

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-06/0220
of 2 August 2016

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

KEIL 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
Bergstraße 3a
83059 Kolbermoor
DEUTSCHLAND

Manufacturing plant

KEIL Hinterschnittanker KH: KEIL Befestigungstechnik
GmbH

Fassadenplatte: Rieder Faserbeton-Elemente GmbH

This European Technical Assessment
contains

16 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

European Assessment Document (EAD)
330030-00-0601

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Specific Part

1 Technical description of the product

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 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 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 for tension and shear loads	See Annex C 1
Characteristic resistance for wind loads	See Annex C 2 and C 3

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Fasteners satisfy requirements for Class A 1
Resistance to fire	No performance determined

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

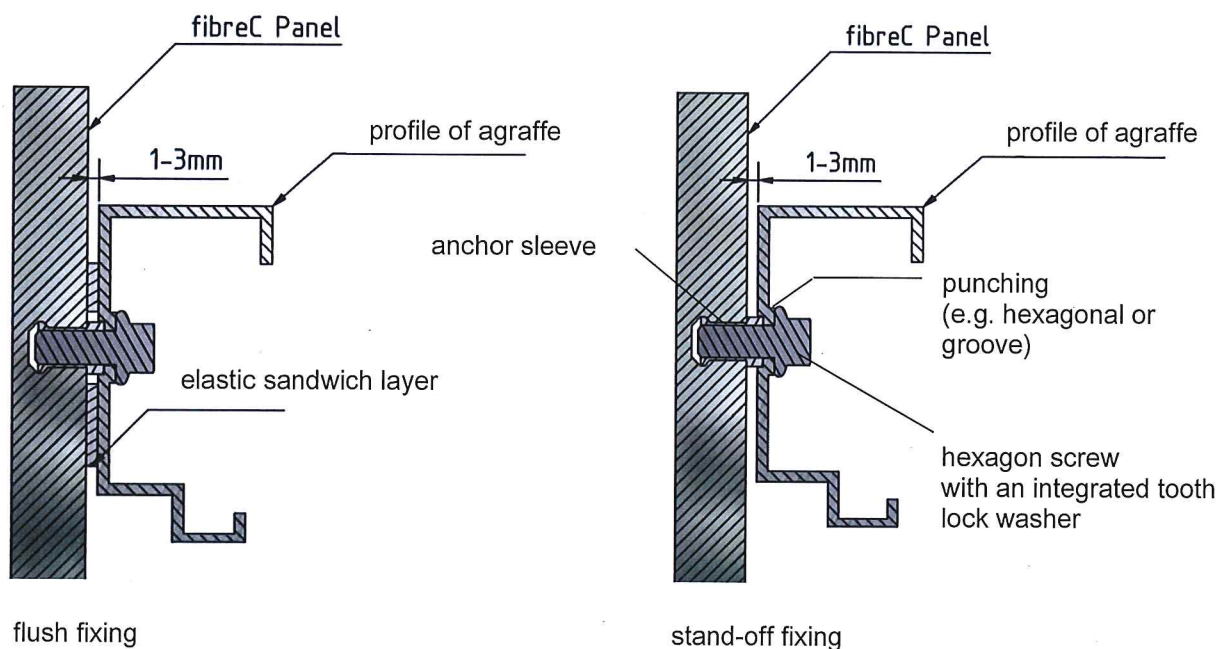
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 2 August 2016 by Deutsches Institut für Bautechnik

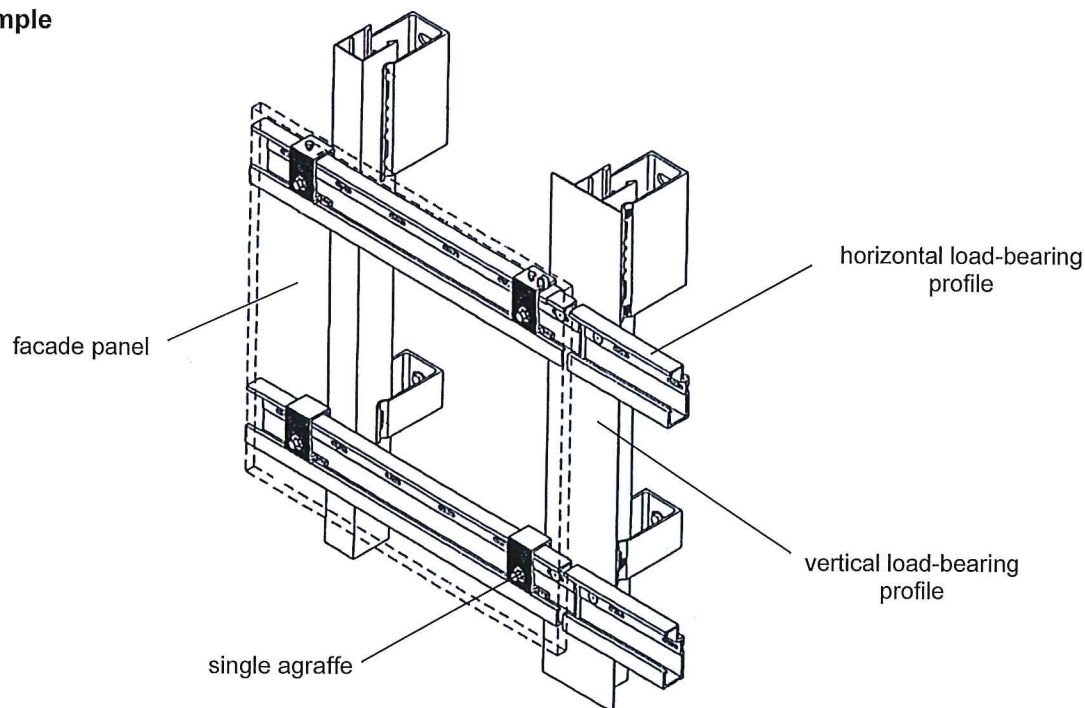
Uwe Bender
Head of Department

beglaubigt:
Aksünger

Installed fastener



Fixing example



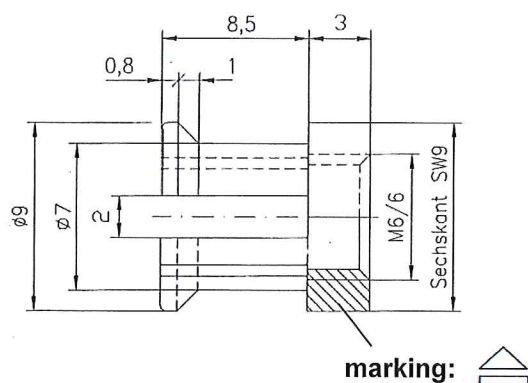
KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Product description
Installed fastener and fixing example

Annex A 1

Anchor parts

Anchor sleeve [dimensions in mm] stainless steel 1.4404 EN 10088:2014



hexagon screw with integrated tooth lock washer stainless steel 1.4401, 1.4578 or 1.4404 EN 10088:2014

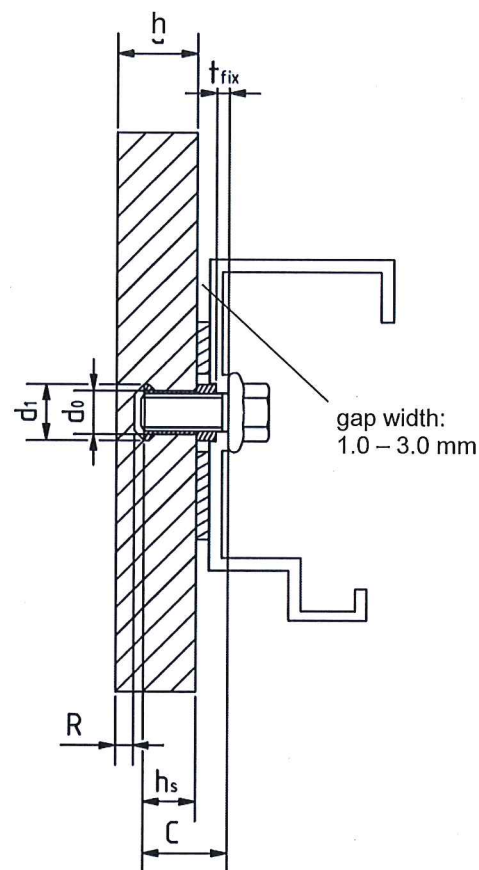
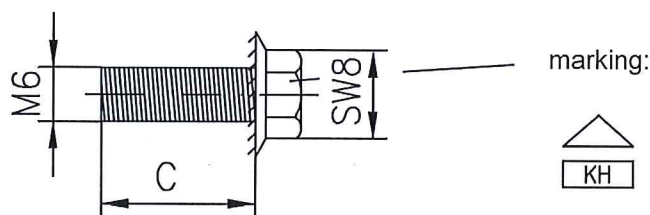


Table 1: Characteristic values of anchor installation

Anchor type			KH AA 8,5
panel thickness	h =	[mm]	13
setting depth	h _s =	[mm]	8,5
diameter of drill hole	d ₀ =	[mm]	7,0
diameter of undercut	d ₁ =	[mm]	9,0
threaded length of screw	c =	[mm]	11,5 + t _{fix}
installation torque moment	T _{inst}	[Nm]	2,5 ≤ T _{inst} ≤ 4,0

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Product description
Dimensions and materials

Annex A 2

Specifications of intended use

Anchorage subject to:

- Static and quasi-static loads.

Base materials:

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

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions.
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist.

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:

- The design of the façade panels and their fixing is carried out according to the conditions given in Annex B 2 to Annex B 4.

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 5 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 5).

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 for glass fibre concrete skin panels "fibreC"	Annex B 1
Intended use Specifications	

Design method

General

The design values of the actions shall be calculated on basis of EN 1990 in consideration of the existing loads. The combinations of actions shall be equal to EN 1990. The actions shall be specified according to EN 1991-1-1 to EN 1991-1-7. 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 $F_{Sk,G}$ (permanent action) and wind $F_{Sk,w}$ (leading variable action).

- For the support systems and panel sizes according to Annex C 2 and C 3 the verification of structural stability is deemed to be verified, if the following conditions are met:

$$W_{Sd} \leq W_{Rk} / \gamma_M$$

- with
- W_{Sd} [kN/m²] = design value of the existing wind load
 - W_{Rk} [kN/m²] = characteristic resistance to wind load according to Annex C 2 and C 3
 - γ_M [-] = partial safety factor according to Annex C 2 and C 3

- For formats, which relevant differ from the support systems and panel sizes according to Annex C 2 and C 3, 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:

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

- with
- F_{Sd} [kN] = design value of the relevant existing force (N_{Sd} , V_{Sd} , σ_{Sd})
 - F_{Rk} [kN] = characteristic resistance to the relevant force (N_{Rd} , V_{Rd} , σ_{Rd}) according to Annex C 1
 - γ_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 arranged in a "reclined" or "upright" 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.

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Intended use
Design method

Annex B 2

Flush fixing

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

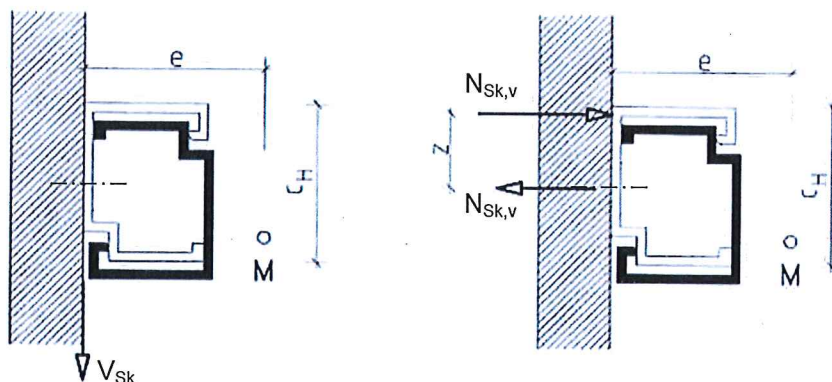
For flush fixed anchors and for installation of horizontal load-bearing profiles permanent loads due to torsion of the profile shall be considered in addition to actions from dead loads and wind in direction of the anchor axes. Simplifying these permanent loads can be determined as follows:

$$N_{Sk,v} = V_{Sk} \cdot 2e/c_H$$

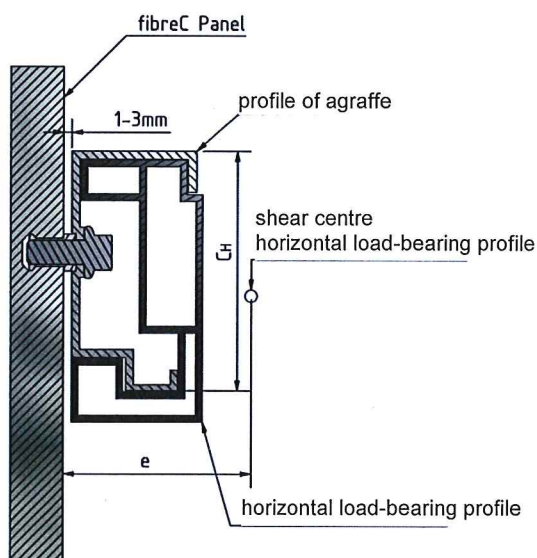
V_{Sk} = shear load due to dead load of the façade panel

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 α results from torsion of the horizontal load-bearing profile and twisting of the façade panel at the fixing point does not exceed the value $\alpha = 2^\circ$.

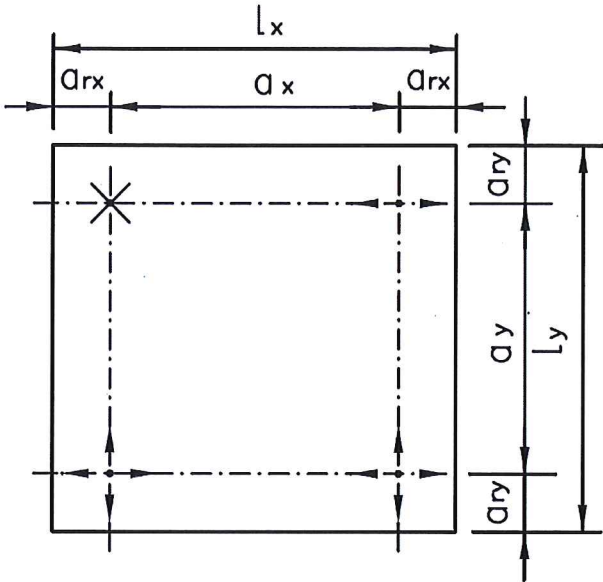
KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Intended use

Flush fixing and stand-off fixing

Annex B 3

Definition of edge distance and spacing



legend

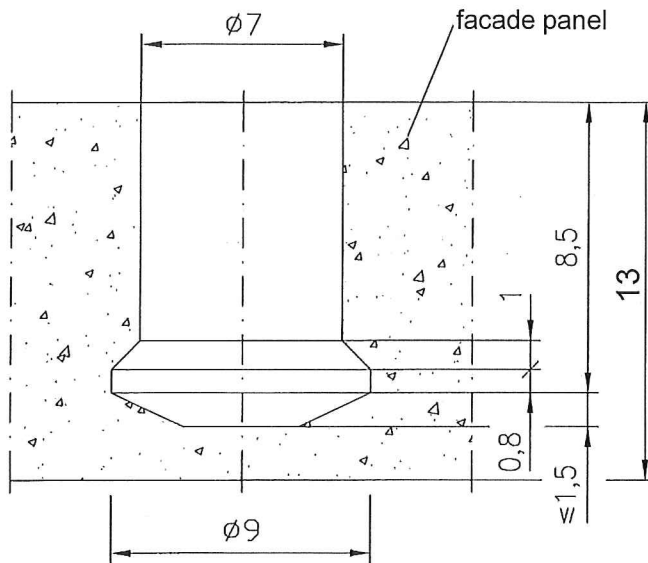
- a_{rx} = distance of the anchor to the edge in horizontal direction
- a_{ry} = distance of the anchor to the edge in vertical direction
- L_x = length of the façade panel in horizontal direction
- L_y = length of the façade panel in vertical direction
- $\times$ = fixed point between plate and substructure
- $\leftrightarrow$ = horizontal skid between plate and substructure
- $\leftrightarrow$ = horizontal and vertical skid between plate and substructure

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

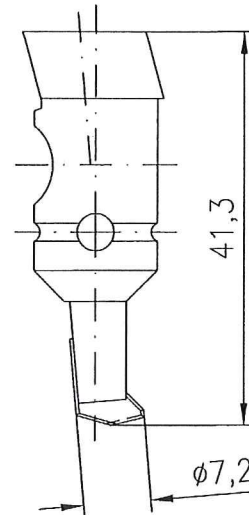
Intended use
Definition of edge distance and spacing

Annex B 4

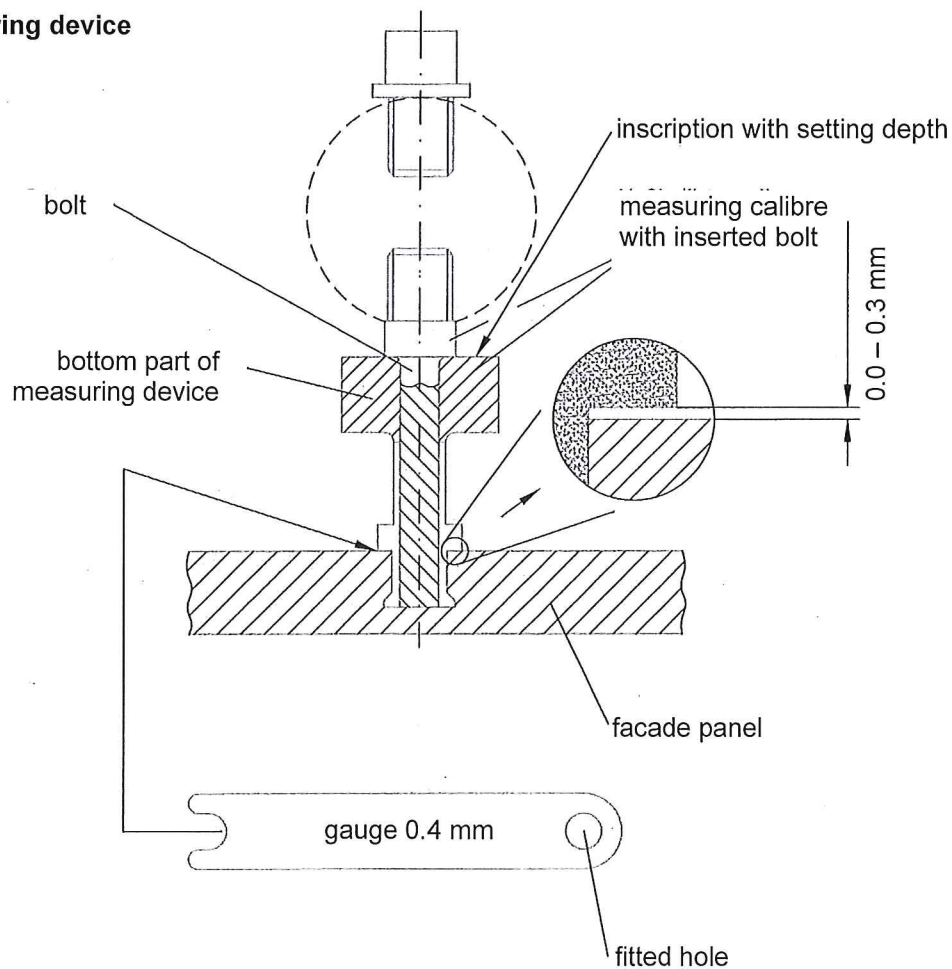
Drill hole geometry



drill geometry for KEIL - Façade drill HM 12/0.8



KEIL measuring device



KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

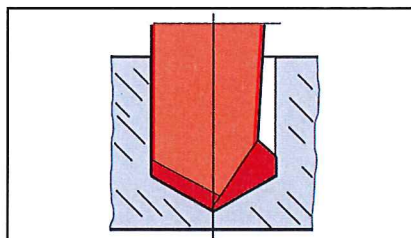
Intended use

Drill hole dimensions
Setting tools and testing equipment

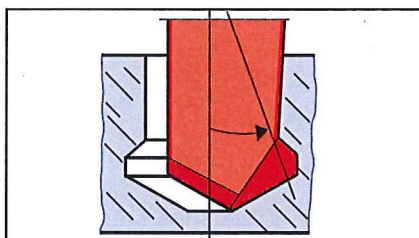
Annex B 5

Installation instructions

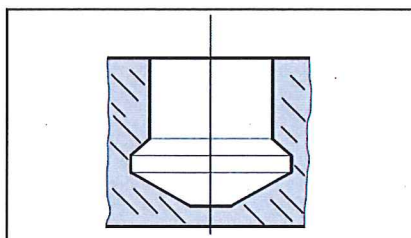
1. Drilling the undercut hole



a) Cylindrical drilling and clean the borehole



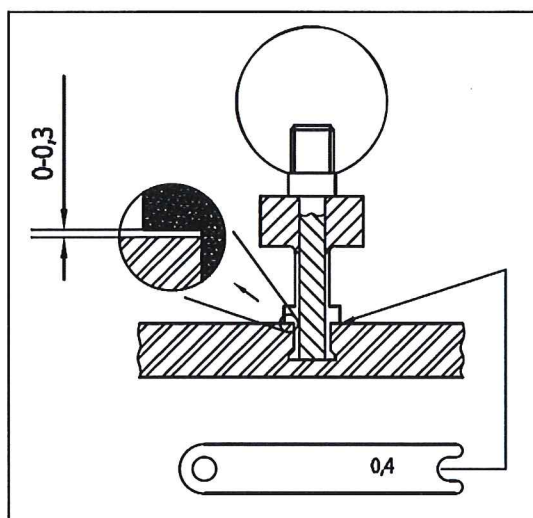
b) Undercutting and clean the borehole



c) Finished undercut hole

2. Checking the undercut hole

With KEIL depth control guide

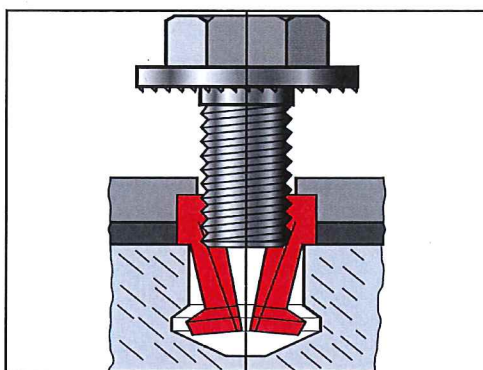


KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

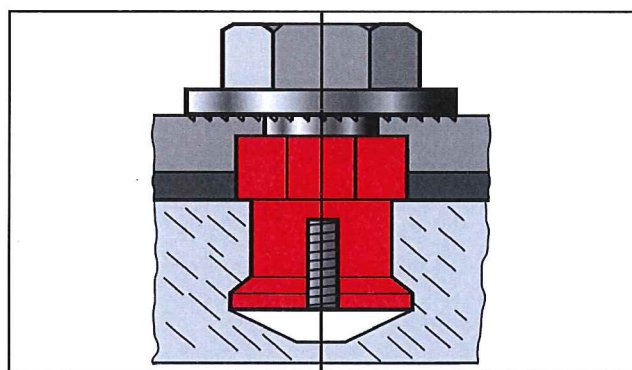
Intended use
Installation instruction

Annex B 6

3. Installation of anchor (sleeve and screw)

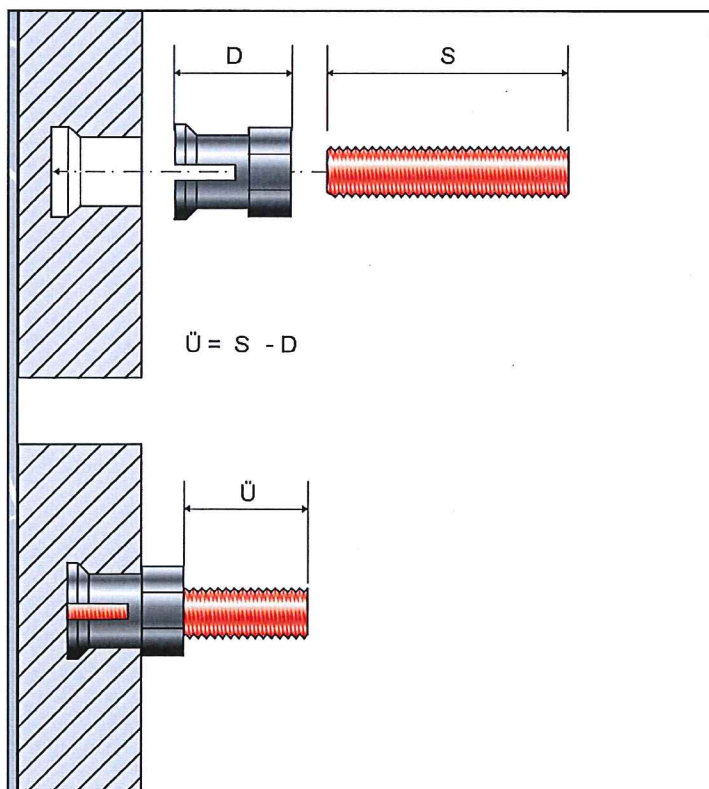


a) Insert the sleeve in the undercut hole and drill the screw in the sleeve



b) Installed anchor

4. Installation of anchor (sleeve and grub screw)



a) Insert the sleeve in the undercut hole

b) Drill the grub screw in the sleeve

c) Installed anchor

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Intended use
Installation instruction

Annex B 7

Table 3: characteristic values of the anchor and the façade panel

characteristic value of glass fibre concrete panel "fibreC"	panel thickness	$h =$	[mm]	13	
	resistance to bending stress	$\sigma_{Rk} =$	[N/mm ²]	16,2	
	partial safety factor ¹⁾	$\gamma_M =$	[-]	2,0	
	E-Modul	$E =$	[N/mm ²]	20.000 (10.000 ²⁾)	
	Poisson's ratio	$\nu =$	[-]	0,2	
	heat coefficient	$\alpha_T =$	[1/K]	10 x 10 ⁻⁶	
	dead load	$g =$	[kN/m ²]	0,27	
characteristic value of anchor KEIL - undercut anchor KH	resistance to ³⁾	tension load	$N_{Rk} =$	[kN]	1,2
		shear load	$V_{Rk} =$	[kN]	3,2
	partial safety factor ¹⁾	$\gamma_M =$	[-]	2,0	
	setting depth	$h_s \geq$	[mm]	8,5	
	edge distance	a_{rx} oder $a_{ry} \geq$	[mm]	60	
				0,1 x a	
	spacing	$a \leq$	[mm]	800	

¹⁾ in absence of other national regulations

²⁾ for verification in the serviceability state: $E = 10.000 \text{ N/mm}^2$

³⁾ in case of coincident stress of an anchor due to tension and shear load the following equation shall be

observed:
$$\frac{N_{Sd}}{N_{Rd}} + \frac{V_{Sd}}{V_{Rd}} \leq 1,1$$

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

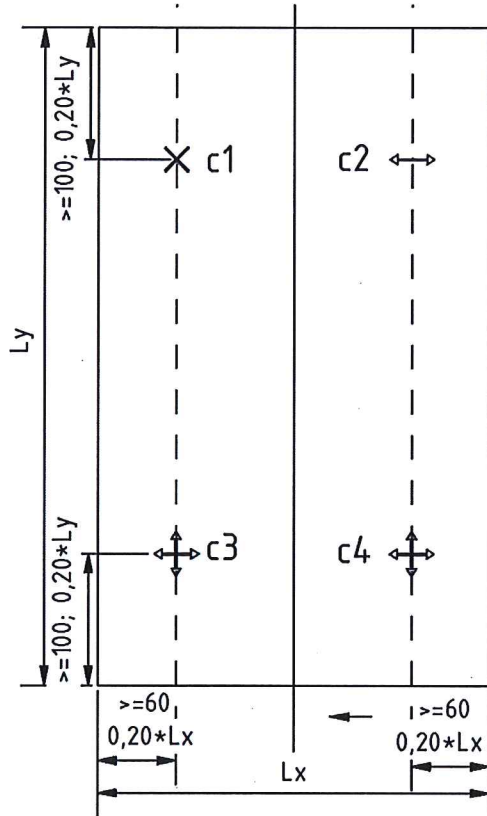
Performances

characteristic values of the anchor and the façade panel

Annex C 1

Bearing condition A

symmetric bearing condition of support system



Bearing condition B

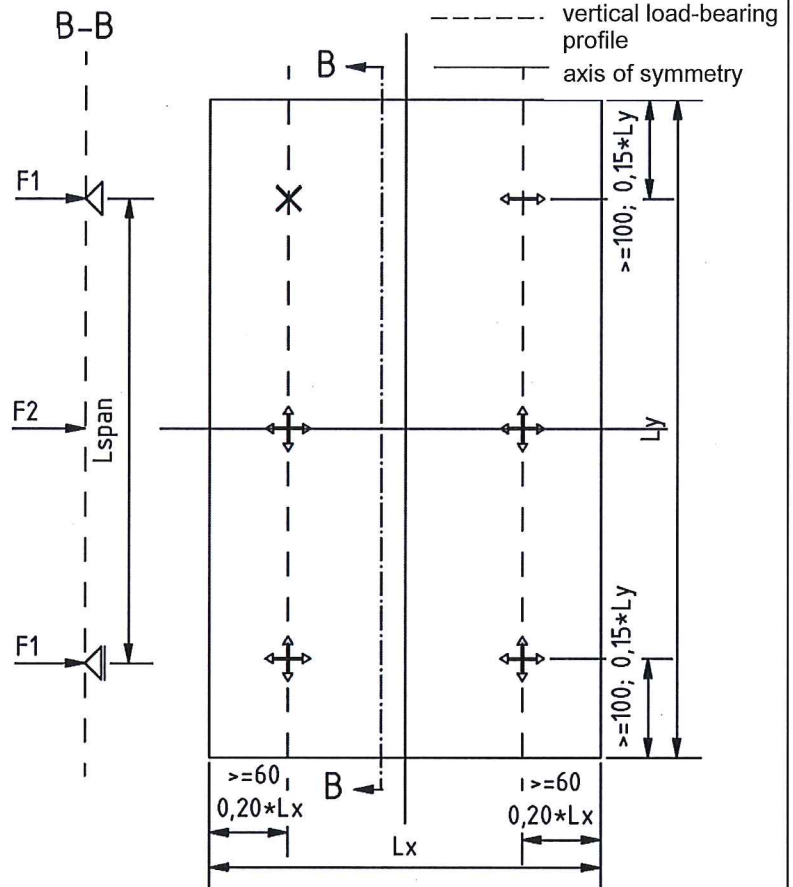


Table 2: characteristic resistance w_{Rk} to wind loads for selective support systems and panel sizes

w_{Rk}		γ_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 4
- 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 $I_{min} [cm^4] = 3 L_{span}^3$ (L_{span} in [m])

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Intended use

Characteristic resistance w_{Rk} to wind loads
for selective support systems and panel sizes

Annex C 2

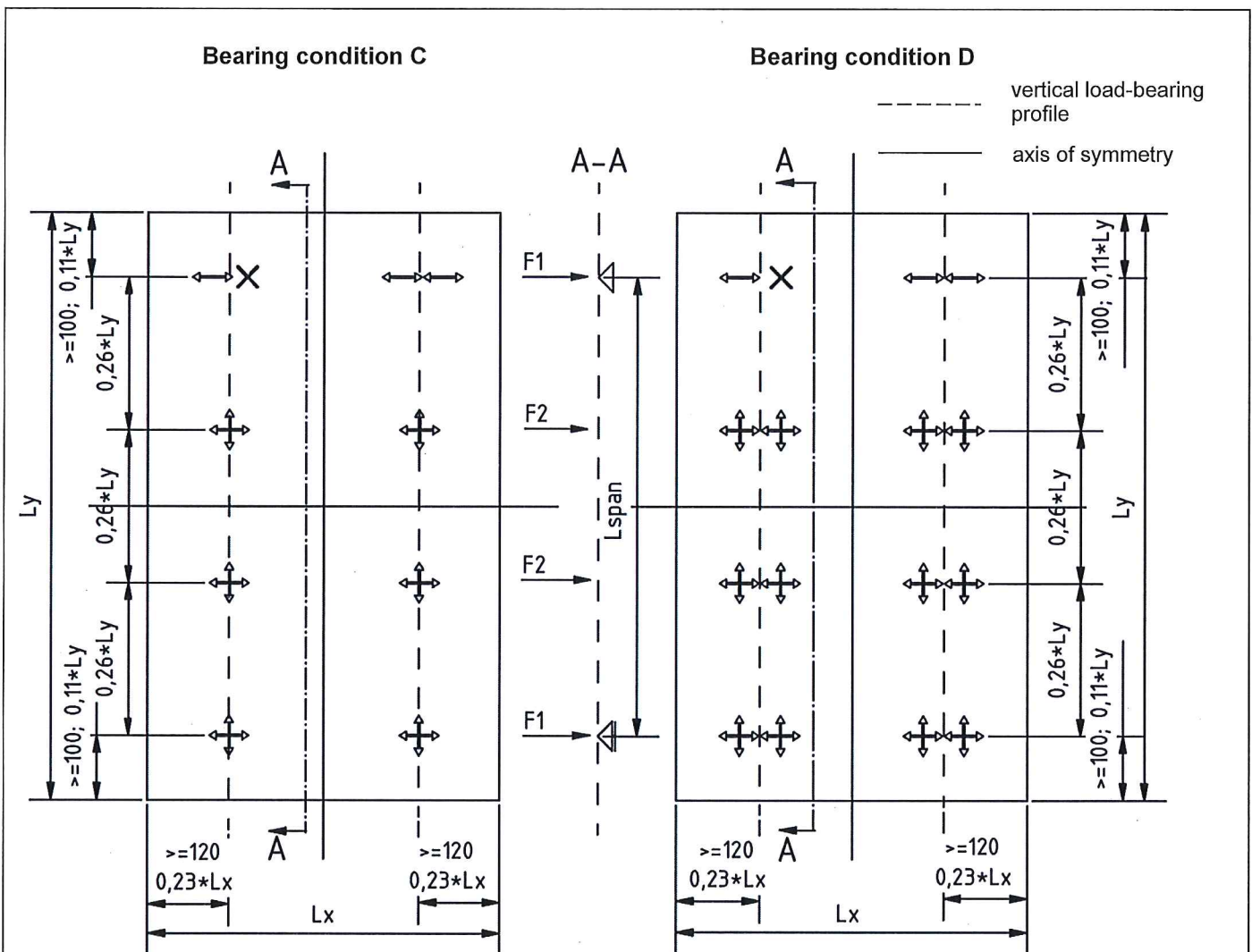


Table 4: characteristic resistance w_{Rk} to wind loads for selective support systems and panel sizes

w_{Rk}		γ_M	bearing condition C	bearing condition D
suction	pressure		plate size $L_x \times L_y$	plate size $L_x \times L_y$
[kN/m ²]	[kN/m ²]	[-]	[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 4
- minimum requirements to the supporting substructure:
 - for span length L_{span} (vertical load-bearing profile) > 1 m:
minimum stiffness of supporting substructure $I_{min} [cm^4] = 3 L_{span}^3$ (L_{span} in [m])

KEIL undercut anchor KH for glass fibre concrete skin panels "fibreC"

Intended use

Characteristic resistance w_{Rk} to wind loads
for selective support systems and panel sizes

Annex C 3