

# Zinc Advice



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**Technical instruction  
handbook**

**NedZink** 

# Foreword

## A useful reference offering inspiration aplenty

NedZink has been manufacturing high quality zinc products for over a hundred years. After all, zinc is a natural and durable material that possesses striking aesthetic properties. This makes the material versatile and easy to apply as a roof, façade and wall cladding.

The world in which architects, installers and zinc workers operate is constantly evolving. New building insights and fresh combinations with other natural materials such as glass, wood and brick require innovative zinc products and applications. We laid strong foundations with NedZink NATUREL, NedZink NOVA and NedZink NOIR and continued to build on these foundations by developing new zinc products such as NedZink Pro-Tec, NedZink NOVA COMPOSITE and NedZink NUANCE.

Thus our extensive and flexible product range developed over the years, requiring specific processing methods. Justifiably proud, we present you with the new, expanded NedZink technical instruction manual. Not only does it contain the very latest zinc applications, this user-friendly technical instruction manual also includes overviews of diverse roof and façade systems, surprising zinc applications and clear construction drawings.

In a nutshell, it's a handy reference offering inspiration aplenty that will provide you with years of pleasure.

NedZink B.V.  
Technical Support Team

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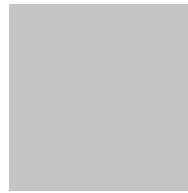
# 1 Materials

NedZink has already been producing high quality zinc products for applications in the construction sector for more than a hundred years. Titanium zinc is sold under the brand names NedZink NATURAL, NedZink NOVA, NedZink NOIR, NedZink NUANCE, NedZink Pro-Tec and NedZink NOVA COMPOSITE and has an excellent reputation on the international market. The basic material NedZink NATUREL is titanium zinc with a smooth rolled surface for applications in roof and façade cladding, roof gutters and rainwater drainage systems.

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## 1.1 Material types



### NedZink NATUREL

NedZink NATUREL is a durable, aesthetic and maintenance-free building material that becomes increasingly attractive over the years under the influence of weather conditions. This is due to the formation of a natural zinc patina layer on the surface. This property means NedZink NATUREL is mainly used where a natural and vibrant appearance, high cost-effectiveness and a long life are required.



### NedZink NOVA

In order to achieve the natural grey tint from the start, NedZink has developed a highly advanced prepatination process. The uniform medium-grey of NedZink NOVA is achieved following a chemical surface treatment after the rolling process. Color fast and approaching the most natural patina tint. Roofing, façade cladding and rainwater drainage systems are the right color from day one.



### NedZink NEO

Additional to the medium-grey NedZink NOVA the slightly darker grey surface has the same advantages and the right color from day one. The uniform matte, mineral grey alternative NedZink NEO gives an extra opportunity in choice.



### NedZink NOIR

In addition to the patina grey NedZink NOVA and the earth grey NedZink NEO, NedZink has a third variant of prepatinated titanium zinc called NedZink NOIR. This variant has a virtually black surface. It can be used to give projects a distinct and unique look.



### NedZink NUANCE

NedZink NUANCE is pre-weathered titanium zinc with pigments. This results, depending on the selected pigment, in a pre-weathered zinc variant with a blue, red or green color nuance.



The natural properties of titanium zinc: high durability, maintenance-free and good deformation properties are fully retained. The pigments also provide extra protection for the pre-weathered titanium zinc. NedZink NUANCE is mainly used for high-quality aesthetic building applications: externally for roofs and façades or internally for various design applications.



NedZink NATUREL Pro-Tec



NedZink NOVA Pro-Tec



NedZink NEO Pro-Tec



NedZink NUANCE Blue Pro-Tec



NedZink NEO Pro-Tec



NedZink NUANCE Red Pro-Tec



NedZink NUANCE Green Pro-Tec

### NedZink Pro-Tec

NedZink Pro-Tec is process-produced titanium zinc with a protective coating on the backside for application on either cold or damp-proof constructions. The protective layer protects the zinc against the effects of water vapor and other substances. The effective processing properties offered by zinc are retained.

< NedZink Pro-Tec is available in the following versions:



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## NedZink NOVA COMPOSITE

NedZink NOVA COMPOSITE is a panel that consists of 2 layers of prepatinated 'NedZink NOVA' zinc and a polymer core (Low-density polyethylene). This combination creates a flat, stiff panel that is exceptionally well suited for façade cladding applications.

Whether using glue, internal brackets, clamps or screws, there is a solution for every application. Aside from the strength and stiffness of the panel, a very flat surface is also achieved by the combination of materials.



## 1.2 Technical specification of basic material

NedZink produces titanium zinc in accordance with EN 988, an alloy based on electrolytically refined zinc with a purity of min. 99.995% Zn (Z1 in accordance with EN 1179) with small additions of the alloy elements copper, titanium and aluminum.

The chemical composition, the mechanical and physical properties and measurement tolerances are determined in the KOMO product certificate and the product certificate from Lloyd's Register, Industrial Quality Scheme for Product Certification by Surveillance of Quality Systems (approval No. QIS 122).

Compliance with the established material properties is checked at regular intervals (several times a year) by an independent and neutral inspection body, Lloyd's Register.

The materials are provided with a continuous stamp featuring a mark in accordance with the provisions of NEN-EN 988, mentioning the producer, the product description in German, Dutch, English and French, the EN 988 standard, the nominal thickness, the batch number, the year of production and the logos of the Lloyd's Register and KOMO inspection bodies.

The product certificate and the ISO 9001 certificate for the quality management system at NedZink ensure consistent and uniform high quality.

NedZink titanium zinc is characterized by high durability and excellent deformation properties, and is extremely weather-

### Chemical composition

| Product requirements | NedZink Titanium zinc |
|----------------------|-----------------------|
| Zinc                 | Zn 99,995%            |
| Copper               | Cu 0,08 - 0,17%       |
| Titanium             | Ti 0,07 - 0,12%       |
| Aluminium            | Al < 0,015%           |

### Size tolerances for standard products

| Product requirements     | NedZink Titanium zinc |
|--------------------------|-----------------------|
| Sheet and coil thickness | ± 0,025 mm            |
| Sheet and coil width     | + 2/-0 mm             |
| Sheet length             | + 2/-0 mm             |

### Mechanical & technological properties

| Product requirements               | NedZink Titanium zinc   |
|------------------------------------|---|
| Yield strength elasticity (Rp 0,2) | min. 110 N/mm <sup>2</sup>                                    |
| Tensile strength (Rm)              | min. 150 N/mm <sup>2</sup>                                    |
| Elongation (A50)                   | min. 40%  |
| Vickers hardness (HV3)             | min. 40   |
| Folding test                       | no fractures on the fold                                      |
|                                    | no cracks   |
|                                    | relative tensile strength D > 0,7 x original tensile strength |
| Permanent stretch in creep test    | max. 0,1%   |
| Edgewise bow                       | max. 1,5 mm/m   |
| Flatness-corrugation               | max. 2 mm   |
| Independent product control        | several times a year  |
| Guarantee                          | 10 years  |
| Quality management system          | DIN-EN-ISO 9001   |

### Physical properties

| Product requirements          | NedZink Titanium zinc |
|-------------------------------|-----------------------|
| Density                       | 7,2 g/cm <sup>3</sup> |
| Melting point                 | 420 °C                |
| Recrystallisation temperature | > 300 °C              |
| Linear expansion coefficient  | 0,022 mm/(mK)         |

resistant, durable and maintenance-free.

### 1.3 Material characteristics

Every rolled metal, NedZink material included, will show tension in a certain way. This is a consequence of the rolling process. With modern techniques, these tensions are reduced to a minimum. Nevertheless, it may be that these tensions occur, to a lesser degree, after the NedZink material is processed by third parties.

NedZink NATUREL has a bright, rolled surface. Exposure to the outside air and moisture results in a protective layer of zinc carbonate, which is called the patina. This process begins immediately after installation and will continue until a uniform patina is obtained. In the beginning, the appearance of the patina layer may be slightly mottled. This is visible particularly on vertical surfaces such as façades. Other factors that play a role in this patina process are: the orientation / geometry of the building, weather conditions during assembly, and the storage of the titanium zinc prior to assembly.

NedZink NOVA, NedZink NEO, NedZink NOIR and NedZink NUANCE are natural products and consequently minor color nuances will occur. A unique production process results in an extremely consistent color, but there is always a possibility of color variations (production batch related). Use material from the same production batch for each particular project to avoid color variations. The production batch number is stated on the back of the material.

Always assemble NedZink NOVA, NedZink NEO, NedZink NOIR and NedZink NUANCE in the same rolling direction in order to avoid color variations. The rolling direction is indicated by arrows on the back of the material. This rolling direction must be checked before installing the material.

After many years the pigments of NedZink NUANCE will gradually fade and the color of the pre-weathered NedZink NOVA will appear on the surface. The durability of the pigments is highly dependent on environmental factors such as the location of the building, temperature, UV exposure and air quality. Damage, perforation and adverse environmental factors can significantly shorten the lifetime of the pigments.



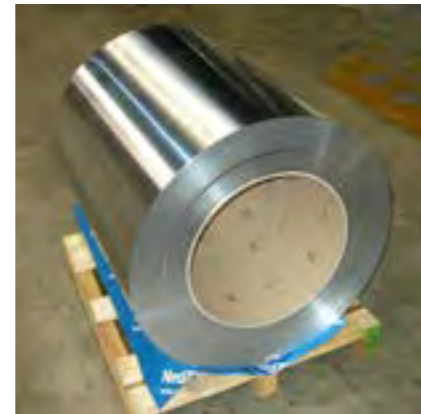
# 2 Products

**NedZink material is supplied in the form of coils, sheets, strips, gutters and pipes. NedZink offers a wide range of dimensions and thicknesses not only in NedZink NATUREL, but also in NedZink NOVA, NedZink NOIR and NedZink NUANCE.**



## 2.1 Coils

| Productdetails coils        |                               |
|-----------------------------|-------------------------------|
| Available widths            | 150 – 1000 mm                 |
| Material thickness          | 0,65 – 0,70 – 0,80 – 1,00 mm  |
| Weight coils of 1000 mm     | max. 2800 kg – min. 930 kg    |
| Coil internal dimension     | standard coils: 508 mm        |
|                             | small coils = 250 kg: 500 mm  |
|                             | small coils < 250 kg: 300 mm  |
| Length small coils < 250 kg | in coil widths < 500 mm: 42 m |
|                             | in coil widths ≥ 500 mm: 30 m |
| Packaging                   | ID 300 mm: 6 per pallet       |
|                             | ID 500 mm: 4 per pallet       |
|                             | ID 508 mm: as agreed          |



Other sizes and thicknesses are available on request.

## 2.2 Sheets

| Productdetails sheets |                                |
|-----------------------|--------------------------------|
| Standard sizes        | 1000 x 2000 mm                 |
|                       | 1000 x 2250 mm                 |
|                       | 1000 x 3000 mm                 |
| Material thickness    | 0,65 – 0,70 – 0,80 – 1,00 mm   |
| Packaging             | on pallets of approx. 1.000 kg |

Other sizes and thicknesses are available on request.



## 2.3 Gutters

The NedZink standard gutter (box gutter and suspended gutter) has been a reliable Dutch, quality product for many years. With a NedZink standard gutter not only the material is KOMO certified, the dimensions are also KOMO/KIWA certified. All NedZink standard gutters feature a unique NedZink embossed stamp on the front of the gutter, directly under the bead. This brand label guarantees it is a genuine top quality, NedZink product.

Standard gutters: Suspended gutter M30, M37 and M44 in NATUREL, NOVA and NOIR  
Box gutter B30, B37, B44 and B55 in NATUREL, NOVA and NOIR



## 2.4 Downpipes

The NedZink rainwater downpipe has been a reliable Dutch, quality product for many years. At NedZink the material as well as the dimensions, including the fit, are KOMO guaranteed. The NedZink rainwater downpipe is guaranteed to be dimensionally stable, quick and easy to mount and also has an extremely long lifespan. All NedZink rainwater downpipes feature a stamp on the exterior showing the KOMO quality label and certificate number.

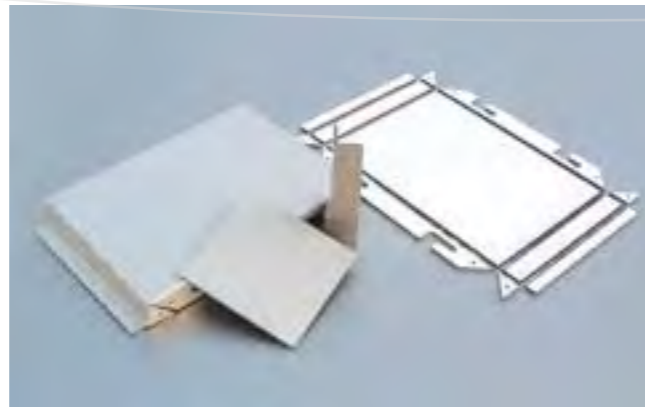


## 2.5 NedZink NOVA COMPOSITE

### Technical characteristics NedZink NOVA COMPOSITE

|                         |  |
|-------------------------|--|
| Standard dimensions     | 3200 x 1000 mm                           |
| Standard panel strength | 4 mm                                     |
| Panel composition       | top and bottom<br>core                   |
| Toleranties             | thickness<br>width<br>length<br>diagonal |

The assembly of the panel can be aligned to the design. The following attachment methods are possible with NOVA COMPOSITE: adhesion, clamping, mechanical screw fixed, and hook-on system.



# 3 Roof gutters and rainwater downpipes

Gutters are used for the collection of rainwater. The rainwater is guided through downpipes into a sewer, other disposal point or collector. Gutters are produced in many variations and their use is various. In general, gutters are available in different forms and numerous applications.





The suspended gutter has a semi-circular cross section, which in the past was made using a piece of round wood. The box gutter has a slightly trough, or box-shaped, cross section. The diagonal gutter has a back height edge in line with the surface of the sloping roof, and a front height edge, which forms a right angle, in other words a 'diagonal' design.

Downpipes are produced in various types. The most common is the round tube, but tubes with square, rectangular and other forms can be applied. The standard rainwater downpipes come with a soldered seam or a double seam. The diameter of the tubes is extended at one end so different lengths can be put together. To complete the drainage system the gutters and pipes must be fitted together with end pieces, brackets, bends, gutter outlets etc.



### 3.1 Roof gutters

Roof gutters must comply with the NEN-EN 612 standard. NedZink standard prefab roof gutters are produced in a standard length of 3 meters. Depending on the type of gutter, different lengths of up to 6 meters can be supplied on request. Non-standard prefab gutters are produced from sheets of NedZink material according to drawings supplied by the installer. Non-standard prefab gutters must also comply with NEN-EN 612.



#### 3.1.1 Standard box and suspended gutters

Dutch standard gutters are subdivided into suspended gutters (semi-circular) and box gutters (rectangular). See examples of both below.



##### Details bead

| Bead diameter | Developed width |
|---------------|-----------------|
| 20 mm         | 65 mm           |
| 22 mm         | 70 mm           |
| 24 mm         | 75 mm           |
| 26 mm         | 85 mm           |
| 35 mm         | 110 mm          |
| 50 mm         | 165 mm          |

Table 3.1

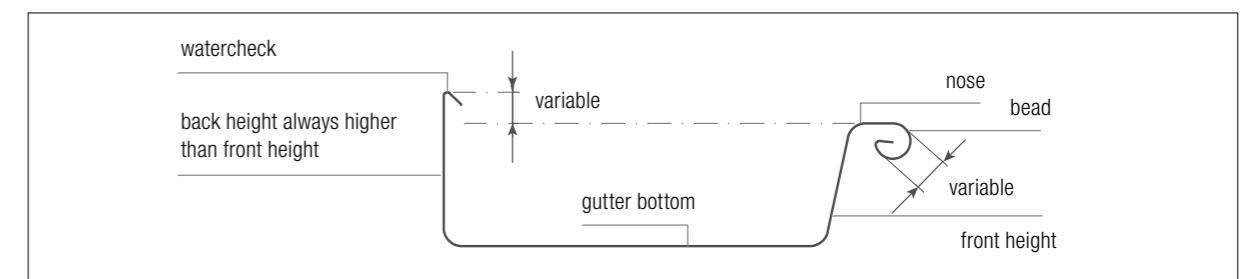


Figure 3.1.1

### 3.1.2 Customised gutters

Non-standard box and suspended gutters are referred to as customised gutters. Below we provide some examples

#### Valley gutters

Valley gutters are used to collect water between two sloping roofs at the point of a valley rafter.

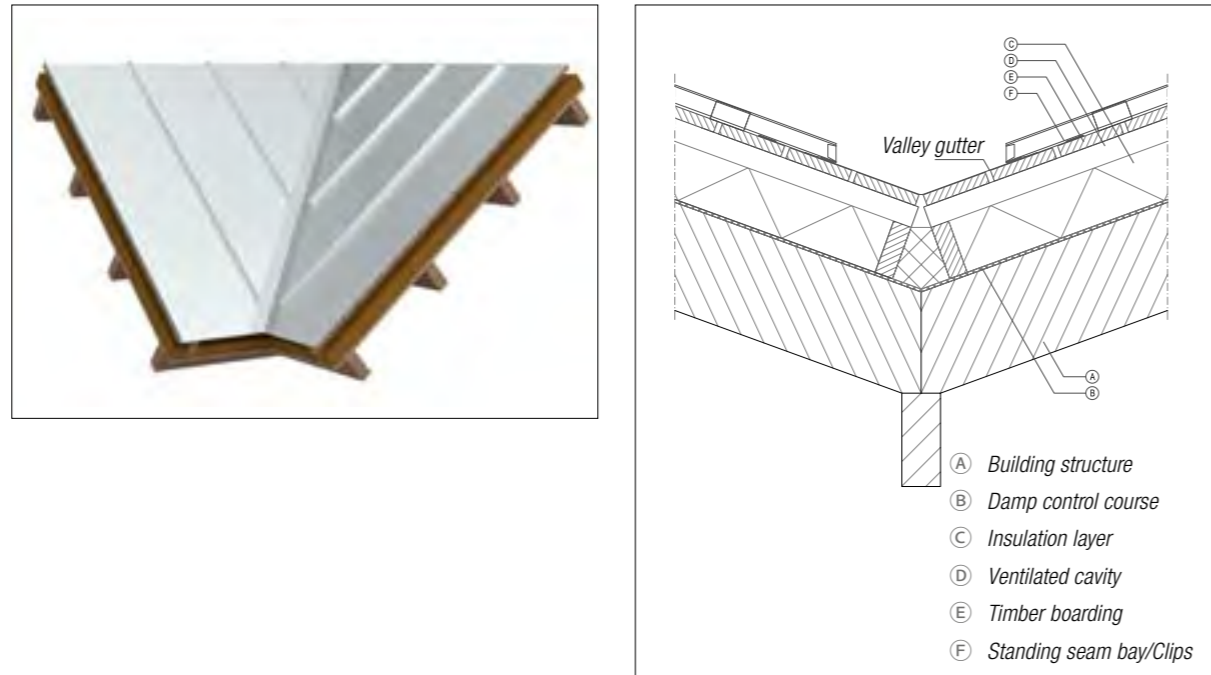


Figure 3.1.2 Valley gutter

#### Gutters in the roof surface

Gutters in the roof surface are sunk into or concealed below the level of the zinc roof covering in, for example, a standing seam structure.

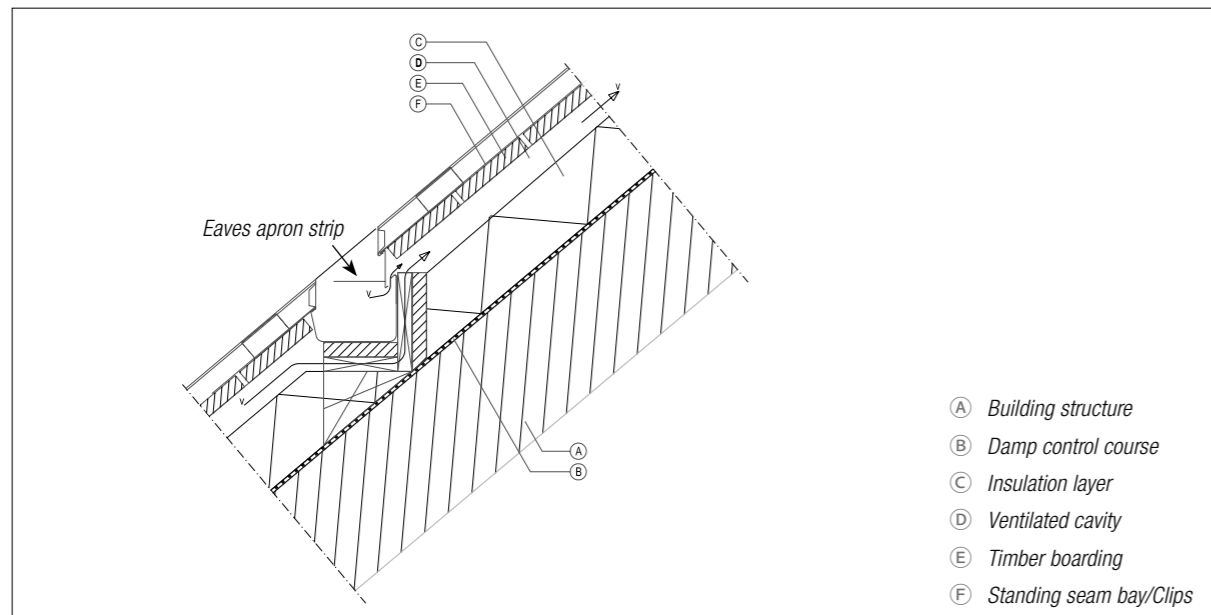


Figure 3.1.3

#### Concealed gutters

Concealed gutters are positioned vertically at a dormer or wall abutment.

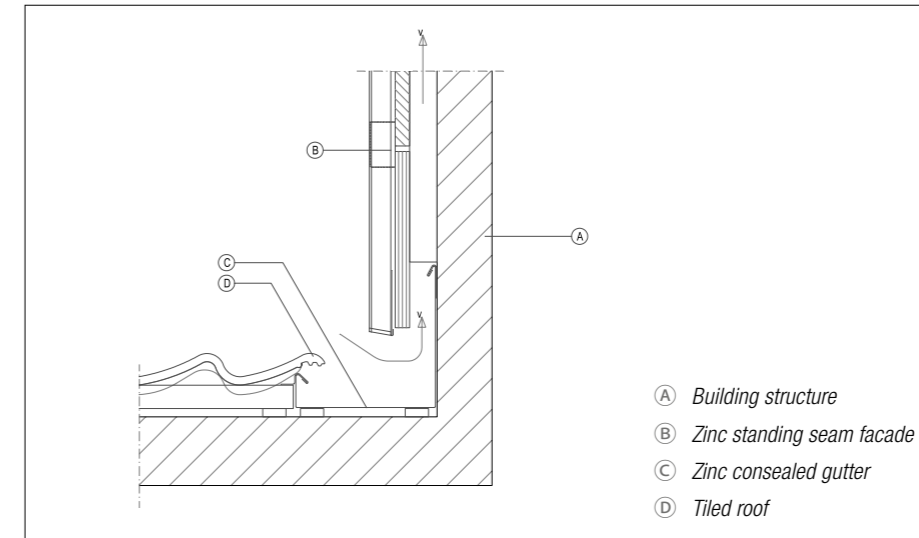


Figure 3.1.4 Concealed gutter

### 3.1.3 Roof gutters supported by brackets

#### Installation

The gutter parts should preferably be installed from left to right and against the slope (from low to high). The structural conditions do not always allow this. When choosing another installation direction, the installation from low to high is more important than from left to right (draining overlap!).

At one side of the gutter a locating edge or fitted edge has been applied to facilitate the joining together of the gutters. The gutter parts, starting at the bead, are joined together with a minimum overlap of 10 mm. With the same rotating movement, the gutter parts with the bead are placed in the correct position over the lip or steel angle profile of the brackets.

The clip at the back height of the bracket is now bent downwards over the water check of the back height, in such a way that the gutter can continue to move in the circumstances of contraction and expansion. The use of nails for the same purpose is not permitted as this is disastrous for the service life of the gutter! The overlap of the gutter can now be soldered. Note the minimum overlap of 10 mm and flow through of the soldering of at least 10 mm.

### Gutter brackets

The hot dip galvanised gutter brackets to be used must meet the NEN-EN 1462 standard and must, according to the specifications of the manufacturer, be suitable for the type of gutter to be installed.



Figure 3.1.5



Figure 3.1.6

The form of standard and non-standard gutter brackets must be adjusted to the form of the wall plate, the required slope, the pitch of the roof and the position of the gutter to be installed (back height higher than front height).

A gutter bracket must be attached to the wall plate with at least 2 galvanised or stainless-steel screws. The distance between the gutter brackets amounts to max. 660 mm centre-to-centre. The slope in the direction of the outlet piece must amount to at least 2 mm per meter of gutter length.

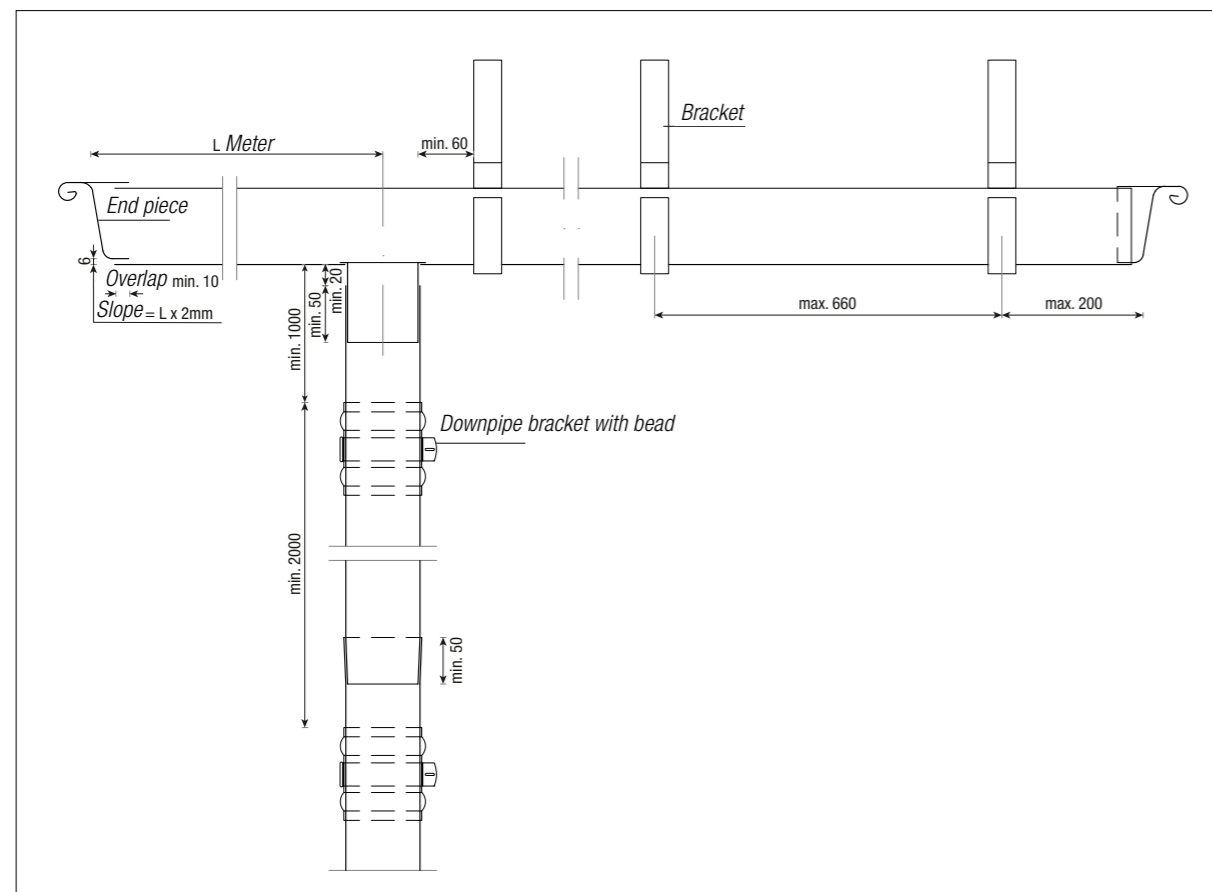


Figure 3.1.7

### 3.1.4 Roof gutters in a wooden box

This type is fully supported by a structural construction. In most cases it consists of a wooden box structure.

#### Installation

- The bottom width of the gutter must be at least 10 mm smaller than that of the box. The back height min. 10 mm higher than the front height.
- The gutter parts must be preferably installed from left to right and against the slope (from low to high). The construction conditions may not always allow for this. When choosing another installation direction the installation from low to high is more important than from left to right (drainage overlap!).
- Clips are attached at the edge of the front height of the box with a minimum width of 70 mm and a thickness of 0.80 mm. Attach the clips with 3 galvanised or stainless-steel flat-headed nails. A clip must pierce approximately  $\frac{3}{4}$  into the bead. Secure the gutter with clips of 30 mm wide at the rear upright. The maximum clearing distance is 660 mm.
- If the bottom width of the gutter is greater than 300 mm, a clip must be applied under the seam on the bottom of the gutter. The overlap of the clip must then be 25 mm and the clip may not be soldered.
- The distance between the clips is max. 660 mm centre-to-centre. Clips of min. 30 mm width are further attached to the wooden back height at the same distances and are bent over the water check of the gutter.
- The outlet piece in the supporting box construction must be spacious enough to allow the gutter to contract and expand. This means that the outlet piece, with the rain pipe slipped around it must have an oval cavity with at least 20 mm of space.

#### Support

The support is part of the building construction and is usually made of wood. Gutters of NedZink material can be applied directly to unplanned wood. NedZink recommends installing a vapor-permeable layer on newly-impregnated and bonded wood at the bottom of the gutter tray in order to prevent attack by condensation on the backside of the zinc. The same advice also applies to supports of concrete or other stony materials, where the separating layer also prevents wear on the zinc. Before applying the zinc, check that the supporting wooden container is clean and does not contain protruding nail heads or screws.

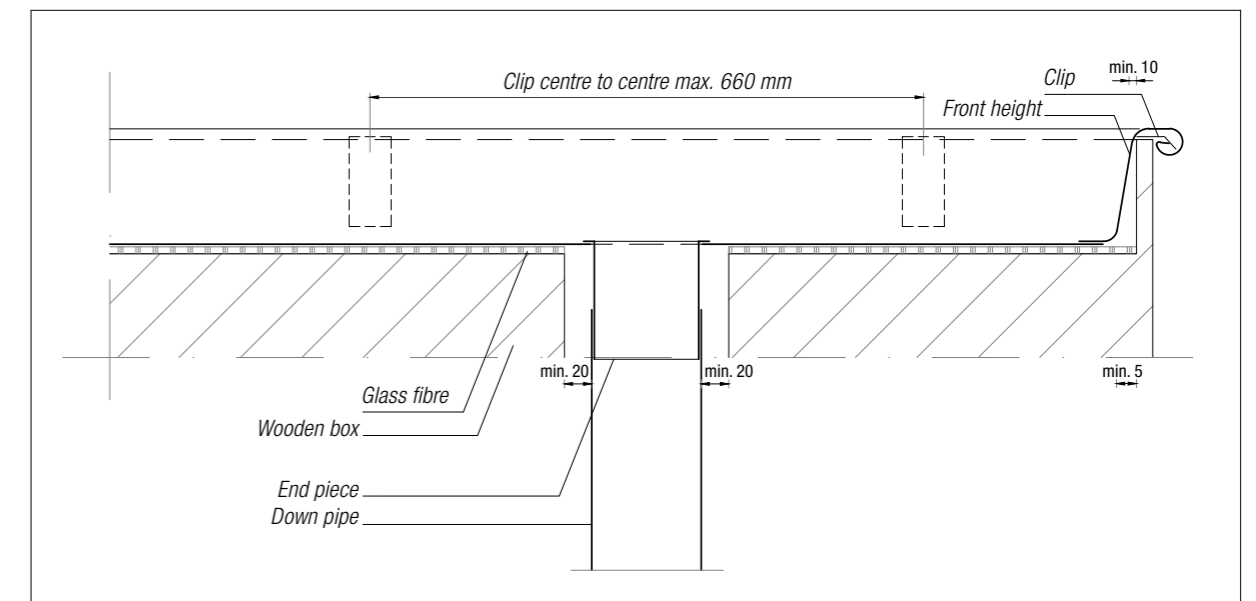


Figure 3.1.8

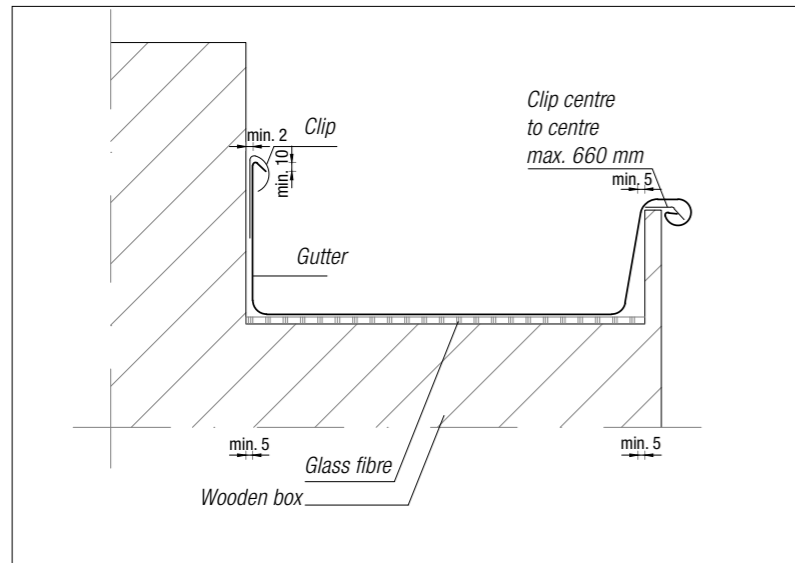


Figure 3.1.9

The box is to be measured at various places and following measurements should be taken:

- Upper opening width.
- Bottom width.
- Height and slope of front height and rear height of the wooden box.
- Thickness of the edge of the front height of the wooden box.
- Length of the various gutter surfaces.

#### Opening of the outlet piece

The outlet piece in the supporting box construction must be spacious enough to allow the gutter to contract and expand. This means the outlet piece, with the rain pipe slipped around it must have an oval cavity with at least 20 mm of space to the left and to the right and in the other two directions, at least 5 mm. See figure 3.1.8.

#### Design of the gutter

See Figures 3.1.8 & 3.1.9. The following basic rules must be observed:

- The upper opening width of the gutter must be at least 4 mm smaller than that of the box.
- The bottom width of the gutter must be at least 10 mm smaller than that of the box.
- The front height of the gutter must be 1 to 2 mm larger than that of the box.
- The bead protrudes over the edge of the box and does not rest on it.
- The back height min. 10 mm higher than the front height.
- The slope of the gutter is equal to that of the box including any bent forms.
- The further dimensional proportions in accordance with NEN-EN 612.
- The ends of the gutter must have at least 10 mm space in relation to the ends of the supporting box

### 3.1.5 Expansion

Expansion sleeves are necessary to absorb the expansion and contraction of the roof gutter. An expansion device must always be supported by a bracket.

In practice we distinguish between two types of expansion pieces, mechanical expansion (see figure 3.1.10) and rubber expansion (see figure 3.1.11).



Figure 3.1.10

A mechanical expansion has an expansion joint and a separation slide on the left and right.



Figure 3.1.11

A rubber expansion is fitted with a rubber galvanised expansion piece and a zinc beaded edge.



### 3.2 Rainwater downpipes

Rainwater downpipes are made from NedZink NTZ® and must meet EN 612. Standard prefab lengths are 2 and 3 meters. Non-standard downpipes can be supplied. Non-standard prefab downpipes must also meet EN 612. Rainwater downpipes can be supplied as a rounded, square, or rectangular model. The longitudinal seam is welded and one of the ends is expanded. Table 3.2 below contains the standard rainwater downpipes.

#### Standard rainwater downpipes

| Diameter      | Mass       | Thickness | length  |
|---------------|------------|-----------|---------|
| Round 80 mm   | 1,161 kg/m | 0,65 mm   | 2 & 3 m |
| Round 100 mm  | 1,451 kg/m | 0,65 mm   | 2 & 3 m |
| Square 80 mm  | 1,485 kg/m | 0,65 mm   | 2 & 3 m |
| Square 100 mm | 1,860 kg/m | 0,65 mm   | 2 & 3 m |

Table 3.2

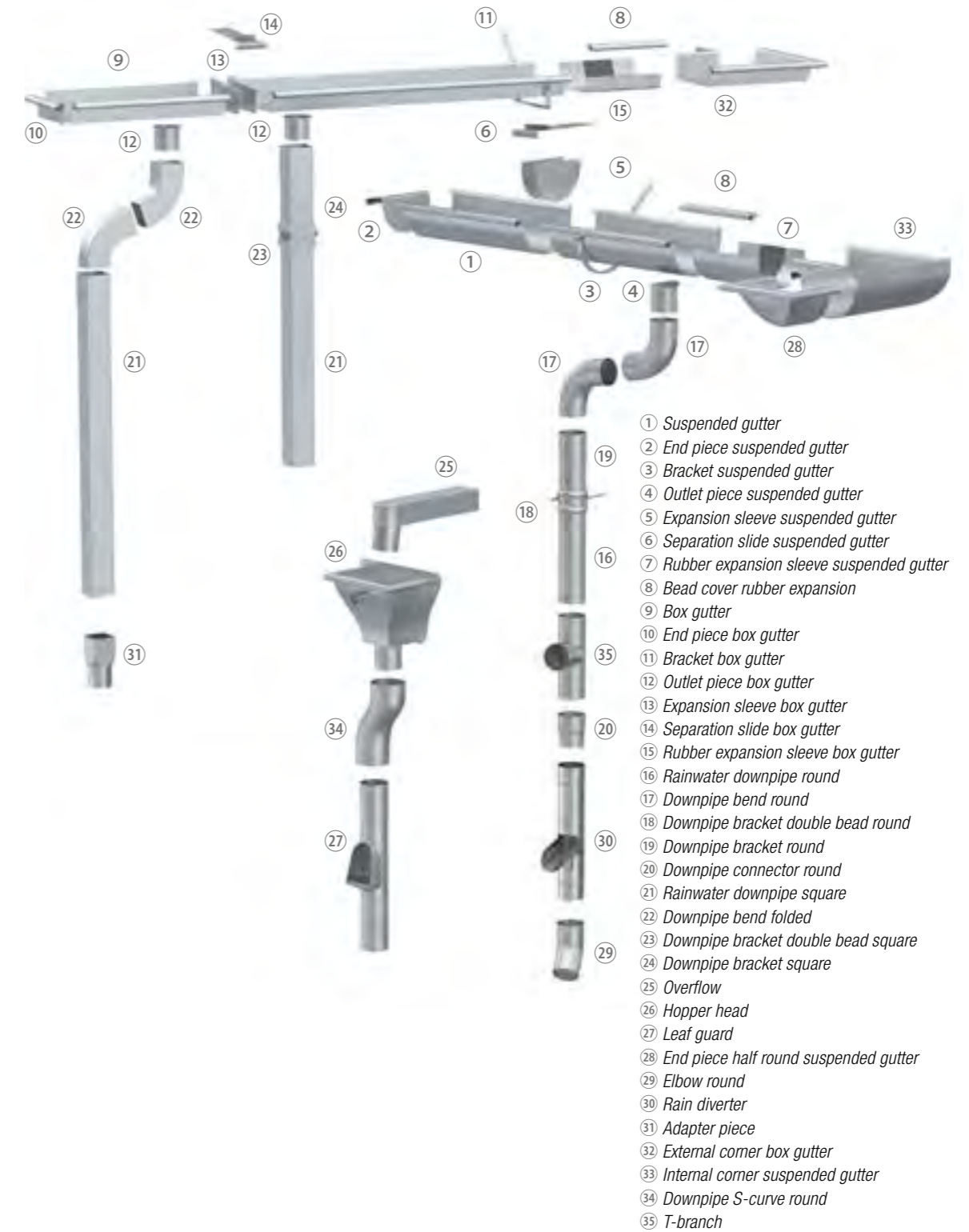
#### Installation

- The down pipes are hung from above to below.
- In principle, the rainwater downpipes are not soldered, they are slipped in to one another with a min. overlap of 50 mm.
- The upper short length of piping may not be able to press against the bottom side of the gutter and must therefore have at least 20 mm space.
- The outlet piece must be slipped at least 50 mm into the downpipe, so that the projecting outlet piece must be 70 mm in length.
- Each length of piping must be bracketed at least once.
- The brackets must be attached at a maximum of 2 meters distance, and the upper bracket must be installed at least 1 meter under the gutter bottom, see Figure 3.1.1.7.
- The distance between the back of the pipe and the façade must be at least 30 mm.
- The bracket spacing is 2 meters.
- To make lateral movement of the gutter possible, the first hinge bracket is to be placed 1 meter from the bottom of the gutter.
- The distance between the bottom gutter and top of the drain pipe is to be at least 20 mm to allow for expansion of the tube.



### 3.3 Accessories

Accessories are required to collect rainwater in gutters and drain it via rainwater downpipes. A wide range of accessories are available, as shown below.



Overview accessories.

# 4 Building physics

A lifespan of between 75 and 100 years is no exception for titanium zinc on a façade or roof, provided it has been properly fitted. However, building physics plays a major role in this lifespan.

Condensation of vapor against the backside of a titanium zinc construction can cause serious corrosion if certain conditions are not met. Thus it must be ensured that there is sufficient ventilation on the backside of the zinc surface if no other measurements are taken to prevent condensation.



For *non-insulated* roofs it is enough to support the zinc with a wooden roof deck consisting of rafters and timber boarding. The boarding is placed with a 5 mm gap between the boards. To decrease the capillary action due to contact with the board, the boards should be unplanned. If, however, plywood decking is used to support the zinc covering for example, it is advised that a vapor-permeable layer be placed between the plywood and the zinc to prevent corrosion.

For *insulated, ventilated* roofs and façades the risk of internal condensation is bigger than for those that are insulated, non-ventilated because the difference between the internal and external temperature is on average larger than for non-insulated constructions. To prevent condensation in these cases, a vapor barrier in combination with a ventilated cavity is necessary.

For an *insulated* construction without ventilated cavity, another insulation system can be used for a quick and easy application. This so called 100% vapor-tight system will prevent condensation problems.

## 4.1 Vapor transmission

### How condensation water is formed

Structures are stressed not only by mechanical forces but also by the physical aspects of a building, such as fluctuating temperatures, which may vary between - 20 °C and + 80 °C, and differences in air humidity on the inside and outside.

In the most common, where the internal temperature ( $T_i$ ) is higher than the external temperature ( $T_e$ ), it is generally also found that the air humidity is greater on the inside than the outside.

The difference in vapor pressure ( $P_i - P_e$ ) causes vapor to be transported through the roof structure from the inside to the outside. If the roof is not constructed properly, condensation or frost will form on the inside of the relatively cold titanium zinc.

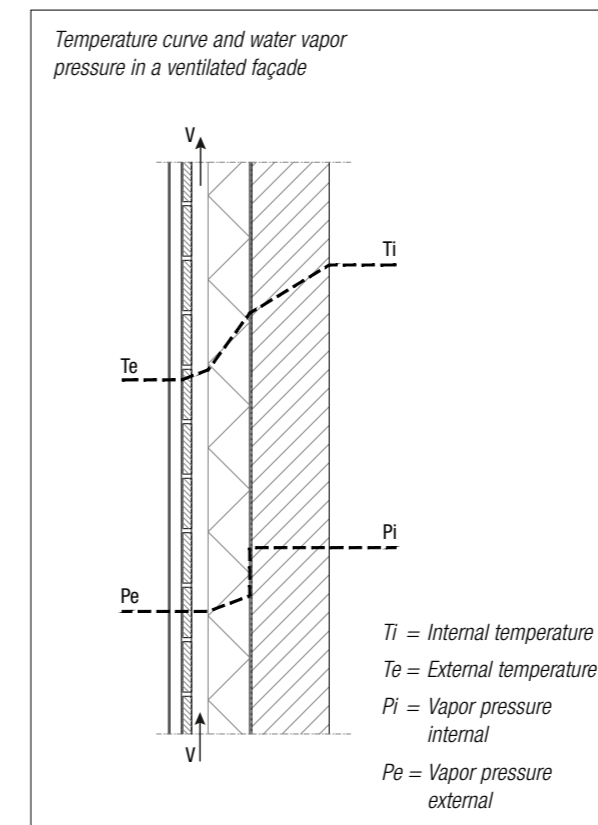


Figure 4.1

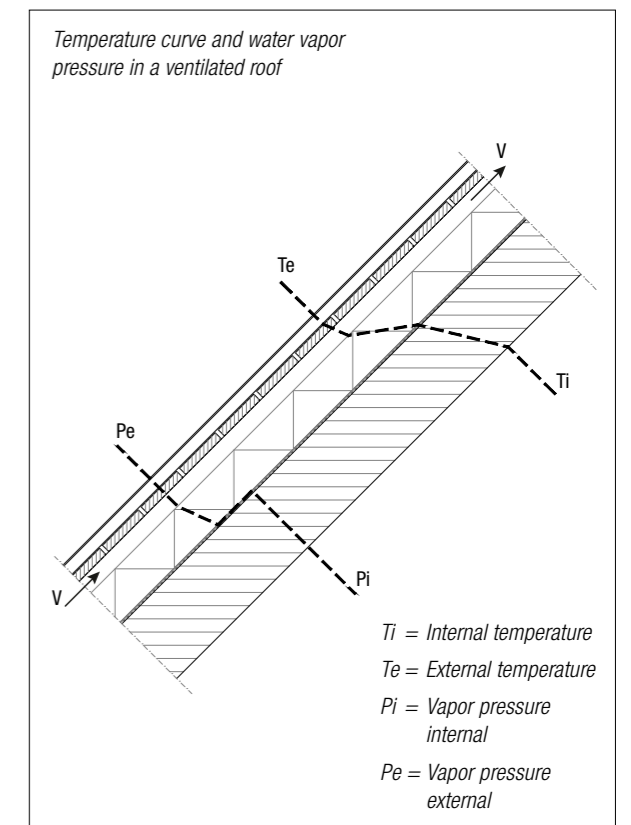


Figure 4.2

### Damage and prevention

Excessive condensation can be harmful in a number of ways. For example, it can damage the titanium zinc on the backside as the result of corrosion, or lead to moisture damage on parts of the supporting structure (corrosion, wood rot or mold). Totally sealing the roof on the inside is not the answer: this cannot be done in practice, and in terms of moisture regulation in a building it is generally not desirable. In order to achieve the desired movement of vapor and to avoid the risk of damage, two main steps must be taken:

- A. Fit a damp control course on the inside of the thermal insulation.
- B. Include a gap on the external side of the thermal insulation to permit ventilation by external air.

#### A. Diffusion layer

This layer is necessary:

1. To let through just enough vapor, but not too much, to remove excess vapor from the building (e.g. vapor produced by the occupants). We recommend the selection of a material which prevents the transmission of vapor, having a minimum Sd-value of 10.
2. To make the structure draught-proof and prevent air from the interior from flowing directly into the ventilation cavity. The cavity is in direct contact with the external air, meaning an unpleasant current of air could flow into or out of the structure through any cracks or gaps.

The diffusion layer is not needed in all cases, e.g. where the structure beneath the ventilation cavity already has a vapor resistance value greater than 10. In such cases, however, the ventilation gap and the air apertures must correspond to the values given in the table, and protection must be provided to seal any cracks between the ventilation gap and the interior air space.

#### B. Ventilation cavity

The ventilation cavity must be open to the external air via ventilation apertures at the lowest and highest points of the façade or roof. The air must be able to flow between apertures without major obstacles. The required dimensions for the gap and the apertures are detailed in the following table.

| Pitch        | Minimum width of ventilation | Minimum cross-section of Ventilation apertures top and bottom per m <sup>2</sup> of roof surface area |
|--------------|------------------------------|---|
| 3° tot 20° * | 80 mm                        | 40 cm <sup>2</sup>  |
| > 20°        | 50 mm                        | 30 cm <sup>2</sup>  |
| 90°          | 20 mm                        | 10 cm <sup>2</sup>  |

\* The exact height of the ventilating cavity is considered per situation.

Table 4.1

## 4.2 Ventilated construction

The quality and service life of a roof or façade covering made of titanium zinc depends firstly on the design and execution of the roof. If the roof or façade is not constructed properly, condensation or frost will be formed on the backside of the titanium zinc.

In principle, the construction of a roof with a titanium zinc covering is, in building physics terms, the same as that of a façade. Therefore, this chapter exclusively concerns roof constructions with a slope of between 3° and 90°.

Flat or almost flat roofs with a pitch of less than 3° should, if possible, not be covered with titanium zinc unless the surface area is smaller than 15 m<sup>2</sup>, for example over dormer windows and canopy roofs.

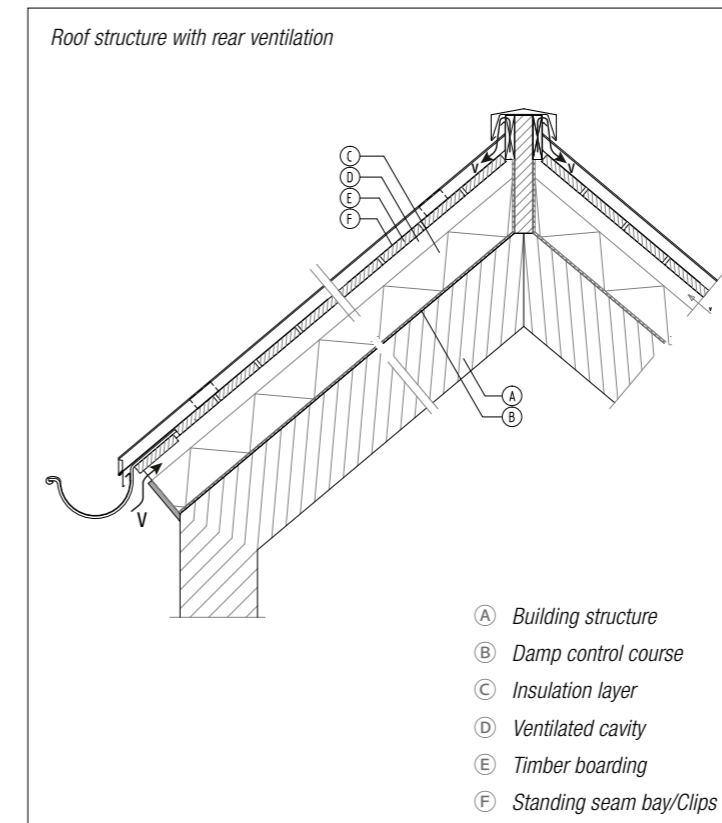


Figure 4.3

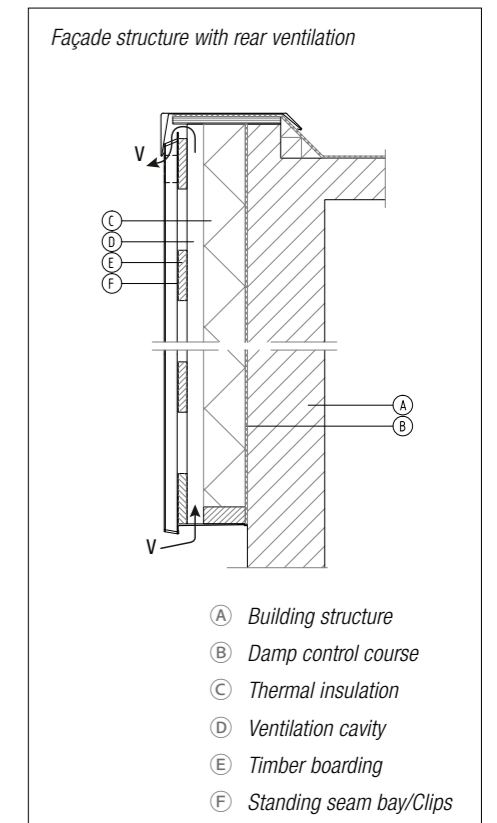


Figure 4.4

The components are identified from inside to outside:

1. Ceiling - any type, although it must be able to support the insulating material, or have the insulation attached to it.
2. Damp control course made of metal or plastic film.
3. Supporting rafters - generally made of wood.
4. Insulation slabs, matting or foam between the rafters. It is even better if they can be made to run across under the rafters, although a different construction is required for this. The thickness of the insulating layer depends on the material used and the degree of insulation required.
5. Ventilated cavity: thickness depends on pitch of roof (see table 4.1).
6. Timber boarding: If titanium zinc is to be used, the preferred type of timber is unplanned, untreated boards no less than 22 mm thick. The boards should be arranged horizontally without tongue and groove, and there should be a 5 mm gap between the boards.
  - roof pitch up to 45°      5 - 10 mm
  - roof pitch from 45° - 70°      5 - 50 mm
  - roof pitch from 70° - 90°      5 - 100 mm

Assemble the wooden parts in such a way that the clips can be arranged at the desired location.  
The nail heads must be well sunk to prevent contact with the zinc.  
Use thermally galvanised nails with a zinc layer thickness of at least 20 microns or stainless steel.
7. NedZink titanium zinc in the form of the chosen roofing type. The principal options are:
  - the standing seam system
  - the roll cap system
  - the lozenge system

## 4.2.1 Ventilated systems

### 4.2.1.1 Standard built up: ventilated cavity and timber boarding

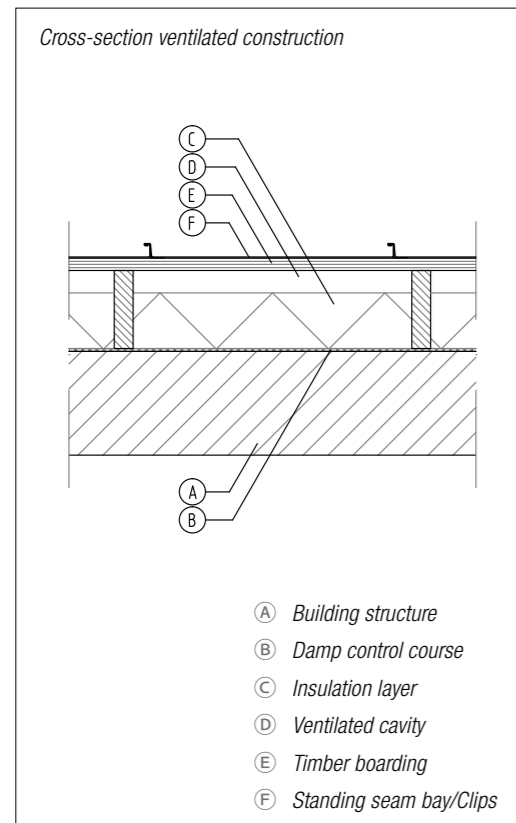


Figure 4.5



Figure 4.6

### 4.2.1.2 Alternative built up: breather membrane, plywood and NedZink Pro-Tec

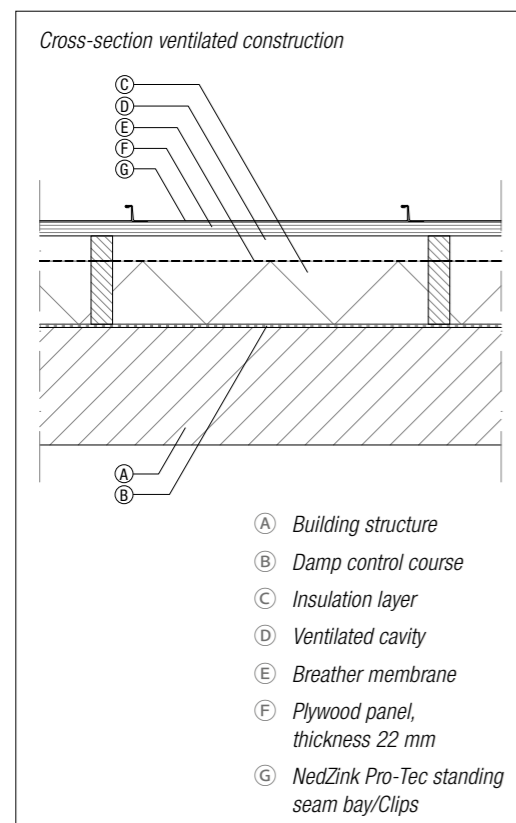


Figure 4.7

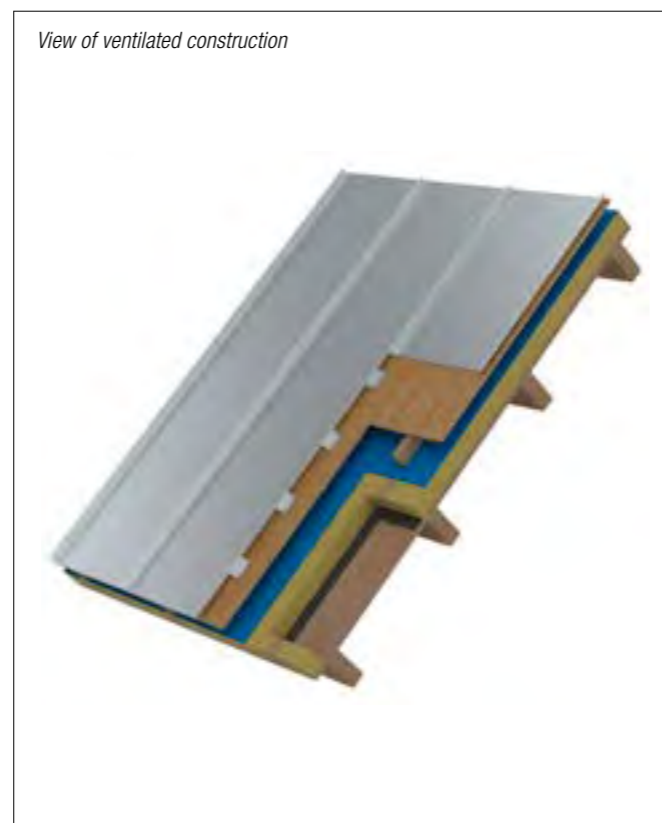


Figure 4.8

### 4.2.1.3 Alternative built up: breather membrane, plywood, structured underlay and standard NedZink

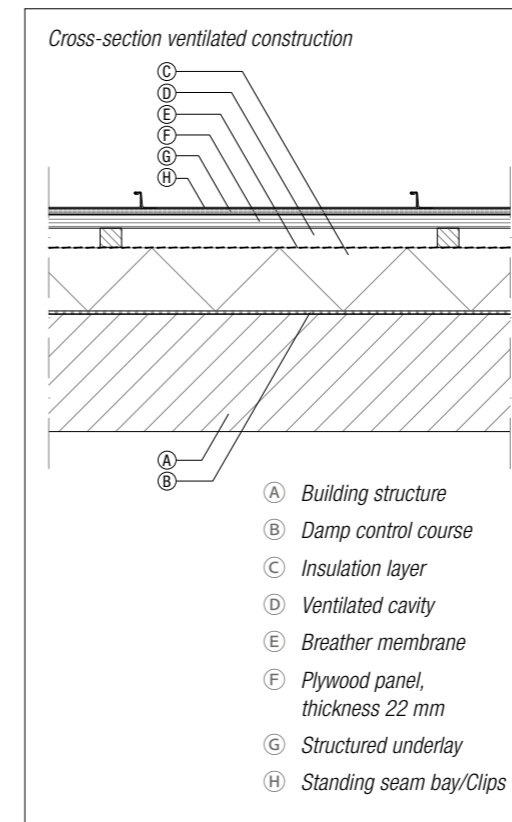


Figure 4.9

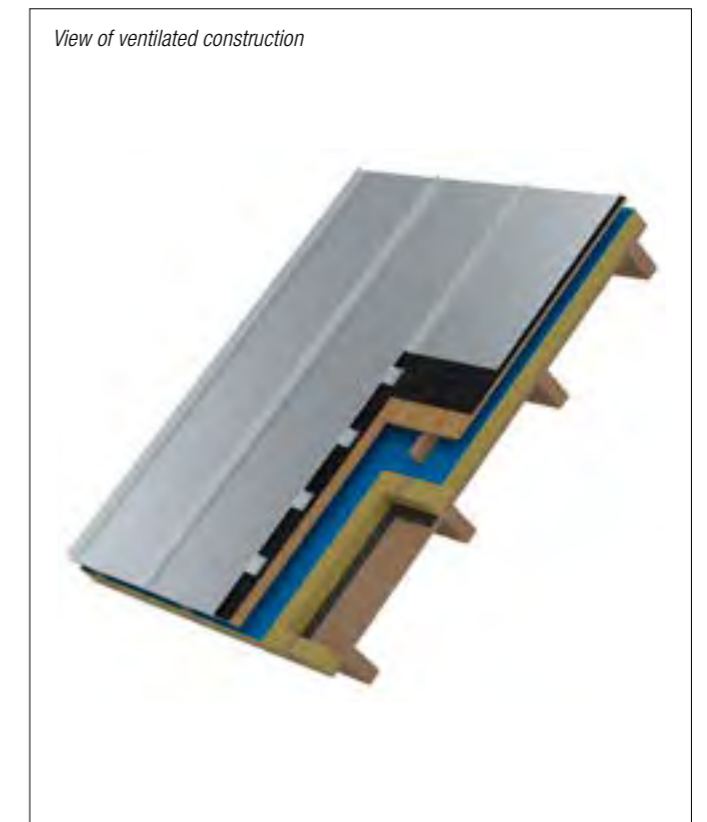


Figure 4.10



### 4.3 Non-ventilated structure

Increasingly, the designer wants to achieve a slim roof package, making it different from the traditional structure with a relatively high ventilated cavity. Also, with the renovation of roofs, the thickness of the total package can be a problem. The choice is on a non-ventilated, vapor-tight system with the advantage of a slimmer design.

#### What is a non-ventilated structure?

A non-ventilated structure is a roof and façade construction with no ventilation or air cavity. Thermal insulation followed by a roof covering system is fitted to the support structure. This produces a single-layer, non-ventilated structure. This concept is highly suited to sloping roofs and façades with zinc. To avoid the formation of condensation the structure must be damp proofed. Internal condensation or condensation resulting from nocturnal temperature drops, do not form in this construction either. This represents a major difference with a traditional cold roof system. When building this structure the preference is for a damp-proof system with a  $\mu.d$  (or  $S_d$ ) value of at least 150 meters.

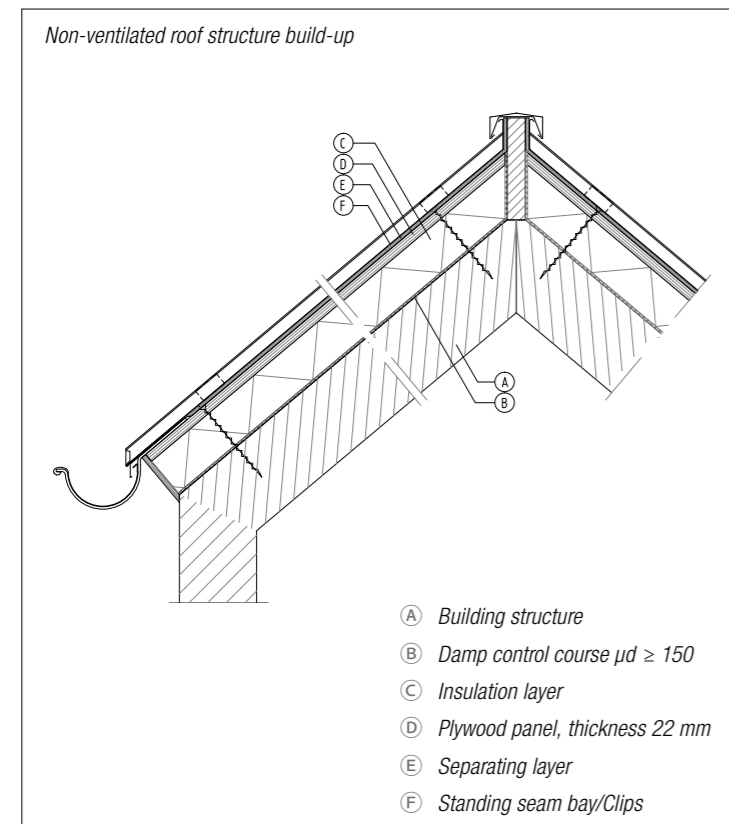


Figure 4.11

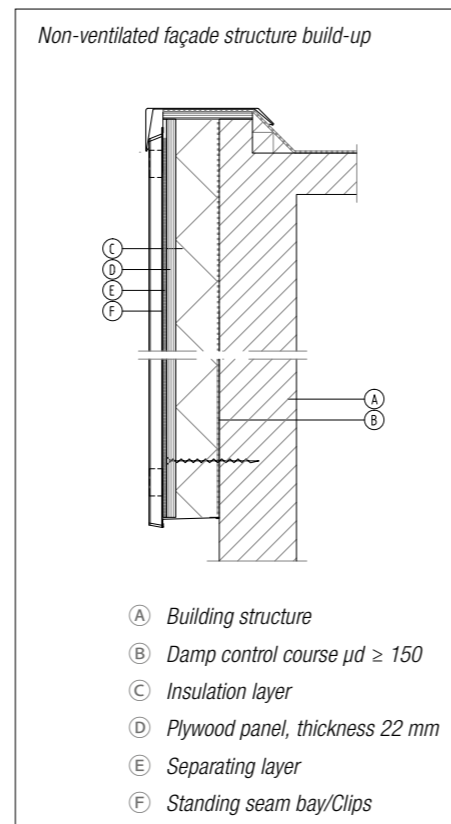


Figure 4.12

#### Benefits of a vapor-tight construction

- Considerably more design freedom for architects and developers
- A slim design, because no ventilation cavity is needed
- Easy to handle and therefore time saving during assembly
- High-quality noise damping and insulation
- The roof or façade construction is immediately rain-proof, which reduces construction time

#### Risks of a vapor-tight construction

In the application of vapor-proof systems, risks are present that may affect the functionality and longevity:

- Mutual seams that are not properly taped
- No rigid substructures
- Making penetrations at a later time, which can cause leaks
- Leaks that may occur through careless installation and detail mistakes

#### 4.3.1 Vapor-tight systems

##### 4.3.1.1 Standard built up: damp control course, plywood panel, separating layer and standard NedZink

**NOTE: the system must be 100% vapor-tight**

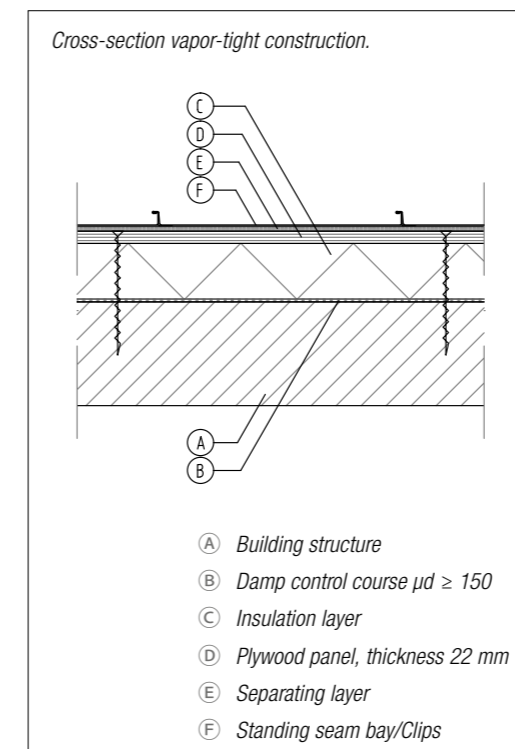


Figure 4.13



Figure 4.14

#### 4.3.1.2 Alternative built up: damp control course, breather membrane and NedZink Pro-Tec

**NOTE: the system must be 100% vapor-tight**

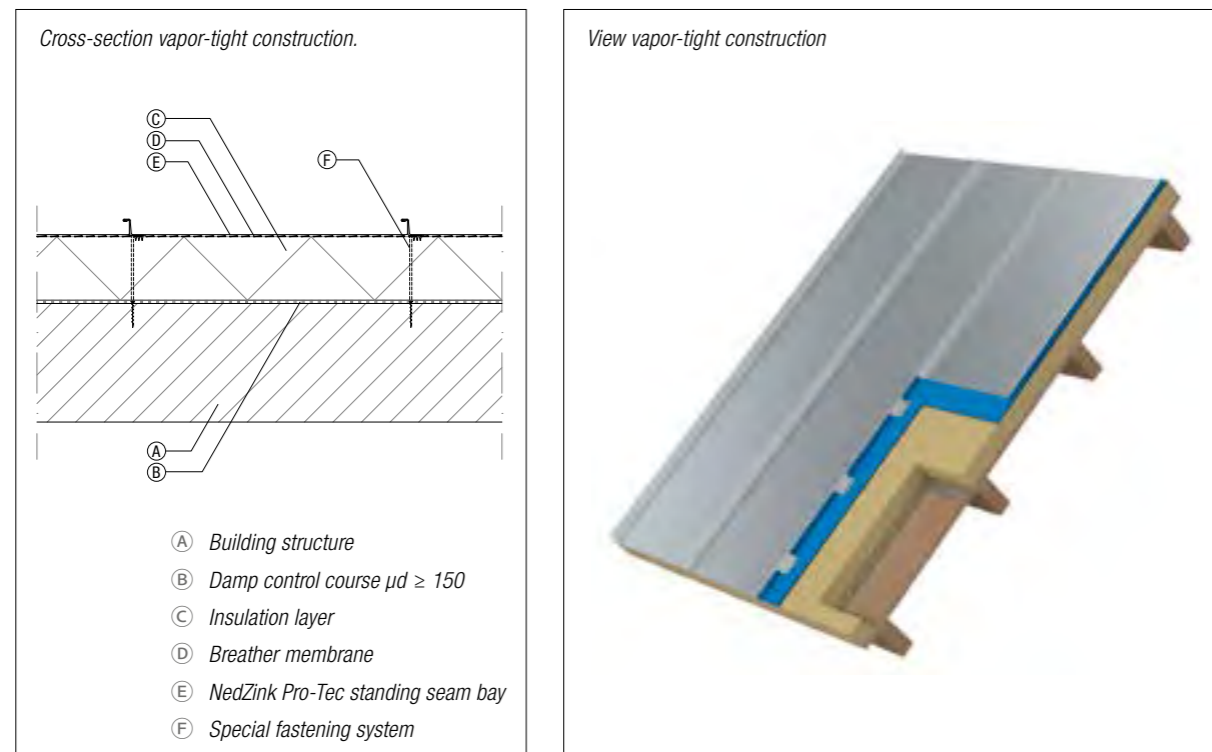


Figure 4.15

Figure 4.16

#### 4.3.1.3 Alternative built up: damp control course, structured underlay and standard NedZink

**NOTE: the system must be 100% vapor-tight**

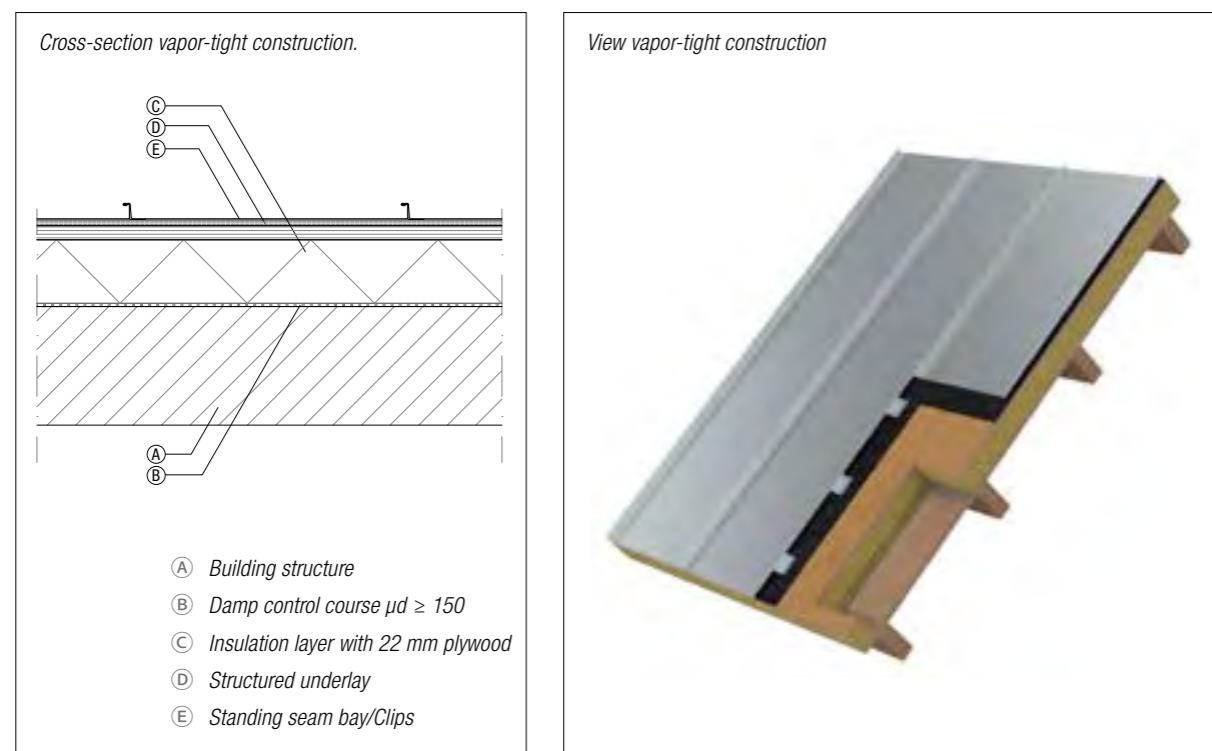


Figure 4.17

Figure 4.18

#### 4.3.1.4 Alternative built up: vapor-tight FOAMGLAS® insulation system

**NOTE: the system must be 100% vapor-tight**

Because in a warm roof system there is no ventilated cavity between the insulation and the roof, the air-tight FOAMGLAS® material can be applied. Internal condensation or condensation caused by nocturnal cooling is therefore no longer an issue. This is an important difference from a traditional cold roof system. This version with FOAMGLAS® is slimmer and can be used in virtually any shape. There are virtually no limitations on the shape, pitch or length of the roof. The system is ideal in combination with our product range and NedZink NOVA Pro-Tec, with the rearside coating, in particular.

A special metal fixing plate has been developed for the FOAMGLAS® roof and façade applications, which is glued to the insulation material. The insulation itself is again adhered to the substrate. This leads to a construction where the roof with no ongoing attachment to the substrate can be achieved, which results in no cold bridges and no leaks.

The vapor-tight system can be applied to different kind of surfaces.

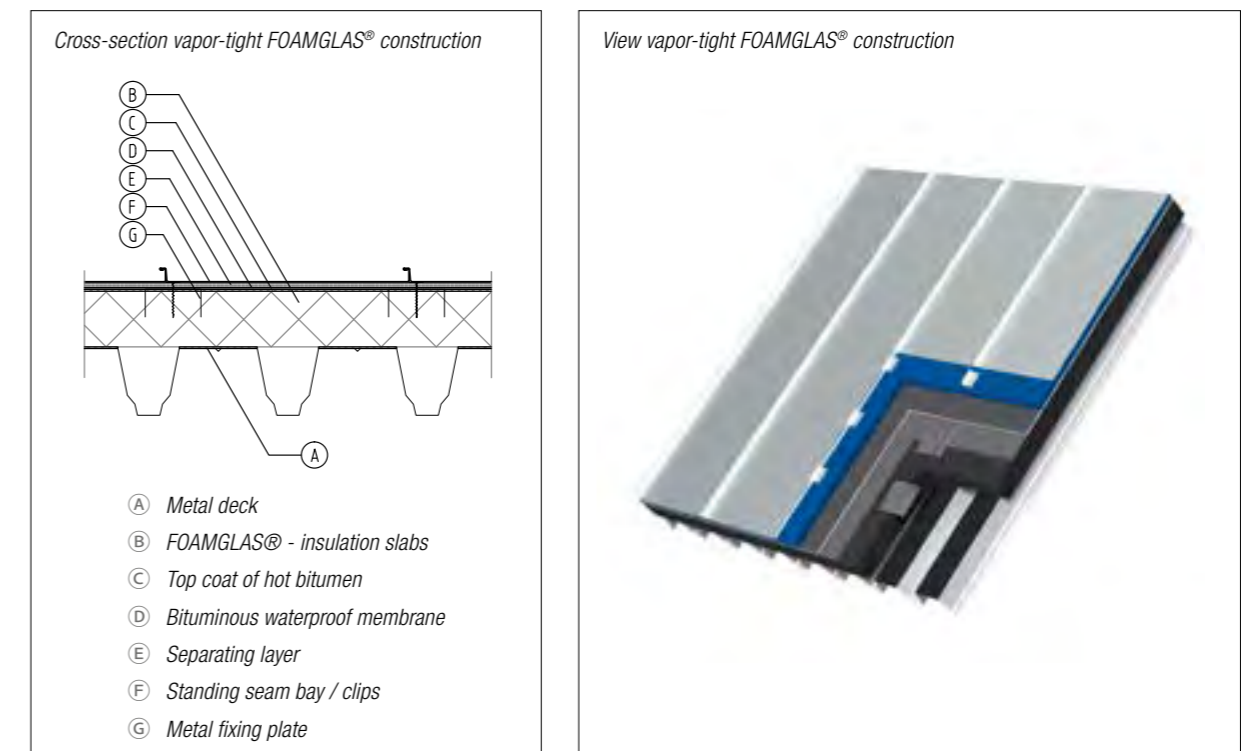


Figure 4.19

Figure 4.20

### 4.3.2 Products for a non-ventilated construction

#### NedZink Pro-Tec

To avoid any risks involved in non-ventilated systems we recommend using NedZink Pro-Tec. NedZink Pro-Tec is process-based compiled titanium zinc, available as NOVA, NOIR and bright-rolled zinc with a protective layer on the rear for applications in ventilated and non-ventilated constructions. The protective layer is a two-layer polymer lacquer system that protects the zinc from damage caused by water vapor and other substances. The outstanding processing properties offered by zinc also apply to this material. The protective layer on the rear makes NedZink NOVA Pro-Tec ideal for damp-proof systems.

**Please note:** if condensation issues occur during construction the zinc will not be affected, but the condensation could have drastic consequences for the construction and the insulation values to be achieved.

#### Separating layer/-foil

- *Structured separating layer*

When a separating layer is part of the construction, a structured separating layer can be used. The resulting airspace is used for gradual drying small amounts of moisture still present directly under the zinc surface. It also decreases the possibility of rearside corrosion of the zinc material. The cavity is not comparable with the ventilation space used in a ventilated construction and cannot replace its function! For sound-insulating and sound-reducing properties of the separating layer please contact the manufacturer.

- *Structured separating layer with foil*

This is a vapor permeable waterproofing barrier that can be installed as a separating layer between zinc roofing or cladding and the supporting substructure. The material has an outer layer of polypropylene mesh bonded to a vapor permeable membrane fleece foil. For small coverings with wooden-based panels the layer can be used only for separation, not as a fully functioning ventilation cavity. This cavity is not comparable with the ventilation space used in a ventilated construction and cannot replace it! For more information contact the manufacturer.

#### Insulation

There is a large variety of insulation systems and materials. Depending on the requirements of the project, application, construction and physical aspects of the building, various materials can be chosen, such as mineral fibers, hard foam, FOAMGLAS®, etc.

#### Damp control

A damp control course must be fitted under the thermal insulation. This screen is designed to make the roof construction airtight and seal it off from the damp produced in the underlying rooms. The damp control course is fitted so that all the seams between the various parts of the damp course, as well as between the damp course and other parts of the building, are airtight. To do so you must seal it. This can be achieved using a sealant or tape, which may or may not be supplemented by mechanical fixation. If possible, it is desirable to always fit the air and damp course on top of the support structure or the battening and on a continuous surface. This can significantly simplify the installation. A damp control course with an Sd value > 150 meters is required.

## 4.4 Noise and wind load

Metal roofing can produce excessive noise in the event of extreme hail or heavy rain. Applying a separation layer for sound insulation can diminish these effects. The separation layer ensures a reduction of 8 dB and can be supplied in different widths.

The requirements for the wind loads that a Dutch building construction must meet are described in the NEN standards of the Dutch Standardization Institute (NEN). The research organisation, TNO has derived calculation rules from these norms for zinc roof systems. They concern rules for establishing the wind load as well as methods for deducing the strength.

For a fully supported structure, such as the traditional standing seam, roll cap or shingle roof, one mainly has to counter any wind suction that occurs. For self-supporting constructions, wind pressure, the structure's own weight and consequently the deflection of the material play a role. In addition, the fixation method as well as the profiling (system option) of the material is important. The wind suction affecting a façade or roof section depends on the shape and dimensions of the building, the slope of the roof and the location of the roof covering.

Wind suction means uniformly distributed wind suction caused by wind and is measured in Newtons per m<sup>2</sup>, perpendicular to a surface facing down from the wind. The calculation of wind suction, depending on the altitude and the differences between the wind areas in the Netherlands is registered in a NEN norm.

Zinc roof coverings and wall claddings are attached to the substructure by means of clips. The clips of the standing seam and roll cap system are located on the longitudinal seam between the bays. The clips of the lozenge system are locked in the folded edges of each lozenge. For flat roofs with soldered sheet coverings the clips are placed underneath the soldered joint. The clips are often made of titanium zinc, but can also be made from stainless steel, galvanised steel or aluminum. Roof and wall coverings that consist of bays mainly are attached with fixed and sliding clips.

## 4.5 Fire safety

A roof or façade with a zinc covering, fitted in accordance with the applicable design and installation guidelines (BRL 5212), does not pose a fire risk in accordance with NEN 6063. Zinc products fall under Euroclass A1 of NEN-EN 13501-1. Euroclass A1 is the "non-combustible" class.

On this basis, zinc façade cladding applies subject to the requirement that the fire propagation contribution on the façade exterior must comply with Class 1, 2 or 4 of fire propagation in accordance with NEN 6065. In the case of a soldered zinc construction, the connections separate at temperatures of 180 °C and higher. Sheets deform and melt at 420 °C.

A roof or façade construction is built from diverse building materials, and each has a particular fire class. The construction must comply with a fire class according to NEN-EN-13501-1. When determining the fire class of the construction as a whole, an expert must take the different materials, the structure of the construction, fire compartmentation, etc. into account.

# 5 Roofs

Titanium zinc is ideal for roofing both small and large areas. The various systems, such as the standing seam system and roll cap system, can be applied to roofs with a pitch of at least 3° (preferably > 7°). The lozenge system is suitable from a minimum roof pitch of 25°, or 18° when the vertex of the lozenge is soldered.



## 5.1 Standing seam system

The standing seam system provides a rain-tight roof and façade covering where the pitch is in excess of 3°, preferably > 7°. The single standing seam is used for roofs with a pitch steeper than 25° and for façades. For roofs with a pitch angle lower than 25° the double standing folded seam is used.

The standing seam system makes it possible for a roof or façade to be covered with titanium zinc quickly and at reasonable cost. This is because preformed bays are used, and the seams are folded mechanically, reducing manual folding to a minimum. The preformed bays are supplied in custom-made sizes and are locked together on site with a single or double fold, by machine or by hand. Aside from straight bays, curved (convex and concave) and tapering bays can be made easily. The bays are secured to the substructure by means of fixed and sliding clips (see figure 5.1.1).



With a standing seam roof, the zinc bays are connected in the longitudinal direction with so-called (double) standing seam. The material thickness is 0.80 mm. The allowable bay width is determined by the wind load and the height of the roof. The advised bay width varies from 330 mm to 530 mm. The advised maximum bay length is 10 meters (thermal movement: 20 mm). When making a selection, think about handling the bays.

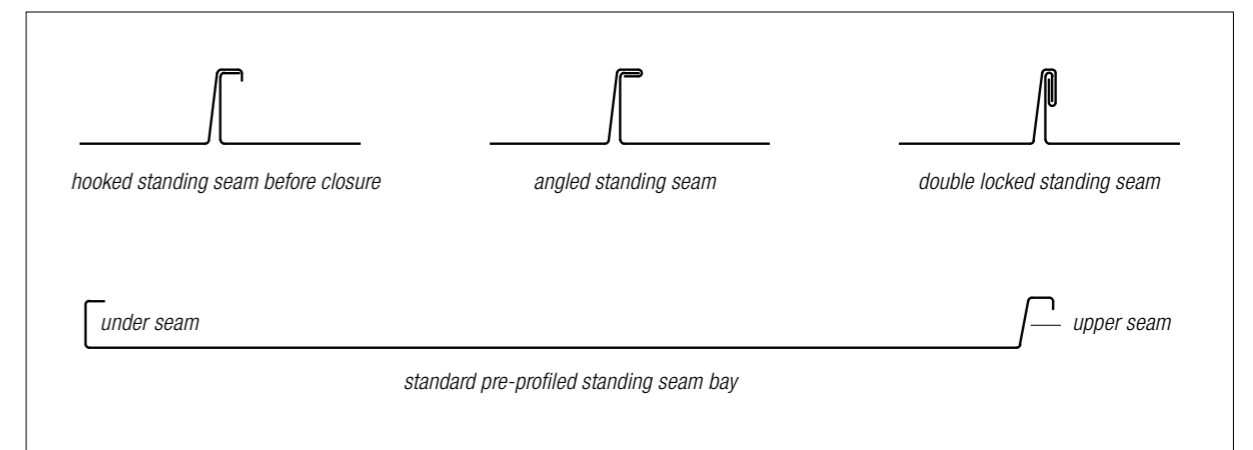


Figure 5.1.1

The standing seam can consist of a single or double connection. A single connection forms a less effective water seal and may therefore only be used on roofs with a pitch angle larger than 25°. With fixed clips the cladding is fixed over a one-meter length. Sliding clips are used for the remaining length of the roof bay. The location of the fixed clips depends on the pitch angle of the roof. The relationship between the location of the fixed clip and the pitch angle is shown in figure 5.1.6. Fixed clips ensure that the standing seam bays don't slip. Bays up to 3 meters long can be fully secured with fixed clips. For lengths greater than 3 meters the bay is secured with fixed clips over a length of one meter, and the rest with sliding clips.

### Standing seam

The standard height of a standing seam for a profiled seam is 25 mm. A seam height of 38 mm is sometimes used to accentuate shadow formation. The higher seam also offers improved rain proofing in the case of windy conditions.



Figure 5.1.2 Dimensions standing seam bay

To promote the rain proofing aspect of a standing seam roof, sealing tape can be affixed between the seams. This is also recommended for unventilated systems that pose a risk of leakage.

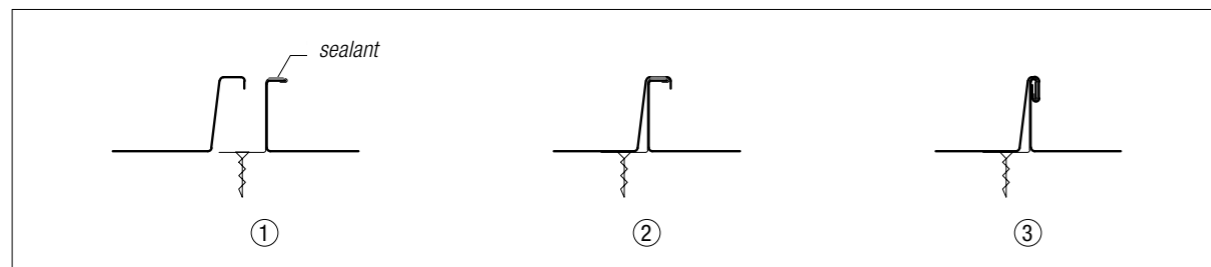
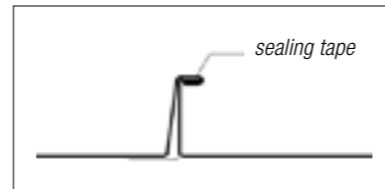


Figure 5.1.3

### Fastening the clips

The bays are secured to the substructure by means of fixed and sliding clips (see figure 5.14, fixed and sliding clip). The fixed clips secure the standing seam bay and the sliding clips make longitudinal expansion possible. The clip is secured over the lowest standing seam bay and on the sub-construction. Then the top standing seam bay is placed over this and folded shut.



Figure 5.1.4

### Support

The standing seam system must be fully supported by unplanned, untreated wooden boards at least 23 mm thick, not tongue and grooved, with gaps of at least 5 mm.

The space between the boards can be larger depending on the pitch of the roof, i.e.

|                           |            |
|---------------------------|------------|
| roof pitch up to 45°      | 5 – 10 mm  |
| roof pitch from 45° - 70° | 5 – 50 mm  |
| roof pitch from 70° - 90° | 5 – 100 mm |

The construction requirements are also important in this. Use galvanised nails with a zinc-layer thickness of at least 20 microns or AISI 304 stainless steel for fastening.

### Standard details

Below are some examples of typical details for roofing. These details outline the standard situation and serve as a guideline for applying the standing seam system on roof structures.

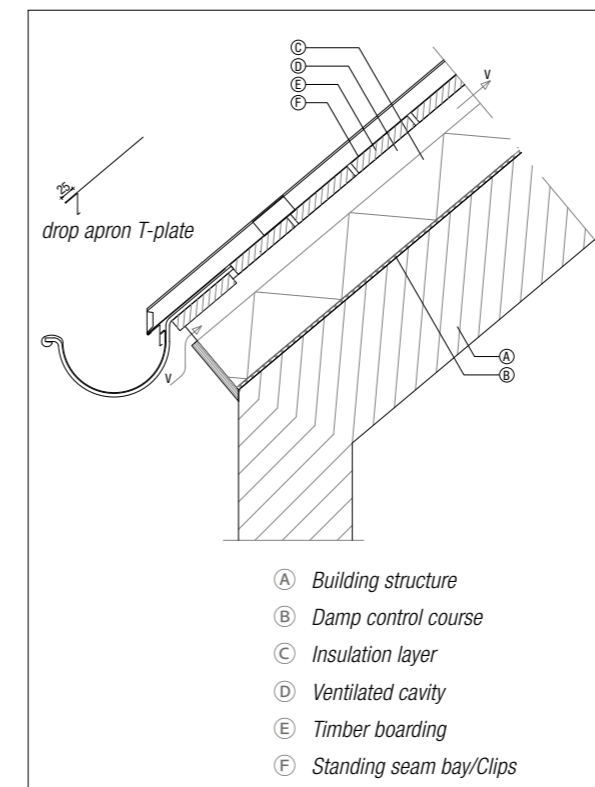


Figure 5.1.5



Figure 5.1.6

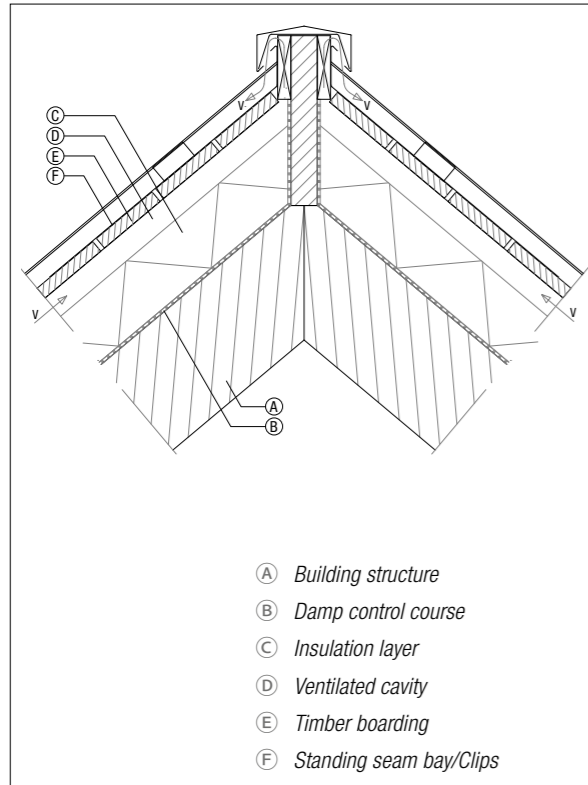


Figure 5.1.7

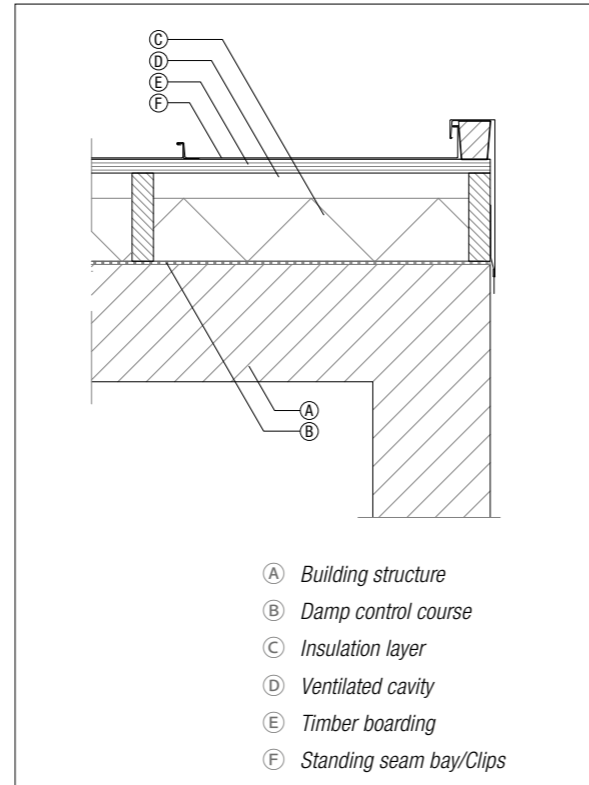


Figure 5.1.8

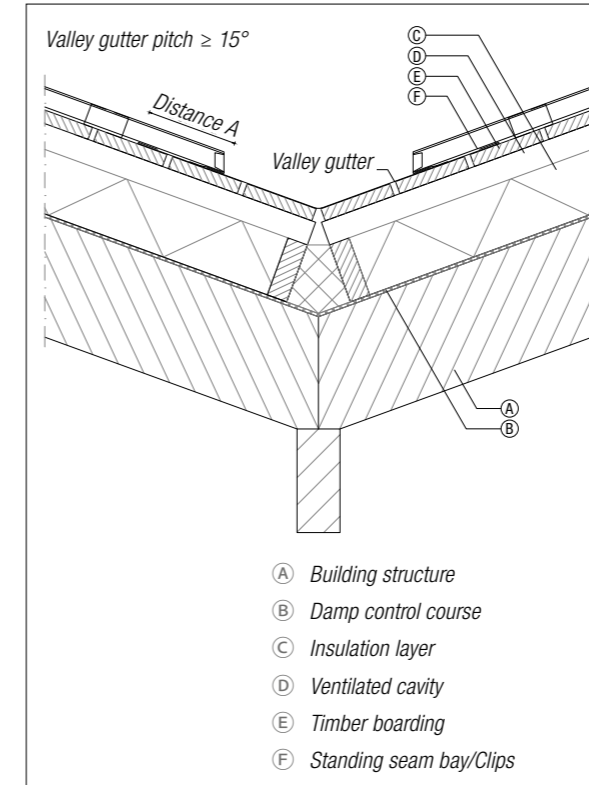


Figure 5.1.10

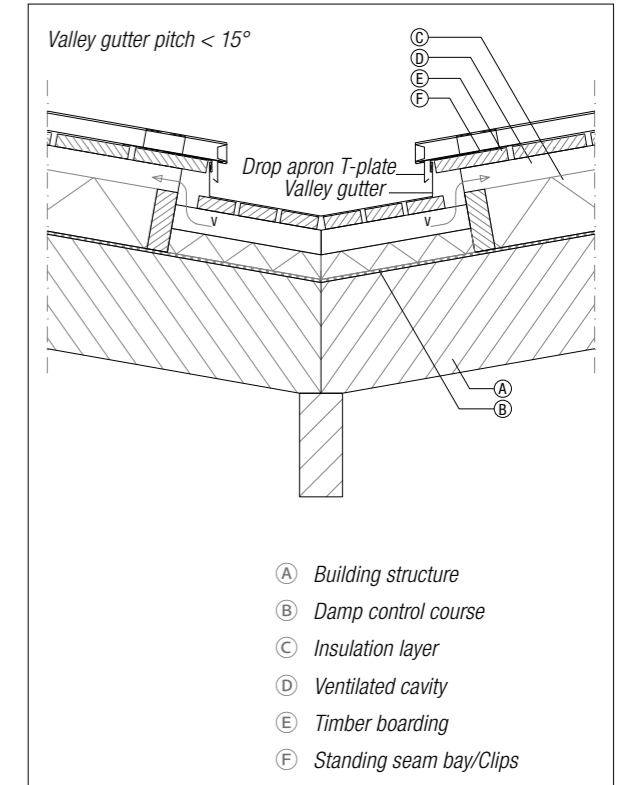


Figure 5.1.11

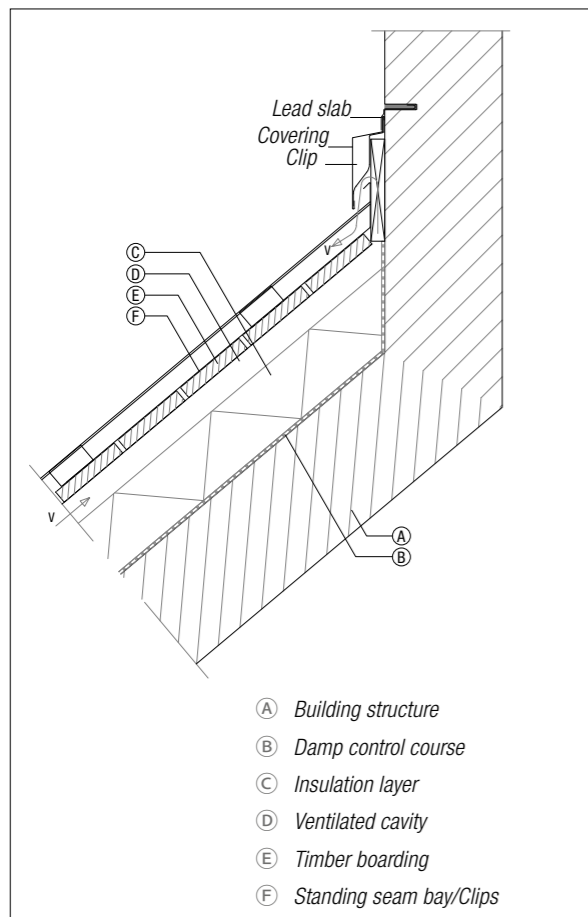


Figure 5.1.9



### 5.1.1 Standing seam roof on a ventilated system

See chapter 4 for standard and alternative built ups.

#### Ventilated roof built up standing seam system



The construction of the roof is built up as follows, beginning on the inside:

1. Ceiling - any type
2. Damp control course made from metal or plastic film
3. Supporting rafters - generally made from wood
4. Insulation material according to thermal requirements
5. Ventilated cavity: thickness depends on the pitch of the roof
6. Timber boarding, planed no less than 23 mm, not tongue-and-grooved, installed horizontally with gaps between the boards of at least 5 mm
7. Zinc standing seam system

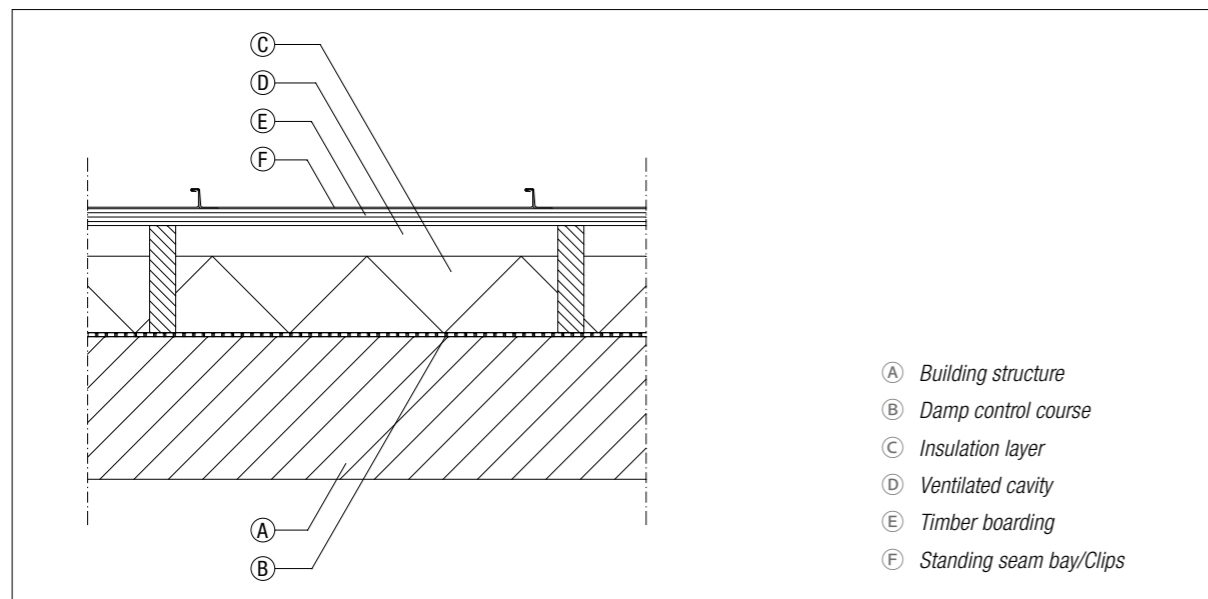


Figure 5.1.12

### 5.1.2 Standing seam roof on a damp proof system

See chapter 4 for standard and alternative built ups.

#### Damp proof roof built up with standing seam system



The construction of the roof is built up as follows, beginning on the inside:

1. Ceiling - any type
2. Damp control course,  $\mu_d \geq 150$
3. Insulation material according to thermal requirements
4. Supporting rafters - generally made from wood
5. Plywood panel, thickness= 22 mm
6. Separating layer
7. Zinc standing seam system

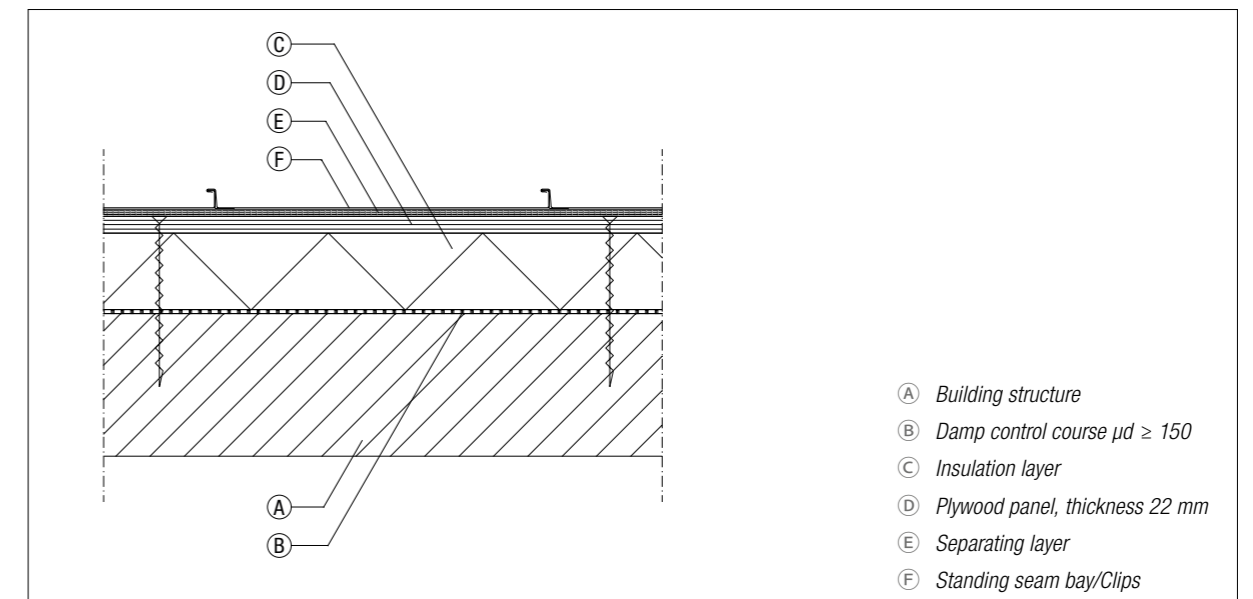


Figure 5.1.12

## 5.2 The Roll cap roof system

The roll cap roof system is suitable for large and small roofs with a pitch of the roof of at least 3°, preferably > 7°, and as façade cladding. The standard NedZink roll cap roof consists of zinc bays with upstands on both sides and separated by trapezoidal wood rolls. Zinc caps are used to cover these wood rolls. This gives the roll cap its characteristic and robust appearance.



A roll cap roof is a cladding that consists of zinc sheets equipped with upstands in the longitudinal direction. Between the bays, so-called wood rolls are installed on the timber boarding. These rolls have a trapezoidal cross section with a width of 40-50 mm and a height of 60 mm. The water tight finishing between roof bays and wood rolls is obtained by a covering profile (roll capping).

Roll cap roofs are installed with clips on the timber boarding. The minimum width of a clip is 50 mm with a minimum sheet thickness of 0.65 mm. Depending on the assembly system, the clip is installed on or under the wood roll. Fixed and sliding clips must also be used with Roll cap roofs. The fixed clips fix the ridge track and the sliding clips allow expansion in the longitudinal direction. For the positioning of the fixed clips, the same rule applies as with a standing seam roof.

### Specifications of Roll Cap standard components

#### Standard roll cap bay (figure 5.2.1)

Bay width: maximum 890 mm, with 2 upstands each 55 mm, girth maximum 1000 mm.  
Material thickness: 0.80 mm or 1.00 mm.

#### Standard Roll capping (figure 5.2.1)

Cross-section: 65 mm x 25 mm  
Material thickness: as for roll cap bay

#### Eaves apron

Width: 330 mm.  
Material thickness: as for roll cap

#### Clips (fixed and sliding) (figure 5.2.2)

Width: 50 mm. Length: > 220 mm.  
Material thickness: as for roll cap bay

These clips are produced by the sheet metal worker. The length must have a little excess so it can be cut to the exact size during fitting. The fixed clips secure the roll cap bay and the sliding clips make longitudinal thermal movement possible.

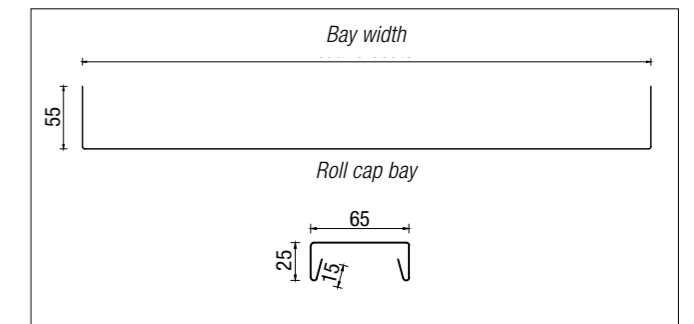


Figure 5.2.1



Figure 5.2.2

#### Wood roll

Trapezoidal wooden bar, of good quality, minimum quality class C compliant with NEN 5466.  
Width: 40-50 mm, height: 60 mm.  
The wood roll must be straight and made to measure.



**Support**

The roll cap system must be fully supported by unplanned, untreated wooden boards at least 23 mm thick, not tongue and grooved, with gaps of at least 5 mm.

The space between the boards can be larger, depending on the pitch of the roof, i.e.

|                           |            |
|---------------------------|------------|
| roof pitch up to 45°      | 5 – 10 mm  |
| roof pitch from 45° - 70° | 5 – 50 mm  |
| roof pitch from 70° - 90° | 5 – 100 mm |

The construction requirements are also important here. Use galvanised nails with a zinc-layer thickness of at least 20 microns or AISI 304 stainless steel for fastening.

**Standard details**

Below are some examples of typical details for roofing. These details outline the standard situation and serve as a guideline for applying the roll cap system on roof structures.

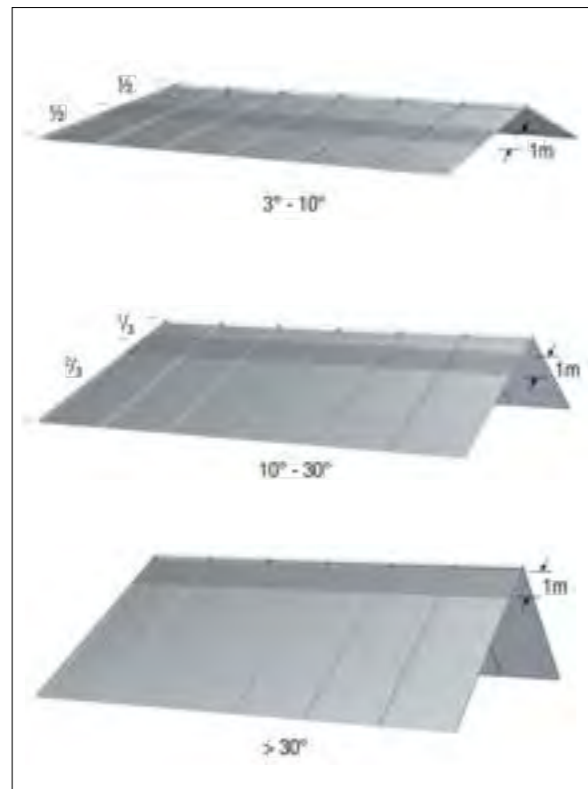


Figure 5.2.3



Figure 5.2.4

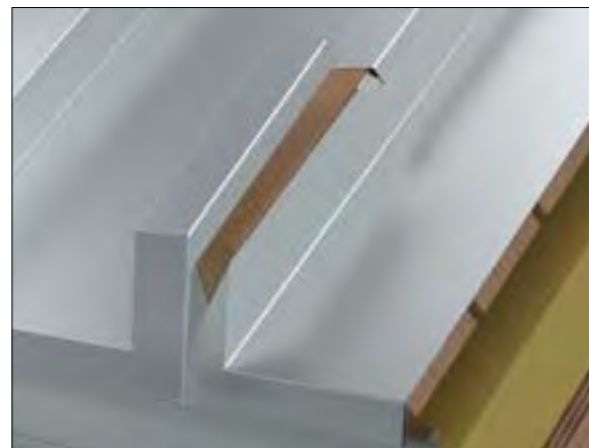


Figure 5.2.5



Figure 5.2.6

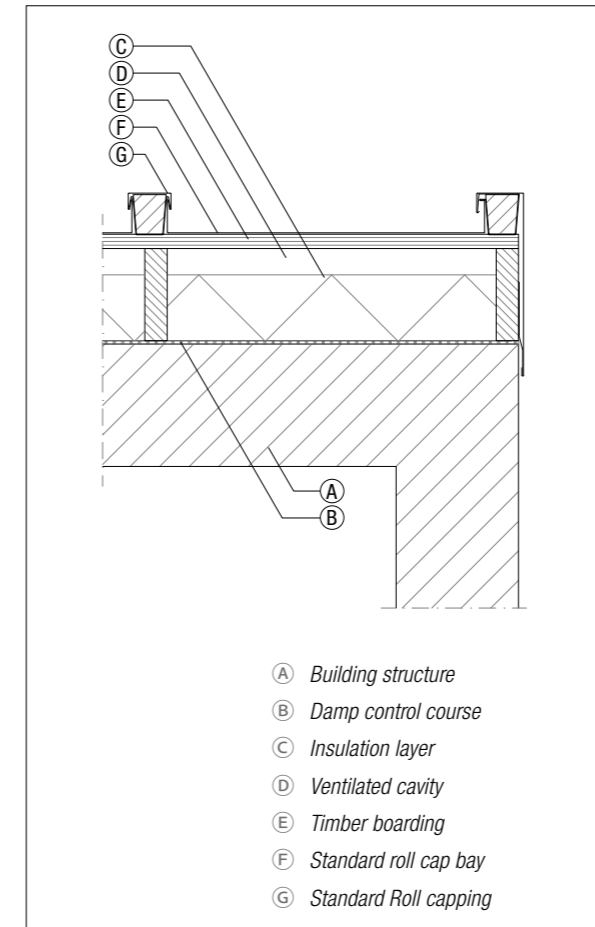


Figure 5.2.7

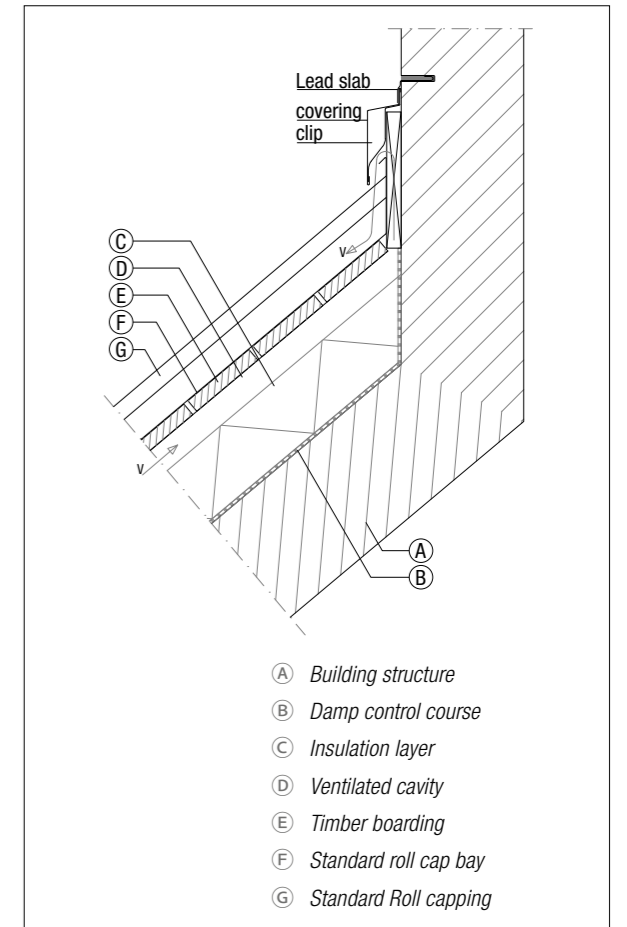


Figure 5.2.9

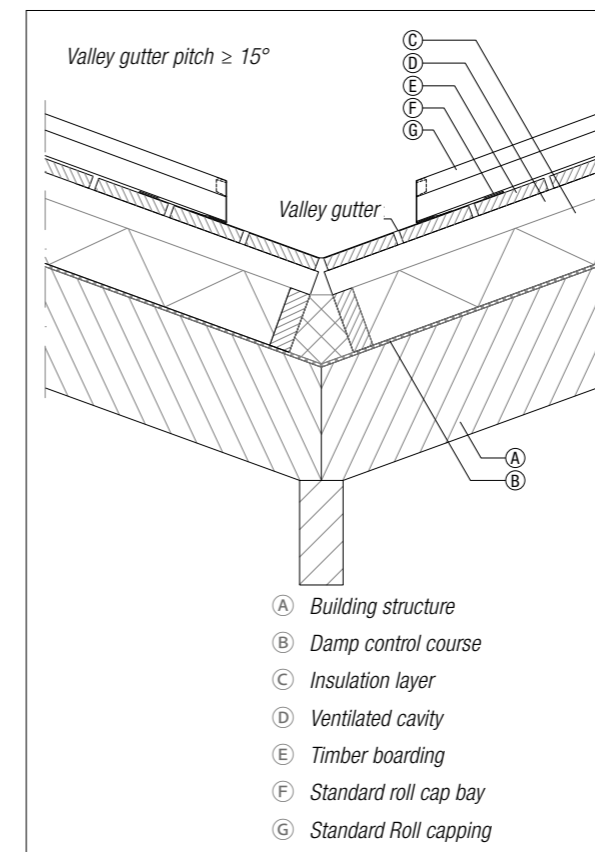


Figure 5.2.8

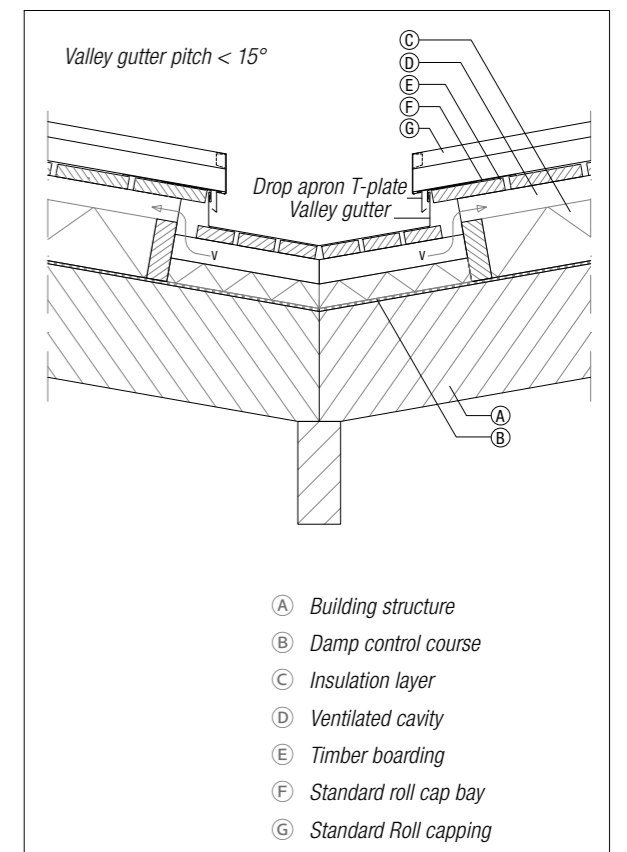


Figure 5.2.10

### 5.2.1 Roll Cap system on a ventilated system

See chapter 4 for standard and alternative built ups.

#### Ventilated roof built up Roll cap system



The construction of the roof is built up as follows, beginning on the inside:

1. Ceiling - any type
2. Damp control course made from metal or plastic film
3. Supporting rafters - generally made from wood
4. Insulation material according to thermal requirements
5. Ventilated cavity: thickness depends on the pitch of the roof
6. Timber boarding, planed no less than 23 mm, not tongue-and-grooved, installed horizontally with gaps between the boards of at least 5 mm
7. Zinc roll cap system

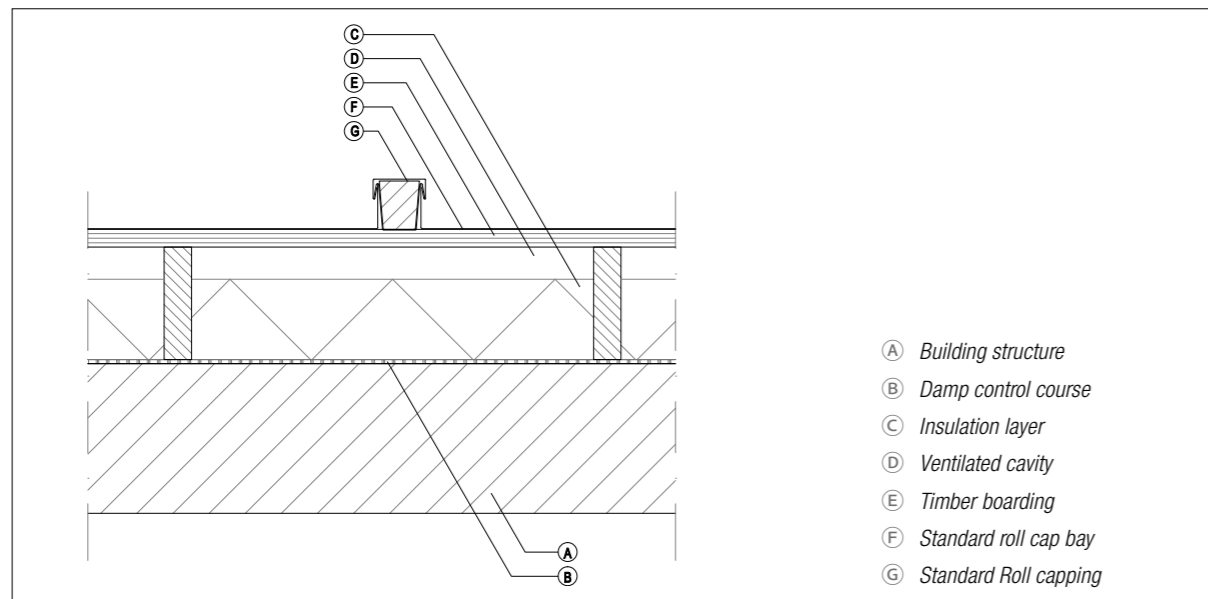
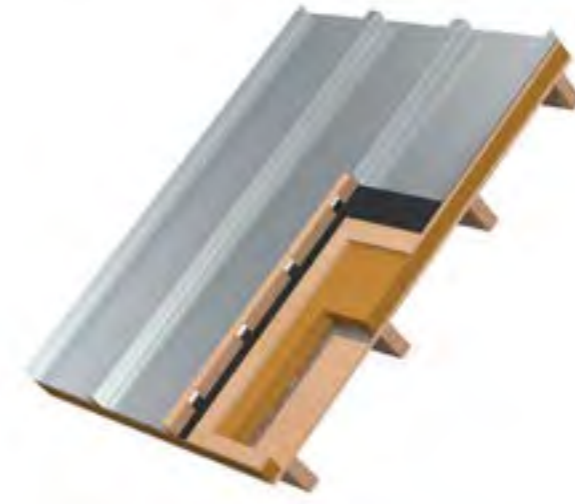


Figure 5.2.11

### 5.2.2 Roll cap system on a damp proof system

See chapter 4 for standard and alternative built ups.

#### Damp proof roof built up with roll cap system



The construction of the roof is built up as follows, beginning on the inside:

1. Ceiling - any type
2. Damp control course,  $\mu \geq 150$
3. Insulation material according to thermal requirements
4. Supporting rafters - generally made from wood
5. Plywood panel, thickness = 22 mm
6. Separating layer
7. Zinc standing seam system

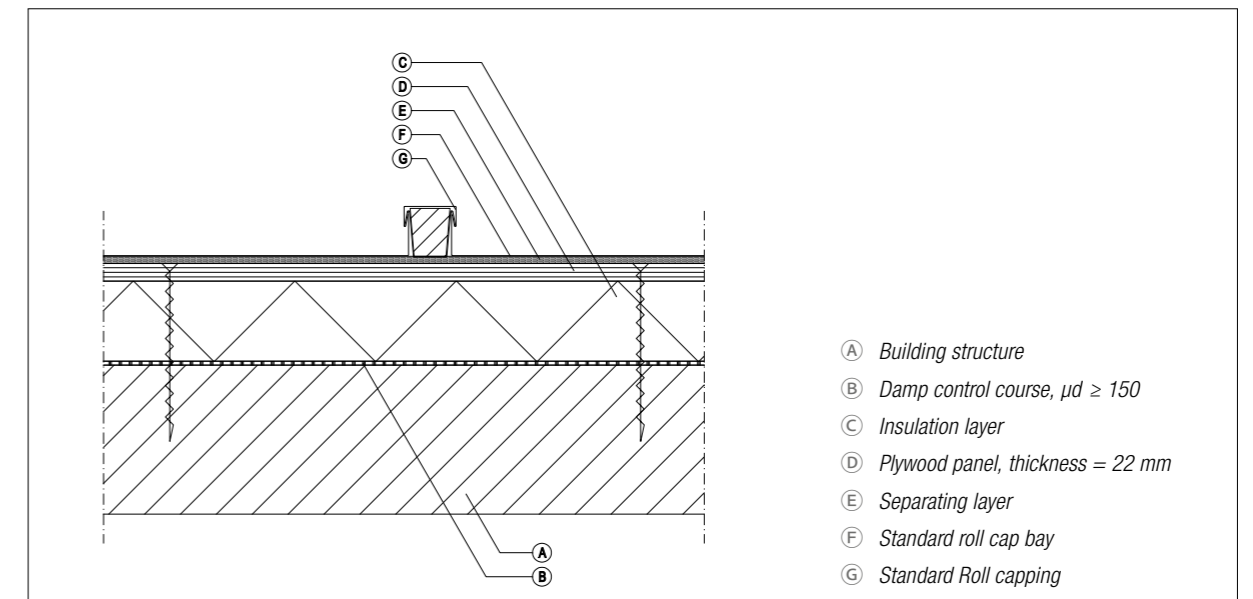


Figure 5.2.11

## 5.3 Lozenge system

The lozenge system is used for covering large and small sloping and vertical surfaces. The minimum pitch of the roof is 25° or 18° when the vertex of the lozenge is soldered. The standard lozenge system consists of small, uniform bent plates which hook onto each other. The most common form of a lozenge is the square, although the rhombus is also used. The square lozenge is discussed in this chapter. In addition to lozenge, the names zinc tiles or zinc slates are also used.



Lozenges provide a good solution for cladding of moderately curved surfaces. When hooked together, the lozenges form a mosaic of uniform surfaces with the vertical and horizontal diagonals.

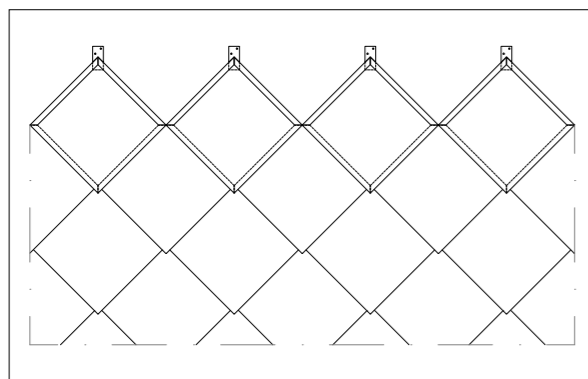


Figure 5.3.1

| Lozenge size | Cutting size | Number/m <sup>2</sup> |
|--------------|--------------|-----------------------|
| 450 x 450 mm | 500 x 500 mm | Approx. 5,6           |
| 280 x 280 mm | 330 x 330 mm | Approx. 15,3          |
| 200 x 200 mm | 250 x 250 mm | Approx. 32            |

Tabel 5.3.1 Dimensions of lozenge, square model

### Specifications of the parts

Figure 5.3.1 is a schematic representation of the lozenge system. Aside from the standard lozenges, other dimensions are also possible.

The lozenges are bent 25 mm as shown in figure 5.3.2

Figure 5.3.3 A shows the half-lozenge for eaves abutment and figure 5.23.3 B shows the half-lozenge for ridge abutment. Seizes and material thicknesses are the same as with whole lozenges. With a “top” half-lozenge, both a sliding clip and a soldered clip can be used.

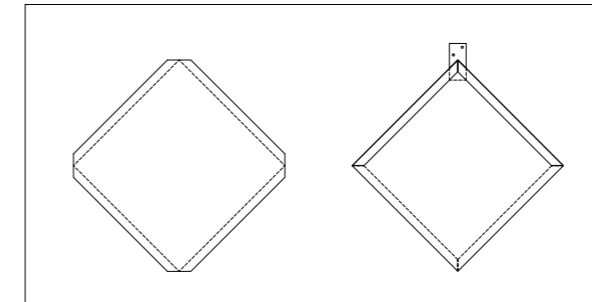


Figure 5.3.2

| Lozenge size width 'B' | Cutting size | Number/m <sup>2</sup> |
|------------------------|--------------|-----------------------|
| 200 mm*                | 250 mm       | Approx. 25,6          |
| 250 mm*                | 300 mm       | Approx. 15,3          |
| 280 mm*                | 330 mm       | Approx. 11,9          |

\* other dimensions are possible  
Table 5.3.2

### Sliding clip, 70 mm x 50 mm

Material thickness as for the lozenge. The sliding clip functions as a support clip. These support clips can be made by the sheet metal worker himself.

### Soldered clips

Width: 50 mm. Length approx. 100 mm, depending on the location and space for fitting on the base. The clip can be made by the sheet metal worker himself and soldered to the lozenge.

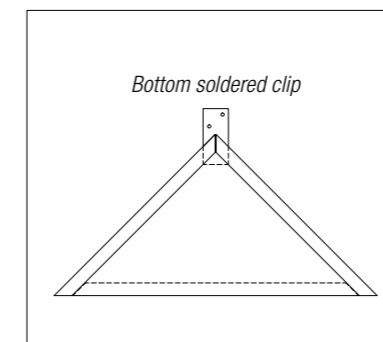


Figure 5.3.3 A

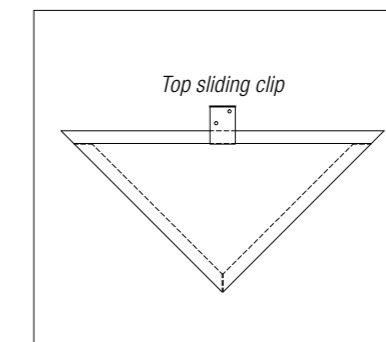


Figure 5.3.3 B

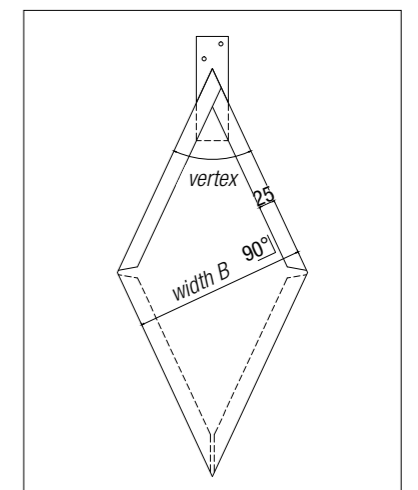


Figure 5.3.4

### Profiles

The dimensions of the eaves profiles, attachment profiles, etc. will depend on the on-site dimensions and can either be made by the sheet metal worker or supplied custom-made in lengths as custom items.

### Support

The lozenge roof must be fully supported by unplanned, untreated wooden boards at least 23 mm thick, not tongue and grooved, with gaps of at least 5 mm. Use galvanised nails with a zinc-layer thickness of at least 20 microns or AISI 304 stainless steel for fastening.

## Standard details

Below are some examples of typical details for roofing. These details outline the standard situation and serve as a guideline for applying the lozenge system on roof structures.

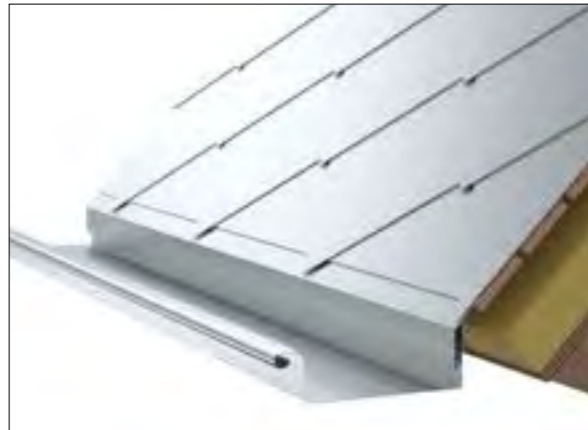


Figure 5.3.5

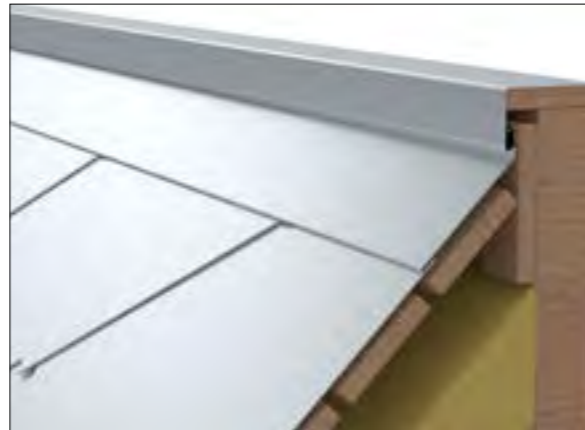


Figure 5.3.7

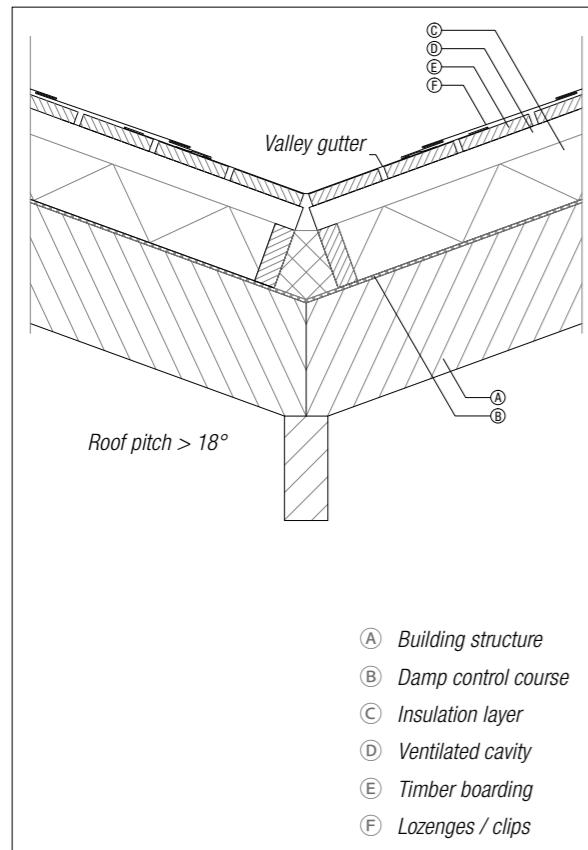


Figure 5.3.6

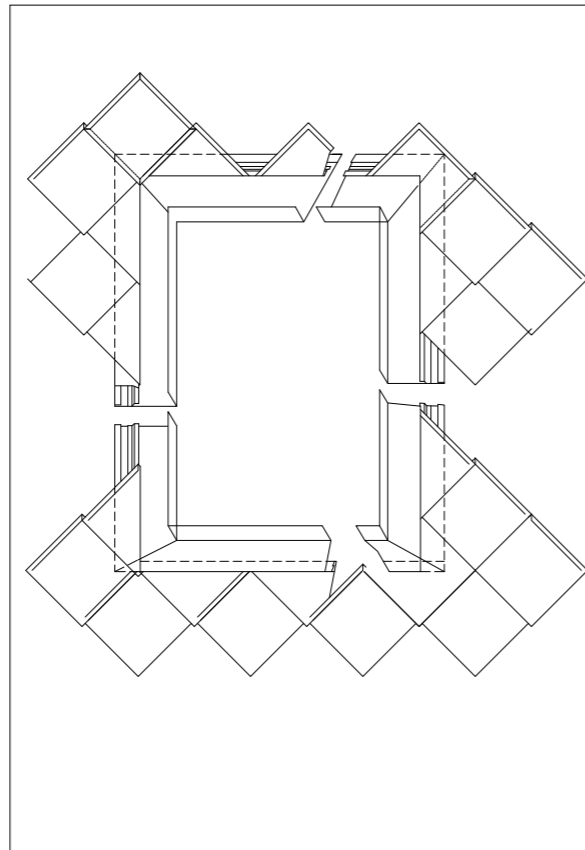


Figure 5.3.8

## 5.3.1 Lozenge system on a ventilated system

See chapter 4 for standard and alternative built ups.

### Ventilated roof built up with the lozenge system



The construction of the roof is built up as follows, beginning on the inside:

1. Ceiling - any type
2. Damp control course made from metal or plastic film
3. Supporting rafters - generally made from wood
4. Insulation material according to thermal requirements
5. Ventilated cavity: thickness depends on the pitch of the roof
6. Timber boarding, planed no less than 23 mm, not tongue-and-grooved, installed horizontally with gaps between the boards of at least 5 mm
7. Zinc lozenge system

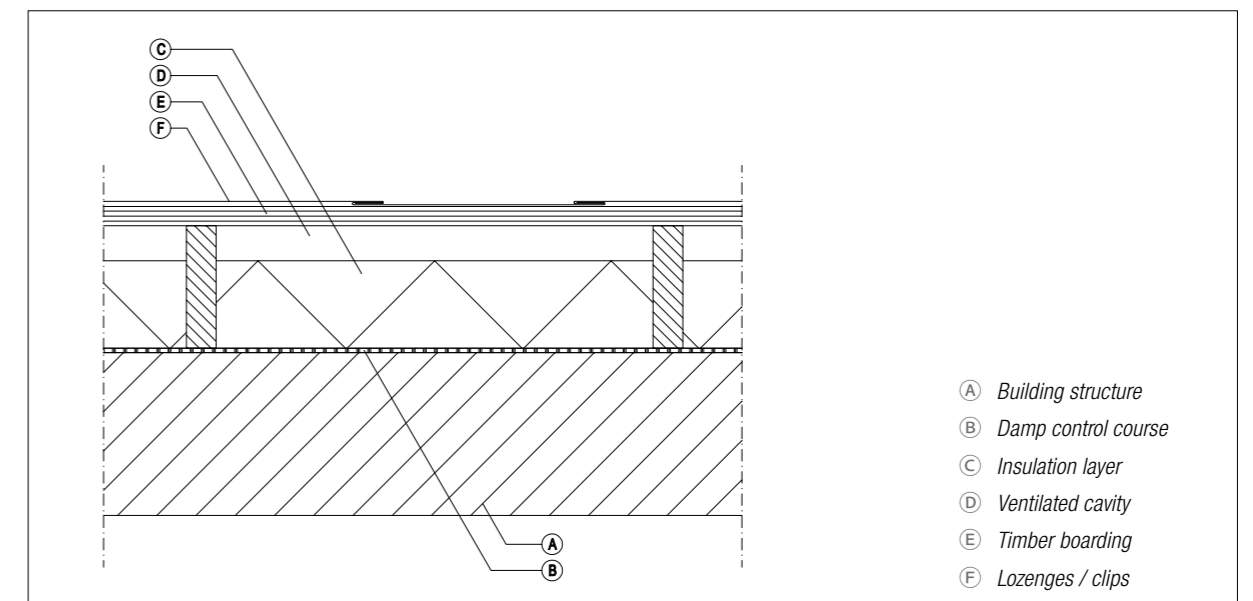


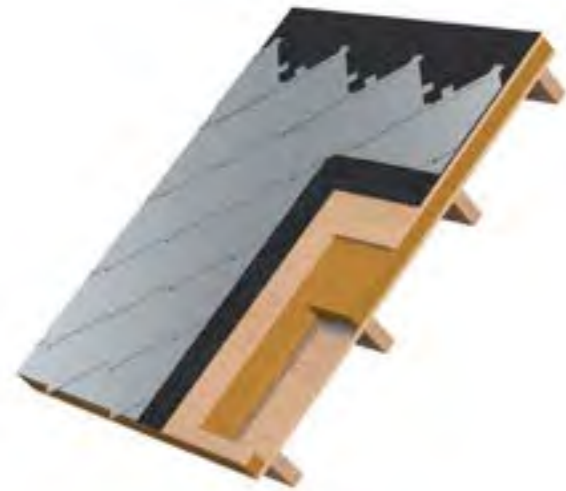
Figure 5.3.9

# 6 Façades

## 5.3.2 Lozenge system on a damp proof system

See chapter 4 for standard and alternative built ups.

### Damp proof roof built up with lozenge system



The construction of the roof is built up as follows, beginning on the inside:

1. Ceiling - any type
2. Damp control course,  $\mu_d \geq 150$
3. Insulation material according to thermal requirements
4. Supporting rafters - generally made from wood
5. Plywood panel, thickness = 22 mm
6. Separating layer
7. Zinc lozenge system

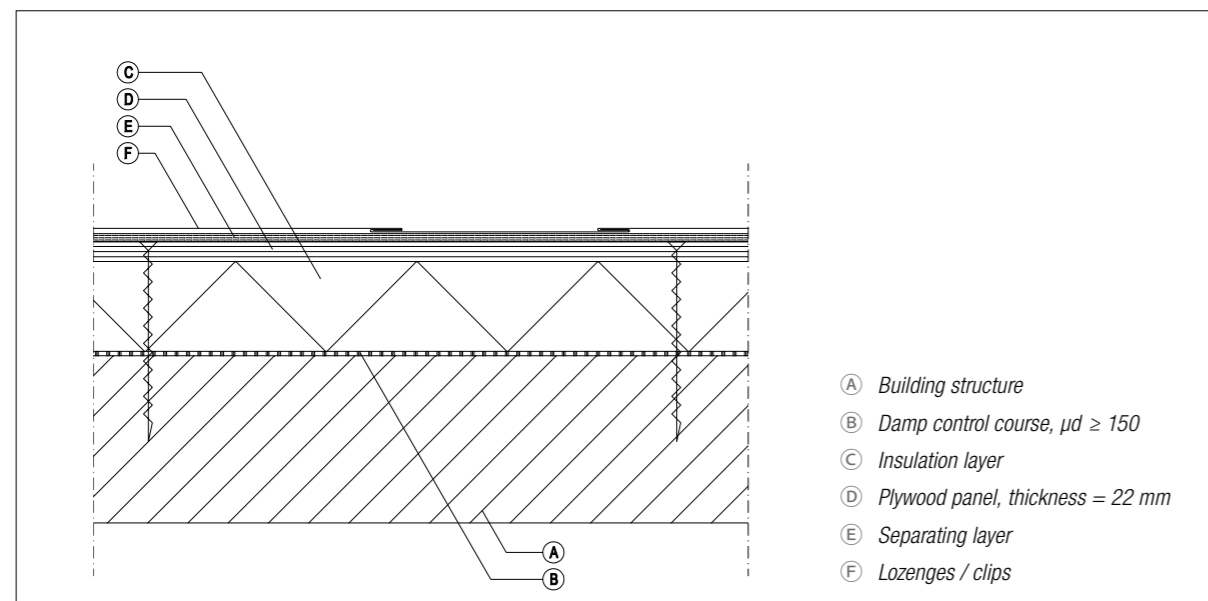


Figure 5.3.10

Titanium zinc is ideal for use as façade cladding for small or large façade surfaces. The traditional (roof) systems such as the standing seam, roll cap and lozenge systems can also be used to great effect. Applications in cassette form and reveal panel profile systems are also highly suitable façade cladding options.



## 6.1 Standing seam system

The standing seam system makes it possible for a roof or façade to be covered with titanium zinc quickly and at reasonable cost. This is because preformed bays are used, and the seams are folded mechanically, reducing manual folding to a minimum. The preformed bays are supplied in custom-made sizes and are locked together on site with a single or double fold, by machine or by hand. Aside from straight bays, curved (convex and concave) and tapering bays can be made without problems. The bays are secured to the substructure by means of fixed and sliding clips (see figure 6.1.4).



### The standing seam system for façades

With a standing seam façade, the zinc bays are connected in the longitudinal direction with so-called standing seams. The material thickness is 0.80 mm. The allowable bay width is determined by the wind load and the height of the façade. If the standing bay is installed horizontally, then it is recommended to limit the bay width to 300 to 430 mm for optimal work, and to limit the length to about 5 meters for handling reasons. If the standing seam bays are installed vertically, then limiting the bay width to 500 mm or less and the bay length to about 6 meters is recommended for handling reasons. The sheets are connected with a single clip at the top end.

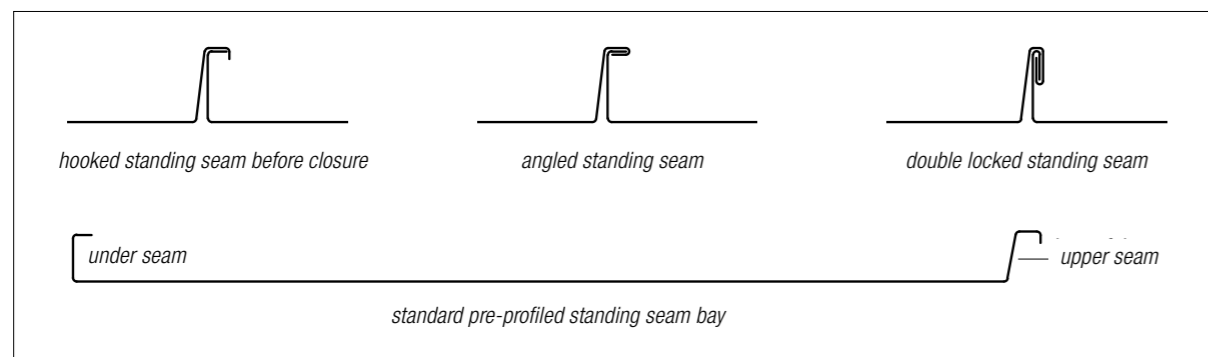


Figure 6.1.1

### Standing seam

The standard height of a standing seam for a profiled seam is 25 mm.



Figure 6.1.2 Dimensions standing seam bay

To promote the rain proofing aspect of a standing seam façade, sealing tape can be affixed between the seams. This is also recommended for unventilated systems that pose a risk of leakage.

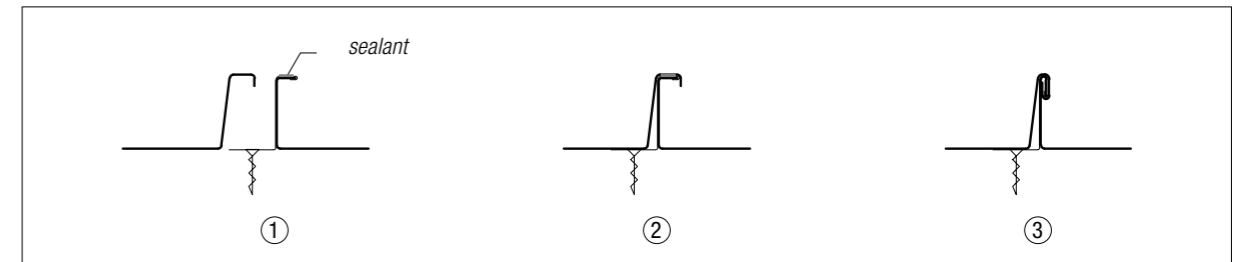
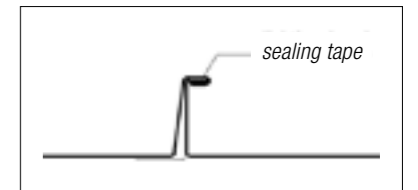


Figure 6.1.3

### Fastening the clips

The bays are secured to the substructure by means of fixed and sliding clips (see figure 6.1.4).

The fixed clips secure the standing seam bay and the sliding clips make longitudinal expansion possible. The clip is secured over the lowest standing seam bay and on the sub construction. Then the top standing seam bay is placed over this and folded shut.



Figure 6.1.4

### Support

The standing seam system must be fully supported by unplanned, untreated wooden boards at least 23 mm thick, not tongue and grooved, with gaps of at least 5 mm and maximum 100 mm. The construction requirements are also important in this. Use galvanised nails with a zinc-layer thickness of at least 20 microns or AISI 304 stainless steel for fastening.

### 6.1.1 Standing seam façade on a ventilated system

See chapter 4 for standard and alternative built ups.

#### Ventilated façade built up standing seam system.



Vertical standing seam system



Horizontal standing seam system

The construction of the façade is built up as follows, beginning on the inside:

1. Building structure - any type, although it must be able to support the insulating material, or have the insulation attached to it
2. Damp control course made of metal or plastic film
3. Supporting rafters – generally made from wood
4. Insulation material according to thermal requirements
5. Ventilated cavity appr. 25 to 30 mm
6. Timber boarding unplanned timber boarding 23 mm minimum thickness, not tongue and groove, installed horizontally with gaps between the boards  
Horizontal bays: The gap depends on the placing of the clips for the horizontal bays  
Vertical bays: The gap must be at least 5 mm. The boards may be spaced up to 100 mm, to be determined by the builder
7. Standing seam system

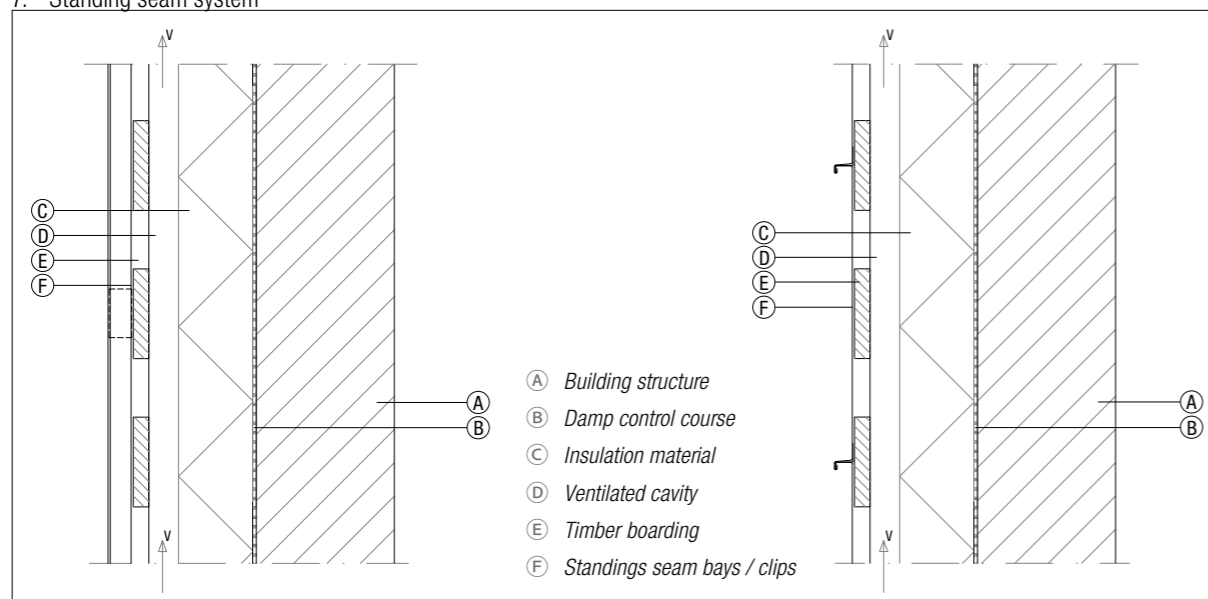


Figure 6.1.5

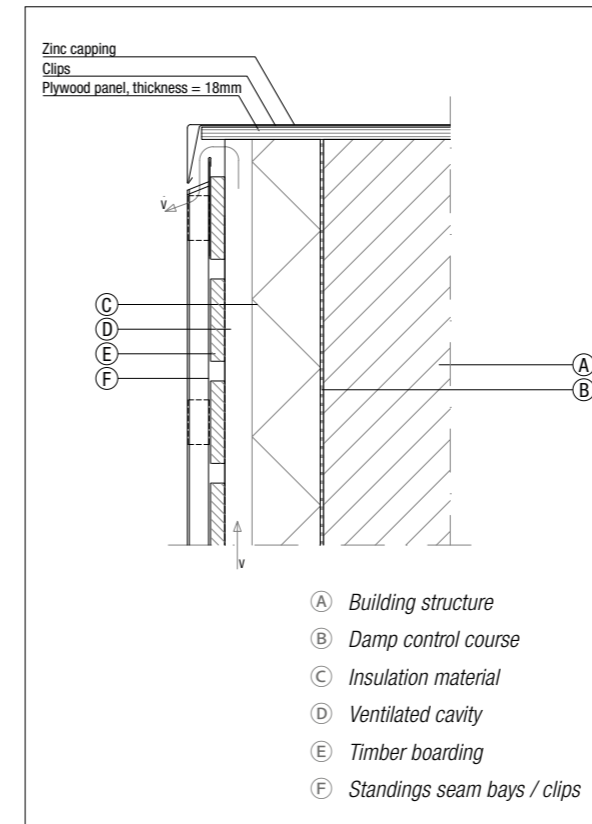


Figure 6.1.6 Ridge connection

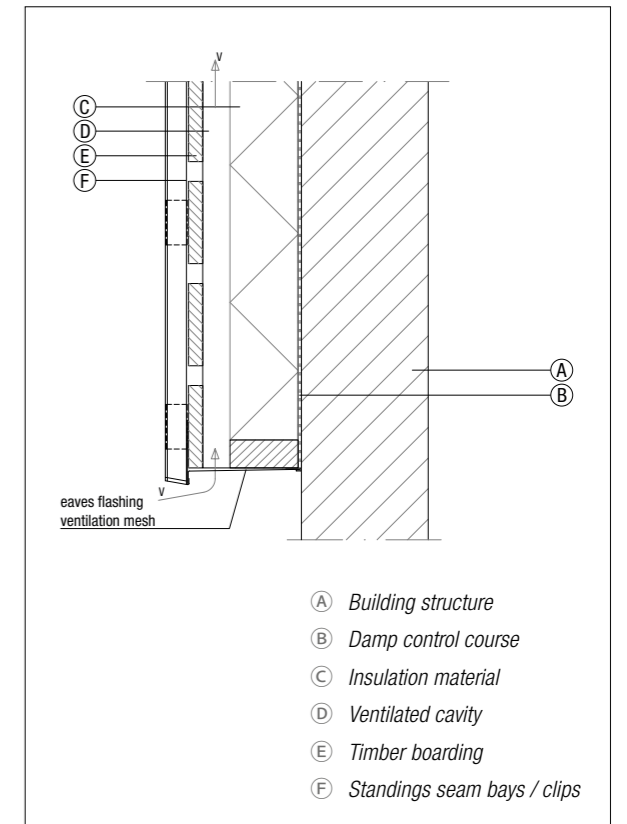


Figure 6.1.7 Eaves connection

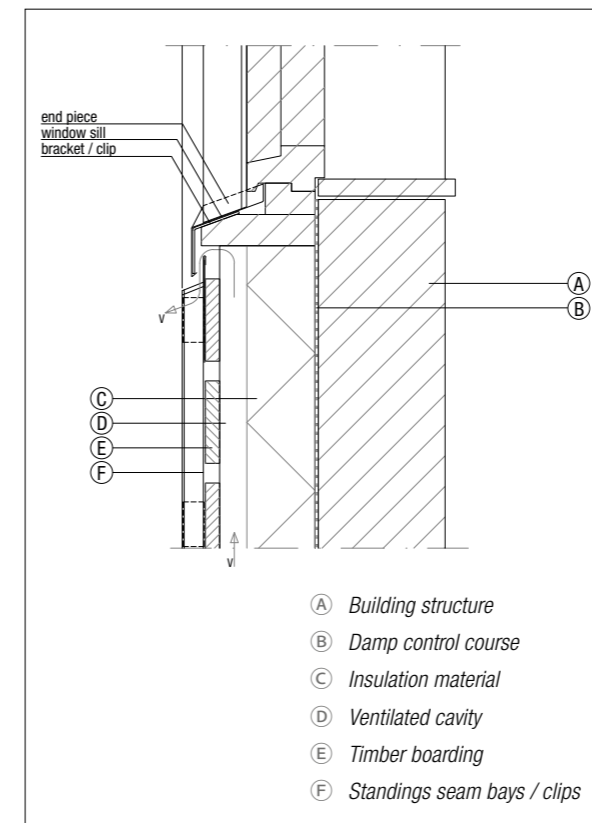


Figure 6.1.8 Window sill

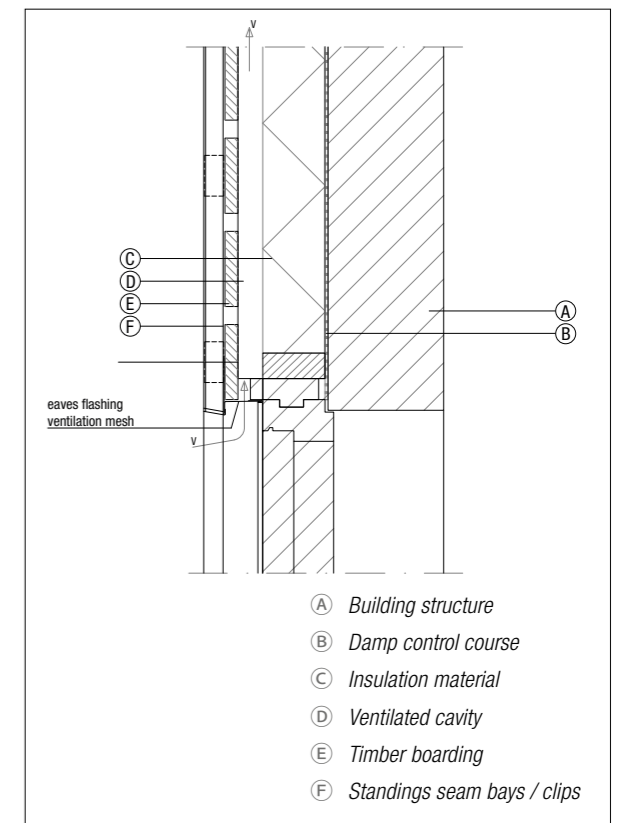


Figure 6.1.9 Window head

**Standing seam system details ventilated vertical bay**

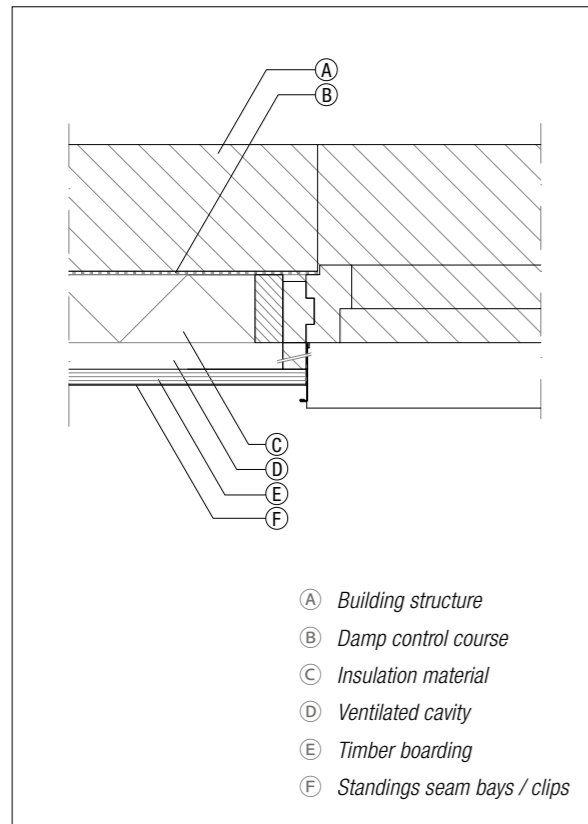


Figure 6.1.10 Window jamb

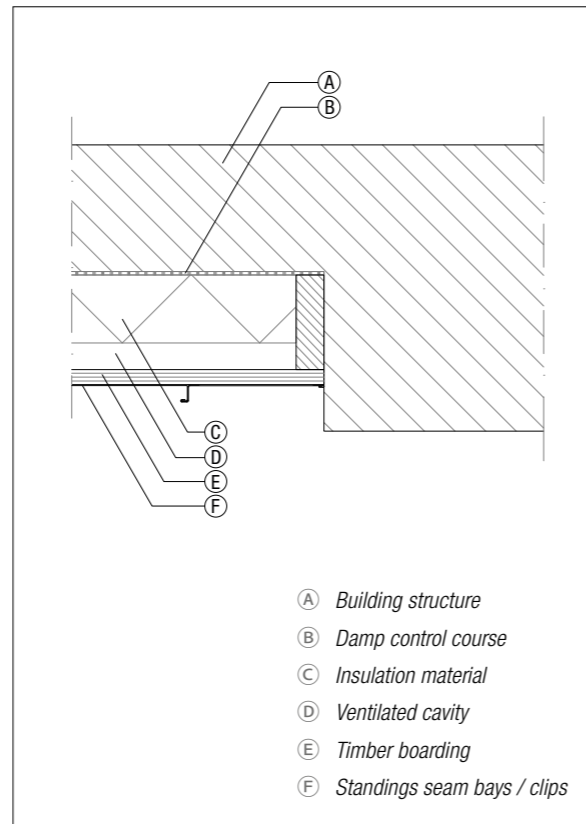


Figure 6.1.11 Wall abutment

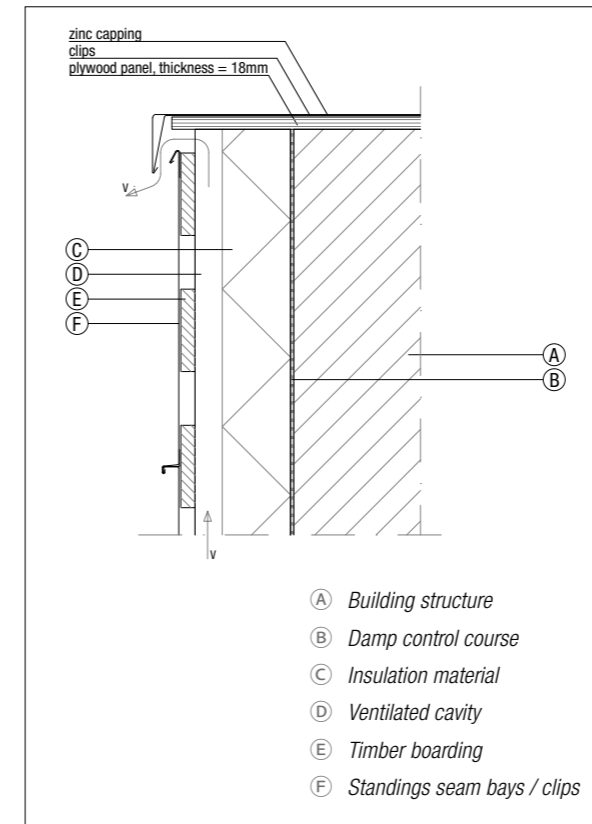


Figure 6.1.13 Ridge connection

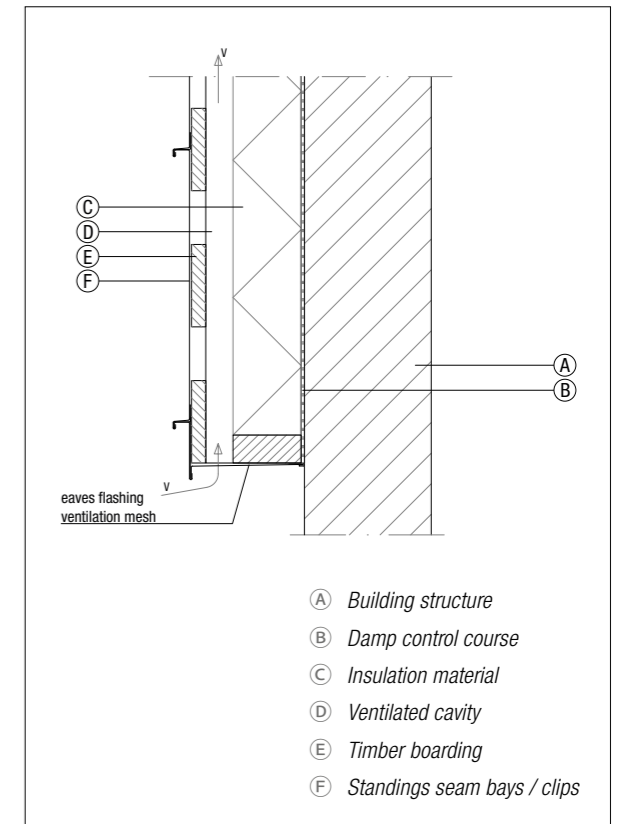


Figure 6.1.14 Eaves connection

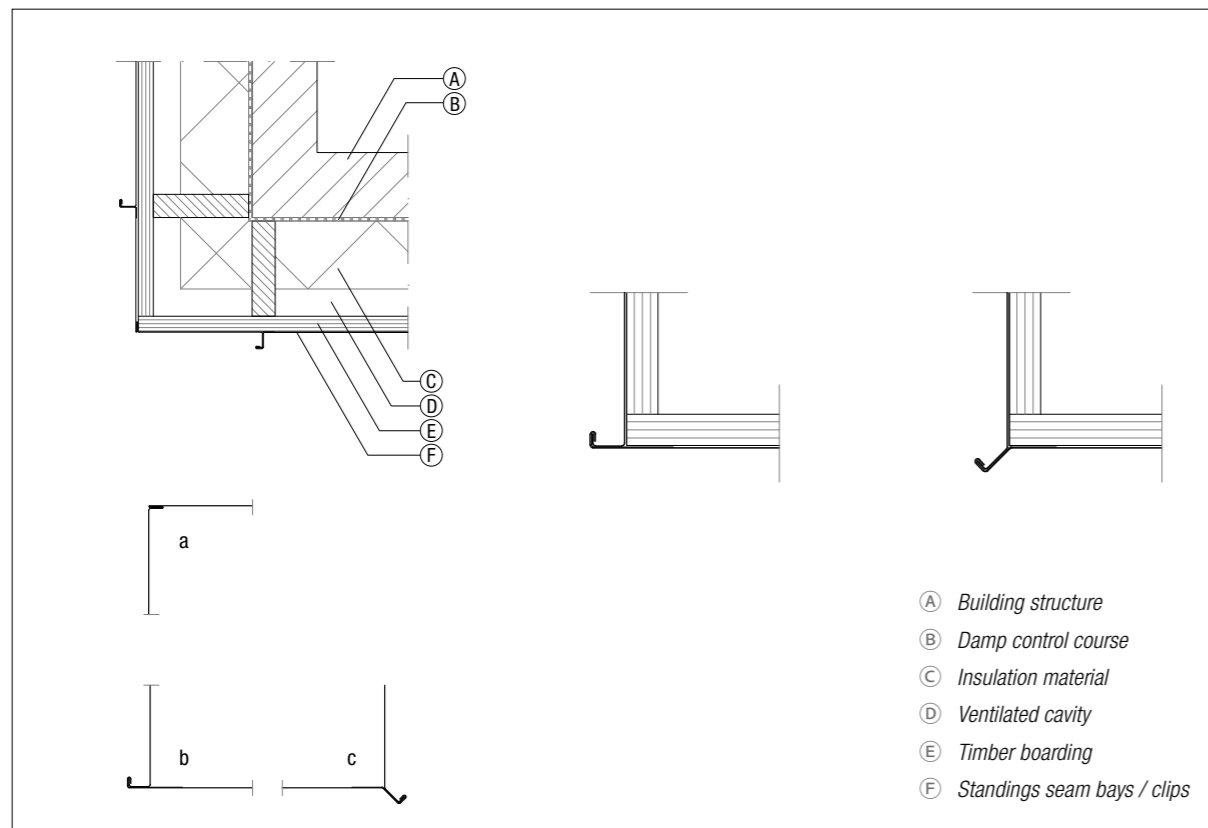


Figure 6.1.12 Outside corner

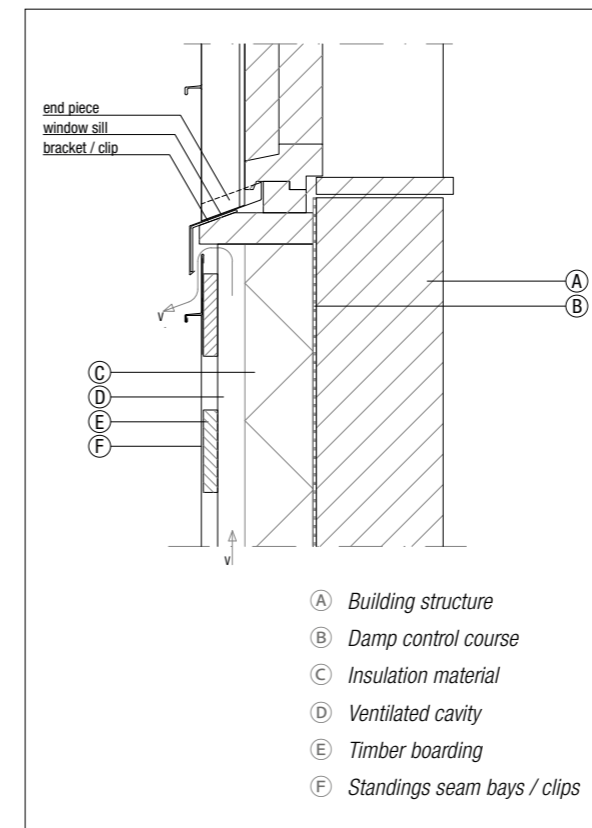


Figure 6.1.15 Window sill

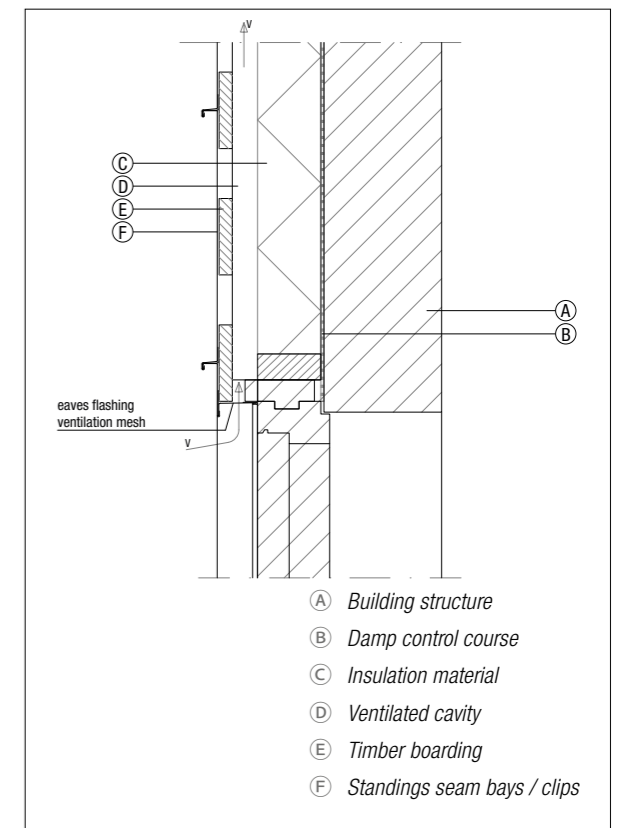


Figure 6.1.16 Window head



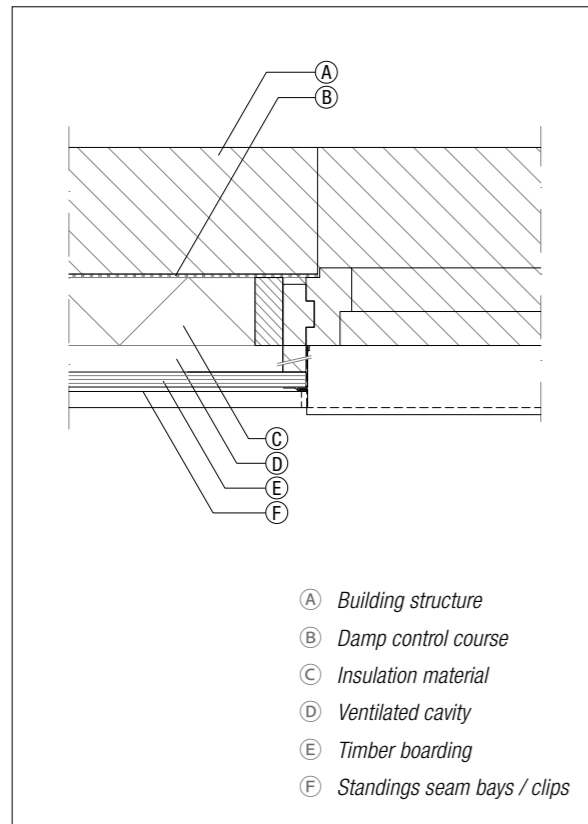


Figure 6.1.17 Window jamb

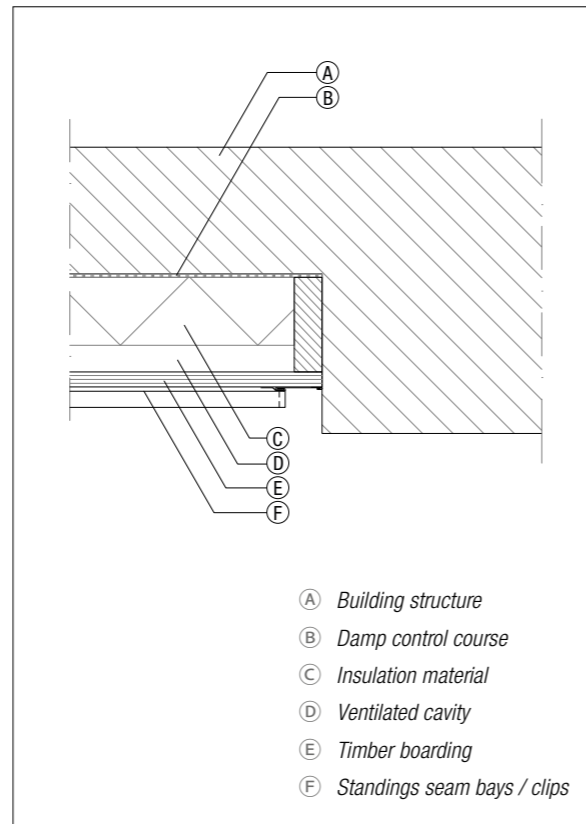


Figure 6.1.18 Wall abutment

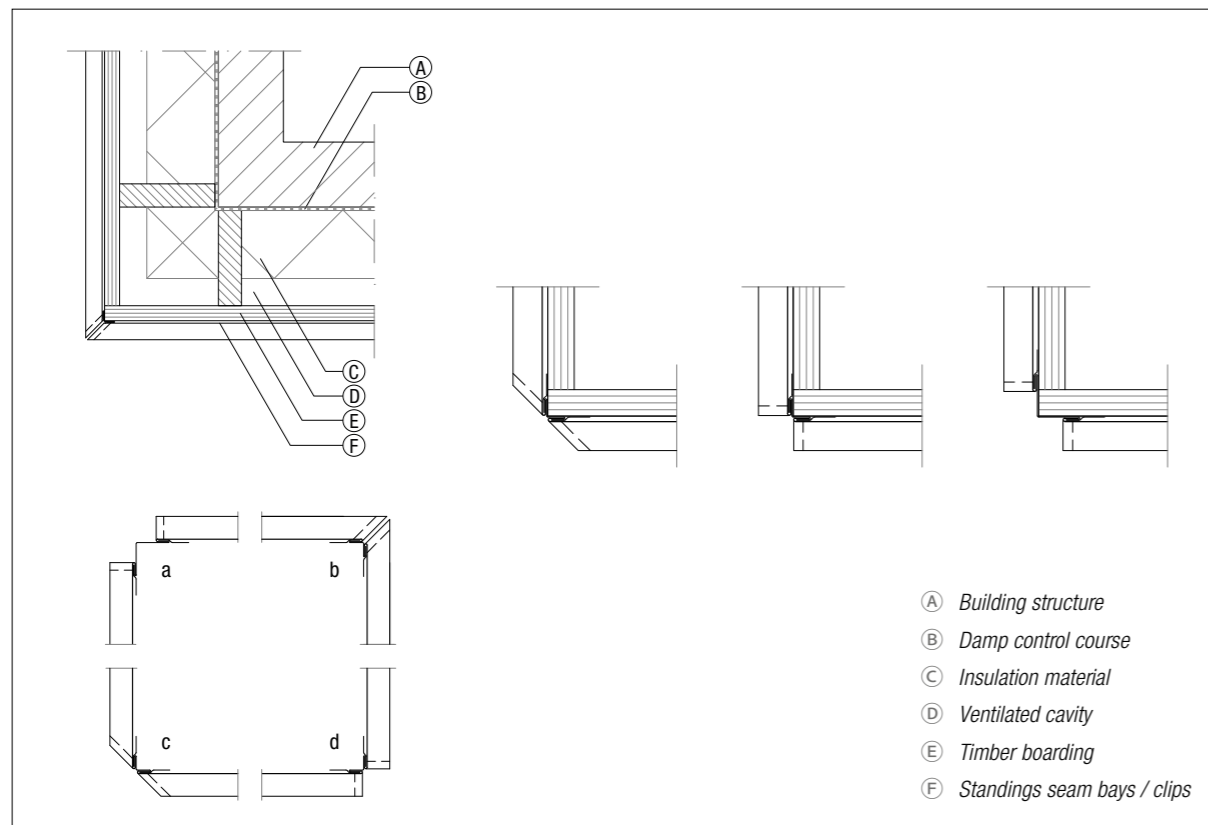


Figure 6.1.19 Outside corner

### Standing seam system details ventilated horizontal bay 6.1.2 Standing seam façade on a damp proof system

See chapter 4 for standard and alternative built ups.



Vertical standing seam system



Horizontal standing seam system

**Damp built up with NedZink standing seam system.**

**p r o o f**

**façade**

The construction of the façade is built up as follows, beginning on the inside:

1. Building structure
2. Damp control course  $\mu_d \geq 150$
3. Insulation layer, according to thermal requirements
4. Wooden substructure
5. Separating layer

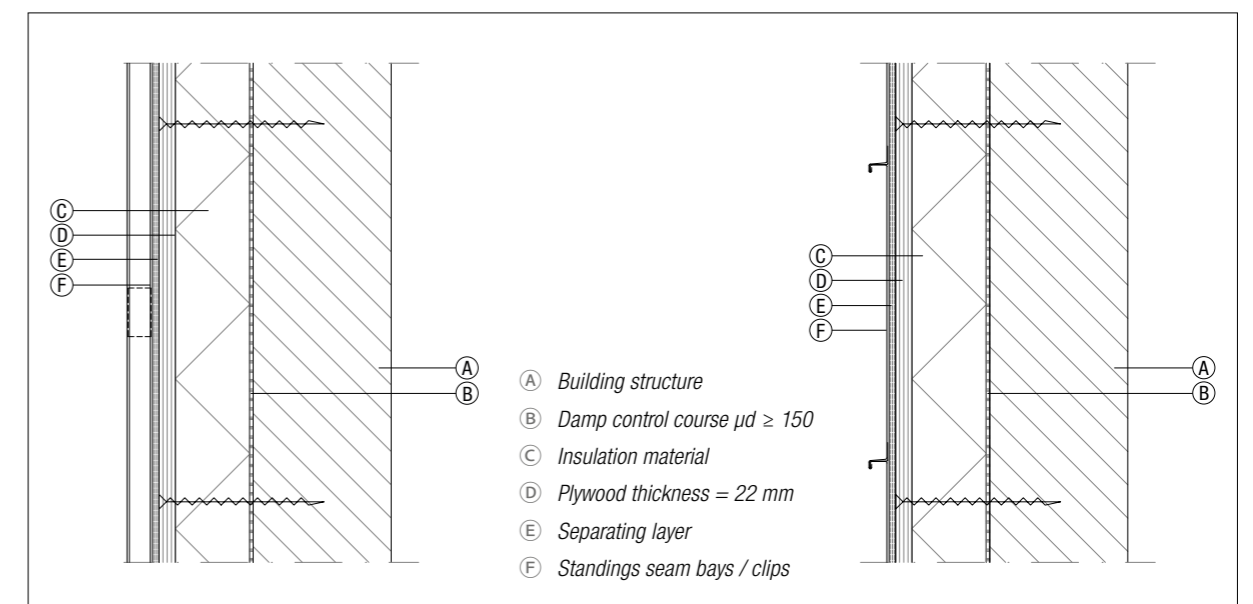


Figure 6.1.20

6. Standing seam system

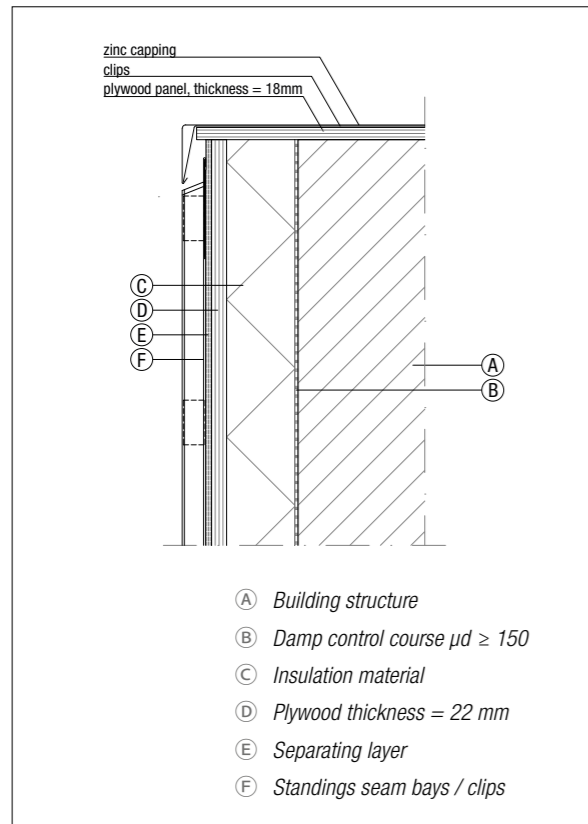


Figure 6.1.21 Ridge connection

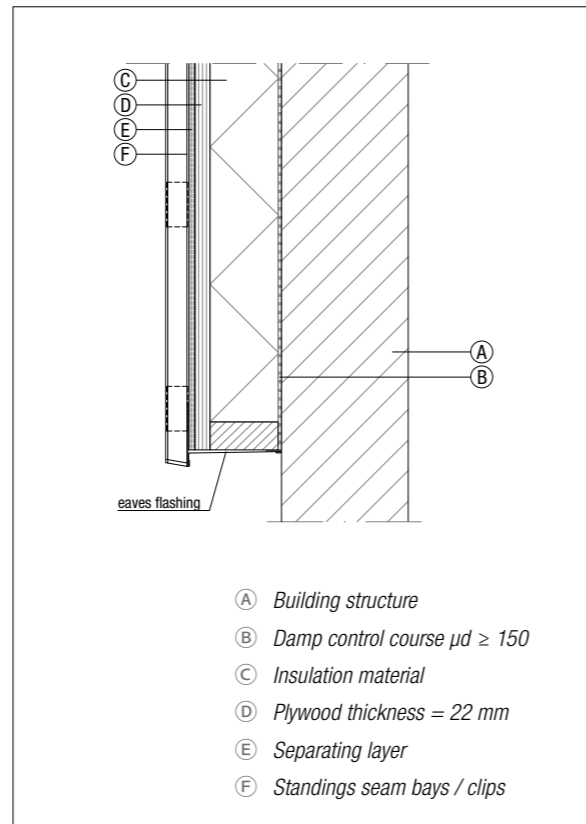


Figure 6.1.22 Eaves connection

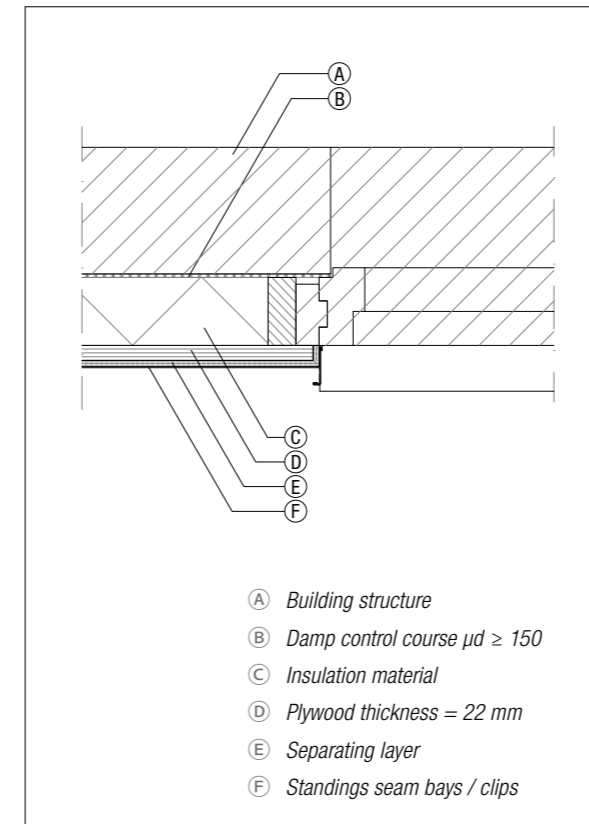


Figure 6.1.25 Window jamb

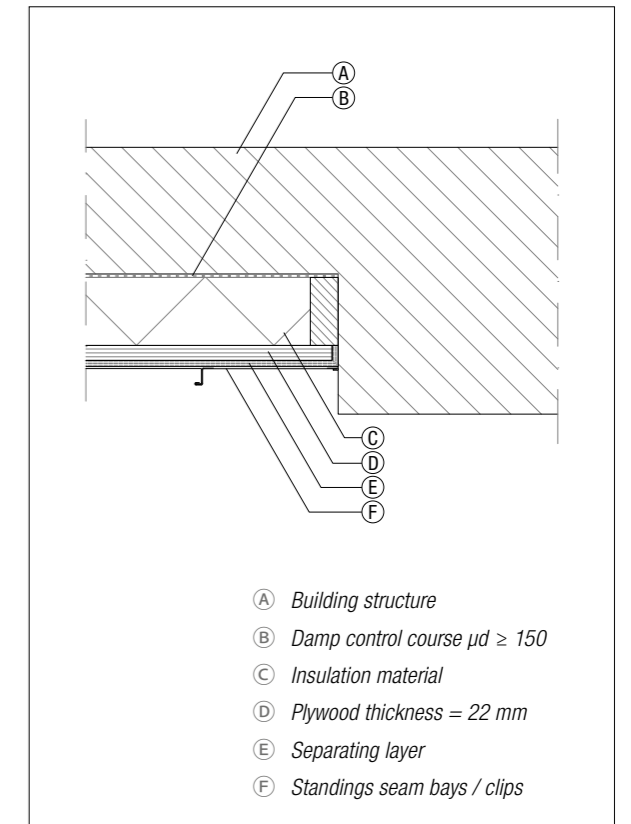


Figure 6.1.26 Wall abutment

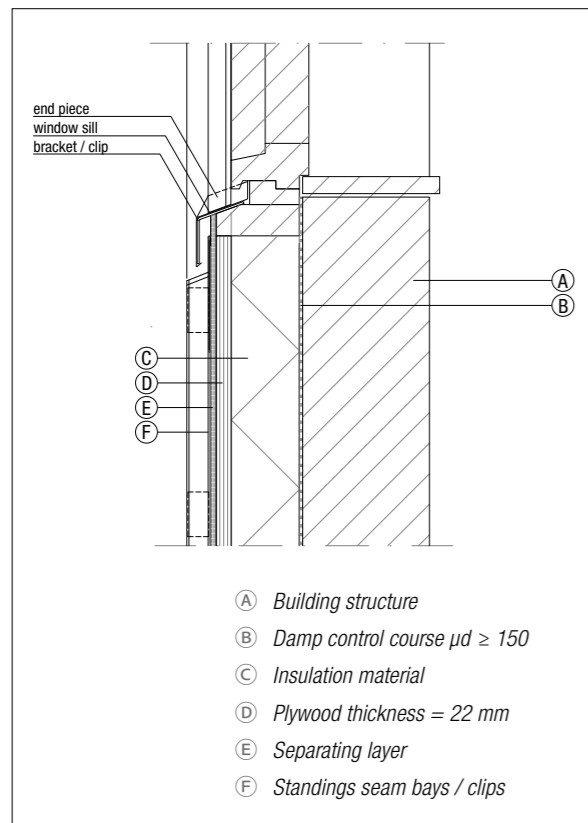


Figure 6.1.23 Window sill

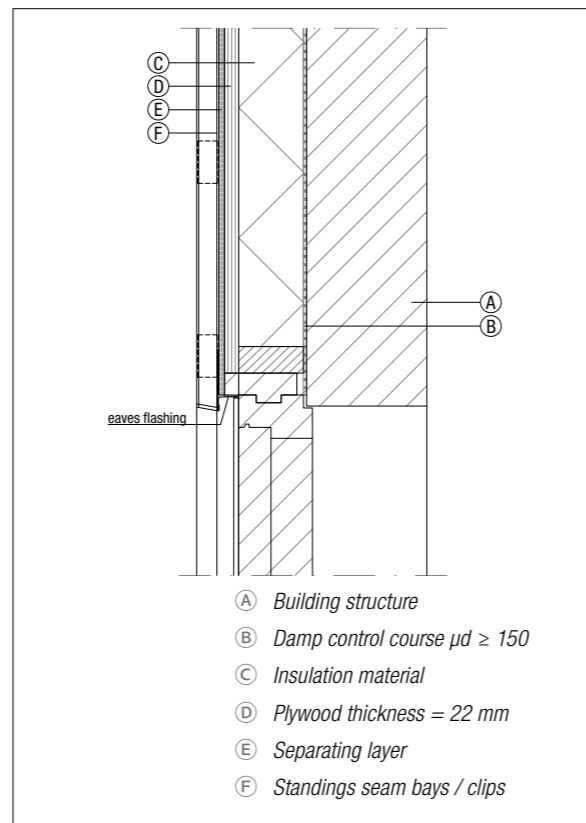


Figure 6.1.24 Window head

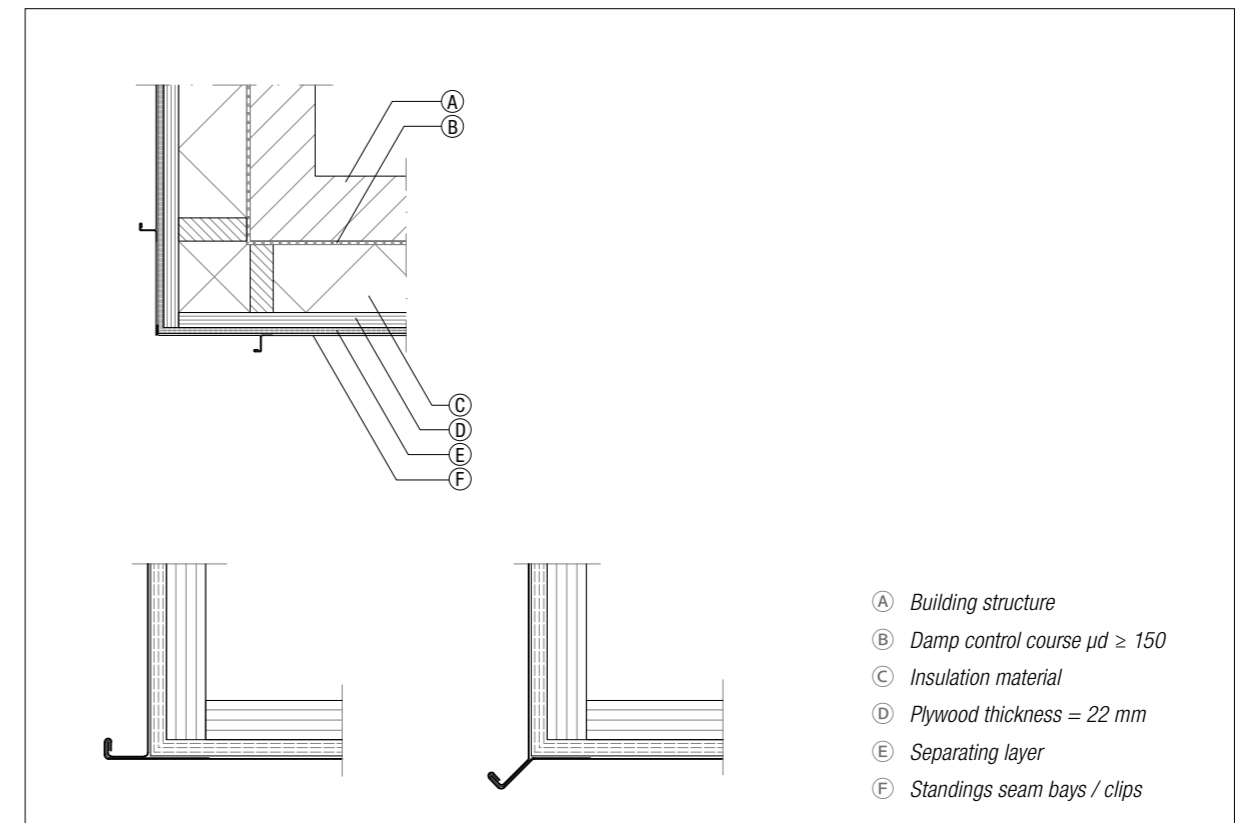


Figure 6.1.27 Outside corner

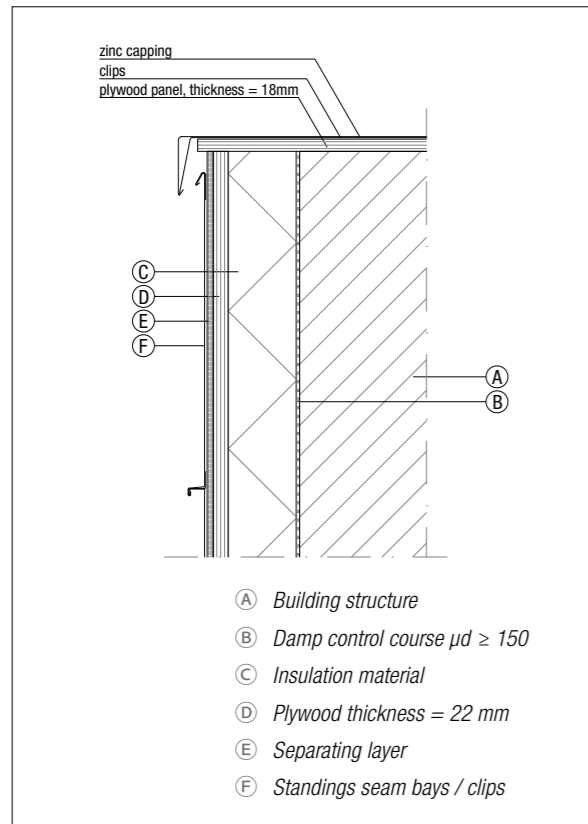


Figure 6.1.28 Ridge connection

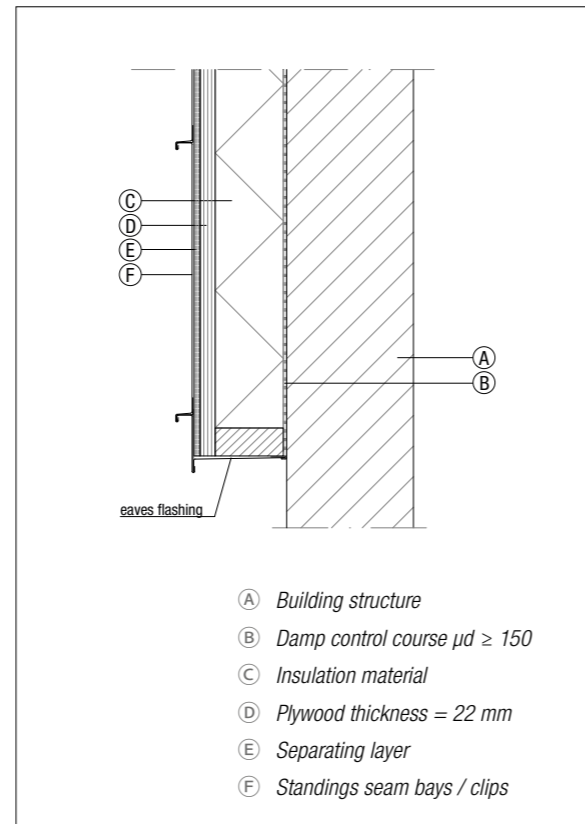


Figure 6.1.29 Eaves connection

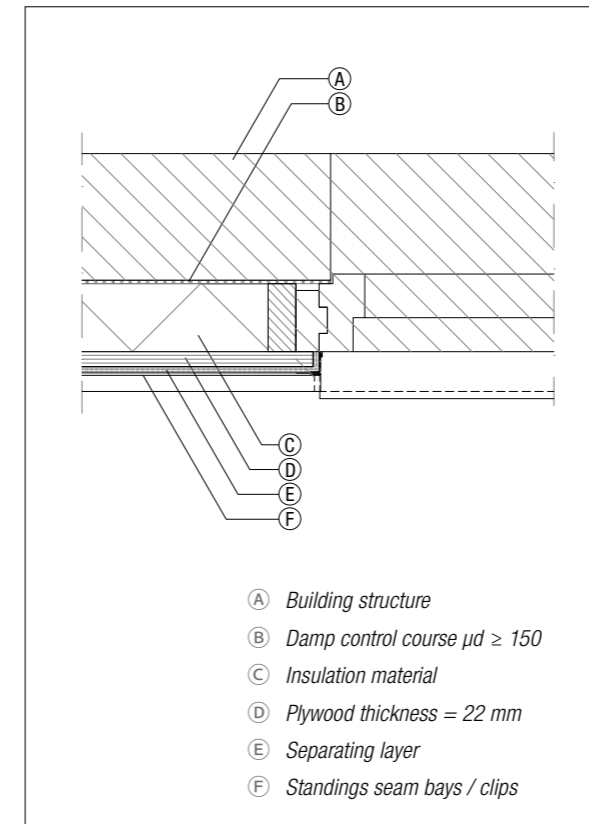


Figure 6.1.32 Window jamb

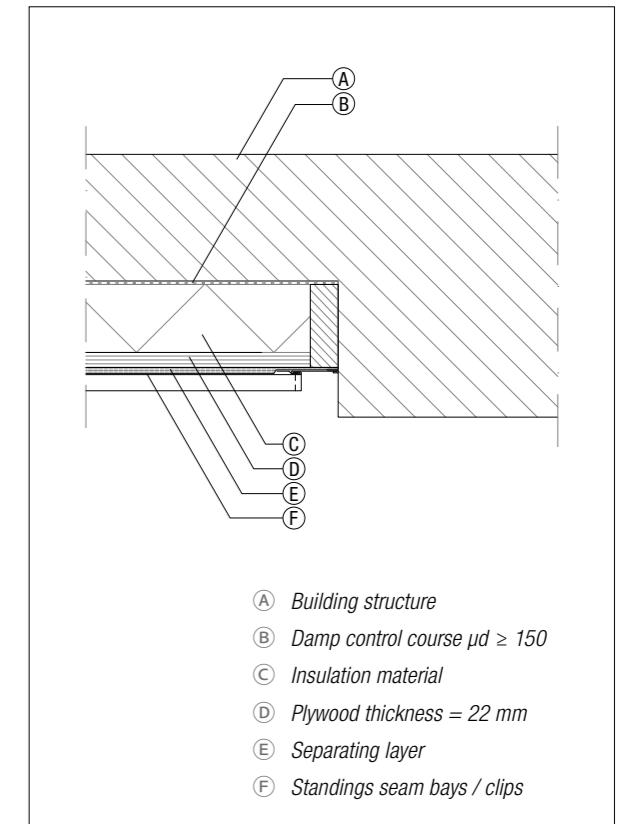


Figure 6.1.33 Wall abutment

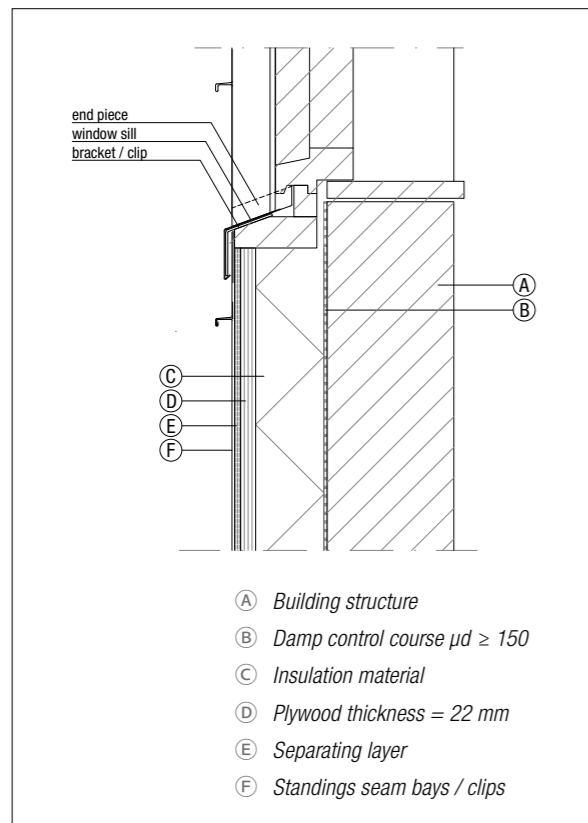


Figure 6.1.30 Window sill

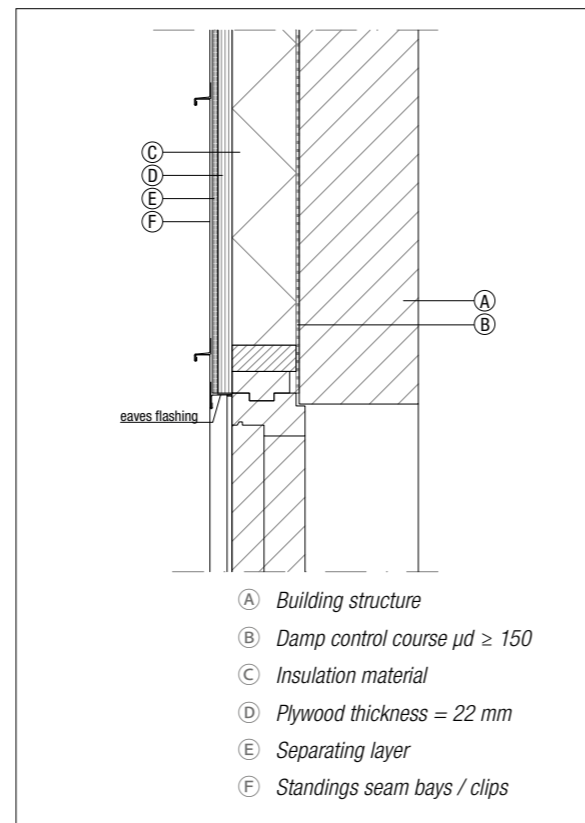


Figure 6.1.31 Window head

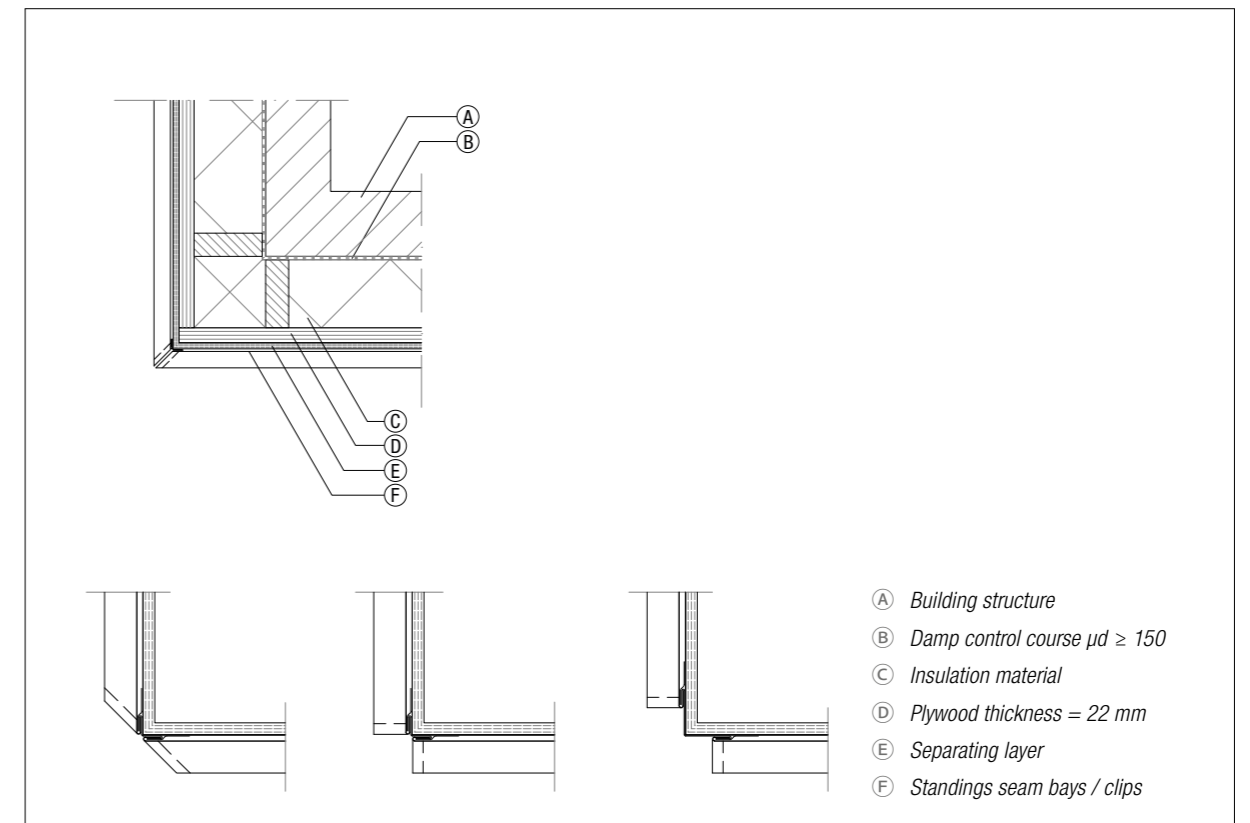


Figure 6.1.34 Outside corner

**Standing seam system details damp proof vertical bay**  
**Standing seam system details damp proof horizontal bay.**

## 6.2 Roll Cap System

A Roll Cap façade is a cladding that consists of zinc sheets provided with upstands in the longitudinal direction. Between the bays, so-called wood rolls are installed on the timber boarding. These rolls have a trapezoidal cross section with a width of 40-50 mm and a height of 60 mm. The rain-tight finishing between roof bays and wood rolls is obtained by a covering profile (roll capping). In



order to maintain a rain-tight façade, special profiles are used with the horizontal roll caps (see fig. 6.2.4 and 6.2.5).

### Specifications of Roll Cap standard components

#### Standard roll cap bay (figure 6.2.1)

Bay width: maximum 890 mm, with 2 upstands each 55 mm and retaining edge  
 Girth: maximum 1000 mm  
 Material thickness: 0.80 mm or 1.00 mm

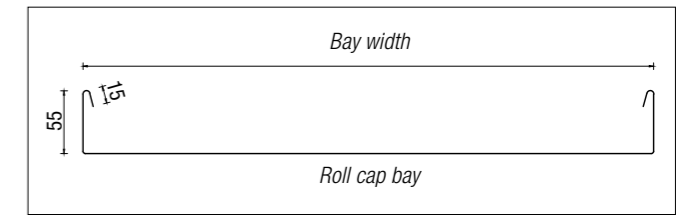


Figure 6.2.1

#### Standard Roll capping (figure 6.2.2)

Cross-section: 65 mm x 25 mm  
 Material thickness : as for roll cap bay

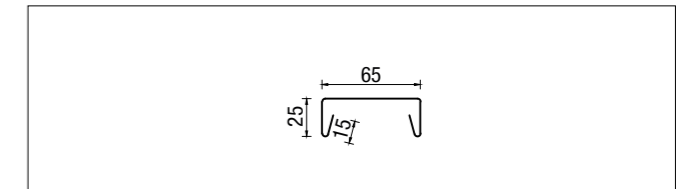


Figure 6.2.2

#### Wood roll

Wood, good quality. The wood roll must be straight and accurately dimensioned



Figure 6.2.3

#### Eaves apron

Width: 330 mm  
 Material thickness: as for roll cap

#### Clips (fixed and sliding)

Width: 50 mm  
 Length: > 220 mm  
 Material thickness: as for roll cap bay

These clips are produced by the sheet metal worker. The length must have a little excess, so that it can be cut to the exact size during fitting. The fixed clips secure the roll cap bay and the sliding clips make longitudinal thermal movement possible.

#### Support

The roll cap system must be fully supported by unplanned, untreated wooden boards at least 23 mm thick, not tongue and grooved, with gaps of at least 5 mm and maximum 100 mm. The construction requirements are also important in this. Use galvanised nails with a zinc-layer thickness of at least 20 microns or AISI 304 stainless steel for fastening.

#### Fastening the clips

When fitting the vertical roll cap bays to the façade the roll cap bay is secured with fixed clips at the uppermost meter. Horizontally

assembled roll cap bays with a length up to 3 meters are fully secured with fixed clips. Bays longer than 3 meters are secured over a zone of one meter, in the middle of the standing seam strips. The rest is done with sliding clips. The timber boarding must be aligned at the point where the clips are fitted.

### Horizontal roll cap façade



Figure 6.2.4

With regard to rain proofing the façade when applying horizontal roll cap bays, use special profiled sheets (see Figure 6.2.4). When using a roll cap system as vertical façade cladding the standing edge of the roll cap bay must have a retaining edge (see Figure 6.2.1).



Vertical roll cap system



Horizontal roll cap system

The

following auxiliary profiles are used to ensure the façade with horizontal roll cap bays is rainproof.

### Horizontal roll cap façade auxiliary profiles

#### 6.2.1 Roll cap system on a ventilated system

See chapter 4 for standard and alternative built ups.

#### Ventilated façade built up with NedZink roll cap system.

The construction of the façade is built up as follows, beginning on the inside:

1. Building structure - any type, although it must be able to support the insulating material, or have the insulation attached to it.
2. Damp control course made of metal or plastic film.
3. Supporting rafters – generally made from wood.
4. Insulation material according to thermal requirements.

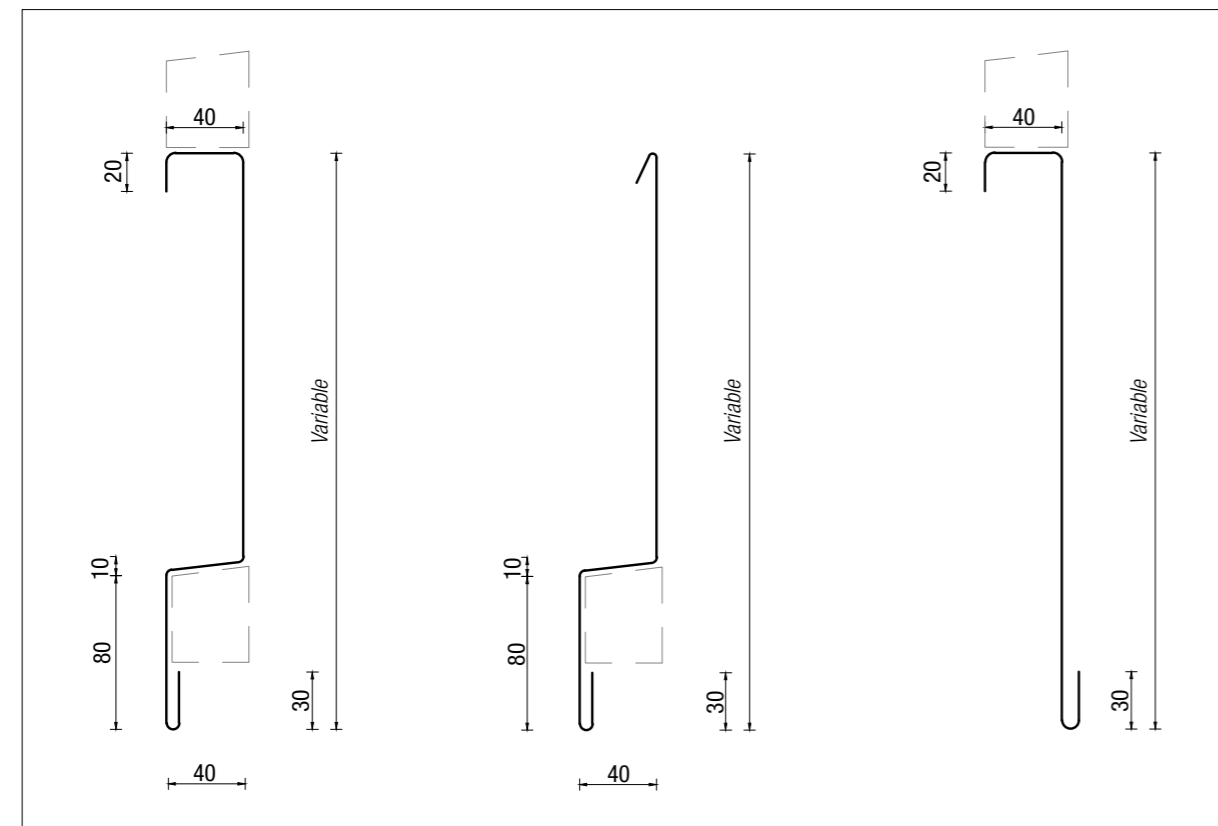


Figure 6.2.5

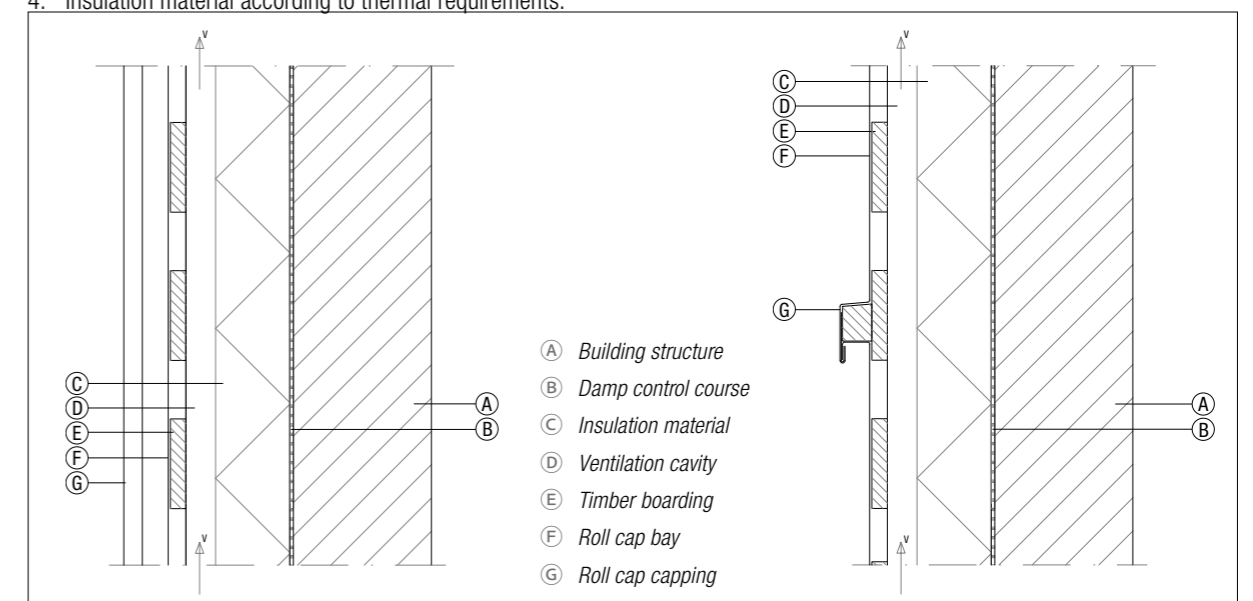


Figure 6.2.6

5. Ventilated cavity appr. 25 to 30 mm.

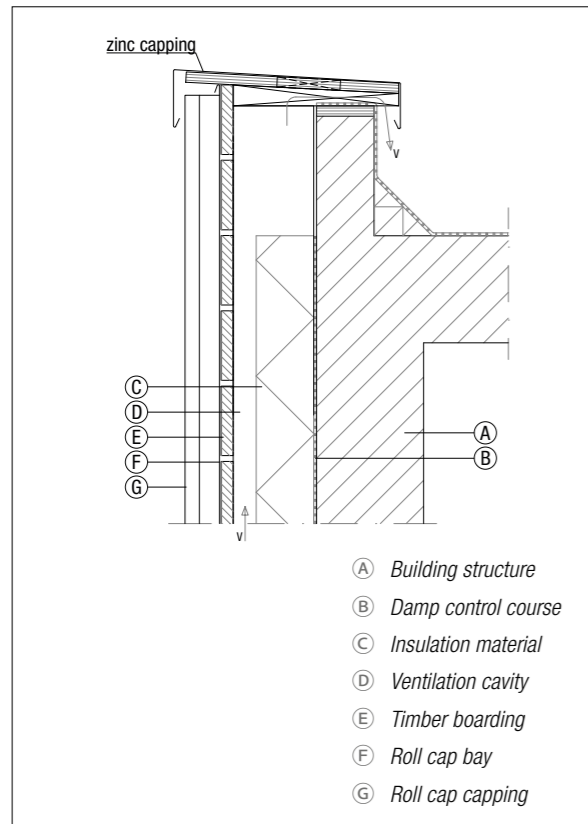


Figure 6.2.7 Ridge connection

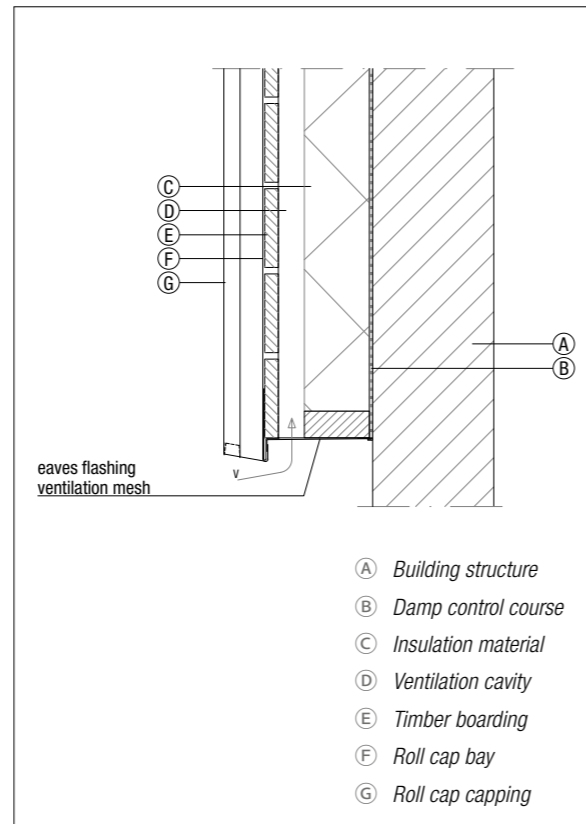


Figure 6.2.8 Eaves connection

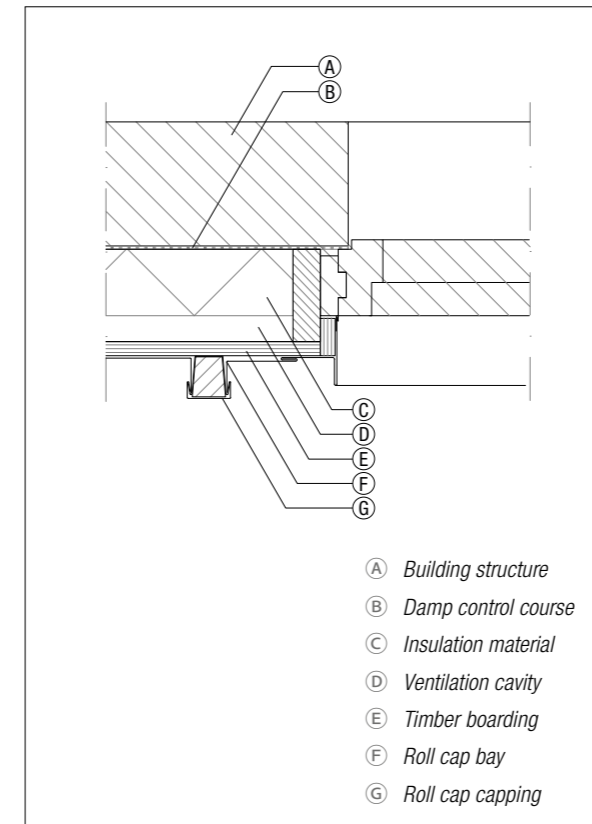


Figure 6.2.11 Window jamb

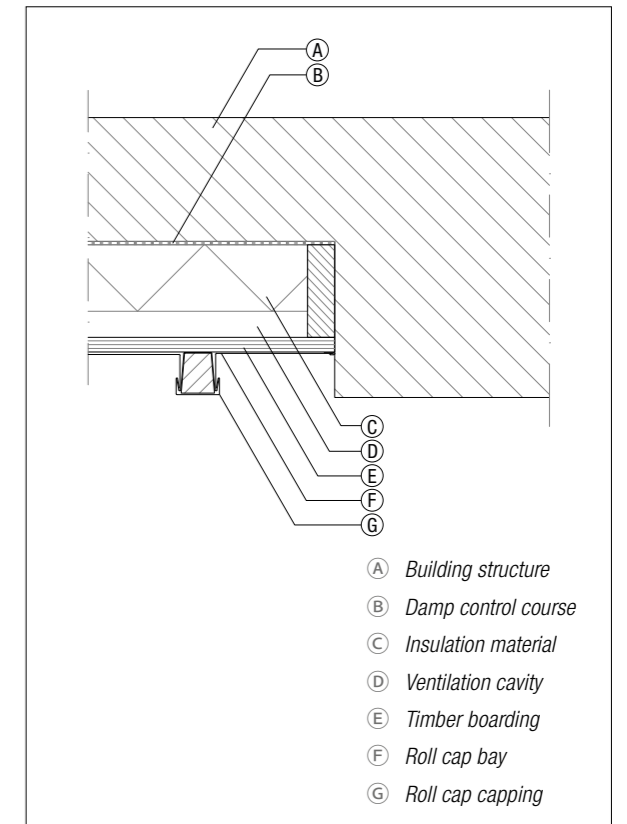


Figure 6.2.12 Wall abutment

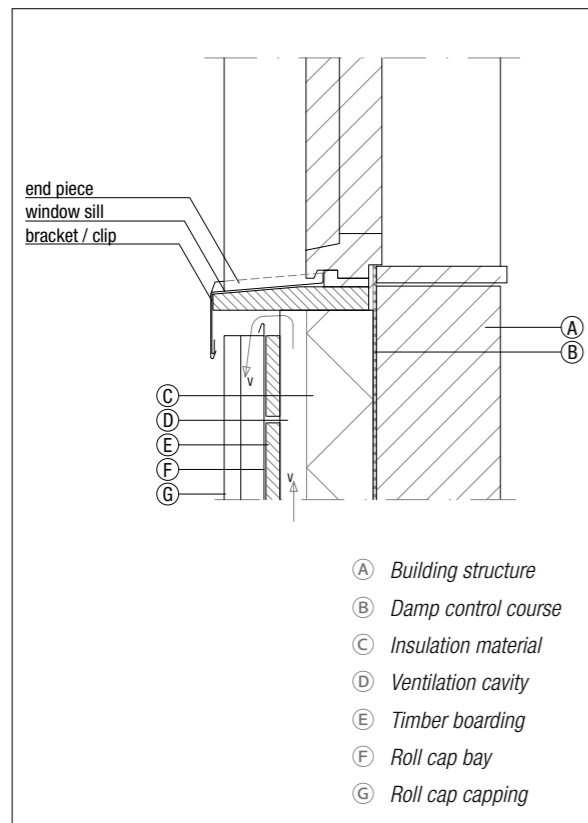


Figure 6.2.9 Window sill

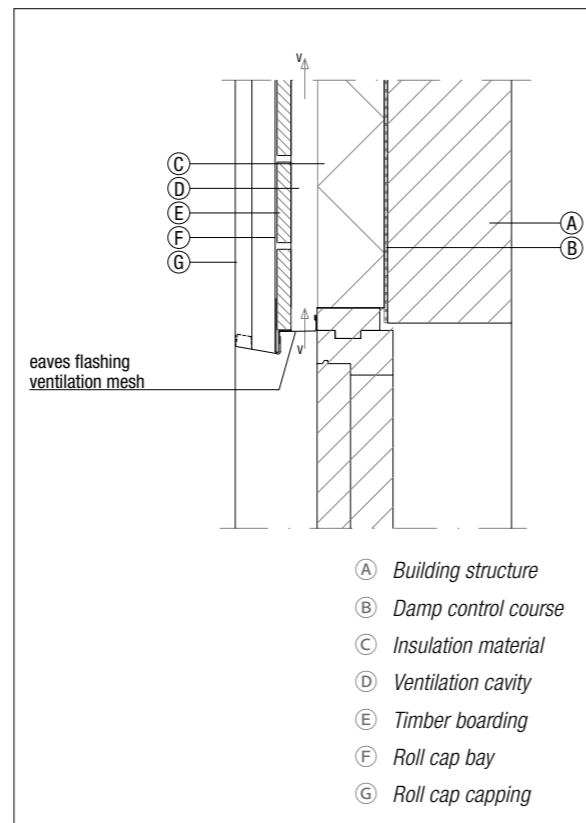


Figure 6.2.10 Window head

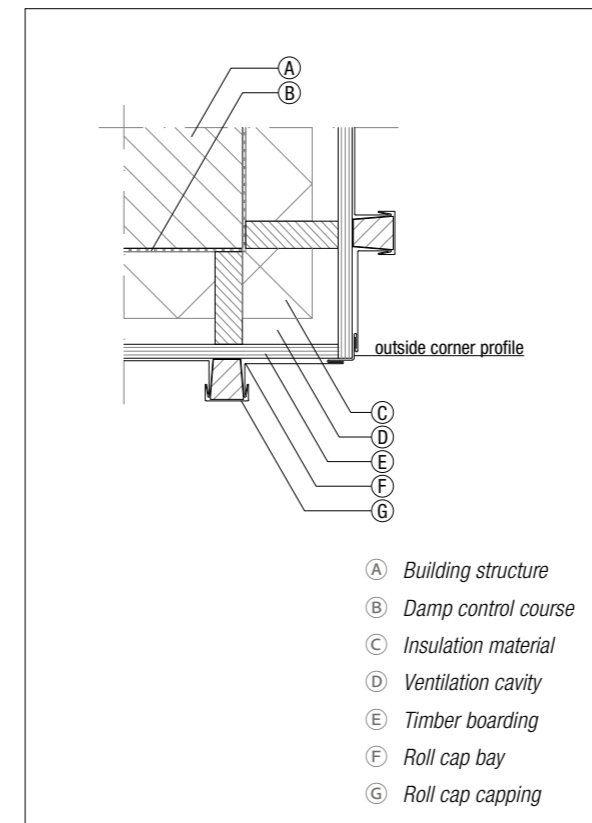


Figure 6.2.13 Outside corner

6. Timber boarding unplanned timber boarding 23 mm minimum thickness, not tongue and groove, installed horizontally with gaps

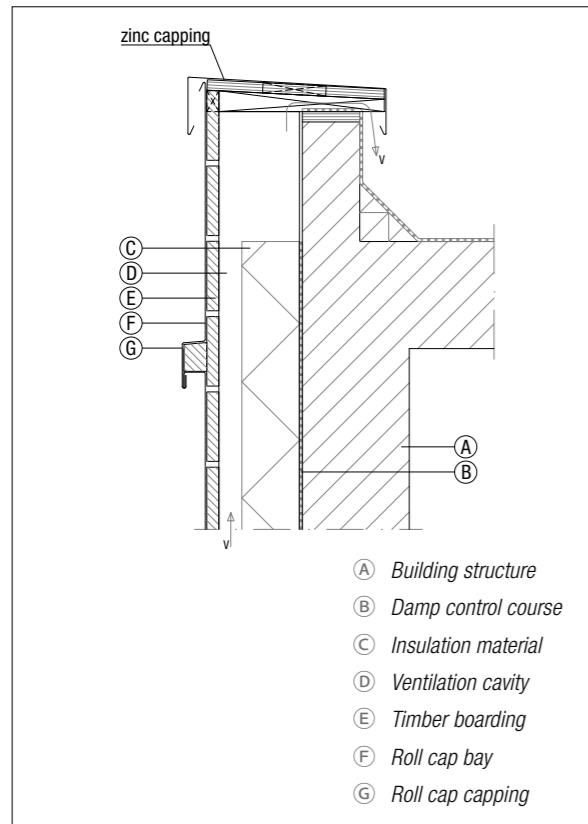


Figure 6.2.14 Ridge connection

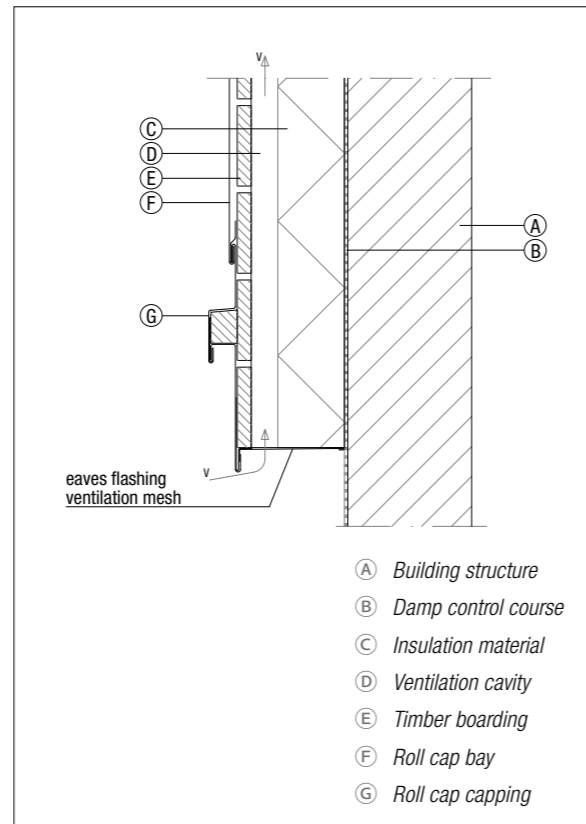


Figure 6.2.15 Eaves connection

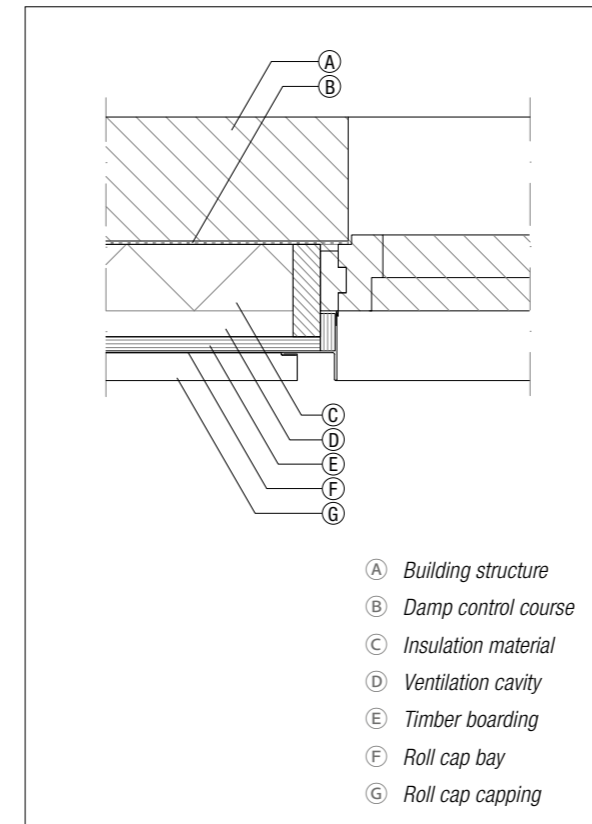


Figure 6.2.18 Window jamb

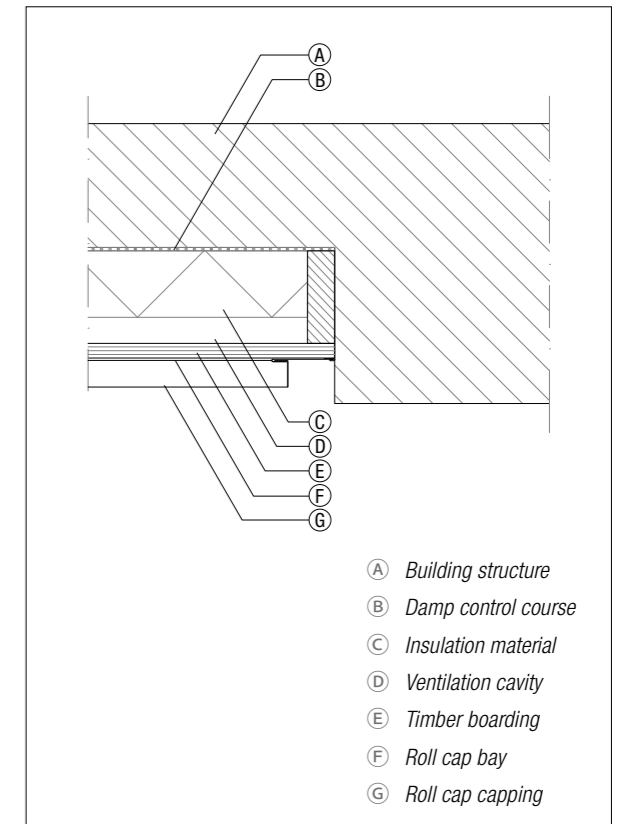


Figure 6.2.19 Wall abutment

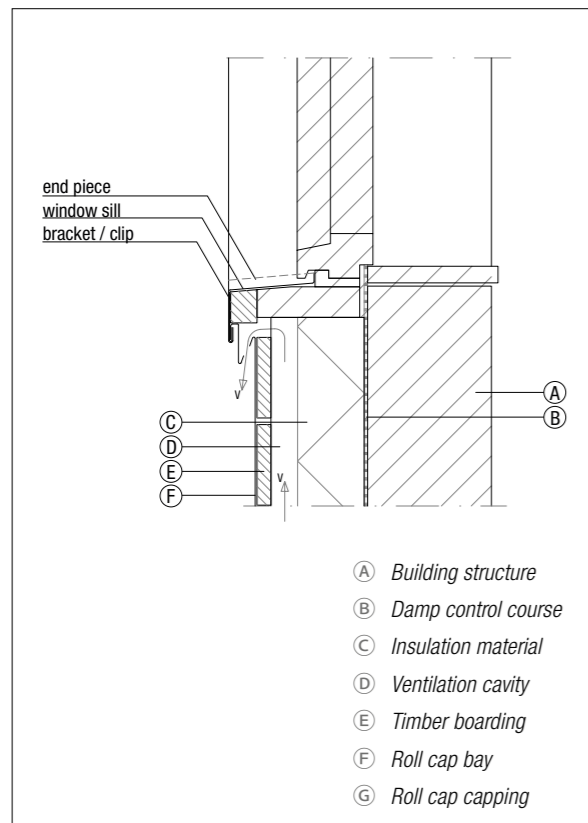


Figure 6.2.16 Window sill

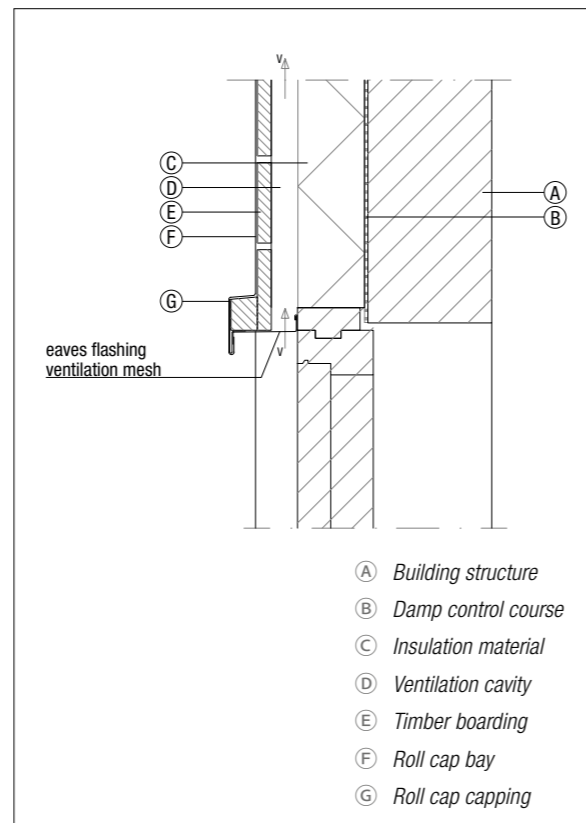


Figure 6.2.17 Window head

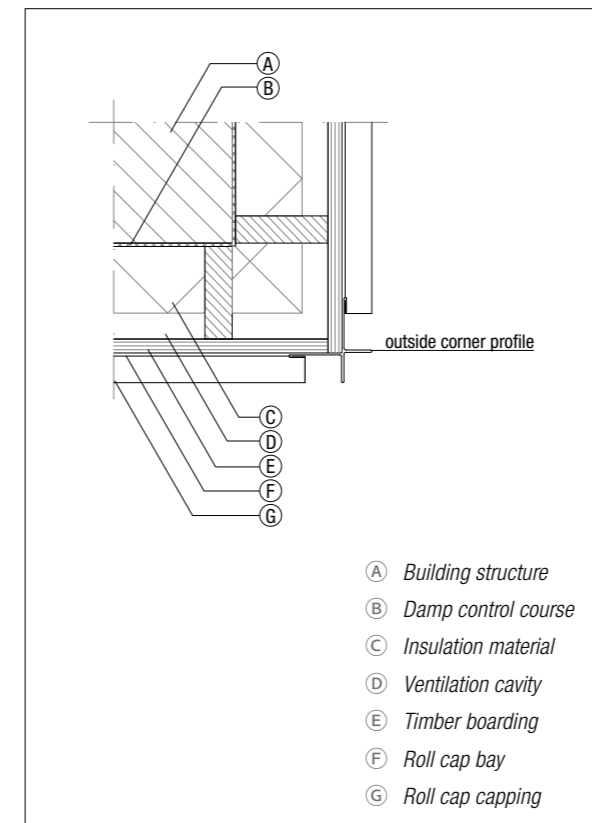


Figure 6.2.20 Outside corner

between the boards.

Horizontal bays: The gap depends on the placing of the clips for the horizontal bays.

Vertical bays: The gap between the timber boards must be at least 5 mm. The boards may be spaced up to 100 mm, to be determined by the builder.



Vertical roll cap system



Horizontal roll cap system

7.

NedZink roll cap system.

**Roll Cap system details ventilated vertical bay**

**Roll cap system ventilated horizontal bay**

**6.2.2 Roll cap system on a damp proof system**

See chapter 4 for standard and alternative built ups.

**Damp proof façade built up with NedZink roll cap system.**

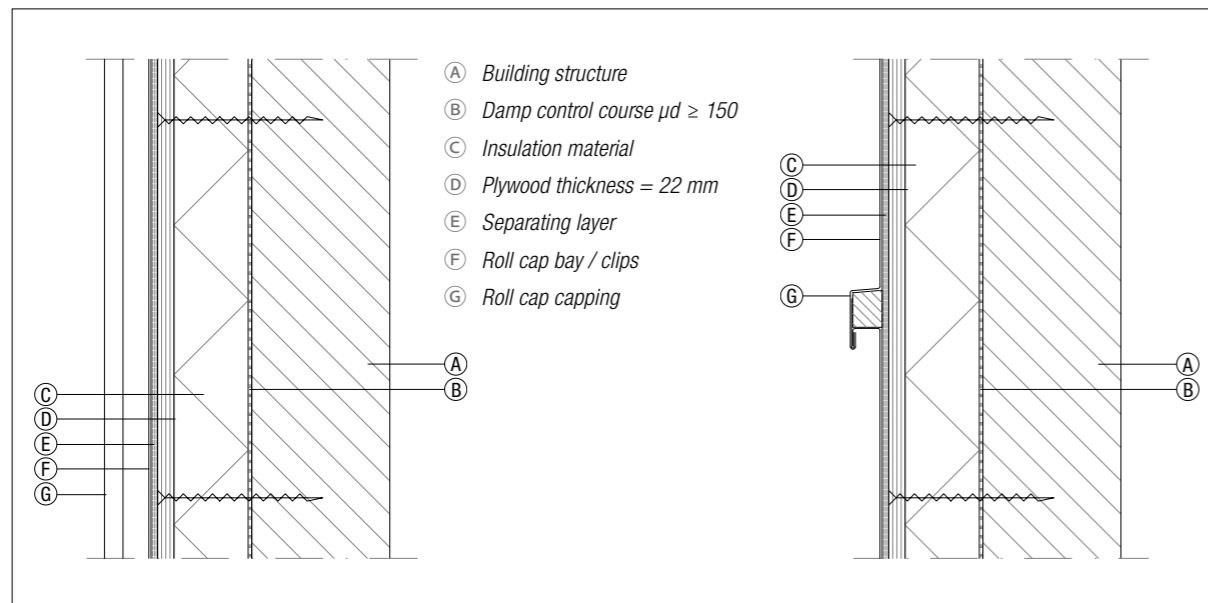


Figure 6.2.21

**Roll cap system details damp proof vertical bay.**

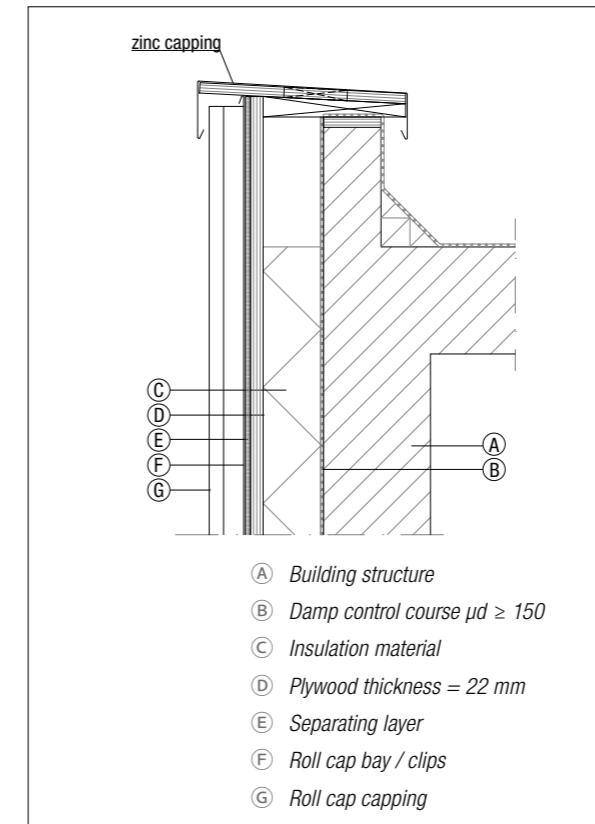


Figure 6.2.22 Ridge connection

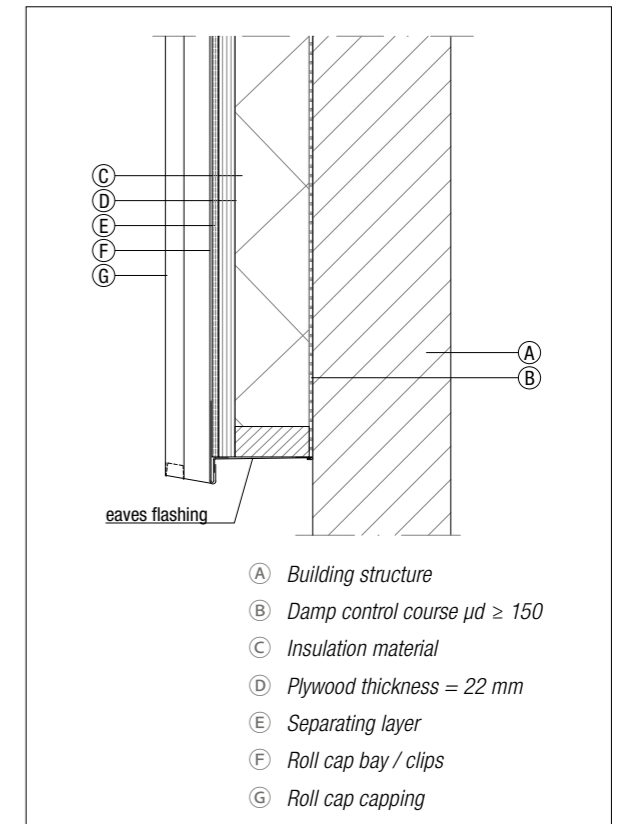


Figure 6.2.23 Eaves connection

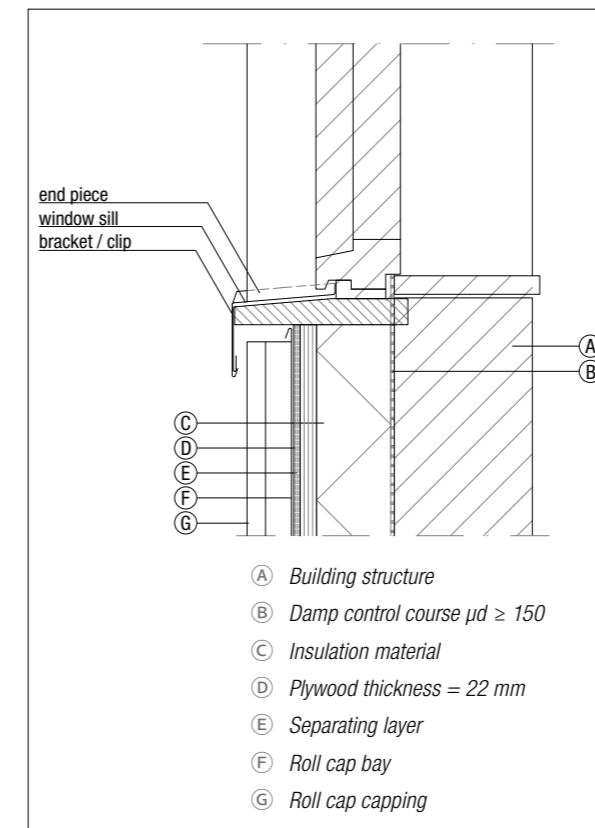


Figure 6.2.24 Window sill

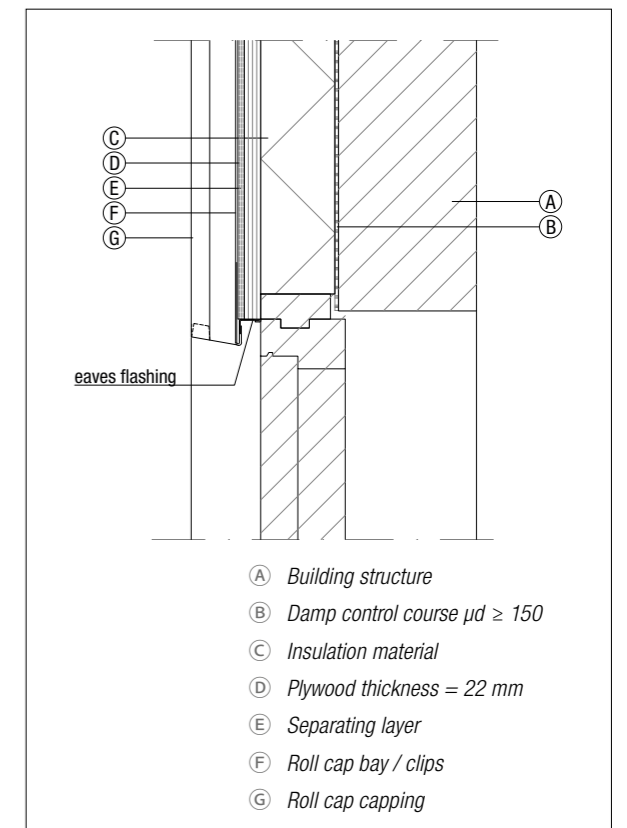


Figure 6.2.25 Window head



**Roll cap system details damp proof horizontal bay.**

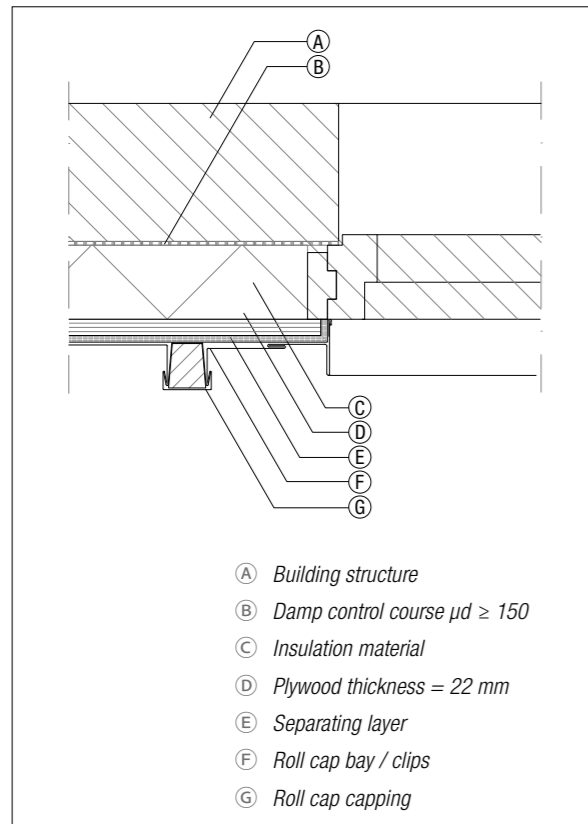


Figure 6.2.26 Window jamb

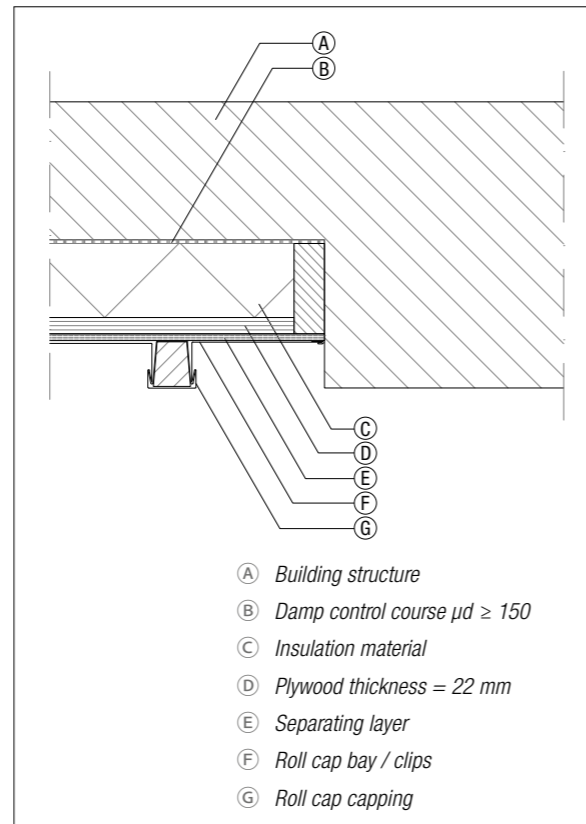


Figure 6.2.27 Wall abutment

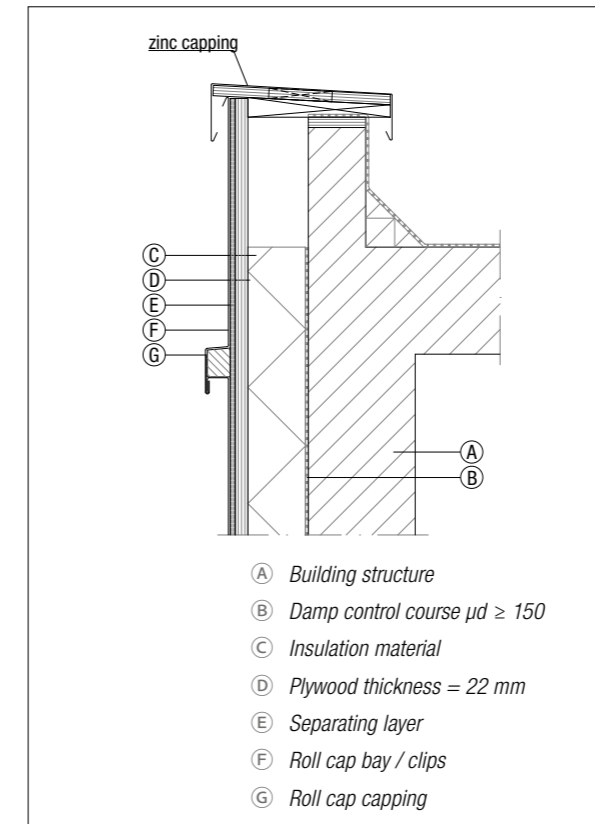


Figure 6.2.29 Ridge connection

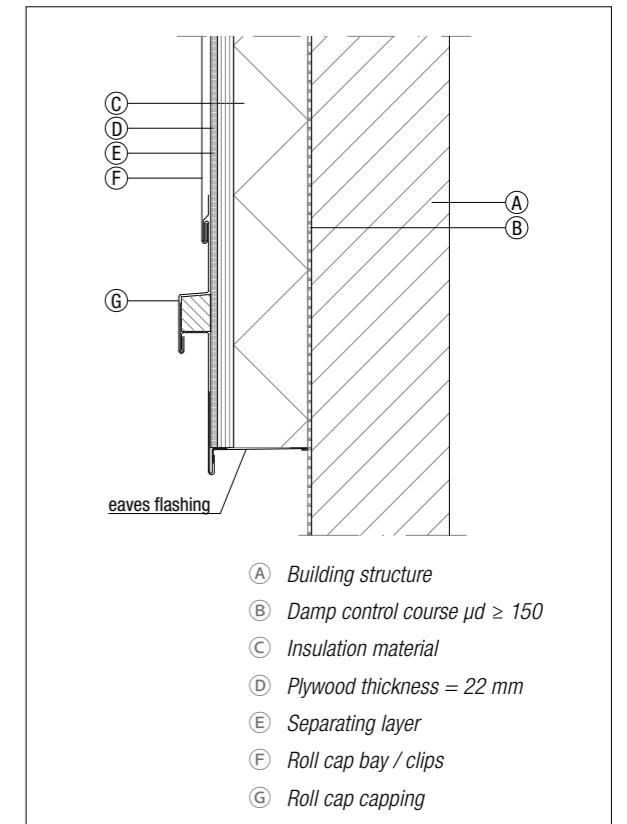


Figure 6.2.30 Eaves connection

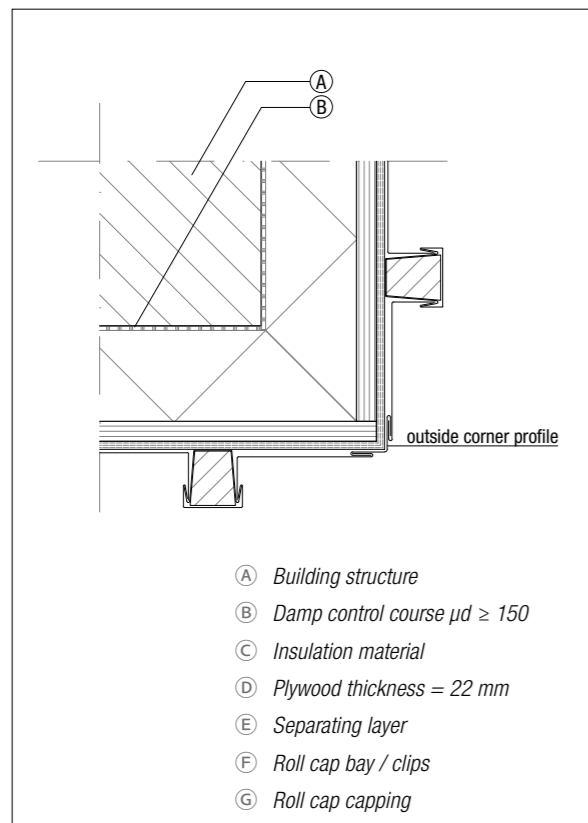


Figure 6.2.28 Outside corner

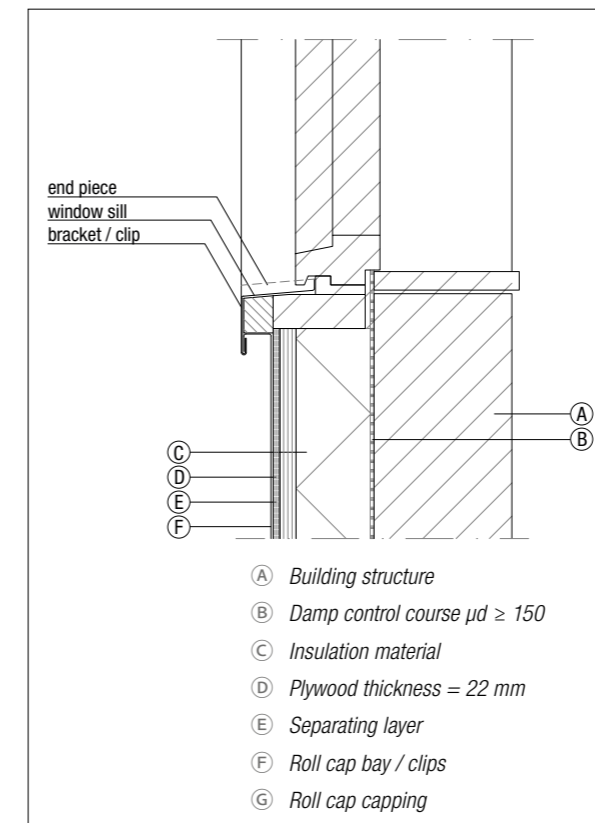


Figure 6.2.31 Window sill

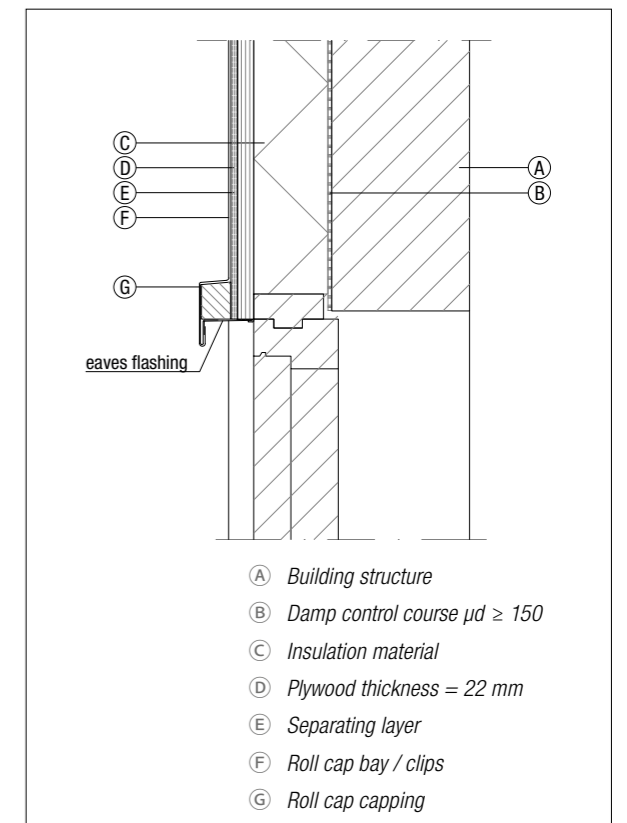


Figure 6.2.32 Window head

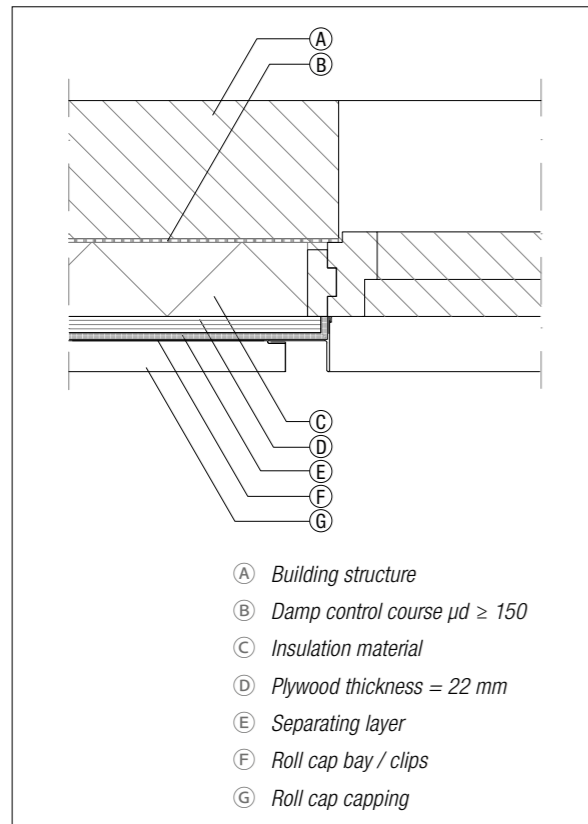


Figure 6.2.33 Window jamb

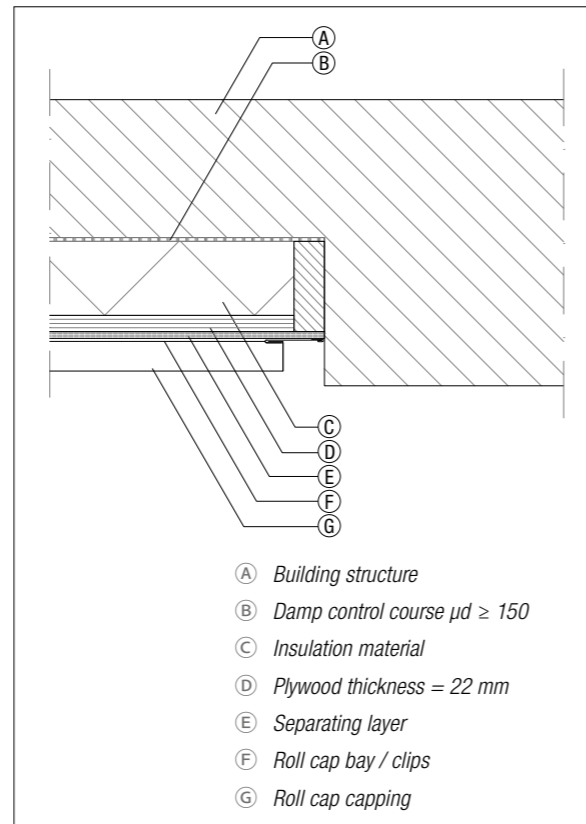


Figure 6.2.34 Wall abutment

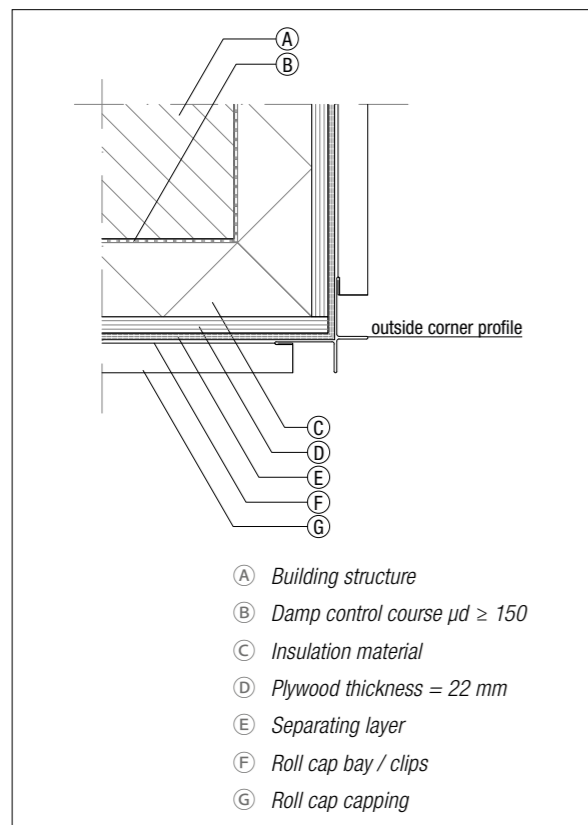


Figure 6.2.35 Outside corner

The construction of the façade is built up as follows, beginning on the inside

1. Building structure
2. Damp control course  $\mu_d \geq 150$
3. Insulation layer, according to thermal requirements
4. Wooden substructure



5. Separating layer
6. Roll cap system

## 6.3 Lozenge system

The lozenge system is used for covering of large and small inclined and vertical surfaces. The standard NedZink lozenge system consists of small, uniform bent plates that hook onto each other. The most common form of a lozenge is the square, although the rhombus is also frequently used. In this book, the square lozenge will be discussed. In addition to lozenge, the names zinc tiles and zinc slates are also used.

Lozenges provide a good solution for the cladding of moderately curved surfaces. When hooked together, the lozenges form a mosaic of uniform surfaces with vertical and horizontal diagonals.

### Specifications of standard components

Figure 6.3.1 is a schematic representation of the lozenge system. Aside from the standard lozenges, other dimensions are also possible. The square lozenges are bent 25 mm as shown in Figure 6.3.2.

Figure 6.3.3 A shows the half-lozenge for eaves abutment and figure 6.3.3 B shows the half-lozenge for ridge abutment. Sizes and material thicknesses are the same as with whole lozenges. With a "top" half-lozenge, both a sliding clip and a soldered clip can be used.

### Sliding clip, 70 mm x 50 mm

Material thickness as for the lozenge. The sliding clip functions

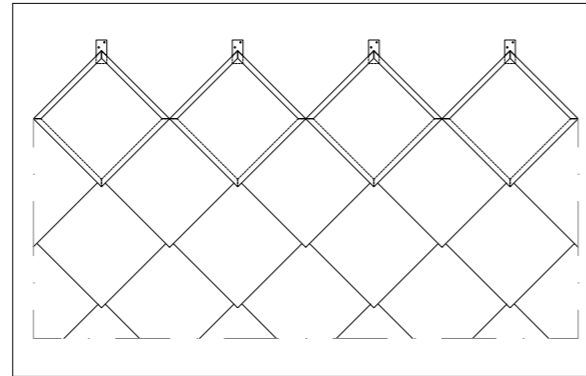


Figure 6.3.1

| Lozenge size | Cutting size | Number/m <sup>2</sup> |
|--------------|--------------|-----------------------|
| 450 x 450 mm | 500 x 500 mm | approx. 5,6           |
| 280 x 280 mm | 330 x 330 mm | approx. 15,3          |
| 200 x 200 mm | 250 x 250 mm | approx. 32            |

Tabel 6.3.1

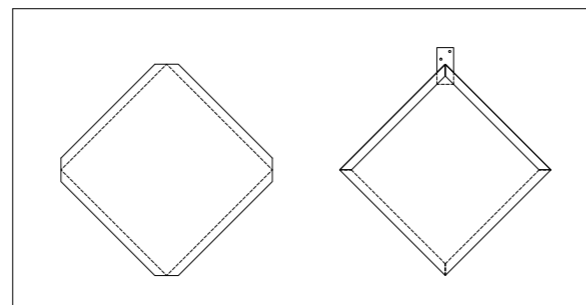


Figure 6.3.2

| Lozenge size width 'b' | Cutting size | Number/m <sup>2</sup> |
|------------------------|--------------|-----------------------|
| 200 mm*                | 250 mm       | approx. 25,6          |
| 250 mm*                | 300 mm       | approx. 15,3          |
| 280 mm*                | 330 mm       | approx. 11,9          |

Table 6.3.2 Dimensions of standard lozenge, rhombus, vertex 50

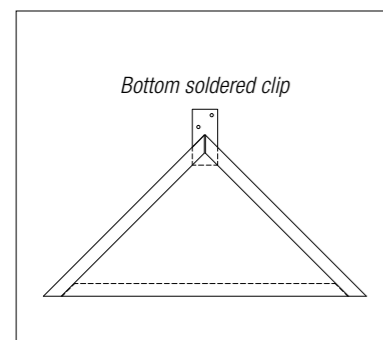


Figure 6.3.3 A

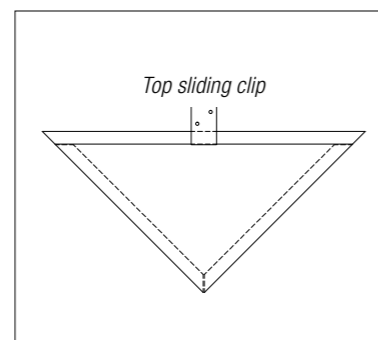


Figure 6.3.3 B

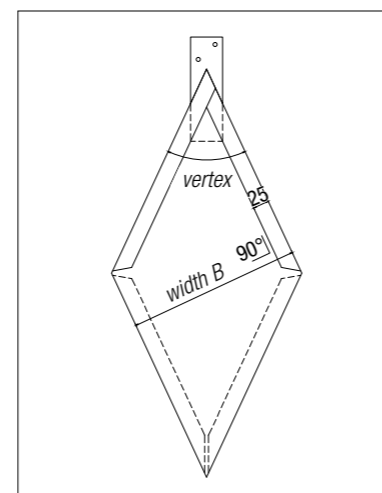


Figure 6.3.4

as a support clip. These support clips can be made by the sheet metal worker himself.

### Soldered clips

Width: 50 mm, length approx. 100 mm, depending on the location and space for fitting on the base.

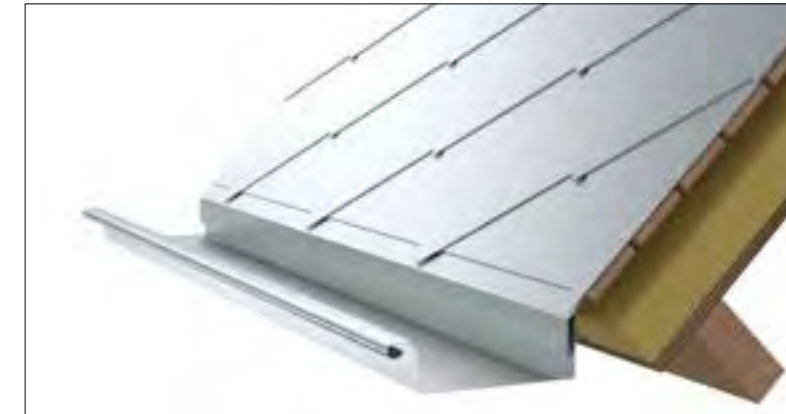


Figure 6.3.5

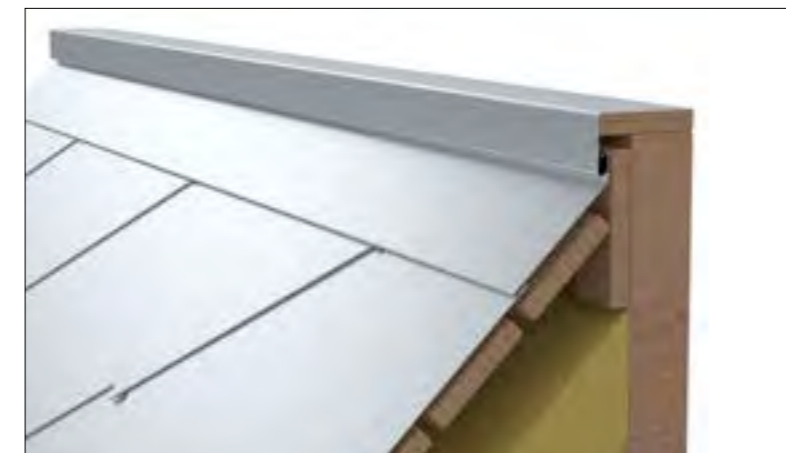


Figure 6.3.6

The clip can be made by the sheet metal worker himself and soldered to the lozenge.

### Profiles

The dimensions of the eaves profiles, attachment profiles, etc. will depend on the on-site dimensions and can either be made by



the sheet metal worker or supplied custom-made in lengths as custom items.

### Support

The lozenge roof must be fully supported by timber, preferably of rough, unplanned boards, 23-25 mm thick and not tongue and -grooved, with gaps of at least 5 mm. Use galvanised nails with a zinc-layer thickness of at least 20 microns or AISI 304 stainless steel for fastening.

#### 6.3.1 Lozenge system on a ventilated system

See chapter 4 for standard and alternative built ups.

#### Ventilated façade built up with the NedZink lozenge system.

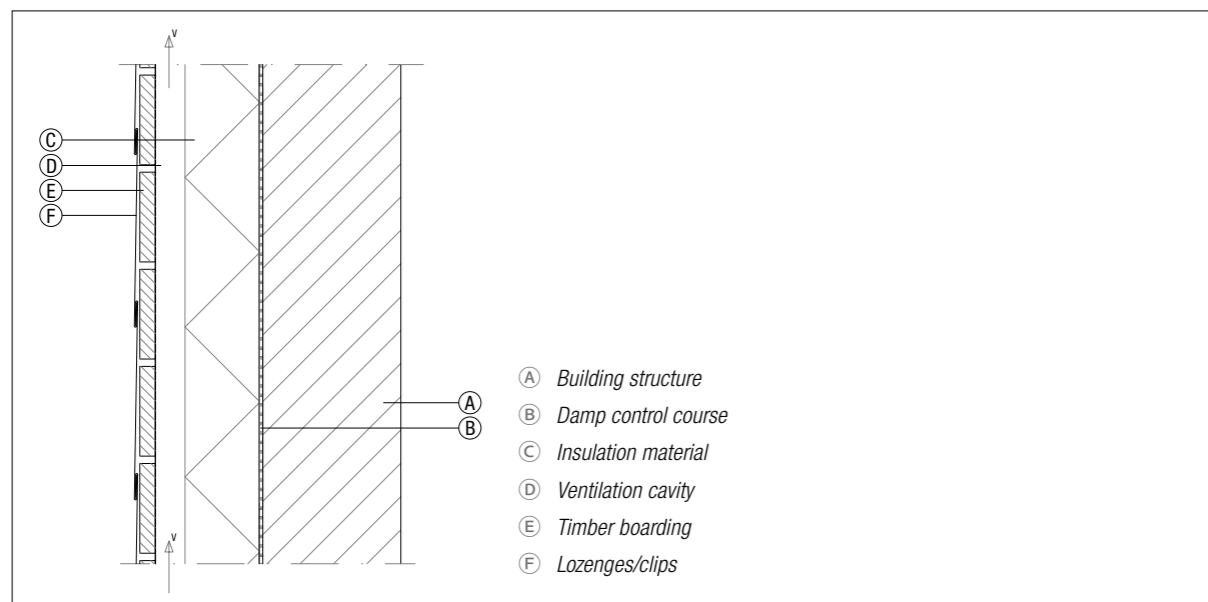


Figure 6.3.7

The construction of the façade is built up as follows, beginning on the inside:

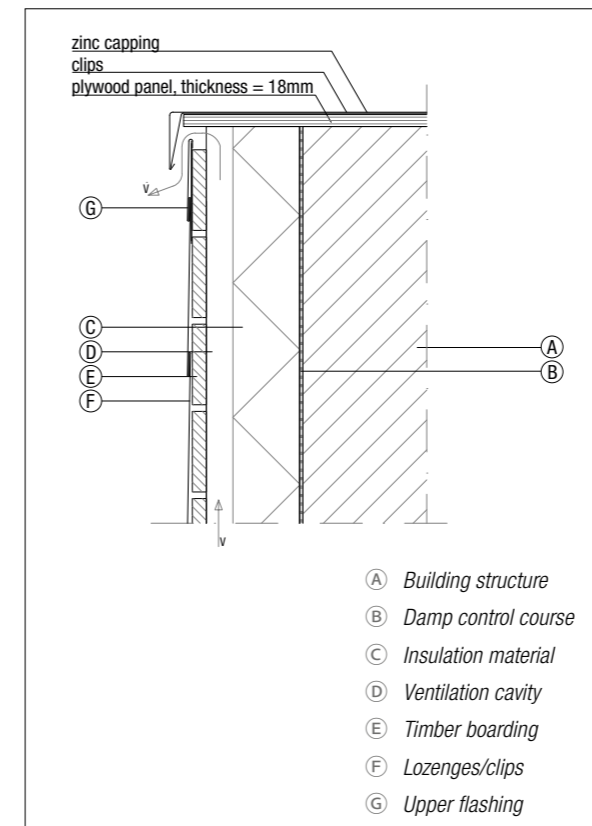


Figure 6.3.8 Ridge connection

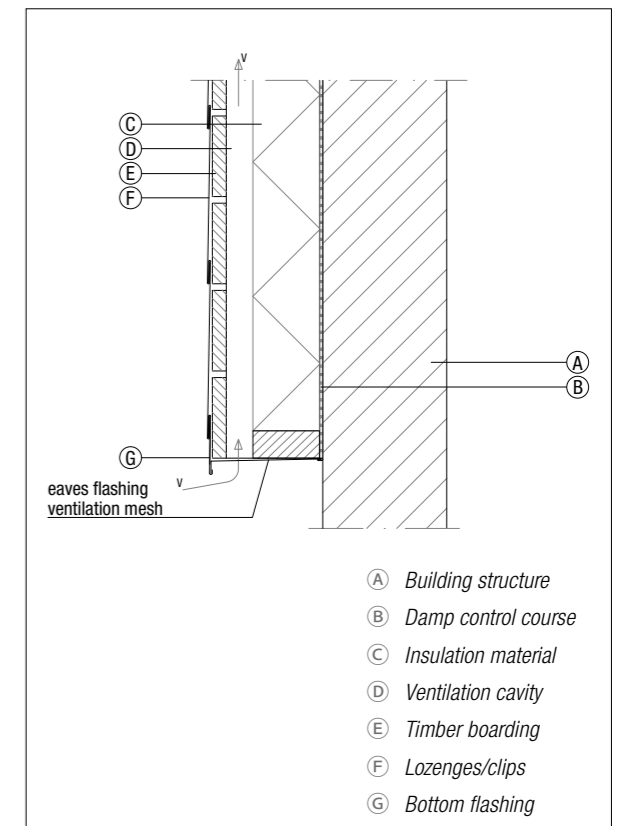


Figure 6.3.9 Eaves connection

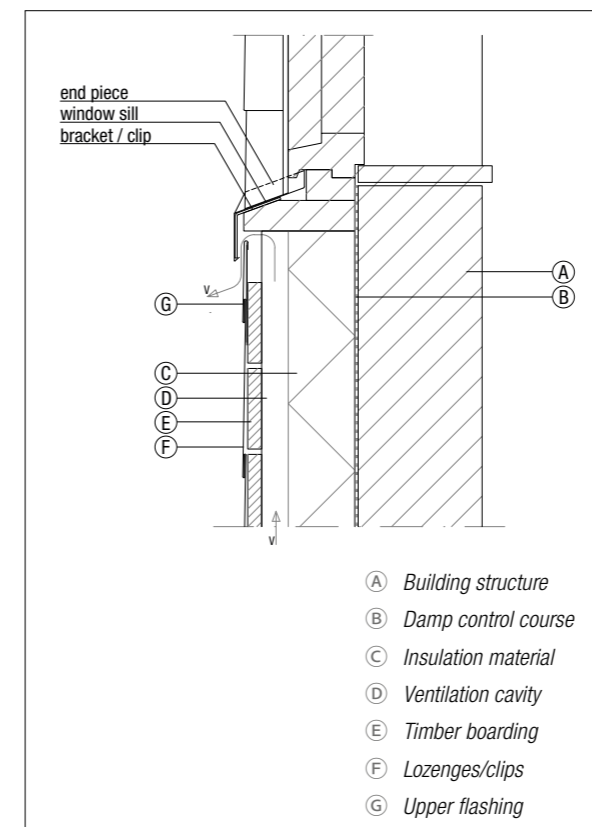


Figure 6.3.10 Window sill

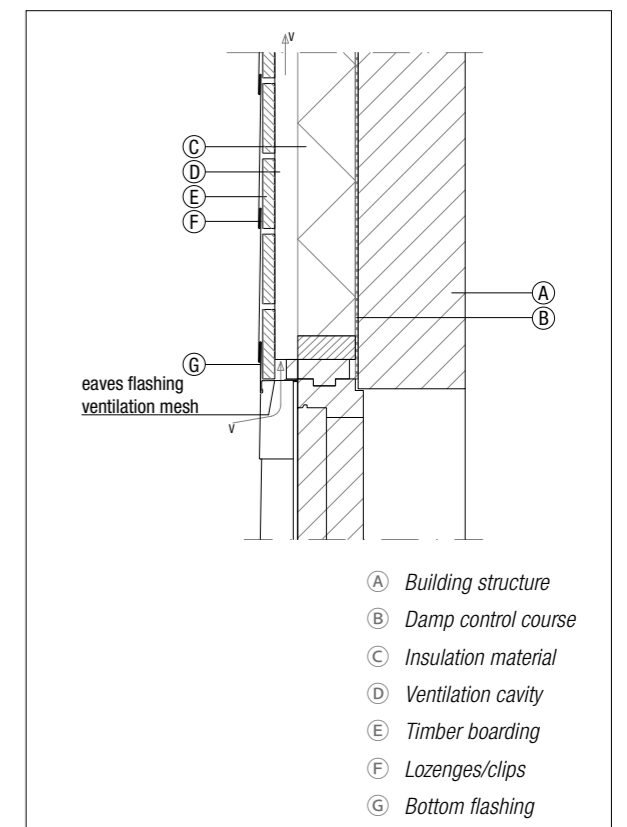


Figure 6.3.11 Window head

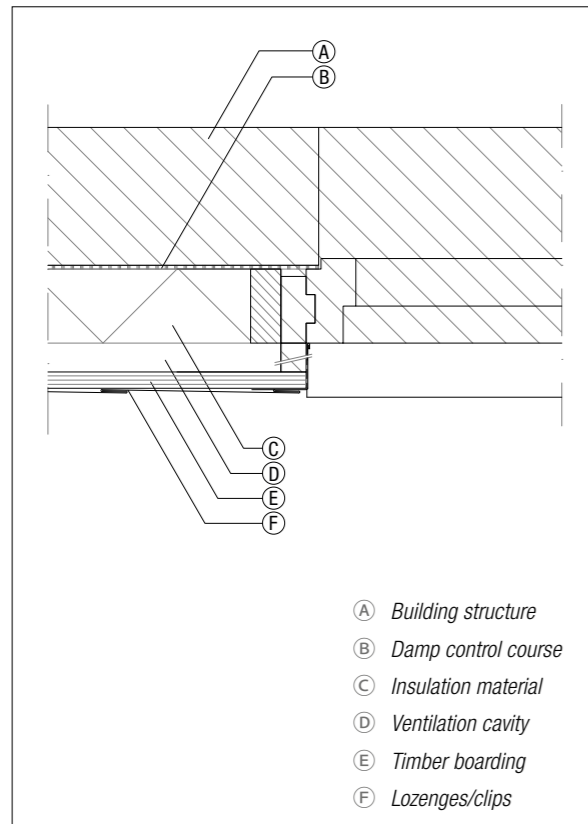


Figure 6.3.12 Window jamb

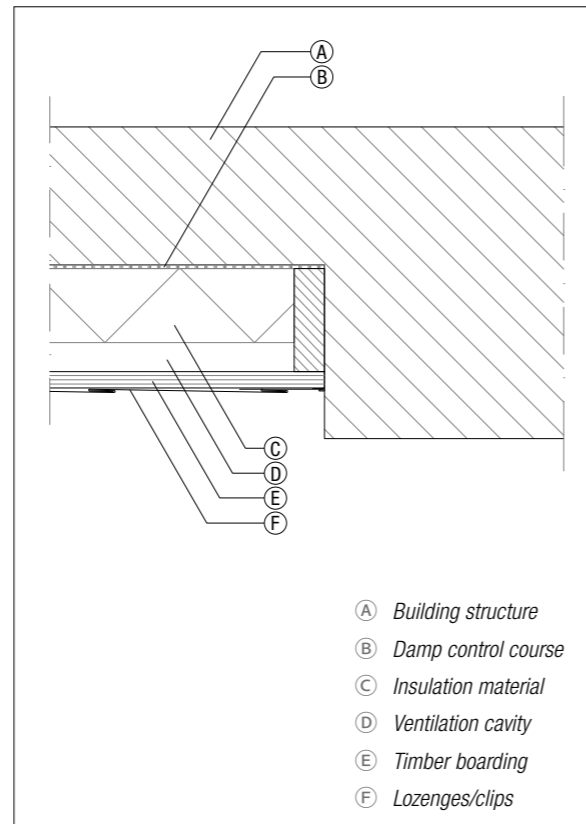


Figure 6.3.13 Wall abutment

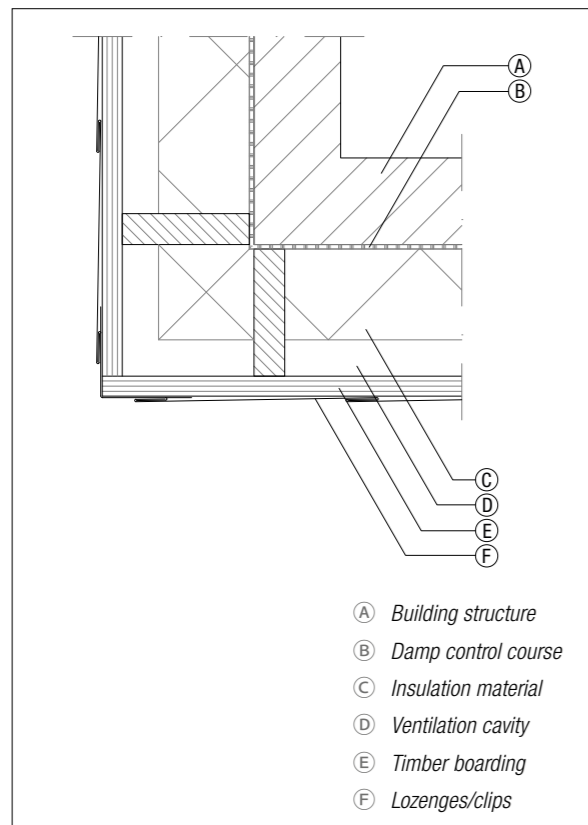


Figure 6.3.14 Outside corner

1. Building structure - any type, although it must be able to support the insulating material, or have the insulation attached to it
2. Damp control course made of metal or plastic film
3. Supporting rafters – generally made from wood



4. Insulation material according to thermal requirements
5. Ventilated cavity appr. 25 to 30 mm
6. Timber boarding, planed no less than 23 mm, not tongue-and-grooved, installed horizontally with gaps between the boards of at least 5 mm
7. Lozenge system

**Lozenge system details ventilated.**

**6.3.2 Lozenge system on a damp proof system**

See chapter 4 for standard and alternative built ups.

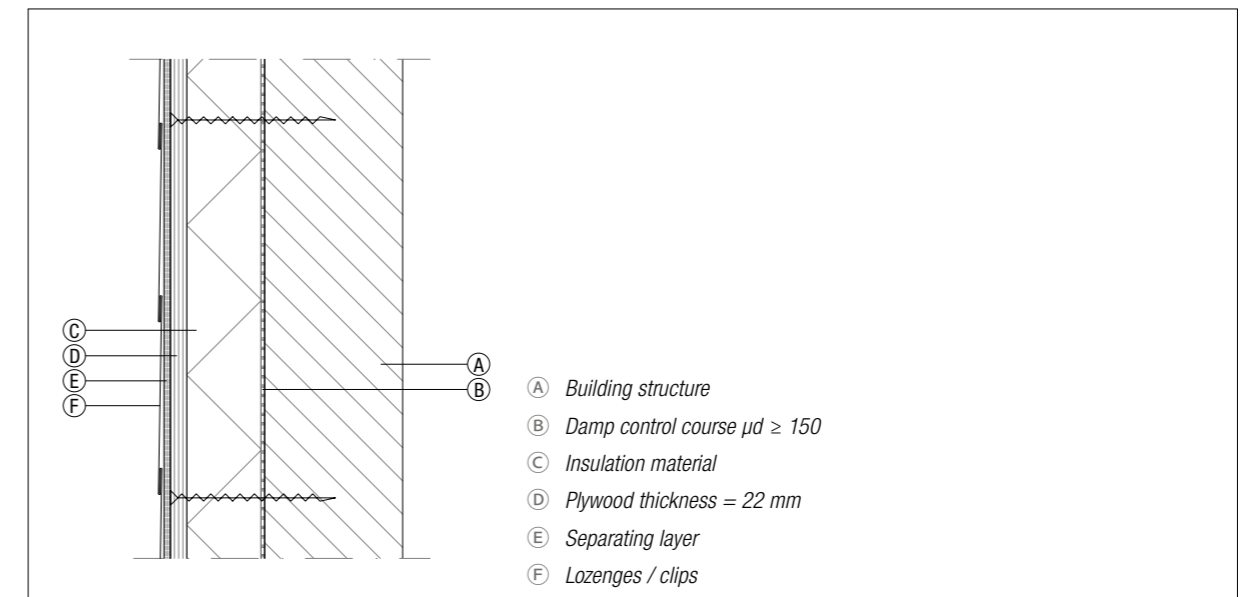


Figure 6.3.15

**Damp proof façade built up with NedZink lozenge system.**

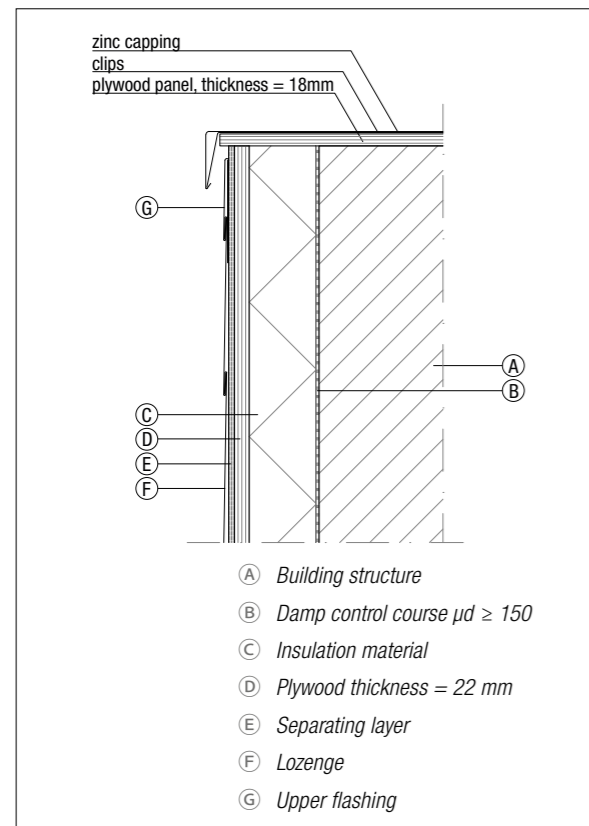


Figure 6.3.16 Ridge connection

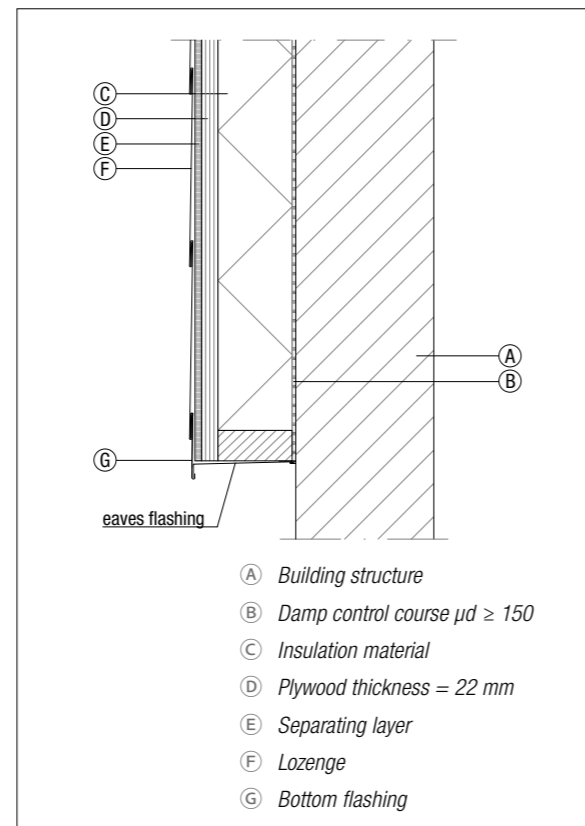


Figure 6.3.17 Eaves connection

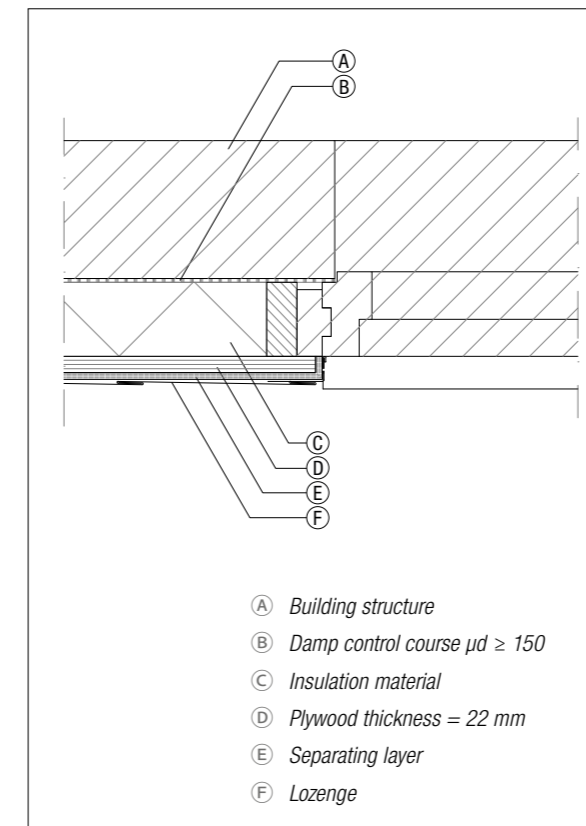


Figure 6.3.20 Window jamb

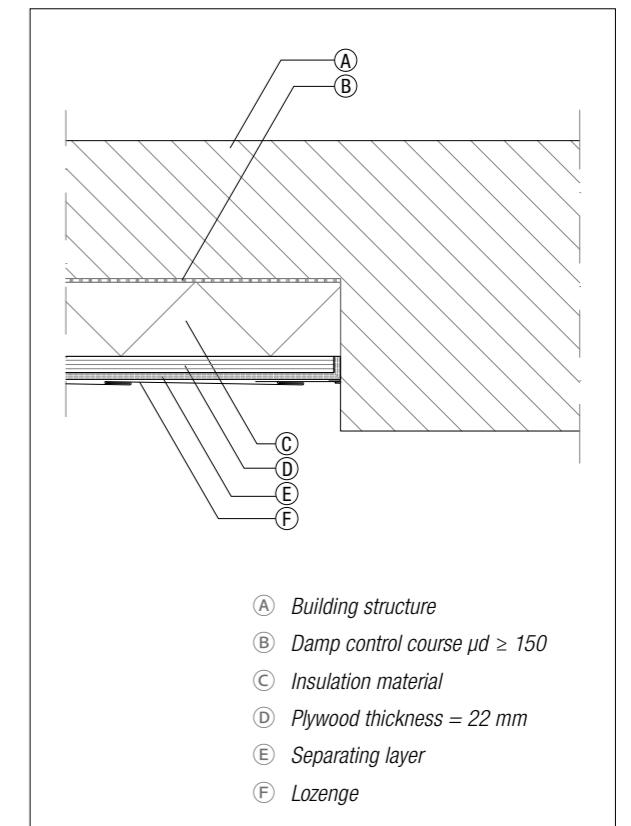


Figure 6.3.21 Wall abutment

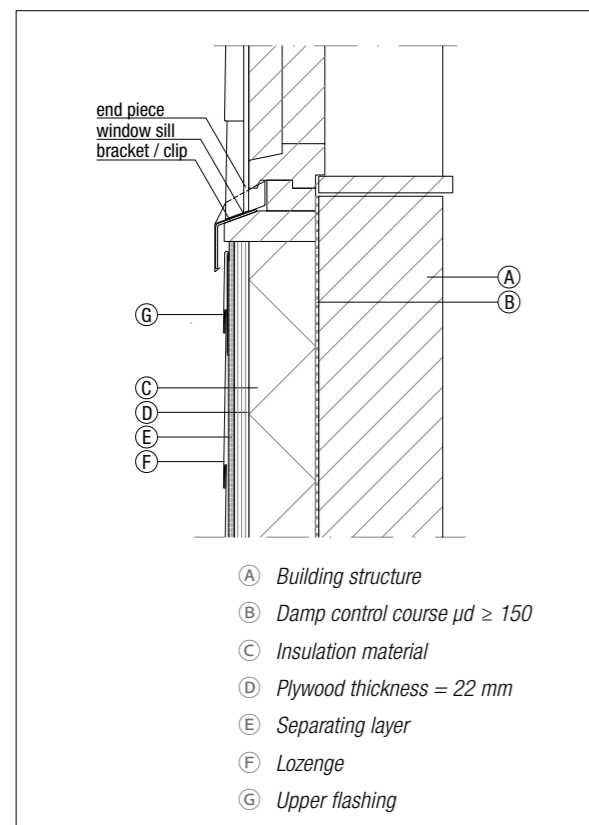


Figure 6.3.18 Window sill

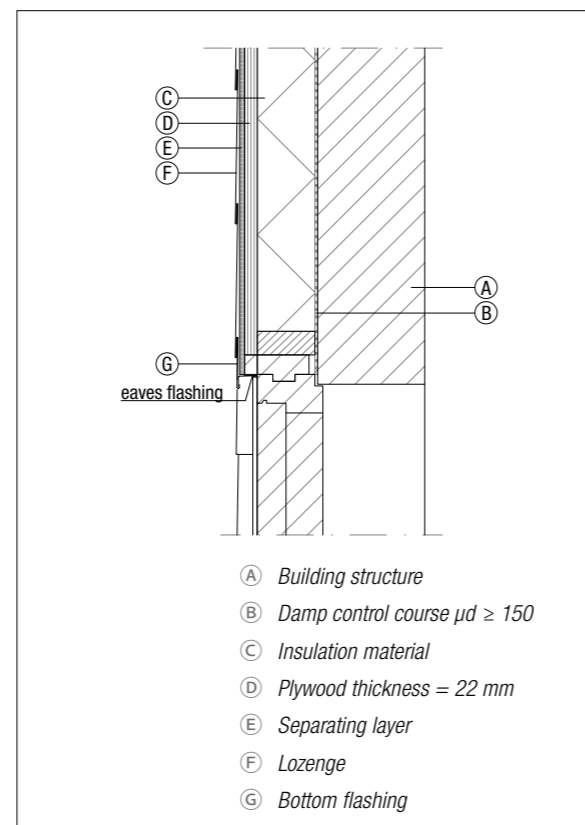


Figure 6.3.19 Window head

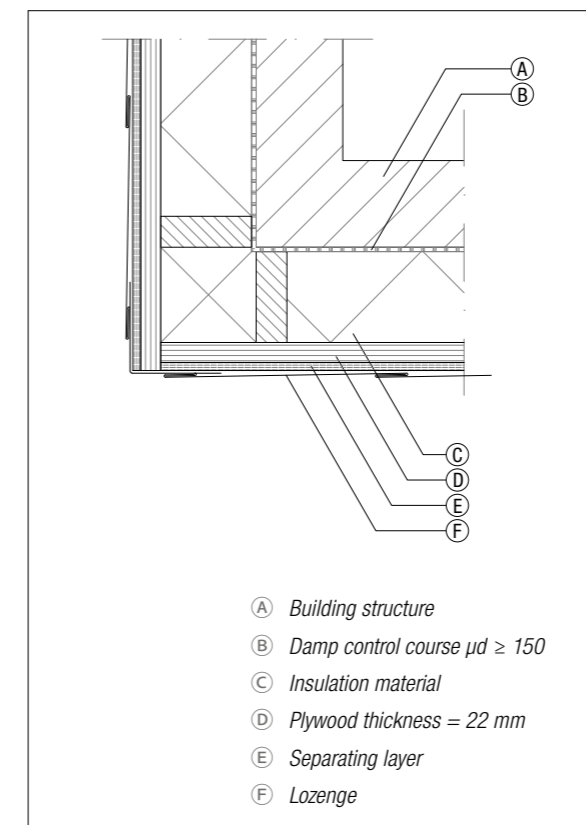


Figure 6.3.22 Outside corner

The construction of the façade is built up as follows, beginning on the inside:

1. Building structure
2. Damp control course  $\mu_d \geq 150$  m
3. Insulation layer, according to thermal requirements
4. Wooden substructure
5. Separating layer

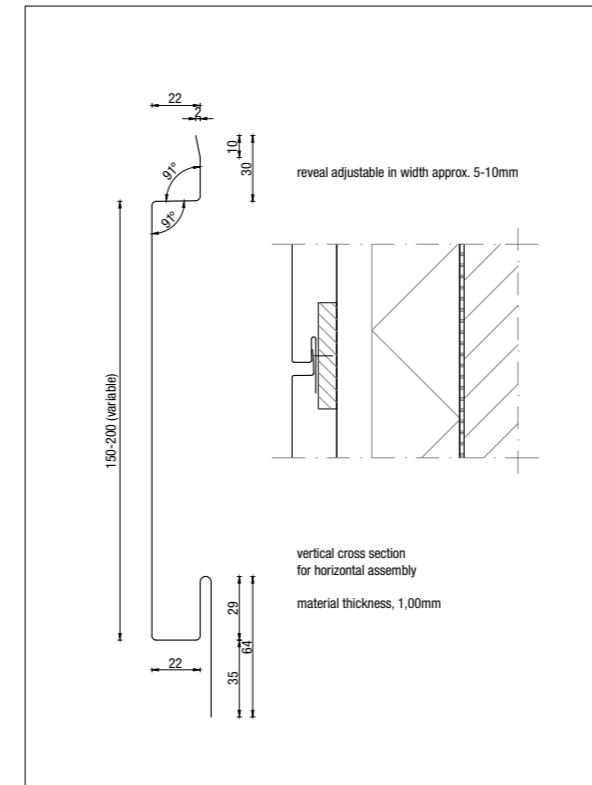


Figure 6.4.1

6. Lozenge system

### Lozenge system details damp proof. 6.4 Reveal Panel system

The Reveal Panel system is suitable for façade cladding and can be installed both vertically and horizontally. The system consists of profiled zinc sheets with a variable width size max. 200 mm. The Reveal Panel profiles are assembled such that a joint (reveal) is created. The system is connected with a tongue and groove. The dimensions of the panels and joints are variable, as are the lengths of the reveal panels.

In this chapter the reveal panel as shown in figure 6.4.1 is used as an example.

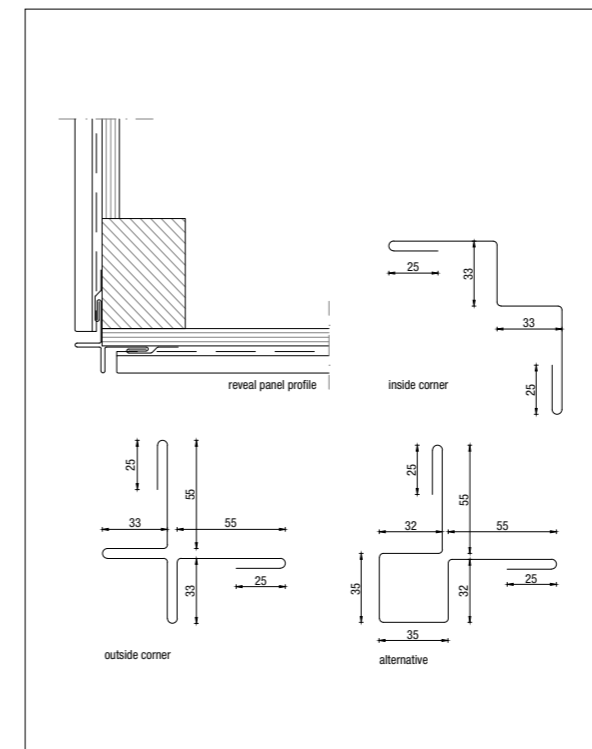


Figure 6.4.2

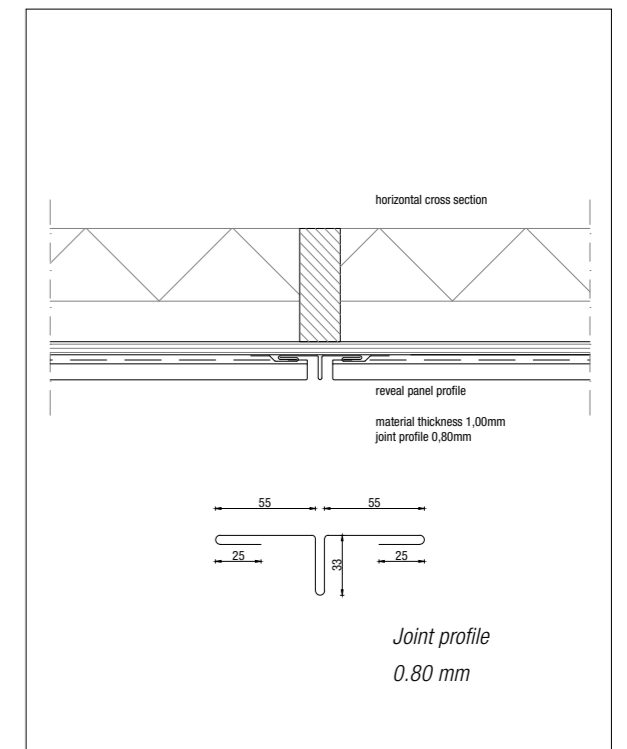


Figure 6.4.3

Generally, the system is applied with a material thickness of 1.0 mm. A standard solution is available for most connections, such as inside and outside corners. Different profiles are available, such as corner, joint and water check profiles (Figures 6.4.1., 6.4.2 and 6.4.3).

#### Support

The façade with Reveal Panel profiles must be supported by a wooden substructure, preferably unplanned timber boarding, 23 - 25

mm thick, not tongue-and-grooved. The gap between the timber boards must be at least 5 to 10 mm. The boards may be spaced up to 100 mm, to be determined by the builder.

**Assembly**



Vertical Reveal panel system



Horizontal Reveal panel system

The

profiled panels are secured to the underlying timber boards, preferably using galvanised steel screws. Depending on the chosen panel profile type, a reveal is created between the different parts, which can be set between 5 and 10 mm width. The profile lengths are a maximum of 5 meters. For lengths longer than 4 meters, slotted holes are recommended to take up length changes of the zinc.

**Reveal Panel System details ventilated vertical bays.**

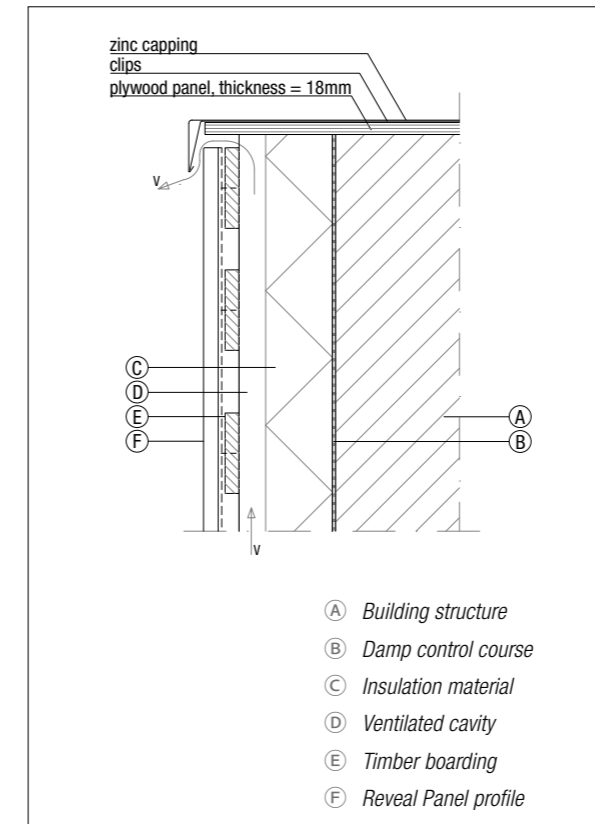


Figure 6.4.5 Ridge connection

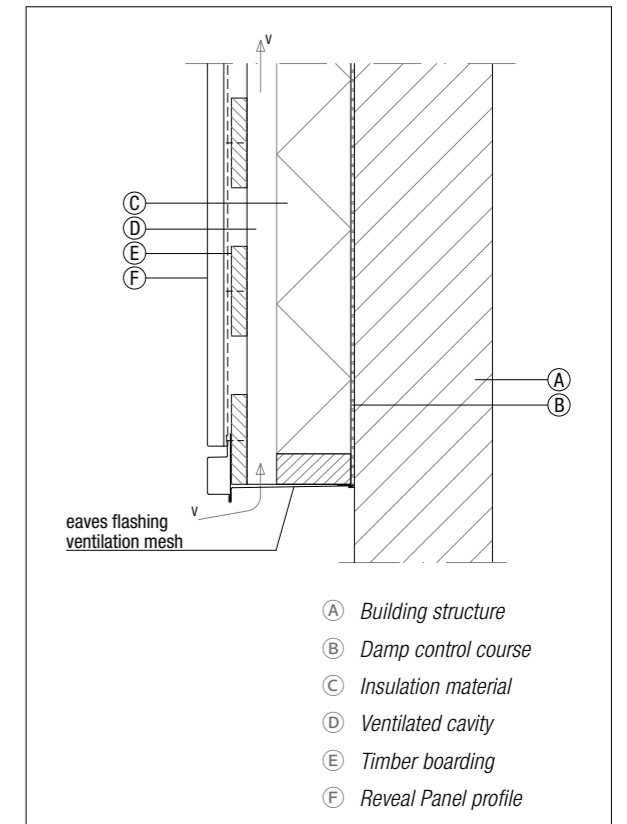


Figure 6.4.6 Eaves connection

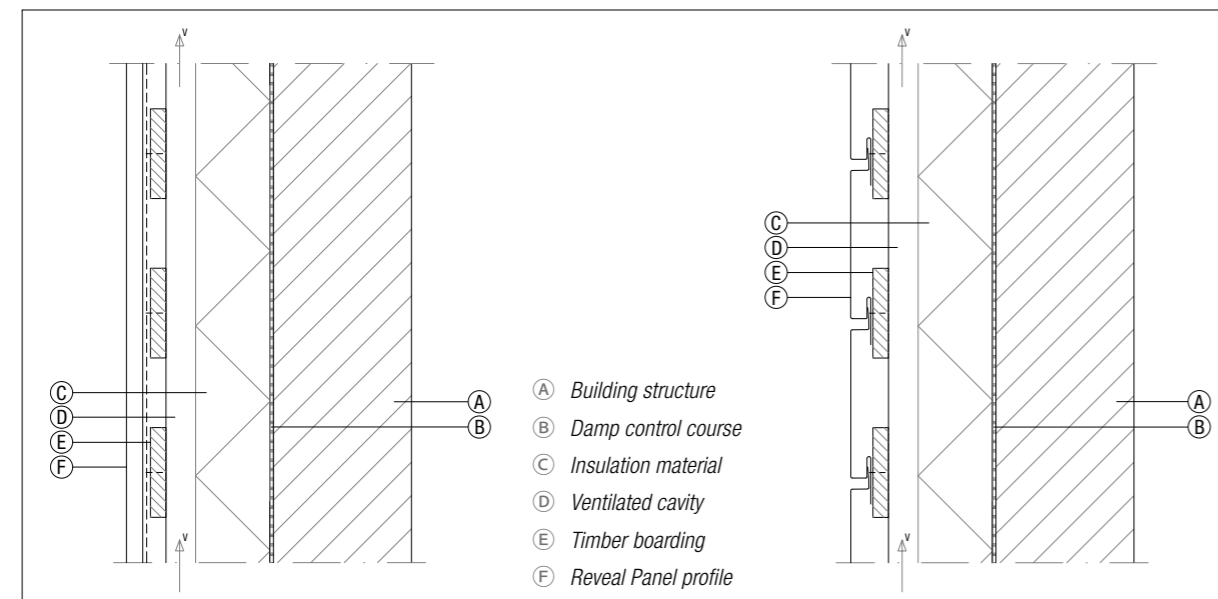


Figure 6.4.4

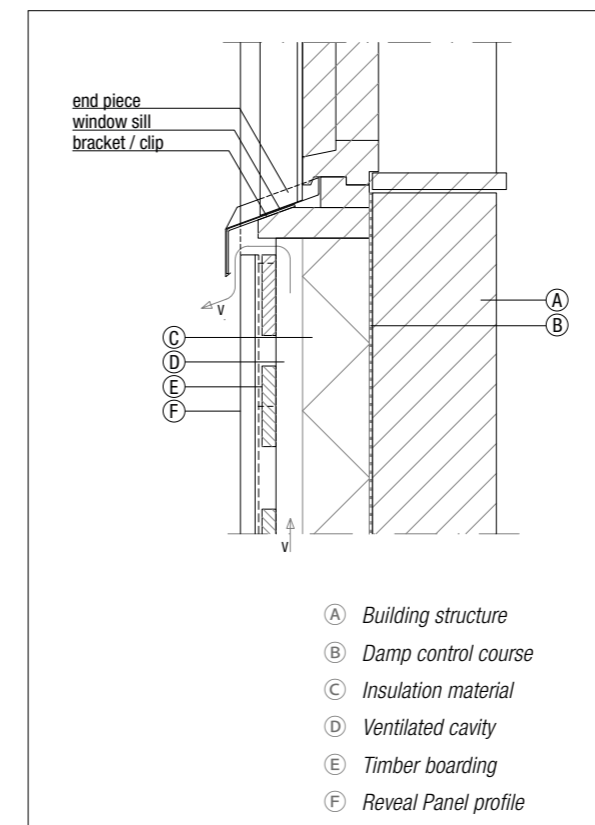


Figure 6.4.7 Window sill

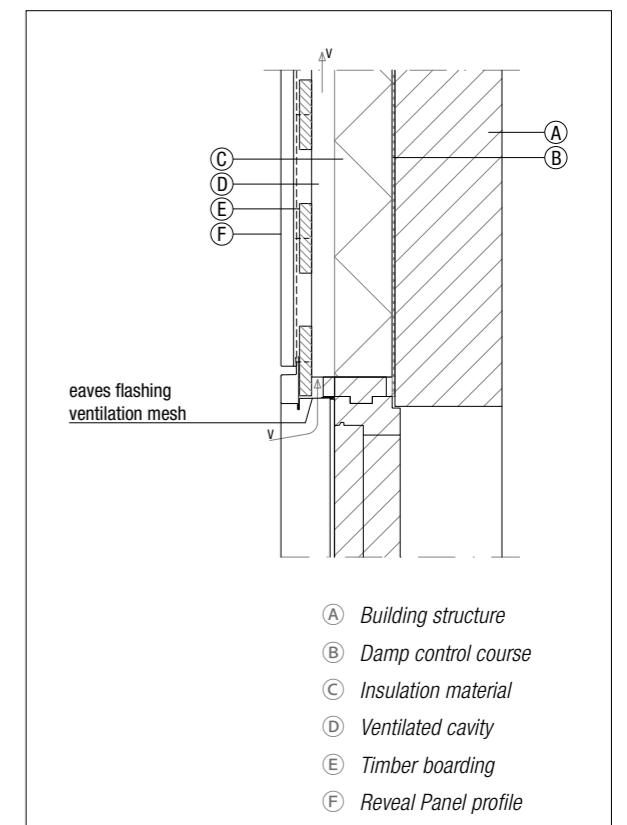


Figure 6.4.8 Window head



### 6.4.1 Reveal panel system 1 mm ventilated system

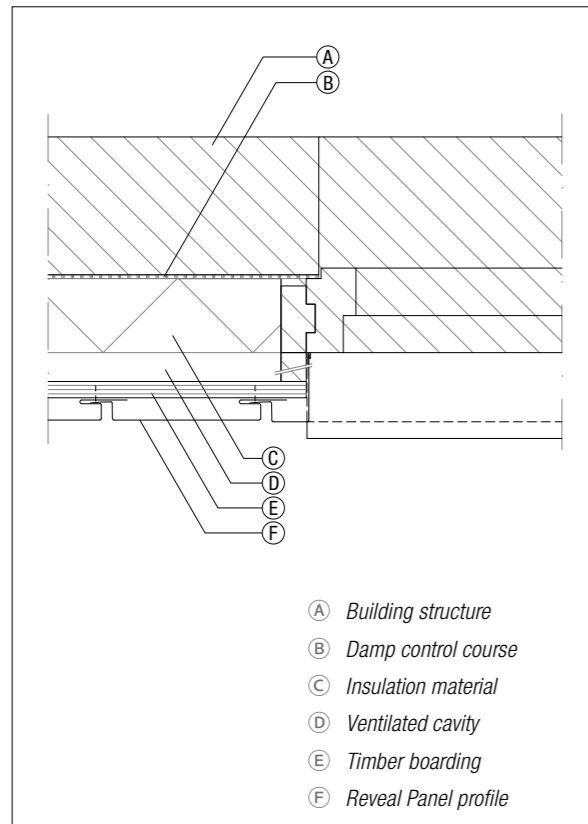


Figure 6.4.9 Window jamb

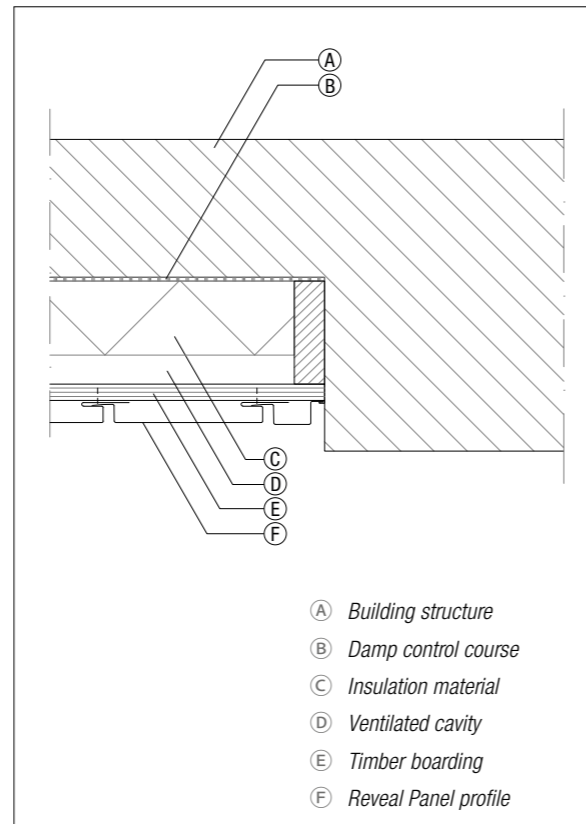


Figure 6.4.10 Wall abutment

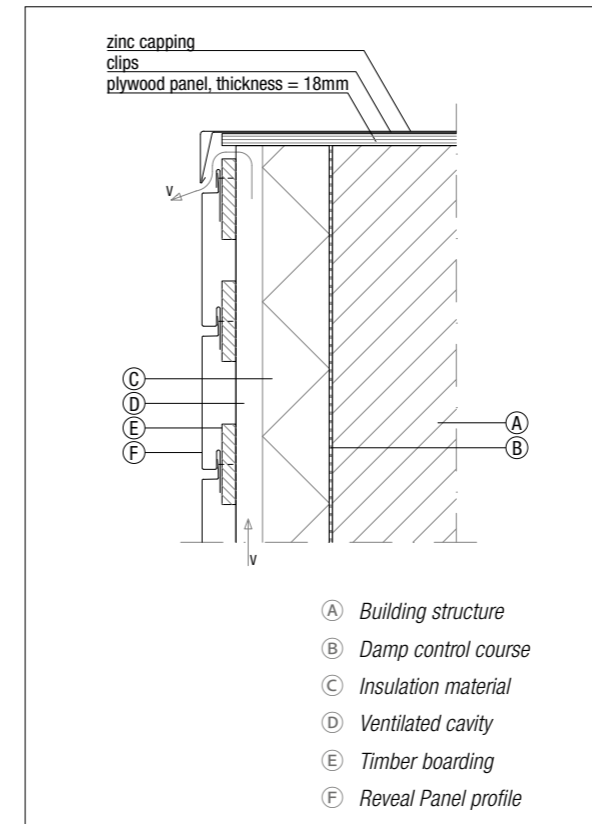


Figure 6.4.12 Ridge connection

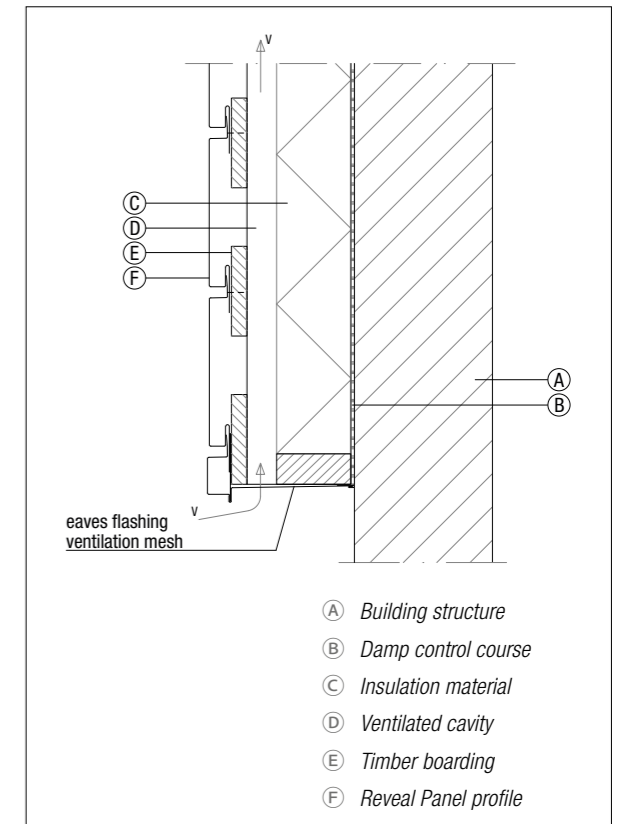


Figure 6.4.13 Eaves connection

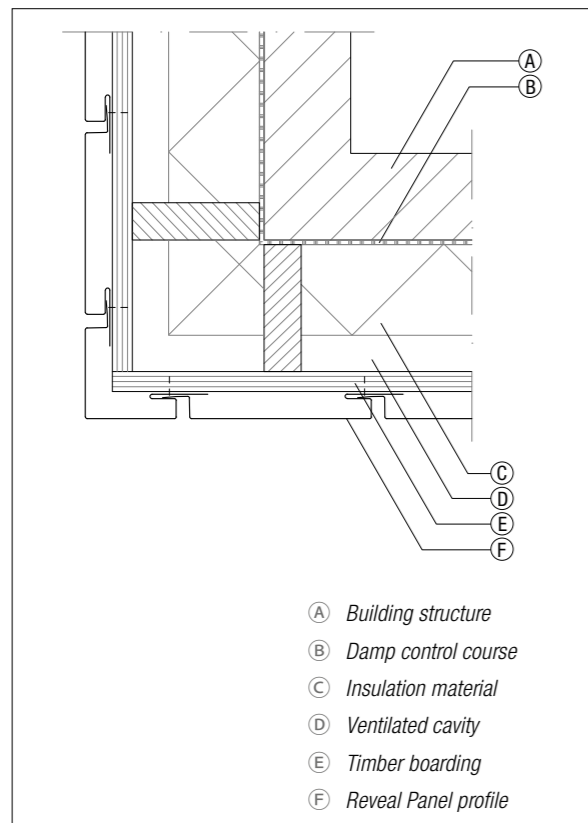


Figure 6.4.11 Outside corner

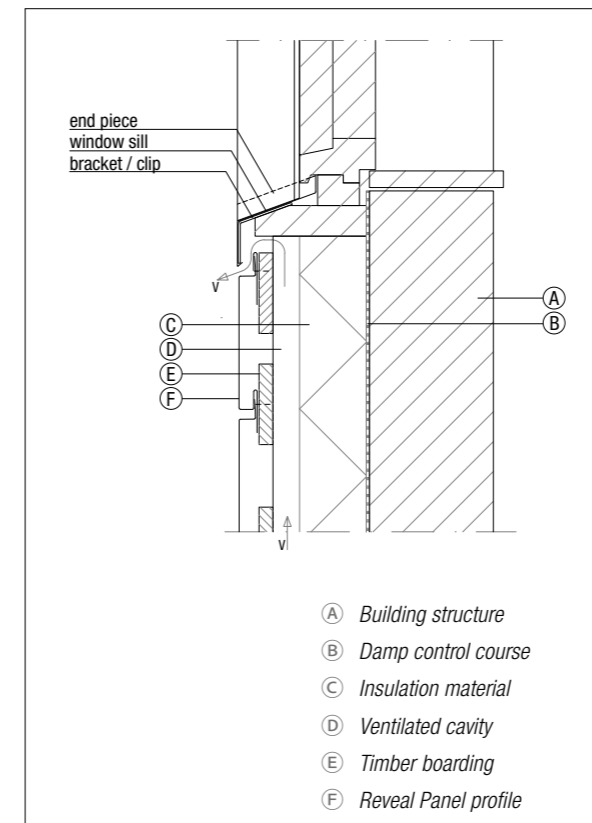


Figure 6.4.14 Window sill

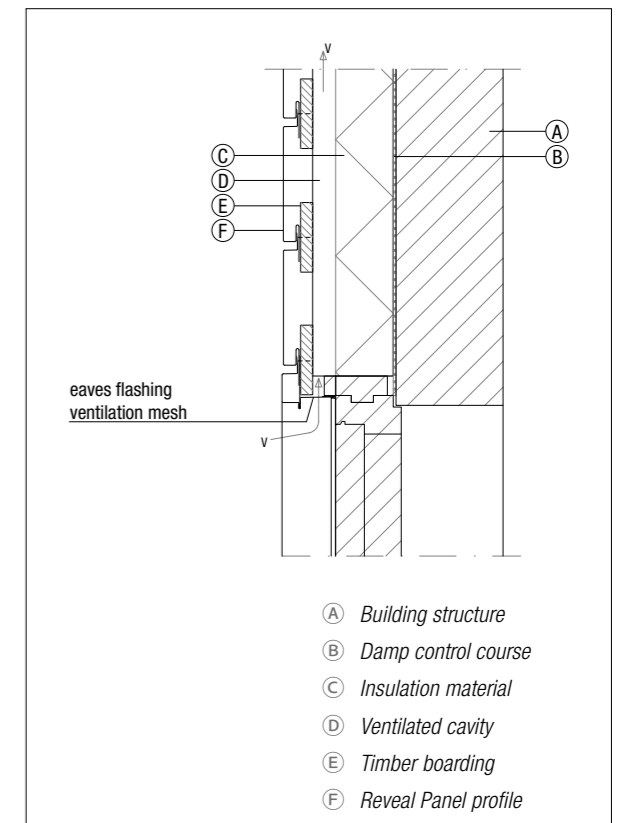


Figure 6.4.15 Window head

See chapter 4 for standard and alternative built ups.

**Ventilated façade built up with NedZink reveal panel system**



Vertical Reveal panel system



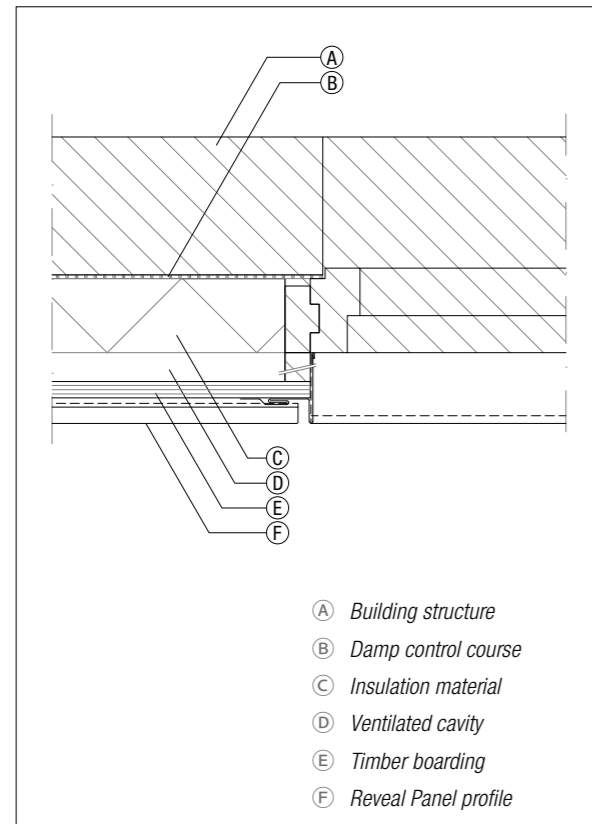
Horizontal Reveal panel system

The

construction of the façade is built up as follows, beginning on the inside:

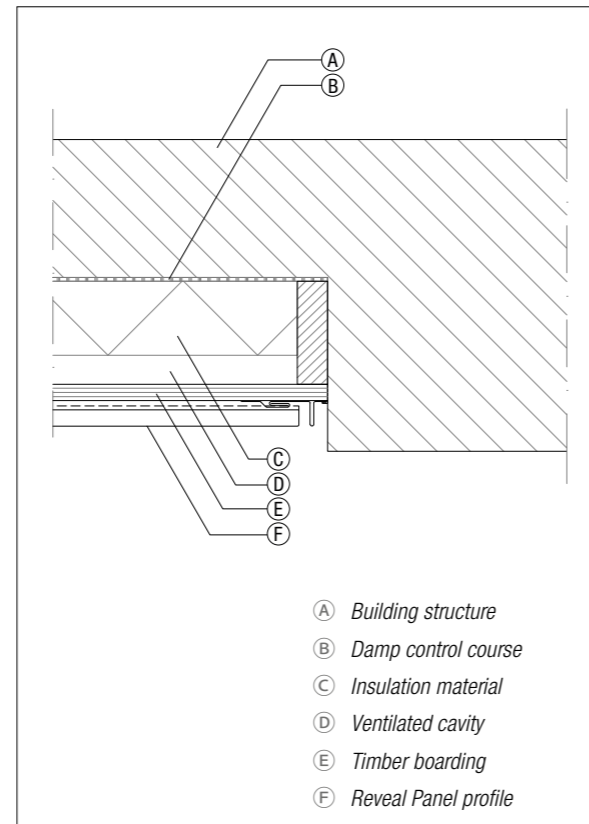
1. Building structure - any type, although it must be able to support the insulating material, or have the insulation attached to it
2. Damp control course made of metal or plastic film
3. Supporting rafters – generally made from wood
4. Insulation material according to thermal requirements
5. Ventilated cavity appr. 25 to 30 mm
6. Timber boarding unplanned timber boarding 23 mm minimum thickness, not tongue and groove, installed horizontally with gaps between the boards

Horizontal bays: The gap depends on the placing of the clips for the horizontal bays



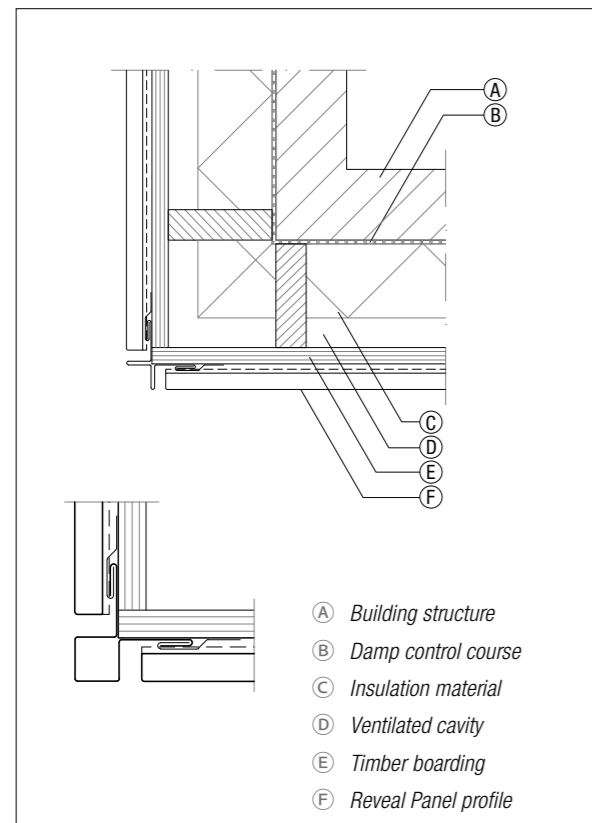
- (A) Building structure
- (B) Damp control course
- (C) Insulation material
- (D) Ventilated cavity
- (E) Timber boarding
- (F) Reveal Panel profile

Figure 6.4.16 Window jamb



- (A) Building structure
- (B) Damp control course
- (C) Insulation material
- (D) Ventilated cavity
- (E) Timber boarding
- (F) Reveal Panel profile

Figure 6.4.17 Wall abutment



- (A) Building structure
- (B) Damp control course
- (C) Insulation material
- (D) Ventilated cavity
- (E) Timber boarding
- (F) Reveal Panel profile

Figure 6.4.18 Outside corner

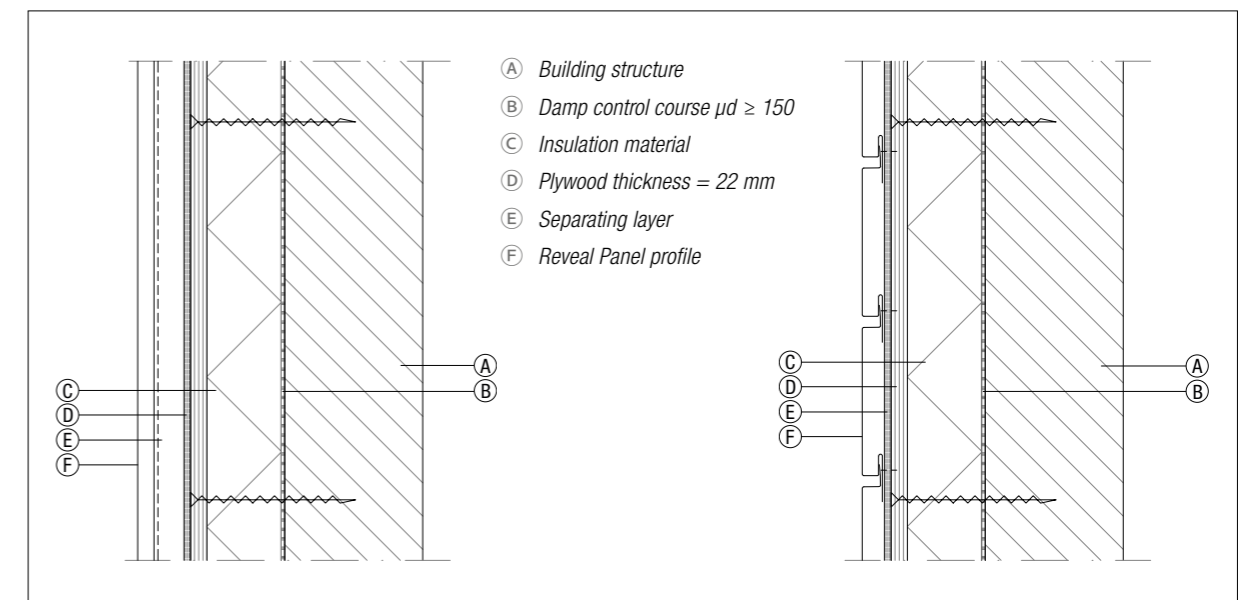


Figure 6.4.19

Vertical bays: The gap between the timber boards must be at least 5 mm. The boards may be spaced up to 100 mm, to be

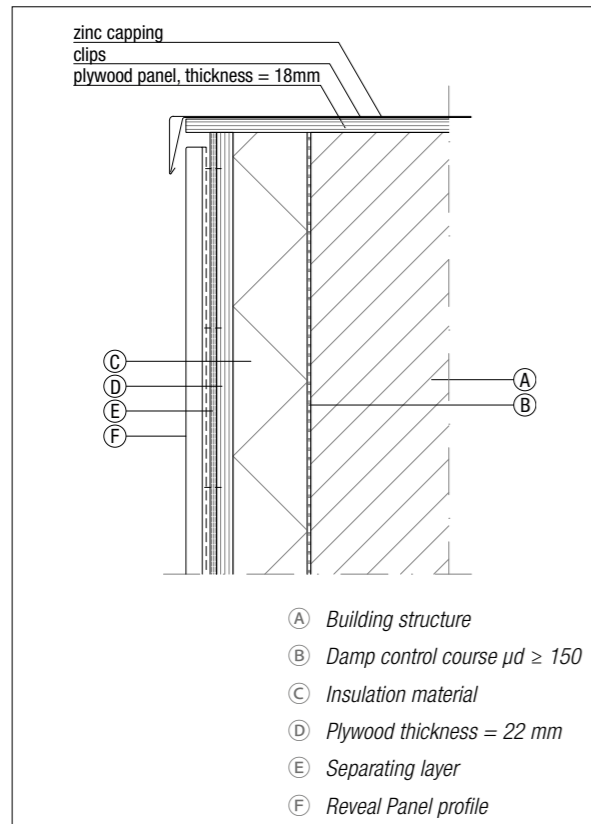


Figure 6.4.20 Ridge connection

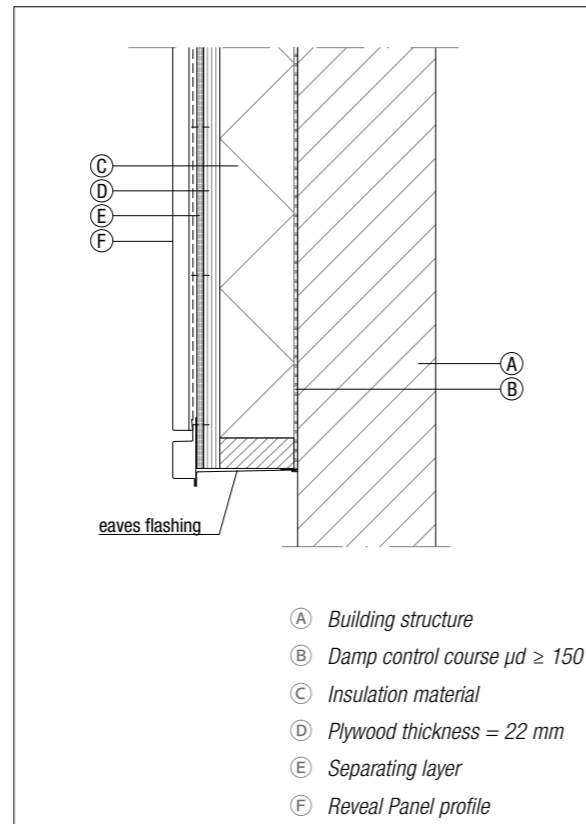


Figure 6.4.21 Eaves connection

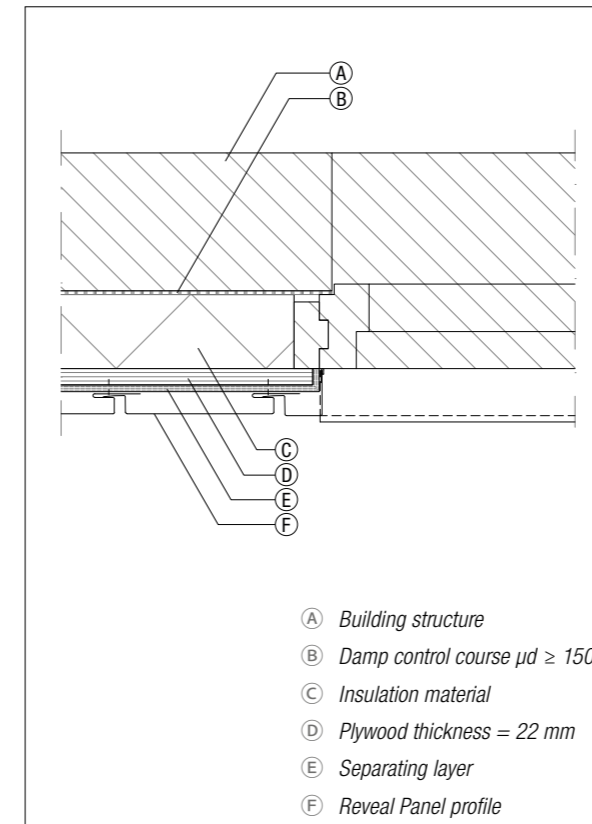


Figure 6.4.24 Window jamb

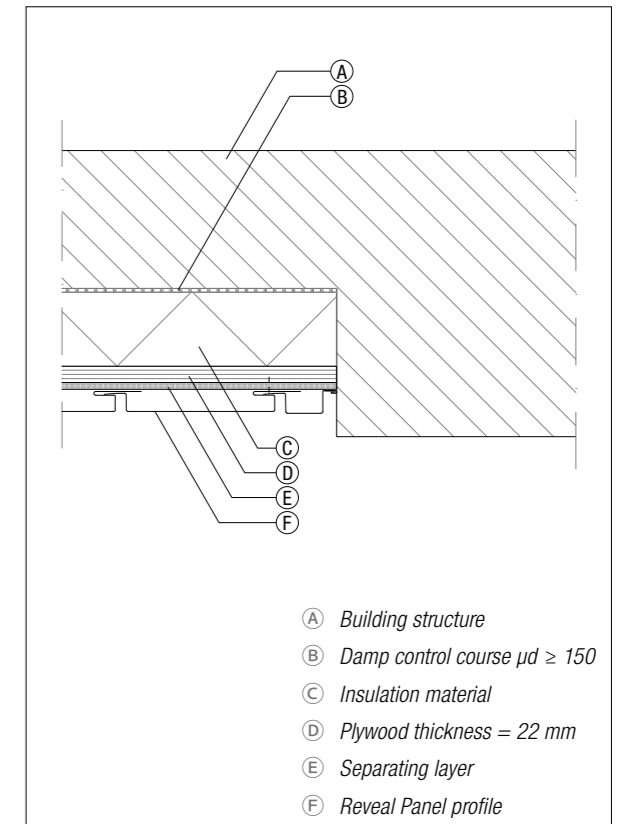


Figure 6.4.25 Wall abutment

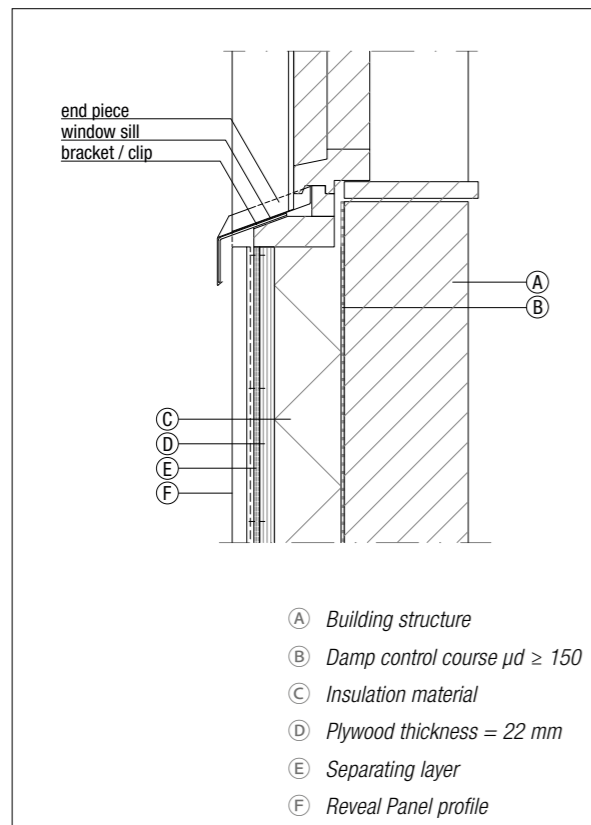


Figure 6.4.22 Window sill

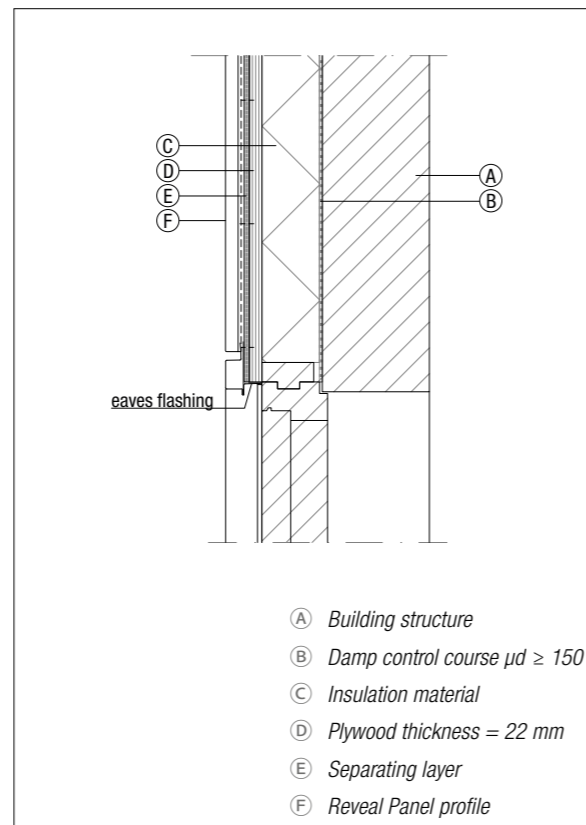


Figure 6.4.23 Window head

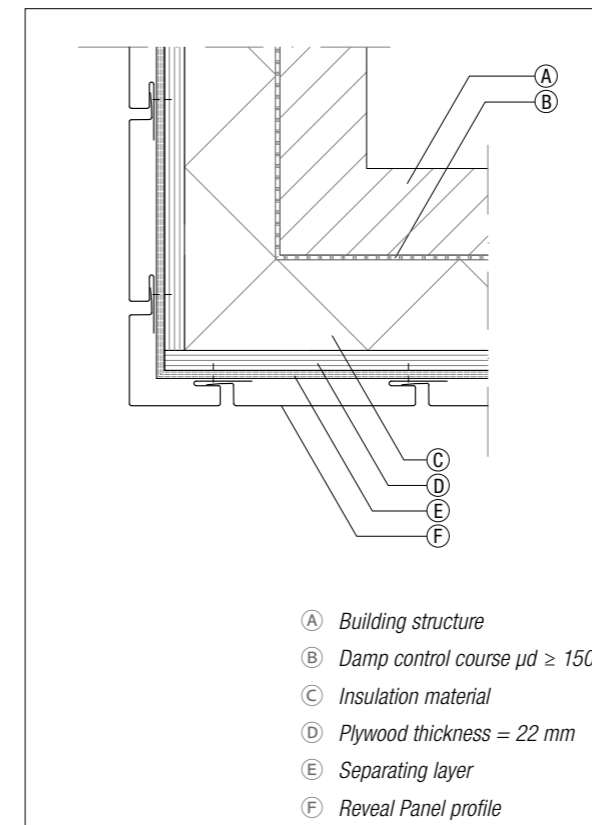


Figure 6.4.26 Outside corner

determined by the builder

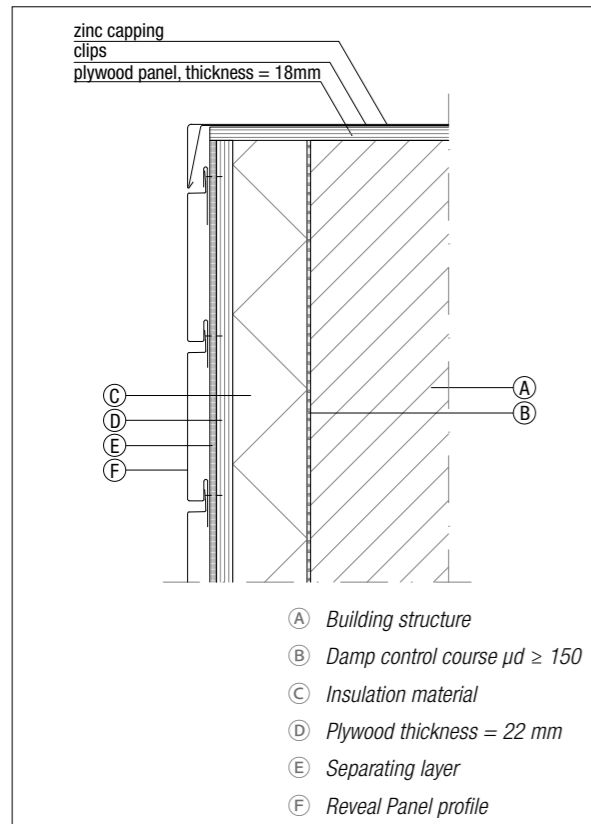


Figure 6.4.27 Ridge connection

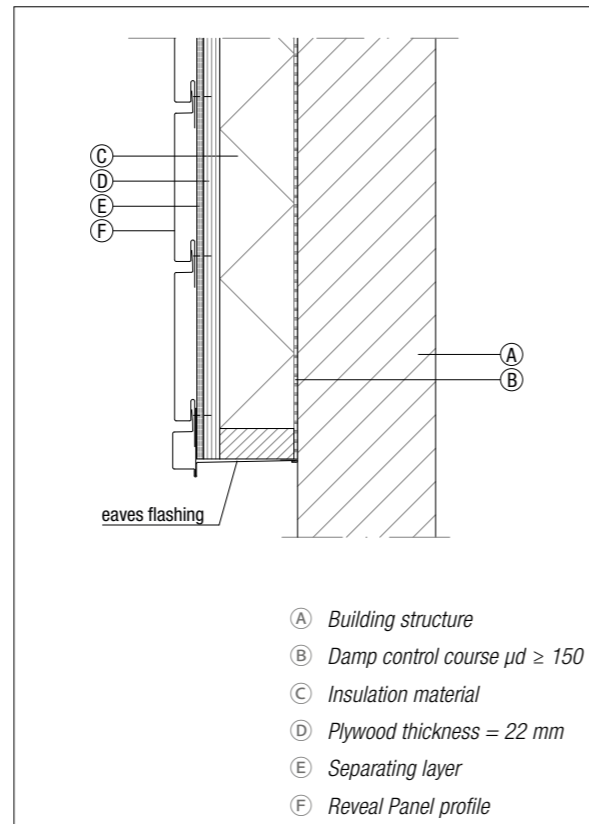


Figure 6.4.28 Eaves connection

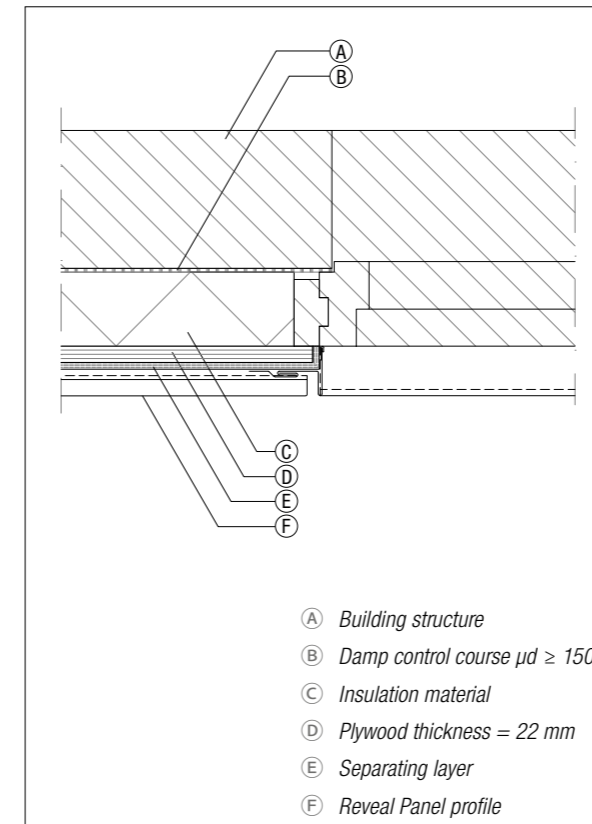


Figure 6.4.31 Window jamb

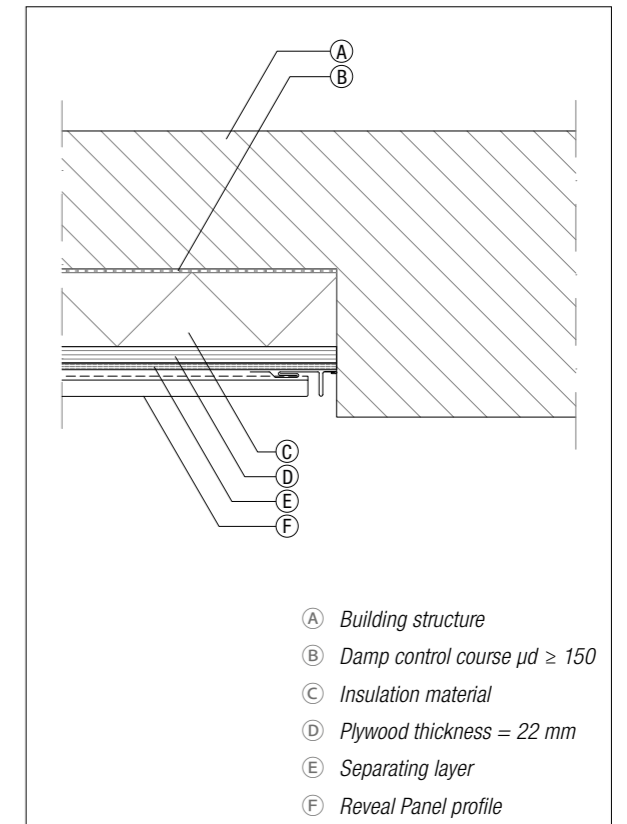


Figure 6.4.32 Wall abutment

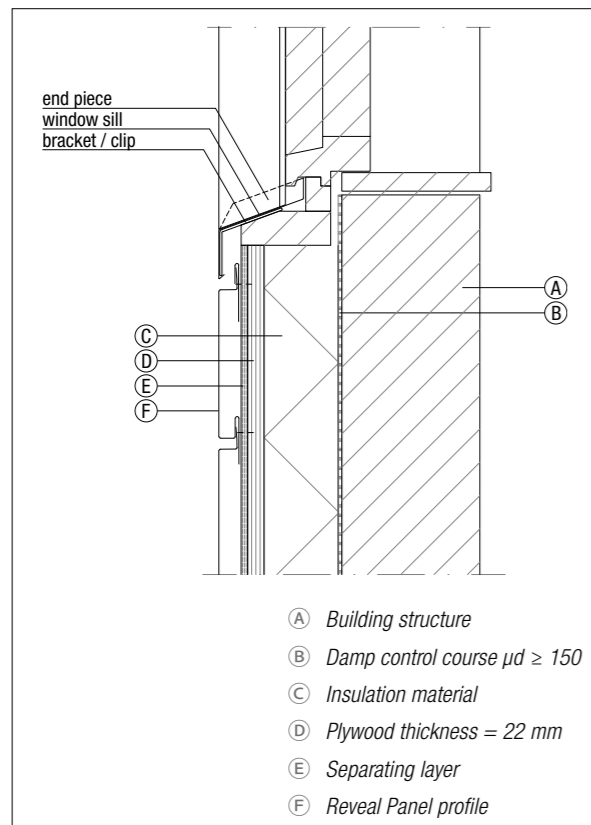


Figure 6.4.29 Window sill

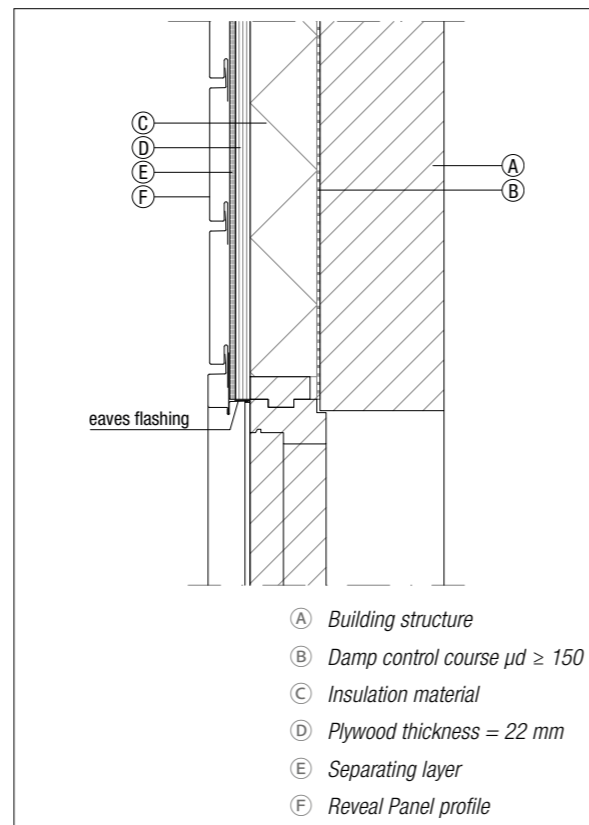


Figure 6.4.30 Window head

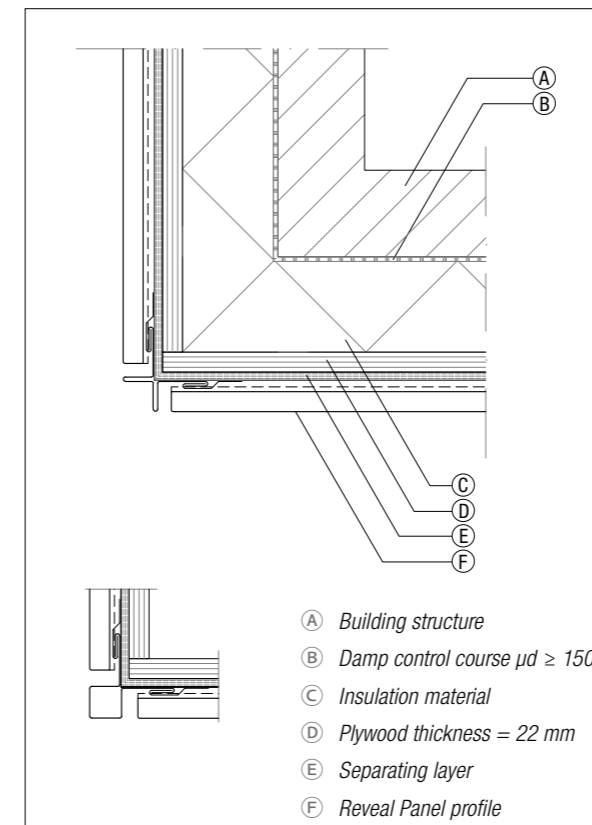


Figure 6.4.33 Outside corner

7. Reveal Panel system

**Reveal panel system details ventilated horizontal bays**

**6.4.2 Reveal Panel system 1 mm damp proof system**

See chapter 4 for standard and alternative built ups.



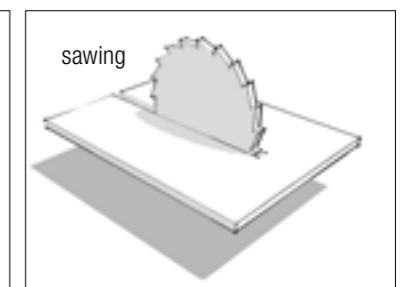
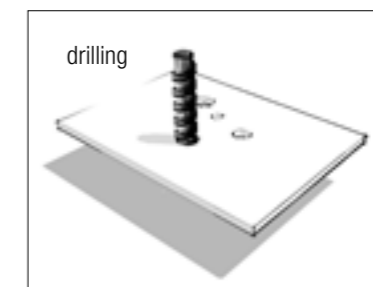
**Damp proof façade built up with NedZink reveal panel system.**

The construction of the façade is built up as follows, beginning on the inside:

1. Building structure
2. Damp control course  $\mu_d \geq 150$  m
3. Insulation layer, according to thermal requirements
4. Wooden substructure
5. Separating layer
6. Reveal Panel system

**Reveal Panel system details damp proof vertical bays**

Nedzink Nova Zinc 0.5 mm      Glue layer      LDPE core

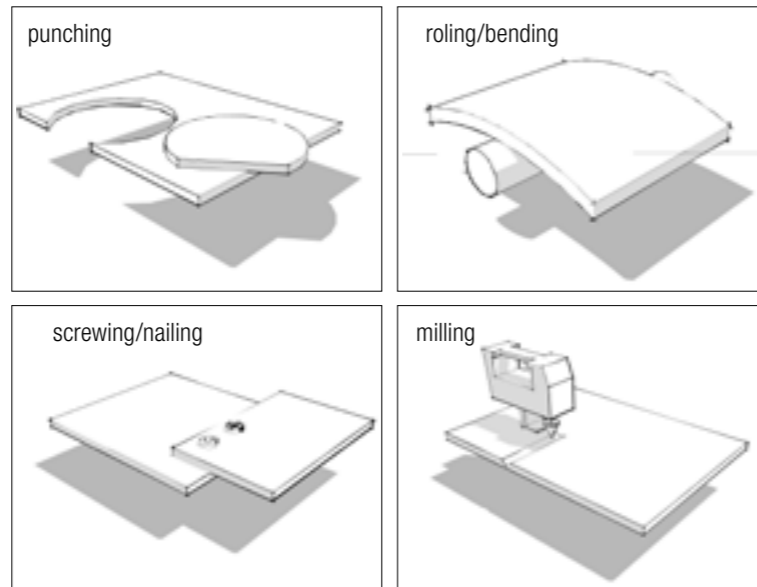


**Reveal Panel system details damp proof horizontal bays**  
**6.5 Cassette system NOVA COMPOSITE**

NOVA COMPOSITE is a prefabricated sandwich panel, with an LDPE core and covered on the outside with pre-weathered NedZink NOVA zinc. This combination creates a flat, stiff panel that is exceptionally suitable for use as façade cladding. Whether using glue, internal bracket cassettes, clamps or screws, there is a solution for every application. The panel is available in a standard thickness of 4 mm, for which the thickness of the NedZink NOVA top and bottom layer is 0.5 mm.

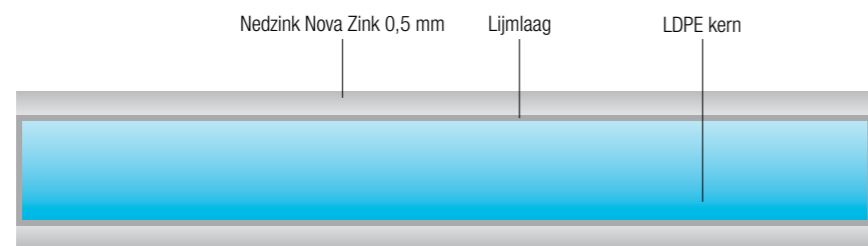
With NedZink NOVA COMPOSITE a façade can be created in zinc with large panel dimensions and exceptional flatness. Rounded elements and curved façades are possible. The assembly of the panel can be adjusted to the design.

NOVA COMPOSITE is delivered as sheets on pallets. The material comes with a protective foil on the visible side as standard. The factory-applied anti-fingerprint coating protects the zinc against fingerprints during handling and assembly.



| Product properties NOVA COMPOSITE |                       |                                      |
|-----------------------------------|-----------------------|--------------------------------------|
| Standard dimensions*              | 3200 x 1000 mm        |                                      |
| Standard panel thickness          | 4 mm                  |                                      |
| Panel composition                 | top and bottom layer: | 2 x 0,5 mm NedZink NOVA              |
|                                   | core:                 | 3 mm low density polyethylene (LDPE) |
| Toleranties                       | thickness:            | -0 / +0,4 mm                         |
|                                   | width:                | + / -2,0 mm                          |
|                                   | length:               | -0 / +4,0 mm                         |
|                                   | diagonal:             | max. 3,0 mm                          |

\*Other lengths are available on request  
 Table 6.5.1



**6.5.1 NOVA COMPOSITE cassette with internal bracket system**

**Façade built up with NedZink NOVA COMPOSITE cassette system and internal bracket system.**



The construction of the façade is built up as follows, beginning on the inside:

1. Building structure
2. Ventilated or damp proof built up
3. extruded aluminum bracket system
4. NedZink NOVA COMPOSITE panel

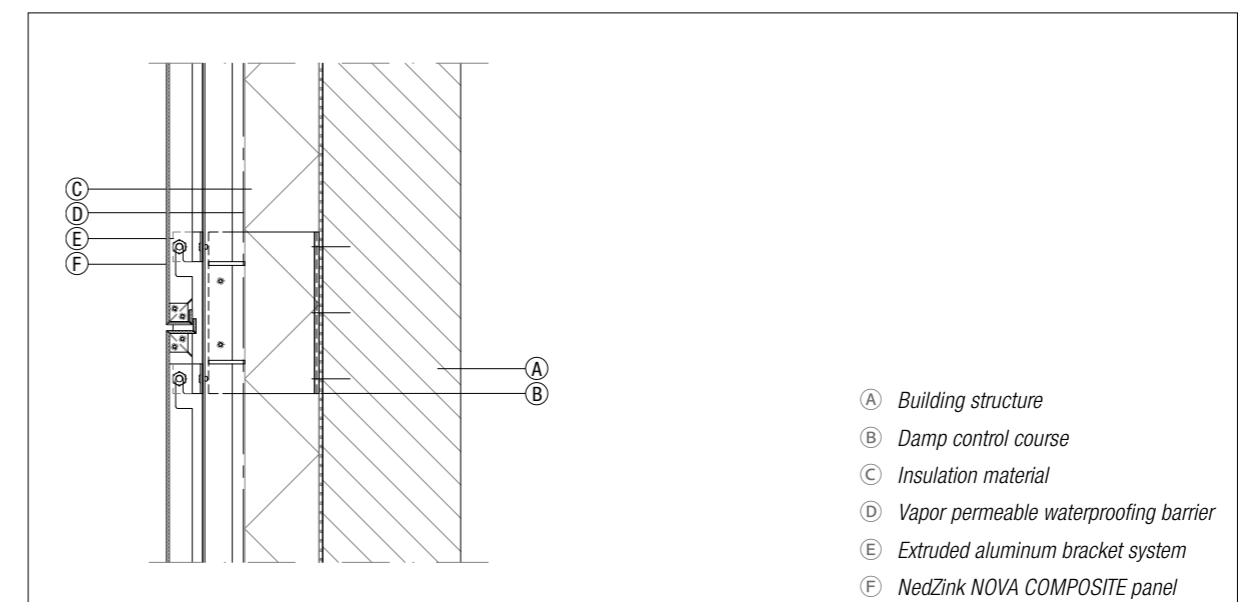


Figure 6.5.1

**NedZink NOVA COMPOSITE cassette system details**

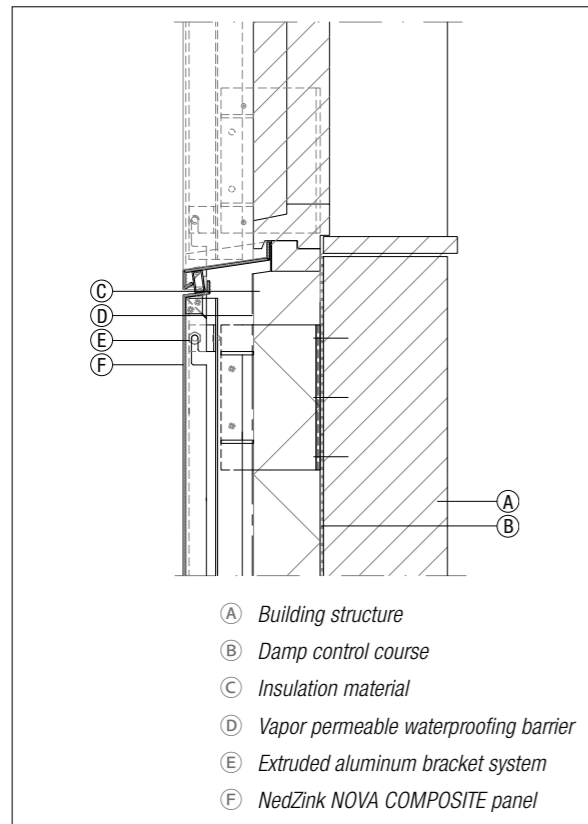


Figure 6.5.2 Window sill joint

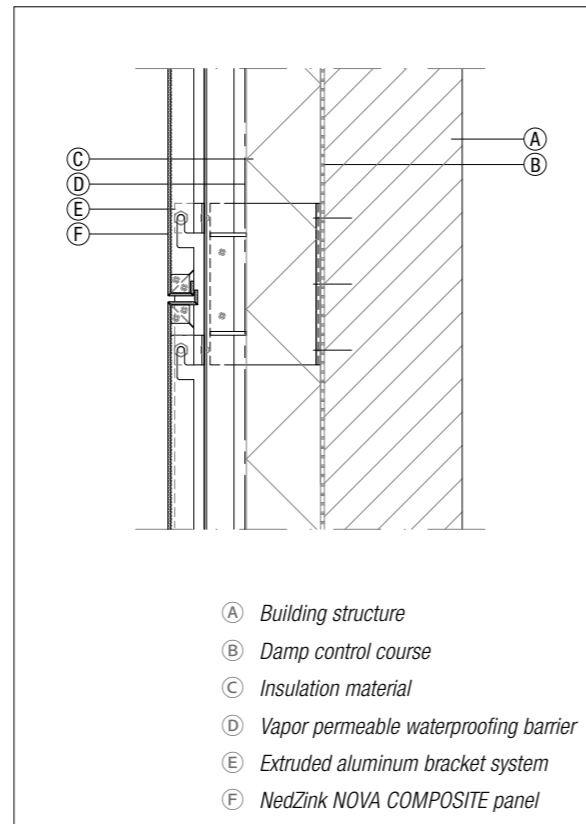


Figure 6.5.3 Horizontal joint

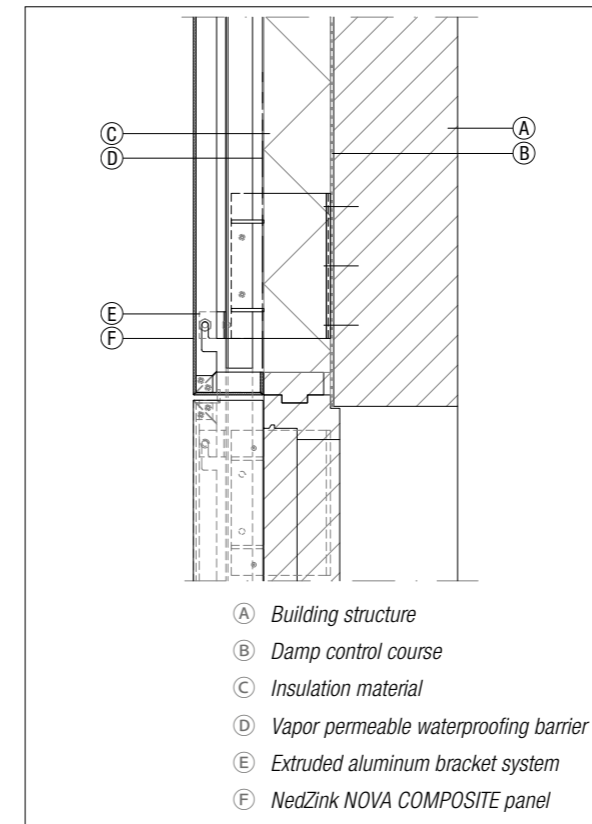


Figure 6.5.6 Window head joint

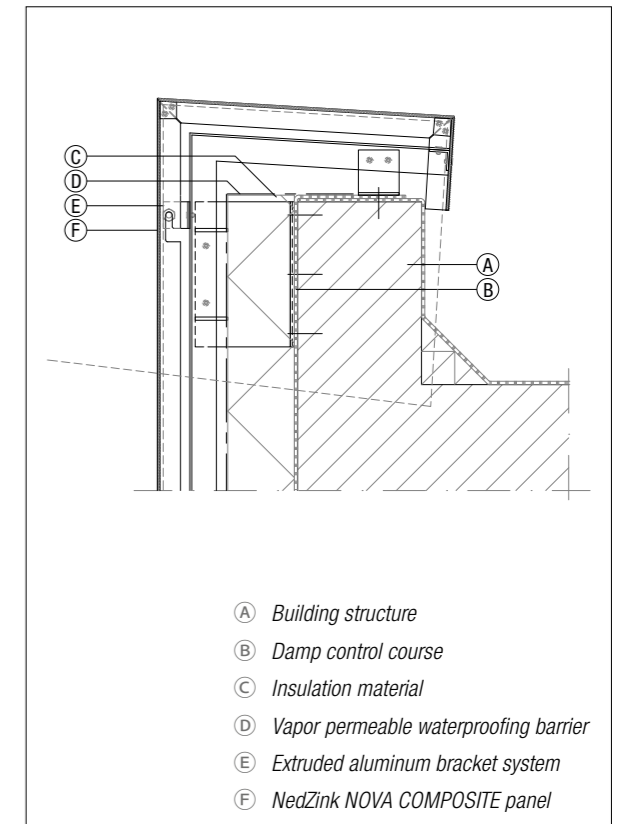


Figure 6.5.7 Parapet return joint

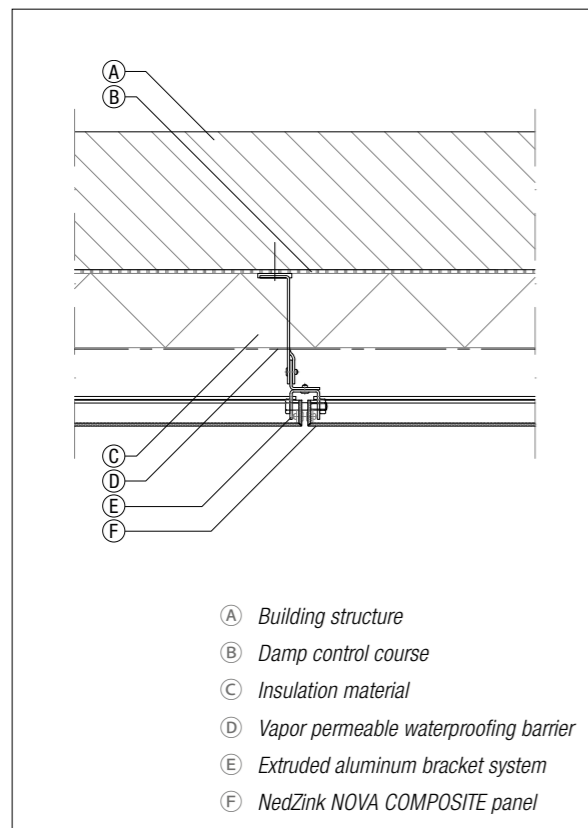


Figure 6.5.4 Vertical joint

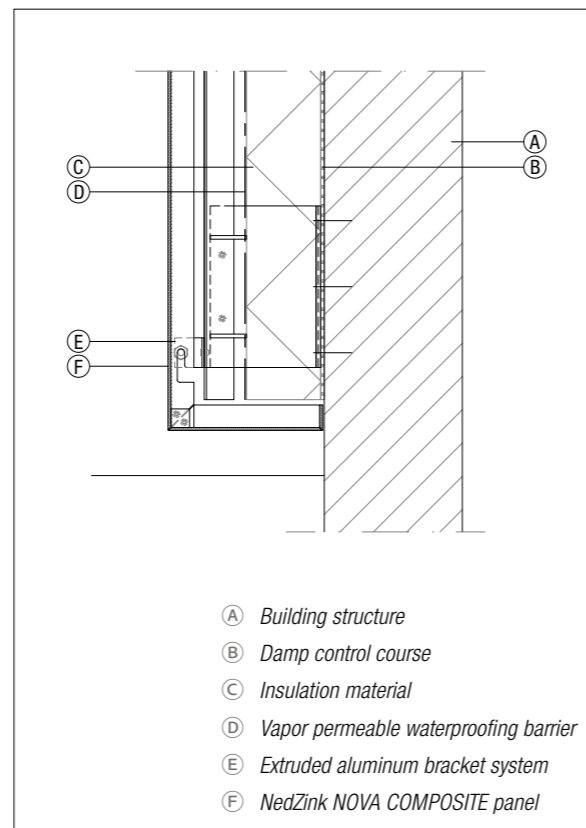


Figure 6.5.5 Lower cladding joint

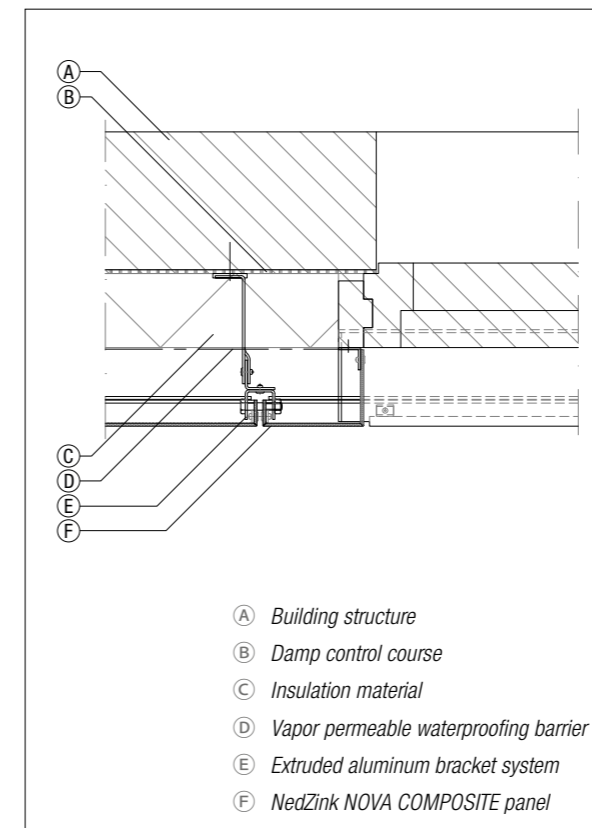


Figure 6.5.8 Window jamb joint

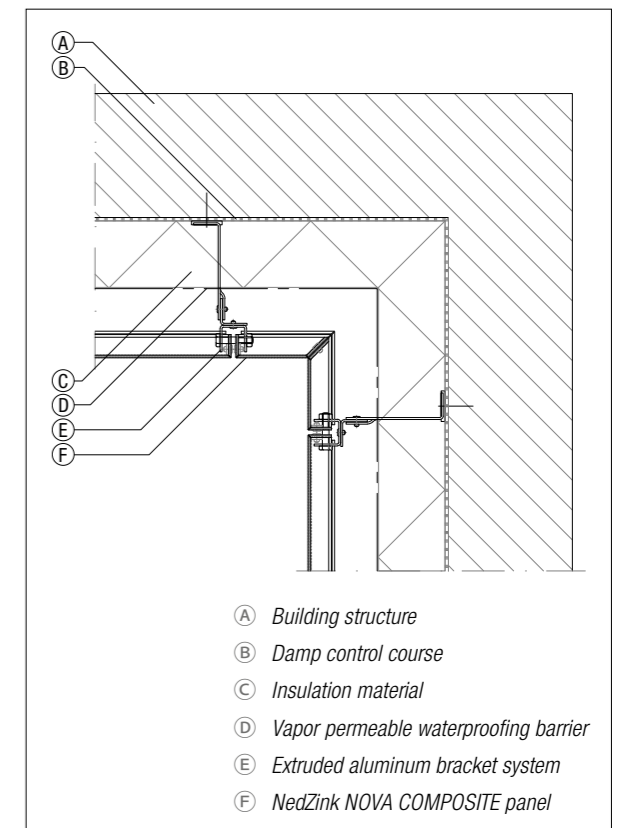


Figure 6.5.9 Inner corner segment joint

# 7

## Building features

Dormers roofing, roof inserts and penetrations can be covered in zinc relatively easily. Zinc is also easy to use to cover window frames. Zinc window sills have a long lifespan and offer the advantage that they can be made fully waterproof by soldering them at the end pieces. Zinc cappings and wall coverings can be customised, including the required bead or flat drip.

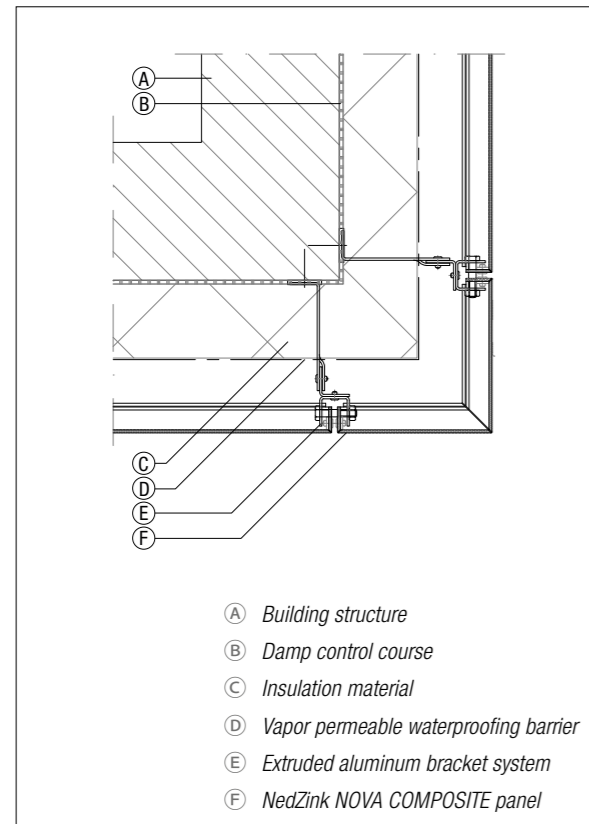


Figure 6.5.10 Outer corner segment joint





## 7.1 Zinc cappings

Zinc cappings made from NedZink material can be applied successfully as a covering to the roof edge of flat roofs that are covered with bituminous, plastic or rubber material, whether or not with gravel or terrace tiles as a load. These roofing materials can cause problems on the roof edge. This is the result of a number of factors:

- effect of sunlight (heat and U.V. rays)
- differences in expansions between trim, substructure and covering
- bulging of bitumen due to a low softening point
- loosening of the glued edge of the roof trim
- mechanical damage of the roof edge

These harmful effects can be avoided by fully covering the edge of the roof with a titanium zinc capping. If NedZink material is used and applied with the necessary craftsmanship, the expected service life is 50 years or longer.

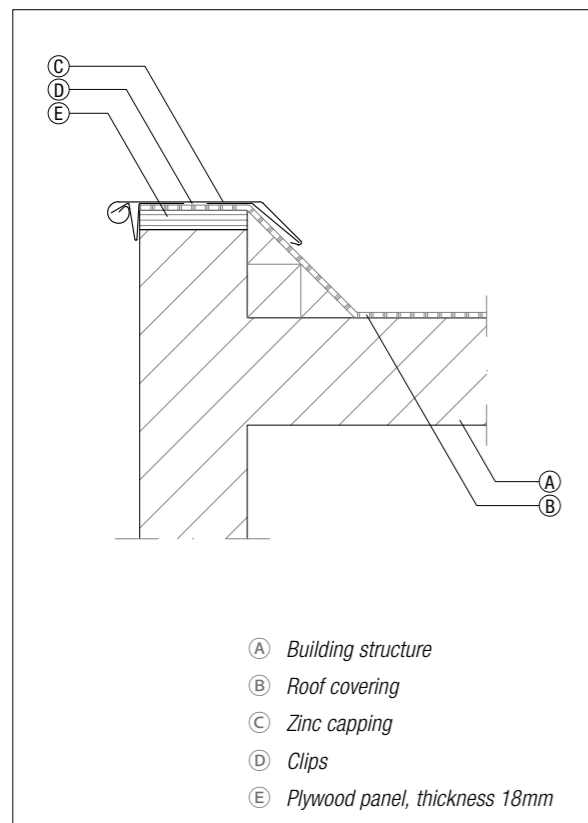


Figure 7.1.1 Zinc capping with bead

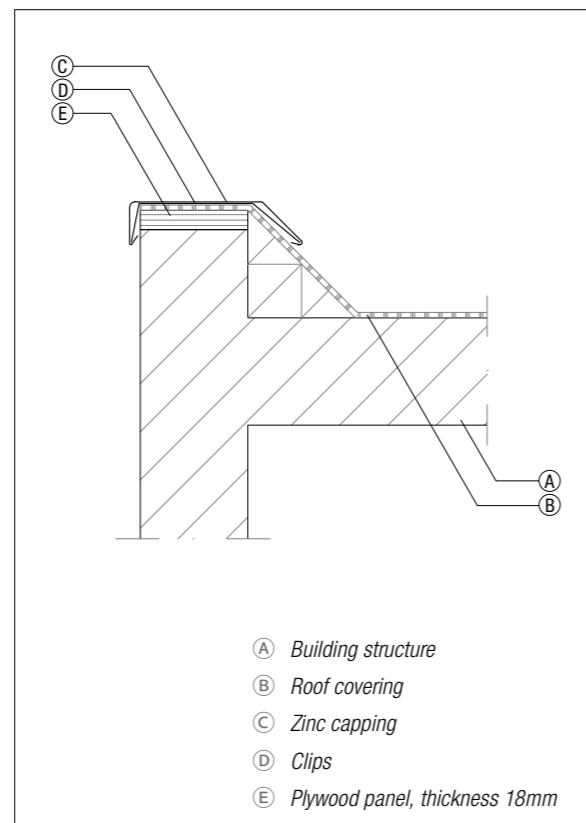


Figure 7.1.2 Zinc capping with flat drip

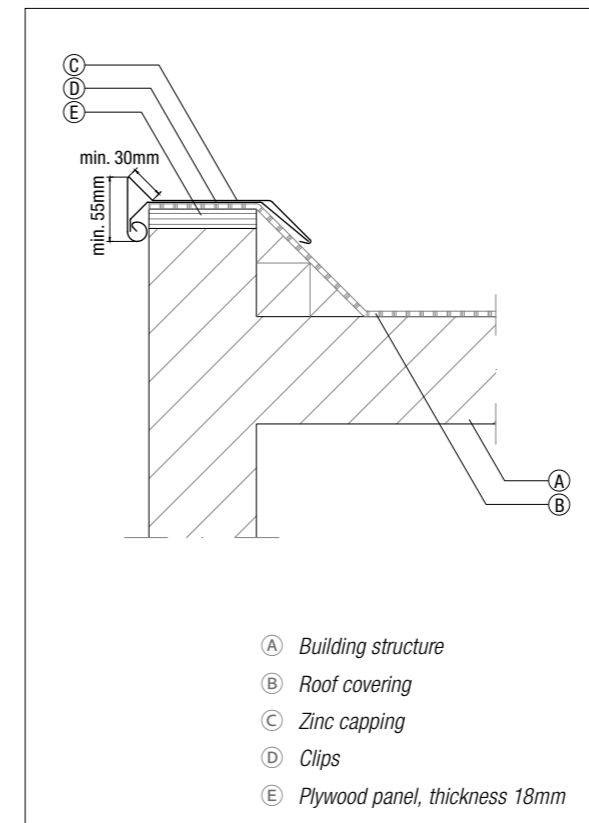


Figure 7.1.3 Zinc capping with ridge

The zinc capping is designed according to the example figures 7.1.1, 7.1.2 and 7.1.3.

A number of important construction details;

- the upper surface of the zinc capping must slope down in the direction of the roof or must be provided with a rain ridge, see figure 7.1.3.
- the zinc capping is attached by means of zinc clips of a width of at least 80 mm that are fastened to the edge of the roof with at least 2 screws or zinc nails. The distance between the clips amounts to a maximum of 1 meter.
- the material for the clips must be at least 0.80 mm thick.
- the use of stainless steel or galvanised steel clips is recommended for zinc cappings with a long sloping part of > 150 mm. The same goes for zinc cappings with a developed width as from 450/500 mm, by which the zinc capping can be regarded as a roof bay. The number of clips must be adapted to this.
- the zinc cappings must be soldered to one another up to a maximum of 12 meters length with an overlap of at least 15 mm. After every 12 meters an expansion sleeve must be fitted at one's option, see figure 7.1.4.
- the underlying roof covering must be glued over the entire width of the roof edge.

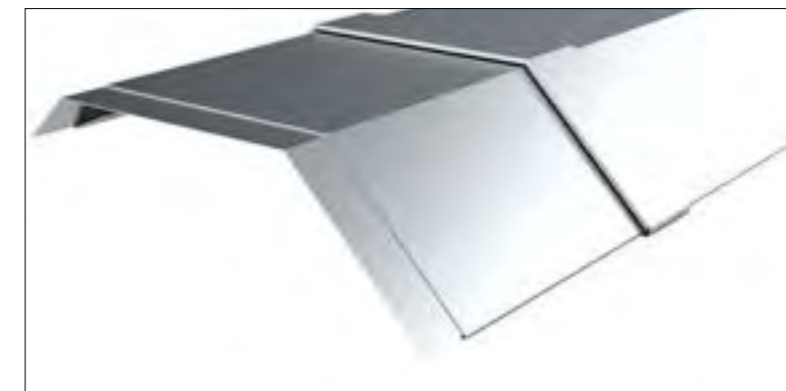


Figure 7.1.4

## 7.2 Wall Copings

The principle of the capping can also be applied as a wall covering. It is recommended that the top of the wall be fitted with wooden components to which the zinc wall covering can be secured. The covering must also be secured with clips to ensure thermal expansion. The same rules apply as those for zinc cappings for attaching the expansion pieces.

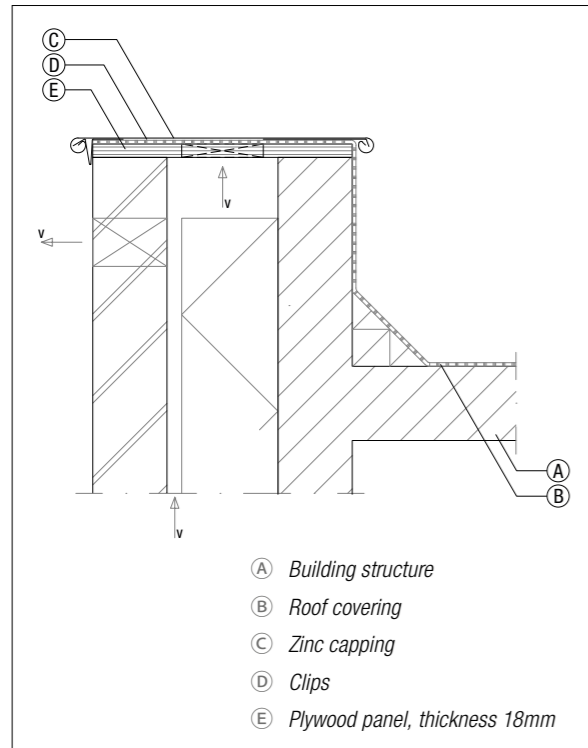


Figure 7.2.1 Wall coping with bead

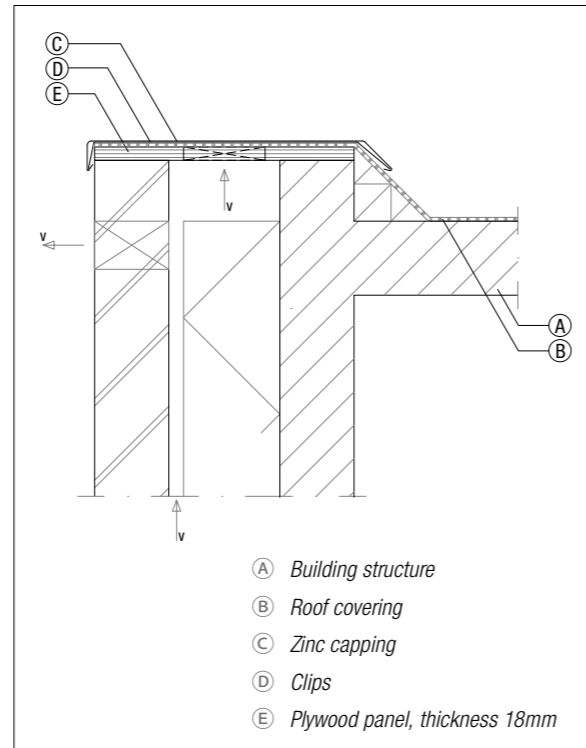


Figure 7.2.2 Wall coping with flat drip

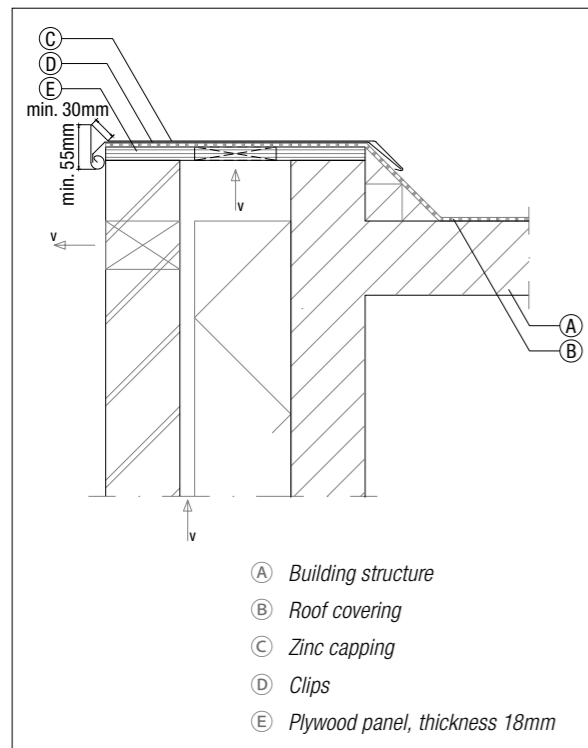


Figure 7.2.3 Wall coping with ridge



## 7.3 Dormers



When a dormer on a tile roof is covered with zinc, first the valley gutters are placed along the side bolsters of the dormer. These gutters will be connected to the existing standard gutter. The gutters are placed at the roof and to the side of the dormer by means of clips.

The side bolsters are fitted as façade cladding and secured with clips to the underlying wooden structure. The preference is for a standard system cladding such as a standard seam system. For small surfaces there is also the option of sheets connected to each other using hooked edges. The hooked edges also contain the clips for fixation to the woodwork. The clips must allow adequate expansion of the side bolsters, to prevent bulging.

Joints and connections should always have sufficient space to guarantee the thermal movement of the zinc. Especially with this kind of application it is advisable to fit the coverings prior to soldering, clipping or seaming to prevent problems due to the thermal effects. Only then it is possible to perform correctly with waterproof details.

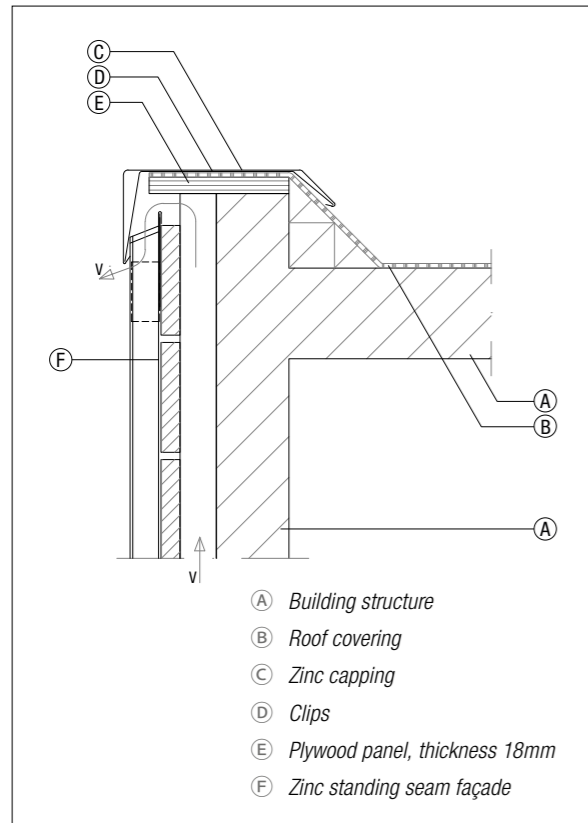


Figure 7.3.1 Zinc capping with dormer cheek

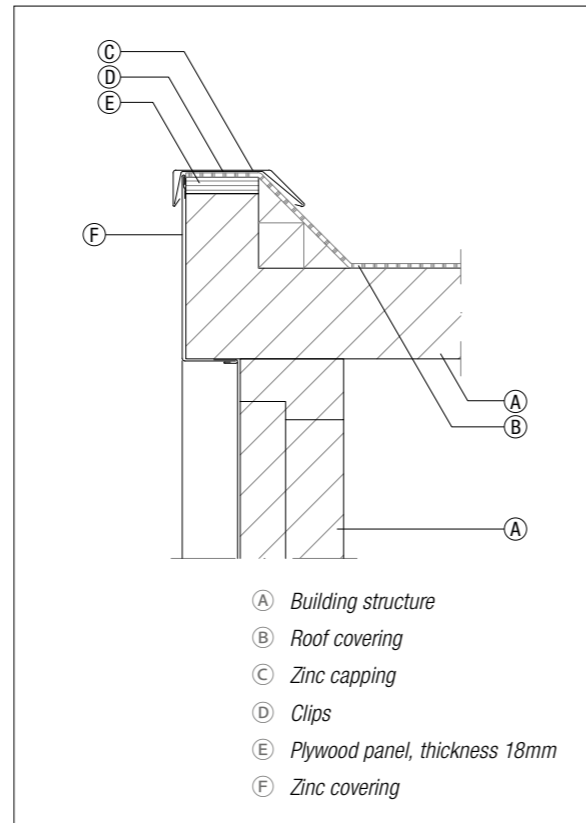


Figure 7.3.2 Zinc capping front vertical standing seam

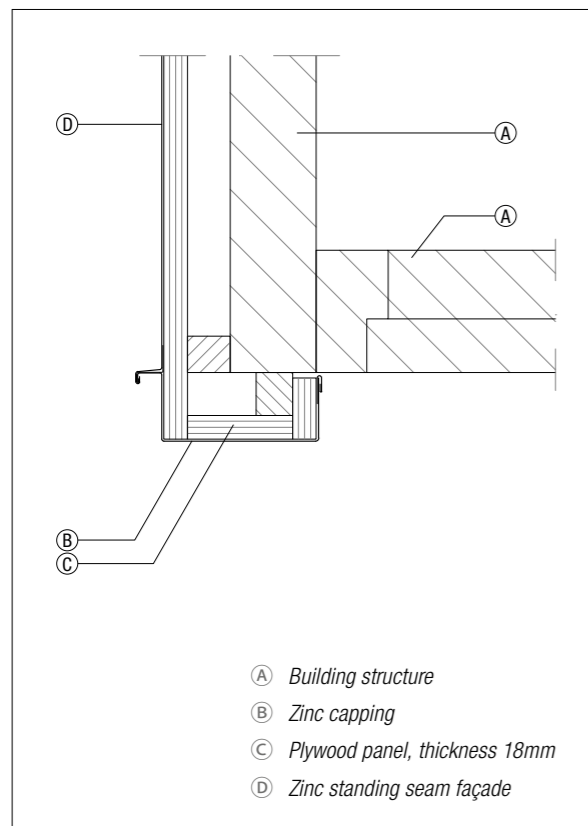


Figure 7.3.3 Dormer front with dormer cheek

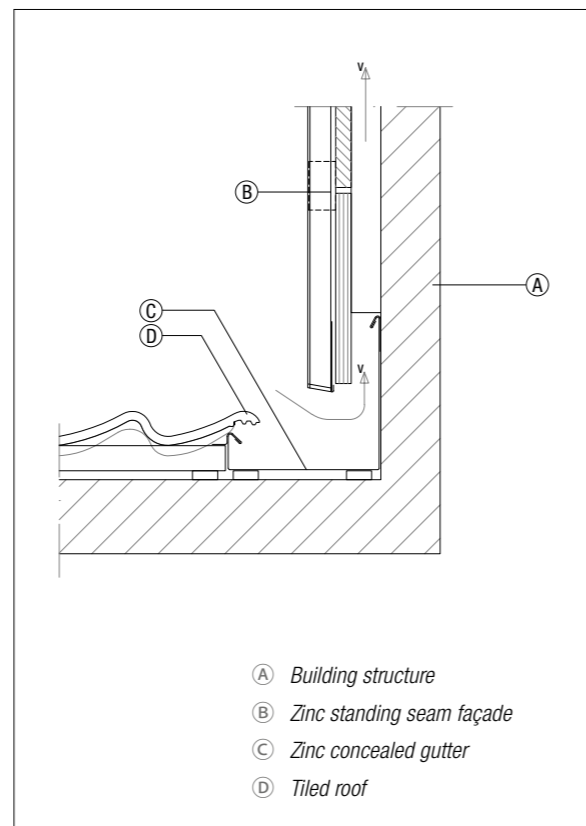


Figure 7.3.4 Dormer, concealed gutter, with vertical standing seam dormer cheek vertical standing seam

## 7.4 Roof penetrations

### 7.4.1 Roof inserts



Joints between vent pipes, ventilation channels and chimneys and the roof covering must be watertight. Titanium zinc can be used in zinc roof coverings as well as coverings made from other materials, such as tiles. A concealed gutter and spreader construction are often used to achieve the correct joint between the insert and the roof covering.

### 7.4.2 Roof penetrations



In the case of roof penetrations techniques, such as a ridge finish, a side connection and bottom connection are used.

The zinc should not be fitted around the roof penetration too tightly. There must be room left for the roof covering to expand and contract.

# 8 Information related to processing

To optimally benefit from the long life span of NedZink material it is important that the zinc is processed in the right way. This chapter describes the processing instructions, such as soldering the different types of NedZink products, the combination of zinc with other materials and transport and storage methods.

## 7.4.3 Skylights



With zin  
to achie  
With ste  
standar

It is possible to insert skylights in zinc roofs to obtain sufficient daylight in the underlying rooms. Accessories are available to achieve a standard or recessed installation for standard skylights.

This involves using flashings that ensure a streamlined



## 8.1 Soldering

Soldering is the process of connecting two metal parts using another metal that has a lower melting point. The metals to be connected are not melted in the process. The metal that creates the connection is the solder.

The soldering work must be carried out in such a way that the solder flows satisfactorily, and the minimum overlap requirements are satisfied:

- For vertical soldered joints (e.g. rainwater downpipes) and soldered joints of gutter ends and other accessories min. 4 to 5 mm.
  - For horizontal and inclined soldered joints an overlap of min. 10 mm.
- These are strength joints.

One must use a soldering bit with a weight of more than 500 gram, which must be used at the correct temperature (350-400 °C).

A bit with a flat sole and a width of 10 - 15 mm gives the best results for soldering most joints in zinc work. One may need a bit with a different form, min. weight 350 gram and a sole of 5 mm in width, only for places that are difficult to reach. For the form of the bits see Figure 8.1.

The lifespan of a soldering bit is determined by regular maintenance. The copper oxide on the bit will always have to be removed and deeply worn bits must be forged into the proper shape. Copper oxides and fluid remnants on the sole of the bit are removed using a sal ammoniac block. This is achieved by rubbing the soldering bit back and forth on the stone at working temperature.

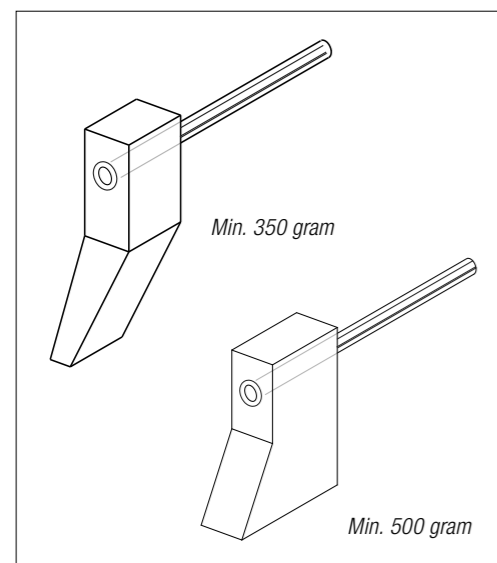


Figure 8.1 Form of the bits



### 8.1.1 Soldering natural titanium zinc

There are various brands of soldering flux "suitable for titanium zinc", which can produce good soldering results. We recommend using soldering fluxes for new and old zinc.

These soldering fluxes must have the following properties:

- The zinc is scarcely or not corroded after the soldering.
- Do not produce harmful vapors.
- The flux residue can be easily removed.
- Do not cause rust on tools.

**Soldering flux application process:**

- Apply soldering flux to the top of the bottom sheet where the soldered joint is to be made. Make sure there is a 10 mm overlap to create a strong joint.
- Apply soldering flux to the bottom surface of the top sheet.
- Place the top sheet on to the bottom sheet and apply the top sheet with soldering flux. Make sure that you also cover the joint.
- Solder the materials together using a hot bit and 50/50 or 40/60 solder. Use a bit with a weight of 500 to 750 gram.
- Carefully remove any remaining soldering flux with a damp sponge or cloth.

It is especially advisable not to work with hydrochloric acid whether or not mixed with soldering flux, as this is harmful to the health, tools and the zinc. Before applying the soldering flux, ensure that the zinc surface is clean and that the lap to be soldered will close properly. The maximum permissible gap is 0.5 mm. When the soldering has been completed, the joints must be cleaned as quickly as possible with a damp sponge or cloth.

For soldering the zinc two alloys are recommended:

- Tin-lead 50/50, low in antimony, melting range 183-216 °C.
- Tin-lead 40/60, low in antimony, melting range 183-235 °C.

A lower temperature results in insufficient heat transfer, which causes 'clumps and blisters' to form between the joint. A higher temperature results in the tin burning or the zinc recrystallizing (annealing). The lead in the alloy is just a filler. The percentage of tin determines the melting area and the tensile strength of the solder. Solder with a low level of antimony must be used to solder zinc. Antimony causes a granular solder joint and increases the melting area.

### 8.1.2 Soldering old zinc

The difference between soldering old and new zinc is the pollution and the patina layer that have formed on the zinc. In order to achieve a good solder joint the overlaps to be soldered must first be thoroughly cleaned and restored to bright metal surfaces. This can best be done by scraping and/or sandpapering, then apply the soldering flux and solder as described for new zinc above.

### 8.1.3 Soldering pre-weathered zinc

In order to obtain a good soldering joint the joint must first be polished to a bright metal surface.

The pre-patina layer must therefore be removed in advance. This is called scraping and there are two possibilities in this case:

- 1 Mechanical sanding, in which the patina is removed by sanding or grinding. This can be done manually or using an electric tool (sander or grinding machine).
- 2 Chemical stripping, in which the patina is removed using a chemical stripper. With NedZink Noir it is necessary to first remove the AFP (Anti-Fingerprint) layer with a special primer. With NedZink Nuance it is first necessary to remove the pigment layer.

*Process for mechanical sanding and soldering NedZink NOVA, NOIR and NUANCE:*

- Mark out the patina layer to be removed using a T-square or ruler.
- Remove the patina layer manually with sanding paper or a power tool until the bright metal surface is visible.
- Then solder the bright metal surface according to the instructions in paragraph 8.1.1.

*Process for chemical stripping and soldering NedZink NOVA:*

- Mark out the patina layer to be removed using a T-square or ruler.
- Coat the Nova patina layer to be removed with a regular stripper (HCL based) and leave to work in a few seconds.
- Remove the patina with a clean cloth.
- Then solder the bright metal surface according to the instructions in paragraph 8.1.1.

*Process for chemical stripping and soldering NedZink NOIR:*

- Mark out the patina layer to be removed using a T-square or ruler.
- Coat the AFP layer to be removed with a special AFP stripping fluid and leave to work in a few seconds.
- Remove the dissolved AFP layer using a clean cloth.
- Coat the Noir patina layer to be removed with a regular stripper (HCL based) and leave to work in a few seconds.
- Remove the patina with a clean cloth.
- Then solder the bright metal surface according to the instructions in paragraph 8.1.1.

*Process for chemical stripping and soldering NedZink NUANCE:*

- Mark out the patina layer to be removed using a T-square or ruler.
- Coat the colored patina layer with a dedicated color stripper and leave to work in a few seconds.
- Remove the dissolved pigment with a clean cloth.
- Coat the patina layer to be removed with a regular stripper (HCL based) and leave to work in a few seconds.
- Remove the patina with a clean cloth.
- Then solder the bright metal surface according to the instructions in paragraph 8.1.1.

The preference is for mechanical sanding rather than chemical stripping because it allows the patina to be removed in a more controlled manner, which means that a stronger and watertight seam is produced after soldering. However, in places that are difficult to reach with a sander or grinding machine, the only option is to remove the patina chemically before soldering.

## 8.2 Titanium zinc and other materials

Titanium zinc is a material that can be easily combined with other materials. Yet there are a number of materials that require extra attention.

### Roofing materials

Bitumen-based roofing materials are based on petroleum with modifications, known as APP and SBS modified bitumen. These will partially break down (SBS to a lesser extent) into soluble substances under the influence of sunlight (UV rays). These substances are carbolic acids, which increase the acidity of the rainwater. When this water then runs off over the zinc, the zinc will severely corrode.

For most plastic roofing materials there are no problems with zinc and the substances discharged. However, PVC roofing materials can have problems with chlorine binding discharges (softeners) that damage the zinc. Corrosion only occurs if the roofing is applied on top of the zinc and rainwater runs over the zinc.

### Copper

Copper is more precious (great difference in potential) than zinc. The electrochemical potential between zinc and copper means that copper cannot be used above zinc. If it is, the zinc will quickly degrade (electrochemical corrosion). Corrosion also takes place if the two substances come into direct contact. If water flows from copper to zinc, the zinc will be damaged.

### Lead

The potential difference between zinc and lead is small and therefore there should be no difficulties in using those metals together. Partly because of the patination of zinc and lead, a transition zone is created, making the potential difference almost equal. We do recommend treating lead with patination oil immediately after assembly. This will prevent the lead from leaving marks on the zinc. To prevent damage when using lead flashing in a zinc gutter, use of a plastic separation layer, such as EPDM rubber, is recommended.

### Thatched roofs

Zinc cannot be used under a thatched roof because it will be corroded by the humus acids that leach out of the reed. The zinc literally dissolves. Zinc is used for ridges, chimneys (above the thatch) and roof penetrations so water does not run off the thatch on to the zinc.

### Wood types

Preferably do not use the following in direct contact with zinc:

- **Plywood:** build up of veneer layers that have been glued together (water-tight). If condensation were to form between the plywood and the zinc, the moisture would damage the zinc after long-term exposure.
- **Preserved wood:** check which preserver has been used on the wood with the applicator.
- **Western Red Cedar** used in an untreated form leaches over time. It contains corrosive substances that can damage the zinc. This only causes problems if the wood is applied above the zinc and water runs off over the zinc.

### Types of glue

A precondition for gluing zinc is to use an elastic non-silicone-based glue, which does not contain any acidic substances. The glue must be elastic to deal with expansion and contraction. Types of glue that are not recommended are: acidic silicones and epoxies, urea/melamine glues and phenol formaldehyde glues.

### Mineral building materials

Mineral construction materials are used in great quantities in construction, such as fresh concrete, calcium, gypsum, cement and mortar. They can damage zinc in combination with moisture. We recommend applying the zinc as late as possible in the building process to reduce the chance of contamination and minimize any damage.

### (Fiber cement) slate

If zinc is used in combination with other materials, some materials cause damage to the zinc. It is recommended when (fiber cement) slates are placed above the zinc to contact the supplier of the slates. When possible, negative effects are ruled out, guaranteeing the zinc's lifetime.

### Galvanized steel, aluminum and stainless steel

Direct contact is permitted between titanium zinc and galvanized steel, aluminum (anodized or enamelled) and stainless steel. Please note: if galvanized steel wears, rust can occur that will leave marks on the zinc.

## 8.3 Guidelines

### Material characteristics

NedZink NATUREL is raw titanium zinc produced according to EN 988 and Lloyd's Register certified. NedZink NATUREL has a natural, rolled surface. NedZink NEO, NedZink NOVA and NedZink NOIR are pre-patinated types of zinc that are produced by means of a phosphating process. The basic material is natural NedZink titanium zinc. By phosphating the material, a surface very close to the regular natural patina is obtained. NedZink NUANCE is pre-weathered titanium zinc with pigments. This results, depending on the selected pigment, in a pre-weathered zinc variant with a blue, red or green color tint. All the properties offered by zinc are retained during this process.

Every rolled metal, NedZink material included, will show tension in a certain way. This is a consequence of the rolling process. With modern techniques, these tensions are reduced to a minimum. Nevertheless, it may be that these tensions occur, to a lesser degree, after the NedZink material is processed by third parties.

### Surface protection

NedZink NATUREL is supplied with a bright, rolled surface. Exposure to the outside air and moisture results in a protective layer of zinc carbonate, which is called the patina. This process begins immediately after installation and will continue until a uniform patina is obtained. In the beginning, the appearance of the patina layer may look slightly mottled. Other factors that play a role in this patina process are: the orientation / geometry of the building, the weather conditions during assembly, and the storage of the titanium zinc prior to assembly.

NedZink NEO, NedZink NOVA, NedZink NOIR and NedZink NUANCE are natural products and as a consequence minor color differences will occur. A unique production process results in an extremely consistent color, but there is always a possibility of color variations (production batch related). Use material from the same production batch for each particular project to avoid color variations. The production batch number is stated on the backside of the material.

Always mount NedZink NEO, NedZink NOVA, NedZink NOIR and NedZink NUANCE in the same rolling direction (also to avoid color variations). The rolling direction is indicated by arrows on the rear of the material. This rolling direction must be checked before installing the material.

After many years the pigments of NedZink NUANCE will gradually fade and the color of the pre-weathered NedZink NOVA will appear on the surface. The durability of the pigments is highly dependent on environmental factors, such as the location of the building, temperature, UV exposure and air quality. Damage, perforation and adverse environmental factors can significantly shorten the lifetime of the pigments.

### Processing NedZink NUANCE

Shaping and profiling must be done with a minimum bending radius of 2 mm (interior radius) with a material thickness of 0.70 mm. Damage, deep scratching and suchlike of the coating during processing should be avoided. If necessary, tools and machines need to be cleaned beforehand and any sharp edges must be removed in order to avoid any risk of damage.

### Salt deposition

In a maritime climate, the salt in the air and/or water can react with zinc and form zinc chloride on surfaces that do not get rinsed off by rainwater. This appears as permanent white patches. These white patches do not have any impact on the functionality of the zinc and do not cause corrosion. In the absence of rain or on surfaces sheltered from rain, it is necessary to clean these areas regularly with (warm) water. NedZink is not responsible for the effects of salt deposition.

### Anti-Fingerprint (AFP)

An Anti-Fingerprint coating is applied to prevent fingerprints during installation and to optimize machine processing. This AFP gives the material a slightly shiny surface, which will disappear over time.

### Protection foil

Upon request, NedZink NOVA and NedZink NUANCE can be delivered with a temporary protective foil in order to reduce the risk of damage during processing & handling. NedZink NEO and NedZink NOIR is supplied with this temporary protective foil as standard. The foil is not permanently UV resistant and is only intended for temporary protection. The foil should be removed immediately after installation at the construction site. The temperature of the zinc must be at least 7 °C when the foil is removed. The foil should not be worked into assembly joints such as standing seams. Moisture between the zinc and the foil must be avoided at all times. If NedZink NEO, NedZink NOVA, NedZink NOIR or NedZink NUANCE are ordered without foil, the material will be more susceptible to scratching during handling.

### Installation

Titanium zinc from NedZink can be used in ventilated and unventilated applications. In all cases (either ventilated or unventilated) the recommendations as stated on [www.nedzink.com](http://www.nedzink.com) or in the NedZink technical instruction manual must be followed.

Zinc is a metal that expands and contracts with changes in temperature. In all cases, there must be an allowance for the free thermal expansion of the material when installed.

### Mechanical processing

Below a material temperature of 7 °C, the zinc should not be deformed mechanically in order to avoid damage to the zinc (e.g. micro-cracks).

## 8.4 Transport and storage


The zinc must be adequately packed to avoid damage during transportation. NedZink products must always be transported in dry and ventilated conditions. The coils and sheets must be protected against transportation damage (scratching, denting).




NedZink material must be stored in a dry and ventilated area and protected against damage and especially against excessively high air humidity. Outdoor storage is not recommended.

### Rules for transportation and storing NedZink material

 **Stacking**  
- Max. up to 10 pallets maximum for sheets

 **Transportation**  
- Max. 4 pallets on top of each other for sheets

 **- Please protect from getting wet**

 **- Must be stored dry and ventilated**  
**- Please avoid condensation**

 **- NedZink material is fully recyclable**

NedZink recommends a humidity of max. 60-70% and a stable temperature of 12-14 °C. Please prevent any damage occurring.

# 9 Certification, environment and health

NedZink is aware of its social responsibility. The policy is designed to prioritize sustainability and the environment. This is reflected in a number of important product certificates, including ISO and an Environmental Product Declaration.



## 9.1 ISO

The ISO certificate for the quality management system at NedZink ensures consistent and uniform high quality, meeting our own standards and far exceeding NEN-EN 988. NedZink material can be recognized by its unique stamp. A continuous stamp is applied to the rear of all products, in accordance with the provisions of EN 988, with the markings:

- NedZink NTZ
- The name titanium zinc in 4 languages; Dutch, German, French and English
- Product standard EN 988
- The nominal thickness
- Batch number
- Year of production
- The KOMO and Lloyd's Register logos



## 9.2 EPD

The independent German institute Bauen und Umwelt e.V. (IBU) awarded NedZink an EPD (Environmental Product Declaration) for NedZink NATUREL, NedZink NOVA and NedZink NOIR.



These EPDs, which also received the ECO platform label, provide information about the product's environmental data based on the lifecycle analysis or its ecological footprint. By comparing the various EPDs with one another customers can now choose an environmentally conscious product more easily. Following this certification NedZink has taken a new step forward in terms of sustainability and quality.

The EPDs provide vital data for the environmental assessment of buildings as set out in the new European project for the "Sustainability of buildings". In order for the independent IBU to objectively compare the environmental impact of NedZink NATUREL, NedZink NOVA and NedZink NOIR, it is tested and validated according to the ISO 14025, 14040 and 15804 standards. They examined the lifecycle analysis (LCA) of each of the three zinc products. The LCA is a tried and tested method, which makes it possible to assess and quantify the environmental impact of the product in every phase of its lifecycle. This includes, among others, CO2 emissions, energy and water consumption and air pollution. The EPDs can be compared based on these indicators, facilitating an environmentally conscious product choice.



### 9.3 Environment

Zinc is a metal that has been used in building and renovation work for centuries. Examples of its application include gutters, rainwater downpipes and roof and façade cladding. Zinc is not only chosen for aesthetic reasons, it is also a sustainable option. Zinc is a reliable and durable material offering a long lifespan. It is consistent with the circular economy. After use the material can be melted down again and serve as a raw material for new applications.

Moreover, zinc is a highly functional metal: it ensures that rainwater is drained in a reliable manner. And this is important because leaks are a major inconvenience and cause serious damage. Zinc is also a popular material due to its unique appearance. There are few building materials that provide a total environmental balance that is as positive as that of zinc. Zinc lasts over 75 years. After use zinc is collected and recycled. Over 95% of zinc is reused. Zinc offers an outstanding environmental profile due to its long lifespan and high degree of recycling.



The Building Decree of 2012 makes it mandatory for building permit applicants to calculate the sustainability of the building to be delivered. This calculation applies to all parts of the building, including the materials used. Data from the National Environment Database is used to perform the calculation. Calculations reveal that zinc scores better than aluminum, PVC and polyester. The score of four materials used to produce a gutter was calculated. For the scores (shadow price in € per year of lifespan) the lower the score, the more sustainable the material. The scores are:

| Scores (shadowprice in € per year of lifespan) |       |
|--|-------|
| Zinc   | 1,88  |
| Polyester                                      | 25,68 |
| PVC  | 6,03  |
| Aluminum                                       | 19,00 |

Source: National Environment Database 2017

### 9.4 Health

Zinc plays an essential role in the biological processes of human beings, fauna and flora. It is one of the minerals vital for the

body's performance and for several of the body's biological functions. Your body needs zinc to create muscles, bones and hair. A zinc deficiency may lead to growth retardation. Your immune system also needs zinc to function properly.

International Zinc Association, 'Zinc Saves Kids' supports undernourished children in developing countries. These children suffer from health problems directly related to zinc deficiency. Zinc supplements are a quick, easy and effective cure.



*Zinc - essential for life!*



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