Deutsches Institut für Bautechnik

DIBt

Allgemeine bauaufsichtliche Zulassung

Zulassungsstelle für Bauprodukte und Bauarten

Bautechnisches Prüfamt

Eine vom Bund und den Ländern gemeinsam getragene Anstalt des öffentlichen Rechts

Mitglied der EOTA, der UEAtc und der WFTAO

Date: 22.09.2015

Reference: I28-1.21.9-25/15

English translation authorized by DIBt – Original version in German language

Approval number:
Z-21.9-2050

Validity
from: **22 September 2015**
to: **22 September 2020**

Applicant:
fischerwerke GmbH & Co. KG
Klaus-Fischer-Straße 1
72178 Waldachtal

Subject of approval:
Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"

The subject of approval mentioned above is herewith generally approved in the field of construction. This *allgemeine bauaufsichtliche Zulassung* ('national technical approval') comprises eight pages and seven annexes.

I GENERAL PROVISIONS

1 With the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') the fitness for use and the applicability of the subject of approval according to the *Landesbauordnungen* ('Building Regulations of the Land') has been verified.

2 If, in the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') requirements are made concerning the special expertise and experience of persons entrusted with the manufacture of construction products and types of construction according to the relevant regulations of the Land following section 17, sub-section 5 *Musterbauordnung* ('Model Building Code'), it is to be noted that this expertise and experience can also be proven by equivalent verifications from other Member States of the European Union. If necessary, this also applies to verifications presented within the framework of the Agreement on the European Economic Area (EEA) or other bilateral agreements.

3 The *allgemeine bauaufsichtliche Zulassung* ('national technical approval') does not replace the permits, approvals and certificates prescribed by law for carrying out building projects.

4 The *allgemeine bauaufsichtliche Zulassung* ('national technical approval') will be granted without prejudice to the rights of third parties, in particular private property rights.

5 Notwithstanding further regulations in the "Specific Provisions" manufacturers and distributors of the subject of approval shall make copies of the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') available to the user and point out that the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') has to be available at the place of use. Upon request copies of the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') shall be placed at the disposal of the authorities involved.

6 The *allgemeine bauaufsichtliche Zulasssung* ('national technical approval') may be reproduced in full only. Publication in the form of extracts requires the consent of *Deutsches Institut für Bautechnik*. Texts and drawings of advertising brochures may not be in contradiction to the *allgemeine bauaufsichtliche Zulassung* ('national technical approval'). Translations of the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') have to contain the note "Translation of the German original, not checked by *Deutsches Institut für Bautechnik*".

7 The *allgemeine bauaufsichtliche Zulassung* ('national technical approval') is granted until revoked. The provisions of the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') can subsequently be supplemented and amended in particular, if this is required by new technical findings.

II SPECIAL PROVISIONS

1 Subject of approval and scope

1.1 Subject of approval

The subject of this approval is the rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+".

The facade panel consisting of fibre-cement flat sheet according *allgemeine bauaufsichtliche Zulassung* ('national technical approval') Z-31.4-172[1].

The undercut anchor "Tergo+" is an anchor of size M 6 which consists of a cone bolt with external thread, an expansion part, a shim washer and, if need to be, a hexagon nut.

The cone bolt and the expansion part made of stainless steel. The shim washer made of polyamide. The hexagon nut made of aluminium or stainless steel.

The anchor is put into an undercut drill hole and is placed form-fit by driving-in the shim washer.

Annex 1 shows the anchor in installed condition.

1.2 Intended use

The fibre-cement flat sheet "Eternit Equitone Tectiva and Linea facade panels" may be used for the rear fixing of façades (facade panels) in internal and external conditions.

Each façade panel shall be fixed technically strain-free with at least four anchors in rectangular arrangement via agraffess to suitable substructure.

For small panels or small fitted pieces, differential or fill- in pieces the number and position of the agraffe shall be chosen constructively.
The undercut anchor "Tergo+" may be used under the conditions according to the corrosion resistance class III of the a*llgemeine bauaufsichtliche Zulassung "Erzeugnisse, Verbindungsmittel und Bauteile aus nichtrostenden Stählen" Nr.* Z-30.3-6[2]
In addition, the provisions of the a*llgemeine bauaufsichtliche Zulassung* ('national technical approval') *Nr. Z-31.4-172* apply.

2 Provisions for the construction product

2.1 Properties and composition

The fibre-cement flat sheet "Eternit Equitone Tectiva and Linea facade panels" shall be in accordance with the a*llgemeine bauaufsichtliche Zulassung* ('national technical approval') *No. Z-31.4-172.*
The anchor shall comply with the drawings and specifications (materials, dimensions and mechanical properties) given in the Annexes of this approval. The material properties, dimensions and tolerances of the anchor not given in this *allgemeine bauaufsichtliche Zulassung* shall comply with the information deposited at *Deutsches Institut für Bautechnik*, the certification body and the external surveillance body.
The anchor is made from a non-flammable material of the Class A in accordance with DIN 4102-01[3].

2.2 Packaging, storage and marking

2.2.1 Façade panel

Packaging, storage and marking of the facade panels shall be in accordance with the a*llgemeine bauaufsichtliche Zulassung* ('national technical approval') *No. Z-31.4-172.*

[1] "national technical approval"Z-31.4-172 fibre-cement flat sheet "Eternit Equitone Tectiva and Linea facade panels" according DIN EN 12467 of 01 June 2015.
[2] "national technical approval" Products, connecting elements and components made of stainless steel no. Z-30.3-6 of 22 April 2014
[3] DIN 4102-01:1998-05 "Fire behaviour of building materials and building components - concepts, requirements and tests"

2.2.1 Anchor

The anchor shall be packed and delivered as fixing unit (cone bolt, expansion part and, if need to be, a hexagon nut).
The delivery note of the anchor shall be marked by the manufacturer with the conformity mark (Ü-mark) according to the *Übereinstimmungszeichen-Verordnungen der Länder* ('Regulations on the conformity mark of the states of the Federal Republic of Germany'). In addition, the manufacturing mark, the approval number and the complete anchor designation shall be declared. The marking may only be carried out if the requirements according to Section 2.3 *"Übereinstimmungsnachweis"* ('Verification of conformity') have been met.

2.3 Übereinstimmungsnachweis ('Verification of conformity')

2.3.1 Façade panel

Verification of conformity of the facade panels shall be in accordance with the a*llgemeine bauaufsichtliche Zulassung* ('national technical approval') *No. Z-31.4-172.*

2.3.2 Anchor

2.3.2.1 General

Each manufacturing plant shall confirm that the anchor complies with the provisions of this *allgemeine bauaufsichtliche Zulassung* by means of a certificate of conformity based on the factory production control and a regular external surveillance, including initial testing of the anchor in accordance with the following provisions. The manufacturer of the anchor shall organize a recognised certification body and a recognised inspection body to issue a certificate of conformity and for the external surveillance, including product testing that has to be carried out. The manufacturer shall state by marking the products with the conformity mark (Ü-mark) with reference to the intended use, that the certificate of conformity is issued. The certification body shall send a copy of the issued certificate of conformity to *Deutsches Institut für Bautechnik*.

2.3.2.2 Factory production control

Each manufacturing plant shall set up and carry out a factory production control. Factory production control is a continuous surveillance of production by the manufacturer who thus ensures that the manufactured construction product is in conformity with the provisions of this *allgemeine bauaufsichtliche Zulassung*.
Extent, type and frequency of the factory production control shall be in accordance with the control plan which is deposited by *Deutsches Institut für Bautechnik* and by the external surveillance body.
The results of factory production control shall be recorded and evaluated. The records shall include at least the following information:

- Designation of the construction product respectively the raw material and its components
- Type of control or test
- Date of manufacture and test of the construction product respectively of the raw material or components
- Results of control and tests and, if applicable, a comparison with requirements
- A signature of the person responsible for factory production control.

The records shall be deposited for at least five years and presented to the recognised external surveillance body. On request, they shall be submitted to *Deutsches Institut für Bautechnik* and to the *zuständige oberste Bauaufsichtsbehörde* ('responsible building authority').
If the test results are unsatisfactory, the manufacturer shall immediately take the action necessary to eliminate the deficiency. Construction products which do not meet requirements shall be treated in such a way that confusion with conforming products is excluded. Once the deficiency has been eliminated, the original test shall be repeated immediately, provided that this is technically possible and also required to verify the elimination of the deficiency.

2.3.2.3 External surveillance

In each production plant, external surveillance shall be carried out regularly, but at least twice a year, to check the factory production control.
During external surveillance, initial testing of the anchor shall be carried out and random samples taken. Sampling and testing are done on responsibility of the recognised surveillance body.
Extent, type and frequency of the external surveillance shall be in accordance with the control plan which is deposited by *Deutsches Institut für Bautechnik* and by the external surveillance body.
The results of certification and external surveillance shall be deposited for at least five years. On request, they shall be submitted to *Deutsches Institut für Bautechnik* and the responsible building authority by the certification body respectively by the surveillance body.

3 Provisions for design

3.1 Design (concept)

The rear fixing of facade panels as well as the connection between the agraffe and the substructure shall be designed according allgemeine bauaufsichtliche Zulassung Z-31.4-172[1], DIN 18516-1[4] and in accordance with the following specifications and engineering practice.

- As a rule, each façade panel is fixed with at least four anchors in a rectangular arrangement via agraffes on the substructure
- The parameter of the façade panel and the parameter of the anchor (thickness of the plate, anchorage depth as well as spacing and edge distance) must be complied with Annex 6, table 3.
- The façade panels are aranged in a "reclined" or "uprigth" position
- The façade panels neither are used to transmit impact loads nor for guard rail
- The substructure is constructed such that the façade panels technically strain-free via sliding points (loose bearings) and a fixed point (fixed bearing) (see Annex 7).
- Two fixing points of the façade panel are designed such that they are able to carry the dead load of the façade panel.
- The fixing points of a façade panel situated horizontally at the same height are fastened in each case to the same load-bearing profile.

[4] DIN 18516-1: Cladding for external walls, ventilated at rear - Part 1: Requirements, principles of testing

- The substructure is constructed such that the agraffes respectively the facade panels that there are no additional loads acting on the panels and their fixings due to excentric load application / load transfer (symmetrical bearing of the panels),
- Assumption from the mounting condition is computationally a displacement between facade panel and the substructure due to temperature and humidity changes considered. The agraffes can be moved to the floating points in the horizontal direction and in the vertical direction within the "Replacement tolerance". For this purpose is to provide evidence that a sufficient "tolerance" is present and minimum replacement (overlapping of agraffe and support profile) remains of 5 mm.
- Joint construction between the façade panels is done by a joint filler or is kept open. It is ensured that additional stresses (e.g. by temperature) do not lead to important additional loadings.
- Taking account of the loads to be fixed checkable calculations and construction drawings are prepared; the position of the anchor is given in the construction drawing.
- The substructure including its connection to wall agraffes and their connection to the construction works as well as existing thermal insulation layers and their anchorages are not covered by this approval.

3.2 Design (dimensioning)

The façade panels, their fixings with undercut anchor taking account the load effects (dead load, wind load) for the respective case of application and the following conditions are designed under the responsibility of an engineer skilled in the field of façade construction according allgemeine bauaufsichtliche Zulassung Z-31.4-172[1], DIN 18516-1[4] and in accordance with the following specifications.

- The stiffness of the substructure shall be considered for the respective case of application.
- The decisive design parameter of the façade panel and the parameter of the anchor (bending stress, modulus of elastic, dead load and the resistance of the anchor) must be complied with Annex 6, Table 3.
- For the determined bending stress of the facade plate and the anchor forces it shall be verified. that the following equation are met:

  $F_{Sd} \leq F_{Rd}$

  with F_{Sd} [kN] = design value of forces (N_{Sd}, V_{Sd}, σ_{Sd}) from existing actions

  F_{Rd} [kN] = design value of resistance (N_{Rd}, V_{Rd}, σ_{Rd}) for existing forces according to Annex 6, Table 3

  In case of coincident stress of an anchor due to tension and shear load the equation according to Annex 6 is observed.
- The calculation is to perform linear elastic.

- For structural calculation by means of the Finite-Element-Method the façade panels are to be idealized with their effective dimensions (size and thickness) as panel elements; the system chosen shall have the capacity to sufficiently precise represent the tension and the deformation state as well as the support reactions of the façade panels. The relevant bending stress for the verification is obtained at the fixing range in a distance of 5 h (h = panel thickness) from the anchor axis. The mesh size at fixing range shall be at least 0.75 h and shall not exceed 2.5 h.

4 Provisions for installation or use of the product

4.1 General points

Installation of the facade panels and of the anchors shall be carried out in accordance with the design drawings provided in Section 3.1. The façade panels and anchors may only be installed by skilled specialists. It applies to DIN 18516-1. The manufacturer's laying instructions must be observed.
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.
The anchor shall only be used as a complete fastening unit delivered in series (as supplied by the manufacturer) are used for mounting the facade panels. Components of the anchor may not be exchanged.
The drillings are done on site under workshop conditions. The execution is supervised by the responsible project supervisor or a skilled representative of the project supervisor. He is responsible for the correct execution of the work.
During installation of anchors records about proof of the proper installation of anchors shall be kept by the construction supervisor or his competent representative.
The records must be available on the job site during construction period and they shall be presented on request for inspection. These records, as well as the delivery notes, shall be deposited by the company for at least five years after completion of the construction work.

4.2 Drilling of the hole

Making of the undercut drilling is done with the drill bit according to Annex 4 and a special drilling device in accordance with the information deposited with Deutsches Institut für Bautechnik.

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.
The drillings are removed from the drill hole; the nominal diameter of the drill corresponds to the values of Annex 2; in case of aborted drill hole a new drilling at a minimum spacing of at least twice the depth of the aborted drill hole is arranged.

The geometry of the drill hole is checked on 1 % of all drillings. In addition, each 500 drill hole and every drill hole change the diameter of the undercut shall be checked with the dial gauge. The following dimensions shall be checked and documented according to manufacturer's information and testing instructions by means of the testing and measuring devices according to Annex 5:

- diameter of the cylindrical drill hole with testing device DPL
- volume of the undercut with testing device HVL
- drill hole depth with calliper

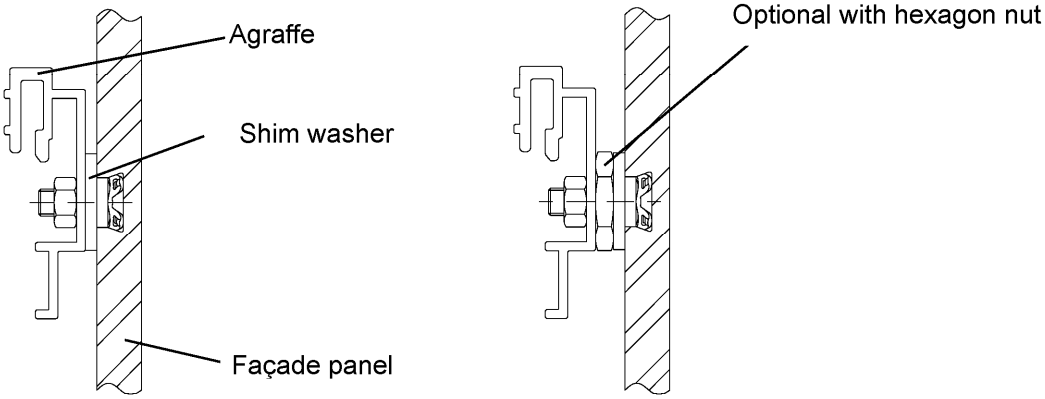
if the tolerances are exceeded, the geometry of the drill hole shall be checked on 25% of the drillings performed; no further drill hole may exceed the tolerances otherwise all the drill holes shall be controlled; drilling holes falling below or exceeding the tolerances shall be rejected.
Note: Checking the geometry of the drill hole on 1% of all drillings means that on one of 25 panels shall be checked (this means 100 drillings). If the tolerances are exceeded the extend of the control shall be increase to 25% of the drillings, i.e. one drill hole of every 25 panels shall be checked.

4.3 Setting the anchor

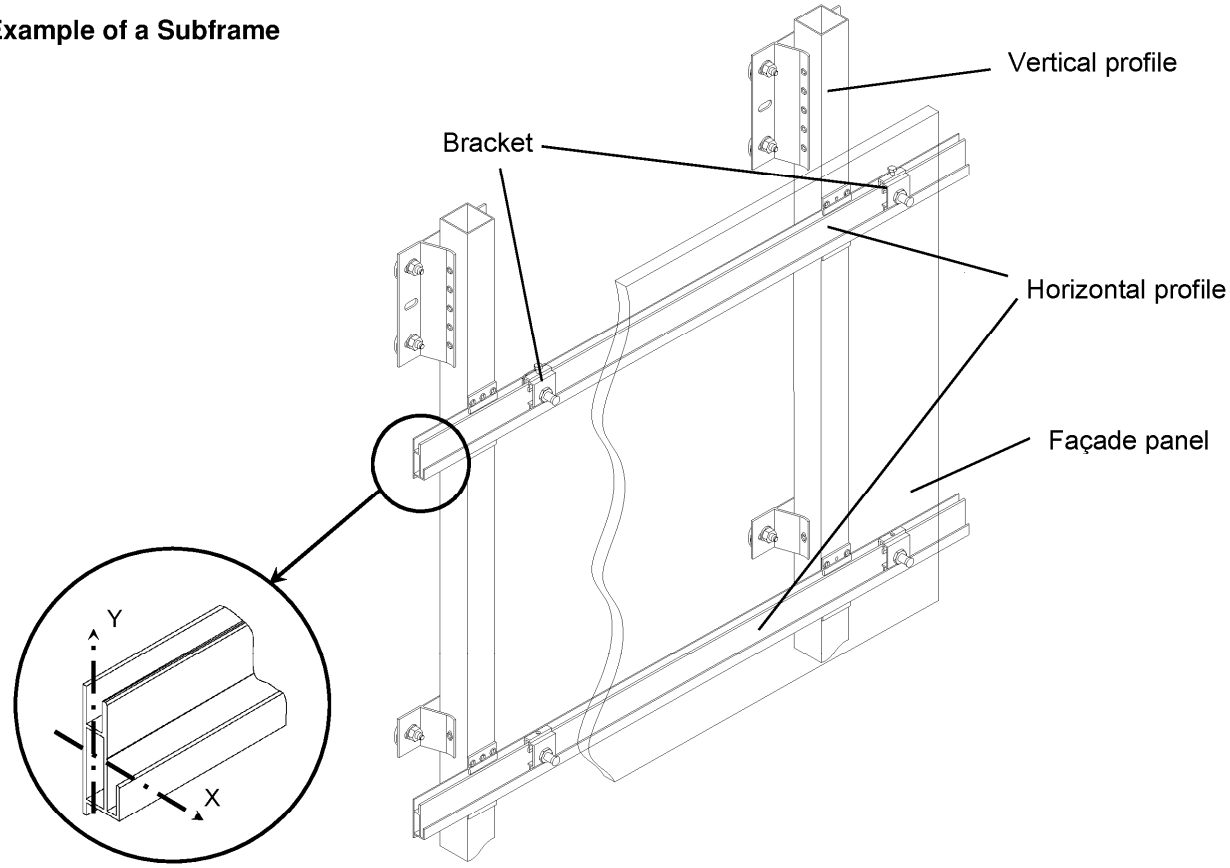
The installation of the anchor is performed with a torque wrench ($T_{inst} \leq 5$ Nm) only or with a drive-in device specifically for this purpose and a setting device respectively according Annex 5.
The anchor is set in the installed condition, if the spacer flush on the back of the façade panels and the projection of the bolt is complied with Annex 2.

Andreas Kummerow
Head of Section

Beglaubigt
Aksünger



Example of a Subframe



Definition of axes

Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"

Annex 1

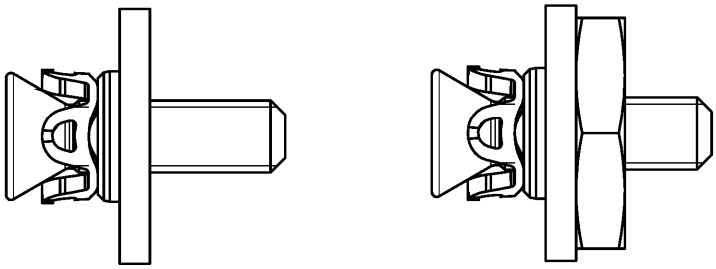
Intended use

Deutsches Institut für Bautechnik DIBt

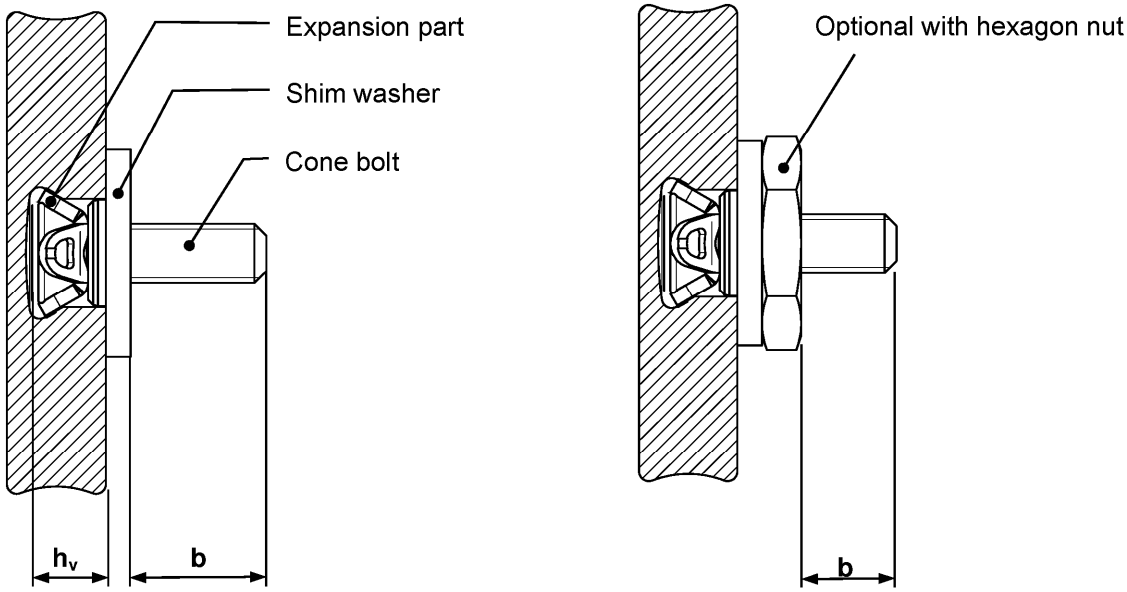
Anchor with external thread M6

without hexagon nut | **with hexagon nut**

Undercut anchor Tergo+



Types of mounting / description



Example:
Tergo+ 11x6 M6 / T / 10 PA
- PA: Material of shim washer / hexagon nut (optional)
- 10: Bolt projection length **b**
- T: **T**hin materials
- M6: Thread diameter
- 11: Drill hole depth **hv**
- 6: Ø Cylindrical drill hole

Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"

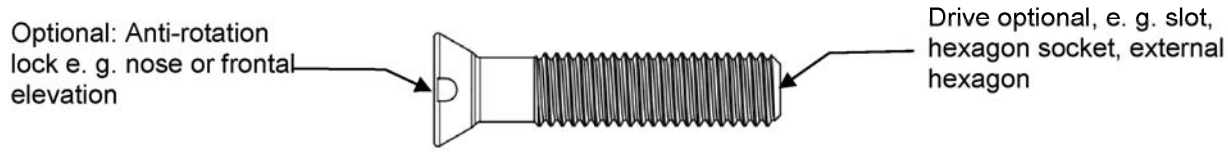
Product and installed condition

Annex 2

Deutsches Institut für Bautechnik DIBt

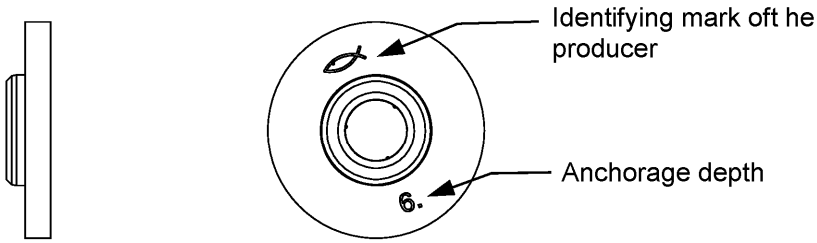
Anchor parts and materials

Cone bolt with external thread M6



Expansion part
For cone bolts with external thread M6

Shim washer
For cone bolts with external thread M6



Hexagon nut
For cone bolts with external thread M6

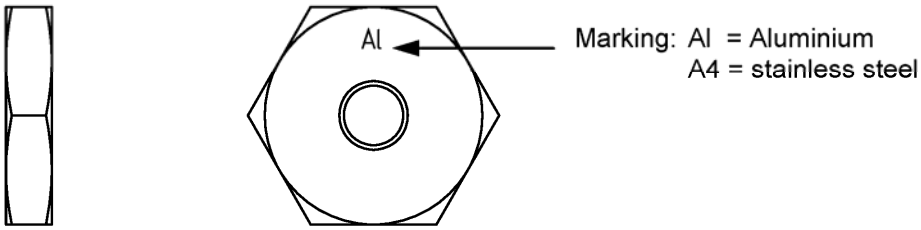


Table 1: Material of anchor parts

Anchor parts	Material
Cone bolt	Stainless steel, EN 10088-1
Expansion part	Stainless steel, EN 10088-1
Shim washer	Polyamide 6.6
Hexagon nut	Aluminium, EN 755-2 Stainless steel, EN 10088-1

Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"	**Annex 3**
Anchor parts and material	

Deutsches Institut für Bautechnik DIBt

Drill bit

Dimension of drill hole

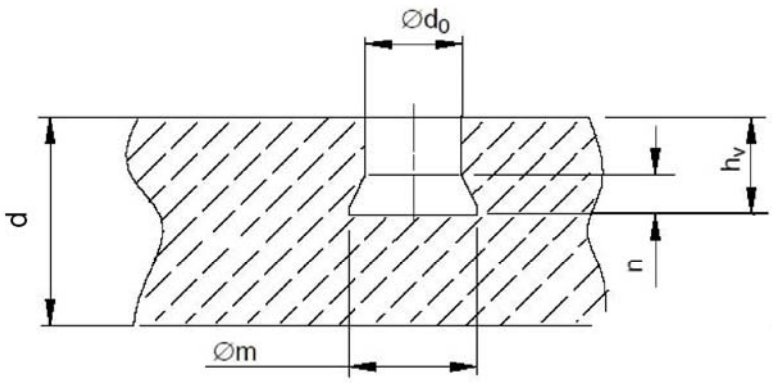
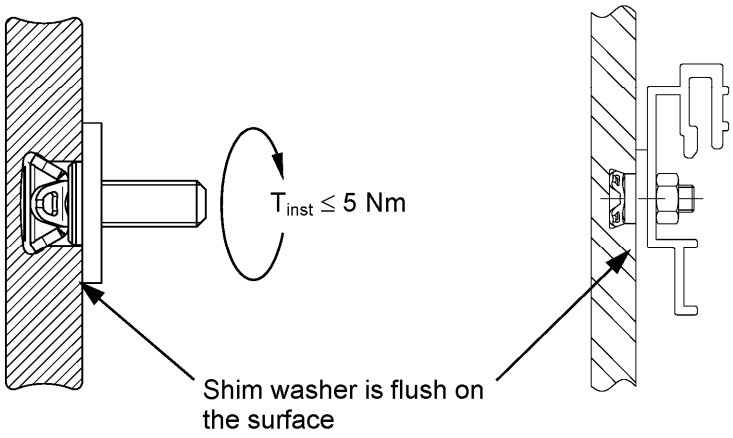


Table 2: Dimensions of drill hole [mm]

Drill bit: e. g. FZPB 11 T CNC					
∅ d_0	∅ m	d	n	h_v	
11 $^{+\ 0,4}_{-\ 0,2}$	13,5 ± 0,3	8	≈ 4	6	$^{+\ 0,4}_{-\ 0,1}$



Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"

Drill bit, geometry of the drill hole and installation parameters

Annex 4

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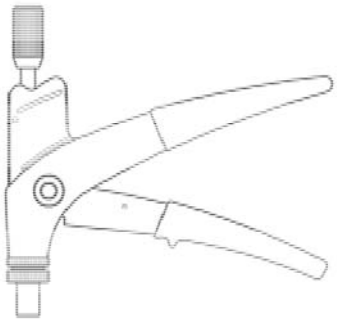
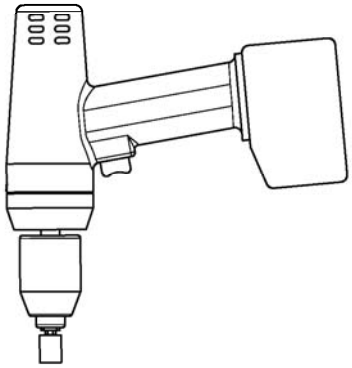
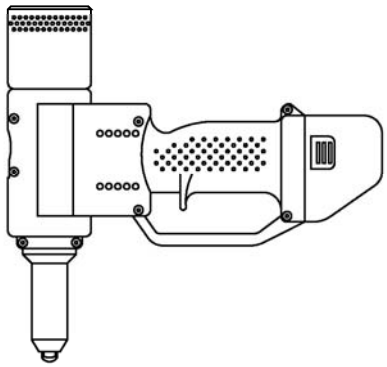
Setting tools



Hand Setting Tool SGT

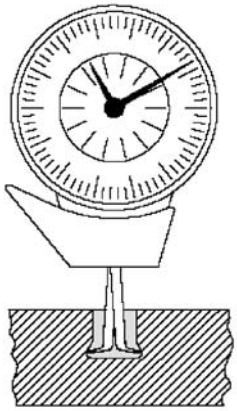


Cordless screwdriver with hexagon socket or mounting extension

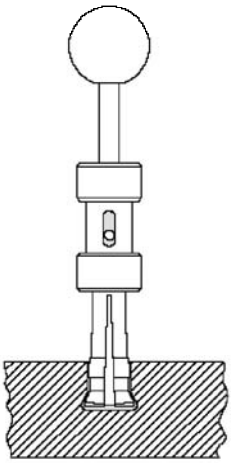


Battery Operated Setting Tool SGB

Testing equipment for checking the undercut ∅ m

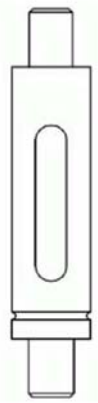


Dial Gauge



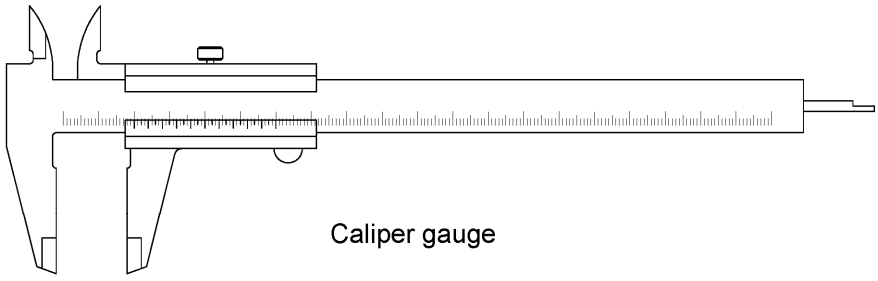
HVL (Undercut minimum volume gauge)

Go / no Go gauge for checking cylindrical drill hole diameter ∅ d_0



DPL (Drill hole diameter gauge)

Testing equipment for checking the drill hole depth h_v



Caliper gauge

Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"	**Annex 5**
Setting devices and testing equipment	

Table 3: Parameter for the design of the anchor and façade panel

Values of façade panels	maximum panel size		L_x x L_y L_y x L_x	[mm]x[mm]	3050 x 1220
	nominal panel thickness		$h_{nom} \geq$	[mm]	8
	design resistance to bending stress		σ_{Rd} =	[N/mm²]	8,4
	modulus of elasticity		E_{mean} =	[N/mm²]	12000
	Poisson's ratio		ν =	[-]	0,25
	dead load	**Tectiva**	g_k =	[kN/m²]	0,16
		Linea	g_k =	[kN/m²]	0,18

Values of Tergo+ anchor	anchor type		FZP II T		Linea	Tectiva
	design resistance to	tension load [1)]	N_{Rd} =	[kN]	0,37	0,44
		shear load [1)]	V_{Rd} =	[kN]	1,61	1,66
	edge distance		$a_r \geq$	[mm]	50	
	spacing		a	[mm]	100 ≤ a ≤ 700	
	double bracket		$a_D \geq$	[mm]	45	

[1)] In case of coincident stress of an anchor due to tension and shear load the following equation shall be observed (for V_{Ed} the value of the panels' dead load that causes shear load on the anchor shall be used).

$$\left(\frac{N_{Ed}}{N_{Rd}}\right) + \left(\frac{V_{Ed}}{V_{Rd}}\right) \leq 1$$

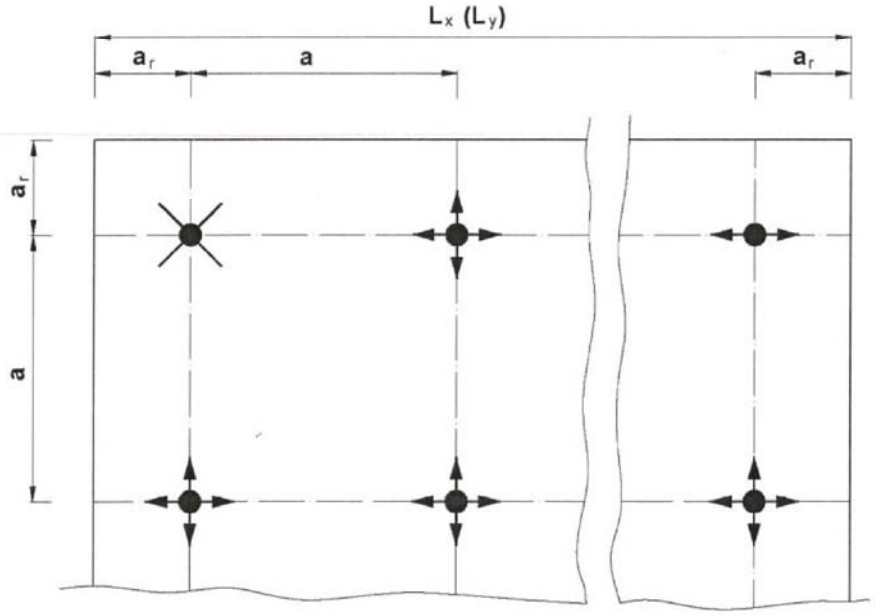
Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"

Anchor and panel values

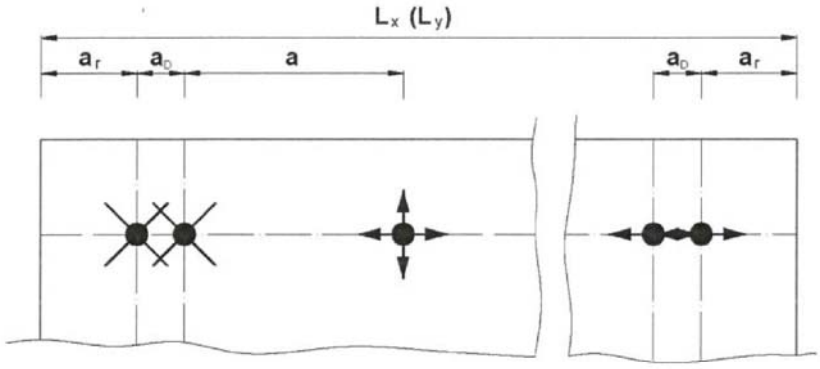
Annex 6

Possible arrangement of the fixing points

Single agraffe



Double agraffe



Legend:

a_r	= edge distance – distance of anchor and panel edge
a	= spacing – distance between two anchors
a_D	= spacing – distance between anchors of double agraffes
L_x	= length of façade panels in horizontal direction
L_y	= length of façade panels in vertical direction
	= fixed point (stiff bearing) between panel and substructure
	= horizontal sliding point (free bearing) between panel and substructure
	= horizontal and vertical sliding point (free bearing) between panel and substructure

Rear fixing of "Eternit Equitone Tectiva and Linea facade panels" with undercut anchor "Tergo+"

Annex 7

Arrangement of fixing points