Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

Member of EOTA
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# European Technical Assessment ETA-06/0220 of 10 June 2025

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 | KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" |
| Product family to which the construction product belongs | Fastener for the rear fixing of façade panels made of glass fibre concrete skin panels according to EN 12467:2012 |
| Manufacturer | Rieder Faserbeton-Elemente GmbH<br>Bergstraße 3a<br>83059 Kolbermoor<br>DEUTSCHLAND |
| Manufacturing plant | Plant 1, Plant 2, Plant 3 |
| This European Technical Assessment contains | 19 pages including 4 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 | EAD 330030-00-0601, edition 10/2018 |
| This version replaces | ETA-06/0220 issued on 2 August 2016 |

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## Specific Part

### 1 Technical description of the product

There are two types of the anchor the KEIL Undercut Anchor KH and the KARL Undercut Anchor KH.

The KEIL Undercut Anchor KH for glass fibre concrete panels "fibreC" 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 an integrated tooth lock washer. The anchor sleeve and the hexagon bolt with an integrated tooth lock washer 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.

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

The product description is given in Annex A. The material values, dimensions and tolerances of the components of the fastener not indicated in the annexes shall correspond to the values laid down in the technical documentation.

### 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 anchors 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 to breakout or pull-out failure under tension load | See Annex C 1 |
| Characteristic resistance to breakout or pull-out failure under shear load | See Annex C 1 |
| Characteristic resistance to breakout or pull-out failure under combined tension and shear load | See Annex C 1 |
| Edge distance and spacing | See Annex C 1 |
| Durability | Corrosion Resistance Class (CRC) III in accordance with EN 1993-1-4:2015 |
| Characteristic resistance to steel failure under tension and shear loads | See Annex C 1 |

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

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Class A1 |

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

In accordance with EAD No. 330030-00-0601 the applicable European legal act is: [97/161/EG].

The system to be applied is: 2+

## 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 with Deutsches Institut für Bautechnik.

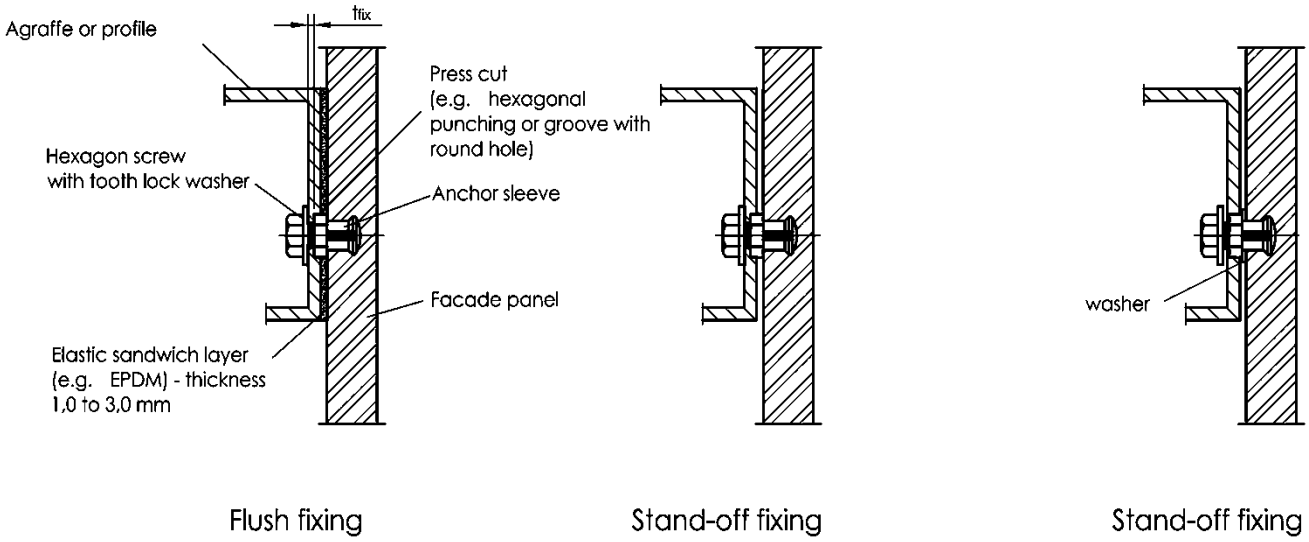
Issued in Berlin on 2 July 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

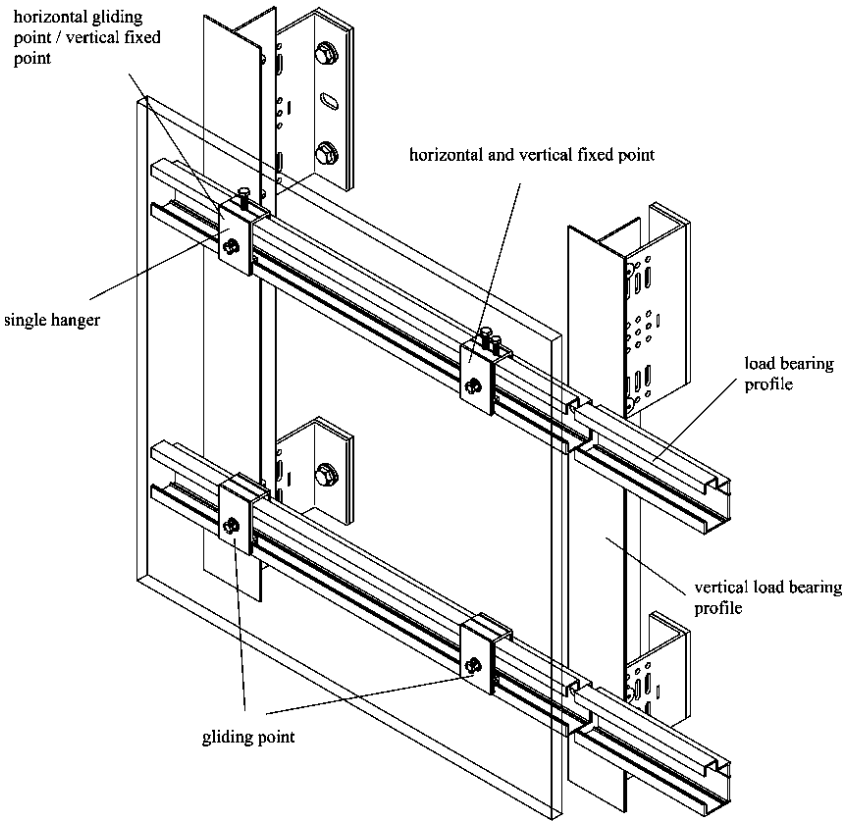
*beglaubigt:*
Aksünger

Deutsches Institut für Bautechnik DIBt

## Installed fastener




## Fixing example




| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex A 1 |
| **Product description**<br>Installed fastener and fixing example | |

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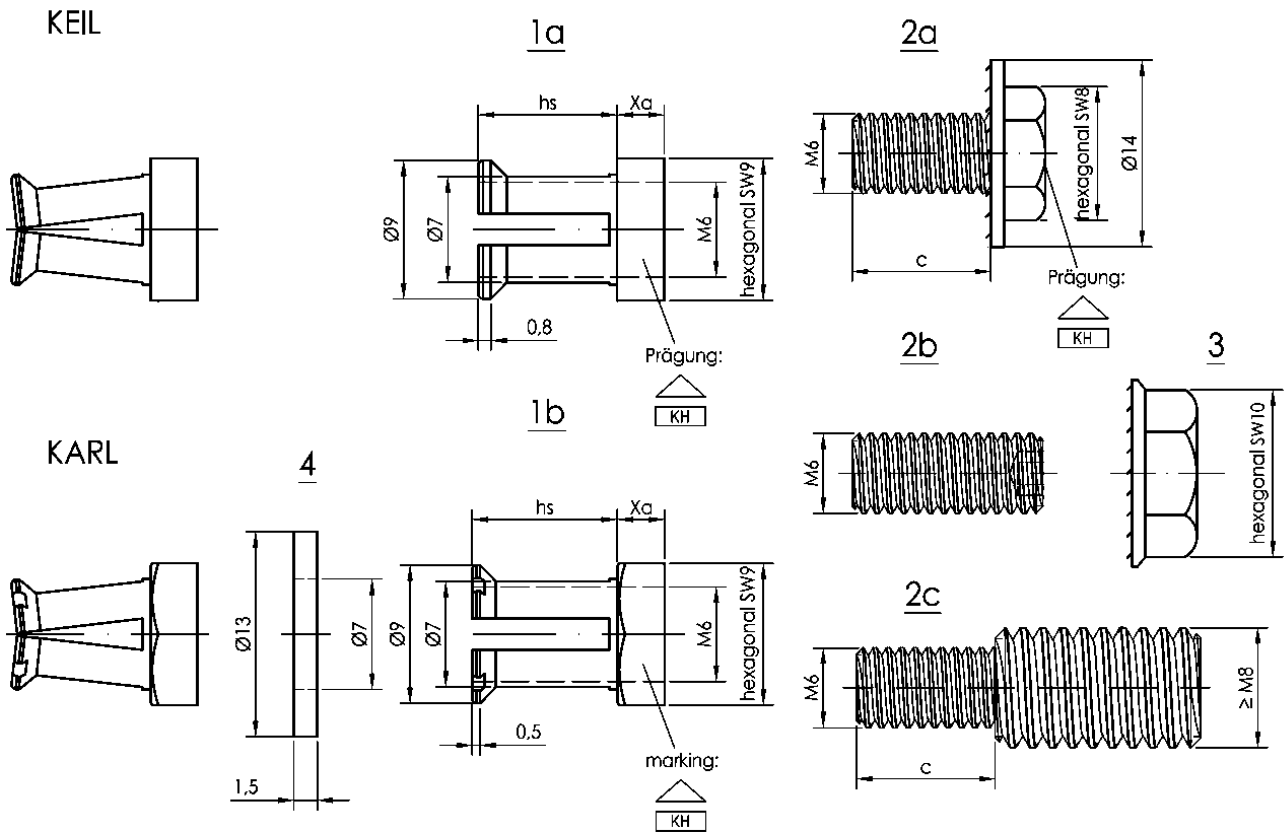
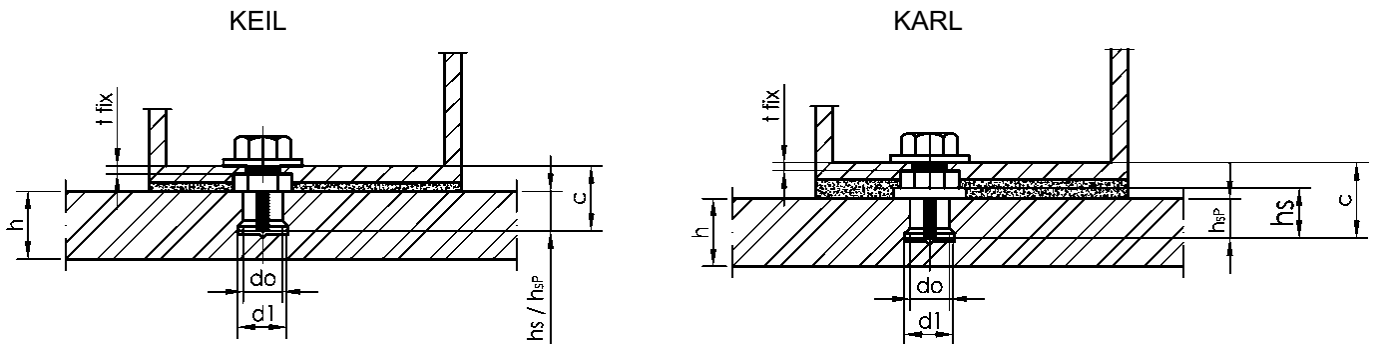
## Anchor parts




c: the screw lenght must be adjusted to the respective design

Drawing scale not true to real scale

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex A 2 |
| **Product description**<br>Dimensions and materials | |

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**Table A1: Characteristic values of anchor installation**

| **Anchor Type** | | | | **KEIL** | **KARL** |
|---|---|---|---|---|---|
| anchorage depth | | $h_{sP}$= | [mm] | 8,5 | 8,5 |
| anchor length | | $h_s$= | [mm] | 8,5 | 10,0 |
| anchor head height | | $x_a$= | [mm] | 3 | 3 resp. 1,5 |
| washer (thickness) | | - | [mm]- | no | Yes (1,5) |
| panel thickness | | h≥ | [mm] | 13 | |
| diameter of the drill hole | | $d_o$= | [mm] | 7,0 | |
| diameter of the undercut | | $h_1$= | [mm] | 9,0 | |
| screw length | | c= | [mm] | $h_{sP} + x_a + t_{fix}$ | $h_{sP} + x_a + 1{,}5mm + t_{fix}$ |
| installation torque moment | | $T_{inst}$= | [Nm] | $2{,}5 \le T_{inst} \le 4{,}0$ | |
| **Materials** | | | | | |
| 1a | anchor sleeve KEIL | | | stainless steel A4/70; 1.4404 according to EN 10088:2014 | |
| 1b | anchor sleeve KARL | | | stainless steel A4/70; 1.4404 according to EN 10088:2014 | |
| 2a | hex bolt with locking ratchets | | | stainless steel A4/70; 1.4404, 1.4404 or 1.4578 according to EN 10088:2014 | |
| 2b | threaded pin | | | stainless steel A4/70; 1.4404, 1.4404 or 1.4578 according to EN 10088:2014 | |
| 2c | threaded bolt | | | stainless steel A4/70; 1.4404, 1.4404 or 1.4578 according to EN 10088:2014 | |
| 3 | nut with locking ratchets | | | stainless steel A4/70; 1.4404 according to EN 10088:2014 | |
| 4 | washer 7x13x1,5 | | | stainless steel A4/70; 1.4404, 1.4404 or 1.4578 according to EN 10088:2014 | |

KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC"

**Product description**
Dimensions and materials

Annex A 3

## Specifications of intended use

**Anchorages subject to:**
- Static and quasi-static loads.

**Base materials:**
- The glass fibre-concrete panels "fibreC" shall correspond to EN 12467:2012.

**Table B1: Characteristic value of the panel**

| | | | |
|---|---|---|---|
| panel thickness | h = | [mm] | 13 |
| resistance to bending stress | $\sigma_{Rk}$ = | [N/mm²] | 16,2 |
| partial safety factor [1)] | $\gamma_M$ = | [-] | 2,0 |
| E-Modul | E = | [N/mm²] | 20.000 (10.000 [1)]) |
| Poisson's ratio | $\nu$ = | [-] | 0,2 |
| heat coefficient | $\alpha_T$ = | [1/K] | 10 x $10^{-6}$ |
| dead load | g = | [kN/m²] | 0,27 |

[1)] for verification in the serviceability state: E =10.000 N/mm²

**Use conditions (Environmental conditions):**
- According to EN 1993-1-4:2015 according to the Corrosion Resistance Class of the fastener III

**Design:**
- Each façade panel is fixed with at least four anchors in a rectangular arrangement via single agraffes on the substructure (for small panels or small fitted pieces, differential or fill- in pieces the number and position of the anchors shall be chosen constructively).
- The façade panels are aranged in a "reclined" or "uprigth" position, they also may be fixed at façade soffits.
- The substructure is constructed such that the façade panels are fixed according to Annex B 3 technically strain-free via skids (loose bearings) and one fixed point (fixed bearing)
- Two fixing points of the façade panel are designed such that they are able to carry the dead load of the façade panel.
- The load-bearing profiles are arranged symmetrically. The arrangement of the agraffes ensures a symmetric introduction of the load into the substructure.
- When using agraffes on horizontal load-bearing profiles the fixing points of a façade panel situated horizontally at the same height are fastened in each case to the same load-bearing profile.
- Joint construction between the façade panels is done by a joint filler or are kept open; it is ensured that additional stresses (e.g. by temperature) do not lead to important additional loadings.
- Verifiable calculation notes and drawings shall be prepared taking account of the loads to be anchored, the nature and strength of the base materials and the dimensions of the anchorage members as well as of the relevant tolerances. The position of the anchor is indicated on the design drawings.
- The façade panels, their fixings as well as the substructure including its connection to wall brackets and their connection to the construction works are designed for the respective case of application under the responsibility of an engineer skilled in the field of façade construction.

**Installation:**

- During transport and storage on site the façade panels are protected from damages; the façade panels are not be hung up jerkily (if need be lifters shall be used for hanging up the façade panels); façade panels and reveal panels respectively with incipient cracks are not be installed. Shrinkage cracks can occur due to the manufacturing process.
- The drillings are done at the factory or on site under workshop conditions; when making the drillings on site the execution is supervised by the responsible project supervisor or a skilled representative of the project supervisor.
- Making of the undercut drilling is done with the drill bit according to Annex B 4 and a special drilling device in accordance with the information deposited with Deutsches Institut für Bautechnik.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole.
- the geometry of the drill hole is checked on 1 % of all drillings. The following dimensions shall be checked and documented according to manufacturer's information and testing instructions by means of a measuring device according to Annex B 7:
  - Volume of the undercut drill hole.
  - Depth position of the undercut; the distance between the lower edge of the measuring device and the façade panel is between 0,0 and 0,3 mm (see Annex B 4).

  If the tolerances given in Annex A 2, Table A1 are exceeded, the geometry of the drill hole shall be checked on 25 % of the drillings performed. No further drill hole may exceed the tolerances otherwise all the drill holes shall be controlled. Drilling holes falling below or exceeding the tolerances shall be rejected.

  Note: Checking the geometry of the drill hole on 1 % of all drillings means that on one of the 25 panels (this corresponds to 100 drillings in façade panels with four anchors) one drilling shall be checked. If the tolerances given in Annex A 2, Table A1 are exceeded the extent of the control shall be increase to 25 % of the drillings, i.e. one drilling each shall be checked on all the 25 panels.
- The façade are installed by skilled specialists and the laying instructions of the manufacturer shall be paid attention to.
- Between agraffe and façade panel an elastic sandwich layer may be placed. (see Annex A 1)

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex B 2 |
| **Intended use**<br>Specifications | |

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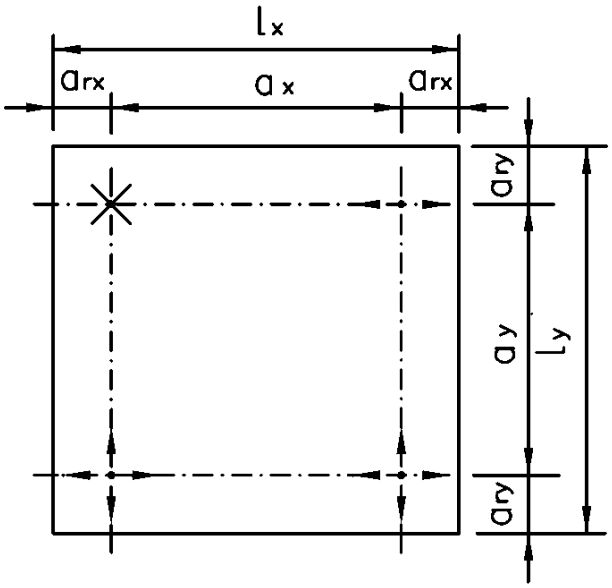
## Definition of edge distance and spacing




**legend**

$a_{rx}$ = distance of the anchor to the edge in horizontal direction

$a_{ry}$ = distance of the anchor to the edge in vertical direction

$L_x$ = length of the façade panel in horizontal direction

$L_y$ = length of the façade panel in vertical direction

= fixed point between plate and substructure

= horizontal skid between plate and substructure

= horizontal and vertical skid between plate and substructure

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex B 3 |
| **Intended use**<br>Definition of edge distance and spacing | |

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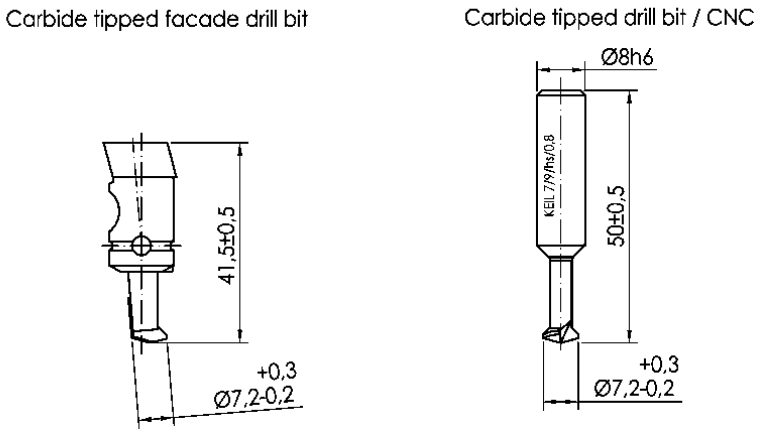
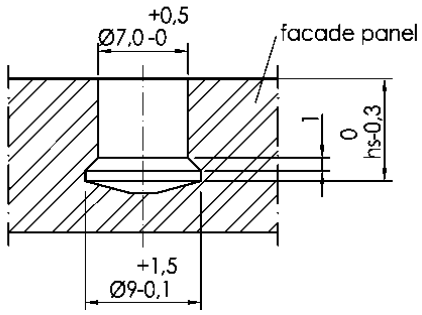
**KEIL drill hole geometry**

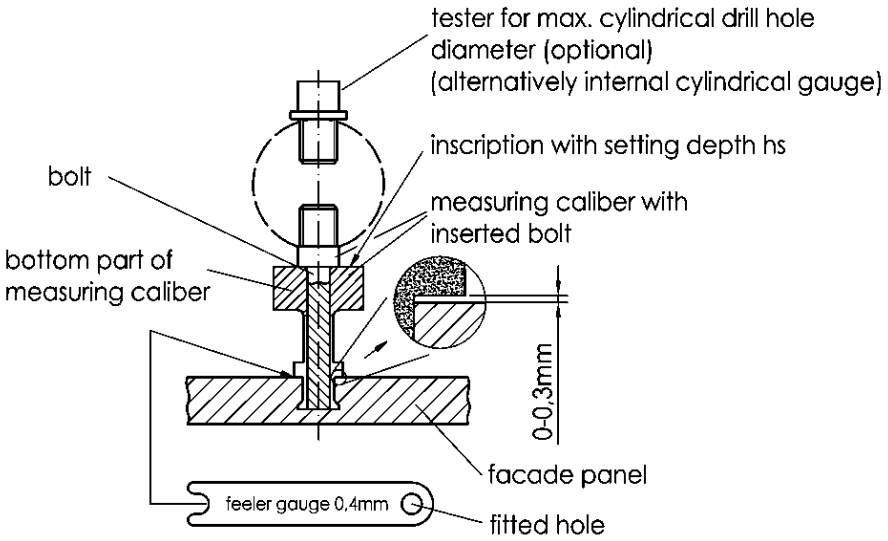
Geometry of the KEIL facade drill
for KEIL facade drill bit 7/9




Geometry of the drill hole




**KEIL measuring device**




Drawing scale not true to real scale

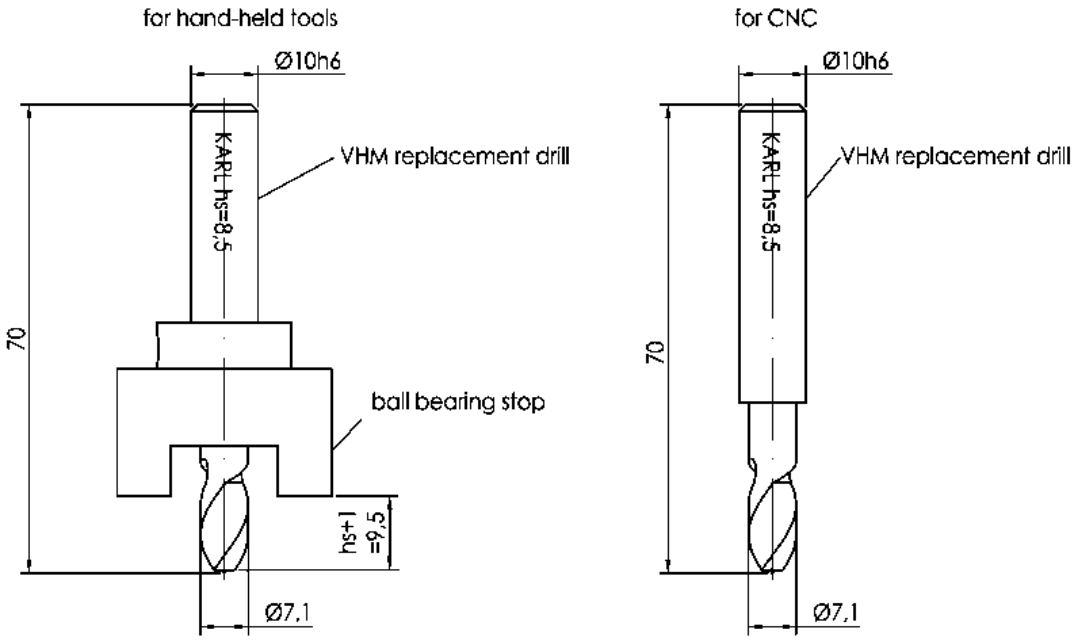
| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex B 4 |
| **Intended use**<br>KEIL Drill hole dimensions and setting tools and testing equipment | |

Deutsches Institut für Bautechnik DIBt

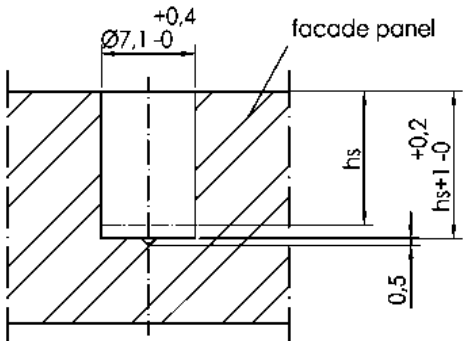
**KARL drill hole geometry**

Geometry of the stop drill

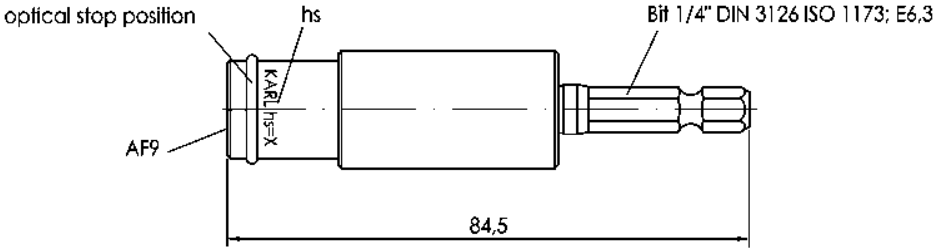
for KARL stop drill hs=8,5




Geometry of the drill hole



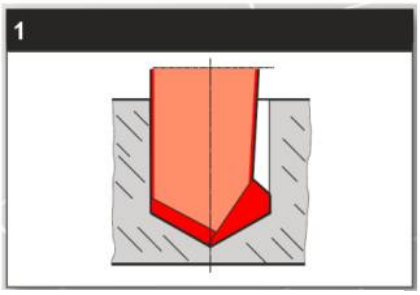

KARL setting tool



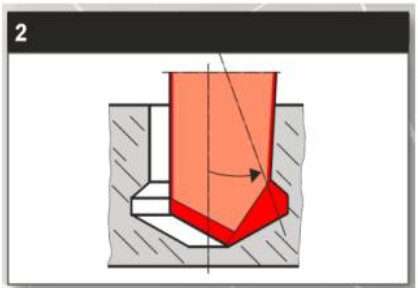

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex B 5 |
| **Intended use**<br>KARL drill hole dimensions and setting tools and testing equipment | |

## Installation instructions KEIL

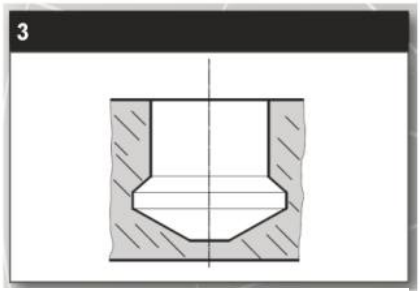
### 1. Drilling the undercut hole




a) Cylindrical drilling

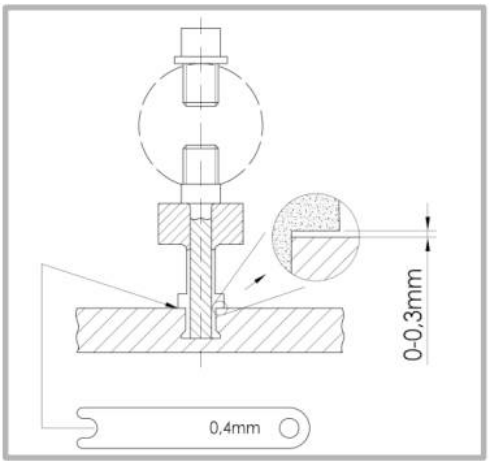



b) Undercutting and clean the borehole



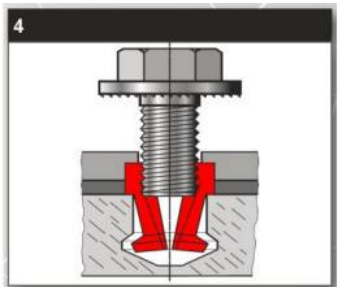

c.) Finished undercut hole

### 2. Checking the undercut hole

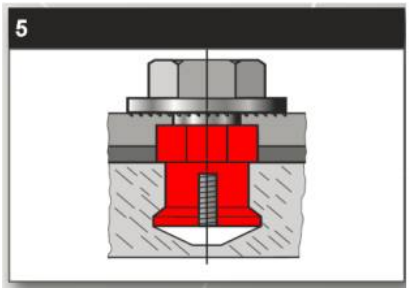



With KEIL depth control guide

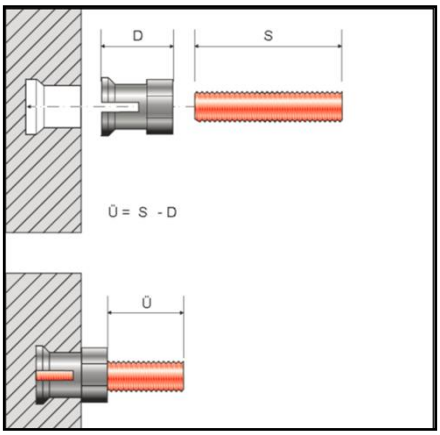
### 3. Installation of anchor (sleeve and screw resp. grub screw)




a.) Insert the sleeve in the undercut hole and drill the screw in the sleeve



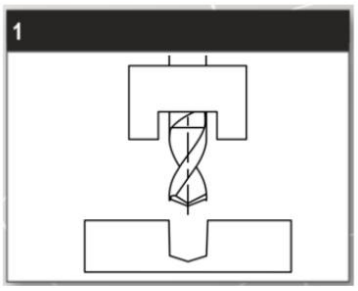

b.) Installed anchor



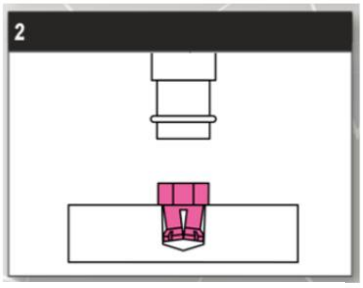

a) Insert the sleeve in the undercut hole
b) Drill the grub screw in the sleeve
c) Installed anchor

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex B 6 |
| **Intended use**<br>Installation instruction of KEIL Undercut Anchor KH | |

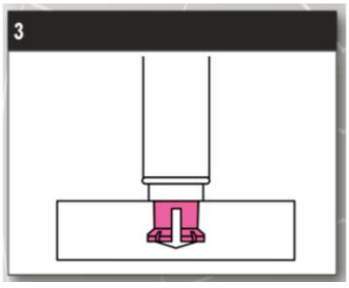
## Installation instructions KARL



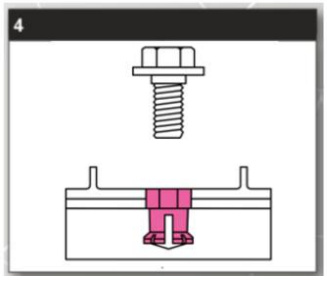

a) Cylindrical drilling and clean the bore hole



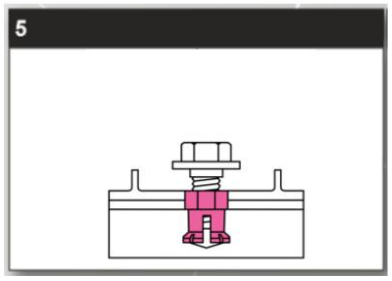

b.) Insert the sleeve and set the setting tool on the anchor head



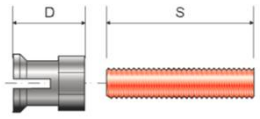

c.) Spread the anchor sleeve under rotation and pressure

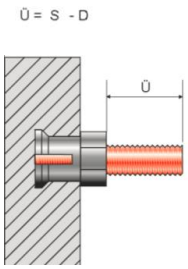



d.) Attach the hanger




e.) Screwing in the Screw




a) Insert the sleeve into the bore hole
b) Place the setting tool on the sleeve head
c) Expand the anchor sleeve under rotation and pressure
d) Screw the grub screw into the sleeve
e) installed undercut anchor

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex B 7 |
| **Intended use**<br>Installation instruction of KARL Undercut Anchor KH | |

**Table C1: characteristic values of the KEIL Undercut Anchor KH and KARL Undercut Anchor KH**

| | | | | |
|---|---|---|---|---|
| resistance to [2] | tension load | $N_{Rk}$ = | [kN] | 1,2 |
| | shear load | $V_{Rk}$ = | [kN] | 3,2 |
| partial safety factor [1] | | $\gamma_M$ = | [-] | 2,0 |
| embedment depth | | $h_s \geq$ | [mm] | 8,5 |
| edge distance | | $a_{rx}$ oder $a_{ry} \geq$ | [mm] | 60 |
| | | | | 0,1 x a |
| spacing | | a ≤ | [mm] | 800 |

[1] in absence of other national regulations

[2] in case of coincident stress of an anchor due to tension and shear load the following equation shall be observed:

$$\frac{N_{Ed}}{N_{Rd}} + \frac{V_{Ed}}{V_{Rd}} \leq 1{,}1$$

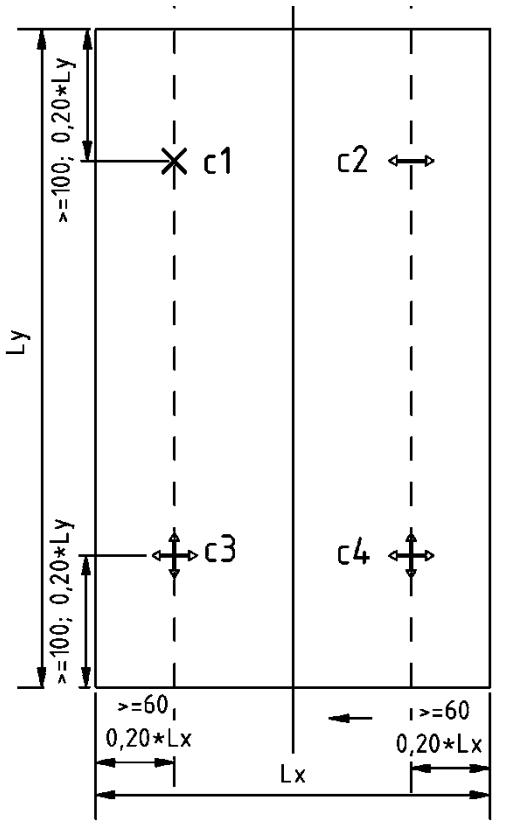
KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC"

**Performance**
Characteristic values of the KEIL KH undercut anchor and KARL KH undercut anchor

Annex C 1

**Bearing condition A**

symmetric bearing condition of support system




**Bearing condition B**

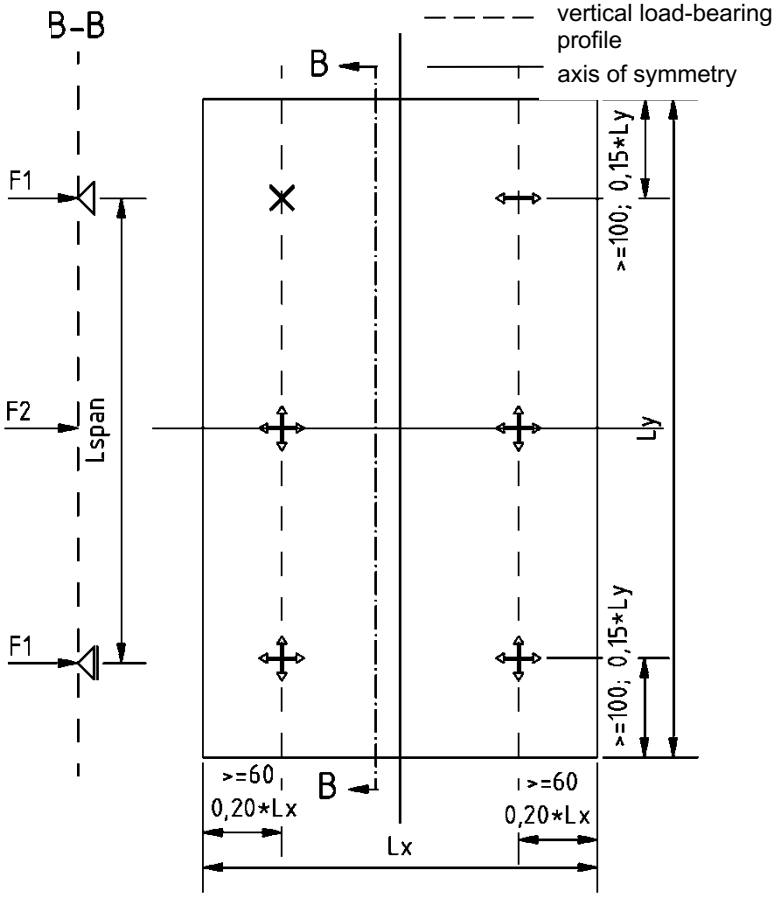



**Table D1: characteristic resistance $w_{Rk}$ to wind loads for selective support systems and panel sizes**

| $w_{Rk}$ | | $\gamma_M$ | bearing condition A | bearing condition B |
|---|---|---|---|---|
| suction | pressure | | panel size $L_x \times L_y$ | panel size $L_x \times L_y$ |
| [kN/m²] | [kN/m²] | [-] | [mm] | [mm] |
| 1,05 | -1,5 | 2,0 | 1250 × 1580 | 1250 × 2000 |
| 1,68 | -2,4 | | 970 × 1250 | 1250 × 1520 |
| 2,23 | -3,3 | | 670 × 1250 | 1190 × 1250 |
| 3,0 | | | 660 × 1250 | 980 × 1250 |
| 4,8 | | | - | 670 × 1250 |
| 6,6 | | | - | 490 × 1250 |

- meaning of the symbols see Annex B 3
- minimum requirements to the supporting substructure:
  - stiffness of the substructure at the fixing points: ($c_1 = c_2$ and $c_3 = c_4$) or ($c_1 = c_3$ and $c_2 = c_4$)
  - for span length $L_{span}$ (vertical load-bearing profile) > 1 m:
    minimum stiffness of supporting substructure $I_{min}$ [cm⁴] = 3 $L_{span}^3$ ($L_{span}$ in [m])

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex D 1 |
| **Informative**<br>Characteristic resistance $w_{Rk}$ to wind loads<br>for selective support systems and panel sizes | |

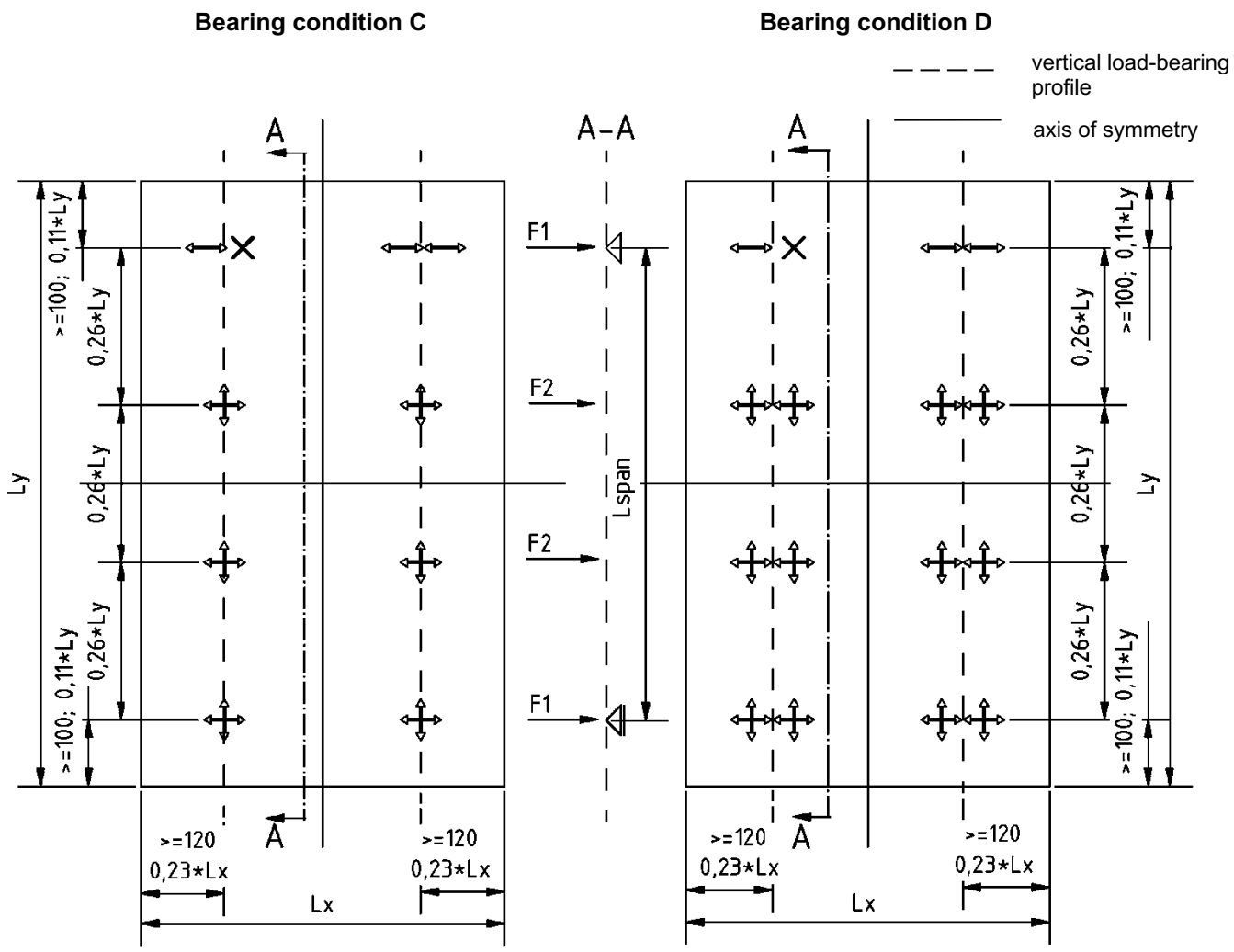



**Table D2: characteristic resistance $w_{Rk}$ to wind loads for selective support systems and panel sizes**

| $w_{Rk}$ | | $\gamma_M$ | bearing condition C | bearing condition D |
|---|---|---|---|---|
| **suction** | **pressure** | | **plate size $L_x \times L_y$** | **plate size $L_x \times L_y$** |
| [kN/m²] | [kN/m²] | [-] | [mm] | [mm] |
| 1,68 | -2,4 | 2,0 | 1250 × 2000 | - |
| 3,0 | -3,3 | | 1250 × 1800 | 1250 × 2000 |
| 4,8 | | | 1100 × 1250 | 1250 × 1950 |
| 6,6 | | | 860 × 1250 | 1250 × 1380 |

- meaning of the symbols see Annex B 3
- minimum requirements to the supporting substructure:
  - for span length $L_{span}$ (vertical load-bearing profile) > 1 m:
    minimum stiffness of supporting substructure $I_{min}$ [cm⁴] = 3 $L_{span}^3$ ($L_{span}$ in [m])

| | |
|---|---|
| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex D 2 |
| **Informative**<br>Characteristic resistance $w_{Rk}$ to wind loads<br>for selective support systems and panel sizes | |

# Design method

## General

The design values of the actions shall be calculated on basis of EN 1990:2010 in consideration of the existing loads. The combinations of actions shall be equal to EN 1990:2010. The actions shall be specified according to EN 1991-1-1:2010 to EN 1991-1-7:2010. Corresponding national regulations shall be taken into consideration. The unfavourable combination is decisive. Where necessary for the design of the anchor and the façade panel several combinations shall be analysed separately.

The typical fundamental combination for façade panels considers actions from dead load $F_{Ek.G}$ (permanent action) and wind $F_{Ek.w}$ (leading variable action).

- For the support systems and panel sizes according to Annex D 1 and D 2 the verification of structural stability is deemed to be verified, if the following conditions are met:

$w_{Ed} \leq w_{Rk} / \gamma_M$

with $w_{Ed}$ [kN/m²] = design value of the existing wind load

$w_{Rk}$ [kN/m²] = characteristic resistance to wind load according to Annex D 1 and D 2

$\gamma_M$ [-] = partial safety factor according to Annex D 1 and D 2

- For formats, which relevant differ from the support systems and panel sizes according to Annex D 1 and D 2, the verification of structural stability of the façade panels including its fixing by the anchor is carried out separately. For the determined forces conditions is to be verified, that the following equation is observed:

$F_{Ed} \leq F_{Rk} / \gamma_M$

with $F_{Ed}$ [kN] = design value of the relevant existing force ($N_{Ed}$, $V_{Ed}$, $\sigma_{Ed}$)

$F_{Rk}$ [kN] = characteristic resistance to the relevant force ($N_{Rd}$, $V_{Rd}$, $\sigma_{Rd}$) according to Annex C 1

$\gamma_M$ [-] = partial safety factor according to Annex C 1

In case of coincident stress of an anchor due to tension and shear load the equation according to Annex C 1 is observed

- Each façade panel is fixed with at least four anchors in a rectangular arrangement via single agraffes on the substructure (for small panels or small fitted pieces, differential or fill- in pieces the number and position of the anchors shall be chosen constructively).
- The façade panels are aranged in a "reclined" or "uprigth" position, they also may be fixed at façade soffits.
- The substructure is constructed such that the façade panels are fixed according to Annex B 4 technically strain-free via skids (loose bearings) and one fixed point (fixed bearing)
- Two fixing points of the façade panel are designed such that they are able to carry the dead load of the façade panel.
- The load-bearing profiles are arranged symmetrically. The arrangement of the agraffes ensures a symmetric introduction of the load into the substructure.
- When using agraffes on horizontal load-bearing profiles the fixing points of a façade panel situated horizontally at the same height are fastened in each case to the same load-bearing profile.
- Joint construction between the façade panels is done by a joint filler or are kept open; it is ensured that additional stresses (e.g. by temperature) do not lead to important additional loadings.
- Verifiable calculation notes and drawings shall be prepared taking account of the loads to be anchored, the nature and strength of the base materials and the dimensions of the anchorage members as well as of the relevant tolerances. The position of the anchor is indicated on the design drawings.
- The façade panels, their fixings as well as the substructure including its connection to wall brackets and their connection to the construction works are designed for the respective case of application under the responsibility of an engineer skilled in the field of façade construction.

**Flush fixing**

**Torsion of horizontal load-bearing profiles resulting from dead load of the façade panels**

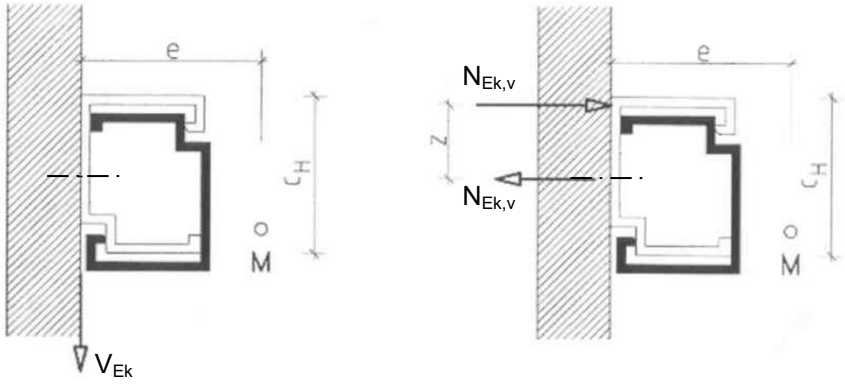
For flush fixed anchors and for installation of horizontal load-bearing profiles permanent loads due to torsion of the profile shall be considered in addition to actions from dead loads and wind in direction of the anchor axes. Simplifying these permanent loads can be determined as follows:

$N_{Ek.V} = V_{Ek} \cdot 2e/c_H$

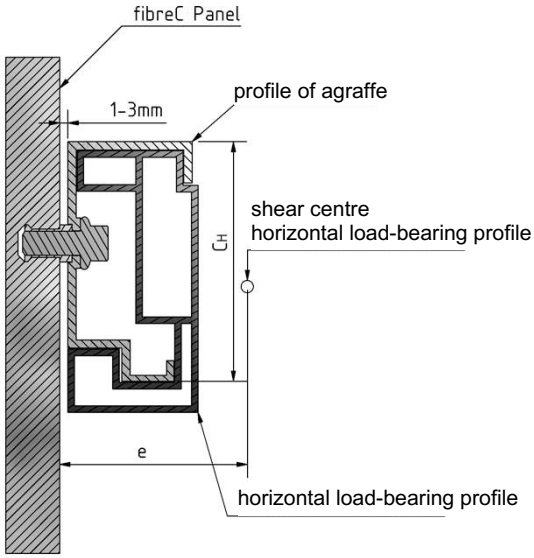
$V_{Ek}$ = shear load due to dead load of the façade panel

e und $c_H$ [mm] see picture

M shear centre




**Stand-off fixing**




For stand-off fixed anchors and for installation of horizontal load-bearing profiles the following shall be verified:

- The agraffes do not prop on the façade panel due to torsion of the horizontal load-bearing profile and twisting of the façade panel.
- The total of the angle $\alpha$ results from torsion of the horizontal load-bearing profile and twisting of the façade panel at the fixing point does not exceed the value $\alpha = 2°$.

| KEIL Undercut Anchor KH and KARL Undercut Anchor KH for glass fibre concrete skin panels "fibreC" | Annex D 4 |
|---|---|
| **Informative**<br>Design method | |