Deutsches Institut für Bautechnik

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

European Technical Assessment Body for construction products

Member of EOTA
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Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-24/1248 of 14 July 2025

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 multicompound system MCS Protect Plus
Product family to which the construction product belongs	Bonded fasteners and bonded expansion fasteners for use in concrete
Manufacturer	Berner Omnichannel Trading Holding SE Bernerstraße 6 74653 Künzelsau GERMANY
Manufacturing plant	Berner Herstellwerk 6
This European Technical Assessment contains	29 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 330499-02-0601, Edition 12/2023

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Specific Part

1 Technical description of the product

The BERNER multicompound system MCS Protect Plus is a bonded fastener consisting of an injection cartridge with injection mortar MCS Protect Plus and a steel element according to Annex A.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection 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 anchor 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 anchor 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 C 1 to C 7, B 3 to B 6
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 to C 4
Displacements under short-term and long-term loading	See Annex C 8 to C 9
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.3 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 330499-02-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable 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 14 July 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

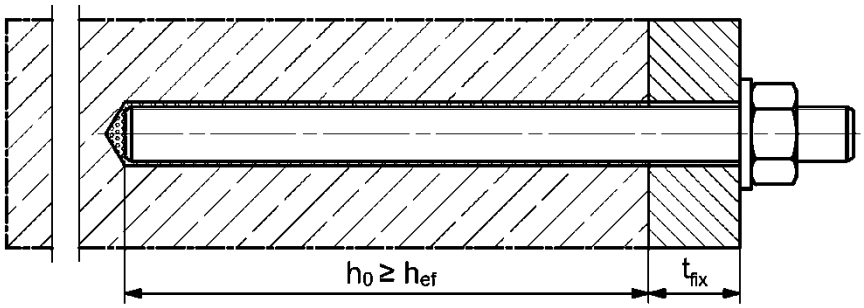
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

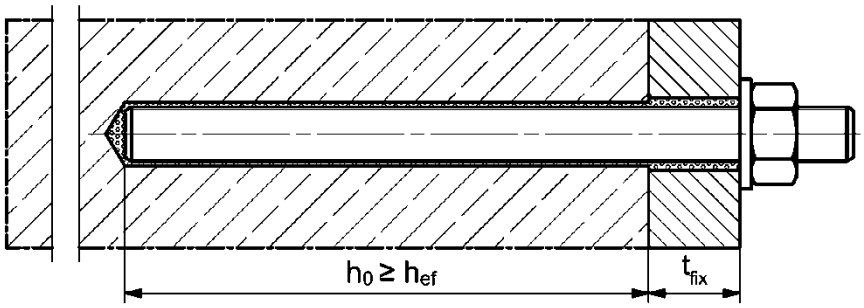
Installation conditions part 1

BERNER Anchor rod MCS Plus A / BCA M (Anchor rod) and commercial standard threaded rod (Threaded rod)

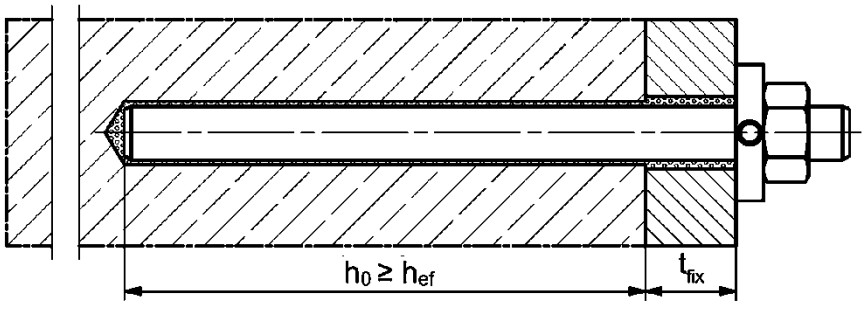
Pre-positioned installation



Push through installation (annular gap filled with mortar)



Pre-positioned or push through installation with subsequently injected BERNER filling disc BFD (annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth
h_{ef} = effective embedment depth
t_{fix} = thickness of fixture

BERNER multicompound system MCS Protect Plus

Product description
Installation conditions part 1

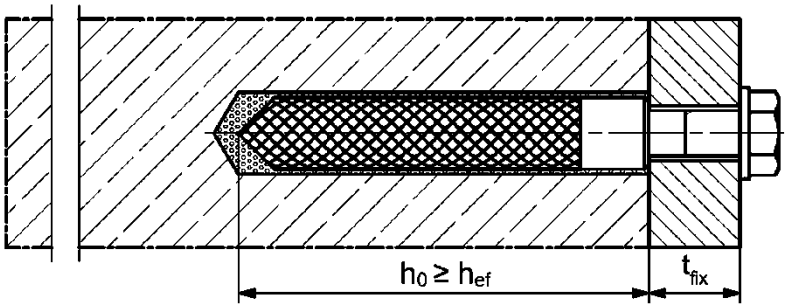
Annex A 1

Deutsches Institut für Bautechnik DIBt

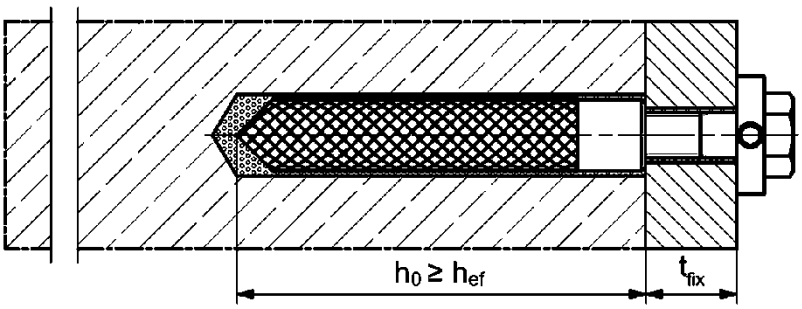
Installation conditions part 2

BERNER internal threaded anchor MCS Plus I (BERNER MCS Plus I)

Pre-positioned installation



Pre-positioned installation with subsequently injected BERNER filling disc BFD (annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth
h_{ef} = effective embedment depth
t_{fix} = thickness of fixture

BERNER multicompound system MCS Protect Plus

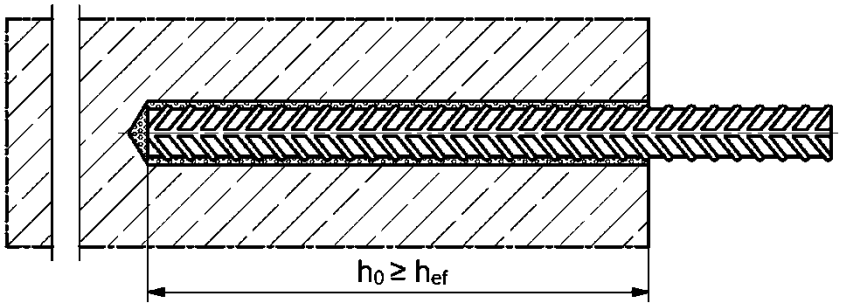
Product description
Installation conditions part 2

Annex A 2

Deutsches Institut für Bautechnik DIBt

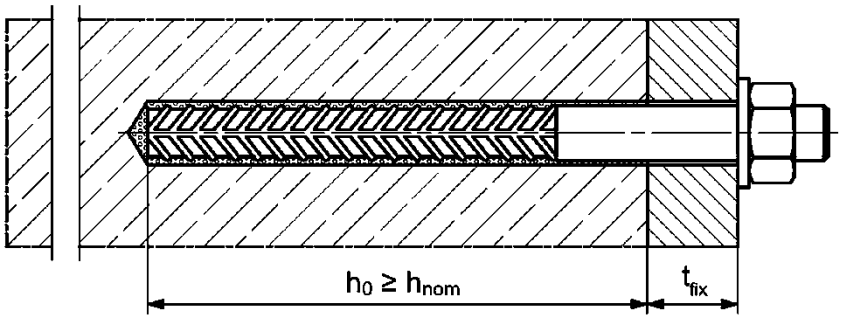
Installation conditions part 3

Reinforcing bar

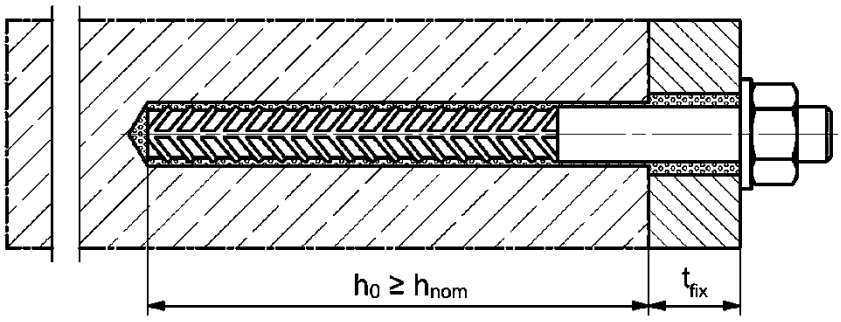


BERNER rebar anchor BRA (BERNER BRA)

Pre-positioned installation



Push through installation (annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth
h_{ef} = effective embedment depth
t_{fix} = thickness of fixture
h_{nom} = overall fastener embedment depth in the concrete

BERNER multicompound system MCS Protect Plus

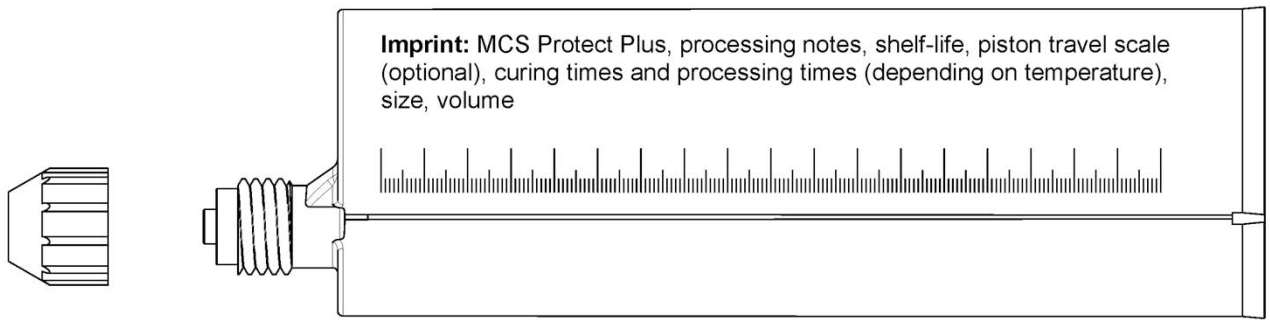
Product description
Installation conditions part 3

Annex A 3

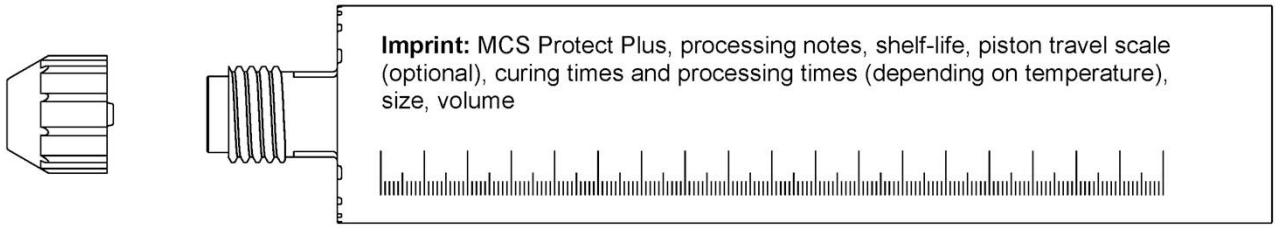
Deutsches Institut für Bautechnik DIBt

Overview system components part 1

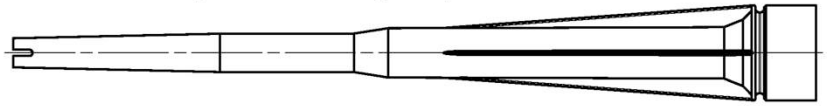
Injection cartridge (shuttle cartridge) with sealing cap; Sizes: 360 ml, 825 ml



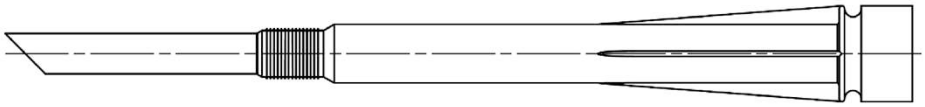
Injection cartridge (coaxial cartridge) with sealing cap; Sizes: 100 ml, 150 ml, 300 ml, 380 ml, 400 ml, 410 ml



Static mixer MCS Protect Plus for injection cartridges up to 410 ml

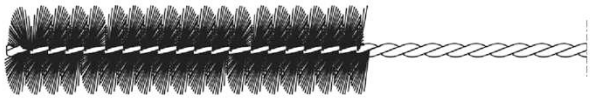


Static mixer MCS Protect Plus for injection cartridges 825 ml



Injection adapter and extension tube Ø 9 for static mixer MCS Protect Plus up to 410 ml;
Injection adapter and extension tube Ø 9 or Ø 15 for static mixer MCS Protect Plus 825 ml

Cleaning brush



Blow-out pump

Compressed-air cleaning tool:

Figures not to scale

BERNER multicompound system MCS Protect Plus

Product description
Overview system components part 1;
cartridges / static mixer / accessories

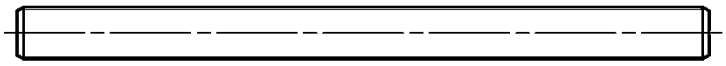
Annex A 4

Deutsches Institut für Bautechnik DIBt

Overview system components part 2

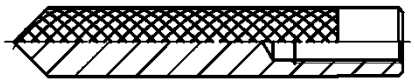
Anchor rod / Threaded rod

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

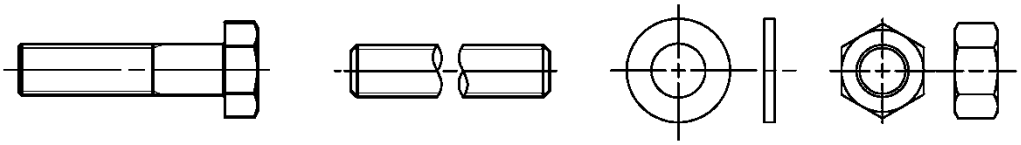


BERNER MCS Plus I

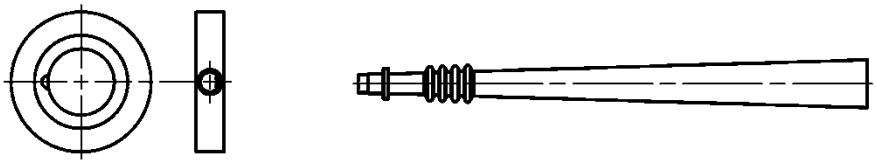
Size: M8, M10, M12, M16



Screw / threaded rod / washer / hexagon nut



BERNER filling disc BFD with injection adapter



Reinforcing bar

Nominal diameter: ϕ8, ϕ10, ϕ12, ϕ14, ϕ16, ϕ20, ϕ22, ϕ24, ϕ25

BERNER BRA

Size: M12, M16, M20, M24

Figures not to scale

BERNER multicompound system MCS Protect Plus

Product description
Overview system components part 2;
steel components, injection adapter

Annex A 5

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Table A6.1: Materials

Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel	Stainless steel R	High corrosion resistant steel HCR
		zinc plated (zp, hdg)	acc. to EN 10088-1:2023 Corrosion resistance class CRC III EN 1993-1-4: 2006+A1:2015	acc. to EN 10088-1:2023 Corrosion resistance class CRC V EN1993-1-4:2006+A1:2015
2	Anchor rod / Threaded rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation	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 10088-1:2023 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation	Property class 50 or 80 EN ISO 3506-1:2020 or property class 70 with f_{yk}= 560 N/mm² 1.4565; 1.4529; EN 10088-1:2023 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	1.4565; 1.4529; EN 10088-1:2014
4	Hexagon nut	Property class 4, 5 or 8; EN ISO 898-2:2022 zinc plated ≥ 5 µm, ISO 4042:2022 or hot dip galvanised ≥ 40 µm 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 10088-1:2023	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2023
5	BERNER MCS Plus I	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:2022	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2023
6	Commercial standard screw or threaded rod for BERNER MCS Plus I	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, EN ISO 4042:2022 $A_5 > 8$ % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023 $A_5 > 8$ % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2023 $A_5 > 8$ % fracture elongation
7	BERNER filling disc similar to DIN 6319-G	zinc plated ≥ 5 µm, EN ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	1.4565;1.4529; EN 10088-1:2023
8	Reinforcing bar	EN 1992-1-1:2004 and AC:2010, Annex C Bars and de-coiled rods, class B or C with f_{yk} and k according to NDP or NCI of according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$ ($A_5 > 8\%$)		
9	BERNER rebar anchor BRA	Rebar part: Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCI of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$ ($A_5 > 8$ %) Threaded part: Property class 80 EN ISO 3506-1:2020	1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 acc. to EN 10088-1:2014 Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015 1.4565; 1.4529 acc. to EN 10088-1:2014 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015 $f_{uk} \leq 1000$ N/mm²; fracture elongation A_5 >8 %	

BERNER multicompound system MCS Protect Plus

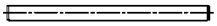
Product description
Materials

Annex A 6

Deutsches Institut für Bautechnik DIBt

Specifications of intended use part 1

Table B1.1: Overview use and performance categories

			MCS Protect Plus with …							
			Anchor rod / Threaded rod 		BERNER MCS Plus I 		Reinforcing bar 		BERNER BRA 	
Hammer drilling with standard drill bit			all sizes							
Hammer drilling with hollow drill bit  (BERNER Cleandrill dustless, fischer „FHD“, Heller „Duster Expert“; Bosch „Speed Clean“; Hilti „TE-CD, TE-YD“)			Nominal drill bit diameter (d_0) 12 mm to 30 mm							
Static and quasi static load, in		uncracked concrete	all sizes	Tables: C1.1 C4.1 C5.1 C8.1	all sizes	Tables: C2.1 C4.1 C6.1 C8.2	all sizes	Tables: C3.1 C4.1 C7.1 C9.1	all sizes	Tables: C3.2 C4.1 C7.2 C9.2
		cracked concrete [2]	all sizes		all sizes		-[1]		-[1]	
Seismic performance category		C1[1]	-[1]		-[1]		-[1]		-[1]	
		C2[1]								
Use conditions	I1	dry or wet concrete	all sizes		all sizes		all sizes		all sizes	
	I2	water filled hole [2]	all sizes		all sizes		all sizes		all sizes	
Installation direction			D3 (downward and horizontal and upwards (e.g. overhead) installation)							
Installation temperature			$T_{i,min}$ = -10 °C to $T_{i,max}$ = +40 °C for the standard variation of temperature after installation							
In-service temperature		Temperature range I	-40 °C to +40 °C		(max. short term temperature +40 °C; max. long term temperature +24 °C)					
		Temperature range II	-40 °C to +80 °C		(max. short term temperature +80 °C; max. long term temperature +50 °C)					
		Temperature range III	-40 °C to +120 °C		(max. short term temperature +120 °C; max. long term temperature +72 °C)					

[1] No performance assessed
[2] No performance assessed for installation with hollow drill bit in cracked concrete or water filled hole

BERNER multicompound system MCS Protect Plus

Intended use
Specifications part 1

Annex B 1

Deutsches Institut für Bautechnik DIBt

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+A2:2021

Use conditions (Environmental conditions):

- Fastener intended for use in structures subject to dry, internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance classes to Annex A6 table A6.1.

Design:

- The structural design is conducted under responsibility of a designer experienced in the field of anchorages and concrete works.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Fastenings are designed in accordance with EN 1992-4:2018.

Installation:

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

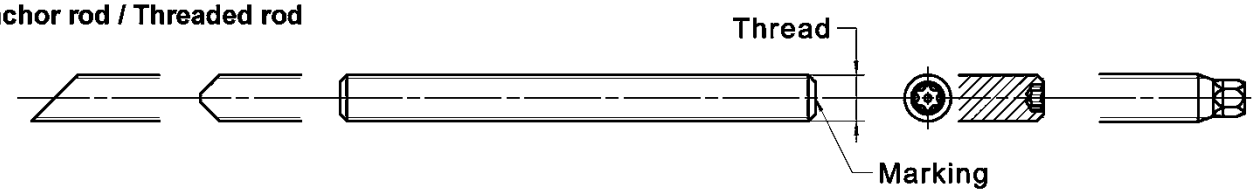
BERNER multicompound system MCS Protect Plus	**Annex B 2**
Intended use Specifications part 2	

Deutsches Institut für Bautechnik DIBt

Table B3.1: Installation parameters for Anchor rods / Threaded rods

Anchor rods / Threaded rods			Thread	M8	M10	M12	M16	M20	M24
Nominal drill hole diameter		d_0		10	12	14	18	22	28
Drill hole depth		h_0		$h_0 = h_{ef}$					
Effective embedment depth		$h_{ef,\,min}$		60	60	70	80	90	96
		$h_{ef,\,max}$		160	200	240	320	400	480
Minimum spacing and minimum edge distance		s_{min} = c_{min}	[mm]	40	45	55	65	85	105
Diameter of the clearance hole of the fixture	pre-positioned installation	d_f		9	12	14	18	22	26
	push through installation	d_f		12	14	16	20	24	30
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

Anchor rod / Threaded rod



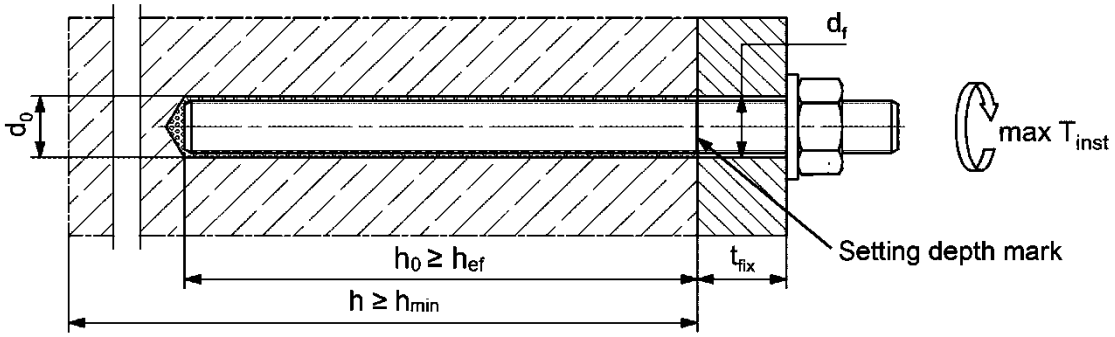
Marking (on random place) BERNER anchor rod:

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:



Commercial standard threaded rods, washers and hexagon nuts may also be used, if the following requirements are fulfilled:

- Materials, dimensions and mechanical properties according to Annex A 6, Table A6.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- Setting depth is marked

Figures not to scale

BERNER multicompound system MCS Protect Plus

Intended use
Installation parameters anchor rods / Threaded rods

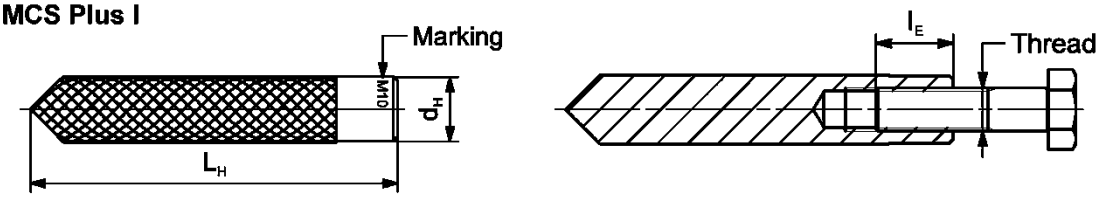
Annex B 3

Deutsches Institut für Bautechnik DIBt

Table B4.1: Installation parameters for **BERNER MCS Plus I**

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

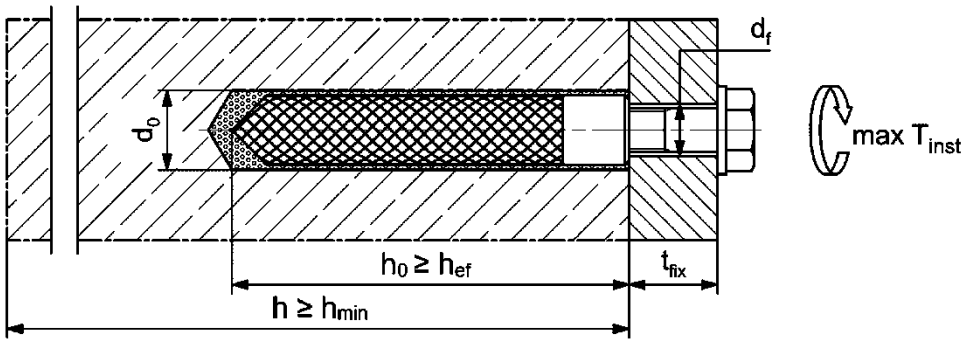
BERNER MCS Plus I



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 A6, Table A6.1

Installation conditions:



Figures not to scale

BERNER multicompound system MCS Protect Plus

Intended use
Installation parameters internal threaded anchors BERNER MCS Plus I

Annex B 4

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Table B5.1: Installation parameters for **reinforcing bars**

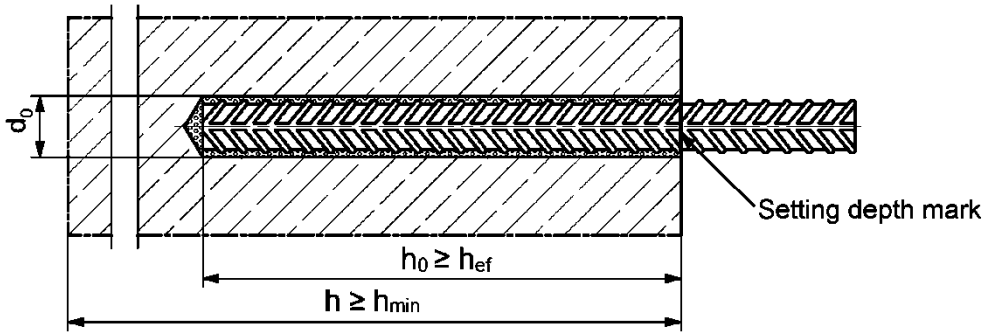
Nominal diameter of the bar		**ϕ**	**8[1)]**	**10[1)]**	**12[1)]**	**14**	**16**	**20**	**22**	**24**	**25**
Nominal drill hole diameter	d_0	[mm]	10 | 12	12 | 14	14 | 16	18	20	25	28	30	30
Drill hole depth	h_0		$h_0 = h_{ef}$								
Effective embedment depth	$h_{ef,min}$		60	60	70	75	80	90	94	98	100
	$h_{ef,max}$		160	200	240	280	320	400	440	480	500
Minimum spacing and minimum edge distance	s_{min} = c_{min}		40	45	55	60	65	85	95	105	110
Minimum thickness of concrete member	h_{min}		h_{ef} + 30 (≥ 100)			h_{ef} + $2d_0$					

[1)] Both drill hole diameters can be used

Reinforcing bar

- The minimum value of related rib area $f_{R,min}$ must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range: $0{,}05 \cdot \phi \le h_{rib} \le 0{,}07 \cdot \phi$
  (ϕ = Nominal diameter of the bar, h_{rib} = rib height)

Installation conditions:



Figures not to scale

BERNER multicompound system MCS Protect Plus

Intended use
Installation parameters reinforcing bars

Annex B 5

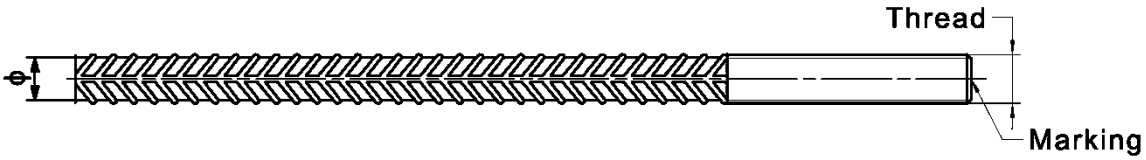
Deutsches Institut für Bautechnik DIBt

Table B6.1: Installation parameters for **BERNER BRA**

BERNER BRA		**Thread**	**M12**[1)]		**M16**	**M20**	**M24**
Nominal diameter of the bar	ϕ		12		16	20	25
Nominal drill hole diameter	d_0		14	16	20	25	30
Drill hole depth	h_0		$h_{ef} + l_e$				
Effective embedment depth	$h_{ef,min}$		70		80	90	96
	$h_{ef,max}$		140		220	300	380
Distance concrete surface to welded joint	l_e		100				
Minimum spacing and minimum edge distance	s_{min} = c_{min}	[mm]	55		65	85	105
Diameter of clearance hole in the fixture — pre-positioned anchorage	$\leq d_f$		14		18	22	26
Diameter of clearance hole in the fixture — push through anchorage	$\leq d_f$		18		22	26	32
Minimum thickness of concrete member	h_{min}		$h_0 + 30$		$h_0 + 2d_0$		
Maximum installation torque	max T_{inst}	[Nm]	40		60	120	150

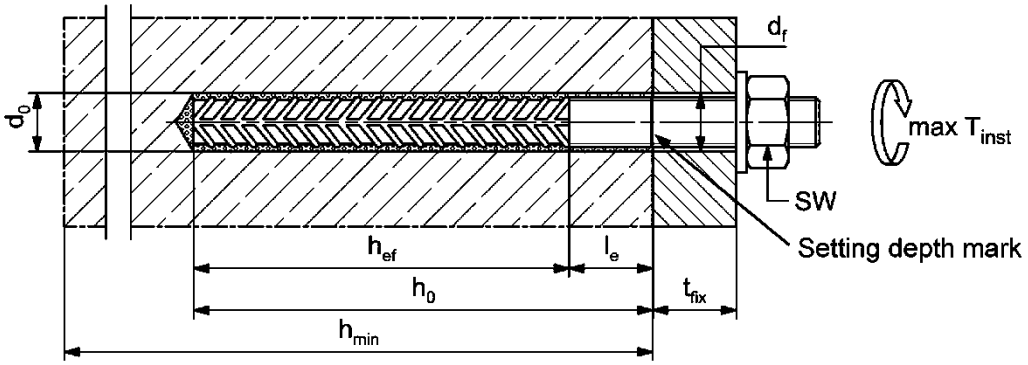
[1)] Both drill hole diameters can be used

BERNER BRA



Marking frontal e.g: BRA (for stainless steel);
BRA HCR (for high corrosion resistant steel)

Installation conditions:



Figures not to scale

BERNER multicompound system MCS Protect Plus

Intended use
Installation parameters BERNER BRA

Annex B 6

Deutsches Institut für Bautechnik DIBt

Table B7.1: Parameters of the **cleaning brush** (steel brush with steel bristles)

The size of the cleaning brush refers to the drill hole diameter

Nominal drill hole diameter	d_0	[mm]	10	12	14	16	18	20	22	24	25	28	30
Steel brush diameter	d_b		11	14	16	20		25		26	27	30	40

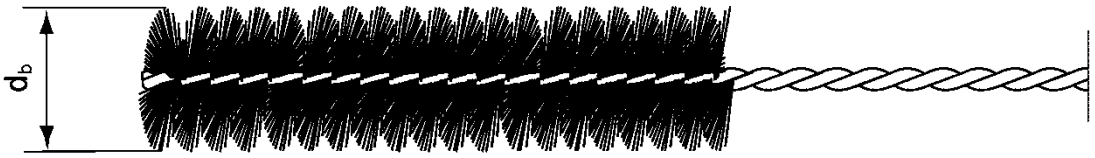


Table B7.2: Conditions for use **static mixer** without an **extension tube**

Nominal drill hole diameter	d_0	[mm]	10	12	14	16	18	20	22	24	25	28	30
Drill hole depth h_0 by using	MCS Protect Plus up to 410 ml	[mm]	≤90		≤120	≤140	≤150	≤160	≤170	≤190	≤210		
	MCS Protect Plus 825 ml		-	-	≤90	≤160	≤180	≤190	≤210	≤220		≤250	

Table B7.3 **Maximum processing** time of the mortar and **minimum curing** time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]	Maximum processing time t_{work}	Minimum curing time [1] t_{cure}
	MCS Protect Plus	**MCS Protect Plus**
-10 to -5 [2]	6 h	72 h
> -5 to 0 [2]	2 h	24 h
> 0 to 5 [2]	45 min	12 h
> 5 to 10	20 min	6 h
> 10 to 15	8 min	3 h
> 15 to 20	5 min	2 h
> 20 to 25	3 min	1 h
> 25 to 30	2 min	45 min
> 30 to 40	1 min	30 min

[1] In wet concrete or water filled holes the curing times must be doubled
[2] Minimum cartridge temperature +5°C

BERNER multicompound system MCS Protect Plus

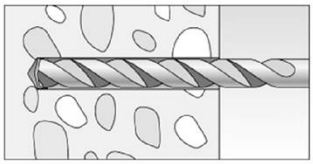
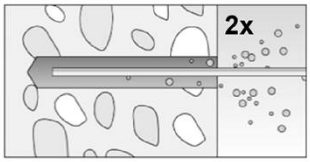
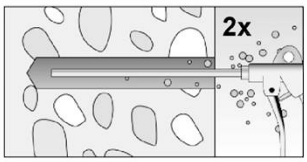
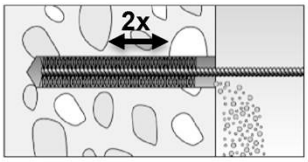
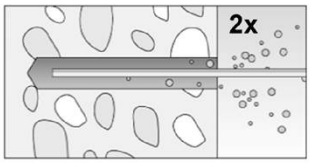
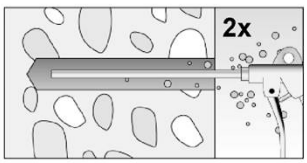
Intended use
Cleaning brush (steel brush)
Processing time and curing time

Annex B 7

Deutsches Institut für Bautechnik DIBt

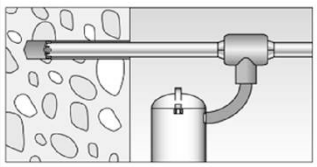
Installation instructions part 1

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

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables B3.1, B4.1, B5.1, B6.1**.
2		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole twice by hand.
		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole twice with oil-free compressed air ($p \geq 6$ bar).
3		Brush the drill hole twice. For drill hole diameter $d_0 \geq 18$ mm and / or $h_{ef} > 12d$ use a power drill. For deep holes use an extension. Corresponding brushes see **Table B7.1**.
4		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole twice by hand.
		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole twice with oil-free compressed air ($p \geq 6$ bar).

Go to step 5

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

1		Check a suitable hollow drill (see **table B1.1**) for correct operation of the dust extraction.
2		Use a suitable dust extraction system, e.g. BERNER BWDVC PERM M-1 or a comparable dust extraction system with equivalent performance data. 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. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables B3.1, B4.1, B5.1, B6.1**.

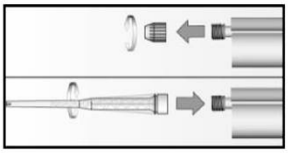
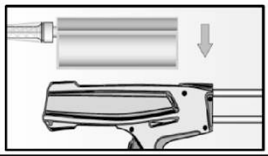
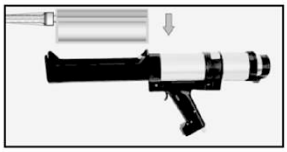
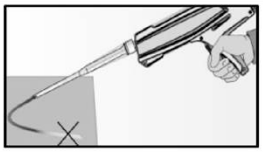
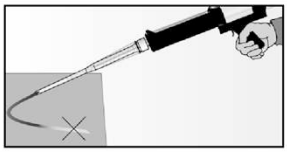
Go to step 5

BERNER multicompound system MCS Protect Plus	**Annex B 8**
Intended use Installation instructions part 1	

Deutsches Institut für Bautechnik DIBt

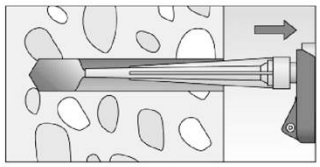
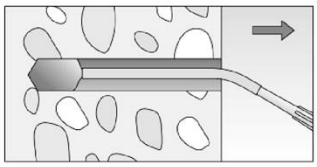
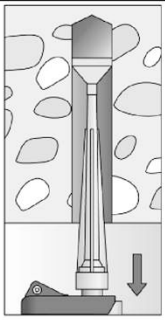
Installation instructions part 2

Preparing the cartridge

5		Remove the sealing cap Screw on the static mixer (the spiral in the static mixer must be clearly visible)
6	 	Place the cartridge into the dispenser
7	 	Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey

Go to step 8

Injection of the mortar

8	 Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles	 The conditions for mortar injection without extension tube can be found in **table B7.2** For deeper drill holes, than those mentioned in **table B7.2,** use a suitable extension tube	 For overhead installation, deep holes (h_0 > 250 mm) or drill hole diameter (d_0 = 30 mm) use an injection adapter

Go to step 9

BERNER multicompound system MCS Protect Plus

Intended use
Installation instructions part 2

Annex B 9

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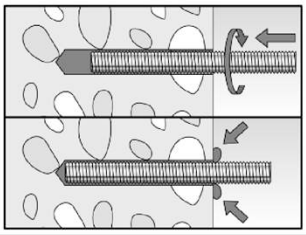
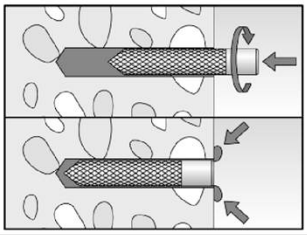
Installation instructions part 3

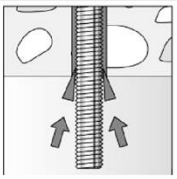
Installation of anchor rods or Threaded rods and BERNER MCS Plus I

9

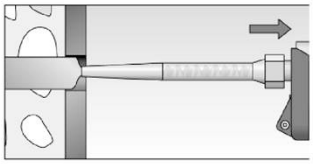




Only use clean and oil-free metal parts.
Mark the setting depth of the metal part. Push the anchor rod or BERNER MCS Plus I down to the bottom of the hole, turning it slightly while doing so.
After inserting the metal parts, excess mortar must be emerged around the anchor element.



For overhead installations support the metal part with centering wedges or overhead clips.

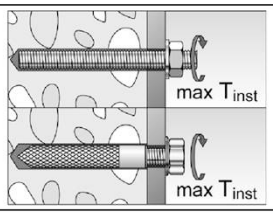


For push through installation fill the annular gap with mortar

10

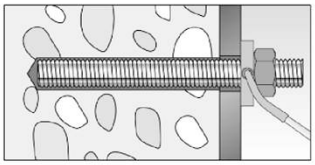
Wait for the specified curing time t_{cure}
see **table B7.3**

11



Mounting the fixture
max T_{inst} see **tables B3.1 and B4.1**.

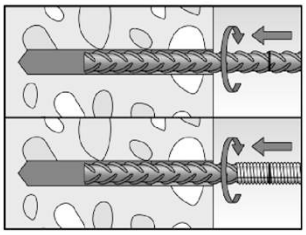
Option



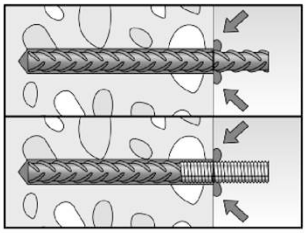
After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the BERNER filling disc. BFD Compressive strength ≥ 50 N/mm² (e.g. BERNER MCS Protect Plus).
ATTENTION: Using BERNER filling disc BFD reduces t_{fix} (usable length of the anchor).

Installation reinforcing bars and BERNER BRA

9

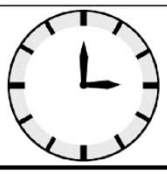


Only use clean and oil-free reinforcing bars or BERNER BRA. Mark the setting depth. Push the reinforcement bar or the BERNER BRA into the filled hole up to the setting depth mark.
Recommendation:
Rotation back and forth of the reinforcement bar or the BERNER BRA makes pushing easy.



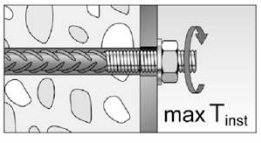
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

10



Wait for the specified curing time t_{cure} see **table B7.3**.

11



Mounting the fixture
max T_{inst}
see **table B6.1**.

BERNER multicompound system MCS Protect Plus

Intended use
Installation instructions part 3

Annex B 10

Deutsches Institut für Bautechnik DIBt

Table C1.1: Characteristic resistance to steel failure under tension / shear loading of Anchor rods / Threaded rods

Anchor rod / Threaded rod				M8	M10	M12	M16	M20	M24
Characteristic resistance to steel failure under tension loading [1)]									
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	14,6(13,2)	23,2(21,4)	33,7	62,8	98,0	141,2
			5.8	18,3(16,6)	29,0(26,8)	42,1	78,5	122,5	176,5
			8.8	29,2(26,5)	46,4(42,8)	67,4	125,6	196,0	282,4
	Stainless steel R and high corrosion resistant steel HCR		50	18,3	29,0	42,1	78,5	122,5	176,5
			70	25,6	40,6	59,0	109,9	171,5	247,1
			80	29,2	46,4	67,4	125,6	196,0	282,4
			[kN]						
Partial factors [2)]									
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		50	2,86					
			70	1,87 / BERNER HCR: 1,50[3)]					
			80	1,60					
			[-]						
Characteristic resistance to steel failure under shear loading [1)]									
without lever arm									
Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	4.8	8,7(7,9)	13,9(12,8)	20,2	37,6	58,8	84,7
			5.8	10,9(9,9)	17,4(16,0)	25,2	47,1	73,5	105,9
			8.8	14,6(13,2)	23,2(21,4)	33,7	62,8	98,0	141,2
	Stainless steel R and high corrosion resistant steel HCR		50	9,1	14,5	21,0	39,2	61,2	88,2
			70	12,8	20,3	29,5	54,9	85,7	123,5
			80	14,6	23,2	33,7	62,8	98,0	141,2
			[kN]						
Ductility factor			k_7	[-]	1,0				
with lever arm									
Characteristic resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	4.8	14,9(12,9)	29,9(26,5)	52,3	132,9	259,6	448,8
			5.8	18,7(16,1)	37,3(33,2)	65,4	166,2	324,6	561,0
			8.8	29,9(25,9)	59,8(53,1)	104,6	265,9	519,3	897,6
	Stainless steel R and high corrosion resistant steel HCR		50	18,7	37,3	65,4	166,2	324,6	561,0
			70	26,2	52,3	91,5	232,6	454,4	785,4
			80	29,9	59,8	104,6	265,9	519,3	897,6
			[Nm]						
Partial factors [2)]									
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		50	2,38					
			70	1,56 / BERNER HCR: 1,25 [3)]					
			80	1,33					
			[-]						

[1)] Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot dip galvanised Threaded rods according to EN ISO 10684:2004+AC:2009.
[2)] In absence of other national regulations.
[3)] Only admissible for high corrosion resist. steel HCR, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. Anchor rods).

BERNER multicompound system MCS Protect Plus

Performances
Characteristic resistance to steel failure under tension / shear loading of Anchor rods / Threaded rods

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C2.1: Characteristic resistance to steel failure under tension / shear loading of BERNER MCS Plus I

BERNER MCS Plus I			MCS Plus I	Screw		M8	M10	M12	M16
Characteristic resistance to steel failure under tension loading									
Characteristic resistance in combination with screw	$N_{Rk,s}$	Property class	5.8	5.8	[kN]	18,3	29,0	42,1	78,3
				8.8		29,2	46,4	67,4	106,7
		Property class	R-70 / HCR-70	R-70 / commercial standard		25,6	40,6	59,0	109,6
				HCR-70		25,6	40,6	59,0	109,6
Partial factors [1]									
Partial factors	$\gamma_{Ms,N}$	Property class	5.8	5.8	[-]	1,50			
				8.8		1,50			
		Property class	R-70 / HCR-70	R-70 / commercial standard		1,87			
				HCR-70		1,87 / BERNER HCR: 1,50 [2]			
Characteristic resistance to steel failure under shear loading									
Without lever arm									
Characteristic resistance in combination with screw	$V^0_{Rk,s}$	Property class	5.8	5.8	[kN]	10,9	17,4	25,2	47,1
				8.8		14,6	23,2	33,7	62,8
		Property class	R-70 / HCR-70	R-70 / commercial standard		12,8	20,3	29,5	54,9
				HCR-70		12,8	20,3	29,5	54,9
Ductility factor				k_7	[-]	1,0			
With lever arm									
Characteristic resistance in combination with screw	$M^0_{Rk,s}$	Property class	5.8	5.8	[Nm]	18,7	37,3	65,4	166,2
				8.8		29,9	59,8	104,6	265,9
		Property class	R-70/ HCR-70	R-70 / commercial standard		26,2	52,3	91,5	232,6
				HCR-70		26,2	52,3	91,5	232,6
Partial factors [1]									
Partial factors	$\gamma_{Ms,V}$	Property class	5.8	5.8	[-]	1,25			
				8.8		1,25			
		Property class	R-70 / HCR-70	R-70 / commercial standard		1,56			
				HCR-70		1,56 / BERNER HCR: 1,25 [2]			

[1] In absence of other national regulations
[2] Only admissible for high corrosion resist. steel HCR, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. Anchor rods).

BERNER multicompound system MCS Protect Plus

Performances
Characteristic resistance to steel failure under tension / shear loading of BERNER MCS Plus I

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3.1: Characteristic restistance to steel failure under tension / shear load of reinforcing bars

Nominal diameter of the bar		**ϕ**	**8 to 25**
Characteristic resistance to steel failure under tension loading			
Characteristic resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1]
Characteristic resistance to steel failure under shear loading			
Without lever arm			
Characteristic resistance	$V^0_{Rk,s}$	[kN]	k_6 [2] $\cdot A_s \cdot f_{uk}$ [1]
Ductility factor	k_7	[-]	1,0
With lever arm			
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$ [1]

[1] f_{uk} respectively shall be taken from the specifications of the reinforcing bar.
[2] In accordance with EN 1992-4:2018 section 7.2.2.3.1:
k_6 = 0,6 for fasteners made of carbon steel with $f_{uk} \leq 500$ N/mm²,
= 0,5 for fasteners made of carbon steel with 500 N/mm² < $f_{uk} \leq 1000$ N/mm²,
= 0,5 for fasteners made of stainless steel.

Table C3.2: Characteristic restistance to steel failure under tension / shear loading of BERNER BRA

BERNER BRA			**M12**	**M16**	**M20**	**M24**
Characteristic resistance to steel failure under tension loading						
Characteristic resistance	$N_{Rk,s}$	[kN]	62,0	111,0	173,0	236,5
Partial factor [1]						
Partial factor	$\gamma_{Ms,N}$	[-]	1,40			
Characteristic resistance to steel failure under shear loading						
Without lever arm						
Characteristic resistance	$V^0_{Rk,s}$	[kN]	34,5	64,3	100,4	144,7
Ductility factor	k_7	[-]	1,0			
With lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	107,4	273,0	532,2	920,4
Partial factor[1]						
Partial factor	$\gamma_{Ms,V}$	[-]	1,50			

[1] In absence of other national regulations

BERNER multicompound system MCS Protect Plus

Performances
Characteristic resistance to steel failure under tension / shear loading of reinforcing bars and BERNER BRA

Annex C 3

Deutsches Institut für Bautechnik DIBt

Table C4.1: Characteristic resistance for concrete failure under tension / shear loading

Size			All sizes								
Tension load											
Installation factor	γ_{inst}	[-]	See Annex C5 to C8								
Factors for the compressive strength of concrete > C20/25											
Increasing factor ψ_c for cracked or uncracked concrete $\tau_{Rk(X,Y)} = \psi_c \cdot \tau_{Rk(C20/25)}$	C25/30	Ψ_c	[-]	1,03							
	C30/37			1,06							
	C35/45			1,09							
	C40/50			1,11							
	C45/55			1,13							
	C50/60			1,15							
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 load											
Temperature range			[-]	24 °C / 40 °C			50 °C / 80 °C			72 °C / 120 °C	
Factor		Ψ^0_{sus}	[-]	0,67			0,67			0,75	
Shear load											
Installation factor		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}) for $d_{nom} > 24$ mm: min (h_{ef}; 8 d_{nom}; 300 mm)							
Calculation diameters											
Size				M8		M10	M12		M16	M20	M24
Anchor rods and Threaded rods		d_{nom}	[mm]	8		10	12		16	20	24
BERNER MCS Plus I		d_{nom}		12		15,7	18		22	-[1]	-[1]
BERNER BRA		d_{nom}		-[1]		-[1]	12		16	20	25
Size (nominal diameter of the bar)			ϕ	8	10	12	14	16	20	22	24	25
Reinforcing bar		d_{nom}	[mm]	8	10	12	14	16	20	22	24	25

[1] Anchor type not part of the assessment

BERNER multicompound system MCS Protect Plus

Performances
Characteristic resistance for concrete failure under tension / shear loading

Annex C 4

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Table C5.1: Characteristic resistance to combined pull-out and concrete failure for Anchor rods and Threaded rods in hammer drilled holes; uncracked or cracked concrete

Anchor rod / standard threaded rod				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									
Hammer-drilling with standard drill bit (dry or wet concrete, water filled hole)									
Temperature range	I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	10	10	10	10	9,5	8,5
	II: 50 °C / 80 °C			10	10	10	10	9,5	8,5
	III: 72 °C / 120 °C			8	8	8	8	8	7
Hammer-drilling with hollow drill bit (dry or wet concrete)									
Temperature range	I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	-[1)]	6,5	6	6	6	5
	II: 50 °C / 80 °C			-[1)]	6,5	6	6	6	5
	III: 72 °C / 120 °C			-[1)]	5,5	5	5	5	4,5
Installation factors									
Dry or wet concrete and water filled hole		γ_{inst}	[-]	1,4					
Cracked concrete									
Characteristic bond resistance in cracked concrete C20/25									
Hammer-drilling with standard drill bit (dry or wet concrete, water filled hole)									
Temperature range	I: 24 °C / 40 °C	$\tau_{Rk,cr}$	[N/mm²]	4	4	4	4	4	4
	II: 50 °C / 80 °C			4	4	4	4	4	4
	III: 72 °C / 120 °C			3	3	3,5	3,5	3,5	3,5
Installation factors									
Dry or wet concrete and water filled hole		γ_{inst}	[-]	1,4					

[1)] No performance assessed

BERNER multicompound system MCS Protect Plus

Performances
Characteristic resistance to combined pull-out and concrete failure for Anchor rod and Threaded rods

Annex C 5

Deutsches Institut für Bautechnik DIBt

Table C6.1: Characteristic resistance to combined pull-out and concrete failure for BERNER MCS Plus I in hammer drilled holes; uncracked or cracked concrete

BERNER MCS Plus I				**M8**	**M10**	**M12**	**M16**
Combined pullout and concrete cone failure							
Calculation diameter		d	[mm]	12	16	18	22
Uncracked concrete							
Characteristic bond resistance in uncracked concrete C20/25							
Hammer-drilling with standard drill bit (dry or wet concrete, water filled hole)							
Temperature range	I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	7,5	7,5	7,5	7
	II: 50 °C / 80 °C			7,5	7,5	7,5	7
	III: 72 °C / 120 °C			6,5	6,5	6,5	6
Hammer-drilling with hollow drill bit (dry or wet concrete)							
Temperature range	I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	6,5
	II: 50 °C / 80 °C			6,5	6,5	6,5	6,5
	III: 72 °C / 120 °C			5,5	5,5	5,5	5,5
Installation factors							
Dry or wet concrete and water filled hole		γ_{inst}	[-]	1,4			
Cracked concrete							
Characteristic bond resistance in cracked concrete C20/25							
Hammer-drilling with standard drill bit (dry or wet concrete, water filled hole)							
Temperature range	I: 24 °C / 40 °C	$\tau_{Rk,cr}$	[N/mm²]	4,5	4	4	3,5
	II: 50 °C / 80 °C			4,5	4	4	3,5
	III: 72 °C / 120 °C			3,5	3,5	3	3
Installation factors							
Dry or wet concrete and water filled hole		γ_{inst}	[-]	1,4			

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Performances
Characteristic resistance to combined pull-out and concrete failure for BERNER MCS Plus I

Annex C 6

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Table C7.1: Characteristic **resistance to combined pull-out** and **concrete failure** for **reinforcing bars** in hammer drilled holes; **uncracked concrete**

Nominal diameter of the bar		**ϕ**	**8**	**10**	**12**	**14**	**16**	**20**	**22**	**24**	**25**
Combined pullout and concrete cone failure											
Calculation diameter	d	[mm]	8	10	12	14	16	20	22	24	25
Uncracked concrete											
Characteristic bond resistance in uncracked concrete C20/25											
Hammer-drilling with standard drill bit (dry or wet concrete, water filled hole)											
Temperature range I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	7	7	7,5	7,5	8	8	8	8
Temperature range II: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	7	7	7,5	7,5	8	8	8	8
Temperature range III: 72 °C / 120 °C	$\tau_{Rk,ucr}$	[N/mm²]	5,5	5,5	6	6	6,5	6,5	6,5	6,5	6,5
Hammer-drilling with hollow drill bit (dry or wet concrete)											
Temperature range I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	6	6	6	5,5	5,5	5,5
Temperature range II: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	6	6	6	5,5	5,5	5,5
Temperature range III: 72 °C / 120 °C	$\tau_{Rk,ucr}$	[N/mm²]	5	5	5	5	5	5	4,5	4,5	4,5
Installation factors											
Dry or wet concrete and water filled hole	γ_{inst}	[-]	1,4								

Table C7.2: Characteristic **resistance to combined pull-out** and **concrete failure** for **BERNER BRA** in hammer drilled holes; **uncracked concrete**

BERNER BRA			**M12**	**M16**	**M20**	**M24**
Combined pullout and concrete cone failure						
Calculation diameter	d	[mm]	12	16	20	25
Uncracked concrete						
Characteristic bond resistance in uncracked concrete C20/25						
Hammer-drilling with standard drill bit (dry or wet concrete, water filled hole)						
Temperature range I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	7	7,5	8	8
Temperature range II: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	7	7,5	8	8
Temperature range III: 72 °C / 120 °C	$\tau_{Rk,ucr}$	[N/mm²]	6	6,5	6,5	6,5
Hammer-drilling with hollow drill bit (dry or wet concrete)						
Temperature range I: 24 °C / 40 °C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	5,5
Temperature range II: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	5,5
Temperature range III: 72 °C / 120 °C	$\tau_{Rk,ucr}$	[N/mm²]	5	5	5	4,5
Installation factors						
Dry or wet concrete and water filled hole	γ_{inst}	[-]	1,4			

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Performances
Characteristic resistance to combined pull-out and concrete failure for reinforcing bars and BERNER BRA

Annex C 7

Deutsches Institut für Bautechnik DIBt

Table C8.1: Displacements for Anchor rods / Threaded rods

Anchor rod		M8	M10	M12	M16	M20	M24
Displacement-Factors for tension load[1)]							
Uncracked concrete; Temperature range I, II, III							
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,04	0,04	0,05	0,06	0,07	0,08
$\delta_{N\infty\text{-Factor}}$		0,04	0,04	0,05	0,06	0,07	0,08
Cracked concrete; Temperature range I, II, III							
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,11	0,11	0,13	0,14	0,16
$\delta_{N\infty\text{-Factor}}$		0,10	0,11	0,11	0,13	0,14	0,16
Displacement-Factors for shear load[2)]							
Uncracked or cracked concrete; Temperature range I, II, III							
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,18	0,15	0,12	0,09	0,07	0,06
$\delta_{V\infty\text{-Factor}}$		0,27	0,22	0,18	0,14	0,11	0,09

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = 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 C8.2: Displacements for BERNER MCS Plus I

BERNER MCS Plus I		M8	M10	M12	M16
Displacement-Factors for tension load[1)]					
Uncracked concrete; Temperature range I, II, III					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,06	0,07	0,07	0,07
$\delta_{N\infty\text{-Factor}}$		0,06	0,07	0,07	0,07
Cracked concrete; Temperature range I, II, III					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,11	0,11	0,12
$\delta_{N\infty\text{-Factor}}$		0,10	0,11	0,11	0,12
Displacement-Factors for shear load[2)]					
Uncracked or cracked concrete; Temperature range I, II, III					
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,12	0,09	0,08	0,07
$\delta_{V\infty\text{-Factor}}$		0,18	0,14	0,12	0,10

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = 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 multicompound system MCS Protect Plus

Performances
Displacements for Anchor rods / Threaded rods and BERNER MCS Plus I

Annex C 8

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Table C9.1: Displacements for reinforcing bars

Nominal diameter of the bar ϕ		8	10	12	14	16	20	22	24	25
Displacement-Factors for tension load[1)]										
Uncracked concrete; Temperature range I, II, III										
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,05	0,06	0,07	0,08	0,09	0,10	0,11	0,12	0,12
$\delta_{N\infty\text{-Factor}}$		0,05	0,06	0,07	0,08	0,09	0,10	0,11	0,12	0,12
Displacement-Factors for shear load[2)]										
Uncracked concrete; Temperature range I, II, III										
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,06
$\delta_{V\infty\text{-Factor}}$		0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,09

1) Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = 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 C9.2: Displacements for BERNER BRA

BERNER BRA		M12	M16	M20	M24
Displacement-Factors for tension load[1)]					
Uncracked concrete; Temperature range I, II, III					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,07	0,09	0,10	0,12
$\delta_{N\infty\text{-Factor}}$		0,07	0,09	0,10	0,12
Displacement-Factors for shear load[2)]					
Uncracked concrete; Temperature range I, II, III					
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,12	0,09	0,07	0,06
$\delta_{V\infty\text{-Factor}}$		0,18	0,14	0,11	0,09

1) Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = 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 multicompound system MCS Protect Plus

Performances
Displacements for reinforcing bars and BERNER BRA

Annex C 9