

GERMAN INSTITUTE OF CONSTRUCTION ENGINEERING

Public Institution

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10th December 2004
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General approval by the building inspectorate

Approval number:

Z-33.2-632

Applicant:

alsecco GmbH & Co KG
Kupferstrasse 50
D-36208 Wildeck-Richelsdorf

Object approved:

“tec Naturstein” ventilated external curtain wall cladding

Valid until:

31st December 2006

The above-mentioned object is herewith awarded general building inspectorate approval*. This general building inspectorate approval consists of five appendices.



* This general building inspectorate approval replaces the general building inspectorate approval no. Z-33.2-632 of 9th December 2002.

I. GENERAL TERMS AND CONDITIONS

- 1 The general building inspectorate approval confirms the suitability or applicability of the approved object for the purposes of the regional building regulations.
- 2 The general building inspectorate approval does not replace the approvals, permits and certification required by law for the execution of construction projects.
- 3 The general building inspectorate approval is issued without prejudice to third-party rights, in particular private property rights or patents.
- 4 The manufacturer and distributor of the approved object are required, without prejudice to other provisions in the "special terms and conditions", to provide the user or applicator of the approved object with copies of the general building inspectorate approval and to point out that the general building inspectorate approval must be available at the point of application or use. The authorities involved must be provided with copies of the general building inspectorate approval on request.
- 5 The general building inspectorate approval must only be copied in its entirety. Extracts may only be published with the approval of the German Institute of Construction Engineering. Texts and drawings of advertising material must not contradict the general building inspectorate approval. Translations of the general building inspectorate approval must be marked "Translation of the German original not checked by the German Institute of Construction Engineering".
- 6 The general building inspectorate approval is revocable. The terms and conditions of the general building inspectorate approval may be supplemented or amended at a later date, particularly if new technical insights make this necessary.



II. SPECIAL TERMS AND CONDITIONS

1 Approved object and scope of application

1.1 Approved object

This general building inspectorate approval covers the ventilated curtain wall cladding “tec naturstein” based on DIN 18 516-1, where façade boards N are fixed to substructure (metal laths) with aluminium clamps (agraffes).

Façade boards N are factory-made composite boards consisting of a lightweight concrete base board N with glass-fibre reinforced lamination on both sides and a cladding panel made of natural stone fully bonded to the exposed face of the board. Fixing points consisting of pre-fabricated ceramic elements are attached to the base board N.

The façade boards N are flame-resistant (building materials class DIN 4102-B1 B1 in accordance with DIN 4102-1).

The substructure (aluminium laths) must be installed in accordance with DIN 18 516-1 without indirect stress. The stability check of the substructure is not included in this general building inspectorate approval.

Any thermal insulation that is installed must consist of non-flammable mineral-fibre insulation materials in accordance with DIN EN 13162¹ (building materials class DIN 4102-A or European class A1 or A2 –s1, d0 to DIN EN 13 501-1) and must be fixed directly to the building, independent of the substructure.

The permissible construction height when using “tec Naturstein” is determined by the applicable regional/national fire prevention regulations unless stability calculations show that these heights need to be reduced.

The subject of this approval and its component parts must comply with the special regulations and the appendices of this general building inspectorate approval, as well as with the specifications filed with the German Institute of Construction Engineering.

2 Regulations for the building products

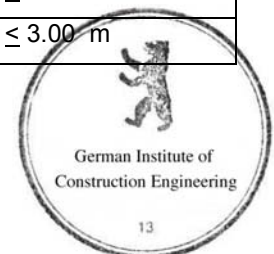
2.1 Properties and composition

2.1.1 Façade boards

Façade board N as specified in appendix 1 must consist of the building products detailed in sections 2.1.1.1 to 2.1.1.8 and may have a total nominal thickness of 25 mm to 29 mm. The thickness tolerance is ± 1 mm. The area and lateral dimensions of each board must not exceed the values shown in table 1.

Table 1: Maximum board dimensions

| Façade board N | Maximum area | Maximum lateral dimension |
|----------------|---------------------------|--|
| Format I | $A \leq 1.00 \text{ m}^2$ | $b \leq l \leq 1.00 \text{ m}$ |
| Format II | $A \leq 1.35 \text{ m}^2$ | $b \leq l \leq 1.35 \text{ m}$ |
| Format III | $A \leq 1.80 \text{ m}^2$ | $b \leq 1.20 \text{ m}; l \leq 1.50 \text{ m}$ |
| Format IV | $A \leq 1.00 \text{ m}^2$ | $b \leq 0.50 \text{ m}; l \leq 2.00 \text{ m}$ |
| Format V | $A \leq 3.00 \text{ m}^2$ | $b \leq 1.00 \text{ m}; l \leq 3.00 \text{ m}$ |



¹ Building regulations list B, part 1, appendix 03 must be complied with as regards fire behaviour.

In tests to determine the bending strength of façade board N in accordance with appendix 4, the following minimum values must be reached for the bending moment at break:

| | |
|---------------|------------|
| Mean value | ≥ 740 Nm/m |
| Minimum value | ≥ 680 Nm/m |

2.1.1.1 Lightweight concrete base board

The base board N must consist of expanded clay that is bound using CEM I 52.5 R cement to DIN 1164-1 and it must be laminated on both sides as follows:

- The lamination on the front face between the base board and the natural stone must consist of mesh N as described in section 2.1.1.2, which must be fully embedded in one layer of the adhesive described in section 2.1.1.3.
- The lamination on the rear face must consist of mesh N as described in section 2.1.1.2, which must be fully embedded in one layer of reinforcing compound as described in section 2.1.1.4.

The unlaminated base board N must have a thickness of 15.5 mm ± 1 mm, a dry density of 0.64 to 0.80 g/cm³ and water absorption of ≤ 30 % w/w (after 7 days immersion in water at 20 °C).

The formulation for base board N must correspond to the details lodged with the German Institute of Construction Engineering.

2.1.1.2 Reinforcing mesh

The mesh N must consist of a coated lattice mesh made of textile glass. The mesh must possess the properties set out in table 2.

Table 2: Properties of reinforcing mesh N

| Properties | Textile glass reinforcing mesh N |
|--|----------------------------------|
| Weight per unit area | 160 – 170 g/m ² |
| Mesh size | 3 mm x 4 mm |
| Tear strength as supplied, tested in accordance with DIN 53 857-1 | ≥ 2 kN/5 cm |
| Residual tear strength after 6 hours ageing at 80 °C in an alkali solution with a pH value of 12.5 | ≥ 1.3 kN/5 cm |

2.1.1.3 Adhesive for lamination on the front of base board N

Adhesive N is to be used for laminating the front of the base board as detailed in section 2.1.1.1 (consumption: approx. 1 kg/m²).

The formulation for the adhesive must correspond to the details lodged with the German Institute of Construction Engineering.

2.1.1.4 Reinforcing compound for lamination on the rear of base board N

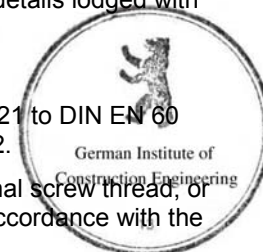
The one-component, cement-bound Spachtel N reinforcing compound is to be used for laminating the rear of the base board as detailed in section 2.1.1.1 (consumption: approx. 3 kg/m²).

The formulation for the reinforcing compound must correspond to the details lodged with the German Institute of Construction Engineering.

2.1.1.5 Ceramic fixing elements

The pre-fabricated ceramic fixing elements must consist of steatite C221 to DIN EN 60 672-3 (DIN VDE 0335) with the dimensions as stipulated in appendix 2.

At the factory they must be step-drilled for fixing with rivets or an internal screw thread, or they must have a threaded aluminium insert for fixing with screws in accordance with the details shown in appendix 2.



2.1.1.6 Adhesive for attaching the ceramic fixing elements

Fixing adhesive N is to be used for attaching the ceramic fixing elements as detailed in section 2.1.1.5 into holes machine-drilled into the lightweight concrete base board as described in section 2.1.1.1.

The formulation for the adhesive must correspond to the details lodged with the German Institute of Construction Engineering.

2.1.1.7 Natural stone panels

Natural stone panels with a minimum thickness of 5 mm and a maximum thickness of 10 mm, with a flexural strength tested to DIN 52 112, process A, of at least 4.5 N/mm² and a frost resistance of at least 25 freeze-thaw cycles tested to DIN 52 104-1, process A, may be used.

2.1.1.8 Adhesive for bonding the natural stone to the base board N

The natural stone panels must be fully bonded to the base board using the adhesive described in section 2.1.1.3.

The bond strength (tear-off strength) between the natural stone panels and the base board must correspond to the transverse tensile strength of the base board, but it must not be less than 0.5 N/mm².

2.1.2 Fixings

2.1.2.1 Screws and rivets

M6 x 20 screws to DIN EN 24 017 made of stainless steel, material no. 1.4541 to DIN 17 440 or 5.0 x 20 K14 rivets with general building inspectorate approval no. Z-14-1-4, sheet 2.4 (rivet N) may be used for fixing the clamps described in section 2.1.2.2.

2.1.2.2 Clamps

The clamps must be made from an aluminium alloy EN AW 6060 T66 to DIN EN 755-2 (AlMgSi0.5 F22 or F25 to DIN 1748-1:1983-02).

The clamps must be at least 35 mm wide.

The wall thickness of the clamps for fixing CNL façade boards formats I, II and IV, as detailed in section 2.1.1, must be $t \geq 2$ mm. The wall thickness of the clamps for fixing CNL I panels formats III and V as detailed in section 2.1.1. must be $t \geq 3$ mm.

The moments of inertia in relation to the axes through the centre of gravity must be $I_{xs} \geq 17 \text{ cm}^4$ and $I_{vs} \geq 1.9 \text{ cm}^4$ (see appendix 5).

2.1.3 Substructure

The horizontal and vertical supporting laths making up the substructure must be made of aluminium alloy EN AW 6060 to DIN EN 755-2 (AlMgSi0.5 F22 or F25 to DIN 1748-1:1983-02).

The moments of inertia to be complied with, in relation to the axes through the centre of gravity, are as follows:

- For the horizontal profiles: $I_{xs} \geq 14.3 \text{ cm}^4$ and $I_{vs} \geq 1.4 \text{ cm}^4$

- For the vertical profiles: $I_{xs} \geq 5.4 \text{ cm}^4$ and $I_{vs} \geq 5.7 \text{ cm}^4$

2.2 Manufacture, packaging, transport, storage, labelling

2.2.1 Manufacture

The building products described in sections 2.1.1 to 2.1.3 are to be manufactured at the factory. The arrangement of the fixing points in the boards must be in accordance with appendix 1.

2.2.2 Packaging, transport and storage

Packaging, transport and storage of the façade boards N must be in accordance with the manufacturer's instructions.



2.2.3 Labelling

Façade boards N as described in section 2.1.1 or their packaging or the delivery note and packaging of the fixing elements as described in section 2.1.2 must be labelled by the manufacturer to show the conformity mark (C-mark) in accordance with the conformity mark regulations of the various states. The mark may only be used if the preconditions stipulated in section 2.3 have been met.

The following details must also be included on the packaging of the building products:

- Designation of the building product
- Building product class DIN 4102-B1: flame-resistant

2.3 Proof of conformity

2.3.1 Proof of conformity based on certificate of conformity

Each production plant must have a certificate of conformity based on its internal production control and regular external control, including an initial test of the building products in accordance with the following requirements to confirm that the façade boards N comply with the requirements of this general inspectorate approval.

The manufacturer of the façade boards N must instruct a certifying body and also an approved monitoring and control agency for the conformity certificate to be issued and the external control to be carried out.

The certifying body is required to send the German Institute for Construction Engineering and the highest building inspectorate in the state where the manufacturer's plant is located a copy – for information – of the conformity certificate it has issued.

2.3.2 Internal production control

Internal production control must be set up and carried out in each manufacturing plant. Internal production control is deemed to be the constant monitoring by the manufacturer of products to ensure that the building products made there comply with the regulations of this general building inspectorate approval.

The tests set out in appendix 4 must be carried out as part of the internal production control.

With regard to the fire behaviour of façade boards N the “Guidelines for proof of conformity of flame-resistant building materials (building materials class DIN 4102-B1) in accordance with the general building inspectorate approval”² must be complied with.

The results of the internal production control must be recorded and analysed. The records must contain at least the following details:

- Designation of the building product or starting material and contents
- Type of control or test
- Date of manufacture and testing of building product or starting material or contents
- Result of controls and tests and, where applicable, comparison with requirements
- Signature of the person responsible for internal production control

The records must be kept for at least five years and they must be submitted to the monitoring and control agency appointed to carry out the external control.

These must be submitted to the German Institute of Construction Engineering and the competent highest building inspectorate on request.



² Published in the “Information Sheets” issued by the German Institute for Construction Engineering.

If the results of the tests do not meet the required standard, the manufacturer must immediately take the necessary measures to remedy the defect. Building products that do not meet the requirements must be handled in such a way that they cannot be mixed up with conforming products. Once the defect has been remedied, the test in question must be repeated without delay, in so far as this is technically possible and necessary to prove that the defect has been remedied.

2.3.3 External control

The internal production control must be checked regularly, and at least twice a year, by means of an external control as regards façade boards N.

An initial test of the building product must be carried out within the scope of the external control. The approved body in each case is required to take samples and to conduct the tests. At least the tests set out in appendix 5 must be carried out on a random basis.

With regard to the fire behaviour the "Guidelines for proof of conformity of flame-resistant building materials (building materials class DIN 4102-B1) in accordance with the general building inspectorate approval"² and the principles of approval are decisive for proving the flame-resistance of building materials (building materials class DIN 4102-B1) in terms of the external control of façade boards N.

The results of the certification process and external control must be kept for at least five years. The certifying body and the external control agency are required to submit these respective documents to the German Institute of Construction Engineering on request.

3 Regulations for design and dimensioning

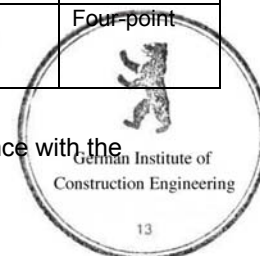
3.1 Proof of static stability

The proof of static stability for façade boards N and their attachment to the clamps has, in the course of the approval procedure, been established for prismatic constructions, plain/closed on all sides, with wind loads to DIN 1055-4:1986-08 for the versions shown in table 3.

Table 3: Maximum permissible wind suction loads

| Format | Board dimensions A = Area b and l = side lengths | Maximum permissible wind suction load | Maximum permissible height of building H above ground | | Fixing * |
|--------|---|---------------------------------------|---|------------------------|------------|
| | | | Main area | Near edges | |
| I | $A \leq 1.00 \text{ m}^2$ $b \leq l \leq 1.00 \text{ m}$ | 2.2 kN/mm ² | $H \leq 100 \text{ m}$ | $H \leq 100 \text{ m}$ | Four-point |
| II | $A \leq 1.35 \text{ m}^2$ $b \leq l \leq 1.35 \text{ m}$ | 1.6 kN/mm ² | $H \leq 100 \text{ m}$ | $H \leq 20 \text{ m}$ | Four-point |
| III | $A \leq 1.80 \text{ m}^2$ $b \leq 1.20 \text{ m}; l \leq 1.50 \text{ m}$ | 1.1 kN/mm ² | $H \leq 100 \text{ m}$ | $H \leq 8 \text{ m}$ | Four-point |
| IV | $A \leq 1.00 \text{ m}^2$ $b \leq 0.50 \text{ m}; l \leq 2.00 \text{ m}$ | 2.2 kN/mm ² | $H \leq 100 \text{ m}$ | $H \leq 100 \text{ m}$ | Four-point |
| V | $A \leq 3.00 \text{ m}^2$ $b \leq 1.00 \text{ m}; l \leq 3.00 \text{ m}$ | 2.2 kN/mm ² | $H \leq 100 \text{ m}$ | $H \leq 100 \text{ m}$ | Four-point |

* Fixing with screws or rivets as detailed in section 2.1.2.1 in accordance with the specifications of appendix 1



The static stability of the clamps, the substructure and its anchoring to the building must be demonstrated in individual cases. The design weight of the façade boards N must be assumed as 0.46 kN/m².

3.2 Thermal protection and climate-related moisture protection

DIN 4108-2 applies with regard to proof of thermal protection.

The air gap (ventilation space) and the façade boards must be ignored for the purpose of calculating the thermal resistance (R value) to DIN EN ISO 6946 for the exterior wall construction.

The calculated proof of thermal protection provided by the insulation material must be based on the theoretical thermal conductivity (design value) in accordance with DIN V 4108-4:2004-07, table 2, category I. A theoretical value in accordance with category II applies to insulation boards where a threshold value $\lambda_{\text{Threshold}}$ has been determined within the scope of a conformity certificate based on a general building inspectorate approval.

The thermal bridges created by the substructure and associated anchors because they penetrate or reduce the thickness of the layer of thermal insulation must be taken into account.

DIN 4108-3 applies with regard to proof of climate-related moisture protection.

3.3 Fire protection

The façade boards N are flame-resistant (building materials class DIN 4102-B1).

3.4 Sound insulation

DIN 4109 applies with regard to proof of sound insulation (against external noise).

4 Regulations concerning application/installation

4.1 Installation and fitting

4.1.1 Attaching the substructure

The aluminium substructure must be installed in accordance with DIN 18 516-1 without indirect stress. Only profiles as described in section 2.1.3 may be used.

The span of the horizontal profiles (i.e. the distance between the vertical profiles) must not exceed 1200 mm.

The span of the vertical profiles (i.e. the vertical distance between the wall brackets) must not exceed 1250 mm.

4.1.2 Fixing the façade boards in position

The façade boards must be fixed to the substructure using the ceramic fixing elements as described in section 2.1.2.1 and the clamps described in section 2.1.2.2. The number of fixing points required is set out in section 3.1 and appendix 1.

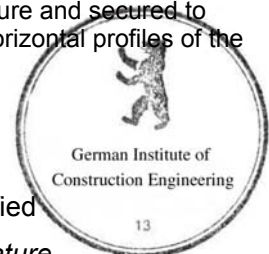
The clamps are hooked into the horizontal profiles of the substructure and secured to prevent them sliding on the lath. They must be connected to the horizontal profiles of the substructure without any indirect stress (see appendix 3).

Signed

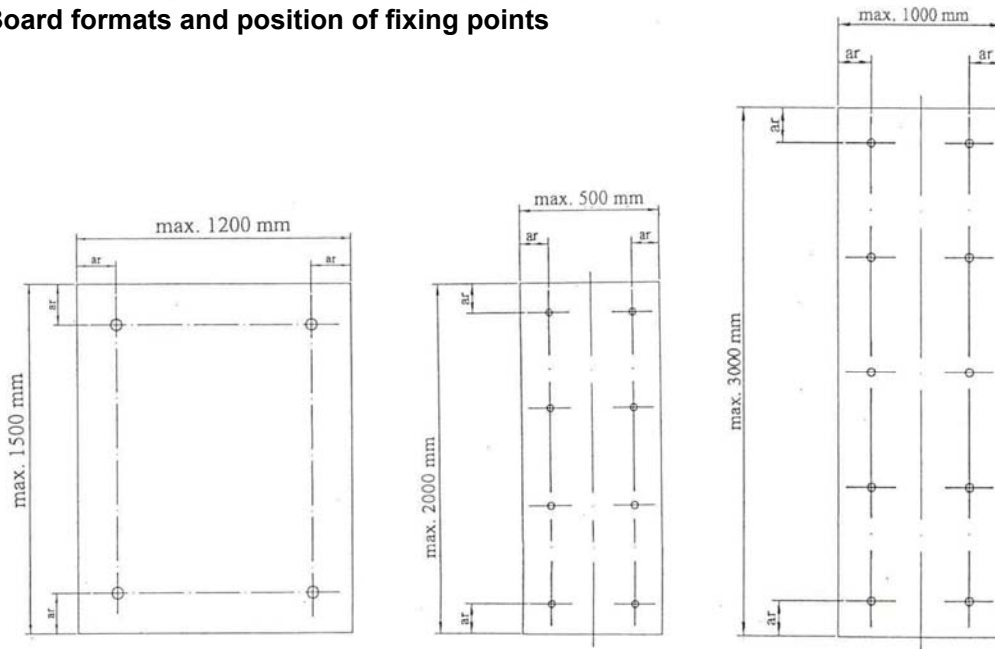
Klein

Certified

Signature



Board formats and position of fixing points



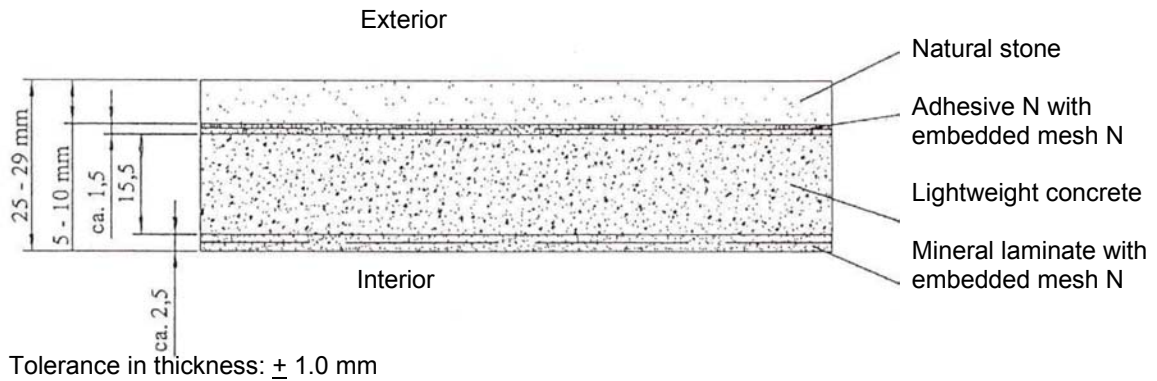
Tolerance:

In length: ± 1 mm
 In breadth: ± 1 mm

Distance of fixings from edge:

$150 \text{ mm} \leq a, \leq 200 \text{ mm}$; a may be reduced to 100 mm for the narrow boards with a breadth $b = 300$ to 400 mm

Composition of façade board N

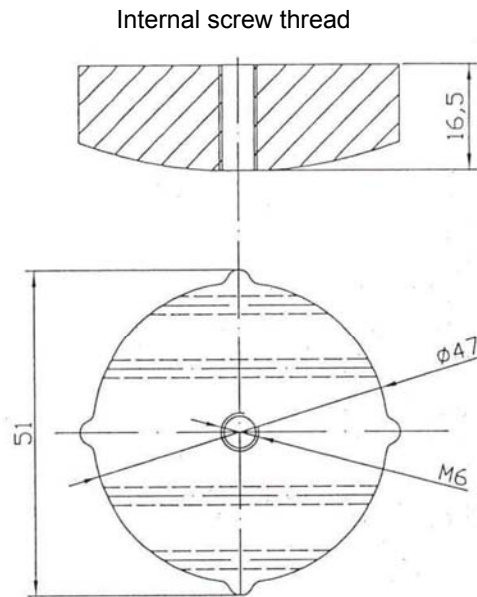


Tolerance in thickness: ± 1.0 mm

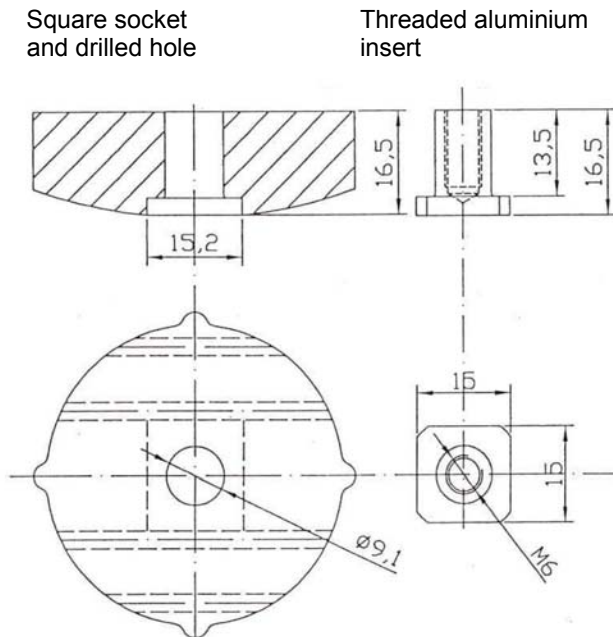
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|---|-----------------------|---|
| alsecco GmbH & Co. KG Kupferstrasse 50 D-36208 Wildeck-Richelsdorf Tel. +49 (0)36922 88-0 Fax +49 (0)36922 88-330 | Façade board N | Appendix 1 to general building inspectorate approval no. Z-33.2-632 dated 10 th December 2004 |
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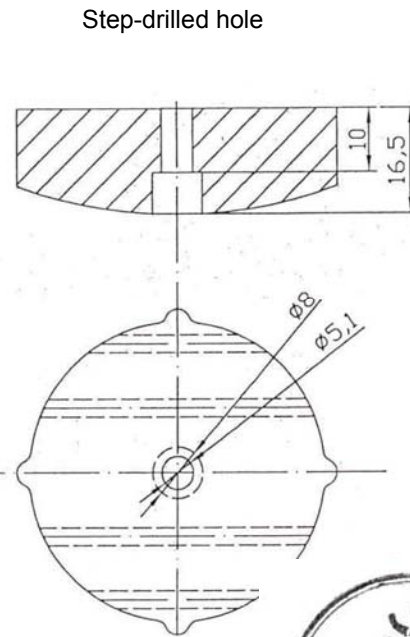
Screw fixing



Screw fixing with threaded aluminium insert



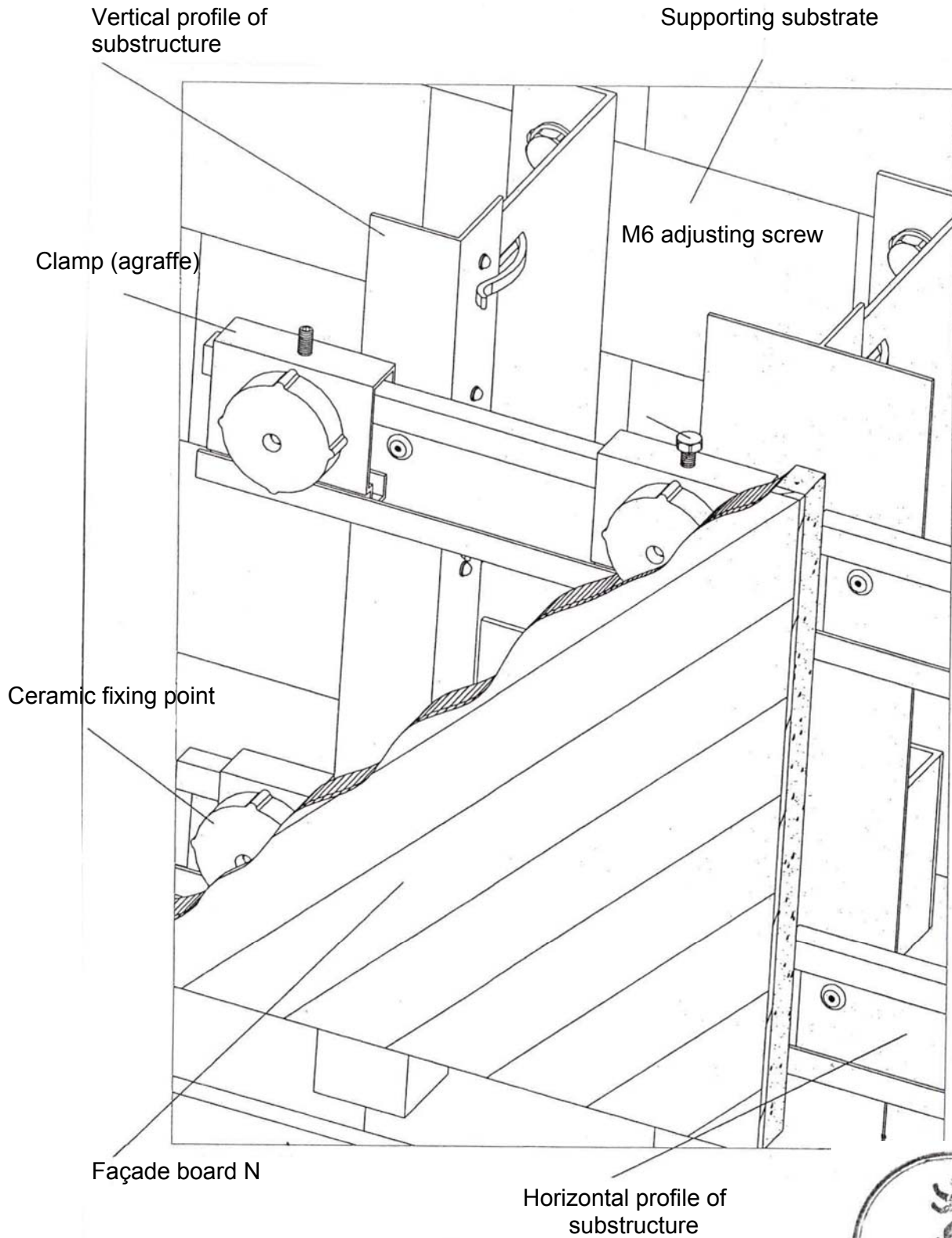
Rivet fixing



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Ceramic fixing elements

Appendix 2
 to general building inspectorate
 approval no. Z-33.2-632
 dated 10th December 2004



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Ventilated external wall
 cladding with façade
 boards N

Appendix 3
 to general building inspectorate
 approval no. Z-33.2-632
 dated 10th December 2004

Overview



Table 1: Incoming goods control, each delivery

| Building product | Properties and requirements | Test certification by |
|-------------------------|---|--|
| Natural stone | See section 2.1.1.7 | Works test report "2.2" to DIN EN 10 204 |
| Reinforcing mesh | See table 2, section 2.1.1.2 | |
| Ceramic fixing elements | Dimensions and material in acc. with section 2.1.1.5 and appendix 2 | |
| Adhesive N | See section 2.1.1.3 | |

Table 2: Internal production control

| Building product | Properties | Requirement | Scope and frequency |
|--|-------------------------------|--|---|
| Lightweight concrete board, unlaminated (base board N) | Thickness | 15.5 mm | Every 10 th board |
| Façade board N | Thickness | 25 mm to 29 mm | 5 samples per order \geq 200 m ² ; but at least 5 samples per 2000 m ² produced |
| | Adhesive pull strength * | Mean value \geq 0.7 N/mm ² Minimum value $>$ 0.5 N/mm ² | |
| | Breaking stress of fixings ** | Mean value \geq 2.85 kN Minimum value \geq 2.65 kN | |
| | Bending moment at break *** | Mean value \geq 740 Nm/m Minimum value \geq 680 Nm/m | |

* Determining the adhesive pull strength (testing the strength of the bond between the natural stone and the lightweight concrete):

- Dimension of samples in mm: l/b/d = 60/60/d

** Determining the breaking stress of fixings under centric tensile stress:

- Dimension of samples in mm: l/b/d = 300/300/d
- Inside diameter of bearing ring $D_s = 250$ mm

*** Testing the bending (flexural) strength by means of the 3-point bending test:

- Dimension of samples in mm: l/b/d = 500/100/d
- Span $l_s = 400$ mm
- Natural stone panel located in zone of tensile stress in bending

| | | |
|---|--|--|
| alsecco GmbH & Co. KG Kupferstrasse 50 D-36208 Wildeck-Richelsdorf Tel. +49 (0)36922 88-0 Fax +49 (0)36922 88-330 | Incoming goods control and internal production control | Appendix 4 to general building inspectorate approval no. Z-33.2-632 dated 10 th December 2004 13 |
|---|--|--|



Clamps (agraffes)

Material thickness:

For board formats I, II and IV: $t \geq 2.0$ mm

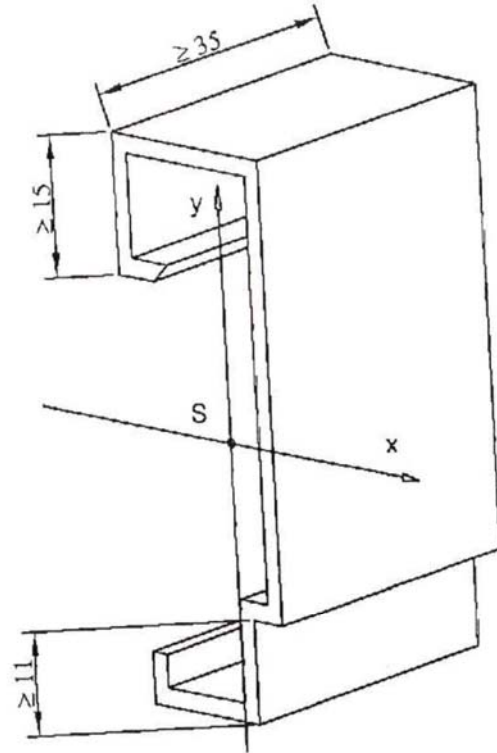
For board formats III and V: $t \geq 3.0$ mm

(Board formats as detailed in section 2.1.1)

Aluminium alloy:

EN AW 6060 T66 to DIN EN 755-2

(AlMgSi0.5 F22 or F25)

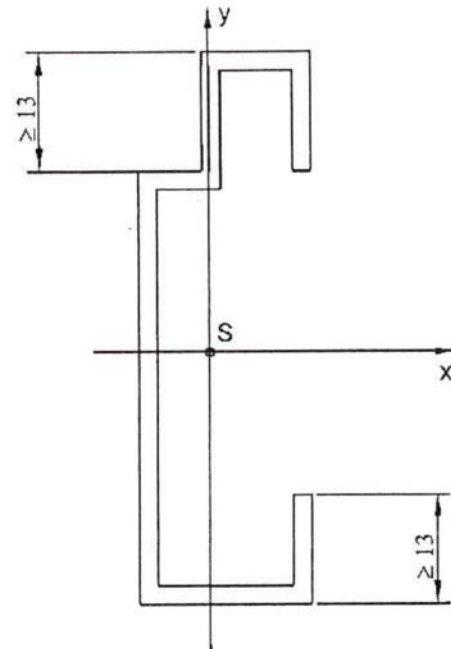


Horizontal supporting lath

Aluminium alloy:

EN AW 6060 T66 to DIN EN 755-2

(AlMgSi0.5 F22 or F25)



S: Centre of gravity

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Clamps and horizontal supporting laths making up the aluminium substructure

Appendix 5 to general building inspectorate approval no. Z-33.2-632 dated 10th December 2004

