Deutsches Institut für Bautechnik

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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 Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-20/1084 of 22 December 2023

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	Undercut anchor Sigma 8 Pro for facade panel Swisspearl Largo, in thickness of 8 mm
Product family to which the construction product belongs	Fastener for the rear fixing of facade panels made of fibre cement flat sheet in accordance with EN 12467:2012
Manufacturer	Swisspearl Group AG Eternitstrasse 3 8867 NIEDERURNEN SCHWEIZ
Manufacturing plant	Plant 1
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	330030-00-0601, Edition 10/2018

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Specific Part

1 Technical description of the product

The Sigma-8-Pro for Swisspearl Largo façade panels of Swisspearl AG consits of two undercut anchors. The undercut anchor consiting of a cone bolt with M6 external thread and a hexagon nut. The spacer between the undercut anchor is for installation with the agraffe. The cone bolt and the hexagon nut made of stainless steel and the spacer made of polyamide.

In the façade panel is drilled a big borehole with a diameter of 15,2 mm and across the bore hole an undercut with a diameter of 15,2 mm is drilling. The two cone bolt are put one after other into the big borehole and there are shifted in both sides within the undercut. The spacer holds the undercut anchor in distance. The hexagon nut is fixing the undercut anchor with the agraffe.

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 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
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 22 December 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Aksünger

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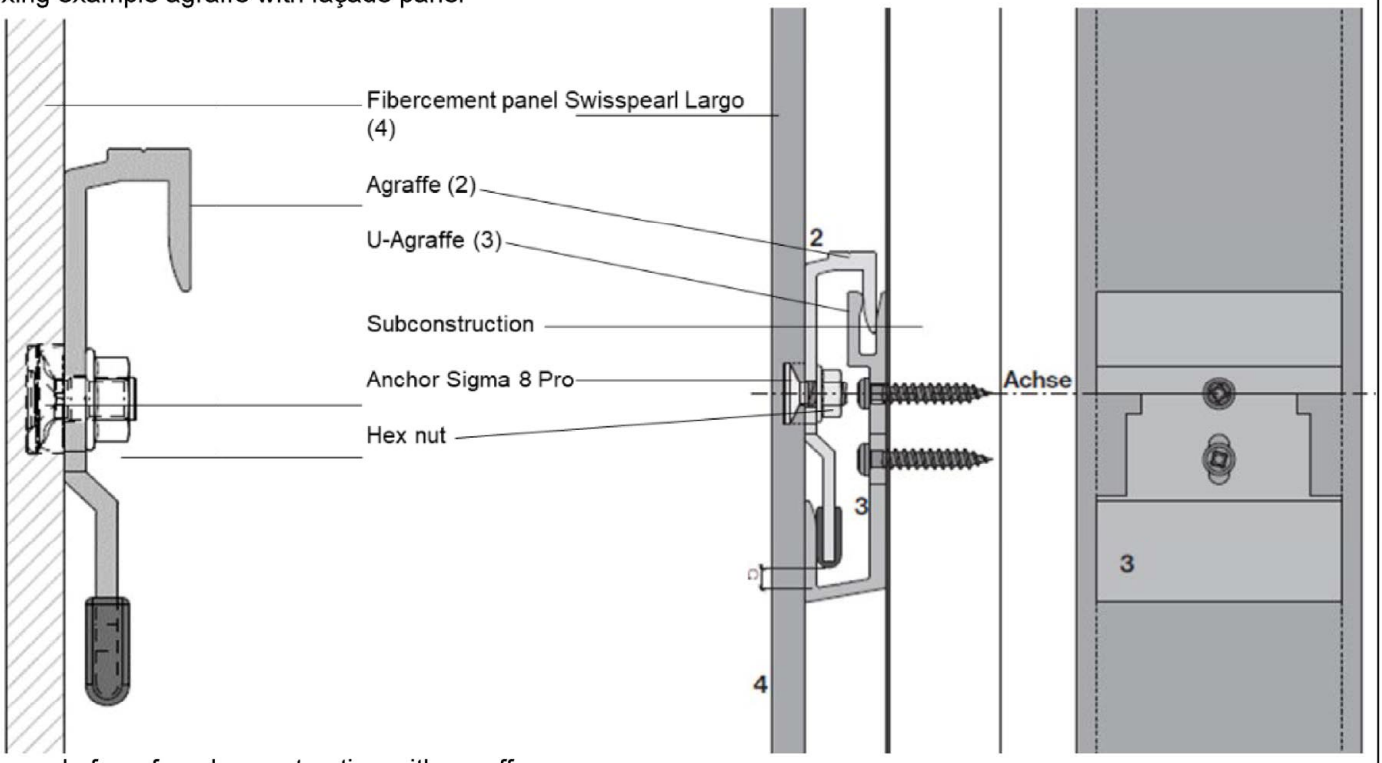
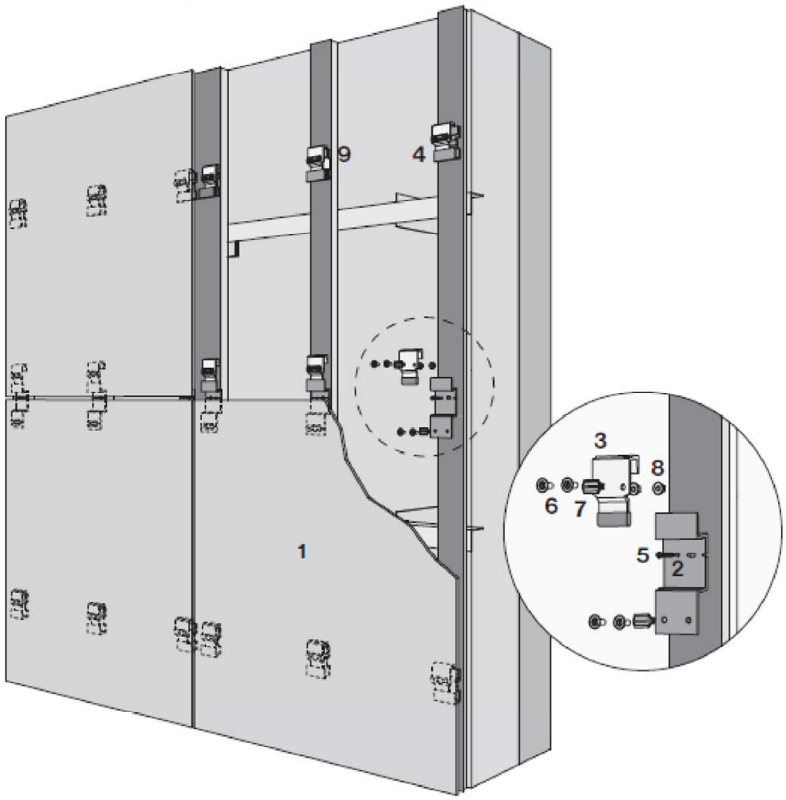
Installed fasterner

Fixing example agraffe with façade panel



Example for a façade construction with agraffes



Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»

Product description
Fixing examples

Annex A 1

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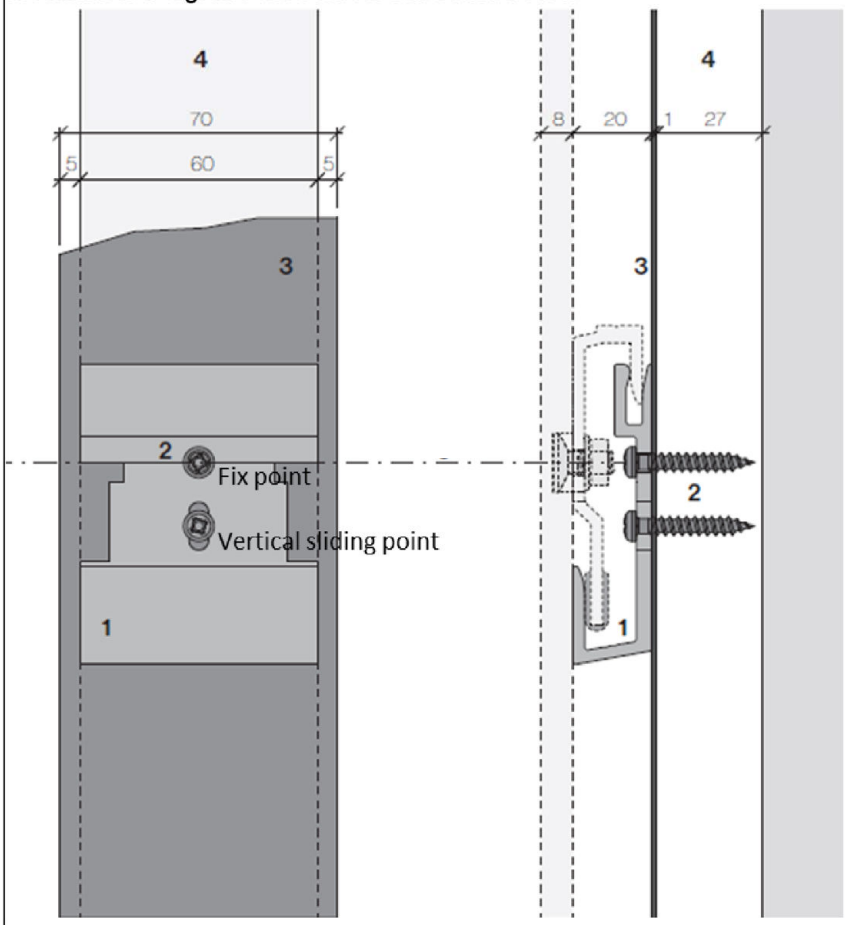
Installation U-agraffe on vertical subconstruction



(1) U-Agraffe
(2) Fixation of agraffe on subconstruction
(3) EPDM Layer
(4) Vertical subconstruction

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex A 2
Product description Fixing examples	

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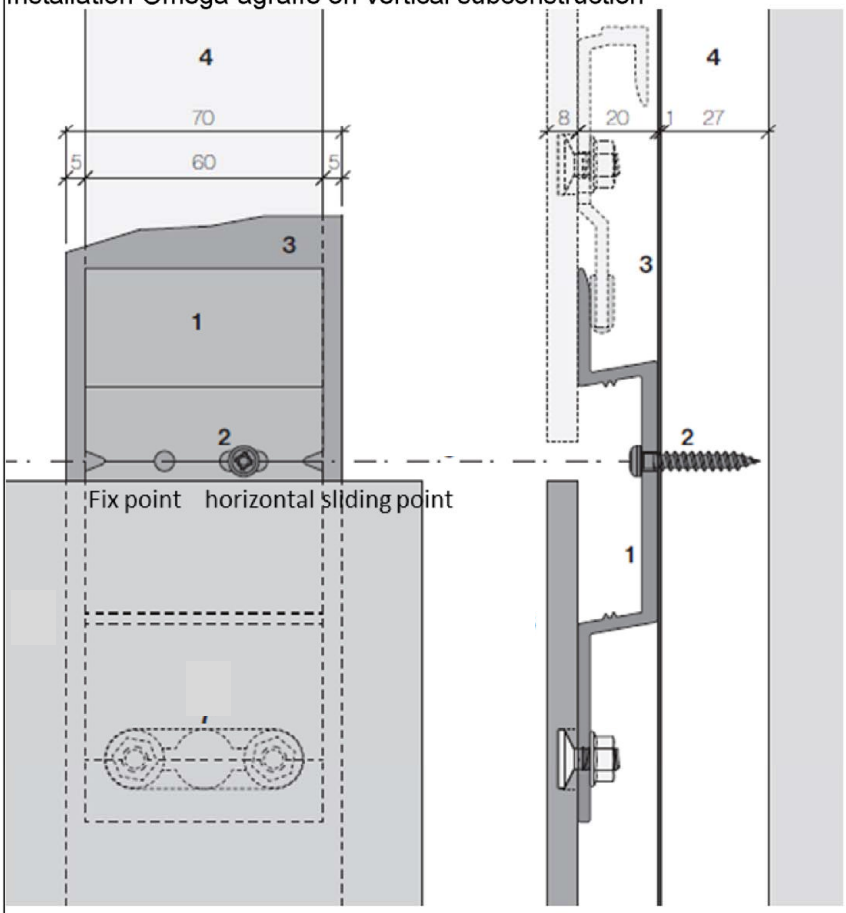
Installation Omega-agraffe on vertical subconstruction



(1) Omega-Agraffe
(2) Fixation of agraffe on subconstruction
(3) EPDM layer
(4) Vertical subconstruction

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex A 3
Product description Fixing examples	

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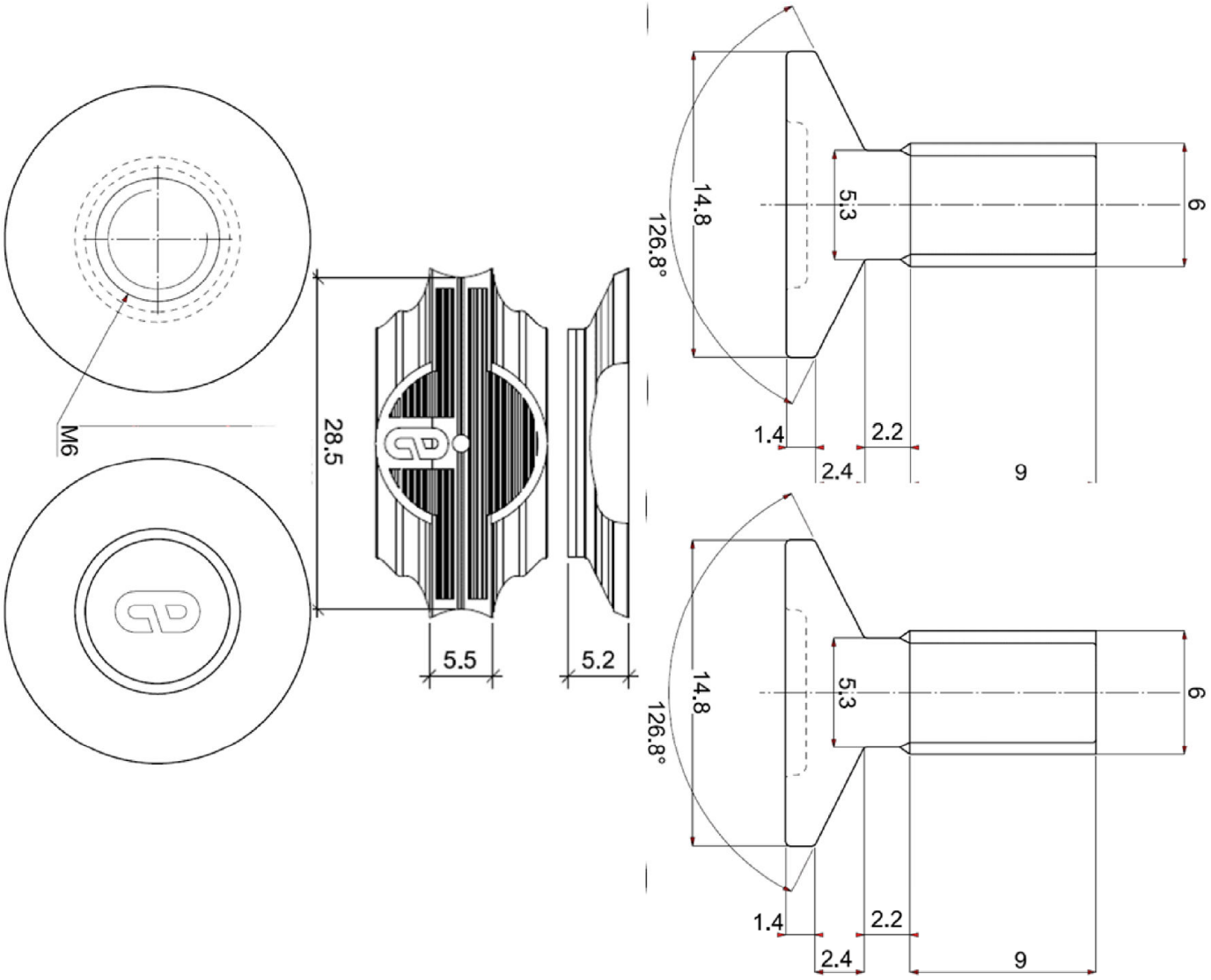
Anchor geometry and drill hole geometry

Anchor



View on anchor | Spacer (Positioning of double-anchor) | integrated part | thread (M6)

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»

Product description
Fixing examples

Annex A 4

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Borehole geometry

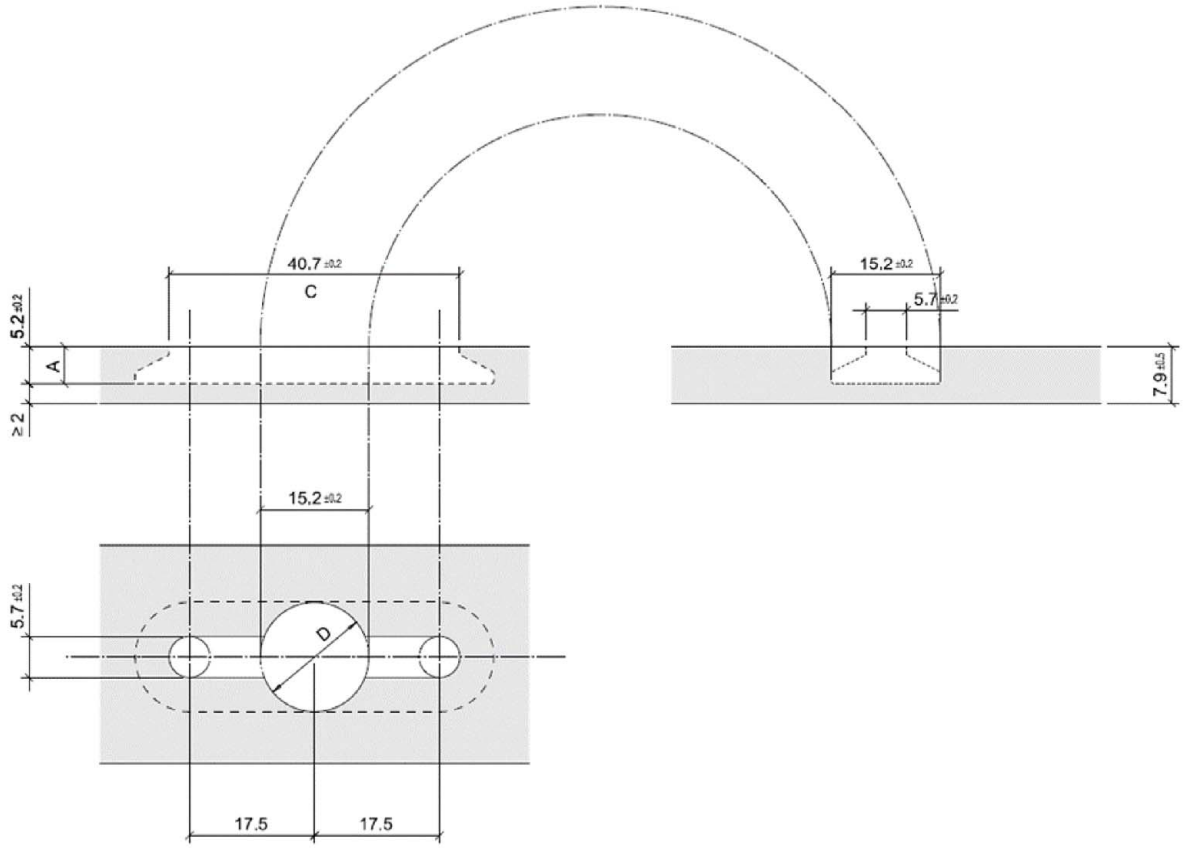

Table A1: Borehole geometry

Embedment depth	h_s =	[mm]	5,2
Panel thickness (nominal)	h_{nom} ≥	[mm]	8
Diameter of drill hole	D =	[mm]	15,2
Diameter of undercut	D =	[mm]	15,2
Length of undercut	C =	[mm]	50,2
Installation torque moment	T_{inst}	[Nm]	T_{inst} = 2,5

Table A2: Anchor materials

Anchor	Stainless steel 1.4401 according to EN 10088:2014, surface blanc
Spacer	Rilsamid™ PA 12 G (Polyamid), red

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»

Product description
Fixing examples

Annex A 5

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads.

Base materials:

- Façade panels «Swisspearl Largo» according to EN 12467:2012+A2:2018
  In regard to the properties, composition and other requirement of fibre-cement flat sheets, the flat sheet type "Swisspearl Largo" comply with class 4, category A according EN 12467:2012+A2:2018.
  For admissible deviation of the nominal dimensions apply level I according to EN 12467:2012+A2:2018. For admissible deviation of straightness of the edges and the admissible deviation of the rectangularity apply level I according to EN 12467:2012+A2:2018.
- The characteristic values of the façade panels correspond to Table B1.

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex B 1
Intended use Specification of intended use	

Table B1: Characteristic of facade panels «Swisspearl Largo» – geometrical and physical properties

Maximal size of panel			L_x x L_y oder L_y x L_x	[mm]	3050 x 1250
Nominal thickness of panel			$h_{nom} \geq$	[mm]	8
Young's modulus			E_{mean} =	[N/mm²]	15000
Poisson ration			ν =	[-]	0,25
Weight			γ =	[kN/m³]	21,7
Density, dry			ρ	[g/cm³]	1,69 - 1,86
Grey-cement panel with and without pigments	With acrylic and 2 K-Pur coating	Bending strength (crosswise) without climate pre-stressing [2]	$\sigma_{5\%}$ [1] $\geq$	[N/mm²]	17,8
		Bending strength (crosswise) after storage in water [3]	$\sigma_{5\%,WL}$ [1] $\geq$	[N/mm²]	17,9
	With acrylic coating: Largo ZENOR	Bending strength (crosswise) without climate pre-stressing [2]	$\sigma_{5\%}$ [1] $\geq$	[N/mm²]	21,3
		Bending strength (crosswise) after storage in water [3]	$\sigma_{5\%,WL}$ [1] $\geq$	[N/mm²]	21,0
White-cement panel with and without pigments	With acrylic and 2 K-pur coating	Bending strength (crosswise) without climate pre-stressing [2]	$\sigma_{5\%}$ [1] $\geq$	[N/mm²]	18,4
		Bending strength (crosswise) after storage in water [3]	$\sigma_{5\%,WL}$ [1] $\geq$	[N/mm²]	15,8

1) 5%-Quantile by a confidence level of 75 % and unknown standard deviation

2) Dry storage, according to EN 12467:2012+A2:2018, table 10, line 2; the visible face of bending pressure zone.

3) Storage in water, according to EN 12467:2012+A2:2018, table 10, line 2; the visible face of bending pressure zone.

Use conditions (Environmental conditions):

- According to EN 1993-1-4:2015 according to the Corrosion Resistance Class of the fastener III

Design:

General:

- Each fixation point of Sigma 8 Pro is achieved as double anchor.
- Each façade panel is fixed with at least with four double anchors in a rectangular arrangement via single agraffes or panel load bearing profiles on a suitable substructure. For small panels or small fitted pieces, differential, or fill- in pieces the number and position of the anchors shall be chosen constructively.
- Edge distance and spacing shall be observed. For small fitted pieces, differential and fill-in pieces the edge distance and spacing shall be chosen constructively.
- The substructure is constructed such that the façade panels are fixed technically strain-free via sliding points (loose bearings) and one fixed point (fixed bearing) - the fixed point may be placed at the panel edge or in the panel field.
- Two fixing points of the façade panel are designed such that they are able to carry the dead load of the façade panel.
- Constraint loads shall be into account for design if constraint loads exist.
- When using agraffes on horizontal load-bearing profiles the fixing points of the façade panel situated horizontally at the same height are fastened in each case to the same load-bearing profile.
- The thickness of the fixing members (agraffe or panel load-bearing profile) shall be at least 2,0 mm and must not exceed 3,0 mm.
- At the agraffes shall be arranged two holes with a diameter of 6.5 mm for fixing both anchors. U-agraffes have a round hole (D = 4.8 mm) and a long hole (D = 4.8 mm, L = 10 mm). Both holes are placed in the vertical heavy axis of the agraffe. In Annex A 2 and A 3 the holes for fixed points and sliding points are shown.
- 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.

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 6 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 borehole 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:
    - Length and diameter of the undercut borehole.
    - 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 7).

  If the tolerances given in Annex A 3, Table 1 are exceeded, the geometry of the borehole shall be checked on 25% of the drillings performed. No further borehole may exceed the tolerances otherwise all the boreholes shall be controlled. Boreholes falling below or exceeding the tolerances shall be rejected.

  Note: Checking the geometry of the borehole 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 3, Table 1 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.

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex B 3
Intended use Specification of intended use	

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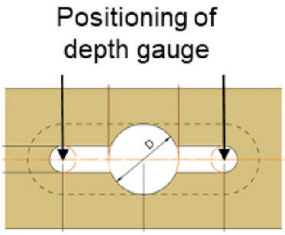
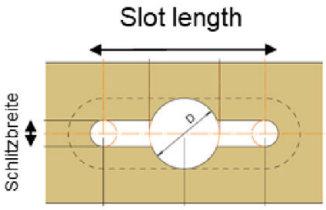
- The façade are installed by skilled specialists and the laying instructions of the manufacturer shall be paid attention to.
- The form fit after inserting the anchor into the borehole is achieved by inserting both anchors in the undercut hole and securing them in position with the spacer and attaching them to the agraffe. Fixing the screw is achieved with a torque moment of 2,5 Nm using a calibrated torque.
- The façade panels are arranged in a "reclined" or "upright" position.
- Panels can also be used for claddings of ceilings.

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex B 4
Intended use Specification of intended use	

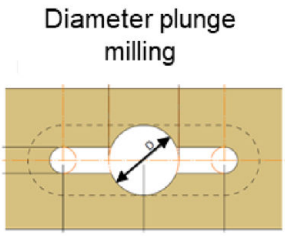
Checking of borehole geometry:



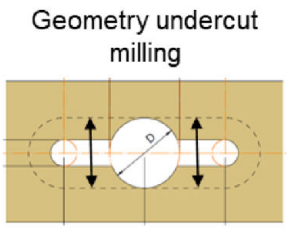
Check of borehole geometry: depth of borehole



Check of borehole geometry: Length of undercut



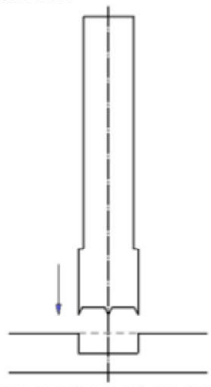
Check of borehole geometry: diameter of plunge milling

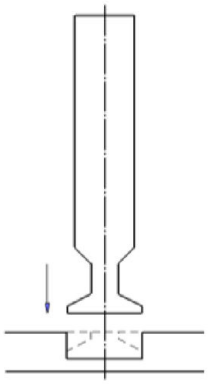


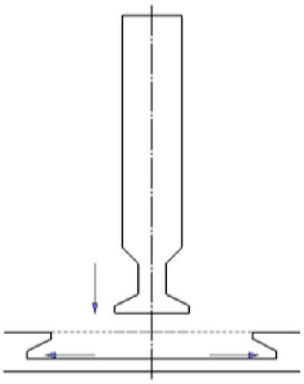
Check of borehole: geometry of undercut

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex B 5
Intended use Installation instructions	

Installation:



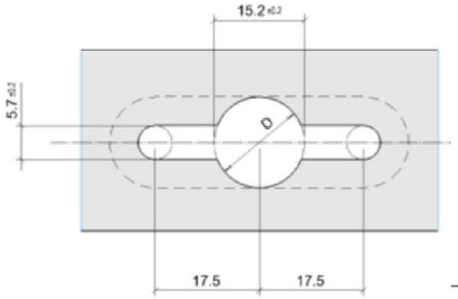


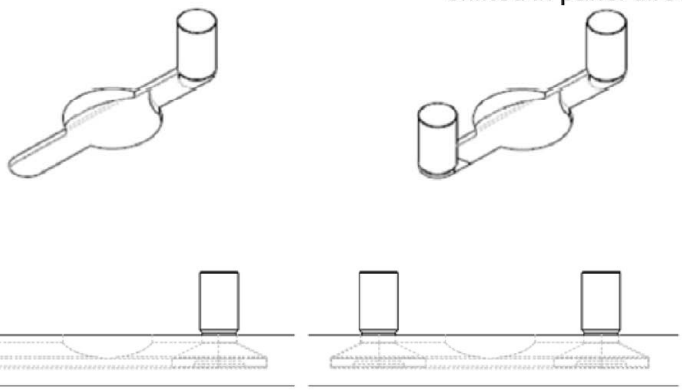


Preparation of undercut:
1. Centric drilling ø = 12 mm

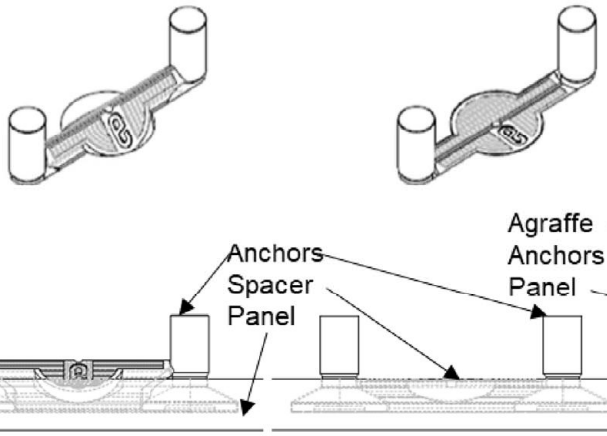
2. Drilling Sigma 8 Pro ø = 15 mm centric

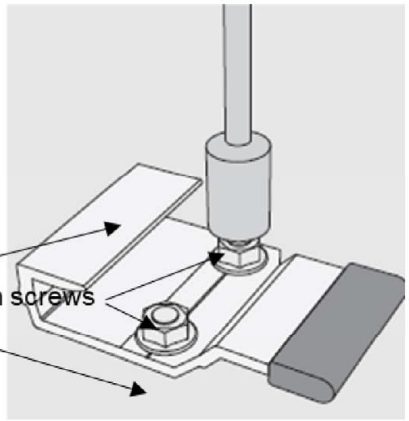
3. Sigma 8 Pro ø = 15 mm shifted in panel direction

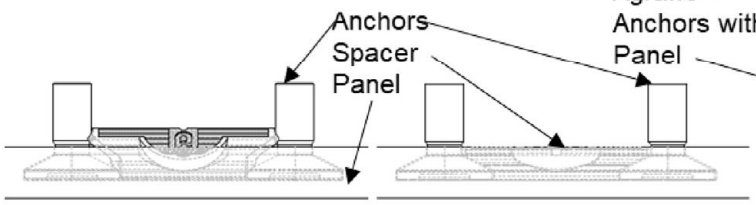




Installation of anchor in undercut







Positioning of Spacer and fixation of agraffe

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex B 6
Intended use Installation instructions	

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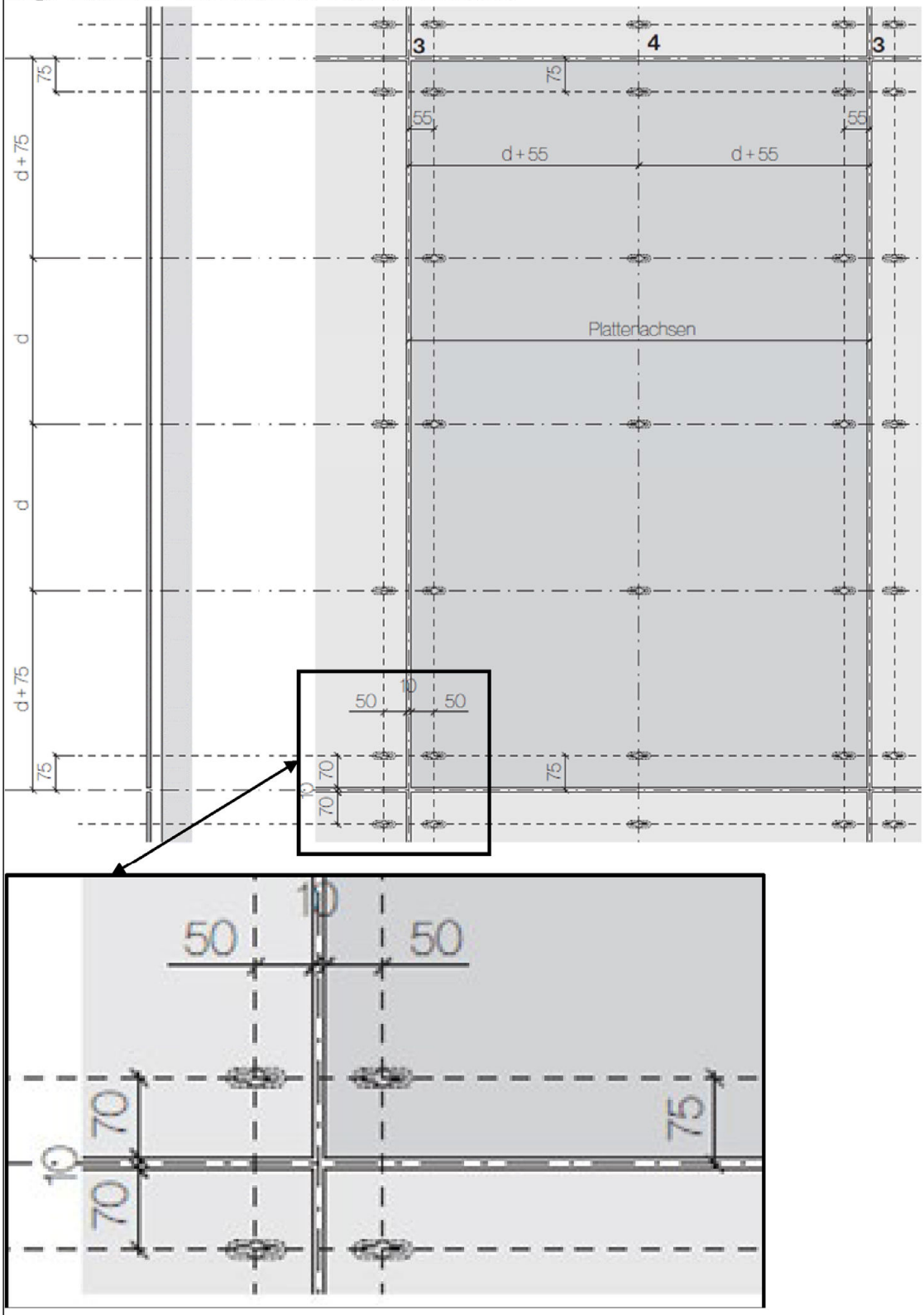
Edge distances and distances between anchors:



Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex B 7
Intended use Edge distances and distances between the anchor	

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Characteristic values of the anchor in façade panels «Swisspearl Largo» according to Table C1

Table C1:

Origin of façade plate			[-]	White cement of Niederurnen	Grey cement of Vöcklabruck	Grey cement of Niederurnen
Embedment depth		h_s =	[mm]	5,2		
Characteristic resistance	tension load	N_{Rk} =	[kN]	0,75	0,94	0,72
	shear load	V_{Rk} =	[kN]	2,05	2,02	1,61
Edge distance		a_{rh} / a_{rv} ≥	[mm]	50/70		
Spacing fixing point		d	[mm]	100 ≤ d ≤ 563		
Characteristic resistance combined value		X	[-]	1,2		
Characteristic resistance steel failure	tension load	$N_{Rk,s}$ =	[kN]	14,0		
	shear load	$V_{Rk,s}$ =	[kN]	7,0		

Verifiction ultimate limit state:

Anchorages are designed under the responsibility of an engineer experienced in anchorages and facade construction.

$$\frac{N_{Ed}}{N_{Rd}} \leq 1$$

$$\frac{V_{Ed}}{V_{Rd}} \leq 1$$

$$\frac{N_{Ed}}{N_{Rd}} + \frac{V_{Ed}}{V_{Rd}} \leq 1{,}2$$

N_{Ed}: Design value of the tensile force

$N_{Ed} = N_{Ek,w} \cdot \gamma_F + N_{Ek,V} \cdot \gamma_F$

$N_{Ek,w}$: characteristic value of the tensile force of wind load

γ_F: partial safety factor according to EN 1990:2010

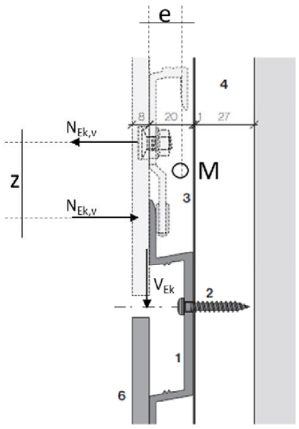
$N_{Ek,V}$: For flush fixed anchors and for installation of horizontal load-bearing profiles permanent loads due to torsion of the profile shall be considered in addition to actions from dead load and wind in direction of the anchor axes. The verification can be omitted, if there is no horizontal distance between anchor and vertical load-bearing profile ($N_{Ek,V}$ =0).

$N_{Ek,V} = V_{Ek} \cdot e/z$

V_{Ek} = characteristic value of the shear force due to dead load of the façade panel

e and z [mm] see picture

M shear centre



N_{Rd}: design value of the tensile load-bearing capacity

$N_{Rd} = N_{Rk} / \gamma_M$

N_{Rk} : characteristic value of the tensile load-bearing capacity according to Table C1

γ_M = 1,8 ; recommended partial safety factor, in absence of national regulations

V_{Ed}: design value of the shear force

$V_{Ed} = V_{Ek} \cdot \gamma_F$

V_{Ek} : characteristic value of the shear force

γ_F: partial safety factor according to EN 1990:2010

V_{Rd}: design value of the shear load-bearing capacity

$V_{Rd} = V_{Rk} / \gamma_M$

V_{Rk} : characteristic value of the shear load-bearing capacity according to Tabelle C1

γ_M = 1,8 ; recommended partial safety factor, in absence of national regulations.

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex D 1
Informative Proof of ultimate limit state	

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Verification to steel failure

$$\frac{N_{Ed}}{N_{Rd,s}} \leq 1{,}0$$

$$\frac{V_{Ed}}{V_{Rd,s}} \leq 1$$

$$\left(\frac{N_{Ed}}{N_{Rd,s}}\right)^2 + \left(\frac{V_{Ed}}{V_{Rd,s}}\right)^2 \leq 1{,}0$$

N_{Ed}: Design value of the tensile force, see Annex D 1

$N_{Rd,s}$: design value of steel failure under tension load

$N_{Rd,s} = N_{Rk,s} / \gamma_{Ms}$

$N_{Rk,s}$: Characteristic resistance to steel failure under tension according to Table C1

γ_{Ms} = 1,87 recommended partial safety factor, in absence of national regulations.

V_{Ed}: design value of the shear force, see Annex D 1

$V_{Rd,s}$: design value of steel failure under shear load

$V_{Rd,s} = V_{Rk,s} / \gamma_{M}$

$V_{Rk,s}$: Characteristic resistance to steel failure shear load according to Table C1

$\gamma_{M,s}$ = 1,56 recommended partial safety factor, in absence of national regulations.

Swisspearl undercut anchor «Sigma 8 Pro» for façade panels «Swisspearl Largo»	Annex D 2
Informative Proof of steel failure	