

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-16/0784
of 13 March 2019

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

HSU-R

Product family
to which the construction product belongs

Fastener for the rear fixing of facade panels made of
selected natural stones in accordance with EN 1469:2015

Manufacturer

Hilti Aktiengesellschaft
9494 SCHAAN
FÜRSTENTUM LIECHTENSTEIN

Manufacturing plant

Hilti Werke

This European Technical Assessment
contains

13 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

EAD 330030-00-0601

This version replaces

ETA-16/0784 issued on 16 January 2018

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Specific Part

1 Technical description of the product

The HSU-R is a fastener of sizes M6 and M8 which consists of a cone bolt with an external thread on one end and a cone with an attached expansion sleeve on the other end. It is used in combination with a flange nut or a spring washer and nut.

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 documentation¹.

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 for tension and shear loads	See Annex C 1
Fastener distances and spacing	See Annex B 3 and C 1
Durability	Corrosion Resistance Class (CRC) III in accordance with EN 1993-1-4:2015

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

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+

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.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

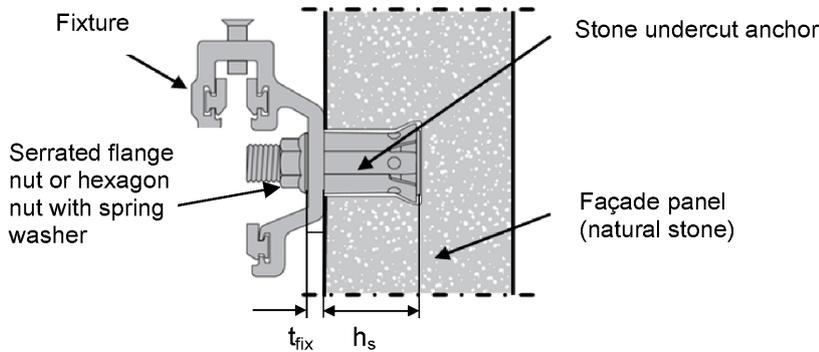
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 13 March 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Aksünger

Installed condition



Product description:

**Hilti undercut anchor HSU-R with flange nut HSU-R FN
or with commercial standard spring washer and nut**

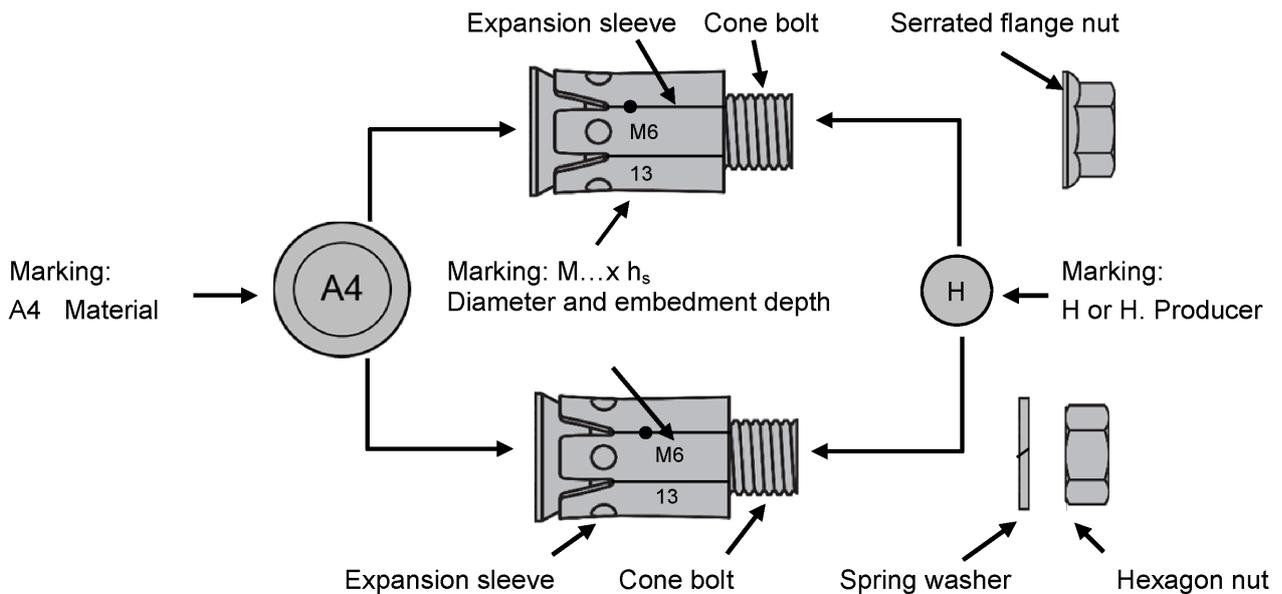


Table A1: Materials

Designation	Material
HSU-R Cone bolt with expansion sleeve	Stainless steel A4 according to EN 10 088: 2014
HSU-R FN Serrated flange nut	Stainless steel A4-80, according to EN 10 088: 2014
Spring washer	Stainless steel A4-80, according to EN 10 088: 2014
Hexagon nut	Stainless steel A4-80, according to EN 10 088: 2014

HSU-R

Product description
Installed condition and marking
Materials

Annex A1

Specifications of intended use

Anchorage subject to:

- Static and quasi-static loading.

Base material:

- Façade panels made of natural stone in accordance with EN 1469:2015.
- Natural stone free of open seams and mechanically active cracks and alterations.
- Natural stone classified in accordance with Table B1.
- Characteristic values of the panels correspond to Table B2.

Table B1: Stone groups

	Stone group	Natural stone type	Boundary conditions
I	High-quality intrusive rocks (plutonic rocks)	granite, granitite, tonalite, diorite, monzonite, gabbro, other magmatic plutonic rocks	None
II	Metamorphic rocks with „hard stone characteristics“	quartzite, granulite, gneiss, migmatite	None
III	High-quality extrusive rocks (volcanic rocks)	basalt and basaltlava without harmful ingredients (e.g. sun burner basalt)	Minimum density ρ : basalt: 2,7 kg/dm ³ basaltic lava: 2,2 kg/dm ³
IV	Sedimentary rocks with „hard stone characteristics“ ¹⁾	Sandstone, limestone and marble	Minimum density ρ : sandstone: 2,1 kg/dm ³

¹⁾ For façade panels made of natural stones with planes of anisotropies, the difference between the flexural strength determined parallel to the planes of anisotropy and perpendicular to the edges of the planes of anisotropy shall not be more than 50 %.

Use conditions (Environmental conditions):

- According to EN 1993-1-4:2015 dependent on Corrosion Resistancy Class (see ETA sect 3.1).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and façade design.
- 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 TR 062 Design of fasteners for façade panels made of natural stone.

HSU-R

Intended use
Installation parameters

Annex B2

Installation:

- The undercut drill holes are prepared at the factory or on site under workshop conditions. In case of drilling on site, supervision of the person responsible for technical matters of the site or a skilled representative thereof is required.
- The undercut drill holes are drilled with a special drill bit according to Table B4. The drill bit should be used with a special HSU ADT/MDT drilling machine. Other suitable drilling machines may also be used.
- The drill dust shall be removed from the drill hole.
- In case of an aborted drill hole, the newly drilled hole must be placed with a minimum spacing of twice the depth of the aborted drill hole.
- The geometry of the drill holes shall be checked in 1% of all drillings. The following dimensions are to be checked and documented following the manufacturer's instructions and using the gauge in accordance with Table B3.
 - Diameter of the drill hole d_0 ,
 - Depth of the drill hole h_1 ,
 - Diameter d_1
 - Height of the undercut h_2 .

If the tolerances in accordance with Table B3 are not met, the drill hole geometry shall be checked in 25 % of the performed drillings. No subsequently checked drill hole may exceed the tolerances, otherwise all drill holes shall be controlled. Drill holes not meeting the tolerances shall not be used for anchor installation.

Note: Checking the drill hole geometry of 1% of the drill holes means that on one out of 25 slabs with four drill holes in each slab (100 drill holes) one drill hole shall be checked. If the tolerances given in Table B3 are not met, then the control shall be increased to 25 % of the drillings e.g. one drill hole on each of the 25 slabs.

- During transport and storage on site the façade panels are protected from damages. The façade panels shall not be mounted with jerking motions to avoid damage to the panels. If necessary, lifting devices can be used. Façade panels or reveal slabs with incipient cracks shall not be installed.
- Overhead installation is allowed.

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HSU-R	Annex B3
Intended use Installation parameters	

Table B2: Properties of natural stone panels

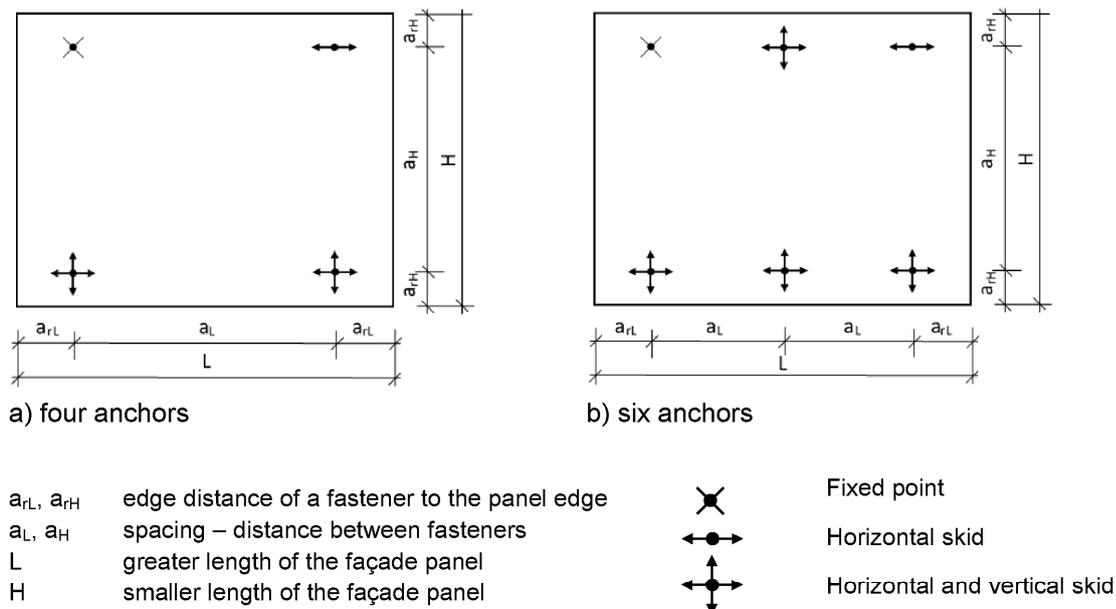
Nominal panel thickness (stone group I / II (Tab. B1))	h_{nom}	[mm]	$20 \leq h_{nom}$	
Minimum panel thickness (stone group I / II (Tab. B1))	$h_{min}^{1)}$	[mm]	$h_s + 5 \text{ mm}$	
Nominal panel thickness (stone group III / IV (Tab. B1))	h_{nom}	[mm]	$25 (30)^{2)} \leq h_{nom}$	
Minimum panel thickness (stone group III / IV (Tab. B1))	$h_{min}^{1)}$	[mm]	$h_s + 10 \text{ mm}$	
Maximum panel size	A	[m ²]	3,0	
Maximum side length	H und L	[m]	3,0	
Number of anchors (rectangular arrangement)	N	[-]	4 or 6	
Minimum edge distance ³⁾	$a_{rH,min}, a_{rL,min}$	[mm]	50	
Maximum edge distance	$a_{rH,max}, a_{rL,max}$	[mm]	$0,25 \cdot L$ and $0,25 \cdot H$	
Minimum spacing ³⁾	a_L and a_H	[mm]	$8 \cdot h_s$	
Minimum characteristic flexural strength in accordance with EN 12372				
Padang Cristallo G603 (G3503), China	stone group I	$\sigma_{5\%}$	[N/mm ²]	12,4
Nero Assoluto, Zimbabwe	stone group I	$\sigma_{5\%}$	[N/mm ²]	26,3
Jura Limestone (yellow), Germany	stone group IV	$\sigma_{5\%}$	[N/mm ²]	14,1

¹⁾ Minimum panel thickness is equal to the lower limit of tolerance.

²⁾ For sandstone, limestone and basaltic lava: panel thickness $\geq 30 \text{ mm}$, if the panel manufacturer warranted lowest expected value (5 % fractile) of the flexural strength is $< 8 \text{ N/mm}^2$.

³⁾ For small fitting or fill-in pieces the minimum edge distance or spacing shall be chosen according to the geometrical boundary conditions. In case of design under static loading using FEM, smaller edge distances are allowed.

Figure B1: Façade panel with fixing points



Substructure according to TR 062

HSU-R

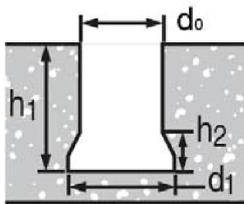
Intended use
Installation parameters

Annex B4

Table B3: Installation parameters

Size			M6	M8
Embedment depth	h_s	[mm]	$(10 \leq h_s \leq 38) +0,4 / -0,1$	
Drill hole depth	h_1	[mm]	$h_s + 0,5$	
Diameter of drill hole	d_0	[mm]	$11 +0,4 / -0,2$	$13 +0,4 / -0,2$
Diameter of undercut	d_1	[mm]	$13,5 \pm 0,3$	$15,5 \pm 0,3$
Height of undercut	h_2	[mm]	$4,5 \pm 0,5$	$4,5 \pm 0,5$
Installation torque moment	T_{inst}	[Nm]	6	10
Width across flats	SW	[mm]	10	13
Max. diameter of clearance hole in fixture	d_f	[mm]	7	9
Max. fixture thickness	t_{fix}	[mm]	10	14

Figure B2: Geometry of drill hole



HSU-R

Intended use
Installation parameters

Annex B5

Drill bit HSU CDB...



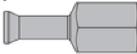
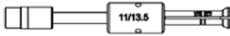
Hilti gauge HSU IG...



Hilti setting tool HSU ST-G...



Table B4: Drilling and setting tools

Anchor	Drilling	Drill hole check	Installation
			
HSU-R M6	HSU CDB M6	HSU IG 11/13.5	HSU ST-G M6
HSU-R M8	HSU CDB M8	HSU IG 13/15.5	HSU ST-G M8

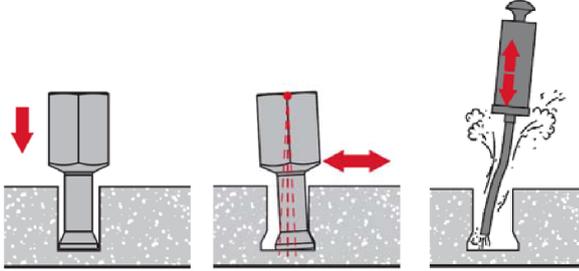
HSU-R

Intended use
Drill bit, gauge and setting tool

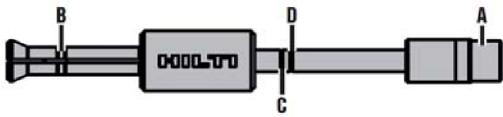
Annex B6

Installation instruction

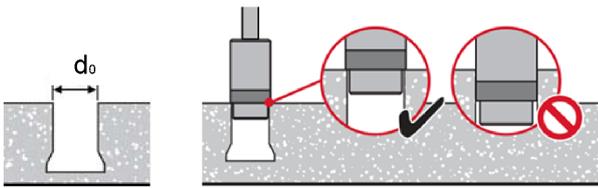
Drilling and cleaning of the undercut drill hole



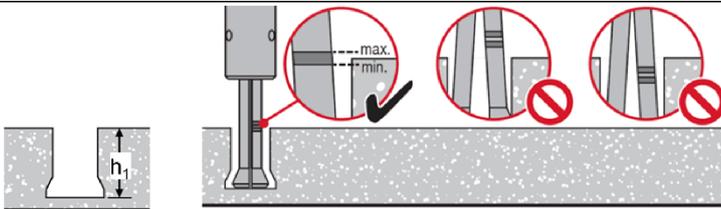
Checking dimensions of drill hole with gauge



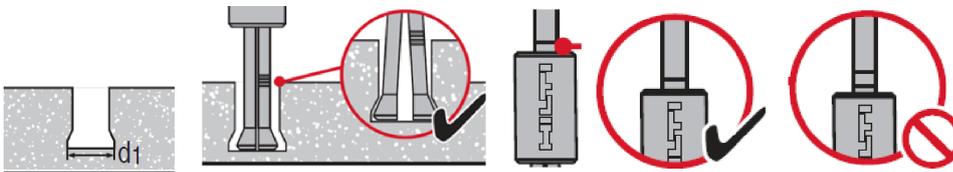
A) Drill hole diameter d_0



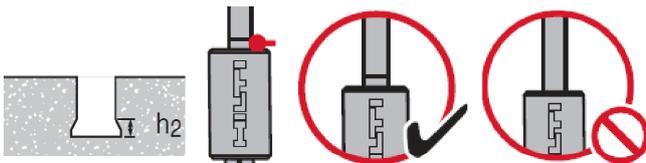
B) Drill hole depth h_1



C) Diameter of the undercut d_1



D) height of the undercut h_2

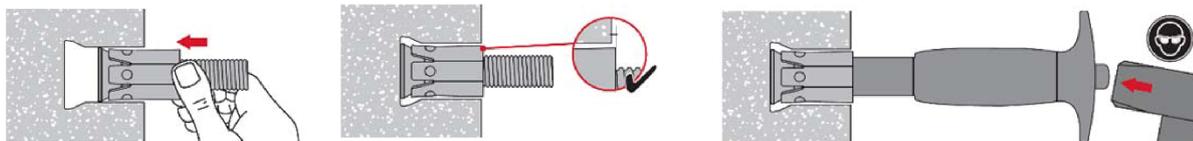


HSU-R

Intended use
Installation instructions

Annex B7

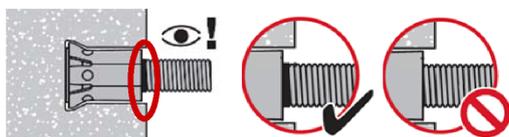
Installation of the undercut anchor



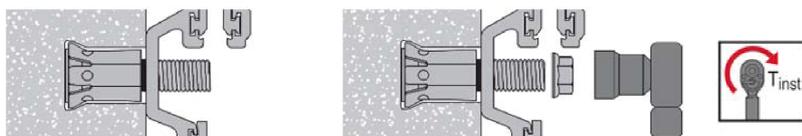
Checking of the embedment depth



Checking of red ring visibility (proof of correct expansion)



Installation of the fixture



HSU-R

Intended use
Installation instructions

Annex B8

Table C1: Characteristic resistance

Size			M6			M8		
Designation of natural stone			Padang Cristallo G603 (G3503)	Nero Assoluto	Jura Limestone (yellow)	Padang Cristallo G603 (G3503)	Nero Assoluto	Jura Limestone (yellow)
Country of origin			China	Zimbabwe	Germany	China	Zimbabwe	Germany
Petrographic description			Granite	Gabbro	Limestone	Granite	Gabbro	Limestone
Panel thickness	h	[mm]	30	25	35	30	25	35
Edge distance	a _r	[mm]	100	150	150	100	150	150
Embedment depth	h _s	[mm]	13	13	15	15	15	21
Characteristic resistance								
Tension load	N _{Rk} ²⁾	[kN]	4,0	11,6	6,2	6,0	17,0	10,2
Shear load	V _{Rk} ²⁾	[kN]	6,6	11,8	8,4	6,9	21,4	11,1
Partial safety factor	γ _M ¹⁾	[-]	1,8					
Combined tension and shear load:								
Trilinear limit value	X		1,2	1,0	1,2	1,2	1,0	1,0

¹⁾ In absence of national regulations.

²⁾ For other natural stones according to Table B1, the resistance is determined in accordance with Technical Report 062 "Design of fasteners for façade panels made of natural stone".

Table C2: Characteristic resistance for steel failure

Size			M6	M8	
Characteristic resistance under tension load			N _{Rk,s} [kN]	16,1	29,3
Partial safety factor			γ _{Ms,N} ¹⁾ [-]	1,5	
Characteristic resistance under shear load			V _{Rk,s} [kN]	9,7	17,6
Partial safety factor			γ _{Ms,V} ¹⁾ [-]	1,25	

¹⁾ In absence of national regulations.

HSU-R

Performances

Characteristic resistance in natural stone and steel resistance

Annex C1