Deutsches Institut für Bautechnik
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European Technical Assessment Body for construction products

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

European Technical Assessment

ETA-10/0457 of 20 May 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 Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR
Product family to which the construction product belongs	Mechanical anchor for use in concrete
Manufacturer	Berner Omnichannel Trading Holding SE Bernerstraße 6 74653 Künzelsau GERMANY
Manufacturing plant	Berner manufacturing plant 6
This European Technical Assessment contains	21 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601, Edition 05/2021
This version replaces	ETA-10/0457 issued on 28 April 2020

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Specific Part

1 Technical description of the product

The Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR is an anchor made of galvanized steel (BAZ+), stainless steel (BAZ+ R) or high corrosion resistant steel (BAZ+ 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 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), Method A	See Annex C1, C5 and C6
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C2
Displacements	See Annex C9
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C7 to C9

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C3 and C4

3.3 Aspects of Durability

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 330232-01-0601 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 EAD

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

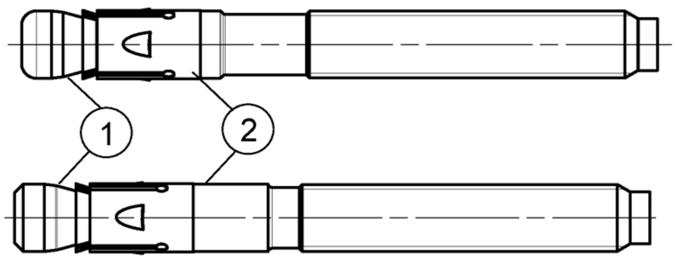
Issued in Berlin on 20 May 2025 by Deutsches Institut für Bautechnik

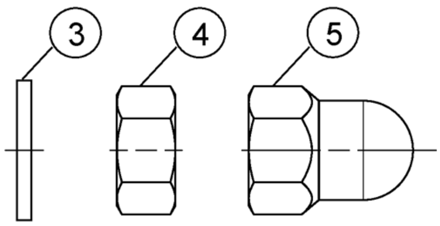
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

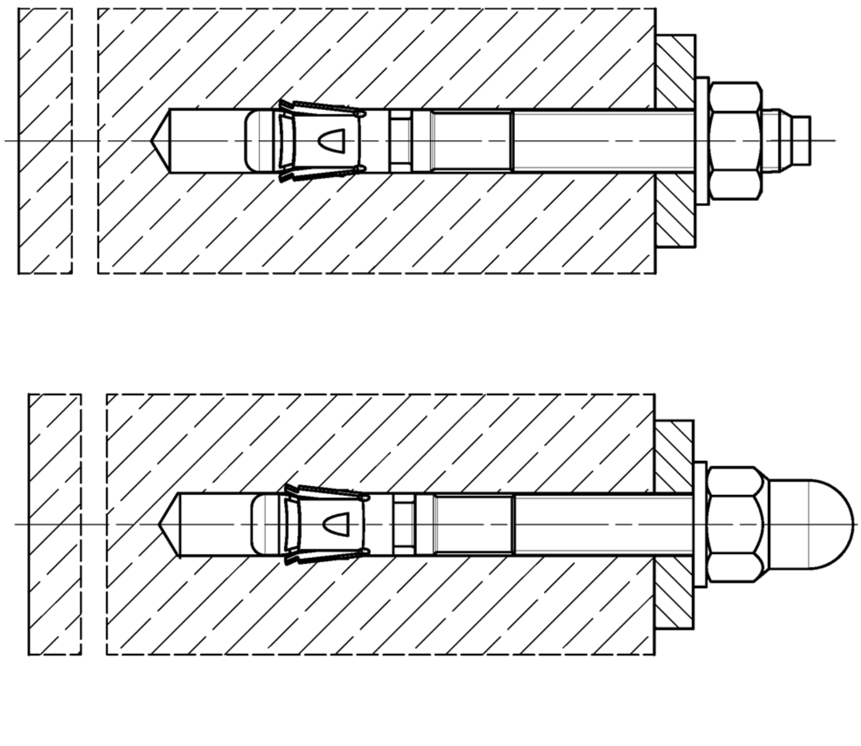
Cone bolt manufactured by cold - forming:

Cone bolt manufactured by turning:





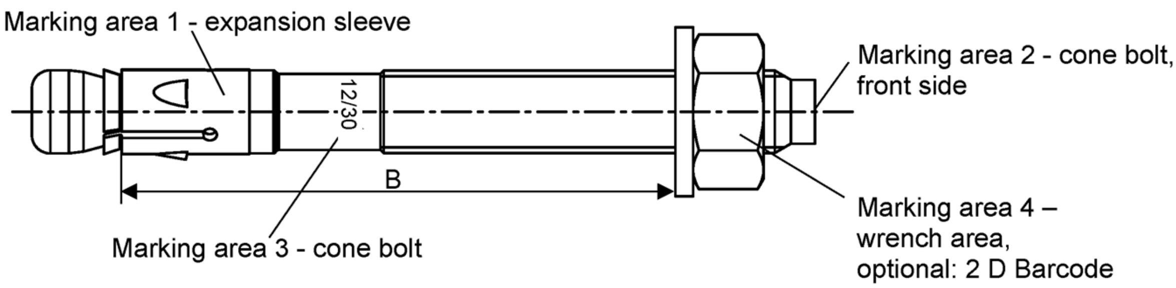
① Expansion sleeve
② Cone bolt (cold – formed or turned)
③ Washer
④ Hexagon nut
⑤ Berner BAZ+ dome nut



(Figure not to scale)

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex A1**
Product description Installed condition	

Product marking and letter-code:



Product marking, example: BAZ+ 12/30 R

Brand | type of fastener placed at marking area 1 or 3

Thread size / max. thickness of the fixture (t_{fix}) identification R or HCR placed at marking area 1 or 3

BAZ+: carbon steel, galvanised
BAZ+ R: stainless steel
BAZ+ HCR: high corrosion resistant steel

Table A2.1: Letter - code at marking area 2:

Marking		(a)	(b)	(c)	(d)	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(K)
Max. t_{fix} [mm]		5	10	15	20	5	10	15	20	25	30	35	40	45	50
B ≥ [mm]	M6	-				45	50	55	60	65	70	75	80	85	90
	M8	40	45	-		50	55	60	65	70	75	80	85	90	95
	M10	45	50	55	60	65	70	75	80	85	90	95	100	105	110
	M12	55	60	65	70	75	80	85	90	95	100	105	110	115	120
	M16	70	75	80	85	90	95	100	105	110	115	120	125	130	135
	M20	-				105	110	115	120	125	130	135	140	145	150
	M24					130	135	140	145	150	155	160	165	170	175

Marking		(L)	(M)	(N)	(O)	(P)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)	(Z)
Max. t_{fix} [mm]		60	70	80	90	100	120	140	160	180	200	250	300	350	400
B ≥ [mm]	M6	100	110	120	130	140	160	180	200	220	240	290	340	390	440
	M8	105	115	125	135	145	165	185	205	225	245	295	345	395	445
	M10	120	130	140	150	160	180	200	220	240	260	310	360	410	460
	M12	130	140	150	160	170	190	210	230	250	270	320	370	420	470
	M16	145	155	165	175	185	205	225	245	265	285	335	385	435	485
	M20	160	170	180	190	200	220	240	260	280	300	350	400	450	500
	M24	185	195	205	215	225	245	265	285	305	325	375	425	475	525

Calculation existing h_{ef} for installed fasteners:

existing h_{ef} = $B_{(\text{according to table A2.1})}$ – existing t_{fix}

Thickness of the fixture t_{fix} including thickness of filling conical washer t and e.g. thickness of grout layer t_{grout} or other non-structural layers

(Figure not to scale)

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR

Product description
Product marking and letter code

Annex A2

Product dimensions

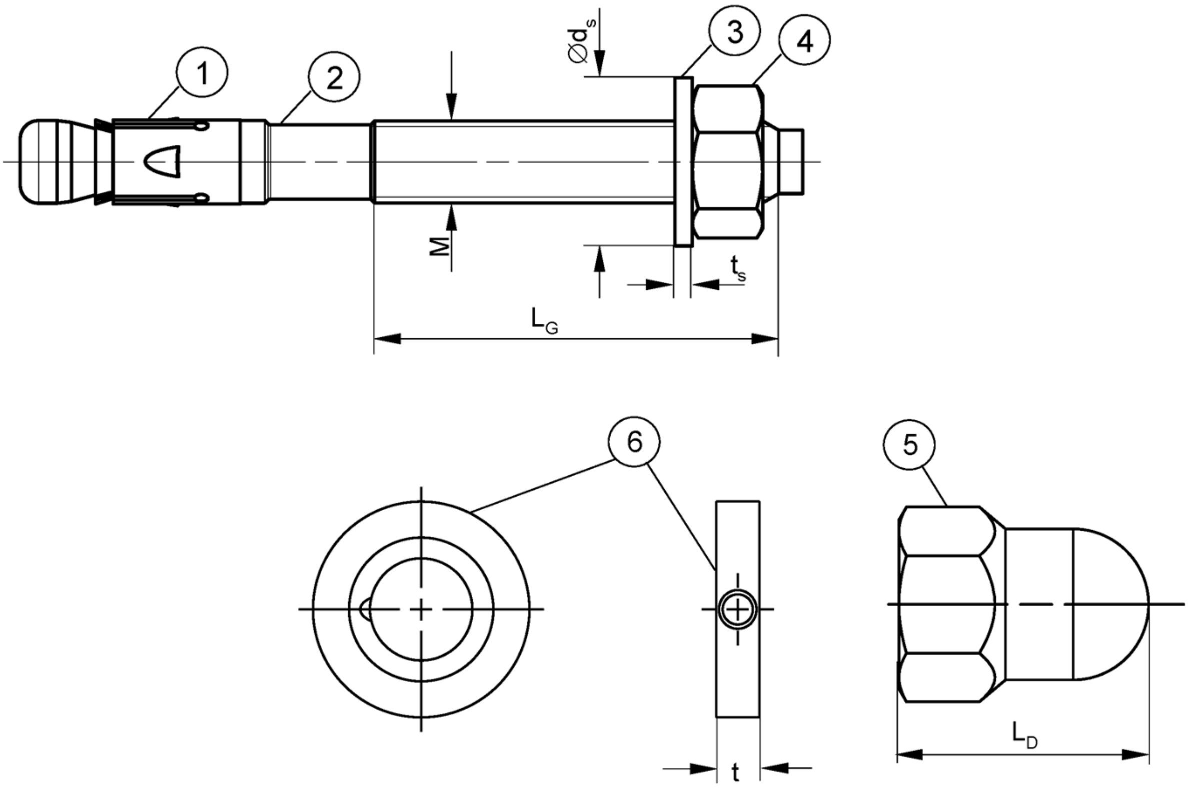


Table A3.1: Dimensions [mm]

Part	Designation			BAZ+, BAZ+ R, BAZ+ HCR M6	M8	M10	M12	M16	M20	M24
1	Expansion sleeve	Sheet thickness		0,8	1,3	1,4	1,6	2,4		3,0
2	Cone bolt	Thread size M		6	8	10	12	16	20	24
		L_G	≥	10	19	26	31	40	50	57
3	Washer	t_S	≥	1,4		1,8	2,3	2,7		3,7
		Ø d_s	≥	11	15	19	23	29	36	43
4 & 5	Hexagon nut / Berner BAZ+ dome nut	Wrench size[1]		10	13	17	19	24	30	36
5		L_D	≥	-[2]		22	27	33	-[2]	
6	Berner filling conical washer BFD	t	=	6				7	8	10

[1] Alternatively according to ISO 4032:2013 allowed
[2] Not part of the assessment

(Figure not to scale)

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR

Product description
Dimensions

Annex A3

Table A4.1: Materials BAZ+

Part	Designation	Material		
		BAZ+	BAZ+ R	BAZ+ HCR
	Steel grade	Steel	Stainless steel R	High corrosion resistant steel HCR
		Zinc plated ≥ 5 µm, ISO 4042:2018	Acc. to EN 10088:2023 Corrosion resistance class CRC III acc. to EN 1993-1-4:2006+A1:2015	Acc. to EN 10088:2023 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015
1	Expansion sleeve	Cold strip, EN 10139:2016 or stainless steel EN 10088:2023	Stainless steel EN 10088:2014	
2	Cone bolt	Cold form steel or free cutting steel	Stainless steel EN 10088:2023	High corrosion resistant steel EN 10088:2023
3	Washer	Cold strip, EN 10139:2016		
4 / 5	Hexagon nut / Berner BAZ+ dome nut	Steel, property class min. 8, EN ISO 898-2:2012	Stainless steel EN 10088:2023; ISO 3506-2:2020; property class – min. 70	High corrosion resistant steel EN 10088:2023; ISO 3506-2:2020; property class – min. 70
6	Berner filling conical washer BFD	Cold form steel or free cutting steel	Stainless steel EN 10088:2023	High corrosion resistant steel EN 10088:2023

Specifications of intended use

Fastenings subject to:

Size		BAZ+, BAZ+ R, BAZ+ HCR					
	M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Hammer drilling with standard drill bit 	✓						
Hammer drilling with hollow drill bit with automatic cleaning 	- [1]	✓					
Diamond drilling 	- [1]	✓ (for non seismic applications only)					
Static and quasi-static loads	✓						
Cracked and uncracked concrete	✓						
Fire exposure	✓						
Seismic performance category C1	- [1]	✓					
Seismic performance category C2	- [1]		✓				

[1] No performance assessed

Base materials:
- Compacted reinforced and unreinforced normal weight concrete without fibres (cracked or uncracked) according to EN 206-1:2013+A2:2021
- Strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions (BAZ+, BAZ+ R, BAZ+ HCR)
- For all other conditions according to EN 1993-1-4:2006 + A1:2015 corresponding to corrosion resistance class
  - CRC III: for BAZ+ R
  - CRC V: for BAZ+ HCR

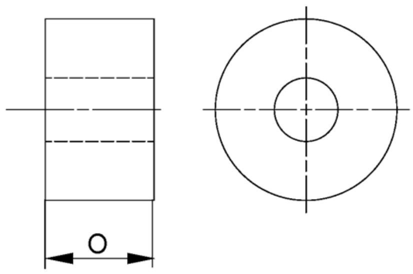
Design:
- Fastenings are to be designed under the responsibility of an engineer experienced in fastenings and concrete work
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.)
- Fastenings in stand-off installation or with a grout layer under seismic action are not covered
- In case of seismic applications the fastener shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure
- Design of fastenings according to EN 1992-4:2018 and EOTA Technical Report TR 055:2018

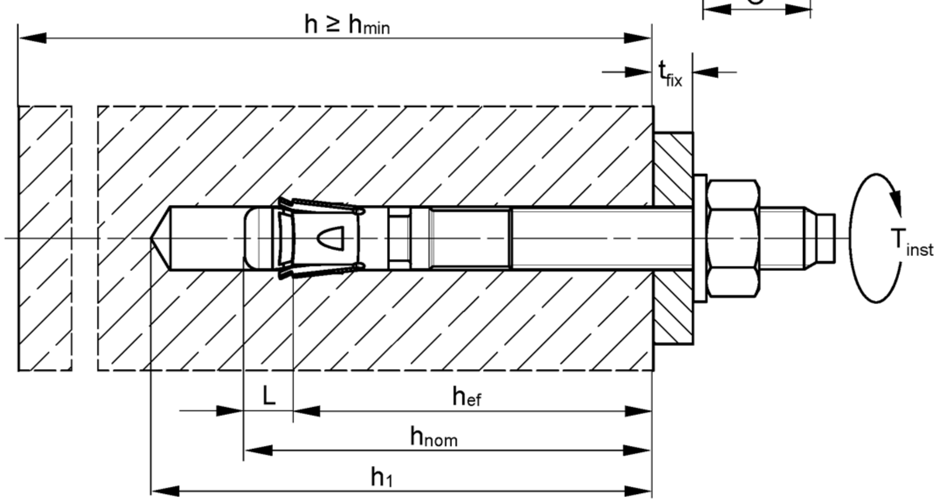
Table B2.1: Installation parameters

Size			BAZ+, BAZ+ R, BAZ+ HCR						
			M6	M8	M10	M12	M16	M20	M24
Nominal drill hole diameter	d_0 =	[mm]	6	8	10	12	16	20	24
Maximum bit diameter with hammer or hollow drilling	$d_{cut,max}$	[mm]	6,40	8,45	10,45	12,5	16,5	20,55	24,55
Maximum bit diameter with diamond drilling	$d_{cut,max}$	[mm]	- 1)	8,15	10,45	12,25	16,45	20,50	24,40
Effective embedment depth	$h_{ef} \geq$	[mm]	40-80	35-90	40-100	50-125	65-160	100-180	125
Length from h_{ef} to end of cone bolt	L	[mm]	6,5	9,5	11,5	13,5	17,5	20,0	23,5
Overall fastener embedment depth in the concrete	$h_{nom} \geq$	[mm]	h_{ef} + L						
Depth of drill hole to deepest point	h_1 2) ≥	[mm]	h_{nom} + 3			h_{nom} + 5		h_{nom} + 10	
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	14	18	22	26
Required setting torque	T_{inst} =	[Nm]	8	20	45	60	110	200	270
Excess length after hammering-in the cone bolt (for Berner dome nut applications according to Annex B4)	O =	[mm]	- 1)		12	16	20	- 1)	

1) Not part of the assessment
2) For the application without drill hole cleaning: $h_{1,nc} = h_1 + 15$ mm

Setting gauge BAZ+ SL-H
for fastener with Berner BAZ+ dome nut:





h_{ef}	=	Effective embedment depth	O =	Length of setting gauge
t_{fix}	=	Thickness of the fixture	L =	Length from h_{ef} to end of cone bolt
h_1	=	Depth of drill hole to deepest point	$h_{1,nc}$ =	Depth of drill hole to deepest point witout cleaning
h	=	Thickness of the concrete member	T_{inst} =	Required setting torque
h_{min}	=	Minimum thickness of concrete member		
h_{nom}	=	Overall fastener embedment depth in the concrete		

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR

Intended Use
Installation parameters

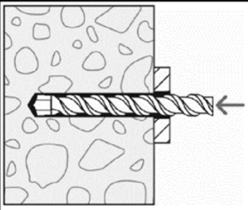
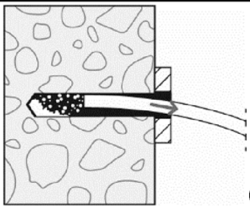
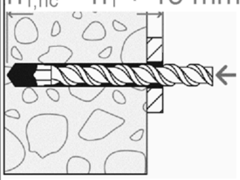
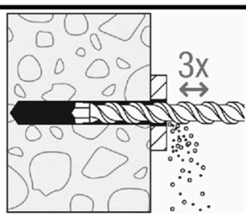
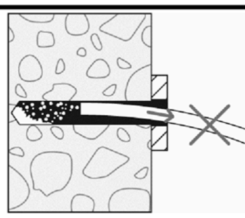
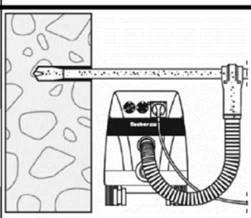
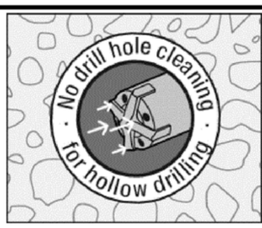
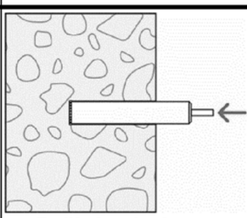
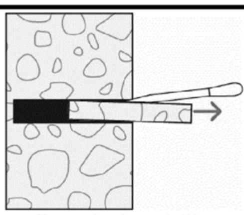
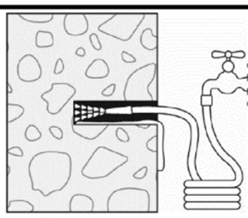
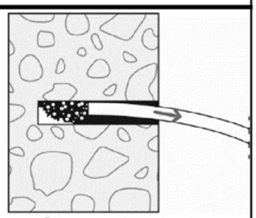
Annex B2

Installation instructions:

- Fastener installation carried out by appropriately qualified personnel according to the design drawings and under the supervision of the person responsible for technical matters on the site
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener Exception: Berner BAZ+ dome nut
- Hammer, hollow or diamond drilling according to Annex B1 + B2
- Drill hole created perpendicular +/- 5° to concrete surface, positioning without damaging the reinforcement
- In case of aborted hole: new drilling at a minimum distance twice the depth of the aborted drill hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application

Installation instructions: Drilling and cleaning the hole

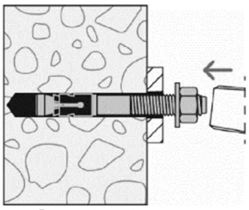
Types of drills and cleaning

Hammer drill with cleaning		 1: Drill the hole	 2: Clean the hole	Continue with step 5	
Hammer drill without cleaning		$h_{1,nc} = h_1 + 15$ mm  1: Drill the hole	 2: When $h_{1,nc}$ is reached: Pull out drill 3 x	 Cleaning not necessary; Continue with step 5	
Hollow drill		 1: Drill the hole with automatic cleaning	 Cleaning obsolete	Continue with step 5	
Diamond drill, for non seismic applications only		 1: Drill the hole	 2: Break the drill core and remove it	 3: Flush the drill hole, until clear water emerges from the drill hole	 4: Clean the hole

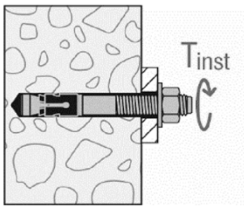
Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex B3**
Intended Use Installation instructions	

Installation instructions: Installation of the fastener

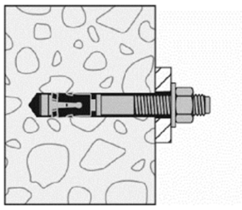
HEXAGON NUT:



5. Set the fastener, e.g. with hammer



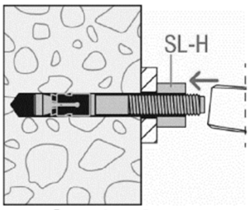
6. Apply T_{inst}



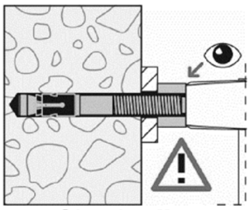
7. Installed fastener

Berner BAZ+ DOME NUT:

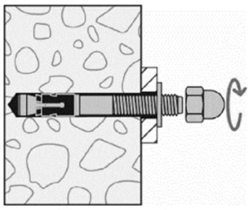
Option 1: Push through installation with setting gauge SL-H:



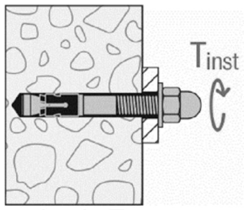
5.1: Set the fastener through the setting gauge and fixture



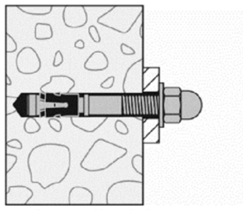
5.2: Check offset



5.3: Turn on the Berner BAZ+ dome nut

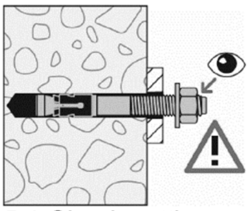


6: Apply T_{inst}

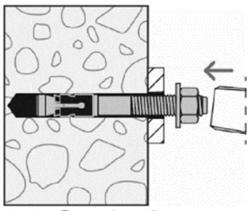


7: Installed fastener

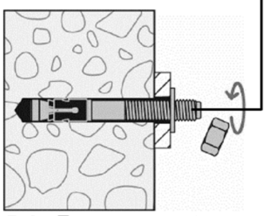
Option 2: Push through installation with hexagon nut:



5.1: Check setting position: Visible one turn of a thread



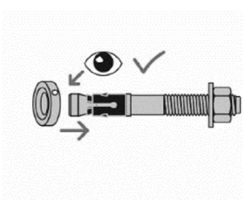
5.2: Set the fastener

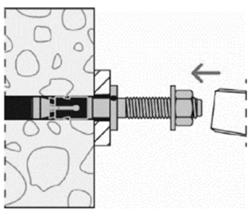


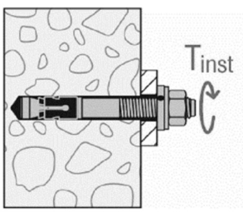
5.3: Remove nut

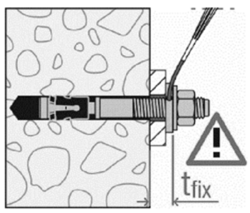
Berner Filling conical washer BFD optional for seismic C2 application or minimising the annular gap:

Optional	The gap between bolt and fixture may be filled with mortar (compressive strength ≥ 50 N/mm² e.g. Berner e.g. MCS UNI Plus) after last step (for eliminating the annular gap). The BFD is additional to the standard washer. The thickness of the BFD must be considered for definition of t_{fix}. Countersunk of the BFD in direction to the anchor plate. Installation with hexagon nut or dome nut is permitted.









Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex B4**
Intended Use Installation instructions	

Table C1.1: Characteristic values of **tension** resistance under static and quasi-static action

Size				M6	M8	M10	M12	M16	M20	M24
				BAZ+, BAZ+ R, BAZ+ HCR						
Steel failure										
Characteristic resistance	BAZ+	$N_{Rk,s}$	[kN]	11,3	19,9	32,7	49,3	78,7	108,4	180,0
	BAZ+ R			12,1	21,0	34,5	52,0	83,0	127,6	187,0
	BAZ+ HCR			11,3	17,6	29,1	43,8	69,9		
Partial factor for steel failure	BAZ+	γ_{Ms} [1]	[-]	1,4					1,4	1,5
	BAZ+ R								1,45	
	BAZ+ HCR			1,5	1,45			1,4	1,5	
Pullout failure										
Effective embedment depth for calculation		h_{ef}	[mm]	40-80	40[3] - < 45 / 45-90	40-100	50-125	65-160	100-180	125
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p}$ (C20/25)	[kN]	1,5	5,5 / 8	13	20	27,0	34,4	48,1
Characteristic resistance in uncracked concrete C20/25				10,5	14	20	22	38,6	49,2	68,8
Increasing factor ψ_c for cracked or uncracked concrete $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25)	C25/30		[-]	1,12						
	C30/37			1,22						
	C35/45			1,32						
	C40/50			1,41						
	C45/55			1,50						
	C50/60			1,58						
Installation sensitivity factor		γ_{inst}	[-]	1,0						
Concrete cone and splitting failure										
Factor for uncracked concrete		$k_{ucr,N}$	[-]	11,0[2]						
Factor for cracked concrete		$k_{cr,N}$	[-]	7,7[2]						
Characteristic spacing		$s_{cr,N}$	[mm]	$3 \cdot h_{ef}$						
Characteristic edge distance		$c_{cr,N}$	[mm]	$1{,}5 \cdot h_{ef}$						
Characteristic spacing for splitting failure		$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$						
Characteristic edge distance for splitting failure h	≥ 80	$c_{cr,sp}$	[mm]	40	$2{,}4 \cdot h_{ef}$	$2 \cdot h_{ef}$	-[5]	-[5]	-[5]	-[5]
	≥ 100			40	$2 \cdot h_{ef}$	$2{,}4 \cdot h_{ef}$	$2 \cdot h_{ef}$	-[5]	-[5]	-[5]
	≥ 120			40	$2 \cdot h_{ef}$	$1{,}9 \cdot h_{ef}$	$2{,}1 \cdot h_{ef}$	-[5]	-[5]	-[5]
	≥ 140			40	$2 \cdot h_{ef}$	$1{,}9 \cdot h_{ef}$	$1{,}5 \cdot h_{ef}$	$2 \cdot h_{ef}$	-[5]	-[5]
	≥ 160			40	$2 \cdot h_{ef}$	$1{,}9 \cdot h_{ef}$	$1{,}5 \cdot h_{ef}$	$2 \cdot h_{ef}$	$2{,}4 \cdot h_{ef}$	-[5]
	≥ 200			40	$2 \cdot h_{ef}$	$1{,}9 \cdot h_{ef}$	$1{,}5 \cdot h_{ef}$	$2 \cdot h_{ef}$	$2{,}4 \cdot h_{ef}$	$2{,}2 \cdot h_{ef}$
Characteristic resistance to splitting		$N^0_{Rk,sp}$	[kN]	min $\{N^0_{Rk,c}; N_{Rk,p}\}$[4]						

1) In absence of other national regulations
2) Based on concrete strength as cylinder strength
3) For dry internal exposure and statically indeterminate redundant components, the minimum effective embedment depth can be reduced to 35 mm without reduction of $N_{Rk,p}$.
4) $N^0_{Rk,c}$ according to EN 1992-4:2018
5) No performance assessed

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex C1**
Performances Characteristic values of tension resistance under static and quasi-static action	

Table C2.1: Characteristic values of **shear** resistance under static and quasi-static action

Size				BAZ+, BAZ+ R, BAZ+ HCR						
				M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure without lever arm										
Characteristic resistance	BAZ+ without filling of the annular gap	$V^0_{Rk,s}$	[kN]	7,5	16,3	26,2	37,0	68,4	82,9	128,3
	BAZ+ with filling				18,1	27,3	40,7	69,8	85,6	
	BAZ+ R without filling			8,8	17,6	26,5	42,1	71,1	107,9	158,1
	BAZ+ R with filling					27,6	44,3	73,6	117,9	
	BAZ+ HCR without filling				17,4	23,7	42,1	71,1	107,9	
	BAZ+ HCR with filling					27,9		73,6	117,9	
Partial factor for steel failure		γ_{Ms} [1)]	[-]	1,25						
Factor for ductility		k_7		1,0						
Steel failure with lever arm and Concrete pryout failure										
Effective embedment depth for calculation		h_{ef}	[mm]	40-80	45-90	60-100	70-125	85-160	100-180	125
Characteristic bending resistance	BAZ+	$M^0_{Rk,s}$	[Nm]	11	30	60	105	266	422	864
	BAZ+ R				29	59	100	256	519	898
	BAZ+ HCR									
Factor for pryout failure		k_8	[-]	2,6	2,8	3,2				
Effective embedment depth for calculation		h_{ef}	[mm]	- [2)]	40 [3)] - < 45	40 - < 60	50 - < 70	65 - < 85	- [2)]	
Characteristic bending resistance	BAZ+	$M^0_{Rk,s}$	[Nm]		27	56	105	251		
	BAZ+ R				29	59	100	256		
	BAZ+ HCR				24	50		223		
Factor for pryout failure		k_8	[-]		2,5	2,6	3,1	3,2		
Partial factor for steel failure		γ_{Ms} [1)]	[-]	1,25						
Factor for ductility		k_7		1,0						
Concrete edge failure										
Effective embedment depth for calculation		l_f	[mm]	h_{ef}						
Outside diameter of a fastener		d_{nom}		6	8	10	12	16	20	24

[1)] In absence of other national regulations

[2)] No performance assessed

[3)] For dry internal exposure and statically indeterminate redundant components, the minimum effective embedment depth can be reduced to 35 mm without reduction of $N_{Rk,p}$.

Table C3.1: Characteristic values of **tension** resistance under **fire exposure**

Size					BAZ+, BAZ+ R, BAZ+ HCR										
					M6	M8		M10		M12		M16		M20	M24
				$h_{ef} \geq$ [mm]	40	35	45	40	60	50	70	65	85	100	125
Characteristic resistance **steel failure**	BAZ+	$N_{Rk,s,fi}$	R30	[kN]	0,6[1] / 0,9[2]	1,4		2,8		5,0		9,4		14,7	21,1
			R60		0,4[1] / 0,9[2]	1,2		2,3		4,1		7,7		12,0	17,3
			R90		0,3[1] / 0,9[2]	0,9		1,9		3,2		6,0		9,4	13,5
			R120		0,2[1] / 0,7[2]	0,8		1,6		2,8		5,2		8,1	11,6
	BAZ+ R / HCR	$N_{Rk,s,fi}$	R30		0,6[1] / 0,9[2]	3,6		7,8		11,5		21,8		34,3	49,4
			R60		0,4[1] / 0,9[2]	2,3		4,8		7,1		13,2		20,7	29,3
			R90		0,3[1] / 0,9[2]	1,9		3,8		5,7		10,5		18,3	26,4
			R120		0,2[1] / 0,7[2]	1,6		3,3		4,9		8,6		17,3	25,0
Characteristic resistance **Concrete cone failure**		$N_{Rk,c,fi}$	R30 - R90		$7,7 \cdot h_{ef}^{1,5} \cdot (20)^{0,5} \cdot h_{ef} / 200 / 1000$										
			R120		$7,7 \cdot h_{ef}^{1,5} \cdot (20)^{0,5} \cdot h_{ef} / 200 / 1000 \cdot 0,8$										
Characteristic resistance **pullout failure**		$N_{Rk,p,fi}$	R30		0,4	0,9	2,0	2,2	3,3	3,0	5,0	4,5	6,8	8,6	12,0
			R60		0,4	0,8	2,0	2,2	3,3	3,0	5,0	4,5	6,8	8,6	12,0
			R90		0,4	0,5	2,0	2,2	3,3	3,0	5,0	4,5	6,8	8,6	12,0
			R120		0,3		1,6	1,7	2,6	2,4	4,0	3,6	5,4	6,9	9,6

Table C3.2: Characteristic values of **shear** resistance under **fire exposure**

BAZ+				R30		R60	
				$V_{Rk,s,fi,30}$ [kN]	$M^0_{Rk,s,fi,30}$ [Nm]	$V_{Rk,s,fi,60}$ [kN]	$M^0_{Rk,s,fi,60}$ [Nm]
M6	$h_{ef} \geq$	40	[mm]	0,6[1] / 0,9[2]	0,5[1] / 0,2[2]	0,4[1] / 0,9[2]	0,3[1] / 0,1[2]
M8		35		1,8	1,4	1,6	1,2
M10		40		3,6	3,6	2,9	3,0
M12		50		6,3	7,8	4,9	6,4
M16		65		11,7	19,9	9,1	16,3
M20		100		18,2	39,0	14,2	31,8
M24		125		26,3	67,3	20,5	55,0

BAZ+				R90		R120	
				$V_{Rk,s,fi,90}$ [kN]	$M^0_{Rk,s,fi,90}$ [Nm]	$V_{Rk,s,fi,120}$ [kN]	$M^0_{Rk,s,fi,120}$ [Nm]
M6	$h_{ef} \geq$	40	[mm]	0,3[1] / 0,9[2]	0,2[1] / 0,1[2]	0,2[1] / 0,7[2]	0,2[1] / 0,1[2]
M8		35		1,3	1,0	1,2	0,8
M10		40		2,2	2,4	1,9	2,1
M12		50		3,5	5,0	2,8	4,3
M16		65		6,6	12,6	5,3	11,0
M20		100		10,3	24,6	8,3	21,4
M24		125		14,8	42,6	11,9	37,0

Concrete pryout failure according to EN 1992-4:2018

[1] BAZ+
[2] BAZ+ R / BAZ+ HCR

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex C3**
Performances Characteristic values of resistance under fire exposure	

Table C4.1: Characteristic values of **shear** resistance under **fire exposure**

BAZ+ R, BAZ+ HCR				R30		R60	
				$V_{Rk,s,fi,30}$ [kN]	$M^0_{Rk,s,fi,30}$ [Nm]	$V_{Rk,s,fi,60}$ [kN]	$M^0_{Rk,s,fi,60}$ [Nm]
M6	$h_{ef} \geq$	40	[mm]	0,6[1)] / 0,9[2)]	0,5[1)] / 0,2[2)]	0,4[1)] / 0,9[2)]	0,3[1)] / 0,1[2)]
M8		35		3,6	3,7	2,3	2,4
M10		40		7,8	10,1	4,8	6,2
M12		50		11,5	17,9	7,1	11,1
M16		65		21,8	46,2	13,2	27,9
M20		100		34,3	90,9	20,7	54,9
M24		125		49,4	157,2	29,3	93,1
BAZ+ R, BAZ+ HCR				**R90**		**R120**	
				$V_{Rk,s,fi,90}$ [kN]	$M^0_{Rk,s,fi,90}$ [Nm]	$V_{Rk,s,fi,120}$ [kN]	$M^0_{Rk,s,fi,120}$ [Nm]
M6	$h_{ef} \geq$	40	[mm]	0,3[1)] / 0,9[2)]	0,2[1)] / 0,1[2)]	0,2[1)] / 0,7[2)]	0,2[1)] / 0,1[2)]
M8		35		1,9	1,9	1,6	1,7
M10		40		3,8	4,9	3,3	4,3
M12		50		5,7	8,8	4,9	7,6
M16		65		10,5	22,1	8,6	18,3
M20		100		18,3	48,6	17,3	45,9
M24		125		26,4	84,0	25,0	79,4

[1)] BAZ+

[2)] BAZ+ R / BAZ+ HCR

Concrete pryout failure according to EN 1992-4:2018

Table C4.2: Minimum spacings and minimum edge distances of fasteners under **fire exposure** for **tension** and **shear** load

Size			BAZ+, BAZ+ R, BAZ+ HCR						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Spacing	s_{min}	[mm]	Annex C5						
Edge distance	c_{min}		$c_{min} = 2 \cdot h_{ef}$, for fire exposure from more than one side $c_{min} \geq 300$ mm						

Table C5.1: Minimum thickness of concrete members, minimum spacing and minimum edge distance

Size			BAZ+, BAZ+ R, BAZ+ HCR						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Minimum edge distance									
Uncracked concrete	c_{min}	[mm]	40	40	45	55	65	95	135
Cracked concrete								85	100
Corresponding	s		according to Annex C6						
Minimum thickness of concrete member	h_{min}		80			100	140	160	200
Thickness of concrete member	h ≥		max. $\{h_{min};\ 1{,}5 \cdot h_{ef};\ h_1^{1)} + 25\}$				max. $\{h_{min};\ 1{,}5 \cdot h_{ef};\ h_1^{1)} + 30\}$		
Minimum spacing									
Uncracked concrete	s_{min}	[mm]	35	40	40	50	65	95	100
Cracked concrete				35					
Corresponding	c		according to Annex C6						
Minimum thickness of concrete member	h_{min}		80			100	140	160	200
Thickness of concrete member	h ≥		max. $\{h_{min};\ 1{,}5 \cdot h_{ef};\ h_1^{1)} + 25\}$				max. $\{h_{min};\ 1{,}5 \cdot h_{ef};\ h_1^{1)} + 30\}$		
Minimum splitting area									
Uncracked concrete	$A_{sp,req}$	[·1000 mm²]	5,1	18	37	54	67	100	117,5
Cracked concrete			1,5	12	27	40	50	77	87,5

1) If borehole cleaning is omitted, h_1 is replaced by $h_{1,nc}$

Table C5.2: Minimum spacing and minimum edge distances - calculated values for **for cracked concrete with one edge** (c_2 and $c_3 \geq 1{,}5\ c_1$) in the cleaned borehole

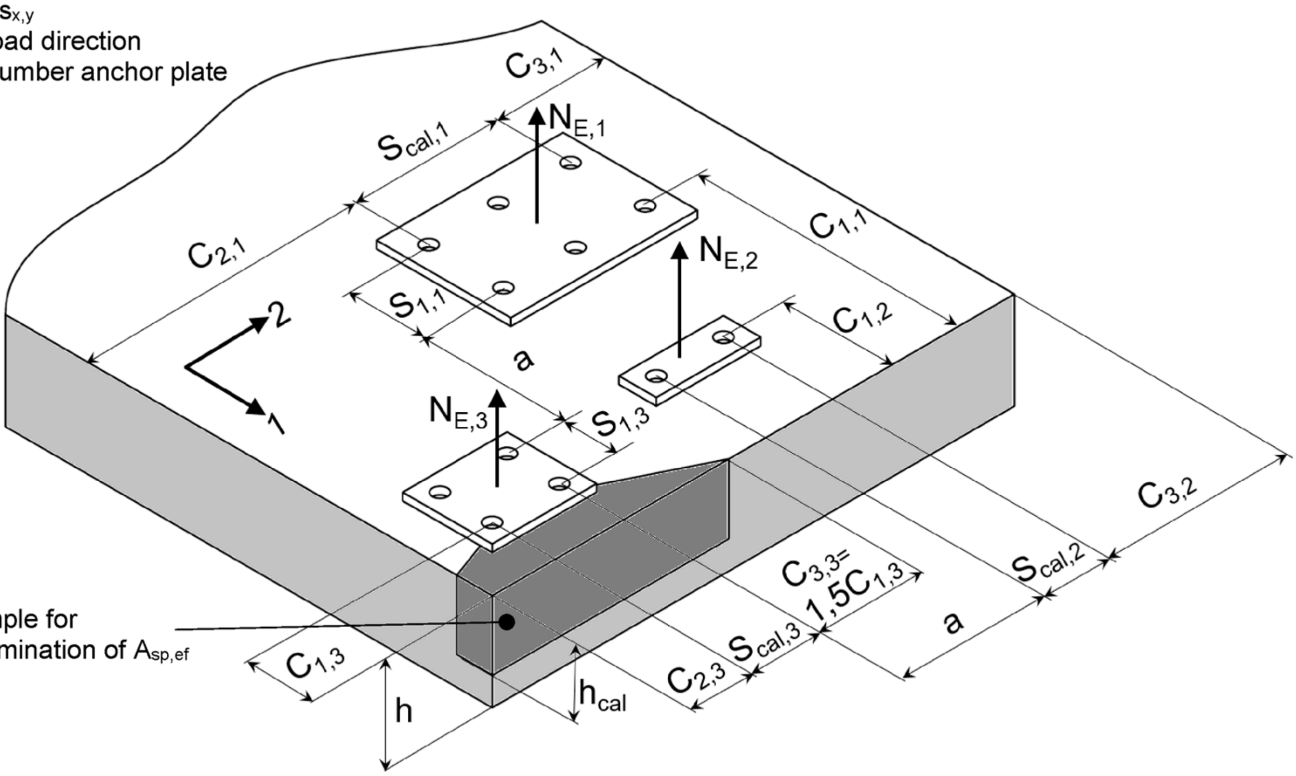
Type of anchor / size		BAZ+, BAZ+ R, BAZ+ HCR										
		M6	**M8**		**M10**		**M12**		**M16**		**M20**	**M24**
Effective anchorage depth	$h_{ef} \geq$ [mm]	40	35	45	40	60	50	70	65	85	100	125
Minimum thickness of concrete member	$h^{1)} \geq$ [mm]	80		85	80	120	100	140	140	180	160	200
Minimum spacing	s_{min} [mm]	35			40		50		65		95	100
	for c ≥ [mm]	40			100	65	120	80	100	75	130	115
Minimum edge distance	c_{min} [mm]	40			60	45	70	55	65		85	100
	for s ≥ [mm]	35			160	90	190	125	165	85	230	140

1) Thickness of concrete member has to be increased by 15 mm, if borehole cleaning is omitted

Determination of $A_{sp,ef}$ for each existing free edge

Splitting failure applied for minimum edge distance and spacing in depending on h_{ef}

Definition Index:
cal = calculatory
e.g.: $s_{x,y}$
x = load direction
y = number anchor plate



Example for different anchor plates: For considering all free edges the direction 1 and 2 must be swaped.

General formulation for each free edge: $A_{sp,ef} = (c_2 + s_{cal} + c_3) \cdot h_{cal} \geq (^n/_2) \cdot A_{sp,req}$
with:
Edge distance c_1: $c_{min} \leq c_1$
Edge distance c_2: $c_{min} \leq c_2 \leq 1{,}5 \cdot c_1$
Edge distance c_3: $c_{min} \leq c_3 \leq 1{,}5 \cdot c_1$
Calculation spacing, distance between outer anchors s_{cal}: $s_{min} \leq s_{cal} \leq 3{,}0 \cdot c_1$
Distance between group of anchors a: For $a \geq 3{,}0\ c_1$ no influence between the anchor groups is taken into account.
Number of anchors n of an anchor plate as well close and parallel to the edge
Effective member thickness h_{cal}: $h_{min} \leq h$; $h_{cal} \leq h$; $h_{cal} \leq (h_{ef} + 1{,}5 \cdot c_1)$
c_1, c_2, c_3, h and s_{cal} have to be set in way that the requirement is fullfiled

For the calculation of minimum spacing and minimum edge distance of fasteners in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

$$A_{sp,req} < A_{sp,ef}$$

$A_{sp,req}$ = required splitting area (according to Annex C 5)
$A_{sp,ef}$ = effective splitting area

(Figure not to scale)

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex C6**
Performances Minimum thickness of member, minimum spacings and edge distances	

Table C7.1: Characteristic values of **tension and shear** resistance under **seismic action category C1**

Size			BAZ+, BAZ+ R, BAZ+ HCR							
			M6	M8		M10	M12	M16	M20	M24
Effective embedment depth	h_{ef}	[mm]	-[2)]	40 - <45	45-90	40-100	50-125	85-160	100-180	125
With filling of the annular gap	α_{gap}	[-]	-[2)]	1,0						
Without filling of the annular gap	α_{gap}	[-]	-[2)]	0,5						
Steel failure $N_{Rk,s,C1} = N_{Rk,s}$; $\gamma_{Ms,C1} = \gamma_{Ms}$ (see Annex C1)										
Pullout failure										
Characteristic resistance in cracked concrete C1	$N_{Rk,p,C1}$	[kN]	-[2)]	5,1	7,4	11,6	20,0	27,0	34,4	48,1
Installation sensitivity factor	γ_{inst}	[-]	-[2)]	1,0						
Concrete cone failure and splitting failure $N_{Rk,c,C1} = N_{Rk,c}$; $N_{Rk,sp,C1} = N_{Rk,sp}$ (see Annex C1)										
Steel failure without lever arm										
Characteristic resistance C1 – **BAZ+**	h_{ef}	[mm]	-[2)]	45-90		60-100	70-125	85-160	100-180	125
Without filling	$V_{Rk,s,C1}$	[kN]		14,8		23,6	33,3	58,1	71,2	102,6
With filling	$V_{Rk,s,C1}$	[kN]		16,5		24,6	39,9	59,3	85,6	
	h_{ef}	[mm]		40-<45		40-<60	50-<70	-[2)]		
Without filling	$V_{Rk,s,C1}$	[kN]		-[2)]			32,9			
With filling	$V_{Rk,s,C1}$	[kN]		15,6		19,7	39,9			
Characteristic resistance C1 – **BAZ+ R**	h_{ef}	[mm]	-[2)]	45-90		60-100	70-125	85-160	100-180	125
Without filling	$V_{Rk,s,C1}$	[kN]		16,0		23,9	37,9	60,4	86,3	126,5
With filling	$V_{Rk,s,C1}$	[kN]				24,8	43,4	62,6	94,3	
	h_{ef}	[mm]		40-<45		40-<60	50-<70	-[2)]		
Without filling	$V_{Rk,s,C1}$	[kN]		-[2)]			37,5			
With filling	$V_{Rk,s,C1}$	[kN]		15,1		19,9	43,4			
Characteristic resistance C1 – **BAZ+ HCR**	h_{ef}	[mm]	-[2)]	45-90		60-100	70-125	85-160	100-180	125
Without filling	$V_{Rk,s,C1}$	[kN]		15,8		21,3	37,9	60,4	86,3	126,5
With filling	$V_{Rk,s,C1}$	[kN]				25,1	41,3	62,6	94,3	
	h_{ef}	[mm]		40-<45		40-<60	50-<70	-[2)]		
Without filling	$V_{Rk,s,C1}$	[kN]		-[2)]			37,5			
With filling	$V_{Rk,s,C1}$	[kN]		15,0		20,1	41,3			
Partial factor for steel failure	$\gamma_{Ms,C1}$[1)]	[-]		1,25						

[1)] In absence of other national regulations

[2)] No performance assessed

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR

Performances
Characteristic values of tension and shear resistance under seismic action category C1

Annex C7

Table C8.1: Characteristic values of **tension and shear** resistance under **seismic action category C2**

Size				M6	M8	M10	M12	M16	M20	M24
				BAZ+, BAZ+ R, BAZ+ HCR						
With filling of the annular gap		α_{gap}	[-]	-2)		1,0				
Without filling of the annular gap		α_{gap}	[-]	-2)		0,5				
Steel failure $N_{Rk,s,C2} = N_{Rk,s}$; $\gamma_{Ms,C2} = \gamma_{Ms}$ (see Annex C1)										
Pullout failure										
Characteristic resistance in cracked concrete C2		h_{ef}	[mm]	-2)		60-100	70-125	85-160	100-180	125
		$N_{Rk,p,C2}$	[kN]			5,1	7,4	21,5	30,7	39,6
		h_{ef}	[mm]			40 - <60	50 - <70	65 - <85	-2)	
		$N_{Rk,p,C2}$	[kN]			2,7	4,4	16,4		
Installation sensitivity factor		γ_{inst}	[-]	1,0						
Concrete cone failure and splitting failure $N_{Rk,c,C2} = N_{Rk,c}$; $N_{Rk,sp,C2} = N_{Rk,sp}$ (see Annex C1)										
Steel failure without lever arm										
	BAZ+									
Characteristic resistance C2		h_{ef}	[mm]	-2)		60-100	70-125	85-160	100-180	125
	Without filling	$V_{Rk,s,C2}$	[kN]			17,6	27,8	37,6	62,2	70,6
	With filling	$V_{Rk,s,C2}$	[kN]			20,5	30,5	52,4	68,5	102,6
		h_{ef}	[mm]			40 - <60	50 - <70	65 - <85	-2)	
	Without filling	$V_{Rk,s,C2}$	[kN]			14,1	24,4	31,2		
	With filling	$V_{Rk,s,C2}$	[kN]			14,7	30,5	52,4		
	BAZ+ R									
		h_{ef}	[mm]	-2)		60-100	70-125	85-160	100-180	125
	Without filling	$V_{Rk,s,C2}$	[kN]			17,8	31,6	39,1	70,5	87,0
	With filling	$V_{Rk,s,C2}$	[kN]			20,7	33,2	55,2	104,9	126,5
		h_{ef}	[mm]			40 - <60	50 - <70	65 - <85	-2)	
	Without filling	$V_{Rk,s,C2}$	[kN]			14,3	27,8	32,4		
	With filling	$V_{Rk,s,C2}$	[kN]			14,9	33,2	55,2		
	BAZ+ HCR									
		h_{ef}	[mm]	-2)		60-100	70-125	85-160	100-180	125
	Without filling	$V_{Rk,s,C2}$	[kN]			15,9	31,6	39,1	70,5	87,0
	With filling	$V_{Rk,s,C2}$	[kN]			20,9		55,2	104,9	126,5
		h_{ef}	[mm]			40 - <60	50 - <70	65 - <85	-2)	
	Without filling	$V_{Rk,s,C2}$	[kN]			12,8	27,8	32,4		
	With filling	$V_{Rk,s,C2}$	[kN]			15,1	31,6	55,2		
Partial factor for steel		$\gamma_{Ms,C2}$ [1)]	[-]	1,25						

1) In absence of other national regulations

2) No performance assessed

Table C9.1: Displacements under static and quasi static **tension** loads

Size			BAZ+, BAZ+ R, BAZ+ HCR						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement – factor for tensile load[1)]									
δ_{N0} - factor	in cracked concrete	[mm/kN]	0,13	0,22	0,12	0,09	0,08	0,07	0,05
$\delta_{N\infty}$ - factor	in cracked concrete	[mm/kN]	1,00	0,78	0,40	0,19	0,09		0,07
δ_{N0} - factor	in uncracked concrete	[mm/kN]	0,16	0,07	0,05	0,06		0,05	0,04
$\delta_{N\infty}$ - factor	in uncracked concrete	[mm/kN]	0,24	0,29	0,21	0,14	0,10	0,06	0,05

Table C9.2: Displacements under static and quasi static **shear** loads

Size			**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement – factor for shear load[2)]									
			BAZ+						
δ_{V0} - factor	in cracked or uncracked concrete	[mm/kN]	0,6	0,35	0,37	0,27	0,10	0,09	0,07
$\delta_{V\infty}$ - factor	in cracked or uncracked concrete	[mm/kN]	0,9	0,52	0,55	0,40	0,14	0,15	0,11
			BAZ+ R, BAZ+ HCR						
δ_{V0} - factor	in cracked or uncracked concrete	[mm/kN]	0,6	0,23	0,19	0,18	0,10	0,11	0,07
$\delta_{V\infty}$ - factor	in cracked or uncracked concrete	[mm/kN]	0,9	0,35	0,29	0,27	0,15	0,17	0,11

[1)] Calculation of effective displacement:
$\delta_{N0} = \delta_{N0}$ – factor · N
$\delta_{N\infty} = \delta_{N\infty}$ – factor · N

N = Action tension loading

[2)] Calculation of effective displacement:
$\delta_{V0} = \delta_{V0}$ – factor · V
$\delta_{V\infty} = \delta_{V\infty}$ – factor · V

V = Action shear loading

Table C9.3: Displacements under **tension** loads for **category C2** for all embedment depths

Size			BAZ+, BAZ+ R, BAZ+ HCR						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
DLS	$\delta_{N,C2\,(DLS)}$	[mm]	-[1)]		2,7	4,4		5,6	4,8
ULS	$\delta_{N,C2\,(ULS)}$	[mm]	-[1)]		11,5	13,0	12,3	14,4	15,2

[1)] No performance assessed

Table C9.4: Displacements under **shear** loads for **category C2** for all embedment depths

Size			BAZ+, BAZ+ R, BAZ+ HCR						
			M6	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
DLS without filling	$\delta_{V,C2\,(DLS)}$	[mm]	-[1)]		5,0			4,8	4,2
ULS without filling	$\delta_{V,C2\,(ULS)}$	[mm]	-[1)]		7,8	6,3	8,8	6,3	7,4
DLS with filling	$\delta_{V,C2\,(DLS)}$	[mm]	-[1)]		1,2			2,0	4,2
ULS with filling	$\delta_{V,C2\,(ULS)}$	[mm]	-[1)]		4,2	5,8	3,1	4,4	7,4

[1)] No performance assessed

Berner Simplexanchor BAZ+, BAZ+ R, BAZ+ HCR	**Annex C9**
Performances Displacements under tension and shear loads	