Deutsches Institut für Bautechnik

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

European Technical Assessment Body for construction products

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# European Technical Assessment ETA-20/0533 of 26 July 2024

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 fasteners and bonded expansion fasteners for use in concrete |
| Manufacturer | MKT<br>Metall-Kunststoff-Technik GmbH & Co. KG<br>Auf dem Immel 2<br>67685 Weilerbach<br>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 330499-02-0601, Edition 12/2023 |
| This version replaces | ETA-20/0533 issued on 16 December 2022 |

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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, 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

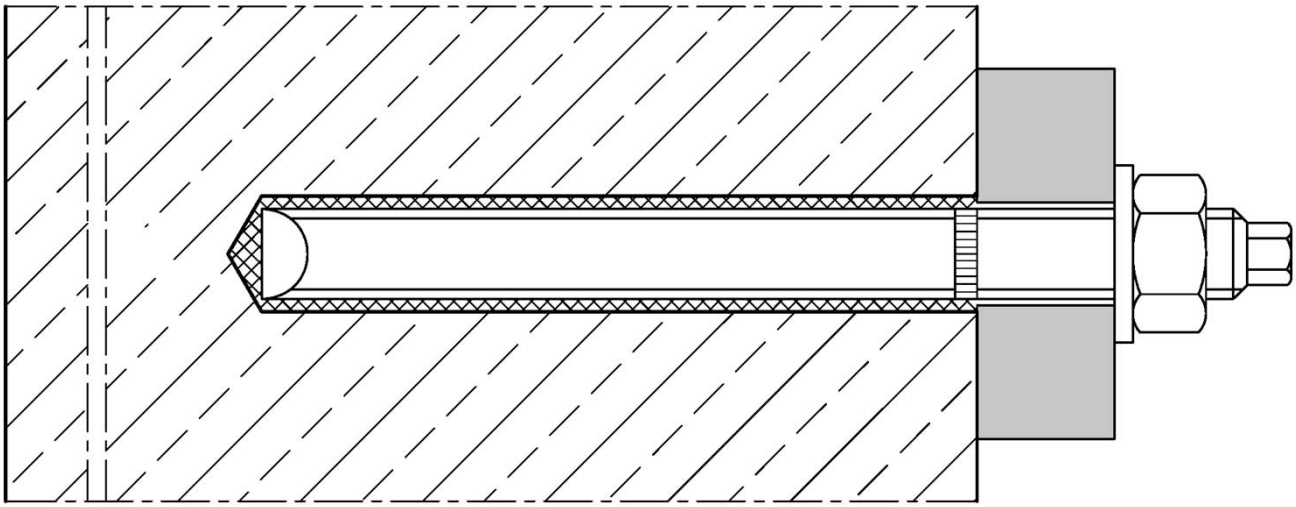
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 26 July 2024 by Deutsches Institut für Bautechnik

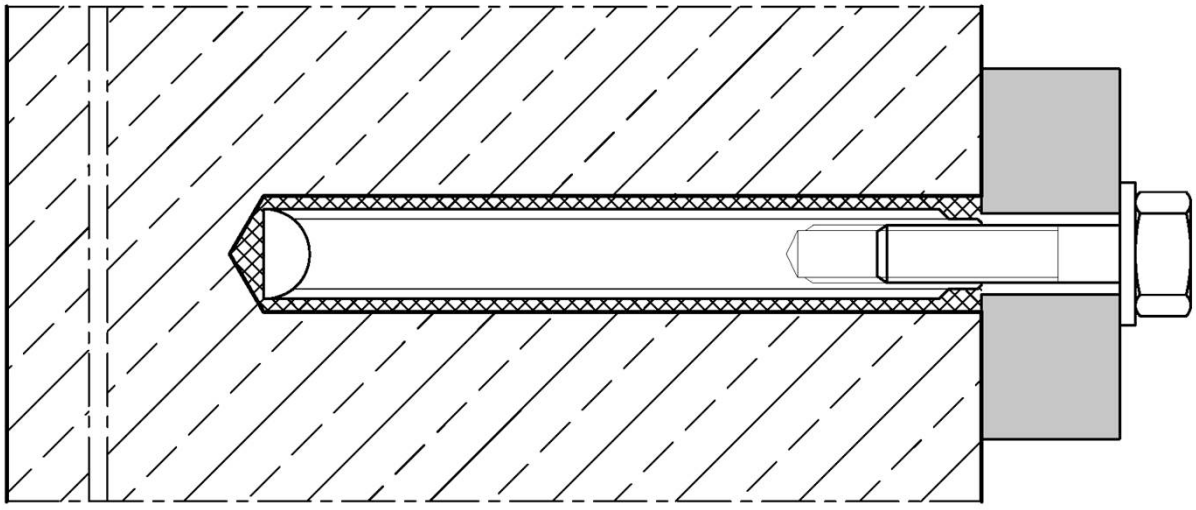
Dipl.-Ing. Beatrix Wittstock
Head of Section

*beglaubigt:*
Stiller

## 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** | |
| **Product Description**<br>Installation situation | **Annex A1** |

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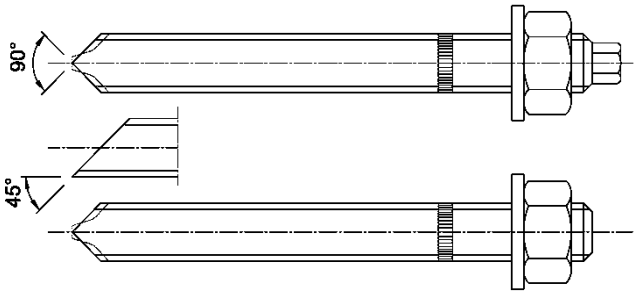
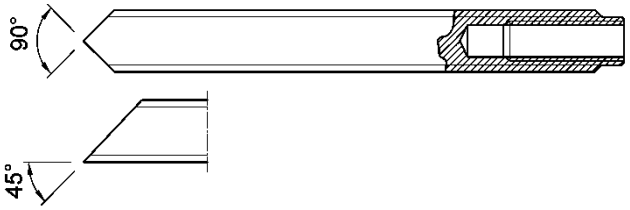
## Resin Anchor Capsule VZ-P


### Anchor rod V-A

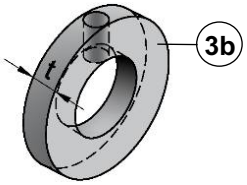



### Internally threaded anchor rod VZ-IG

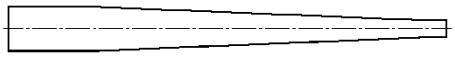



### Supplies

**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**<br>**≤ IG M16** | **Vacuum drill bit**<br>  | 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)**<br>  | **Cleaning Brush RB**<br>  |
| **≤ M20**<br>**≤ IG M12** | **Blow-out pump (volume 750 ml)**<br>  | |

| | |
|---|---|
| **Chemical Anchor VZ** | **Annex A2** |
| **Product Description**<br>Resin Anchor Capsule, anchor rods and supplies | |

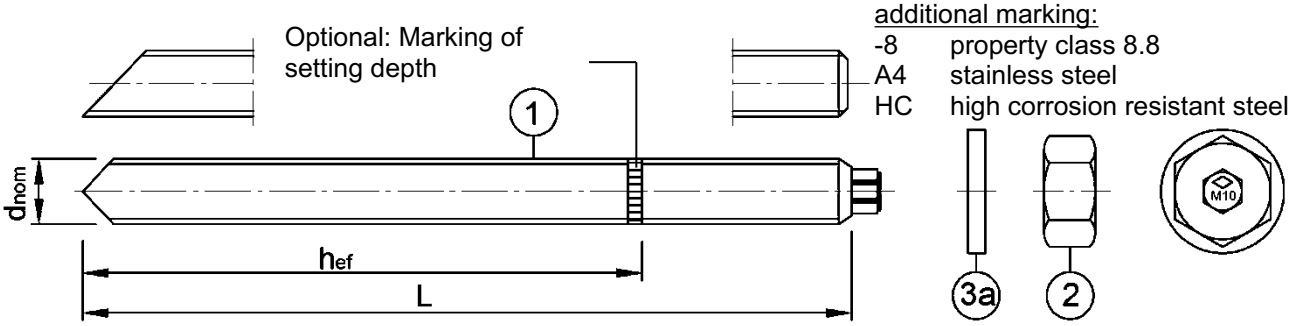
## Anchor rod V-A

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

**Marking**: e.g.: ◇ M10

◇ identifying mark of manufacturing plant
M10 anchor size

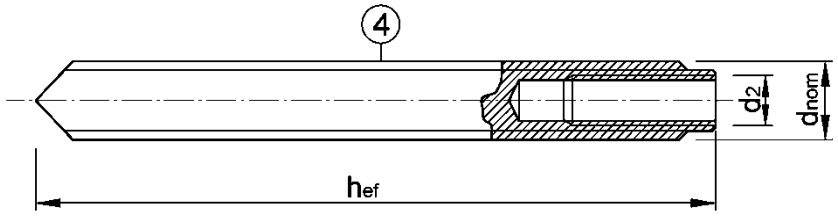
additional marking:
-8 property class 8.8
A4 stainless steel
HC high corrosion resistant steel




| 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

**Chemical Anchor VZ**

**Product Description**
Marking

**Annex A3**

Deutsches Institut für Bautechnik DIBt

## Table A1: Materials

| Part | Designation | Materials | | | | |
|---|---|---|---|---|---|---|
| **Steel, zinc plated**<br>electroplated ≥ 5 µm according to EN ISO 4042:2018<br>hot-dip galvanized ≥ 50 µm average coating thickness according to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009<br>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 | $A_5 \geq 12$ % |
| 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<br>**High corrosion resistant steel HCR** **CRC V** acc. to EN 1993-1-4:2006+A1:2015<br>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 | $A_5 \geq 12$ % |
| | | 80 | | 800 | 640 | $A_5 \geq 12$ % |
| 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;<br>high corrosion resistant steel HCR | | | | |
| 3b | Filling washer | stainless steel A4;<br>high corrosion resistant steel HCR | | | | |
| 4 | Internally threaded anchor rod | 50 | IG-M20 | | stainless steel A4;<br>high corrosion resistant steel HCR | |
| | | 70 | IG-M6 bis IG M20 | | stainless steel A4;<br>high corrosion resistant steel HCR | |
| **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 **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

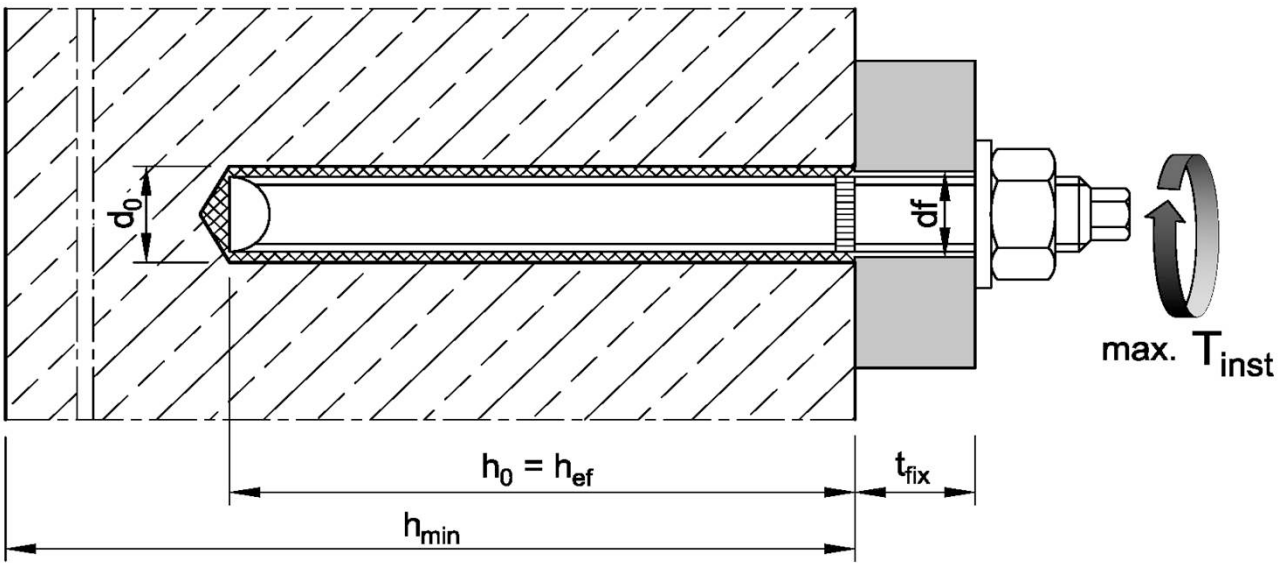
**Installation:**

- 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 $L_{sd,min}$.

| **Chemical Anchor VZ** | **Annex B1** |
|---|---|
| **Intended Use**<br>Specifications | |

## 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 |



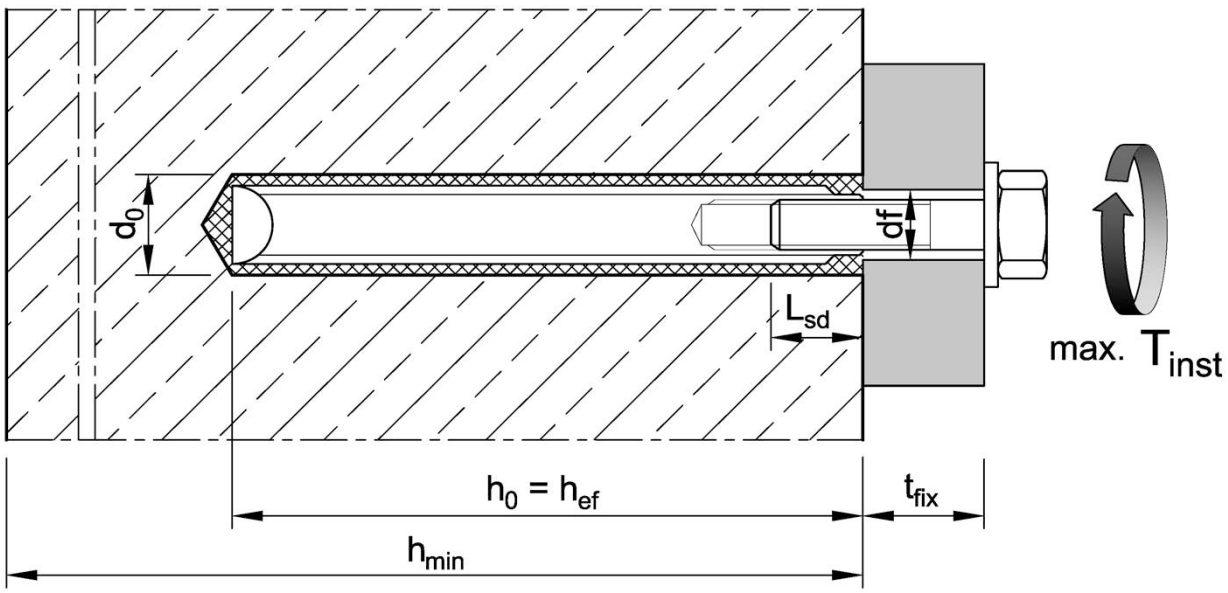

**Chemical Anchor VZ**

**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** | **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 |




**Chemical Anchor VZ**

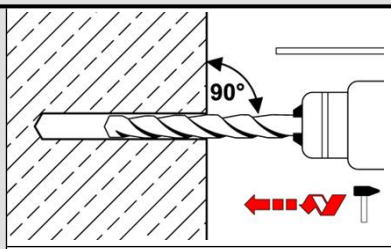
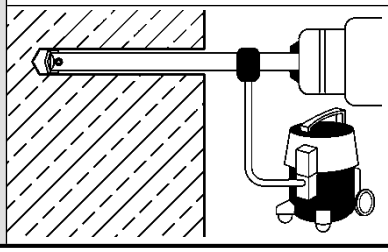
**Intended Use**
Installation parameters – Internally threaded anchor rod VZ-IG

**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:**<br>Drill the hole with diameter and depth according to Table B1 and B2.<br>Continue with step 2. |
| |  | **Vacuum drill:** see Annex A2<br>Drill the hole with diameter and depth according to Table B1 and B2.<br>Additional cleaning is not necessary - continue with step 3. |

**Chemical Anchor VZ**

**Intended Use**
Curing time / Installation instructions - drilling

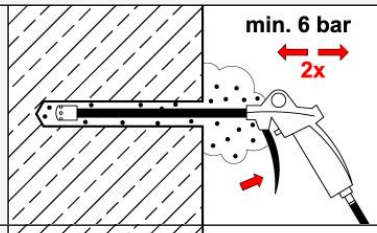
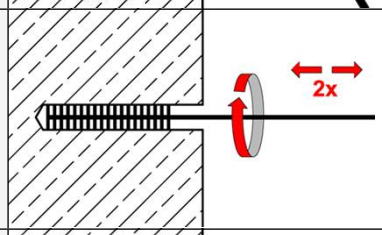
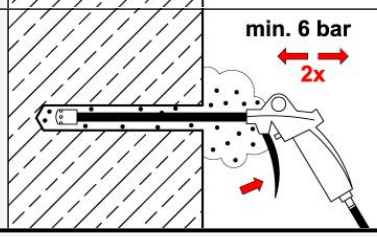
**Annex B4**

## Installation instructions – continuation

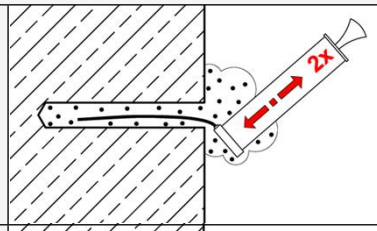
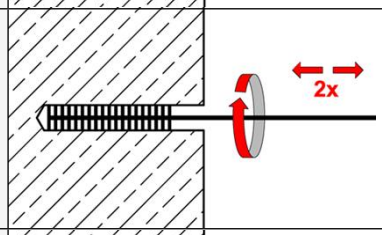
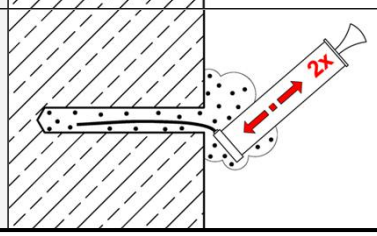
**Cleaning -** Drill hole must be cleaned directly before installation of the anchor, or it must be protected against recontamination in a suitable manner until installation of the anchor.

**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

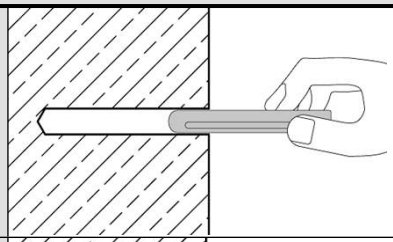
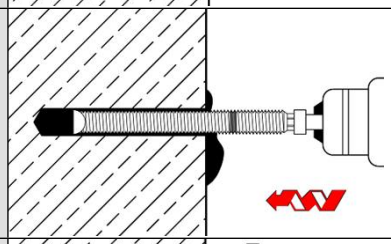
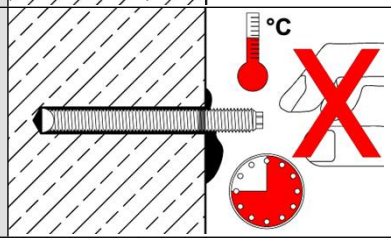
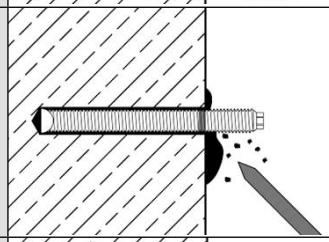
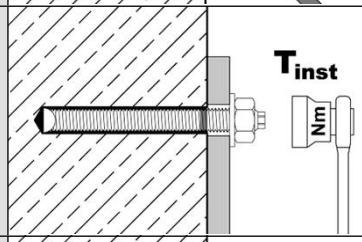
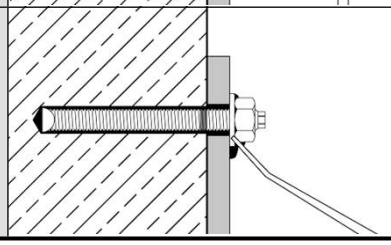
| | | |
|---|---|---|
| **2a** |  | Blow out the drill hole completely at least **2x** from the bottom of the drill hole with blow-out pump. |
| **2b** |  | Brush the drill hole **2x** with Cleaning Brush RB (Table B1 or B2). Observe and check brush diameter $d_b$. When inserting the brush into the drill 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. |

**Chemical Anchor VZ**

**Intended Use**
Installation instructions - Cleaning

**Annex B5**

## Installation instructions - continuation

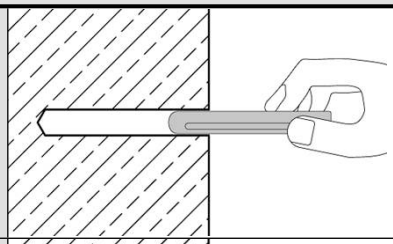
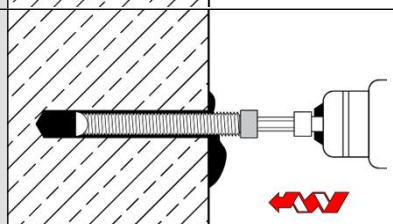
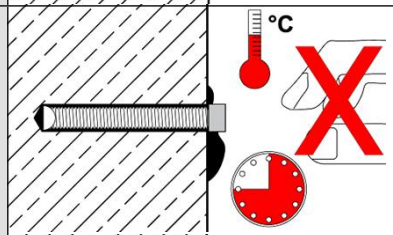
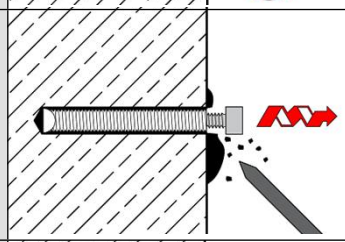
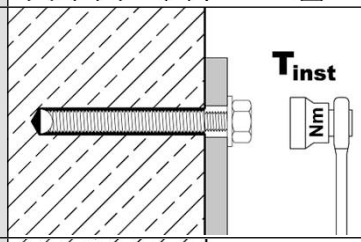
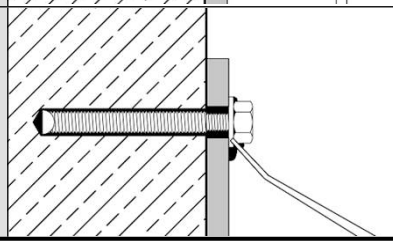
| Inserting the anchor rod V-A | | |
|---|---|---|
| 3 |  | Check the depth of drill hole. If necessary, mark anchoring depth on the anchor rods.<br><br>Insert the capsule into the drill hole. |
| 4 |  | Drive in the anchor rod using a hammer drill set on rotary impact. Stop immediately after reaching 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.<br>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.<br><br>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.<br>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** | **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

**Chemical Anchor VZ**

**Performances**
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** | **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 $\psi^0_{sus}$ in concrete C20/25** | | | | | | | | | | |
| Temperature range I: | +24°C / +40°C | $\psi^0_{sus}$ | [-] | 0,64 | | | | | | |
| Temperature range II: | +50°C / +80°C | $\psi^0_{sus}$ | [-] | 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 | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |

**Chemical Anchor VZ**

**Performances**
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** | **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 | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |

**Chemical Anchor VZ**

**Performances**
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** | **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 | | $\gamma_{inst}$ | [-] | 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 | $\alpha_{gap}$ | [-] | 0,5 | | | | | | |
| | **without** annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |

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

**Chemical Anchor VZ**

**Performances**
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 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 $\psi^0_{sus}$ in concrete C20/25** | | | | | | | | | |
| Temperature range I: | +24°C / +40°C | $\psi^0_{sus}$ | [-] | 0,64 | | | | | |
| Temperature range II: | +50°C / +80°C | $\psi^0_{sus}$ | [-] | 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 | | $\gamma_{inst}$ | [-] | 1,0 | | | | | |

[1] In absence of other national regulations

[2] IG M20: property class 50

**Chemical Anchor VZ**

**Performances**
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 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 | | $\gamma_{inst}$ | [-] | 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

**Chemical Anchor VZ**

**Performances**
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 | M30 IG-M20 |
|---|---|---|---|---|---|---|---|---|---|
| **Displacement factor[1] for uncracked concrete** | | | | | | | | | |
| Displacement | $\delta_{N0}$-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 | $\delta_{N0}$-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
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; $\tau$: 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 | $\delta_{V0}$-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
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

**Chemical Anchor VZ**

**Performances**
Displacements

**Annex C7**