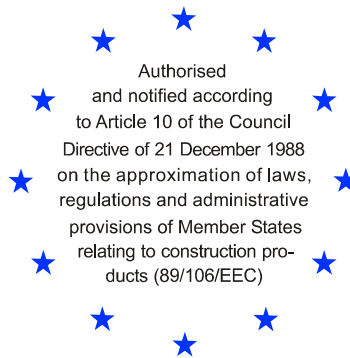


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# DIBt

Mitglied der EOTA  
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## European Technical Approval ETA-05/0198

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	KEIL Hinterschnittanker KH <i>KEIL undercut anchor KH</i>
Zulassungsinhaber <i>Holder of approval</i>	MIRAGE GRANITO CERAMICO S.p.a. Via P. Giardini Nord 225 41026 Pavullo (MO) ITALIEN
Zulassungsgegenstand und Verwendungszweck  <i>Generic type and use of construction product</i>	Spezialdübel zur rückseitigen Befestigung von Fassadenplatten aus trockengepressten keramischen Platten (Feinsteinzeug) "Granito Ceramico" nach EN 14411  <i>Special anchor for the fixing of façade plates from their back side made of dust-pressed ceramic plates (stoneware) "Granito Ceramico" according to EN 14411</i>
Geltungsdauer: <i>Validity:</i>	vom <i>from</i> 15 August 2005 bis <i>to</i> 15 August 2010
Herstellwerk <i>Manufacturing plant</i>	Herstellwerk 1

Diese Zulassung umfasst  
*This Approval contains*

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



Europäische Organisation für Technische Zulassungen  
European Organisation for Technical Approvals

## **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>, zuletzt geändert durch Gesetz vom 06.01.2004<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>.
- 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 in EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities N° L 40, 11.2.1989, p. 12  
2 Official Journal of the European Communities N° L 220, 30.8.1993, p. 1  
3 Official Journal of the European Union N° L 284, 31.10.2003, p. 25  
4 Bundesgesetzblatt I, p. 812  
5 Bundesgesetzblatt I, p.2, 15  
6 Official Journal of the European Communities N° L 17, 20.1.1994, p. 34

## **II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL**

### **1 Definition of the product and intended use**

#### **1.1 Definition of the product**

The "KEIL undercut anchor KH" is a special anchor consisting of a crosswise slotted anchor sleeve with an M6 internal thread, at the upper edge of which a hexagon is formed to it and a respective hexagon bolt with a tooth lock washer formed to it. The anchor sleeve and the hexagon bolt with a tooth lock washer formed to it are made of stainless steel. The anchor is put into an undercut drill hole and by driving-in the screw it is placed form-fitted and deformation-controlled.

For the installed anchor see figure in Annex 1.

#### **1.2 Intended use**

The anchor may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure (including industrial and marine environment), 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 desulphurisation plants or road tunnels where de-icing materials are used).

The "KEIL undercut anchor KH" may be used for the fixing of façade plates from their back side made of dust-pressed ceramic plates (stoneware) "Granito Ceramico" according to EN 14411:2003. The façade plates shall correspond to EN 14411 – "Ceramic tiles", Annex G with a low water absorption  $E \leq 0,5 \%$  – and to the drawings and specifications of the annexes. Deviating from EN 14411 the characteristic bending strength shall be at least 45 N/mm<sup>2</sup>.

The façade plates with fixing from their back side by the anchor may only be used for front curtain walls, ventilated at rear. Each façade plate shall be fixed technically strain-free with four anchors in a rectangular arrangement via individual agraffes on a capable substructure.

The provisions made in this European Technical Approval are based on an assumed working life of the 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 method of verification**

#### **2.1 Characteristics of the product**

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

The anchor is considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that decision.

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<sup>7</sup> The technical documentation comprises all information necessary for the production, installation and maintenance of the anchor; these are in particular the design drawings and the installation instructions. The part to be treated confidentially is deposited with Deutsches Institut für Bautechnik and, as far as this is relevant to the tasks of the approved bodies involved in the procedure of attestation of conformity, shall only be handed over to the approved body.

According to the manufacturer's declaration, taking account of the EU database<sup>8</sup>, the anchor does not contain any dangerous substances.

Note: 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.

The admissible values for the design of the façade plates with fixing from their back side by the anchor are given in Annex 3.

Each anchor shall be marked with the identifying mark of the producer according to Annex 2.

The Anchor shall only be packaged and supplied as a complete unit (anchor sleeve and screw).

## **2.2 Methods of verification**

The assessment of fitness of the anchor for the intended use in relation to the requirement for safety in use in the sense of the Essential Requirements 4 has been made based on the following test carried out:

- (1) Axial tension tests
- (2) Shear tests
- (3) Tests with combined tension and shear loading
- (4) Tests on structural members
- (5) Tests on functioning under repeated loads
- (6) Tests on functioning under sustained loads
- (7) Tests on functioning under freeze/thaw conditions (25 freeze/thaw cycles; Option 1)
- (8) Tests on functioning after immersion in water

## **3 Evaluation and attestation of conformity and CE marking**

### **3.1 System of attestation of conformity**

According to the communication of the European Commission<sup>9</sup> the system 2 (ii)-1 (referred to as System 2+) of attestation of conformity applies.

These systems of attestation of conformity are defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
  - (1) initial type-testing of the product;
  - (2) factory production control;
  - (3) testing of samples taken at the factory in accordance with a prescribed test plan.
- (b) Tasks for the approved body:
  - (4) certification of factory production control on the basis of:
    - initial inspection of factory and of factory production control;
    - continuous surveillance, assessment and approval of factory production control.

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<sup>8</sup> Notes are stated in Guidance Paper H: "A harmonized approach relating to dangerous substances under the Construction Products Directive", Brussels, 18 February 2000.

<sup>9</sup> Letter of the European Commission of 22/07/2002 to EOTA

## **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 materials and components stated in the technical documentation of this European Technical Approval.

The factory production control shall be in accordance with the "Control Plan"<sup>10</sup> 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 the Deutsches Institut für Bautechnik.

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 3.3. 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 the European Technical Approval ETA - 05/0198 issued on 15 August 2005.

### **3.2.2 Tasks of approved bodies**

The approved body shall perform the following tasks in accordance with the provisions laid down in the "Control Plan":

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

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 factory production control 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 the Deutsches Institut für Bautechnik without delay.

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<sup>10</sup> The "Control Plan" is a confidential part of the European technical approval 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 or on the accompanying commercial documents (e.g. the EC declaration of conformity). The CE marking consists of the initials "CE" followed by the identification number of the certification body. In addition the following information shall be given:

- identification of the anchor (trade name)
- name or identifying mark of producer and manufacturing plant;
- the last two digits of the year in which the CE marking was affixed;
- the number of the EC certificate for the factory production control;
- number of the European Technical Approval;
- use category (Option 1)
- size.

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

### **4.1 Manufacturing**

The anchor is manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as identified in the inspection of the plant by the Deutsches Institut für Bautechnik and the approved body and laid down in the technical documentation.

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 Installation**

#### **4.2.1 Design of the fixings**

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

- The fixing of the façade plates as well as the substructure including its connecting to wall brackets and their anchorage on the construction works are designed under the responsibility of an engineer experienced in façade work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be fixed and anchored. The position of the anchor is indicated on the design drawings.
- Each façade plate is fixed with four anchors in a rectangular arrangement via individual agraffes on a substructure. The substructure is constructed such that the façade plates are fixed technically strain-free via three sliding points (horizontal/vertical movable) and a defined fixed point (horizontal/vertical fixed) (see Annex 3). Two fixing points of the façade plate are designed such that they are able to carry the dead load of the façade plate. The fixing points of a façade plate being horizontally at the same level are arranged at one and the same load-bearing profile. The load-bearing profiles are arranged symmetrically. The arrangement of the agraffes ensures a symmetric introduction of the load into the substructure.
- The façade panels are stored according to manufacturer's specifications. They are protected from being damaged during transport and storage on site. The manufacturing plant is stated on the façade panels.
- The façade plates are not used for the transmission of impact loads.

- Reveal plates are fastened to the sub-structure led around the corner just like plates in the boundary region.
- The sufficient load-bearing capacity of the substructure including its connection and anchorages is verified.
- Joint construction between the façade plates is made by a joint filler profile or is remained open. Ensuring that additional stresses (e.g. by temperature) do not lead to any extra considerable loads.

The proof of stability for the façade plate and the anchor fastening is furnished by observing the conditions listed below:

- The façade plates are correspond to EN 14411 – "Ceramic tiles", Annex G with a low water absorption  $E \leq 0,5 \%$  – and to the drawings and specifications of the annexes. Deviating from EN 14411 the bending strength is at least  $45 \text{ N/mm}^2$ . The following data are on hand for each construction project:
  - a) Verification and testing of the properties required pursuant to EN 14411, for the taking of samples EN ISO 10 545-1 applies
  - b) Deviating from EN ISO 10 545-1, section 5, the following verifications are produced separately for each construction project and per  $2000 \text{ m}^2$  of façade surface on at least 10 samples independent of the scope of delivery:
    - Checking the bending strength according to EN ISO 10 545-4. Deviating from EN ISO 10 545-4 the dimension of the test specimen is  $l/b = 400/200 \text{ mm}$  and the support span is  $l_s = 300 \text{ mm}$ . The 5%-fractile (confidence level 75 % and an unknown standard deviation of the population) of the failure values is  $\geq 45 \text{ N/mm}^2$ .
    - Checking the pull-out load by axial tension tests on test specimens with dimensions of  $l/b = 200/200 \text{ mm}$  and support  $\varnothing = 135 \text{ mm}$ . The 5%-fractile (confidence level 75 % and an unknown standard deviation of the population) of the failure loads is  $\geq 1,20 \text{ kN}$ .
    - Checking the dimensions.
- The characteristic values of the anchor, the edge distances and dimensions of the façade plates according to Annex 3 are kept.
- The effective wind load does not exceed the values given in Annex 3, Table 2.
- The dimensions, cross section properties and materials of the agraffes as well as the vertical and horizontal load-bearing profiles correspond to or are equivalent to the drawings and specifications given in Annex 6. The deflection of the substructure is limited to  $l/300$ .
- Depending on the admissible wind load the standard distance of the vertical profiles amounts to:

admissible wind load <b>w</b> [kN/m <sup>2</sup> ]	standard distance of vertical sections <b>a</b> [mm]
$w \leq 1.1$	1200
$1.1 < w \leq 2.2$	600

#### 4.2.2 Installation of the anchors

The fitness for use of the anchor can be assumed only, if the following installation conditions are observed:

- 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 using the tools indicated in the technical documentation of this European Technical Approval.

- Keeping of the embedment depth.
- Keeping of the edge distance and spacing to the specified values without minus tolerances.
- Making of the undercut drillings on the back side of the façade plates at the factory or with the transportable drilling equipment of the company KEIL under workshop conditions on site using the KEIL façade drill according to Annex 4 and a special drilling equipment corresponding to the information deposited with Deutsches Institut für Bautechnik. The execution is supervised by the responsible project supervisor or a skilled representative of the project supervisor. The drillings are removed from the drill hole. The nominal diameter of the drill corresponds to the values of Annex 4.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole.
- Placing an elastic sandwich layer between agraffe and façade plate (see Annex 1).
- Fixing the screw with a torque moment  $2.5 \text{ Nm} \leq T_{\text{inst}} \leq 4.0 \text{ Nm}$  using a calibrated torque wrench.
- Checking on 1 % of all drillings the geometry of the drill hole. Thereby controlling and documenting the following dimensions corresponding to manufacturer's information and checking instructions by means of a measuring device according to Annex 4:
  - volume of the undercut drill hole
  - depth position of the undercut. The distance between the lower edge of the measuring device and the façade plate (see Annex 5) is between 0 and 0.3 mm.
- Installation of the façade only by skilled personnel and compliance with the laying instructions of the manufacturer.

## 5 Indications to the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to and 4.2.1 and 4.2.2 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:

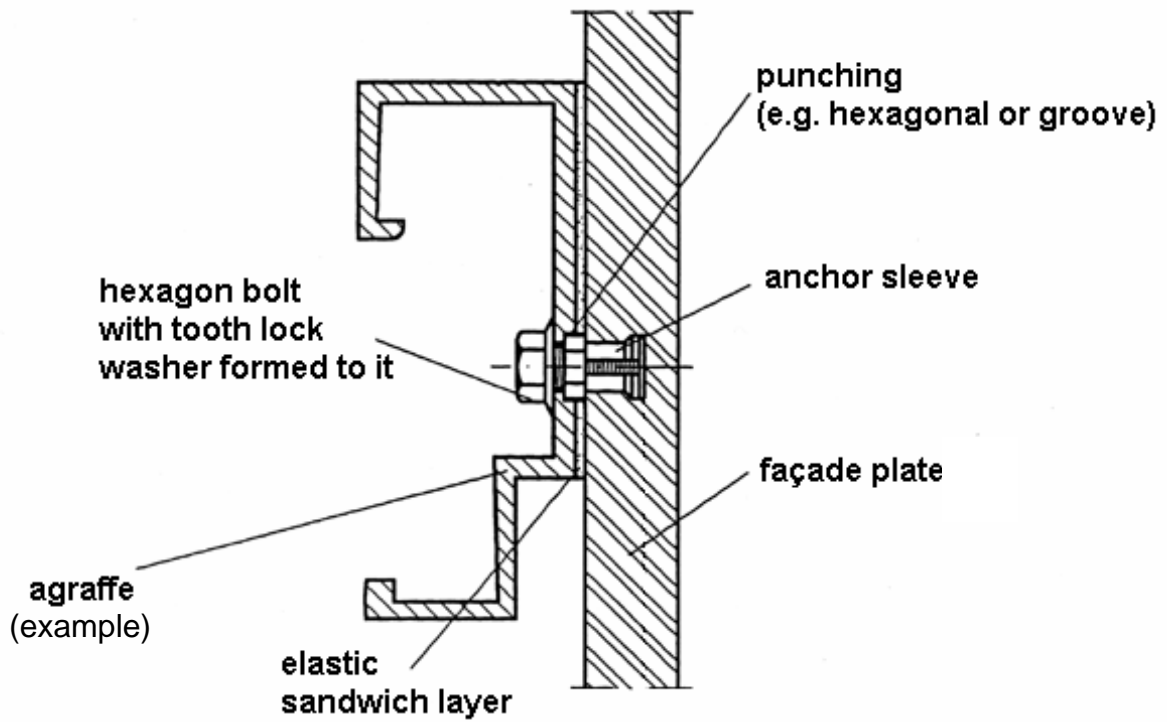
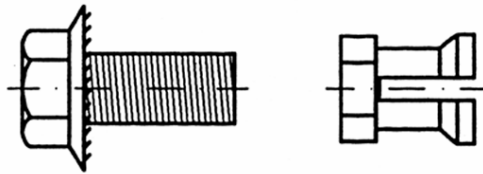
- embedment depth;
- thickness of the joint structure;

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

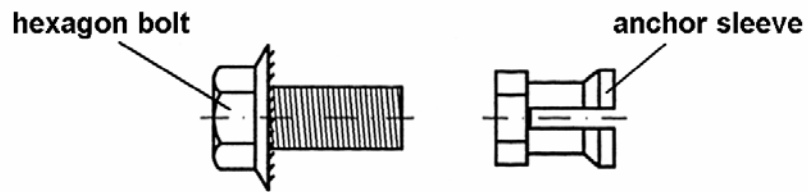
Dipl.-Ing. Erich Jasch

*Beglaubigt:*  
Andreas Kummerow





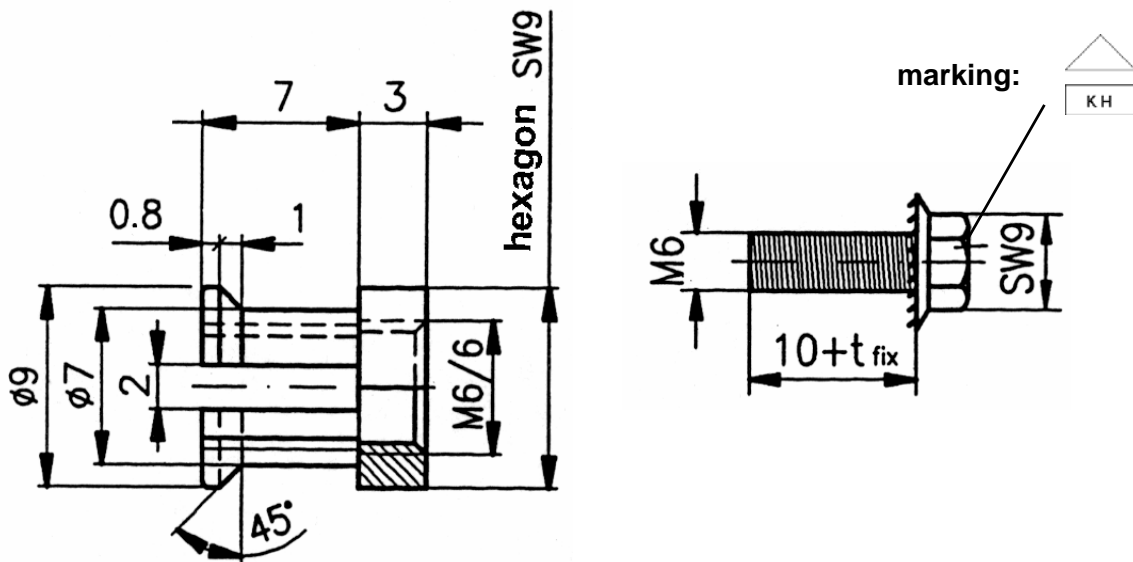
<p style="text-align: center;"><b>KEIL undercut anchor KH for dust - pressed ceramic plates "Granito Ceramico"</b></p>	<p style="text-align: center;"><b>Annex 1</b> of European Technical Approval  <b>ETA - 05/0198</b></p>
<p style="text-align: center;">Product and intended use</p>	



**Table 1: Anchor parts and materials**

Anchor part	Material
Anchor sleeve	Stainless steel EN 10 088 1.4401, 1.4571 or 1.4404
Hexagon bolt with tooth lock	

**Anchor dimensions [mm]**



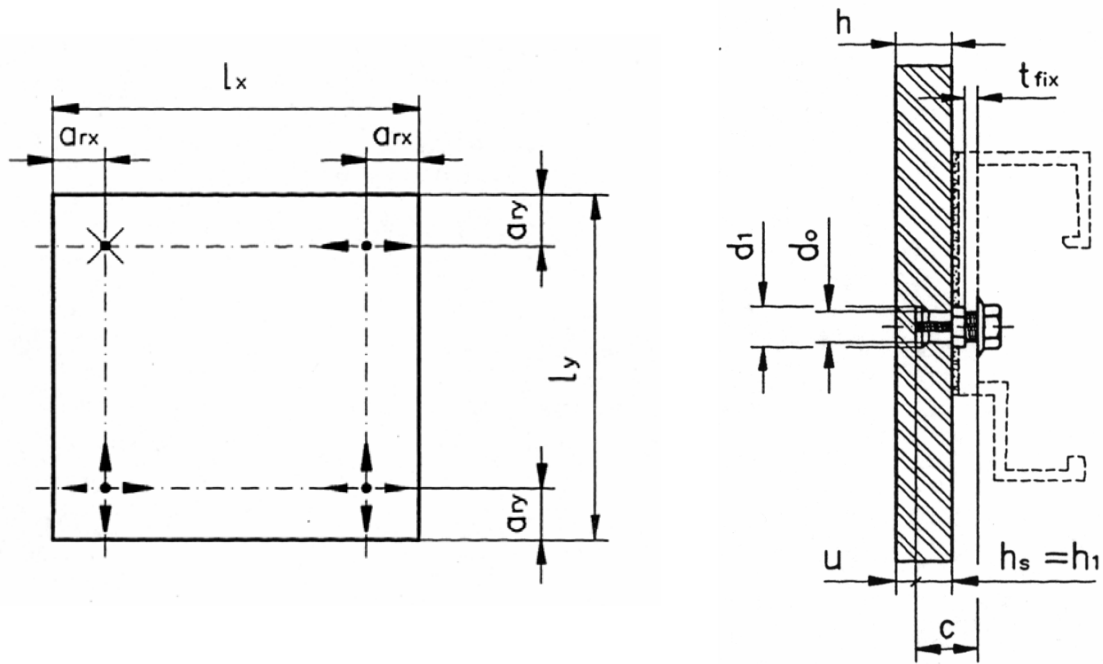
**KEIL undercut anchor KH  
 for dust - pressed ceramic plates "Granito Ceramico"**

Materials and anchor dimensions

**Annex 2**

of European  
 Technical Approval

**ETA - 05/0198**



**Table 2: Admissible values of design of the façade plates , characteristic values of anchor installation**

size of façade plate <sup>1)</sup>	$(l_x \times l_y)$ [mm <sup>2</sup> ]	600 × 1200	600 × 900	600 × 600
thickness of façade plate	h [mm]	11.5 ≤ h ≤ 13		9.5 ≤ h ≤ 13
edge distance <sup>2)</sup>	min a <sub>rx</sub> ≤ a <sub>rx</sub> ≤ max a <sub>rx</sub> [mm]	60 ≤ a <sub>rx</sub> ≤ 120		
edge distance <sup>2)</sup>	min a <sub>ry</sub> ≤ a <sub>ry</sub> ≤ max a <sub>ry</sub> [mm]	100 ≤ a <sub>ry</sub> ≤ 200	75 ≤ a <sub>ry</sub> ≤ 150	60 ≤ a <sub>ry</sub> ≤ 120
admissible wind load <sup>3)</sup>	w ≤ [kN/m <sup>2</sup> ]	1.6	2.2	

number of anchors (rectangular arrangement)	[-]	4
embedment depth/drill hole depth	$h_s = h_1 \geq$ [mm]	7
coverage of drill hole	u ≥ [mm]	2
diameter of drill hole	∅ d <sub>0</sub> [mm]	7
diameter of undercut	∅ d <sub>1</sub> [mm]	9
diameter of the clearance hole in the agraffe	d <sub>f</sub> [mm]	7
Thickness of the agraffe	t <sub>fix</sub> ≥ [mm]	1.5
threaded length of screw	c [mm]	10 + t <sub>fix</sub>

- 1) Arrangement of the plates positioned vertically or horizontally.  
 2) For small fitted pieces, differential or fill- in pieces the minimum edge distance shall be chosen constructively.  
 3) Varying distances of the vertical substructure sections depending on the admissible wind load, note section 4.2.1.

**KEIL undercut anchor KH  
 for dust - pressed ceramic plates "Granito Ceramico"**

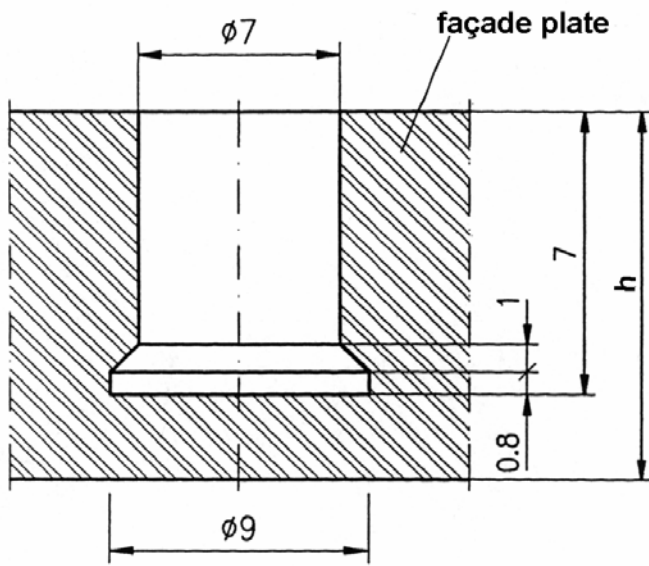
Admissible values of design of the façade plates,  
 characteristic values of anchor installation

**Annex 3**

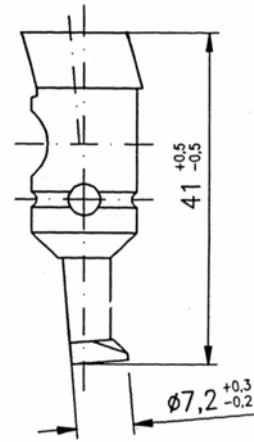
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 Technical Approval

**ETA - 05/0198**

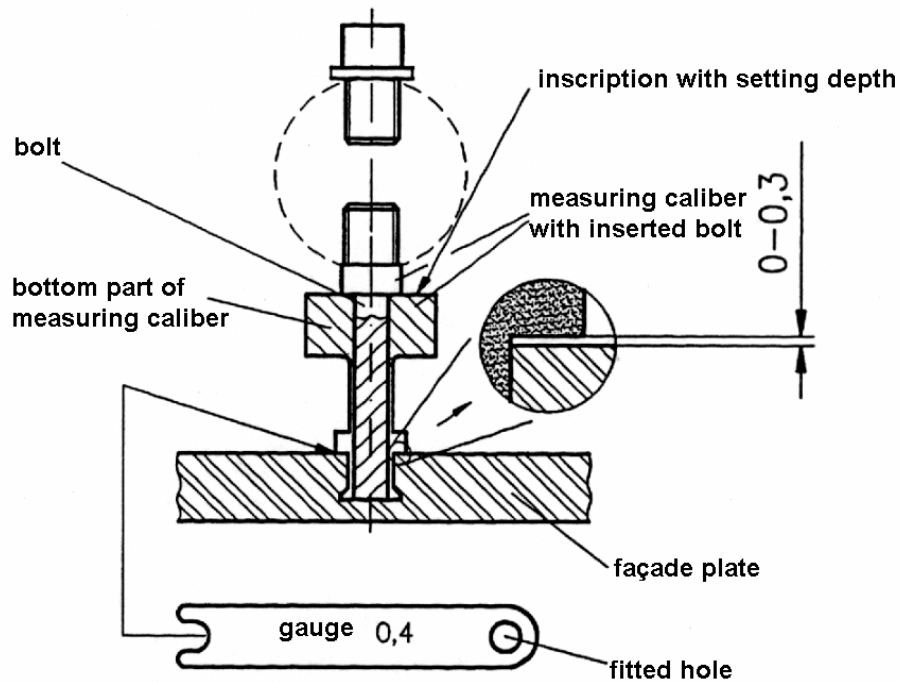
**Drill hole geometry**



**KEIL façade drill DIA 12/0.8**



**KEIL measuring device**



**KEIL undercut anchor KH  
 for dust - pressed ceramic plates "Granito Ceramico"**

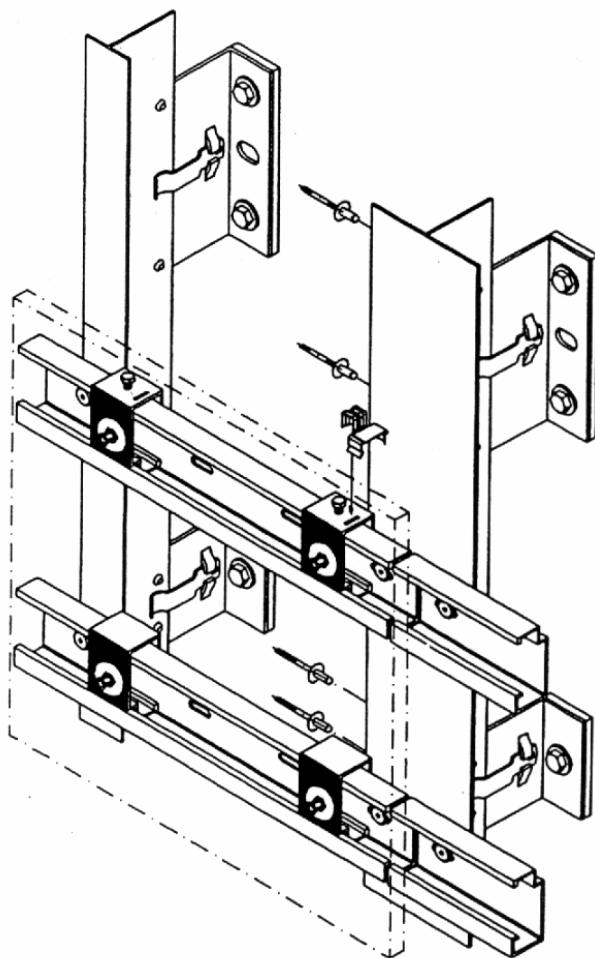
Drill hole dimensions and measuring device

**Annex 4**

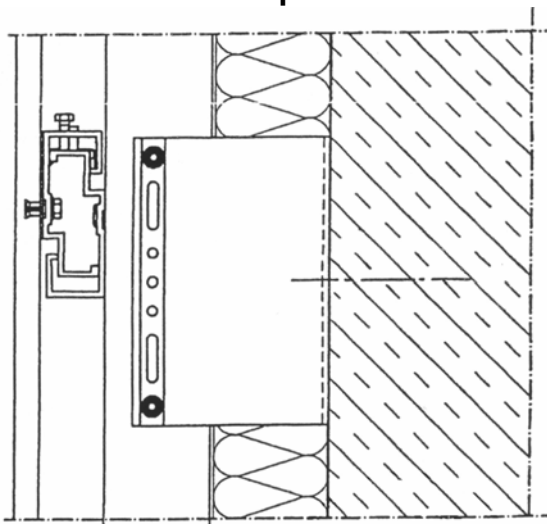
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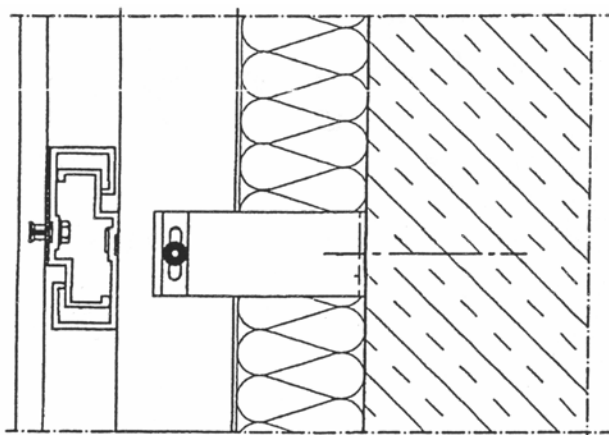
**Example for a strain-free fixing of façade plates**



**Fixed point**



**Sliding point**



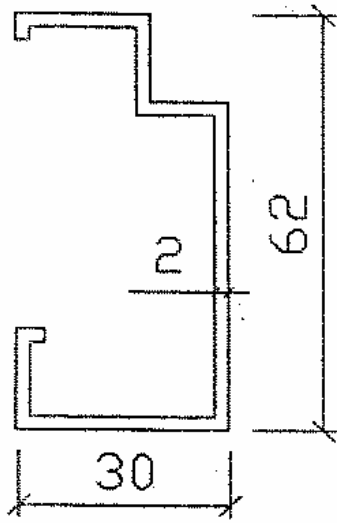
**KEIL undercut anchor KH  
 for dust - pressed ceramic plates "Granito Ceramico"**

Examples for a strain-free fixing of the plates

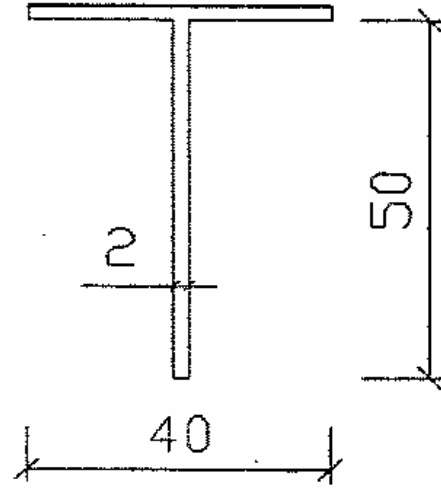
**Annex 5**  
 of European  
 Technical Approval  
**ETA - 05/0198**

**Example of design of the agraffe and load-bearing profiles**

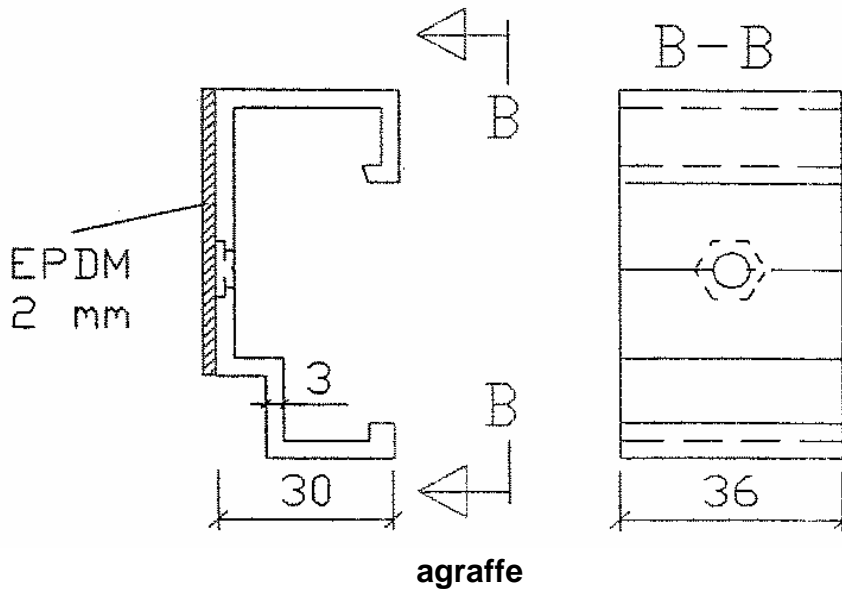
from the dimensions and cross section properties can be deviated, if a equivalent load bearing behavior is verified



**horizontal load-bearing profile**



**vertical load-bearing profile**



**agraffe**

**Materials of the agraffe and load-bearing profiles:**

- stainless steel 1.4401, 1.4571 or 1.4404 according to EN 10 088
- Aluminium EN AW-6060, EN AW-5005 A EN 755-2;  
 Aluminium EN AW-3103, EN AW-3004, EN AW-3005, EN AW-5005 A EN 485-2

**KEIL undercut anchor KH  
 for dust - pressed ceramic plates "Granito Ceramico"**

Example for dimensions, cross section properties and materials of the agraffe and load-bearing profiles

**Annex 6**

**of European  
 Technical Approval**

**ETA - 05/0198**