



## European Technical Approval ETA-05/0241

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung  
*Trade name*

KALM Keilanker KDK, KDK-E, KDK-H  
*KALM Wedge Anchor KDK, KDK-E, KDK-H*

Zulassungsinhaber  
*Holder of approval*

KALM  
Befestigungssysteme GmbH  
Marie-Curie-Straße 5  
67661 Kaiserslautern  
DEUTSCHLAND

Zulassungsgegenstand  
und Verwendungszweck  
*Generic type and use  
of construction product*

Kraftkontrolliert spreizender Dübel in den Größen M8, M10, M12 und  
M16 zur Verankerung im Beton  
*Torque controlled expansion anchor of sizes M8, M10, M12 and M16  
for use in concrete*

Geltungsdauer:  
*Validity:* vom  
*from*  
bis  
*to*

23 April 2012  
13 September 2015

Herstellwerk  
*Manufacturing plant*

KALM  
Befestigungssysteme GmbH  
Marie-Curie-Straße 5  
67661 Kaiserslautern  
DEUTSCHLAND

Diese Zulassung umfasst  
*This Approval contains*

13 Seiten einschließlich 6 Anhänge  
*13 pages including 6 annexes*

Diese Zulassung ersetzt  
*This Approval replaces*

ETA-05/0241 mit Geltungsdauer vom 13.09.2010 bis 13.09.2015  
*ETA-05/0241 with validity from 13.09.2010 to 13.09.2015*

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by law of 31 October 2006<sup>5</sup>;*
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - Guideline for European technical approval of "Metal anchors for use in concrete - Part 2: Torque controlled expansion anchors", ETAG 001-02.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12  
<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1  
<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25  
<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812  
<sup>5</sup> *Bundesgesetzblatt Teil I 2006*, p. 2407, 2416  
<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of product and intended use

#### 1.1 Definition of the construction product

The KALM Wedge Anchor KDK, KDK-E and KDK-H in the sizes M8, M10, M12 and M16 is an anchor made of galvanised steel (Version KDK), stainless steel (Version KDK-E) and high corrosion resistant steel (Version KDK-H) which is placed into a drilled hole and anchored by torque-controlled expansion.

An illustration of the product and intended use is given in Annex 1.

#### 1.2 Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106 EEC shall be fulfilled and failure of anchorages made with these products would cause risk to human life and/or lead to considerable economic consequences.

The anchor may be used for anchorages with requirements related to resistance to fire.

The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C20/25 at minimum and C50/60 at most according to EN 206:2000-12.

It may be used in cracked and non-cracked concrete.

##### KALM Wedge Anchor KDK (galvanised steel):

The anchor made of galvanised steel may only be used in structures subject to dry internal conditions.

##### KALM Wedge Anchor KDK-E (stainless steel 1.4401, 1.4404, 1.4571):

The anchor made of stainless steel may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist. Such 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).

##### KALM Wedge Anchor KDK-H (high corrosion resistant steel 1.4529):

The anchor made of high corrosion resistant steel may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions. Such 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 chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

The provisions made in this European Technical Approval are based on an assumed working life of the anchor of 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.

## 2 Characteristics of the product and methods of verification

### 2.1 Characteristics of the product

The anchor corresponds to the drawings and provisions given in Annex 2. The characteristic material values, dimensions and tolerances of the anchor not given in Annex 2 shall correspond to the respective values laid down in the technical documentation<sup>7</sup> of this European Technical Approval.

The characteristic values for the design of anchorages are given in Annexes 4 and 5.

The characteristic values for the design of anchorages regarding resistance to fire are given in Annexe 6. They are valid for use in a system that is required to provide a specific fire resistance class.

Each anchor is marked according to Annex 2 with the identifying mark of the manufacturing plant (including the trade name), the anchor size and the maximum thickness of fixture as well as an additional marking "E" for stainless steel or "H" for high corrosion resistant steel respectively.

The anchor shall only be packaged and supplied as a complete unit.

### 2.2 Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the "Guideline for European Technical Approval of Metal Anchors for Use in Concrete", Part 1 "Anchors in general" and Part 2 "Torque-controlled expansion anchors", on the basis of Option 1.

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

## 3 Evaluation and attestation of conformity and CE marking

### 3.1 System of attestation of conformity

According to the decision 96/582/EG of the European Commission<sup>8</sup> the system 2(i) (referred to as system 1) of attestation of conformity applies.

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

- (a) Tasks for the manufacturer:
  - (1) factory production control;
  - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;

<sup>7</sup> The technical documentation of this European Technical Approval is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

<sup>8</sup> Official Journal of the European Communities L 254 of 08.10.1996.

- (b) Tasks for the approved body:
- (3) initial type-testing of the product;
  - (4) initial inspection of factory and of factory production control;
  - (5) continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

## 3.2 Responsibilities

### 3.2.1 Tasks of the manufacturer

#### 3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European Technical Approval.

The manufacturer may only use initial/raw/constituent materials stated in the technical documentation of this European Technical Approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European Technical Approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik<sup>9</sup>.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

#### 3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European Technical Approval.

### 3.2.2 Tasks of approved bodies

The approved body shall perform the

- initial type-testing of the product ,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European Technical Approval.

In cases where the provisions of the European Technical Approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

<sup>9</sup>

The control plan is a confidential part of the documentation of the European Technical Approval, but not published together with the ETA and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

### 3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European Technical Approval,
- the number of the guideline for European Technical Approval
- use category (ETAG 001-1, Option 1),
- size.

## 4 Assumptions under which the fitness of the product for the intended use was favourably assessed

### 4.1 Manufacturing

The European Technical Approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

### 4.2 Design of anchorages

The fitness of the anchor for the intended use is given under the following conditions:

The anchorages are designed in accordance with the "Guideline for European Technical Approval of Metal Anchors for Use in Concrete", Annex C, Method A, for torque controlled expansion anchors under the responsibility of an engineer experienced in anchorages and concrete work.

Verifiable calculation notes and drawings are 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).

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The relevant characteristic anchor values are given in Annexe 6. The design method covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only, if the edge distance of the anchor is  $c \geq 300$  mm.

Local spalling is possible at fire attack. To avoid any influence of the spalling on the anchorage, the concrete member must be designed according to prEN 1992-1-2. The members shall be made of concrete with quartzite additives and have to be protected from direct moisture; and the moisture content of the concrete has to be like in dry internal conditions respectively. The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value in the approval.

#### 4.3 Installation of anchors

The fitness for use of the anchor can only be assumed if the anchor is installed as follows:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site,
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor,
- Anchor installation in accordance with the manufacturer's specifications and drawings and using the appropriate tools,
- Checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply,
- Check of concrete being well compacted, e.g. without significant voids,
- Edge distances and spacing not less than the specified values without minus tolerances,
- Positioning of the drill holes without damaging the reinforcement,
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application,
- Cleaning of the hole of drilling dust in accordance with Annex 3,
- Anchor installation such that the effective anchorage depth is complied with. This compliance is ensured if the embedment mark of the anchor does no more exceed the concrete surface,
- Application of the torque moment given in Annex 3 using a calibrated torque wrench.

#### 5 Responsibility of the manufacturer

The manufacturer is responsible to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to as well as sections 4.2 and 4.3 is given to those who are concerned. This information may be made by reproduction of the respective parts of the European Technical Approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

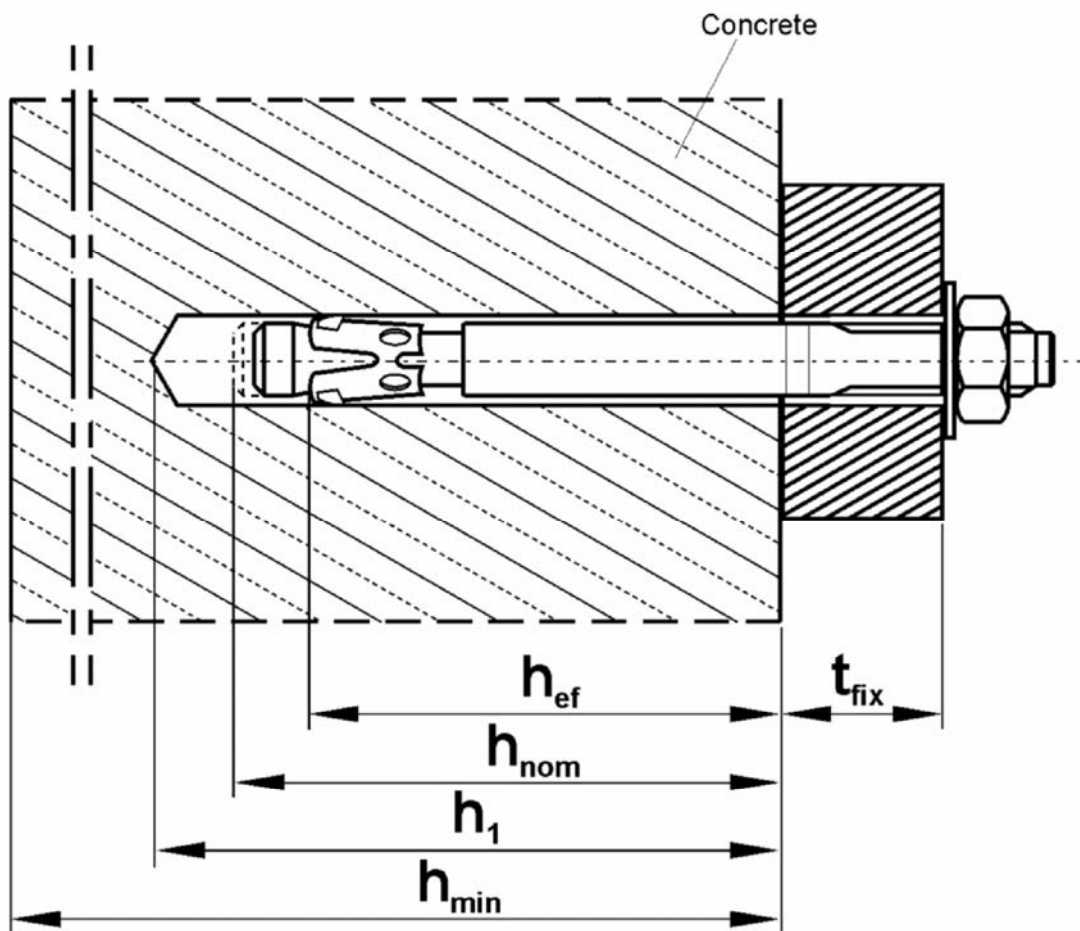
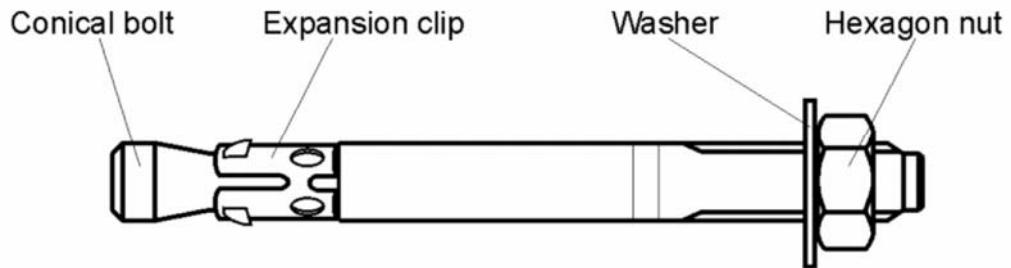
The minimum data required are:

- Diameter of drill bit,
- Thread diameter,
- Maximum thickness of the fixture,
- Minimum effective anchorage depth,
- Minimum hole depth,
- Torque moment,
- Information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- Reference to any special installation equipment needed,
- Identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

Georg Feistel  
Head of Department

*beglaubigt:*  
Tempel

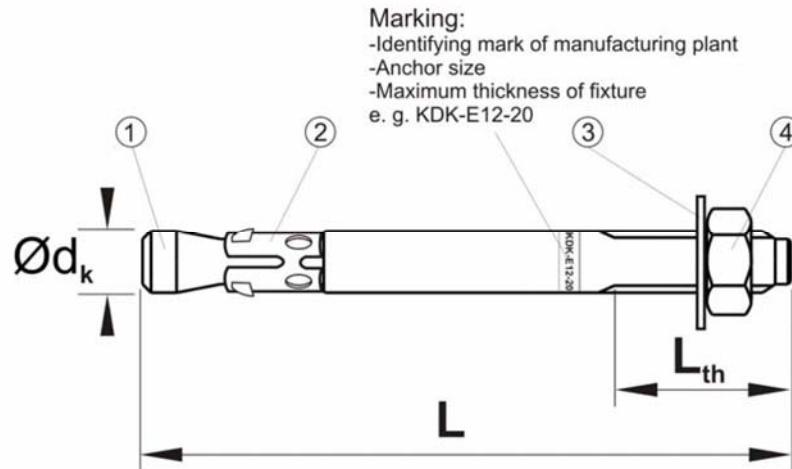


KALM Wedge Anchor KDK, KDK-E, KDK-H

Product and intended use

Annex 1





**Table 1: Designations and Materials**

Part	Designation	Material
<b>Version KDK – steel galvanized <math>\geq 5\mu\text{m}</math> EN ISO 4042</b>		
1	Conical bolt	machined steel 46S20 EN 10277-3
2	Expansion clip	steel EN 10149-2
3	washer (EN ISO 7089)	steel EN 10025-2
4	nut (EN ISO 4032)	strength class 8 EN 20 898-2
<b>Version KDK-E – stainless steel</b>		
1	Conical bolt	stainless steel 1.4401; 1.4404; 1.4571 EN 10088; strength class 70 EN ISO 3506-1
2	Expansion clip	stainless steel 1.4401; 1.4404; 1.4571 EN 10088;
3	washer (EN ISO 7089)	stainless steel 1.4401; 1.4404; 1.4571 EN 10088;
4	nut (EN ISO 4032)	stainless steel 1.4401; 1.4404; 1.4571 EN 10088; strength class 70 EN ISO 3506-2
<b>Version KDK-H – high corrosion resistant steel</b>		
1	Conical bolt	stainless steel 1.4529; EN 10088; strength class 70 EN ISO 3506-1
2	Expansion clip	stainless steel 1.4401; 1.4404; 1.4571 EN 10088;
3	washer (EN ISO 7089)	stainless steel 1.4529; EN 10088
4	nut (EN ISO 4032)	stainless steel 1.4529; EN 10088; strength class 70 EN ISO 3506-2

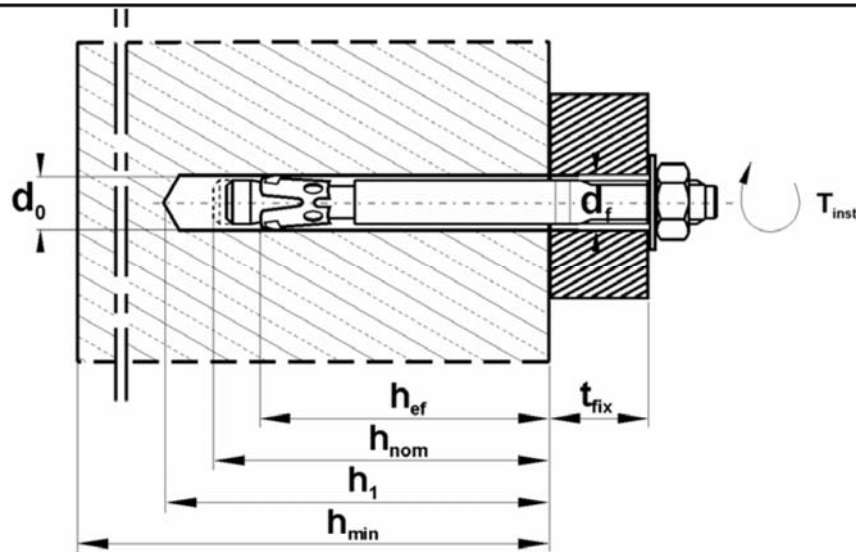
**Table 2: Dimensions**

Anchor size	L [mm]		Thread		$\varnothing d_k$
	min.	max.	Size	$L_{th}$	
M8	65	350	M8	25-120	8
M10	70	410	M10	30-120	10
M12	95	555	M12	35-120	12
M16	115	515	M16	40-120	16

KALM Wedge Anchor KDK, KDK-E, KDK-H

Designation, materials and dimensions of anchors

Annex 2



**Table 3: Installation data**

Anchor size			M8	M10	M12	M16
Nominal drill hole diameter	$d_0 =$	mm	8	10	12	16
Cutting diameter of drill bit	$d_{cut} \leq$	mm	8,45	10,45	12,5	16,5
Depth of drill hole	$h_1 \geq$	mm	65	70	90	110
Anchor embedment depth	$h_{nom}$	mm	55	60	80	100
Effective anchorage depth	$h_{ef}$	mm	45	50	65	80
Thickness of the fixture	$t_{fix}$	mm	1-285	1-340	1-460	1-400
Diameter of clearance hole in the fixture	$d_r \leq$	mm	9	12	14	18
Torque moment for non-cracked concrete	$T_{inst} =$	Nm	15	30	50	100
Torque moment for cracked concrete	$T_{inst} =$	Nm	20	40	65	130

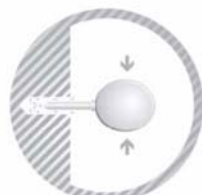
**Table 4: Minimum thickness of concrete member, minimum spacing and minimum edge distances**

Anchor size			M8	M10	M12	M16
Minimum member thickness	$h_{min}$	mm	100	100	120	160
Minimum spacing	$s_{min}$	mm	50	55	100	90
Minimum edge distance	$c_{min}$	mm	60	100	150	110

### Installation instructions



drilling



blowing



setting anchor



fastening  
fixture

KALM Wedge Anchor KDK, KDK-E, KDK-H

Installation data and installation instructions

Annex 3

**Table 5: Design method A, Characteristic values for tension loads**

Anchor size			M8	M10	M12	M16
<b>Steel failure – Version KDK</b>						
Characteristic resistance	$N_{Rk,S}$	[kN]	18	29	39	73
Partial safety factor	$\gamma_{Ms}^{1)}$		1,43		1,45	
<b>Steel failure – Version KDK-E / KDK-H</b>						
Characteristic resistance	$N_{Rk,S}$	[kN]	17	28	40	74
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,87			
<b>Pullout failure</b>						
Characteristic resistance in $N_{Rk,p}$ cracked concrete	C20/25	[kN]	3	6	7,5	12
Characteristic resistance in $N_{Rk,p}$ in non-cracked concrete	C20/25	[kN]	9	12	16	20
Partial safety factor	$\gamma_{Mp}^{1)}$	[-]	1,8 <sup>2)</sup>			
Increasing factors for $N_{Rk,p}$ for Cracked and non-cracked concrete	$\psi_c$	[-]	1,22			
	C30/37		1,41			
	C40/50		1,55			
	C50/60					
<b>Concrete cone and splitting failure</b>						
Effective anchorage depth	$h_{ef}$	[mm]	45	50	65	80
Spacing	$s_{cr,N}$	[mm]	3 x $h_{ef}$			
	$s_{cr,sp}$	[mm]	220	240	320	400
Edge distance	$c_{cr,N}$	[mm]	1,5 x $h_{ef}$			
	$c_{cr,sp}$	[mm]	110	120	160	200
Partial safety factor	$\gamma_{Mc} = \gamma_{MSp}^{1)}$	[-]	1,8 <sup>2)</sup>			

**Table 6: Displacements under tension loads**

Anchor size			M8	M10	M12	M16
Tension load in non-cracked concrete	N	[kN]	1,6	3,0	3,6	6,3
Displacements	$\delta_{N0}$	[mm]	0,4	0,5	0,7	0,7
	$\delta_{N\infty}$	[mm]	0,5	1,0	1,5	1,4

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

<sup>2)</sup> The installation safety factor  $\gamma_2 = 1,2$  is included

KALM Wedge Anchor KDK, KDK-E, KDK-H

Design method A, characteristic values for shear loads and displacements

Annex 4

**Table 7: Design method A, Characteristic values for shear loads**

Anchor size			M8	M10	M12	M16
<b>Steel failure without lever arm – Version KDK</b>						
Characteristic resistance	$V_{Rk,s}$	[kN]	7	15	20	36
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,5			
<b>Steel failure without lever arm – Version KDK-E / KDK-H</b>						
Characteristic resistance	$V_{Rk,s}$	[kN]	8	14	20	37
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,56			
<b>Steel failure with lever arm – Version KDK</b>						
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	28	55	90	229
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,5			
<b>Steel failure with lever arm – Version KDK-E / KDK-H</b>						
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	26	52	92	233
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,56			
<b>Concrete pryout failure</b>						
Faktor k in equation (5.6) of ETAG 001, Annex C, section 5.2.3.3	k	[-]	1,0		2,0	
Partial safety factor	$\gamma_{Mcp}^{1)}$	[-]	1,5 <sup>2)</sup>			
<b>Concrete edge failure</b>						
Effective length of anchor in shear loading	$l_f$	[mm]	45	50	65	80
Effective outside diameter of anchor	$d_{nom}$	[mm]	8	10	12	16
Partial safety factor	$\gamma_{Mc}$	[-]	1,5 <sup>2)</sup>			

**Table 8: Displacements under shear loads**

Anchor size			M8	M10	M12	M16
Shear load in non-cracked concrete	V	[kN]	3,2	7,0	9,3	17,4
Displacement	$\delta_{v0}$	[mm]	0,8	1,3	1,5	3,1
	$\delta_{v\infty}$	[mm]	1,2	2,0	2,3	4,7

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

<sup>2)</sup> The partial safety factor  $\gamma_2 = 1,0$  is included

KALM Wedge Anchor KDK, KDK-E, KDK-H

Design method A, characteristic values for shear loads and displacements

Annex 5

**Table 9: Characteristic values to tension loads under fire exposure  
in cracked and non-cracked concrete C20/25 to C50/60**

Type of anchor/size	KDK gvz, KDK-E, KDK-H															
	M8				M10				M12				M16			
Fire resistance duration R... [min]	30	60	90	120	30	60	90	120	30	60	90	120	30	60	90	120
<b>Steel failure</b>																
Characteristic resistance N <sub>Rk,s,fi</sub> [kN]	0,2	0,2	0,2	0,1	0,6	0,5	0,4	0,3	1,1	0,8	0,7	0,6	2,1	1,6	1,4	1,0
<b>Pullout failure</b>																
Characteristic resistance in concrete C20/25 to C50/60 N <sub>Rk,p,fi</sub> [kN]	1,0			0,8	1,5			1,2	2,3			1,8	3,0			2,4
<b>Concrete cone failure</b>																
Characteristic resistance in concrete C20/25 to C50/60 N <sup>0</sup> <sub>Rk,c,fi</sub> [kN]	2,4			1,9	3,1			2,5	6,0			4,8	10,2			8,1
Spacing S <sub>cr,N,fi</sub> [mm]	4 x h <sub>ef</sub>															
Edge distance C <sub>cr,N,fi</sub> [mm]	2 x h <sub>ef</sub>															
If fire attack is from more than one side, the edge distance of the anchor has to be ≥300mm.																

In absence of other national regulations the partial safety factor for resistance under fire exposure  $\gamma_{M,fi} = 1,0$  is recommended.

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Characteristic values under fire exposure

Annex 6