Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

# European Technical Assessment ETA-04/0072 of 12 September 2016

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 | K-A-L-M bonded anchor VMK-SF |
| Product family to which the construction product belongs | Bonded anchor for use in uncracked concrete |
| Manufacturer | KALM<br>Befestigungssysteme GmbH<br>Marie-Curie-Straße 5<br>67661 Kaiserslautern<br>DEUTSCHLAND |
| Manufacturing plant | KALM<br>Befestigungssysteme GmbH<br>Marie-Curie-Straße 5<br>67661 Kaiserslautern |
| This European Technical Assessment contains | 14 pages including 3 annexes |
| This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of | Guideline for European technical approval of "Metal anchors for use in concrete", ETAG 001 Part 5: "Bonded anchors", April 2013,<br>used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011. |
| This version replaces | ETA-04/0072 issued on 25 August 2014 |

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## Specific Part

### 1 Technical description of the product

The "K-A-L-M bonded anchor VMK-SF" consists of a cartridge with injection mortar VMK-SF and a threaded rod for VMK-SF with washer and hexagon nut in the range of M10 to M20.

The threaded rod is placed into a drilled hole filled with injection mortar and is anchored via bond between threaded rod, injection mortar and concrete.

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 for static and quasi-static loads | See Annex C 1 to C 2 |
| Displacements | See Annex C 2 |

### 3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Anchorages satisfy requirements for Class A1 |
| Resistance to fire | No performance assessed |

### 3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply..

### 3.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 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 EAD

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

Issued in Berlin on 12 September 2016 by Deutsches Institut für Bautechnik

Andreas Kummerow
p. p. Head of Department

*beglaubigt:*
Lange

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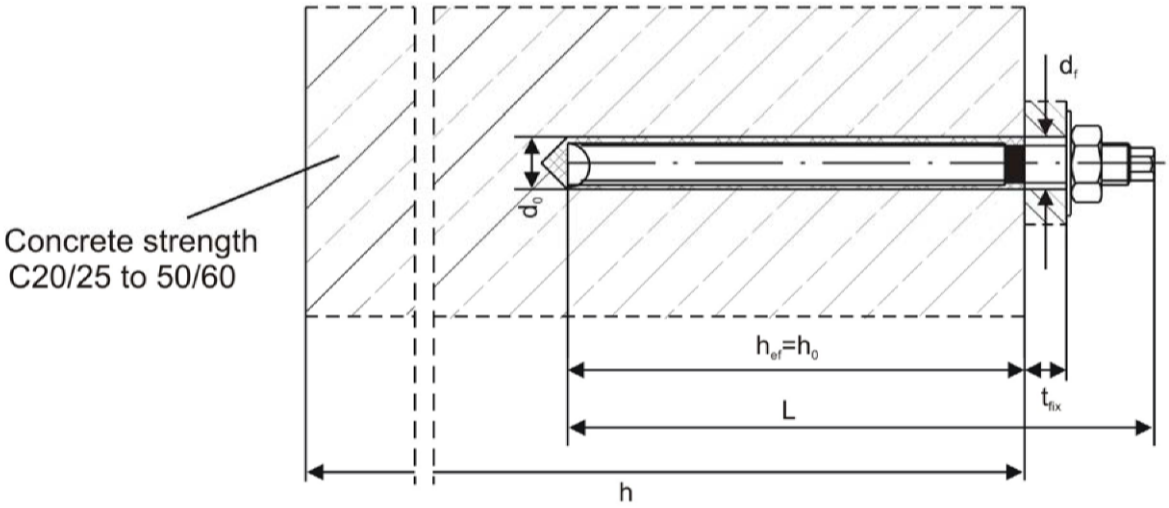
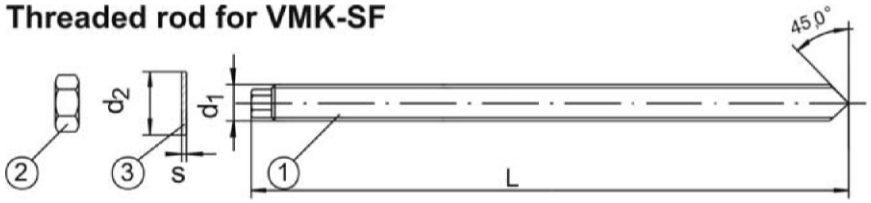
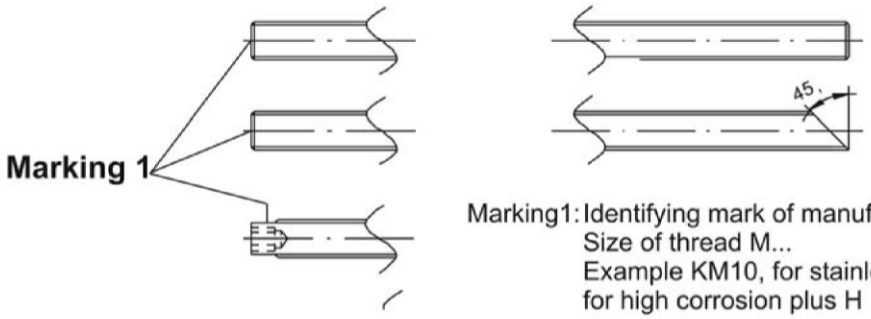
## Installation conditions

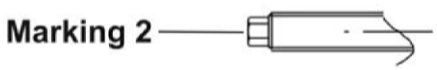



## Threaded rod for VMK-SF




Marking1: Identifying mark of manufacturing plant K
Size of thread M...
Example KM10, for stainless steel plus E,
for high corrosion plus H




Marking2: Example: , for stainless steel plus E,
for high corrosion plus H

## Dimensions

| Anchor size | | | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|
| Threaded rod | Ø $d_1$ | [mm] | M10 | M12 | M16 | M20 |
| | L ≥ | [mm] | 100 | 120 | 140 | 200 |
| | $h_{ef}$ | [mm] | 90 | 110 | 125 | 170 |

**K-A-L-M bonded anchor VMK-SF**

**Product description**
Installation conditions, threaded rod ASK

**Annex A 1**

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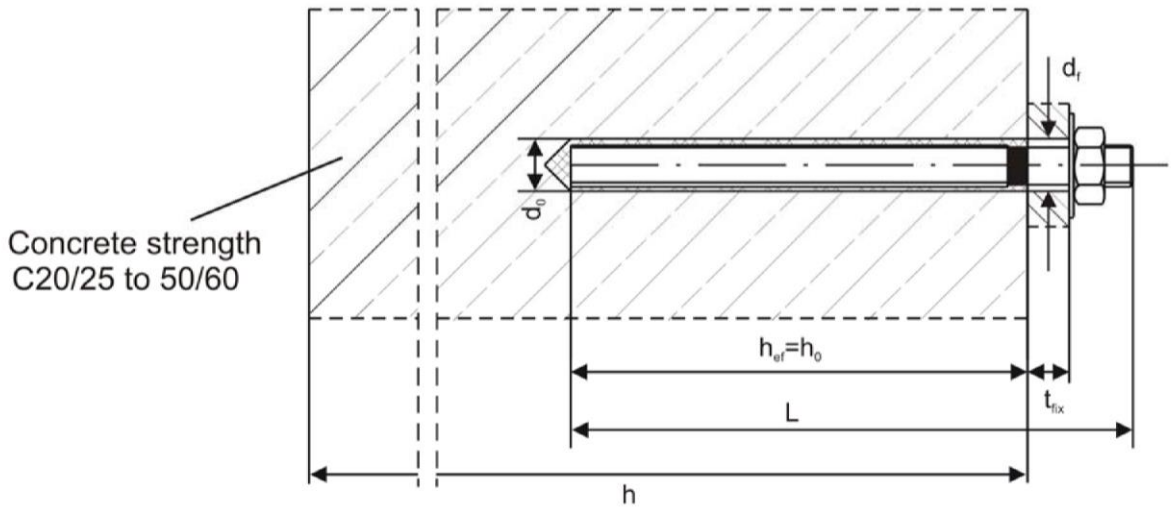
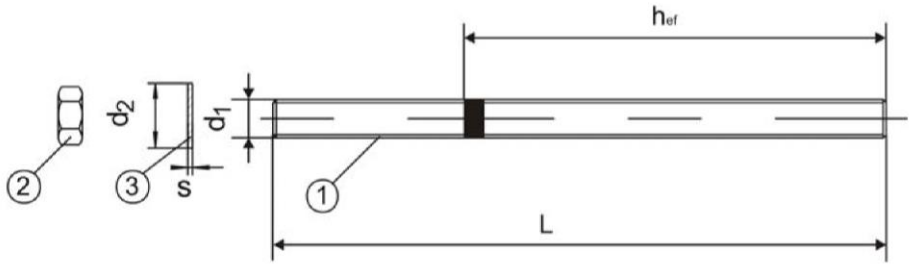
## Installation conditions




## Commercial threaded rod for VMK-SF




## Dimensions

| Anchor size | | | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|
| Threaded rod | Ø $d_1$ | [mm] | M10 | M12 | M16 | M20 |
| | $h_{ef,min}$ | [mm] | 60 | 70 | 80 | 90 |
| | $h_{ef,max}$ | [mm] | 100 | 120 | 160 | 200 |



**K-A-L-M bonded anchor VMK-SF**

**Product description**
Installation conditions, threaded rod (commercial standard rod)

**Annex A 2**

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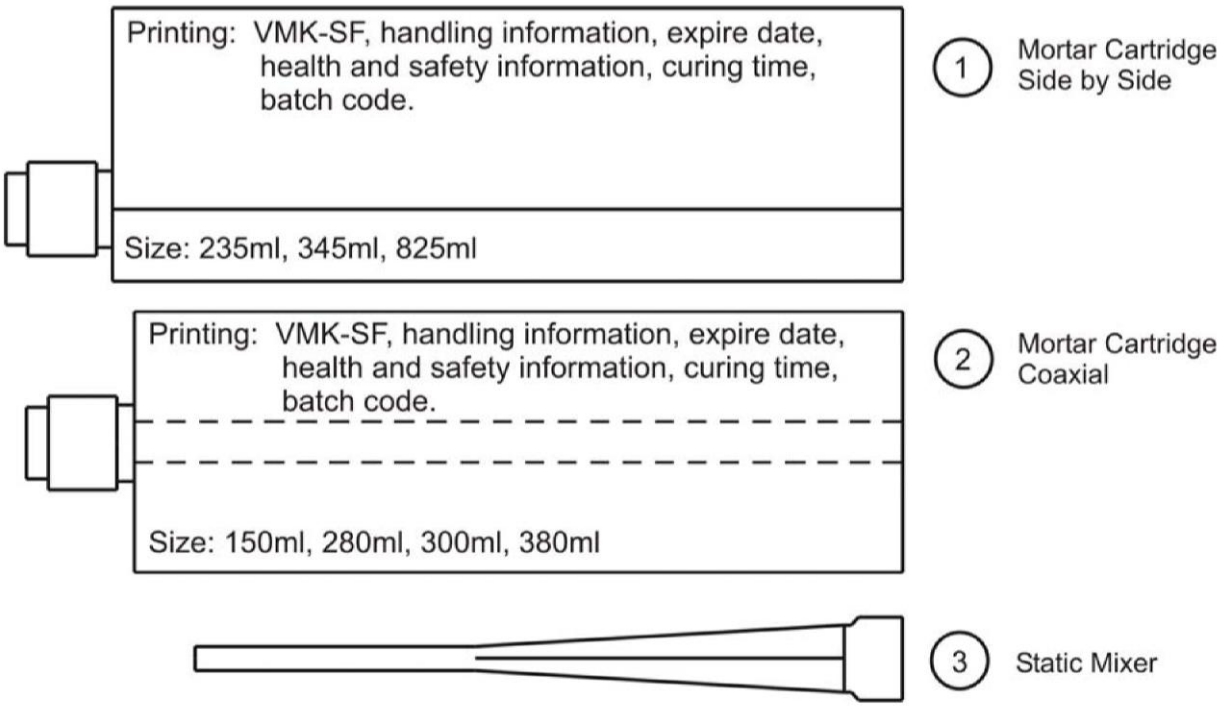
## Cartridges




| K-A-L-M bonded anchor VMK-SF | Annex A 3 |
|---|---|
| **Product description**<br>Cartridges / Static mixer | |

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## Materials

| Part | Designation | Steel, zinc plated ≥ 5 µm plated acc. to DIN EN ISO 4042 | Steel, hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461 |
|---|---|---|---|
| 1 | Threaded rod | Steel acc. to EN 10087:1998 or EN 10263:2001, Property class 4.6, 5.8, 8.8, acc. to EN 1993-1-8:2005 | Steel acc. to EN 10087:1998 or EN 10263:2001, Property class 4.6, 5.8, 8.8, acc. to EN 1993-1-8:2005 |
| 2 | Hexagon nut acc. to EN ISO 4032:2012 | Steel acc. to EN10087:1998 or EN 10263:2001 Property class 4,5,8 acc. to EN ISO 898-2:2012 | Steel acc. to EN10087:1998 or EN 10263:2001 Property class 4,5,8 acc. to EN ISO 898-2:2012 |
| 3 | Washer acc. to EN ISO 887:2006 EN ISO 7089:2000 EN ISO 7093:2000 EN ISO 7094:2000 | Steel, galvanised | Steel, hot-dip galvanised |

| Part | Designation | Stainless steel A4 | High corrosion resistant steel (HCR) |
|---|---|---|---|
| 1 | Threaded rod | Stainless steel, 1.4401, 1.4404, 1.4571 acc. to EN 10088-1:2005 | High corrosion resistant steel 1.4529, 1.4565 acc. to EN 10088-1:2005 |
| 2 | Hexagon nut acc. to EN ISO 4032:2012 | Stainless steel, 1.4401, 1.4404, 1.4571 acc. to EN 10088-1:2005 | High corrosion resistant steel 1.4529, 1.4565 acc. to EN 10088-1:2005 |
| 3 | Washer acc. to EN ISO 887:2006 EN ISO 7089:2000 EN ISO 7093:2000 EN ISO 7094:2000 | Stainless steel, 1.4401, 1.4404, 1.4571 acc. to EN 10088-1:2005 | High corrosion resistant steel 1.4529, 1.4565 acc. to EN 10088-1:2005 |



**K-A-L-M bonded anchor VMK-SF**

**Product description**
Materials

**Annex A 4**

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**Specifications of intended use (part 1)**

**Anchorages subject to:**

- Static and quasi-static loads: M10 to M20

**Base materials:**

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C50/60 according to EN 206-1:2000.
- Non-cracked concrete: M10-M20

**Temperature Range:**

- I: -40°C to +40°C
  (max long term temperature +24 °C and max short term temperature +40 °C)
- II: -40°C to +60°C
  (max long term temperature +43 °C and max short term temperature +60 °C)
- III: -40°C to +80°C
  (max long term temperature +50 °C and max short term temperature +80 °C)

**Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist
  (high corrosion resistant steel).

  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution
  (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

**Design:**

- Anchorages have to be designed under the responsibility of an engineer experienced in anchorages and concrete work.
- 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 under static and quasi-static actions are designed in accordance with
  - EOTA Technical Report TR 029 “Design of bonded anchors”, Edition September 2010
  - CEN/TS 1992-4:2009

| K-A-L-M bonded anchor VMK-SF | Annex B 1 |
|---|---|
| **Intended Use**<br>Specifications (Part 1) | |

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**Specifications of intended use (part 2)**

**Installation:**

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the of the person responsible for technical matters of the site.
- Use category 1: dry or wet concrete (not in flooded holes)
- Sizes M10 to M20
- Hole drilling by hammer drilling.
- In case of aborted hole: The hole shall be filled with mortar.
- Marking and keeping the effective anchorage depth
- Overhead installation is allowed.

**Commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:**

- Material and mechanical properties acc. to Annex A3
- Inspection certificate 3.1 acc. to EN 10204:2004, the documents should be stored
- Marking of the embedment depth



| | |
|---|---|
| **K-A-L-M bonded anchor VMK-SF** | **Annex B 2** |
| **Intended Use**<br>Specifications (Part 2) | |

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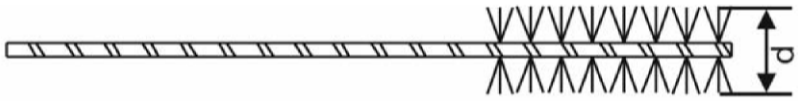
## Installation parameters

| Anchor size | | | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|
| Nominal diameter of drill hole | $d_0$ | [mm] | 12 | 14 | 18 | 24 |
| Effective embedment depth ($h_{ef}$ = drill hole depth L (see Annex A1)) | $h_{ef,min}$ | [mm] | see Annex A1 and A2 | | | |
| | $h_{ef,max}$ | [mm] | | | | |
| Diameter of clearance hole in fixture | $d_f$ | [mm] | 12 | 14 | 18 | 22 |
| Diameter of steel brush | d | [mm] | 13 | 16 | 20 | 27 |
| Installation torque | $T_{inst}$ | [Nm] | 20 | 30 | 50 | 80 |
| Minimum member thickness | $h_{min}$ | [mm] | ($h_{ef}$+40)mm | | | |
| Minimum edge distance | $c_{min}$ | [mm] | 100 | 100 | 100 | 100 |
| Minimum spacing | $s_{min}$ | [mm] | 120 | 140 | 160 | 200 |

## Steel brush




## Blow Pump ABK (Standard Cleaning)

## Dispenser

## Maximum processing time and minimum curing time

| Temperature in the anchorage base [°C] | Maximum processing time [min] | Minimum curing time in dry concrete [min] | Minimum curing time in wet concrete [min] |
|---|---|---|---|
| -5 – 0 | 45 | 360 | 720 |
| 0 – 5 | 25 | 180 | 360 |
| 5 – 20 | 12 | 90 | 180 |
| 20 – 30 | 4 | 45 | 90 |
| 30 - 40 | 3 | 25 | 50 |
| >40 | 2 | 15 | 30 |



**K-A-L-M bonded anchor VMK-SF**

**Annex B 3**

**Intended Use**
Installation parameters / Cleaning and setting tools / Processing time / Curing time

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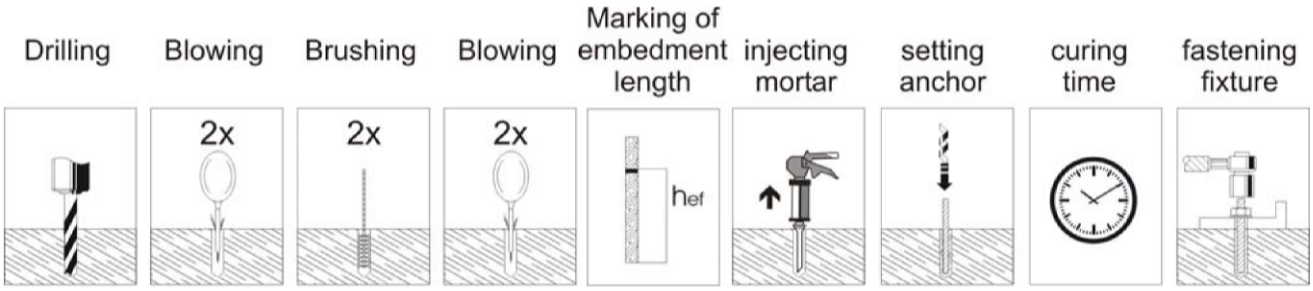
## Installation instructions




| Step | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|

| Step | Installation instructions |
|---|---|
| 1 | Drill the hole. Drill hole diameter and drill hole depth, see Annex B 3 |
| 2 | Clean the drill hole: Blow out the drill hole two times, using a hand pump |
| 3 | Check brush diameter (Annex B 3)<br>Brush the drill hole a minimum of two times.<br>For drill hole diameter ≥ 24 mm (M20) attach the brush to a drilling machine or a battery screwdriver. If the bore hole ground is not reached with the brush use an extension. |
| 4 | Clean the drill hole: Blow out the drill hole two times, using a hand pump |
| 5 | Marking of the embedment depth. |
| 6 | Twist off the sealing cap<br>Twist on the static mixer (the spiral in the static mixer must be clearly visible)<br>Load the cartridge into the dispenser<br>The first swings of mortar (appr. 10 cm strand) shall be discarded until the color of the mortar has turned into a uniform grey.<br>The hole shall be uniformly filled starting from the hole bottom, in order to avoid entrapment of air. During pressing-out the mixer shall be slowly removed bit by bit. The drill hole shall be filled with the minimum quantity of the injection mortar given in the manufacturer's installation instruction (approximately 2/3 of the drill hole).<br>**Overhead installation: Insert the static mixer to the back of the hole and inject adhesive. It is required that the bore hole is completely filled with adhesive approximately 2/3 of the drill hole.** |
| 7 | The anchor rod shall be pressed by manual turning into the mortar-filled hole up to the marked anchorage depth. If work is interrupted for a time exceeding the indicated processing time of the cartridge, the static mixer has to be replaced.<br>**Overhead installation: It is required that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length. Afterwards fix the anchor rod with e.g. wedges.** |
| 8 | Wait for the specified curing time (see Annex B 3) |
| 9 | Mounting the fixture, $T_{inst}$, see Annex B 3 |



| **K-A-L-M bonded anchor VMK-SF** | **Annex B 4** |
|---|---|
| **Intended Use**<br>Installation instructions | |

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# Characteristic values of resistance to tension load

| **Steel Failure** | | | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|
| Characteristic Resistance, Steel, strength class 4.6 | $N_{Rk,s}$ | [kN] | 23,2 | 33,7 | 62,8 | 98,0 |
| | $\gamma_{Ms}$ | [-] | 2,0 | | | |
| Characteristic Resistance, Steel, strength class 5.8 | $N_{Rk,s}$ | [kN] | 29,0 | 42,2 | 78,5 | 122,5 |
| | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| Characteristic Resistance, Steel, strength class 8.8 | $N_{Rk,s}$ | [kN] | 46,4 | 67,4 | 125,6 | 196,0 |
| | $\gamma_{Ms}$ | [-] | 1,5 | | | |
| Characteristic Resistance, Stainless Steel, class 70 | $N_{Rk,s}$ | [kN] | 40,6 | 59,0 | 109,9 | 171,5 |
| | $\gamma_{Ms}$ | [-] | 1,87 | | | |

| **Combined pull-out and concrete cone failure in uncracked concrete** | | | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|
| Temperature Range I: 40/24°C, Dry and Wet Concrete | $\tau_{Rk,ucr}$ | [N/mm²] | 7,0 | 6,0 | 5,0 | 4,0 |
| Temperature Range II: 60/43°C, Dry and Wet Concrete | $\tau_{Rk,ucr}$ | [N/mm²] | 7,0 | 6,0 | 5,0 | 4,0 |
| Temperature Range III: 80/50°C, Dry and Wet Concrete | $\tau_{Rk,ucr}$ | [N/mm²] | 6,3 | 5,4 | 4,5 | 3,6 |
| Increasing factor for concrete | C30/37 | | 1,10 | | | |
| | C40/50 | | 1,18 | | | |
| | C50/60 | | 1,25 | | | |
| **Concrete cone failure** | | | | | | |
| Factor for uncracked concrete | $k_{ucr}$ [2)] | | 10,1 | | | |
| **Splitting Failure** | | | | | | |
| Edge Distance | $c_{cr,sp}$ | [mm] | $c_{cr,sp} = h_{ef} \cdot \left(\frac{\tau_{Rk,uncr}}{8}\right)^{0,4} \cdot \left(3,1 - 0,7 \cdot \frac{h}{h_{ef}}\right)$ | | | |
| Spacing | $s_{cr,sp}$ | [mm] | $2 * c_{Cr,Sp}$ | | | |
| Installation safety factor | $\gamma_2$ [1)] $= \gamma_{inst}$ [2)] | [-] | 1,4 | | | |

1) according to "EOTA Technical Report TR 029, 09/2010"
2) according to "CEN/TS 1992-4:2009"



**K-A-L-M bonded anchor VMK-SF**

**Performances**
Characteristic resistance under tension load - static and quasi-static loading
Design according to „EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C 1**

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## Characteristic values of resistance to shear load

| **Steel Failure without lever arm** | | | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|
| Characteristic Resistance, Steel, strength class 4.6 | $V_{Rk,s}$ | [kN] | 11,6 | 16,9 | 31,4 | 49,0 |
| | $\gamma_{Ms}$ | [-] | 1,67 | | | |
| Characteristic Resistance, Steel, strength class 5.8 | $V_{Rk,s}$ | [kN] | 14,5 | 21,1 | 39,3 | 61,3 |
| | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Characteristic Resistance, Steel, strength class 8.8 | $V_{Rk,s}$ | [kN] | 23,2 | 33,7 | 62,8 | 98,0 |
| | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Characteristic Resistance, Stainless Steel, class 70 | $V_{Rk,s}$ | [kN] | 20,3 | 29,5 | 55,0 | 85,8 |
| | $\gamma_{Ms}$ | [-] | 1,56 | | | |

| **Steel Failure with lever arm** | | | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|
| Bending Moment, Steel, strength class 4.6 | $M^0_{Rk,s}$ | [Nm] | 25,6 | 45,0 | 117,2 | 228,6 |
| | $\gamma_{Ms}$ | [-] | 1,67 | | | |
| Bending Moment, Steel, strength class 5.8 | $M^0_{Rk,s}$ | [Nm] | 32,0 | 56,3 | 146,5 | 285,7 |
| | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Bending Moment, Steel, strength class 8.8 | $M^0_{Rk,s}$ | [Nm] | 51,2 | 90,0 | 234,4 | 457,1 |
| | $\gamma_{Ms}$ | [-] | 1,25 | | | |
| Bending Moment, Stainless Steel, class 70 | $M^0_{Rk,s}$ | [Nm] | 44,8 | 78,8 | 205,1 | 400,0 |
| | $\gamma_{Ms}$ | [-] | 1,56 | | | |

| **Pryout failure** | | | |
|---|---|---|---|
| Factor k | $k^{1)} = k_3{}^{2)}$ | [-] | 1,0 for $h_{ef} \leq 60$mm<br>2,0 for $h_{ef} > 60$mm |
| Installation safety factor | $\gamma_2{}^{1)} = \gamma_{inst}{}^{2)}$ | [-] | 1,0 |

1) according to "EOTA Technical Report TR 029, 09/2010"
2) according to "CEN/TS 1992-4:2009"

## Displacement under tension load

| | | | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|
| Temperature Range I: 40°C / 24°C | Load | [kN] | 3,0 | 2,5 | 2,0 | 1,6 |
| | $\delta_{N0}$ | [mm] | 1,6 | 1,5 | 1,4 | 1,3 |
| | $\delta_{N\infty}$ | [mm] | 2,4 | 2,3 | 2,1 | 2,0 |
| Temperature Range II: 60°C / 43°C | Load | [kN] | 3,0 | 2,5 | 2,0 | 1,6 |
| | $\delta_{N0}$ | [mm] | 1,6 | 1,5 | 1,4 | 1,3 |
| | $\delta_{N\infty}$ | [mm] | 2,4 | 2,3 | 2,1 | 2,0 |
| Temperature Range III: 80°C / 50°C | Load | [kN] | 2,5 | 2,2 | 1,8 | 1,4 |
| | $\delta_{N0}$ | [mm] | 1,5 | 1,5 | 1,4 | 1,3 |
| | $\delta_{N\infty}$ | [mm] | 2,3 | 2,2 | 2,0 | 2,0 |



**K-A-L-M bonded anchor VMK-SF**

**Performances**
Characteristic resistance under shear load - static and quasi-static loading
Design according to „EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C 2**