



RHEINZINK®

RHEINZINK® Design Recommendations for Roof Coverings

7th Updated Edition

Ventilated Roof Structure

Ventilated roofs with RHEINZINK® coverings are double-shell structures which consist of three components layers:

- roofing
- ventilation level with sufficiently dimensioned vent openings
- framework with heat insulation and airtight layer (vapour barrier)

European Lowland

	Roof pitch	Particularly advisable	Advisable	Acceptable	Not advisable
RHEINZINK®-Click Roll Cap System	≥ 3°	1	2	/	4
	≥ 15°	1	2	4	/
Double Standing Seam	≥ 3°	1	2	2	3/4
	≥ 15°	1	2	4	/
Angled Standing Seam					
	■ Lowland	≥ 25°	1	2	2/4
■ High Alpine Region	≥ 35°	1	2	2/4	/

Tab. 1: Sub-roofs, underlays and sealing strips for ventilated design, depending on the climate at the location of the building

Legend for Tables 1 and 2:

- 1 No underlay with sub-roof
- 2 Structured underlay
- 3 Underlay (e.g. V 13 or equal) in addition to RHEINZINK-sealing strip
- 4 Underlay (e.g. V 13 or equal)

General:

1. Full rafter insulation with a roofing membrane (rainproof breather membrane) is the ideal solution for unventilated rafters.
2. Chemical wood protection can only be omitted with unventilated roof frameworks (rafters with rainproof breather membrane).
3. The greater the diffusion offered by the design, the lower the susceptibility of the roof cross-section to unforeseen moisture, something which can never be excluded.
4. The airtight layer on the underside of the rafters is essential for the fastening functionality of the design as it prevents damage from condensation due to water vapour convection. In terms of thermal protection and protection against moisture regional regulations have to be followed.
5. When doing without a separating layer with use of timber boarding an additional evaporation factor should be included, something which is of benefit to the entire design. In this regard OSB or plywood sheets are not to be recommended.
6. Installation of a rainproof breather membrane offers additional protection against drifting snow and back-water particularly in regions exposed to heavy snowfall.
7. The breather membrane can be basically used as an installation cover during the construction phase.

For waterproof substructures such as large OSB or plywood sheets the use of a structured separating layer is generally recommended.

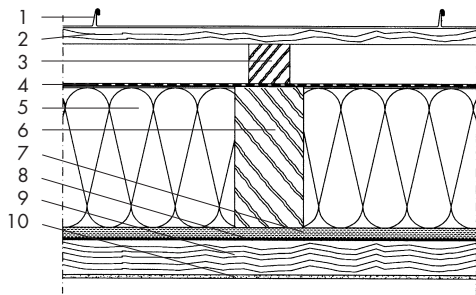


I. Ventilated roof design for metal roof systems with non-ventilated supporting structure and full rafter insulation

Normal-case values for height of ventilated space

Ventilated cross-sections depending on roof pitch

Roof pitch	Free height ² of ventilated space (min.)	Width of groove (net)
$\geq 3^\circ - \leq 15^\circ$	8 cm	≥ 4 cm
$> 15^\circ$	4 cm	≥ 3 cm



- 1 RHEINZINK®-standing seam roofing
- 2 Timber boarding 24/max. 160 mm, chemical wood protection not necessary
- 3 Battens, chemical wood protection not necessary, Height of ventilated space (see chart)
- 4 Breather membrane S_d -value $\leq 0,2 \text{ m}^1$ (possibly)
- 5 Fully insulated rafters
- 6 Rafters, chemical wood protection not necessary
- 7 Plywood sheets for summer heat protection (plywood or OSB boarding as a storage layer)
- 8 Airtight layer which acts as a vapour barrier, UV-resistant, S_d -value¹ depending on the length of the rafter, $\geq 2,0 \text{ m}$
- 9 Support batten to take internal lining (additional insulation)
- 10 Internal lining

Measures

For measures pertaining to the use of underlays and sealing strips, see Table 1.

- For roof pitches $\geq 3^\circ - \leq 7^\circ$ additional sealing strips are recommended.
- In regions with extreme weather conditions (alpine, etc.): Fundamental use of sealing strips in double standing seams up to $\geq 2 \text{ m}$ of the roof pitch within the building in case of ice dams/water back-up.
- In the case of waterproof substructures, e.g. plywood sheets used as roof sheathing, a structured underlay is always required.

Additional measures are the obligation of the planner or, respectively, the individual carrying out the work.

Noise reduction

- Noise reduction value R_w : 48 dB³

These Design Recommendations are developed for western european climate. Please ask other possibilities of constructions in other climates or regions.

Length of rafter	$\leq 10 \text{ m}$	$\leq 15 \text{ m}$	$> 15 \text{ m}$
S_d -value ($\mu\text{-s}$)	$\geq 2 \text{ m}$	$\geq 5 \text{ m}$	$\geq 10 \text{ m}$

¹ S_d -value of the breather membrane is smaller than the S_d -value of the airtight layer

² Project-related deviations are possible following discussions with the RHEINZINK® Department of Application Engineering

³ Testmethod referring to EN 20 717

For waterproof substructures such as large OSB or plywood sheets the use of a structured separating layer is generally recommended.



II. Ventilated roof design with a ventilated supporting structure without full rafter insulation, with a structured underlay, for metal roof systems.

Normal-case values for the height of ventilated space

Ventilated cross-sections depending on roof pitch

Roof pitch	Free height ventilated space (min.)	Width of groove (net)
$\geq 3^\circ - \leq 15^\circ$	8 cm	≥ 4 cm
$> 15^\circ$	4 cm	≥ 3 cm

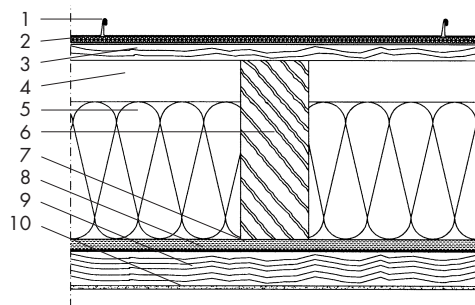
Measures

For measures pertaining to the use of underlays and sealing strips, see Table 1.

- For roof pitches $\geq 3^\circ - \leq 7^\circ$ additional sealing strips are recommended.
- In regions with extreme weather conditions (alpine, etc.):
The use of sealing strips within double standing seams for the first 2 m of the roof pitch within the building is highly recommended. This will help prevent infiltration in case of ice dams/water back-up.
- In the case of waterproof substructures, e.g. plywood sheets used as roof sheathing, a structured underlay is always required.

Additional measures are the obligation of the planner or, respectively, the individual carrying out the work.

These Design Recommendations are developed for western european climate. Please ask other possibilities of constructions in other climates or regions.



- RHEINZINK®-standing seam roofing
- Structured underlay
- Timber boarding 24/max. 160 mm, chemical wood protection not necessary or a suitable plywood sheet
- Ventilated layer, note height of ventilated space (see chart)
- Insulation, height referring to local recommendations or standards
- Rafters, chemical wood protection recommended
- Plywood sheets for summer heat protection (plywood or OSB boarding as a storage layer)
- Airtight layer which acts as a vapour barrier, UV-resistant, S_d -value ¹ depending on the length of the rafter, $\geq 2,0$ m
- Support batten to take internal lining (additional insulation)
- Internal lining

Length of rafter	≤ 10 m	≤ 15 m	> 15 m
S_d -value (μ -s)	≥ 2 m	≥ 5 m	≥ 10 m

¹ Project-related deviations are possible following discussions with the RHEINZINK Department of Application Engineering

Non-ventilated Roof Structure

Non-ventilated roofs with RHEINZINK® coverings are single-shell structures which consist of two components layers:

- roofing incl. level to equalise vapour pressure
- framework with airtight vapour barrier

European Lowland

	Roof pitch	Particularly advisable	Advisable	Acceptable	Not advisable
RHEINZINK®-Click Roll Cap System	≥ 3°	2		2	4
	≥ 15°	2		2	4
Double Standing Seam	≥ 3°	2		2	3/4
	≥ 15°	2		2	4
Angled Standing Seam					
	■ Lowland	≥ 25°	2		2
■ High Alpine Region	≥ 35°	2		2	4

Tab. 2: Sub-roofs, underlays and sealing strips for non-ventilated design, depending on the climate at the building site

The choices given in the tables are based on standard cases.

Deviation is possible when the following is taken into account:

- Detail design
- Roof geometry/landscape (penetrations)
- Regional climate conditions (blowing snow, ice dams, humidity, rain, wind conditions)
- Roofing requirements for buildings for special purposes (e. g. hospitals, swimming pools, etc.)
- Engineering design, insulation used (watch gradient of vapour pressure)

Due to the drying behaviour of plywood sheets, roof insulation systems and other large substructures, structured underlays should always be used.

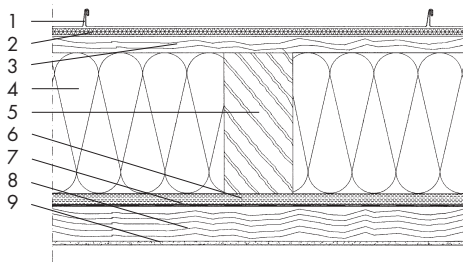
Structured underlays are always required in the tropics.

The height of standing seams should also be increased to 35 mm (downpours).

Pay close attention to customary substructures specific to the country in question.

General:

1. The construction of non-ventilated roofs with RHEINZINK® standing seam roofings is possible in a wide range of designs.
2. Chemical wood protection is required for non-ventilated timber constructions (see construction III.).
3. Only the use of industrially predried wood (structural solid timber) dispenses with the need for chemical wood protection.
4. The structures are susceptible for unforeseen moisture. The Inclusion of moisture in the structure should be prevented.
5. The airtight layer on the underside of the structure is essential for the lastening functionality of the roof structure as it prevents damage from condensation due to water vapour convection. In terms of thermal protection and protection against moisture regional regulations have to be followed.
6. The dimensioning of the airtight layer acting as a vapour barrier is specified as a S_d -value ≥ 100 m. If this value is not observed, a moisture check calculation is required.
7. Non-ventilated roofs with RHEINZINK® standing seam coverings are generally designed with a structured separating layer. Informations about structured layers can be taken from our Department of Application Engineering. This measure provides a rainproof underlay which offers additional protection against drifting snow and back-water and enables drainage of such water particularly in regions exposed to heavy snowfall.



- 1 RHEINZINK®-standing seam roofing
- 2 Structured underlayment
- 3 Timber Boarding 24/max. 160 mm, chemical wood protection or suitable plywood sheet
- 4 Thermal insulation, height referring to local recommendations or standards
- 5 Rafters, chemical wood protection
- 6 Plywood sheet for summer insulation (plywood or OSB boarding as a temperature reducing storage layer)
- 7 Airtight layer with vapour barrier, UV-resistant, S_d -value 100 m or a calculated moisture certificate
- 8 Support batten to take internal lining (additional insulation)
- 9 Internal lining

Note

The S_d -value of the airtight layer pertains to normal living space temperatures. Special purpose buildings (swimming pools, hospitals, etc.) always require a special moisture certificate.

III. Non-ventilated roof structure with fully insulated rafters and structured underlay

Measures

For measures pertaining to the use of underlays and sealing strips, see Table 2.

- For roof pitches $\geq 3^\circ - \leq 7^\circ$ additional sealing strips are recommended.
- In regions with extreme weather conditions (alpine, etc.):
The use of waterproof sheeting within double standing seams for the first 2 m of the roof pitch within the building is highly recommended. This will prevent infiltration in case of ice dams/water back-up.

Additional measures are the obligation of the planner or, respectively, the individual carrying out the work.

Noise Reduction

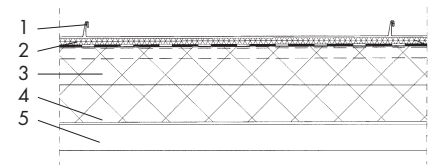
- Noise reduction value R_w : 48 dB¹

These Design Recommendations are developed for western european climate. Please ask other possibilities of constructions in other climates or regions.

¹ Testmethod referring to EN 20 717

IV. Non-ventilated roof design for metal roof systems with insulating components made of

- Foam glass system
- Rockwool-Prodach-Insulation System
- Puren M roof-insulation system
- Non-crushing mineral wool with Krabban fasteners (Warm fast fixings)



Measures

For measures pertaining to the use of underlays and sealing strips, see Table 2.

- For roof pitches $\geq 3^\circ$ - $\leq 7^\circ$ additional sealing strips are recommended.
- In regions with extreme weather conditions (alpine, etc.):
The use of sealing strips within double standing seams for the first 2 m of the roof pitch within the building is highly recommended. This will prevent infiltration in case of ice dams/water back-up.

Additional measures are the obligation of the planner or, respectively, the individual carrying out the work.

These Design Recommendations are developed for western european climate. Please ask other possibilities of constructions in other climates or regions.

Foam glass system

- 1 RHEINZINK®-standing seam roofing
- 2 Enka®-Vent, Colbond Geosynthetics, Obernburg, Germany, with Polymer bituminous waterproof sheeting PYE PV 200 S5
- 3 Foam glass panels
- 4/5 Supporting structure:
 - Steel trapezoidal profile
 - Reinforced concrete, even surface according to DIN 18202 and bituminous sub-coating
 - Timber boarding with bituminous layer G 200 DD, butt jointed and nailed

Rockwool-Prodach-Insulation System

- 1 RHEINZINK®-standing seam roofing
- 2 Structured underlay
- 3/4 Prodach-insulating element with vapour barrier S_d -value ≥ 100 m
- 5 Supporting structure:
 - Steel trapezoidal profile
 - Reinforced concrete, even surface
 - Timber boarding

Puren M roof - insulating system

- 1 RHEINZINK®-standing seam roofing
- 2 Structured underlay
- 3 Puren M roof-insulating (Productinformation: Puren M, D-Obermarchtal)
- 4 Vapour barrier S_d -value ≥ 100 m or a calculated moisture certificate
- 5 Supporting structure
 - Timber boarding

Bjarnes Krabban-Fastener (Warm fast fixings)

- 1 RHEINZINK®-standing seam roofing with Bjarnes Krabban-fasteners
- 2 Structured underlay
- 3 Non-crushing mineral wool
- 4 Vapour barrier S_d -value ≥ 100 m or a calculated moisture certificate
- 5 Supporting structure:
 - Steel trapezoidal profile
 - Reinforced concrete, even surface
 - Wooden sheathing

Note

The S_d -value of the airtight layer pertains to normal living space temperatures. Special purpose buildings (swimming pools, hospitals, etc.) always require a special moisture certificate.

The construction of ventilated and non-ventilated roof structures is not a matter of belief. Both types of design have their justification according to the requirements of planning and execution.

The ingress of moisture into building materials may impair, change or entirely do away with their characteristics and function.

Large amounts of moisture in building materials may ruin them and have an adverse effect on adjacent layers and materials. This is true for structural parts and heat insulation. For this reason the ingress of moisture (e. g. melted water resulting from the damming effect of ice in cold weather or consequences of both from leakage or defects in building substance) must be prevented to a major extent and any moisture which has penetrated the structure must be eliminated.

Where metal coverings based on the Standing Seam/Click Roll Cap System are concerned, this is of particular importance as these connection techniques without additional measures can be used only to create a rainproof structure (in particular in the case of complex details).

As flat roofs in particular with a pitch up to 15° do not have such good drainage properties, additional suitable and especially reliable structure need to be used to guarantee a building which is free of defects.

These design recommendations have been written for planners and contractors to ensure that these requirements are fulfilled.

We should like to point out that these design recommendations only apply to buildings used for normal purposes (e. g. residential and commercial buildings). Design should be checked in the case of other applications.

Literature

„RHEINZINK® – Application in Architecture“, 2nd updated edition
RHEINZINK GmbH & Co. KG, Datteln, 2000

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