Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

# European Technical Assessment ETA-08/0231 of 26 May 2014

**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 VPK-SF |
| Product family to which the construction product belongs | Bonded anchor for use in non-cracked 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<br>DEUTSCHLAND |
| This European Technical Assessment contains | 11 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 | 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-08/0231 issued on 17 June 2013 |

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## Specific Part

### 1 Technical description of the product

The K-A-L-M bonded anchor VPK-SF is a bonded anchor consisting of a mortar capsule VPK-SF and a threaded anchor rod with hexagon nut and washer of sizes M8, M10, M12, M16, M20 and M24. The anchor rod (including nut and washer) is made of galvanised steel, hot-dip galvanised steel, stainless steel or made of high corrosion resistant steel.

The mortar capsule is placed in the hole and the anchor rod is driven by machine with simultaneous hammering and turning. The anchor rod is anchored via the bond between anchor rod, chemical 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 tension loads | See Annex C 1 |
| Characteristic resistance for shear loads | See Annex C 2 |
| Displacements under tension loads | See Annex C 1 |
| Displacements under shear loads | 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 determined (NPD) |

#### 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.

### 3.5 Protection against noise (BWR 5)

Not applicable.

### 3.6 Energy economy and heat retention (BWR 6)

Not applicable.

### 3.7 Sustainable use of natural resources (BWR 7)

The sustainable use of natural resources was not investigated.

### 3.8 General aspects

The verification of durability is part of testing the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

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

According to Decision of the Commission of 24 June 1996 (96/582/EC) (OJ L 254 of 08.10.96 p. 62-65), the system of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

| Product | Intended use | Level or class | System |
|---|---|---|---|
| Metal anchors for use in concrete (heavy-duty type) | For fixing and/or supporting concrete structural elements or heavy units such as cladding and suspended ceilings | — | 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.

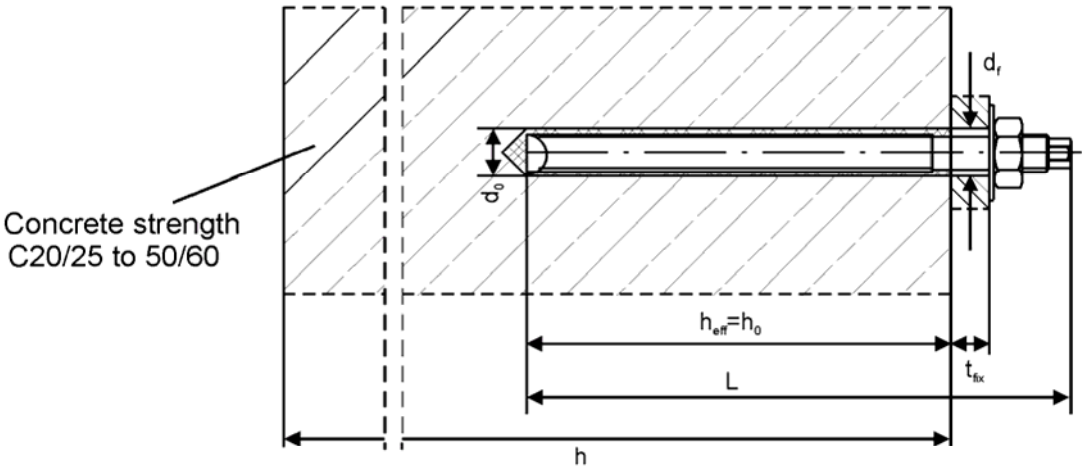
Issued in Berlin on 26 May 2014 by Deutsches Institut für Bautechnik

Dr.-Ing- Karsten Kathage
Vice President

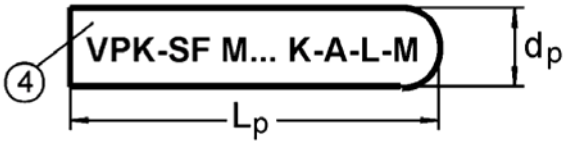
*Beglaubigt:*
Baderschneider

Deutsches Institut für Bautechnik

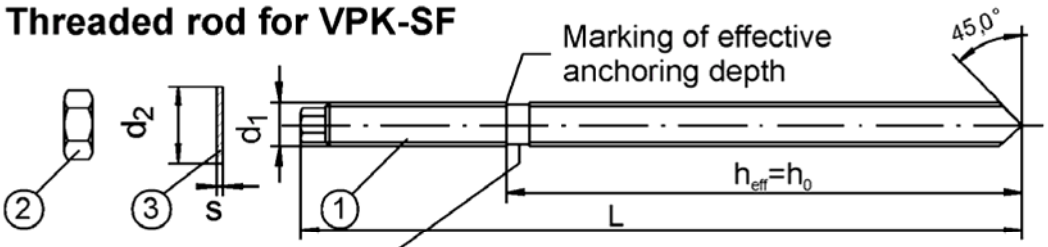
## Installation anchor

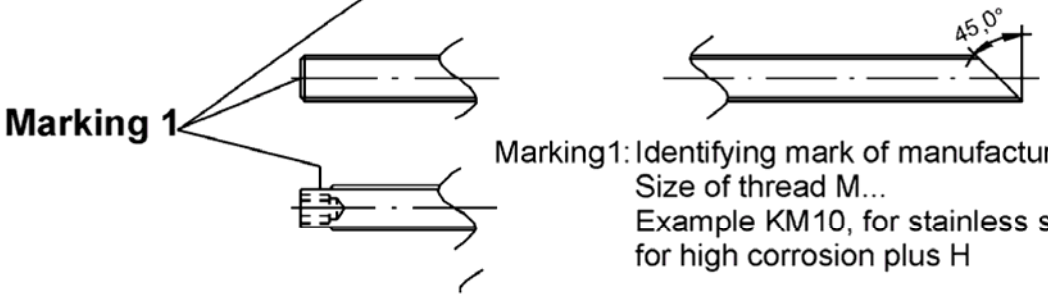



## Mortar Capsule



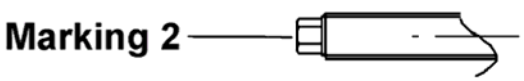

## Threaded rod for VPK-SF




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

For threaded rod without marking of the effective depth, the depth must be marked manual before use.

| K-A-L-M bonded anchor VPK-SF | Annex A 1 |
|---|---|
| **Product description**<br>Installed condition<br>Mortar Capsule, Threaded rod | |

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## Table A1: Dimensions

| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Threaded rod | Ø $d_1$ | [mm] | M8 | M10 | M12 | M16 | M20 | M24 |
| | L ≥ | [mm] | 90 | 100 | 120 | 140 | 190 | 235 |
| | $h_{eff}$ | [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Mortar Capsule | $d_p$ | [mm] | 9 | 10,5 | 12,5 | 16,5 | 23 | 23 |
| | $L_p$ | | 80 | 85 | 95 | 95 | 160 | 190 |

## Table A2: Materials

| Part | Designation | Material | |
|---|---|---|---|
| | | **Steel, zinc plated ≥ 5 µm plated acc. to EN ISO 4042:1999** | **Steel, hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461:2009** |
| 1 | Threaded rod | Steel DIN EN 10087:1998, DIN EN 10263:2001<br>Property class 5.8, acc. to EN 1993-1-8:2005+AC:2009 | |
| 2 | Hexagon nut<br>EN ISO 4032:2012 | Steel<br>Property class 8, acc. to EN ISO 898-2:2012 | |
| 3 | Washer<br>EN ISO 7089:2000<br>EN ISO 7093:2000<br>EN ISO 7094:2000 | Steel, galvanized | Steel, hot-dip galvanized |
| **Part** | **Designation** | **Material** | |
| | | **Stainless steel A4** | **High corrosion resistant steel (HCR)** |
| 1 | Threaded rod | Material 1.4401, 1.4404, 1.4571, 1.4578, EN 10088:2005,<br>Property class 70,<br>EN ISO 3506-1:2009 | Material 1.4529, 1.4565, EN 10088:2005,<br>Property class 70,<br>EN ISO 3506-1:2009 |
| 2 | Hexagon nut<br>EN ISO 4032:2012 | Material, 1.4401, 1.4404, 1.4571, EN 10088:2005,<br>Property class 70,<br>EN ISO 3506-2:2009 | Material 1.4529, 1.4565, EN 10088:2005,<br>Property class 70,<br>EN ISO 3506-2:2009 |
| 3 | Washer<br>EN ISO 7089:2000<br>EN ISO 7093:2000<br>EN ISO 7094:2000 | Material, 1.4401, 1.4404, 1.4571,<br>EN 10088:2005 | Material 1.4529, 1.4565,<br>EN 10088:2005 |
| **Part** | **Designation** | **Material** | |
| 4 | Mortar capsule | Glass, Quartz, Resin, Hardener | |

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## Specifications of intended use

**Anchorages subject to:**

- Static and quasi-static loads: all sizes.

**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.

**Temperature Range:**

- -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 are 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 are designed in accordance with ETAG 001, Annex C, design method A, Edition August 2010

**Installation:**

- Dry or wet concrete: all sizes.
- Flooded holes (not sea water): M12 to M24.
- Hole drilling by hammer drilling.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- The mortar capsule is placed into the drilled hole; connecting the anchor rod with the percussion drill by using a corresponding adapter; driving the anchor rod into the mortar capsule by simultaneous hammering and turning of the drill; if the anchorage depth is achieved the drill must stopped immediately by using some pressure; if the anchor is proper installed mortar must be visible at the member surface.



| K-A-L-M bonded anchor VPK-SF | Annex B 1 |
|---|---|
| **Intended Use**<br>Specifications | |

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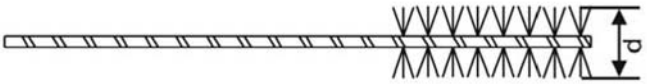
## Table B1: Installation parameters

| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Nominal diameter of drill hole | $d_0$ | [mm] | 10 | 12 | 14 | 18 | 25 | 28 |
| Cutting diameter of drill hole | $d_{cut}$ | [mm] | 10,45 | 12,45 | 14,5 | 18,5 | 25,5 | 28,5 |
| Depth of drill hole | $h_0$ | [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Effective embedment depth | $h_{eff}$ | [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Diameter of clearance hole in fixture | $d_f$ | [mm] | 9 | 12 | 14 | 18 | 22 | 26 |
| Installation torque | $T_{inst}$ | [Nm] | 10 | 20 | 40 | 60 | 120 | 150 |
| Minimum member thickness | $h_{min}$ | [mm] | 110 | 120 | 150 | 160 | 220 | 300 |
| Minimum edge distance | $c_{min}$ | [mm] | 60 | 70 | 85 | 95 | 130 | 160 |
| Minimum spacing | $s_{min}$ | [mm] | 60 | 70 | 85 | 95 | 130 | 160 |

### Cleaning Tools

#### Steel Brush




| Size | | M | 8 | 10 | 12 | 16 | 20 | 24 |
|---|---|---|---|---|---|---|---|---|
| Diameter of steel brush | d | [mm] | 12 | 14 | 16 | 20 | 27 | 30 |

#### Blow Pump ABK (Standard Cleaning)

#### Compressed Air (Premium Cleaning)

Use a conventional compressed air pump with a pressure ≥ 6bar

### Table B2: Minimum curing time

| Temperature in the anchorage base | Minimum curing time in dry concrete [min] | Minimum curing time in wet concrete [min] |
|---|---|---|
| -5°C to 0°C | 360 | 720 |
| 0°C to 5°C | 180 | 360 |
| 5°C to 10°C | 90 | 180 |
| 10°C to 20°C | 40 | 80 |
| > 20°C | 20 | 40 |



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

**Intended Use**
Installation parameters, Cleaning and Setting Tools
Minimum curing time

**Annex B 2**

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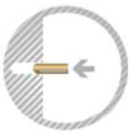
## Installation instructions

### Standard Cleaning

- Drill the hole.
  Blow out the dust with the blow pump ABK twice.


- Brush the drill hole twice with the steel brush DBK,
  again blow out the dust with the blow pump ABK twice.


- Check the capsule before using. The capsule can be used if it is undamaged and the resin is vicious. Insert the capsule into the drill hole.



- Drive the anchor stud into the drill hole with the help of a percussion drill. Notice the curing times. In case of a wet base material the curing time has to be doubled.

- Considering the curing times the nut can be tightened. Respect the torque moment.

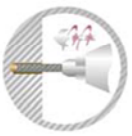
### Premium Cleaning

- Drill the hole.
  Blow out the dust with compressed air (>6 bar) twice.


- Brush the drill hole twice with the steel brush DBK,
  again blow out the dust with compressed air (>6 bar) twice.


- Check the capsule before using. The capsule can be used if it is undamaged and the resin is vicious. Insert the capsule into the drill hole.

- Drive the anchor stud into the drill hole with the help of a percussion drill. Notice the curing times. In case of a wet base material the curing time has to be doubled.



- Considering the curing times the nut can be tightened. Respect the torque moment.

For all installations the max setting time of 10 seconds should not be exceeded.

| | |
|---|---|
| **K-A-L-M bonded anchor VPK-SF** | **Annex B 3** |
| **Intended Use**<br>Installation instructions | |

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## Table C1: Characteristic values of resistance under tension loads

| anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **Steel failure** | | | | | | | | |
| Characteristic resistance, Steel property class 5.8 | $N_{Rk,s}$ | [kN] | 17 | 26 | 38 | 72 | 114 | 165 |
| Characteristic resistance, Steel property class 70 | $N_{Rk,s}$ | [kN] | 23 | 34 | 52 | 97 | 153 | 222 |
| **Combined pull-out and concrete cone failure** | | | | | | | | |
| Characteristic resistance in non-cracked concrete 50/80°C Standard Cleaning | $N_{Rk,p}$ | [kN] | 9 | 12 | 16 | 25 | 40 | 60 |
| Characteristic resistance in non-cracked concrete 50/80°C Premium Cleaning | $N_{Rk,p}$ | [kN] | 12 | 16 | 25 | 35 | 60 | 75 |
| Increasing factors for concrete $\psi_c$ | C 30/37 | | 1,08 | | | | | |
| | C 40/50 | | 1,15 | | | | | |
| | C 50/60 | | 1,19 | | | | | |
| **Splitting failure** | | | | | | | | |
| edge distance | $c_{cr,Sp}$ | [mm] | 120 | 135 | 165 | 190 | 255 | 315 |
| spacing | $s_{cr,Sp}$ | [mm] | 240 | 270 | 330 | 380 | 510 | 630 |
| Installation safety factor in dry and wet concrete | $\gamma_2$ | [-] | 1,2 | | | | | |
| Installation safety factor in flooded holes | $\gamma_2$ | [-] | - | | 1,2 | | | |

## Table C2: Displacements under tension loads

| anchor size | | | M 8 | M 10 | M 12 | M 16 | M 20 | M 24 |
|---|---|---|---|---|---|---|---|---|
| Displacement | $\delta_{N0}$ | [mm] | 0,1 | 0,1 | 0,1 | 0,2 | 0,3 | 0,3 |
| Displacement | $\delta_{N\infty}$ | [mm] | 1,1 | 1,1 | 1,1 | 2,2 | 3,3 | 3,3 |



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

**Annex C 1**

**Performances**
Characteristic values of resistance under tension loads
Displacements under tension loads

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## Table C3: Characteristic values of resistance under shear loads

| anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **Steel failure without lever arm** | | | | | | | | |
| Characteristic resistance, Steel property class 5.8 | $V^0_{Rk,s}$ | [kN] | 8 | 13 | 19 | 36 | 57 | 83 |
| Characteristic resistance, Steel property class 70 | $V^0_{Rk,s}$ | [kN] | 11 | 17 | 26 | 49 | 77 | 111 |
| **Steel failure with lever arm** | | | | | | | | |
| Characteristic bending moment, Steel property class 5.8 | $M^0_{Rk,s}$ | [Nm] | 16 | 30 | 56 | 144 | 285 | 498 |
| Characteristic bending moment, Steel property class 70 | $M^0_{Rk,s}$ | [Nm] | 22 | 41 | 75 | 194 | 384 | 670 |
| **Concrete pry-out failure** | | | | | | | | |
| Factor k in equation (5.6) of ETAG 001, Annex C, section 5.2.3.3 | | | 2,0 | | | | | |
| Installation safety factor | $\gamma_2$ | [-] | 1,0 | | | | | |
| **Concrete edge failure** | | | | | | | | |
| effective length of anchor in shear loading | $l_f$ | [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| outside diameter of anchor | $d_{nom}$ | [mm] | 10 | 12 | 14 | 18 | 25 | 28 |
| Installation safety factor | $\gamma_2$ | [-] | 1,0 | | | | | |

## Table C4: Displacements under shear loads

| anchor size | | | M 8 | M 10 | M 12 | M 16 | M 20 | M 24 |
|---|---|---|---|---|---|---|---|---|
| Displacement | $\delta_{V0}$ | [mm] | 1,5 | 1,6 | 1,8 | 2,0 | 2,5 | 3,0 |
| Displacement | $\delta_{V\infty}$ | [mm] | 2,3 | 2,4 | 2,7 | 3,0 | 3,8 | 4,5 |