CONDENSATION CONTROL (NCC 2019 EDITION)

LYSAGHT

IN AUSTRALIA BUILDINGS CONSTRUCTED WITH LYSAGHT® CLADDINGS

FOR COMPLIANCE WITH NCC 2019

INSPIRATION TO BUILD BETTER

This publication contains Lysaght recommendations for Condensation Control for compliance to NCC 2019. For NCC 2022 compliance recommendations, please refer to Lysaght publication “Condensation Control (NCC 2022 Edition)”.

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1.0 INTRODUCTION AND GENERAL NOTES

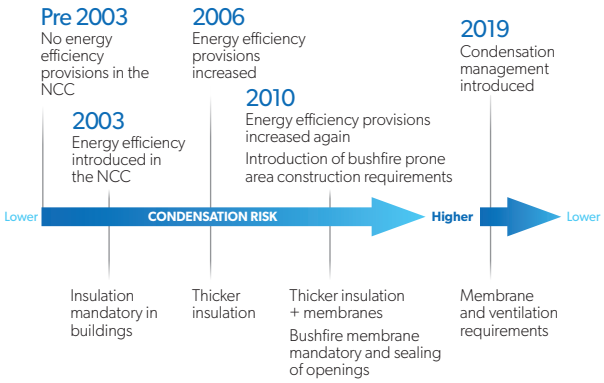
1.1 INTRODUCTION

Traditional residential construction practices provided buildings that were not tightly sealed and allowed moisture to escape.

In recognition that evolving construction practices, driven by NCC requirements for increased energy efficiency (see Figure 1.1) and bushfire detailing, was leading to tighter sealing of buildings, the Australian National Construction Code (NCC) 2019 introduced new provisions to help minimise the impacts of condensation within houses and apartments.

Further measures are being considered for NCC 2022.

FIGURE 1.1



1.2 SCOPE

This manual is a guide to the design and installation of steel roofing and walling manufactured by Lysaght. We intend that it be used by all trades and professions involved with specifying and applying the wide range of our products.

We refer only to genuine steel roofing and walling manufactured by us and marketed under our brand names. Our recommendations should only be used for our products because they are based on comprehensive testing of our profiles, Base Metal Thicknesses (BMT) and material finishes.

1.3 CONDITIONS OF USE

If you use this Manual, you acknowledge and agree that your use is subject to the terms and conditions in this manual. Lysaght, its agents, officers, employees, sub-contractors or consultants make no representations, either expressed or implied, as to the suitability of the information and data in this Manual for your particular purposes. It's your responsibility to ensure the design you use is appropriate for your needs, the products you have purchased, your site and structural limitations and your building and construction capabilities.

This manual endeavours to present information on products, details, installation and practices in a clearly prescribed manner and it is the user's responsibility to apply the information in the way intended. If there is any uncertainty then it is the user's responsibility to seek clarification. Where we recommend use of third party materials, ensure you check the qualities and capabilities of those products with the relevant manufacturer before use.

1.4 USE OF GENUINE MATERIALS

Structures in this Manual should only be built or constructed using genuine LYSAGHT® products or recommended third party products. Except as otherwise provided in these terms, any warranties only apply to you (if at all) if you use the recommended genuine LYSAGHT® products or third party products and method of construction.

1.5 CHECK DELIVERY

It is important that you check all materials delivered to site against your invoice before you use them in your building or construction to ensure all components have arrived, are of the appropriate quality and are ready for installation.

1.6 WARRANTIES

For over 150 years we have consistently manufactured the highest quality building products. The LYSAGHT® brand is synonymous with Australian building. Our continuing confidence in our products is shown in the warranties we offer.

Our products are engineered to perform according to our specifications only if they are used in the appropriate conditions and installed to the recommendations in this manual and our other publications.

Naturally, the warranties require specifiers and installers to exercise due care in how the products are applied and installed and are subject to final use and installation. Also, owners need to maintain the finished work.

We invite you to ask about the warranties applicable to your proposed purchase, at your supplier of LYSAGHT® products.

1.7 GENERAL NOTES TO READ BEFORE YOU USE THIS GUIDE

This manual has been prepared for a range of roofing and walling applications including water drainage systems, using products manufactured or supplied by Lysaght.

1.8 PROFESSIONAL ADVICE

All erection and connection details are to be made in accordance with the relevant standard connection details drawing contained in this Manual.

We recommend you get professional advice to ensure your particular needs are adequately met.

Before you commence construction:

a. you should check with your local government authority to see if any form of prior permission or approval is required;

b. if you want to build or construct any attached structure, you should seek advice from a suitably qualified engineer to verify the capacity of your existing structure to withstand any additional load arising from the attached structure. You should also check with your local government authority to determine any specific requirements for the attachment to existing structures;

c you should check with your local workplace health and safety authority to see what safety measures you need to put in place prior to and during construction. It is the responsibility of the installer/erector to ensure all local safe work practices are adhered to and the safety of the whole site is maintained at all times.

To ensure maximum lifespan of your building, consult your nearest Lysaght branch for information regarding maintenance, handling, storage and any other technical assistance you may require.

1.9 FURTHER INFORMATION ON PRODUCTS AND SERVICES

LYSAGHT.COM. Your supplier of LYSAGHT® products
LYSAGHT® Information Service on 1800 641 417

2.0 DESIGNER PRELIMINARIES

2.1 WHAT IS CONDENSATION?

When a surface temperature falls below the dew point of its surrounding air, condensation in the form of water vapour from the humid air will take place on the colder surface. In order to avoid condensation, the surface temperature must be increased and/or the moisture in the surrounding air must be reduced.

Condensation within a building can form as visible surface condensation or can form within the building fabric or layers, referred to as interstitial condensation. Generally small quantities of condensation in a building are tolerable provided it can dry. However, if the environment remains wet or humid for a substantial period of time materials may degrade and mould growth may occur that can have an effect to the health of the occupants in the building.

Increasing levels of energy efficiency provisions in buildings has resulted in greater levels of insulation and buildings being built to be more air tight. Consequently this has led to potential for increased humidity in living spaces and greater risk of problematic condensation.

It is important to note that the new provisions are seeking to minimise the health impact through the management of condensation. It does not look at eradication of condensation as it acknowledges that dealing with condensation in buildings is a complex matter and is as much about how the building is used, as it is about how it is built.

This is reflected in the NCC 2019 Performance Requirement which states:

> At P2.4.7 - Condensation and water vapour management - risks associated with water vapour and condensation must be managed to minimise their impact on the health of occupants.

2.2 EFFECT OF CONDENSATION (MOISTURE) IN BUILDINGS

In extreme circumstances, it has been documented[2] that moisture in buildings can be associated with a range of adverse health and wellness issues including upper respiratory (nasal and throat) symptoms, coughs, wheezing and asthma symptoms in sensitised persons with asthma. More typically, moisture can cause damage to building materials and components.

For example:

- Prolonged damp conditions can lead to the colonisation of building materials and HVAC systems by moulds, bacteria, wood-decaying moulds and insect pests (e.g., termites and carpenter ants).
- Chemical reactions with building materials and components can cause, for example, structural fasteners, wiring, metal roofing and conditioning coils to corrode and flooring or roofing adhesives to fail.
- Water-soluble building materials (e.g., gypsum board) can return to solution.
- Wooden materials can warp, swell or rot.
- Brick or concrete can be damaged during freeze-thaw cycles and by sub-surface salt deposition.
- Paints and varnishes can be damaged.
- The insulating value (R-value) of thermal insulation can be reduced.

2.3 MAIN CAUSES OF CONDENSATION IN ROOF SPACES

There are two main causes of condensation in roof cavities;

1. High levels of internal water vapour passing into roof spaces through the ceiling or through exhaust fans which are not externally ducted. This is a particular problem in areas of the home where moisture is generated such as laundries, kitchens and bathrooms.
2. Insufficient ability for the roof space to dry due to lack of ventilation to remove unwanted water vapour. Once high levels of moisture exist in a roof space the consequence of poor installation, inappropriate materials and or poor construction details further increase issues associated with condensation.

2.4 KEY WAYS TO MINIMISE CONDENSATION IN ROOF SPACES

1. Extraction systems which duct moist air outside the building
2. Maintaining the natural ventilation of the roof space by ensuring insulation and membranes do not block ventilation paths.
3. Installing supplementary ventilation as required.
4. Providing roof level insulation, such as blanket and foil, particularly in cooler climates.

2.5 VENTILATION OF ROOF SPACES

Amendments have been made to the ventilation requirements in NCC 2019. Clause F6.4 (NCC Volume One) and 3.8.7.4 (NCC Volume Two) outline the minimum requirements of an adequately ventilated roof space. These amendments remove ambiguity around what constitutes an adequately ventilated roof space, providing detailed information regarding

1. the amount of ventilation required and
2. their locations.

Where an exhaust system covered by NCC clauses F6.4 or 3.8.7.3 discharges into a roof space, the roof space must be ventilated to outdoor air through evenly distributed openings. The total area of the openings required for ventilation will vary depending on the pitch of the roof and the ceiling area of the roof space being ventilated.

Roofs with a pitch greater than 22° require a total unobstructed area of 1/300 of the respective ceiling area. This means that a large house with a ceiling area of 300m^2 would require 1 m^2 of unobstructed ventilation, with 30% or 0.3m^2 of this ventilation to be located not more than 900mm below the ridge or highest point of the roof space, measured vertically.

Similarly roofs with a pitch equal to or less than 22° require a total unobstructed area of 1/150 of the respective ceiling area. This means that a small house with a ceiling area of 150m^2 would also require 1 m^2 of unobstructed ventilation.

2.6 ROOF VENTILATION SYSTEMS

Where exhaust systems discharge into a roof space, the roof must be ventilated evenly

Installed Pitch	Relative Ceiling Area	Ventilation at Ridge	Example
>22°	1/300	30%	Ceiling area: 300m² Ventilation required: 1m² Ventilation at ridge: 0.3m²
≤22°	1/150	30%	Ceiling area: 300m² Ventilation required: 2m² Ventilation at ridge: 0.6m²

There are a number of rooftop ventilations systems available that can be used to meet the requirements of NCC 2019.

These include:

- **Turbine style ventilators** – these are also known as 'whirlybirds' and are a semi-mechanical vent comprising a cylindrical dome with fins that spin in the wind creating a vacuum, drawing out air from the roof cavity. Various brand names are readily available and also supplied by Lysaght.
- **'Ridge Vent' systems** – ridge vents have been widely used throughout Europe for many years and comprise an integrated addition under the ridge cap that utilises natural upward air flow facilitated by air intake via soffit vents that draws air through the roof cavity an out the (slightly) raised ridge. VENT-A-ROOF® is a leading example of this technology and is available from Lysaght.
- **Roof fan systems** – a wide variety of solar and mains powered ventilation fans systems are available.

2.7 CONDENSATION MANAGEMENT DETAILING EXAMPLES FOR LYSAGHT® CLADDINGS

Increasing levels of energy efficiency provisions in buildings has resulted in greater levels of insulation and buildings being built to be more air tight. Consequently this has led to potential for increased humidity in living spaces and greater risk of problematic condensation.

The following 'moisture management' diagrams outline typical passive ventilation and moisture paths for metal cladding systems to best control building cavity moisture. The resulting specific construction details are based on these moisture management principles.

All materials and products used should be fit for purpose including suitable durability, compatibility and account for movement when exposed to temperature, moisture and corrosivity of the installed micro-environment.

For specific information on using any product and for details outside of the following, such as for low pitch and bushfire or marine requirements, refer to Lysaght for specialist advice.

The two key principles for moisture management for roofs and walls are:

1. Keep moisture out. This involves keeping the rain out and controlling internal moisture.
2. Allow moisture that enters building cavities to escape. Moisture will get in, and when it does it must be able to escape without consequential damage.

Ensuring a roof or external wall is designed to both keep moisture out and provide for escape of any moisture that enters, is key to reducing moisture related issues. Installing your metal cladding in accordance with these typical construction details will maximise the lifespan of the cladding and building.

As a general rule the following minimum gaps for ventilation and drainage have been adopted:

- For walling.
  - Unobstructed ventilation area of a minimum 5,000mm²/lm of wall run at both the top and bottom of the wall.
- For roof cavities where no exhaust fan discharges into the roof cavity (not receiving exhaust)
  - Roof pitches greater than 15° with truss spans less than or equal to 10m
    - Unobstructed ventilation area of 10,000mm²/lm at eave
    - Unobstructed ventilation area of 5,000mm²/lm at ridge
  - Roof pitches 15° or less or single pitched roofs or truss spans greater than 10m
    - Unobstructed ventilation area of 25,000mm²/lm at eave
    - Unobstructed ventilation area of 5,000mm²/lm at ridge
- For roof cavities where an exhaust fan discharges into it (receiving exhaust) NCC 2019 provision apply i.e.
  - Regularly distributed ventilation of an unobstructed vented area of 1/300 of the respective ceiling area for roof pitches ≥ 22°;
  - or 1/150 of the respective ceiling area for roof pitches <22°;
  - and 30% Of the vented area must be provided at the ridge or not more than 900mm below the ridge with the remaining requirement provided by eave vents.

3.0 MOISTURE MANAGEMENT SOLUTIONS

Moisture Management Solution - Selection Criteria Flow Chart

NCC Climate Zone	Supported or Unsupported (or self-supported) cladding profile	Open or Closed or Panelised (Rain Screen) Profile	Determine if the Cladding is for Wall or Roof	Refer Moisture Management Solution
Refer National Construction Code to determine the Climate Zone the project is in.	Has the cladding been tested to span between supports (Unsupported), or does it require a rigid continuous support behind (Supported).	Is the cladding type open, closed or panelised. Refer typical cladding type legend.		Is the cladding type open, closed or panelised. Refer typical cladding type legend.

3.1 STEPS TO DEVELOP PROJECT BASED MOISTURE MANAGEMENT SOLUTIONS

Step 1 – Determine the application climate zones as per the National Construction Code (NCC).

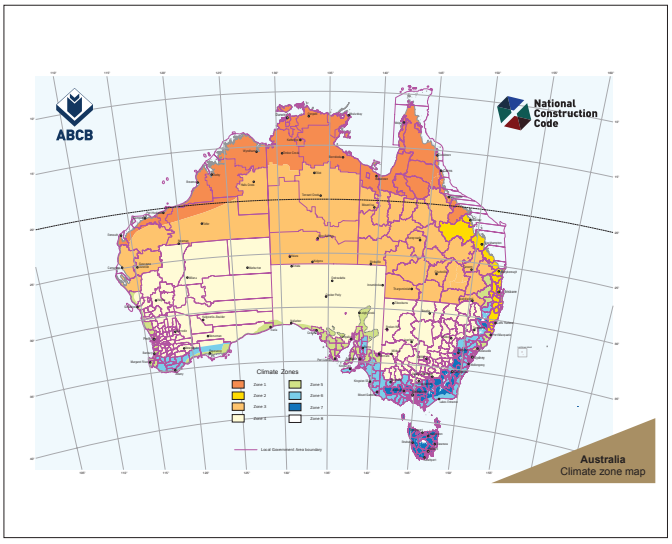
The NCC outline 8 climate zones for Australia as follows;

Climate Zone #	Climate Zone Characteristics
Zone 1	high humidity summer, warm winter
Zone 2	warm humid summer, mild winter
Zone 3	hot dry summer, warm winter
Zone 4	hot dry summer, cool winter
Zone 5	warm temperate
Zone 6	mild temperate
Zone 7	cool temperate
Zone 8	alpine

The applicable geographic regions are outlined at Figure 3.1 which is available from https://www.abcb.gov.au/Resources/Tools-Calculators/Climate-Zone-Map-Australia-Wide.

The details provided are generally applicable for Climate Zones 1-6. For Climate Zones 7 and 8 i.e. Alpine specialist advise should be sought.

FIGURE 3.1



Step 2 – Determine if the cladding to be used is supported or unsupported.

Supported claddings require a rigid continuous support such as plywood or similar. Unsupported cladding free span between batten or purlin supports. The majority of LYSAGHT® cladding profiles are unsupported, with the exceptions being;

- IMPERIAL™ over 325mm wide
- ENSEAM® over 265mm wide
- SNAPSEAM™ over 265mm wide
- BAROQUE™

Step 3 – Determine if the cladding to be used is open or closed.

Open profile claddings are those with open ribs that will allow airflow. Examples of these profiles include CUSTOM ORB®, TRIMDEK®, and SPANDEK® and KLIP-LOK®.

Closed profiles claddings those with closed ribs that do not allow easy airflow. Examples of these profiles include IMPERIAL™, ENSEAM®, SNAPSEAM™.

Step 4 – Determine if the cladding is for wall or roof.

Additional considerations include; assessment of Project Bush Fire Attack rating (BAL) to ensure that ventilation solutions comply to BAL requirements assessment of the marine or corrosive influence for the project to ensure that ventilations solutions are sufficiently durable to mitigate aerosol (salt and contaminates) entering building cavities. The control of embers and aerosols migration into buildings can be achieved with the use of mesh covers with typical aperture of max~3mm. When mesh screens are incorporated will require inspection and maintenance to maintain good ventilation.

Step 5 – Refer to the Lysaght Moisture Management Solution details.

Refer to the appropriate solution detail for the project.

Release Date: Sep 2019
Last amended: Aug 2015
Version: VC00031.3
Developed from a map from the Bureau of Meteorology

4.0 LYSAGHT MOISTURE MANAGEMENT SOLUTION DETAILS

4.1. TRUSSED ROOFS WITH SELF-SUPPORTED METAL CLADDINGS

Trussed roofs comprise of a pitched roof, roof space and flat ceiling. Moisture entering the roof space must be removed by either passive or mechanical ventilation to reduce condensation risk. The following diagrams are relative to passive ventilation paths.

Roof cavity not receiving exhaust

For roof pitches < 15° passive ventilation must have the min following path:

- 1a **or** 1b (on opposing eaves); **and** 2, with both having a min opening area of 25,000mm²/lm.

For roof pitches ≥ 15° or a truss span > 10m, passive ventilation must have the min flow path: :

- 1a or 1b (on opposing eaves); and 2, with both having a min opening area of 10,000mm²/m; and 3, with 3 having a min opening area of 5,000mm²/Lm.

Where an exhaust system discharges into an roof space NCC 2019 sets out that:

- Regularly distributed ventilation of an unobstructed vented area of 1/300 of the respective ceiling area for roof pitches ≥ 22°;
- or 1/150 of the respective ceiling area for roof pitches <22°;
- **and** 30% Of the vented area must be provided at the ridge (3) or not more than 900mm below the ridge with the remaining requirement provided by eave vents (1).

Passive vents must prevent water penetration, animals and limit insects from entering the roof space.

When mechanical ventilation is used, it must be substituted for and not used in combination with passive venting at the ridge as this may short circuit the eave to ridge ventilation creating stagnant areas within the roof space. Mechanical vents are best used in combination with passive eave or low-level vents to create air exchange throughout the roof space.

Impermeable membranes limit internal moisture between roof cladding and membrane. Metal roof claddings have a low risk of external water penetration. As a consequence, the membrane does not need to act as a drainage plane and may be terminated prior to the gutter. Terminating the membrane can allow open profiles to provide similar ventilation to 10,000mm²/m in Australian climates (our CUSTOM ORB®corrugated profile provides approx 8,000mm²/m) at eaves and at ridges where flashings have not been scribed.

FIGURE 4.1

a) Detail – Trussed Roof - No Insulation or membrane at roof level

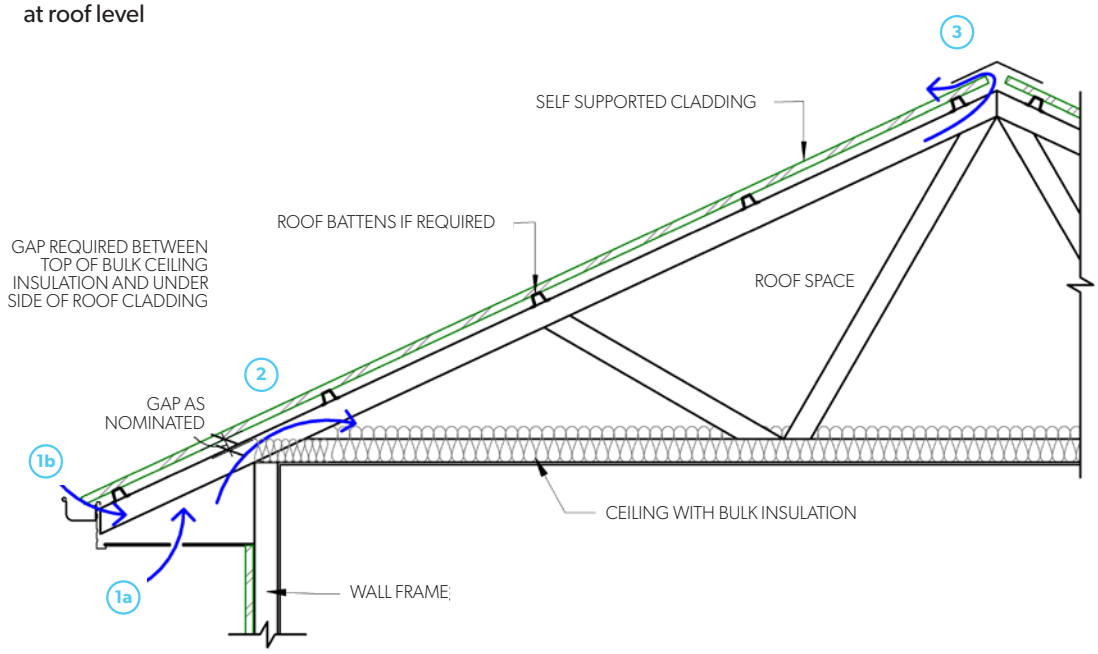


FIGURE 4.2

b) Trussed roof - Draped Impermeable Membrane at Roof Level

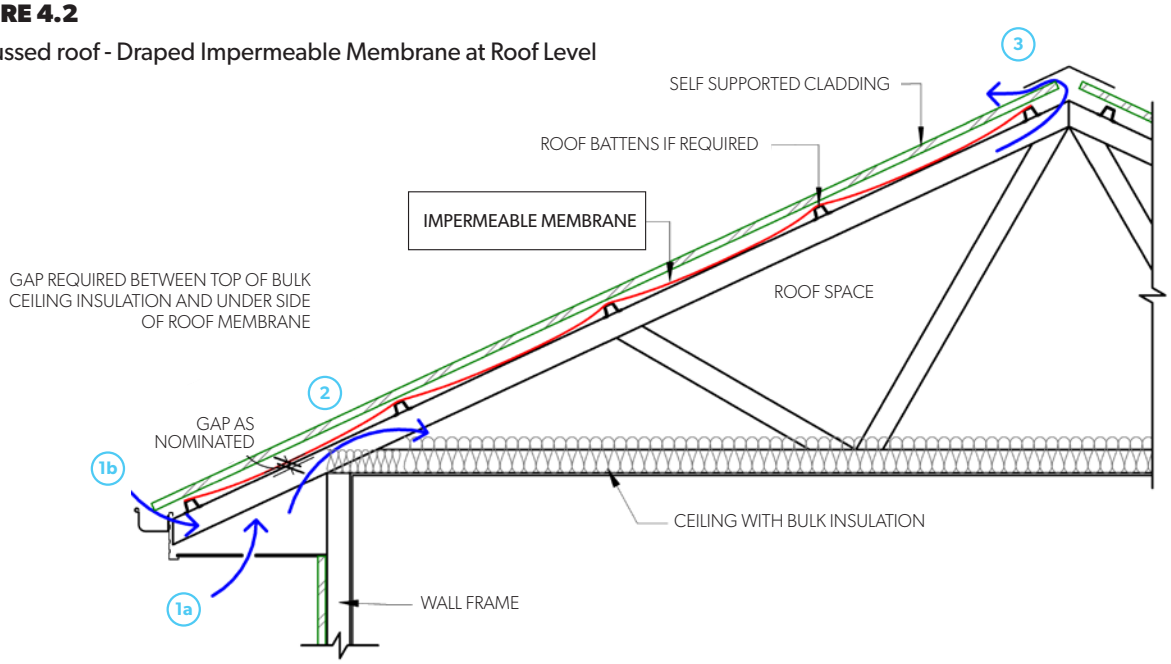
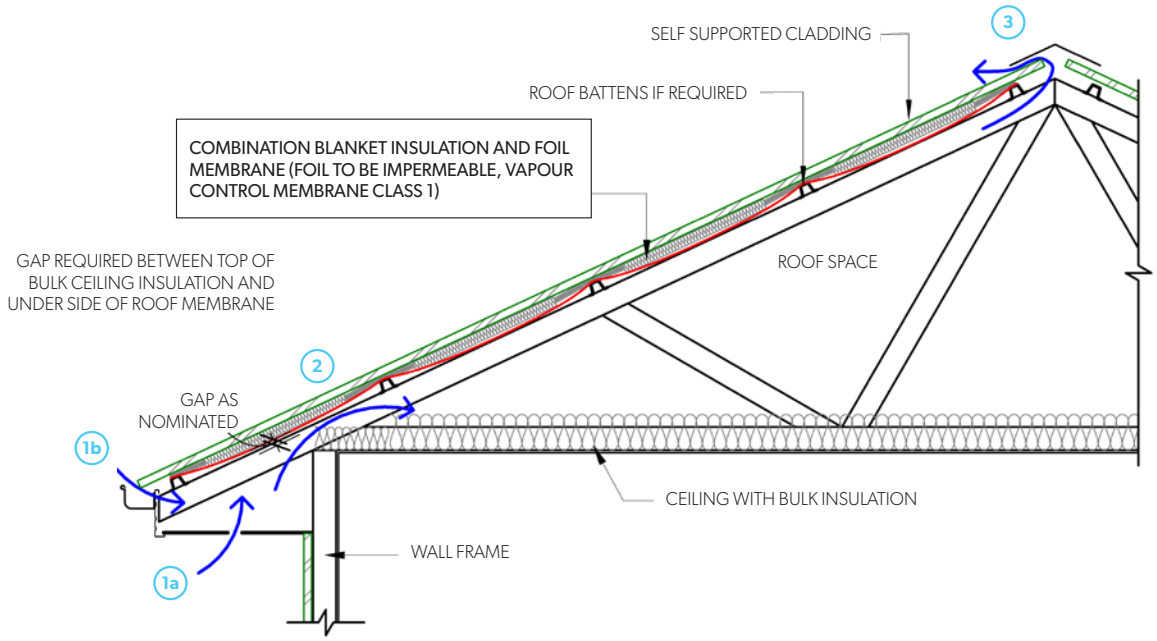


FIGURE 4.3

c) Trussed roof - Blanket Insulation with Impermeable Foil at Roof Level



4.2 SKILLION ROOFS WITH SELF-SUPPORTED METAL CLADDINGS

Skillion roofs comprise of a pitched roof that incorporates a small cavity with ceiling lining that follows the pitch of the roof. Skillion roofs are more prone to moisture due to a smaller cavity that may be restricted. This coupled with their frequent use at low pitches reduces ventilation and drying potential. Therefore it is recommended that slopes on skillion roofs should be ≥ 3°.
For roof pitches < 3° powered roof fan solutions combined with eave ventilation will need to be considered.

Diagrams below are relative to passive ventilation paths. Passive vents must prevent water penetration, animals and limit Insects from entering the space.

For all roof pitches ≥ 3° passive ventilation must have the min following path:

- 1a or 1b; **and** 3.
- *For roof cavities not receiving exhaust;*
  - 1a or 1b must have a min opening area of 25,000mm²/lm, an unrestricted air-flow path of min 20,000mm²/lm to the ridge or high level point and escape ventilation at the ridge or high level point of min 5,000mm²/lm.
- For roof cavities receiving exhaust NCC 2019 sets out that;
  - Regularly distributed ventilation of an unobstructed vented area of 1/300 of the respective ceiling area for roof pitches ≥ 22°;
  - or 1/150 of the respective ceiling area for roof pitches <22°;
  - **and** 30% of the vented area must be provided at the ridge (3) or not more than 900mm below the Ridge with the remaining requirement provided by eave vents (1).

There is to be a minimum clearance of 20mm at the centre of the underlay of the drape of the impermeable membrane to the insulation.

Impermeable membrane to be Class 1 as per AS 4200.1. It is typically installed above the supporting battens/purlins and as such should be draped to create a thermal barrier and minimise contact with the cladding above.

Impermeable membranes limit internal moisture between cladding and membrane. Metal roof claddings have a low risk of external water penetration. As a consequence, the membrane does not need to act as a drainage plane and may be terminated prior to the gutter.

When mechanical ventilation is used it must be substituted for and not used in combination with passive venting at the ridge as this may short circuit the eave to ridge ventilation creating stagnant areas within the roof space. Mechanical vents are best used in combination with Passive eave or low-level vents to create air exchange throughout the roof space.

FIGURE 4.4

Skillion Roof - Draped Impermeable Membrane

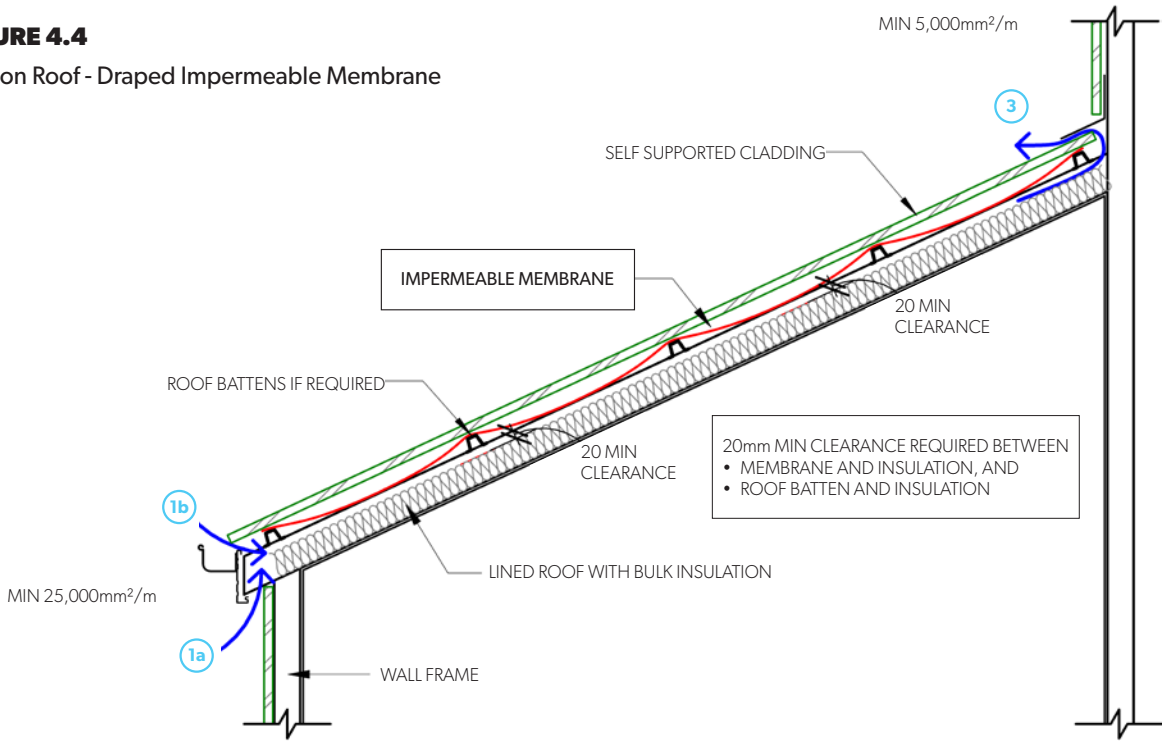
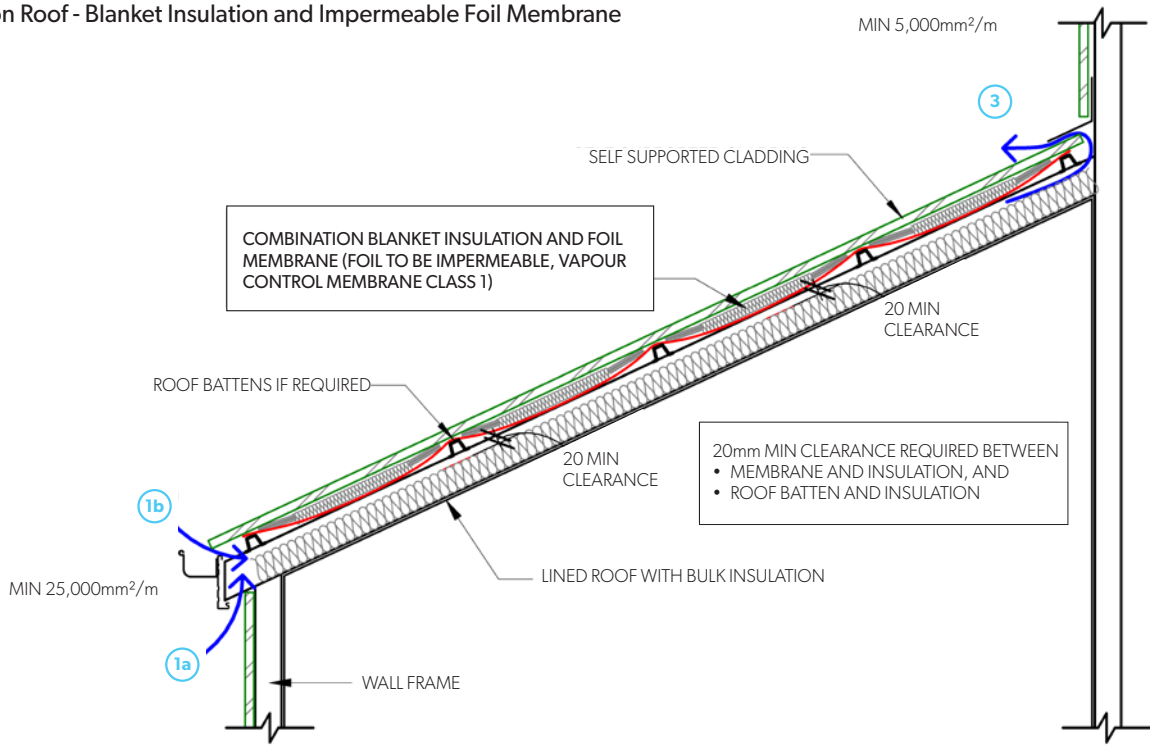


FIGURE 4.5

Skillion Roof - Blanket Insulation and Impermeable Foil Membrane



4.3 TRUSSED ROOFS WITH SUPPORTED METAL CLADDINGS

Trussed roofs comprise of a pitched roof, roof space and flat ceiling. For supported claddings the system incorporates a rigid support over the top of trusses/battens to which the cladding is attached. Moisture entering the roof space must be removed by either passive or mechanical ventilation to avoid moisture build-up (condensation) and consequential damage. The following diagrams are relative to passive ventilation paths.

Passive ventilation should have the following flow path –

- For roof cavities not receiving exhaust;

  a) for roofs without ridge ventilation

  - 1 on opposing eaves; **and** 2 with both 1 and 2 having a min opening area of 25,000mm²/lm)/ or

  b) For roofs with ridge ventilation

  - 1 (on opposing eaves with a min opening area of 10,000mm²/lm); **and** 2; **and** 3 (with a min opening area of 5,000mm²/lm).

- For roof cavities receiving exhaust NCC 2019 sets out that;

  - Regularly distributed ventilation of an unobstructed vented area of 1/300 of the Respective ceiling area for roof pitches ≥ 22°;
  - or 1/150 of the respective ceiling area for roof pitches <22°;
  - **and** 30% of the vented area must be provided at the ridge (3) or not more than 900mm below the ridge with the remaining requirement provided by eave vents (1).

Passive vents must prevent water penetration, animals and limit insects from entering the space.

A pliable building membrane is usually installed between the cladding and rigid support as described below as appropriate;

i. Impermeable membranes

   a) Installed as a vapour barrier when installed <10° pitch.

   b) Membrane shall be self-healing, anti-abrasive and stable at temperatures consistent with metal roof sheet temperatures.

ii. Permeable membranes

   a) Permeable membrane shall be class 4 and water barrier to ensure drainage of condensate out of the cavity

   b) Rigid support to also be permeable to ensure moisture within the roof space can escape via vapour transmitting through to the cladding. Cladding will require venting and draining above the membrane.

   c) Membrane must have the following properties:

      a. for open profile cladding,

         i. Membrane Class 4 as per AS 4200.1, anti-abrasive, water barrier and have absorbency of 150g/m² and drainage capability;

      b. for all closed profile cladding,

         i. Membrane Class 4 as per AS 4200.1, anti-abrasive and is capable of ventilation & drainage (3d mesh types).

      c. Membrane shall be stable at temperatures consistent with metal roof sheet temperatures.

   d) Supported roof cladding on permeable membranes is not recommended in climate zones 7 & 8 as defined by NCC 2019.

   e) Permeable Membranes are not recommended for roof pitches below 10° as they will not facilitate above membrane drainage at low pitches. Impermeable membranes must be used for roof pitches ≤ 10°.

FIGURE 4.6

Trussed Roof - Impermeable Membrane at Roof Level

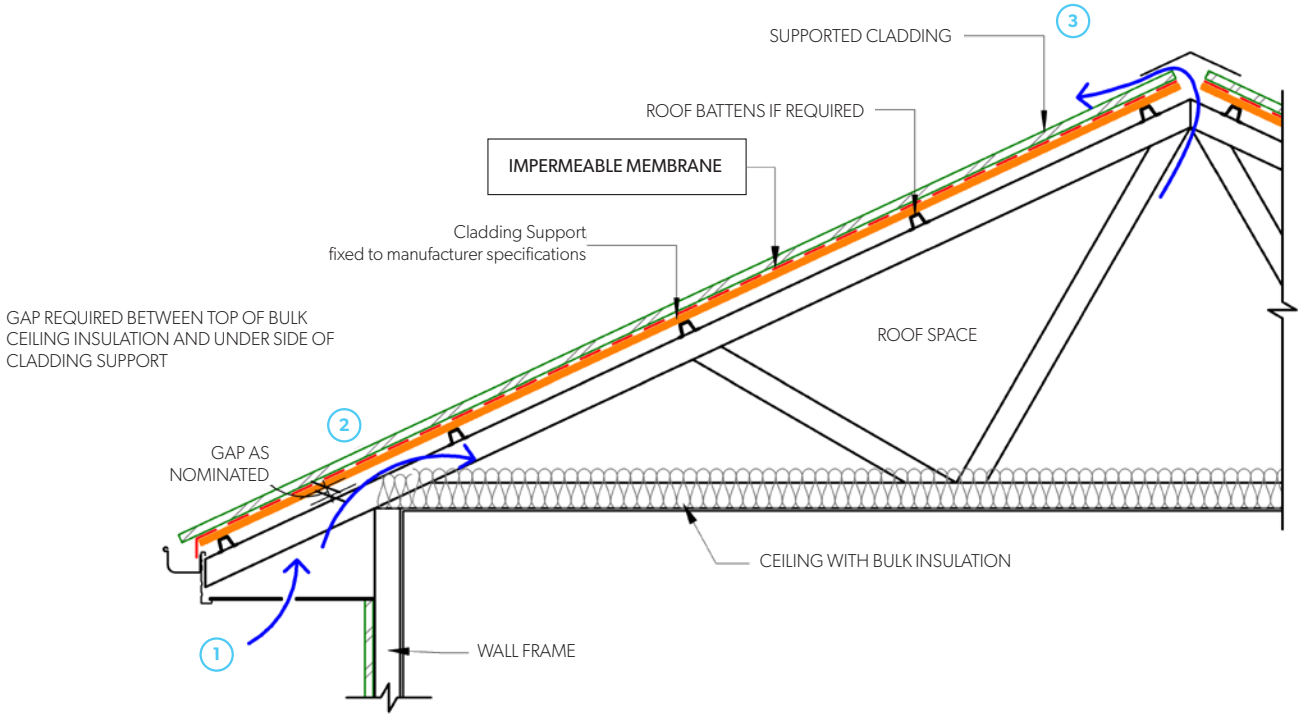
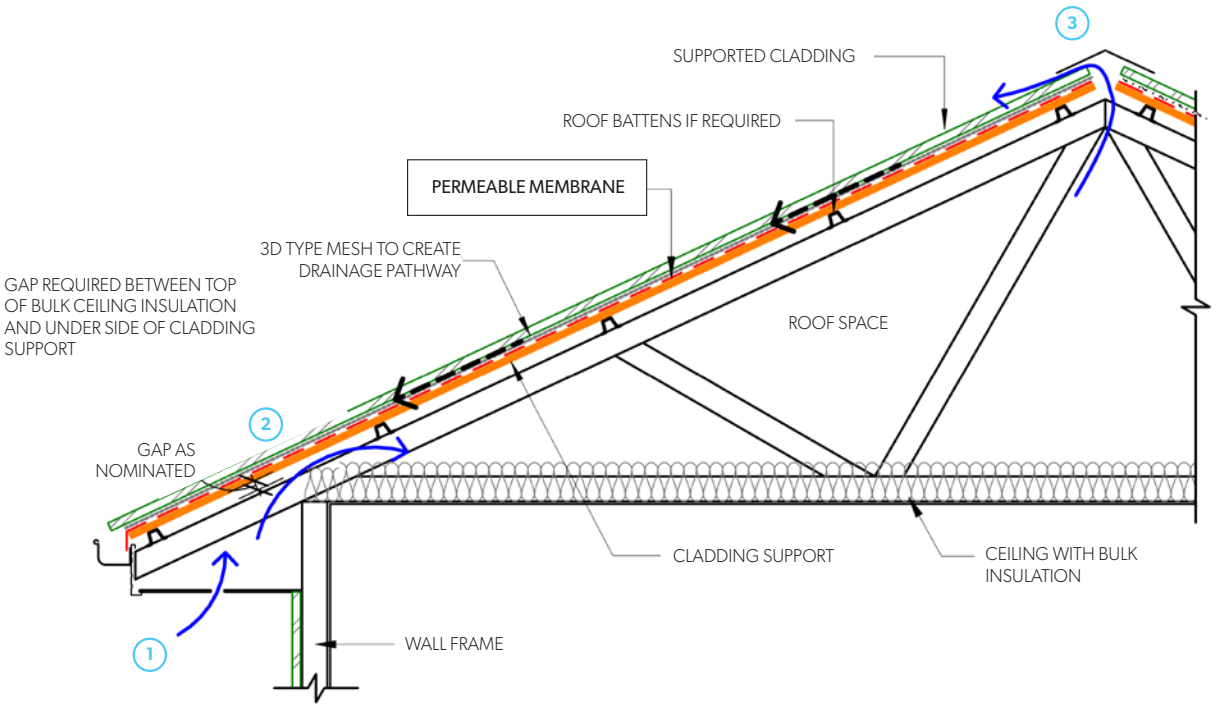


FIGURE 4.7

Trussed Roof - Permeable Membrane at Roof Level



4.4 SKILLION ROOFS WITH SUPPORTED METAL CLADDINGS

Skillion roofs with supported claddings comprise a pitched roof that incorporates a small cavity with ceiling lining that follows the pitch of the roof. The system further incorporates a rigid support over the top of trusses/battens to which the cladding is attached.

Skillion roofs are more prone to moisture due to a smaller cavity that may be restricted. This coupled with their frequent use at low pitches reduces ventilation and drying potential. Therefore, it is recommended that slopes on skillion roofs should be min 3°. For roof pitches < 3° powered roof fan solutions combined with eave ventilation will need to be considered.

Moisture entering the cavity must be removed by either passive or mechanical ventilation to avoid moisture build-up (condensation) and consequential damage.

The following diagrams are relative to passive ventilation paths. Passive vents must prevent water penetration, animals and limit insects from entering the space.

A membrane is usually installed between the cladding and the cladding support.

For all roof pitches ≥ 3° passive ventilation must have the min following path:

- 1a **or** 1b; **and** 3.

- *For roof cavities not receiving exhaust;*
  - 1a or 1b must have a min opening area of 25,000mm²/lm, an unrestricted air-flow path of min 20,000mm²/lm to the high level point and escape ventilation potential at the high level point of min 5,000mm²/lm.
- *For roof cavities receiving exhaust NCC 2019 sets out that;*
  - Regularly distributed ventilation of an unobstructed vented area of 1/300 of the Respective ceiling area for roof pitches ≥ 22°;
  - or 1/150 of the respective ceiling area for roof pitches <22°;
  - **and** 30% of the vented area must be provided at the ridge (3) or not more than 900mm below the ridge with the remaining requirement provided by eave vents (1).

i. *Impermeable membrane*

a) Membrane to be installed as a vapour barrier when installed <10°.

b) Membrane to be vapour control Class 1 as per AS 4200.1, self-healing, anti-abrasive and stable at Temperatures consistent with metal roof sheet temperatures.

ii. *Permeable membrane*

a) Permeable membrane shall be class 4 and water barrier to ensure drainage of condensate out of the cavity

b) Rigid support to also be permeable to ensure moisture within the roof space can escape via vapour transmitting through to the cladding. Cladding will require venting and draining above the membrane.

c) Membrane must have the following properties:

i. for open profile cladding,

1. Membrane Class 4 as per AS 4200.1, anti-abrasive, have absorbency of 150g/m² and drainage capability;

ii. for all closed profile cladding,

1. Membrane Class 4 as per AS 4200.1, anti-abrasive and is capable of ventilation & drainage (3d mesh types).

iii. Membrane shall be stable at temperatures consistent with metal roof sheet temperatures.

iv. Supported roof cladding, on permeable membranes, is not recommended in NCC climate zones 7 & 8.

d) Permeable Membranes are not recommended for roof pitches below 10° as they will not facilitate above membrane drainage at low pitches. Impermeable membranes must be used for roof pitches ≤ 10°.

FIGURE 4.8

Skillion Roof - Impermeable Membrane

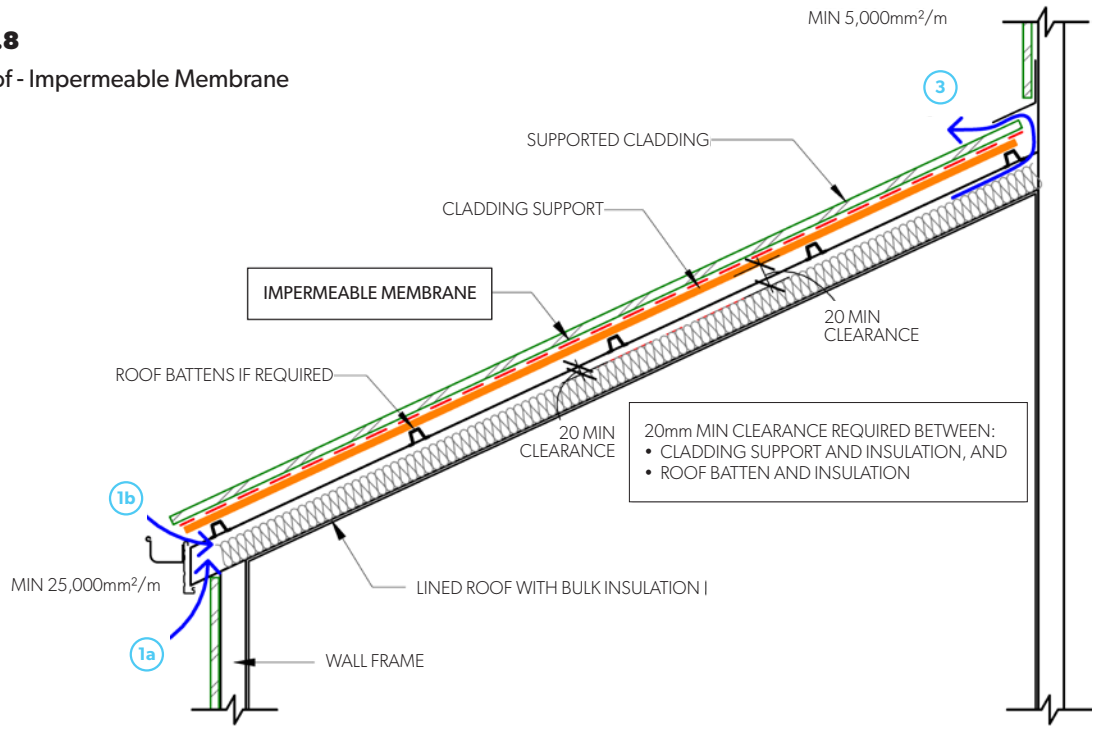
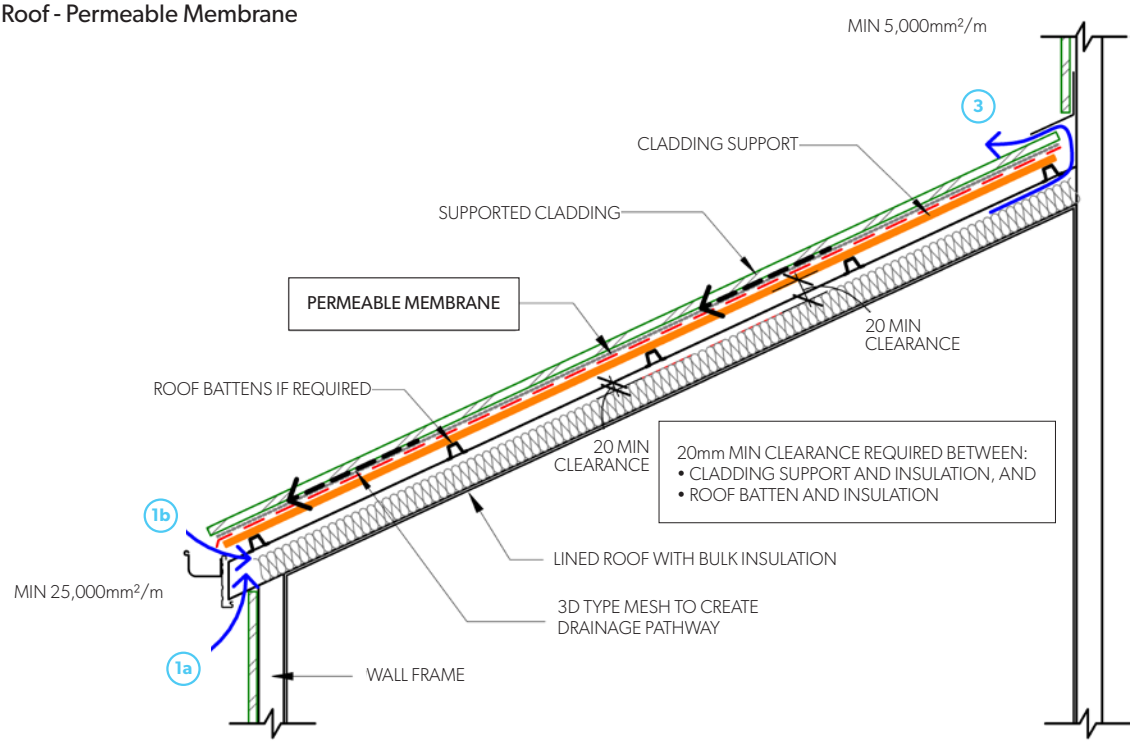


FIGURE 4.9

Skillion Roof - Permeable Membrane



5.0 CONDENSATION CONTROL IN WALLS

NCC 2019 condensation management principles apply to walling as well as roof cavities.

NCC 2019 Deemed to Satisfy (DTS) Provisions are outlined in Figure 5.1 which presents a flow chart of the DTS Provisions for condensation management using pliable building membranes.

When using a pliable building membrane, there are two key points to consider:

1. Is a pliable building membrane required?
2. Does the pliable building membrane need to be vapour permeable?

FIGURE 5.1

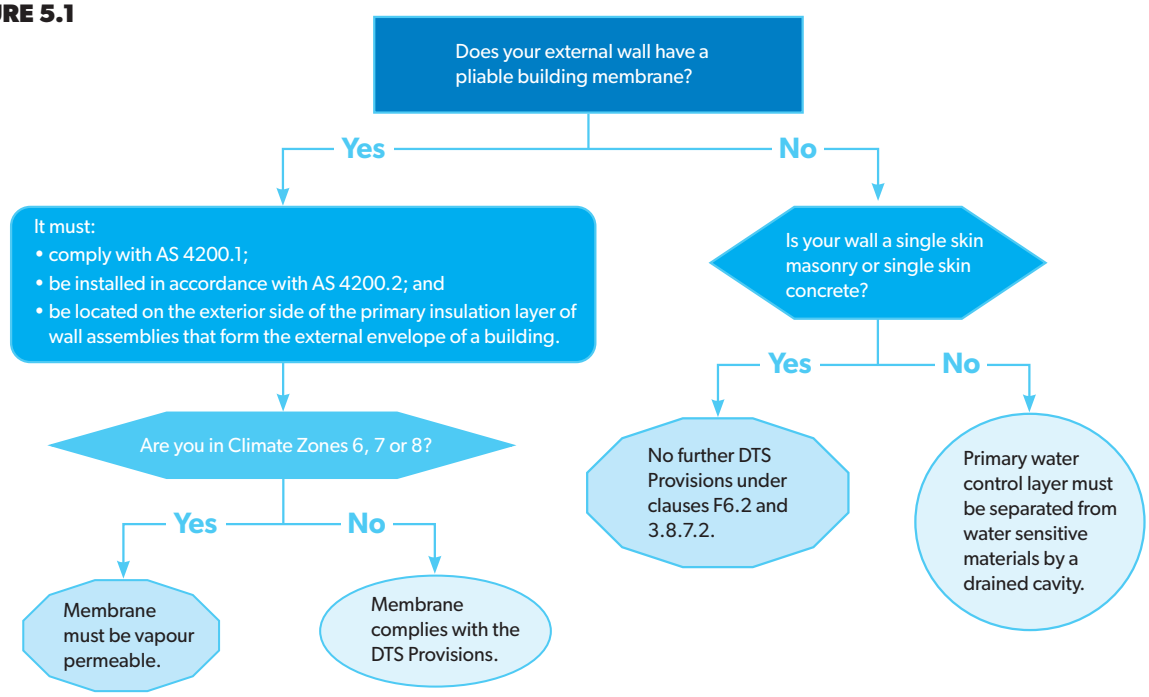


TABLE 1:

Recommended best practice application of pliable membranes in walling				
Climate Zone	**Warm Humid**	**Temperate**		**Cold**
Pliable wall membrane as per AS 4200.1	**Climate Zone 1**	**Climate Zone 2-5**	**Climate Zone 6**	**Climate Zone 7-8**
Impermeable wall membrane	Suitable		Not suitable	
Class 3 impermeable wall membrane	Not suitable	Suitable		Not suitable
Class 4 impermeable wall membrane		Suitable		

A pliable building membrane may be required for different reasons such as weatherproofing purposes, energy efficiency (i.e. part of the total R Value of the envelope) or managing condensation. In some instances, it's also common practice to install a pliable building membrane where it's not strictly required. As an example, a builder or designer might include a pliable building membrane as an extra layer of weatherproofing/insulation or to protect water sensitive materials. In this situation, whilst well-intentioned, it might inadvertently create a risk associated with water vapour and condensation.

When thinking about whether a pliable building membrane needs to be vapour permeable or not, how the water vapour moves through the building envelope needs to be considered. A pliable building membrane is often placed on the external side of water sensitive materials. This may prevent water vapour from escaping the building envelope, creating a situation where condensation accumulates on the internal side of the pliable building membrane (where the water sensitive materials are located). NCC 2019 addresses this issue by requiring that pliable building membranes installed in cooler climate zones i.e. 6, 7 and 8 be vapour permeable membranes regardless of why they have been installed.

5.1. WALLS WITH SELF- SUPPORTED METAL CLADDINGS – INSTALLED HORIZONTALLY OR VERTICALLY

Internal linings of all wall systems (timber or steel framed) should be tightly sealed to minimise the risk of internally generated moisture moving into the wall. Insulation placed within the wall should be adequately contained so that it will not move, be subject to moisture or restrict ventilation of a cavity.

The membrane outside the frame should be suitable to the applicable climate zone as per table 1 and be stable at temperatures consistent with metal wall sheet temperatures.

Open mesh, screen or similar with an open area of min 5,000mm²/m may be provided at the bottom and/or top of the profile.

Open profile claddings – Installed Vertically

- Cladding maybe fixed to battens or directly to framing. Direct fixing is suitable as open Profiles provide sufficient ventilation and drainage. Direct fixed cladding to steel frame requires inclusion of a thermal break between the cladding and the steel framing in accordance with NCC 2019 requirements.
- The profile flashings should not seal the cladding so as to allow ventilation and drainage from behind the cladding profile.

Open profile claddings - Installed Horizontally

- Fix to vertically installed battens so as to allow suitable ventilation drainage from behind the cladding profile.

Closed profile claddings - Installed Vertically or Horizontally

- Cladding must be fixed to battens to create a drained and ventilated cavity behind the cladding. Batten installation shall be designed to avoid pondage of water. We recommend a packing piece behind every fixing point.

FIGURE 5.2

Side Elevation - Closed Profile - Horizontal Fix

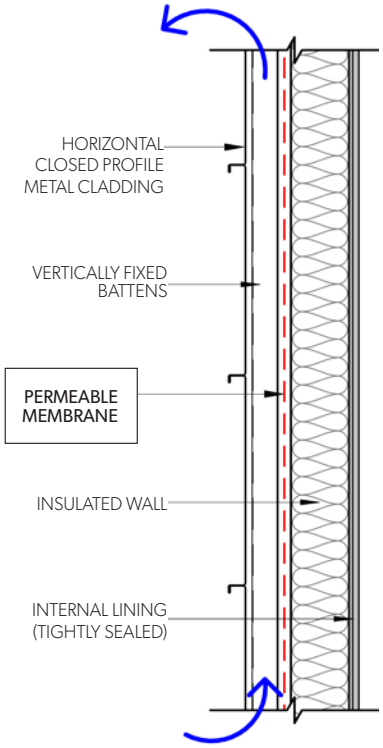


FIGURE 5.3

Plan View - Closed Profile - Horizontal Fix

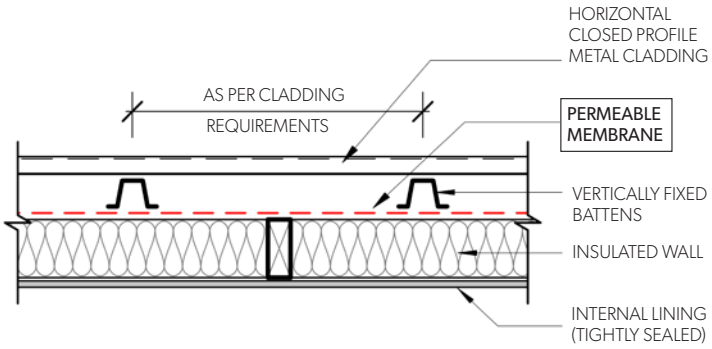


FIGURE 5.4

Side Elevation - Open Profile - Horizontal Fix

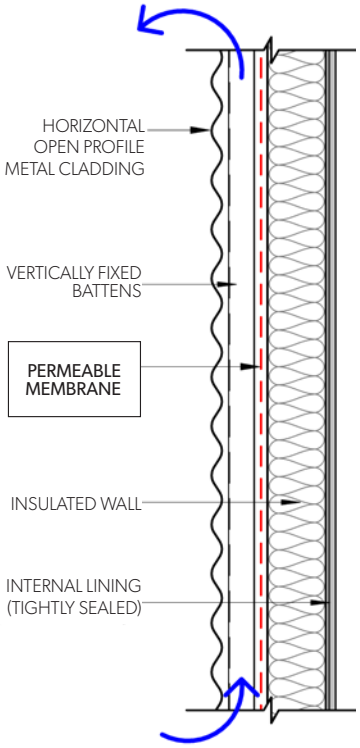


FIGURE 5.5

Plan View - Open Profile - Horizontal Fix

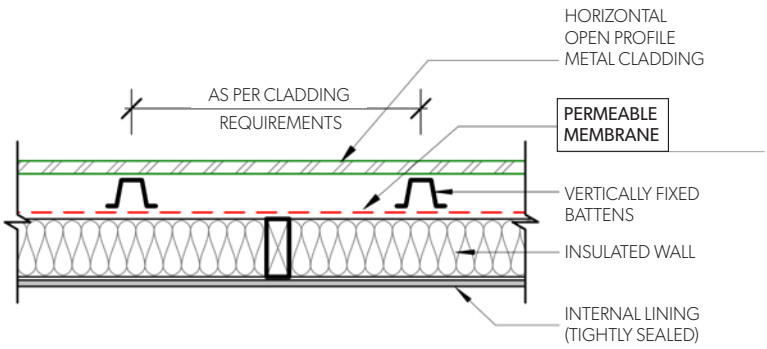


FIGURE 5.6

Side Elevation - Closed Profile - Vertical Fix

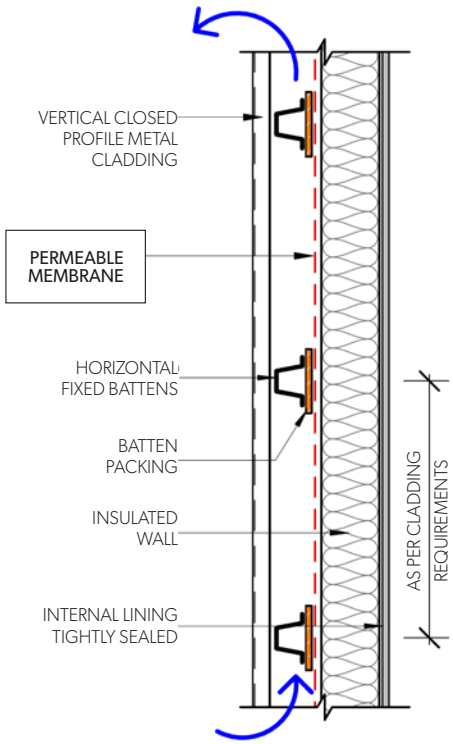


FIGURE 5.7

Plan View - Closed Profile - Vertical Fix

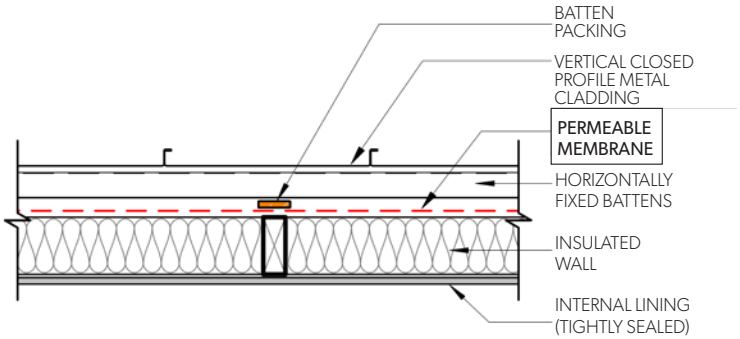


FIGURE 5.8

Side Elevation - Open Profile - Vertical Fix

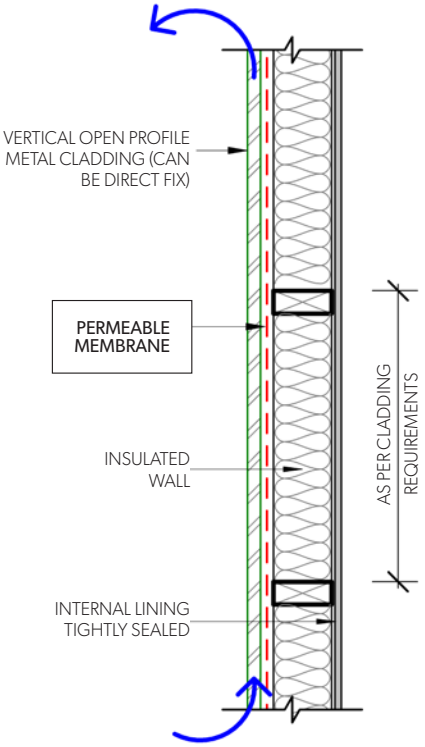
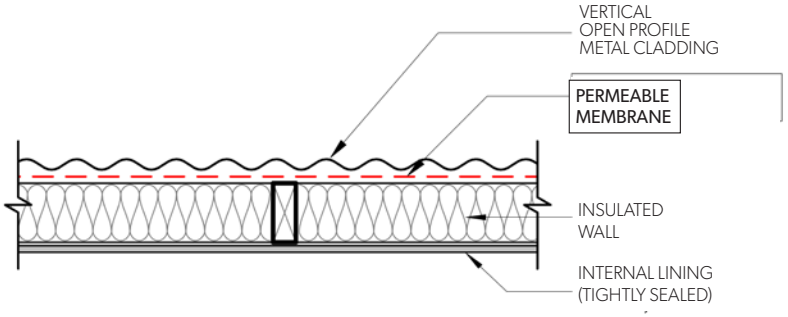


FIGURE 5.9

Plan View - Open Profile - Vertical Fix



5.2 WALLS WITH SUPPORTED METAL CLADDINGS – INSTALLED HORIZONTALLY OR VERTICALLY

Information outlined herein assumes that supported metal wall claddings are Closed profiles. (Open profiles are generally self–supporting).

Internal linings of all wall systems (timber or steel framed) should be tightly sealed to minimise the risk of internally generated moisture moving into the wall. Insulation placed within the wall should be adequately contained so that it will not move, be subject to moisture or restrict ventilation of a cavity.

Membranes are to be installed between the cladding and the rigid support. The following considerations are applicable to Impermeable and Permeable membranes.

i. *Impermeable membrane*

a. Passive ventilation of the cavity behind the rigid support must be provided to remove internal moisture. This is achieved by installing battens behind the rigid support to create a drained and ventilated cavity.

b. The batten installation shall be designed to avoid pondage of water.

c. Open mesh, screen or similar with an open area of min 5,000mm^2/m may be provided at the bottom and/or top of the profile to block pests.

d. The impermeable membrane to be vapour control Class 1 as per AS 4200.1, self-healing, anti-abrasive and stable at temperatures consistent with metal wall sheet temperatures.

ii. *Permeable membrane*

a. The rigid support should also be permeable to ensure moisture within the wall space can escape via vapour transmitting through to the cladding. The cladding must be designed to be vented and draining at the membrane.

b. The Permeable membrane must have the following properties:

i. Suitable to the applicable climate zone as per table 1, anti-abrasive and is capable of ventilation and drainage (3d mesh types).

ii. Membrane shall be stable at temperatures consistent with metal sheet temperatures.

c. The rigid support may be directly fixed to the frame providing the internal lining is adequately sealed so as to provide an air barrier to the wall cavity. There is usually doubt about the ability to create this air gap, so it is recommended to fix to battens to create a vented and drained cavity as per impermeable membrane.

FIGURE 5.10

Side Elevation - Closed Profile - Horizontal & Vertical Fix

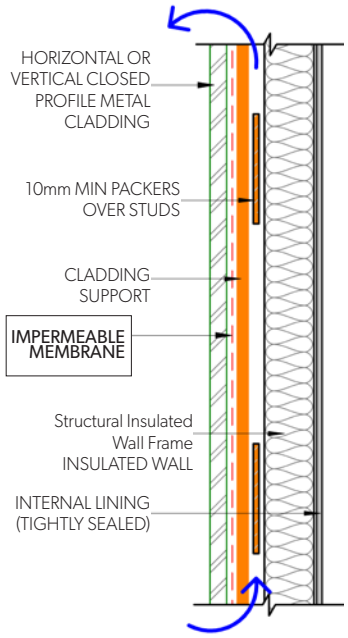


FIGURE 5.11

Plan View - Closed Profile - Horizontal & Vertical Fix

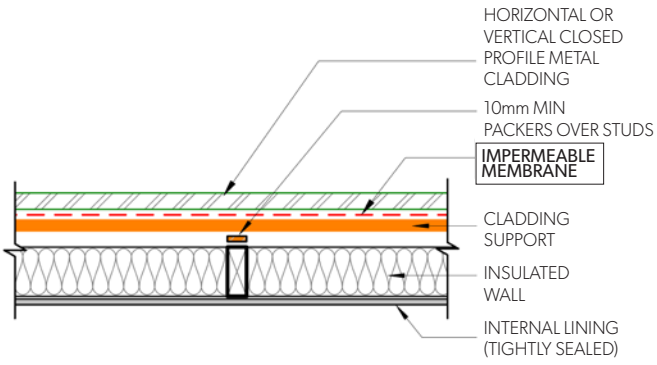


FIGURE 5.12

Side Elevation - Closed Profile - Horizontal & Vertical Fix

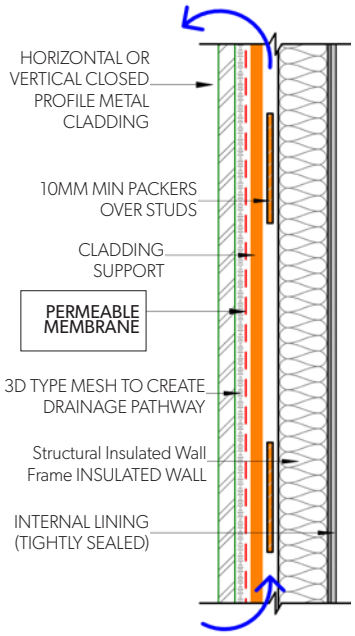
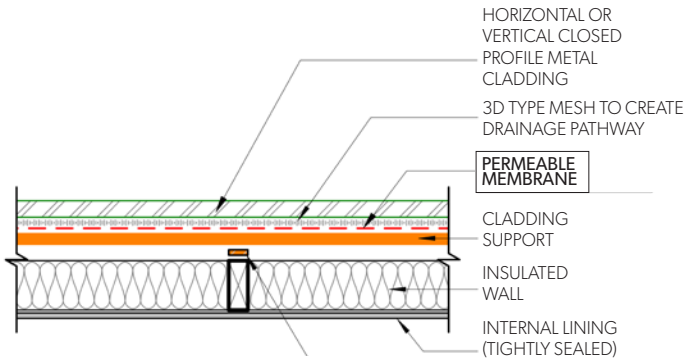


FIGURE 5.13

Plan View - Closed Profile - Horizontal & Vertical Fix



5.3 WALLS WITH SELF-SUPPORTED METAL RAIN SCREEN OR PANELISED CLADDINGS – INSTALLED HORIZONTALLY OR VERTICALLY

Metal rain screen/panelised wall systems require a secondary weather protection layer (membrane) behind to provide both drainage of the rain that penetrates to outer metal skin, and ventilation to dry the cavity behind.

Internal linings of all wall systems (timber or steel framed) should be tightly sealed to minimise the risk of internally generated moisture moving into the wall. Insulation placed within the wall should be adequately contained so that it will not move, be subject to moisture or restrict ventilation of a cavity.

Battens and membrane installation should be designed to avoid pondage of water and protection from capillary action at joints and laps.

i. Impermeable membrane

a) When impermeable membrane is selected, it must be installed to allow Internal moisture to escape and protect internal framing and insulation. As this method is hard to achieve, we recommend the use of Permeable membranes only with self-supporting panelised metal cladding.

ii. Permeable membrane

b) Membrane must have the following properties:

a. Membrane shall be suitable to the applicable climate zone as per table 1 and anti-abrasive,

b. Have absorbency of 150g/m² and drainage capability

c. Membrane shall be stable at temperatures consistent with metal cladding temperatures

FIGURE 5.14

Side Elevation - Panelised Profile - Vertical Fix

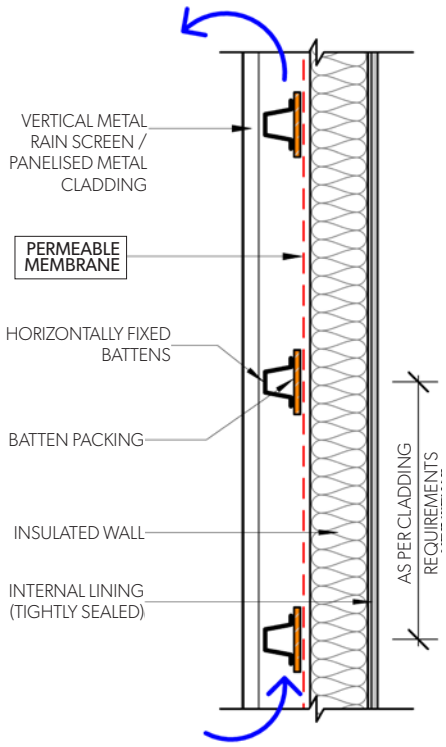


FIGURE 5.15

Plan View - Panelised Profile - Vertical Fix

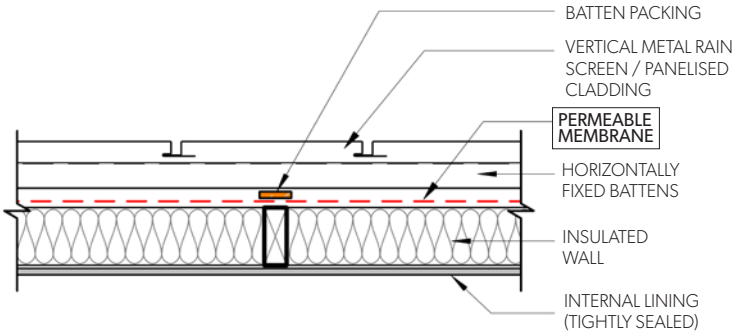


FIGURE 5.16

Side Elevation - Panelised Profile - Horizontal Fix

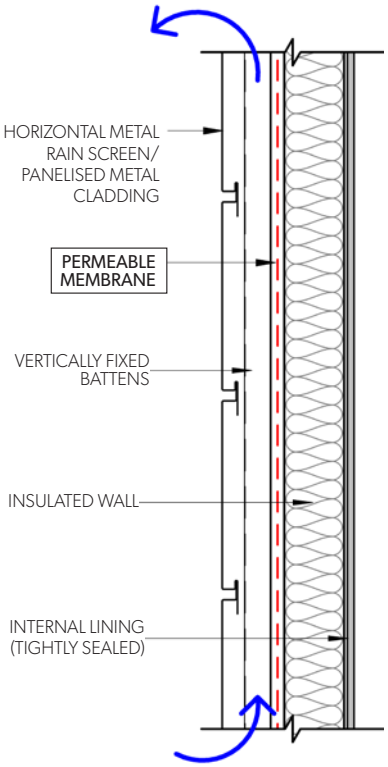
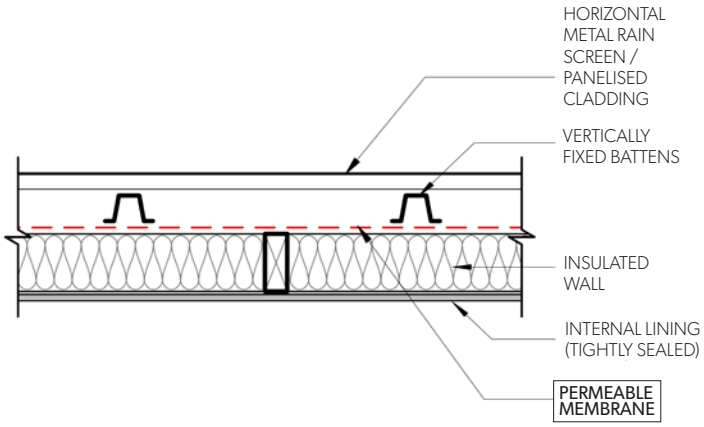


FIGURE 5.17

Plan View - Panelised Profile - Horizontal Fix



6.0 APPENDIX

a. AS 4200.1 - Table 4 Vapour Control Membrane classification

TABLE 1:

VAPOUR CONTROL MEMBRANE (VCM) CLASSIFICATION

Vapour Permeance (see note) µg/N.s			
Class	VCM category	Min.(≥)	Max. (<)
Class 1	Vapour barrier	0.0000	0.0022
Class 2		0.0022	0.1429
Class 3	Vapour permeable	0.1429	1.1403
Class 4		1.1403	No max.
	ASTM-E96 Method B Wet Cup–23°C 50%RH		

Note: Vapour permeance is the inverse of vapour resistance. It shall be calculated as follows:

Vapour permeance µg/N.s = 1/ (Vapour resistance MN.s/g)

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AUSTRALIAN STANDARDS

Australian Standard	Definition
AS 4200.1:2017	Pliable building membranes and underlays, Part 1: Materials
AS 4200.2:2017	Pliable building membranes and underlays, Part 2: Installation

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