Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment

ETA-20/0533 of 16 December 2022

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	Chemical Anchor VZ
Product family to which the construction product belongs	Bonded anchor for use in concrete
Manufacturer	MKT Metall-Kunststoff-Technik GmbH & Co. KG Auf dem Immel 2 67685 Weilerbach DEUTSCHLAND
Manufacturing plant	Plant 1, D
This European Technical Assessment contains	22 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601 Edition 04/2020
This version replaces	ETA-20/0533 issued on 17 April 2021

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Specific Part

1 Technical description of the product

The "Chemical Anchor VZ" is a bonded fastener consisting of a resin anchor capsule VZ-P and an anchor rod V-A or an internally threaded anchor rod VZ-IG.

The resin anchor capsule VZ-P is placed in the hole and the anchor rod V-A or the internally threaded anchor rod VZ-IG is driven by machine as specified in Annex B6 and B7.

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, C2, C5, B2 to B3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1, C3, C6
Displacements under short-term and long-term loading	See Annex C7
Characteristic resistance for seismic performance categories C1	See Annex C4
Characteristic resistance and displacements for seismic performance categories 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.

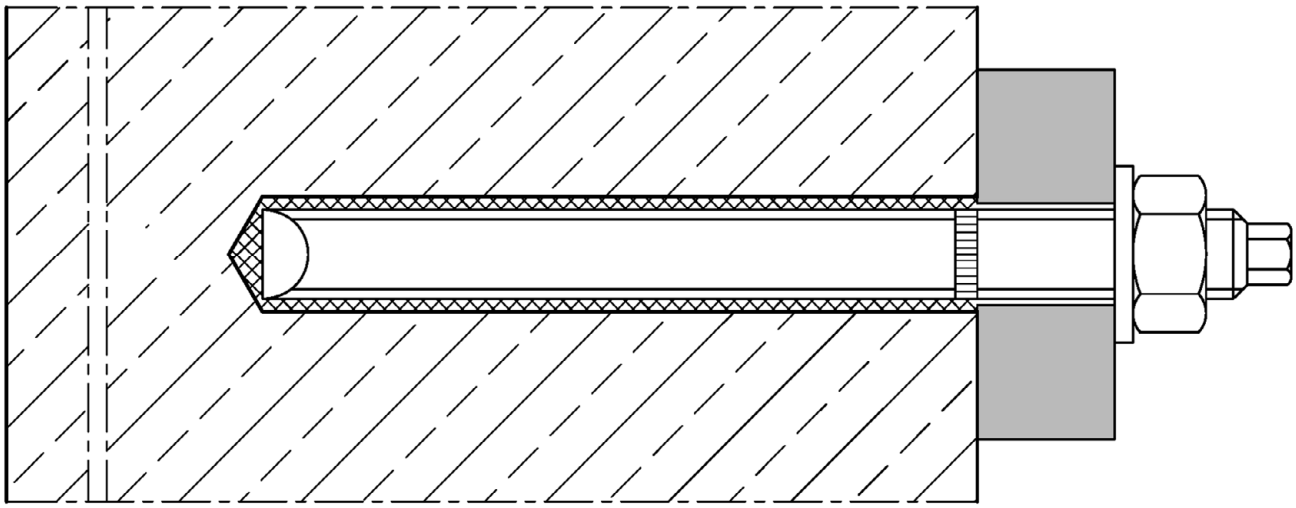
Issued in Berlin on 16 December 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

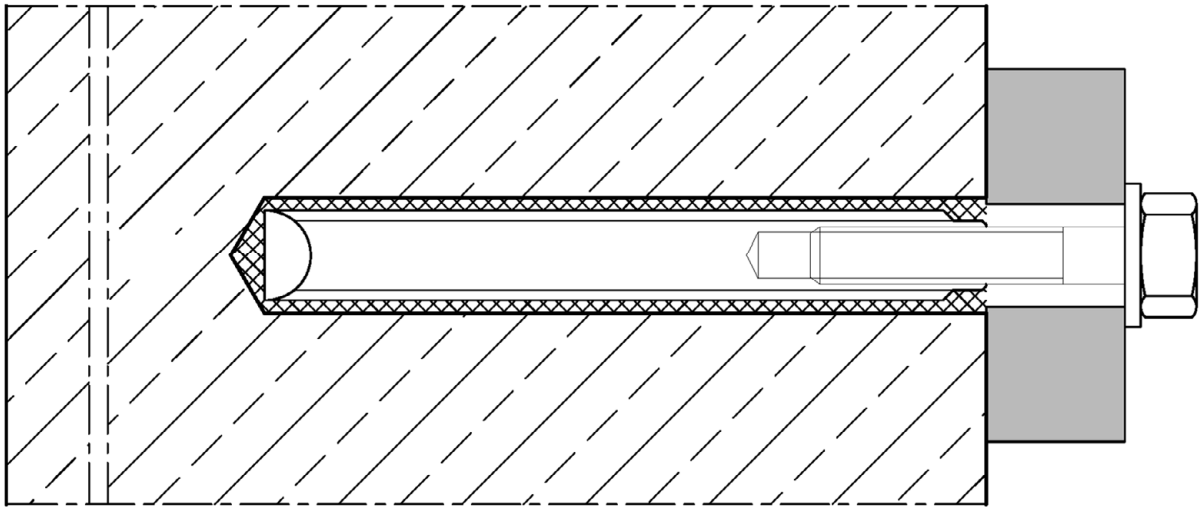
beglaubigt:
Stiller

Deutsches Institut für Bautechnik DIBt

Installation situation Chemical Anchor VZ with anchor rod V-A
(optional annular gap filled with mortar)



Installation situation Chemical Anchor VZ with Internally threaded anchor rod VZ-IG [1] (optional annular gap filled with mortar)



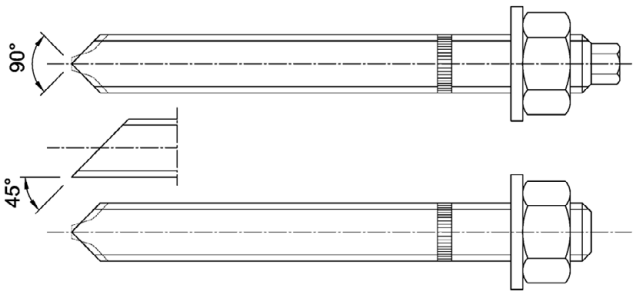
[1] Illustration exemplary with hexagon head screw; fastening also possible with other screws or with threaded rods.

Chemical Anchor VZ	**Annex A1**
Product description Installation situation	

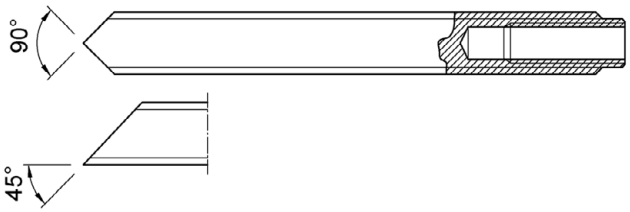
Deutsches Institut für Bautechnik DIBt

Resin Anchor Capsule VZ-P

Anchor rod V-A

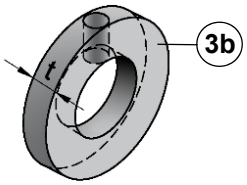


Internally threaded anchor rod VZ-IG

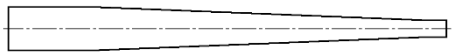


Supplies

Filling washer VS and reducing adapter for filling gap between anchor rod and fixture



Thickness of filling washer
for diameter
M8 to M20: t = 5 mm
M24: t = 6 mm



Cleaning supplies

M8 – M24	**Vacuum drill bit** 	Vacuum drill bit (MKT Hollow drill bit SB, Würth extraction drill bit or Heller Duster Expert) and a class M vacuum cleaner with minimum negative pressure of 253 hPa and a flow rate of minimum 42 l/s
or		
M8 – M24	**Compressed air tool (min 6 bar)** 	**Cleaning Brush RB** 
M8 – M20	**Blow-out pump (volume 750 ml)** 	

Chemical Anchor VZ	**Annex A2**
Product description Resin Anchor Capsule, anchor rods and supplies	

Anchor rod V-A

M8, M10, M12, M16, M20, M24

Marking: e.g.: ◇ M10

◇ identifying mark of manufacturing plant

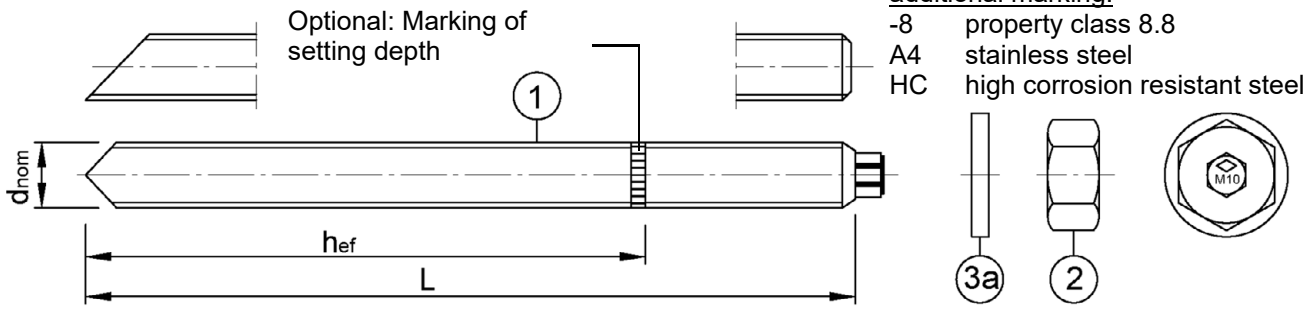
M10 anchor size

additional marking:

-8 property class 8.8

A4 stainless steel

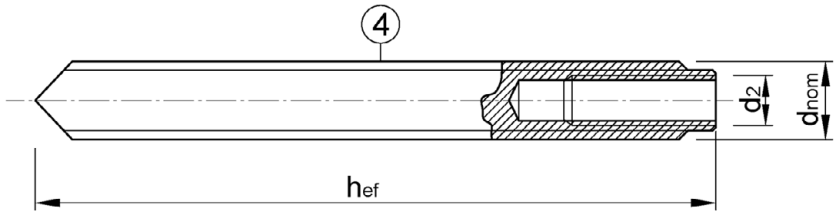
HC high corrosion resistant steel



Anchor rod V-A			M8	M10	M12	M16	M20	M24
Outer diameter	$d=d_{nom}$	[mm]	8	10	12	16	20	24
Length	$L \geq$	[mm]	90	101	125	145	192	235
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210
Hexagon nut	wrench size	[mm]	13	17	19	24	30	36

Internally threaded anchor rod VZ-IG

VZ-IG M6, VZ-IG M8, VZ-IG M10, VZ-IG M12, VZ-IG M16



Marking e.g.: ◇ M8

◇ identifying mark of manufacturing plant

M8 size of internal thread

additional marking:

-8 property class 8.8

A4 stainless steel

HCR high corrosion resistant steel

Internally threaded anchor rod VZ-IG			IG-M 6	IG-M 8	IG-M 10	IG-M 12	IG-M 16
Outer diameter of threaded rod [1]	$d=d_{nom}$	[mm]	10	12	16	20	24
Inner diameter of threaded rod	d_2	[mm]	6	8	10	12	16
Minimum screw in-depth	l_{IG}	[mm]	8	8	10	12	16
Effective anchorage depth	h_{ef}	[mm]	90	110	125	170	210

[1] With metric thread acc. to EN 1993-1-8:2005+AC:2009

Requirements for screws or threaded rods (incl. nut and washer):

These must at least correspond to the material and strength class of the internally threaded anchor rod used.

Material:

- **Steel, zinc plated:** Minimum property class 5.8 or 8.8 according to EN ISO 898-1:2013 or EN ISO 898-2:2012
- **Stainless steel A4:** Minimum property class 70 according to EN ISO 3506:2020
- **High corrosion resistant steel (HCR):** Minimum property class 70 according to EN ISO 3506:2020

Chemical Anchor VZ

Product description
Marking

Annex A3

Table A1: Materials

Part	Designation	Materials				
Steel, zinc plated electroplated ≥ 5 µm according to EN ISO 4042:2018 hot-dip galvanized ≥ 50 µm average coating thickness according to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 sherardized ≥ 45 µm according to EN ISO 17668:2016						
1	Anchor rod	Property class	characteristic ultimate strength		characteristic yield strength	fracture elongation
		5.8	f_{uk} [N/mm²]	500	f_{yk} [N/mm²] 400	A_5 > 8 %
		8.8		800	640	A_5 > 12 %
2	Hexagon nut	5	for class 5.8 anchor rods			
		8	for class 5.8, 8.8 anchor rods			
3a	Washer		steel, zinc plated			
3b	Filling washer		steel, zinc plated			
4	Internally threaded anchor rod	5.8	steel, electroplated or sherardized			A_5 > 8 %
		8.8				A_5 > 8 %
Stainless steel A4 **CRC III** acc. to EN 1993-1-4:2006+A1:2015 **High corrosion resistant steel HCR** **CRC V** acc. to EN 1993-1-4:2006+A1:2015 acc. to EN 10088:2014						
1	Anchor rod	Property class	characteristic ultimate strength		characteristic steel yield strength	fracture elongation
		70	f_{uk} [N/mm²]	700	f_{yk} [N/mm²] 560	A_5 > 12 %
		80		800	600	A_5 > 12 %
2	Hexagon nut	70	for class 70 anchor rods			
		80	for class 70, 80 anchor rods			
3a	Washer		stainless steel A4; high corrosion resistant steel HCR			
3b	Filling washer		stainless steel A4; high corrosion resistant steel HCR			
4	Internally threaded anchor rod	70	stainless steel A4; high corrosion resistant steel HCR			A_5 > 8 %
Glass capsule						
5	Resin Anchor Capsule		glass, quartz, resin, hardener			

Chemical Anchor VZ

Product description
Material

Annex A4

Specifications of intended use

Chemical Anchor VZ with		**Anchor rod V-A**	**Internally threaded anchor rod VZ-IG**
Static or quasi-static action		**M8** to **M24**	**IG-M6** to **IG-M16**
Seismic action, performance category C1		**M8** to **M24**	**no performance assessed**
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 versions
- For all other conditions corresponding to corrosion resistance classes CRC according to EN 1993-1-4:2015, Annex A, Table A1:
  - V-A A4: CRC III
  - V-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

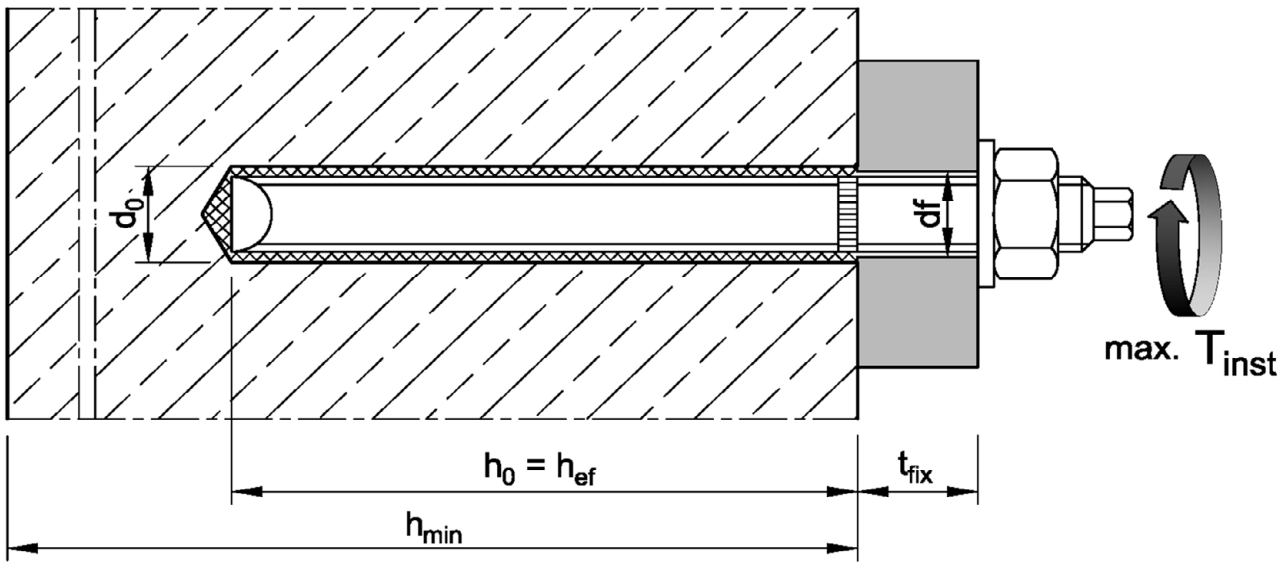
Installation:

- 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
- Optionally, the annular gap between anchor rod and attachment can be backfilled. In this case, the washer is replaced by the filling washer (Part 3b, Annex A2). MKT injection mortars VMH, VMU plus, VMZ or other high-strength injection mortars with a compressive strength ≥ 40N/mm² can be used for backfilling.
- Internally threaded anchor rods: Bolts or threaded rod (incl. nut and washer) must at least correspond to the material and strength class of the internally threaded anchor rod that is used.

Chemical Anchor VZ	**Annex B1**
Intended Use Specifications	

Table B1: Installation parameters for anchor rods V-A

Anchor rod V-A			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Resin Anchor Capsule			VZ-P 8	VZ-P 10	VZ-P 12	VZ-P 16	VZ-P 20	VZ-P 24
Diameter of threaded rod	$d=d_{nom}$	[mm]	8	10	12	16	20	24
Nominal diameter of drill hole	d_0	[mm]	10	12	14	18	22	28
Depth of drill hole	h_0	[mm]	80	90	110	125	170	210
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26
Cleaning Brush		[-]	RB 10	RB 12	RB 14	RB 18	RB 22	RB 28
Diameter of Cleaning Brush	$d_b \geq$	[mm]	10,5	12,5	14,5	18,5	22,5	28,5
Maximum installation torque	max T_{inst}	[Nm]	10	20	40	80	150	200
Minimum member thickness	h_{min}	[mm]	110	120	140	160	220	270
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55	60
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115



Chemical Anchor VZ

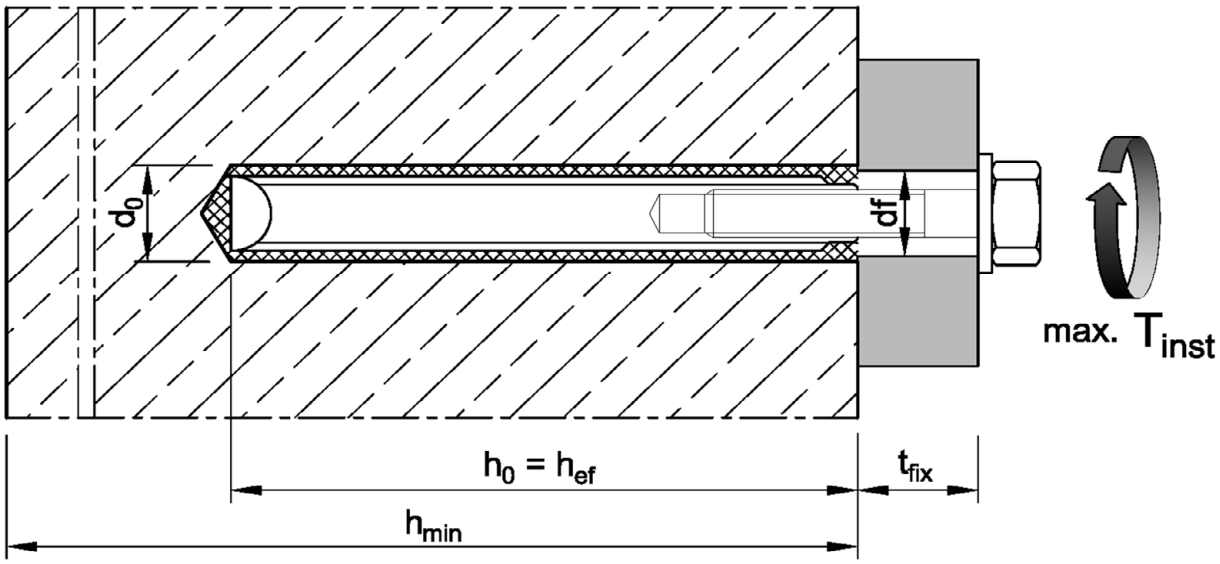
Intended Use
Installation parameters – Anchor rod V-A

Annex B2

Table B2: Installation parameters for internally threaded anchor rods VZ-IG

Internally threaded anchor rod VZ-IG			**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**
Resin Anchor Capsule			VZ-P 10	VZ-P 12	VZ-P 16	VZ-P 20	VZ-P 24
Outer diameter of threaded rod [1]	$d=d_{nom}$	[mm]	10	12	16	20	24
Inner diameter of threaded rod	d_2	[mm]	6	8	10	12	16
Nominal drill hole diameter	d_0	[mm]	12	14	18	22	28
Depth of drill hole	h_0	[mm]	90	110	125	170	210
Effective anchorage depth	h_{ef}	[mm]	90	110	125	170	210
Diameter of clearance hole in the fixture	d_f	[mm]	7	9	12	14	18
Cleaning Brush		[-]	RB 12	RB 14	RB 18	RB 22	RB 28
Diameter of Cleaning Brush	$d_b \geq$	[mm]	12,5	14,5	18,5	22,5	28,5
Maximum installation torque	max T_{inst}	[Nm]	10	10	20	40	60
Minimum member thickness	h_{min}	[mm]	120	140	160	220	270
Minimum edge distance	c_{min}	[mm]	45	45	50	55	60
Minimum spacing	s_{min}	[mm]	50	60	75	90	115

[1] With metric thread acc. to EN 1993-1-8:2005+AC:2009



Chemical Anchor VZ

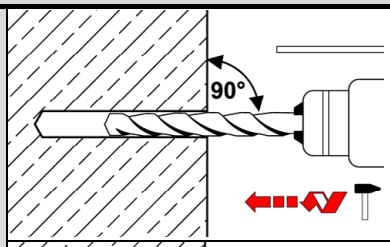
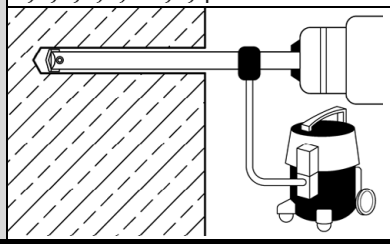
Intended Use
Installation parameters – Internally threaded anchor rod VZ-IG

Annex B3

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

Installation instructions

Drilling		
1		**Hammer drill or compressed air drill:** Drill the hole with diameter and depth according to Table B1 and B2. Continue with step 2.
		**Vacuum drill:** see Annex A2 Drill the hole with diameter and depth according to Table B1 and B2. Additional cleaning is not necessary - continue with step 3.

Chemical Anchor VZ

Intended Use
Curing time / Installation instruction - drilling

Annex B4

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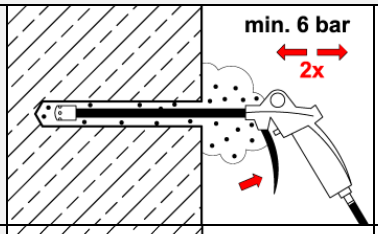
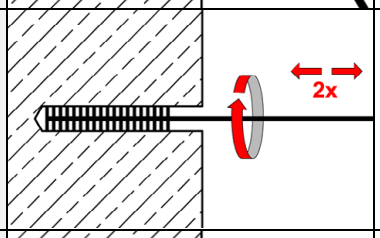
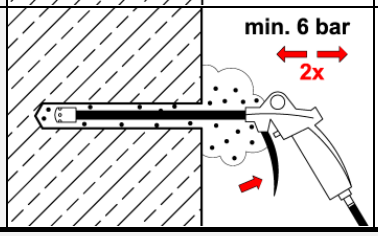
Installation instructions – continuation

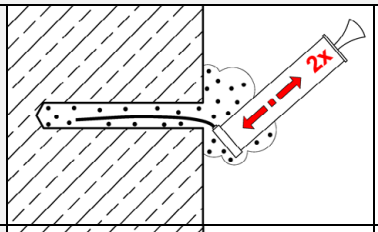
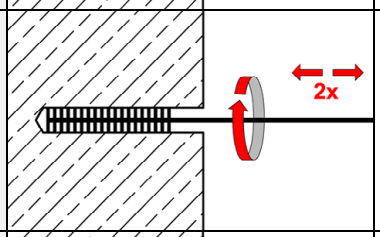
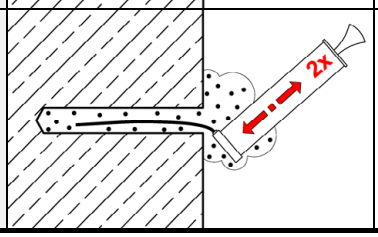
Cleaning - Drill hole must be cleaned directly before installation of the anchor, or it must be protected against recontamination in a suitable manner until installation of the anchor.

2

Cleaning with compressed air
Sizes M8 to M24

2a		Blow out the drill hole completely at least **2x** from the bottom of the drill hole with compressed air.
2b		Brush the drill hole **2x** with Cleaning Brush RB (Table B1 or B2). 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 compressed air.

Manual cleaning
Sizes M8 to M20

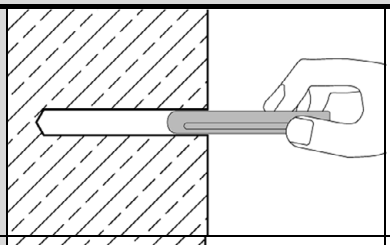
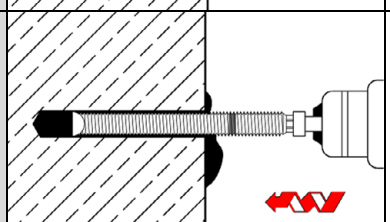
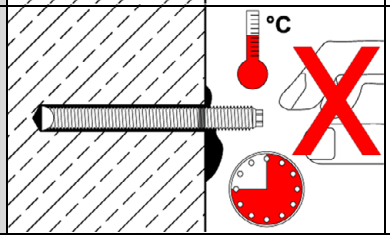
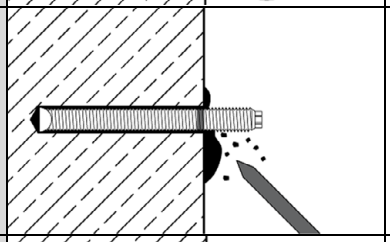
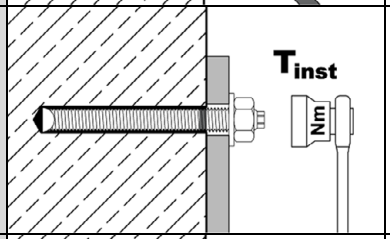
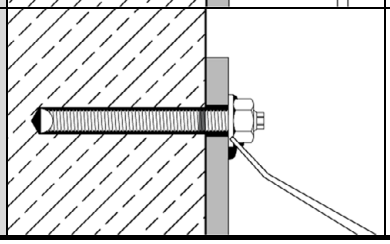
2a		Blow out the drill hole completely at least **2x** from the bottom of the drill hole with blow-out pump.
2b		Brush the drill hole **2x** with Cleaning Brush RB (Table B1 or B2). Observe and check brush diameter $d_{b,min}$. When inserting the brush into the drill hole, a clear resistance must be 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.

Chemical Anchor VZ

Intended Use
Installation instructions - Cleaning

Annex B5

Installation instructions - continuation

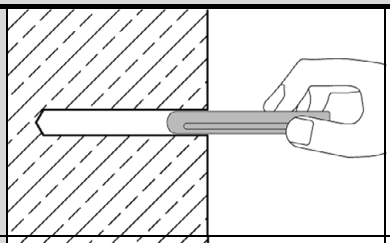
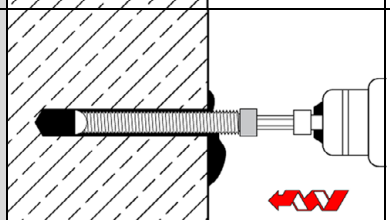
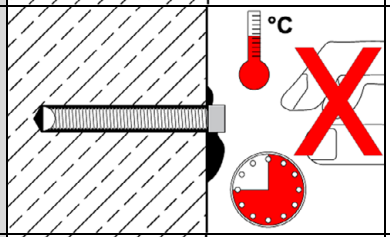
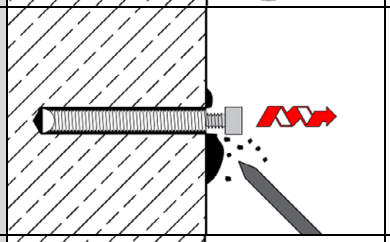
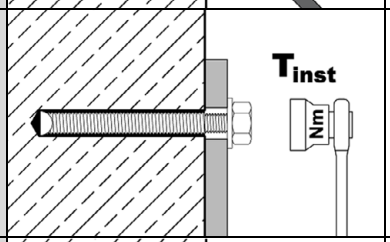
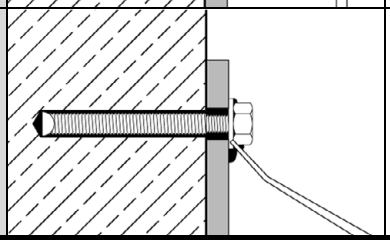
Inserting the anchor rod V-A		
3		Check the depth of drill hole. If necessary, mark anchoring depth on the anchor rods. Insert the capsule into the drill hole.
4		Drive in the anchor rod using a hammer drill set on rotary impact. Stop immediately after reaching the setting depth.
5		Observe curing time 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.
8		The annular gap between anchor rod and fixture may optionally be filled with mortar (see Annex B1). Therefore, replace regular washer by filling washer (note thickness of the filling washer) and plug on reducing adapter on static mixer. Annular gap is completely filled, when excess mortar seeps out.

Chemical Anchor VZ

Intended Use
Installation instructions – Inserting anchor rod V-A

Annex B6

Installation instructions - continuation

Inserting the internally threaded anchor rod VZ-IG		
3		Check the depth of drill hole. Insert the capsule into the drill hole.
4		Screw the setting tool into the internally threaded anchor rod VZ-IG until stop. Drive in the internally threaded anchor rod with a hammer drill set to rotary impact. Switch off the hammer drill immediately after reaching the setting depth.
5		Observe curing time according to Table B3. Do not move or load the anchor and don't remove the setting tool until it is fully cured.
6		Remove excess adhesive and unscrew the setting tool.
7		The fixture can be mounted with threaded rod, nut and washer or screw. Apply the installation torque T_{inst} according to Table B2.
8		The annular gap between threaded rod or screw and fixture may optionally be filled with mortar (see Annex B1). Therefore, replace regular washer by filling washer or assemble it on the screw (observe thickness of filling washer and minimum screw-in depth). Plug on reducing adapter on static mixer and fill annular gap. It is completely filled, when excess mortar seeps out.

Chemical Anchor VZ

Intended Use
Installation instructions – Inserting internally threaded anchor rod VZ-IG

Annex B7

Deutsches Institut für Bautechnik DIBt

Table C1: Characteristic **steel resistance** under **tension load** for **anchor rods V-A**

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure									
Characteristic resistance under tension load									
Steel, zinc plated	Property class 5.8	$N_{Rk,s}$	[kN]	18	29	42	79	123	176
	Property class 8.8	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Stainless steel / High corrosion resistant steel	Property class 70	$N_{Rk,s}$	[kN]	26	41	59	110	172	247
	Property class 80	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
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	$\gamma_{Ms,N}$	[-]	1,5					
	Property class 80	$\gamma_{Ms,N}$	[-]	1,6					

[1] In absence of other national regulations

Table C2: Characteristic **steel resistance** under **shear load** for **anchor rods V-A**

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
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	106
	Property class 8.8	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141
Stainless steel / High corrosion resistant steel	Property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	123
	Property class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141
Steel failure <u>with</u> lever arm									
Steel, zinc plated	Property class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	325	561
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898
Stainless steel / High corrosion resistant steel	Property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	785
	Property class 80	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898
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	$\gamma_{Ms,V}$	[-]	1,25					
	Property class 80	$\gamma_{Ms,V}$	[-]	1,33					

[1] In absence of other national regulations

Chemical Anchor VZ

Performance
Characteristic **steel resistance** under **tension** and **shear load** for **anchor rods V-A**

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values of **tension loads** for **anchor rods V-A**

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
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	13,0
Temperature range II:	+50°C / +80°C	$\tau_{Rk,ucr}$	[N/mm²]	8,5	11,0	11,0	11,0	11,0	11,0
Increasing factors for $\tau_{Rk,ucr}$ $\tau_{Rk,ucr} = \psi_{c,ucr} \cdot \tau_{Rk,ucr}(C20/25)$		$\psi_{c,ucr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,17}$					
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	7,5
Temperature range II:	+50°C / +80°C	$\tau_{Rk,cr}$	[N/mm²]	4,5	5,5	6,0	6,0	6,0	6,5
Increasing factors for $\tau_{Rk,cr}$ $\tau_{Rk,cr} = \psi_{c,cr} \cdot \tau_{Rk,cr}(C20/25)$		$\psi_{c,cr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,14}$					
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 for	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}					
	$2,0 > h/h_{ef} > 1,3$			$2 \cdot h_{ef} (2,5 - h / h_{ef})$					
	$h/h_{ef} \leq 1,3$			2,4 h_{ef}					
Spacing		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$					
Installation factor		γ_{inst}	[-]	1,2					

Chemical Anchor VZ

Performance
Characteristic values under **tension load** for **anchor rods V-A**

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic values of **shear loads** for **anchor rods V-A**

Anchor rod V-A			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure <u>without</u> lever arm								
Characteristic 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]	80	90	110	125	170	210
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24
Installation factor	γ_{inst}	[-]	1,0					

Chemical Anchor VZ

Performance
Characteristic values under **shear load** for **anchor rods V-A**

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C5: Characteristic values of **tension loads** for **anchor rods V-A** under **seismic action, performance category C1**

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure									
Characteristic resistance under tension load									
Characteristic tension resistance		$N_{Rk,s,C1}$	[kN]	$N_{Rk,s}$ see Table C1					
Partial factor		$\gamma_{Ms,N}$	[-]	see Table C1					
Combined pull-out and concrete failure									
Characteristic bond resistance in concrete C20/25 to C50/60									
Temperature range I:	+24°C / +40°C	$\tau_{Rk,C1}$	[N/mm²]	4,5	5,5	6,0	6,0	7,5	7,0
Temperature range II:	+50°C / +80°C	$\tau_{Rk,C1}$	[N/mm²]	4,0	4,5	5,5	5,0	6,0	5,5
Installation factor		γ_{inst}	[-]	1,2					

Table C6: Characteristic values of **shear loads** for **anchor rods V-A** under **seismic action, performance category C1**

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure without lever arm									
Characteristic resistance under shear load									
Steel, zinc plated	Property class 5.8	$V_{Rk,s,C1}$	[kN]	9,0	14,3	20,7	36,3	56,2	81,5
	Property class 8.8	$V_{Rk,s,C1}$	[kN]	12,0	19,0	27,7	48,4	75,5	109,3
Stainless steel / High corrosion resistant steel	Property class 70	$V_{Rk,s,C1}$	[kN]	10,5	16,6	24,2	42,3	66,0	94,7
	Property class 80	$V_{Rk,s,C1}$	[kN]	12,0	19,0	27,7	48,4	75,5	108,7
Partial factor		$\gamma_{Ms,V}$	[-]	see Table C2					
Factor for anchorages	**with** annular gap	α_{gap}	[-]	0,5					
	without annular gap	α_{gap}	[-]	1,0					
Installation factor		γ_{inst}	[-]	1,0					

Chemical Anchor VZ

Performance
Characteristic values under **seismic action, performance category C1** for **anchor rods V-A**

Annex C4

Deutsches Institut für Bautechnik DIBt

Table C7: Characteristic **steel resistance** under **tension load** for **internally threaded anchor rods VZ-IG**

Internally threaded anchor rod				**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**
Steel failure								
Characteristic resistance, steel, zinc plated	Property class 5.8	$N_{Rk,s}$	[kN]	10	17	29	42	76
	Property class 8.8	$N_{Rk,s}$	[kN]	16	27	46	67	121
Partial factor [1]		$\gamma_{Ms,N}$	[-]	1,5				
Characteristic resistance, stainless steel A4 / HCR	Property class 70	$N_{Rk,s}$	[kN]	14	26	41	59	110
Partial factor [1]		$\gamma_{Ms,N}$	[-]	1,87				
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]	13,0	13,0	13,0	13,0	13,0
Temperature range II:	+50°C / +80°C	$\tau_{Rk,ucr}$	[N/mm²]	11,0	11,0	11,0	11,0	11,0
Increasing factors for $\tau_{Rk,ucr}$ $\tau_{Rk,ucr} = \psi_{c,ucr} \cdot \tau_{Rk,ucr\,(C20/25)}$		$\psi_{c,ucr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,17}$				
Characteristic bond resistance in cracked concrete C20/25								
Temperature range I:	+24°C / +40°C	$\tau_{Rk,cr}$	[N/mm²]	6,5	7,0	7,5	7,5	7,5
Temperature range II:	+50°C / +80°C	$\tau_{Rk,cr}$	[N/mm²]	5,5	6,0	6,0	6,0	6,5
Increasing factors for $\tau_{Rk,cr}$ $\tau_{Rk,cr} = \psi_{c,cr} \cdot \tau_{Rk,cr\,(C20/25)}$		$\psi_{c,cr}$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,14}$				
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 for	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				

[1] In absence of other national regulations

Chemical Anchor VZ

Performance
Characteristic values under **tension load** for **internally threaded anchor rods VZ-IG**

Annex C5

Deutsches Institut für Bautechnik DIBt

Table C8: Characteristic **steel resistance** under **shear load** for **internally threaded anchor rods VZ-IG**

Internally threaded anchor rod				**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**
Steel failure <u>without</u> lever arm [1]								
Steel, zinc plated	Property class 5.8	$V^0_{Rk,s}$	[kN]	6	10	17	25	45
	Property class 8.8	$V^0_{Rk,s}$	[kN]	8	14	23	34	60
Stainless steel A4 / HCR	Property class 70	$V^0_{Rk,s}$	[kN]	7	13	20	30	55
Ductility factor		k_7	[-]	1,0				
Steel failure <u>with</u> lever arm [1]								
Steel, zinc plated	Property class 5.8	$M^0_{Rk,s}$	[Nm]	8	19	37	66	167
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	105	267
Stainless steel A4 / HCR	Property class 70	$M^0_{Rk,s}$	[Nm]	11	26	53	92	234
Partial factor [2]								
Steel, zinc plated	Property class 5.8	$\gamma_{Ms,V}$	[-]	1,25				
	Property class 8.8	$\gamma_{Ms,V}$	[-]	1,25				
Stainless steel A4 / HCR	Property class 70	$\gamma_{Ms,V}$	[-]	1,56				
Concrete pry-out failure								
Pry-out factor		k_8	[-]	2,0				
Concrete edge failure								
Effective length of fastener		l_f	[mm]	90	110	125	170	210
Outside diameter of fastener		d_{nom}	[mm]	10	12	16	20	24
Installation factor		γ_{inst}	[-]	1,0				

[1] Fastening screws or threaded rods (incl. nut and washer) must comply with the appropriate material and property class of the internally threaded anchor rod. The characteristic shear resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element

[2] In absence of other national regulations

Chemical Anchor VZ

Performance
Characteristic values under **shear load** for **internally threaded anchor rods VZ-IG**

Annex C6

Table C9: Displacements under tension load

Anchor size			M8	M10 IG-M6	M12 IG-M8	M16 IG-M10	M20 IG-M12	M24 IG-M16
Displacement factor[1] for uncracked concrete								
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,015	0,031	0,035	0,015	0,046	0,060
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,085	0,067	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	0,133
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,192	0,142	0,090	0,104	0,082	0,069

[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 C10: Displacements under shear load

Anchor size			M8	M10 IG-M6	M12 IG-M8	M16 IG-M10	M20 IG-M12	M24 IG-M16
Displacement factor[1]								
Displacement	δ_{V0}-factor	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04	0,03
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05

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

Chemical Anchor VZ

Performance
Displacements

Annex C7