ductility factor		k_7	[-]	1,0				
with lever arm								
Characteristic bending moment with screw	$M^0_{Rk,s}$	Property class 5.8	[Nm]	20	39	68	173	337
		Property class 8.8		30	60	105	266	519
		Property class 70 R		26	52	92	232	454
		Property class 70 HCR		26	52	92	232	454
Partial factors¹⁾								
Partial factor	$\gamma_{Ms,V}$	Property class 5.8	[-]	1,25				
		Property class 8.8		1,25				
		Property class 70 R		1,56				
		Property class 70 HCR		1,56				
¹⁾ In absence of other national regulations								
Berner chemical anchor BCA II							Annex C 2	
Performances Characteristic resistance to steel failure under tension / shear loading of Berner internal threaded anchor MCS Plus I								

Table C3.1: Characteristic resistance to concrete failure under tension / shear loading								
Size		All sizes						
Characteristic resistance to concrete failure under tension loading								
Installation factor	γ_{inst}	[-]	See annex C 4 to C 5					
Factors for the compressive strength of concrete > C20/25								
Increasing factor ψ_c for cracked or uncracked concrete $\tau_{RK} = \psi_c \cdot \tau_{RK}(C20/25)$	C25/30	[-]	1,02					
	C30/37		1,04					
	C35/45		1,07					
	C40/50		1,08					
	C45/55		1,09					
	C50/60		1,10					
Splitting failure								
Edge distance	$h / h_{ef} \geq 2,0$	$C_{cr,sp}$	[mm]	1,0 h_{ef}				
	$2,0 > h / h_{ef} > 1,3$			4,6 $h_{ef} - 1,8 h$				
	$h / h_{ef} \leq 1,3$			2,26 h_{ef}				
Spacing	$S_{cr,sp}$			2 $C_{cr,sp}$				
Concrete cone failure								
Uncracked concrete	$k_{ucr,N}$	[-]	11,0					
Cracked concrete	$k_{cr,N}$		7,7					
Edge distance	$C_{cr,N}$	[mm]	1,5 h_{ef}					
Spacing	$S_{cr,N}$		2 $C_{cr,N}$					
Factors for sustained tension loading								
Factor	ψ_{sus}^0	[-]	-2)					
Characteristic resistance to concrete failure under shear loading								
All installation conditions	γ_{inst}	[-]	1,0					
Concrete pry-out failure								
Factor for pry-out failure	k_8	[-]	2,0					
Concrete edge failure								
Effective length of fastener in shear loading	l_f	[mm]	for $d_{nom} \leq 24$ mm: min (h_{ef} , 12 d_{nom})					
Calculation diameters								
Size			M8	M10	M12	M16	M20	M24
Berner anchor rods BCA M	d	[mm]	8	10	12	16	20	24
Berner internal threaded anchors MCS Plus I	d_{nom}		12	16	18	22	28	-1)
1) Anchor type not part of the assessment 2) No performance assessed								
Berner chemical anchor BCA II							Annex C 3	
Performances Characteristic resistance to concrete failure under tension / shear loading								

Table C4.1: Characteristic resistance to combined pull-out and concrete failure for Berner anchor rods BCA M in hammer drilled holes; uncracked or cracked concrete										
Anchor rod BCA M			M8	M10	M12	M16	M20	M24		
Combined pullout and concrete cone failure										
Calculation diameter	d	[mm]	8	10	12	16	20	24		
Uncracked concrete										
Characteristic bond resistance in uncracked concrete C20/25										
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>										
Tem- perature range	I: 40 °C / 24 °C		$\tau_{Rk,ucr}$	[N/mm ²]	12,5	12,5	12,5	12,5	12,5	
	II: 80 °C / 50 °C				12,0	12,0	12,0	12,0	12,0	12,0
	III: 120 °C / 72 °C				10,5	10,5	10,5	10,5	10,5	10,5
<u>Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)</u>										
Tem- perature range	I: 40 °C / 24 °C		$\tau_{Rk,ucr}$	[N/mm ²]	- ¹⁾	- ¹⁾	12,5	12,5	12,5	
	II: 80 °C / 50 °C				- ¹⁾	- ¹⁾	12,0	12,0	12,0	12,0
	III: 120 °C / 72 °C				- ¹⁾	- ¹⁾	10,5	10,5	10,5	10,5
Installation factors										
Dry and wet concrete		γ_{inst}	[-]	1,2						
Water-filled hole				- ¹⁾	- ¹⁾	1,4				
Cracked concrete										
Characteristic bond resistance in cracked concrete C20/25										
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>										
Tem- perature range	I: 40 °C / 24 °C		$\tau_{Rk,cr}$	[N/mm ²]	- ¹⁾	4,5	4,5	4,5	4,5	
	II: 80 °C / 50 °C				- ¹⁾	4,0	4,0	4,0	4,0	4,0
	III: 120 °C / 72 °C				- ¹⁾	3,5	3,5	3,5	3,5	3,5
<u>Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)</u>										
Tem- perature range	I: 40 °C / 24 °C		$\tau_{Rk,cr}$	[N/mm ²]	- ¹⁾	- ¹⁾	4,5	4,5	4,5	
	II: 80 °C / 50 °C				- ¹⁾	- ¹⁾	4,0	4,0	4,0	4,0
	III: 120 °C / 72 °C				- ¹⁾	- ¹⁾	3,5	3,5	3,5	3,5
Installation factors										
Dry and wet concrete		γ_{inst}	[-]	- ¹⁾	1,2					
Water-filled hole				- ¹⁾	- ¹⁾	1,4				
¹⁾ No performance assessed										
Berner chemical anchor BCA II							Annex C 4			
Performances Characteristic resistance to combined pull-out and concrete failure for Berner anchor rod BCA M										

Table C5.1: Characteristic resistance to combined pull-out and concrete failure for Berner internal threaded anchors MCS Plus I in hammer drilled holes; uncracked or cracked concrete								
Internal threaded anchors MCS Plus I			M8	M10	M12	M16	M20	
Combined pullout and concrete cone failure								
Calculation diameter	d	[mm]	12	16	18	22	28	
Uncracked concrete								
Characteristic bond resistance in uncracked concrete C20/25								
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>								
Tem- perature range	I: 40 °C / 24 °C	$\tau_{RK,ucr}$	[N/mm ²]	11	11	11	11	11
	II: 80 °C / 50 °C			10,5	10,5	10,5	10,5	10,5
	III: 120 °C / 72 °C			9,5	9,5	9,5	9,5	9,5
<u>Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)</u>								
Tem- perature range	I: 40 °C / 24 °C	$\tau_{RK,ucr}$	[N/mm ²]	11	11	- ¹⁾	11	- ¹⁾
	II: 80 °C / 50 °C			10,5	10,5	- ¹⁾	10,5	- ¹⁾
	III: 120 °C / 72 °C			9,5	9,5	- ¹⁾	9,5	- ¹⁾
Installation factors								
Dry and wet concrete	γ_{inst}	[-]	1,2					
Water-filled hole			1,4	- ¹⁾	1,4	- ¹⁾		
Cracked concrete								
Characteristic bond resistance in cracked concrete C20/25								
<u>Hammer-drilling with standard drill bit or hollow drill bit (dry and wet concrete)</u>								
Tem- perature range	I: 40 °C / 24 °C	$\tau_{RK,cr}$	[N/mm ²]	4,5	4,5	4,5	4,5	4,5
	II: 80 °C / 50 °C			4,0	4,0	4,0	4,0	4,0
	III: 120 °C / 72 °C			3,5	3,5	3,5	3,5	3,5
<u>Hammer-drilling with standard drill bit or hollow drill bit (water-filled hole)</u>								
Tem- perature range	I: 40 °C / 24 °C	$\tau_{RK,cr}$	[N/mm ²]	4,5	4,5	- ¹⁾	4,5	- ¹⁾
	II: 80 °C / 50 °C			4,0	4,0	- ¹⁾	4,0	- ¹⁾
	III: 120 °C / 72 °C			3,5	3,5	- ¹⁾	3,5	- ¹⁾
Installation factors								
Dry and wet concrete	γ_{inst}	[-]	1,2					
Water-filled hole			1,4	- ¹⁾	1,4	- ¹⁾		
¹⁾ No performance assessed								
Berner chemical anchor BCA II							Annex C 5	
Performances Characteristic resistance to combined pull-out and concrete failure for Berner internal threaded anchors MCS Plus I								

Table C6.1: Displacements for Berner anchor rods BCA M							
Anchor rod BCA M		M8	M10	M12	M16	M20	M24
Displacement-Factors for tension loading¹⁾							
Uncracked or cracked concrete; Temperature range I, II, III							
δ_{N0} -Factor	[mm/(N/mm ²)]	0,07	0,08	0,09	0,10	0,11	0,12
$\delta_{N\infty}$ -Factor		0,13	0,14	0,15	0,17	0,17	0,18
Displacement-Factors for shear loading²⁾							
Uncracked or cracked concrete; Temperature range I, II, III							
δ_{V0} -Factor	[mm/kN]	0,18	0,15	0,12	0,09	0,07	0,06
$\delta_{V\infty}$ -Factor		0,27	0,22	0,18	0,14	0,11	0,09
1) Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\tau =$ acting bond strength under tension loading				2) Calculation of effective displacement: $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$ $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$ $V =$ acting shear loading			
Table C6.2: Displacements for Berner internal threaded anchors MCS Plus I							
Internal threaded anchor MCS Plus I		M8	M10	M12	M16	M20	
Displacement-Factors for tension loading¹⁾							
Uncracked or cracked concrete; Temperature range I, II, III							
δ_{N0} -Factor	[mm/(N/mm ²)]	0,09	0,10	0,10	0,11	0,19	
$\delta_{N\infty}$ -Factor		0,13	0,15	0,15	0,17	0,19	
Displacement-Factors for shear loading²⁾							
Uncracked or cracked concrete; Temperature range I, II, III							
δ_{V0} -Factor	[mm/kN]	0,12	0,09	0,08	0,07	0,05	
$\delta_{V\infty}$ -Factor		0,18	0,14	0,12	0,10	0,08	
1) Calculation of effective displacement: $\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$ $\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$ $\tau =$ acting bond strength under tension loading				2) Calculation of effective displacement: $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$ $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$ $V =$ acting shear loading			
Berner chemical anchor BCA II						Annex C 6	
Performances Displacements for anchor rods BCA M and Berner internal threaded anchors MCS Plus I							