RHEINZINK®

CLICK ROLL CAP SYSTEM

System Technology for Roofs

DESIGN AND APPLICATION

For up-to-date information, technical reports, advanced technical information, parts lists, standard details or specifications please visit our website.

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4th edition

Foreword

This document describes the use of the RHEINZINK-Click Roll Cap System. Although it forms the basis for proper planning and classical application solutions, it is no more than a guide for users. The detailed drawings included here describe solutions which are feasible at a practical level.

We should like to explicitly point out that in actual practice it may not be possible to create the type of roofing illustrated in this document – or not to their full extent. In this context every situation should be examined in detail by the planner in charge. It is necessary here to take account of the system-specific effects on the property and local/climatic conditions as well as the requirements in terms of building physics. Compliance with the application techniques and specifications described here does not release users from any responsibility in this regard.

This document is based on our practical experience and represents the latest findings from research and development, recognised standards and state-of-the-art technology. We reserve the right to make changes at any time in the course of further development.

If you have any queries or suggestions, please contact your customer advisor or get in touch with your local RHEINZINK sales office. All contact data can be found on our homepage **www.rheinzink.com/contact**
For an overview of our sales offices see page 56 of this document.

Datteln, November 2017

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PRODUCT LINES

CLASSIC

artCOLOR

ONE BRAND – 3 PRODUCT LINES
A perfect solution for every requirement

To give you even more design freedom, we offer our material in three different product lines and in numerous finishes. You get the perfect solution for every requirement with the trusted RHEINZINK quality. All products exceed the high standards of EN 988 and the TÜV QUALITY ZINC criteria. The high level of manufacture is guaranteed by constant inspections and extensive laboratory tests. On this double page, we have summarised the characteristic features of our three product lines. On request, we will gladly send you samples of material.

RHEINZINK-CLASSIC
The natural material in its most original form

RHEINZINK-CLASSIC is the most original of all material options. The bright rolled version has proven itself for over 50 years of application. Depending on the weather conditions, over time a typical blue-grey patina is formed on the naturally shiny metallic surface. The patina gradually becomes more and more distinctive and develops a unique surface character.

Surface quality:
RHEINZINK-CLASSIC® bright rolled

RHEINZINK-artCOLOR
Unlimited design in a variety of colours

RHEINZINK-artCOLOR is the coloured version for roofing and facade cladding. A durable coating allows a wide range of colours and opens up a variety of design options for architects, planners, builders and trade customers. Classically elegant, contemporary avant-garde, contrasting or tone-on-tone. If you have a special colour requirement, we will be happy to produce RHEINZINK-artCOLOR in the shade of your choice.

Surface qualities:
RHEINZINK-artCOLOR® anthracite
RHEINZINK-artCOLOR® pure-white
RHEINZINK-artCOLOR® pearl-gold
RHEINZINK-artCOLOR® moss-green
RHEINZINK-artCOLOR® nut-brown
RHEINZINK-artCOLOR® blue
RHEINZINK-artCOLOR® tile-red

prePATINA

prePATINA

THE WORLD'S ONLY NATURALLY PRE-WEATHERED SURFACES

Only RHEINZINK has a special process in which the blue-grey or graphite-grey colour of the natural patina is achieved naturally in production. As the inventors, we called this unique pickling process "pre-weathering". Virtually imperceptible to the human eye, atmospheric influences over time create a natural protective patina that reliably protects the product. In production, any use of artificial coatings, varnishes or phosphating is avoided completely. The prePATINA line products are the only ready-made natural surfaces in the entire global zinc construction market.

Natural weathering compensates for any installation-related scratches. Only the RHEINZINK-prePATINA and the RHEINZINK-CLASSIC lines offer this self-healing effect. They are environmentally friendly and absolutely maintenance-free.

100% SELF-HEALING
100% MAINTENANCE-FREE
Only available from RHEINZINK

Surface qualities:
RHEINZINK-prePATINA® blue-grey
RHEINZINK-prePATINA® graphite-grey

Only RHEINZINK with its CLASSIC and prePATINA line offers three entirely natural material options made with titanium zinc!

1. Material RHEINZINK Titanium Zinc

1.1 Alloy and Quality

RHEINZINK is titanium zinc according to DIN EN 988. The RHEINZINK alloy consists of electrolytically refined zinc according to DIN EN 1179 with a purity grade of 99.995% and precisely determined proportions of copper and titanium.
All RHEINZINK products are certified according to DIN EN ISO 9001:2008 and are subject to a voluntary inspection by TÜV Rheinland according to the strict QUALITY ZINC criteria catalogue *(please request free of charge)*.

Ecological Relevance

RHEINZINK is a natural, 100% recyclable material that has always complied fully with today's strict ecological requirements. The latest production facilities, sophisticated logistics and favourable processing properties are available. Environmentally-conscious action is documented through the introduction of the environmental management system ISO 14001:2004. It is checked and certified according to TÜV Rheinland.
We also document responsible action in regard to the environment through the introduction of an energy management system according to ISO 50001:2011. It is our intention to save as much energy as possible, to save resources and to keep the environmental impact of our products as low as possible.

Aspects of ecological Assessment

According to the holistic assessment from the Institute for Construction and Environment e.V., RHEINZINK is declared an environmentally friendly construction product according to ISO 14025, type III (EPD) and EN 18504 „Sustainability of construction works. Environmental product declarations". The examination of the environmental and health compatibility criteria also includes the entire life cycle of RHEINZINK products, from the raw material extraction to processing and use to recycling and disposal. It is based on a life cycle assessment according to ISO 14040 (LCA) *(please request the certificate free of charge)*.

Electromagnetic Radiation is safely shielded

There is much public controversial debate about electromagnetic radiation. The International Society for Electrosmog Research (IGEF e.V.) has provided information here on RHEINZINK's shielding properties. The result: Over 99 % of electromagnetic smog present is shielded. Biological measurements on people confirm the technical measurements and show a harmonising effect on heart, circulation and the nervous system. Body relaxation increases.

Remaining Values

With a service life that spans several generations, RHEINZINK is a material that sets news standards. The 30-year guarantee highlights the durability of the 100% recyclable material. This offers additional protection.

1.2 Marking

RHEINZINK sheets and coils:
Recognisable by the consecutive coloured stamping on the metal underside.

RHEINZINK-
Roof Drainage Products:
Recognisable by the brand embossing.

RHEINZINK-
Roof Drainage Accessories:
Recognisable by the brand embossing.

RHEINZINK-Palette Identification:
Recognisable by the packaging label with detailed product data.

1.3 Material Properties

- Density (spec. weight) 7.2 g/cm³
- Melting point approx. 420 °C
- Expansion coefficient: in a longitudinal rolling direction: 2.2 mm/m x 100 K in a transverse rolling direction: 1.7 mm/m x 100 K
- Typical joining techniques: seaming, soft soldering, bonding, screwing, riveting
- Non-magnetic
- Non-combustable
- Electromagnetic radiation shielding
- Recyclability 100 %
- High recycling rate
- Assured material cycle
- Environmentally compatible (EPD)
- Natural material
- Low energy use
- Long service life
- Vital trace element
- Extensive resources

Metal thickness (mm)	Weight (kg/m²)
0.70	5.04
0.80	5.76
1.00	7.20

RHEINZINK weight according to Metal thickness in kg/m² (Numbers are rounded)

A

B

C

D

1.4 Patina Formation

On the natural RHEINZINK-prePATINA surface forms a bonded natural patina in the atmosphere. In so doing all the environmental influences from the air and rain water are integrated into the surface development. The material surface is maintenance free and as a natural product does not require care or cleaning.
When using the natural RHEINZINK-prePATINA line surfaces in areas subject to a marine climate, white deposits may develop on the surface due to the salt in the atmosphere. These natural deposits integrate into the natural patina and because of the colour contrast, are more visible on the darker, RHEINZINK-prePATINA graphite-grey surface. This will not affect the function or expected service life of the material when used on facades, roofs or other cladded building components. The natural patina will appear lighter when used in locations where the air contains chlorides. When used in environments where sulphur levels are higher, (e.g. industrial pollution), the patina may appear somewhat darker than usual.

1.4.1 RHEINZINK-CLASSIC bright rolled

Application for all sheet metal work in seaming and soldering techniques. Natural patina forms at different times depending on the application or roof pitch. In areas protected from rain water e. g beneath eaves or on roof edges sometimes only after a few years.

1.4.2 RHEINZINK-prePATINA blue-grey and graphite-grey

The pre-weathering process was developed by RHEINZINK 25 years ago especially for use in areas where a "finished" picture of the RHEINZINK surface is desired even at the hand-over of keys. This process allows the production of colour of a natural patina although the natural patina itself only forms after installation.

RHEINZINK is the only manufacturer world wide who uses this unique pre-weathering process. The use of a pickling process compared to a coating or phosphating process has two distinct advantages: Pickling gives the surface the appearance of a genuine patina, something that only occurs otherwise after a long time through natural influences. Pickling produces an even colour tone but is not comparable however with a RAL shade. A protective coating applied to the surface achieves temporary protection for storage, transport and processing. This protective film makes oil-free forming possible for processing in the profile roll forming machines.

The RHEINZINK quality prePATINA graphite-grey is the dark alternative and may, after a few years during the formation of patina and depending on the regional climate, develop a slight dark green sheen as with slate.

During the pickling process other natural surface properties are preserved - the surface remains solderable. The visible "Ageing with dignity" is not prevented by pre-weathering and has proved its worth in practice over many decades. The material largely reduces the typical reflections of the surface of thin sheets (oil canning).

1.4.3 Information about Processing

In order to avoid surface reactions from excessive sweating from the skin and other impurities caused by the building site, oil-free clean textile gloves should be worn.
Suitable products can be found at
www.rheinzink.de/werbemittelshop

1.4.4 Surface Uniformity

We make every effort to supply profiles with surface uniformity. Production-related slight differences can occur, which are purely of appearance in nature and which, in the prePATINA line, usually even out during the formation of patina. In order to exclude specific product-related visual imperfections, particular requirements should be requested with respect to surface uniformity.

Environmental Profile Scheme
ENP 453

* *environmental label for building products recongnized by the German Federal Environmental Agency*

1.4.5 Protection during Transportation and Installation

To protect the surface during the transport, storage and installation our façade profiles and also our surface quality art-COLOR line are delivered with a protective plastic film. It also protects against negative influences during the construction phase.

The foliation is a self-adhesive protective plastic film that is applied at the factory and is exposed during installation to UV radiation and temperature variations. If this exposure continues for a long time, the properties of the film may change and cause adhesive residues on the metal surface. To avoid these changes, we recommend removing the film immediately after the installation process.

1.4.6 Information on Wave Formation Strip Material

A characteristic surface phenomenon with strip material is the typical slight wavy structure of thin sheet metal.
These waves form because of the reaction of a natural material to the winding and unwinding process in the factory and the corresponding reworking (profiling etc.) during workshop preparation and installation.

The surface finish CLASSIC bright rolled emphasises the changing appearance because of light reflection. With increasing patination this perception reduces. If from the start e. g. for facades and roof surfaces, a high grade appearance is desired, we recommend, the surface finishes prePATINA blue-grey or prePATINA graphite-grey.

Panels
An improved evenness is obtained by using panels, which RHEINZINK can manufacture and supply at lengths up to 6 m. The measurement of corrugations is subject to strict controls and must not exceed the value defined under DIN EN 988 (max. 2 mm per metre). The RHEINZINKworks standard prescribes for each metre of sheet length e. g. max. 1 wave 1 mm in height.

1.5 Response to external Influences

1.5.1 Influence of other Metals placed on Top

Unproblematic:
- Aluminium, shiny or coated
- Lead
- Stainless steel
- Galvanised steel (rust streaking possible, e. g. caused by unprotected cut edges)

Problematic:
- Copper

1.5.2 Influence of other Building Materials placed on Top

Problematic:
- Unprotected bitumen roof sheeting without grit layer/gravel fill (acid oxidation)
- PVC roof sheeting (hydrochloric acid emissions)

1.5.3 Influence of other Substances incl. Mortar

- Mineral-based materials such as chalk, cement or plaster plus moisture have a corrosive effect on metals.
- A suitable separating layer must be fitted between RHEINZINK building profiles and these building materials.
- Installation sequence: Plasterwork prior to RHEINZINK (if possible use material with plastic film)
- Road salt and moisture have a corrosive effect on metals.

1.5.4 Effect of Oil Heating

Discolouration on RHEINZINK surfaces can occur in the case of oil-driven heating systems because of the ingredients of the heating oil and additives. Such discolouration is more or less visible on all covering materials and has no influence on the durability of the roofing.

Note:
The builder must be informed about this situation. With gas-operated plants, discolouration is not expected.

1.6 General Processing Principles

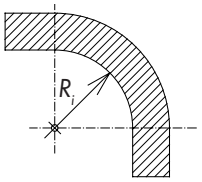
1.6.1 Marking

Mark using soft pens and not sharp pointed objects (scribing tool, pocket knife).

1.6.2 Forming/Radii of Curvature

Zinc and its alloys are anisotropic, which means they have different properties parallel and crosswise to the rolling direction.

The mechanical effect of this anisotropism is reduced to such a degree with RHEINZINK through the alloy and rolling process, that RHEINZINK independent of the rolling direction can be folded at 180° without incipient cracking.



Material thickness	Radius of curvature R_i minimum
1.00 mm	1.75 mm
1.20 mm	2.10 mm
1.50 mm	2.63 mm

Recommended radii of curvature (inner radius) for RHEINZINK

1.6.3 Metal Temperature

Processing without additional measures ≥ 10 °C:

If the temperature of the material is under 10 °C, and folding, bending or profiling has to take place, then the processing area must be heated.

Heating must occur constantly in parallel to the shaping process. Increased costs, if not covered in the contract specification, must be clarified with the building management before commencement.

Soft soldering is an option independent of the metal temperature.

1.6.4 Jointing Techniques

1.6.4.1 Soft Soldering

- Substance-to-substance-bonded and water-tight connection of the seams of water-conducting profiles in only a single work process (gutters, valleys, copings); install expansion elements

Aids and tools:

- Soldering bit (hammer bit), weight > 350 g, better 500 g
- Flux, the company Felder ZD-pro, for surface prePATINA graphite-grey: also use stainless steel wool for abrasive treatment
- RHEINZINK-Lötzinn für Titanzink gemäß ISO 9453 - SnZn 801 – bleifrei, umweltverträglich, nachhaltig

Note:

Please pay attention to the RHEINZINK Processing Guide „Joining Technique".

1.6.4.2 Seams

Double standing seam system, angled standing seam system, click roll cap system

1.6.4.3 Overlap

- Application for instance for valleys in the case of scaled roofs such as tiles, slate etc
- Overlap widths
  Valley slope ≥ 15°, at least 150 mm
  Valley slope ≥ 22°, at least 100 mm
- Design of profile butts with cranked edges

1.6.4.4 Bonding

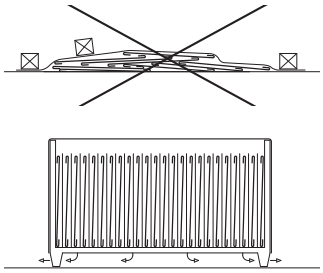
- Bonding of coverings has been standard for decades.
- Bonding of metal facades (e.g. large flat-locked tiles) has been successfully used for some years.
  In particular in the case of extremely unfavourable conditions such as
  – Position of the structure
  – large metal widths
  there is a considerable reduction in fluttering noise through bonding (e.g. on metal brackets).
- The manufacturer's guidelines must be observed with respect to suitable polyurethane adhesives for the above given areas of application.
- The RHEINZINK gutter adhesive can be used as an alternative to soldering techniques for bonding RHEINZINK gutters.

1.6.5 Length Change caused by Temperature

With coverings, roofs, and facade cladding (panel length), sheet metal work and roof drainage (profile length), changes in length caused by temperature (expansion and contraction) must be taken into account in the design. In particular for penetrations, corners, joints and other transitions, the right design measures must be implemented; e.g. panels or profiles must be installed stress-free from the expansion technology perspective.

1.7 Storage and Transportation

RHEINZINK products must always be stored and transported in dry and ventilated conditions.



Storage and Transportation (Schema)

Note:

Container storage is the best method for optimum storage at the building site. If necessary request a dry and well-ventilated room from the building management. Do not place covers directly over the material as this can cause moisture or rain water to penetrate between the profiles and in the absence of ventilation lead to deterioration in appearance because of the formation of zinc hydroxide.

2. Moisture Protection for Buildings

2.1 Introduction

Traditionally roof systems were built with metal roofing on ventilated roof structures. Some time ago metal roofing started to be installed on unventilated roof structures due to the rising costs of energy, increased requirements on thermal insulation, more complex roof geometries and the latest research into building physics. This design dispenses with a ventilated layer between the thermal insulation, the entire surface of the substructure and the metal roofing.

We will now look at both ventilated and unventilated types of construction.

2.2 Ventilated Systems with unventilated supporting Structures

Roofing built with the RHEINZINK-Click Roll Cap system satisfies the requirements in terms of tightness to rain. In comparison with standing seam systems, this is better than with the double standing seam. According to the rules of the German roofing trade (ZVDH – German umbrella association of roofers) it is generally the case for all ventilated and unventilated systems that an additional measure should be provided for the roofing material underneath the water-bearing level. This is referred to below as the functional layer. It should be designed according to the building physics of the roof and affords protection to the roof structure. It protects the insulation from the penetration of moisture with any leaks in the roofing, prevents the upper layer of thermal insulation from cooling by acting as a wind barrier and also conserves the full insulating effect. The functional layer is extremely important for proper functioning of the building in terms of energy consumption.

The design of the functional layer is laid down in the rules of the German roofing trade. The type of installation used in each case (membrane, underlay covering, underroof) depends on usage of the roof space, the climatic conditions, the roof pitch and standard roof pitch of the roofing material, etc. Hereinafter follows a brief description of the design and characteristics of each variant.

Rainproof Membrane

Roofing membranes take the form of sheets which are freely suspended or extended to ensure that the roofing remains rainproof. The individual sheets are installed so that they overlap at least 10 cm at the edges and are affixed to the substructure (e.g. rafters) with nails or clips.

Rainproof Underlay Covering

Underlay coverings take the form of layered sheets or boards laid on a substructure. The counter battens are positioned above and not incorporated in the underlay covering. Additional sealant or sealant strips can be used to waterproof the perforations made by the fixings.

Rainproof Underroof

Underroofs are built with the help of waterproof sheeting. The seam and butt joint connections must also be waterproof when installed. The counterbattens are not incorporated here. Sealant or sealant strips can be used to waterproof the perforations made by the fixings for the counterbattens. Penetrations must be rainproofed on installation.

Waterproof Underroof

This variant is installed with waterproof sheeting and seam/butt joints which have been bonded so that they are waterproof. The counterbattens are incorporated here. Penetrations are likewise incorporated so they are waterproof. Openings and exposed penetrations made by fixings are not permitted. Unlike the other variants there should be no penetration of drifting snow or rain here.

Note on Underlay Coverings/ Underroofs

When selecting the appropriate type of installation, it is necessary to consider its effects on the requirements of the construction system in terms of building physics. For example, a structure designed to be breathable in an upward direction cannot be finished with sheeting that inhibits diffusion (vapour barrier) above the thermal insulation. Unless verified by means of building physics, the s_d-value of the sheeting on top of the thermal insulation should normally be approx. 1/6 to 1/10 of the value of the sheeting underneath the insulation.

In the case of rooms where the indoor climate is subject to higher requirements (e.g. swimming pools, etc.) the calculations made in terms of building physics should comply with DIN 4108-3 and DIN EN 15026.

2.2.1 Depth of Air Space for Seam Systems

Nominal values for depth of air space as listed for example in the rules of ZVSHK (German Central Sanitary, Heating and Air Conditioning Association) for sheet metal work have proved their worth:

Individual Verification

Ventilation cross-sections and depth of air space are nominal values, with deviations being possible in terms of structural physics, based on individual verification. The efficiency and functionality of the ventilation is not necessarily restricted even if values are lower.

In the case of the fibre insulating materials frequently used for roofing it must be ensured that their subsequent increase in volume and associated reduction in the actual depth of air space is taken into account at the planning stage.

Roof pitch	Clear depth of air space	Slot width (net)
≥ 3° – ≤ 15° (≥ 5.2% – ≤ 27%)	≥ 80 mm	≥ 40 mm
> 15° (> 27%)	≥ 40 mm	≥ 30 mm
≥ 3° – ≤ 5° * (≥ 5.2% – ≤ 8. 7%)	≥ 100 mm	≥ 60 mm
Facade (90°)	≥ 40 mm	≥ 20 mm

Table 1: Nominal values for depth of air space and linear intake or exhaust openings as a function of roof pitch (nominal values)

* *Eaves cross-ventilation – eaves without ridge ventilation, ventilation of critical areas. According to ZVSHK rules, diffusion-inhibiting layer with s_d-value ≥ 100 m positioned underneath.*

2.2.2 Air Intake and Exhaust Openings for Seam Systems

See Table 1 for the standard slot widths for intake and exhaust openings.

With special cases involving systems largely ventilated by suction/pressure from wind, e.g. low-gradient roofs, a net cross-section of min. 6 cm is recommended for the slot width.

In terms of aerodynamics the airflow should be deflected by intake or exhaust openings as little as possible. With three or more deflections within the roof structure the functionality of the intake/exhaust system must be fundamentally questioned.

Structured Underlays

Structured underlays are not considered to be a ventilation layer in terms of aerodynamics. They act as a buffer between the roofing and substructure and are designed to dry moisture by means of thermal processes. Boarding made of wood or plywood sheathing with underlay is commonly installed as installation covering. If the installation covering is left on the softwood boarding, the structured underlay can be replaced by a RHEINZINK-AIR-Z structured mat. This "drainage mat" also acts as a buffer between the zinc and the substructure. For further information about structured underlays see 3.4.

2.3 Unventilated Roof Systems

When planning unventilated roof systems the following influencing factors need to be taken into account:

- Introduction of moisture from building materials and on site
- Introduction of moisture via diffusion
- Introduction of moisture via convection
- Transport of moisture due to design
- Thermal bridges, e.g. created by fixings
- Installation of a suitable structured underlay

Unventilated roof systems include thermal insulation covered over for example entirely with boarding as well as the roofing itself. In the case of using rigid insulation it is possible to dispense with boarding underneath the entire surface of the RHEINZINK roofing material. The insulation must be sufficiently heat-stable and, where the joints are concerned, must also remain dimensionally stable on a long-term basis.

A diffusion-inhibiting vapour control layer with an s_d-value of >100 m is generally installed underneath the thermal insulation. Here it must be ensured that the vapour control layer must be fitted at all butt joints and adjacent components so that it is airtight. Due care should be taken during planning and execution. The introduction of moisture in the form of damp building materials, rain or snow, condensation inside or from outside, etc. must be avoided throughout the construction phase.

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Besides diffusion-inhibiting vapour control layers, so-called variable vapour control layers have also been used underneath thermal insulation for some years now. Such products are commercially available, with s_d-values ranging between e.g. 0.2 m to >10 m. Variable vapour control layers are more diffusion-tight in winter and protect the construction from the ingress of warm air from the interior. In summer they become more open to diffusion and within the construction allow moisture to dry back into the drier interior (inverse diffusion).

During planning and execution the following aspects should be taken into account:

- So-called numerical hygrothermal simulation must be performed with variable vapour control layers for each construction system (according to DIN EN 15026).
- Plywood sheathing should not be positioned between thermal insulating materials and the variable vapour control layer.
- The vapour control layer should be protected from the effects of strong sunlight while unclad.
  The vapour control layer must be installed after the insulation at the very latest.
- With large-scale building projects it is advisable to adopt a section-by-section approach.
- Increased humidity must be allowed to evaporate – it may be necessary to use building dryers in winter.

Blower-door testing has proved to be useful when checking air tightness, and this has become a standard procedure.

2.4 Structured Underlays

VAPOZINC is a structured underlay incorporating a drainage function and consists of a roofing membrane with a monofilament fabric laminated on top. It is approx. 8 mm high and is manufactured in a width of 1.4 m. It is recommended for use with ventilated and unventilated substructures underneath RHEINZINK.

Thanks to its material properties the underlay offers the following benefits:

- Open to diffusion: s_d-value < 0.02 m
- buffer for any trapped moisture
- Improves the slide properties of long panels
- Sound transmission caused by rain is reduced by as much as 8 dB.
- Secondary condensate is drained off by the underlay.
- Tolerance compensation for minor variations in height of the substructure
- With roof pitches < 20° approved for use as an underlay for the requirement “Hard Roofing”
- Minimises ingress of rain during construction
- Suitable for softwood and derived timber boarding (OSB, veneer plywood etc.)
- For rigid insulation
- Self-adhesive seams

When a structured underlay is installed on top of bitumen sheeting (V13), moisture, e.g. from rain, may be trapped between these layers prior to installation of the roofing. The structured underlay allows it to diffuse outwards (s_d-value < 0.02 m).
Please make sure that underlays with moisture-retaining properties are not laid underneath structured underlays.
Strukturierte Trennlagen stellen keine Belüftungsebene gemäß DIN 4108 dar.

Besides installing a structured underlay it may also be necessary to fit the AIR-Z structured mat. This mat takes the form of a grey fabric of randomly oriented fibres and is designed to drain off water resulting e.g. through capillary action with the formation of ice dams. Where trades are carried out separately and derived timber boarding is provided by the customer for an unventilated roof system, this is protected from moisture by a temporary covering open to diffusion. This should be followed by installation of the RHEINZINK-AIR-Z structured mat to ensure the necessary moisture buffer for the RHEINZINK roofing. RHEINZINK AIR-Z is designed to be moisture-compensating and has been developed for large area covering sealing underlays. It also improves the sound insulation value with rain. When used in combination with a bitumen roof sheeting with an inlay of glass fibre fleece, it fulfils the criteria of "Hard Roofing".

2.5 Summer Thermal Insulation

In terms of summer thermal protection the flow of heat that entering the building from outside should be minimised to ensure a pleasant indoor climate. Where possible, the aim should be to do without air-conditioning to comply with the regulations of the Energy Saving Ordinance. The summer thermal protection specified in DIN 4108 is influenced not only by the dimensions of the space, the orientation and size of the windows, the type of glazing and sunscreens, ventilation behaviour, internal sources of heat (e.g. heat output per person, waste heat given off by computer equipment or lighting), as well as the heat storage capacity of the building materials used (internal/external walls, floor slabs, insulating material in the roof).

To ensure satisfactory summer thermal protection the following measures may for example be used in the structure: a thick heat insulating layer, properly insulated windows and weighty building materials. Modern building materials such as cellulose insulation or softwood fibreboard store heat well while radiating it back with a time delay. Where windows are concerned, the reduction in diathermancy of the frame and glass must be taken into consideration.

The advantage of a ventilated roof system is that some of the heat radiating onto the roofing is dissipated through convective air exchange.

2.6 Tightness to Air and Wind

The current standards and regulations governing energy-saving construction call for air and wind-tight structures. This not only offers numerous benefits for the building itself and its service life, but also for the occupants: in addition to improved comfort at home, they stand to make significant savings in terms of heating costs.

Overview of benefits:

- Save energy – no uncontrolled heat losses
- Avoid damage to building, e.g. caused by condensate in construction
- No draughts on windy days
- Avoid harm to health, e.g. due to mould
- No ingress of undesirable odours, heat or harmful substances
- Improvement in sound insulation
- Improvement in summer thermal protection
- Grants possibly available from the German government, individual federal state or local authority (e.g. KfW aid programmes)
- Increase in value of property
- The windproof layer is located on the cold side of the structure. Acting as the functional layer (e.g. bonded windtight underlay), it protects the structure from drifting snow, insects, wood pests, dust, etc. The insulation is protected from undercurrents of cold air (heat loss). Please bear in mind that it is essential for all joints, sides and penetrations to be connected to the windproof layer without any gaps. Penetrations are permissible: sanitary fans, antenna cables, chimney openings, middle purlins, jamb wall connections etc.

The airtight layer (vapour control layer, vapour barrier, etc.) is located on the warm side of the roof structure. Airtight execution of all connections and terminations and penetrations is the prerequisite for impeccable damage-free building.

Blower-door testing can be used to check whether the building is airtight. This involves measuring the volume of air (with a constant under- or overpressure of 50 Pascal) required to maintain the pressure level. The test should be performed prior to fit-out of the building to allow any leakage to be readily localised and eliminated.

3. Description of System

3.1 History of System

Once the rollability of zinc had been discovered in 1812, the hollow bead and double bead with cap were swiftly followed by development of the batten system. From 1839 it is mentioned in the literature dealing with sheet metal working of zinc as the most common system of the day and is the oldest of the standard installation systems in use today .

The ease of exchangeability and avoidance of capillary action were the key benefits offered at the time the batten system was developed. In the last century the classical metal thickness was 1.1 mm (zinc No.16), while the panel width was approx. 430 mm.

Today little remains of the systems which came into being over the years, for example the “Berlin”, “Silesian”, “English”, “Belgian”, “Rhenish”, “French” batten or those developed by Karl Frick. They are now mainly to be found in France, Belgium, Great Britain and the Netherlands, where they are among the most common installation systems in these countries.

Such systems are not as popular in the German-speaking world and Scandinavia and are only used when surface structuring on a building is to be more apparent than with other seaming techniques. It is not uncommon for standing seam and roll cap systems to be combined. The batten system is however not usual in southern Europe.

3.2 Individual Design

The use of metal roofing has a long tradition behind it. The roll cap design in particular has proved to be a robust installation system over the years. An improved tightness to rain, its striking design and economical installation are factors that make the RHEINZINK-Click Roll Cap system so appealing.

It can easily be combined with the standing seam system or tile coverings and provides for a range of different roof designs, depending on what the architect has in mind.

3.3 System Description

The roll cap or batten system characterises the type of longitudinal connection. A wooden batten or the RHEINZINK-Click Roll Cap Fastener made of galvanised steel is installed between the panels. It is used to attach the fixings and is covered with a roll cap.
Development of this system gave range to different variants, with three still being of importance today:

- Belgian batten roll cap system
- German batten roll cap system
- RHEINZINK-Click Roll Cap system

The RHEINZINK-Click Roll Cap system takes the Belgian and German batten roll cap system further and caters for the increased requirements in terms of fast, i.e. cost-effective installation. The special technique used here does away with the need for visible fixing of the roll cap, something that would otherwise spoil the final appearance.

The tightness to rain of this installation system is even better than with other metal roofing systems (e.g. standing seam etc.).

RHEINZINK has developed a mobil roll former for this system which is available for hire. The mobil roll former permits on-site production of panels without the roll cap. (ref. Chapter 5)

If you require roll formers for standing seam claddings or roll cap claddings: www.rheinzink.de/kontakt

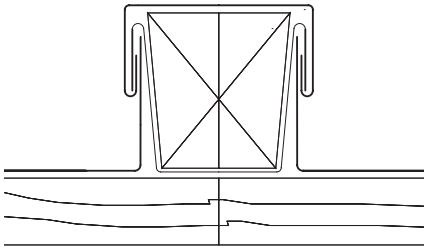

Fig. 2: Belgian batten roll cap system

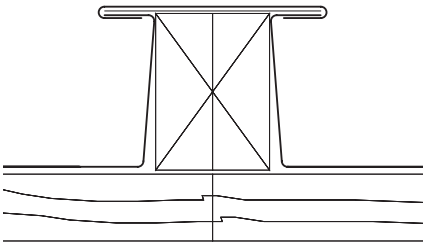

Fig. 3: German batten roll cap system

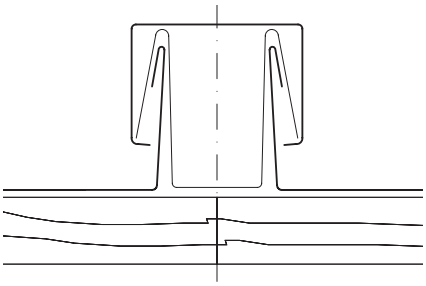

Fig. 4: RHEINZINK-Click Roll Cap System

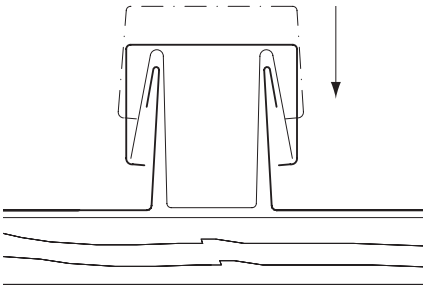

Fig. 5: With the RHEINZINK-Click Roll Cap System the roll cap is pressed laterally over the fastening rail until the bottom of the cap audibly snaps into place.

Fig. 6: Fastener mounted on panels

Height of Roll Cap System Seam
In the case of the RHEINZINK-Click Roll Cap system the cross-section of the roll cap incl. cap measures approx. (H x W) 53 or 60 mm x 60 mm. The lateral upfold of the panel is 47 mm.

Roof Pitch
The Click Roll Cap system can be used with a roof pitch of min. 3° in all weather groups without additional measures.

Fixing
With the RHEINZINK-Click Roll Cap system the roll cap is clicked into place onto aligned RHEINZINK-Click Roll Cap Fasteners made of galvanised steel, 50 cm long (d =1.0 mm) (see Fig. 5).

The fasteners are screwed to the substructure with a spacing of 50 cm - 150 cm (centre distance between Click Roll Cap Fasteners (depending on the local wind loads as per Eurocode DIN EN 1991 – 1-4). The roll caps are then each fixed to the side of the Roll Cap fastener with one rivet or self-tapping screw.

3.4 Technique end economic Efficiency
Thanks to the relatively high degree of prefabrication characterising the elements and accessories of the RHEINZINK-Click Roll Cap System it is possible to produce roofing quickly and efficiently without using many tools or machines. Compared with mass-produced roofing systems this represents a major benefit in terms of economic efficiency.

3.5 System Benefits
- Highly aesthetic architectural design
- Structuring of areas through effect of light and shadow
- Harmonious proportions
- Suitable for roof pitches > 3°
- Longitudinal connection without capillaries
- Rainproof longitudinal seam
- System components not combustible, not flammable
- Easier exchangeability or reworking of panels with subsequent changes (retrofitting of penetrations etc.).
- Good compensation for lateral tolerances (approx. 5 mm / roll cap)
- Excellent linear expansion behaviour with thermal load
- Prefabrication of panels simple with mobile roll former
- Suitable for use on winter building sites
- Time-saving assembly over large areas thanks to prefabricated fasteners
- Straightfoward, time-saving installation of terminations
- Prefabricated eaves and ridge terminations
- Efficient fitting of roll cap thanks to Click device on both sides
- Few tools required:
  Assembly over large areas with cordless screwdriver
- Designed to be especially efficient whatever the roof structure
- Minimum waste: With diagonal cuts at valleys and hips, etc. the offcut can be re-used
- Penetrations on low-gradient roofs created with waterproof soldered joints. Less effort in terms of labour / time and tool requirements compared with necessary welding of light metals for waterproof joints
- No cracking noises with thermal linear expansion in comparison with mass-produced crimped seam systems with other metal roofing materials

3.6 Characteristics
- Application:
  Roof pitch ≥ 3° bis 75°
  Facades ≥ 75°
- More rainproof due to height of seams (47 mm)
- Metal thickness of roofing: 0.70 mm and 0.80 mm
- Surface qualities:
  RHEINZINK-CLASSIC
  bright rolled,
  RHEINZINK-prePATINA blue-grey and RHEINZINK-prePATINA graphite-grey
- Maximum panel lengths: 25 m
- Ventilated and unventilated roof systems
- Excellent thermal expansion behaviour
- Benefit in terms of building phys-ics:
  Increased size of joint between seam and roll cap facilitates vapour pressure equalisation

3.7 Sound Insulation Value R'_w

In 2005 joint testing was carried out with the organisation Ingenieurgesellschaft für technische Akustik, subjecting double standing seam roofing to the measurement of airborne sound according to DIN EN ISO 140-3. The measured values were rated according to DIN EN ISO 717-1, and this resulted in a value of R'w of 44 dB for an unventilated roof system with a rafter height of 200 mm, full-rafter insulation and a structured underlay. From experience it is known that this value is applicable to the Click Roll Cap system. RHEINZINK roofing has been tested for characteristic noise from rain in comparison with various roofing materials These tests showed that the sound emission values for roofing made of RHEINZINK are only slightly higher than those of concrete roof tiles.

3.8 Fire Protection

Planning of the fire protection for the building is at the discretion of the planner, subject to the applicable standards and regulations.
The requirements on fire protection for buildings are laid down in DIN 4102 and the relevant building regulations of Germany's federal states and should be agreed in each case with the local fire services department (e.g. fire prevention). They depend on the purpose of the relevant structure and its height.

All components of the RHEINZINK-Click Roll Cap System are non-combustible and in accordance with DIN 4102, are made of materials with a fire rating of A1. When combined with suitable substructures, they comply with even the most stringent fire protection requirements.

In addition, the Click Roll Cap system satisfies the requirements of the German Model Building Code (MBO) or the building regulations of Germany's individual federal states as regards its suitability as "Hard Roofing". Where the following prerequisites are met, it is resistant to floating/burning materials and radiant heat:

- RHEINZINK-Click Roll Cap System installed directly on softwood boarding for all roof pitches
- RHEINZINK-Click Roll Cap System for roof pitches < 20° with
- suitable softwood boarding as well as rigid substructures (e.g. mineral wool) with joints < 5 mm and Vapozinc structured underlay
- RHEINZINK-Click Roll Cap System laid on bitumen underlay with an inlay of glass fibre fleece/glass-fibre fabric with AIR-Z structured mat according to DIN 4102-4 for all roof pitches

We would be delighted to send you test certificates on request!

3.9 Lightning Protection

The roofing can serve as natural elements of the lightning protection system. The provisions of DIN EN 62305-3/Supplement 4 apply here.

4. Planning of Roof Areas

The bay width for the Click Roll Cap system necessary in terms of function or possible in terms of design is calculated as a function of the roof height above the ground level, the wind uplift load and the shape of the roof. See below for suggestions regarding details for design of the connections.
Please contact RHEINZINK's sales advisors should you require detailed design that is customised for your project. They would be delighted to help to realise your ideas.

4.1 Roof Systems

In principle all unventilated and ventilated roof structures are suitable for roofing with the RHEINZINK-Click Roll Cap System. The use of structured underlays underneath zinc depends on criteria of building physics such as fire and moisture protection.
If the roll cap system is laid on VAPOZINC, it is essential to use the higher fastener as this provides for thermal linear expansion of the roll cap panels and avoids them becoming bowed.

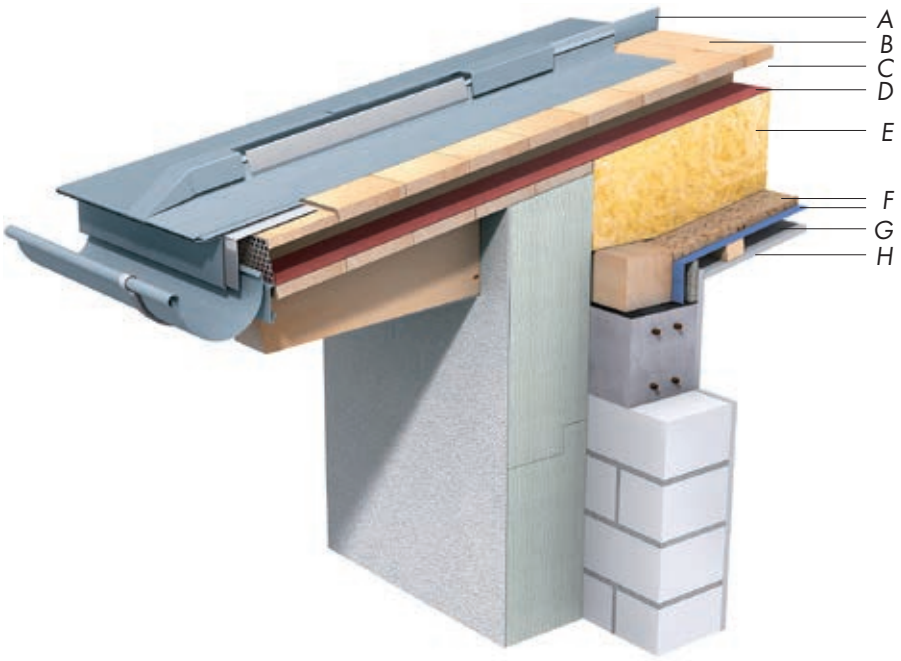

Fig. 7: Construction example with installation of Click Roll Cap system on softwood boarding

4.1.1 Roof Structure ventilated Roof System

A RHEINZINK-Click Roll Cap System
B Softwood boarding, square-edged sawn in parallel, grading S 10 as per DIN 4074-1 with b < 160 mm and d < 24 mm
C Ventilated air space – minimum height as a function of roof pitch, see Table 2
D Underlay as per EN 13859-1 designed as breathable functional layer or rigid sheet underlay as per EN 14964, with sd-values acc. to DIN 4108-3, Table 3
E Thermal insulation as full-rafter insulation in the required thicknesses and as material as per EN 13164 to EN 13171
F Diffusion-inhibiting layer with sd-value acc. to DIN 4108-3, Table 3, poss. also taking the form of plywood sheathing or softwood fibreboard (with the effect of improving summer thermal protection) – airtight layer
G Installation level
H Interior lining

Roof pitch	≥ 3° to ≤ 15°	> 15°
Ventilated air space, minimum height	80 mm	40 mm
Intake or exhaust slots, min. net width	40 mm	30 mm
Gross cross-section of RHEINZINK-Diamond Mesh Sheet, 63 % free ventilation shaft	approx. 65 mm	approx. 50 mm
Gross cross-section of diamond mesh sheets with free ventilation shaft of approx. 46 %	approx. 90 mm	approx. 70 mm

Table 2: Depth of air space as a function of roof pitch

Vapour diffusion-equivalent air layer thickness s_d m	
outside $s_{d,e}$ [1]	inside $s_{d,i}$ [2]
≤ 0,1	≥ 1,0
0,1 < $s_{d,e}$ ≤ 0,3	≥ 2,0
0,3 < $s_{d,e}$ ≤ 0,2	$s_{d,i}$ ≥ 6 $s_{d,e}$
> 2,0	$s_{d,i}$ ≥ 6 $s_{d,e}$

[1] $s_{d,e}$ is the sum of the values for vapour diffusion-equivalent air layer thicknesses of the layers located above the thermal insulation layer up to the first ventilated air layer.

[2] $s_{d,i}$ is the sum of the values for vapour diffusion-equivalent air layer thicknesses of the layers located below the thermal insulation layer or below any under-rafter insulation up to the first ventilated air layer.

[3] Gilt nur für den Fall, dass sich weder Holz noch Holzwerkstoffe zwischen $s_{d,i}$ und $s_{d,i}$ befinden.

Table 3: Allocation of values for vapour diffusion-equivalent air layer thicknesses of layers above/below the thermal insulation layer; excerpt from DIN 4108-3

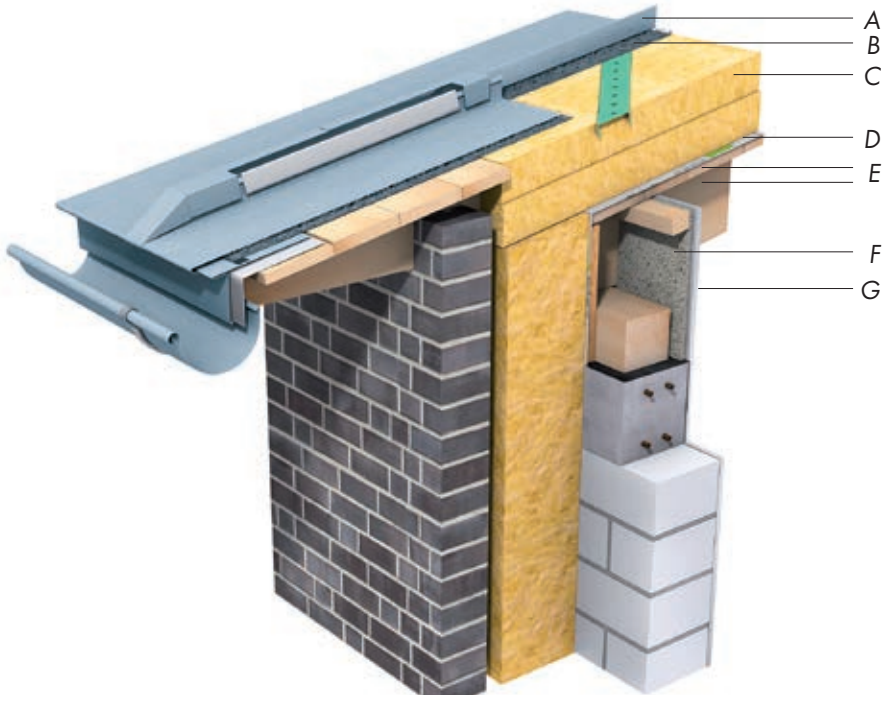

Fig. 8: Construction example with installation of Click Roll Cap system on Rockwool® Prodach insulating system

4.1.2 Roof Structure unventilated Roof System

A RHEINZINK-Click Roll Cap System with click roll cap fastener (high version)

B VAPOZINC structured underlay as functional layer with properties as per EN 13859-1 and an s_d-value < 0.1 m

C ROCKWOOL®-Prodach insulating system in the thicknesses specified by DIN 4108-2 and EnEV in their latest version

D Diffusion-inhibiting layer with variable vapour control layer Intello® Rockfol climate

E Supporting structure, with uppermost layer consisting e.g. of:
- steel trapezoidal sheeting with technical approval as per DIN 18807
- Softwood boarding

F Installation level

G Interior lining

4.2 Length of Panels and Metal Thickness

To permit thermal expansion with the RHEINZINK-Click Roll Cap System a gap of 5 mm to the fastener should be left on each side and the upfolds angled outwards accordingly.
Given the relatively unproblematic system-specific linear expansion behaviour of the panels, their length is merely limited in relation to building design or roof penetrations. The roofing system is suitable for panel lengths of up to 25 m.

Mono Pitch Roofs: please note
However, given our practical construction experience we recommend limiting the panel width to a bay width of ≤ 485 mm in the case of mono pitch roofs. This will avoid noise being caused by the arching of panels through uplift in high winds. In case of mono pitched roofs in exposed locations and also for mono pitched roofs on softwood boarding with open gaps we also recommend using a metal thickness of 0.80 mm. The installation of structured underlay is only of limited use when it comes to preventing noise.
See Table 4 for the weight per m² (incl. roll cap). Other grid measurements are of course also possible here.
The metal thickness to be selected depends on the length and width of the panel, the wind loads, design of the connections and terminations as well as positioning of the fixed clip area.
With panel lengths > 20 m a metal thickness of 0.8 mm should generally be used.

Coil width	Bay width approx.	Material-spec. allowance incl. cap	Approx. wgt/m² with 0.7 mm	Approx. wgt/m² with 0.8 mm
470 mm	385 mm	~ 52 %	8.1 kg/ m²	9.2 kg/ m²
570 mm	485 mm	~ 50 %	7.5 kg/ m²	8.6 kg/ m²
600 mm	515 mm	~ 47 %	7.3 kg/ m²	8.4 kg/ m²
670 mm	585 mm	~ 42 %	7.1 kg/ m²	8.1 kg/ m²

Table 4: Weight of RHEINZINK-Click Roll Cap System per m²

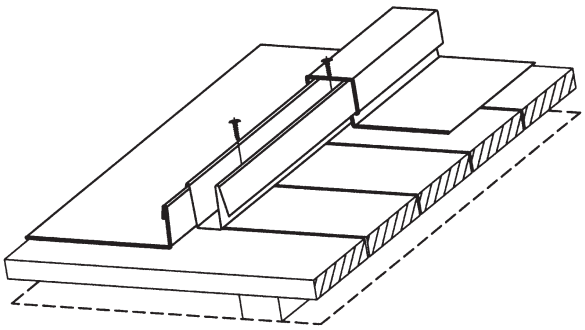

Fig. 9: RHEINZINK-Click Roll Cap System – fixing of roll cap panel to fastener as well as roll cap to fastener

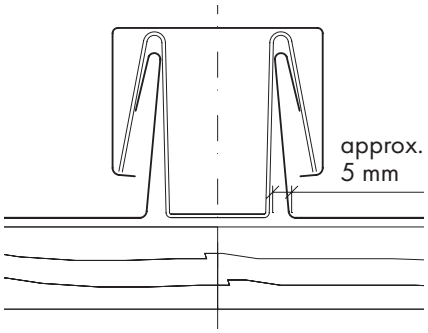

Fig. 10: Spacing of seam to fastener at base

4.3 Division of Roof Areas

Number of Fasteners and Spacing

The number of fasteners and their spacing are calculated as a function of the expected wind uplift loads. This depends on the design loads calculated by the engineer for the building according to EN 1991-1-4.

As a general rule the maximum spacing for the fasteners is 1.50 m (= 1.0 m between fasteners).

Besides the wind uplift loads, the tables indicating the number of fasteners required also specify the screw fixing necessary, the number of screws per fastener and the fastener spacing. The adjacent fastener spacing and the number of screws necessary per fastener should be used here according to the wind uplift loads determined by the engineer.

Coil width (C)	Bay width approx. (A)	Panel width without seam (S)
470 mm	385 mm	345 mm
500 mm	415 mm	375 mm
570 mm	485 mm	445 mm
600 mm	515 mm	475 mm
670 mm	585 mm	545 mm
C mm	A = C - 85 mm	S = C - 125 mm

Table 5: Panel widths of RHEINZINK-Click Roll Cap System referred to coil and bay widths

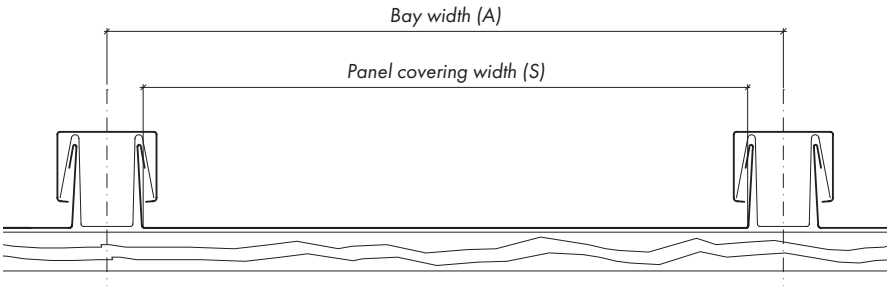

Fig. 11: RHEINZINK-Click Roll Cap System, bay width and panel covering width

Determination of Bay Width

- Determination of actual length/width of roof area including roof overhangs and overlaps
- Consideration of any distinctive architectural features of the facade (e.g. vertical joints, grid for supports or windows)
- Division of roof area using a standard bay width (see Table 5) or bay widths which have been individually determined for the Click Roll Cap system (see Table 5, bottom line)
- Determination of necessary number of panels

Tables for number of fasteners on pages 52 - 55

When sectioning a roof area, it is essential to take into account penetrations such as chimneys, skylights and dormers. At the edge of the penetration there must be a minimum distance of 200 mm from such roof components to the next seam. This will ensure proper connections in terms of workmanship and economy for incorporation of the penetration in the roofing as a whole and is simple to carry out. Under certain circumstances consideration should also be given to using adapter panels, which may deviate from the standard bay width.
The length of the panels is measured from the front edge of the eaves flashing to the substructure of the ridge flashing. Here it is then necessary to add allowances for the panel lengths as appropriate for turnover of the eaves and ridge design (see example of calculation on page 25 for panel length, taking account of thermal behaviour).

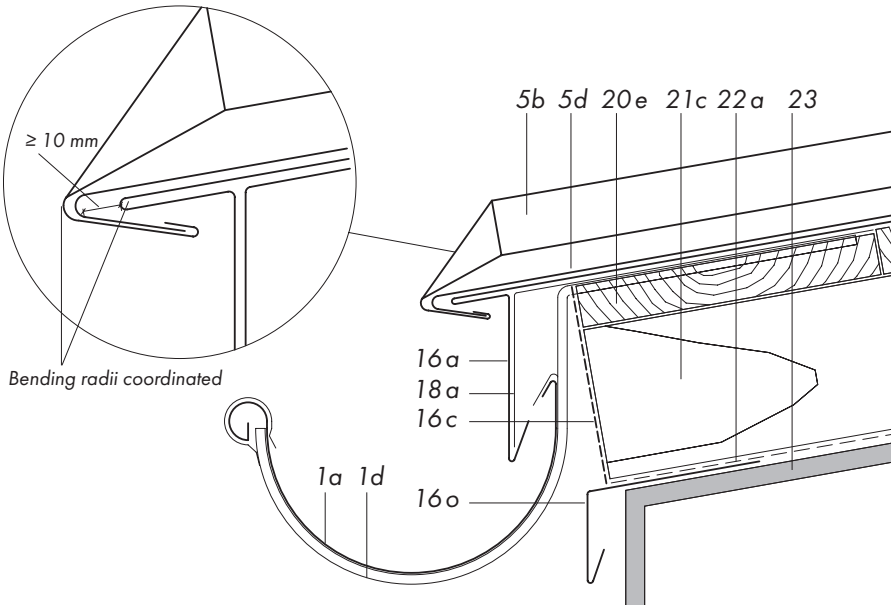

Fig. 12: Hollow seam of eaves termination cap around fold-back of panel

1 RHEINZINK-Roof Drainage
- a Gutter
- d Gutter bracket, cladded with RHEINZINK

5 RHEINZINK-Click Roll Cap
- b Eaves termination cap
- d Roll cap panel

16 RHEINZINK-Building Profile
- a Eaves flashing
- c Perforated strip
- o Eaves profile

18 Support Profile
- a Galvanised Steel

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

Depending on the positioning of the fixed clip area, a joint of approx. 10 mm or more should be provided as a function of expansion at the ridge between the panel upstand and e.g. the installation board or a piece of squared timber.
Expansion of the panels at the eaves must also be taken into account according to the positioning of the fixed clip area. The panel fold-back at the eaves is min. 30 mm.

Example of Calculation
for thermal linear expansion of the panel length under consideration of the installation temperature:

- Roof: Double pitch roof, gradient 9 degrees
- Panel length 20 m
- Installation temperature +15 °C
- Fixed clip area centred, panel length to be taken into account: up and down 10 m in each case
- Coefficient of expansion: 2.2 mm/m at 100 K;
- Temperature range: - 20 °C to + 80 °C = 100 K

Expansion:
Temperature range
+80 °C - (+15 °C) = 65 K

$$\frac{10\ \text{m} \times 2{,}2\ \text{mm} \times 65\ \text{K}}{100\ \text{K}} = 14{,}3\ \text{mm}$$

Contraction:
Temperature range
-20 °C - (+15 °C) = 35 K

$$\frac{10\ \text{m} \times 2{,}2\ \text{mm} \times 35\ \text{K}}{100\ \text{K}} = 7{,}7\ \text{mm}$$

This calculation gives rise to the following consequences in terms of detailing.

Roof pitch	Positioning of fixed clip area from top	Panel length
3°	Centred	≤ 25 m
4° - 30°	1/3 Rafter length	≤ 25 m
> 30°	1/4 Rafter length	≤ 25 m

Tabelle 6: Fixed clip area and maximum panel lengths

Design of Eaves
A joint of min. 10 mm should be created between the eaves turnover of the panel and the eaves flashing. The eaves termination cap can be fitted as a prefabricated component with a hollow turndown at the eaves turnover of the panel.

Design of Ridge
A joint of min. 15 mm should be created between the upfold of the panel and the squared timber/installation board (or similar).

4.3.1 Fixed Clip Area
The fixed clip area for the roofing should be determined as a function of roof pitch according to Table 6. Depending on the shape of the roof the areas at the edge should be provided with more fasteners due to the higher wind uplift loads. The positioning of the individual Click Roll Cap Fasteners can be determined by marking out the roof area. The distances specified in the fixing tables should be observed here.
The first Click Roll Cap Fastener is fixed in place approx. 230 mm from the eaves. For the Roll Cap fastener positioned on the ridge side a distance of min. 100 mm to max. 300 mm from the ridge termination is sufficient. Where it is necessary to make connections to penetrations which are some distance from the sectioning grid of Roll Cap fasteners, it should be checked whether the detailing has to be supported by a fastener.

4.3.2 Installation and Fixing

The building and site-specific wind loads must be taken into consideration for fixing of the roll cap panels. The eaves profile with roll caps is not used to absorb wind loads, and underlays are not capable of taking up structural loads either.

The roof areas are sectioned to determine the positions of the fasteners in the field as well as the edge areas of the roof. The Click Roll Cap Panels are laid out over the roof area, spaced at approx. 50 mm.

The Click Roll Cap Fasteners are fixed in place with the fixings required for the substructure:

- Softwood boarding:
  min. 2 screws
  e.g. EJOT® JT3-2-6.0 x L in mm
  when using a structured underlay:
  min. 2 screws
  e.g. EJOT® JT3-X-2-6.0 x L in mm
- Plywood sheathing: min. 2 screws
  e.g. EJOT® JT3-2-6.0 x L in mm
  when using a structured underlay:
  min. 2 screws
  e.g. EJOT® JT3-X-2-6.0 x L in mm

The panels should be riveted to at least one roll cap fastener in the fixed clip area as soon as the roll cap fasteners have been fixed in place .
To create the fixed points between panel/roll cap fasteners we recommend using stainless steel rivets, size 5.0/10 mm.
To fix the roll caps to the roll cap fasteners we recommend using stainless steel rivets size 4.0/10 mm.

Fig. 13: Marking of roof area

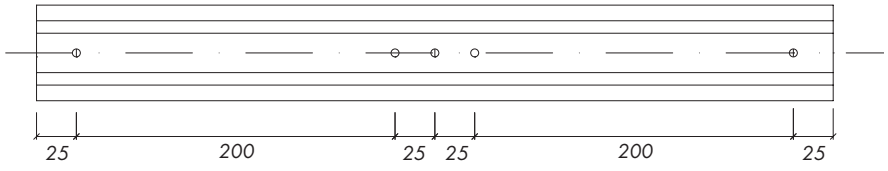

Fig. 14: Top view of Click Roll Cap Fastener with hole pattern

4.3.3 RHEINZINK-Click Roll Cap Fastener

Unlike the fixed and sliding clips of the standing seam systems the RHEINZINK-Click Roll Cap Fastener is designed so that it is solely subject to structural suction forces. This is an advantage both in relation to the number of fasteners and the number of screws for each fastener.
The base of the fastener is provided with fixing holes for different applications. The two or four outer holes are used to fix the fastener in place with screws. The centre hole is not suitable for fixing the fastener in position.

Screws recommended for different Substructures

Softwood boarding and plywood sheathing (with/without using a structured underlay):
e. g. EJOT® JT3-2-6,0 x L

Rockwool® metal rails:
e. g. EJOT® JT3-2H-5.5 x L in mm

Trapezoidal profiles:
e. g. EJOT® JT3-2H-5.5 x L in mm

Equivalent screws made by other manufacturers are permissible.

4.3.4 Installation Sequence

1. Installation of functional layer (take note of manufacturer's guidelines and trade regulations)
2. Installation of battens/squared timber on rafters
3. Installation of softwood boarding (first board at eaves is lowered)
   Note: Installation of the eaves flashing with or without water drip must be taken into consideration here as well as the thickness of the metal and an additional galvanised continuous cleat.
4. Sectioning and installation of the gutter brackets, the RHEINZINK-Snap-Lock Bracket system as well as the RHEINZINK-Guttering.
5. Installation of the galvanised continuous cleat as well as the continuous cleat for the eaves
6. Marking of the roof area, e.g. from verge to verge to determine positioning of the roll cap fasteners
   - distance of the first roll cap fastener to the front edge of the eaves flashing min. 23 cm
   - maximum distance between roll cap fasteners according to values from the wind load tables
7. Installation of the first Click Roll Cap Panels spaced at approx. 50 mm
8. Installation of Click Roll Cap Fasteners with the specified distance
9. Fixing of panel to a fastener on the left and right in the fixed clip area with one rivet each (protective plate essential, see Fig. 16).
10. Creation of additional fixed points (up to 3 m fixed clip area per panel)
11. Attachment of eaves termination cap to eaves turndown of panel with additional hollow seam of tongue around panel turndown.
12. One Click Roll Cap Fastener must be secured at the join between the roll caps.
13. Installation and fixing of roll caps starting from the eaves by clicking into position. The roll caps are available in lengths of 3 to 6 m (in increments of 1 m). Each roll cap is flared at the factory (L = 60 mm) to allow them to be overlapped. The roll caps and eaves termination should be affixed to the roll cap fastener with one rivet each on the right or left to prevent slipping, ideally fitted "invisibly" at the end of the roll cap, which is covered by the next cap.

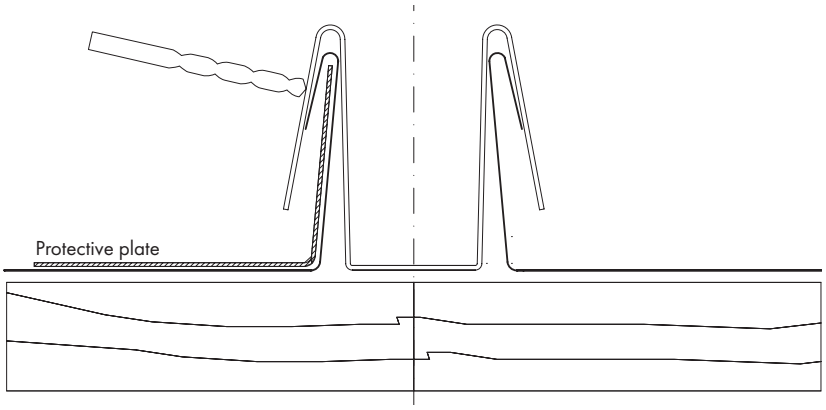

Fig. 15: Drilling hole for rivet using a protective plate to prevent damage to panel

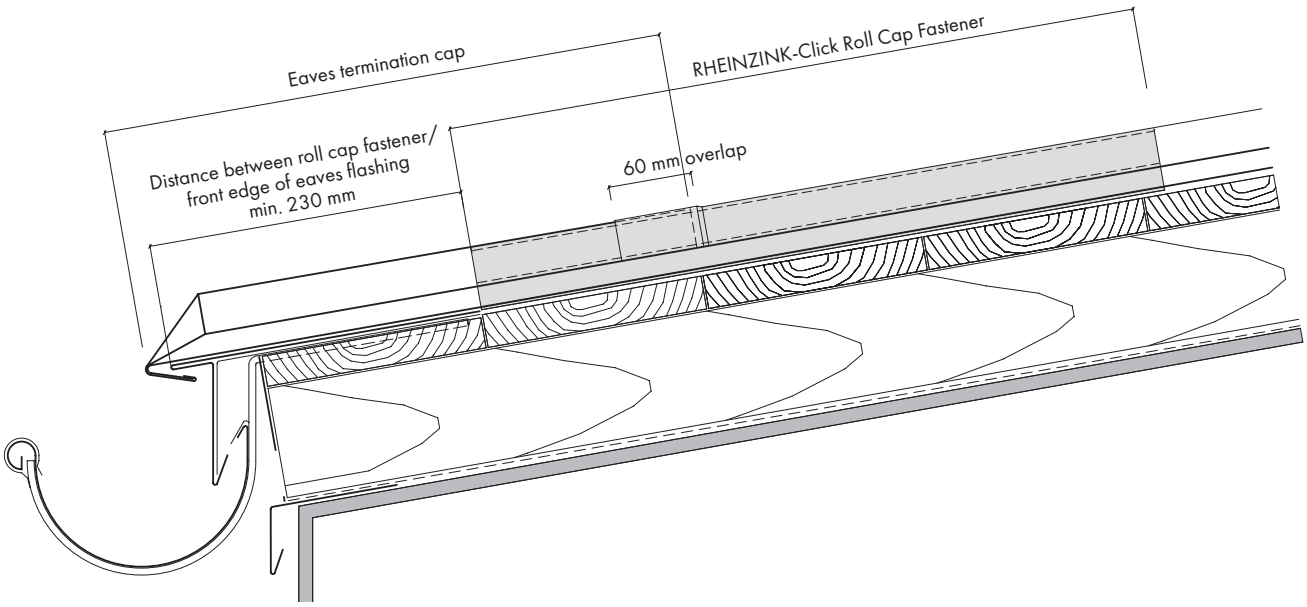

Fig. 16: Eaves with positioning of roll cap fastener and overlap area of roll caps

4.3.5 Fixing of Roll Caps

The roll caps should be fixed in position independently of each other by securing the upper end to a fastener with one rivet. As each one is covered by the next roll cap, fixing is invisible. If the roll caps are to be bonded at the join, it must be ensured that bonding covers the entire surface of the overlap (see ZVSHK leaflet about bonding). Several roll caps should not be joined/bonded together due to excessive linear expansion.
If there is no need for fixing to be invisible, two roll caps can be rivetted together at the join with the roll cap fastener. In this case allowance must be made for expansion of the cap in an upward or downwards direction.

Fig. 17: Drilling a hole for the rivet

Fig.18: Installation of rivet

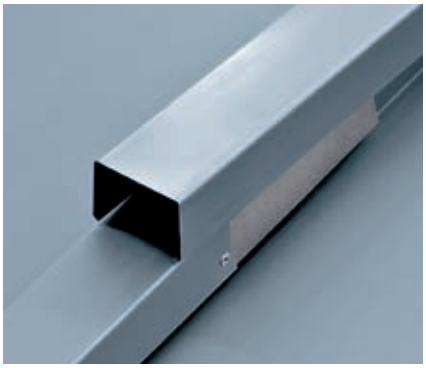

Fig. 19: Rivet fixing once completed

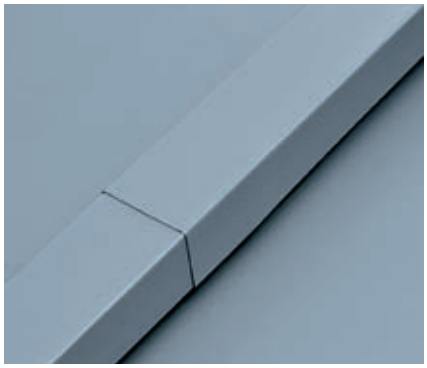

Fig. 20: Overlap with covering roll cap

4.4 Retrofitted Solar Units

Square steel tubing or U-profiles made of stainless steel can be used to retrofit a Solar PV or SolarThermie unit. U-profiles in the relevant material thickness are positioned on the roll cap fastener and rivetted to the foldover of the fastener at the side. The structural requirements for retrofitted solar units and fixing to the roll cap fasteners and fasteners in the substructure must be specified by a structural engineer.

4.5 Curved Areas

Convex curves in the roll cap system are a special case that is virtually impossible to realise economically with the machines available on the market. Roof areas with a radius > 65 m can be created with straight panels and roll caps. When straight panels are installed on curved surfaces, a slight increase in the waviness typical of thin metal sheeting should possibly be expected (depending on the angle of view).

5. Roll Cap Rollformer

5.1 Data

The mobile roll cap rollformer can be used to produce panels on site in any length that might be required.

Technical Data

- Length: 3.00 m
- Width: 1.80 m
- Height: 1.20 m
- Weight: 1.700 kg
- Three-phase gear motor, 380 V, 50 Hertz, 3 kW
- Fuse 16 amp
- Combined on/emergency stop switch with undervoltage release
- Direction of rotation changed via phase changing switch on connecting cable
- Inlet width infinitely variable between 425 - 925 mm.
- can be lifted by crane

The left-hand set of rollers is fixed, while the right-hand set is brought into position by turning the handwheel. The material is inserted between the two stops, with minor movement of the material being possible. Once the panels have reached the required length, they can be cut off manually, or you can use individual coils with the right panel length. To prevent bending after forming, make sure that the finished panels are fed out over their full length onto a scissor table or a stable base.

Single-sided profiling is also possible with the roll cap rollformer, so permitting combination with standing seam profiles or tapered panels without difficulty. When combined with the standing seam system, the standing seam profile has to be produced first (under-cloak or over-cloak).

5.2 Rental

Roll cap rollformers are readily available for hire. Please contact your local RHEINZINK sales office or speak to one of our technical sales advisors or contact us via **www.rheinzink.com/contakt**.

5.3 Recommendations for site-profiled Panels

A suitable location should be identified for setting up the roll cap rollformer on site. It is of course also possible to set up the machine on a stable and if necessary, slanting platform that allows panels to be directly transported to the sloping roof and set down. In this case it is necessary to take account not only of the weight of the rollformer and coils but also the weight of the operator.

Panels produced on site should be stored under dry conditions with ventilation and must be protected from rain and condensation at all times. The same applies to the rollformer itself and any coils awaiting processing.

Another option for transporting panels is to lift with a crane on spreader bars.

When producing tapered panels, pay special attention to tolerances. Panels which have been cut so that they are slightly smaller or larger should be stored together.

Bei der Fertigung konischer Scharen (z. B. für große Kuppeln) ist besonders auf Toleranzen bei der Vorfertigung zu achten. Entsprechend schmaler oder breiter abgeschnittene Schare sollten passend den jeweiligen Teilflächen der Dachform zugeordnet werden.

When performing single-sided profiling, make sure that sufficient space is available in front of and behind the rollformer to set up scissor tables.

6. Detailing

This section contains precise descriptions of the linear details mainly occurring with RHEINZINK-Click Roll Cap roofing.

6.1 Eaves

6.1.1 Eaves with prefabricated Roll Cap Termination

Time will be saved during installation of the RHEINZINK-Click Roll Cap System if prefabricated system components are used for the eaves and ridge termination. When installing the prefabricated eaves termination for the roll cap, make sure that the first roll cap fastener is fitted at least 23 cm from the front edge of the eaves flashing (with higher wind loads please take note of structural data!).

The use of a spacer template for the eaves turnover is a handy aid for ensuring the necessary expansion joints.

The eaves termination with seam is approx. 30 mm longer (measured from the tip of the eaves plug-in) and is cut off diagonally to the water drip in an upwards direction. This "overhang" is flanged in the free space of the Click Roll Cap Fastener to produce an angled contact surface for the eaves termination.

The prefabricated eaves termination cap is positioned on the roll cap fastener and clicked into place. The tongue of the eaves termination is secured around the panel foldover at the eaves flashing with an open angle of approx. 30° using an additional hollow seam. This allows the eaves termination to freely expand with the panel while ensuring the line along the eaves looks straight.

Here the overlap area must be generally executed with sufficient space to allow for expansion of the eaves termination cap, incorporated in the panel and the next to it independently fixed roll cap. With large panel length and thermal linear expansion the eaves termination cap should be notched for approx. 20 mm in the overlap area (Fig. 21). This measure supports the expansion behavoir of the eaves termination cap and the overlapping roll cap.

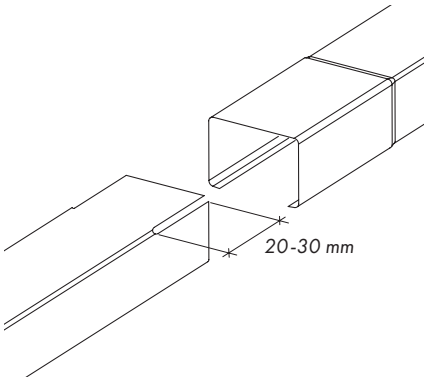

Fig.. 21: Overlap of roll cap and eaves termination cap with 20 mm incisions

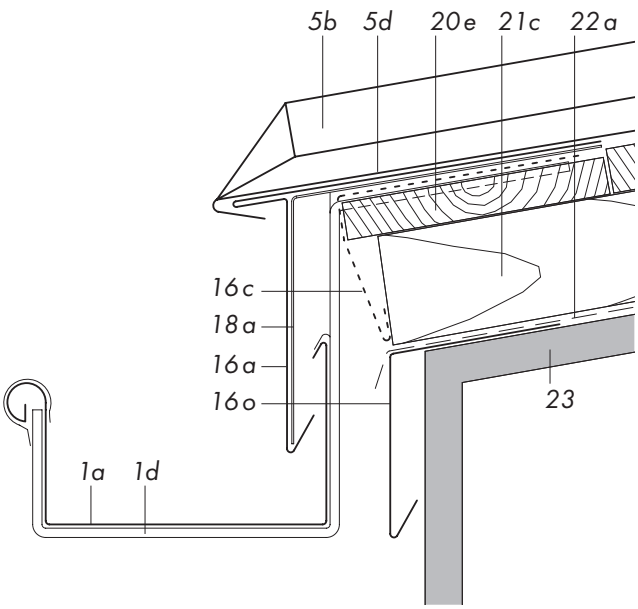

Fig. 22: Eaves with bracket-mounted box gutter
(Depth of air space as a function of roof pitch, see tab. 1, page 10)

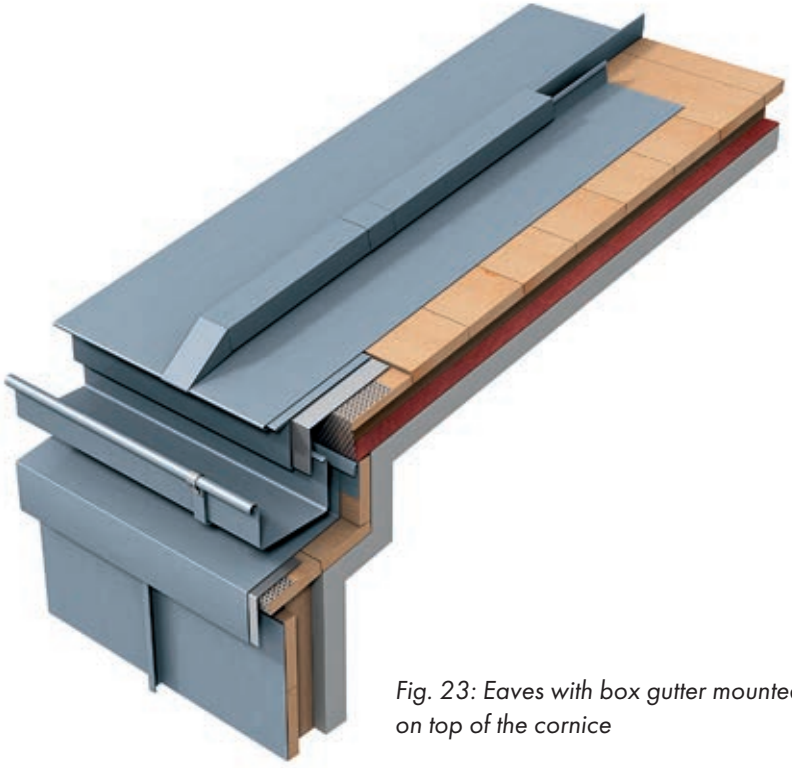

Fig. 23: Eaves with box gutter mounted on top of the cornice

6.1.2 Eaves with straight Roll Cap Termination

The (eaves-side) stopend of the roll cap is soldered in place on all sides: rivet fixings should not be used for aesthetic reasons. To prevent the stopend from bowing out, the underside should either be seamed or a hollow seam created here.

1 RHEINZINK-Roof Drainage
- a Gutter
- d Gutter bracket, cladded with RHEINZINK

5 RHEINZINK-Click Roll Cap
- b Eaves termination cap
- d Roll cap panel

16 RHEINZINK-Building Profile
- a Eaves flashing
- c Perforated strip
- o Eaves profile

18 Support Profile
- a Galvanised steel

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

6.2 Verge

When selecting a verge detail and its dimensions, it is essential to take account of the detailing on the ridge and eaves. In particular, connections such as those at the verge and eaves are so important in terms of design that they should be developed in a three-dimensional context.

To ensure the lines of the roof are as straight as possible, verges will generally require support in the form of a galvanised steel profile (min. 1 mm thick). This is not only necessary for structural reasons (edge of roof, greater wind loads), but also on aesthetic grounds. Any wave formation that occurs with thin metal sheeting will be especially visible due to the angle of view and can be avoided with the use of continuous cleats.

Cross joints in the verge flashing may be necessary in visible areas depending on the length of each verge. To prevent them from popping open, they should not overlap loosely with a visible width of 6-8 cm or more but must be connected with continuous cleats. Soldered joints should not be used here. The individual verge profiles are fixed in place using clips or rivets in the overlap.

The roof-side connection height depends on the detail selected.

6.2.1 Verge with Click Roll Cap Fastener

This detail will impress thanks to its simple installation technique and the shadow gap along the verge. Higher verge flashings have a more elegant look to them.
A galvanised continuous cleat is fitted at the verge and used to mount a fascia profile as an edge trim. This is placed against the galvanised continuous cleat to form a horizontal support approx. 10 to 12 mm wide and is held in position by the clamping effect in the Click Roll Cap Fastener. The roll cap is then clicked into place.

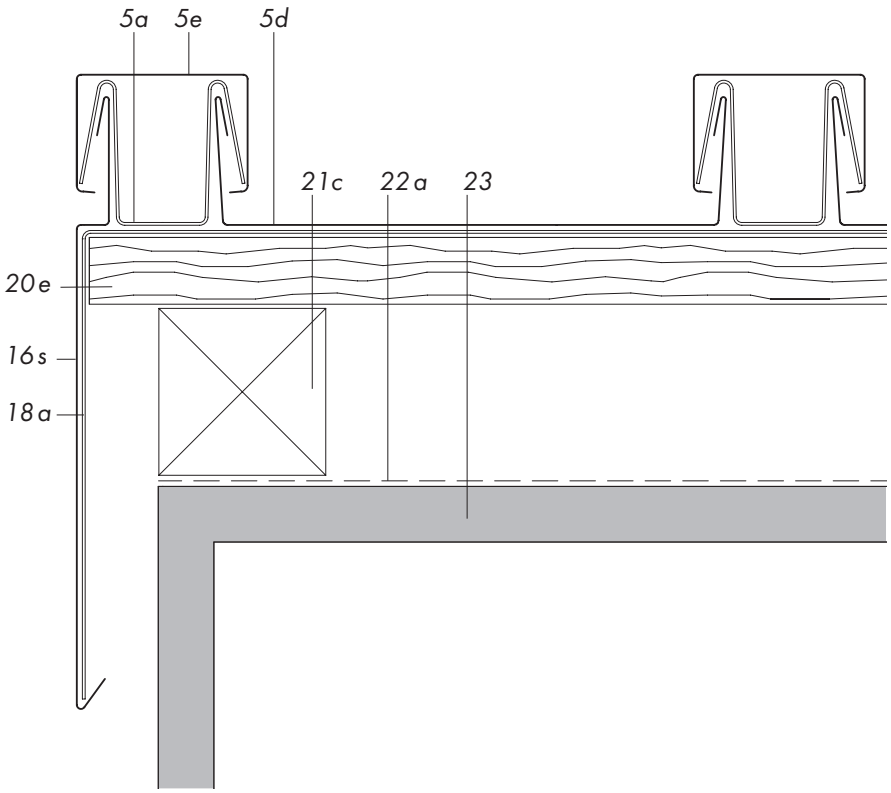

Fig. 24: Verge with Click Roll Cap Fastener

5 RHEINZINK-Click Roll Cap
- a Roll cap fastener
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- s Verge flashing

18 Support Profile
- a Galvanised steel

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

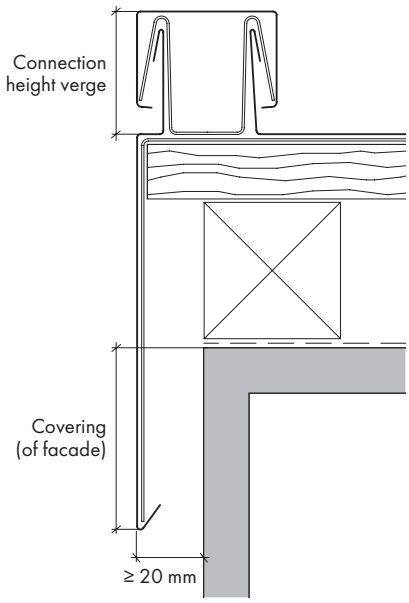

Fig. 25: Example of connection heights at verge

6.2.2 Verge with Timber Batten

On a galvanised continious cleat, which accommodates the lower fold back of the verge fascia profile, a timber batten (e.g. 6 x 4 cm) is fixed in place. On the timber batten a galvanized continious cleat is fixed on the roof side for mounting of the the verge fascia profile and the verge flashing finally installed. (see Fig. 26)

Alternatively, the verge fascia profile can be directly inserted in the roll cap system seam. The upper fold-back of the roll cap panel is rollformed at right angles to the seam. A galvanised steel sheet should also be fitted to reinforce the edge. The upper termination of the fascia profile is then inserted in the reinforced roll cap seam. Although this detail is not as wide as the version with the wooden rail, the termination is equally stable.

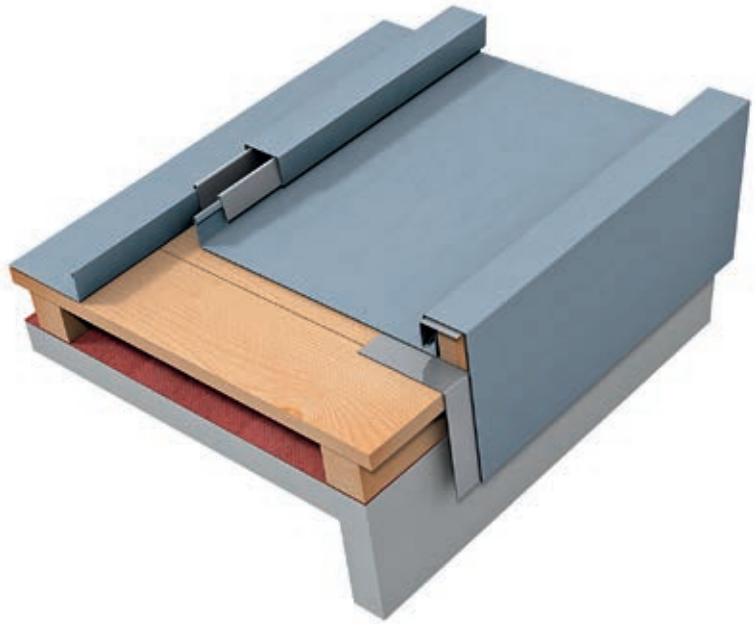

Fig. 26: Verge with fascia profile

6.2.3 Verge with Seamed Fascia Profile

With verge heights of > 20 cm or more it is no longer possible to produce a wave-free verge from a single-section bent profile with sheet thicknesses of 0.7 or 0.8 mm. Sheeting with a thickness of 1 mm is suitable here.

If your design includes sectioning with higher fascia profiles, we recommend using standing seam fascia profiles. They can be sectioned vertically with the standing seam or with an angled standing seam installed horizontally. We recommend using a bay width of between 300 and 400 mm. Please remember here that the verge-eaves and verge-ridge corners have an effect on the overall widths of the angled standing seam panels.

Verge with Profiled Design

With steep mono pitch roofs where the fascia profile of the verge and ridge are to have the same height on all sides, the height of the fascia profile for the verge will become very large due to the geometry of the roof. "Profiling" allows this to be corrected in visual terms at least by dividing up the verge into strips parallel to the slope. A shadow gap should then be included when joining the individual strips.

Building height (m)	Covering (mm)	Distance drip edge (mm)	Connection height verge (mm)
to 8	≥ 50	≥ 20	40 - 60
8 - 20	≥ 80	≥ 20	40 - 60
20 - 100	≥ 100	≥ 20	60 - 100

Table 7: Minimum connection heights for verge upfolds (fascia profile of verge simply hooked in), see example below of connection heights etc.

6.3 Mono Pitch Ridge

General
Special requirements are made on the ridge in terms of design, building physics, tightness to drifting snow and construction/seaming technique.

Design
The design of a ridge detail is frequently misjudged when it comes to dimensioning. A detailed 1:1 drawing often does not properly represent the effect of a ridge which may be installed at a height of 10 meters or more. What is more important to the design is the type of connection between the ridge and verge. Here the dimensioning of the ridge detail can either be emphasised or concealed behind the fascia profile of the verge depending on the architectural intention.

Building Physics
The ridge is the highest point of the roof and in the case of ventilated roofs, acts as a linear ventilation system. Please remember it has been scientifically proven that individual exhaust openings will not offer effective ridge ventilation and are at best only suitable for small areas (< 3 m²) .

According to the German standard, roofs with pitches < 5° do not require ridge ventilation as the air flow produced here by thermal currents is minimal. Instead the roof is ventilated via wind pressure or suction between the eaves. The construction must be equipped with a vapour barrier with an s_d-value >100 m on the room side.

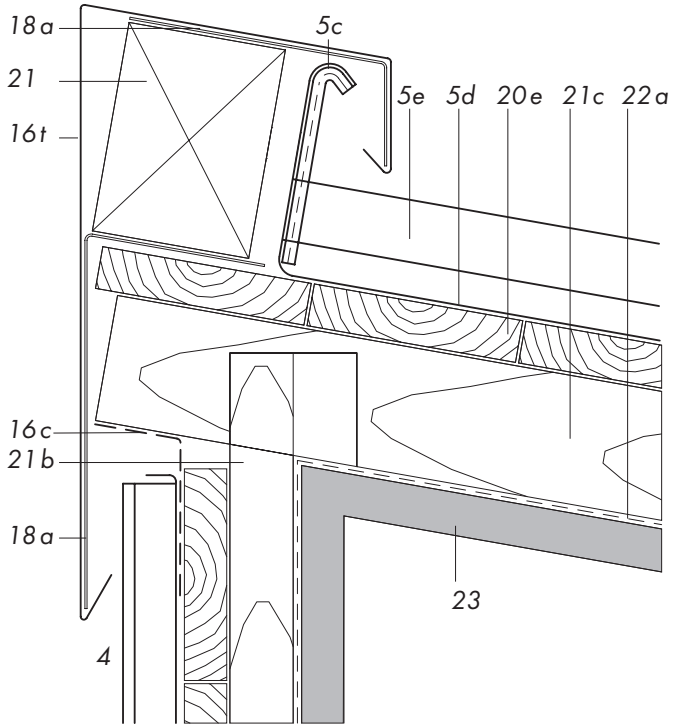

Fig. 27: Mono pitch ridge with standing seam fascia profile at side

4 RHEINZINK-Angled Standing Seam
5 RHEINZINK-Click Roll Cap
- c Ridge termination cap
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- c Perforated strip
- t Ridge flashing, mono pitch roof

18 Support Profile
- a Galvanised steel

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- b 40/60 mm
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

Drifting Snow
The ventilation openings at the ridge and the eave allow for sufficient ventilation if executed with appropriate intake or exhaust slots. In regions where drifting snow must be expected, stopping it from being blown in is a key priority. This can be reliably achieved by installing perforated sheets with round holes (46% perforations) or RHEINZINK-Diamond Mesh Sheets (63 % perforations). The expanded metals offer the combined benefits of not greatly impeding air flow while offering protection from drifting snow.

Construction/Seaming Technique
Bei belüfteten Firstausbildungen muss das obere Scharende in der Regel mindestens 8 cm aufgekantet und mit einer Rückkantung (Wasserfalz) versehen werden.

The main features of the ridge are identical to those of the double or angled standing seam. In the case of the ventilated ridge this also concerns the connection heights with roof-side ventilation (< 7° roof pitch – connection height 150 mm, > 7° roof pitch – connection height 100 mm).

Ridge Design
The panels are provided on both sides with a pinched seam which opens laterally. The outer end is turned under. Incisions of approx. 20 mm are made in the uppermost roll cap at the edges at the top and the horizontal section bent up some 20 mm. The side legs of the cap are bent approx. 20 mm to the side, with approx. 10 mm then being cut off. Finally the ridge termination cap is positioned over the squeezed folds and the foldovers of the roll cap projecting sideways and upwards.
Thermal linear expansion of the panel depends on the length from the fixed clip area to the ridge upstand. Do not forget to calculate this, and when doing so, make an allowance of at least 15 mm here.

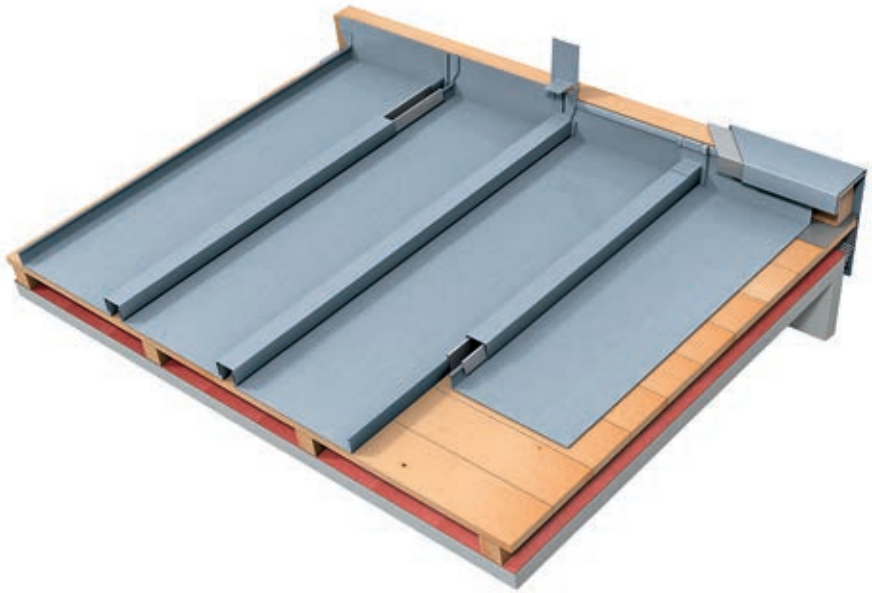

Fig. 28: Mono pitch ridge with ridge termination cap and ridge flashing

6.4 Double Pitch Ridge

6.4.1 Double Pitch Ridge with Ventilation

The necessary minimum width and height of a ventilated ridge detail depends on the following factors:

- roof pitch/height of air layer
- exposure to weathering -> connection height
- use of a round hole perforated or diamond mesh sheet
- material of substructure

For reasons of aerodynamics the passage through the ridge should measure at least 60 mm. The two ventilation openings on either side should have a minimum width of 40 mm (net cross-section).

As a general rule ventilated ridge constructions should mainly be made of wood or a suitable wood-based material. The escaping air can have higher humidity levels. Where substructures are made solely of metal, the cooling effects produced there may give rise to undesirable condensation.

To prevent rainwater pooling on the covering, the ridge flashing should be installed where possible with the same slope as the roof areas (folded to the form of the roof).

6.4.2 Double Pitch Ridge without Ventilation

One option for creating the ridge in unventilated roof structures is connection of the roll cap panel with a pinched seam. A piece of squared timber which is slightly higher than the roll cap fastener can be used for mounting the ridge flashing. The roll caps end on the ridge side with a horizontal water drip of approx. 20 mm. The panels are provided with a horizontal water drip at the same height as the roll caps so that, as in the case of a hipped design, it is possible to incorporate a ridge flashing modelled on the German batten roll cap.

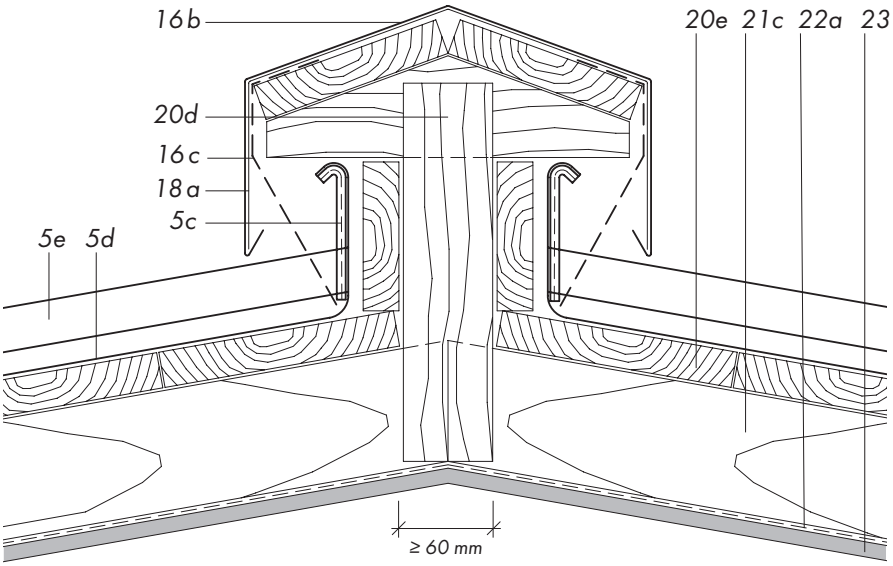

Fig. 29: Example of ventilated double pitch ridge with roof pitches < 25°

5 RHEINZINK-Click Roll Cap
- c Ridge termination cap
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- b Ridge flashing, double pitch roof/hipped roof
- c Perforated strip

18 Support Profile
- a Galvanised steel

20 Substructure
- d Wood (post with bracket)
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

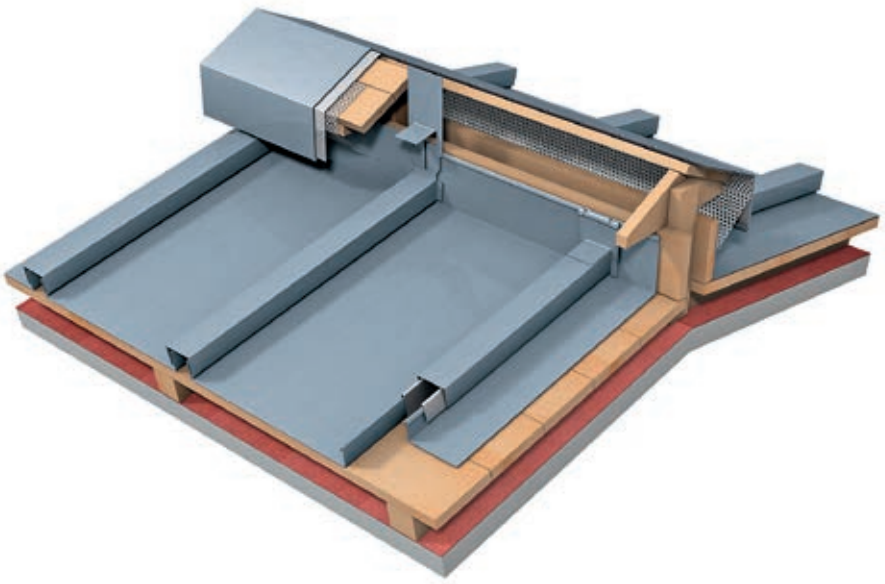

Fig. 30: Ventilated double pitch roof

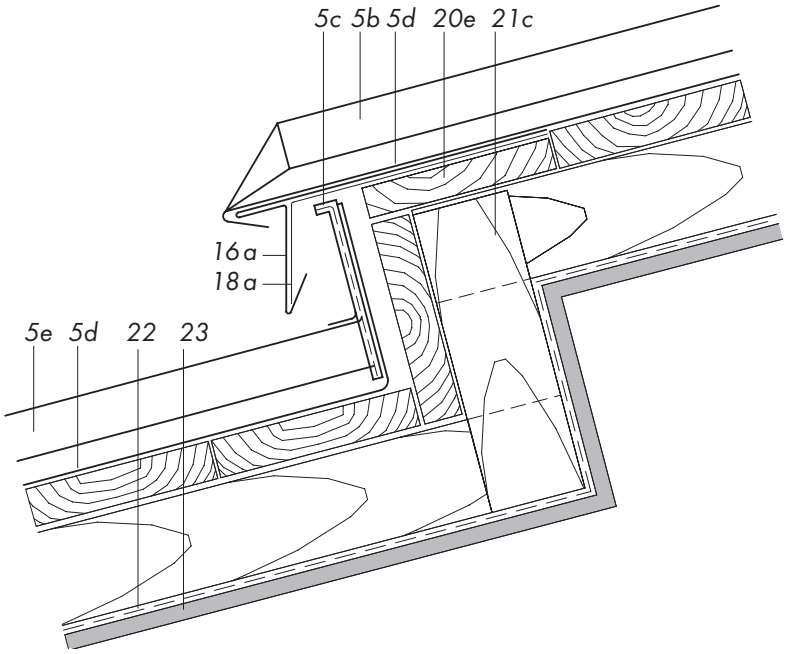

Fig. 31: Stepped fall

6.5 Stepped Fall/Cross Seams

6.5.1 Stepped Fall

Stepped falls are needed at rafter or beam lengths > 25 m at a roof pitch of < 10° for the longitudinal subdevision of the panels. Stepping for this detail generally takes the form of a parallel offset to the next higher roof area. Where stepping is to be realised with firring strips, it must be ensured that the roof pitch at the firring strip is not less than 3°. The height of the stepped fall is approx. 10 cm.

5 RHEINZINK-Click Roll Cap
- b Eaves termination cap
- c Ridge termination cap
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- a Eaves flashing

18 Support Profile
- a Galvanised steel

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

6.5.2 Cross Seam with soldered continuous Cleat

Tests involving driving rain have demonstrated that the minimum roof pitch for this installation variant is 10°.

Although this detail resembles a simple cross seam, offers additional protection: The fold-back and extra soldered continuous cleat present rising water with a double "obstruction" to overcome.

5 RHEINZINK-Click Roll Cap
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- Eaves flashing

18 Support Profile
- c Soldered continuous cleat

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

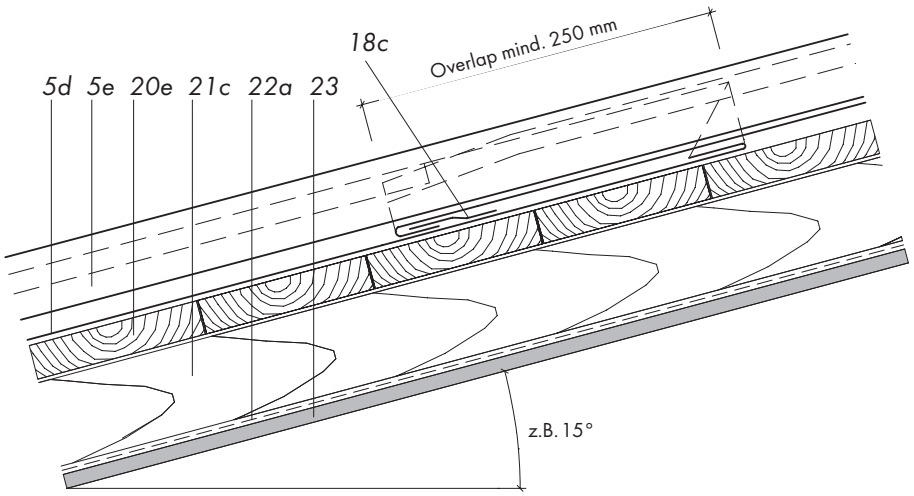

Fig. 32: Detail of cross seam with overlap of min. 250 mm (The seam of the overlapping panel must be inserted below the seam of the underlapping panel - for sloping fold use clinching pliers)

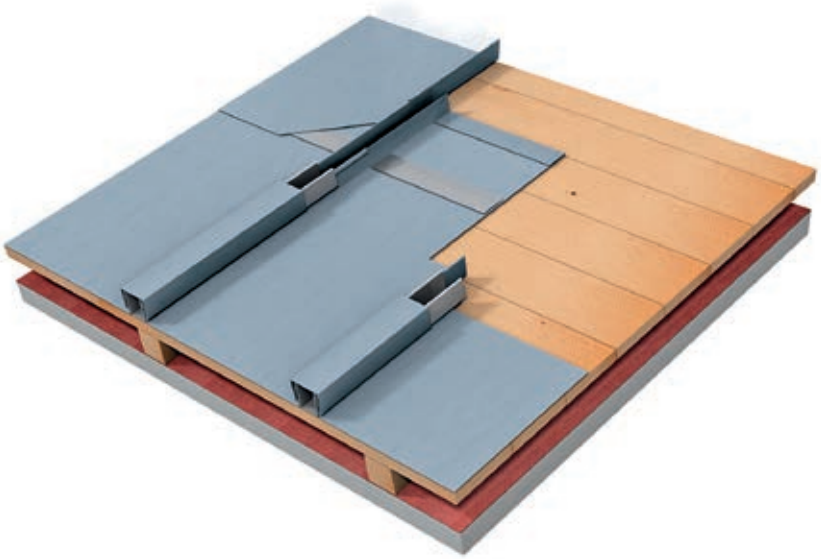

Fig. 33: Cross seam with soldered continuous cleat

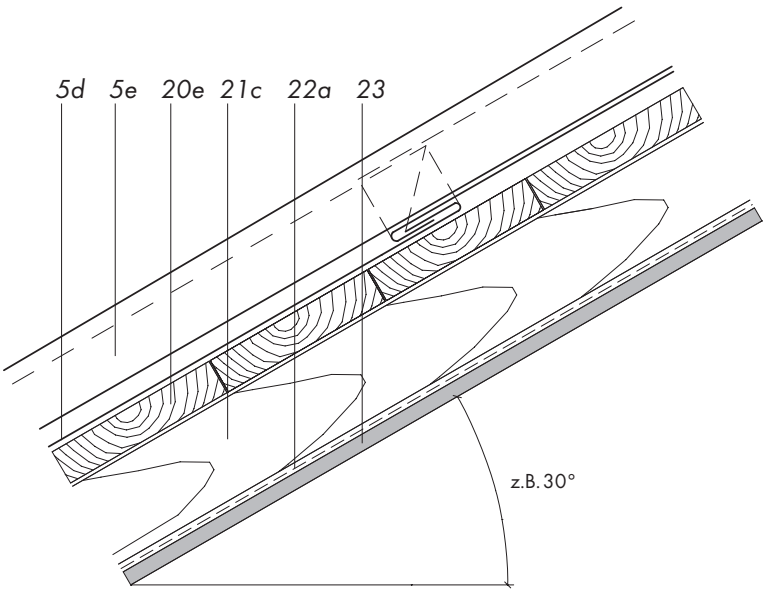

Fig. 34: Detail of cross seam with overlap of approx. 60 mm

Fig. 35: Cross seam with single seam

6.5.3 Cross Seam with single Seam

This very simple cross seam connection is created using hollow seams of 50 mm with the underlapping panel and 30 mm with the covering panel. The joint for expansion should be at least 10 mm in width. This seam connection can be used with roof pitches of min. 25°. The covering panel is adapted to fit with the underlapping panel by the installer.

5 RHEINZINK-Click Roll Cap
- d Roll cap panel
- e Roll cap

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

6.6 Side Wall Connection

Side wall connections can be made to rising masonry/render etc. or a rising seamed facade. This distinction is relevant with regard to flashings and thus also regarding the necessary connection heights. While sufficient protection from splashing water will be provided with a connection height of

> 60 mm (roof pitch ≥ 25°)
>100 mm (roof pitch < 25°)

subject to proper seaming with connection to rising seamed facades, the connection height should on average be approx. 4-5 cm greater for all other connections. In regions with above-average snowfall the connection height should generally be 15 cm for roofs with a pitch of less than 25°.

In all the above cases it is always recommended including a water drip with any exposure to driving rain.
With connection to tiled roofs, the connection height is min. 80 mm, measured from the top edge of the rooftile, depending on the roof pitch.

6.6.1 Side Connection to rising RHEINZINK Facade

The side connection to a rising RHEINZINK facade is made using a single seam at a height of
> 6 cm with a roof pitch ≥ 25° and
> 10 cm with a roof pitch < 25°.

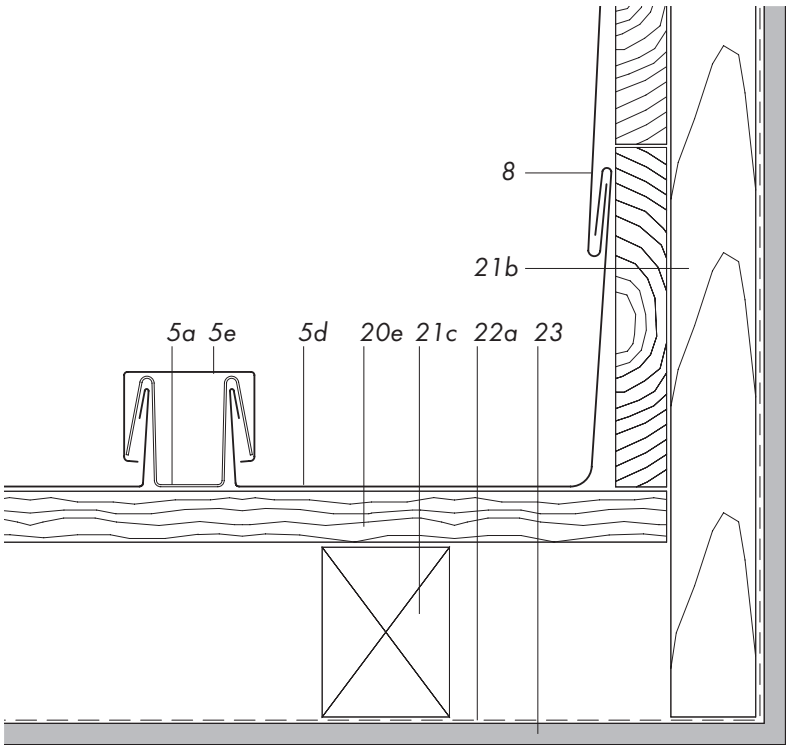

Fig. 36: Detail of wall connection to RHEINZINK-Flat Lock Tile facade

5 RHEINZINK-Click Roll Cap
- a Roll cap fastener
- d Roll cap panel
- e Roll cap

8 RHEINZINK-Tile

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- b 40/60 mm
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

6.6.2 Side Connection to rising rendered Facade

With connection to rendered facades it will be necessary coordinate with the involved plasterer the installation of the required flashing profiles before the rendering starts. It is urgently recommended that rendering is completed before the sheet metal work starts as it is virtually impossible to adequately protect areas already covered with RHEINZINK from mortar. This particularly applies whenever rain or snow is expected. This can get under protective sheeting and result in large areas of zinc hydroxide.

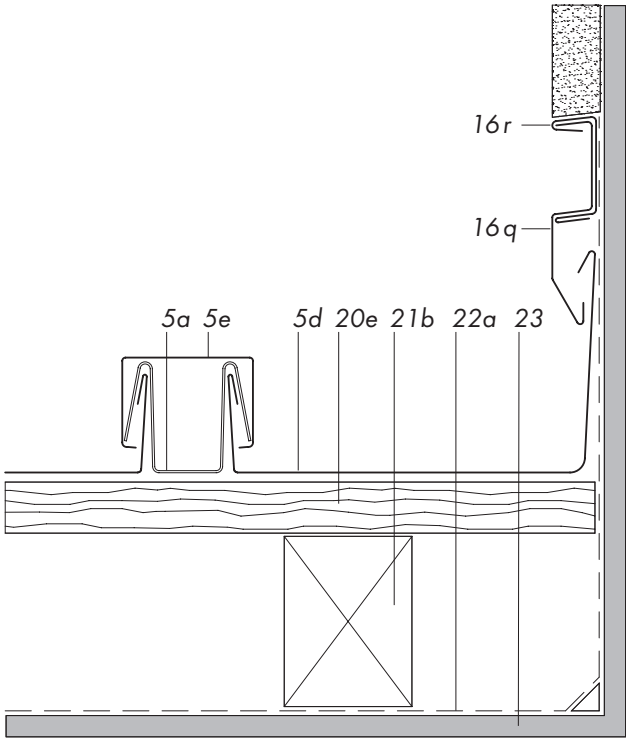

Fig. 37: Side connection to render

5 RHEINZINK-Click Roll Cap
- a Roll cap fastener
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- q Cover flashing
- r Plaster flashing

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

The setting angle of the flashing (metal thickness > 0.8 mm) should slope down min. 15°. We also recommend backing the flashing with sealant tape, depending to the uneaveness of the surface. The flashing is fixed with corrosion-protected screws at a spaceing of max. 200 mm.

6.6.3 Side Connection to rising Masonry

Whenever side connections are made to rising masonry, bricklaying should always have finished before installation of the RHEINZINK roof starts. Otherwise damage should be expected, for example from mortar, footprints or pickling solutions.

To fulfil this requirement on site, it is necessary to support the rising (facing) brickwork using a stainless steel console. The edge panel is also connected underneath. This allows rainwater to run freely off the facade while simultaneously avoiding a typical weak point.

7.6.4 Side Connection to rising Wall, Slanting

If a rising wall is not parallel to the panel, a two-step detail will be necessary for technical reasons, unless the termination is positioned at an angle, something that is a relatively complex affair. One solution is to use an edge board, which should be min. 5 cm higher than the planned connection height of the panels including fold-back. The panels are installed with a slight gap between the upstand and edge board. The edge board is used to attach the flashings of the panel terminations and is connected facing the wall with upstand, fold-back and sealing tape (Compriband).

6.7 Hip

The connection principle is identical to the description for the mono pitch ridge. The pinched seam is also provided with a fold-back at the outer end to allow a sliding cap to be fitted. A fold-back is also created for the roll cap at the upper end, with the cap of the hip batten being inserted in the fold-back. Covering the hip batten is modelled on the German batten system as a water drip at the hip should not be omitted even with milder climates.

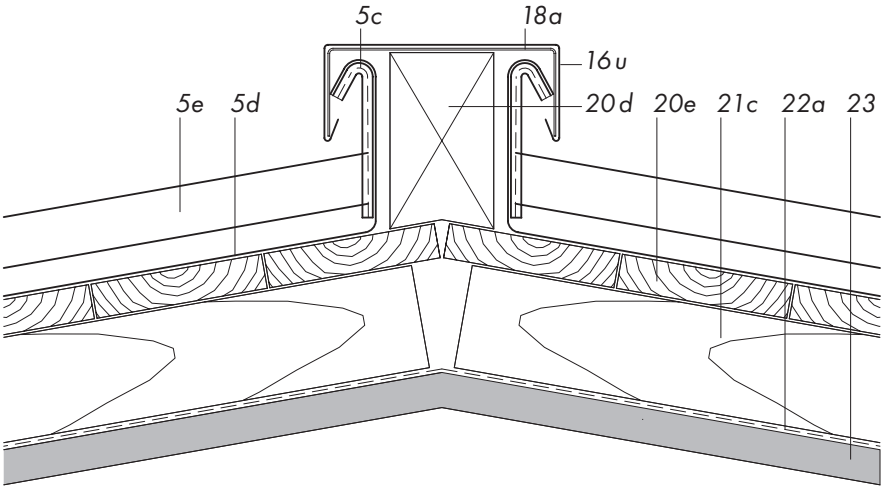

Fig. 38: Hip design

5 RHEINZINK-Click Roll Cap
- c Ridge termination cap
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- u Hip flashing

18 Support Profile
- a Galvanised steel

20 Substructure
- d Wood
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

Fig. 39: Hip

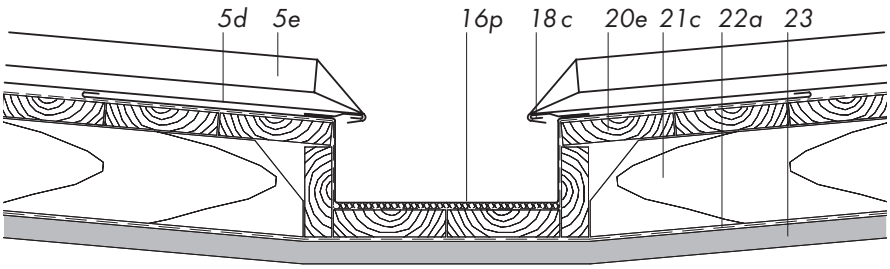

Fig. 40: box-shaped valley gutter with soldered continuous cleat and sealed overflow gutter with AIR-Z structured mat

5 RHEINZINK-Click Roll Cap
- d Roll cap panel
- e Roll cap

16 RHEINZINK-Building Profile
- p Valley profile

18 Support Profile
- c Soldered continuous cleat

19 c Structured mat AIR-Z

20 Substructure
- e Softwood boarding, thickness min. 24 mm, width max. 160 mm

21 Batten/Squared Timber
- c 80/80 mm

22 Functional Layer
- a Underlay covering

23 Supporting Structure

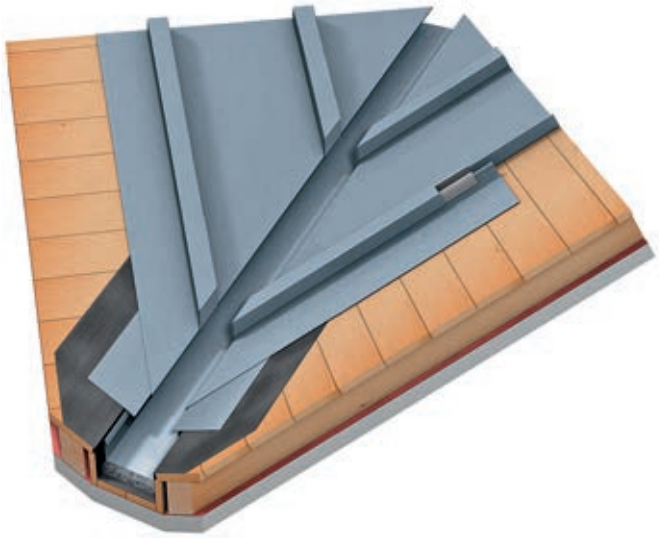

Fig. 41: Recessed valley gutter; permissible roof pitch ≥ 3° to ≤ 10° (Roll cap manually fitted with straight termination)

6.8 Valley

Whether the majority of details can be used here depends on the roof pitch. The valley pitch is of importance when it is a question of cross seam connection between the valley flashings.

6.8.1 Roll Cap Termination at Valley

The roll caps are installed at the angle of the valley with straight terminations to prevent any ingress of water in the construction at the shorter end of the panel. It must also be ensured here that the roll cap and panel have sufficient space to expand at the valley profiles.

6.8.2 Recessed Valley

Valleys must be recessed with roof pitches < 10°. This factor should already be taken into account at the design stage as this detail affects both the height of the roof structure and the appearance of the roof drainage system, which generally has to be lowered. The valley profile itself is produced as a box-shaped profile. The individual lengths are soldered together with valley pitches ranging between 3° and 10°.

A minimum height of 80 mm and a minimum width of 250 mm should be provided for the recessed valley gutter in the substructure.

Recessed valley gutter with soldered continuous cleat and sealed overflow gutter
Permissible roof pitch:
≥ 3° to ≤ 10°

Recessed valley gutter with sealed overflow gutter and AIR-Z structured mat
Permissible roof pitch:
≥ 3° to ≤ 10°

6.8.3 Valley with continuous Cleat, soldered or flanged

With roof pitches >10° the valley no longer has to be recessed, and a valley panel with soldered continuous cleat is sufficient here.

Nor does this variant have to be taken into account in the substructure. The visible face of the valley is variable, but the minimum girth is 750 mm. For the variant with a flanged continuous cleat the valley should be produced from a single length due to the difficult abutting cross connection. The panels overlap the valley on both sides for 250 mm, measured from the hook-in of the continious cleat.

Termination of the roll cap is carried out as described in the section dealing with the eaves. The terminations of the roll caps can be made by hand. Where you want roll caps to slope, the continuous cleat should be provided with a fold-back at the upper end. To make sure that the double layer of material is not visible on the surface of the panel, the height of the substructure should be adjusted accordingly. When installing the roll cap fasteners, it should be ensured that the fixing does not pierce the continuous cleat (impermissible fixed point in longitudinal direction of the valley as well as defects in water tightness).

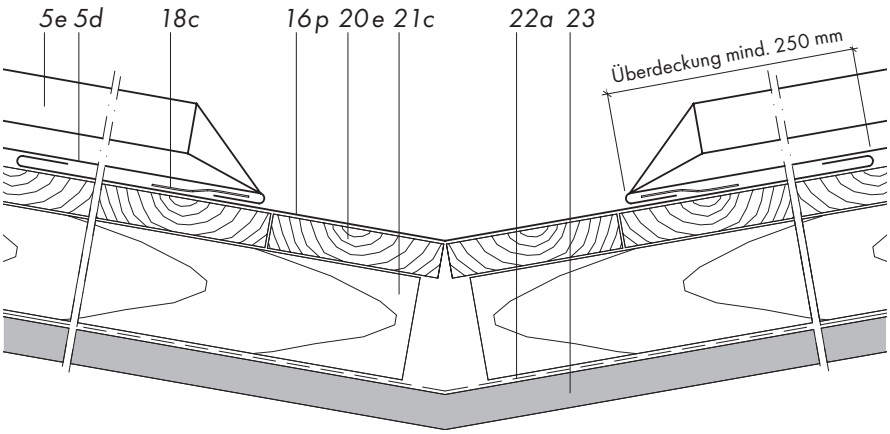

Fig. 42: Valley with soldered continuous cleat

5 RHEINZINK-Click Roll Cap
d Roll cap panel
e Roll cap
16 RHEINZINK-Building Profile
p Valley profile
18 Support Profile
c Soldered continuous cleat
20 Substructure
e Softwood boarding, thickness min. 24 mm, width max. 160 mm
21 Batten/Squared Timber
c 80/80 mm
22 Functional Layer
a Underlay covering
23 Supporting Structure

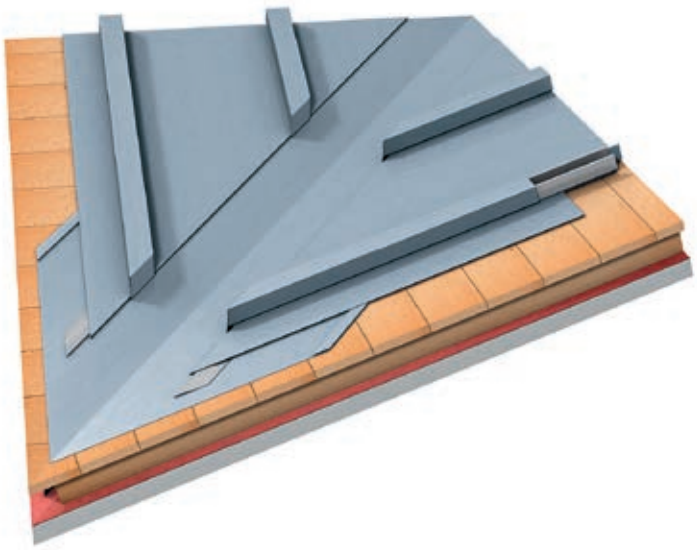

Fig. 43: Valley with soldered continuous cleat, permissible roof pitch > 10° to ≤ 30°

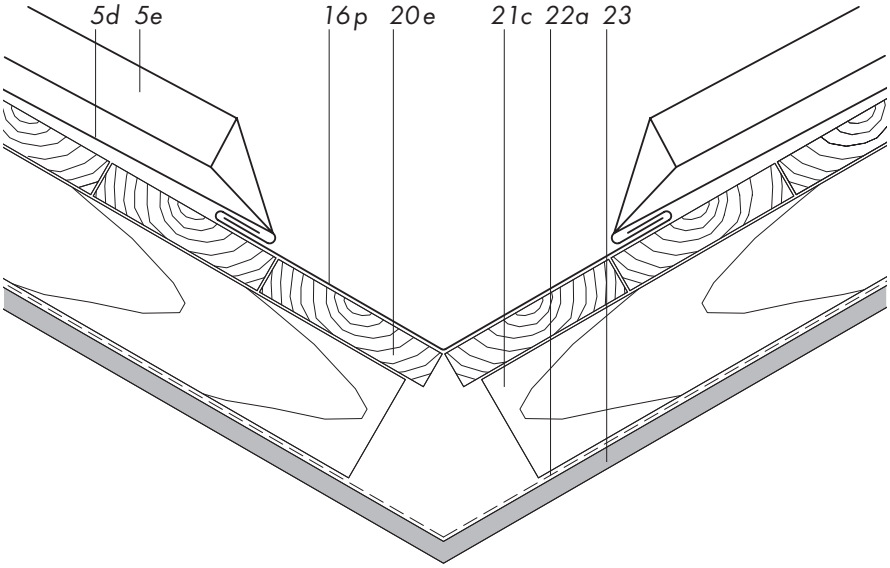

Fig. 44: Section through detail of valley with single seam

5 RHEINZINK-Click Roll Cap
d Roll cap panel
e Roll cap
16 RHEINZINK-Building Profile
p Valley profile
20 Substructure
e Softwood boarding, thickness min. 24 mm, width max. 160 mm
21 Batten/Squared Timber
c 80/80 mm
22 Functional Layer
a Underlay covering
23 Supporting Structure

6.8.4 Valley with single Seam
This detail of a valley with a single seam is permissible with roof pitches > 30°. A capillary-breaking gap of min. 10 mm should also be provided between the lower end of the fold-back on the valley as well as the eaves intersection of the panel.

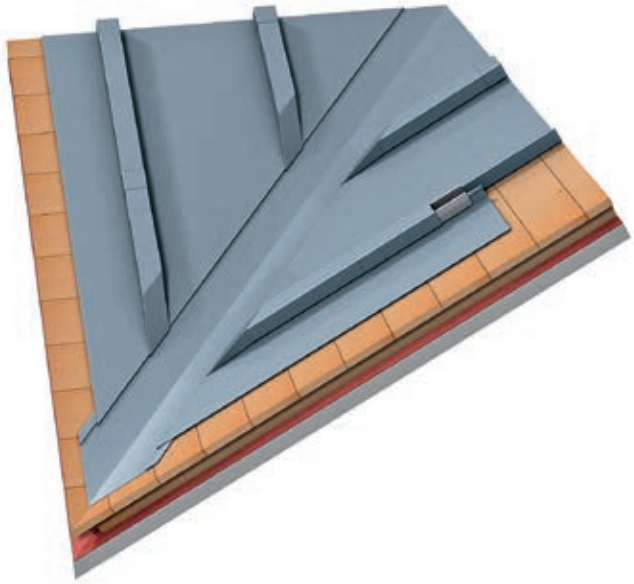

Fig. 45: Valley with single seam, permissible roof pitch > 30°

6.9 Roof Penetrations

Roof penetrations are the great plus point of metal roofs produced with sheet metalworking techniques. Here the expansion spacing needs to be large enough to permit thermal linear expansion of the panels.

In individual cases roof penetrations must also be provided with a wedge-shaped neck at back. This offers stability from slipping snow with small openings such as those used for vent pipes, while with larger openings the main function is water drainage.

6.9.1 Round Roof Penetrations, smaller than a single Panel

Round penetrations are generally used for making openings in a roof or for fixing round sections in place. A distinction is made here between solid sections, e.g. aerials, fixings for advertising signs or railings, and hollow sections such as sanitary fans and chimneys made of stainless steel tubing.

To prevent the roof covering from being marked by rust, the sections used here should have good protection from corrosion. With solid and hollow sections a collar min. 150 mm in height is soldered in place, with a sealed sleeve being used for sealing at the top.

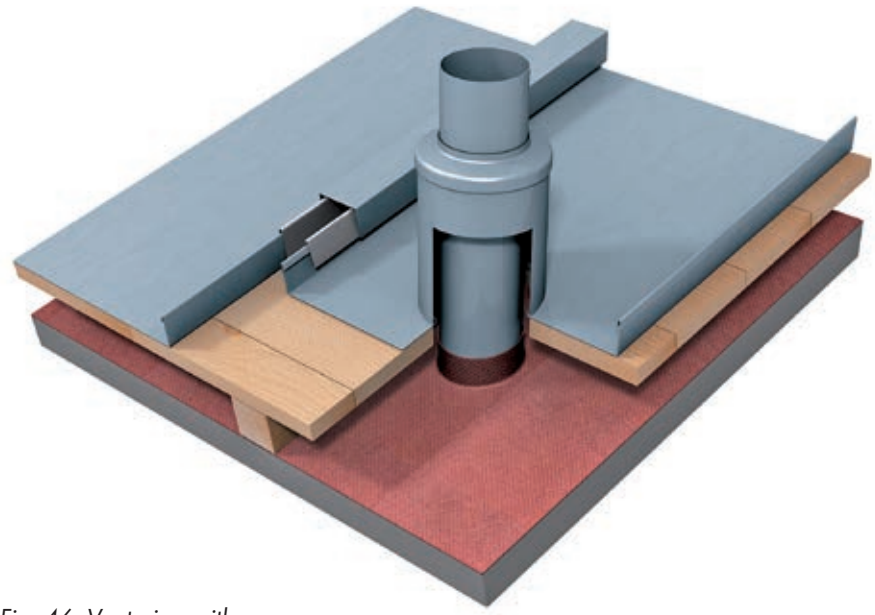

Fig. 46: Vent pipe with cap

Please avoid roof penetrations which are positioned less than 50 mm from the panel seams as this is the minimum distance required for soldering. Alternativly, a titanium zinc sheet in the lenght of to panel width can also be used to incorporate the penetration. It should be connected to the panels at the top and bottom with cross seams.

In regions with heavy snowfall a wedge-shaped neck will be necessary to stabilise the hollow section.

6.9.2. Roof Penetrations over more than 2 Panels

6.9.2.1 Roof Pitch ≥ 3° to < 10°

For low roof pitches the connection at the front of the penetration is made as for the ridge connection with a vertical upstand, pinched seam, ridge termination cap, all covered by a cover flashing.

The solution for connection of the roll cap to the back gutter calls for a roll cap adapter, which acts as an adapter to close the area between the two seams. They are reduced to standing seam height, turned down and seamed into the back gutter. To use the double standing seam technique this part needs to be wedge-shaped.

The front flashing and back gutter are each joined to the side flashings with straight or diagonally running pinched seams.

6.9.2.2 Roof Pitch ≥ 10° to < 25°/35°

Alternativly to the previously described connection of the seam it is possible to incorporate roof penetrations larger than one section at a roof pitch of ≥ 10° to < 25° or 35° in regions with heavy snowfall, by using a front flashing.

The front flashing is hooked into a continoues cleat, soldered onto the panel and overlaps both, panel and roll cap by 250 mm, measured from the hook-in to the vertical upstand at the penetration.

The seam including the roll cap must be flattened while the hook-in of the front flashing is located just behind the breakpoint of the roll cap. Panel and roll cap terminate with a water check.

The side flashings are connected to the front flashing and back gutter with straight or diagonally running pinched seams. The back gutter needs a wedge-shaped neck with a continious soldered cleat at its upper end and is connected to the panel above with an overlap of 250 mm.

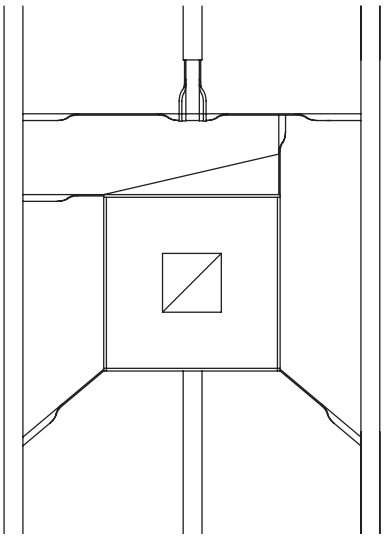

Abb. 47: Chimney with direct connection of the panel (as made for the ridge connection with vertical upstand) – suitable from ≥ 3° roof pitch

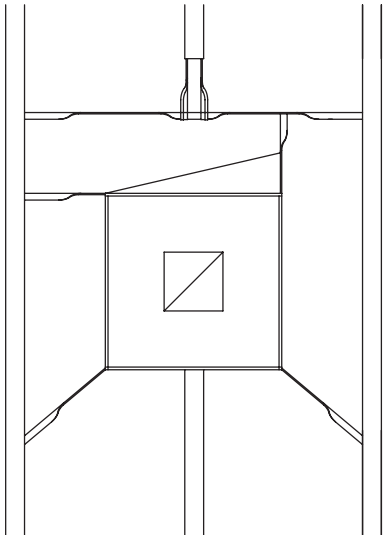

Abb. 48: Chimney with back gutter, connected in double standing seam technique with roll cap adapter – suitable from ≥ 3° roof pitch

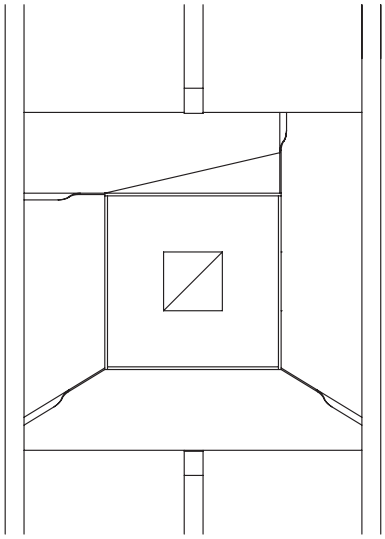

Abb. 49: Chimney with front flashing - suitable for a roof pitch of ≥ 10° to < 25° or 35° in regions with heavy snowfall

Abb. 50: Connection to chimney at front with ridge upstand and ridge cap

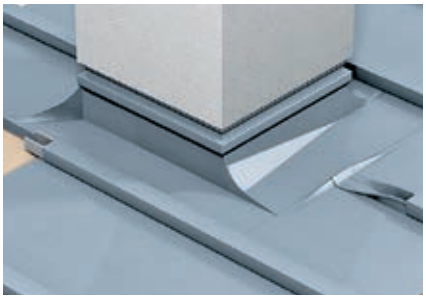

Abb. 51: Connection to chimney with wedge-shape back gutter and roll cap adapter in double standing seam technique

Abb. 52: Connection to chimney with front flashing (version with continious soldered cleat)

Abb. 53: Connection to chimney

6.9.2.3 Roof Pitch ≥ 25° or ≥ 35° in Regions with heavy Snowfall

The connection at the front is made as previously described for the ridge connection or by using a front flashing with a single seam. Here the seam of the front flashing should be located just behind the break-point of the roll cap. The connections of the side flashings with the front flashing are made with straight running pinched seams. The back gutter is made with a wedge-shaped neck and a single seam, overlaped by the panel and roll cap.

For the heigth of vertical upstands for panels, front flashings, side flashings and back gutters the respective heights depending on the roof pitch do apply:

Roof Pitch	Upstand
< 5°	≥ 150 mm
< 22°	≥ 100 mm
≥ 22°	≥ 80 mm

6.9.3 Velux Skylights

One solution that is challenging both in terms of aesthetics and manual skill is to fit a roll cap adapter to the Velux mounting frame all around the skylight. The minimum roof pitch for this connection detail is 25° or 35° in regions with heavy snowfall.

Here the roll cap system seam is cut down diagonally towards the front flashing to approx. 150 mm to leave a seam height of around 20 mm.

This 20 mm is turned down outwards and the roll cap adapter slid onto the turned-down seams. The roll cap adapter is then turned over upwards with the panel and the front flashing then incorporated in the structure.

200 mm is sufficient as the minimum distance between the roll cap system seam and the side upfold to the skylight.

The Velux mounting frame can also be incorporated in the roof area using the method described above.

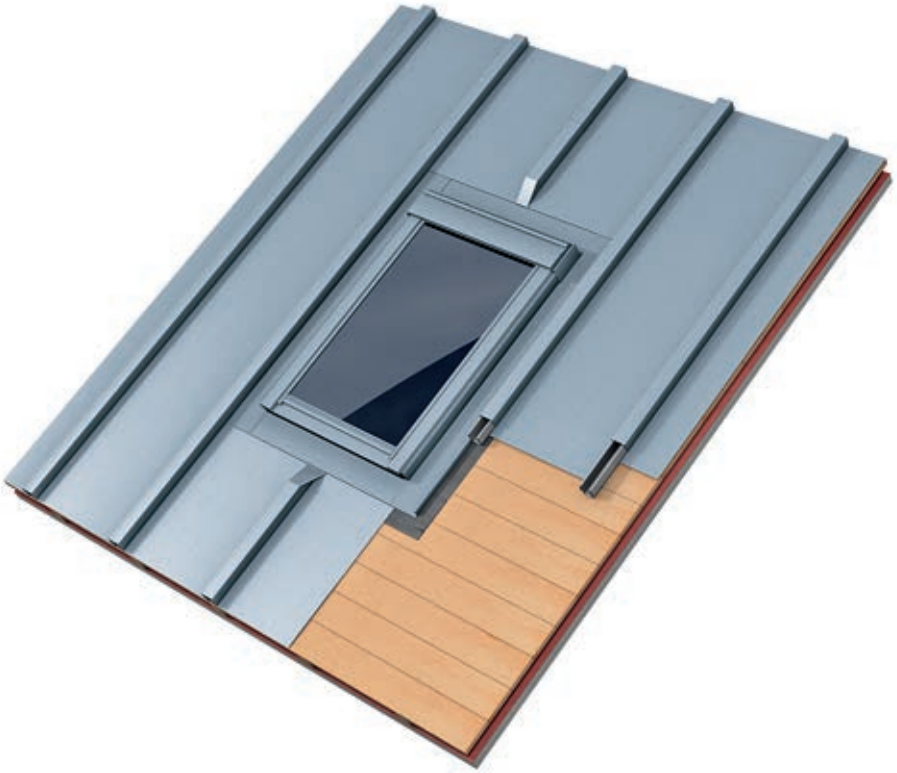

Fig. 54: Skylight fitted with seamed connection

7. Accessoiries Range

7.1 Snow Guard

A special snow guard clamp is available for the snow guard from SM-Befestigungstechnik. This consists of a stainless steel shoe which is mounted on the roll cap fastener and secured by inserting self-tapping screws or rivets into the predrilled holes on the fastener. This shoe is equipped on the eaves side with a tongue made of stainless steel with a tab for insertion of the snow guard tube (Ø 40 mm).

On installation it should be ensured that the eaves termination cap is first attached to the lowest roll cap fastener and then the snow guard clamp. Finally the roll cap is positioned over the clamp and clicked into roll cap fastener. The tongue with the tab and snow guard tube must cover the eaves termination cap.

Generally it is to be ensured that the panel is not attached to the RHEINZINK-Click Roll Cap Fastener when fixing the snow guard clamp in order to avoid obstruction of expansion.

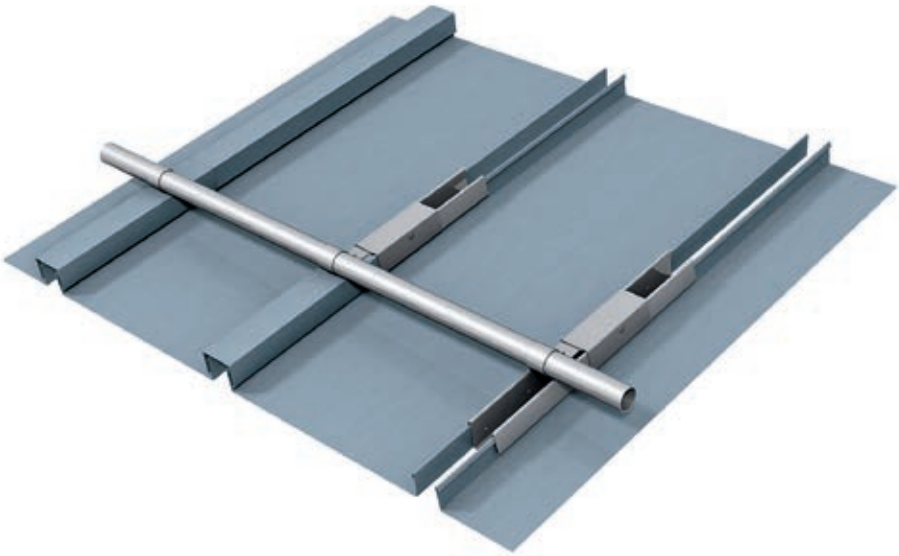

Fig. 55: Snow Guard System Type SM
(Fa. SM-Befestigungssysteme GmbH, Ludwigsburg)

Suitable ice stops are available from RA Icestop, Eging am See.

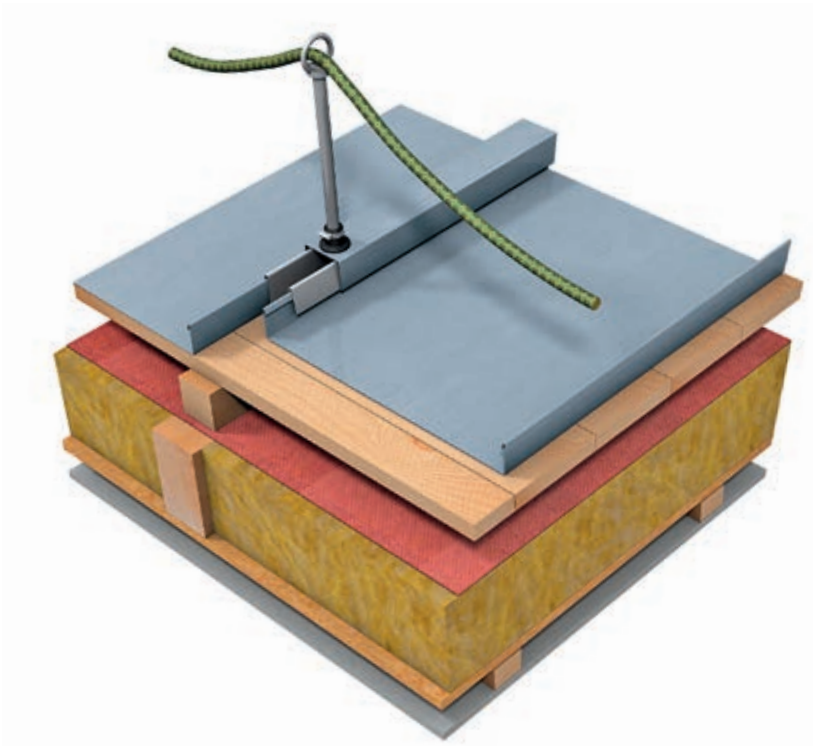

Fig. 56: Secupoint as anchorage point according to EN 795

7.2 Anchorage Point

When performing maintenance on roofs with flat roof pitches, it is necessary to create temporary attachment points as a flat-roof fall arrest system according to DIN EN 795. The product Secupoint sold by Pohl for example is ideal for this purpose. A stainless steel tube with a stainless steel eye is screwed into the load-bearing substructure between the seams of the roll cap panels. The Secupoint is then removed again. The roll cap should be positioned on the roll cap fasteners with a hole matching the diameter of the Secupoint over the hole in the substructure. The Secupoint is then friction-locked to the substructure through the roll cap. Lastly the hole in the roll cap for the Secupoint should be sealed, e.g. with an EPDM sleeve attached to the tube with a bracket.

8. Other

8.1 Curved Panels

Radii greater than 65 m allow straight panels to be fitted to a curved substructure free of stress. Here the panels are simply laid on the roof area and they will automatically mould themselves to the substructure.

8.2 Tapered Panels

The mobile roll cap rollformer can of course be used to produce tapered panels for cupolas or conical roofs. Here the minimum width of the panels at the ridge should be ≥ 150 mm.

When doing so, make sure that there is sufficient space in front of and behind the rollformer. Scissor tables etc. can be used for setting down the panels.

For lengths of up to 7 m panels with a minimum width of 80 mm can be profiled on the stationary rollformer at Datteln.

8.3 Texts for Tendering

Texts for invitations to tender can be found at:

www.rheinzink.com
www.ausschreiben.de
www.heinze.de

You can download individual text modules for RHEINZINK products here as well as specimen tender documents, including for roof drainage and roofing using the RHEINZINK-Click Roll Cap System.

TABLE FOR FIXING CLICK ROLL CAP FASTENERS TO PLYWOOD SHEATHING

With any bay widths not listed in the table the spacing for the Click Roll Cap Fasteners and the number of screws required for these fasteners should be based on the following rule:

If for example, the bay width of the panels is 400 mm and the wind load 1.6 kN/m², the number of screws and spacing for the roll cap fasteners necessary for the wind load 1.6 kN/m² must be taken from the column with bay widths of 415 mm.

The next greater bay width must always be used for sizes falling between standard bay widths.

Intermediate values for wind uplift loads such as 1.5 kN/m² must always be rounded up to the next higher value in the tables, i.e. 1.6 kN/m².

Further information about installation of the RHEINZINK-Click Roll Cap System on diverse base materials, e.g. Rockwool Prodach insulating system, is available on request. Please contact your locall sales advisor.

Note
Be on the safe side: document the type of fixing selected for your building project with our contractor's declaration form. Simply download from:
www.rheinzink.de/produkte/dachsysteme/dachdeckungssysteme/klick-leiste/planung-anwendung/systemtechnik/

req. s/n = number of screws/ roll cap fasteners
a = spacing for roll cap fasteners in m referred to centre of fasteners

* Das Achsmaß 615 mm ist zulässig und geeignet für Dächer mit einer Höhe ≤ 20 m über Gelände. Nicht zulässig für Dächer mit einer Höhe > 20 m über Gelände.

Substructure **Plywood sheathing (OSB) with VAPOZINC (structured underlay)**
Fixings **0.89 kN, retention force 0,89kN or greater**
For constructions using OSB sheathing and VAPOZINC it is required to use the high version of the RHEINZINK-Click Roll Cap Fastener
Designation **EJOT® self-drilling screw JT3-X-2-6.0 x L**

Coil width, mm		370		400		470		500
Bay width, mm		285		315		385		415
Metal thickness, mm		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8
$W_{suction}$	req. s/n	a	req. s/n	a	req. s/n	a	req. s/n	a
0.2	2	1.50	2	1.50	2	1.50	2	1.50
0.4	2	1.50	2	1.50	2	1.50	2	1.50
0.6	2	1.50	2	1.50	2	1.50	2	1.50
0.8	2	1.50	2	1.50	2	1.50	2	1.50
1.0	2	1.50	2	1.50	2	1.50	2	1.50
1.2	2	1.50	2	1.50	2	1.50	2	1.50
1.4	2	1.50	2	1.50	2	1.50	2	1.50
1.6	2	1.50	2	1.50	2	1.50	2	1.50
1.8	2	1.50	2	1.50	2	1.50	2	1.50
2.0	2	1.50	2	1.50	2	1.50	2	1.50
2.2	2	1.50	2	1.50	2	1.50	2	1.50
2.4	2	1.50	2	1.50	2	1.50	2	1.50
2.6	2	1.50	2	1.50	2	1.50	2	1.50
2.8	2	1.50	2	1.50	2	1.50	2	1.50
3.0	2	1.50	2	1.50	2	1.50	2	1.43
3.2	2	1.50	2	1.50	2	1.44	2	1.34
3.4	2	1.50	2	1.50	2	1.36	2	1.26
3.6	2	1.50	2	1.50	2	1.28	2	1.19
3.8	2	1.50	2	1.49	2	1.22	2	1.13
4.0	2	1.50	2	1.41	2	1.16	2	1.07
4.2	2	1.49	2	1.35	2	1.10	2	1.02
4.4	2	1.42	2	1.28	2	1.05	4	1.50
4.6	2	1.36	2	1.23	2	1.01	4	1.50
4.8	2	1.30	2	1.18	4	1.50	4	1.50
5.0	2	1.25	2	1.13	4	1.50	4	1.50
5.2	2	1.20	2	1.09	4	1.50	4	1.46
5.4	2	1.16	2	1.05	4	1.50	4	1.41
5.6	2	1.12	2	1.01	4	1.46	4	1.36
5.8	2	1.08	2	0.97	4	1.41	4	1.31
6.0	2	1.04	4	1.50	4	1.37	4	1.27
6.2	2	1.01	4	1.50	4	1.32	4	1.23
6.4	4	1.50	4	1.50	4	1.28	4	1.19
6.6	4	1.50	4	1.50	4	1.24	4	1.15
6.8	4	1.50	4	1.47	4	1.21	4	1.12
7.0	4	1.50	4	1.43	4	1.17	4	1.09
7.2	4	1.50	4	1.39	4	1.14	4	1.06
7.4	4	1.50	4	1.35	4	1.11	4	1.03
7.6	4	1.46	4	1.32	4	1.08	4	1.00
7.8	4	1.42	4	1.28	4	1.05	4	0.97
8.0	4	1.38	4	1.25	4	1.02	4	0.95
8.2	4	1.35	4	1.22	4	1.00	4	0.93

TABLE FOR FIXING CLICK ROLL CAP FASTENERS TO PLYWOOD SHEATHING

Coil width, mm		570		570		600		670		700
Bay width, mm		485		485		515		585		615*
Metal thickness, mm		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8
$W_{suction}$	req. s/n	a	req. s/n	a	req. s/n	a	req. s/n	a	req. s/n	a
0.2	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
0.4	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
0.6	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
0.8	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.0	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.2	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.4	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.6	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.8	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
2.0	2	1.50	2	1.50	2	1.50	2	1.50	2	1.45
2.2	2	1.50	2	1.50	2	1.50	2	1.38	2	1.32
2.4	2	1.50	2	1.50	2	1.44	2	1.27	2	1.21
2.6	2	1.50	2	1.41	2	1.33	2	1.17	2	1.11
2.8	2	1.50	2	1.31	2	1.23	2	1.09	2	1.03
3.0	2	1.43	2	1.22	2	1.15	2	1.01	4	1.50
3.2	2	1.34	2	1.15	2	1.08	4	1.50	4	1.50
3.4	2	1.26	2	1.08	2	1.02	4	1.50	4	1.50
3.6	2	1.19	2	1.02	2	0.96	4	1.50	4	1.43
3.8	2	1.13	4	1.50	4	1.50	4	1.42	4	1.35
4.0	2	1.07	4	1.50	4	1.50	4	1.35	4	1.28
4.2	2	1.02	4	1.50	4	1.46	4	1.28	4	1.22
4.4	4	1.50	4	1.48	4	1.39	4	1.23	4	1.17
4.6	4	1.50	4	1.41	4	1.33	4	1.17	4	1.12
4.8	4	1.50	4	1.36	4	1.28	4	1.12	4	1.07
5.0	4	1.50	4	1.30	4	1.23	4	1.08	4	1.03
5.2	4	1.46	4	1.25	4	1.18	4	1.04	4	0.99
5.4	4	1.41	4	1.21	4	1.13	4	1.00	4	0.95
5.6	4	1.36	4	1.16	4	1.09	4	0.96	4	0.92
5.8	4	1.31	4	1.12	4	1.06	4	0.93	4	0.88
6.0	4	1.27	4	1.08	4	1.02	4	0.90	4	0.86
6.2	4	1.23	4	1.05	4	0.99	4	0.87	4	0.83
6.4	4	1.19	4	1.02	4	0.96	4	0.84	4	0.80
6.6	4	1.15	4	0.99	4	0.93	4	0.82	4	0.78
6.8	4	1.12	4	0.96	4	0.90	4	0.79	4	0.75
7.0	4	1.09	4	0.93	4	0.88	4	0.77	4	0.73
7.2	4	1.06	4	0.90	4	0.85	4	0.75	4	0.71
7.4	4	1.03	4	0.88	4	0.83	4	0.73	4	0.69
7.6	4	1.00	4	0.86	4	0.81	4	0.71	4	0.68
7.8	4	0.97	4	0.83	4	0.79	4	0.69	4	0.66
8.0	4	0.95	4	0.81	4	0.77	4	0.67	4	0.64
8.2	4	0.93	4	0.79	4	0.75	4	0.66	4	0.63

TABLE FOR FIXING CLICK ROLL CAP FASTENERS TO SOFTWOOD BOARDING

Substructure Softwood boarding (solid timber ≥ C24)
Fixings 1.06 kN
Designation EJOT® self-drilling screw JT3-2-6.0 x L

Coil width, mm		370		400		470		500
Bay width, mm		285		315		385		415
Metal thickness, mm		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8
$W_{suction}$	req. s/n	a	req. s/n	a	req. s/n	a	req. s/n	a
0.2	2	1.50	2	1.50	2	1.50	2	1.50
0.4	2	1.50	2	1.50	2	1.50	2	1.50
0.6	2	1.50	2	1.50	2	1.50	2	1.50
0.8	2	1.50	2	1.50	2	1.50	2	1.50
1.0	2	1.50	2	1.50	2	1.50	2	1.50
1.2	2	1.50	2	1.50	2	1.50	2	1.50
1.4	2	1.50	2	1.50	2	1.50	2	1.50
1.6	2	1.50	2	1.50	2	1.50	2	1.50
1.8	2	1.50	2	1.50	2	1.50	2	1.50
2.0	2	1.50	2	1.50	2	1.50	2	1.50
2.2	2	1.50	2	1.50	2	1.50	2	1.50
2.4	2	1.50	2	1.50	2	1.50	2	1.50
2.6	2	1.50	2	1.50	2	1.50	2	1.50
2.8	2	1.50	2	1.50	2	1.50	2	1.50
3.0	2	1.50	2	1.50	2	1.50	2	1.50
3.2	2	1.50	2	1.50	2	1.50	2	1.50
3.4	2	1.50	2	1.50	2	1.50	2	1.50
3.6	2	1.50	2	1.50	2	1.50	2	1.42
3.8	2	1.50	2	1.50	2	1.45	2	1.34
4.0	2	1.50	2	1.50	2	1.38	2	1.28
4.2	2	1.50	2	1.50	2	1.31	2	1.22
4.4	2	1.50	2	1.50	2	1.25	2	1.16
4.6	2	1.50	2	1.46	2	1.20	2	1.11
4.8	2	1.50	2	1.40	2	1.15	2	1.06
5.0	2	1.49	2	1.35	2	1.10	2	1.02
5.2	2	1.43	2	1.29	2	1.06	2	0.98
5.4	2	1.38	2	1.25	2	1.02	4	1.50
5.6	2	1.33	2	1.20	2	0.98	4	1.50
5.8	2	1.28	2	1.16	4	1.50	4	1.50
6.0	2	1.24	2	1.12	4	1.50	4	1.50
6.2	2	1.20	2	1.09	4	1.50	4	1.46
6.4	2	1.16	2	1.05	4	1.50	4	1.42
6.6	2	1.13	2	1.02	4	1.48	4	1.37
6.8	2	1.09	2	0.99	4	1.44	4	1.33
7.0	2	1.06	4	1.50	4	1.39	4	1.29
7.2	2	1.03	4	1.50	4	1.36	4	1.26
7.4	2	1.01	4	1.50	4	1.32	4	1.22
7.6	2	0.98	4	1.50	4	1.28	4	1.19
7.8	4	1.50	4	1.50	4	1.25	4	1.16
8.0	4	1.50	4	1.49	4	1.22	4	1.13
8.2	4	1.50	4	1.46	4	1.19	4	1.10

req. s/n = number of screws/ roll cap fasteners
a = spacing for roll cap fasteners in m referred to centre of fasteners

* Das Achsmaß 615 mm ist zulässig und geeignet für Dächer mit einer Höhe ≤ 20 m über Gelände. Nicht zulässig für Dächer mit einer Höhe > 20 m über Gelände.

TABLE FOR FIXING CLICK ROLL CAP FASTENERS TO SOFTWOOD BOARDING

Coil width. mm		570		570		600		670		700
Bay width. mm		485		485		515		585		615*
Metal thickness. mm		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8		0.7 / 0.8
$W_{suction}$	req. s/n	a	req. s/n	a	req. s/n	a	req. s/n	a	req. s/n	a
0.2	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
0.4	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
0.6	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
0.8	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.0	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.2	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.4	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.6	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
1.8	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
2.0	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
2.2	2	1.50	2	1.50	2	1.50	2	1.50	2	1.50
2.4	2	1.50	2	1.50	2	1.50	2	1.50	2	1.44
2.6	2	1.50	2	1.50	2	1.50	2	1.39	2	1.33
2.8	2	1.50	2	1.50	2	1.47	2	1.29	2	1.23
3.0	2	1.50	2	1.46	2	1.37	2	1.21	2	1.15
3.2	2	1.50	2	1.37	2	1.29	2	1.13	2	1.08
3.4	2	1.50	2	1.29	2	1.21	2	1.07	2	1.01
3.6	2	1.42	2	1.21	2	1.14	2	1.01	4	1.50
3.8	2	1.34	2	1.15	2	1.08	4	1.50	4	1.50
4.0	2	1.28	2	1.09	2	1.03	4	1.50	4	1.50
4.2	2	1.22	2	1.04	2	0.98	4	1.50	4	1.46
4.4	2	1.16	2	0.99	4	1.50	4	1.46	4	1.39
4.6	2	1.11	4	1.50	4	1.50	4	1.40	4	1.33
4.8	2	1.06	4	1.50	4	1.50	4	1.34	4	1.27
5.0	2	1.02	4	1.50	4	1.46	4	1.29	4	1.22
5.2	2	0.98	4	1.49	4	1.40	4	1.24	4	1.18
5.4	4	1.50	4	1.44	4	1.35	4	1.19	4	1.13
5.6	4	1.50	4	1.38	4	1.30	4	1.15	4	1.09
5.8	4	1.50	4	1.34	4	1.26	4	1.11	4	1.05
6.0	4	1.50	4	1.29	4	1.22	4	1.07	4	1.02
6.2	4	1.46	4	1.25	4	1.18	4	1.04	4	0.99
6.4	4	1.42	4	1.21	4	1.14	4	1.00	4	0.95
6.6	4	1.37	4	1.17	4	1.11	4	0.97	4	0.93
6.8	4	1.33	4	1.14	4	1.07	4	0.94	4	0.90
7.0	4	1.29	4	1.11	4	1.04	4	0.92	4	0.87
7.2	4	1.26	4	1.08	4	1.01	4	0.89	4	0.85
7.4	4	1.22	4	1.05	4	0.99	4	0.87	4	0.83
7.6	4	1.19	4	1.02	4	0.96	4	0.85	4	0.80
7.8	4	1.16	4	0.99	4	0.94	4	0.82	4	0.78
8.0	4	1.13	4	0.97	4	0.91	4	0.80	4	0.76
8.2	4	1.10	4	0.95	4	0.89	4	0.78	4	0.75

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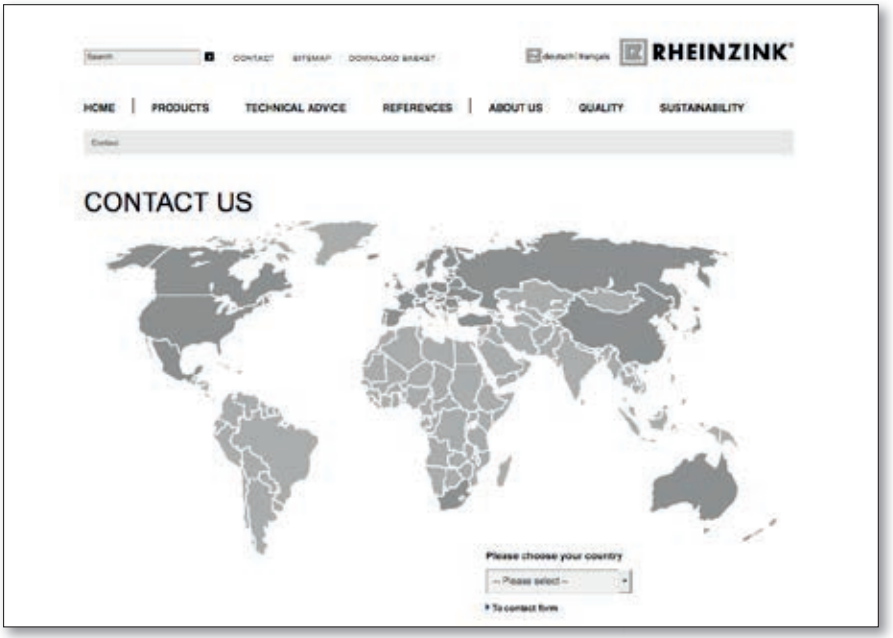

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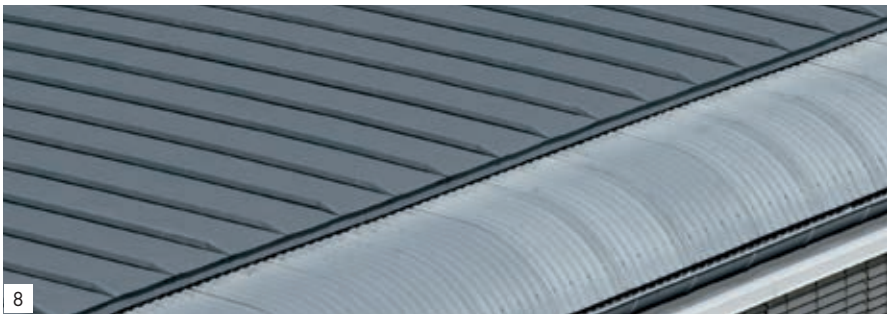
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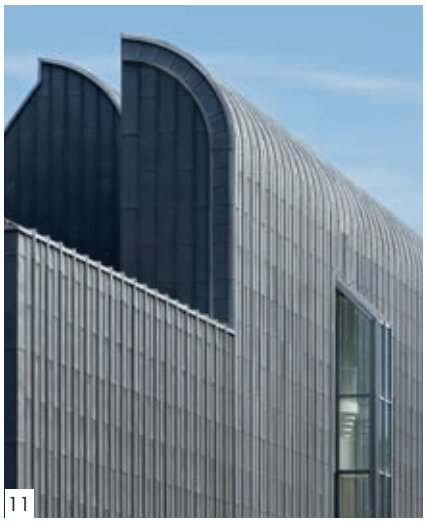
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REFERENCE PROJECTS

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Additional project references can be found on the Internet at www.rheinzink.com

Title page: **Nursery/Creche, Peißen, Germany**
Architect: WALTERPLAN Architektur – Statik Ingenieurbau, Cörmigk, Germany
RHEINZINK-work by: Klempnerei Mehler GmbH, Zwickau, Germany

1/11 **Museum Ludwig, Cologne, Germany**
Architect: Busmann & Haberer, Arch. BDA, Cologne, Germany
RHEINZINK-work by: ARGE, Kessler & Koolen, Aachen, Germany
Jacobs, Düsseldorf, Germany

2 **Les Grands Moulins de Pantin, Pantin, France**
Architect: Reichen et Robert Architectes associés, Paris, France
RHEINZINK-work by: UTB, Pantin, France

3 **Private Residence near Dresden, Germany**
Architect: Architektur- and Bauwerkstatt Kamenz, Jörg Hehl Dipl.-Ing. Architect,
Kamenz, Germany
RHEINZINK-work by: Bad & Heizung Frank Schickel GmbH & Co. KG,
Pulsnitz, Germany

4 **bademaxx, Sports and Swimming Pool Complex, Speyer, Germany**
Architect: blass architekten, Euskirchen, Germany
RHEINZINK-work by: Pistorius GmbH, Zwickau, Germany

5 **Hotel du Louvre, Paris, France**
Architect: S.E.C.C., Alfortville, France
RHEINZINK-work by: Balas & Mahey, Saint-Ouen, France

6/12 **Event Hall, Prague, Czech Republic**
Architect: ATIP, a.s., Ing. Arch. Martin Vokatý, Trutnov, Czech Republic;
Helika a.s., Prague, Czech Republic
RHEINZINK-work by: Izolprag s.r.o., Prague, Czech Republic; Site supervisor: Petr Kareš

7 **University of Fine Arts, Dresden, Germany**
Architect: IPRO Dresden, Architekten- und Ingenieurgesellschaft mbH, Dresden, Germany
RHEINZINK-work by: Böhme Haustechnik, Boxdorf b. Dresden, Germany;
Fuchs & Gierke, Bau- und Denkmalpflege, Ottendorf-Okrilla, Germany;
Rüdiger Buhlan Metallgestaltung, Radebeul, Germany

8/9 **DeTeMobil, Bonn, Germany**
Architect: Steidtle + Partner Architekten, Cologne, Germany
RHEINZINK-work by: Roof: G + H Montage, Bonn, Germany;
Facade: Sepp Schano, Bonn, Germany

10/14 **Spreenhagen Sports Hall, Spreenhagen, Germany**
Architect: Unknown
RHEINZINK-work by: Holzbaugeschäft Schikowski GmbH, Seelow, Germany

13 **Palais Lumière, Cultural and Convention Centre, Evian, France**
Architect: Michel Spitz, Colmar, France;
François Chatillon, architecte du patrimoine, Ferney Voltaire, France
RHEINZINK-work by: Entreprise Bourgeois, Vaulx en Velin, France;
Ferblanterie Thonnonaise, Thonon-les-Bain, France

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