Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment

ETA-21/0168 of 1 June 2021

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	Capsule Adhesive Anchor W-VPZ
Product family to which the construction product belongs	Bonded anchor for use in concrete
Manufacturer	Adolf Würth GmbH & Co. KG Reinhold-Würth-Straße 12-17 74653 Künzelsau DEUTSCHLAND
Manufacturing plant	Werk 1
This European Technical Assessment contains	15 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601, Edition 04/2020

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Specific Part

1 Technical description of the product

The Capsule Adhesive Anchor W-VPZ is a bonded fastener consisting of a glass capsule W-VPZ and a threaded rod W-VD-A according to Annex A1.

The glass capsule W-VPZ is placed in the hole and the threaded rod W-VD-A is driven by machine as specified in Annex B4.

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 C1 to C2, B2
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1, C3
Displacements under short-term and long-term loading	See Annex C4
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Hygiene, health and the environment (BWR 3)

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

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

Issued in Berlin on 1 June 2021 by Deutsches Institut für Bautechnik

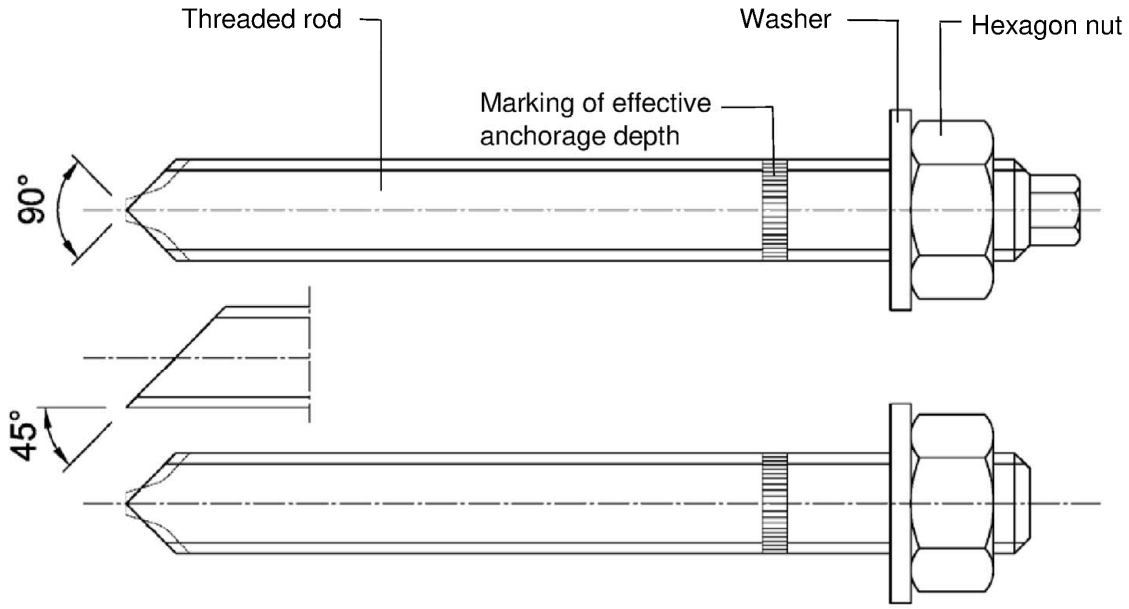
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

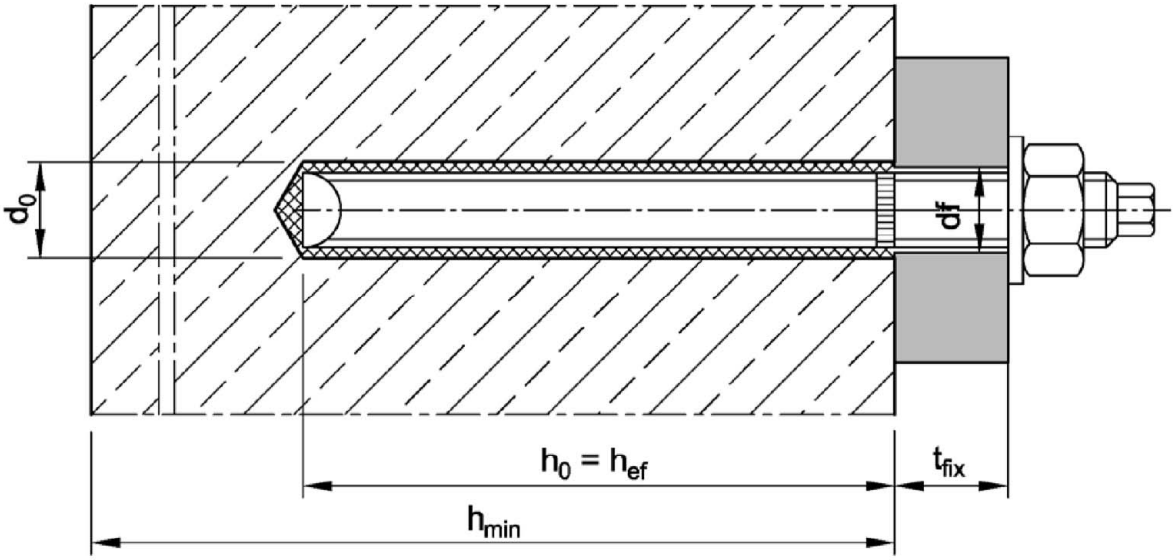
Deutsches Institut für Bautechnik DIBt

Glass capsule W-VPZ

Threaded rod W-VD-A



Installation condition



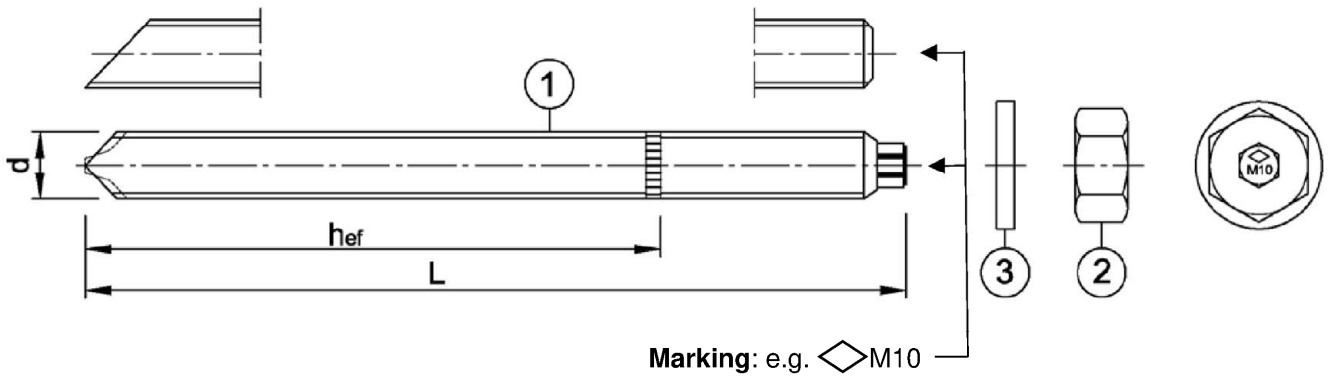
Capsule Adhesive Anchor W-VPZ

Product description
Product and installation condition

Annex A1

Deutsches Institut für Bautechnik DIBt

Threaded rod W-VD-A M8, M10, M12, M16, M20



Marking: e.g. ◇M10

◇ identifying mark of manufacturing plant
M10 anchor size

Additional marking:
-8 property class 8.8
A4 stainless steel
HC high corrosion resistant steel

Glass capsule W-VPZ

Table A1: Dimensions

Part	Anchor size			M8	M10	M12	M16	M20
1	Threaded rod	d	[mm]	8	10	12	16	20
		L ≥	[mm]	95	100	120	140	190
		h_{ef}	[mm]	80	90	110	125	170
2	Hexagon nut	SW	[mm]	13	17	19	24	30
4	Glass capsule, imprint		[-]	VZ-P 8	VZ-P 10	VZ-P 12	VZ-P 16	VZ-P 20

Capsule Adhesive Anchor W-VPZ

Product description
Marking and dimensions

Annex A2

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Table A2: Materials

Part	Designation	Materials						
Steel, zinc plated electroplated ≥ 5 µm according to EN ISO 4042:2018 hot-dip galvanized ≥ 40 µm (50 µm in average) according to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 sherardized ≥ 45 µm according to EN ISO 17668:2016								
1	Threaded rod	Property class	characteristic ultimate strength		characteristic yield strength		fracture elongation	EN 10277:2018, EN 10263:2001, EN 10025-2:2019
		5.8	f_{uk} [N/mm²]	500	f_{yk} [N/mm²]	400	A_5 > 8 %	
		8.8		800		640	A_5 > 8 %	
2	Hexagon nut	5	for class 5.8					EN ISO 898-2:2012
		8	for class 5.8, 8.8					
3	Washer	steel, zinc plated						
Stainless steel A2 **Stainless steel A4** **High corrosion resistant steel HCR**								
1	Threaded rod	Property class	characteristic ultimate strength		characteristic yield strength		fracture elongation	EN 10088:2014 EN ISO 3506-1:2009
		70	f_{uk} [N/mm²]	700	f_{yk} [N/mm²]	450	A_5 > 8 %	
		80		800		600	A_5 > 8 %	
2	Hexagon nut	70	for class 70					EN 10088:2014 EN ISO 3506-2:2009
		80	for class 70, 80					
3	Washer	stainless steel or high corrosion resistant steel (corrosion resistant class at least corresponding to the threaded rod)						EN 10088:2014
Glass capsule								
4	Glass capsule	glass, quartz, resin, hardener						

Capsule Adhesive Anchor W-VPZ

Product description
Materials

Annex A3

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Specifications of intended use

Anchor size		M8	M10	M12	M16	M20
Static or quasi-static action		✔				
Base materials		compacted, reinforced or unreinforced normal weight concrete without fibers acc. to EN 206:2013+A1:2016				
		strength classes C20/25 to C50/60, acc. to EN 206:2013+A1:2016				
		cracked or uncracked concrete				
Temperature range I	-40°C to +40°C	max long term temperature +24°C; max short term temperature +40°C				
Temperature range II	-40°C to +80°C	max long term temperature +50°C; max short term temperature +80°C				

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials)
- For all other conditions:

Threaded rod	Use according to EN 1993-1-4:2015 corresponding to the corrosion resistance class CRC according to Annex A, Table A.2
W-VD-A/A2	CRC II
W-VD-A/A4	CRC III
W-VD-A/HCR	CRC V

Design:

- Verifiable calculation notes and drawings are 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.)
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work
- Anchorages are designed according to EN 1992-4:2018 or TR 055, version February 2018

Installation:

- Dry or wet concrete
- Making of drill hole by hammer drilling, compressed air drilling or vacuum drilling
- Installation direction: D3 - downwards, horizontally and upwards (e.g. overhead) installation

Capsule Adhesive Anchor W-VPZ	**Annex B1**
Intended use Specifications	

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Table B1: Installation parameters

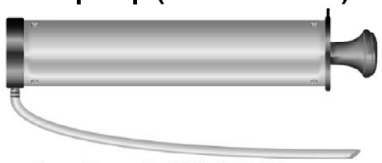
Anchor size			M8	M10	M12	M16	M20
Diameter of threaded rod	$d=d_{nom}$	[mm]	8	10	12	16	20
Nominal diameter of drill hole	d_0	[mm]	10	12	14	18	22
Depth of drill hole	h_0	[mm]	80	90	110	125	170
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Cleaning Brush WIT-		[-]	RMB 10	RMB 12	RMB 14	RMB 18	RMB 22
Diameter of Cleaning Brush	$d_{b,min}\geq$	[mm]	10,5	12,5	14,5	18,5	22,5
Maximum installation torque	$T_{inst}\leq$	[Nm]	10	20	40	80	150

Accessories

Vacuum drill bit

Vacuum drill bit (Würth extraction drill bit, MKT Hollow drill bit SB or Heller Duster Expert) and a class M vacuum with minimum negative pressure of 253 hPa and a flow rate of minimum 42 l/s

Blow-out pump (volume 750ml)



Cleaning Brush WIT-RMB

Table B2: Minimum member thickness, edge distance and spacing

Anchor size			M8	M10	M12	M16	M20
Minimum member thickness	h_{min}	[mm]	110	120	140	160	220
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55
Minimum spacing	s_{min}	[mm]	40	50	60	75	90

Table B3: Curing time

Concrete temperature			Minimum curing time
-20°C	to	-16°C	17 h
-15°C	to	-11°C	7 h
-10°C	to	-6°C	4 h
-5°C	to	-1°C	3 h
0°C	to	+4°C	50 min
+5°C	to	+9°C	25 min
+10°C	to	+19°C	15 min
+20°C	to	+29°C	6 min
+30°C	to	+40°C	6 min
Capsule temperature			-15°C to +40°C

Capsule Adhesive Anchor W-VPZ

Intended use
Installation parameters, accessories, minimum member thickness, edge distance and spacing, curing time

Annex B2

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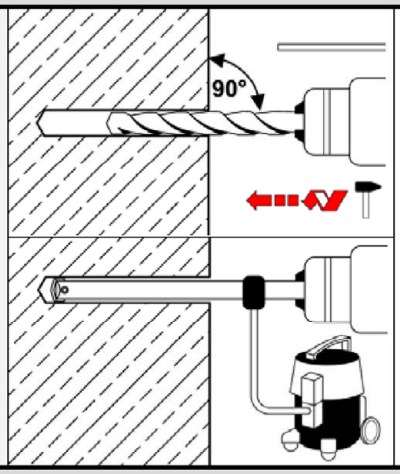
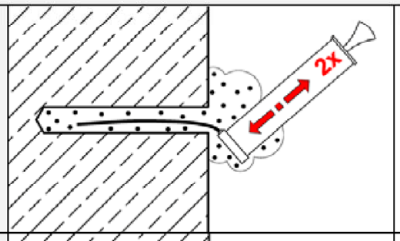
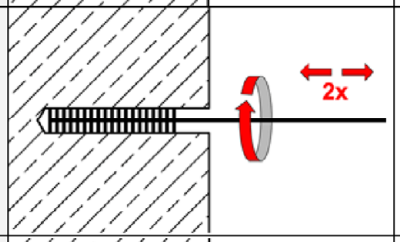
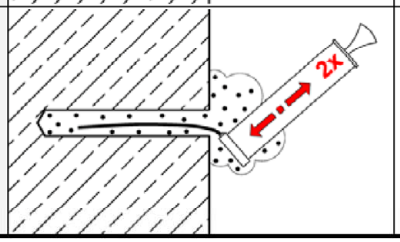
Installation instructions

Drilling			
1			**Hammer drill or compressed air drill:** Drill the hole with diameter and depth according to Table B1. Continue with step 2. **Vacuum drill:** see Annex B2 Drill the hole with diameter and depth according to Table B1. Additional cleaning is not necessary - continue with step 3.
Cleaning			
2		Drill hole must be cleaned directly before installation of the anchor, or it must be protected against recontamination in a suitable manner until installation of the anchor.	
	2a		Blow out the drill hole completely at least **2x** from the bottom of the drill hole with blow-out pump or compressed air.
	2b		Brush the drill hole **2x** with Cleaning Brush WIT-RMB (Table B1). Observe and check brush diameter $d_{b,min}$. When inserting the brush into the drill hole, a clear resistance must be noticeable. Otherwise use a new Cleaning Brush.
	2c		Blow out the drill hole completely at least **2x** from the bottom of the drill hole with blow-out pump or compressed air.

Capsule Adhesive Anchor W-VPZ

Intended use
Installation instructions

Annex B3

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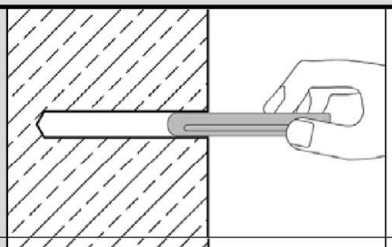
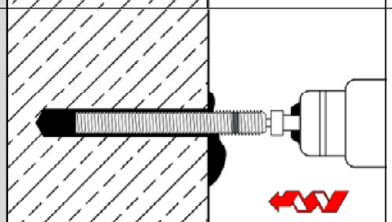
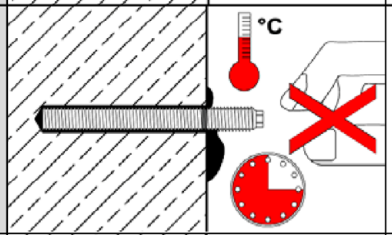
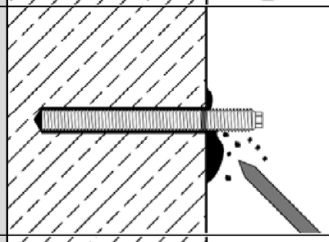
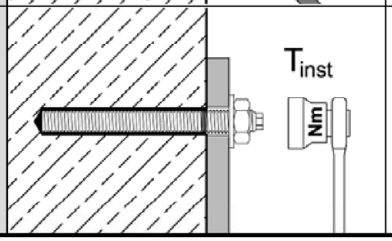
Installation instructions - continuation

Inserting the threaded rod		
3		Insert the capsule into the drill hole.
4		Drive in the anchor rod using a hammer drill set on rotary impact. Stop immediately after reaching the setting depth.
5		Observe curing time according to Table B3. Do not move or load the anchor until it is fully cured.
6		Remove excess adhesive.
7		Install fixture and apply installation torque T_{inst} according to Table B1.

Capsule Adhesive Anchor W-VPZ

Intended Use
Installation instructions - continuation

Annex B4

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Table C1: Characteristic steel resistance under tension load

Anchor size				M8	M10	M12	M16	M20
Steel failure								
Characteristic resistance under tension load								
Steel, zinc plated	Property class 5.8	$N_{Rk,s}$	[kN]	18	29	42	79	123
	Property class 8.8	$N_{Rk,s}$	[kN]	29	46	67	126	196
Stainless steel / high corrosion resistant steel	Property class 70	$N_{Rk,s}$	[kN]	26	41	59	110	172
	Property class 80	$N_{Rk,s}$	[kN]	29	46	67	126	196
Partial factor [1)]								
Steel, zinc plated	Property class 5.8	$\gamma_{Ms,N}$	[-]	1,5				
	Property class 8.8	$\gamma_{Ms,N}$	[-]	1,5				
Stainless steel / high corrosion resistant steel	Property class 70	$\gamma_{Ms,N}$	[-]	1,87				
	Property class 80	$\gamma_{Ms,N}$	[-]	1,6				

[1)] In absence of other national regulations

Table C2: Characteristic steel resistance under shear load

Anchor size				M8	M10	M12	M16	M20
Characteristic resistances under shear load								
Steel failure <u>without</u> lever arm								
Steel, zinc plated	Property class 5.8	$V^0_{Rk,s}$	[kN]	11	17	25	47	73
	Property class 8.8	$V^0_{Rk,s}$	[kN]	15	23	34	63	98
Stainless steel / high corrosion resistant steel	Property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86
	Property class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98
Steel failure <u>with</u> lever arm								
Steel, zinc plated	Property class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	325
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519
Stainless steel / high corrosion resistant steel	Property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454
	Property class 80	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519
Partial factor [1)]								
Steel, zinc plated	Property class 5.8	$\gamma_{Ms,V}$	[-]	1,25				
	Property class 8.8	$\gamma_{Ms,V}$	[-]	1,25				
Stainless steel / high corrosion resistant steel	Property class 70	$\gamma_{Ms,V}$	[-]	1,56				
	Property class 80	$\gamma_{Ms,V}$	[-]	1,33				

[1)] In absence of other national regulations

Capsule Adhesive Anchor W-VPZ

Performance
Characteristic **steel resistance** under **tension** and **shear load**

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values for tension load

Anchor size				**M8**	**M10**	**M12**	**M16**	**M20**
Steel failure								
Characteristic resistance under tension load								
Characteristic tension resistance		$N_{Rk,s}$	[kN]	see Table C1				
Partial factor		$\gamma_{Ms,N}$	[-]	see Table C1				
Combined pull-out and concrete failure								
Characteristic bond resistance in uncracked concrete C20/25								
Temperature range I:	+24°C / +40°C	$\tau_{Rk,ucr}$	[N/mm²]	10,0	13,0	13,0	13,0	13,0
Temperature range II:	+50°C / +80°C	$\tau_{Rk,ucr}$	[N/mm²]	8,5	11,0	11,0	11,0	11,0
Increasing factors for uncracked concrete		ψ_c	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,17}$				
Characteristic bond resistance in cracked concrete C20/25								
Temperature range I:	+24°C / +40°C	$\tau_{Rk,cr}$	[N/mm²]	5,0	6,5	7,0	7,5	7,5
Temperature range II:	+50°C / +80°C	$\tau_{Rk,cr}$	[N/mm²]	4,5	5,5	6,0	6,0	6,0
Increasing factors for cracked concrete		ψ_c	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,14}$				
Reduction factor ψ^0_{sus} in concrete C20/25								
Temperature range I:	+24°C / +40°C	ψ^0_{sus}	[-]	0,64				
Temperature range II:	+50°C / +80°C	ψ^0_{sus}	[-]	0,63				
Concrete cone failure								
Factor k_1	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		$s_{cr,N}$	[mm]	3 h_{ef}				
Splitting failure								
Edge distance	$h/h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	1,0 h_{ef}				
	$2,0 > h/h_{ef} > 1,3$			2 • h_{ef} (2,5 - h / h_{ef})				
	$h/h_{ef} \leq 1,3$			2,4 h_{ef}				
Spacing		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$				
Installation factor		γ_{inst}	[-]	1,2				

Capsule Adhesive Anchor W-VPZ

Performance
Characteristic values under **tension load**

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic values for shear loads

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Steel failure <u>without</u> lever arm							
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]	see Table C2				
Ductility factor	k_7	[-]	1,0				
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C2				
Steel failure <u>with</u> lever arm							
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	see Table C2				
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C2				
Concrete pry-out failure							
Pry-out factor	k_8	[-]	2,0				
Concrete edge failure							
Effective length of anchor	l_f	[mm]	min (h_{ef} ;12 d_{nom})				
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20
Installation factor	γ_{inst}	[-]	1,0				

Capsule Adhesive Anchor W-VPZ

Performance
Characteristic values under **shear load**

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C5: Displacements under tension load

Anchor size			M8	M10	M12	M16	M20
Displacement factor[1] for uncracked concrete							
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,015	0,031	0,035	0,015	0,046
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,085	0,067	0,067	0,067	0,067
Displacement factor[1] for cracked concrete							
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,046	0,038	0,024	0,008	0,024
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,192	0,142	0,090	0,104	0,082

[1] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: acting bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{- factor} \cdot \tau$;

Table C6: Displacements under shear load

Anchor size			M8	M10	M12	M16	M20
Displacement factor[1]							
Displacement	δ_{V0}-factor	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06

[1] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: acting shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

Capsule Adhesive Anchor W-VPZ

Performance
Displacements

Annex C4