Deutsches Institut für Bautechnik

DIBt

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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-15/0476 of 12 July 2017

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	TUF-S
Product family to which the construction product belongs	Fastener for the rear fixing of facade panels made of high-pressure decorative laminates (HPL) according to EN 438-7:2005
Manufacturer	SFS intec AG Rosenbergsaustraße 10 9435 HEERBRUGG SCHWEIZ
Manufacturing plant	Werke der SFS intec AG
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 TUF-S-6xL is special anchor made of stainless steel for fixing HPL-facade panels according to EN 438-7:2015 to metal substructures. The anchor consits of a mandrel made of carbon steel zinced and a stainless steel sleeve. The anchor is put in a drill hole and placed by pulling out the mandrel. The pull out of the mandrel widens the body of the sleeve and punches the thread of the sleeve into the façade panel.

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
Anchor distances	See Annex C 1

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+

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.

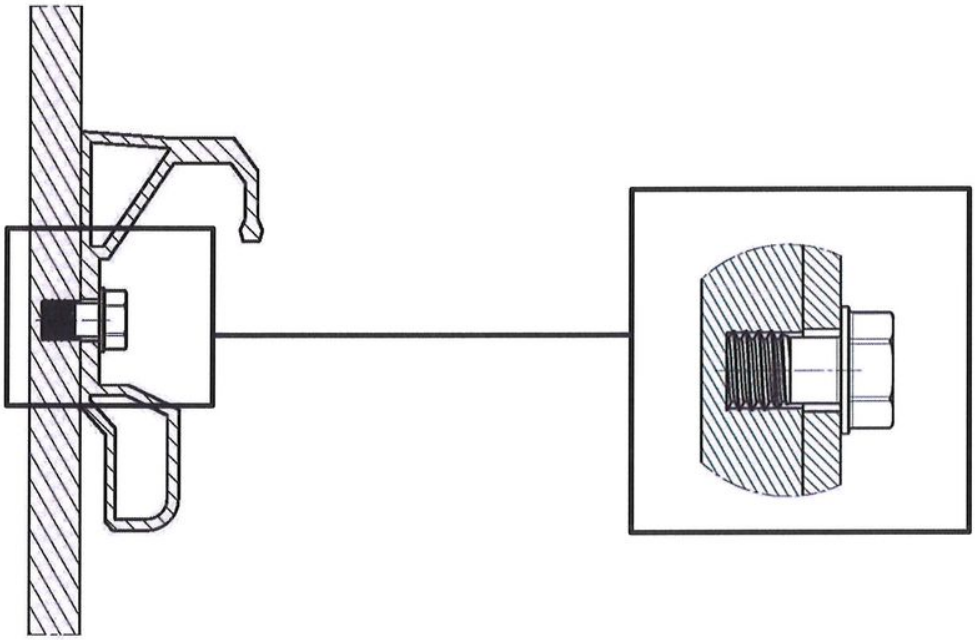
Issued in Berlin on 12 July 2017 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

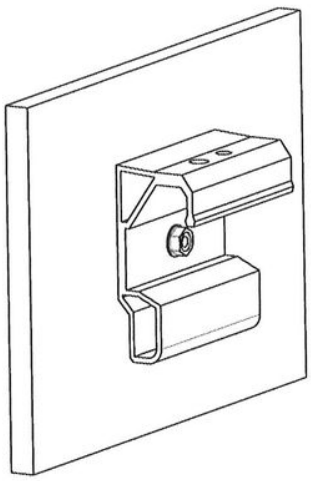
beglaubigt:
Aksünger

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Installed Anchor



Fixing example



TUF-S

Product description
Installed anchor and fixing example

Annex A 1

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System components

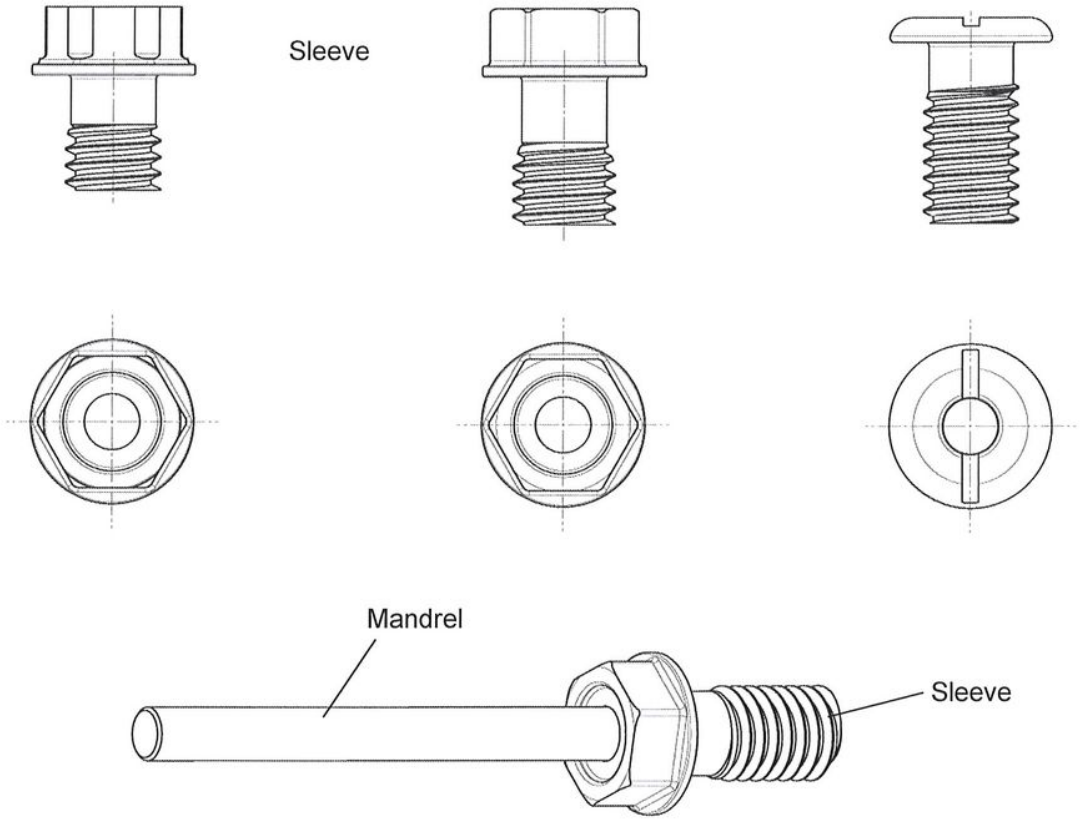


Table 1

Anchor parts	**Material**
Sleeve	Stainless steel A4
Mandrel	Carbon steel zinced

TUF-S

Product description
System components

Annex A 2

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Specifications of intended use

Anchorages subject to

- Static and quasi-static loads

Base material

- The façade panel made of HPL shall correspond to Annex B 4

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 and B 3.

Installation

- Each façade panel shall be fixed technically strain-free with at least four anchors in a rectangular arrangement.
- The substructure is constructed such that the façade panels are fixed technically strain free via skids (loose bearings) and one fixed point (fixed bearing).
- The thickness of the fixing member (clamp or panel load-bearing profile) shall be at least 2,0 mm and shall be at least made of aluminum with $R_m \geq 215$ N/mm^2.
- The drillings are done at the factory or on site. The drillings are executed with special drill bits made available by SFS intec AG. The drillings are executed by skilled personnel.
- The façade panel is pre-drilled with diameter Ø 5,9 mm to 6,0 mm.
- The drilling is always in a 90°- angle to the panel's surface.
- The minimum edge distance of the drilling is 40,0 mm.
- The clamps are predrilled with diameter Ø 6,5 mm to 7,0 mm.
- The geometry of the drill hole shall be checked minimum on 1% of all drillings.
- 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.
- The panels are installed by skilled specialists and the laying instructions of the manufacturer shall be paid attention to.
- Overhead mounting is not possible

TUF-S	Annex B 1
Intended use Specifications	

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Design method

Loads

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

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

According to EN 1990 the following fundamental combination depending on the load direction results for a vertical façade panel:

Fundamental combination for loads parallel to the panel: $F_{Edll} = F_{Ek,G} \cdot \gamma_G$

Fundamental combination for loads perpendicular to the panel: $F_{Ed\perp} = F_{Ek,w} \cdot \gamma_Q$

mit $\gamma_G = 1{,}35$; $\gamma_Q = 1{,}50$

Resistance:

$$N_{Rd} = \frac{N_{Rk}}{\gamma_M} \cdot \alpha_{F0} \cdot \alpha_{bend} \cdot \alpha_{wet}$$

$$V_{Rd} = \frac{V_{Rk}}{\gamma_M} \cdot \alpha_{F0} \cdot \alpha_{wet}$$

$$\sigma_{Rd} = \frac{\sigma Rk}{\gamma_M}$$

with:

N_{Rk} = characteristic tension resistance according to Annex C 1, Table 5 to 7

V_{Rk} = characteristic shear resistance according to Annex C 1, Table 5 to 7

σ_{Rk} = characteristing bending stress according to EN 438:2016

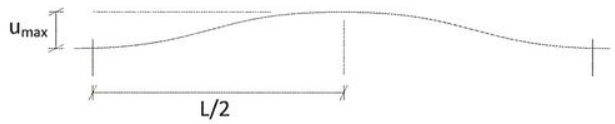
α_{F0} = If the façade panels do not meet the minimum requirements according to Annex B 4, Table 2, the characteristic values of load bearing capacity have to be multiplied additionally by α_{F0}:

$$\alpha_{F0} = min\left\{\frac{\sigma_{f,L,min}}{130\ N/mm^2}; \frac{E_{L,min}}{14000\ N/mm^2}; \frac{\sigma_{f,T,min}}{100\ N/mm^2}; \frac{E_{T,min}}{10000\ N/mm^2}; 1\right\}$$

α_{bend} = reduction factor of bearing of facade panel

The bending angle of the façade panel

$$ß = arctan\left(\frac{u_{max}}{L/2}\right)$$



ß ≤ 1,0° => α_{bend} = 1,0

1,0° < ß ≤ 1,5° => α_{bend} = 0,89

1,5° < ß ≤ 2,0° => α_{bend} = 0,80

α_{wet} = If the façade panels do not meet the minimum requirements regarding the maximum mass increase of δ_w = 2.0% according to Table 2, the characteristic values of load bearing capacity have to be multiplied additionally by α_{wet} = 0,78.

γ_M = 1,8

TUF-S	Annex B 2
Intended use Design method	

Verification

The calculation shall be carried out in a linear elastic manner. The stiffness of the substructure shall be considered for the respective case of application.

For the determined anchor loads it shall be verified, that the following equations are met.

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

Equation 2: $$\frac{V_{Ed}}{V_{Rd}} \leq 1$$

Equation 3: $$\frac{V_{Ed}}{V_{Rd}} + \frac{N_{Ed}}{N_{Rd}} \leq 1$$

with:

N_{Ed} = design value of the tensile force acting on the anchor

V_{Ed} = design value of the shear force acting on the anchor

N_{Rd} = design value of the tensile load bearing capacity of the anchor

V_{Rd} = design value of the shear load bearing capacity of the anchor

For the determined panel loads it shall be verified, that the following equation according is met:

Equation 4: $$\frac{\sigma_{Ed}}{\sigma_{Rd}} \leq 1$$

with:

σ_{Ed} = design value of the bending stress of the façade panel

σ_{Rd} = design value of the bending stress resistance of the façade panel

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Requirements to the façade panels

The HPL façade panels shall be classified "EDS" or "EDF" according to EN 438-6:2014.

The minimum requirements for the façade panels are documented in the following table

Table 2: Minimum requirements for the façade panel

Characteristic values for the facade panel	Thickness of the panel	h ≥	[mm]	8
	Bending stress [1]	$\sigma_{fm,T}$ [2]	N/mm²	≥ 100
		$\sigma_{fm,L}$ [2]		≥ 130
	Bending modulus	E_T [3]	N/mm²	10000
		E_L [3]		14000
	Maximum mass increase according to EN 438-2:2016-06, section 15 (Resistance to wet conditions)	δ_w	[%]	2,00

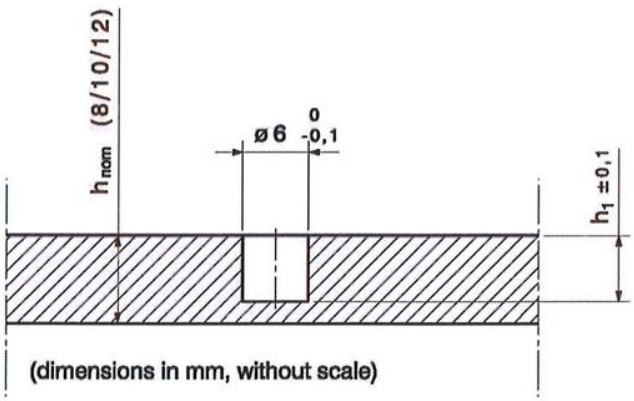
1) σ_{fm} according to EN ISO 178:2013-09
2) $\sigma_{fm,T}$: Bending strength transverse
   $\sigma_{fm,L}$: Bending strength longitudinal
3) E_T : Bending modulus transverse
   E_L : Bending modulus longitudinal

TUF-S	Annex B 4
Intended use Requirements to the HPL-facade panels	

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Drill hole geometry and drill bit

Drill hole geometry

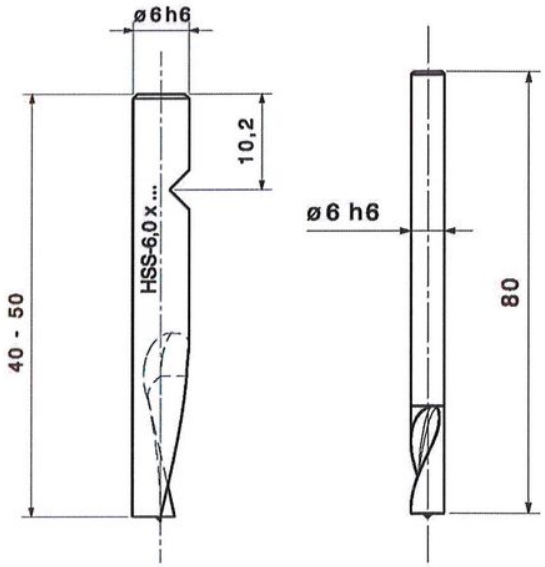


h_{nom}	8 / 10 / 12			10 / 12			
h_1	5	5.5	6	6.5	7	7.5	8
h_s	5	5.5	6	6.5	7	7.5	8

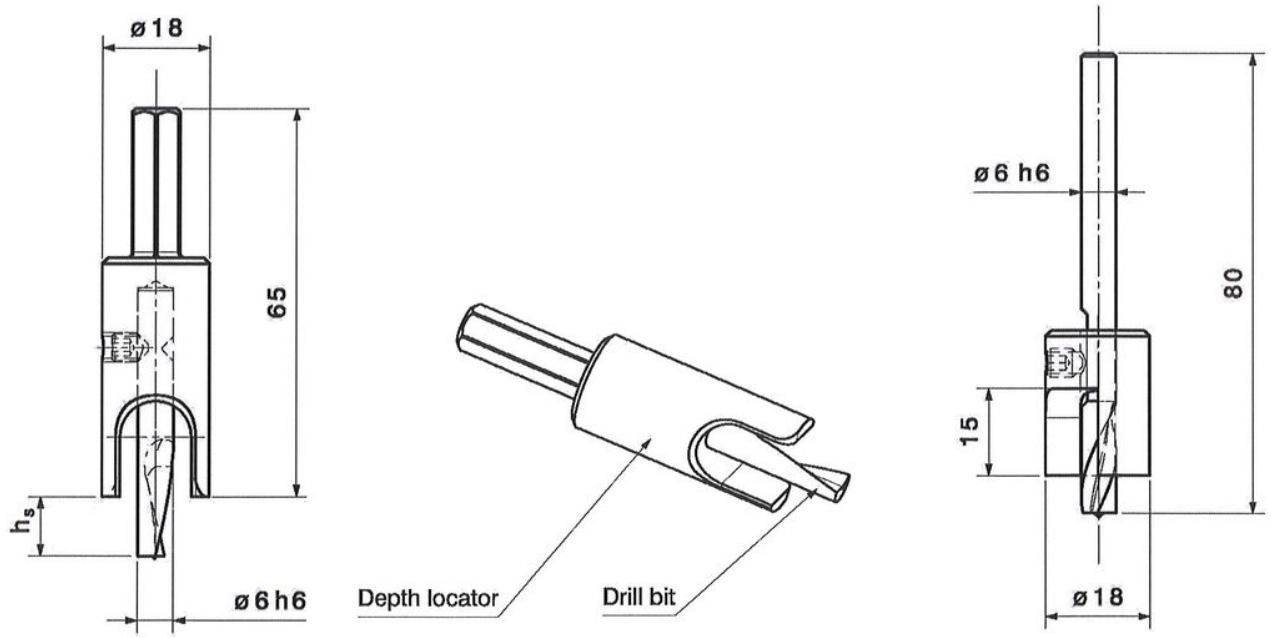
h_{nom} = Panel nominal thickness
h_s = anchorage depth
h_1 = depth of drill hole

special drill bit

HSS-6xL



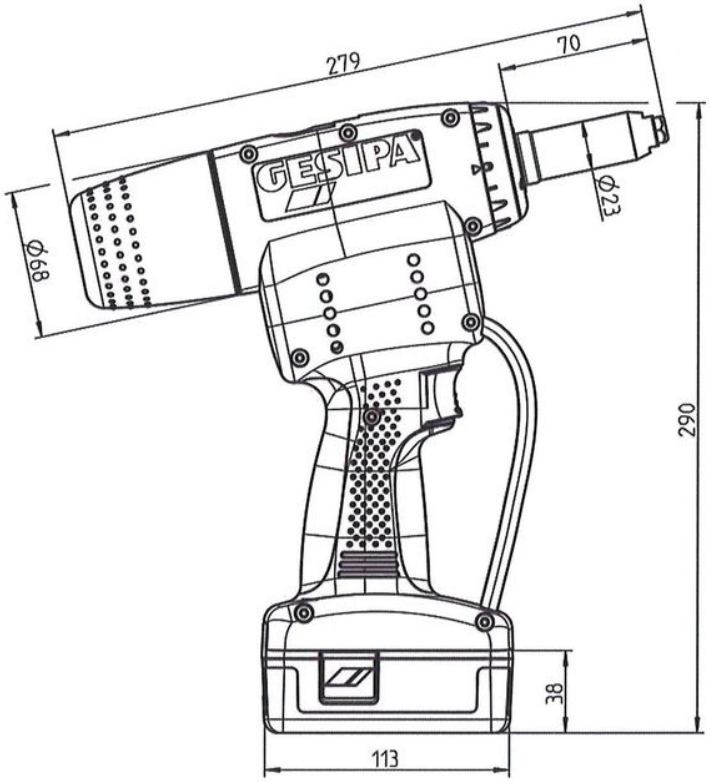
Depth locator and Drill bit



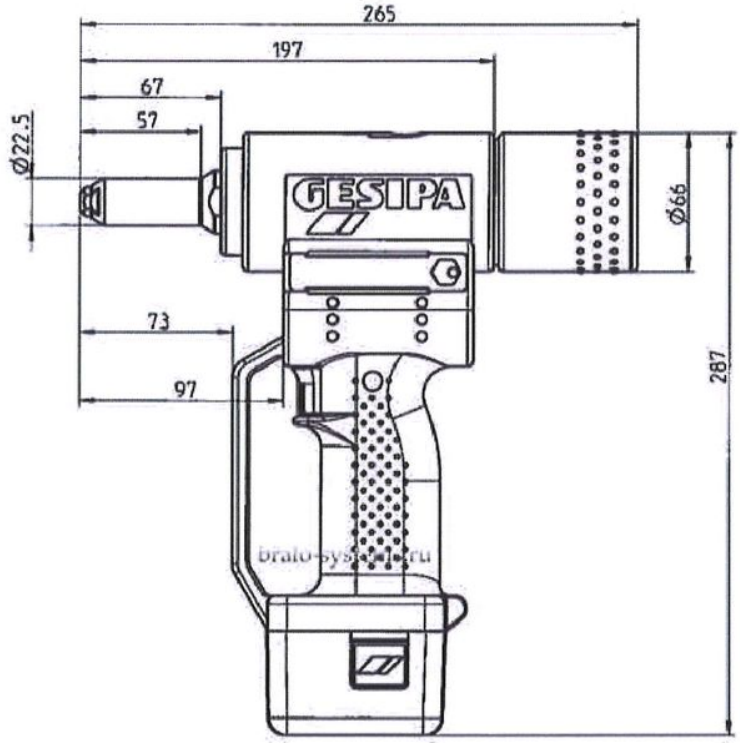
TUF-S	Annex B 5
Intended use Drill hole dimensions and drill bit	

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Setting tools



Riveting tool
GESIPA PowerBird Pro



Riveting tool
GESIPA PowerBird

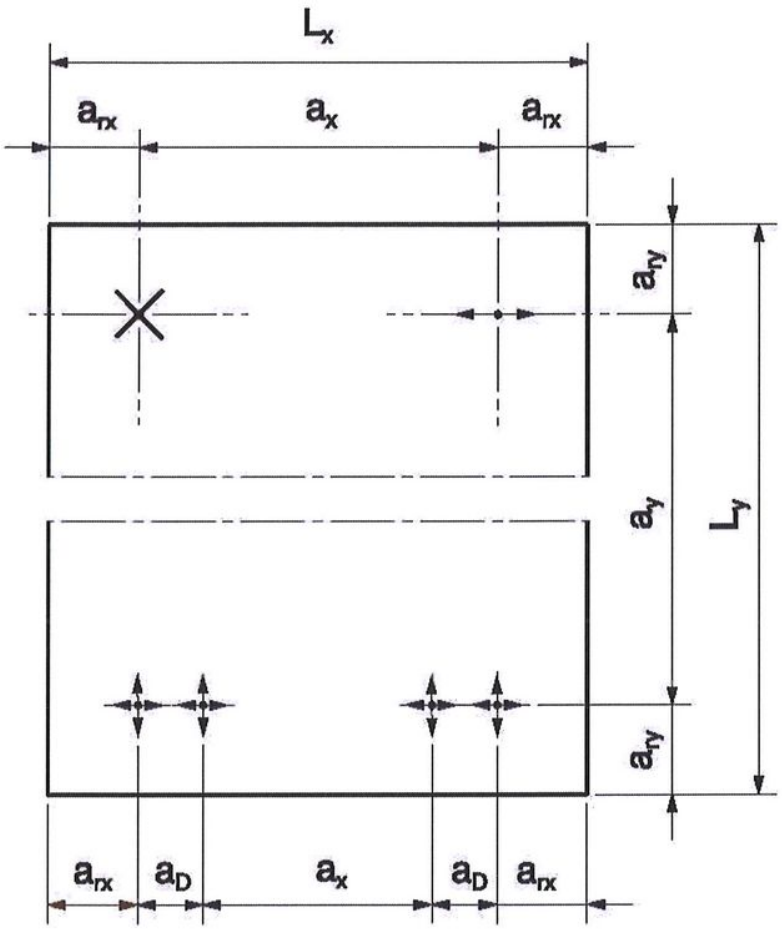
TUF-S

Intended use
Setting tool

Annex B 6

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Definition of edge distance and spacing



Legend:

$a_{rx,y}$ = edge distance – distance of an anchor to the panel edge

$a_{x,y}$ = spacing between outer anchors in adjoining groups or between single anchors distance between anchors

a_D = spacing of anchors in an anchor group

L_x = greater length of the façade panel

L_y = smaller length of the façade panel

= fixed point (fixed bearing)

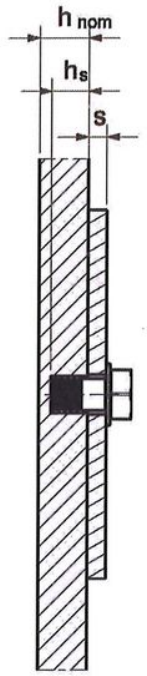
= horizontal skid (loose bearing)

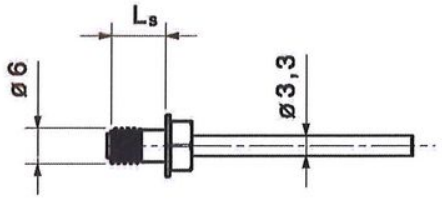
= horizontal and vertical skid (loose bearing)

TUF-S	Annex B 7
Intended use Definition of edge distance and spacing	

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Installation parameters





h_{nom} = Panel nominal thickness
h_s = anchorage depth
s = bracket thickness
L_s = length TUF-S
[h_s + s = Ls]

Table 4

Product	Panel nominal thickness	Bracket thickness	anchorage depth
TUF-S-6X7-A4	8mm	2mm	5mm
TUF-S-6X7.5-A4	8mm	2mm	5.5mm
		2.5mm	5mm
TUF-S-6X8-A4	8mm	2mm	6mm
		2.5mm	5.5mm
		3mm	5mm
TUF-S-6X8.5-A4	8mm	3mm	5.5mm
		2.5mm	6mm
TUF-S-6X9-A4	8mm	3mm	6mm
		4mm	5mm
	10mm	2mm	7mm
		2,5mm	6,5mm
		3mm	6mm
TUF-S-6X10-A4	10mm / 12mm	2mm	8mm
		2,5mm	7,5mm
		3mm	7mm
		3,5mm	6,5mm
		4mm	6mm
TUF-S-6X11-A4	10mm	3mm	8mm
		4mm	7mm
	12mm	2mm	9mm
		2,5mm	8,5mm
		3mm	8mm
		4mm	7mm
TUF-S-6X12-A4	10mm	4mm	8mm
	12mm	2mm	10mm
		3mm	9mm
		4mm	8mm
TUF-S-6X13-A4	10mm	5mm	8mm
	12mm	3mm	10mm
		4mm	9mm

TUF-S-6X7-A4

TUF…name product
S…….stainless steel
6…….Ø (diameter)
7…….L_s (length)
A4…..stainless steel A4 material

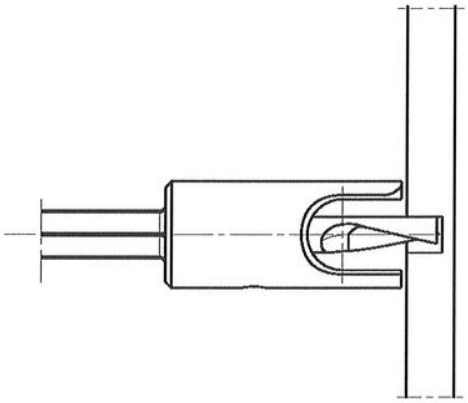
TUF-S

Intended use
Installation parameters

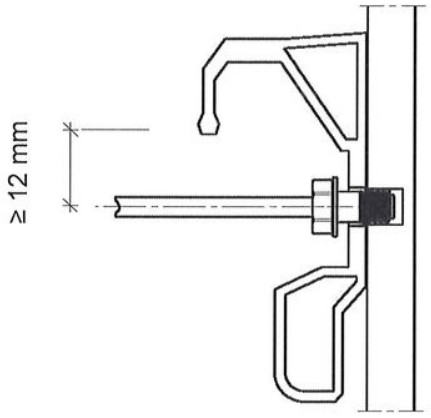
Annex B 8

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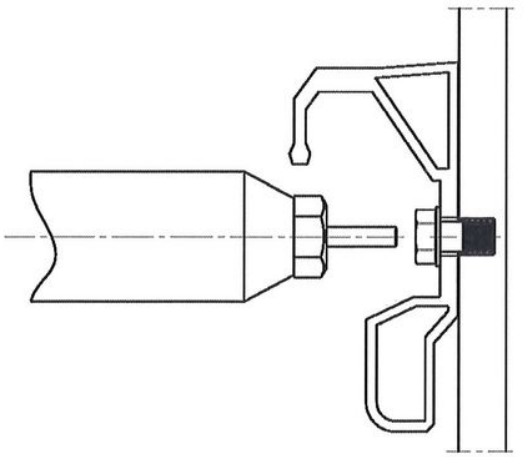
Installation instructions



Pilot drilling in the panel with the
6 mm dia. HSS drill bit with depth locator
or CNC machine



Position the pre-drilled bracket over the
hole in the panel and push through the TUF-S
blind fastener



Apply pressure with the rivet setting tool during the
setting process.
Remove the mandrel completely with the riveting
tool (GESIPA PowerBird, PowerBird Pro,
use nosepiece 17/36 or 17/40)

TUF-S	Annex B 9
Intended use Installation instructions	

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Characteristic value of the anchor

Table 5: Characteristic values of the anchor with single clamp

Single clamp												
Characteristic values for the anchor	Setting depth [2]			[mm]	5,0	5,5	6,0	6,5	7,0	7,5	8,0
	Characteristic resistance	Tension [1]	N_{Rk}	[kN]	1,12	1,26	1,40	1,65	1,90	1,97	2,04
		Shear	V_{Rk}	[kN]	2,78	2,89	2,99	3,28	3,57	3,79	4,00
	Edge distance		a_r	[mm]	≥ 40						
	Spacing		a	[mm]	≥ 100						

Table 6: Characteristic values of the anchor with double clamp (20,0 mm ≤ a_D < 40,0 mm)

Double clamp with 20,0 mm ≤ a_D < 40,0 mm												
Characteristic values for two anchors	Setting depth [2]			[mm]	5,0	5,5	6,0	6,5	7,0	7,5	8,0
	Characteristic resistance	Tension [1]	N_{Rk}	[kN]	1,93	2,03	2,11	2,41	2,71	2,71	2,71
		Shear	V_{Rk}	[kN]	4,85	4,85	4,85	5,83	6,80	6,80	6,80
	Edge distance		a_r	[mm]	≥ 40						
	Spacing		a	[mm]	≥ 100						

Table 7: Characteristic values of the anchor with double clamp (40,0 mm ≤ a_D < 100,0 mm)

Double clamp with 40,0 mm ≤ a_D < 100,0 mm												
Characteristic values for two anchors	Setting depth [2]			[mm]	5,0	5,5	6,0	6,5	7,0	7,5	8,0
	Characteristic resistance	Tension [1]	N_{Rk}	[kN]	2,07	2,26	2,44	3,17	3,89	3,89	3,89
		Shear	V_{Rk}	[kN]	4,85	4,85	4,85	5,83	6,80	6,80	6,80
	Edge distance		a_r	[mm]	≥ 40						
	Spacing		a	[mm]	≥ 100						

1 Values valid for bending angle of the façade panels ß ≤ 1,0° (Definition of ß see Annex B 2)
2 A minimum remaining panel thickness (panel thickness – setting depth) of 2,0 mm is required. For intermediate values of the setting depth, linear interpolation is possible.

TUF-S

Performances
Characteristic value of the anchor

Annex C 1