Deutsches Institut für Bautechnik

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

European Technical Assessment Body for construction products

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

European Technical Assessment ETA-25/0099 of 31 March 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	TILCA Chemical Anchor VZ-P
Product family to which the construction product belongs	Bonded anchor for use in concrete
Manufacturer	EFCO Befestigungstechnik AG Grabenstraße 1 8606 NÄNIKON SCHWEIZ
Manufacturing plant	Werk 1, Deutschland
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 330499-02-0601, Edition 12/2023

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Specific Part

1 Technical description of the product

The "TILCA TILCA Chemical Anchor VZ-P-P" 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, 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 category C1	See Annex C4
Characteristic resistance and displacements for seismic performance category C2	No performance assessed

3.2 Safety in case of fire (BWR 2)

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

3.3 Hygiene, health and the environment (BWR 3)

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

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

In accordance with the European Assessment Document EAD 330499-02-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

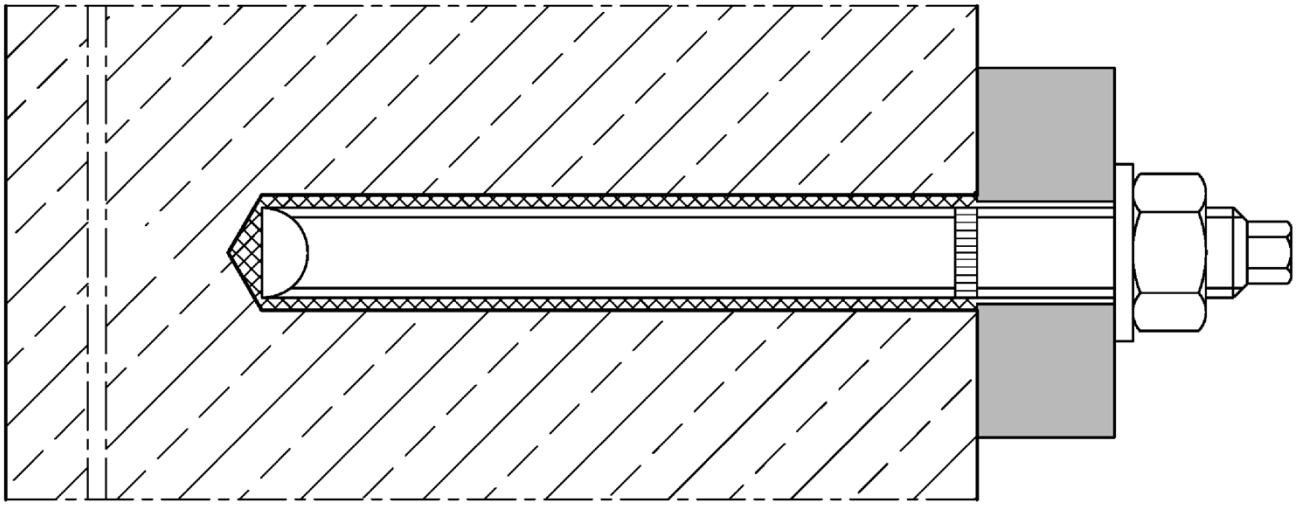
Issued in Berlin on 31 March 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

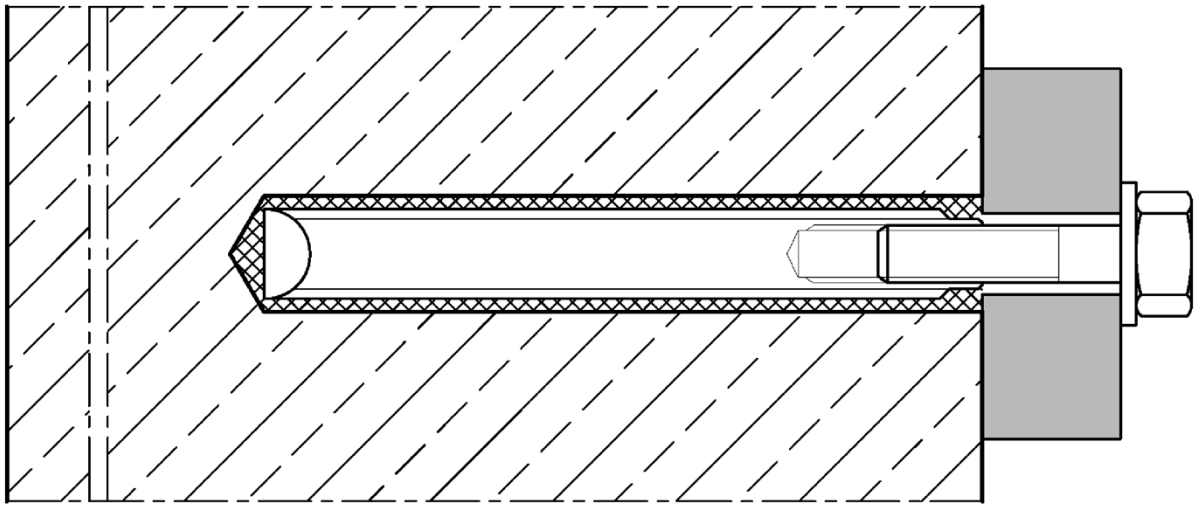
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

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



Installation situation TILCA Chemical Anchor VZ-P 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.

TILCA Chemical Anchor VZ-P	Annex A1
Product Description Installation situation	

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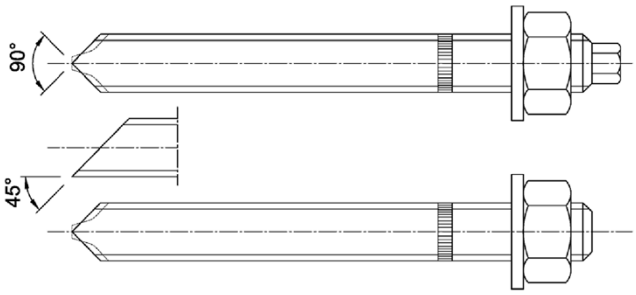
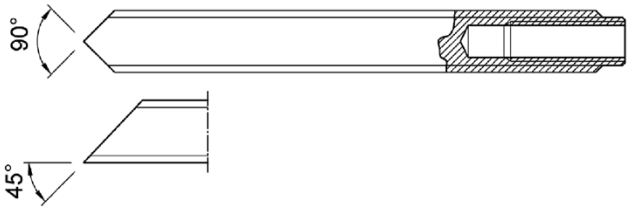
Resin Anchor Capsule VZ-P

Anchor rod V-A

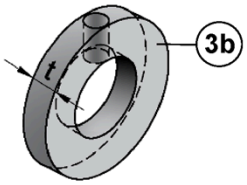


Internally threaded anchor rod VZ-IG

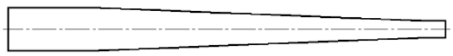


Supplies

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 to M30: t = 6 mm



Cleaning supplies

≤ M24 **≤ IG M16**	**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		
all diameters	**Compressed air tool (min 6 bar)** 	**Cleaning Brush RB** 
≤ M20 **≤ IG M12**	**Blow-out pump (volume 750 ml)** 	

TILCA Chemical Anchor VZ-P	**Annex A2**
Product Description Resin Anchor Capsule, anchor rods and supplies	

Anchor rod V-A

M8, M10, M12, M16, M20, M24, M30

Marking: e.g.: ◇ M10

◇ identifying mark of manufacturing plant

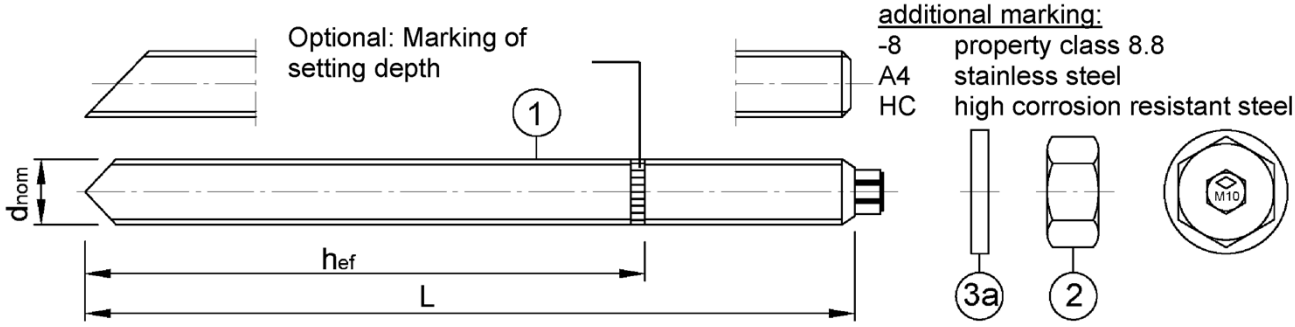
M10 anchor size

additional marking:

-8 property class 8.8

A4 stainless steel

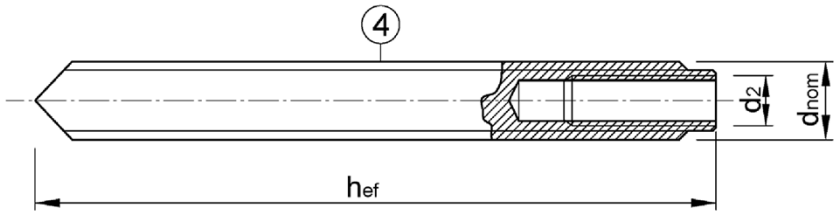
HC high corrosion resistant steel



Anchor rod V-A			M8	M10	M12	M16	M20	M24	M30
Outer diameter	$d=d_{nom}$	[mm]	8	10	12	16	20	24	30
Length	$L \geq$	[mm]	90	101	125	145	192	235	301
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210	270
Hexagon nut	wrench size	[mm]	13	17	19	24	30	36	46

Internally threaded anchor rod VZ-IG

VZ-IG M6, VZ-IG M8, VZ-IG M10, VZ-IG M12, VZ-IG M16, VZ-IG M20



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	IG-M 20
Outer diameter of threaded rod	$d=d_{nom}$	[mm]	10	12	16	20	24	30
Inner diameter of threaded rod	d_2	[mm]	6	8	10	12	16	20
Minimum screw in-depth	l_{IG}	[mm]	8	8	10	12	16	20
Effective anchorage depth	h_{ef}	[mm]	90	110	125	170	210	270

Requirements for fastening 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** or **high corrosion resistant steel (HCR):** Minimum property class 70 according to EN ISO 3506-1:2020 or EN ISO 3506-2:2020

TILCA Chemical Anchor VZ-P

Product Description
Marking

Annex A3

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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			
		8.8				
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
		50	f_{uk} [N/mm²]	500	f_{yk} [N/mm²] 210	A_5 > 8 %
		70		700	560	A_5 ≥ 12 %
		80		800	640	A_5 ≥ 12 %
2	Hexagon nut	50	for class 50 anchor rods			
		70	for class 50, 70 anchor rods			
		80	for class 50, 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	50	IG-M20		stainless steel A4; high corrosion resistant steel HCR	
		70	IG-M6 bis IG M20		stainless steel A4; high corrosion resistant steel HCR	
Glass capsule						
5	Resin Anchor Capsule		glass, quartz, resin, hardener			

TILCA Chemical Anchor VZ-P

Product Description
Material

Annex A4

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Specifications of intended use

TILCA Chemical Anchor VZ-P with	**Anchor rod V-A**	**Internally threaded anchor rod VZ-IG**
Static or quasi-static action	**M8** to **M30**	**IG-M6** to **IG-M20**
Seismic action, performance category C1	**M8** to **M30**[1)]	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	

[1)] M30: property class 8.8 and A4/ HCR property class ≥ 70

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions: all versions
- For all other conditions according to EN 1993-1-4:2006+A1:2015, corresponding to corrosion resistance classes CRC according to Annex A4, Table A1

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:

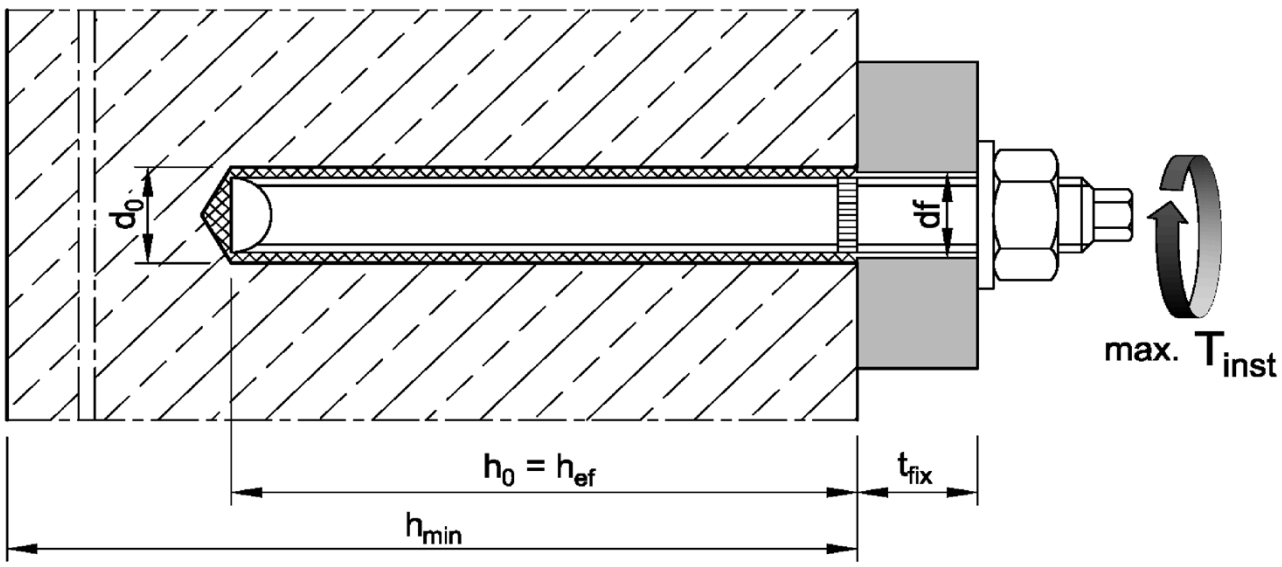
- Dry or wet concrete
- Making of drill hole by hammer drilling, compressed air drilling or vacuum drilling (see Annex A2)
- Installation direction: D3 - downwards, horizontally and upwards (e.g. overhead) installation
- Installation temperature in concrete:
  -20°C up to +40°C for the standard variation of temperature after 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.
  The length of screw or the threaded rod shall be determined depending on the thickness of fixture t_{fix}, available thread length and the minimum screw-in depth $L_{sd,min}$.

TILCA Chemical Anchor VZ-P	**Annex B1**
Intended Use Specifications	

Deutsches Institut für Bautechnik DIBt

Table B1: Installation parameters for anchor rods V-A

Anchor rod V-A			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
Resin Anchor Capsule			VZ-P 8	VZ-P 10	VZ-P 12	VZ-P 16	VZ-P 20	VZ-P 24	VZ-P 30
Diameter of threaded rod	$d=d_{nom}$	[mm]	8	10	12	16	20	24	30
Nominal diameter of drill hole	d_0	[mm]	10	12	14	18	22	28	35
Depth of drill hole	h_0	[mm]	80	90	110	125	170	210	270
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210	270
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	33
Cleaning Brush		[-]	RB 10	RB 12	RB 14	RB 18	RB 22	RB 28	RB 35
Diameter of Cleaning Brush	$d_b \geq$	[mm]	10,5	12,5	14,5	18,5	22,5	28,5	35,5
Maximum installation torque	$\max T_{inst}$	[Nm]	10	20	40	80	150	200	300
Minimum member thickness	h_{min}	[mm]	110	120	140	160	220	270	340
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55	60	80
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115	140



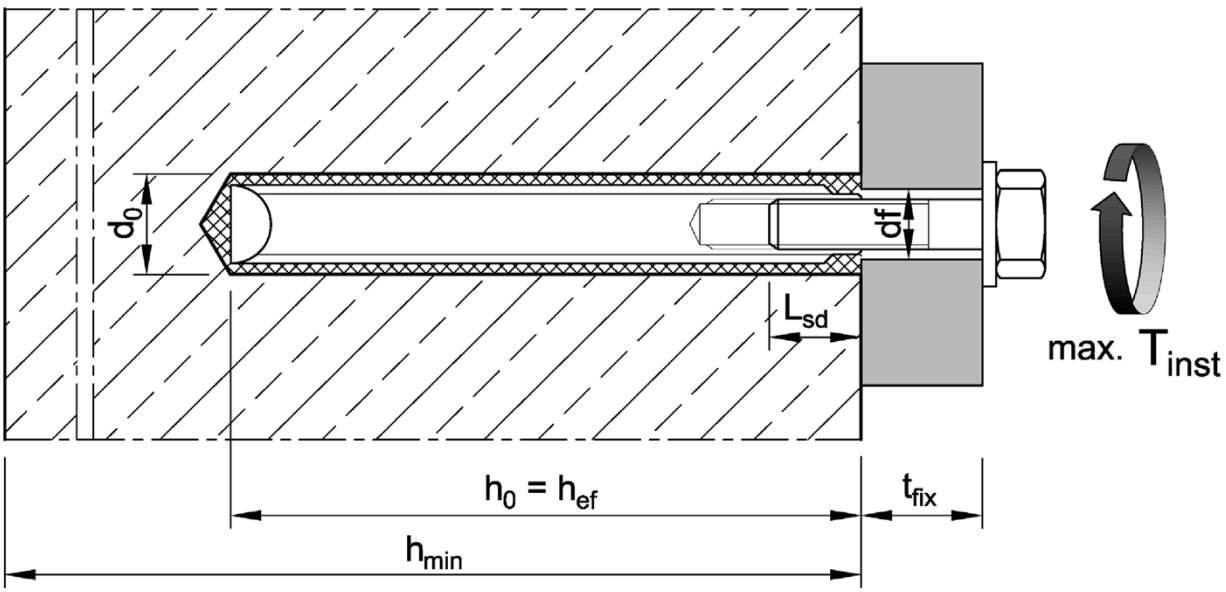
TILCA Chemical Anchor VZ-P

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**	**IG-M 20**
Resin Anchor Capsule			VZ-P 10	VZ-P 12	VZ-P 16	VZ-P 20	VZ-P 24	VZ-P 30
Outer diameter of threaded rod	$d=d_{nom}$	[mm]	10	12	16	20	24	30
Inner diameter of threaded rod	d_2	[mm]	6	8	10	12	16	20
Nominal drill hole diameter	d_0	[mm]	12	14	18	22	28	35
Depth of drill hole	h_0	[mm]	90	110	125	170	210	270
Effective anchorage depth	h_{ef}	[mm]	90	110	125	170	210	270
Diameter of clearance hole in the fixture	d_f	[mm]	7	9	12	14	18	22
Cleaning Brush		[-]	RB 12	RB 14	RB 18	RB 22	RB 28	RB 35
Diameter of Cleaning Brush	$d_b \geq$	[mm]	12,5	14,5	18,5	22,5	28,5	35,5
Minimum screw-in depth	$L_{sd,min}$	[mm]	8	8	10	12	16	20
Maximum installation torque	max T_{inst}	[Nm]	10	10	20	40	60	100
Minimum member thickness	h_{min}	[mm]	120	140	160	220	270	340
Minimum edge distance	c_{min}	[mm]	45	45	50	55	60	80
Minimum spacing	s_{min}	[mm]	50	60	75	90	115	140



TILCA Chemical Anchor VZ-P

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

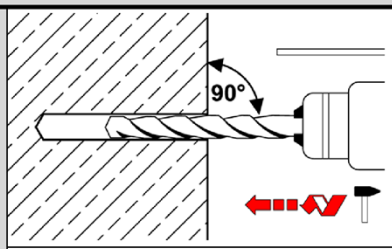
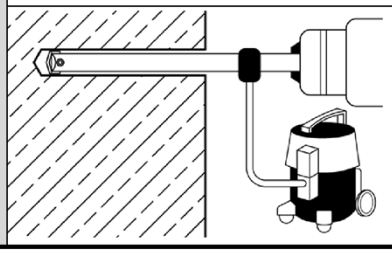
Annex B3

Table B3: Curing time

Concrete temperature [1]	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

[1] for the standard variation of temperature after installation

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.

TILCA Chemical Anchor VZ-P

Intended Use
Curing time / Installation instructions - drilling

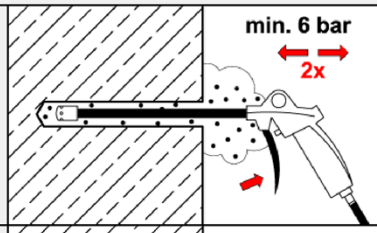
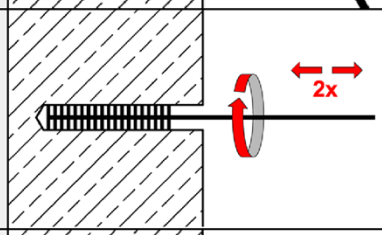
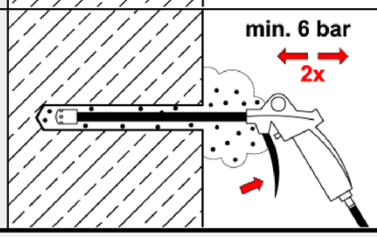
Annex B4

Installation instructions – continuation

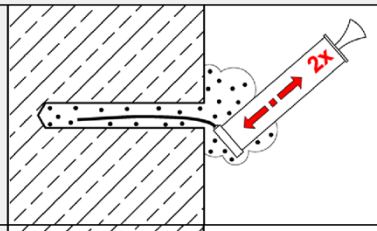
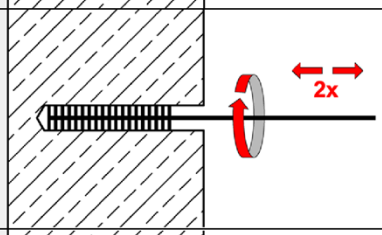
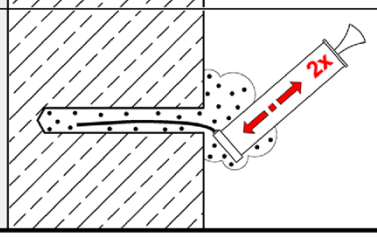
Cleaning - Drill hole must be cleaned directly before installation of the anchor, or it must be protected against recontamination in a suitable manner until installation of the anchor.

2

Cleaning with compressed air
all diameters

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. 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, IG-M6 to IG M12

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. 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.

TILCA Chemical Anchor VZ-P	**Annex B5**
Intended Use Installation instructions - Cleaning	

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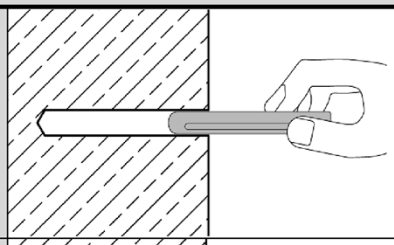
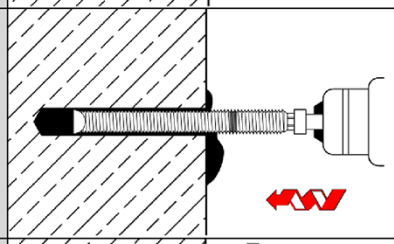
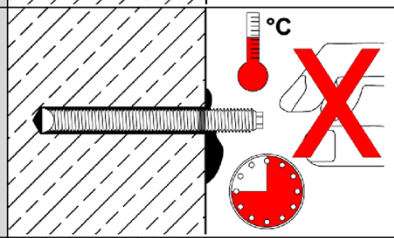
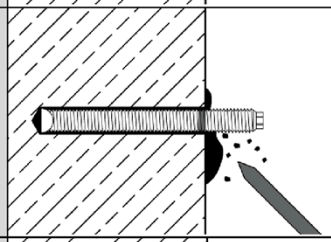
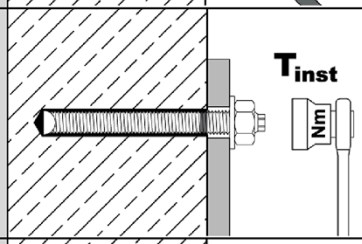
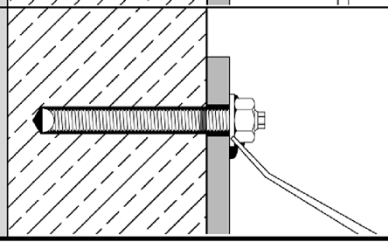
Installation instructions - continuation

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.

TILCA Chemical Anchor VZ-P	Annex B6
Intended Use Installation instructions – Inserting anchor rod V-A	

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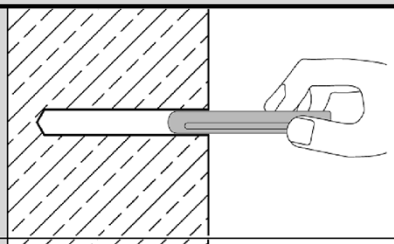
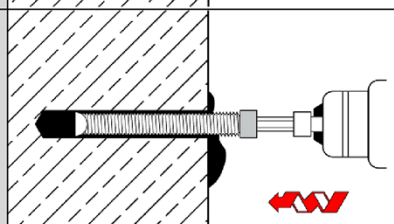
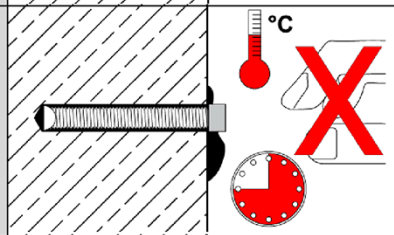
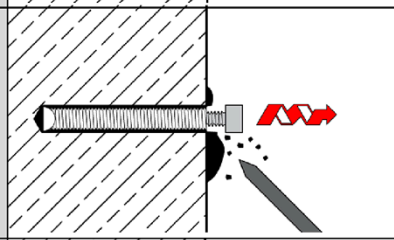
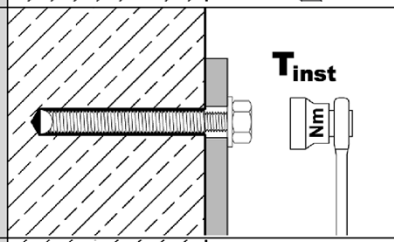
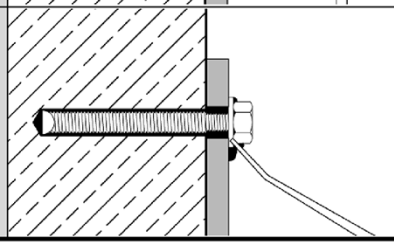
Installation instructions - continuation

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.

TILCA Chemical Anchor VZ-P	Annex B7
Intended Use Installation instructions – Inserting internally threaded anchor rod VZ-IG	

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

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**[2]
Steel failure										
Characteristic resistance under tension load										
Steel, zinc plated	Property class 5.8	$N_{Rk,s}$	[kN]	18	29	42	79	123	176	280
	Property class 8.8	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	448
Stainless steel / high corrosion resistant steel	Property class 70	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	392
	Property class 80	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	- [3]
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	$\gamma_{Ms,N}$	[-]	1,5						

[1] In absence of other national regulations

[2] M30 A4/HCR also in strength class 50 with $N_{Rk,s}$ = 281 kN and $\gamma_{Ms,N}$ = 2,86

[3] Anchor type not part of the ETA

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

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**[2]
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	168
	Property class 8.8	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	224
Stainless steel / high corrosion resistant steel	Property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	123	196
	Property class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	- [3]
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	1124
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	1799
Stainless steel / high corrosion resistant steel	Property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	785	1574
	Property class 80	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	- [3]
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	$\gamma_{Ms,V}$	[-]	1,25						

[1] In absence of other national regulations

[2] M30 A4/HCR also in strength class 50 with $V_{Rk,s}$ = 140 kN; $M^0_{Rk,s}$ = 1124 Nm and $\gamma_{Ms,V}$ =2,38

[3] Anchor type not part of the ETA

TILCA Chemical Anchor VZ-P

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

Annex C1

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

Anchor rod V-A				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
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]	8,7	11,4	11,4	11,4	11,4	11,3	11,6
Temperature range II:	+50°C / +80°C	$\tau_{Rk,ucr}$	[N/mm²]	7,3	9,7	9,7	9,7	9,7	9,5	9,8
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]	4,4	5,6	5,9	6,2	6,2	6,4	6,7
Temperature range II:	+50°C / +80°C	$\tau_{Rk,cr}$	[N/mm²]	3,7	4,7	5,0	5,2	5,2	5,4	5,6
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}	[-]	1,0						

TILCA Chemical Anchor VZ-P

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

Annex C2

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

Anchor rod V-A			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
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	270
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24	30
Installation factor	γ_{inst}	[-]	1,0						

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

Annex C3

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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**	**M30**
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]	4,0	4,8	5,4	5,1	6,2	5,9	5,8
Temperature range II:	+50°C / +80°C	$\tau_{Rk,C1}$	[N/mm²]	3,3	4,0	4,6	4,3	5,2	5,0	4,8
Installation factor		γ_{inst}	[-]	1,0						

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**	**M30**
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	- [1]
	Property class 8.8	$V_{Rk,s,C1}$	[kN]	12,0	19,0	27,7	48,4	75,5	109,3	177,6
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	154,9
	Property class 80	$V_{Rk,s,C1}$	[kN]	12,0	19,0	27,7	48,4	75,5	108,7	- [2]
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						

[1] No performance assessed
[2] Anchor type not part of the ETA

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

Annex C4

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

Internally threaded anchor rod VZ-				**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**	**IG-M 20**
Steel failure									
Characteristic resistance, steel, zinc plated	Property class 5.8	$N_{Rk,s}$	[kN]	10	17	29	42	76	123
	Property class 8.8	$N_{Rk,s}$	[kN]	16	27	46	67	121	196
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	124[2]
Partial factor [1]		$\gamma_{Ms,N}$	[-]	1,87					2,86
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]	11,4	11,4	11,4	11,4	11,3	11,6
Temperature range II:	+50°C / +80°C	$\tau_{Rk,ucr}$	[N/mm²]	9,7	9,7	9,7	9,7	9,5	9,8
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]	5,6	5,9	6,2	6,2	6,4	6,7
Temperature range II:	+50°C / +80°C	$\tau_{Rk,cr}$	[N/mm²]	4,7	5,0	5,2	5,2	5,4	5,6
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}	[-]	1,0					

[1] In absence of other national regulations

[2] IG M20: property class 50

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

Internally threaded anchor rod VZ-				**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**	**IG-M 20**
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	74
	Property class 8.8	$V^0_{Rk,s}$	[kN]	8	14	23	34	60	98
Stainless steel A4 / HCR	Property class 70	$V^0_{Rk,s}$	[kN]	7	13	20	30	55	62 [3]
Ductility factor		k_7	[-]	1,0					
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					2,38
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	325
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	105	267	519
Stainless steel A4 / HCR	Property class 70	$M^0_{Rk,s}$	[Nm]	11	26	53	92	234	456 [3]
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	270
Outside diameter of fastener		d_{nom}	[mm]	10	12	16	20	24	30
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

[3] IG M20: Internally threaded rod: property class 50;
Fastening screws or threaded rods (incl. nut and washer): property class 70

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

Annex C6

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Table C9: Displacements under tension load

Anchor size			M8	M10 IG-M6	M12 IG-M8	M16 IG-M10	M20 IG-M12	M24 IG-M16	M30 IG-M20
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	0,060
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,085	0,067	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	0,061
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,192	0,142	0,090	0,104	0,082	0,069	0,087

[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	M30 IG-M20
Displacement factor[1]									
Displacement	δ_{V0}-factor	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,04

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

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Performances
Displacements

Annex C7