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Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

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Handelsbezeichnung *Trade name*		Kalzip-Aluminium-Stehfalzprofil-System *Kalzip Aluminium Standing Seam System*
Zulassungsinhaber *Holder of approval*		Kalzip GmbH August-Horch-Straße 20-22 56070 Koblenz DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*		Wand- und Dachsysteme mit verdeckten Befestigungen *Wall and roof systems with hidden fastenings*
Geltungsdauer: *Validity:*	vom *from* bis *to*	4 June 2013 4 June 2018
Herstellwerk *Manufacturing plant*		Kalzip GmbH August-Horch-Straße 20-22 56070 Koblenz DEUTSCHLAND

Diese Zulassung umfasst *This Approval contains*	46 Seiten einschließlich 34 Anhänge *46 pages including 34 annexes*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by law of 31 October 2006[5];
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6].

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.

3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.

4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2006*, p. 2407, 2416
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of the product and intended use

1.1 Definition of the construction product

The "Kalzip Aluminium Standing Seam System" consists of prefabricated load-bearing separating wall and roof elements and the appropriate hidden spacer kit (clips and rotatable clip rails) thermal barrier pads and fastening elements. The wall and roof elements are made of stucco-embossed, mill finish, galvanized or plastic-coated aluminium strip, which is roll formed into profiled sheets in cold condition with a trough-shaped cross section of constant height. The clips are made of extruded aluminium bars or of a steel plate encased with polyamide (composite clip). Plastic parts (thermal barrier pads or spacer pads) can be placed under the clips which are fastened to the substructure with fasting elements. Alternatively, clips (rotatable clips) can also be used in an extruded aluminium profile (rotatable clip rail).

Single plastic roof lights, which themselves are not part of the ETA, can be laid between the profiled sheeting. The plastic light tracks correspond to the profiled sheeting in their geometry insofar that they can be arranged anywhere between the profiled sheeting. The connection with the profiled sheeting takes place at the lateral edge ribs with specially provided closing leaves.

The profiled sheeting is connected with each other continuously forming a rainproof standing seam by crimping the lateral edge ribs of adjacent roof elements. The connection to the substructure is made by clips, not visible from above, crimped between the edge ribs, which are fastened to the substructure.

1.2 Intended use

The construction products are used as load-bearing wall and roof elements.

The provisions made in this European technical approval are based on an assumed working life of wall and roof systems with hidden fastenings of 25 years provided that the conditions laid down in sections 4 and 5 are met. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, 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 construction.

2 Characteristics of the product and methods of verification

2.1 Characteristics of the product

2.1.1 Dimensions

The dimensions of the profiled sheeting, the hidden fastenings (clips and rotatable clip rails), the pads and the drilling screws shall correspond to the specifications in Annexes 1 to 8, 12, 32 and 33 as well as the information in the technical documentation[7] to this European technical approval. The profiled sheeting of the variant AF can alternatively be produced with stiffening ribs in the bottom flange (AS variant).

[7] The technical documentation of this ETA is deposited with DIBt and, as far as this is important for the tasks of the body involved in the procedure of attestation of conformity, shall be handed over to the approved bodies.

For the tolerances of the nominal sheet thickness of the profiled sheeting the tolerances according to EN 485-4:1993 shall apply; but only half the values for the lower tolerances.

For the remaining connection elements according to Annexes 9, 10 and 26 to 29, the specifications in the corresponding European technical approvals or standards (e.g. EN 1995-1-1) shall apply or the provisions of the Member States according to Annex A.

2.1.2 Materials

2.1.2.1 Profiled sheeting

As material for the manufacture of the profiled sheeting with the sheet thicknesses given in the annexes, the aluminium alloys EN AW-3004 (AlMn1Mg1), EN AW-3005 (AlMn1Mg0.5) or EN AW-6025 (AlMg2.5SiMnCu) according to EN 573-3:2009 shall be used.

If the aluminium strip is additionally plated, then the plating thickness on each side shall be at least 4 % of the nominal sheet thickness t. As plating material the aluminium alloy EN AW-7072 (ALZn1) according to EN 573-3:2009 shall be used.

The profiled sheeting can be fitted with polyester or PVDF coating of maximum 35 µm on the visible side and with back coating of maximum 5 µm on the back side.

Detailed information concerning plastic paint coating of the aluminium strips are contained in the Technical Documentation[7].

The initial aluminium strip material not yet roll formed (mill finish, stucco-embossed or plastic paint-coated) shall show at least the following mechanical properties in the longitudinal direction for all sheet thicknesses (resistance values and elongation at break determined in accordance with EN 10002-1:2001 on flat samples t x 12.5 mm x 50 mm):

Sheet thickness t [mm]	$R_{p0.2}$ [N/mm²]	R_m [N/mm²]	$A_{50\ mm}$ [%]
0.7	185	220	3.0
0.8			3.5
0.9			3.8
1.0			4.0
1.2			4.0

These requirements shall also be fulfilled by the finished building component in the final state of use.

2.1.2.2 Hidden spacer kit (clips, rotatable clip rails) and thermal barrier pads

As material for the manufacture of the clips and the rotatable clip rails, the aluminium alloy AW-6060 (AlMgSi) according to EN 573-3:2009, 0.2% offset yield stress $R_{p0.2}$ = 220 N/mm², or the aluminium alloy EN AW-6061 (AlMg1SiCu), condition T6, according to EN 755-2:2008, shall be used.

The initial material of the steel core of the composite clips shown in Annexes 5 to 7 shall at least show the mechanical properties of a steel of grade S320GD according to EN 10346:2009.

Information on material properties of polyamide (density, melt index, shore D hardness, tensile strength, notched bar impact test) as well as on the manufacturing process of the composite clips shown in Annexes 5 to 7 and for the pads shown in Annexes 4 and 8 are contained in the technical documentation[7] to this ETA.

2.1.2.3 Fastening elements

The drilling screws according to Annexes 12 and 33 are made of stainless steel with the material number 1.4567. For the remaining fastening elements according to Annexes 9, 10 and 26 to 29, the specifications in the corresponding European technical approvals or standards (e.g. EN 1995-1-1) shall apply or the provisions in the Member States according to Annex A.

2.1.3 Mechanical resistance and stability, safety in use

2.1.3.1 General

The values in this European technical approval given as partial safety factors γ_M are recommended values. They should be used provided that no values are defined in the national rules of the Member State in which the Kalzip Aluminium Standing Seam Systems are used and/or in the National Annex to the corresponding Eurocode.

2.1.3.2 Profiled sheeting

The section properties and the characteristic values of the resistance of the profiled sheeting are given in Annexes 13 to 22. The design values are the result of dividing the characteristic values by the partial safety factor γ_M (cf. Annexes 13 to 22).

For profiled sheeting with cover widths between the cover widths indicated in the Annexes and for conical profiled sheeting, the characteristic values of the resistances may be determined by linear interpolation.

The characteristic values specified for the profiles of variant AF may also be used for the corresponding profiles with stiffening ribs in the bottom flange stated in section 2.1.1 (AS variant).

The verification of the load-bearing capacity for the profiled sheeting under a single load of up to 1 kN according to EN 1991-1-1:2002 (Table 6.10) has been provided by adhering to the provisions of this European technical approval (cf. section 4.5).

2.1.3.3 Hidden spacer kit (clips, rotatable clip rails)

The characteristic values of the resistances are given in Annexes 23, 24 and 32. The design values are the result of dividing the characteristic values by the partial safety factor γ_M (cf. Annexes 23, 24 and 32).

2.1.3.4 Fastening elements

The characteristic values of the resistances are stated in Annexes 9, 10 and 26 to 29 and 33 or can be gathered from the corresponding European technical approvals or standards (e. g. EN 1995-1-1) or from the provisions of the Member States according to Annex A. The design values are the result of dividing the characteristic values by the partial safety factor γ_M (cf. Annexes 26 to 29 and 33).

2.1.4 Corrosion protection and durability of the composite clips

For the profiled sheeting, the clips of aluminium and the rotatable clip rail the provisions of EN 1999-1-4:2007 and EN 1090-3:2008 shall apply.

For the steel core of the composite clips, the provisions of EN 10346:2009 and EN 1090-2:2008 shall apply. As corrosion protection at least one layer according to coating code AZ185 following EN 10346:2009 shall be provided.

For the drilling screws according to Annexes 12 and 33 the specifications in the European technical approvals for fasteners shall apply analogously. For the fasteners according to the Annexes 9, 10 and 26 to 29 the details in the corresponding European technical approvals or standards (e.g. EN 1995-1-1) shall apply or the provisions in the Member States pursuant to Annex A.

Requirements with respect to the durability of the composite clips are included in the values set out in Annex 24.

2.1.5 Safety in case of fire

2.1.5.1 Reaction to Fire

The products of stucco-embossed, mill finish or galvanized aluminium strip, the clips of aluminium and the fastenings of stainless steel meet the requirements of class A1 concerning the safety in case of fire according to Commission Decisions 96/603/EG[8], 2000/605/EG[9] and 2003/424/EG[10].

The products of plastic paint-coated aluminium strip meet the requirements of class A1 according to EN 13501-1:2007+A1:2009.

The composite clips meet the requirements of class E according to EN 13501-1:2007+A1:2009.

For reaction to fire of the plastic lighting elements no evidence has been provided (class F according to EN 13501-1:2007+A1:2009). If necessary, reaction to fire needs to be proved in the individual case.

2.1.5.2 External fire performance of the roof covering

Aluminium profiled sheeting of stucco-embossed, mill finish, galvanized or plastic paint-coated aluminium strip are in conformity with the requirements of resistant roofing for the characteristic "External fire performance" in accordance with Commission Decision 2000/553/EG[11]. When executing, the applicable national provisions of the Member State shall be observed at the place of use.

2.2 Methods of verification

2.2.1 General

The assessment of the fitness for the intended use of the Kalzip Aluminium Standing Seam Systems relating to the essential requirements ER1, ER2 and ER4 was performed in accordance with section 3.2 of the Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6].

2.2.2 Mechanical resistance and stability (ER1) Safety in use (ER4)

2.2.2.1 Profiled sheeting

2.2.2.1.1 Section properties and mechanical resistance

The characteristic values of the resistances of the profiled sheeting given in Annexes 13 to 22 were determined by testing and calculation following EN 1999-1-4:2007 in consideration of EN 1993-1-3:2006.

2.2.2.1.2 Accessibility

The limited spans given in Annexes 30 and 31 were determined by testing in accordance with EN 14782:2006, Annex B.

2.2.2.1.3 Sliding of the profiled sheeting

No performance determined.

2.2.2.2 Hidden spacer kit (clips, rotatable clip rails)

The characteristic values of the resistances given in Annexes 23, 24 and 32 were determined by testing.

2.2.2.3 Fastening elements

The characteristic values of the resistances given in Annexes 9, 26 to 29 and 33 were determined by testing.

8 Official Journal of the European Communities L 267/23, 19 October 1996
9 Official Journal of the European Communities L 258/36, 19 October 2000
10 Official Journal of the European Communities L 144/9, 12 June 2003
11 Official Journal of the European Communities L 235/19, 19 September 2000

2.2.3 Safety in case of fire (ER2)

2.2.3.1 Reaction to fire

The products of stucco-embossed, mill finish or galvanized aluminium strip, the clips of aluminium and the fastening elements of stainless steel meet the requirements of class A1 of the reaction-to-fire performance in accordance with Commission Decisions 96/603/EG[8], 2000/605/EG[9] und 2003/424/EG[10] without the need for testing on the basis of its listing in that Decision.

The products of plastic paint-coated aluminium strip meet the requirements of class A1 according to EN 13501-1:2007+A1:2009 on the basis of tests according to EN ISO 1716:2010 and EN 13823:2010.

The composite clips meet the requirements of class E according to EN 13501-1:2007+A1:2009 on the basis of tests according to EN ISO 11925-2:2010.

Note: A European reference fire scenario for façades is still pending. In some Member States, the classification of the wall and roof systems with hidden spacer kits pursuant to EN 13501 -1:2007 for the use in façades may not be sufficient. In order to meet the provisions of such Member States, an additional assessment of the wall and roof systems with hidden spacer kits according to national provisions (e.g. on the basis of a large-scale test) may be necessary, until the European classification system has been completed.

2.2.3.2 External fire performance of the roof covering

The aluminium profiled sheeting of stucco-embossed, mill finish, galvanized or plastic paint-coated strip correspond to the requirements of resistant roofing for the characteristics "external fire performance" in accordance with Commission Decision 2000/553/EG[11] without the need for testing on the basis of its listing in that Decision.

By tests only compliance with requirements for the plastic coating of such roofs of Commission Decisions 96/603/EG[8], 2000/605/EG[9] and 2003/424/EG[10] has been verified.

2.2.4 Corrosion protection and durability

Concerning corrosion protection of the Kalzip Aluminium Standing Seam Systems, the specifications of section 2.1.4 shall apply.

The durability of the composite clips was taken into account during the tests (cf. section 2.2.2.2) and can be assumed to suffice regarding the intended use and the performance with regard to the essential requirements.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the communication of the European Commission[12] system 2+ of the attestation of conformity applies.

In addition, according to the Decision 2001/596/EC of the European Commission[13] system 1 of the attestation of conformity applies with regard to reaction to fire of products of class A1 according to EN 13501-1:2007+A1:2009 on the basis of tests and system 3 of the attestation of conformity applies with regard to reaction to fire of products of class E according to EN 13501-1:2007+A1:2009.

These systems of attestation of conformity are defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

[12] Letter of the European Commission of 16/01/2009 to EOTA
[13] Official Journal of the European Communities L 209/33, 2 August 2001

(a) Tasks for the manufacturer:
- (1) factory production control;
- (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;

(b) Tasks for the approved body:
- (3) initial type–testing of the product;
- (4) initial inspection of factory and of factory production control;
- (5) continuous surveillance, assessment and approval of factory production control.

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

(a) Tasks for the manufacturer:
- (1) initial type–testing of the product;
- (2) factory production control;
- (3) testing of samples taken at the factory in accordance with a prescribed test plan.

(b) Tasks for the approved body:
- (4) certification of factory production control on the basis of:
  - initial inspection of factory and of factory production control;
  - continuous surveillance, assessment and approval of factory production control.

System 3: Declaration of conformity of the product by the manufacturer on the basis of:

(a) Tasks for the manufacturer:
- (1) factory production control;

(b) Tasks for the approved body:
- (2) initial type-testing of the product.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of tests performed and their results. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial/raw/constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation[7] of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.[14]

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

[14] The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of wall and roof systems with hidden spacer kits referred to in section 3.1 in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be provided on the product itself, (if necessary on the label attached to it), on its packaging on the delivery note or on accompanying commercial documents, e.g. the EC declaration of conformity. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European technical approval.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Design

The verification of the load-bearing capacity and serviceability is provided in each individual case according to EN 1990:2002 and EN 1999-1-4:2007 in consideration of the information in this European technical approval and the additionally applicable national provisions of the Member State at the place of installation. In general, it is verified that the design value of the effect of the action E_d does not exceed the design values of the related load-bearing capacity R_d e.g., $E_d \leq R_d$.

The design values of the load-bearing capacities are the result of dividing the characteristic values by the partial safety factor γ_M (cf. section 2.1.3.1).

The verification of the interaction of moment and shear force of the profiled sheeting at the intermediate support is given in deviation from equation (6.22), clause 6.1.11 of EN 1999-1-4:2007 according to the interaction equation given in Annexes 13 to 22.

If there is the possibility of the formation of a water pocket[15], this load case is verified with the following loads: permanent load and water load as a result of the total deflection of the profiled sheeting from the loads to be applied.

The profiled sheeting are supported in a single span configuration or continuously across several spans. The center-to-center distance of the clips is assumed as span. Continuous beams with spans of less than 1.0 m are verified with an effective span of at least 1.0 m

Fundamentally, the stresses acting normal to the installed profiled sheets will be calculated using the theory of elasticity.

The stresses are predominantly static.

A transmission of shear and direct forces acting in the plane of the roof due to a roof pitch by the profiled sheeting must not be considered by way of calculation without special requirements concerning the execution - e. g. formation of fixed points according to Annex 9 (cf. also section 4.1). The forces from fixed points shall be further followed up in the substructure.

A racking resistance of the profiled sheeting for stiffening the total works or for stabilizing the substructure against lateral torsional buckling will not be taken into account by way of calculation.

The verification of the ultimate limit state is performed by a structural engineer experienced in the field of lightweight metal construction.

4.3 Execution

4.3.1 Profiled sheeting

The profiled sheeting are connected to the substructure at each edge rib by clips. For fixing the profiled sheeting during thermal movement and for transmitting the shear in case of sloped roofs or wall coverings, fixed points are provided according to Annex 9. Transverse joints are permitted only if even under full load complete water run-off is still possible.

A minimum purlin width of 50 mm is required at end and intermediate supports. To ensure the load-bearing capacity at the end supports a profiled sheeting overhang of at least 100 mm is required.

Exposed edges in the direction of span of the profiled sheeting are stiffened by suitable edge stiffening (verge profile).

Transverse joints may only be installed directly over a support if the joint is at a fixed point. Otherwise the profiled sheeting is overlapped just above a support (cf. Annex 10). For roof pitches of up to 17° (30 %) the mutual overlap of the profiled sheeting amounts to at least 20 cm, for larger roof pitches at least 15 cm.

[15] Note: Generally applies to roof slopes less than 2% and to unfavourable position concerning drainage engineering of the roof outlets.

When using the profiled sheeting as the weathering outer skin of roofs, the minimum roof pitch for roofs without transverse joints or with welded transverse joints is 1.5° (2.6 %). The required minimum roof pitch increases to 2.9° (5 %) for roofs with sealed transverse joints and/or openings (e.g. domed roof-lights).

The required increase of the minimum roof slope for roof penetrations - e.g. for domed roof lights - may not be required, if completely welded flashings are used and the aluminium flashings are welded with the upper shell of the roof such that a completely watertight joint is achieved.

The requirement of the minimum roof slope does not apply to the ridge area, if the roof elements in the area with pitches ≤ 2.9° (5 %) are arranged continuously over the ridge.

4.3.2 Hidden spacer kit (clips and rotatable clip rail)

For the connection of the profiled sheeting to the substructure clips according to Annexes 4 to 7 are used, whose upper end is crimped with the lateral edge ribs of adjacent profiled sheeting. The clips (if need be, together with the pads according to Annexes 4 and 8) are attached directly to substructures made of steel, aluminium or wood.

Attachment of the clips to the substructure is carried out with the appropriate screws or rivets indicated in Annexes 12 and 26 to 29 and/or in the European technical approvals or standards (e. g. EN 1995-1-1).

For the connection of the profiled sheeting to the substructure rotatable clips in accordance with Annex 32 may also be used. The anchorage of the rotatable clips is carried out directly with the rotatable clip rail in accordance with Annex 32. At built-in stage the axis of the rotating clip shall be swiveled by at least 45° against the axis of the rotatable clip rail.

Attachment of the rotatable clip rail to the substructure is performed with the drilling screw shown in Annex 33 or with the suitable screws indicated in the European technical approvals or standards (e. g. EN 1995-1-1).

For connections of the profiled sheeting with a concrete substructure, sufficiently anchored continuous steel parts (e.g. HTU rails or 8 mm thick flat steels) or timber battens (minimum thickness 40 mm) with a width that corresponds to at least the width of the clip base (if need be, with pad) are interposed.

4.3.3 Fastening elements according to Annexes 9, 10 and 26 to 28

Suitable fastening elements will be employed for the intended use and which meet the provisions of the relevant European technical approval or of the Member States pursuant to Annex A.

4.3.4 Plastic roof lights

Plastic light tracks are installed in accordance with Annex 11. At least three profiled sheeting follow each light track on both sides (cf. also Annex 25). Apart from that section 4.3.1 shall be considered analogously.

4.3.5 Installation of the profiled sheeting

The profiled sheeting may only be installed by specialists of the manufacturing plant or by companies having received appropriate training and authorization by the manufacturer. The manufacturer or the person laying the profiled sheeting shall prepare implementation instructions for the laying of the elements to be handed over to the assemblers.

Damaged profiled sheeting including plastic deformations must not be installed.

When using profiled sheeting of different sheet thicknesses in a roof, these shall be marked according to sheet thicknesses, in order to avoid mix-ups.

The individual elements are connected immediately after laying by crimping the lateral edge ribs. In doing so, attention shall be paid to a faultless connection to the clips. If the laying of the profiled sheeting is interrupted before completion of the full roof or wall extents, then the last laid profiled sheeting shall always be secured to provide adequate restraint against detachment from the clips due to wind loads.

An additional securing against sheet detachment from the clips is also required if the construction, during installation, is exposed to larger stresses from wind loads than at the final state.

During the installation, profiled sheeting still unsecured at an edge may be accessed up to limited spans according to Annexes 30 and 31 without load-distributing measures. In case of larger spans, they may only be accessed by placing planks (cf. section 4.3.8).

Single, uncrimped profiled sheeting as well as plastic light tracks must not be accessed.

After completion of a roof installation, all foreign objects shall be cleaned from the roof (e. g swarf and pins from blind rivets).

The conformity of the wall and roof systems with hidden spacer kits within the provisions of this European technical approval shall be certified by the company executing the building work. This declaration shall be handed over to the builder in order to be presented to the responsible authority, if need be.

4.4 Packaging, transport and storage

The manufacturer's instructions shall be followed.

4.5 Use, maintenance, repair

After completion of the roof the profiled sheeting may be accessed for cleaning and maintenance work without load-distributing measures up to spans according to Annexes 30 and 31.

Load-distributing measures, e. g. wooden planks of strength class C24 according to EN 14081-1:2006 with a cross section of 4 x 24 cm and a length of > 3.0 m shall be applied if the effective span exceeds the aforementioned maximum values.

The planks may be laid on the ribs in the direction of the span of the profiled sheeting or transverse to the direction of the span.

Plastic light tracks must not be accessed.

5 Indications to the manufacturer

The manufacturer shall ensure that the requirements in accordance with sections 1, 2 and 4 (including Annexes referred to) are made known to the parties concerned. This can be done, for example, by handing over copies of the European technical approval.

In addition, all the information relevant for the installation shall be clearly indicated on the packaging or in an enclosed description. Preferably, illustrations should be used for this purpose.

"Kalzip Aluminium Standing Seam Systems" may only be packed and delivered as complete unit (wall and roof elements and the appropriate hidden spacer kit (clips and rotatable clip rails], caps and connection elements).

Andreas Kummerow
p. p. Head of Department

beglaubigt:
Hahn

Annex A

National provisions on the connection elements

Provisions for connection elements according to Annexes 9, 10 and 26 to 28*

Class	Member States	Technical rule	Additional provisions
A	Germany	National approval for connection elements for connecting building components for metal light-weight construction: *Allgemeine bauaufsichtliche Zulassung* ('national technical approval') Z-14.1-4	Specification of characteristic values of the load-bearing capacity of connection elements
		National approval for mechanical connection elements for the connection of building components with each other made of aluminium or with substructures of aluminium, steel or wood *Allgemeine bauaufsichtliche Zulassung* ('national technical approval') Z-14.1-537	Specification of characteristic values of the load-bearing capacity of connection elements
B			
C			

* The necessary national provisions of the Member States, which are not included in this column shall be asked for there.

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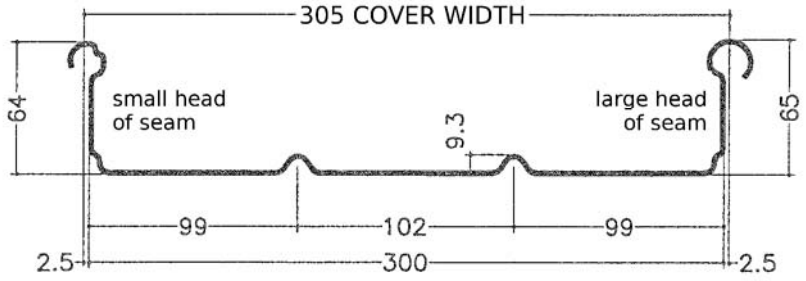
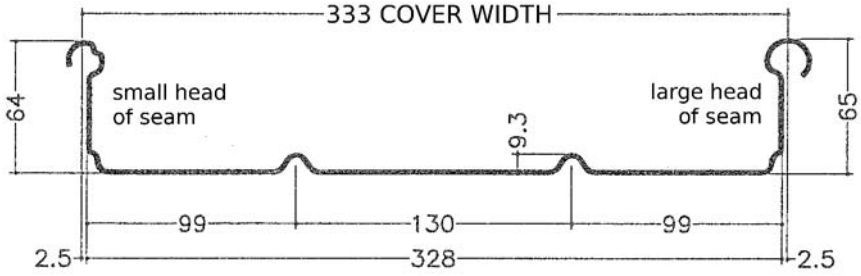
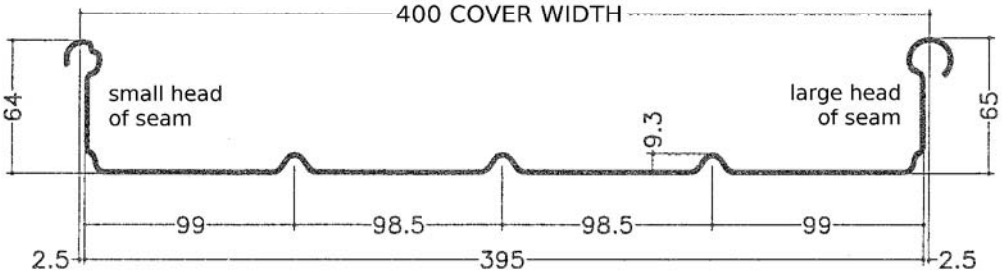
Kalzip 65/305



Kalzip 65/333



Kalzip 65/400



Kalzip Aluminium Standing Seam System	**Annex 1**
Profile Dimensions **Kalzip 65/305/333/400**	

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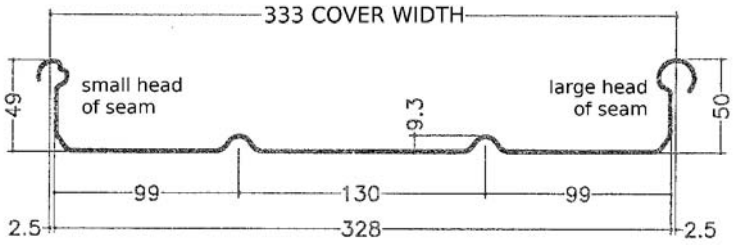
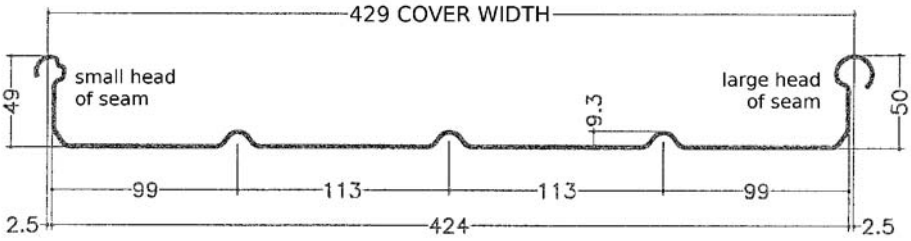
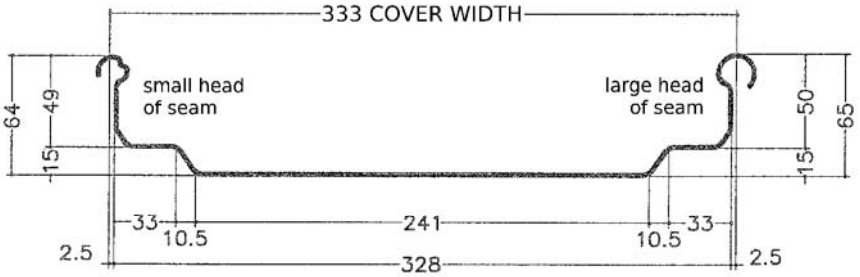
Kalzip 50/333



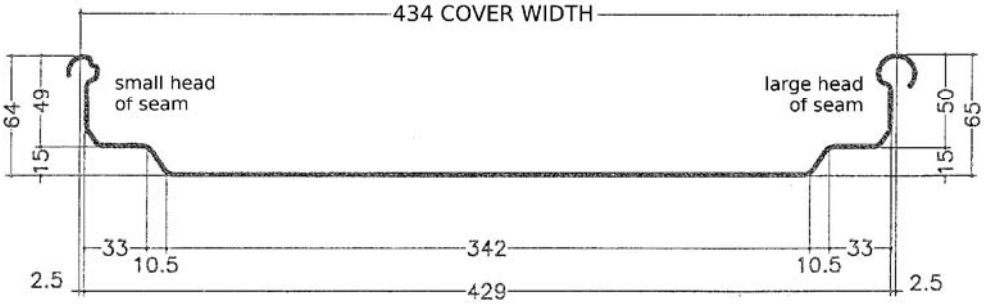
Kalzip 50/429



Kalzip AF 65/333



Kalzip AF 65/434



Kalzip Aluminium Standing Seam System	
Profile Dimensions **Kalzip 50/333/429** **Kalzip AF 65/333/434**	**Annex 2**

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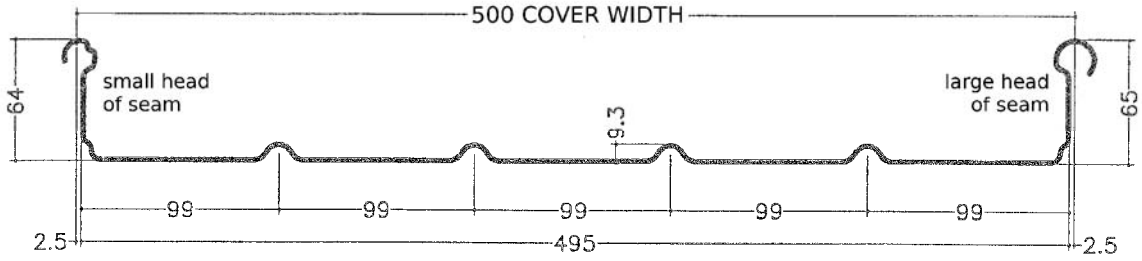
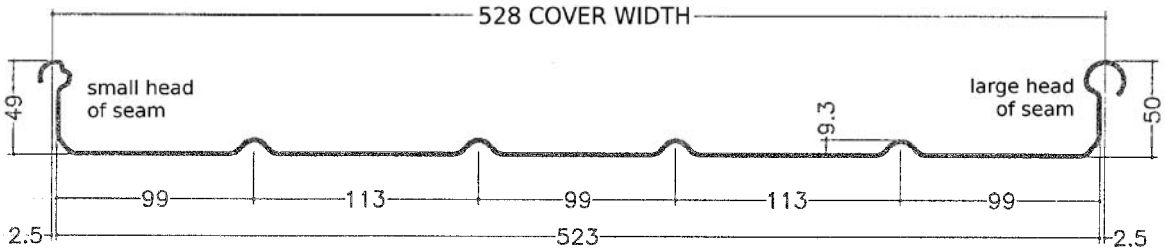
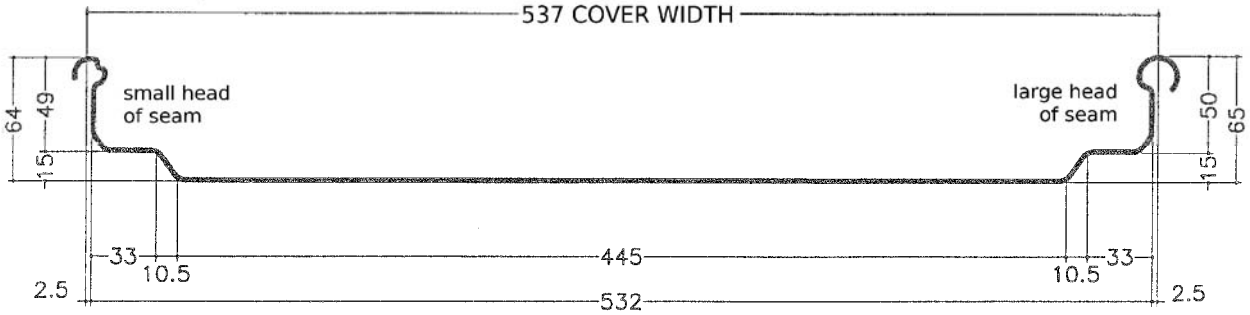
Kalzip 65/500



Kalzip 50/528



Kalzip AF 65/537



Kalzip Aluminium Standing Seam System	
Profile Dimensions **Kalzip 65/500** **Kalzip 50/528** **Kalzip AF 65/537**	**Annex 3**

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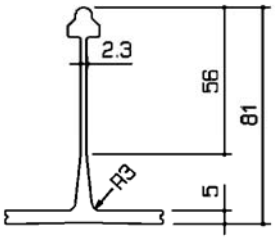
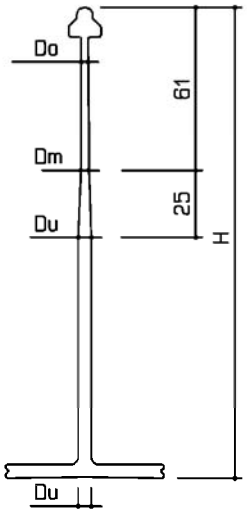
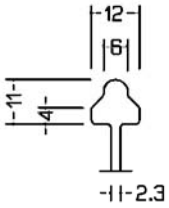
Type L 25

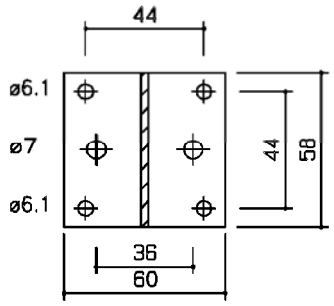


Type L 10, L 40 up to L 150

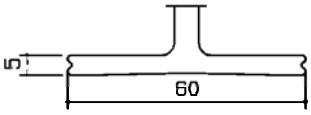


Clip head

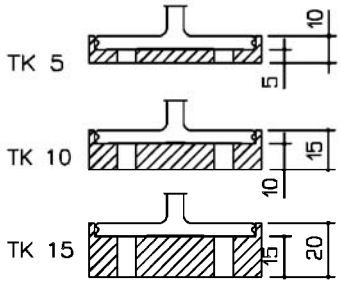


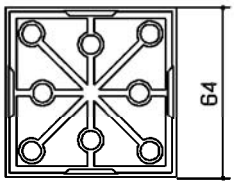


Clip base



Thermal caps





Clip dimensions type L10 - L150 mm													
Typ	L10	L25	L40	L50	L60	L80	L90	L100	L110	L120	L130	L140	L150
H	66	81	96	106	116	136	146	156	166	176	186	196	206
Do	2.5	2.3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dm	3.0	2.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Du	3.0	6.2	3.3	3.3	3.6	4.1	4.3	4.4	4.6	4.8	5.0	5.2	5.3

Kalzip Aluminium Standing Seam System

Aluminium Clip

Dimensions

Annex 4

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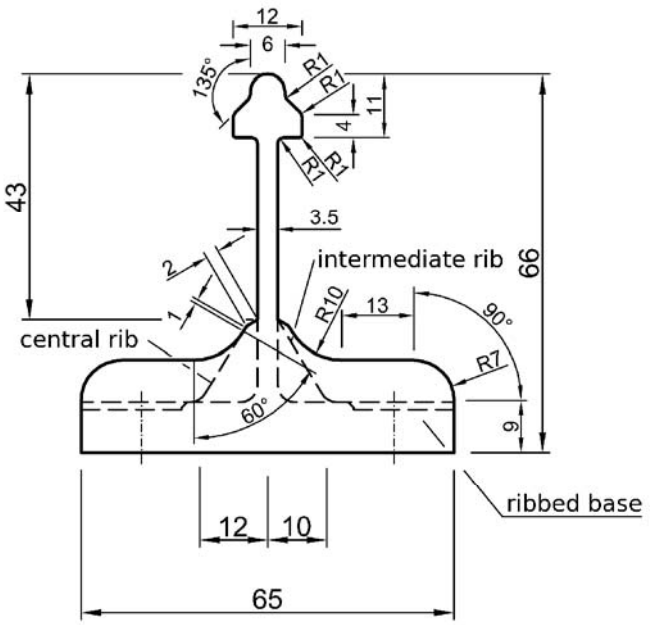

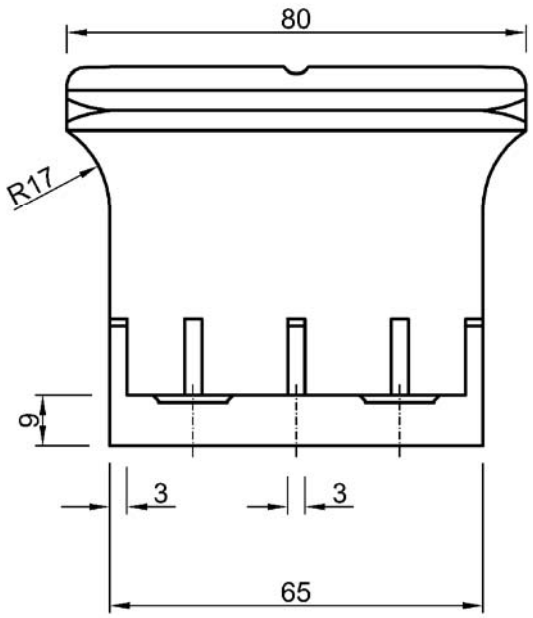

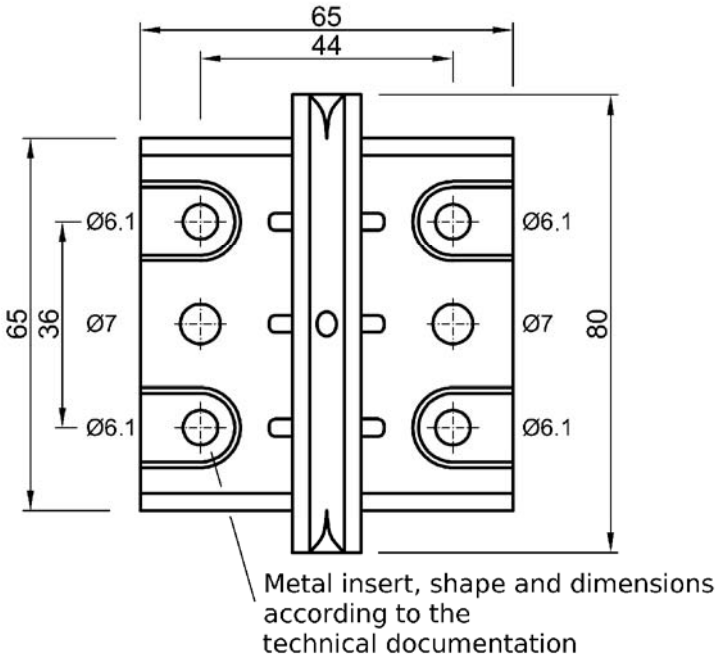

Kalzip Aluminium Standing Seam System	Annex 5
Composite Clip E 5 Dimensions	

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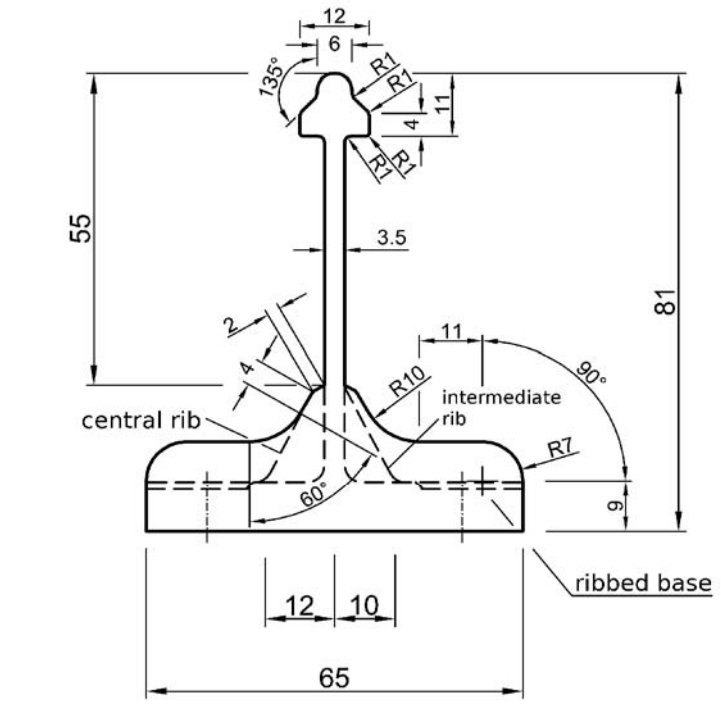

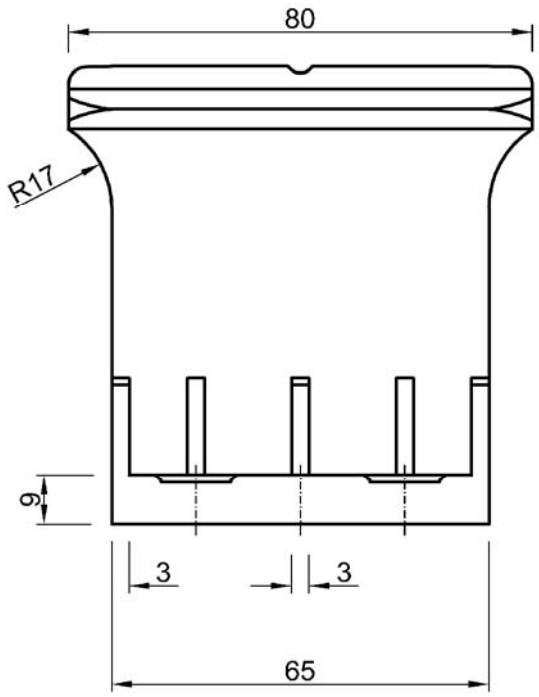

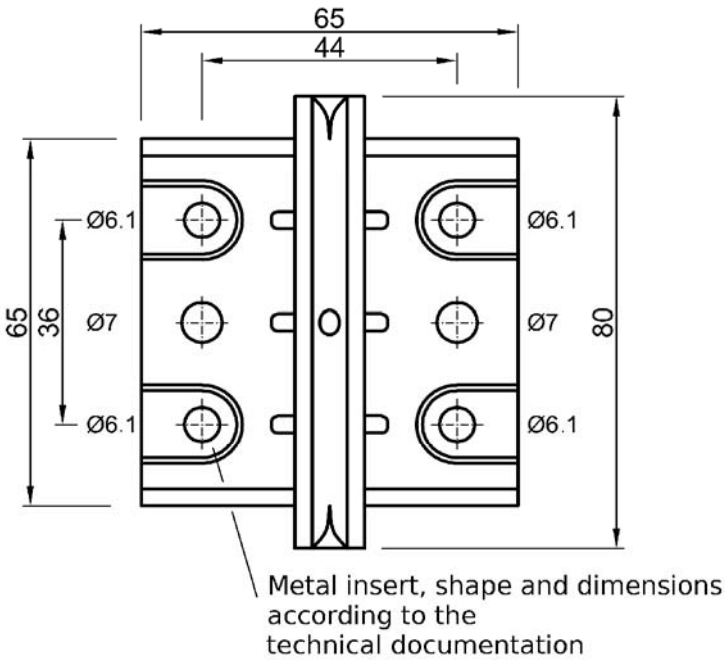

Kalzip Aluminium Standing Seam System	Annex 6
Composite Clip E 20 Dimensions	

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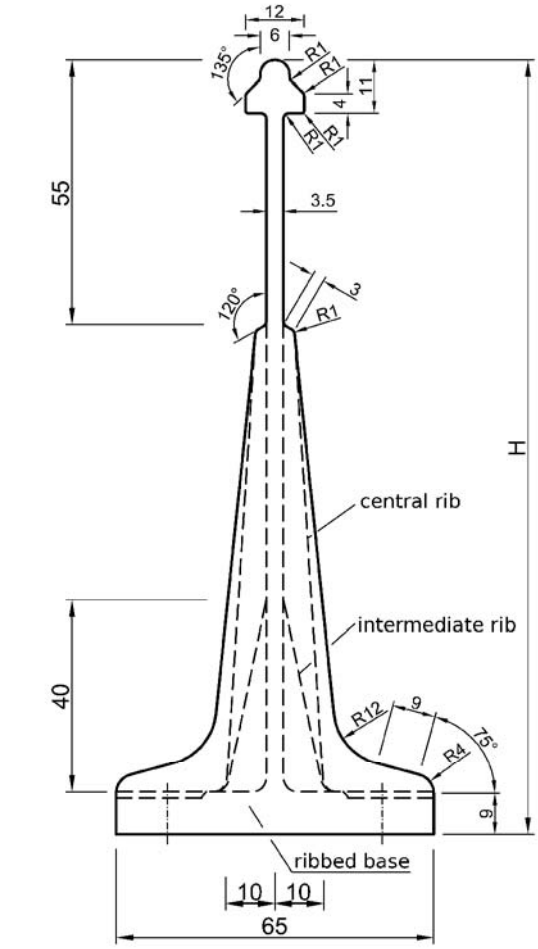

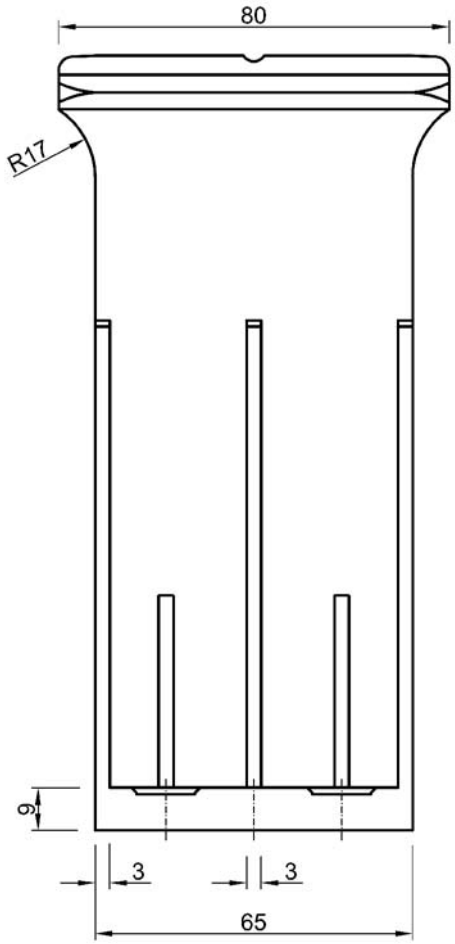

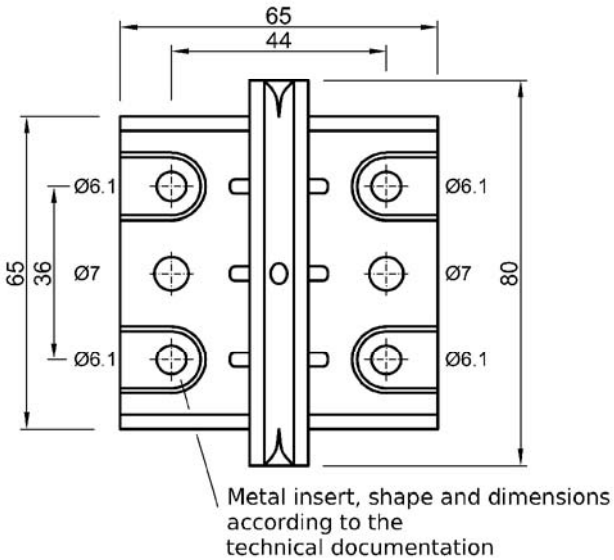

Clip heights H in mm	
Type	H
E40	101
E60	121
E80	141
E100	161
E120	181
E140	201
E160	221
E180	241

Kalzip Aluminium Standing Seam System

Composite Clip E 40 – 180

Dimensions

Annex 7

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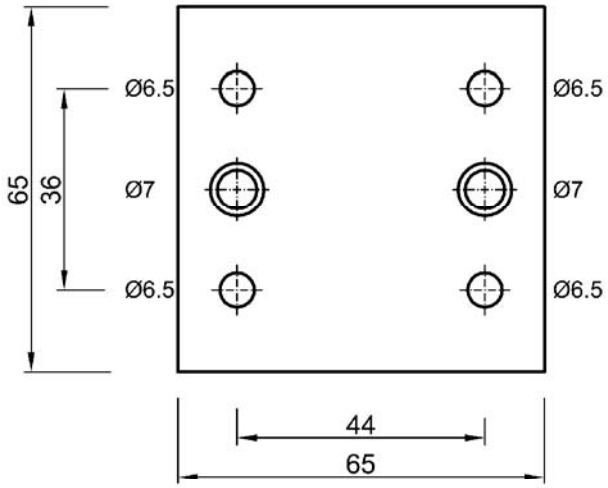
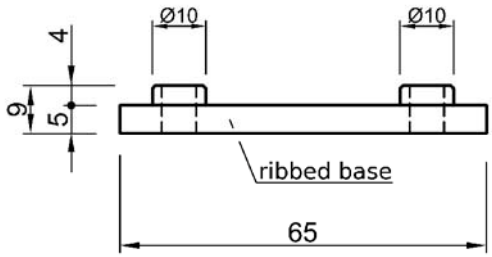
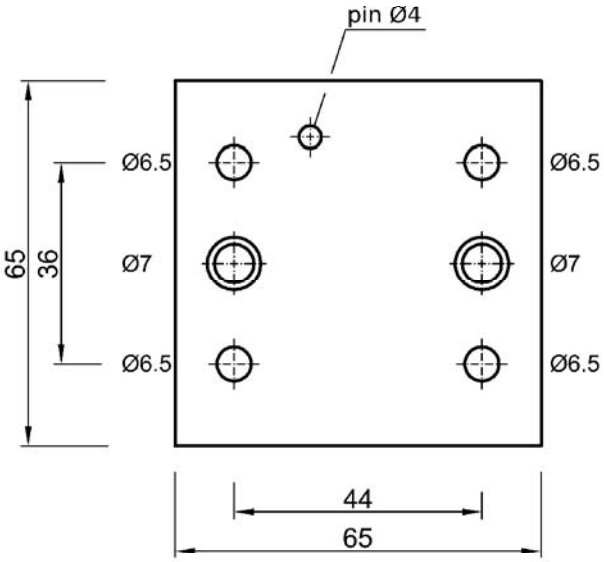
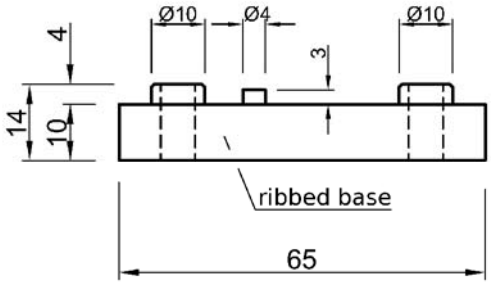
Spacer cap 5





Spacer cap 10





Kalzip Aluminium Standing Seam System	
Composite Clip Spacer Cap 5 and 10 Dimensions	**Annex 8**

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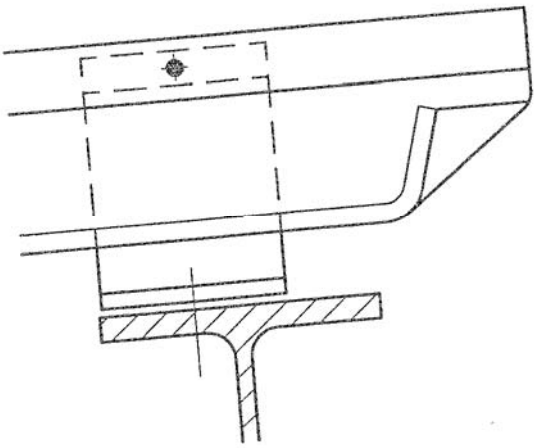
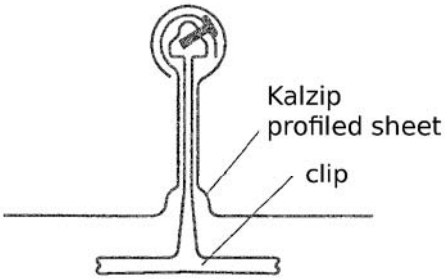
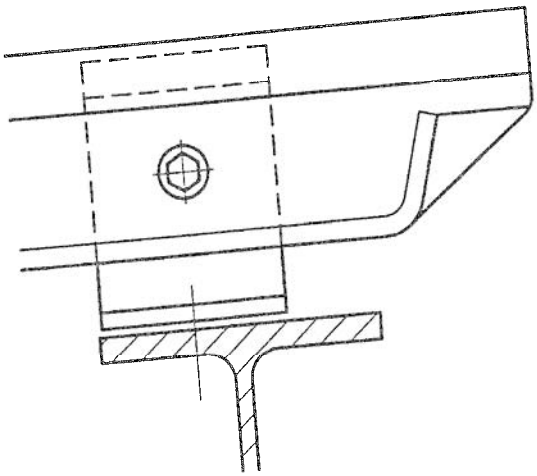


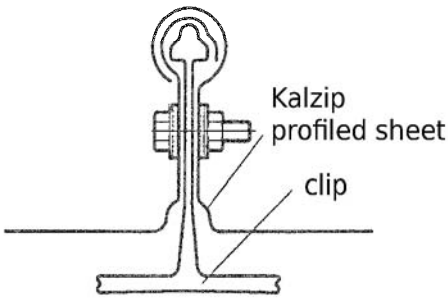


blind rivet Ø4.8x10-11 or Ø5.0x12,
each with 8 to 10 mm head diameter,
e.g. Gesipa Poly Grip Alu Ø4.8 [1)]

Characteristic value of shear force for rivets Gesipa Poly Grip Alu Ø4.8x10 [1)] in kN/rivet		
Sheet thickness mm	Aluminium clip	Composite clip
0.7	1.50	0.60
0.8	1.50	0.70
0.9	1.50	0.75
1.0	1.50	0.85
1.2	1.50	0.85
$\gamma_M = 1.33$		

[1)] in accordance with the regulations of the member states according to appendix A





at least M6x25 screw (EN 1993-1-1) with nut and washer with vulcanised sealant

material: stainless steel

Kalzip Aluminium Standing Seam System	**Annex 9**
Kalzip Fixed Point Formation with Aluminium or Composite Clip Characteristic values for rivets	

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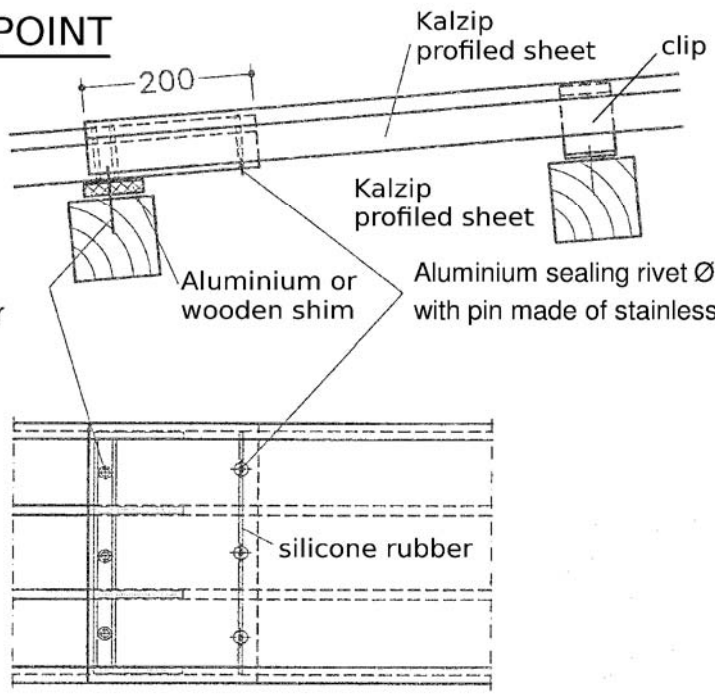
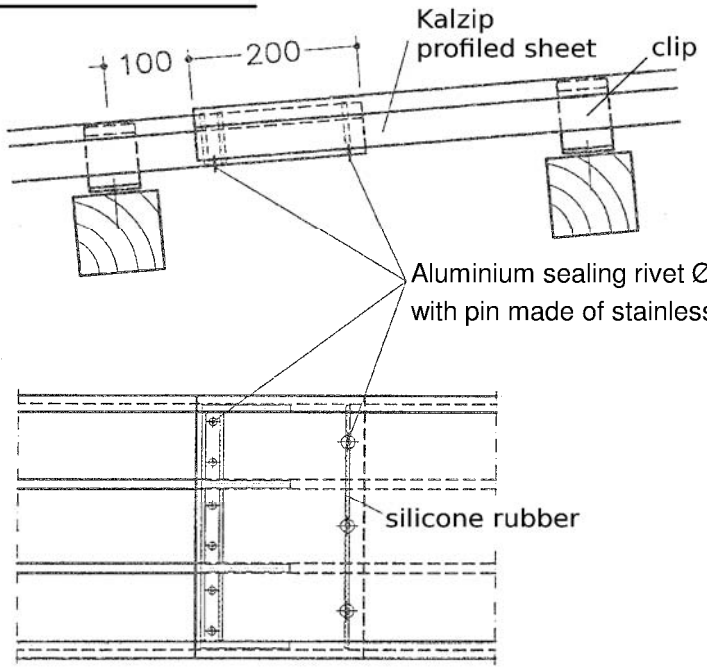
JOINT AT FIXED POINT



Fastener min. Ø6 made of stainless steel according to european technical approval or EN 1995

JOINT WITHOUT FIXED POINT



1) in accordance with the regulations of the member states according to appendix A

Kalzip Aluminium Standing Seam System	Annex 10
Kalzip Joint Formations	

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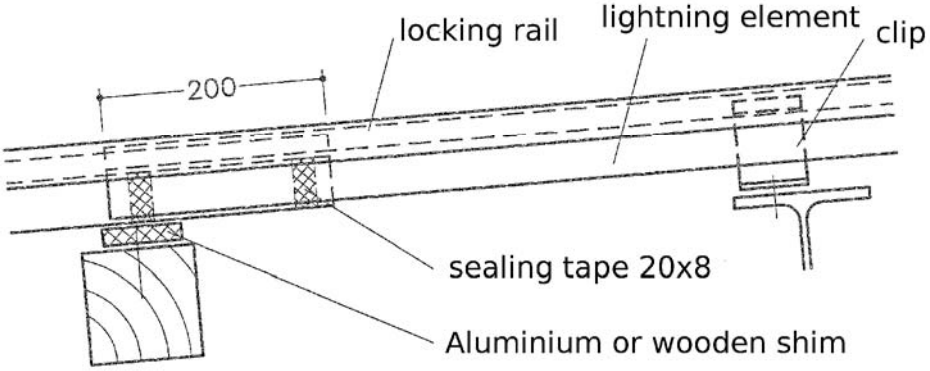
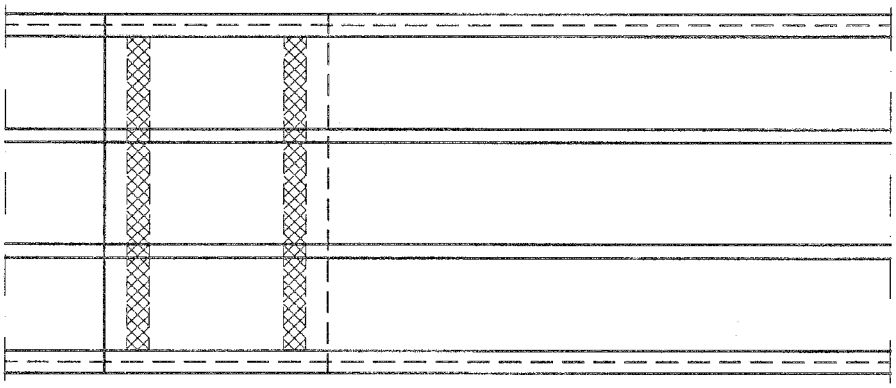
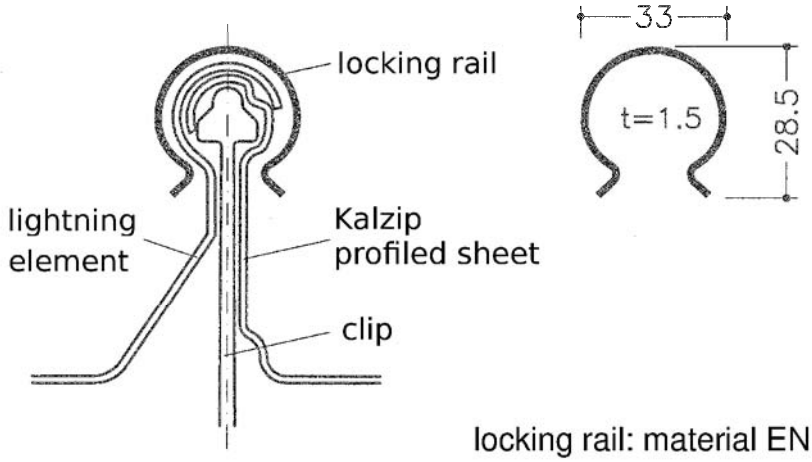
LIGHTNING ELEMENT JOINT







locking rail: material EN AW-6060

Kalzip Aluminium Standing Seam System	
Plastic Lightning Elements Joint Formation	**Annex 11**

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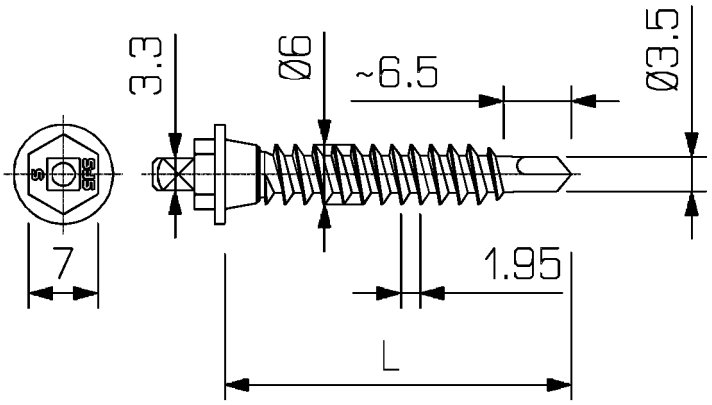
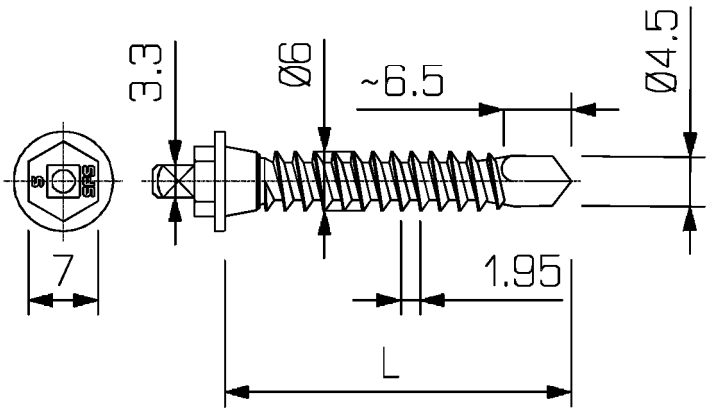
SFS SDK2-S-377-6.0 x L



SFS SDK3-S-377-6.0 x L



Kalzip Aluminium Standing Seam System	
Self-drilling Screws SFS SDK2-S-377-6.0xL SFS SDK3-S-377-6.0xL	**Annex 12**

Deutsches Institut für Bautechnik DIBt

Kalzip 65/305

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0296	51.3	1.20	8.34	1.57	853	1.56	17.1
0.8	0.0339	58.6	1.57	10.9	2.05	1115	2.03	22.3
0.9	0.0381	65.9	2.03	14.2	2.51	707	2.46	26.1
1.0	0.0423	73.2	2.48	17.5	2.98	299	2.89	29.9
1.2	0.0508	87.9	2.93	20.0	3.58	426	3.50	36.5
		γ_M= 1.0	γ_M= 1.1					

Kalzip 65/305

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	33.8	1.33	11.1	1.28	18.8	1.01	6.50
0.8	44.2	1.73	14.5	1.67	24.6	1.32	8.49
0.9	55.7	2.32	18.3	2.19	59.0	1.90	11.8
1.0	67.2	2.91	22.1	2.70	93.4	2.47	15.1
1.2	82.8	3.45	26.2	3.27	247	3.15	17.6
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip 65/305

Annex 13

Deutsches Institut für Bautechnik DIBt

Kalzip 65/333

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0287	48.2	1.14	7.97	1.49	806	1.48	16.2
0.8	0.0328	55.1	1.48	10.4	1.95	1052	1.94	21.1
0.9	0.0369	61.9	1.91	13.5	2.40	667	2.35	24.6
1.0	0.0410	68.8	2.34	16.7	2.84	282	2.75	28.2
1.2	0.0492	82.6	2.76	19.1	3.42	402	3.34	34.4
		γ_M= 1.0	γ_M= 1.1					

Kalzip 65/333

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	31.9	1.25	10.4	1.23	17.7	0.971	6.14
0.8	41.7	1.64	13.6	1.60	23.2	1.27	8.02
0.9	52.6	2.19	17.2	2.10	55.7	1.82	11.1
1.0	63.5	2.75	20.8	2.59	88.2	2.36	14.2
1.2	78.2	3.25	24.7	3.13	233	3.02	16.7
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip 65/333

Annex 14

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Kalzip 65/400

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0274	41.9	0.974	7.07	1.32	691	1.31	13.9
0.8	0.0313	47.9	1.27	9.23	1.73	903	1.71	18.1
0.9	0.0352	53.9	1.64	12.0	2.12	572	2.07	21.1
1.0	0.0392	59.9	2.01	14.8	2.51	242	2.43	24.2
1.2	0.0470	71.9	2.37	17.0	3.02	345	2.95	29.6
		γ_M= 1.0	γ_M= 1.1					

Kalzip 65/400

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\leq 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	27.4	1.08	8.96	1.10	15.2	0.870	5.27
0.8	35.8	1.41	11.7	1.43	19.9	1.14	6.88
0.9	45.1	1.88	14.8	1.88	47.8	1.63	9.54
1.0	54.4	2.36	17.9	2.32	75.6	2.12	12.2
1.2	67.1	2.79	21.2	2.81	200	2.70	14.3
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System	**Annex 15**
Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M **Kalzip 65/400**	

Deutsches Institut für Bautechnik DIBt

Kalzip 50/333

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0271	26.3	1.04	6.61	0.992	58.7	0.905	11.5
0.8	0.0310	30.0	1.35	8.63	1.30	76.7	1.18	15.0
0.9	0.0349	33.8	1.63	10.2	1.60	82.7	1.46	15.0
1.0	0.0388	37.5	1.90	11.8	1.91	88.7	1.73	15.1
1.2	0.0465	45.0	2.31	13.3	-	-	1.96	18.7
		γ_M= 1.0	γ_M= 1.1					

Kalzip 50/333

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\leq 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	15.9	0.828	9.78	-	-	0.815	7.57
0.8	20.8	1.08	12.8	-	-	1.06	9.89
0.9	22.7	1.32	14.0	1.49	49.5	1.44	10.7
1.0	24.6	1.56	15.2	1.91	131	1.82	11.6
1.2	35.0	2.12	19.6	2.70	37.3	2.24	15.7
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip 50/333

Annex 16

Deutsches Institut für Bautechnik DIBt

Kalzip 50/429

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0256	21.6	0.848	5.59	0.944	48.0	0.861	9.37
0.8	0.0292	24.7	1.11	7.30	1.23	62.7	1.13	12.2
0.9	0.0329	27.8	1.33	8.65	1.52	67.7	1.39	12.3
1.0	0.0365	30.8	1.56	10.0	1.82	72.6	1.65	12.4
1.2	0.0438	36.9	1.89	11.2	-	-	1.87	15.3
		γ_M= 1.0	γ_M= 1.1					

Kalzip 50/429

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	13.5	0.678	8.00	-	-	0.667	6.20
0.8	17.7	0.885	10.5	-	-	0.871	8.09
0.9	19.3	1.08	11.4	1.22	40.5	1.18	8.80
1.0	20.9	1.28	12.4	1.56	107	1.49	9.50
1.2	29.8	1.74	16.1	2.21	30.5	1.83	12.8
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip 50/429

Annex 17

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Kalzip AF 65/333

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M)+F_{Ed}/(R^0_{Rk,B}/\gamma_M)\leq 1$			
t mm	g kN/m²	I_{ef} cm⁴/m	$M_{c,Rk,F}$ kNm/m	$R_{w,RK,A}$ kN/m	$M^0_{Rk,B}$ kNm/m	$R^0_{Rk,B}$ kN/m	$M_{c,Rk,B}$ kNm/m	$R_{w,Rk,B}$ kN/m
0.7	0.0271	48.0	1.47	11.1	1.34	47.7	1.21	11.4
0.8	0.0310	54.8	1.93	14.5	1.75	62.3	1.58	14.8
0.9	0.0349	61.7	2.39	15.6	2.35	46.5	1.93	15.4
1.0	0.0388	68.5	2.85	16.6	2.96	30.7	2.27	15.9
1.2	0.0465	82.2	3.45	19.6	3.37	33.5	2.64	17.7
		γ_M= 1.0	γ_M= 1.1					

Kalzip AF 65/333

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M)+F_{Ed}/(R^0_{Rk,B}/\gamma_M)\leq 1$			
t mm	I_{ef} cm⁴/m	$M_{c,Rk,F}$ kNm/m	$R_{w,RK,A}$ kN/m	$M^0_{Rk,B}$ kNm/m	$R^0_{Rk,B}$ kN/m	$M_{c,Rk,B}$ kNm/m	$R_{w,Rk,B}$ kN/m
0.7	21.6	0.964	9.98	1.09	18.5	0.909	5.21
0.8	28.2	1.26	13.0	1.42	24.2	1.19	6.81
0.9	36.5	1.62	13.6	1.90	29.0	1.49	8.11
1.0	44.7	1.98	14.1	2.37	33.8	1.80	9.42
1.2	47.6	2.48	15.2	3.33	43.4	2.80	12.0
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip AF 65/333

Annex 18

Deutsches Institut für Bautechnik DIBt

Kalzip AF 65/434

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{E,d}/\left(M^0_{B,k}/\gamma_M\right)+F_{E,d}/\left(R^0_{B,k}/\gamma_M\right)\le 1$			
t	g	$J_{ef,k}$	$M_{F,k}$	$R_{A,k}$	$M^0_{B,k}$	$R^0_{B,k}$	max $M_{B,k}$	max $R_{B,k}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0253	40.5	1.20	9.04	1.13	38.7	1.03	9.23
0.8	0.0289	46.6	1.56	11.8	1.48	50.6	1.34	12.1
0.9	0.0325	52.1	1.94	12.6	1.99	37.7	1.63	12.5
1.0	0.0361	57.8	2.31	13.5	2.50	24.9	1.92	12.9
1.2	0.0433	69.4	2.80	15.9	2.85	27.2	2.23	14.4
		γ_M= 1.0	γ_M= 1.1					

Kalzip AF 65/434

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{E,d}/\left(M^0_{B,k}/\gamma_M\right)+F_{E,d}/\left(R^0_{B,k}/\gamma_M\right)\le 1$			
t	$J_{ef,k}$	$M_{F,k}$	$R_{A,k}$	$M^0_{B,k}$	$R^0_{B,k}$	max $M_{B,k}$	max $R_{B,k}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	18.0	0.783	8.10	0.881	15.0	0.738	4.23
0.8	23.5	1.02	10.6	1.15	19.6	0.964	5.53
0.9	30.4	1.32	11.0	1.54	23.5	1.21	6.59
1.0	37.3	1.61	11.5	1.93	27.4	1.46	7.65
1.2	39.7	2.01	12.3	2.70	35.2	2.27	9.76
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip AF 65/434

Annex 19

Deutsches Institut für Bautechnik DIBt

Kalzip 65/500

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0258	35.3	0.734	5.73	1.06	521	1.06	10.4
0.8	0.0295	40.3	0.958	7.49	1.39	680	1.38	13.6
0.9	0.0331	45.3	1.24	9.74	1.70	431	1.67	15.9
1.0	0.0368	50.4	1.51	12.0	2.02	182	1.96	18.2
1.2	0.0442	60.4	1.79	13.8	2.43	260	2.37	22.3
		γ_M= 1.0	γ_M= 1.1					

Kalzip 65/500

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\le 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	20.6	0.810	6.75	0.907	11.5	0.719	4.00
0.8	27.0	1.06	8.81	1.19	15.0	0.939	5.18
0.9	34.0	1.42	11.1	1.55	36.0	1.35	7.19
1.0	41.0	1.78	13.5	1.92	57.0	1.75	9.19
1.2	50.5	2.10	16.0	2.32	151	2.23	10.8
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip 65/500

Annex 20

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Kalzip 50/528

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0244	18.3	0.654	4.53	0.894	37.0	0.815	7.23
0.8	0.0279	20.9	0.854	5.91	1.17	48.4	1.07	9.44
0.9	0.0314	23.5	1.03	7.01	1.44	52.2	1.31	9.48
1.0	0.0349	26.1	1.20	8.11	1.72	55.9	1.56	9.53
1.2	0.0419	30.0	1.46	9.09	-	-	1.77	11.8
		γ_M= 1.0	γ_M= 1.1					

Kalzip 50/528

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/\left(M^0_{Rk,B}/\gamma_M\right)+F_{Ed}/\left(R^0_{Rk,B}/\gamma_M\right)\leq 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	11.1	0.522	6.17	-	-	0.514	4.78
0.8	14.5	0.682	8.06	-	-	0.671	6.24
0.9	15.8	0.833	8.81	0.937	31.2	0.909	6.78
1.0	17.1	0.985	9.56	1.20	82.4	1.15	7.32
1.2	24.4	1.34	12.4	1.70	23.5	1.41	9.90
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip 50/528

Annex 21

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Kalzip AF 65/537

Characteristic values for downward load

Sheet thick-ness	Dead load	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M)+F_{Ed}/(R^0_{Rk,B}/\gamma_M)\leq 1$			
t	g	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	kN/m²	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	0.0240	34.9	0.914	6.90	0.921	29.6	0.835	7.05
0.8	0.0274	39.8	1.19	9.02	1.20	38.6	1.09	9.20
0.9	0.0309	44.8	1.48	9.64	1.62	28.8	1.33	9.52
1.0	0.0343	49.8	1.77	10.3	2.04	19.0	1.56	9.84
1.2	0.0411	59.8	2.14	12.2	2.32	20.8	1.82	11.0
		γ_M= 1.0	γ_M= 1.1					

Kalzip AF 65/537

Characteristic values for uplift load

Sheet thick-ness	Moment of inertia	Field moment	End support reaction	Moment and reaction forces at intermediate supports $M_{Ed}/(M^0_{Rk,B}/\gamma_M)+F_{Ed}/(R^0_{Rk,B}/\gamma_M)\leq 1$			
t	I_{ef}	$M_{c,Rk,F}$	$R_{w,RK,A}$	$M^0_{Rk,B}$	$R^0_{Rk,B}$	$M_{c,Rk,B}$	$R_{w,Rk,B}$
mm	cm⁴/m	kNm/m	kN/m	kNm/m	kN/m	kNm/m	kN/m
0.7	14.3	0.598	6.19	0.673	11.5	0.564	3.23
0.8	18.7	0.781	8.08	0.879	15.0	0.736	4.22
0.9	24.2	1.01	8.41	1.18	18.0	0.926	5.03
1.0	29.7	1.23	8.74	1.47	20.9	1.12	5.84
1.2	31.6	1.54	9.40	2.07	26.9	1.73	7.46
	γ_M= 1.0	γ_M= 1.1					

Kalzip Aluminium Standing Seam System

Cross Section Properties, characteristic Resistance Values and Partial Safety Factors γ_M

Kalzip AF 65/537

Annex 22

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Characteristic resistance values for Aluminium clips under pressure load in kN/clip	
Clip type	End or intermediate support
L 10	5.89
L 25	5.89
L 40	5.89
L 50	5.89
L 60	5.87
L 80	5.67
L 90	5.49
L 100	5.26
L 110	4.98
L 120	4.65
L 130	4.27
L 140	3.84
L 150	3.36
γ_M = 1.1	

Characteristic pull out resistance for clips in head of seam in kN/clipp				
Sheet thickness mm	End or intermediate support			
	Kalzip 65	Kalzip 50	Kalzip AF 65	Mixed webs of Aluminium/ lightning elements
0.7	2.60	2.10	1.55	-
0.8	3.40	2.75	2.00	1.77
0.9	5.05	3.80	2.95	1.77
1.0	6.65	4.85	3.95	1.77
1.2	8.55	5.25	4.80	1.77
γ_M = 1.33				

Kalzip Aluminium Standing Seam System	**Annex 23**
Characteristic Resistance Values for **Aluminium Clips** and Partial Safety Factors γ_M **Kalzip 65, Kalzip 50, Kalzip AF 65**	

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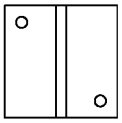
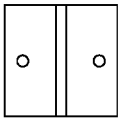
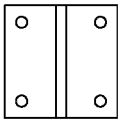
Characteristic resistance values for composite clips under pressure load in kN/clip										
Profile type	Thick-ness mm	E5/E20	E40	E60	E80	E100	E120	E140	E160	E180
All	0.7	1.73								
Kalzip AF 65	0.8 0.9									
Kalzip AF 65	≥ 1.0	4.75	4.55	4.35	4.10	3.90	3.65	3.45	3.25	3.00
Kalzip 50	≥ 0.8	4.40	4.25	4.10	3.95	3.80	3.60	3.45	3.30	3.15
Kalzip 65	≥ 0.8	4.15	4.10	4.05	3.95	3.90	3.85	3.75	3.70	3.65
$\gamma_M = 1.1$										

Characteristic pull out resistance for clips in head of seam in kN/clip			
Sheet thickness mm	End or intermediate support		
	Kalzip 65	Kalzip 50	Kalzip AF 65
0.7	1.60	1.40	1.60
0.8	2.10	1.80	2.10
0.9	2.90	2.60	3.05
1.0	3.70	3.35	4.00
1.2	4.95	4.95	5.15
$\gamma_M = 1.33$			

Limitation of characteristic tensile force for connection to substructure in kN/clip in case of verification acc. Annex 26 - 29	
Connection layout	$F_{z,k}$
	3.39
	3.81 (washer Ø 16)
	5.15
$\gamma_M = 1.33$	

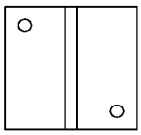
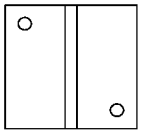
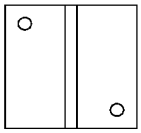
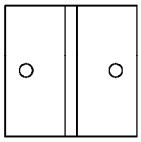
Kalzip Aluminium Standing Seam System	**Annex 24**
Characteristic Resistance Values for **Composite Clips** and Partial Safety Factors γ_M **Kalzip 65, Kalzip 50, Kalzip AF 65**	

Deutsches Institut für Bautechnik DIBt

Reduction of Characteristic values and moments of inertia according to Annexes 13 – 19 when using plastic lightning elements				
	4 Al- profiled sheets 1 plastic lightning element	3 Al- profiled sheets 1 plastic lightning element	Sheet thickness mm	$J_{ef,k}$
Downward load	10%	12%	0.8 0.9 1.0 1.2	20%
Uplift load	20%	25%		
Kalzip 0.7 mm is not suitable for use in connection with plastic lightning elements. When using more than 4 Aluminium profiled sheets, the excessive profiled sheets between the plastic lightning element can be dimensioned according to Annexes 13 - 19. Use of plastic lightning elements for sheets ≤ Kalzip 65/400, Kalzip 50/429 and Kalzip AF 65/434.				

Kalzip Aluminium Standing Seam System	**Annex 25**
Reduction of Characteristic values and Moments of Inertia When Using **Plastic Lightning Elements**	

Deutsches Institut für Bautechnik DIBt

Row	Substructure	Flange thickness mm	Connection layout	Fastener	Drill hole Ø mm	Tension force F_k [2] kN/clip
1	Aluminium $R_{p0,2} \geq 200$ N/mm² [5]	0.8 1.0 1.1 1.2		bulb-tite rivet Ø 5 mm [3]	5.5	1.60 2.51 2.76 3.00
2	Aluminium $R_{p0,2} \geq 225$ N/mm² [1)5]	0.9 1.0 1.2 ≥ 1.8 (max 2.5)		self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	-	1.55 1.90 2.70 5.10
3		≥ 2.0 (max 3.2)		self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	-	4.10
4	Aluminium EN AW-6060 T6 [6]	2.0		bulb-tite rivet Ø 5 mm [3]	5.5	2.46
5		2.5 3.0		self-tapping screw Ø 6.3 mm [4]	5.0 5.0	2.08 2.40
$\gamma_M = 1.33$						

1) In case of Aluminium substructure of values $R_{m,min} < 225$ N/mm² the characteristic values must be reduced in relation to the respective strengths.
2) Verification of "clip in head of seam" according to Annexes 23 / 24 and "limitation of tension force" for the composite clips according to Annex 24 must be provided in addition.
In case of a double-symmetrical layout with 4 fasteners the values F_k given in rows 1 to 4 may be doubled.
3) In accordance with the regulations of the member states according to appendix A.
4) According to european technical approval.
5) EN 485, EN 586, EN 755, EN 1396
6) EN 485, EN 586, EN 755

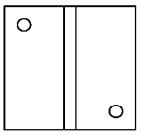
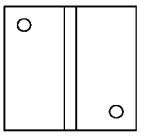
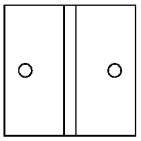
Kalzip Aluminium Standing Seam System

Characteristic Resistance Values for Connecting Clips to Substructure and Partial Safety Factor γ_M

Aluminium Substructure

Annex 26

Deutsches Institut für Bautechnik DIBt

Row	Substructure	Flange thickness mm	Connection layout	Fastener	Drill hole Ø mm	Tension force F_k [1] kN/clip
1	Steel trapezoidal sheeting acc. to EN 1993-1-3	≥ 0.75		bulb-tite rivet Ø 5 mm [3]	5.5	2.46
2	Steel trapezoidal sheeting acc. to EN 1993-1-3	0.75 0.88 1.00 1.25		self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	-	2.10 2.90 3.75 5.00
3	Steel S 235 [5]	1.30 1.50 ≥ 2.00 (max 2.5)		self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12		2.79 4.27 7.23
4	Steel S 235 [2] [5]	1.5 2.0 2.5 4.0 5.5		self-tapping screw Ø 6.3 mm [4]	5.0 5.3 5.3 5.3 5.6	3.56 4.92 6.32 10.82 12.40
$\gamma_M = 1.33$						

[1] Verification of "clip in head of seam" according to Annexes 23 / 24 and "limitation of tension force" for the composite clips according to Annex 24 must be provided in addition.
In case of a double-symmetrical layout with 4 fasteners the values F_k given in rows 1 to 3 may be doubled.

[2] In case of flange thicknesses ≥ 5.5 mm and using Aluminium clips a connection layout with one single screw (F_K = 6.20 kN/clip) is permitted.

[3] In accordance with the regulations of the member states according to appendix A.

[4] According to european technical approval.

[5] EN 10025, EN 10210, EN 10219

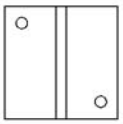
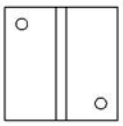
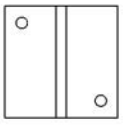
Kalzip Aluminium Standing Seam System

Characteristic Resistance Values for Connecting Clips to Substructure and Partial Safety Factor γ_M

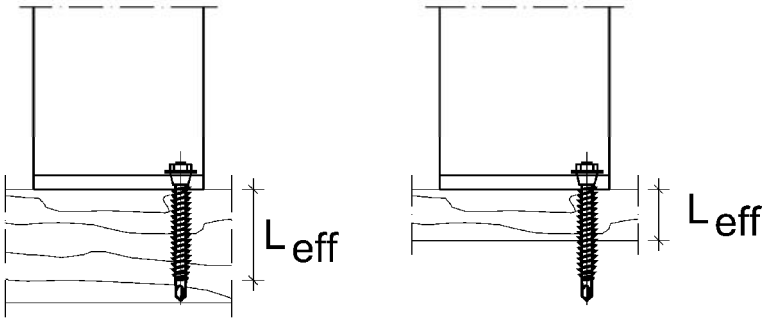
Steel Substructure

Annex 27

Deutsches Institut für Bautechnik DIBt

Row	Substructure	Connection layout	Fastener	Effective penetration length L_{eff} in mm	Tension force F_k [2] kN/clip
1	Coniferous wood strength class C24		self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	18	2.10
2				23 (30 mm incl. drill bit)	3.44
3				33 (40 mm incl. drill bit)	4.98
4	Particle board nominal thickness 19 mm (≥ P5 acc. EN 312)		self-drilling screw SFS SDK2-S-377-6,0xL acc. to Annex 12	19 [1]	2.25
5	OSB- board nominal thickness 18 mm (OSB/3 or OSB/4 acc. EN 300)		self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	18 [1]	2.64
6	Timber	For fasteners not listed the rules according to EN 1995-1-1 or the relevant european technical approvals apply.			
γ_M = 1,33					

1) The thread must cover the entire board width, see right diagram.
2) Verification of "clip in head of seam" according to Annexes 23 / 24 and "limitation of tension force" for the composite clips according to Annex 24 must be provided in addition.
In case of a double-symmetrical layout with 4 fasteners the values F_k given in rows 1 to 5 may be doubled.



Kalzip Aluminium Standing Seam System

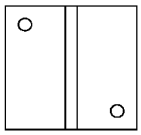
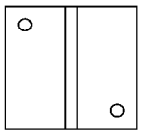
Characteristic Resistance Values for Connecting Clips to Substructure and Partial Safety Factor γ_M

Wooden Substructure

Annex 28

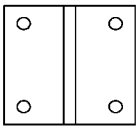
Deutsches Institut für Bautechnik DIBt

Characteristic shear force in kN/clip, metal substructure
Aluminium clip

Row	Substructure	Flange thickness mm	Connection layout	Fastener	Drill hole Ø mm	Shear force F_k kN/clip
1	Aluminium $R_{p0.2} \geq 225$ N/mm² [1)]	0.9 1.0 ≥ 1.2 (max 2.5)		Self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	-	2.65 2.85 3.05 3.25
2	Steel trapezoidal sheeting acc. to EN 1993-1-3	≥ 0.75		Self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	-	3.25
$\gamma_M = 1.33$						

1) EN 485, EN 586, EN 755, EN 1396. In case of Aluminium substructure of values $R_{m.min} < 225$ N/mm² the characteristic values must be reduced in relation to the respective strengths.

Characteristic shear force in kN/clip, wooden substructure [1)]

Row	Substructure	Connection layout	Fastener	Effective penetration length L_{eff} in mm	Shear force F_k kN/clip
1	Coniferous wood strength class C24		Self-drilling screw SFS SDK2-S-377-6.0xL acc. to Annex 12	18	5.10
2	Timber	For fasteners not listed the rules according to EN 1995-1-1 or the relevant european technical approvals apply. [2)]			
$\gamma_M = 1.33$					

1) The values apply to composite clips without spacer cap and with spacer cap 5 and 10 as well as to Aluminium clips without thermal caps and with thermal caps up to TK15.
2) The shear force must be limited to the value specified in row 1.

Kalzip Aluminium Standing Seam System	Annex 29
Characteristic Resistance Values for Connecting Clips to Substructure and Partial Safety Factor γ_M **Shear Force Resistance**	

Deutsches Institut für Bautechnik DIBt

Walkability during assembly

Profiled sheets in the assembly area which are zipped on at least one side may be walked on without taking any load-distributing measure up to the following spans:

Sheet thickness	Kalzip						
	65/305	**65/333**	**65/400**	**50/333**	**50/429**	**AF 65/633**	**AF 65/434**
t mm	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m
0.7	1.65	1.65	1.85	1.60	1.60	2.00	2.00
0.8	2.15	2.15	2.40	2.10	2.00	2.60	2.60
0.9	2.25	2.25	2.70	2.15	2.05	2.70	2.70
1.0	2.40	2.40	2.70	2.20	2.10	2.80	2.80
1.2	2.80	2.80	2.70	2.30	2.20	3.00	3.10

Walkability after assembly

Zipped profiled sheets may be walked on without taking any load-distributing measure up to the following spans:

Sheet thickness	Kalzip						
	65/305	**65/333**	**65/400**	**50/333**	**50/429**	**AF 65/633**	**AF 65/434**
t mm	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m	l_{gr} m
0.7	2.20	2.20	2.30	1.90	1.90	2.20	2.65
0.8	2.90	2.90	3.00	2.50	2.50	2.90	3.50
0.9	3.35	3.35	3.40	2.65	2.60	3.20	3.55
1.0	3.80	3.80	3.80	2.80	2.70	3.50	3.60
1.2	3.80	3.80	3.80	3.00	2.90	3.50	3.60

Individual, unzipped Aluminium profiles sheets and plastic lightning elements must not be walked on.

Kalzip Aluminium Standing Seam System	**Annex 30**
Walkability	

Deutsches Institut für Bautechnik DIBt

Walkability during assembly

Profiled sheets in the assembly area which are zipped on at least one side may be walked on without taking any load-distributing measure up to the following spans:

Sheet thickness	Kalzip		
	65/500	**50/528**	**AF 65/537**
t mm	l_{gr} m	l_{gr} m	l_{gr} m
0.7	1.85	1.60	2.00
0.8	2.40	2.00	2.60
0.9	2.70	2.05	3.00
1.0	3.00	2.10	3.45
1.2	3.00	2.20	3.45

Walkability after assembly

Zipped profiled sheets may be walked on without taking any load-distributing measure up to the following spans:

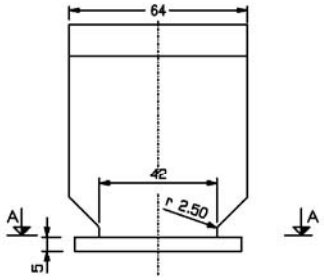
Sheet thickness	Kalzip		
	65/500	**50/528**	**AF 65/537**
t mm	l_{gr} m	l_{gr} m	l_{gr} m
0.7	2.30	1.90	2.75
0.8	3.00	2.50	3.60
0.9	3.40	2.60	3.60
1.0	3.80	2.70	3.60
1.2	3.80	2.90	3.60

Individual, unzipped Aluminium profiles sheets and plastic lightning elements must not be walked on.

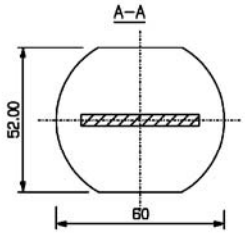
Kalzip Aluminium Standing Seam System	**Annex 31**
Walkability	

Deutsches Institut für Bautechnik DIBt

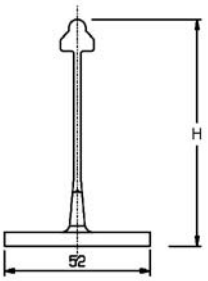
CROSS SECTION OF ROTATING CLIP SWIVELLED BY 90°



A–A

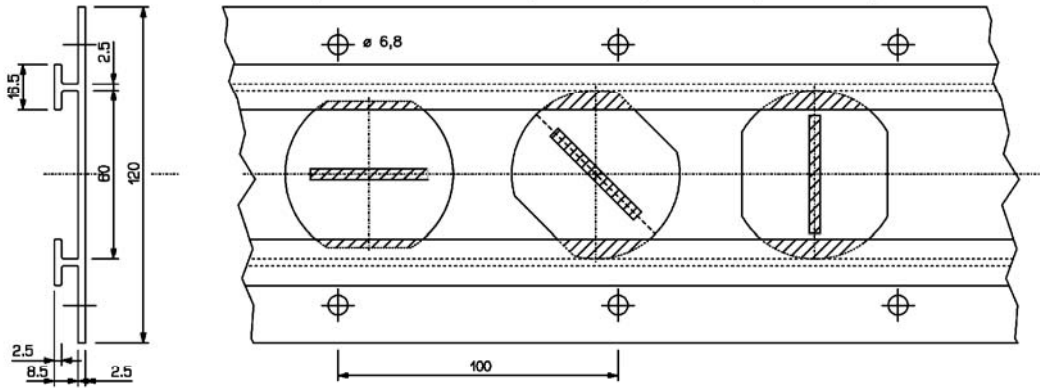


CROSS SECTION OF ROTATING CLIP



ANCHORAGE RAIL FOR ROTATING CLIP

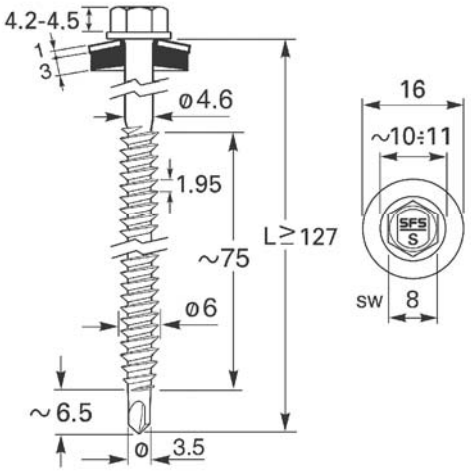
clip 0° installation clip swivelled by 45° clip swivelled by 90°



Characteristic resistance values of rotating clips and rotating clip rail under tension load		
Securing forces for clip on rail	3.1 kN/clip	$\gamma_M = 1.1$
Admissible bending moment at a tension clip force of $F_z = \gamma \cdot F$		
F_Z in kN	M_k in kNm	
0.0	0.218	$\gamma_M = 1.1$
2.0	0.206	
3.1	0.199	

For clip dimensions and securing forces of clips in head seams not listed above, see Annex 5 and 23.
The positioning of holes in the rail can be staggered, if desired.

Kalzip Aluminium Standing Seam System	
Rotating Clip **Rotating Clip Rail**	**Annex 32**



Row	Characteristic pull-out resistance from steel substructure in kN/screw			
	t_{II} in mm	Steel S280 ($R_{m,min}$ = 360 N/mm²)	Steel S320 ($R_{m,min}$ = 390 N/mm²)	Steel S350 ($R_{m,min}$ = 420 N/mm²)
1	0.75	1.05	1.14	1.23
2	0.88	1.47	1.59	1.66
3	1.00	1.88	2.04	2.08
4	1.13	2.19	2.37	2.50
5	1.25	2.50	2.71	2.92
	γ_M = 1.33			

Row	Characteristic pull-out resistance from wooden substructure in kN/screw		
	Substructure	**Effective penetration length L_{eff}**	**F_K kN/screw**
1	Coniferous wood, strength class C24	23 (30 mm incl. drill bit)	1.72
2	Coniferous wood, strength class C24	68 mm (75 mm incl. drill bit)	5.20
3	Particle board (≥ P5 acc. EN 312) nominal thickness 19 mm	The thread must cover the entire board width, Annex 28.	1.13
4	OSB- board (OSB/3 or OSB/4 acc. EN 300), nominal thickness 18 mm		1.32
5	Timber	For fasteners not listed the rules according to EN 1995-1-1 or the relevant european technical approvals apply.	
	γ_M = 1.33		

Kalzip Aluminium Standing Seam System

Characteristic Pull-out Resistance Values for Connections Substructure and Partial Safety Factor γ_M

Self-drilling Screw SFS SD2-S-6.0xL

Annex 33