**Deutsches Institut für Bautechnik**

Approval body for construction products
and types of construction

**Bautechnisches Prüfamt**

An institution established by the Federal and
Laender Governments

Designated
according to
Article 29 of Regula-
tion (EU) No 305/2011
and member of EOTA
(European Organi-
sation for Technical
Assessment)

## European Technical Assessment

## ETA-20/0227
## of 13 November 2020

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 | Primero KEIL undercut anchor KH |
| Product family to which the construction product belongs | Anchor for the rear fixing of facade panels made of selected natural stones according to EN 1469:2015 |
| Manufacturer | Primero-Schiefer GmbH Neeskotten 5 51688 Wipperfürth DEUTSCHLAND |
| Manufacturing plant | Plant 1 |
| This European Technical Assessment contains | 29 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 |

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**Specific Part**

## 1 Technical description of the product

The Primero KEIL undercut anchor KH is a special anchor made of stainless steel 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 as well as distance washer for levelling of thickness tolerances $\Delta d_p = +6$ mm / $\pm 0$ mm. Alternatively, instead of the hexagon bolt with an integrated tooth lock washer, a threaded pin or threaded rod is used. 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. 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[1].

## 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 fastener 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 fasteners 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 and C 2 |
| Characteristic resistance to breakout or pull-out failure under shear load | See Annex C 1 and C 2 |
| Characteristic resistance to breakout or pull-out failure under combined tension and shear load | See Annex C 1 and C 2 |
| 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 2 |

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[1] The technical documentation comprises all information of the holder of this ETA necessary for the production, installation and maintenance of the fastener; these are in particular design drawings. 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 be handed over to the approved body.

## 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.
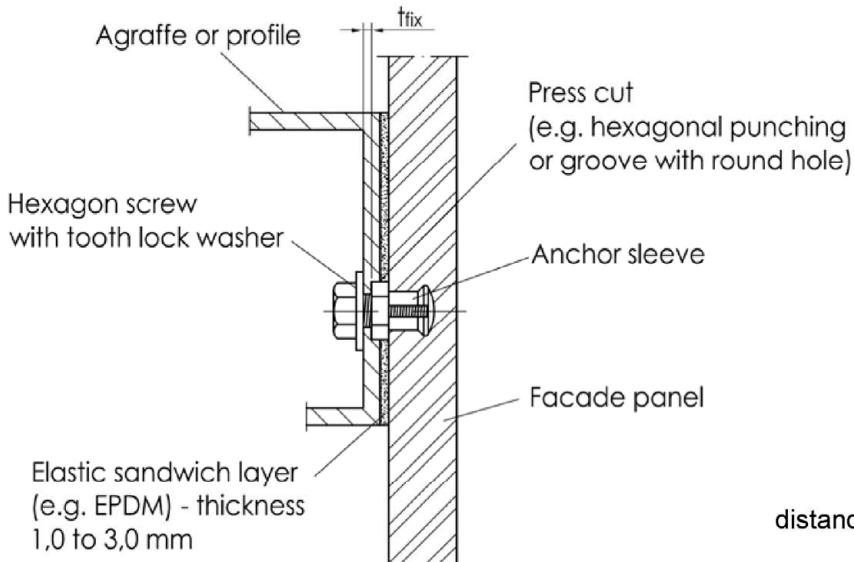
Issued in Berlin on 13 November 2020 by Deutsches Institut für Bautechnik

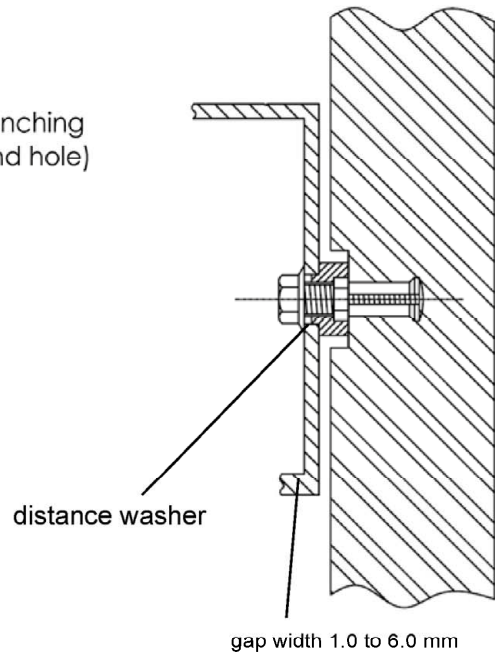Dipl.-Ing. Beatrix Wittstock
Head of Section

*beglaubigt:*
Aksünger

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**Installed anchor**

**Example without distance washer**

Agraffe or profile

$t_{fix}$

Press cut
(e.g. hexagonal punching
or groove with round hole)

Hexagon screw
with tooth lock washer

Anchor sleeve

Facade panel

Elastic sandwich layer
(e.g. EPDM) - thickness
1,0 to 3,0 mm

**Example with distance washer**

distance washer

gap width 1.0 to 6.0 mm

**Example Stand-off fixing**
- for facade panel
- not applicable in slate

gap width 1.0 to 6.0 mm
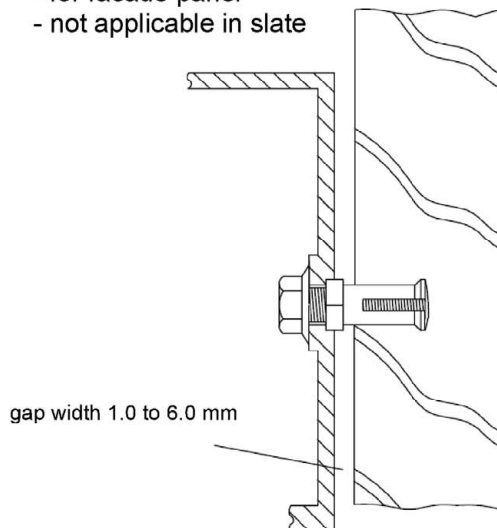
**Example Flush fixing**
- for reveal panel
- applicable for slate panels

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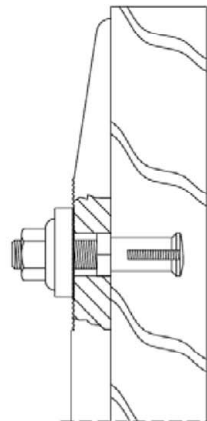
Primero KEIL undercut anchor KH

**Product description**
Installed anchor

Annex A 1

**Example of a substructure**

Fixed point (vertical)

single agraffe

Fixed point (vertical and horizontal)

horizontal profile

vertical load bearing profile

skid

Primero KEIL undercut anchor KH

**Product description**
Example of substructure and fixing of the panel

Annex A 2

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**Anchor** (dimensions in mm)



Marking:

c: The screw length must be adjusted to the respective design
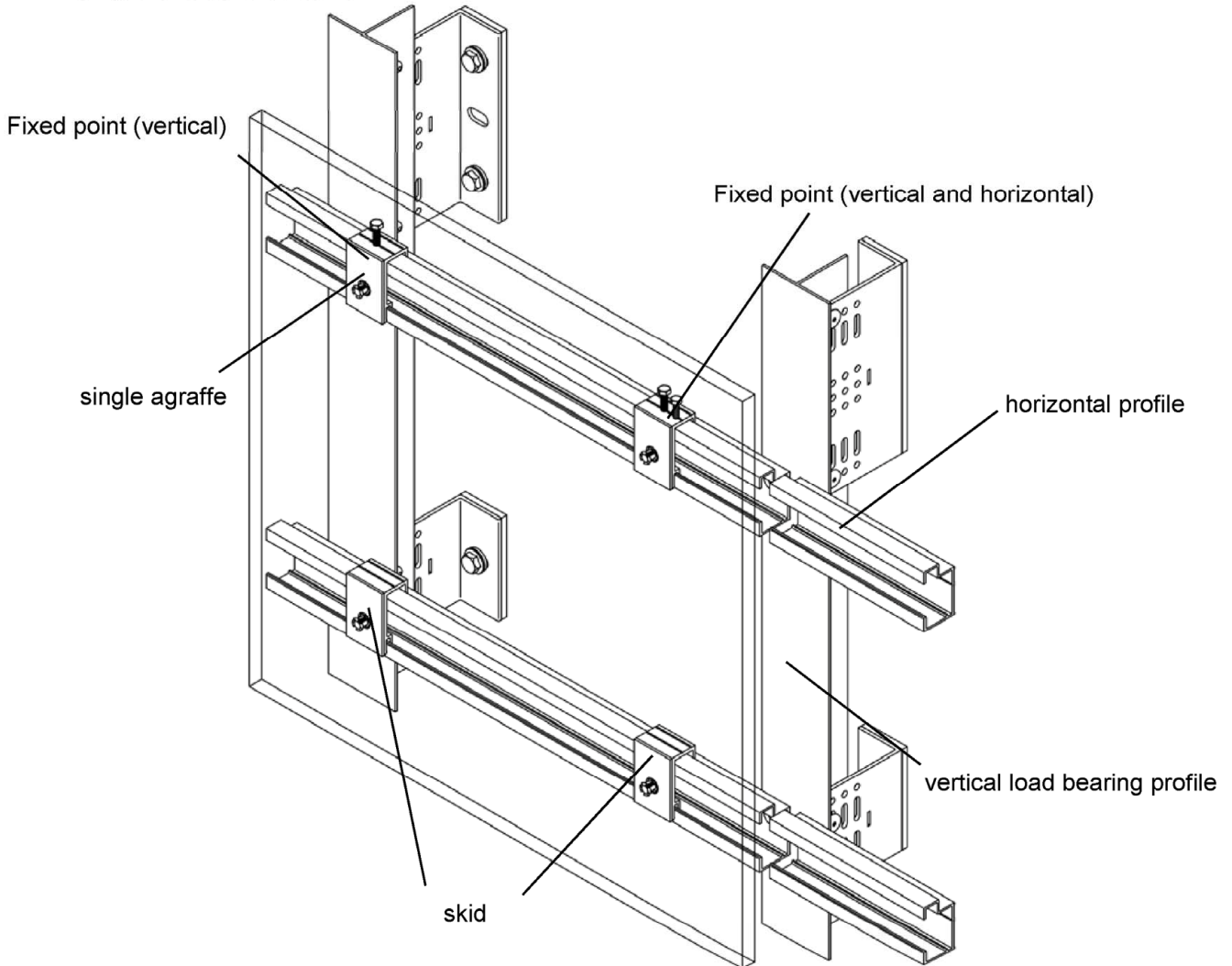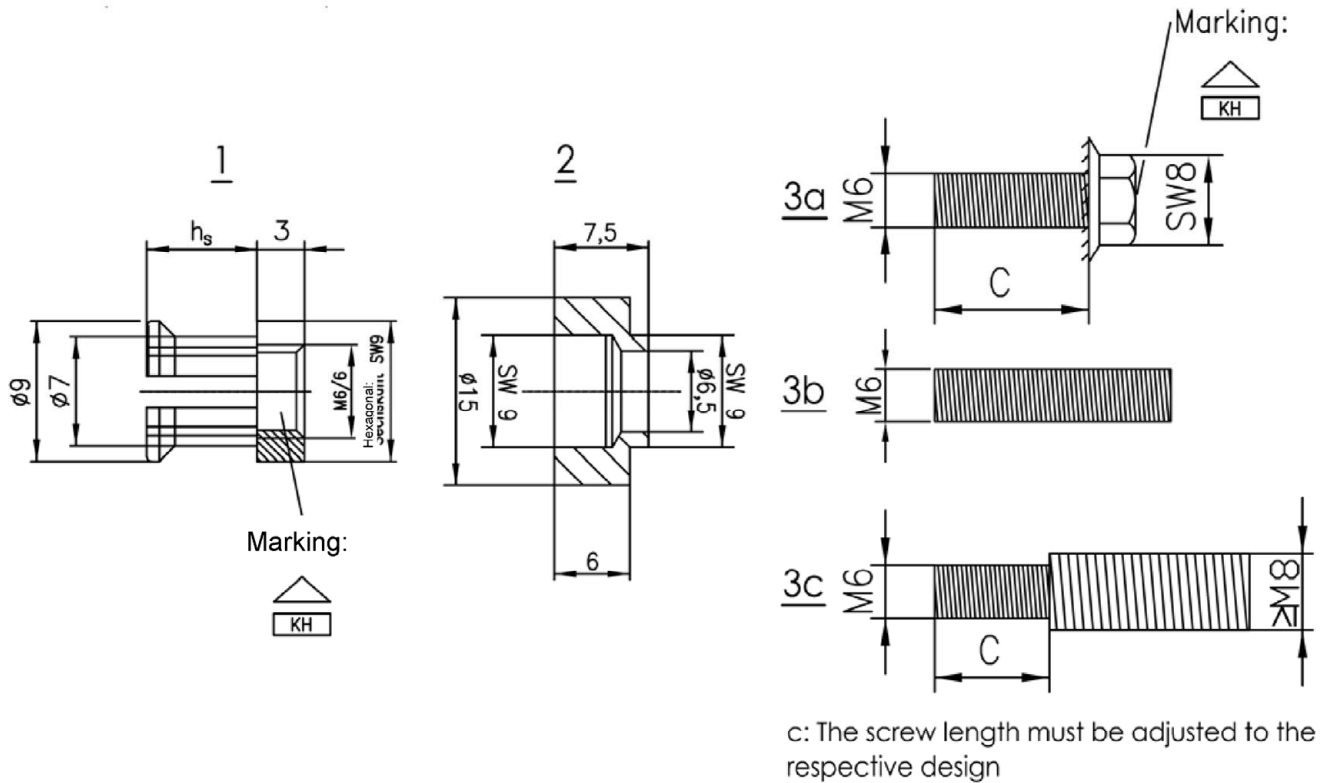
**Table A1:    Dimensions and Materials**

| Anchor type | | | KH 7 | KH 10 | KH 15 |
|---|---|---|---|---|---|
| anchorage depth | $h_s =$ | [mm] | 7,0 | 10 | 15 |
| screw length | $c =$ | [mm] | $h_s$ + 3mm + $t_{fix}$ | | |
| installation torque moment | $T_{inst}$ | [Nm] | $2,5 \leq T_{inst} \leq 4,0$ | | |
| **Materials** | | | | | |
| 1 | anchor sleeve | | stainless steel 1.4404 according to EN 10 088:2014 | | |
| 2 | washer | | aluminum 3.1645/ EN AW-2007 according to EN 573-3:2013-12 | | |
| 3a | hexagon screw with tooth lock washer | | stainless steel 1.4401, 1.4404 or 1.4578 according to EN 10 088:2014 | | |
| 3b | threaded pin | | stainless steel 1.4401, 1.4404 or 1.4578 according to EN 10 088:2014 | | |
| 3c | threaded bold | | stainless steel 1.4401, 1.4404 or 1.4578 according to EN 10 088:2014 | | |

| | |
|---|---|
| Primero KEIL undercut anchor KH | |
| **Product description**<br>Example of substructure and fixing of the panel | Annex A 3 |

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## Specifications of intended use

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

**Base materials:**
- Facade panels made of natural stone according EN 1469:2015
- Natural stone free of fractures, mechanically effective cracks and aging.
- Natural stone according to Table B1
- Parameters of facade panel according to Table B2 to B4

**Table B1: Natural stone group**

| Group of stone | | Natural stone | Conditions |
|---|---|---|---|
| I | High-quality intrusive rocks (plutonic rocks) | granite, granitite, syenite, tonalite, diorite, monzonite, gabbro other magmatic plutonic rocks | none |
| II | Metamorphic rocks with "hard stone character" | quarzite, granulite, gneiss, migmatite, slate [1] | slate type: only slates according to Table B2 and Table B3 |
| III | High-quality extrusive rocks (volcanic rocks) | basalt and basaltlava damaging ingredients (see Sonnenbrennerbasalt) may not existent | Density: basalt: $\rho \geq 2{,}7$ kg/dm³ basaltlava: $\rho \geq 2{,}2$ kg/dm³ |
| IV | Sedimentary rocks with "hard stone character" [3,4] | sandstone and limestone | sandstone: $\rho \geq 2{,}1$ kg/dm³ |

[1] For façade panels made of natural stones with planes of anisotropy, the difference between the bending strengths determined parallel to the planes of anisotropy and perpendicular to the edges of the planes of anisotropy shall not be more than 50 %.

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Primero KEIL undercut anchor KH

**Intended use**
Specifications

Annex B 1

**Table B2:** Characteristic values of anchors, façade, reveal panel and soffit made of natural stone

| Natural stone exceed slate | | |
|---|---|---|
| Panel thickness | $h_{nom}$ [mm] | 20 (30) [1] $\leq h_{nom} \leq 70$ |
| Maximum size of panel | $A \leq$ [m²] | 3,0 |
| Maximum side length | $H$ or $L \leq$ [m] | 3,0 |
| Number of anchors (rectangular arrangement) | [-] | 4 |
| Anchorage depth | $h_s =$ [mm] | 10 or 15 |
| Nominal diameter of drill hole | $\varnothing\, d_0 =$ [mm] | 7 |
| Edge distance of anchor | $a_r =$ [mm] | 50 mm $\leq a_r \leq 0{,}25L$ or $0{,}25H$ |
| Spacing of anchor for reveal panel | $b_r =$ [mm] | 40 mm $\leq b_r = 0{,}2H$ or $0{,}2L$ |
| Spacing | $a \geq$ [mm] | $8\, h_s$ |
| Screw length — without distance washer | $c =$ [mm] | $h_s + 3$ mm $+ t_{fix}$ |
| Screw length — with distance washer | $c =$ [mm] | $h_s + 7{,}5$ mm $+ t_{fix}$ |
| Remaining wall thickness [2] | $R \geq$ [mm] | $0{,}4\, h_{nom}$ |
| Bending stress — Epprechtstein yellow | $\sigma_{5\%} \geq$ [N/mm²] | 15,6 |
| Bending stress — Padang light | $\sigma_{5\%} \geq$ [N/mm²] | 10,3 |
| Bending stress — Sto-Kilzinger sandstone | $\sigma_{5\%} \geq$ [N/mm²] | 4,3 |

[1] for sandstone, limestone and basaltlava: panel thickness $h_{nom} \geq 30$ mm, if from the panel manufacturer warrented lowest expect-value (5% fractile) of the bending tensile strength is < 8 N/mm².

[2] only stand-off fixing

**Table B3:** Characteristic values of anchors, façade, reveal panel and soffit made of slate CS 50, SIN 120 or SIN 150

| Slate | | CS 50 | SIN 120 | SIN 150 |
|---|---|---|---|---|
| Panel thickness | $h_{nom} \geq$ [mm] | 10 | | |
| Maximum size of panel | $A \leq$ [m²] | 1,0 | | |
| Maximum side length | $H$ oder $L \leq$ [m] | 1,2 | | |
| Number of anchors (rectangular arrangement) | [-] | 4 or 6 | 4 | 4 |
| Density | $\gamma =$ [kN/m³] | 28,0 | | |
| E-Modulus | $E =$ [N/mm²] | 130000 | 120000 | 90000 |
| Bending stress | $\sigma_{5\%} \geq$ [N/mm²] | 40 | 25 | 30 |

| | |
|---|---|
| Primero KEIL undercut anchor KH | |
| **Intended use**<br>Specifications | Annex B 2 |

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**Table B4:** Characteristic values of anchors, façade, reveal panel and soffit made of slate Primero Vulcano Schiefer

| Slate | | |
|---|---|---|
| Panel thickness | $h_{nom} \geq$ [mm] | 20 |
| Number of anchors (rectangular arrangement) | [-] | 4 |
| Density | $\gamma =$ [kN/m³] | 28 |
| E-Modulus | E,mean = [N/mm²] | 65 000 |
| Bending stress | $\sigma_{5\%} \geq$ [N/mm²] | 35,0 |

**Use conditions (Environmental conditions):**
· In accordance with EN 1993-1-4:2015 dependent on Corrosion Resistancy Class (see ETA section 3.1).

**Design:**
· The facade anchorage must be dimensioned for the respective application under the responsibility of an engineer experienced in the field of facade construction.
· Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.
· Anchorages under static or quasi-static loading are designed in accordance with: EOTA Technical Report TR062 "Design of fasteners for facade panels made of natural stone".

**Installation:**
· 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.
· The drill dust must be removed from the borehole.
· 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 5:
    · 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 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 B 22 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.
· 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.
· Between agraffe and façade panel an elastic sandwich layer may be placed.
· Overhead installation is allowed

| Primero KEIL undercut anchor KH | |
|---|---|
| **Intended use**<br>Specifications | Annex B 3 |

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

Dia without countersink    Dia with countersink    CNC without countersink    CNC with countersink

$43\pm0,5$    $43\pm0,5$   hs    $\varnothing10h6$   $53\pm0,5$   KEIL 7/9/hs    $\varnothing10h6$   $53\pm0,5$   KEIL 7/9/hs   hs

$\varnothing7,2^{+0,3}_{-0,2}$    $\varnothing7,2^{+0,3}_{-0,2}$    $\varnothing7,2^{+0,3}_{-0,2}$    $\varnothing7,2^{+0,3}_{-0,2}$

## Geometry of the drill hole

without countersink      with countersink

$\varnothing7,0^{+0,5}_{-0}$   facade panel      $\varnothing7,0^{+0,5}_{-0}$   facade panel

$1^{0}$   $hs-0,3$      $1^{0}$   $hs-0,3$

$\varnothing9^{+1,5}_{-0,1}$      $\varnothing9^{+1,5}_{-0,1}$

## KEIL measuring device

tester for max. cylindrical drill hole diameter (optional)
(alternatively internal cylindrical gauge)

inscription with setting depth hs

bolt

measuring caliber with inserted botl

bottom part of measuring caliber

$0-0,3mm$

facade panel

feeler gauge 0,4mm — fitted hole

Drawing scale not true to real scale

| Primero KEIL undercut anchor KH | |
|---|---|
| **Intended use**<br>Setting tools and testing equipment | Annex B 4 |

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## Supports – Definition of edge distances and spacing
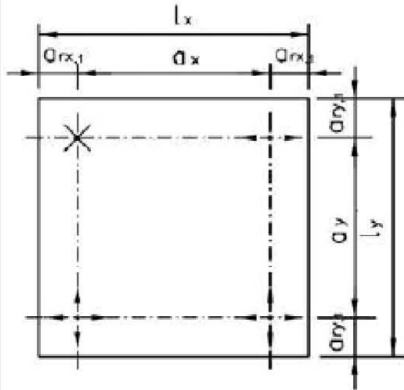
Legend:

| | | |
|---|---|---|
| $a_{rx}$, $a_{ry}$ | = | edge distance – anchor distance to the panel edge |
| $a_x$, $a_y$ | = | spacing – distance between the anchors |
| $l_x$ | = | length of the panel in horizontal direction |
| $l_y$ | = | length of the panel in vertical direction |
| ✕ | = | fixed bearing (fixed support) |
| ↔ | = | horizontal slide bearing (slide support) |
| ✛ | = | horizontal and vertical slide bearing (slide support) |

Figure 2: Façade panel with 4 agraffes – support condition 1
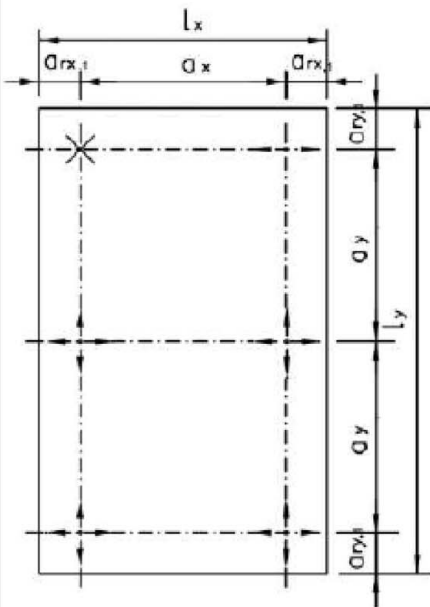
Figure 3: Façade panel with 6 agraffes – support condition 2
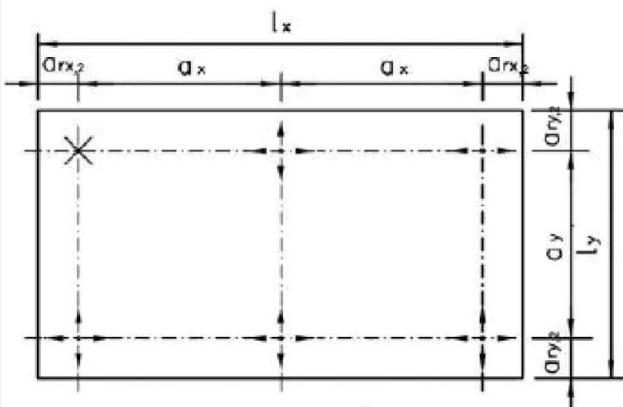
Figure 4: Façade panel with 6 agraffes – support condition 3

Primero KEIL undercut anchor KH

**Intended use**
Supports - definition of edge distance and spacing

Annex B 5

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## Definition of dimensions of the reveal angles and soffits
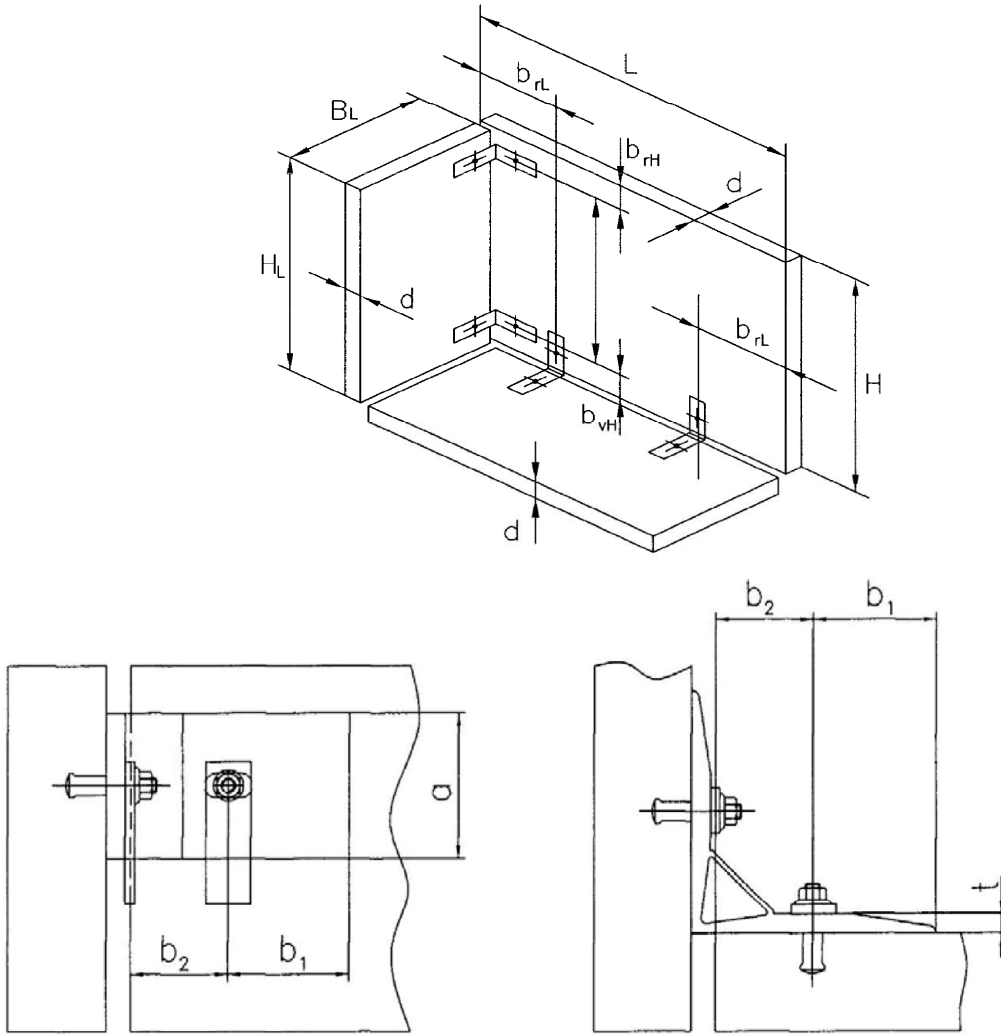


**Table B5:** Characteristic values of the reveal angles

| | | stainless steel 1.4401. 1.4404 bzw. 1.4571 EN 10088-3:2014 | aluminium EN 755:2016 |
|---|---|---|---|
| angle thickness | t [mm] | $t \geq 4$ | $t \geq 5$ |
| angle width | a [mm] | $40 \leq a \leq 100$ | $40 \leq a \leq 100$ |
| Distance between the centre of anchor to outer edge of reveal angle | $b_1$ [mm] | $25 \leq b_1 \leq 10\ t$ | $25 \leq b_1 \leq 8\ t$ |
| Distance between the centre of anchor to inner edge of reveal angle | $b_2$ [mm] | $40 \leq b_2 \leq 10\ t$ | $40 \leq b_2 \leq 8\ t$ |
| cross tension stiffness | $c_q$ [MN/m] | $c_q \leq 2{,}5$ | |

Primero KEIL undercut anchor KH

**Intended use**
Reveal angle and soffit of the panel made of natural stone (except slate)

Annex B 6

## Installation instructions

### 1.  Drilling the undercut hole
a) cylindrical drilling
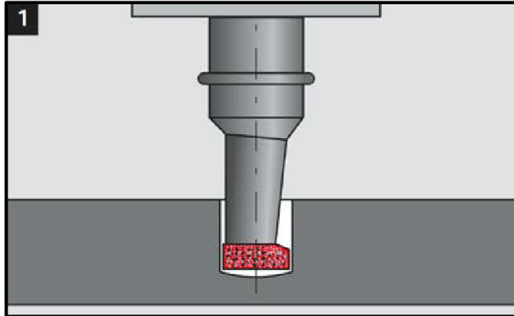


b) undercutting and cleaning
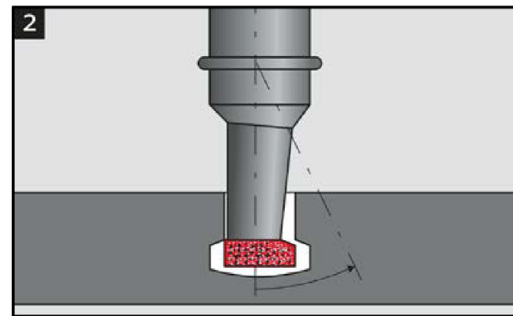


c) finished undercut hole
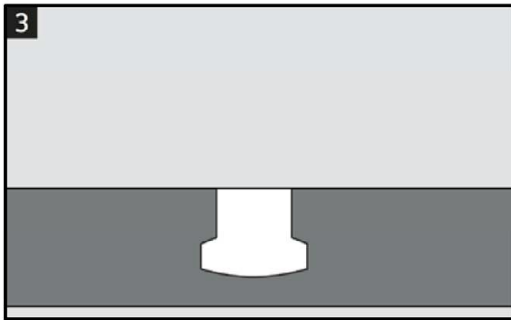


### 2.  Checking the undercut hole
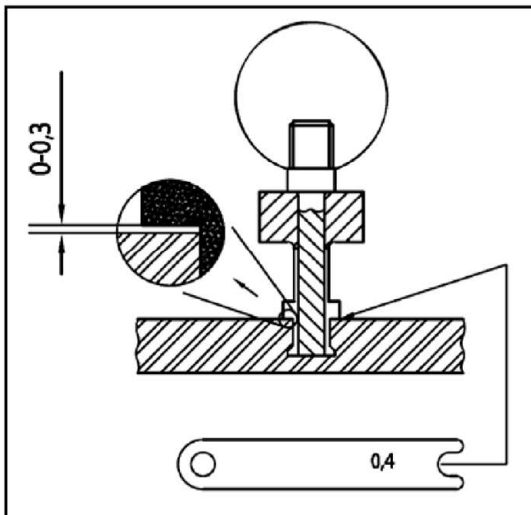
with KEIL depth control guide



| Primero KEIL undercut anchor KH | |
|---|---|
| **Intended use**<br>Installation instructions | Annex B 7 |

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### 3. Installation of anchor (sleeve and screw)
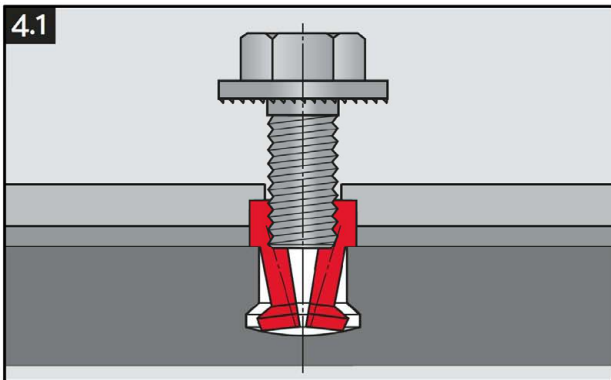
a) Insert the sleeve in the undercut hole
and screw in the screw in the sleeve
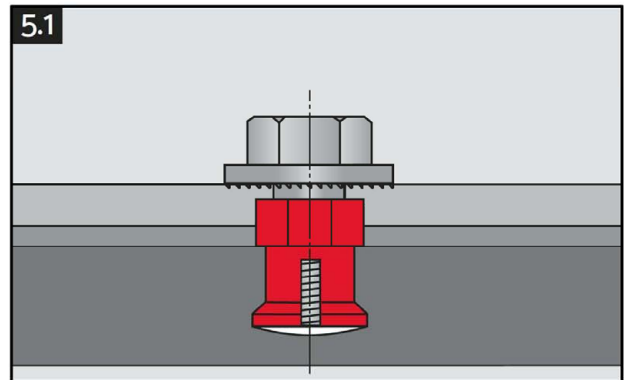
b) Installed anchor

### 4. Installation of anchor (sleeve and grub screw)
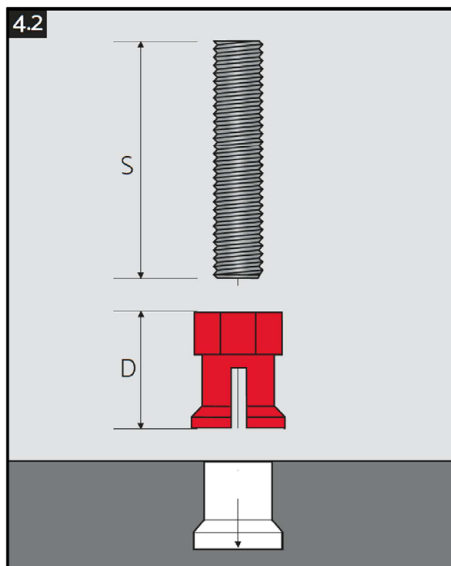
a) Insert the sleeve in the undercut hole
and screw in the grub screw in the sleeve

$$Ü = S - D$$
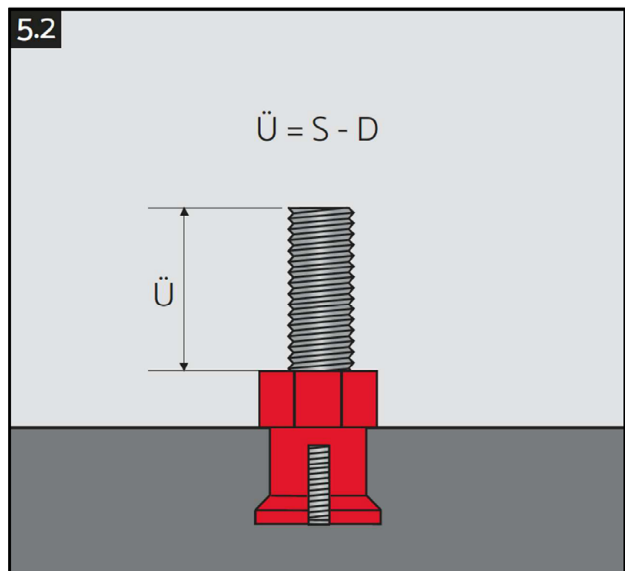
b) Installed anchor

| KEIL undercut anchor KH | |
| --- | --- |
| **Intended use**<br>Installation instructions | Annex B 8 |

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**Characteristic load-bearing capacity of the anchor**

**Table C1:** Characteristic values for facade panels and reveal panels

| Natural stone | | | Epprechstein yellow | Padang light | Sto-Kilzinger Sandstein |
|---|---|---|---|---|---|
| Country of origin | | | Germany | China | Poland |
| Petrographic desription | | | granite | granite | sandstone |
| Embedment depth | $h_s =$ | [mm] | 15 | 10 | 15 |
| Edge distance | $a_r \geq$ | [mm] | 100 | 50 | 100 |
| Spacing | $a \geq$ | [mm] | 120 | 80 | 120 |
| **Characteristic resistance** | | | | | |
| under tension load | $N_{Rk} =$ | [kN] | 4,6 | 3,6 | 2,9 |
| under shear load | $V_{Rk} =$ | [kN] | 5,1 | 4,2 | 3,0 |
| **Combined tension and shear load** | | | | | |
| Value for tri-linear function | X | [-] | 1,2 | 1,2 | 1,2 |

**Table C2:** Characteristic values for facade panels made of slate CS 50, SIN 120 und SIN 150

| | | | CS 50[1] | | SIN 120[1] | SIN 150[1] |
|---|---|---|---|---|---|---|
| Country of origin | | | Brasilia | | Spain | Spain |
| Petrographic desription | | | slate | | slate | slate |
| Embedment depth | $h_s =$ | [mm] | 7 | | | |
| Edge distance | $a_r \geq$ | [mm] | 50 | 100 | 50 | |
| Spacing | $a \geq$ | [mm] | 100 | 200 | 100 | |
| **Characteristic resistance** | | | | | | |
| Characteristic resistance to tension load | $N_{Rk} =$ | [kN] | 1,1 | 1,5 | 1,3 | 1,2 |
| Characteristic resistance to shear load | $V_{Rk} =$ | [kN] | 1,6 | 1,9 | 2,7 | 3,0 |
| **Combined tension and shear load** | | | | | | |
| Value for tri-linear function | X | [-] | 1,0 | 1,0 | 1,0 | 1,0 |

[1] According to Table B3

| Primero KEIL undercut anchor KH | Annex C 1 |
|---|---|
| **Performance** Characteristic resistance | |

**Table C3:** Characteristic values for facade panels made of slate Primero Vulcano Schiefer

| | | | |
|---|---|---|---|
| Country of origin | | | Spain |
| Petrographic desription | | | slate |
| Embedment depth | $h_s =$ | [mm] | 15 |
| Edge distance | $a_r \geq$ | [mm] | 50 |
| Spacing | $a \geq$ | [mm] | 100 |
| **Characteristic resistance** | | | |
| Characteristic resistance to tension load | $N_{Rk} =$ | [kN] | 4,2 |
| Characteristic resistance to shear load | $V_{Rk} =$ | [kN] | 6,0 |
| **Combined tension and shear load** | | | |
| Value for tri-linear function | X | [-] | 1,2 |

[1] According to Table B4

**Table C4: Characteristic resistance for steel failure**

| Characteristic resistance | | | |
|---|---|---|---|
| Characteristic resistance under tension load | $N_{Rk,s}$ | [kN] | 14,1 |
| Partial safety factor for tension load | $\gamma_{Ms}$[1] | [-] | 1,87 |
| Characteristic resistance under shear load | $V_{Rk,s}$ | [kN] | 7,0 |
| Partial safety factor | $\gamma_{Ms}$[1] | [-] | 1,56 |

[1] In absence of national regulations.

**Table C5: reduction factor $\alpha_{TR}$**

| Reduction factor | $\alpha_{TR}$ | [-] | 1,0 |
|---|---|---|---|

| | |
|---|---|
| Primero KEIL undercut anchor KH | |
| **Performance** <br> Characteristic resistance and $\alpha_{TR}$ | **Annex C2** |

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**Design of slate according to table B 3**

1    Admissible wind loads for selective panel sizes and bearing conditions for slate panels CS 50, SIN 120 and SIN 150

1.1   General

In Annex D 3 to D 12 several panel systems are listed as a function of the panel thickness, anchorage depth, edge distance, panel size, number of agraffes and the kind of support. The substructure has to be symmetrical.

For flush-fixed profiles following has to be considered:

$c_H$ =   height of the agraffe

Classification of the profiles in the following ratios:
$e/c_H$    $\leq 0,75$
$e/c_H$    $\leq 0,54$
$e/c_H$    $\leq 0,33$
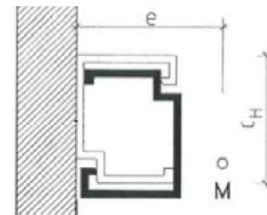
e  =   distance between of the facade panel and
        shear centre of the horizontal profile
        (s. figure 1)



**figure 1:** Open profile with shear centre

The proof of structural stability is fulfilled if Eq. (1) is satisfied.

$$w_{Ek} \leq w_{Tab} \tag{1}$$

mit:   $w_{Ek}$   =   characteristic wind load according to EN 1991-1-4
        $w_{Tab}$   =   value of admissible wind loads, see Annex D
                Following partial safety factors are fundamental for evaluation:
                $\gamma_G = 1,35$; $\gamma_Q = 1,5$; $\gamma_M = 1,8$.

The constructional requirements of Annex D 3 for the support with 6 fixing points must be fulfilled.

For subframes supporting three fixing points of a one panel or unsymmetrical supported panels with 4 fixing points, the moment of inertia of profiles must be at minimum:

$$I_Y \, [cm^4] = 65,2 \bullet L_i \, [m] - 58,5 \quad (gilt \; für: \; 0,9 \; m \leq L_i \leq 1,4 \; m) \tag{2}$$

with:   $L_i$       = equivalent support width (Annex D 3)
        $I_Y$       = moment of inertia of profiles (y-axis of the profile: parallel to the façade panel layer)

The module of elasticity of the profiles has to be $E \geq 70.000$ N/mm².

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Annex D 1

## 1.2 Smaller panel dimensions

In case of smaller panel dimensions for panels supported with 4 anchors Eq. (3) must be satisfied. For positioning of the fixings the relation of edge distance to length of the panel must be kept. The minimum edge distances can be taken from the respective Tables (Annex D 3 to D 12).

$$w_{Ek} \leq 0,9 \times \frac{A_{Tab}}{A_{vorh}} \, w_{Tab} \tag{3}$$

mit:
$w_{Ek}$ = characteristic wind load according to EN 1991-1-4

$w_{Tab}$ = value of admissible wind loads aus Anhang D

$A_{Tab}$ = panel size given in the Tables (Annex D 3 to D 12), related to admissible wind loads of the Tables

$A_{vorh}$ = existing panel size (area)

## 1.3 Unsymmetrical substructure

Unsymmetrical substructures can only be applied for panels supported with 4 fixing points. In this case Eq. (4) has to be fulfilled.

$$w_{Ek} \leq 0,5 \, w_{Tab} \tag{4}$$

mit:
$w_{Ek}$ = characteristic wind load according to EN 1991-1-4

$w_{Tab}$ = value of admissible wind loads according to Annex D 3 to D 12

•

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| --- | --- |
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**Dimensioning aid**

The following bearing conditions are to use for the admissible wind loads in Annex D 4 to D 12.
By object-releated calculation other admissible wind load tables may be determined.

### Maximum support spacing and location of the substructure fixings
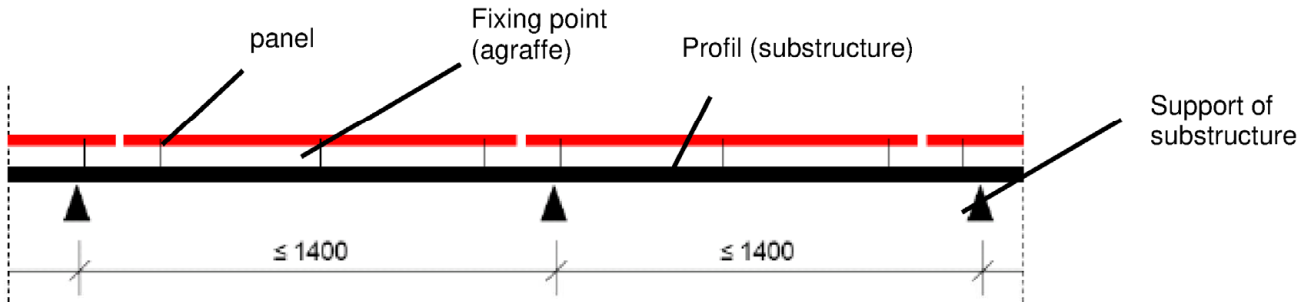


**Figure 5:** Profiles, supporting three fixing points of a panel, have a maximum spacing of the supports of 1.4 m.
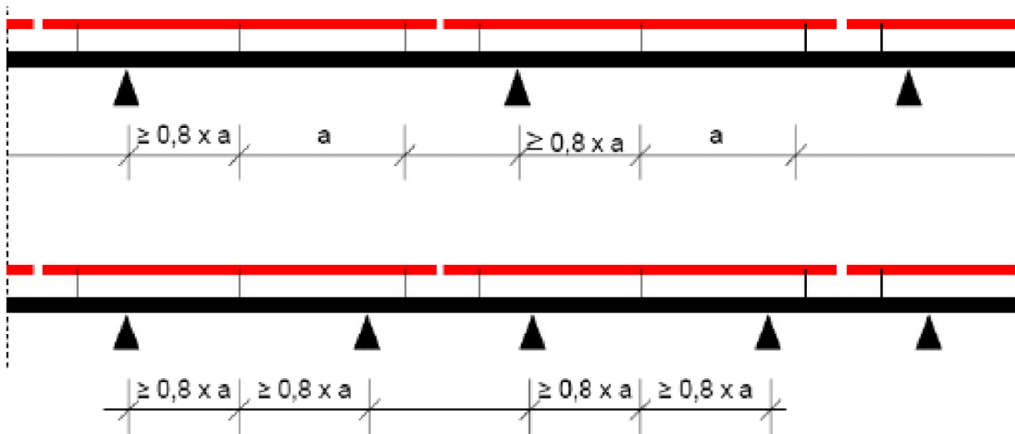


**Figure 6:** In profiles, supporting three fixing points of a panel, the central fixing points must have a minimum distance of 0,8 x a (a= spacing of the fixing points of the panel) to the supports.
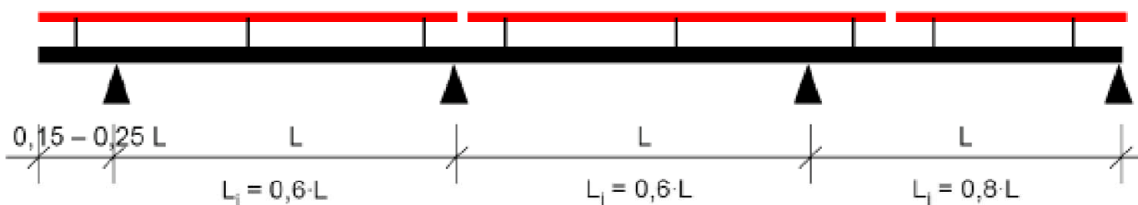


**Figure 7:** Equivalent support spacing

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Primero KEIL undercut anchor KH

**Informative**
Maximum support spacing and location of the substructure fixings for slate CS 50, SIN 120 and SIN 150

Annex D 3

**Dimensioning aid for facade panels made of slate CS 50**

**Table D1:** admissible wind loads – flush-fixed, $e/c_H = 0{,}75$; $a_r \geq 50$ mm

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 3,6 |
|  | 12,5 |  |  |  |  |  |  | 3,3 |
|  | 15 |  |  |  |  |  |  | 3,0 |
| 2 | 10 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 2,0 |
|  | 12,5 |  |  |  |  |  |  | 1,7 |
|  | 15 |  |  |  |  |  |  | 1,5 |
| 3 | 10 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,2 |
|  | 12,5 |  |  |  |  |  |  | 1,0 |
|  | 15 |  |  |  |  |  |  | 0,7 |
| 4 | 10 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 1,9 |
|  | 12,5 |  |  |  |  |  |  | 1,6 |
|  | 15 |  |  |  |  |  |  | 1,4 |
| 7 | 10 | 7 | 50-100 | 100-150 | 600 x 1200 | 6 | 2 3 | 1,3 |
|  | 12,5 |  |  |  |  |  |  | 1,1 |
|  | 15 |  |  |  |  |  |  | 0,8 |
| 8 | 10 | 7 | 50-100 | 150-225 | 1000 x 1000 | 6 | 2 3 | 0,6 |

**Table D2:** admissible wind loads – flush-fixed, $e/c_H = 0{,}75$; $a_r \geq 100$ mm

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 7 | 100-150 | 100-150 | 600 x 600 | 4 | 1 | 4,0 |
|  | 12,5 |  |  |  |  |  |  | 4,7 |
|  | 15 |  |  |  |  |  |  | 4,4 |
| 2 | 10 | 7 | 100-150 | 100-200 | 600 x 900 | 4 | 1 | 2,2 |
|  | 12,5 |  |  |  |  |  |  | 2,7 |
|  | 15 |  |  |  |  |  |  | 2,4 |
| 3 | 10 | 7 | 100-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,3 |
|  | 12,5 |  |  |  |  |  |  | 1,6 |
|  | 15 |  |  |  |  |  |  | 1,4 |
| 4 | 10 | 7 | 100-200 | 100-200 | 750 x 750 | 4 | 1 | 1,9 |
|  | 12,5 |  |  |  |  |  |  | 2,5 |
|  | 15 |  |  |  |  |  |  | 2,2 |
| 5 | 10 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 1,4 |
|  | 12,5 |  |  |  |  |  |  | 1,3 |
|  | 15 |  |  |  |  |  |  | 1,0 |
| 6 | 10 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 1,0 |
|  | 12,5 |  |  |  |  |  |  | 0,8 |
|  | 15 |  |  |  |  |  |  | 0,5 |
| 7 | 10 | 7 | 100 | 100-150 | 600 x 1200 | 6 | 2 3 | 2,0 |
|  | 12,5 |  |  |  |  |  |  | 1,8 |
|  | 15 |  |  |  |  |  |  | 1,5 |
| 8 | 10 | 7 | 100 | 150-225 | 1000 x 1000 | 6 | 2 3 | 0,8 |
|  | 12,5 |  |  |  |  |  |  | 0,8 |
|  | 15 |  |  |  |  |  |  | 0,5 |

Primero KEIL undercut anchor KH

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Dimensioning aid for façade panels made of slate CS 50

Annex D 4

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**Table D3:** admissible wind loads – flush-fixed, $e/c_H = 0,54$; $a_r \geq 50$ mm

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 3,8 |
| | 12,5 | | | | | | | 3,5 |
| | 15 | | | | | | | 3,3 |
| 2 | 10 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 2,2 |
| | 12,5 | | | | | | | 2,0 |
| | 15 | | | | | | | 1,8 |
| 3 | 10 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,5 |
| | 12,5 | | | | | | | 1,2 |
| | 15 | | | | | | | 1,0 |
| 4 | 10 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 2,1 |
| | 12,5 | | | | | | | 1,9 |
| | 15 | | | | | | | 1,7 |
| 7 | 10 | 7 | 50-100 | 100-150 | 600 x 1200 | 6 | 2 3 | 1,6 |
| | 12,5 | | | | | | | 1,3 |
| | 15 | | | | | | | 1,1 |
| 8 | 10 | 7 | 50-100 | 150-225 | 1000 x 1000 | 6 | 2 3 | 0,9 |

**Table D4:** admissible wind loads – flush-fixed, $e/c_H = 0,54$; $a_r \geq 100$ mm

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 7 | 100-150 | 100-150 | 600 x 600 | 4 | 1 | 4,2 |
| | 12,5 | | | | | | | 5,0 |
| | 15 | | | | | | | 4,8 |
| 2 | 10 | 7 | 100-150 | 100-200 | 600 x 900 | 4 | 1 | 2,4 |
| | 12,5 | | | | | | | 2,9 |
| | 15 | | | | | | | 2,7 |
| 3 | 10 | 7 | 100-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,5 |
| | 12,5 | | | | | | | 1,9 |
| | 15 | | | | | | | 1,7 |
| 4 | 10 | 7 | 100-200 | 100-200 | 750 x 750 | 4 | 1 | 2,1 |
| | 12,5 | | | | | | | 2,8 |
| | 15 | | | | | | | 2,5 |
| 5 | 10 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 1,6 |
| | 12,5 | | | | | | | 1,6 |
| | 15 | | | | | | | 1,3 |
| 6 | 10 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 1,2 |
| | 12,5 | | | | | | | 1,0 |
| | 15 | | | | | | | 0,8 |
| 7 | 10 | 7 | 100 | 100-150 | 600 x 1200 | 6 | 2 3 | 2,0 |
| | 12,5 | | | | | | | 2,1 |
| | 15 | | | | | | | 1,8 |
| 8 | 10 | 7 | 100 | 150-225 | 1000 x 1000 | 6 | 2 3 | 1,0 |
| | 12,5 | | | | | | | 1,1 |
| | 15 | | | | | | | 0,9 |

Primero KEIL undercut anchor KH

**Informative**
Dimensioning aid for façade panels made of slate CS 50

Annex D 5

**Table D5:** admissible wind loads – flush-fixed, $e/c_H = 0.33$; $a_r \geq 50$ mm

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 4,0 |
|   | 12,5 | | | | | | | 3,8 |
|   | 15 | | | | | | | 3,7 |
| 2 | 10 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 2,4 |
|   | 12,5 | | | | | | | 2,3 |
|   | 15 | | | | | | | 2,1 |
| 3 | 10 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,7 |
|   | 12,5 | | | | | | | 1,5 |
|   | 15 | | | | | | | 1,3 |
| 4 | 10 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 2,3 |
|   | 12,5 | | | | | | | 2,1 |
|   | 15 | | | | | | | 2,0 |
| 7 | 10 | 7 | 50-100 | 100-150 | 600 x 1200 | 6 | 2 3 | 1,8 |
|   | 12,5 | | | | | | | 1,6 |
|   | 15 | | | | | | | 1,4 |
| 8 | 10 | 7 | 50-100 | 150-225 | 1000 x 1000 | 6 | 2 3 | 1,1 |
|   | 12,5 | | | | | | | 0,9 |
|   | 15 | | | | | | | 0,7 |

**Table D6:** admissible wind loads – flush-fixed, $e/c_H = 0.33$; $a_r \geq 100$ mm

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 7 | 100-150 | 100-150 | 600 x 600 | 4 | 1 | 4,4 |
|   | 12,5 | | | | | | | 5,2 |
|   | 15 | | | | | | | 5,1 |
| 2 | 10 | 7 | 100-150 | 100-200 | 600 x 900 | 4 | 1 | 2,6 |
|   | 12,5 | | | | | | | 3,2 |
|   | 15 | | | | | | | 3,0 |
| 3 | 10 | 7 | 100-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,7 |
|   | 12,5 | | | | | | | 2,2 |
|   | 15 | | | | | | | 2,0 |
| 4 | 10 | 7 | 100-200 | 100-200 | 750 x 750 | 4 | 1 | 2,3 |
|   | 12,5 | | | | | | | 3,0 |
|   | 15 | | | | | | | 2,9 |
| 5 | 10 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 1,8 |
|   | 12,5 | | | | | | | 1,8 |
|   | 15 | | | | | | | 1,6 |
| 6 | 10 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 1,4 |
|   | 12,5 | | | | | | | 1,3 |
|   | 15 | | | | | | | 1,1 |
| 7 | 10 | 7 | 100 | 100-150 | 600 x 1200 | 6 | 2 3 | 2,0 |
|   | 12,5 | | | | | | | 2,3 |
|   | 15 | | | | | | | 2,1 |
| 8 | 10 | 7 | 100 | 150-225 | 1000 x 1000 | 6 | 2 3 | 1,2 |
|   | 12,5 | | | | | | | 1,4 |
|   | 15 | | | | | | | 1,2 |

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Dimensioning aid for façade panels made of slate CS 50

Annex D 6

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**Dimensioning aid for facade panels made of slate SIN 120**
**Table D7:** admissible wind loads – flush-fixed, $e/c_H = 0,75$

| System | $d = $ [mm] | $h_v = $ [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10,0 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 2,2 |
|   | 12,5 |   |   |   |   |   |   | 3,3 |
|   | 15,0 |   |   |   |   |   |   | 3,0 |
|   | 17,5 |   |   |   |   |   |   | 2,8 |
|   | 20,0 |   |   |   |   |   |   | 2,6 |
| 2 | 10,0 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 1,1 |
|   | 12,5 |   |   |   |   |   |   | 1,8 |
|   | 15,0 |   |   |   |   |   |   | 1,5 |
|   | 17,5 |   |   |   |   |   |   | 1,3 |
|   | 20,0 |   |   |   |   |   |   | 1,1 |
| 3 | 10,0 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 0,5 |
|   | 12,5 |   |   |   |   |   |   | 1,0 |
|   | 15,0 |   |   |   |   |   |   | 0,8 |
|   | 17,5 |   |   |   |   |   |   | 0,6 |
|   | 20,0 |   |   |   |   |   |   | 0,3 |
| 4 | 10,0 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 0,9 |
|   | 12,5 |   |   |   |   |   |   | 1,7 |
|   | 15,0 |   |   |   |   |   |   | 1,4 |
|   | 17,5 |   |   |   |   |   |   | 1,2 |
|   | 20,0 |   |   |   |   |   |   | 0,9 |
| 5 | 10,0 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 0,6 |
|   | 12,5 |   |   |   |   |   |   | 0,8 |
|   | 15,0 |   |   |   |   |   |   | 0,5 |
|   | 17,5 |   |   |   |   |   |   | 0,3 |
|   | 20,0 |   |   |   |   |   |   | 0,1 |
| 6 | 10,0 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 0,3 |
|   | 12,5 |   |   |   |   |   |   | 0,4 |
|   | 15,0 |   |   |   |   |   |   | 0,2 |

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**Informative**
Dimensioning aid for façade panels made of slate SIN 120

Annex D 7

**Table D8:** admissible wind loads – flush-fixed, $e/c_H = 0,54$

| System | $d$ = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10,0 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 2,4 |
|   | 12,5 |   |        |        |           |   |   | 3,5 |
|   | 15,0 |   |        |        |           |   |   | 3,3 |
|   | 17,5 |   |        |        |           |   |   | 3,1 |
|   | 20,0 |   |        |        |           |   |   | 2,9 |
| 2 | 10,0 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 1,3 |
|   | 12,5 |   |        |        |           |   |   | 2,0 |
|   | 15,0 |   |        |        |           |   |   | 1,8 |
|   | 17,5 |   |        |        |           |   |   | 1,7 |
|   | 20,0 |   |        |        |           |   |   | 1,5 |
| 3 | 10,0 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 0,7 |
|   | 12,5 |   |        |         |            |   |   | 1,3 |
|   | 15,0 |   |        |         |            |   |   | 1,1 |
|   | 17,5 |   |        |         |            |   |   | 0,9 |
|   | 20,0 |   |        |         |            |   |   | 0,7 |
| 4 | 10,0 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 1,1 |
|   | 12,5 |   |        |        |           |   |   | 1,9 |
|   | 15,0 |   |        |        |           |   |   | 1,7 |
|   | 17,5 |   |        |        |           |   |   | 1,5 |
|   | 20,0 |   |        |        |           |   |   | 1,4 |
| 5 | 10,0 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 0,8 |
|   | 12,5 |   |         |         |           |   |   | 1,1 |
|   | 15,0 |   |         |         |           |   |   | 0,9 |
|   | 17,5 |   |         |         |           |   |   | 0,7 |
|   | 20,0 |   |         |         |           |   |   | 0,5 |
| 6 | 10,0 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 0,6 |
|   | 12,5 |   |         |         |             |   |   | 0,7 |
|   | 15,0 |   |         |         |             |   |   | 0,5 |
|   | 17,5 |   |         |         |             |   |   | 0,3 |
|   | 20,0 |   |         |         |             |   |   | 0,1 |

Primero KEIL undercut anchor KH

**Informative**
Dimensioning aid for façade panels made of slate SIN 120

Annex D 8

**Table D9:** admissible wind loads – flush-fixed, $e/c_H = 0,33$

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10,0 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 2,6 |
|   | 12,5 |   |   |   |   |   |   | 3,8 |
|   | 15,0 |   |   |   |   |   |   | 3,7 |
|   | 17,5 |   |   |   |   |   |   | 3,5 |
|   | 20,0 |   |   |   |   |   |   | 3,4 |
| 2 | 10,0 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 1,5 |
|   | 12,5 |   |   |   |   |   |   | 2,3 |
|   | 15,0 |   |   |   |   |   |   | 2,2 |
|   | 17,5 |   |   |   |   |   |   | 2,0 |
|   | 20,0 |   |   |   |   |   |   | 1,9 |
| 3 | 10,0 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 0,9 |
|   | 12,5 |   |   |   |   |   |   | 1,6 |
|   | 15,0 |   |   |   |   |   |   | 1,4 |
|   | 17,5 |   |   |   |   |   |   | 1,3 |
|   | 20,0 |   |   |   |   |   |   | 1,2 |
| 4 | 10,0 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 1,3 |
|   | 12,5 |   |   |   |   |   |   | 2,2 |
|   | 15,0 |   |   |   |   |   |   | 2,0 |
|   | 17,5 |   |   |   |   |   |   | 1,9 |
|   | 20,0 |   |   |   |   |   |   | 1,8 |
| 5 | 10,0 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 1,0 |
|   | 12,5 |   |   |   |   |   |   | 1,3 |
|   | 15,0 |   |   |   |   |   |   | 1,2 |
|   | 17,5 |   |   |   |   |   |   | 1,0 |
|   | 20,0 |   |   |   |   |   |   | 0,9 |
| 6 | 10,0 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 0,8 |
|   | 12,5 |   |   |   |   |   |   | 0,9 |
|   | 15,0 |   |   |   |   |   |   | 0,8 |
|   | 17,5 |   |   |   |   |   |   | 0,7 |
|   | 20,0 |   |   |   |   |   |   | 0,5 |

Primero KEIL undercut anchor KH

**Informative**
Dimensioning aid for façade panels made of slate SIN 120

Annex D 9

**Deutsches
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**DIBt**

**Dimensioning aid for facade panels made of slate SIN 150**
   **Table D10:**   admissible wind loads – flush-fixed, $e/c_H = 0,75$

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10,0 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 2,8 |
|   | 12,5 |   |   |   |   |   |   | 3,4 |
|   | 15,0 |   |   |   |   |   |   | 3,1 |
|   | 17,5 |   |   |   |   |   |   | 2,9 |
|   | 20,0 |   |   |   |   |   |   | 2,7 |
| 2 | 10,0 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 1,5 |
|   | 12,5 |   |   |   |   |   |   | 1,9 |
|   | 15,0 |   |   |   |   |   |   | 1,6 |
|   | 17,5 |   |   |   |   |   |   | 1,4 |
|   | 20,0 |   |   |   |   |   |   | 1,2 |
| 3 | 10,0 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 0,8 |
|   | 12,5 |   |   |   |   |   |   | 1,1 |
|   | 15,0 |   |   |   |   |   |   | 0,9 |
|   | 17,5 |   |   |   |   |   |   | 0,6 |
|   | 20,0 |   |   |   |   |   |   | 0,4 |
| 4 | 10,0 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 1,3 |
|   | 12,5 |   |   |   |   |   |   | 1,7 |
|   | 15,0 |   |   |   |   |   |   | 1,5 |
|   | 17,5 |   |   |   |   |   |   | 1,3 |
|   | 20,0 |   |   |   |   |   |   | 1,0 |
| 5 | 10,0 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 0,9 |
|   | 12,5 |   |   |   |   |   |   | 0,8 |
|   | 15,0 |   |   |   |   |   |   | 0,6 |
|   | 17,5 |   |   |   |   |   |   | 0,4 |
|   | 20,0 |   |   |   |   |   |   | 0,1 |
| 6 | 10,0 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 0,6 |
|   | 12,5 |   |   |   |   |   |   | 0,5 |
|   | 15,0 |   |   |   |   |   |   | 0,2 |

Primero KEIL undercut anchor KH

**Informative**
Dimensioning aid for façade panels made of slate SIN 150

Annex D 10

**Table D11:** admissible wind loads – flush-fixed, $e/c_H = 0,54$

| System | d = [mm] | $h_v$ = [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10,0 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 3,0 |
|   | 12,5 |   |   |   |   |   |   | 3,6 |
|   | 15,0 |   |   |   |   |   |   | 3,4 |
|   | 17,5 |   |   |   |   |   |   | 3,2 |
|   | 20,0 |   |   |   |   |   |   | 3,1 |
| 2 | 10,0 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 1,7 |
|   | 12,5 |   |   |   |   |   |   | 2,1 |
|   | 15,0 |   |   |   |   |   |   | 1,9 |
|   | 17,5 |   |   |   |   |   |   | 1,7 |
|   | 20,0 |   |   |   |   |   |   | 1,6 |
| 3 | 10,0 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,0 |
|   | 12,5 |   |   |   |   |   |   | 1,4 |
|   | 15,0 |   |   |   |   |   |   | 1,2 |
|   | 17,5 |   |   |   |   |   |   | 1,0 |
|   | 20,0 |   |   |   |   |   |   | 0,8 |
| 4 | 10,0 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 1,5 |
|   | 12,5 |   |   |   |   |   |   | 2,0 |
|   | 15,0 |   |   |   |   |   |   | 1,8 |
|   | 17,5 |   |   |   |   |   |   | 1,6 |
|   | 20,0 |   |   |   |   |   |   | 1,4 |
| 5 | 10,0 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 1,1 |
|   | 12,5 |   |   |   |   |   |   | 1,1 |
|   | 15,0 |   |   |   |   |   |   | 0,9 |
|   | 17,5 |   |   |   |   |   |   | 0,7 |
|   | 20,0 |   |   |   |   |   |   | 0,6 |
| 6 | 10,0 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 0,8 |
|   | 12,5 |   |   |   |   |   |   | 0,7 |
|   | 15,0 |   |   |   |   |   |   | 0,5 |
|   | 17,5 |   |   |   |   |   |   | 0,4 |
|   | 20,0 |   |   |   |   |   |   | 0,2 |

Primero KEIL undercut anchor KH

**Informative**
Dimensioning aid for façade panels made of slate SIN 150

Annex D 11

**Deutsches Institut für Bautechnik** — DIBt

**Table D12:** admissible wind loads – flush-fixed, $e/c_H = 0{,}33$

| System | $d =$ [mm] | $h_v =$ [mm] | $a_{rx,1}$ $a_{ry,2}$ [mm] | $a_{ry,1}$ $a_{rx,2}$ [mm] | Panel length x width [mm] | No. of agraffes | Support condition (Annex B 5) | Admissible windloads $w_{Tab}$ [kN/m²] |
|---|---|---|---|---|---|---|---|---|
| 1 | 10,0 | 7 | 50-150 | 50-150 | 600 x 600 | 4 | 1 | 3,2 |
| | 12,5 | | | | | | | 3,9 |
| | 15,0 | | | | | | | 3,8 |
| | 17,5 | | | | | | | 3,6 |
| | 20,0 | | | | | | | 3,5 |
| 2 | 10,0 | 7 | 50-150 | 50-200 | 600 x 900 | 4 | 1 | 1,9 |
| | 12,5 | | | | | | | 2,4 |
| | 15,0 | | | | | | | 2,3 |
| | 17,5 | | | | | | | 2,1 |
| | 20,0 | | | | | | | 2,0 |
| 3 | 10,0 | 7 | 50-150 | 100-250 | 600 x 1200 | 4 | 1 | 1,2 |
| | 12,5 | | | | | | | 1,6 |
| | 15,0 | | | | | | | 1,5 |
| | 17,5 | | | | | | | 1,4 |
| | 20,0 | | | | | | | 1,2 |
| 4 | 10,0 | 7 | 50-200 | 50-200 | 750 x 750 | 4 | 1 | 1,7 |
| | 12,5 | | | | | | | 2,3 |
| | 15,0 | | | | | | | 2,1 |
| | 17,5 | | | | | | | 2,0 |
| | 20,0 | | | | | | | 1,9 |
| 5 | 10,0 | 7 | 100-200 | 100-200 | 900 x 900 | 4 | 1 | 1,3 |
| | 12,5 | | | | | | | 1,4 |
| | 15,0 | | | | | | | 1,2 |
| | 17,5 | | | | | | | 1,1 |
| | 20,0 | | | | | | | 1,0 |
| 6 | 10,0 | 7 | 100-200 | 100-200 | 1000 x 1000 | 4 | 1 | 1,0 |
| | 12,5 | | | | | | | 1,0 |
| | 15,0 | | | | | | | 0,9 |
| | 17,5 | | | | | | | 0,7 |
| | 20,0 | | | | | | | 0,6 |

Primero KEIL undercut anchor KH

**Informative**
Dimensioning aid for façade panels made of slate SIN 150

Annex D 12