RHEINZINK®

RHEINZINK PRODUCT LINES

Information on Material and Processing

PLANNING AND APPLICATION

Up-to-date information, reports and specialist publications, further technical information, measurement lists, standard details and tender texts can be found at **www.rheinzink.de**

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Introduction

A high-quality material, robustly alloyed and naturally beautiful. Durable and sustainable. Easy to process and highly versatile. For those who want all of these properties, RHEINZINK products are the perfect solution. In a manufacturing process developed by RHEINZINK and unique in the world, high-quality premium surfaces are produced which fulfil the high requirements of EN 988. This brochure examines important aspects relating to the material and gives information and recommendations on the topics of quality, product lines, transport/storage, processing, external influences, cleaning and maintenance. This information is based on many years of experience and is based on the latest technological developments.

RHEINZINK Application Technology is happy to help with all questions relating to RHEINZINK products.

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Datteln, July 2025

Product lines

4 Processing instructions

5 External influences

6 Cleaning recommendations

7 Maintenance

8 Complaints


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RHEINZINK®

The perfect solution for every requirement. Discover our diverse product lines now.

Every surface meets the high standards of material, workmanship, and functionality.

CLASSIC

PRISMO

prePATINA

ECO ZINC

GRANUM EXTRA

1 QUALITY

1.1 Alloy

RHEINZINK is the brand name for titanium zinc according to DIN EN 988. The RHEINZINK alloy consists of electrolyte primary zinc according to DIN EN 1179 with a purity grade of 99.995% and precisely determined proportions of copper, titanium and aluminium. Alongside increasing creep strength, titanium also increases the recrystallization limit as compared to unalloyed zinc; copper increases ductility for every type of deformation. In addition to other factors, the alloy composition is not only of importance for the technological material properties of RHEINZINK, but also for the colour of its patina (see Subsections 2.1 and 2.2.).

1.2 Manufacturing processes

RHEINZINK is the only manufacturer worldwide with a continuous wide-strip casting and rolling mill for producing construction zinc. With this milling process, which is technically extremely advanced and is being continually improved, the RHEINZINK alloy undergoes a continuous process (melting, casting, rolling, coiling) to become coils in specified thicknesses, which are then cut into strips, panels or bands along shearing lines.

The manufacturing process comprises the following steps:

Master alloy
To improve the quality and for energy reasons, a master alloy is produced in a crucible induction furnace at 760 °C (a molten mass of primary zinc, copper and titanium). The master alloy blocks produced contain the titanium and copper ratios of the subsequent milled alloy.

Melting
The master alloy blocks and primary zinc are melted in large melting furnaces (channel induction furnaces) at 500 – 550°C and completely blended by induced current.

Casting
The finished alloy is cooled by a closed water circuit in the casting machine far enough below the melting point that a solid casting strip is formed.

Rolling
A cooling phase is incorporated between the casting machine and the rolling stands. The rolling process takes place with 5 pairs of rollers, the so-called rolling stands. At each of these rolling stands, the material is subjected to specific pressures reducing it by up to 50 % in thickness. At the same time, the material is cooled and lubricated with a special emulsion.

Coiling
Finally, the rolled RHEINZINK is coiled onto large rolls, or coils, weighing 20 tons. These are still at a temperature of approximately 100°C and are stored for further cooling.

Stretching
The tensions in the RHEINZINK strips created by the rolling process are “pulled out” of the material during a stretching-bending-straightening process.

1.3 Material properties

Physical and chemical properties

- Density (spec. weight): 7.2 g/cm³
- Melting point: approx. 420 °C
- Recrystallization limit: > 300 °C
- Coefficient of expansion:
  in longitudinal rolling direction:
  2.2 mm/m x 100 K
  in transverse rolling direction:
  1.7 mm/m x 100 K
- Elasticity modulus: ≥ 80,000 N/mm²
- Thermal conductivity: 110 W/m · K
- Electrical conductivity: 17 m/Ω mm²
- Non-magnetic
- Reaction to fire: Euroclass A1: RHEINZINK-CLASSIC, -prePATINA ECO ZINC, -GRANUM EXTRA

Mechanical-technical properties according to DIN EN 988

Testing criteria	
0.2 % creep limit (R_p0.2)	min. 100 N/mm²
Tensile strength (R_m)	min. 150 N/mm²
Tensile stretch (A50)	min. 35 %
Vickers hardness (HV3)	min. 45
Folding test	No cracks on bending edge
Erichsen cupping	min. 8.0 mm
Permanent elongation in creep rupture test (R_p0.1)	max. 0.1 %
Camber	max. 1.5 mm/m
Evenness	max. 2.0 mm wave height

RHEINZINK is a brand name for titanium zinc. Although the European standard DIN EN 988 stipulates that certain material properties must be guaranteed for titanium zinc, these only represent minimum requirements, which are often exceeded by RHEINZINK. In the case of titanium zinc alloys, material properties are not only the result of a specific alloy, but also depend on many other influencing factors.

With RHEINZINK, the unique rolling process, with its controlled interplay of pressure and cooling (thermo-dynamics), is decisive for adjusting the metallurgical properties of the RHEINZINK alloy.

All metals are based on the fact that they develop a microstructure when they solidify from the molten liquid. This metal microstructure, consisting of individual grains/crystals, can be influenced, depending on the alloy, in such a way that the desired properties can be set. The microstructure of a material is the basis of all its properties.

RHEINZINK monitors these properties by subjecting each furnace batch to extensive analyses. We use various material tests to determine compliance with the requirements of DIN EN 988.

In addition to very good formability (ductility), we also want titanium zinc alloys to have high tensile strength and creep strength. The material should also be easy to solder and heat during further processing by the craftsman, but must not become brittle; no cracks should occur.
In order to achieve these various property requirements, a fine-grained structure must be achieved on the one hand and recrystallisation at low temperatures (soldering/heating) must be prevented on the other.

Thanks to the RHEINZINK alloy composition, the recrystallisation limit has risen to >300°C compared to unalloyed zinc.

Mechanical tests:
Our mechanical tests include tensile tests in which the yield strength, tensile strength and elongation at break of the material are determined. These tests are carried out in standardised testing machines in order to create stress-strain diagrams that serve as a basis for the calculation of statically stressed components.

Technological tests:
The technological tests focus on the processing behaviour of our material. The Erichsen cupping test assesses the material's stretch-forming ability based on the penetration depth achieved by the punch at the moment of tearing. In addition, the formation of cracks and the surface condition allow conclusions to be drawn about grain size and microstructure. These tests are crucial for assessing the forming properties of the material.

1.4 Identification

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

RHEINZINK-Roof drainage accessories: recognisable by the branding.

1.5 Certifications

RHEINZINK is certified according to ISO 9001. RHEINZINK is a natural, 100% recyclable material, which has always effortlessly fulfilled the strict ecological requirements of today. The latest production facilities, sophisticated logistics and favourable processing properties speak to this. Environmentally conscious action is documented through the introduction of the environmental management system ISO 14001. It is checked and certified according to TÜV Rheinland.

RHEINZINK also documents responsible action in regard to the environment through the introduction of an energy management system according to ISO 50001. The intention is to save energy and resources and to keep the environmental impacts of RHEINZINK products as low as possible. RHEINZINK's dedication to the environment has been assessed and certified by independent institutes.

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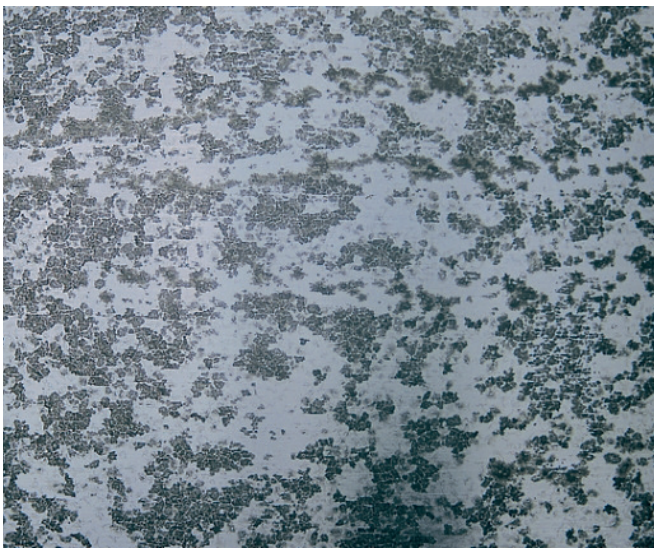
* Federal Environmental Agency recognised eco-label for construction productst

2 PRODUCT LINES

2.1 RHEINZINK-CLASSIC

The material RHEINZINK-CLASSIC is a natural material which develops a firmly adhering zinc carbonate patina during its lifetime exposed to the atmosphere. Initially, the zinc surface reacts with the oxygen in the air to form zinc oxide. The effect of water (rain and humidity) leads to the formation of zinc hydroxide, which reacts with carbon dioxide in the air to form a dense, firmly adhering and water-insoluble coating layer of zinc carbonate (patina). This protective layer is responsible for the high corrosion resistance of the zinc.

This process does not take place simultaneously everywhere. First, droplet-shaped grey areas develop, which merge together as the protective layer continues to grow, creating the familiar uniform blue-grey patina. This process is very characteristic for bright-rolled surfaces and does not constitute grounds for complaint. Depending on the intensity of the external moisture, orientation and position of the building, as well as the inclination of the clad area, the process can take months or years. As a basic rule, the more intensively or the longer rainwater remains on the surface, the quicker the patina develops. This material property is often used by architects as a design tool to emphasise the building's natural ageing process.



Patina formation

While the basis of the protective layer is zinc carbonate, additional substances from the surroundings are also integrated into the protective layer. That is why the colour of the patina can vary slightly from one place to another.

Additionally, the use of material with different production dates can lead to initial differences in patina formation. The colour differences slowly converge over the course of the patina formation.

Furthermore, according to DIN EN 988, slight discolouration, white rust, residues of grease or lubricants are permissible because they disappear in the course of patina formation without impairing the mechanical or physical properties of the material.

Leuphana University, Lüneburg

2.2 RHEINZINK-prePATINA ECO ZINC

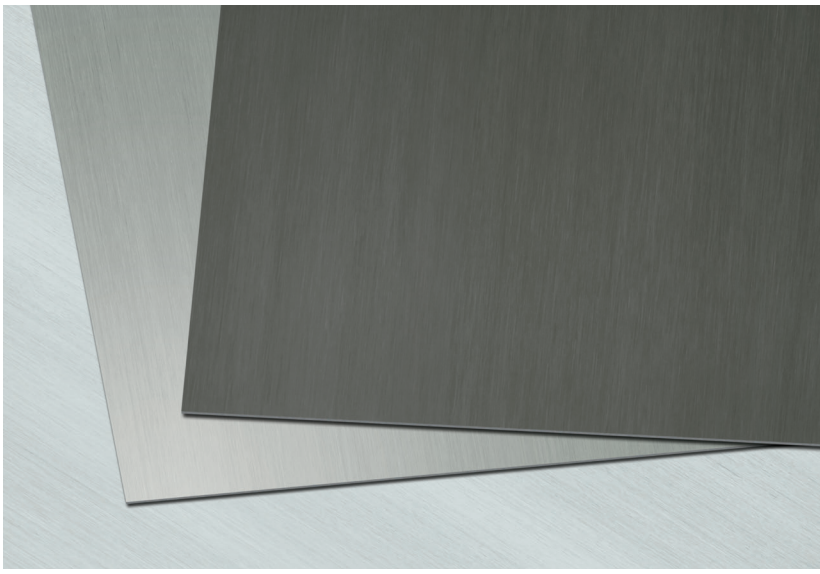
As an alternative to using bright-rolled material, the pre-weathered RHEINZINK surface variants are available.

RHEINZINK-prePATINA ECO ZINC blue-grey and graphite-grey are the only pre-weathered products without phosphating on the market that allow the formation of a natural and durable zinc carbonate layer (patina). They are neither coated nor varnished. The colour effect is in fact created by the metal alloy itself. In comparison to RHEINZINK-prePATINA ECO ZINC blue-grey, the RHEINZINK-prePATINA ECO ZINC graphite-grey surface has a slightly higher copper content, meaning that the unique RHEINZINK pickling process results in a darker colouring.

Both colours of the prePATINA ECO ZINC surfaces thus result from the natural basis material and when they leave the factory, the materials already have a colour very similar to that which results from the subsequent patina formation on the finished property. During the natural weathering process, any scratches (such as those which may result from installation) are evened out in the zinc typical way.

By contrast, the natural patina of the other surface qualities is only formed after the phosphate layer or coating has been broken down.

Colour tolerances
RHEINZINK-CLASSIC and the pre-weathered surfaces RHEINZINK-prePATINA ECO ZINC blue-grey and graphite-grey are natural materials which begin to form a natural patina when exposed to the atmosphere. A special pickling used on the prePATINA ECO ZINC range creates the look of a true patina in the factory from the RHEINZINK alloy, which would only set in after a longer period of time under natural influences. The pickling produces a uniform colour, though one which cannot be compared with a RAL colour.



RHEINZINK-prePATINA ECO ZINC surfaces

Due to the higher copper content in RHEINZINK-prePATINA ECO ZINC graphite-grey, the copper is also able to react with the atmosphere, meaning that a natural greenish tint develops on the surface. During the course of patina formation, the surface may become brighter.
For production reasons, colour differences may occur but are purely visual and, as a rule for RHEINZINK-prePATINA ECO ZINC, these differences are evened out during patina formation on the finished property. Therefor colour differences can also occur within a coil. Colour differences do not constitute grounds for complaint.

Care must be taken to ensure that the same surface material is ordered for the property or that connected surfaces are ideally completed simultaneously with the same surface material. When manufacturing roof drainage products from prePATINA ECO ZINC graphite-grey, colour differences between the individual components cannot be avoided in the production process due to the aforementioned properties.

2.3 RHEINZINK-GRANUM EXTRA

The granite and basalt surfaces of the GRANUM EXTRA product line complement the existing RHEINZINK product range.

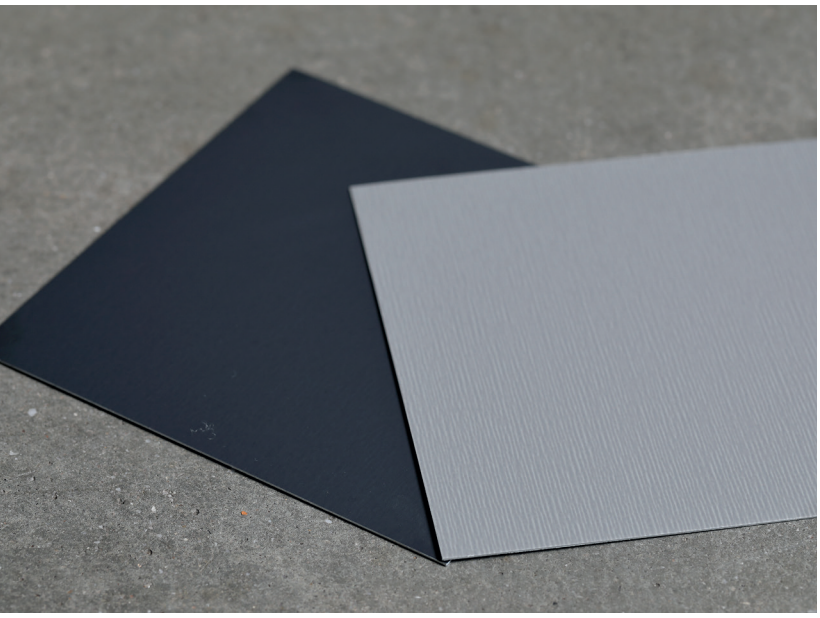
The RHEINZINK-GRANUM EXTRA product line stands for an elegant, matt appearance. GRANUM EXTRA is characterised by its durable high-performance coating with exceptional colour stability and corrosion resistance. GRANUM EXTRA basalte is a dark surface variant with a puristic and timeless dark grey, almost black appearance. GRANUM EXTRA granite is a light-coloured surface variant, which gives a hint of the typical zinc structure of a natural patina and is aesthetically pleasing and traditional in its simplicity. The material offers weather-resistant protection for long-lasting aesthetics.

The in-house developed high-performance, mainly resin based, coating using thin-layer technology is applied to both the front and back in a layer thickness of approx. 8 µm. Compared to zinc products with phosphated surfaces, where a thin layer of phosphate is applied, the new coating is characterised by significantly better colour stability and corrosion resistance. The typical zinc appearance and processing quality are thus combined with the advantages of a long-lasting appearance that reliably adapts to the desired design of the building.

The GRANUM EXTRA coating replaces the natural patina as corrosion protection, which occurs in the atmosphere with our proven CLASSIC and prePATINA ECO ZINC product lines and affects the colouring.

Corrosivity category
C5 according to DIN EN ISO 12 944-2

Colour tolerances
The surfaces have very low tolerances in terms of colour values. Batch uniformity can therefore be assumed.



RHEINZINK-GRANUM EXTRA surfaces

3 TRANSPORTATION AND STORAGE

3.1 General

In general, care must be taken that RHEINZINK is transported and stored under dry, ventilated conditions. This means that open transportation, particularly in unsettled weather, must be avoided. If these rules cannot be followed, the formation of zinc hydroxide can be expected (see Subsection 5.2).

Storage of coils with wooden sleepers

- A full quantitative and random qualitative check must always be carried out when goods are received. Any deviations found must be acknowledged on the proof of delivery with the date and signature of the driver.
- Small coils of up to 100 kg must be stored upright to avoid deformation.
- During rearrangement of larger coils, which are delivered horizontally, the accompanying wooden sleepers must continue to be used for stabilisation and weight distribution.
- If desired, coils with a weight of at least 1 t can be delivered with a cardboard tube. The cardboard tube serves to reinforce the coil and prevent deformation in the event of longer-term storage which can result in stronger wave formation.

Storage of small coils

- Material with protective plastic film should not be stored for more than 12 months. In the event of longer-term storage, there may be difficulties removing the film which is not subject to complaint.
- The film protects against mechanical damage, but not against moisture impact. The information on transport and storage described in this chapter applies.

Avoid at all costs!

- Covering coils, panels or profiles without ventilation
- Change in dew point/condensation
- Storage on a damp floor
- Transportation/storage on damp pallets
- Stacking the material too tightly during transportation or storage (to avoid abrasions)

3.2 Storage on-site

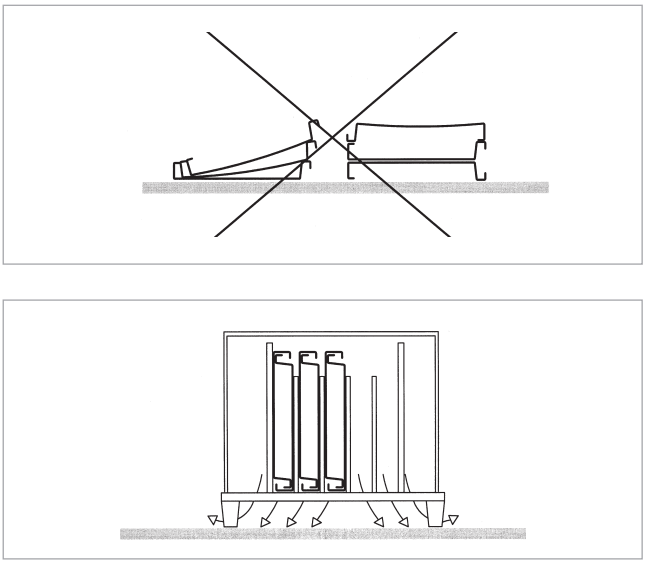
For optimal storage on-site, storage in a dry, well-ventilated room or container is advised.

If no room or container is available, the following should be observed:

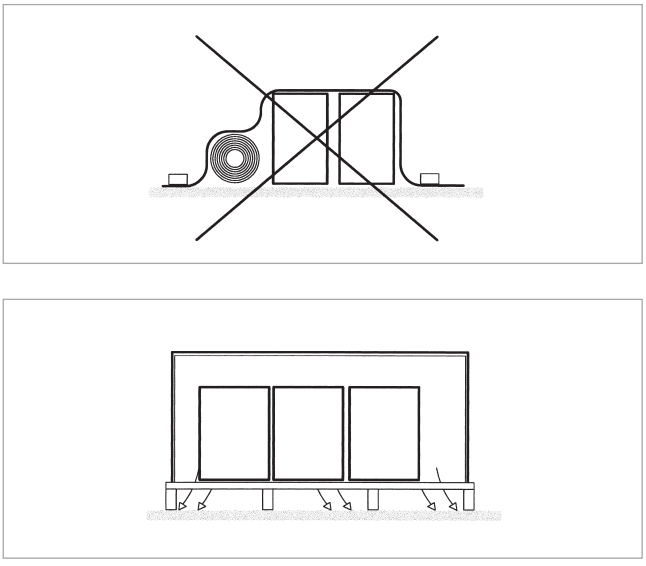
- The material should be protected from rain and moisture with appropriate covers. However, sufficient ventilation should also be ensured.
- Tarpaulins should not be placed directly onto the material, as moisture may get between the profiles and, in the absence of air, may lead to visual damage through the formation of zinc hydroxide (see Subsection 5.2).
- The material must not be stored directly on the ground, but must have sufficient clearance for condensation to evaporate
- Foiled material should not be exposed to direct sunlight (high temperatures); this can favour adhesive residues. For further information, see chapter 4.12.

Additionally, the material should be protected against typical "building-related soiling", such as cement and plaster dust, dust from stone cutting and stone dust etc. – both during storage and during relocation. Building dust combines with air humidity and constitutes lasting contamination of the metal surfaces. They should therefore be removed immediately, see chapter 6.

Incorrect storage on-site



Transportation and storage of panels



Transportation and storage of coils

4 PROCESSING INSTRUCTIONS

4.1 Recommendations for workflow on-site

In order to protect RHEINZINK from potential negative impacts from other trades during the building phase, such as plastering, it is recommended to plan the order of work amongst the parties involved so that sheet metal work is carried out afterwards, if possible.

If the trades cannot be separated in this way, the RHEINZINK material must be protected by a cover. This should be applied in such a way that ventilation of the covered components is ensured. If this is not possible for practical reasons, the following points should be observed:

- Do not directly cover damp RHEINZINK material
- Use dry covering material
- Fully adhere coverings, without air bubbles or wrinkles (danger of condensation formation)
- Only apply coverings in partial areas and immediately after work, at the latest at the end of the working day

If these notes are not followed, the formation of zinc hydroxide can be expected, which may lead to a visual defect on the surface (see Subsection 5.2). Affected surfaces should be cleaned immediately with RHEINZINK-Sweeper.

The storage of components or prepared metal sheets on site must always be planned such that they are protected and dry, ensuring that soiling or mechanical damage of the stored components can be avoided (see Section 3).

4.2 Avoidance of colour differences

Care must be taken to ensure that the same surface material is ordered for the property or that connected surfaces are ideally completed simultaneously with the same surface material.

In the event that long delays are unavoidable due to unplanned interruptions to construction, it should always be ensured that all common visible faces involving same surface material are completed as simultaneously as possible.

If this is not feasible due to logistical circumstances, it is to be expected in the case of long interruptions that small colour differences may initially occur due to the difference in reaction period. This type of colour difference is not evidence of a material defect, but rather highlights the material's natural properties and does not constitute grounds for complaint. The colour differences will even out as the patina forms. Ideally, the rolling direction should be observed during installation.
Note: For special thicknesses (1.5 mm), surface uniformity cannot be guaranteed for production reasons.

4.3 Working temperature

At metal temperatures of < 10°C, the additional measure of warming the working area, e.g. with a hot air gun, is necessary when abruptly reshaping the material (seaming, bending). This represents an additional cost, which must be separately compensated for.

At temperatures below zero, flawless processing can no longer be guaranteed.

It is therefore recommended to take account of work delays caused by the weather and the additional costs when planning.

Please note the additional information in Subsection 4.12.

4.4 Processing traces

Scratches can arise during forming with profiling machines, during transport, loading and unloading on site etc. They cannot be completely avoided during manual processing of metals. These areas weather over time. An even surface will develop once more (product lines RHEINZINK-CLASSIC and RHEINZINK-prePATINA ECO ZINC). These scratch marks do not affect the durability of the RHEINZINK materials.

To avoid processing traces, the use of foiled material is recommended.

4.5 Avoidance of fingerprints

Gloves should be worn in order to avoid fingerprints. Fingerprints which occur on the metal surface due to sweat on the skin may not be completely covered by natural weathering over time, dependent on intensity, and may be visually conspicuous for a long period of time.

4.6 Bending and roll forming

Zinc and its alloys are anisotropic, which means they have different properties parallel and perpendicular to the rolling direction. The mechanical effect of this anisotropy is reduced by the RHEINZINK alloy and rolling process such that the material can be folded 180° irrespective of the rolling direction.

A minimum bend radius of 1.75 mm should be applied. Where the metal thickness (t) exceeds 1.0 mm, the following applies to the minimum bend radius: 1.75 x t [mm].

The processing with standard roll formers is possible with no restrictions. Any soiling and deposits on the roll sets should be removed to avoid damage to the surface or coatings. The correct settings for the roll sets should continue to be ensured. The forward feed of the band material must take place without tension or slack, in order to avoid the formation of bulges during the roll forming process.

Imprints from bending machines and presses are unavoidable and do not constitute grounds for complaint. This also applies to so-called idle marks, which can arise during the roll forming process. If a higher level of flatness is required, bending the panels is therefore preferable to roll forming.

4.7 Soft soldering

The soft soldering process is a fast and easy method to produce a water-tight, firmly bonded and lasting connection. The temperature for soft soldering is about 250 °C and is therefore ideally suited for soldering the RHEINZINK material! The RHEINZINK parts to be joined remain in the solid state, but are bonded on the surface with the solder. The strength of the soldered seam (due to the connection of the solder with the material) is achieved through an alloy formation on the contact surfaces. With the right workmanship, the strength is is just as high as that of the base material.

Preparation of the soldered seam
The RHEINZINK surfaces to be soldered must be absolutely clean. If pieces of the RHEINZINK-CLASSIC bright-rolled surface variant are to be attached to each other, the following information should be observed: RHEINZINK-CLASSIC bright rolled can form a slight oxide layer on the surface, despite being stored correctly. In this case, the surface must be cleaned mechanically with stainless steel wool or chemically by repeated application of the flux.

Soldered seam overlap
The overlap area should be 10 to 15 mm. Soldered-through seams, i.e. overlap width = attached soldered seam width, yield the greatest strength. Larger overlap widths mean that soldering through is more difficult, such that a reduction in strength occurs in the soldered seam.

Flux
We recommend Felder's 'ZD-pro' soldering water as a flux for all surfaces. For RHEINZINK-CLASSIC, Chemet's 'Z-04-S' soldering water can also be used. Please note that for the surface quality RHEINZINK-prePATINA ECO ZINC graphite-grey, the temporary protective coating must be removed in advance, e.g. abrasively with stainless steel wool. For our RHEINZINK-GRANUM EXTRA surface, we recommend the newly developed 'Solvent EXTRA' from Felder for preparing the soldering process. As an alternative the surface can be treated abrasively. The soldering water 'ZD-pro' can then be used as a flux.

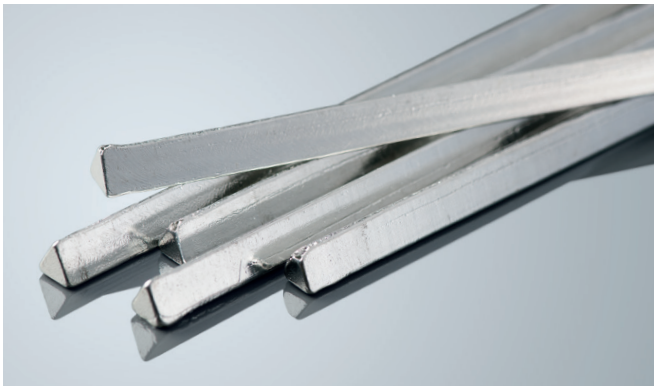
Tin solder
The task of the tin solder is the full dispersion on the material and the forming of a permanent bond with the material. That is why the solder and material must be perfectly matched.
Our recommendation is therefore the lead-free RHEINZINK Tin solder, SnZn 801 according to DIN EN ISO 9453. Alternatively: Tin solder low antimony, DIN EN 29453, S-Pb 60 Sn 40, manufacturer's label L-Pb Sn 40 (Sb)

Soldering bit
It is recommended to use a hammer bit with a weight of 500 g (min. 350 g). These weights allow for an optimal heat retention without overheating. The wide application surface (fin) ensures a rapid and even heat transfer to the soldering point. Please note that the heat must be added to the entire overlap area, because the solder only flows to where the corresponding heat is given. Pointed bits should only be used for areas that are inaccessible with the hammer bit.

In order to avoid later ruptures of the soldered seam, the thermal linear expansion of metal components must be taken into account. When the elements are assembled, the individual lengths add up to a total length. Movement in the event of temperature differences must, however, still be assured.

After soldering, it is imperative to remove all residues with a damp cloth.

Note:
Further information on soft solder joining technique can be found in the RHEINZINK brochure "Joining echniques – soft soldering and bonding".



Lead-free RHEINZINK-tin solder

4.8 Bonding

Full-surface bonding
Cold-applied bitumen adhesives, such as ENKOLIT from the Enke company, have proven themselves for the flat fixing of wall, cornice or windowsill coverings.

Suitable sub-surfaces for bonding with bitumen adhesives are all mineral surfaces, such as masonry, natural stone, cement screed, concrete, slate etc., as well as wood and wooden materials. Unsuitable surfaces are those sensitive to solvents, for example bitumen surfaces, most soft elastic plastics or polystyrene.
The bonding technique requires an even, firm base, which must be dust-free, clean and dry.

The adhesive is applied with a notched trowel. Full-surface bonding avoids the transmission of sound, particularly in the region of windowsills (no resonance vibrations of the fixed components). Components which are to be mounted in angled or vertical areas using bitumen adhesives must also be mechanically fixated. The adhesive manufacturer's instructions must also be observed.

Note:
Further information on full-surface bonding can be found in the RHEINZINK brochure "Design and Application – copings and connections".

Strip bonding
For many years, the bonding of metals has been a proven connection technology in various industrial production areas. It requires an adhesive adapted to the base material and a defined processing. Particular attention must be given to the preparation of the parts to be bonded. A clean and dust-free environment is to be ensured, especially on construction sites. Strip bonding is usually carried out with polyurethane adhesives with one or two components. Areas of application include joints of wall coverings or façade elements.

For strip bonding, the adhesive is ideally applied as a triangular bead, which is then compressed during joining to the intended height, usually half the original height.

Suitable sub-surfaces for bonding with polyurethane are all types of metal, mineral surfaces such as masonry and concrete, wood and wooden materials. When bonding plastics and coated components, the suitability of the adhesive should be checked. Unsuitable surfaces include bitumen surfaces and polystyrene.

To ensure secure bonding, sufficient surface adhesion is necessary and should be guaranteed by appropriate pre-treatment. All layers and coatings which reduce adhesion must be removed. In particular, greasy or oily films must be removed from metals using an appropriate cleaning agent. It may be necessary to roughen the surface. To improve adhesion, a primer or undercoat may be required, depending on the adhesive and surface. Before bonding, the primer must be sufficiently cured.

When bonding, the manufacturer's instructions must be observed.

A special gutter adhesive has been developed for the RHEINZINK roof drainage systems, and has been being used in some European countries for many years.

Note:
Further information on bonding RHEINZINK gutters can be found in the RHEINZINK brochure "Joining techniques – soft soldering and bonding".

4.9 Evenness

Coil material
A characteristic surface appearance for coil material is the slight wave structure typical of thin sheet material. These waves form as the reaction of a natural material to the rolling/unrolling process in the factory and the corresponding reshaping processes (profiling etc.) during workshop production or installation, see chapter 4.6.

This wave development (oil canning), typical for rolling, come to the fore after installation due to reflection of light.

DIN EN 988 allows for deviations in evenness of up to 2mm for rolled titanium zinc coils/sheets, before further processing. For all surface variants, such waves are visually less noticeable, if the viewing direction of the surface surface is changed (change in the the incidence of the sun's rays and thus the angle of reflection).

Additionally, these slight waves, specific to thin sheet material, become significantly less visually apparent once patina formation begins on the bright-rolled surface or the temporary protective surface film begins to weather, as no strong reflections occur from the pre-weathered surfaces. The period of time required for further patina formation on the property depends on the weather conditions (in particular, humidity) and local conditions. It is therefore not possible to specify a binding date.

Thin sheet cladding does not have a completely even surface. If there are increased requirements for the visual appearance, it is recommended to increase the metal thickness, reduce the panel width and possibly use sheet material.

Incorrect installation (only using fixed fixings, not taking account of linear expansion at detail points, non-flatness of the boarding) can also lead to increased waviness.

For the aforementioned reasons, only an assessment of unprocessed material prior to forming can be made.

Waviness

4.10 Toughness

The toughness of a material is the ability to convert externally applied energy into plastic deformation work without cracking or breaking. The demand for toughness / ductility is therefore correspondingly high for titanium zinc alloys.

However, toughness is not a material property in the classic sense, which is only determined by structure and microstructure, but is rather influenced by a variety of external conditions:
Applied stresses, e.g:

- notches, soldered seams, folds
- low temperatures
- sudden stresses

A material is therefore not tough (or brittle), it behaves tough (or brittle)! It is therefore important to critically scrutinise the conditions in the event of any processing difficulties.

4.11 Marking

As a rule, soft pencils should be used, no sharp or pointed objects.

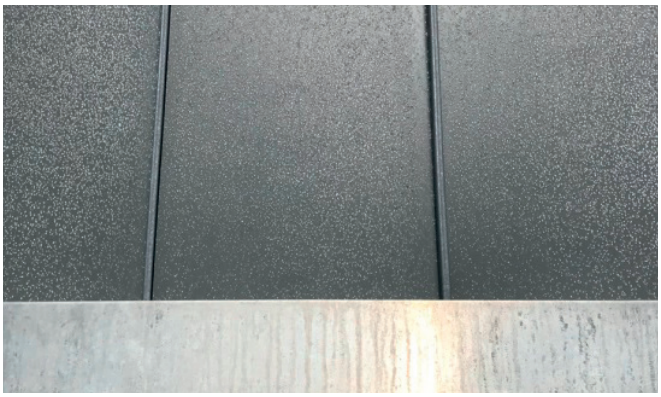
4.12 Protective plastic film

Note that the properties of protective plastic films and the glue can change due to environmental influences (sun/UV radiation, frost, temperature changes and humidity). When stored on site, the film-coated material must therefore be kept dry, ventilated and protected from direct sunlight. It is recommended to remove the film immediately after installation, at the end of the working day. A maximum storage period of 12 months must be observed.

5 EXTERNAL INFLUENCES

5.1 Use in regions with maritime climates

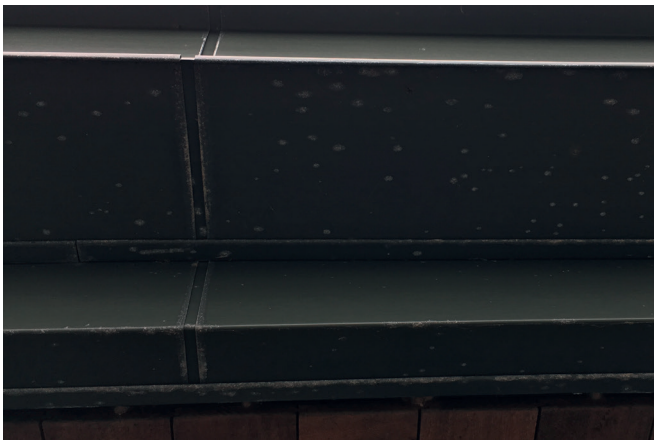
When RHEINZINK materials are used in regions with maritime climates, white deposits may form on the material due to the saline or chloride-containing air. These salt deposits may occur kilometres inland and may affect roofs and façades. These natural deposits are integrated into the material's patina and are more clearly visible on the surface of darker materials due to the colour contrast. Overall, the natural patina in these regions with saline or chloride-containing air appears brighter. The function and lifetime of the material used for façades, roofs and other parts of the building are not affected when the RHEINZINK installation guidelines are followed.



Examples of salt deposits on façades, seams and drip edges

The occurrence of salt deposits in regions with maritime climates is to be expected regardless of the material and surface chosen. This also applies to the coated product lines and surface variants. It is not possible to precisely identify regions with maritime climates which affect the material, due to variables such as local temperature, precipitation and wind conditions. For this reason, the extent or appearance of changes to the material's appearance cannot be predicted and varies from location to location.

In the event of precipitation, surfaces which are not exposed to regular rainfall or which are protected from rain (e.g. soffits or the underside of gutters) are usually more strongly impacted by the salty air and the white deposits, which are more visible on these surfaces. In addition, salt deposits may form on seams and drip edges. Again, this does not reduce functionality. It is recommended to clean the surface of the material with clean water (not seawater) at least once a year or more if necessary in maritime climate zones, depending on local conditions.



Examples of salt deposits on soffits and undersides of gutters

5.2 Formation of zinc hydroxide (white rust) on RHEINZINK-CLASSIC and -prePATINA ECO ZINC

As described in Subsection 2.1, RHEINZINK develops a protective zinc carbonate patina when exposed to the air.

When there is an inadequate supply of carbon dioxide from the air, for example in cases of poor storage, transportation or unsatisfactory covering, the patina development remains in the zinc hydroxide stage, which in the presence of sufficient moisture will grow in volume and appear as a whitish coating. It should be pointed out that, as a rule, the formation of zinc hydroxide on the upper surface of the material is a purely visual defect and does not affect the material's durability.

Zinc hydroxide formation due to insufficient slope

In the case of horizontally installed wall copings or similar applications, an insufficient slope can result in the formation of puddles, in which the material is exposed to moisture without an air supply. The result is the formation of zinc hydroxide. However, as this exposure is only temporary and the formation of zinc hydroxide is continually interrupted, the statement above that these are purely visual defects still applies.

For copings, there is a risk of formation of zinc hydroxide if they are covered with foil, e.g. for protection during plastering or painting work. In the event of rain or a change in temperature, moisture may penetrate under the foil. This appearance of zinc hydroxide on cladding can be avoided if the foil is removed at the end of the workday. Furthermore, appropriate planning of assembly sequences contributes to avoiding the formation of zinc hydroxide on RHEINZINK.

Hot water corrosion
If the underside of the metal is exposed to moisture in combination with high temperatures over a long period of time, due to physical property or installation errors, hot water corrosion may occur. Zinc carbonate cannot form on the underside because of the lack of carbon dioxide from the air. No exchange of air is possible. This type of hot water corrosion eventually leads to a pointwise deep corrosion (pitting).

5.3 Influence of metals laid above

Electrolytic corrosion can arise when different metals are assembled together if the metal (component) with the higher electrical potential is higher up in the flow direction of the water.

Harmless

- Aluminium, blank or coated
- Lead
- Stainless steel
- Galvanised steel (rust traces are however possible, from unprotected cut edges etc.)

Problematic

- Copper

5.4 Influence of roof sheeting laid above

When using the following products, a protective coat is required, e.g. Enke Multi Protect:

- Exposed bituminous roof sheeting without gravel surface/shingle (oxidation acid corrosion)
- PVC roof sheeting (acidic emissions)
- ECB roof sheeting (acidic emissions)

When using other products, it is recommended to request from the manufacturer the expected pH values of the resulting degradation products due to UV radiation. pH values between 5.5 and 11 are harmless for RHEINZINK material with regards to corrosion damage.

5.5 Influence of wooden cladding laid above

Interactions with the natural material of wood are essentially the result of its pH value. The pH value of a substance is an important chemical parameter defining how acidic or alkaline the substance is. In principle, pH values between 5.5 and 11 are harmless for RHEINZINK material with regards to corrosion damage.

RHEINZINK is not aware of any cases of significant corrosion occurring due to surface water on wooden-clad façade surfaces which led to a demonstrable reduction of the durability of a RHEINZINK-clad surface. Nevertheless, surface water on some types of wood, such as oak or red cedar, can lead to extreme surface colour changes. However, these are a purely visual defect.

Certain fire retardant or impregnating treatments of the wood can, however, have a corrosive effect on metals. The manufacturer information must be observed.

In order to avoid potential visual defects due to drips – resulting from dirt accumulation and/or the pH value arising – the collection of gathered surface water from wooden-clad areasby a gutter should ideally be taken into account during the detailed planning stage.

If, according to the manufacturer's information, corrosive effects are to be expected for treated wood, a protective coating is recommended.

5.6 Influence of oil heating

As for all light-coloured roofing materials, discolourations may become visible which are caused by the deposit of exhaust gas constituents from oil burning. Heating oil still contains minor, non-combustible ash content such as sulphur and sometimes ferriferous additives. The resulting deposits on the surface do not affect the durability of RHEINZINK material.

5.7 Influences during the construction phase

Splatters of paint or mortar, cement, plaster dust
Splatters usually occur during the transportation or use of paint or mortar or subsequent tasks on areas which are not correctly covered. As long as the splatters and deposits are still fresh or liquid, the marks can usually be largely removed by clear tap water with the addition of washing up liquid/neutral cleaner using a soft cloth. It is always recommended to remove this kind of splatter immediately if possible.

The following applies equally to all types of mortar and concrete:

1. They can become a corrosion problem caused by chlorides, which may have been added to the mixing water in the form of calcium or magnesium chlorides as part of the bonding agents or anti-freeze. Such problems may actively persist beyond the bonding or drying phase.
2. When they accidentally touch RHEINZINK, e.g. in the form of fallen mortar residues, they can cause a superficial change due to their moisture content alone, which is not of corrosive significance, but can constitute a visual defect.

Brick cleaning
Generally speaking, it can be assumed that brick cleaning agents damage the cladding due to their usually extremely low pH value, causing corrosion. Roof or façade surfaces underneath should therefore be protected.

Rust traces
Red rust stains can arise when steel components above RHEINZINK surfaces rust, or through drilling chips/swarf from processing of the steel which were not removed. In general, rust stains can only be removed via abrasion. However, this would lead to these areas appearing bright-rolled once more in the case of "pre-weathered" surfaces or those which already have a patina. Furthermore, it can be assumed that these rust stains would occur again if the cause cannot be eliminated.

Such cases are, as a rule, purely visual defects, which are not relevant to the durability of RHEINZINK materials.

Use of surfaces during installation
Walking on surfaces with dirty shoes, which could transfer building dust such as cement, plaster, lime, which have a corrosive effect when combined with moisture, onto the installed surface, should be avoided. In general, walking on completed surfaces should be avoided as far as possible to avoid scratches.

Adhesive residues
Adhesive residues from adhesive tape or protective plastic films which were left on the surface too long usually do not affect the surface. However, they can be complex to remove.

Information on cleaning RHEINZINK surfaces can be found in the Cleaning recommendations in Section 6.

5.8 Base and spray area, road salt, swimming pools

In the base area, soiling and changes to the patina formation may occur due to spray. In combination with moisture, road salt has a corrosive effect on metal. For this reason, façade cladding should in general be at a sufficient distance from the ground – usually ≥ 30cm.

For swimming pools with chlorinated or salt water, ensure that there is sufficient distance from the RHEINZINK cladding or coverings to prevent staining or corrosion caused by splashing water.

5.9 Influence of other materials

- Wood fibre plates installed above can lead to drips on eaves flashing or roof drainage products, which are however not usually corrosive.
- Only neutrally reacting silicon sealing compounds should be used.
- Extreme exposure can be expected if roof drainage systems must be replaced under a layer of old roof tiles (which may even be covered with moss). In these cases, corrosion marks may appear at the preferred drip points at the outlet of troughed tiles (e.g. pantiles), as the tiles have stored pollutants from the atmosphere as they aged. Particularly when they are dissolved by small flows of water (fog, dew, drizzle), these may be slightly acidic. Under such circumstances, new gutters often (depending on weather conditions during installation) do not have a chance to form a protective layer in the areas where they are predominantly subjected to these stresses. For this reason, a protective coat is recommended here, e.g. Enke Multi Protect.
- Die-cast accessories may cause stains
- In isolated cases, there may be wash outs with a corrosive effect from new roof tiles or shingles. The manufacturer should be asked about this as a precaution.
- When cleaning, e.g. window or PV module cleaning, it must be ensured that only pH-neutral cleaning products are used, in order to avoid stains on RHEINZINK material.

6 CLEANING RECOMMENDATIONS

6.1 General comments

Changes to the natural surface usually do not affect the material or reduce durability, but are purely a visual defect. However, contamination on material surfaces cannot always be avoided and may, for example during installation, be caused by external or environmental influences. RHEINZINK cannot guarantee that these recommendations will achieve an appearance as new.

Cleaning success depends on the level of contamination and the circumstances, including how long the contamination has already been present on the material. During cleaning, it is necessary to distinguish between the various product lines and surfaces. In general, the surfaces should not be cleaned with "hard objects" and/or acidic cleaning products, as the surface may be damaged. An abrasive treatment would lead to the surface appearing bright-rolled once more. In the case of the patina-forming surfaces only, these areas increasingly blend in visually during the weathering process.

In order to achieve long-lasting cleaning success, it is important to proceed extremely carefully. It is recommended to test the cleaning on a small surface. During the weathering process and the formation of the protective layer, the areas cleaned will increasingly blend in visually. When these cleaning recommendations are followed, visual defects of the material surface can usually be minimised.

Basic cleaning for all surfaces

- Clean the material quickly after the contamination has been identified with plenty of clear tap water, with the addition of a little washing up liquid/neutral cleaner (no abrasive cleaners), using a soft cloth or sponge and rubbing with a moderate amount of pressure in the direction of rolling.
- If necessary, repeat the process several times.
- In this case, too, dry with soft, lint-free cloths or paper microfibre cloths.
- It is imperative to change the cleaning cloth frequently.

6.2 Recommendations for cleaning RHEINZINK-CLASSIC bright-rolled and RHEINZINK-prePATINA ECO ZINC

Type of contamination	Surface	Step 1	Step 2	Step 3
Dust Slight contamination Slight zinc hydroxide stains	CLASSIC bright rolled, prePATINA ECO ZINC blue-grey and graphite-grey	Basic cleaning		
Fingerprints Plaster, mortar and paint residues Building and lime dust, pollen, bird droppings, chimney combustion residues, brown discolouration, rust stains	CLASSIC bright rolled	Basic cleaning	Possible abrasive pre-treatment with stainless steel wire wool	RHEINZINK-Sweeper
	prePATINA ECO ZINC blue-grey and graphite-grey	Basic cleaning	RHEINZINK-Sweeper	
Formation of white rust/ Formation of zinc hydroxide Road salt residue	CLASSIC bright rolled	Basic cleaning	Possible abrasive pre-treatment with stainless steel wire wool	RHEINZINK-Sweeper
	prePATINA ECO ZINC blue-grey and graphite-grey	Basic cleaning	WEICON® Metal-Fluid	RHEINZINK-Sweeper
Adhesive residues	CLASSIC bright rolled, prePATINA ECO ZINC blue-grey and graphite-grey	Basic cleaning	Citronex or Sika®-Remover-208 Sonax Adhesive Residue Remover	RHEINZINK-Sweeper
Salt deposits in maritime climate	It is recommended to clean the surface of the material with clean water (not seawater) at least once a year in maritime climate zones, depending on local conditions, please see basic cleaning.			
Heavy contamination Changes to surface	In these cases, cleaning the natural surface is not possible and matching the original condition is not to be expected. The changes are purely visual, in general a reduction in durability is not to be expected.			

Recommended products

- **RHEINZINK-Sweeper** is suitable for cleaning metals in the roof and façade areas. It does not leave greasy or sticky residue and is a temporary protective layer for the surface / available in RHEINZINK specialist shops (www.rheinzink.de)
- **WEICON Metal-Fluid** / available in specialist shops (www.weicon.de)
- **Citronex** / available in specialist shops (www.metallit.com)
- **Sika® Remover-208** / available in specialist shops (www.sika.com)
- **Sonax Adhesive Residue Remover** / commercially available

When using cleaning and care products, please observe the manufacturer's processing information and health and safety regulations.

6.3 Recommendations for cleaning RHEINZINK-GRANUM EXTRA

Type of contamination	Step 1	Step 2
Dust Slight contamination Slight zinc hydroxide stains	Basic cleaning	
Fingerprints Plaster, mortar and paint residues Building and lime dust, pollen, Bird droppings, combustion residues chimney, brown discolouration, traces of rust	Basic cleaning	
Road salt residues	Basic cleaning	
Adhesive residues	Basic cleaning	hebro®sol Citrus
Salt deposits in the maritime climate	It is recommended to clean the material surfaces in maritime climate zones at least once a year or more fre-quently, depending on local conditions, with clear water (not seawater), please see basic cleaning.	

Recommended products:

- **hebro®sol Citrus** / available in specialist shops (www.hebro-chemie.de)

When using cleaning and care products, please observe the manufacturer's processing instructions and health and safety regulations.

7 MAINTENANCE

7.1 General information

RHEINZINK-CLASSIC and RHEINZINK- prePATINA ECO ZINC are in general low maintenance respectively maintenance-free. The zinc carbonate patina which forms over time consistently protects the material from corrosive atmospheric pollution. Regular maintenance measures to preserve the material's functionality and durability are not required.

Solely when salt deposits form in areas with maritime climates or road salt reaches the surface in winter is it recommended to clean surfaces regularly.

Regardless of the material, gutters must be cleaned regularly, so that blockages do not arise and the rainwater is free to flow away at all times. It is recommended to enter into a maintenance contract with a specialised tradesperson.

The RHEINZINK-Leaf Guard helps reduce maintenance effort. This perforated plate profile, deliverable in 2m lengths, is inserted into half-round gutters of different dimensions and protects securely and durably without any fixing. The leaves remain on the perforated plate, dry there and are mostly blown away by the wind. Coarser dirt does not get into the gutter and is easy to remove. Even with a heavy build-up of leaves and heavy rain, the product's geometry, which is protected by technology, ensures a permanent flow of water, thereby safeguarding the functioning of the roof drainage system year-round.

Patina formation

Special information on patina formation
The patina formation described in Section 2 is dependent on various factors which influence the appearance of the property. Differing impact of rain can, e.g. in the case of varying roof pitches in a property or on the differently oriented façade surfaces, lead to temporary colour differences, as the patina forms at different speeds. Over the long-term, the surfaces converge in colour.

The situation is different for surfaces which are protected from the rain, e.g. below roof overhangs. Here, permanent colour differences may remain.

In the area of soffit cladding, changes to the patina formation may occur in some cases. This can be independent of the size and/or orientation (compass direction) of the soffit. There may be formation of zinc hydroxide. Particularly in maritime climates, salt deposits are to be expected.

If unfavourable weather conditions occur shortly after installation, this can lead to rapid, inhomogeneous patina formation. This is not a material defect and does not constitute grounds for complaint.

7.2 Soiling

The non-coated surface qualities in particular react with their surroundings in a manner typical of the material.

Discolourations, among other things due to greasy deposits or deposits of pollen, may occur. Stains can also be caused by road salt, urine, leaves or by objects such as ashtrays or plant pots being placed on horizontal surfaces.

Bird droppings
Soiling with bird droppings is in general a purely visual defect, which is not relevant for the material's durability.

Removal of the soiling without visually affecting the material should be carried out with water and a soft cotton cloth as soon as possible. If the droppings are allowed to remain on the surface for a longer period, stains may form.

Leaves
In general, leaves or the tannic acid formed by moisture do not affect RHEINZINK materials. However, it cannot be ruled out that visual defects on the metal surface remain after removal of the leaves, both for RHEINZINK-CLASSIC bright-rolled and for RHEINZINK-prePATINA ECO ZINC and RHEINZINK-GRANUM EXTRA.

Please observe the cleaning recommendations for the various surface qualities in Section 6.

8 COMPLAINTS

For an initial assessment of e.g. waviness or surface changes, please note the following general rules:

- Maintain a standard viewing distance that is appropriate to the size of the roof or façade surface and captures the overall impression.
- Consideration of the influence of changing light conditions due to sunlight or artificial lighting.
- Only normally visible surfaces can be assessed.

Surface changes caused by external influences from the surroundings cannot be objected to.

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