

General Design Approval

Approval body for construction products and types of construction

A public agency financed jointly by the Federal
Government and the Länder

Member of EOTA, UEAtc and WFTAO

Date:
12.09.2017

Reference:
I 73-1.10.3-771/1

Number:
Z-10.3-771

Validity:
From: 12 September 2017
To: 12 September 2017

Applicant:
NBK- Keramik GmbH
Reeser Straße 235
46446 Emmerich am Rhein, Germany

Subject matter of this approval:
"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

This document comprises nine pages and seven appendices comprising ten pages.

DIBt

I GENERAL PROVISIONS

- 1 The general design approval verifies the suitability of the object in question within the context of state building codes.
- 2 This document does not replace the legally prescribed approval, consent and certification required for building projects.
- 3 This document has been compiled without prejudice to the rights of third parties, particularly private property rights.
- 4 Users of the object in question must be provided with a copy of this document notwithstanding further provisions listed under "Special provisions". Users of the object in question must also note that this document must be kept at the building site. On request, the authorities involved must also be provided with a copy.
- 5 This document may be duplicated only in unabridged form. The publication of extracts requires the approval of the German Institute for Building Technology. Texts and drawings in leaflets must not contradict this document, and translations must contain the statement "Translation of the original German version that has not been reviewed by the German Institute for Building Technology".
- 6 This document may be revoked at any time. Provisions may subsequently be supplemented or changed, particularly on the basis of new technical knowledge.
- 7 This document relates to the information and documentation pertaining to the object in question submitted by the applicant within the scope of the approval process. Any changes to the basis of this approval are not recorded in this document and must be disclosed to the German Institute for Building Technology immediately.
- 8 The general design approval covered by this document also applies as a general building approval for the design.

II SPECIAL PROVISIONS

1 Object in question and application

1.1 Object in question

The general design approval covers the "TerrArt-LIGHT" rear-ventilated façade system made from "TerrArt-LIGHT" extruded hollow-body ceramic tiles and their attachment to the vertical support profiles of an aluminium substructure by means of tile holders.

The ceramic tiles are each attached by means of four tile holders made from aluminium, which hold the seams at the top and bottom edges of the tiles.

The "TerrArt-LIGHT" ceramic tiles as well as the tile holders and support profiles made from aluminium are non-combustible.

The stability of the substructure and its anchoring to the construction are not covered by this general design approval.

1.2 Area of application

The "TerrArt-LIGHT" façade system may be used for rear-ventilated external wall cladding in accordance with DIN 18516-1¹.

The area of application in which the façade system may be used is based on the proof of stability and the applicable fire protection regulations of the countries in question.

Any thermal insulation must be attached directly to the construction independently of the substructure.

2 Provisions regarding planning and measurements

2.1 Components for the design

The object in question (the design) and its components (building products) must comply with the special provisions and the Appendices of the general design approval as well as the appendices held by the German Institute for Building Technology.

2.1.1 "TerrArt-LIGHT" ceramic tiles

The "TerrArt-LIGHT" ceramic tiles are manufactured with cavities and with seams along the long sides. They may be manufactured with a smooth surface (exterior), whereby the geometry of the edge seams must be identical for all tile types (see Appendix 2).

The "TerrArt-LIGHT" ceramic tiles must be CE-marked extruded ceramic tiles from Group All_{b-1} in accordance with DIN EN 14411² and have the following properties in accordance with the declaration of performance:

- Bulk density (dry density): 2.05 to 2.20 kg/dm³
- Thermal shock resistance and durability for outdoor applications in accordance with DIN EN 14411 must be guaranteed.
- The cross-section geometry of the ceramic tiles must comply with the specifications in Appendix 2.

1	DIN 18516-1:2010-06	Cladding for external walls, ventilated at rear – Part 1: Requirements, principles of testing
2	DIN EN 14411:2012-12	Ceramic tiles – Definitions, classification, characteristics, evaluation of conformity and marking

- The bending strength as a minimum single value and as an average minimum value of the bending strength in accordance with DIN EN 14411 must be adhered to in accordance with Table 1 below:

Table 1: Bending strength

"TerrArt-LIGHT" ceramic tiles	Requirements for bending strength
Group All _{b-1}	Average minimum value $\geq 17.5 \text{ N/mm}^2$ Minimum single value $\geq 15 \text{ N/mm}^2$

- The tile dimensions must be adhered to in accordance with Table 2 below:

Table 2: Dimensions of the ceramic tiles

Width W (dimension between axes in the direction of the hole)	Height H (on the visible surface, perpendicular to the direction of the hole)	Total thickness t	Seam thickness
$W \leq 1800 \text{ mm}$	$150 \leq H \leq 600 \text{ mm}$	$t = 28 \text{ mm}$	12 mm
Tolerances			
$W \pm 1 \text{ mm}$	$150 \leq H \leq 250 \text{ mm}$	$H \pm 2 \text{ mm}$	$t \pm 1.0 \text{ mm}$
	$300 \leq H \leq 400 \text{ mm}$	$H + 2.5 \text{ mm}$ $H - 2.0 \text{ mm}$	
	$500 \leq H \leq 600 \text{ mm}$	$H + 3.0 \text{ mm}$ $H - 2.0 \text{ mm}$	
			$\pm 1.0 \text{ mm}$

The fire behaviour of the "TerrArt-LIGHT" ceramic tiles falls into Class A1 in accordance with DIN EN 13501-1.

2.1.2 Tile holders

The THB 09-110 tile holders (central holders) for attachments in the area of tile joints, the THB 09-300 tile holders (upper holders) for attachments at the upper edge and the THB 09-200 tile holders (lower holders) for attachments at the lower edge must be made from aluminium alloy EN AW 6063 in accordance with DIN EN 755-2₃, material grade T6, have a geometry that complies with Appendix 4 and CE marking in accordance with DIN EN 1090-1₄.

The tile holders must be attached to the vertical support profiles of the substructure as per Section 2.2.1 by means of M5x16 hexagon screws in accordance with DIN EN ISO 4017₅ made from stainless steel A4-70, M5 nuts in accordance with DIN EN ISO 7040₆ made from stainless steel A4, strength class ≥ 5 and M5 washers in accordance with ISO 7093-1₇ made from stainless steel A4.

The tile holders can be used as single holders (type A) or as double holders (type B) (see Appendix 5).

3	DIN EN 755-2:2016-10	Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties
4	DIN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components
5	DIN EN ISO 4017:2015-05	Fasteners – Hexagon head screws – Product grades A and B
6	DIN EN ISO 7040:2013-04	Prevailing torque type hexagon regular nuts (with non-metallic insert) – Property classes 5, 8 and 10
7	DIN EN ISO 7093-1:2000-11	Plain washers – Large series – Part 1: Product grade A

2.1.3 Accessories (spacers)

The EPDM spacer profiles must be normally flammable as a minimum (building material class DIN 4102-B2 in accordance with DIN 4102-1 or Class E in accordance with DIN EN 13501-1) and comply with the specifications in Appendix 4.1.

2.2 Measurements

2.2.1 General

Unless set forth otherwise in the following sections, all of the necessary statistical proofs must be provided on the basis of the Technical Building Rules⁸ adopted by the building supervisory authority.

The stability of the façade panels and their attachment by means of tile holders must be verified on an object-specific basis for the area of application described in Section 1 and in compliance with the provisions regarding execution in accordance with Section 3 and Appendices 3–6.

The system-specific support profiles described in Appendix 4.1 or other standard support profiles (e.g. T80/50/2 or L50/40/2) with the following properties can be used as support profiles for the substructure:

- Alloy EN AW 6060 in accordance with DIN EN 755-2, material grade T66
- A thickness of ≥ 2.0 mm
- Deflection must be limited to $L/200$ (L = span of the substructure)

The profile length of the substructure and the distance between the fixed points of support profiles lying on top of one another must be limited to 3.4 m.

The stability of the substructure and its anchoring to the construction must be verified on an object-specific basis in accordance with the Technical Building Rules.

The surface weight of the ceramic tiles is 48 kg/m².

2.2.2 Rated values of E_d influences

The rated values for the effects of E_d influences must be determined in accordance with the Technical Building Rules introduced by the building supervisory authority.

The wind loads are based on the Technical Building Rules introduced by the building supervisory authority.

The loads on the façade panels (ceramic tiles) and their fixtures must be determined taking into account the flexibility of the substructure⁹, the pointwise support of the façade panels and possible changes to storage conditions as a result of temperature, swelling and shrinkage.

⁸ Go to www.dibt.de: >Fields of activity<, >Construction Products Lists/Technical Building Rules<

⁹ E.g. According to E. Zuber: Einfluss nachgiebiger Fassadenunterkonstruktionen auf Bekleidungen und Befestigungen in the "Official Communications" of the German Institute for Building Technology, 1979, Book 2, pages 45–50

2.2.3 Rated value of component resistance R_d

The rated values for the component resistance of the ceramic tiles against wind effects (positive and negative direction) can be found in Table 3 (single holders) and Table 4 (double holders) based on the tile length and tile height. The influence of the dead weight is already included in the rated values of the component resistance. A linear interpolation of the rated values is possible.

Table 3: Rated values for the component resistance R_d [kN/m²] of the ceramic tiles against wind effects in the case of single holders

Tile length [m]	≤ 0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Nominal height [mm]	Rated values for the component resistance R_d against wind effects in the case of single holders										
150	5.60	4.17	3.33	3.03	2.78	2.56	2.38	2.22	2.08	1.96	1.85
200	4.20	3.13	2.50	2.27	2.08	1.92	1.79	1.67	1.56	1.47	1.39
250	3.30	2.50	2.00	1.82	1.67	1.54	1.43	1.33	1.25	1.18	1.11
300	2.78	2.08	1.67	1.52	1.39	1.28	1.19	1.11	1.04	0.98	0.93
400	2.08	1.56	1.25	1.14	1.04	0.96	0.89	0.83	0.78	0.74	0.69
500	1.67	1.25	1.00	0.91	0.83	0.77	0.71	0.67	0.63	0.59	0.56
600	1.39	1.04	0.83	0.76	0.69	0.64	0.60	0.56	0.52	0.49	0.46

Table 4: Rated values for the component resistance R_d [kN/m²] of the ceramic tiles against wind effects in the case of double holders

Tile length [m]	≤ 0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Nominal height [mm]	Rated values for the component resistance R_d against wind effects in the case of double holders										
150	13.80	10.33	8.27	7.52	6.89	6.36	5.90	5.51	5.17	4.86	4.59
200	10.30	7.75	6.20	5.64	5.17	4.77	4.43	4.13	3.88	3.65	3.44
250	8.30	6.20	4.96	4.51	4.13	3.82	3.54	3.31	3.10	2.92	2.76
300	6.89	5.17	4.13	3.76	3.44	3.18	2.95	2.76	2.58	2.43	2.30
400	5.17	3.88	3.10	2.82	2.58	2.38	2.21	2.07	1.94	1.82	1.72
500	4.13	3.10	2.48	2.25	2.07	1.91	1.77	1.65	1.55	1.46	1.38
600	3.44	2.58	2.07	1.88	1.72	1.59	1.48	1.38	1.29	1.22	1.15

2.2.4 Verification

The stability of the ceramic tiles for the limit state of the stability is, with

$$E_d \leq R_d$$

with

E_d : Rated value of the influence

R_d : Rated value of the component resistance

The verification is carried out at the level of applicable wind loads. The influence of the dead weight is already included in the rated values for the component resistance against wind effects. Fitness for purpose is verified with the proof of stability.

The stability of the tile holders and their attachment to the vertical substructure is verified with the proof of suitability of the ceramic tiles.

2.3 Fire protection

The "TerrArt-LIGHT" façade system is non-combustible.

Any thermal insulation must be made from non-combustible mineral wool panels in accordance with DIN EN 13162¹⁰ and must be attached directly to the construction independently of the substructure.

When the system is used in conjunction with rear-ventilated external cladding, the provisions of the Technical Building Rules¹¹ as per DIN 18516-1 must be taken into account in terms of structural fire protection measures.

2.4 Thermal protection and climatic protection against moisture

DIN 4108-2¹² applies to the verification of thermal protection.

The air layer (rear ventilation gap) and the façade panels must not be included in the calculation of thermal resistance (R value) in accordance with DIN EN ISO 6946 for the external wall construction.

During the thermal protection verification, the rated thermal conductivity value in accordance with DIN 4108-4¹³ Table 2 must be applied to the insulating material used.

Thermal bridges created by the substructure and its anchoring as a result of the thermal insulation layer being penetrated or its thickness being reduced must be taken into account.

DIN 4108-3¹⁴ applies to the verification of climatic protection against moisture.

2.5 Sound insulation

DIN 4109-1¹⁵ applies to the verification of sound insulation (protection against outside noise).

10	DIN EN 13162:2015-04	Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification
11	Go to www.dibt.de > Technical Building Rules <	
12	DIN 4108-2:2013-02	Thermal protection and energy economy in buildings – Part 2: Minimum requirements to thermal insulation
13	DIN 4108-4:2017-03	Thermal insulation and energy economy in buildings – Part 4: Hygrothermal design values
14	DIN 4108-3:2014-11	Thermal protection and energy economy in buildings – Part 3: Protection against moisture subject to climate conditions – Requirements and directions for design and construction
15	DIN 4109-1:2016-07	Sound insulation in buildings – Part 1: Minimum requirements

3 Provisions regarding execution

3.1 Requirements regarding the applicant and the company performing the work

– Applicant

The applicant is obliged to make the special provisions of this design approval and all further peculiarities applicable to proper execution available to all persons tasked with the development and execution of the "TerrArt-LIGHT" curtain-wall-facing, rear-ventilated façade system.

– Company performing the work

The specialist staff from the company performing the work must familiarise themselves with the special provisions of this design approval as well as all peculiarities applicable to proper execution of the "TerrArt-LIGHT" curtain-wall-facing, rear-ventilated façade system.

The company performing the work must confirm that the execution is appropriate for the design in question in accordance with Appendix 7. This confirmation must be submitted to the building owner.

3.2 Incoming inspection of building products

An incoming inspection of the product marking must be conducted on the construction site for the "TerrArt-LIGHT" ceramic tiles in accordance with Section 2.2.1 and for the tile holders in accordance with Section 2.1.2.

3.3 Installation and assembly

The vertical aluminium support profiles of the substructure must be assembled without any constraint forces on the load-bearing surface, whereby one anchoring point must be designed as a fixed point and all others as sliding points. The profile length of the substructure and the distance between the fixed points of support profiles lying on top of one another must be limited to 3.4 m.

The "TerrArt-LIGHT" ceramic tiles must only be laid transversely to ensure that the tile edges held by the tile holders with seams and the cavities always lie in a horizontal direction.

This can be implemented in accordance with the types described in Appendix 5:

- Type A with 4x1 single tile holders at the corners of the tiles ($a_R = 25$ mm)

Each ceramic tile is attached to two support profiles with four tile holders. The tile holders are positioned at the corners of the tiles. Two adjacent tiles are attached to a support profile located near the vertical joints. The edge distance a_R from the centre of a tile holder to the front of the ceramic tile is 25 mm (see Appendix 3.2).

- Type B with 4x2 double tile holders; edge distance $a_R = 85$ mm

Each ceramic tile is attached to two support profiles with eight tile holders, whereby each attachment point consists of two adjacent tile holders. The centre distance between two adjacent tile holders is 60.5 mm. The edge distance a_R from the centre of the inside tile holder to the front of the ceramic tile is 85 mm (see Appendix 3.3).

The ceramic tiles are assembled from bottom to top on a three-dimensional, vertical aluminium substructure in accordance with Section 2.2.1. The \varnothing 5.1 mm holes must first be drilled for attaching the tile holders to the support profiles. Gauges must be used to ensure compliance with the positional tolerance of +0.5 mm for the holes.

The tile holders described in Section 2.1.2 must be attached to the support profiles by means of the fixtures described in Section 2.1.2. The nuts used for tile holders THB 09-200 and THB 09-300 must not be tightened fully; this ensures that the tile holders can still move within the elongated hole during tile assembly.

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To prevent tile holder THB 09-300 from moving at the top end of the profile, the nut must be tightened after the holder has been pressed down or a drilling screw must be placed above the tile holder as a safety screw.

In the assembled condition, the space between the top edge of the "TerrArt-LIGHT" ceramic tiles and tile holders THB 09-110 must be $7.5 +3.5/-2.5$ mm.

The clear distance between the vertical support profiles at the profile butt joint should be $10 +2.0$ mm. Support profile butt joints in the substructure must not be covered by ceramic tiles; d.h. the upper and lower tile holders of a ceramic tile must always be positioned on a support profile of the substructure (support profile butt joint = tile butt joint).

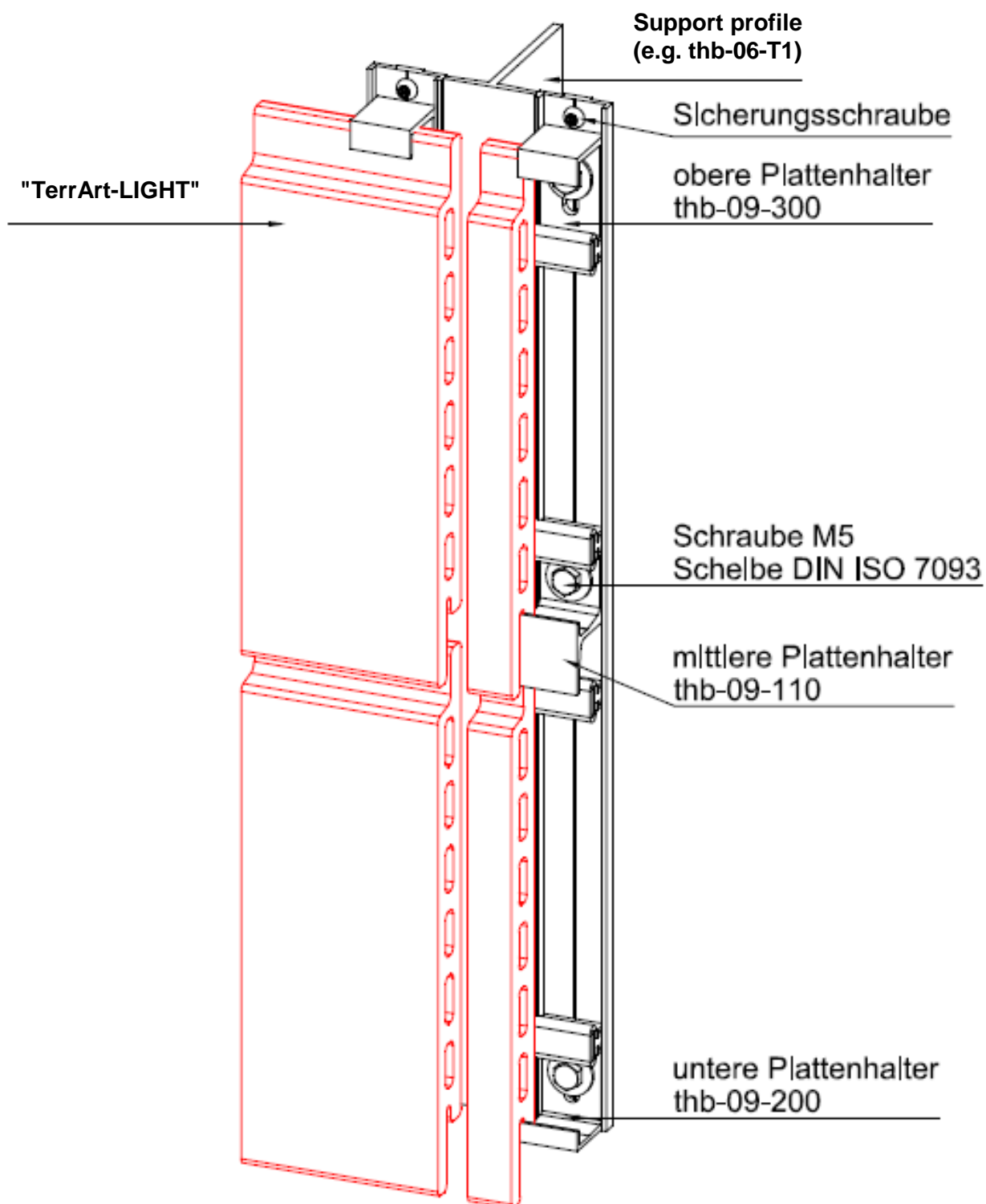
To prevent the tiles from moving, spacers must be positioned between the tile and the support profile in accordance with Section 2.1.3.

The specifications in Appendix 6 must be adhered to for the joint design between the ceramic tiles.

Damaged ceramic tiles must not be installed.

Renée Kamanzi-Fechner
Head of Division

Certified

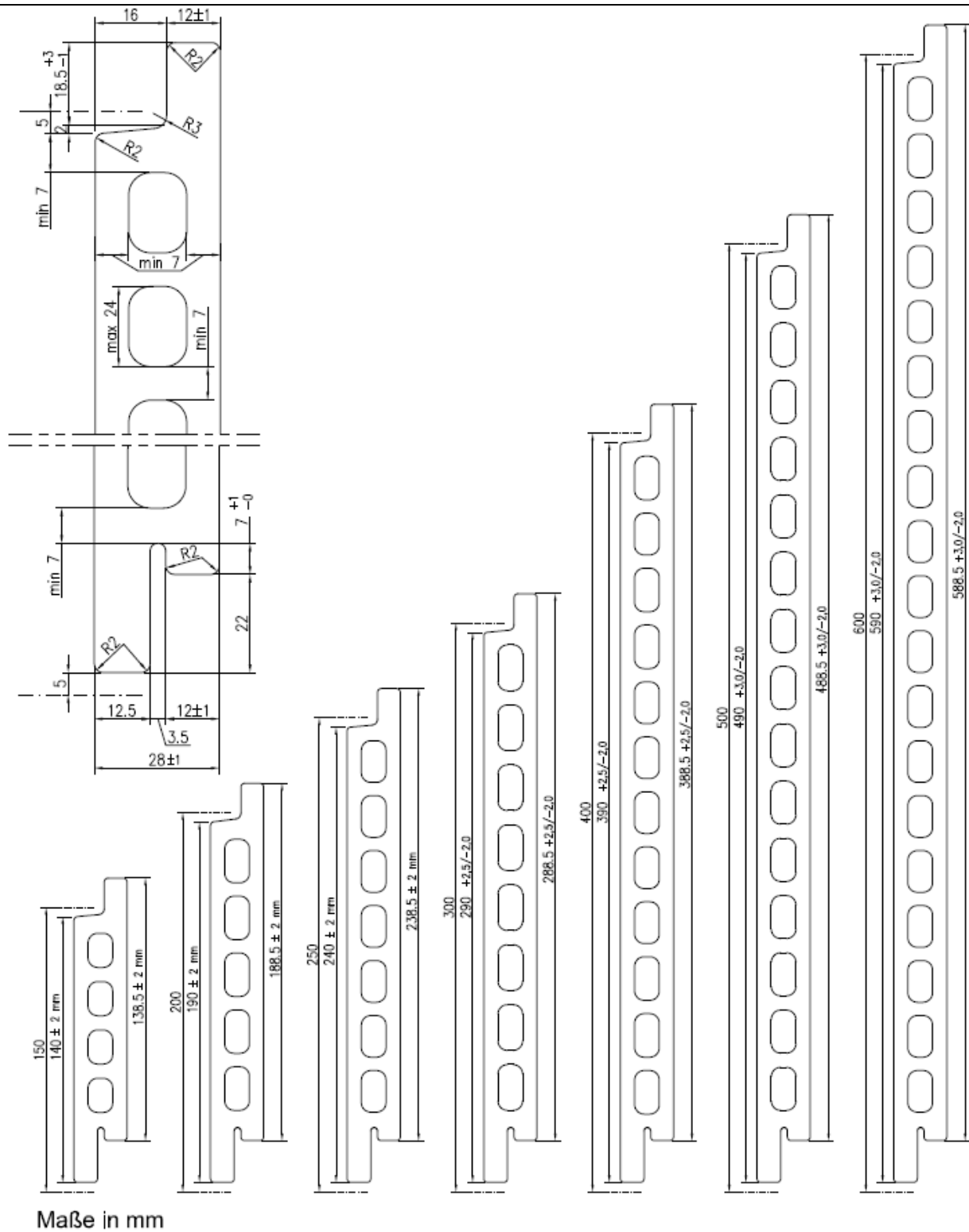


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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Structure of the façade system

Appendix 1

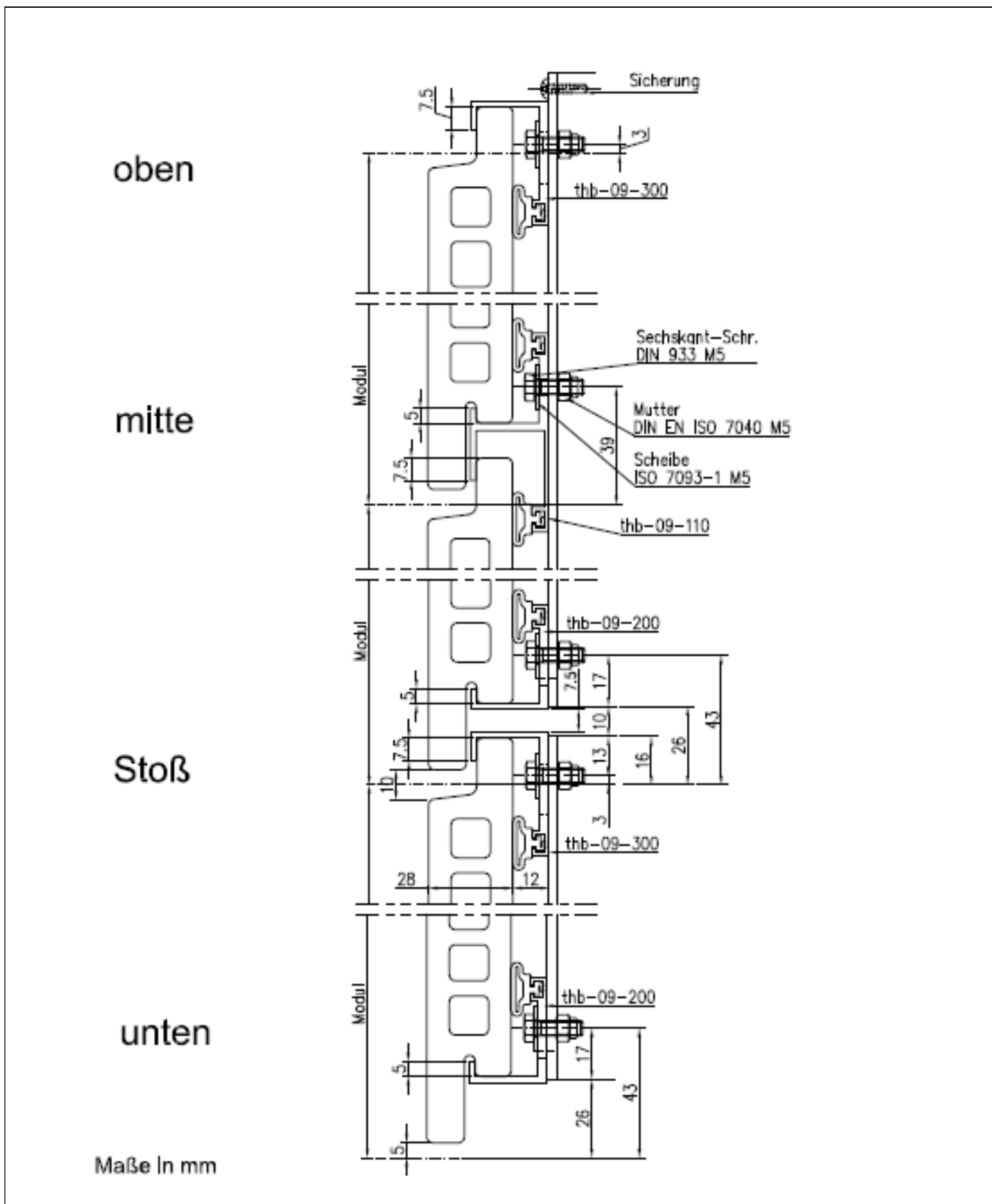


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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Cross-section geometry of the TerrArt-LIGHT ceramic tiles

Appendix 2

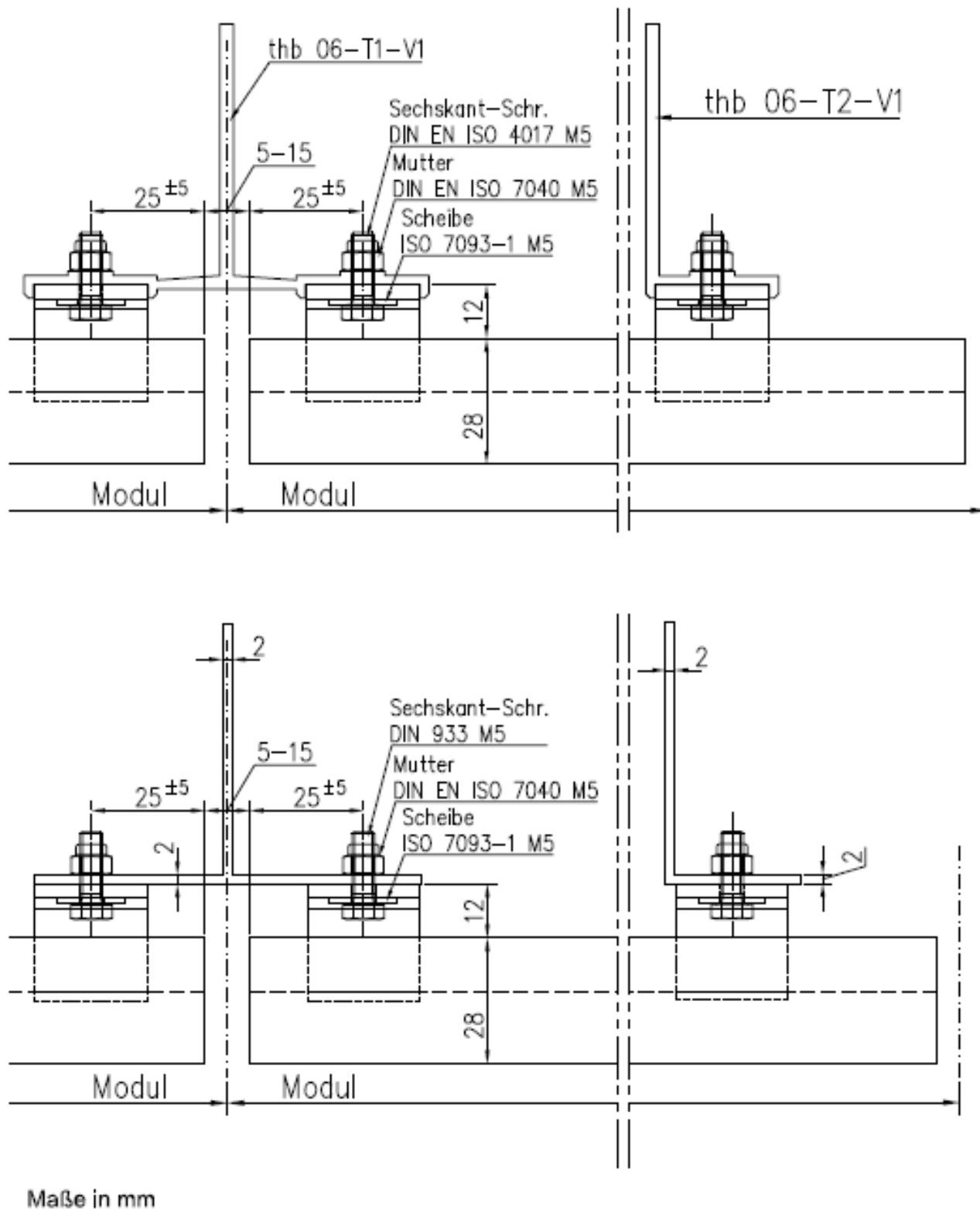


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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Arrangement of the tile holders/accessories and their attachment – vertical section

Appendix 3.1

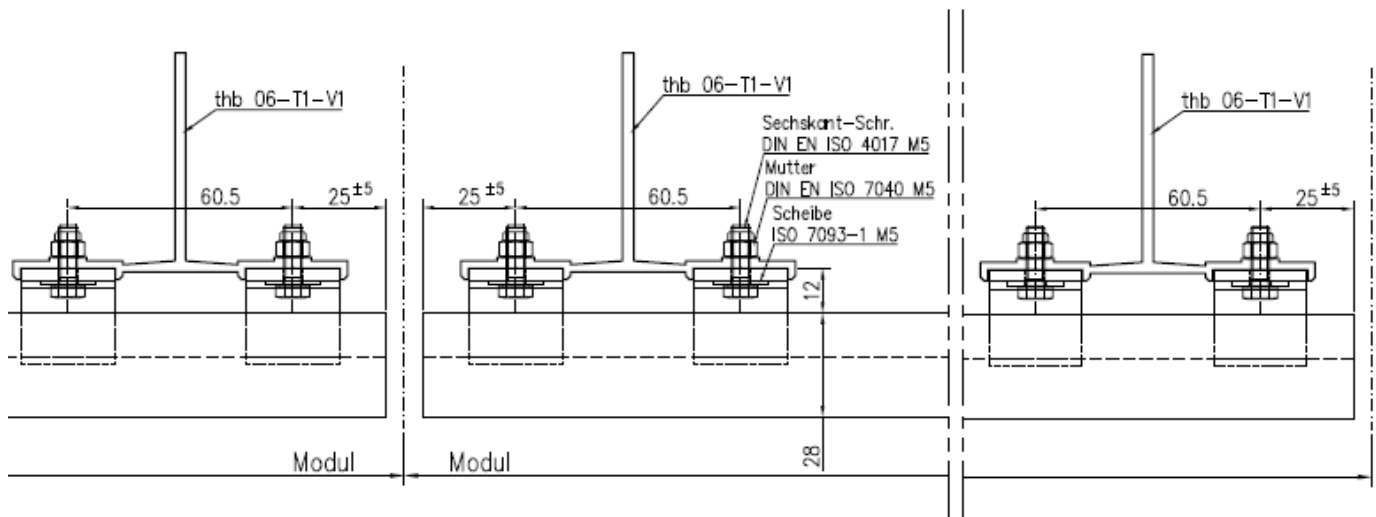


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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Arrangement of the tile holders – type A (single holders)

Appendix 3.2

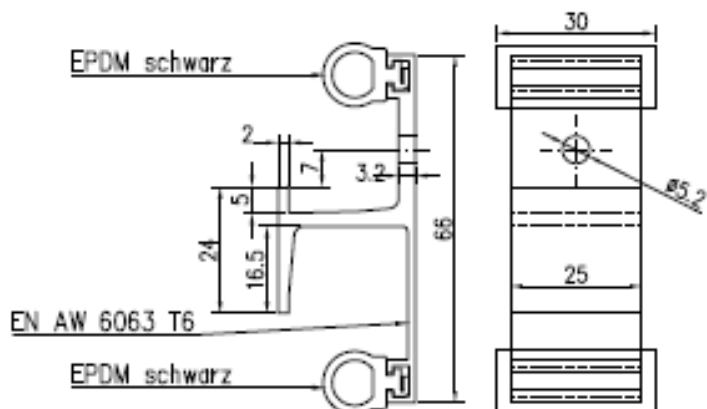


Maße in mm

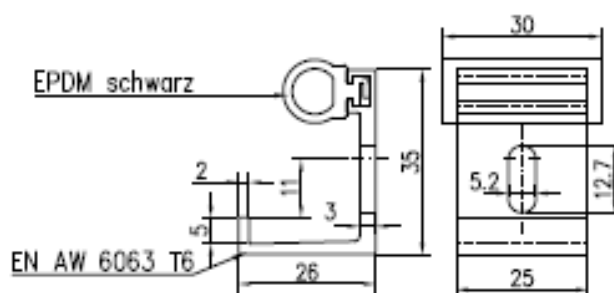
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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding	Appendix 3.3
Arrangement of the tile holders – type B (double holders)	

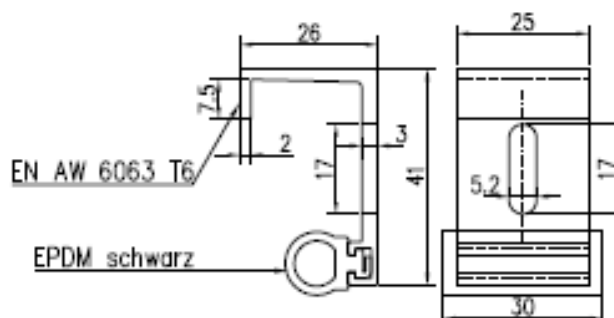
THB 09-110
 Mittlerer Halter



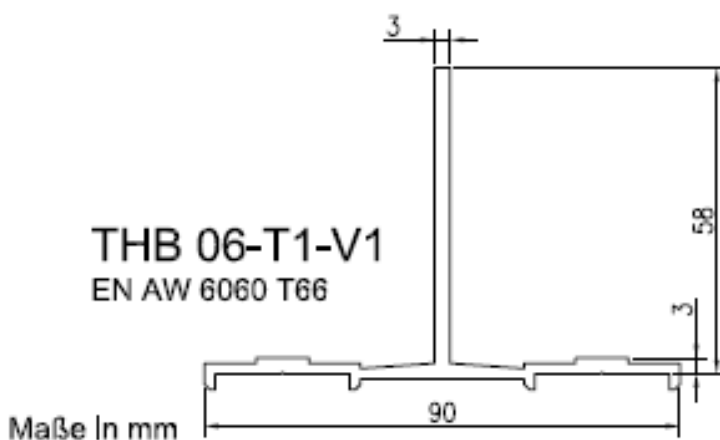
THB 09-200
 Unterer Halter



THB 09-300
 Oberer Halter



THB 06-T1-V1
 EN AW 6060 T66



THB 06-T2-V1
 EN AW 6060 T66

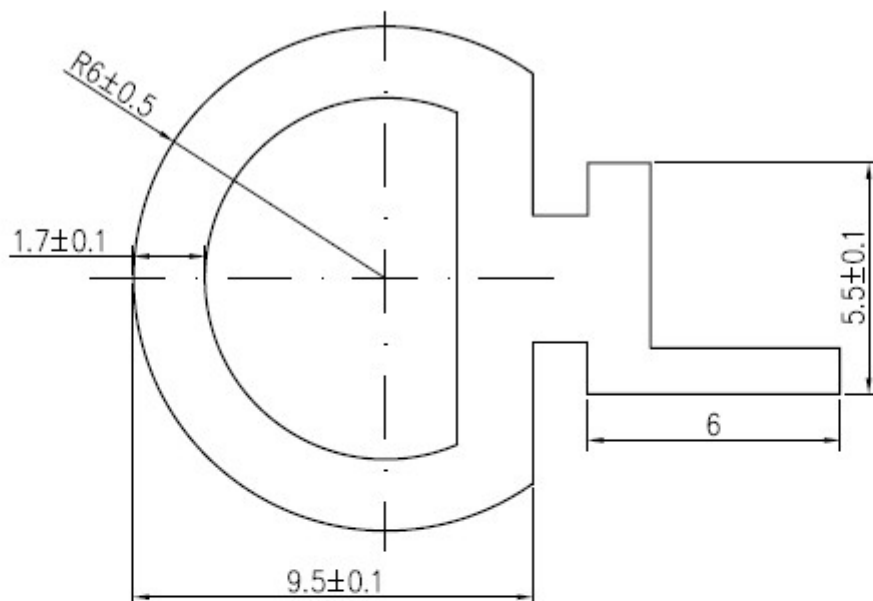


Maße in mm

"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Cross-section geometry of the tile holders and the system-specific substructure

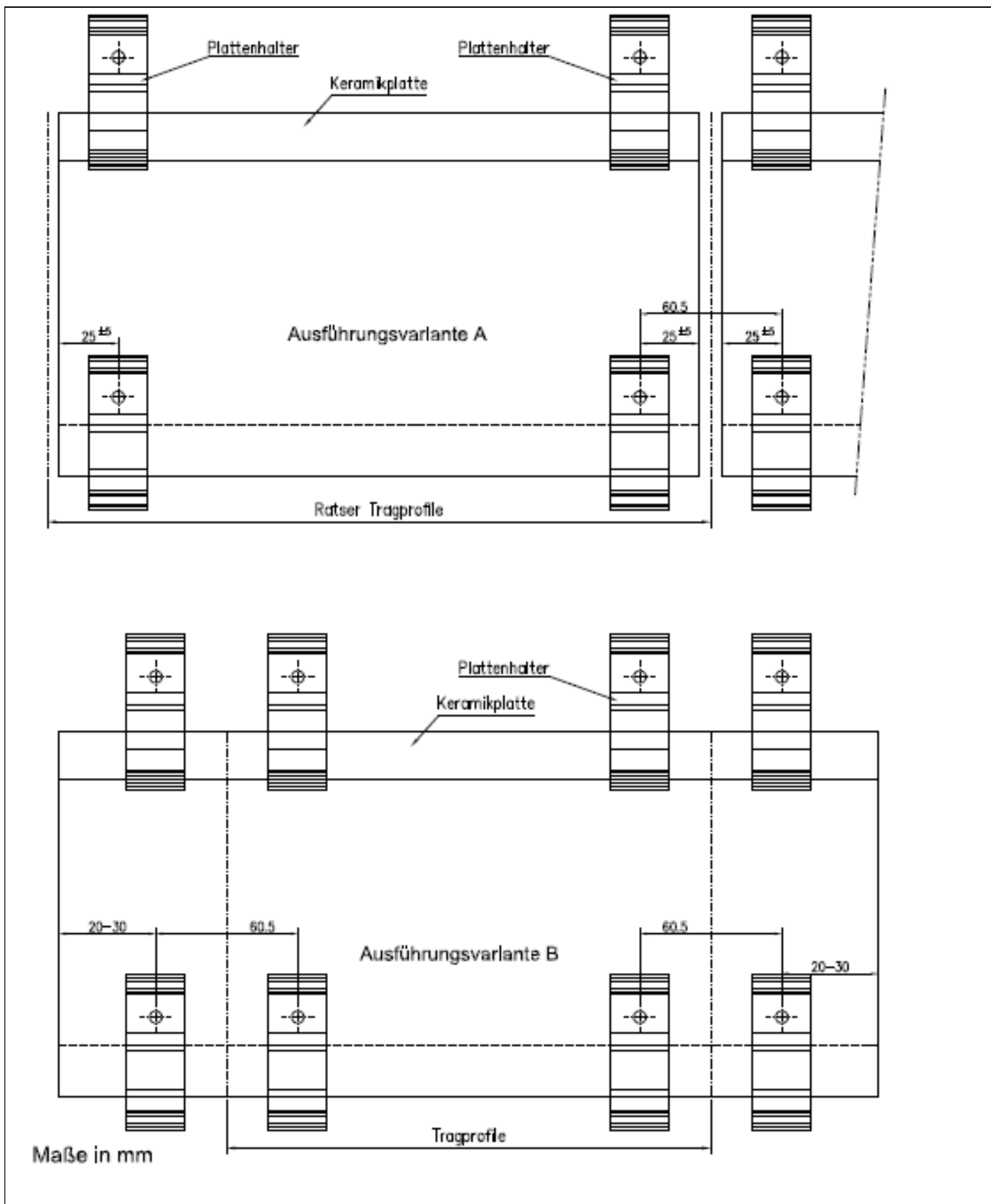
Appendix 4.1



EPDM black, Shore $80^\circ \pm 5^\circ$



M1:1

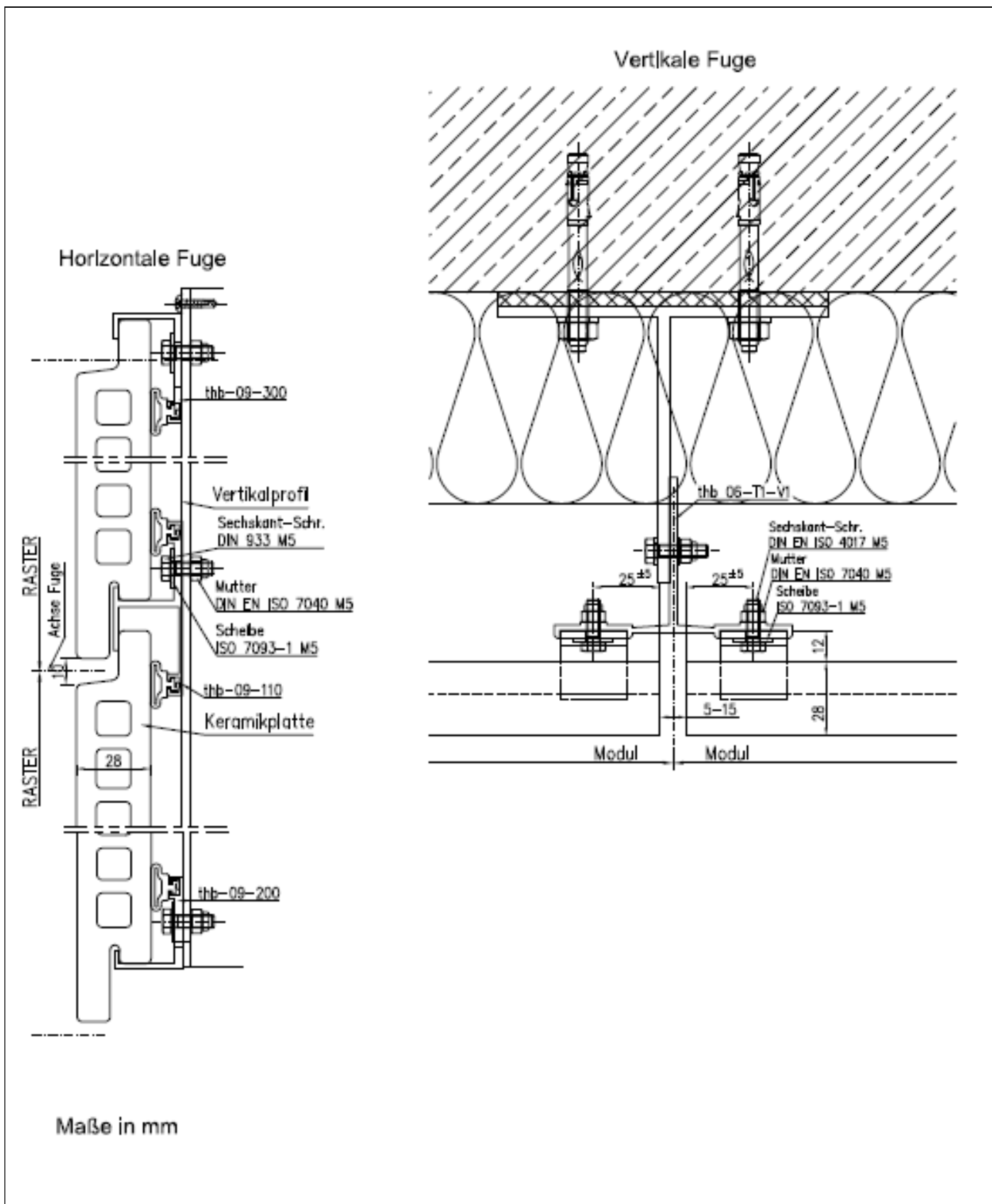


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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Arrangement of the tile plates

Appendix 5



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"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Details of the attachment points, joint design

Appendix 6

This form must be filled out on the construction site by the installer from the company performing the work once the façade system has been completed and submitted to the client (building owner).

Postal address of the building:

Street/house number: _____ Postal code / town/city: _____

**Description of the constructed façade system in accordance
 with design approval no. Z-10.3-771**

"TERRART-LIGHT" ceramic tile used in accordance with Appendix 2.1 (Width $W \leq 1800$ mm)

- H = 150 H = 200 mm H = 250 mm
 mm H = H = 400 mm H = 500 mm H = 600

H = Height

Fixtures used

- "thb 09-110" central tile holder
 "thb 09-300" upper tile holder
 "thb 09-200" lower tile holder

Type (in accordance with Appendix 5)

- Type A with 4 tile holders
 Type B with 8 tile holders

Support profile of the vertical substructure (in accordance with Section 2.2.1)

- THB 06-T1-V1 THB 06-T2-V1 Other support profiles ($t \geq 2$ mm)

Postal address of the company performing the work:

Company: _____ Street: _____
 Postal code / town/city: _____ State: _____

We hereby declare that we have installed the façade system described above in accordance with the provisions of design approval no. Z-10.3-771 and the manufacturer's instructions.

Date/signature of the installer:

"TerrArt-LIGHT" façade system for use with rear-ventilated external wall cladding

Confirmation from the company performing the work, to be submitted to the building owner

Appendix 7