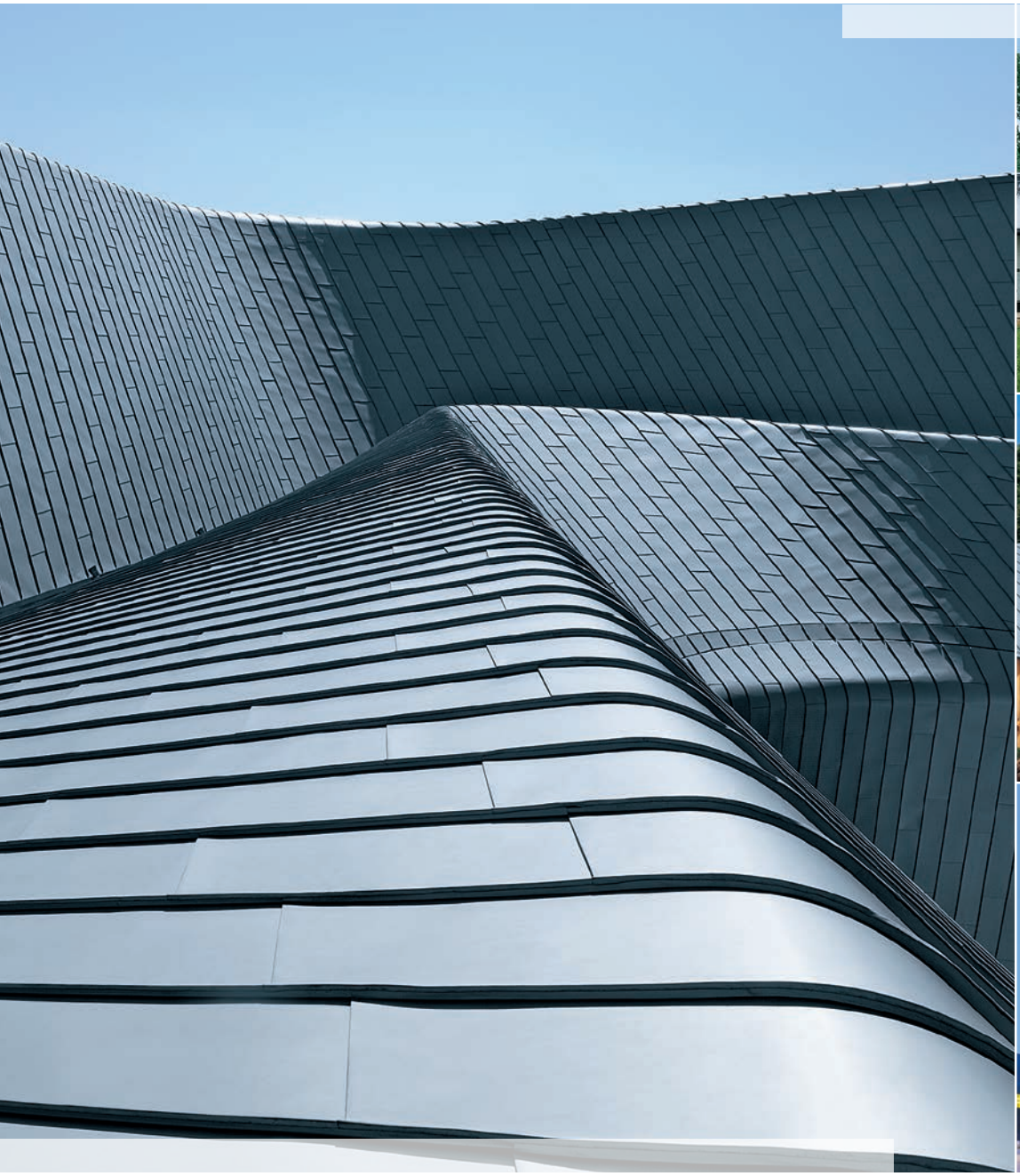
RHEINZINK®



DESIGN RECOMMENDATIONS

For Roof Coverings

PROCESSING AND INSTALLATION

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

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12th edition

These design recommendations offer architects, metal roofing installers, planners and interested developers an overview of RHEINZINK's roof covering systems and possible roof structures.

They include brief examples illustrating ventilated and non-ventilated roof constructions combined with different roof coverings. It is also important to inform you on important planning aspects which should be taken into account in order to satisfy the requirements to ensure a durable, maintenance-free and aesthetically appealing roof covering made of RHEINZINK.

Besides the legends for the design examples describing the roof structures, you will find relevant information about individual aspects of building behaviour. These aspects outline the "standard case" but do not relieve you of the responsibility for checking their relevance to your specific building project, which may in turn be subject to local requirements and regulations.

Page

Lightning Protection
The RHEINZINK roofing systems including the standing seam covering, the click roll cap system, QUICK STEP and the tile application can be used as an integral part of a lightning protection system (EN 62305-3, supplement 4 and VDE 0185-305).

Fire Protection
According to BS EN 13501-1 RHEINZINK is a non-combustible building material belonging to Class A1. This classification is the best possible and emphasizes the superior properties of RHEINZINK with regard to smoke emission and burning drip offs.

Wood Preservatives
Wood preservative treatments must be considered when using a timber structure. Components such as CCA, organic solvents or emulsions can be used but we recommend that you consult a recognized manufacturer for specific guidance.

Sound Insulation
With the help of the VAPOZINC structured underlay, sound transmission levels caused by rainfall can be reduced by up to 8 dB.

Protection from Snow
In areas with high snowfall it is essential that sealing strips are used in the standing seams. This will prevent capillary action occurring due to ice dams forming in the roof. The sealing strips should be positioned 2 m above the line of the external wall and taken down to the eave of the roof. Sealing strips should also be included for standing seam coverings where snow guard systems are in use. The installation of snow guard systems and ice guards depends on the local climate and its prevelance to low temperatures. They should be installed on buildings at public access locations. Please contact your RHEINZINK representative for further guidance.

Product Recommendations
Snow and Ice Guards
- Standing seam systems: RHEINZINK S5 snow guard system
- Click roll system: Snow guard clamps from SM-Systeme GmbH, D-Ludwigsburg, with aluminium tubing and ice guards
- Tile system: Heuel snow guard bracket with aluminium tubing and ice guards
- QUICK STEP: RHEINZINK QUICK STEP snow guard system

Structural Design
All roof and facade installations will need to perform to current wind loadings as per BS EN 1991-1-4:2005+A1:2010. These loads will determine the substructures design including rafter thickness, batten spacing and the fixing centres for the supporting timber substrate to take the zinc.
Additional loads will need to be allowed for at the roof overhangs. The use of perforated meshes and wind permeable soffit linings should also be taken into consideration. Roof coverings based on the click roll cap, QUICK STEP, tile and standing seam systems can be designed to withstand maximum wind loads by correctly selecting the appropriate metal thickness, seam spacing, number of clips/ click roll cap fasteners and their fixing to the substructure.

Substructures:
The following requirements are applicable to substructures:

Requirements for Softwood Boarding
Square-edged sawn in parallel, with $b \leq 160$ mm and $d \geq 22$ mm

Requirements for Plywood/OSB Boards
Thickness $d \geq 18$ mm and a length of ≤ 2.5 m

- Structural grade plywood as per BS EN 1995 and BS EN 313/314
- Structural grade OSB/3 or OSB/4 as per BS EN 300
- Solid wood panels as per BS EN 12775-2
- Cement-bonded particleboard as per BS EN 633 as material belonging to class B-s1-d0 or A2-s1-d0

Requirements for Metal Substructures
- Steel structural deck profiles as per BS EN 14782

Thermal Insulation
The minimum insulation thicknesses as specified by the planner, must be taken into account.

Moisture Protection

It is imperative to keep the build-up moisture free. When wet, the insulation's performance may decrease and the integrity of the construction could fail over a period of time.

To ensure the build-up performs properly certain layers are installed to regulate diffusion transitions and to drain off any moisture.

The s_d-values shown in table 2 for breathable/ diffusioninhibiting layers for ventilated roof structures will give guidance for the correct choice of breather membranes. In addition, the planner must ensure sufficient moisture protection for the structure and supply a condensation analysis as per BS EN ISO 13788 where required. This is especially relevant to buildings with extremely high humidity levels, e.g. rooms with swimming pool, sauna etc.

Breather membranes are recommended as they provide additional protection for the insulation from the elements. Moreover, they form a windtight layer and prevent cold air from penetrating into the surface of open cell insulation. This ensures that the thermal performance of the insulation is maintained.

Height of Ventilation Space

Roof pitch	Ventilation space (mm)	Intake/exhaust Openings (mm)
≥ 3° to ≤ 15°	≥ 75	≥ 40
> 15°	≥ 40	≥ 30

Table 1

Non-ventilated roof structures are subjected to higher requirements. To prevent moisture caused by diffusion the vapour barrier has to have an s_d-value > 100 m (> 500 MNs/g). In all cases it is important that these layers are installed air tight. Calculations show that when moisture is trapped by means of convection, caused by small air gaps in the vapour barrier, it is by a factor of over 150 times greater than that caused by diffusion. If a humidity-controlled intelligent vapour barrier is used with non-ventilated build-ups, then a condensation analysis as per BS EN 15026 is required

The following aspects should be considered, especially in the case of non-ventilated roof structures:

- Avoid moisture in building materials and on site
- Avoid introducing moisture via vapour diffusion and convection (airtight design)
- Avoid thermal bridges, e.g. created by fixings
- Install a structured underlay or employ equivalent additional measures
- An non-ventilated roof structure must be carefully protected from the ingress of water as there is no ventilation zone to remove trapped moisture.

New Developments

The following aspects should be considered during the planning and installation of intelligent vapour barriers in relation to the latest standards:

- Numerical hygrothermal simulations must be performed with variable vapour retarders for each structure (BS EN15026).
- Non-permeable boarding (e.g plywood or OSB) should not be positioned between the thermal insulating materials and the intelligent vapour barrier.
- Vapour barriers should be protected from the effects of strong sunlight during installation.
- The vapour barrier must be installed once the insulation is in place.
- Trapped moisture must be allowed to disperse. In winter, it may be necessary to use dryers to remove the moisture.

Allocation of Values for Vapour diffusion-equivalent Air Layer Thicknesses of Layers above/below the thermal Insulation Layer*; RHEINZINK Guideline

Vapour diffusion-equivalent air layer thickness s_d [1] measured in m	
outside $s_{d,e}$ [2]	inside $s_{d,i}$ [3]
≤ 0.1	≥ 1.0
≤ 0.3	≥ 2.0
> 0.3	$s_{d,i} \geq 6 \times s_{d,e}$

Table 2

[1] s_d is the symbol for Equivalent Air layer Thickness. It is a measure of the material´s resistance to let water vapour pass through. It is measured in meter's.
You will also find Vapour Resistance is measured in MNs/g as a measure of the material´s resistance to let water vapour pass through.
To convert s_d-value to Vapour Resistance: s_d divided by 0.2 gm/MNs (typical value for the vapour permeability of still air)

[2] $s_{d,e}$ 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.

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

* The values only apply when permeable insulation types are used, e. g. mineral wool.

V 01: Ventilated Roof Standard – Double Standing Seam on structured Underlay and Plywood

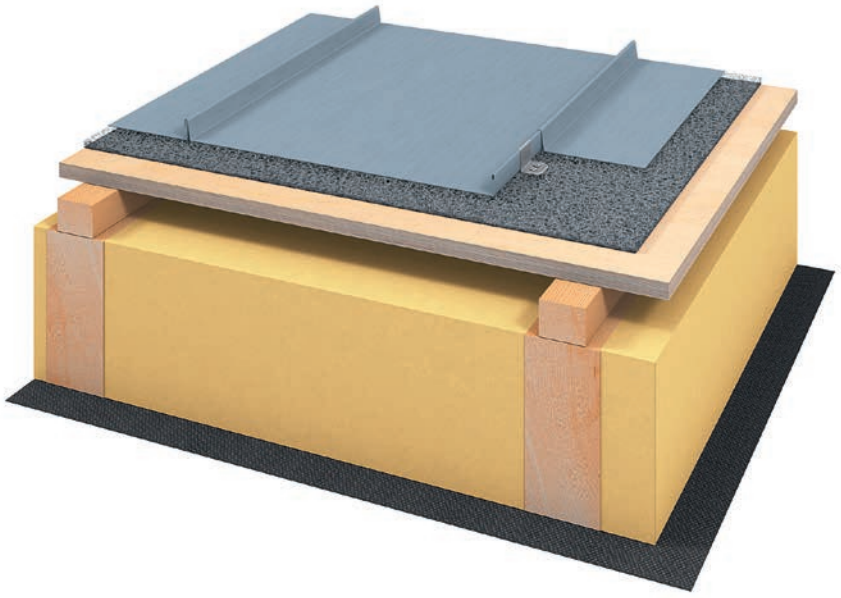
Characteristics
This construction is one of the most common ventilated build-ups. Any moisture in the structure resulting from incorrect installation of the zinc covering or vapour barrier, or the moisture content of the materials themselves, could cause damage to the construction. With this build-up, moisture can ventilate out of the construction by using the air space. A diffusion-open construction helps the build-up to stay moisture free and offers a reliable and "safe" build up solution.

Substructure
Plywood or OSB boarding is the most common substructure, thickness ≥ 18 mm.

Fastening
The clips are fixed with screws or ring shank nails into the boarding. The distances between the clips result from the local wind loads. Please use the RHEINZINK windload table or contact a structural engineer for further information. The use of fixed and sliding clips need to be considered when it comes to scheduling the build.

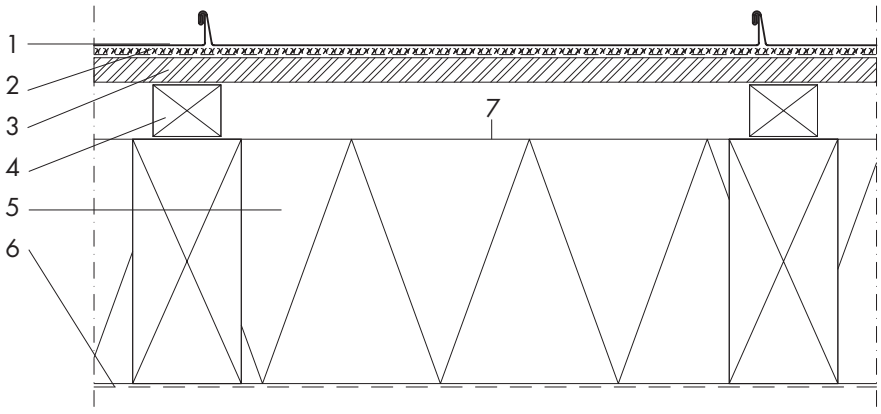
Height of Ventilation Space
Please see Table 1, page 5

Roof Build-up
1 RHEINZINK-Double Standing Seam System
RHEINZINK-Sealing Strip should generally be included with roof pitches between ≥ 3° and ≤ 7°.
2 VAPOZINC – structured underlay by RHEINZINK
3 Plywood/OSB, thickness ≥ 18 mm
4 Timber battens for ventilation space, height subject to roof pitch
5 Fully insulated joist zone with wooden rafters, in accordance with the planner's specifications
6 Vapour control layer, with airtight installation, s_d-value according to Table 2, page 5
7 Optional: Breather membrane, fully supported flexible underlay as per BS EN 13859-1+2 with sealed overlaps where required



Advantages
- BRE Green Guide A rated
- Noise reduction up to 8 dB with VAPOZINC
- A diffusion open VAPOZINC helps the construction to "breathe".
- Moisture can be ventilated out of the construction

By the way, did you know that…
… RHEINZINK-Standing Seam Systems can be installed up to lenghts of 16 m without a cross joint (Trays of this length must not be laid on pitches > 30°).
… RHEINZINK-Angled Standing Seam is used for roof pitches ≥ 25° and facade application.



V 02: Ventilated Roof Build-up with RHEINZINK-Flat Lock Tiles on Softwood Boarding and AIR-Z, Roof Pitch ≥ 25°, applicable for tile sizes > 0,4 m²

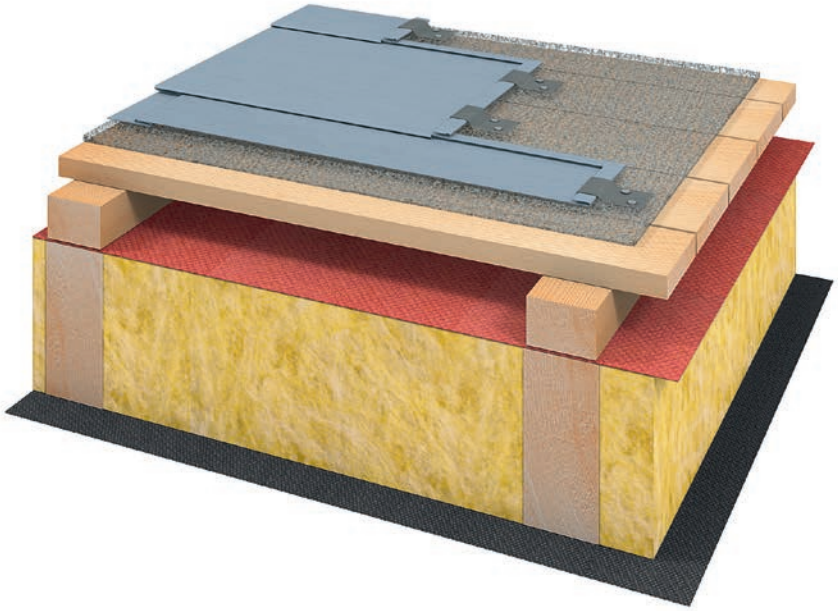
Characteristics
A ventilated build-up is strongly recommended to allow the release of moisture. A diffusion open membrane as a rainproof layer enables the construction to remain dry and will also allow any rainwater or snow to drain off. The AIR-Z structured mat serves as a buffer between the underside of the zinc and the substructure and sound transmission levels caused by rainfall can be reduced by up to 8 dB.

Substructure
For this build-up we strongly recommend softwood board substructure with gaps (5 mm), thickness ≥ 22 mm, width ≤160 mm. Avoid cupping whem installing the bonding.

Fastening
The clips are fixed with screws or ring shank nails into the soft wood boarding. There are different clips or clip rails for different tile dimensions. The distances between the clips result from the local wind loads. For more information please contact your RHEINZINK representative.

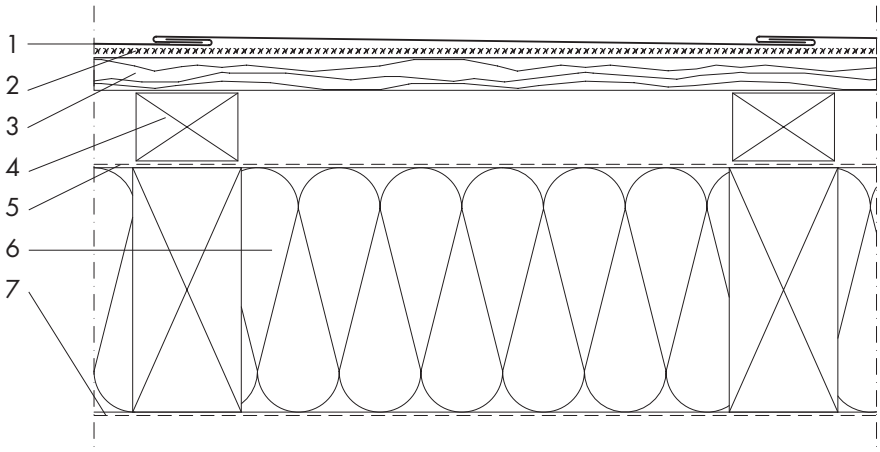
Height of Ventilation Space
Please see Table 1, page 5.

Roof Build-up
1 RHEINZINK-Flat Lock Tile System
2 AIR-Z – structured mat by RHEINZINK
3 Softwood boarding, thickness ≥ 22 mm
4 Timber battens for ventilation space, height subject to roof pitch
5 Breather membrane: Fully supported flexible underlay as per BS EN 13859-1+2 with sealed overlaps and nail sealant tapes under counter battens
6 Fully insulated joist zone with wooden rafters, in accordance with the planner's specifications
7 Vapour control layer, with airtight installation, s_d-value according to Table 2, page 5



Advantages
- BRE Green Guide A/B rated
- Noise reduction up to 8 dB with AIR-Z
- Structured mat prevents trapped moisture
- Breather membrane serves as a rainproof layer

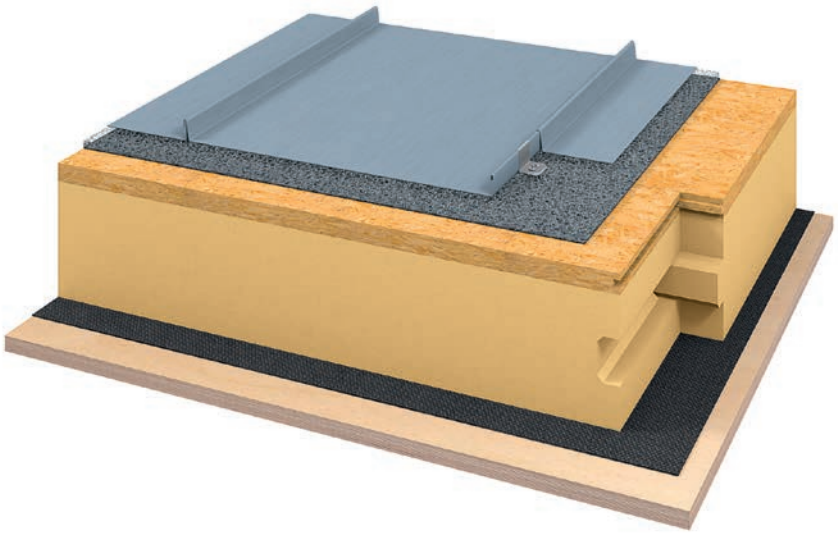
By the way, did you know that…
… Flat Lock Tiles are available in many sizes offering endless design possibilities. The maximum tile size is subject to local wind loads and should not exceed 600 x 3000 mm. Please contact our representative for further guidance.
… we offer the fullest support to find suitable build-ups for RHEINZINK-Flat Lock Tile Systems at roof pitches < 25°.



NV 01: Non-ventilated Roof Build-up – sealed Warm Roof on structured Underlay and Linitherm OSB PAL System

Characteristics

This build-up is a non-ventilated construction with a minimum of thermal bridges. The provision of easy fastening clips into the timber battens which are fixed to the insulation will save time and cost. Non-ventilated build-ups will need specific planning, with care taken over the installation. An airtight installation of a diffusion-tight, or an intelligent vapour barrier from the inside, will avoid the uptake of moisture through gaps (convection), or the layer itself (diffusion). The construction has to be kept dry in order to avoid rotting or a breakdown of the construction. Therefore, throughout the build time, the construction should be protected from rain or snow ingress.



Substructure

The pre-fabricated insulation system consists of rigid insulation with a bonded layer of 22mm OSB grade 3 to the outer surface. The thickness of the system will be specified by the planner.

Fastening

The clips are fixed with screws or ring shank nails into the OSB layer. The distances between the clips will be determined by the local wind loads. Please use the RHEINZINK windload table or contact a structural engineer for further information. The use of fixed and sliding clips need to be considered.

Advantages

- VAPOZINC allows the drying out of moisture
- Noise reduction up to 8 dB with VAPOZINC
- VAPOZINC helps to even out substructure tolerances and nail marks
- Less penetration through vapour barrier

By the way, did you know that…

… the intake of moisture through gaps (convection) can be up to 150 times higher compared to that through the material itself (diffusion).

… different substructures are possible e.g. steel deck, timber deck or concrete

Roof Build-up

1 RHEINZINK-Double Standing Seam System
RHEINZINK-Sealing Strip should generally be included with roof pitches between ≥ 3° and ≤ 7°.

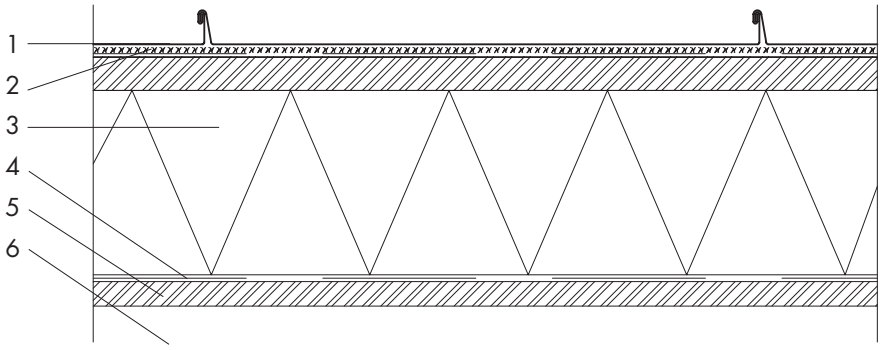
2 VAPOZINC – structured underlay by RHEINZINK

3 Pre-fabricated insulation element with 22mm OSB layer

4 Vapour control layer, with airtight installation,
s_d-value ≥ 100 m (≥ 500 MNs/g)

5 Plywood, thickness in accordance with the planner's specifications

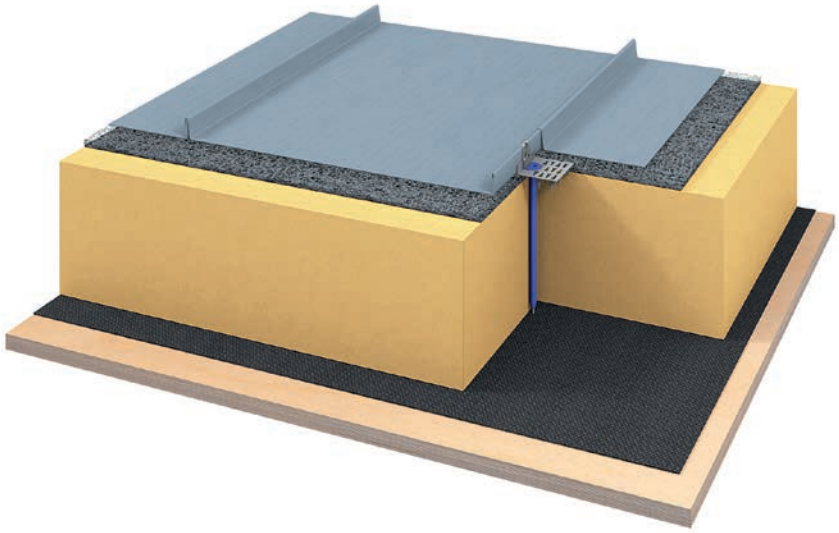
6 Rafter zone



NV 02: Non-ventilated Roof Build-up – sealed Warm Roof on structured Underlay with Warmfast Fixing

Characteristics

The warmfast fixing system is used to reduce thermal bridges. A special fastening system with plastic sleeves of various lenghts penetrate the insulation at clip centres. Non-ventilated build-ups will need specific planning, with care taken over the installation. An airtight installation of a diffusion-tight vapour control layer will avoid the uptake of moisture through gaps (convection), or the layer itself (diffusion). The construction has to be kept dry in order to avoid rotting or a breakdown of the construction. Therefore, throughout the build time, the construction should be protected from rain or snow ingress.



Substructure

A rigid mineral wool or a rigid foam insulation is to be used. Requirements for foam insulation: compression strength σ_{10} ≥ 100 kPa, density ≥ 17 kg/m³.
Requirements for mineral wool: compression strength σ_{10} ≥ 50 kPa, with a high density top surface. The type and thickness of the insulation should be specified by the planner.

Advantages

- Noise reduction by up to 8 dB with VAPOZINC
- VAPOZINC allows the drying out of moisture
- VAPOZINC helps to even out substructure tolerances and nail marks
- Reduction of thermal bridges
- Flexible positioning of clips

By the way, did you know that…

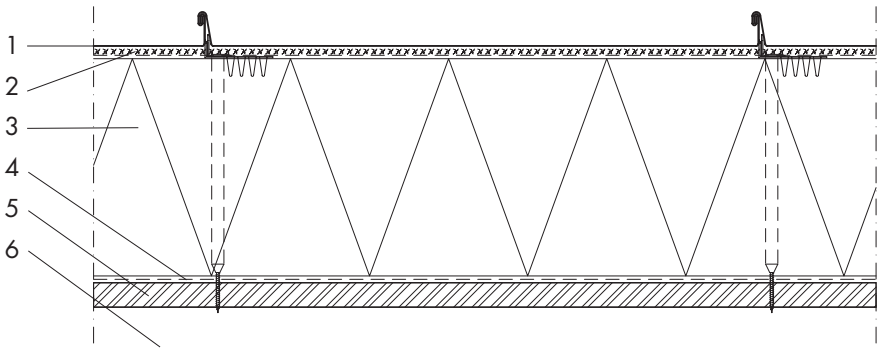
… the fixing screws may be visible from the underside.

Fastening

The distances between the clips are subject to the local wind loads. Please contact the manufacturer of the fixing system for further guidance. The use of fixed and sliding clips need to be considered when it comes to scheduling the build.

Roof Build-up

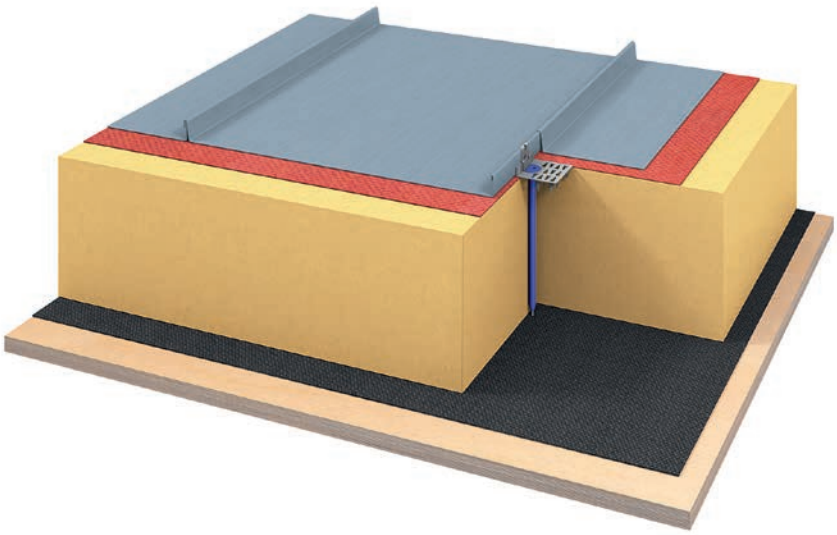
1 RHEINZINK-Double Standing Seam System
RHEINZINK-Sealing strip should generally be included with roof pitches between ≥ 3° and ≤ 7°.
2 VAPOZINC – structured underlay by RHEINZINK
3 Rigid insulation
4 Vapour control layer, with airtight installation,
s_d-value ≥ 100 m (≥ 500 MNs/g), e.g. DSAL, Bituthene
5 Plywood, thickness in accordance with the planner's specifications
6 Rafter zone



NV 03 – ProRoofing: Non-ventilated Roof Build-up – sealed Warm Roof on Breather Membrane with Warmfast Fixing

Characteristics

This build-up can be compared to build-up NV 02. The only difference is the RHEINZINK material is underside protected with a coating (ProRoofing) which offers a higher protection against moisture. A common breather membrane provides a dividing layer between the zinc and the insulation.



Substructure

A rigid mineral wool or a rigid foam insulation is to be used. Requirements for foam insulation: compression strength σ_{10} ≥ 100 kPa, density ≥ 17 kg/m³. Requirements for mineral wool: compression strength σ_{10} ≥ 50 kPa, with a high density top surface. The type and thickness of the insulation should be specified by the planner.

Fastening

The distances between the clips are subject to the local wind loads. Please contact the manufacturer of the fixing system for further guidance. The use of fixed and sliding clips need to be considered when it comes to scheduling the build.

Advantages

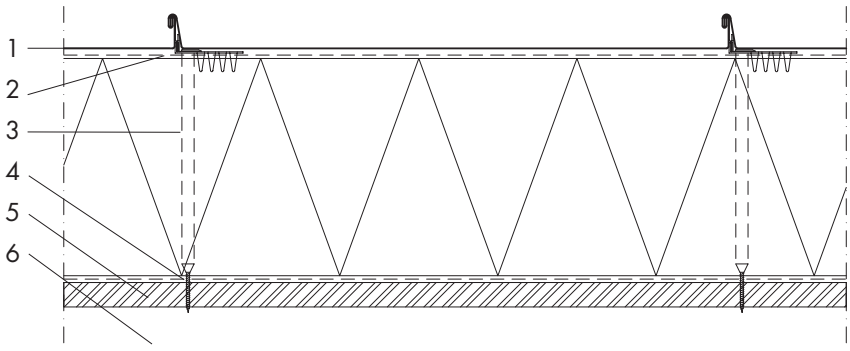
- Underside coating offers added protection and omits the use of structured underlays
- Reduction of thermal bridges
- Flexible positioning of clips

By the way, did you know that…

… the RHEINZINIK underside coating is abrasion resistant, offers protection from trapped moisture and has excellent folding and adhesive properties.

Roof Build-up

1 RHEINZINK-Double Standing Seam System, ProRoofing material quality
RHEINZINK-Sealing Strip should generally be included with roof pitches between ≥ 3° and ≤ 7°.
2 Breather membrane: Fully supported flexible underlay as per BS EN 13859-1+2 with sealed overlaps, do not use moisture-absorbing materials
3 Rigid insulation
4 Vapour control layer, with airtight installation,
s_d-value ≥ 100 m (≥ 500 MNs/g), e.g. DSAL, Bituthene
5 Plywood, thickness in accordance with the planner's specifications, minimum thickness ≥ 18 mm
6 Rafter zone



NV 04 – ProRoofing: Non-ventilated Roof Build-up – sealed Warm Roof on Breather Membrane and Composite Panel

Characteristics

The underside coated material RHEINZINK-ProRoofing is installed on a breather membrane and a composite panel. Clips are fastened directly into the metal skin of the composite panel. As there are various composite panels please contact the manufacturer for the panel's properties. For detailing reasons the minimum roof pitch is ≥ 5°.

Substructure

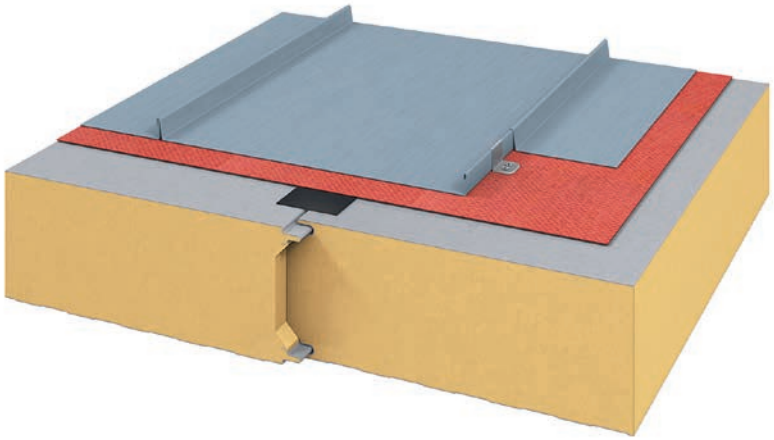
Composite panels consist of e.g. a PIR-insulation and a metal skin. Insulated panels enhance weathertightness and thermal airtightness. The particular thickness of the system should be specified by the planner.

Fastening

The clips are fixed directly into the thin sheet metal covering of the composite panel. Please contact the panel manufacturer for the right choice of fixings to achieve the required pull-out strength of 400 N/clip. The distances between the clips will be determined by the local wind loads. Please use the RHEINZINK windload table or contact a structural engineer for further information. The use of fixed and sliding clips need to be considered when it comes to scheduling the build.

Roof Build-up

1 RHEINZINK-Double Standing Seam System, ProRoofing material quality
RHEINZINK-Sealing Strip should generally be included with roof pitches between ≥ 3° and ≤ 7°.
2 Breather membrane:
Fully supported flexible underlay as per BS EN 13859-1+2 with sealed overlaps, do not use moisture-absorbing materials
3 Composite panel, all joints to be taped and sealed as per manufacturer´s recommendation
4 Rafter zone

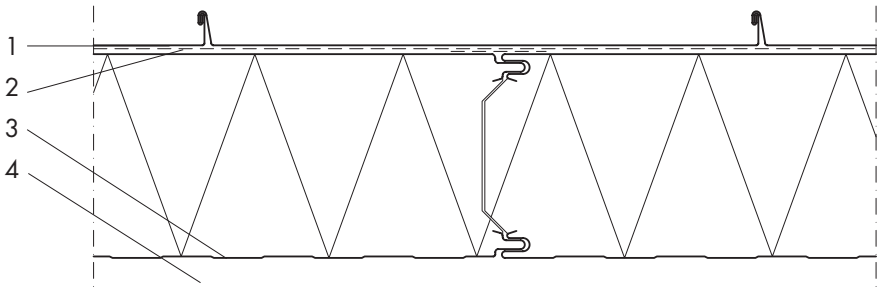


Advantages

- ProRoofing means safe application of RHEINZINK
- Easy and time-saving installation
- Reduced construction height providing slim architectural details
- Composite panels are weathertight allowing for early progression of internal work

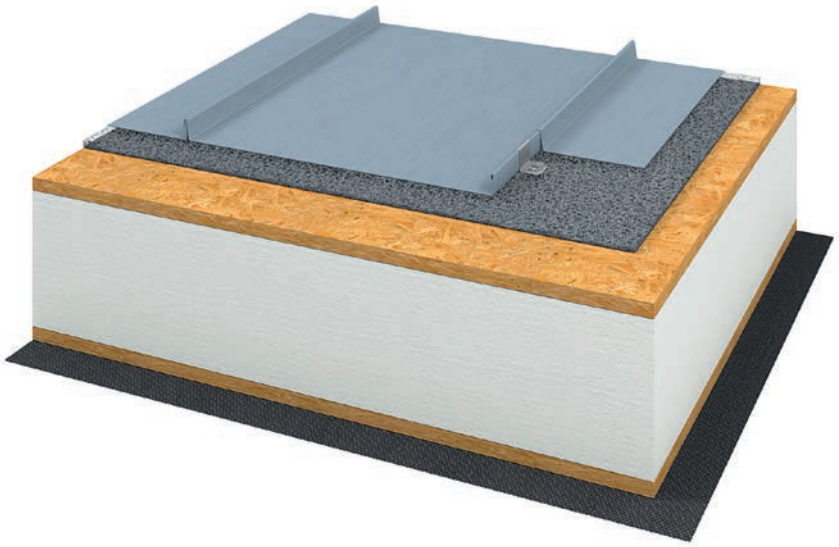
By the way, did you know that…

… RHEINZINK produce a range of rainwater goods to match the roof covering.



NV 05: Non-ventilated Roof Build-up – sealed warm Roof on structured Underlay and Structural Insulated Panel (SIP)

Characteristics
This build-up can be compared to the previous sections. It differs in its use being a Structural Insulated Panel. As with the other non-ventilated build-ups, this also has to be installed with high degree of precision and kept dry.



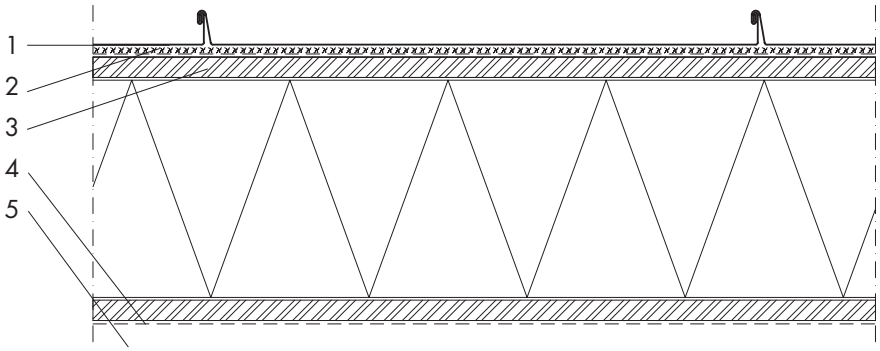
Substructure
SIPs consist of two parallel faces – usually Oriented Strand Board (OSB), with a rigid core of Polyurethane (PU) foam or Expanded Polystyrene (EPS). The particular thickness of the system should be specified by the planner.

Fastening
The clips are screwed into the OSB covering layer of the SI panel. The OSB layer must be able to resist pull out forces of 400 N/clip. The distances between the clips will be determined by the local wind loads. Please use the RHEINZINK windload table or contact a structural engineer for further information. The use of fixed and sliding clips need to be considered when it comes to scheduling the build.

Advantages
- BRE Green Guide A rated
- Noise reduction by up to 8 dB with VAPOZINC
- Easy and time-saving installation
- Reduction of thermal bridges

By the way, did you know that…
… RHEINZINK is the building metal with the lowest primary energy content.

Roof Build-up
1 RHEINZINK-Double Standing Seam System
RHEINZINK-Sealing Strip should generally be included with roof pitches between ≥ 3° and ≤ 7°.
2 VAPOZINC – structured underlay by RHEINZINK
3 SI panel, sealed joints as per manufacturer´s recommendation
4 Vapour control layer, with airtight installation,
s_d-value ≥ 100 m (≥ 500 MNs/g)
5 Rafter zone



Olgiata Sporting Club, Rom, Italy

Avenham Park Pavilion, Preston, United Kingdom

Avenham Park Pavilion, Preston, United Kingdom

Museum of Transport, Glasgow, United Kingdom

Maggie's Centre, Swansea, United Kingdom

Natural Living in De Weel, Zijdewind, The Netherlands

South Lodge, Buckinghamshire United Kingdom

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

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