



...eine starke Verbindung

## SUORITUSTASOILMOITUS

DoP Nro: **MKT-2.5-301**\_fi

- ✧ **Tuotetyypin yksilöllinen tunniste:** **Kemiallinen ankkuri VZ**
- ✧ **Aiottu käyttötarkoitus (aiotut käyttötarkoitukset):** Liimattu ankkuri ankkuroitavaksi betonissa, katso liite / Annex B
- ✧ **Valmistaja:** MKT Metall-Kunststoff-Technik GmbH & Co.KG  
Auf dem Immel 2  
67685 Weilerbach
- ✧ **Rakennustuotteen suoritustason pysyvyyden arviointi- ja varmennusjärjestelmä(t):** 1
- ✧ **Eurooppalainen arviointiasiakirja:** **EAD 330499-01-0601**  
Eurooppalainen tekninen arviointi: **ETA-20/0533, 16.12.2022**  
Teknisestä arvioinnista vastaava laitos: DIBt, Berlin  
Ilmoitettu laitos/ilmoitetut laitokset: NB 2873 – Technische Universität Darmstadt

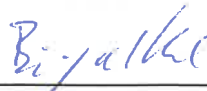
✧ **Ilmoitettu suoritustaso/ilmoitetut suoritustasot:**

| Olennaiset ominaisuudet  | Suoritustaso                     |
|--|----------------------------------|
| <b>Mekaaninen lujuus ja vakaus (BWR 1)</b>   |                                  |
| Ominaisresistanssit vetolujuudessa (staattiset ja lähes staattiset vaikutukset)              | Liite / Annex C1, C2, C5, B2, B3 |
| Ominaisresistanssit poikittaisessa rasituksessa (staattiset ja lähes staattiset vaikutukset) | Liite / Annex C1, C3, C6         |
| Vuorossa   | Liite / Annex C7                 |
| Ominainen kestävyys seismisen suorituskyvyn luokassa C1                                      | Liite / Annex C4                 |
| Ominaisvastus ja siirtymät seismiselle suorituskykyluokalle C2                               | Suorituskykyä ei arvioitu        |
| <b>Hygienia, terveys ja ympäristö (BWR 3)</b>  |                                  |
| Vaarallisten aineiden pitoisuus, päästöt ja / tai päästöt                                    | Suorituskykyä ei arvioitu        |

Edellä yksilöidyn tuotteen suoritustaso on ilmoitettujen suoritustasojen joukon mukainen. Tämä suoritustasoilmoitus on asetuksen (EU) N:o 305/2011 mukaisesti annettu edellä ilmoitetun valmistajan yksinomaisella vastuulla.

Valmistajan puolesta allekirjoittanut:

  
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**Weilerbach, 16.12.2022**

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Tämän suoritusilmoituksen alkuperäinen teksti on kirjoitettu saksaksi. Jos käännökset poikkeavat toisistaan, saksankielinen versio on pätevä.

## 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

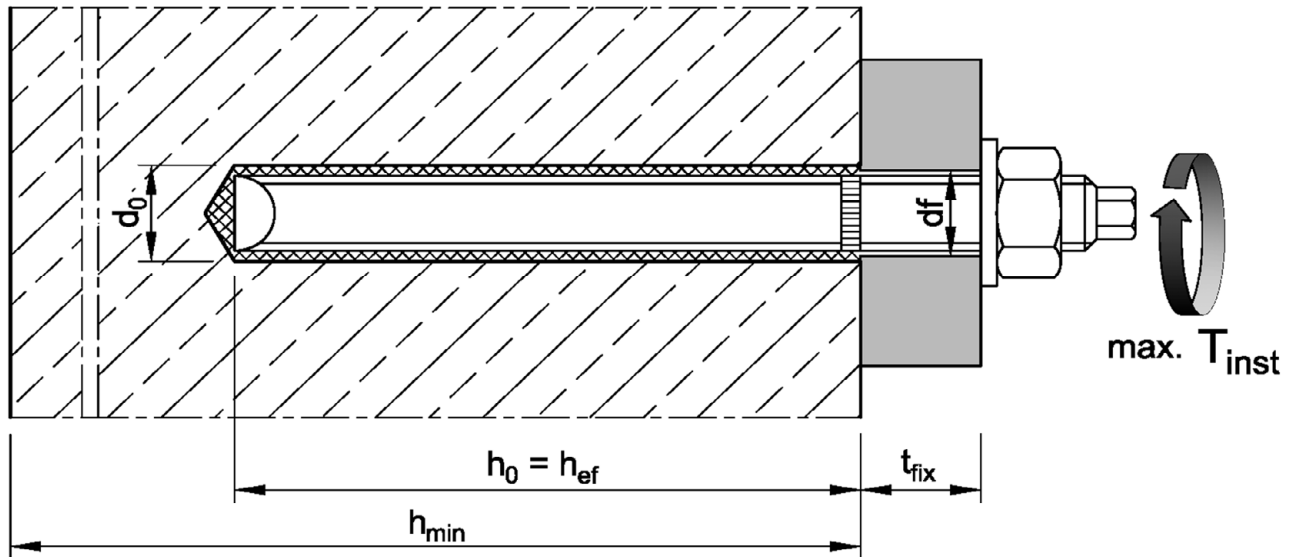
### Installation:

- 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  $\geq 40\text{N/mm}^2$  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.

|                                    |                 |
|------------------------------------|-----------------|
| <b>Chemical Anchor VZ</b>          | <b>Annex B1</b> |
| <b>Intended Use Specifications</b> |                 |

**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**

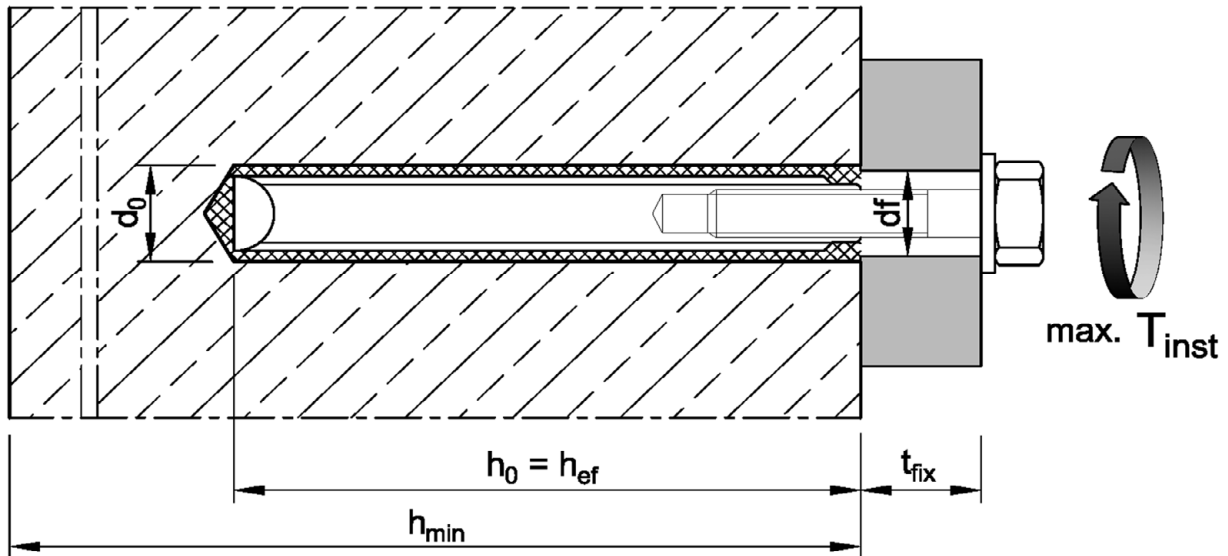
**Intended Use**  
Installation parameters – Anchor rod V-A

**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 <sup>1)</sup> | $d=d_{nom}$     | [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     |

<sup>1)</sup> With metric thread acc. to EN 1993-1-8:2005+AC:2009



**Chemical Anchor VZ**

**Intended Use**

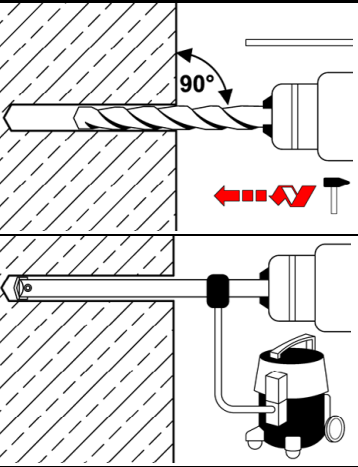
Installation parameters – Internally threaded anchor rod VZ-IG

**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               |
| <b>Capsule temperature</b> | -15°C to +40°C      |

**Installation instructions**

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

**Chemical Anchor VZ**

**Intended Use**

Curing time / Installation instruction - drilling

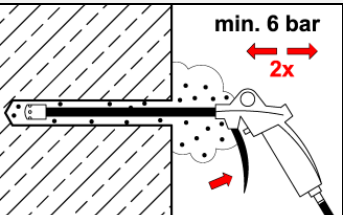
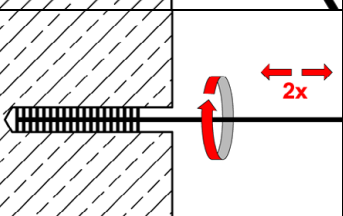
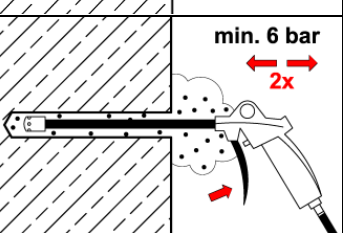
**Annex B4**

## 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.

### Cleaning with compressed air

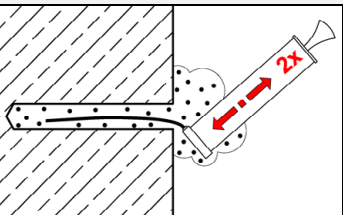
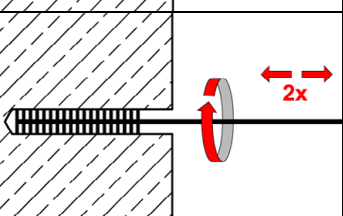
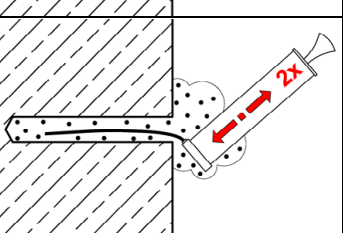
Sizes M8 to M24

|    |   |  |
|----|---|--|
| 2a |  | <p>Blow out the drill hole completely at least <b>2x</b> from the bottom of the drill hole with compressed air.</p>  |
| 2b |  | <p>Brush the drill hole <b>2x</b> with Cleaning Brush RB (Table B1 or B2). Observe and check brush diameter <math>d_{b,min}</math>. When inserting the brush into the drill hole, a clear resistance must be noticeable. Otherwise use a new Cleaning Brush.</p> |
| 2c |  | <p>Blow out the drill hole completely at least <b>2x</b> from the bottom of the drill hole with compressed air.</p>  |

2

### Manual cleaning

Sizes M8 to M20

|    |   |  |
|----|---|--|
| 2a |  | <p>Blow out the drill hole completely at least <b>2x</b> from the bottom of the drill hole with blow-out pump.</p>   |
| 2b |  | <p>Brush the drill hole <b>2x</b> with Cleaning Brush RB (Table B1 or B2). Observe and check brush diameter <math>d_{b,min}</math>. When inserting the brush into the drill hole, a clear resistance must be noticeable. Otherwise use a new Cleaning Brush.</p> |
| 2c |  | <p>Blow out the drill hole completely at least <b>2x</b> from the bottom of the drill hole with blow-out pump.</p>   |

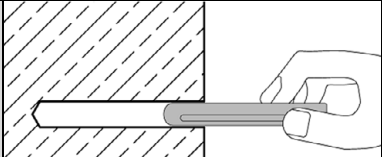
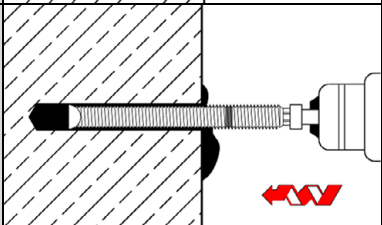
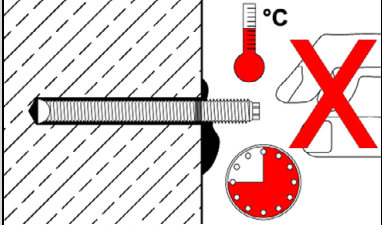
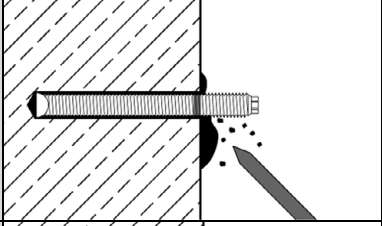
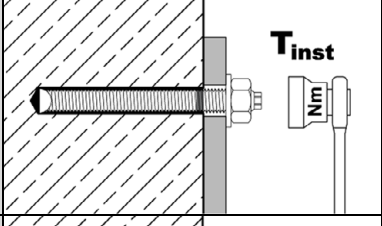
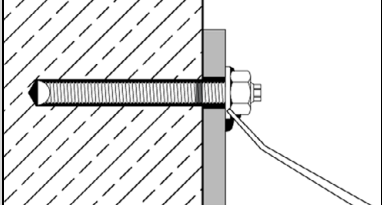
**Chemical Anchor VZ**

**Intended Use**

Installation instructions - Cleaning

**Annex B5**

## Installation instructions - continuation

| Inserting the anchor rod V-A |   |  |
|------------------------------|---|--|
| 3                            |    | <p>Check the depth of drill hole. If necessary, mark anchoring depth on the anchor rods.</p> <p>Insert the capsule into the drill hole.</p>  |
| 4                            |    | <p>Drive in the anchor rod using a hammer drill set on rotary impact. Stop immediately after reaching the setting depth.</p>   |
| 5                            |    | <p>Observe curing time according to Table B3. Do not move or load the anchor until it is fully cured.</p>  |
| 6                            |   | <p>Remove excess adhesive.</p>   |
| 7                            |  | <p>Install fixture and apply installation torque <math>T_{inst}</math> according to Table B1.</p>  |
| 8                            |  | <p>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.</p> <p>Annular gap is completely filled, when excess mortar seeps out.</p> |

### 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  |  | <p>Check the depth of drill hole.</p> <p>Insert the capsule into the drill hole.</p>  |
| 4  |  | <p>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.</p>   |
| 5  |  | <p>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.</p>   |
| 6  |  | <p>Remove excess adhesive and unscrew the setting tool.</p>   |
| 7  |  | <p>The fixture can be mounted with threaded rod, nut and washer or screw. Apply the installation torque <math>T_{inst}</math> according to Table B2.</p>  |
| 8  |  | <p>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.</p> |

### Chemical Anchor VZ

#### Intended Use

Installation instructions – Inserting internally threaded anchor rod VZ-IG

Annex B7



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

| Anchor rod V-A                                      |                    |                 |      | M8  | M10 | M12 | M16 | M20 | M24 |
|---|--------------------|-----------------|------|-----|-----|-----|-----|-----|-----|
| <b>Steel failure</b>                                |                    |                 |      |     |     |     |     |     |     |
| <b>Characteristic resistance under tension load</b> |                    |                 |      |     |     |     |     |     |     |
| 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 |
| <b>Partial factor <sup>1)</sup></b>                 |                    |                 |      |     |     |     |     |     |     |
| 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 |     |     |     |     |     |

<sup>1)</sup> 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 |
|--|--------------------|-----------------|------|------|-----|-----|-----|-----|-----|
| <b>Characteristic resistances under shear load</b> |                    |                 |      |      |     |     |     |     |     |
| <b>Steel failure <u>without</u> lever arm</b>      |                    |                 |      |      |     |     |     |     |     |
| 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 |
| <b>Steel failure <u>with</u> lever arm</b>         |                    |                 |      |      |     |     |     |     |     |
| 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 |
| <b>Partial factor <sup>1)</sup></b>                |                    |                 |      |      |     |     |     |     |     |
| 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 |     |     |     |     |     |

<sup>1)</sup> 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**

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

| Anchor rod V-A   |                        |                 |                      | M8                                      | M10  | M12  | M16  | M20  | M24  |
|--|------------------------|-----------------|----------------------|---|------|------|------|------|------|
| <b>Steel failure</b>   |                        |                 |                      |   |      |      |      |      |      |
| <b>Characteristic resistance under tension load</b>  |                        |                 |                      |   |      |      |      |      |      |
| Characteristic tension resistance  | $N_{Rk,s}$             | [kN]            | see Table C1         |   |      |      |      |      |      |
| Partial factor   | $\gamma_{Ms,N}$        | [-]             | see Table C1         |   |      |      |      |      |      |
| <b>Combined pull-out and concrete failure</b>  |                        |                 |                      |   |      |      |      |      |      |
| <b>Characteristic bond resistance in <u>uncracked</u> concrete C20/25</b>                            |                        |                 |                      |   |      |      |      |      |      |
| Temperature range I:   | +24°C / +40°C          | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 10,0                                    | 13,0 | 13,0 | 13,0 | 13,0 | 13,0 |
| Temperature range II:  | +50°C / +80°C          | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 8,5                                     | 11,0 | 11,0 | 11,0 | 11,0 | 11,0 |
| Increasing factors for $\tau_{Rk,ucr}$<br>$\tau_{Rk,ucr} = \psi_{c,ucr} \cdot \tau_{Rk,ucr}(C20/25)$ |                        | $\psi_{c,ucr}$  | [-]                  | $\left(\frac{f_{ck}}{20}\right)^{0,17}$ |      |      |      |      |      |
| <b>Characteristic bond resistance in <u>cracked</u> concrete C20/25</b>                              |                        |                 |                      |   |      |      |      |      |      |
| Temperature range I:   | +24°C / +40°C          | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 5,0                                     | 6,5  | 7,0  | 7,5  | 7,5  | 7,5  |
| Temperature range II:  | +50°C / +80°C          | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 4,5                                     | 5,5  | 6,0  | 6,0  | 6,0  | 6,5  |
| Increasing factors for $\tau_{Rk,cr}$<br>$\tau_{Rk,cr} = \psi_{c,cr} \cdot \tau_{Rk,cr}(C20/25)$     |                        | $\psi_{c,cr}$   | [-]                  | $\left(\frac{f_{ck}}{20}\right)^{0,14}$ |      |      |      |      |      |
| <b>Reduction factor <math>\psi^0_{sus}</math> in concrete C20/25</b>                                 |                        |                 |                      |   |      |      |      |      |      |
| Temperature range I:   | +24°C / +40°C          | $\psi^0_{sus}$  | [-]                  | 0,64                                    |      |      |      |      |      |
| Temperature range II:  | +50°C / +80°C          | $\psi^0_{sus}$  | [-]                  | 0,63                                    |      |      |      |      |      |
| <b>Concrete cone failure</b>   |                        |                 |                      |   |      |      |      |      |      |
| 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 $h_{ef}$                              |      |      |      |      |      |
| <b>Splitting failure</b>   |                        |                 |                      |   |      |      |      |      |      |
| 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  |                        | $\gamma_{inst}$ | [-]                  | 1,2                                     |      |      |      |      |      |

**Chemical Anchor VZ**

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

**Annex C2**

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

| Anchor rod V-A                                |                 |      | M8           | M10 | M12 | M16 | M20 | M24 |
|---|-----------------|------|--------------|-----|-----|-----|-----|-----|
| <b>Steel failure <u>without</u> lever arm</b> |                 |      |              |     |     |     |     |     |
| Characteristic resistance                     | $V^0_{RK,s}$    | [kN] | see Table C2 |     |     |     |     |     |
| Ductility factor                              | $k_7$           | [-]  | 1,0          |     |     |     |     |     |
| Partial factor                                | $\gamma_{Ms,V}$ | [-]  | see Table C2 |     |     |     |     |     |
| <b>Steel failure <u>with</u> lever arm</b>    |                 |      |              |     |     |     |     |     |
| Characteristic bending resistance             | $M^0_{RK,s}$    | [Nm] | see Table C2 |     |     |     |     |     |
| Partial factor                                | $\gamma_{Ms,V}$ | [-]  | see Table C2 |     |     |     |     |     |
| <b>Concrete pry-out failure</b>               |                 |      |              |     |     |     |     |     |
| Pry-out factor                                | $k_8$           | [-]  | 2,0          |     |     |     |     |     |
| <b>Concrete edge failure</b>                  |                 |      |              |     |     |     |     |     |
| 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                           | $\gamma_{inst}$ | [-]  | 1,0          |     |     |     |     |     |

**Chemical Anchor VZ**

**Performance**

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

**Annex C3**

**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 |
|--|-----------------|----------------|----------------------------|-----|-----|-----|-----|-----|-----|
| <b>Steel failure</b>   |                 |                |                            |     |     |     |     |     |     |
| <b>Characteristic resistance under tension load</b>                |                 |                |                            |     |     |     |     |     |     |
| Characteristic tension resistance                                  | $N_{Rk,s,C1}$   | [kN]           | $N_{Rk,s}$<br>see Table C1 |     |     |     |     |     |     |
| Partial factor   | $\gamma_{Ms,N}$ | [-]            | see Table C1               |     |     |     |     |     |     |
| <b>Combined pull-out and concrete failure</b>                      |                 |                |                            |     |     |     |     |     |     |
| <b>Characteristic bond resistance in concrete C20/25 to C50/60</b> |                 |                |                            |     |     |     |     |     |     |
| Temperature range I:   | +24°C / +40°C   | $\tau_{Rk,C1}$ | [N/mm <sup>2</sup> ]       | 4,5 | 5,5 | 6,0 | 6,0 | 7,5 | 7,0 |
| Temperature range II:  | +50°C / +80°C   | $\tau_{Rk,C1}$ | [N/mm <sup>2</sup> ]       | 4,0 | 4,5 | 5,5 | 5,0 | 6,0 | 5,5 |
| Installation factor  | $\gamma_{inst}$ | [-]            | 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   |
|--|----------------------------|----------------|--------------|------|------|------|------|------|-------|
| <b>Steel failure without lever arm</b>                 |                            |                |              |      |      |      |      |      |       |
| <b>Characteristic resistance under shear load</b>      |                            |                |              |      |      |      |      |      |       |
| Steel,<br>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 /<br>High corrosion<br>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                                  | <b>with</b> annular gap    | $\alpha_{gap}$ | [-]          | 0,5  |      |      |      |      |       |
|  | <b>without</b> annular gap | $\alpha_{gap}$ | [-]          | 1,0  |      |      |      |      |       |
| Installation factor                                    | $\gamma_{inst}$            | [-]            | 1,0          |      |      |      |      |      |       |

**Chemical Anchor VZ**

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

**Annex C4**

**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 |
|---|------------------------------|-----------------|----------------------|---|--------|---------|---------|---------|
| <b>Steel failure</b>  |                              |                 |                      |   |        |         |         |         |
| 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 <sup>1)</sup>  |                              | $\gamma_{Ms,N}$ | [-]                  | 1,5                                     |        |         |         |         |
| Characteristic resistance, stainless steel A4 / HCR   | Property class 70            | $N_{Rk,s}$      | [kN]                 | 14                                      | 26     | 41      | 59      | 110     |
|   | Partial factor <sup>1)</sup> |                 | $\gamma_{Ms,N}$      | [-]                                     | 1,87   |         |         |         |
| <b>Combined pull-out and concrete failure</b>   |                              |                 |                      |   |        |         |         |         |
| <b>Characteristic bond resistance in <u>uncracked</u> concrete C20/25</b>                             |                              |                 |                      |   |        |         |         |         |
| Temperature range I:  | +24°C / +40°C                | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 13,0                                    | 13,0   | 13,0    | 13,0    | 13,0    |
| Temperature range II:   | +50°C / +80°C                | $\tau_{Rk,ucr}$ | [N/mm <sup>2</sup> ] | 11,0                                    | 11,0   | 11,0    | 11,0    | 11,0    |
| Increasing factors for $\tau_{Rk,ucr}$<br>$\tau_{Rk,ucr} = \psi_{c,ucr} \cdot \tau_{Rk,ucr} (C20/25)$ |                              | $\psi_{c,ucr}$  | [-]                  | $\left(\frac{f_{ck}}{20}\right)^{0,17}$ |        |         |         |         |
| <b>Characteristic bond resistance in <u>cracked</u> concrete C20/25</b>                               |                              |                 |                      |   |        |         |         |         |
| Temperature range I:  | +24°C / +40°C                | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 6,5                                     | 7,0    | 7,5     | 7,5     | 7,5     |
| Temperature range II:   | +50°C / +80°C                | $\tau_{Rk,cr}$  | [N/mm <sup>2</sup> ] | 5,5                                     | 6,0    | 6,0     | 6,0     | 6,5     |
| Increasing factors for $\tau_{Rk,cr}$<br>$\tau_{Rk,cr} = \psi_{c,cr} \cdot \tau_{Rk,cr} (C20/25)$     |                              | $\psi_{c,cr}$   | [-]                  | $\left(\frac{f_{ck}}{20}\right)^{0,14}$ |        |         |         |         |
| <b>Reduction factor <math>\psi^0_{sus}</math> in concrete C20/25</b>                                  |                              |                 |                      |   |        |         |         |         |
| Temperature range I:  | +24°C / +40°C                | $\psi^0_{sus}$  | [-]                  | 0,64                                    |        |         |         |         |
| Temperature range II:   | +50°C / +80°C                | $\psi^0_{sus}$  | [-]                  | 0,63                                    |        |         |         |         |
| <b>Concrete cone failure</b>  |                              |                 |                      |   |        |         |         |         |
| 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 $h_{ef}$                              |        |         |         |         |
| <b>Splitting failure</b>  |                              |                 |                      |   |        |         |         |         |
| 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   |                              | $\gamma_{inst}$ | [-]                  | 1,2                                     |        |         |         |         |

<sup>1)</sup> In absence of other national regulations

**Chemical Anchor VZ**

**Performance**

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

**Annex C5**

**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 |
|---|--------------------|-----------------|------|--------|--------|---------|---------|---------|
| <b>Steel failure <u>without</u> lever arm <sup>1)</sup></b> |                    |                 |      |        |        |         |         |         |
| Steel,<br>zinc plated                                       | Property class 5.8 | $V_{Rk,s}^0$    | [kN] | 6      | 10     | 17      | 25      | 45      |
|   | Property class 8.8 | $V_{Rk,s}^0$    | [kN] | 8      | 14     | 23      | 34      | 60      |
| Stainless steel A4 / HCR                                    | Property class 70  | $V_{Rk,s}^0$    | [kN] | 7      | 13     | 20      | 30      | 55      |
| Ductility factor  |                    | $k_7$           | [-]  | 1,0    |        |         |         |         |
| <b>Steel failure <u>with</u> lever arm <sup>1)</sup></b>    |                    |                 |      |        |        |         |         |         |
| Steel,<br>zinc plated                                       | Property class 5.8 | $M_{Rk,s}^0$    | [Nm] | 8      | 19     | 37      | 66      | 167     |
|   | Property class 8.8 | $M_{Rk,s}^0$    | [Nm] | 12     | 30     | 60      | 105     | 267     |
| Stainless steel A4 / HCR                                    | Property class 70  | $M_{Rk,s}^0$    | [Nm] | 11     | 26     | 53      | 92      | 234     |
| <b>Partial factor <sup>2)</sup></b>                         |                    |                 |      |        |        |         |         |         |
| Steel,<br>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   |        |         |         |         |
| <b>Concrete pry-out failure</b>                             |                    |                 |      |        |        |         |         |         |
| Pry-out factor  |                    | $k_8$           | [-]  | 2,0    |        |         |         |         |
| <b>Concrete edge failure</b>                                |                    |                 |      |        |        |         |         |         |
| 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   |                    | $\gamma_{inst}$ | [-]  | 1,0    |        |         |         |         |

<sup>1)</sup> 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

<sup>2)</sup> 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<br>IG-M6 | M12<br>IG-M8 | M16<br>IG-M10 | M20<br>IG-M12 | M24<br>IG-M16 |
|--|----------------------------|---------------------------|-------|--------------|--------------|---------------|---------------|---------------|
| <b>Displacement factor<sup>1)</sup> for uncracked concrete</b> |                            |                           |       |              |              |               |               |               |
| Displacement   | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,015 | 0,031        | 0,035        | 0,015         | 0,046         | 0,060         |
|  | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,085 | 0,067        | 0,067        | 0,067         | 0,067         | 0,067         |
| <b>Displacement factor<sup>1)</sup> for cracked concrete</b>   |                            |                           |       |              |              |               |               |               |
| Displacement   | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,046 | 0,038        | 0,024        | 0,008         | 0,024         | 0,133         |
|  | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,192 | 0,142        | 0,090        | 0,104         | 0,082         | 0,069         |

<sup>1)</sup> Calculation of the displacement

$$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau; \quad \tau: \text{acting bond stress for tension}$$

$$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau;$$

**Table C10: Displacements under shear load**

| Anchor size                             |                            |           | M8   | M10<br>IG-M6 | M12<br>IG-M8 | M16<br>IG-M10 | M20<br>IG-M12 | M24<br>IG-M16 |
|---|----------------------------|-----------|------|--------------|--------------|---------------|---------------|---------------|
| <b>Displacement factor<sup>1)</sup></b> |                            |           |      |              |              |               |               |               |
| Displacement                            | $\delta_{V0}$ -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          |

<sup>1)</sup> Calculation of the displacement

$$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V; \quad V: \text{acting shear load}$$

$$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V;$$

**Chemical Anchor VZ**

**Performance**  
Displacements

**Annex C7**