VM ZINC

Architectural guide

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A Umicore brand

VM ZINC

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IN SEVERAL MEDITERRANEAN COUNTRIES

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VM ZINC REFERENCES
in several Mediterranean countries

GREECE

Ano Liossia Olympic Hall (Athens)
Architect: Molfessis-Genias-Gavrilis & Associates

Private house (Epidavros)
Architect: Sissy Kiriaki

Petrol station (Megara) - Architect: George Agelis

LEBANON

Al Majidiyeh Mosque (Beirut)
Architect: Dar Al-Handasah

French Embassy (Beirut)
Architect: Yves Lion architectural offices

Private house (Marjeyoun)
Architect: Atef Tabet & Associates

ISRAEL

Private house (Herzelia)
Architect: Moran Palmoni

Private house (Bitan Aharon)
Architect: Nir Mamon & Zvia Golad

Private house (Jerusalem)
Architect: Samir Srouji

TURKEY

Gidasa General Management
Office (Istanbul)
Architect: Dost Construction

Gıdasa Hendek Beverage
Factory Buildings (Adapazarı)
Architect: Hakan Adas

THE MATERIAL

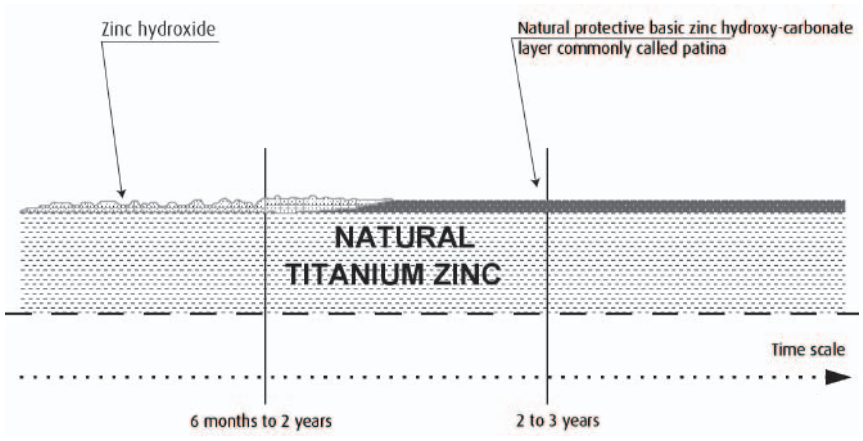
Zinc is naturally resistant to corrosion and is extremely durable. Also It is so malleable and flexible that it meets virtually every architectural demand and provides aesthetic and engineering solutions that most other roofing materials do not.

Zinc patina: a natural protective process

The many examples of zinc roofs being renovated in Europe after about a hundred years of loyal service are perfect proof of zinc's resistance to corrosion.

When zinc is initially produced and rolled, it has a shiny surface. This surface goes through a passivation process to form a layer, commonly called patina, on the surface. Patina is created in a two-part process that occurs when zinc interacts with compounds in the atmosphere, notably carbon dioxide (CO_2) and water (H_2O).

The first reaction is between zinc and water, which forms zinc hydroxide. This compound then reacts with carbon dioxide to form the very stable zinc hydroxy-carbonate. Once it has formed, patina slows down the interaction between the zinc and the oxygen in the atmosphere and thus maintains a very slow rate of zinc corrosion. The patina has the matt grey colour that is associated with weathered zinc.



Marine environment

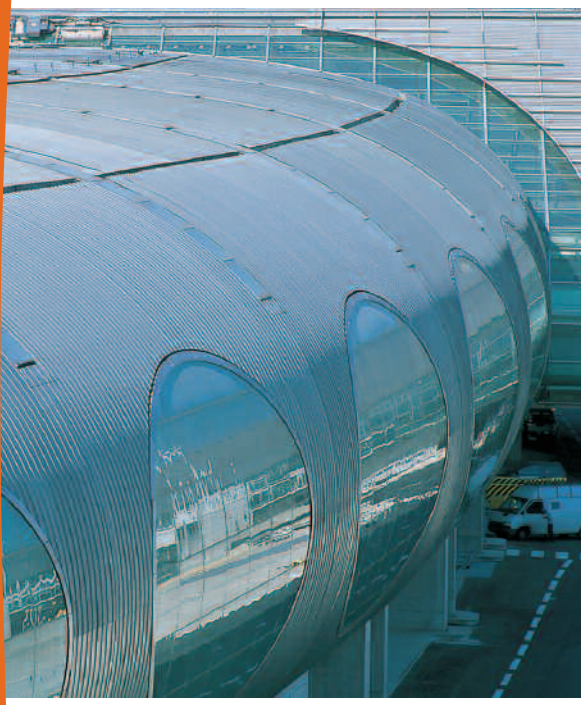
In a marine environment, along a coastal strip several kilometres in width, the composition of the patina is different. It is relatively compact and insoluble, and is made up of zinc oxychloride, but plays the same protective role.

Private house (Epidavros)
Architect: Sissy Kiriaki

Durability and low maintenance

Thanks to this natural resistance, zinc has an extremely long life span compared to other materials. With an average corrosion rate of 1 µm/year, zinc can achieve life spans of 100 years depending on the environment (90 to 100 years in rural areas, 40 to 60 years in urban or marine environments).

In addition, VM ZINC is a low maintenance material. There is no need for protective coatings, such as paint or varnish to be applied. Zinc continues to develop a protective layer (patina) throughout its life and will self-repair imperfections or scratches.



Charles-de-Gaulle Airport (France)
Architects: P. Andreu and J.M. Fourcade

Style made flexible

VM ZINC provides the freedom to create architectural masterpieces which are difficult to realize with other construction materials. It is very malleable and can therefore meet virtually every architectural demand. Zinc allows interesting treatments of corners and angles and can adapt to an almost infinite variety of shapes: straight, curved, convex or concave.

As for its installation, VM ZINC, contrary to some other roofing metals, does not need to be factory-preformed and thus can be delivered directly to the site in the form of coils, requiring relatively low cost profiling and seaming equipment.

Environment-friendly material

Zinc is a non-toxic, durable, recyclable and plentiful material. As an essential trace element, zinc is also vital to biological equilibrium and growth.

Last but not least, the recovery and recycling of rolled zinc avoids waste of a valuable raw material, adding an economic advantage of considerable worth.

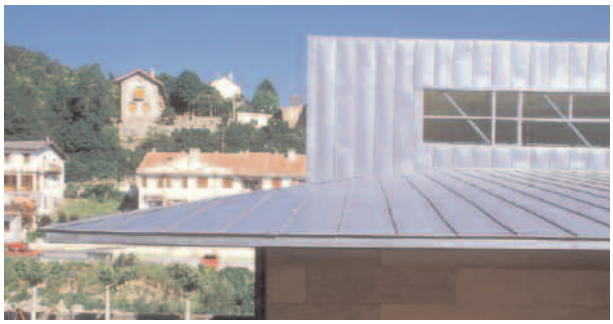
Private house, Zeberio (Spain)
Architect: A. Vizcargüenaga

Natural warm grey colour

VM ZINC offers a variety of finishes ranging from natural zinc to pre-weathered zinc and lacquered zinc.

Natural VM ZINC

When the zinc leaves the rolling mill, it has a shiny, luminous aspect which changes over time as a natural, semi-matt, light grey patina is formed. The patina takes between six months and two years to form, depending on the climate, the exposure of the site and the composition of the atmosphere.



Civic Center, Roncal (Spain) - Architect: J.L Tena

Pre-weathered QUARTZ-ZINC and ANTHRA-ZINC

Both finishes are obtained by immersing the natural rolled zinc in a solution which modifies the crystalline structure of the surface of the metal over a thickness of approximately one micron. This treatment by phosphatization is a durable chemical conversion of the superficial structure of the metal.

From the start, QUARTZ-ZINC has an appearance similar to that of the natural patina normally obtained after a few years of exposure to the atmosphere. It has a textured and luminous aspect that evokes the mineral universe.

ANTHRA-ZINC owes its name to its dark grey colour, which is similar to that of slate with which it is often used. It is coated on both sides with an organic resin that contains anti-corrosion agents.

These two pre-weathered materials can be bent, folded or profiled without any surface change just like natural VM ZINC and therefore the same installation method can be used.

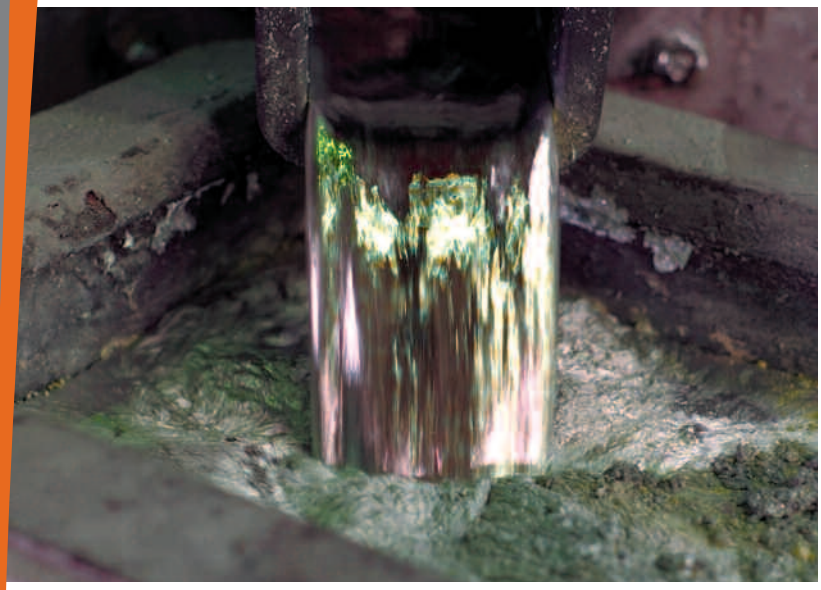
Hotel, Zaragosse (Spain) - Architect: Jesus Marco Llombart

Lacquered VM ZINC

Lacquered VM ZINC is produced from natural rolled zinc covered on both sides with a layer of polyester lacquer and a primer continuously applied then polymerised at a high temperature in a furnace. It is produced in three complementary pairs of standard colours (stone white-tile brown; copper green-Macao brown; slate grey-sky blue).

Scratches on bilacquered VM ZINC do not cause scaling, and, if the zinc is exposed, it repairs itself by forming its natural patina.

French Embassy, Beirut (Lebanon) - Architect: Yves Lion architectural offices



A recognised top performing alloy

VM ZINC is rolled zinc alloyed with copper and titanium to produce a material with optimum mechanical and physical characteristics for building applications, particularly with regard to the material's mechanical and creep resistance.

VM ZINC is composed of very high quality zinc Z1 (99.995% pure zinc), as defined by the EN 1179 standard, to which titanium and copper are added, hence the commonly used designation "Titanium Zinc":

- titanium: min. 0.06% - max. 0.20%
- copper: min. 0.08% - max. 1.00%

Copper increases the hardness and tensile strength of the zinc. Titanium increases creep resistance allowing greater thermal expansion and contraction of the material without causing metal fatigue.
The combination of copper and titanium lowers the expansion coefficient of metal.

Physical characteristics of VM ZINC titanium zinc:

• Density	7.2 kg/dm^3
• Thermal expansion coefficient (in the direction of rolling)	0.022 mm/m/°C
• Melting temperature	420 °C
• Recrystallization temperature	300°C
• Thermal conductivity	110 W/(Mk)
• Electrical conductivity	17 MS/m

The PREMIUMZINC quality label

The European Standard EN 988 has been applied since 1997 in 18 European countries. This standard imposes very stringent specifications for the composition of rolled zinc and its physical, mechanical and dimensional characteristics, which make it an international reference.
Whilst the VM ZINC brand complies with all the specifications of the EN 988 standard, it has gone beyond the requirements of this standard to create the PREMIUMZINC quality label, which demands stricter specifications than EN 988 for some measurements, particularly flatness, chemical composition and some mechanical properties not defined under the EN 988 standard and of interest to roofers and transformers.

Controlled characteristics	PREMIUMZINC standard	EN 988 standard
Chemical composition		
Zinc	ZI with limited Pb and Cd	Z1
Copper	0.08 - 0.2%	0.08 - 1.0%
Titanium	0.07 - 0.12%	0.06 - 0.2%
Aluminium	≤ 0.015%	≤ 0.015%
Dimensional characteristics		
Thickness of sheets / coils	± 0.02 mm	± 0.03 mm
Width of sheets / coils	+ 2/0 mm	+ 2/0 mm
Length of sheets	+ 5/0 mm	+ 10/0 mm
Curvature	≤ 1.5 mm/m	≤ 1.5 mm/m
Flatness	≤ 2 mm and omega ≤ 0.6	≤ 2 mm
Mechanical characteristics (in the direction of rolling)		
0.2% yield strength	110 - 150 N/mm	≥ 100 N/mm
Tensile strength	152 - 190 N/mm	≥ 150 N/mm
Breaking elongation	≥ 40%	≥ 35%
Bending test (at 180° C)	No cracking at fold	No cracking at fold
Unbending after bending	No cracking at fold	-
Creep resistance (during one hour under a load of 50 N/sq. mm)	≤ 0.08%	≤ 0.1%
Bending test at 4°C	No cracking	-
Stamping (Erichsen test)	7.5 mm without cracking	-
Vickers hardness	≥ 45	-

A broad application range

The VM ZINC brand name covers a full range of titanium zinc products in the form of sheets, coils and manufactured products and systems. The brand is constantly evolving in response to the needs of growing markets and various climates and standards such as Mediterranean markets, South-East Asia, the USA or Australia.

St George Cathedral of the Greek Orthodox, Beirut (Lebanon)
Architect: Builders Design Consultants

Building "Torre Princesa", Hilarion Eslava, Madrid (Spain)
Architects: A. Amann, A. Canovas, N. Maruri, A. Saura

Roofing

Since it can be adapted to all types of pitches from 3° (5%) and to all roof shapes (flat, curved, double curvature, etc.), VM ZINC allows designers total freedom of expression.

The principle of cold roof should always be encouraged since cold roof provides the maximum guarantee of durability. The following pages of this guide provide, in particular, detailed information about traditional techniques such as standing seam and roll cap used according to cold roof specifications.

However, in cases where warm roof is required, i.e. buildings with high levels of hygrometry, a specific study can be carried out by the Design Assistance Office, including for non standard solutions (which might require for instance the use of a specially designed VM ZINC PLUS system).

Facades

Traditional roofing techniques such as standing seam, where craftsmen shape the zinc from sheets and coils during installation, have been used traditionally to protect exposed facades.

Today, in response to architects' expectations, VM ZINC has developed specific systems that use all the qualities of zinc. The following pages of the guide will focus in particular on Interlocking panels, Flat lock panels and Sine Wave profiles.

Other building applications, not detailed in the present guide, include:

- **Rainwater systems: gutters, downpipes, end pieces, outlets, bends, self-locking rings, etc.**
- **Flashings and accessories to ensure the watertightness and ventilation of roofs (whether metallic or not)**
- **Ornaments, sold under the brand name of "Ateliers d'Art Français": weather vanes, weather cocks, ridge cap finials, balustrades, bull's eye windows, campaniles, etc.**

THE ESSENTIALS

VM ZINC has a long history as a building material. A strong, flexible and malleable material which can be adapted to the complex shapes of modern architecture.

In this chapter, we present the basic principles to be taken into account to make your project a great success. In many cases, the building basics for roofs and facades are the same. Both require managing condensation and ventilation risks. Both are also submitted to climatic stresses, like wind loads.

Perissos railway station, Athens (Greece) - Architect: Petra Coop Project Managers Ltd

To ensure the longest lifespan of a titanium zinc roof, 5 basic principles must be respected:

- Ventilation of the underside
- Minimum slope
- Supporting structure
- Thermal expansion
- Contact with other metals.

Umicore Building Products is your bridge to over a century of experience with this material. Don't hesitate to contact us.

Warning:

The recommendations hereunder relate to specifications traditionally used in Europe and their aim is to present the basic and specific techniques of roofing and cladding with VM ZINC.
Other roofing and cladding techniques have been developed, the particularities of which are described later in this document.
Some parts can be adapted to your projects while others cannot, for various reasons including climatic conditions, local resources, traditional workmanship or standards, etc. To establish correct specifications adapted to local conditions, it is highly recommended that you consult VM ZINC.

Ventilation of the underside

In general, zinc has to be installed in a ventilated environment.

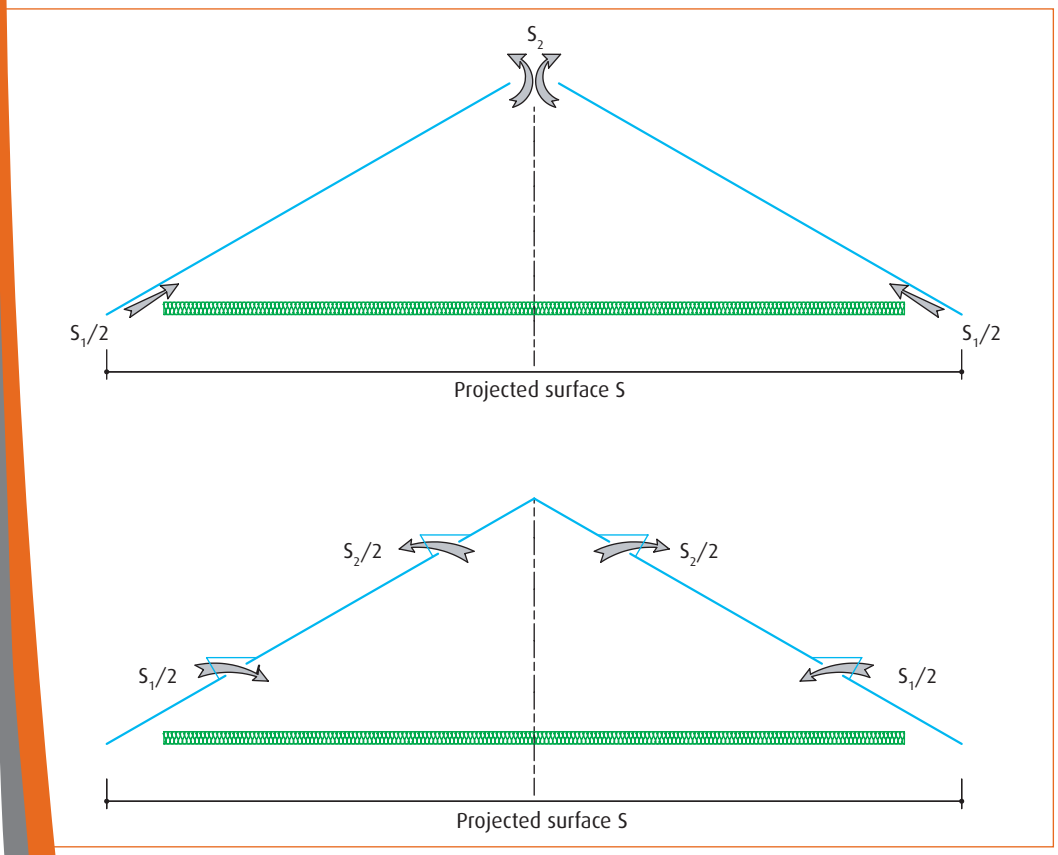
It is important that the surfaces of VM ZINC are ventilated so that there is sufficient CO_2 to allow a protective patina to form. This is particularly important for the underside of VM ZINC.

Ventilation also ensures that the dew point is not reached on the underside of the zinc. The air gap located beneath the decking allows the evacuation of humidity caused by internal condensation.

Description of a cold roof

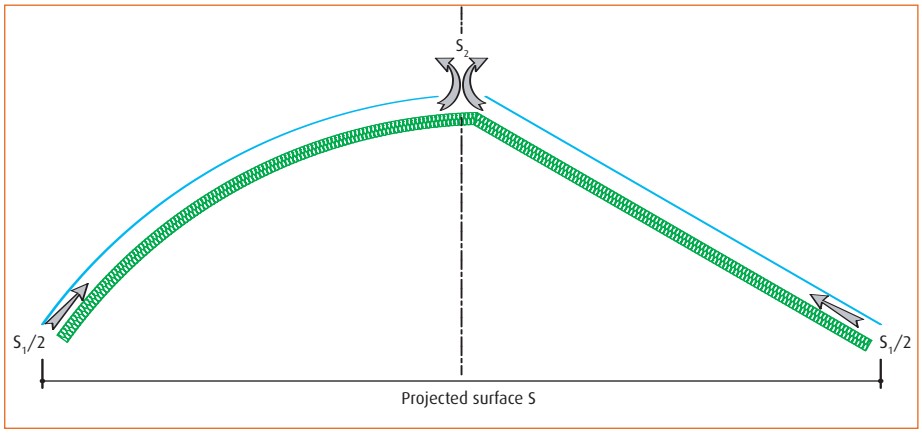
Most VM ZINC roof applications are "cold roofs" or ventilated roofs i.e. with an air gap under the wooden decking. The air gap located beneath the decking allows the evacuation of humidity caused by internal condensation.
In addition, if water infiltration occurs, moisture can be absorbed by the wooden substrate and evacuated through the air gap. This air gap should have **a minimum thickness of 40 mm**. If the slope exceeds 13 metres, **this minimum should be 60 mm**.
To ensure proper airflow in the ventilation space, an air inlet should be set at the eaves and an outlet at the ridge.
In the case of an empty roof space it is possible to set vents in the gable to replace linear openings, provided that the gables are no more than 13 metres apart.
At the very minimum, there should be a ventilation opening equal to 1/5000th of the projected roof surface and divided equally between inlet and outlet.
When the slope length is greater than 13 meters, the openings should be distributed in line with each other with a maximum distance of 13 meters between them.
For cladding, the air gap may be reduced to a minimum of 20 mm.

Cold attic space



Advantage:
Easy air circulation. The total surface of the air intake must be 1/5000th of the projected surface of the roof.

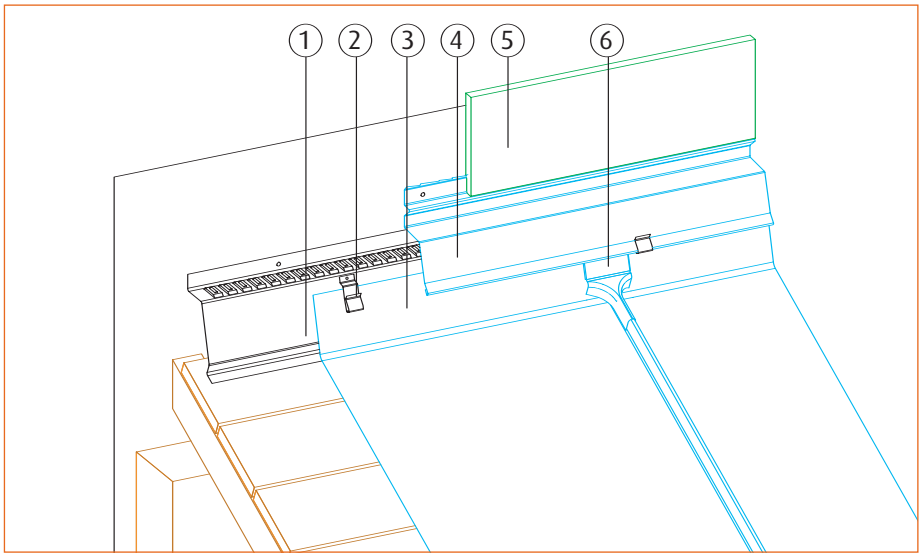
Insulation under slope



Thickness of the air space:

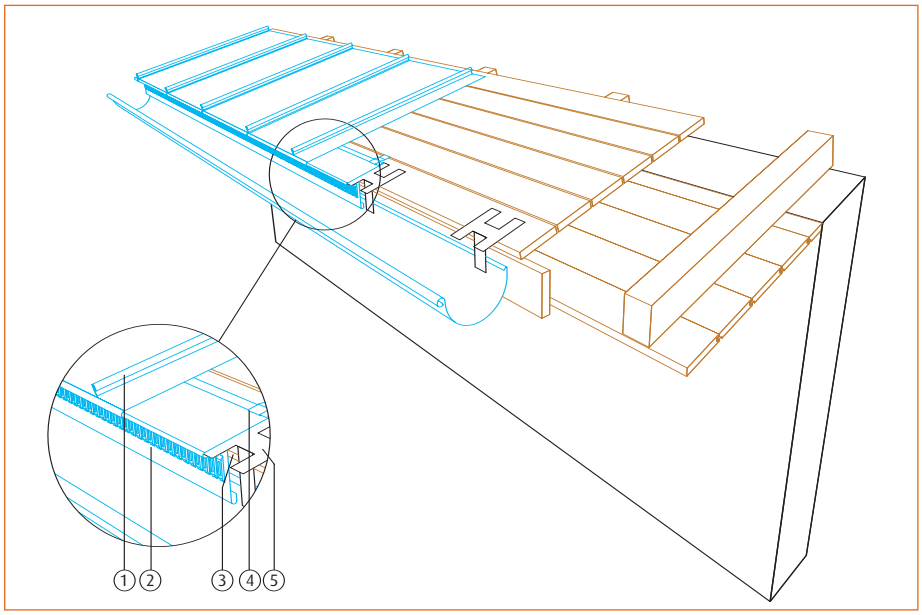
- 4 cm for a slope < 13 m
- 6 cm for a slope > 13 m
- The total surface of the air intake must be 1/3000th of the projected surface of the roof.

Example of linear ventilation



1. Ventilated profile in galvanised steel
2. Stainless steel clips
3. Zinc sheets
4. VM 943 ventilated ridge
5. Flashing cover strip
6. Head slider

Ventilated eaves flashing



1. Standing seam
2. Ventilated eaves flashing
3. Wooden boarding
4. Zinc clip
5. Galvanised stiffener

Evacuation of infiltrated moisture

Softwood timber decking of gapped boarding, with timbers spaced at 5 mm to 10 mm, will give increased ventilation to the underside of metal. If, for various reasons (see above), any moisture occurs between the VM ZINC and the timber, the ventilation space under the timber decking will allow this moisture to evacuate once the roof is completed.

Minimum slope

As with most roofing metals, the slope should be 5% (3°) at least.
The width between sheets is calculated with respect to the local climate and wind conditions of individual projects.

Common widths for standing seam systems are as follows:

Developed width	Centre-to-centre
650 mm	580 mm
500 mm	430 mm

Widths for roll cap roofs are as follows:

Developed width	Centre-to-centre 40 mm battens	Centre-to-centre 50 mm battens
650 mm	480 mm	470 mm
500 mm	630 mm	620 mm

Al-Omari Mosque, Beirut (Lebanon)
Architects: Youssef Haïdar

University library, Volos (Greece)
Architect: Helen Galliprogidou

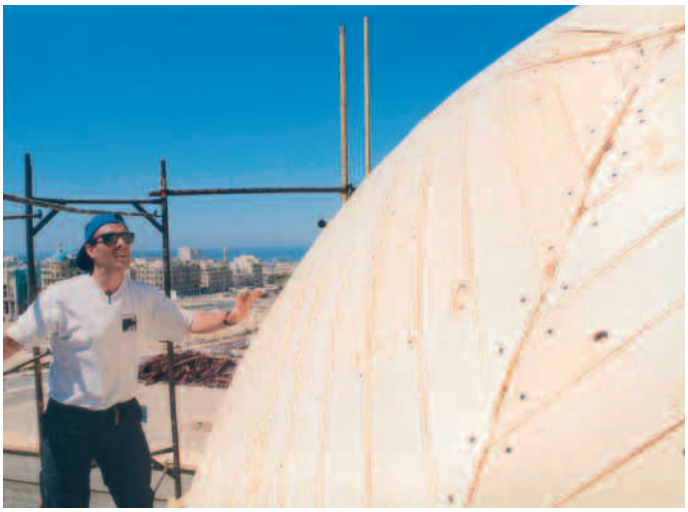
**Note: Depending on the location of the project (protected or exposed site), a special calculation for spacing the clips might be necessary.
In this case, it is essential to consult the VM ZINC Design Office for a specific study.**

Supporting structure

Installing zinc sheets on continuous decking is part of the traditional roofing method.
In order to ensure the durability of VM ZINC, the decking must meet the following requirements:

- **Geometrical continuity:** The decking is considered to be continuous when there is no more than a 5-mm difference in height (flush tolerance) between its components at their junction. There should be no protruding elements on the decking (e.g. screws or nails) that could damage the underside of the zinc. The roofing company responsible for the installation of VM ZINC must check that these minimum requirements are met.
- **Project structural conformity** according to the loads: the building design team should make sure that the project loads are compatible with the performance of VM ZINC systems. These loads include, in particular, the weight of the system, live loads, loads due to climatic constraints as well as the effect of wind.
- **Physico-chemical compatibility** of surfaces in contact with zinc.

The geometric continuity, structural conformity and physico-chemical compatibility of the VM ZINC substructure should be studied at the design stage of the roofing or facade complex in order to select the appropriate VM ZINC system.



Compatible wooden decking

To achieve the expected lifespan of titanium zinc, it is recommended that the zinc be installed on a compatible ventilated timber deck.
It is essential to make sure that the timber in direct contact with the zinc has a neutral pH value (between 5 and 7). Some wood species are acceptable, whilst others must be avoided.

Table of wood species	
Recommended	**Not allowed**
5 < pH < 7	pH < 5 and pH > 7
Pine Norwegian spruce Scots pine Poplar	Larch Oak Chestnut Red cedar Douglas fir White cedar Birch

In some countries, the correct wood species might be difficult to source or use, while other decking materials might be suitable. In such cases, please consult your VM ZINC representative.

Non compatible decking

• Plywood and chipboard:
Plywood is not allowed as decking for titanium zinc. Very often its timber composition is not controlled correctly and it might contain timber species which are harmful to VM ZINC. Moreover, the phenolic glues used in plywood are also corrosive to zinc.
Chipboard may be acceptable for use with VM ZINC only with the manufacturer's approval.

• Concrete, mortar or bituminous felt:
The use of a non-ventilated underlay as an intermediate layer between the zinc and the roof deck may create problems in the following cases:

- Bituminous felt:
  Bituminous felt is prohibited for use in direct contact with zinc because of the risk of water being retained.
  This constitutes a corrosion risk since the water cannot be removed from the felt.
- Concrete:
  Installing VM ZINC on a concrete or reinforced concrete deck must also be avoided.
- Cement mortar:
  In the case of small sections (parapets, gutters, etc.) less than 40 cm wide, cement mortar can be used as long as a "neutral" separation membrane (Ph 5 to 7) is placed between the VM ZINC and the cement mortar.
- Using sealing compounds:
  Generally, VM ZINC does not recommend the use of sealing compounds. However, some facade and roof joints require the use of sealing compounds to ensure continuous watertightness over the entire building envelope. Sealing compounds that are compatible with VM ZINC and adhere to it must be used. MS polymer-based compounds (without solvents) usually have the required properties (follow the manufacturer's recommendations). However, the use of acetogenic silicones must be avoided (contain acidic solvent which attacks zinc).

Our conclusions:

- Non-ventilated underlays prevent any ventilation of the underside of the zinc. This stops or greatly reduces the ability of VM ZINC to form its natural self-protection against corrosion of the underside surface. If any moisture resulting in condensation appears under the zinc, either from rain during construction, climatic conditions inside or outside the building or because of poor workmanship on the part of the roofing contractor, there is a risk that this moisture will collect and cause corrosion of the zinc from the underside.
- Following a number of failures in countries where the use of non-ventilated underlays was common, it is now recommended that such underlay be avoided and removed from specifications on zinc roofing.
- Any alternative roof decking material must have a pull-out strength value of at least 50 daN to the screws and fixing clips being used.

Zinc thermal expansion

Like all metals, zinc expands and contracts. Its expansion coefficient is 2.2 mm/m for a temperature variation of 100°C.

By way of comparison, the thermal expansion coefficients of other metals are as follows (100°C temperature variation per metre):

Stainless steel	1.02 to 1.65 mm
Steel	1.2 to 1.4 mm
Copper	1.7 mm
Aluminium	2.4 mm
Lead	2.9 mm

This means that an allowance should be made for expansion when titanium zinc sheets and strips are installed.

The maximum length of sheets in long strips for roofing depends on the degree of the slope, i.e.:

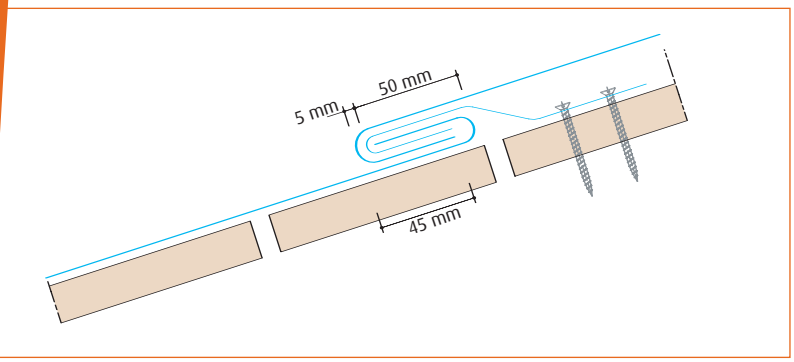
Slope in %	Degree of slope	Maximum length
< 60 %	< 31°	15 metres
> 60 %	> 31°	10 metres

Note: **These maximum lengths, valid for most countries in Europe, may be adapted according to the slope of the roof, the width and the thickness of the sheets, and the prevailing local weather conditions in the country of your project (please consult your VM ZINC representative).**

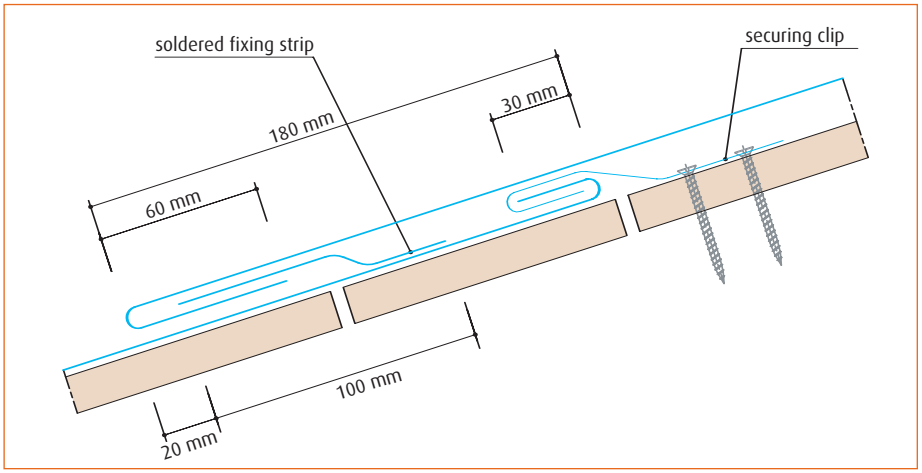
When the length of the span on a roof exceeds the recommended maximum for VM ZINC, a transverse junction will be necessary. The type of junction may vary according to the degree of slope (single welt, double welt, roof step).

Lebanese Banks Association,
Beirut (Lebanon)
Architects: Architectural Design Unit

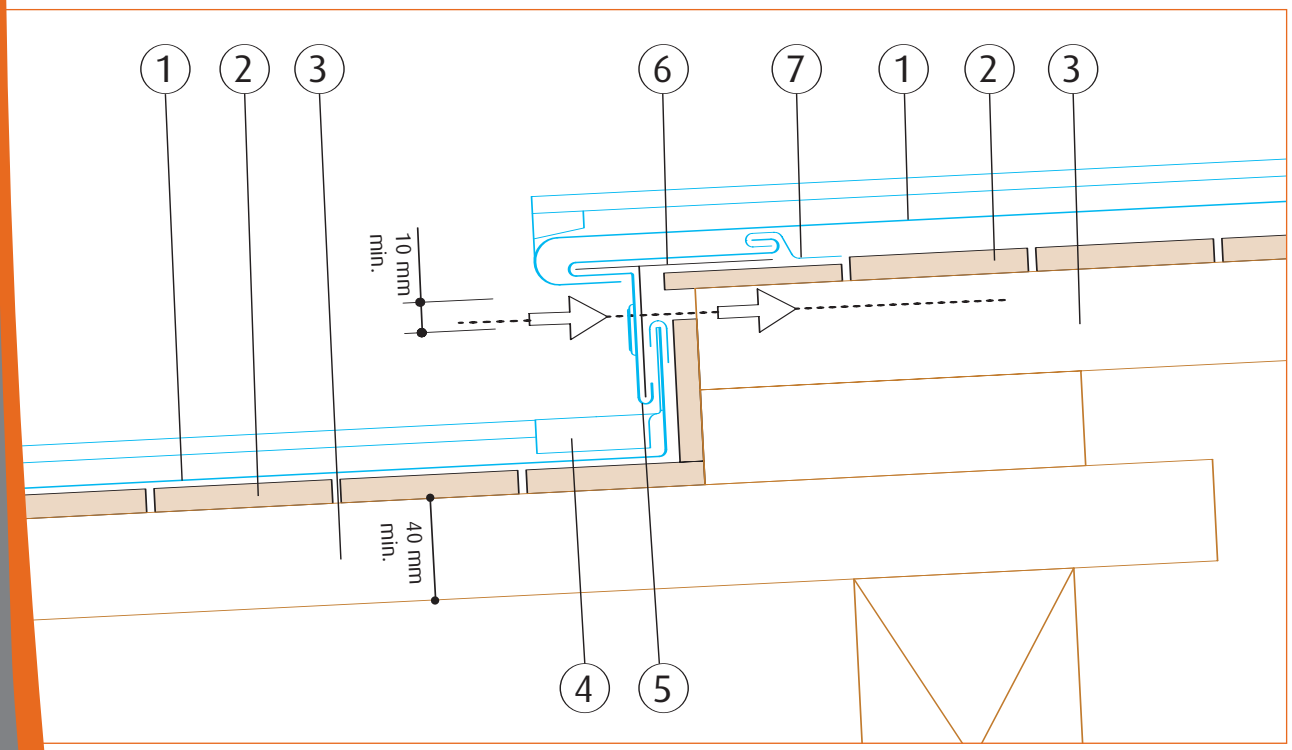
Single welt



Double welt



Step



1 VM ZINC standing seam roofing
2 Wooden boarding
3 Rafter
4 Head slider
5 Ventilated eaves flashing
6 Galvanised stiffener
7 Fixing clip

Contact with other metals

Contact between zinc and other metals must take into account the electro-chemical reactions caused by a difference in electrical potential between the surfaces of the metals. Generally speaking, a metal with the higher potential on the electro-chemical scale decomposes a metal with a lower potential and causes its destruction after a certain time by accelerating corrosion. Therefore, some contacts are acceptable whilst others must be avoided.

This electro-chemical reaction:
- is accelerated in hot and humid conditions
- is related to the electrical conductivity of the contact
- decreases when surface treatments or natural patinas bring them closer to their standard potentials.

In the building industry, two types of contact can cause electro-chemical corrosion: direct contact and indirect contact.

Direct contact

Direct contact may involve, among other things, fixing elements, metal decking and flashings.
In such cases of intermittent or direct surface contacts, the basic principles in the electro-chemical table should be respected. For example, the metal grounds for lightning conductors should be made of aluminium so that they are compatible with VM ZINC. Particular attention should be paid to VM ZINC fixing elements such as clips, screws, etc.

Indirect contact

It is more difficult to take into account indirect contacts since they develop between metals that are at a distance from each other through a conductor (electrolyte) which is active only intermittently.

For example:
- Rainwater must never flow from a high potential metal onto a metal of lower potential. The water, in this case, becomes charged with metal ions which can destroy the weaker metal.
- The metallic reinforcement contained in concrete exposed to the weather, can set off electrolytic reactions in the presence of moisture.

Contacts allowed	Contacts not allowed
Lead	Copper
Aluminium	Unprotected iron or steel
Stainless steel	
Protected copper (covered with tin)	

ROOFING: Standing seam

The traditional standing seam system allows long strips of profiled VM ZINC to be assembled by forming double folds on the upstands. The sheets of VM ZINC are laid on continuous decking and anchored with fixing clips.

Private house, Udim (Israel) - Architect: Orit Giladi

Key advantages:

- **Flexibility:** adapts to almost any architectural design
- **Design:** discreet joints
- **Performance and waterproofing:** maximum water and wind resistance
- **Easy and cost-effective installation:** use of profiling and seaming machines, optimisation of metal consumption.

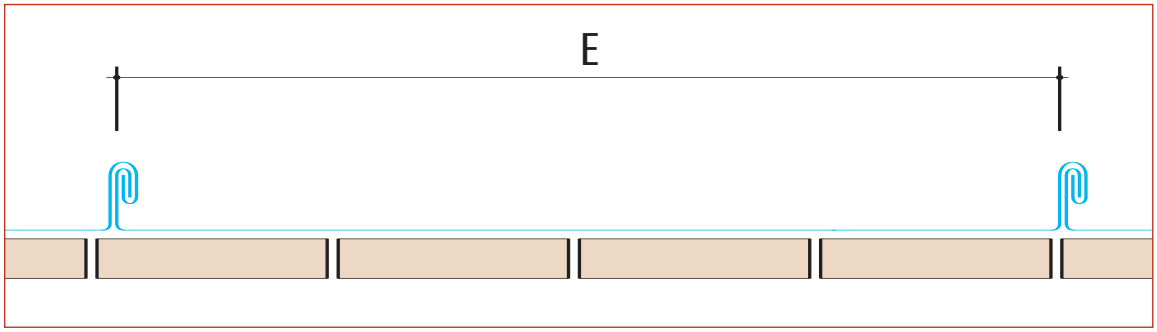
Areas of application:

- All types of roofing, for new construction or refurbishment projects
- Ideally suited to large roofing surfaces
- Suited to all roof shapes, including the most complex: curved, concave and convex, conical, domes, etc.
- Suited to regions with a harsh climate subject to strong winds or heavy rain
- Possible use on undersides (width of 500 mm, length of 2 m).

Main components

VM ZINC standing seam panels

Packaging	Coils for profiling
Surface aspects	Natural VM ZINC, QUARTZ-ZINC, ANTHRA-ZINC, lacquered zinc
Thickness	0.70 mm – 0.80 mm
Stretchout widths	500 mm – 650 mm
Centre-to-centre distance (E)	430 mm (500 mm coils) – 580 mm (650 mm coils)

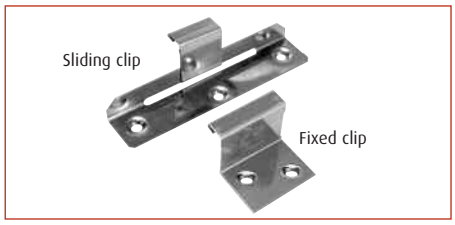


Fixing

Stainless steel fixed and sliding clips are spaced at 33 cm intervals. A fixed section is created using 1 to 5 fixed clips. The sliding clips are spaced along the rest of the roof bay.

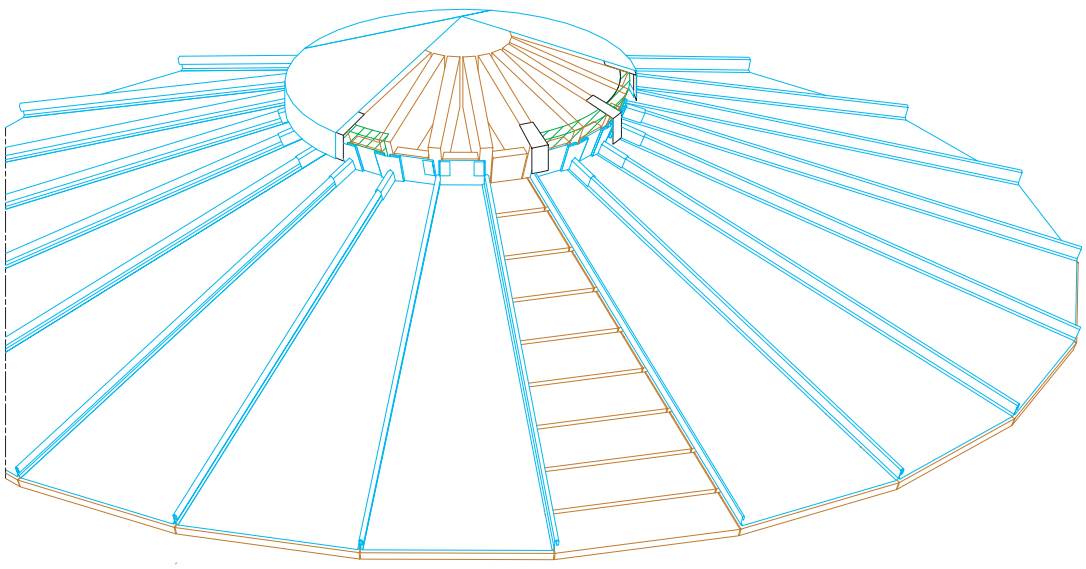
At the eaves, the first 3 sliding clips are placed at 16.5 cm intervals.

Type 1 clips

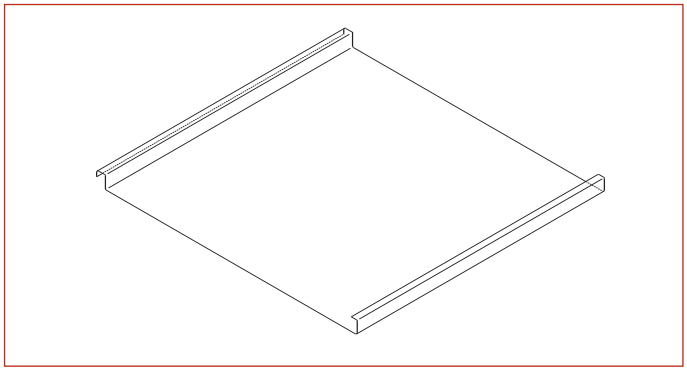


Accessories

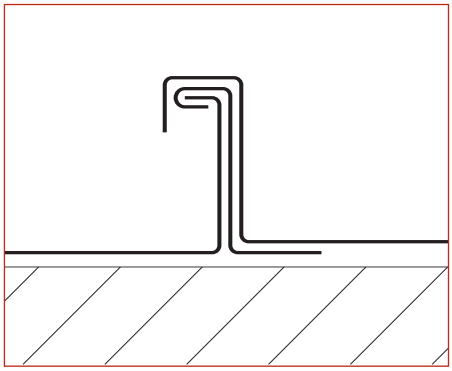
A wide range of accessories is available, designed for all types of standing seam roofs and flashings.



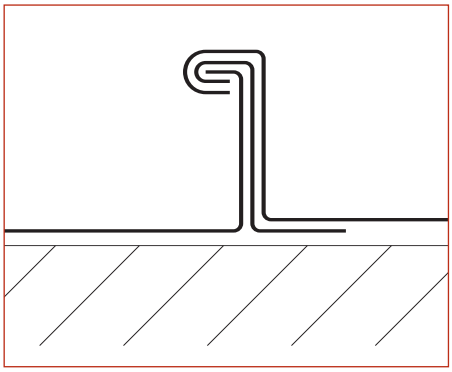
Flat pre-formed profiles



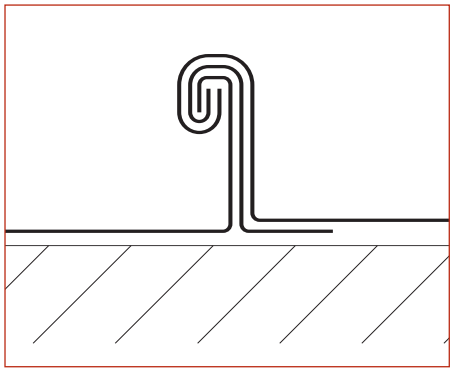
Folding of seam



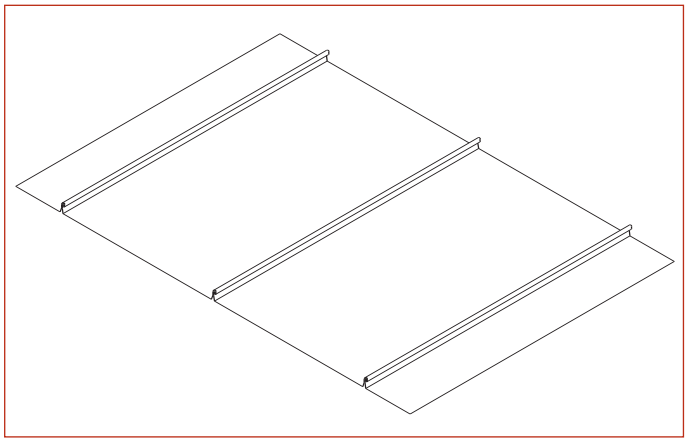
First seam is closed

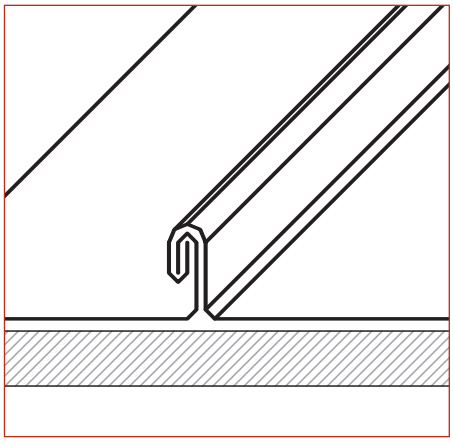


Second seam is closed



Final double lock standing seam





Specifications for design and installation

Climate

The standing seam technique adapts to all climates, as long as the building design team makes sure that the loads due to climatic constraints as well as the effect of the wind are compatible with the performance of VM ZINC systems.

For sites that are exposed to strong winds or for very high buildings, it is advisable to increase the number of fixing clips. Please consult VM ZINC for recommendations.

In mountainous regions, installation should be carried out using a complementary waterproofing system and double ventilation.

Pitch

A minimum 5% (3°) pitch must always be respected.

The only exception to this rule is where a curved roof has a 0% pitch at the ridge, provided that the roofing is continuous at the ridge (no linear ventilation outlet). The area with a pitch between 0% and 5% must not exceed 3 meters on either side of the highest point.

If the curved roof has a ridge (with a linear ventilation outlet), a pitch of 5% should be maintained on either side of the ridge; if not, there is a risk of water retention in the area of the 0% pitch near the upright sections of the ridge.

Roofing shape

Roofing	Specification
• Flat roofing	- Maximum sheet length of 15 m - Possible upstand up to 90 mm for eaves sheets against wall
• Curved, concave and convex roofing	- Curving necessary below 10 mm - Minimum convex radius: 0.30 m - Minimum concave radius: 3.50 m
• Conical roofing	- Panels can be tapered: 50 mm bottom of panel (i.e. centre-to-centre distance of 55 mm) - Maximum length: 13 m
• Domes	- Minimum convex radius: 1 m - Maximum length: 13 m - Panels can be tapered: 100 mm bottom of panel (i.e. centre-to-centre distance of 105 mm)

Roofing panel

Correct management of expansion of the material depends on the proper choice and positioning of the fixing clips as well as the maximum length of the sheets and long strips.

When working on roofs, the maximum length of the panels depends on the slope of the roof. The sheets can be up to 15 m long for pitches between 5% and 60%, and 10 m for pitches above 60%.

Product	Pitch	Maximum length
Sheets	over 5% (3°)	3 metres
Coils	5 to 60% (3 to 30°)	15 metres
Coils	60 to 170% (30 to 60°)	10 metres

The overall width is 650 mm with an effective panel width of 580 mm. A width of 500 mm (with an effective width of 430 mm) should be used in exposed areas. The thickness of the zinc sheets (0.70 or 0.80 mm) should also be determined according to climate conditions.
Seam height is 25 mm. The lateral edges should be formed using a correctly adjusted roll-forming machine either on site or in the workshop. The seams should be closed by a crimping machine suitable for the formed profile.
The system should be installed by experienced professional contractors used to similar types of roofing materials and techniques.

Roofing substrate

The decking must be rigid, continuous and compatible for all areas where titanium zinc is installed, under the roofing sheets as well as under all the box gutters, flashings, etc. There should be no more than 5 mm difference in height (flush tolerance) between the components at their junction. There should be no protruding elements on the support, e.g. screws or nails that could damage the underside of the zinc.
The substrate must meet load requirements in conformity with a pull-out strength of 50 daN for each of the fixing clips (fixed and sliding), provided that the entire supporting structure transmits the cumulated load of all fixing clips to the structure.
The boarding should be laid perpendicular to the standing seam in order to ensure that the panels are adequately fixed.

Ventilation

Correct ventilation of 4 cm minimum on the underside of the zinc and the roof decking is ensured by using a ventilated ridge at the top of the roof and proper ventilation outlets at the eaves or with roof ventilators. The manufacturer will provide all necessary recommendations.

Fixing

Fixing clips have a dual function:
• ensuring the mechanical resistance of the entire roof
• allowing free expansion of the metal.

The VM ZINC clips are made of stainless steel. Their thickness is 0.6 mm.
A clip should offer an acceptable tearing resistance of 50 DaN. It is recommended that screws in stainless steel be used to secure the clips. At least two screws per clip are recommended but three screws on sliding clips are preferred. The use of nails offers significantly less resistance, but in the event of their use, contractors are advised to use twist shank nails.

For standing seam roofing, the correct positioning of the clips (fixed or sliding clips) is fundamental for effective expansion control. The number of clips required will depend upon anticipated wind loads. Towards the edge or corners of the roof, where windloads are stronger, spacing should be reduced and more clips should be used.

The usual centre-to-centre distance between clips is:

- 330 mm on the main part of the roof
- 165 mm at the perimeter on a distance equal to 1/8 of the projected roof, minimum of 3 clips to ensure wind resistance.

It is important to make a precise calculation for each specific project according to its location, the climatic conditions and the wind exposure of the building. Please consult VM ZINC for specific recommendations.

Transverse junction

When the length of the roof slope exceeds the maximum recommended length, it is necessary to join the sheets using transverse junctions.
Several techniques are recommended depending on the pitch of the roof.

Roof pitch	Technique
5% (3°) ≤ x ≤ 20% (11°)	Step
20% (11) ≤ x 47% (25°)	Double welt
≥ 47% (25°)	Single welt

- Step for pitches of 5% (3°) or more:
  The step height will be a minimum of 8 cm for standing seam.
- Double welt for pitches of 20% (11°) or more:
  Double welt can be used in the standing seam technique for pitches of 20% and above.
  The minimum length of the overlap is 200 mm with a securing clip at the top. Depending on climate conditions, such as wind and rain, the overlap can be increased. The VM ZINC fixing clips should be fastened on the zinc sheet.
- Single welt for pitches ≥ 47% (25°)
  Single welt with an overlap of 50 mm can be adapted for pitches over 47% in the standing seam technique. VM ZINC recommends using the double welt over the single welt for the standing seam technique as it provides greater water resistance.

Handling and storage

Particular care must be taken to avoid scratches when handling titanium zinc products and they must be stored in a dry and ventilated area.

Soldering

Whenever necessary, soldering should be in accordance with the manufacturer's recommendations. The zinc must be cleaned chemically (with stripping products) or mechanically (brush, sandpaper, etc.). The usual composition for the soldering filler is 33% tin and 67% lead, or 50% tin and 50% lead.
Stripping products and paint for finishing touches are available from VM ZINC.

ROOFING: Roll cap

This traditional longitudinal assembly technique involves timber battens and capping strips. The zinc sheets and long zinc strips are held in place by a zinc batten clip supporting the peripheral upstands. The capping strips are placed in position by overlapping, thus ensuring that the roof is watertight.

St Nichan Cathedral, Beirut (Lebanon) - Architect: Meguerditch Yapoudjian & Pierre Neema

Key advantages:

- **Performance:** adaptable to all shapes and roof penetrations
- **Design:** expression of strong, conspicuous contours, shadow effects and urban character
- **Easy installation:** requires only a simple mechanical folding tool
- **Easy dismantling** in case of repair.

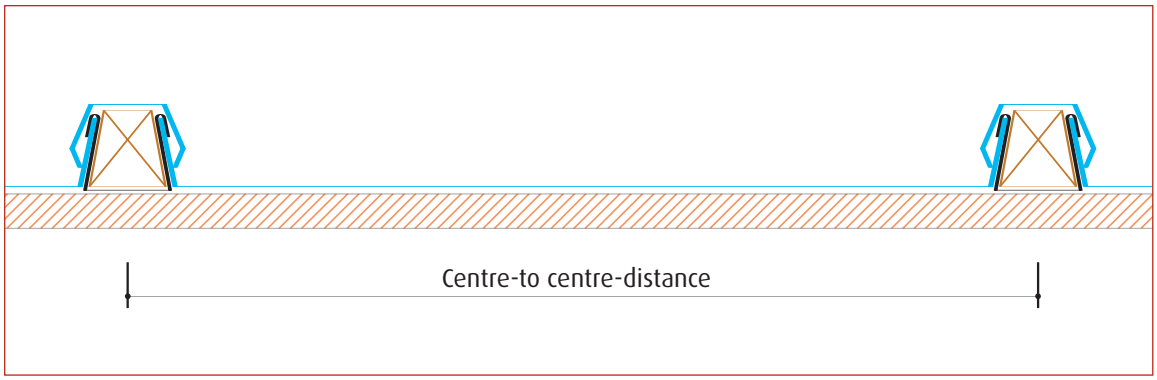
Areas of application:

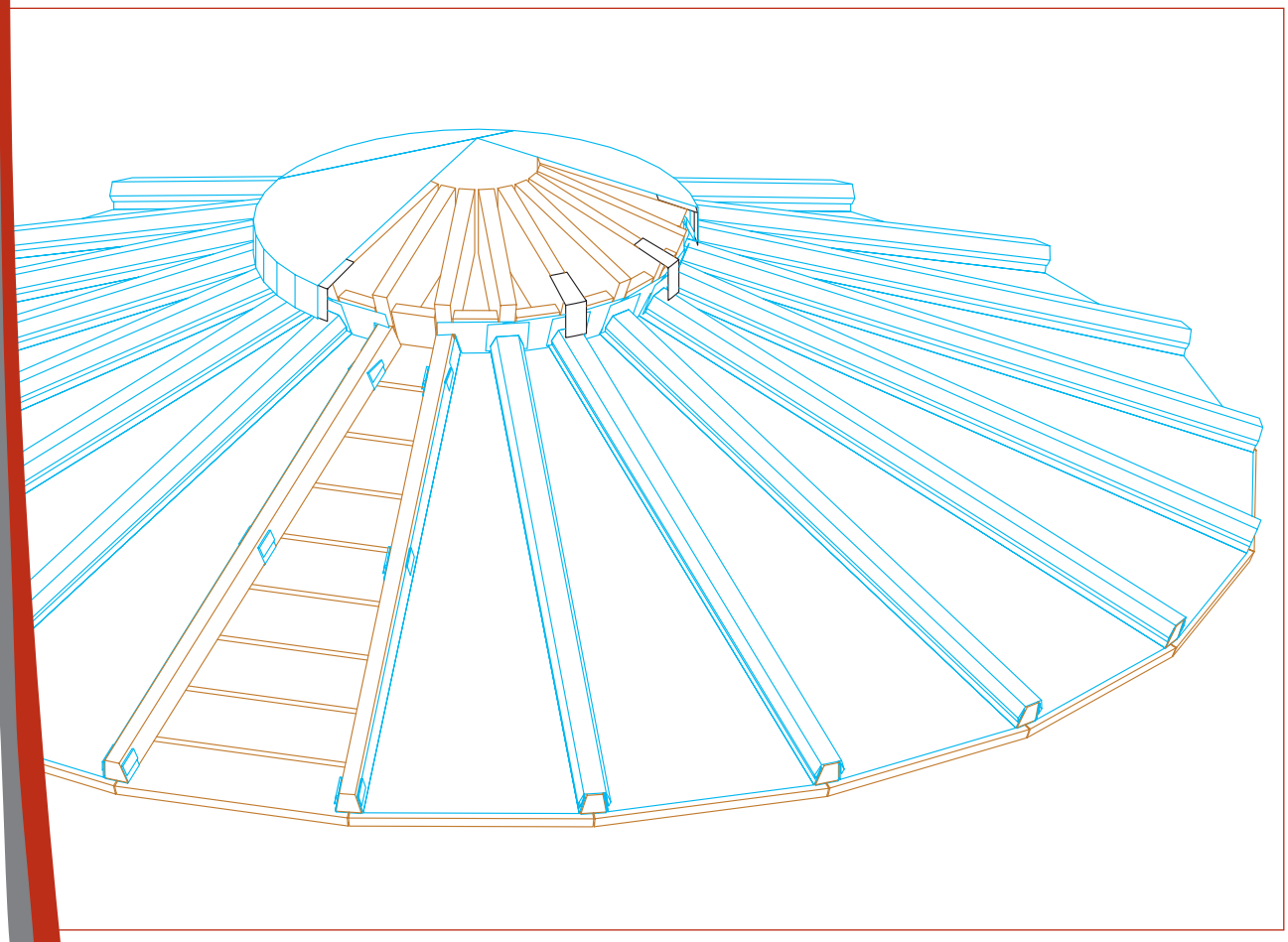
- All types of roofing, mostly traditional roofs
- Urban buildings.

Description of main components

■ VM ZINC roll cap roofing system

Packaging	Coils for profiling or preformed panels on request
Surface aspects	Natural VM ZINC, QUARTZ-ZINC, ANTHRA-ZINC, lacquered zinc
Thickness	0.70 mm – 0.80 mm
Stretchout width	500 mm – 650 mm
Centre-to-centre distance (E)	480 mm (500 mm coils) and 630 mm (650 mm coils) for 40 mm battens 470 mm (500 mm coils) and 620 mm (650 mm coils) for 50 mm battens





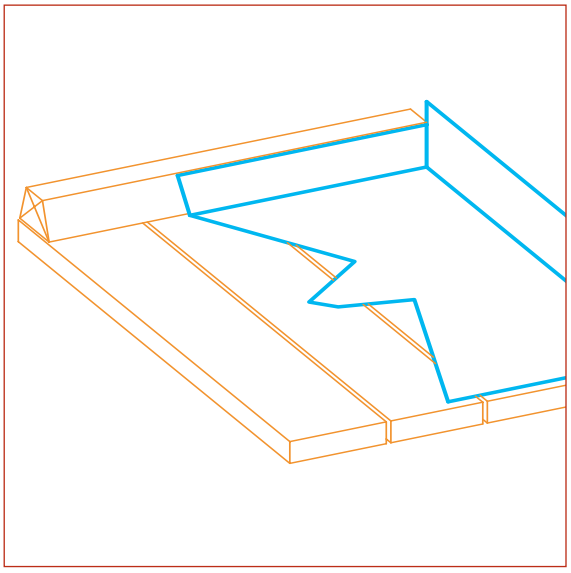
Battens and capping strips

- Battens: height 40 mm or 50 mm, trapezoidal or rectangular in shape for straight panels, height 60 mm for hip capping and 80 mm for ridges.
- Capping strips adapted to the size of the batten seam, widths of 100 mm, 120 mm, 140 mm or 166 mm.

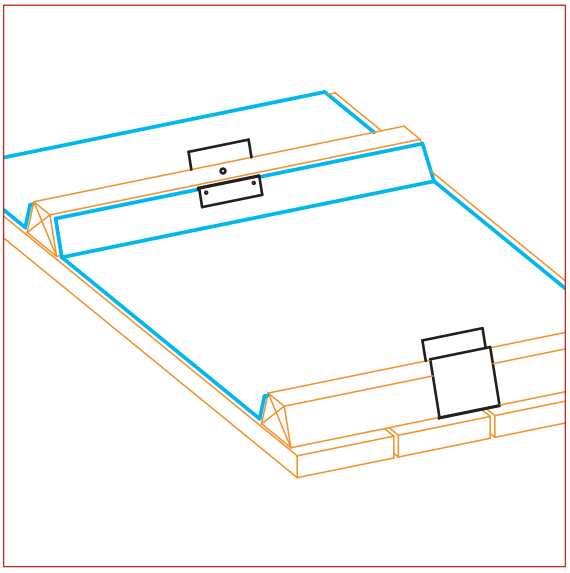
Accessories

Wide range of accessories for all types of roll cap roofs and flashings - Sheet clips for head fixing, batten clips for side fixing, spring clips for capping strips.

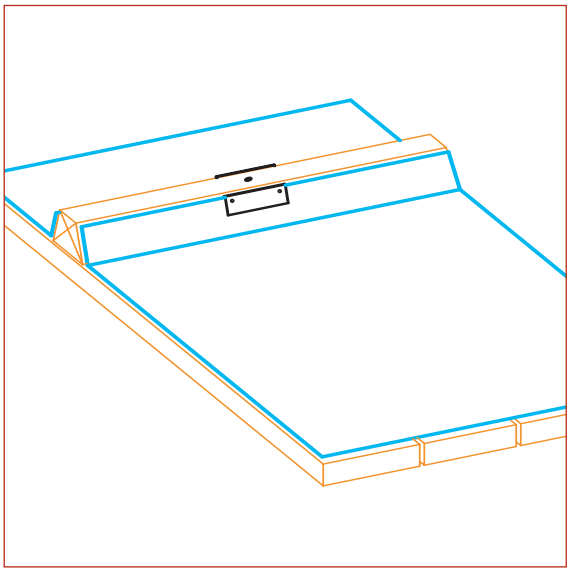
Top of long sheet



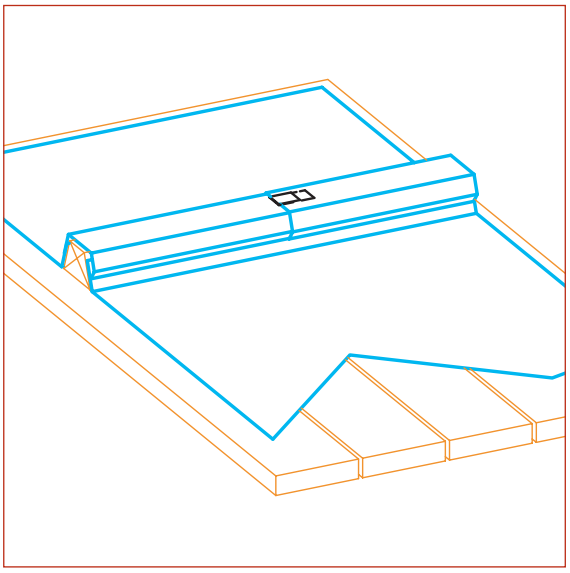
Fixing clip for roll cap



Nailing down at top



Spring clip for capping clip



Specifications for design and installation

Climate

The roll cap technique is suitable for all climates, though the designer needs to check the wind loads and the effect of wind. For sites that are exposed to strong winds or for very high buildings, it is advisable to increase the number of fixing clips. Please consult VM ZINC for recommendations.

Pitch

A minimum pitch of 5% (3°) must always be respected.
The only exception to this rule is when there is a 0% pitch at the ridge of a curved roof, provided that the roofing is continuous at the ridge (no linear ventilation outlet). The area with a pitch between 0% and 5% must not exceed 3 meters on either side of the highest point.
If the curved roof has a ridge (with a linear ventilation outlet), a pitch of 5% should be maintained on either side of the ridge. If not respected, there is a risk of water retention in the area of the 0% pitch near the upright sections of the ridge. The 5% pitch can be formed using (a) wedge(s).

Roofing panel

A 40 mm or 50 mm high timber batten is fixed with nails or screws onto the wood decking. The zinc sheets and long strips are held in place by a zinc batten clip supporting the peripheral upstands. One meter long capping strips are placed in position by overlapping, thus ensuring the waterproofing of the covering. They are fixed at the top by nailing a special clip which secures the upper end of the panel while at the same time allowing it to expand freely.

The maximum length of the roofing panels is 15 meters and the width 500 or 650 mm. The useable width is 480 mm or 630 mm in the case of 40 mm battens, and 470 mm or 620 mm in the case of 50 mm battens.

Professional and experienced contractors used to similar types of roofing materials and techniques should install the system.

Roofing substrate

The decking must be rigid, compatible and continuous for all areas where titanium zinc is installed, under the roofing sheets as well as under all box gutters, flashing, etc. There must be no more than a 5 mm difference in height (flush tolerance) between the components at their junction. There should be no protruding elements on the support, i.e. screws or nails that could damage the underside of the zinc.

The substrate must also meet loading requirements in conformity with a pullout strength of 50 daN for each of the fixing clips, provided that the entire support transmits the cumulated load of all fixing clips to the structure.

Ventilation

Correct ventilation of 4 cm minimum on the underside of the zinc and roof decking is obtained by using a ventilated ridge at the top of the roof and proper ventilation outlets at the eaves, or through roof ventilators. The ventilation section must be equal to or greater than 1/5000th of the projected roof area. The manufacturer will provide all necessary recommendations.

Fixing

The upstands of the titanium zinc panels are held in place by batten clips (0.65 mm thick and 40 mm wide zinc clips). The length of the clips varies according to the batten height, 160 mm for 40 mm battens and 180 mm for 50 mm battens.

Transverse junctions

Depending on the slope of the roof, single or double welts or roof steps are used for transversal junctions. If the slope of the roof is less than 10%, a roof step is mandatory to ensure a proper junction between panels over 15 m long. If, however, the slope is greater than or equal to 10%, a double welt can be used. In the case of a slope greater than or equal to 20%, only a single welt is necessary.

Soldering

Whenever necessary, soldering should be in accordance with the manufacturer's recommendations. The zinc must be cleaned chemically (with stripping products) or mechanically (brush, sandpaper, etc.).
The usual composition for the soldering filler is 33% tin and 67% lead, or 50% tin and 50% lead.
Stripping products and paint for finishing touches are available from VM ZINC.

Handling and storage

Particular care must be taken to avoid scratches during handling and storage of the titanium zinc products.

Albergo Hotel, Beirut (Lebanon) - Architect: AAA (Atelier des Architectes Associés s.a.r.l.)

CLADDING: Standing seam

The traditional standing seam system allows long strips of profiled VM ZINC to be assembled by forming single or double folds on the upstands. The sheets of VM ZINC are laid on continuous decking and anchored with fixing clips.

Viokosmos offices, Athens (Greece) - Architect: Eleftherios Pavlides

Key advantages:

- **Versatile technique** that provides continuity of both style and appearance between the roof and the cladding
- **Performance:** maximum watertightness and wind resistance
- **Easy and cost-effective installation:** use of profiling and seaming machines, shorter installation time compared to other cladding systems
- **Vertical or horizontal installation.**

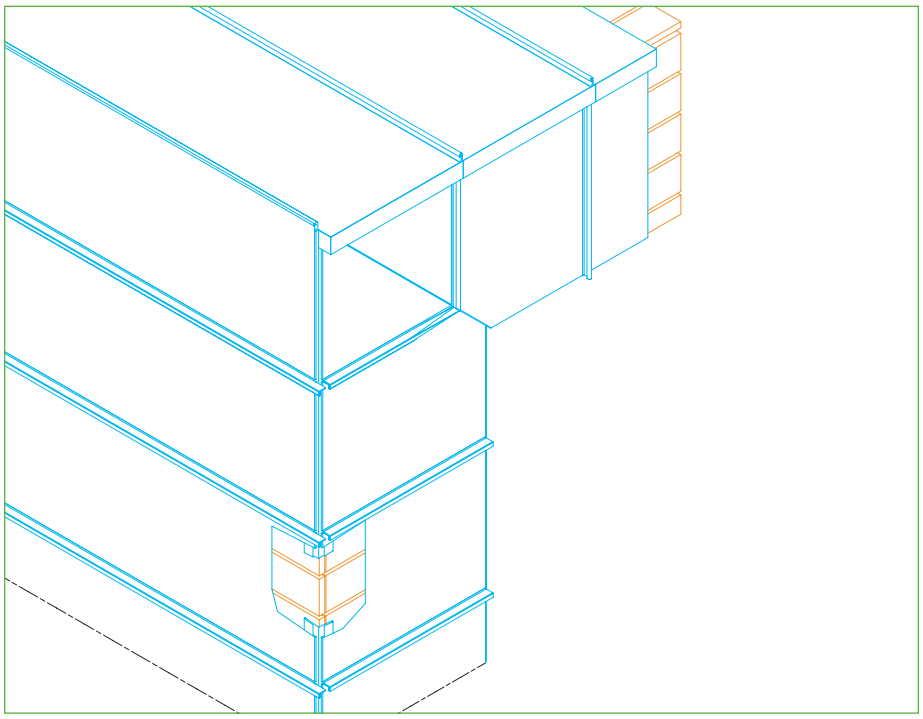
Areas of application:

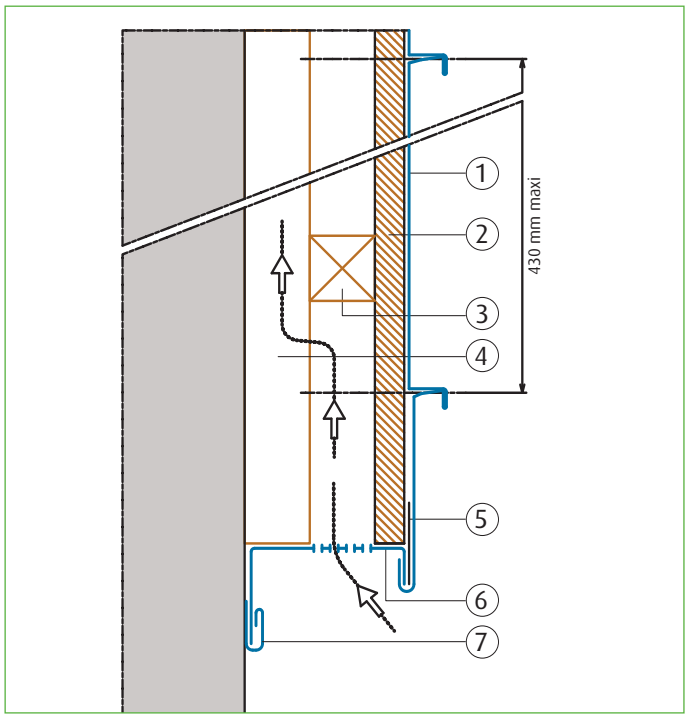
- New construction or refurbishment projects
- All types of claddings
- Flat or curved facades.

Description of main components

VM ZINC standing seam cladding

Surface aspects	Natural VM ZINC, QUARTZ-ZINC, ANTHRA-ZINC, lacquered zinc
Thickness	0.70 mm – 0.80 mm
Stretchout width	only 500 mm
Centre-to-centre distance	only 430 mm





1 VM ZINC single lock standing seam
2 Wood boarding
3 Secondary wooden substructure
4 Vertical rafter for ventilation flow
5 Securing strip
6 Perforated bottom strip for ventilation inlet
7 Folded flashing strip

Specifications for design and installation

Climate

Temperate and mountain climates.

Particular conditions

Possible use for undersides with a stretchout width of 500 mm (centre-to-centre distance of 430 mm) and a maximum length of 2 m.

Cladding panel

The standing seam system can be installed in strips up to 4 meters long for horizontal installation and 6 m long for vertical installation. We recommend the single lock standing seam instead of the double lock standing seam which is more subject to pillowing. Stretchout width is 500 mm, with an effective width of 430 mm. The height of the seam is 25 mm and the thickness is 0.7 mm or 0.8 mm (recommended) according to the site location. The lateral edges should be formed using a correctly adjusted roll-forming machine either on site or in the workshop. The seams should be closed by a crimping machine suitable for the formed profile. For the single lock standing seam, the seaming can be executed with pliers but should nevertheless have a perfectly rectilinear appearance.
The system should be installed by experienced, professional contractors used to similar types of cladding materials and techniques.

Supporting structure

A rigid, continuous and compatible substructure is required in order to provide effective support for the zinc cladding panels. It must also meet load requirements (tearing resistance of 50 daN for the fixing clips) and should be installed perpendicular to the standing seam in order to ensure adequate securing of the cladding panels.

Ventilation

There must be a 20 mm minimum air gap to ventilate the underside of the support. Air inlets and outlets shall be provided at the top and bottom of the wall.

Fixing

Correct management of expansion of the material depends on the proper choice of fixing clips and their correct positioning. The use of stainless steel fixed and sliding clips, with a minimum pullout strength of 50 daN to secure the panels to the supporting structure, allows free expansion/contraction of the material. For vertical cladding with single lock standing seam panels, the fixed section is placed at the top of the panel, allowing it to expand freely towards the bottom. For horizontal ones, the fixed section is in the centre of the panel and the expansion occurs on both sides. The usual spacing between clips is 33 cm and 16.5 cm at edges, but it is important to have a precise calculation for each specific project according to its location, the climate conditions and the wind exposure of the building. The junction between two panels will be by single welt, the vertical fixing by two securing clips on the side fold. Installation is from bottom to top.

Transversal junction

For single lock seams, the transversal junction can be single welt type (35 to 40 mm folds) with a minimum expansion of 5 mm. At the top of the upper panel, a 40 mm fold with a reinforced galvanised clip (25 mm wide and 1.5 mm thick) is nailed to the wood boarding. At the bottom of the lower panel, a 35 to 40 mm fold will be fixed by a galvanised steel securing strip. A corner slider fixed with galvanised steel clips is used at the corner junction and a single welt is used to join the side panels.

Handling and storage

Particular care must be taken to avoid scratches during handling and storage of the titanium zinc products.

Soldering

Whenever necessary soldering should be in accordance with the manufacturer's recommendations. The zinc must be cleaned chemically with stripping products or mechanically (brush, sandpaper, etc.). The usual composition for the soldering filler is 33% tin and 67% lead, or 50% tin and 50% lead.

Stripping products for finishing touches for QUARTZ-ZINC are available from VM ZINC.

"The Harbour" business and shopping centre, Thessalonica (Greece)
Architects: Irena Sakellaridou & Morpho Papanikolaou

CLADDING: Interlocking panel

The system belongs to the rain-screen family (wall cladding installed with a ventilated air space). This self-supporting system can easily be installed on a non-continuous framework for both new and refurbishment projects. It involves installing interlocking VM ZINC panels on a metal framework fixed to the supporting structure (masonry or metal structure). The panels are simply connected by the use of an interlocking groove giving the elegant appearance of a recessed joint. They are fixed onto the framework using the clips provided, which are concealed in the inside edge of the groove.

Avil@llull building, Barcelona (Spain) - Architect: BCA Arquitectos

Key advantages:

- **Structured design** of long and flat panels
- **Horizontal or vertical installation**
- **Interlocking attachment** with concealed fastening
- **Range of components** offering a wide variety of flashing details

Areas of application:

- New construction or refurbishment
- Vertical cladding and flat undersides
- All types of buildings, in particular offices, public buildings and collective housing.

Constituent elements:

VM ZINC Interlocking Panels

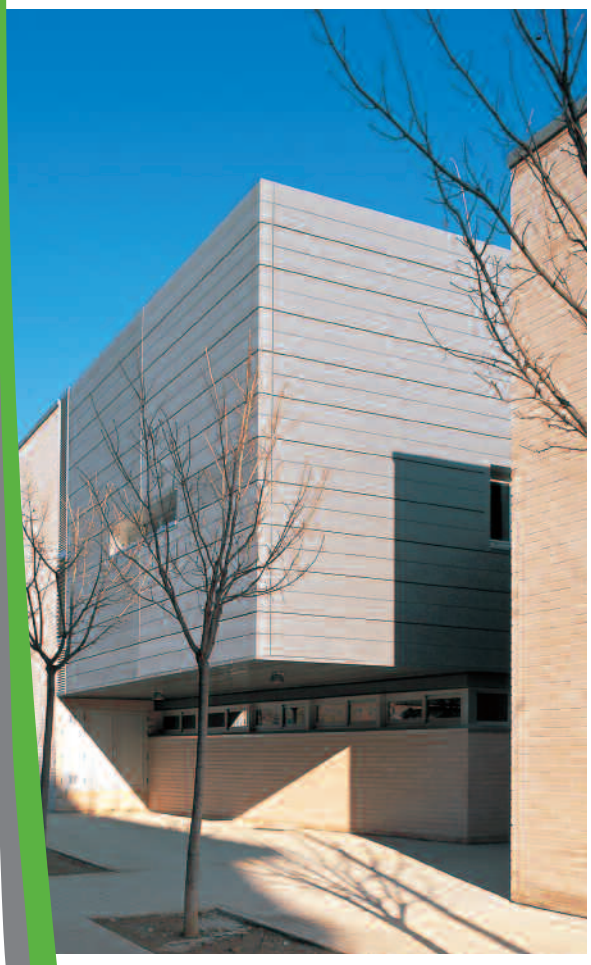
Surface aspects	QUARTZ-ZINC		
Thickness	1 mm		
Centre-to-centre distances	200 mm	250 mm	300 mm
Weight per sq. m (*)	11.18 kg	10.40 kg	9.85 kg
Length	From 500 mm to 6000 mm (according to layout)		
Joint width	10 or 20 mm (to be determined before establishing the layout)		
Profile depth	24 mm		

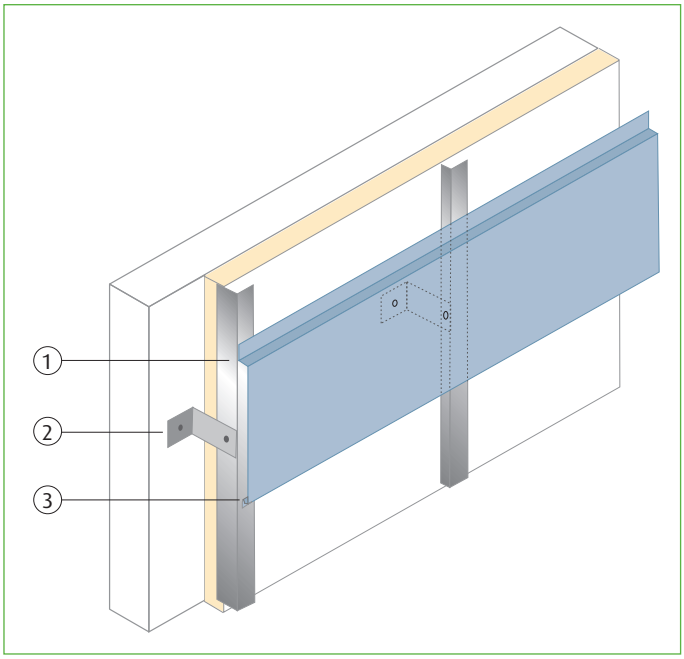
(*) Excluding framework.

The panels can be laid horizontally or vertically. The choice of direction implies different aesthetic and technical solutions for the main flashings.

A range of standard accessories has been designed for the main flashings:

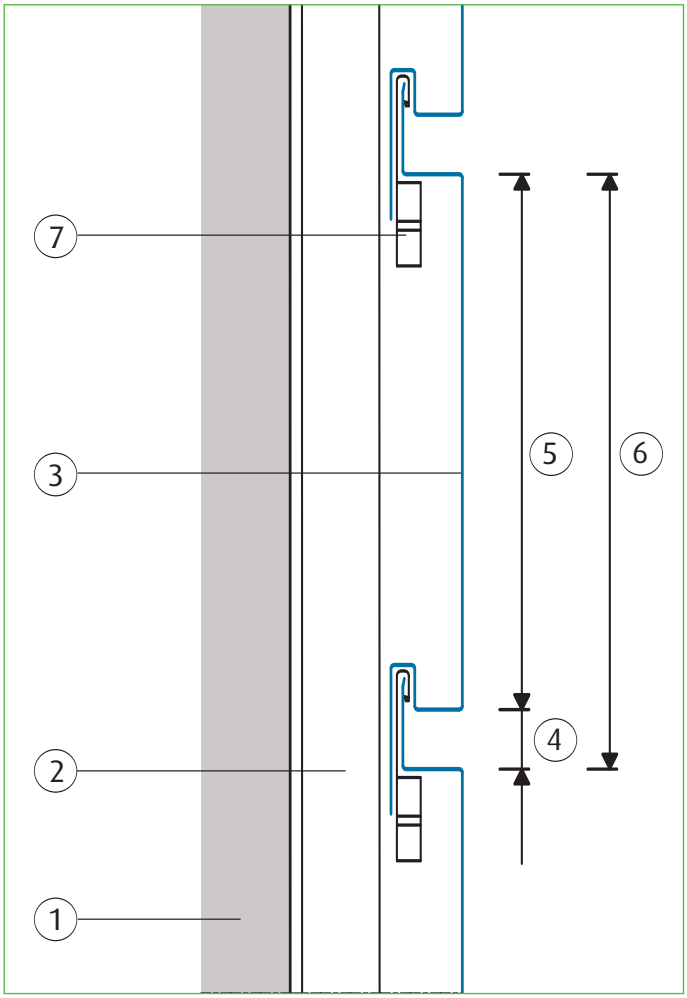
- External and interior corners
- Top and bottom pieces
- Window lintels, etc.



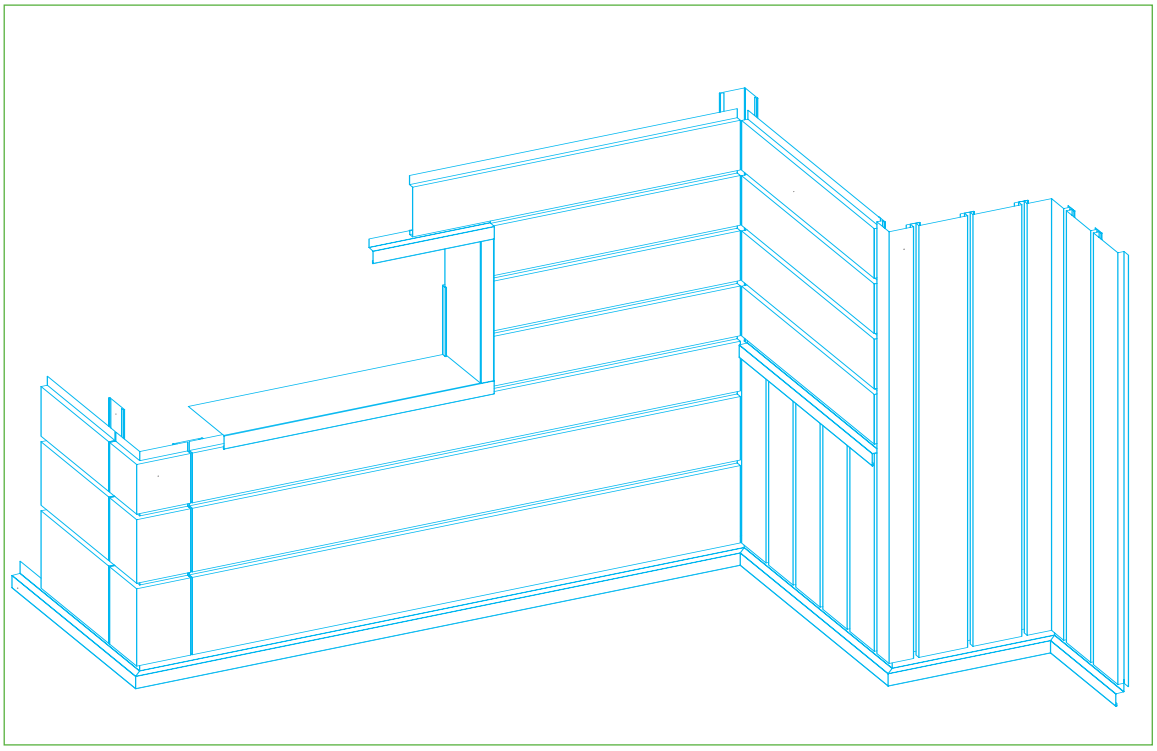


1 Profile in galvanised steel
2 Angle
3 Interlocking panel

Conservatory of musique, Huesca (Spain)
Architect: SR Humberto Bahilio Monne



1 Loadbearing structure
2 Secondary structure
3 Grooved edge
4 Joint (10 mm or 20 mm)
5 Panel face
6 Centre-to-centre distance (200, 250 or 500 mm)
7 Fixing clip



Specifications for design and installation

Climate

The system is suitable for use

- in plains and in temperate climates (maximum profile length: 6 m)
- mountain climates (maximum profile length: 4 m).

Please consult VM ZINC for

- high rise buildings (over 30 m)
- allowable resistance to wind suction in windy areas.

Cladding panel

The maximum length of the cladding panels should be 6 metres for both horizontal and vertical installation and the minimum length 500 mm. The interlocking technique consists of an interlocking groove which looks like a recessed joint and is secured to the framework with screws. The screws are concealed on the inside edge of the groove. The joints vary from 10 to 20 mm for pre-formed panels in three standard widths 200, 250, and 300 mm including the joint. If laid horizontally, the panels have a right angle fold of 20 mm at each end of the panel.

Design rules

At the design stage, we recommend that a layout plan be drawn up to enable accurate calculation of the panel dimensions, quantities and additional flashing.

- Horizontal panels are installed from top to bottom in horizontal rows with the non-grooved side up
- Vertical panels are laid from bottom to top.

Load bearing structure

The load bearing structure can be

- solid concrete wall
- masonry wall
- main steel framing.

Substructure (not supplied)

The system is self-supporting and can be installed on a non-continuous wood (timber or other woods according to local building codes) or metal framework (galvanised steel or aluminium rail). The framework must be perpendicular to the direction of installation and should be spaced every 600 mm, in order to ensure adequate securing of the cladding panels. It must also meet loading requirements (resistance to tearing of 50 daN for the fixing clips).
VM ZINC is not responsible for the design and layout of the framework.

Transverse joint

For horizontal installation, the framework must provide a minimum supporting surface of 100 mm.
For vertical installation, two framework elements are placed at either side of the transversal joint.

Insulation

The type of insulation must comply with national requirements where they exist, in particular with regard to fixing. Preferably, the insulation should be fire resistant on the outside. A galvanised steel stop must be installed at the bottom of the cladding to protect the insulation.

Ventilation

Ventilation at the top and bottom of the cladding is provided by air inlets and outlets which may be protected by a perforated grid. For horizontally-laid panels, there must be a minimum 20 mm continuous ventilation space. For vertically laid panels, a 10 mm air space between the insulation and the panel is required.

Invisible fixing and expansion coefficient

The panels are fixed onto the framework using concealed fastenings.

- Fixed area: the panels are fixed directly onto the secondary framework (aluminium or galvanised steel rails) using self tapping screws over a fixed area, which has a maximum length of 1800 mm (at the top of the panel for vertical installation and in the middle for horizontal installation).
- Sliding area: outside the fixed area, the panels are held in place by special fixing clips which allow for expansion and contraction of the zinc, by gripping the edge of the profile on the grooved side.

Soldering

Whenever necessary soldering should be in accordance with the manufacturer's recommendations. The zinc must be cleaned chemically (with stripping products) or mechanically (brush, sandpaper, etc.). The usual composition for the soldering filler is 33% tin and 67% lead, or 50% tin and 50% lead.
Stripping products for the QUARTZ-ZINC are available from VM ZINC.

Handling and storage

Particular care must be taken to avoid scratches during handling and storage of the titanium zinc products. In order to protect the panels during handling and installation, the outside surface (visible) is covered by a plastic film, which is removed only after installation is completed, thus guaranteeing an optimal aesthetic result.

Conservatory of music, Huesca (Spain) - Architect: SR Humberto Bahilio Monne

CLADDING: Flat lock seam

The flat lock system belongs to the rain-screen family (wall cladding installed with a ventilated air space). The system involves laying the panels on a compatible wooden framework fixed to the supporting structure (masonry or metal structure). It consists of a wall system of factory-formed panels. The rectangular-shaped panels interlock into each other on the four sides and are secured with concealed fasteners and clips.
Flat lock panels offer a simple, yet elegant cladding solution that provides a longitudinal flat seam.

Arno (Italy) - Architect: MBM Arquitectes

Key advantages:

- **Versatile system** with a traditional design
- **Vertical or horizontal installation**
- **Interlocking with a single fold on all 4 sides**
- **Recessed joints with concealed fastenings**
- **Range of components** offering a wide variety of flashing details.

Areas of application:

- New or refurbishment projects
- Flat facades for public and office buildings or collective housing.

Description of the main components:

VM ZINC flat lock seam

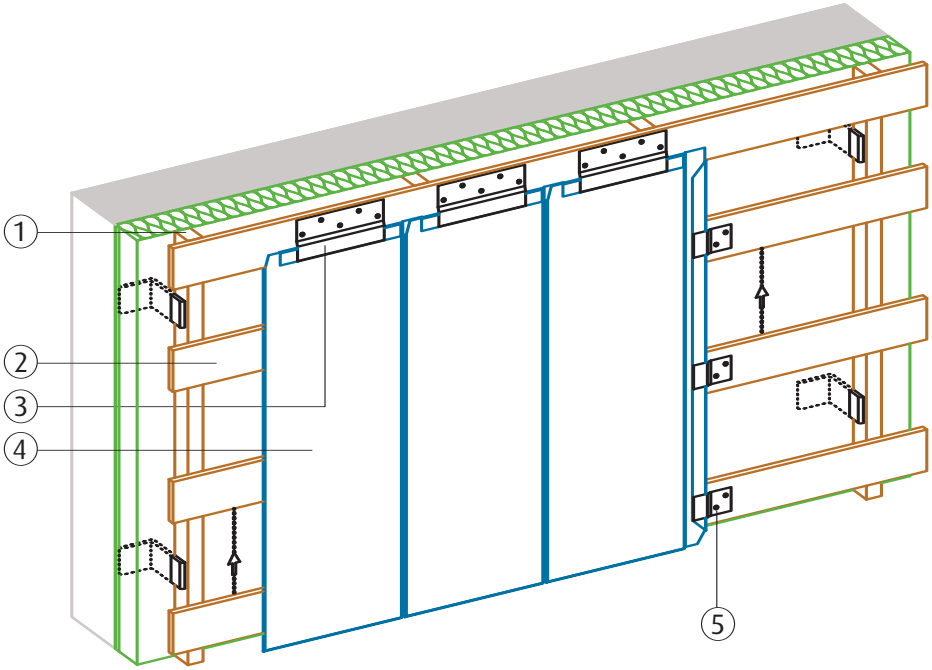
Surface aspects	Natural VM ZINC, QUARTZ-ZINC
Thickness	0.80 mm
Centre-to-centre distance	375 mm – 285 mm
Weight per sq. m (*)	7.83 kg
Length	From 500 to 4000 mm
Width of the joint	10 mm

(*) Excluding framework.

The panels can be installed horizontally or vertically. The choice of direction implies different aesthetic and technical solutions for the main flashings.

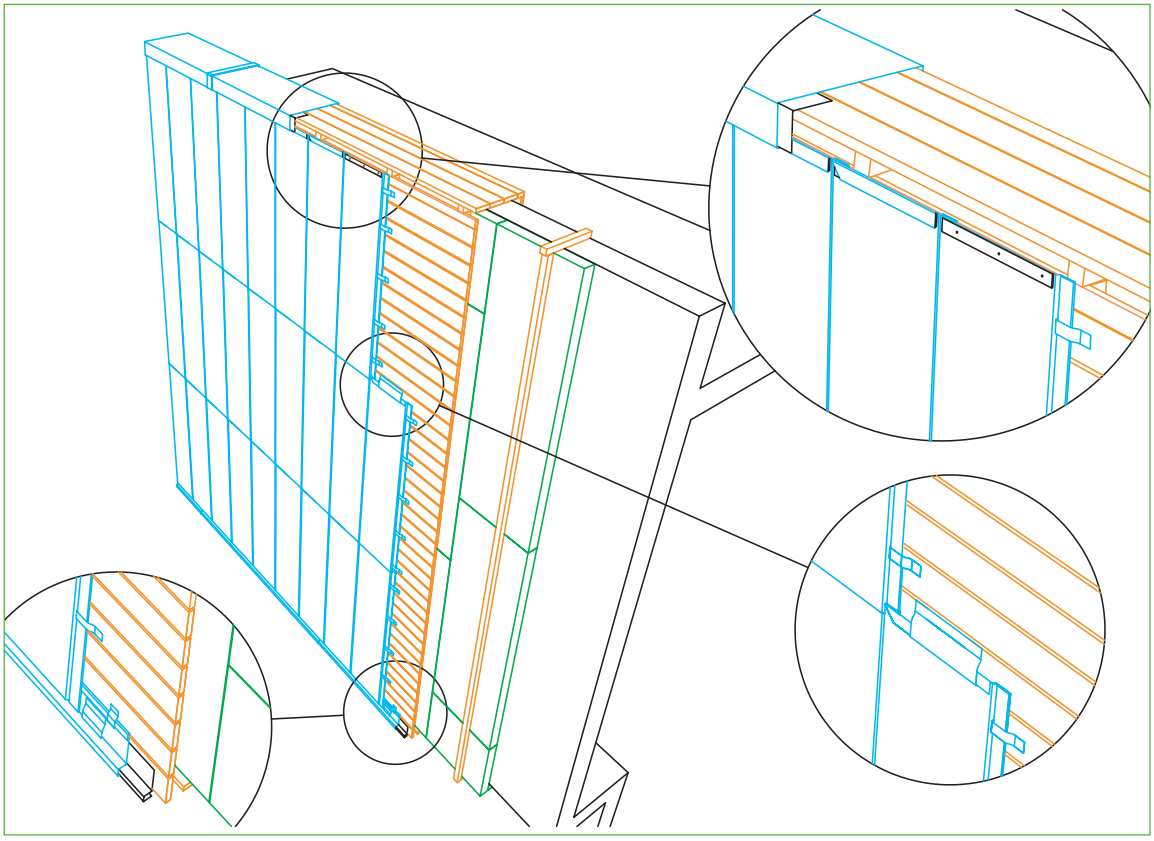
A range of standard accessories has been designed, including

- external and interior corners
- top and bottom pieces
- window lintels, etc.



1 Rafter
2 Wood boarding
3 Fixing strip
4 Flat lock panel
5 Securing clip

Neapolis building, Vilanova (Spain) - Architect: MBM arquitectes S.A.



Specifications for design and installation

Climate

Temperate and mountain climates.

Particular conditions

Please consult VM ZINC for

- high rise buildings (over 30 m)
- allowable resistance to wind suction in windy areas (fixing might be reinforced)
- application for undersides (centre-to-centre distance of 285 mm and maximum length of 2 m)
- curved horizontal panels allowed (horizontal radius of curvature ≥ 10 m).

Cladding panel

The maximum length of the pre-formed cladding panels should be 4 metres and the minimum length 500 mm. They can be installed vertically or horizontally with a centre-to-centre distance equal to 375 mm or 285 mm. This system uses a single fold interlock on all four sides. The longitudinal joint should be equal to 10 mm. Installation must be from bottom to top and from right to left.

Substructure

The decking (not supplied) must be rigid, compatible and continuous in order to provide effective support for the flat lock panels. It must also meet load requirements (resistance to tearing of 50 daN for the fixing clips) and should be laid perpendicular to the longer side in order to ensure adequate securing of the cladding panels.

Load bearing structure

It can consist of:
- solid concrete wall
- masonry wall
- main steel framing

Fire classification

Determined according to the combustible mass of the entire system (framework and insulation).

Ventilation

Ventilation at the top and bottom of the cladding is provided by air inlets and outlets, which may be protected by a perforated grid. Sections are calculated to ensure satisfactory ventilation of the air space (20 mm minimum).

Fixing

Panels are secured to the substructure with 0.5 mm galvanised steel clips along the length of the panels (every 33 cm) and with 0.5 mm galvanised steel strips for the width.

Soldering

Whenever necessary soldering should be in accordance with the manufacturer's recommendations. The zinc must be cleaned chemically with stripping products or mechanically (brush, sandpaper, etc.). The usual composition for the soldering filler is 33% tin and 67% lead, or 50% tin and 50% lead.
Stripping products and paint for finishing touches for QUARTZ-ZINC and ANTHRA-ZINC are available from VM ZINC.

Protective film

In order to protect the panels during handling and installation, the outside surface (visible) is covered by plastic film which is removed after installation is completed, thus guaranteeing an optimum aesthetic result.

CLADDING: Sine wave panel

The system belongs to the rain-screen family (wall cladding installed on a ventilated air space). This self-supporting system can easily be installed on a non-continuous supporting structure. It involves installing the VM ZINC sine wave panels on a metal framework fixed to the supporting structure (masonry or metal structure).
The sine wave panels provide increased freedom of choice and design through the play of light and shadow on the cladding.

Gıdasa Hendek Beverage Factory Buildings, Adapazarı (Turkey) - Architect: Hakan Adas

Key advantages:

- **Rhythmic wave aesthetic**
- **Vertical or horizontal cladding**
- **Easy installation** with overlapping and fixing
- **Range of components** offering a wide variety of flashing details.

Areas of application:

- New construction or refurbishment projects
- Flat or curved facade with large radius
- All types of buildings, in particular office and public buildings and collective housing.

Description of the main components

VM ZINC Sine wave panels:

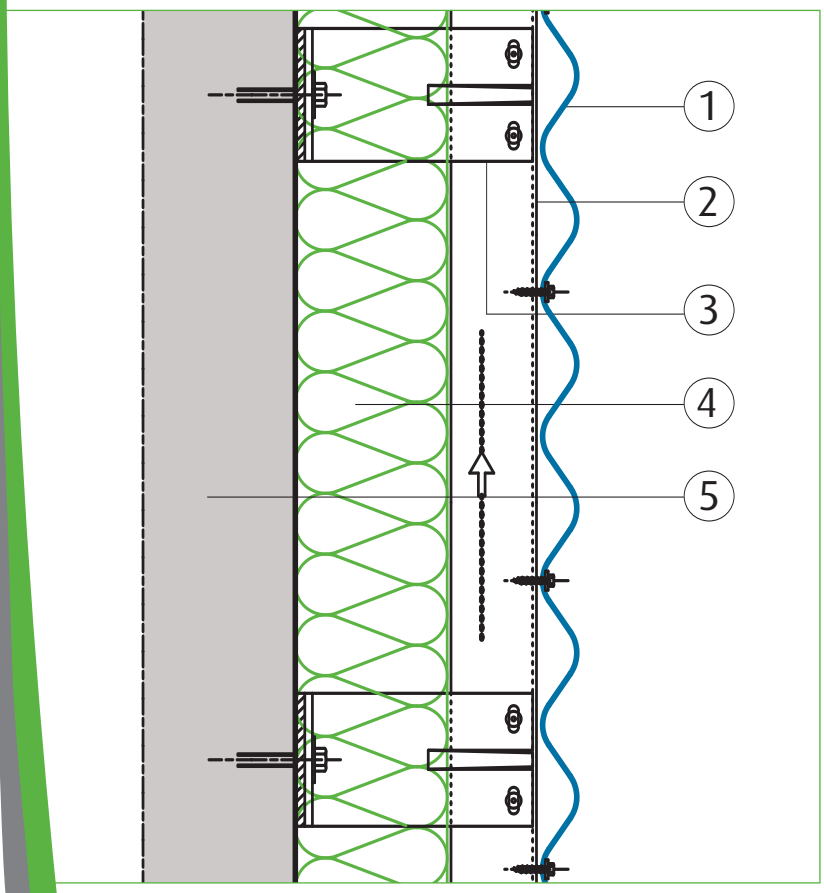
Surface aspects	QUARTZ-ZINC		
Thickness	0.80 mm – 1 mm		
Type	18/76	25/115	43/180
Wave depth	18 mm	25 mm	43 mm
Wave width	76 mm	115 mm	180 mm
Useable width	836 mm	805 mm	720 mm
Length *	1800 mm to 6000 mm		
Weight per sq. m ** (0.8 mm)	6.9 kg	7.2 kg	7.6 kg
Weight per sq. m ** (1 mm)	8.7 kg	9 kg	9.5 kg
Radius for natural curving (horizontal installation)	15 m	30 m	40 m

* Limited to 4 meters in mountain areas and exposed areas (500 m to seashore)

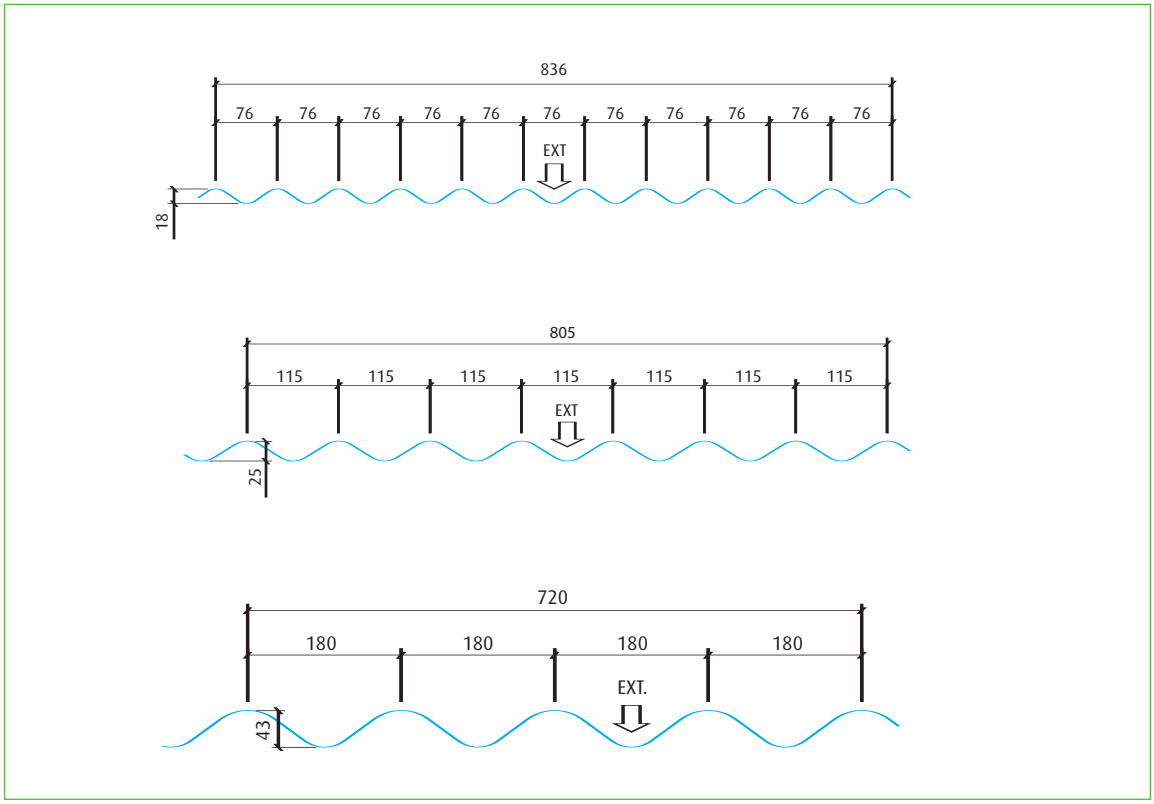
** Excluding framework

A range of standard accessories has been designed for the main flashings:

- internal and external corners
- junction flashing
- window framing.



1 Sinus profile
2 Metallic profile
3 Fixing bracket
4 Insulation
5 Masonry wall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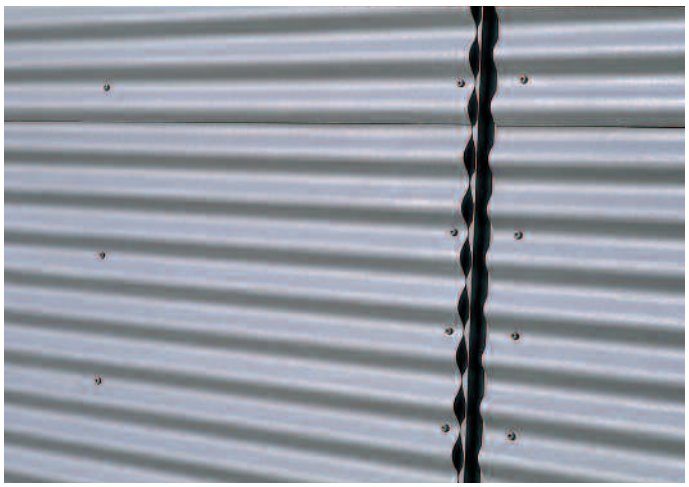


Specifications for design and installation

Climate

The system can be used in:

- temperate climate (maximum profile length: 6 m)
- mountain climate (maximum profile length: 4 m)

Please consult VM ZINC for:

- high rise buildings (over 30 m)
- allowable resistance to wind suction in windy areas.

Cladding panel

The cladding panels can be installed in lengths up to 6 meters either vertically or horizontally with a longitudinal junction formed by overlapping one wave.

Load bearing structure

The load bearing structure can consist of:

- masonry wall for horizontal and vertical installation with frame perpendicular to profile
- metal panel walls (on post and beam supporting structure) for horizontal installation only.

Substructure (not supplied)

The system is self-supporting and can be installed on non-continuous wooden or metallic framework perpendicular to the direction of installation. It shall meet loading requirements (resistance to tearing of 50 daN for the fixing clips) and should be laid perpendicular to the longer side in order to ensure adequate securing of the cladding panels. Its dimensions should be calculated according to the space between the rails. It should take into account the wind load of the project as well as the weight of the VM ZINC sine wave cladding system and the substructure. The project manager and the installer must ensure that the framework is ready to install, that flatness is checked as well as the continuity of the fixing rails which will support the cladding. VM ZINC does not take responsibility for the design, layout, or installation of the framework.

Fire classification

The fire classification of the wall is determined according to the combustible mass of the system (framework, insulation). There is no restriction on the use of the VM ZINC sine wave cladding system except for high rise buildings.

Ventilation

Ventilation at the top and bottom of the cladding is provided by 20 mm air inlets and outlets.

Thermal expansion

VM ZINC has a theoretical thermal expansion coefficient of 2.2 mm/m per temperature variation of 100°C. To accommodate this, the following should be taken into consideration:

- For vertical installation, the fixed section should be at the top (maximum recommended length is 3 m) and the expanding section at bottom.
- For horizontal installation, the fixed section is in the centre (maximum authorized length is 3 m) and the expanding section at both ends.

Install fixed points with self-drilling screws. Sliding points, the diameter of which is adapted to the expansion differential between the substructure and the cladding, should be pre-drilled in the VM ZINC corrugated profiles (about 3 mm > the diameter of the screws). When larger holes are used, a larger washer is also required.

Junction

The sine wave profiles are fixed in the concave area between every second wave for the 18/76 profile and in the concave area between every wave for the 25/115 and the 43/180 profiles.

- Transverse: by overlapping one wave with a stitching screw on a wave peak every 50 cm
- For vertical installation, we recommend using an apron or splice plate.

Handling and storage

Particular care must be taken to avoid scratches during handling and storage of VM ZINC products.

Soldering

Whenever necessary, soldering should be done in accordance with the manufacturer's recommendations. The zinc must be cleaned chemically (with stripping products) or mechanically (brush, sandpaper, etc.). The usual composition for the soldering filler is 33% tin and 67% lead, or 50% tin and 50% lead.
Stripping products for the QUARTZ-ZINC are available from VM ZINC.

Art School, Guadalajara (Spain) - Architect: V. Escolano, S.L.

THE BRAND

VM ZINC: A Umicore Group brand

Umicore is an international specialty materials group. Its activities are centred on four business areas: Advanced Materials, Precious Metals Products and Catalysts, Precious Metals Services, and Zinc Specialties. Each business area is divided into market-focused business units.
The Umicore Group has industrial operations on all continents and serves a global customer base; it generated a turnover of EUR 5.7 billion euros in 2004 and currently employs some 13,000 people.

The Zinc business is organised around three operational units:
- Umicore Zinc: extraction of zinc from ore and production of pure zinc and zinc alloys in ingots
- Umicore Chemicals: production of zinc oxides and zinc dust
- Umicore Building Products (VM ZINC).

A long-standing tradition

VM ZINC is the international brand name of zinc products manufactured and marketed by the Building Products Unit.

With over 100,000 tons of rolled zinc products sold world-wide every year, Umicore Building Products is the world leader in zinc and is particularly well established in European markets. The Unit pursues its international development through its internationally recognised brand name. Evidence of this international presence can be seen today on exciting buildings - from private houses to opera houses - all around the world.

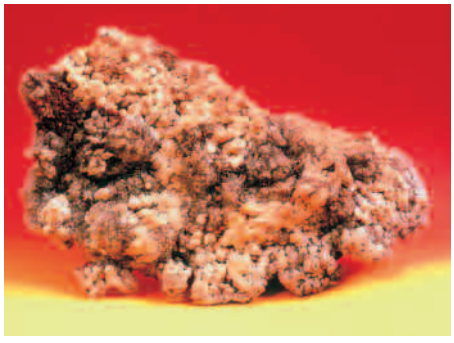
The brand, recognised under the name of VM ZINC, a name which reflects the company's origin and the nearly 170 years of history of the zinc manufacturer "VIEILLE MONTAGNE", founded in 1837.
VM ZINC was closely involved with the construction of modern Paris in the late 19th century under Baron Haussmann. Today, most of the roofs in Paris are covered with zinc. Zinc has become the emblem of Paris for the entire world and its zinc roofs, evoked in films, artistic photography and paintings, are a testimony to the natural beauty and enduring qualities of this exceptional material.
Today, this traditional material is not only suited to the restoration of older buildings but also lends itself to the increasingly imaginative creations of modern construction.

Industrial production

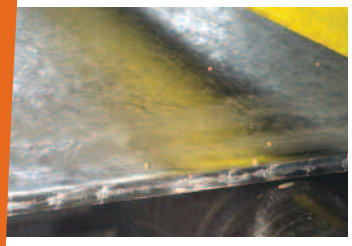
Zinc is a naturally occurring metal which is found in large quantities in the form of ore in the earth's crust.

All operations, from the transformation of the ore to the production of rolled zinc and finished products, are carried out within the Umicore Zinc Group.

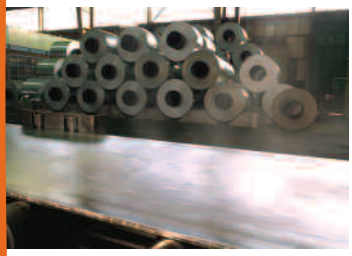
After the electrolytic process, the zinc is rolled in two VM ZINC rolling mills, one in northern France (Auby) and the other in south western France (Viviez).



(1) Alloying
The first stage consists of melting the pure metal deposited on the cathodes during the electrolysis process and adding a controlled amount of copper and titanium in a series of induction furnaces to produce a liquid alloy.



(2) Casting
The liquid metal is then transferred to a continuous casting machine for solidification into a continuous slab, about twelve millimetres thick and slightly above one metre wide.
The controlled cooling process within the machine produces a fine, homogeneous grain structure.



(3) Rolling
Three to five rolling operations are performed to reduce the slab to the required commercial thickness. Throughout this process, temperature, rolling speed and reduction rate are closely monitored and adjusted to obtain the requisite mechanical and dimensional characteristics.

(4) Slitting into sheets and coils
One of the final steps involves slitting the rolled zinc into sheets or coils of the requisite weight, width and thickness on specialised finishing lines.

The sheets and coils produced by the above process are used by roofers in their workshops and on building sites. They are also used in the production of VM ZINC transformed products (profiled sheets for roofing and cladding systems, finishing and waterproofing accessories, rainwater systems) or for transformation by partner companies.

Besides the two rolling mills in France, Umicore Building Products operates a plant for transformed products in the Paris area (Bray-et-Lû), other smaller plants in Germany, Switzerland and Portugal, and a workshop near Paris which produces large ornaments.

Quality standards

Umicore Building Products is committed to a total quality approach. Since 1998, Umicore France has had ISO 9001 certification for all its main production plants and its head office in Paris.

VM ZINC and traceability

It is very easy to recognise VM ZINC rolled products: they have continuous ink marking which indicates the thickness of the metal, the date and place of production. Formed products are generally stamped.

Quality services

At Umicore Building Products, our commitment goes much further than the delivery of quality goods. We want to ensure the satisfaction of the final customer i.e. the building owner or investor. To this end, the teams work closely with all those involved, from architects and specification writers to manufacturers, general contractors and roofers, in order to provide service from the initial idea right down to the finished building.
Some of the services offered are listed below:

Design assistance

Design assistance is provided by architects, engineers and specialised draftsmen using CAD systems. Their mission is to study the feasibility of even the most complex projects and offer reliable, innovative and cost-free solutions that respect budgetary requirements and standards. They assist the clients in designing their projects, from the feasibility study to 3D models, and help them every step of the way with detail drawings, layout plans, quantity estimates and even the development of new systems.

PRO-ZINC international

The PRO-ZINC training programme is a service available to professional roofers. It provides comprehensive training in every aspect of using zinc as a building material in a variety of courses which last from one to three days. These training courses are organised in our dedicated centres or on work sites, with the aim of providing fast start-up and effective trouble-shooting. The workshop environment, equipped with full-scale models, provides participants with solutions in a comfortable setting, without the daily pressure associated with the job site.

Technical assistance for roofing companies

International Technical Assistance is made up of operational teams of roofers who are experts in the most advanced techniques in their field as well as in the specific installation methods of each country. They can maximise the roofing companies' performance by assisting them at the beginning of a project or by providing follow-up on all continents.

Other services include:

- **Advice on the purchase of machines and tools appropriate for forming VM ZINC on-site**
- **Pre-forming in VM ZINC workshops for specific shapes (roofing or cladding panels, roofing sheets and accessories), which guarantees a professional finish.**

The sole purpose of this document is to describe the main technical characteristics of VM ZINC products manufactured by Umicore.

The specification and installation of these products are the sole responsibility of the architects and building professionals who must ensure these products are used in a way suited to the end purpose of the construction and that they are compatible with other products and techniques used.

The specification and installation of the products implies respecting the standards in force and the manufacturer's recommendations. In this regard, Umicore publishes and regularly updates specification and installation manuals for specific geographic areas and provides training courses. All the information on the latter can be obtained from the local VM ZINC team.

Umicore can't be held responsible for any specification or use of its products that has not respected all these standards, recommendations and practices.

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