Condensation management solutions for residential pitched metal roof applications

Vapour permeable sarking

Fletcher Insulation

Building Better, Together

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INTRODUCTION

Metal roofs are a high performing choice for Australian homes, providing fire resistance, protection from the elements, structural strength and durability. However, incorrect design, specification or installation of metal roofing systems can lead to problems such as condensation.

Across the country, condensation affects thousands of homes and apartment blocks each year. Structural damage, mould growth and poor indoor air quality are only some of the consequences of poorly-managed moisture levels within a home. Such problems often go unnoticed by homeowners until it is too late, when extensive repairs are unavoidable.

Without proper design, condensation on the underside of metal roofing can happen on many nights, in many locations throughout Australia. Fluctuating differences in internal and external air temperatures causes water vapour to build up inside the building structure. When the metal roof's temperature drops at night, the moisture in the air condenses on the underside of the roof. Metal is an effective conductor, heating up and cooling down faster than other materials, which is a factor that contributes to the risk of condensation.

Issues with condensation have emerged as a significant problem in Australian homes due to increased energy efficiency requirements, which have led to the construction of 'air tight' buildings.[1] This, along with a lack of ventilation, results in water vapour being trapped within the building envelope. In cooler climates, the greater difference in internal and external air temperatures causes more water vapour to build up, increasing the risk of condensation.

Design decisions for roof and/or ceiling systems can be complex in relation to condensation control as products need to be specified for other attributes as well as to manage water vapour in roofs. Requirements will vary by climate zone, so selecting the right products is important for compliance, as well as protecting homeowners and occupants from the harmful effects of condensation.

In this whitepaper, we take a closer look at the effects of condensation in residential pitched metal roof applications and consider appropriate approaches to condensation management for standard pitched metal roofs in temperate and cold climates.

METAL ROOFING AND CONDENSATION EXPLAINED

In temperate and cold climates in Australia, condensation on the underside of a metal roof is mainly caused by warm moist air escaping from the home into the roof space. This warm moist air permeates the ceiling and insulation, rising to the space underneath the metal roof. When the heated air comes into contact with the underside of the cold roof sheeting, the moisture in the air condensates as water droplets on the inside surface of the roof.

This phenomenon is sometimes referred to as metal roof 'sweating', and is a result of temperature differential between the inside and outside of the roof. On cold, clear nights, the surface of the metal roof is colder than the interior. For as long as the metal sheeting remains cooler than the air that is in contact with it, there is a risk of condensation forming on its surface.

In Australian homes, there could be several factors that increase the risk of condensation such as the local weather condition, the home design and non-absorbent building materials. In recent years, a major focus in building design has been on improving the energy efficiency and thermal comfort of homes.[2] Sealing homes against air leakage is one of the most common design strategies to improve thermal comfort by minimising heat loss, but it can have adverse consequences in condensation management. Where there is insufficient ventilation in the roof space, water vapour generated by household activities (e.g. clothes drying, showering, cooking and washing) can build up, triggering condensation issues especially during the winter.

Foil-faced, under roof insulation is one measure used to help address condensation issues with metal roofs. It does so by regulating the building temperature and preventing humid, moist indoor air from coming into contact with the cool metal surface. However, without proper design, any thermal bridging in the roof and ceiling structure can still result in condensation.

Thermal bridging occurs when a more conductive or poorly insulated material provides a pathway for heat to flow across a thermal barrier, bypassing otherwise effective insulation. In roof structures, thermal bridges can often be seen between roofing and sarking materials, between sarking and ceiling insulation, and between uninsulated and insulated areas of the ceiling. On cold nights, these thermal bridges can transfer that external cold temperature through to the internal linings, providing the conditions for condensation to form on the interior surface.

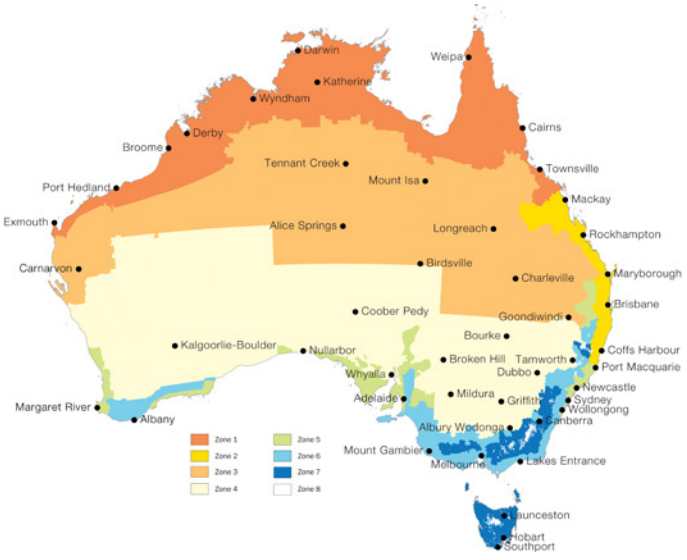
EFFECTS OF CONDENSATION

A 2015 scoping study into condensation in residential buildings was conducted by the Australian Building Codes Board (ABCB) in response to concerns raised by industry stakeholders in relation to a spate of Australian buildings experiencing unacceptable levels of condensation and mould. The study found that up to 40% of new buildings in Australia displayed signs of condensation and mould.[3]

The study also highlighted examples of the negative impacts of condensation, particularly relating to human health and amenity as well as building structural integrity. Some of the most concerning effects are as follows:

- corrosion of metal structures, timber decay, cladding rot or swelling, particularly on structural building elements;
- poor indoor comfort due to reduced effectiveness of thermal insulation; and
- growth of fungus, mould and mildew that reduces indoor air quality and can have adverse effects on the health of occupants.

In many cases, condensation damage requires significant remediation, leading to high costs of deconstruction, reconstruction and repairs, not to mention the costs of poor health to individuals as well as the broader economy.



CONDENSATION MANAGEMENT IN THE NCC 2019

In response to the growing condensation crisis, the National Construction Code 2019 (NCC 2019) introduced regulations relating to condensation management in residential homes. In relation to standalone single residential dwellings, P2.4.7 in NCC 2019 Vol. 2 provides that any risk associated with water vapour and condensation must be managed to minimise their impact on the health of occupants.

These requirements are supported by a shift towards more passive condensation control measures within Australian design. And some experts provide guidance on condensation management that is suitable for most temperate and cold climates in Australia.

For example, with other recommendations, The condensation in buildings - Tasmanian Designers' Guide - Version 2 describes the following solutions to manage roof space condensation:[4]

- extraction systems which duct moist air outside the building.
- installing supply and exhaust ventilation to remove water vapour from the roof space;
- moving sarking to underneath battens to minimise thermal bridging;
- ventilation in the sarking space; and/or
- using vapour permeable sarking.

VAPOUR PERMEABLE SARKING

Vapour permeable roof sarking is a flexible laminated membrane installed under metal roof cladding for added long-term protection of the roof's structural components. As the name suggests, it allows water vapour to escape the roof structure while simultaneously preventing condensate water from dripping into the roof space.

The Tasmanian Designers' Guide recommends a sarking under battens installation method. This method minimises thermal bridging and provides a drying path with the sarking acting as a water barrier that prevents water dripping into the ceiling. Designers can add ventilation and/or a drainage batten to the roof structure to further reduce the risk of condensation.

CONDENSATION MANAGEMENT SOLUTIONS FROM FLETCHER INSULATION

SISALATION® VAPAWRAP® VAPOUR PERMEABLE METAL ROOF SARKING

Fletcher Insulation has developed two condensation management solutions using Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking to manage condensation in standard pitched roof spaces for the comfort of occupants in temperate and cold climates. (The solutions are not suitable for buildings in hot and humid climates such as Climate Zone 1.)

- **Solution 1:** Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking installed under roof batten.
- **Solution 2:** Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking installed under drainage batten.

Both solutions are based on recommended installation methods described in the Tasmanian Designers' Guide (referenced in the ABCB's *Condensation in buildings Handbook* 2019).

Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking is a synthetic sarking specifically designed for use under metal roof cladding materials. It provides a lightweight, flexible water barrier and water vapour permeable membrane that can be used underneath metal roofing.

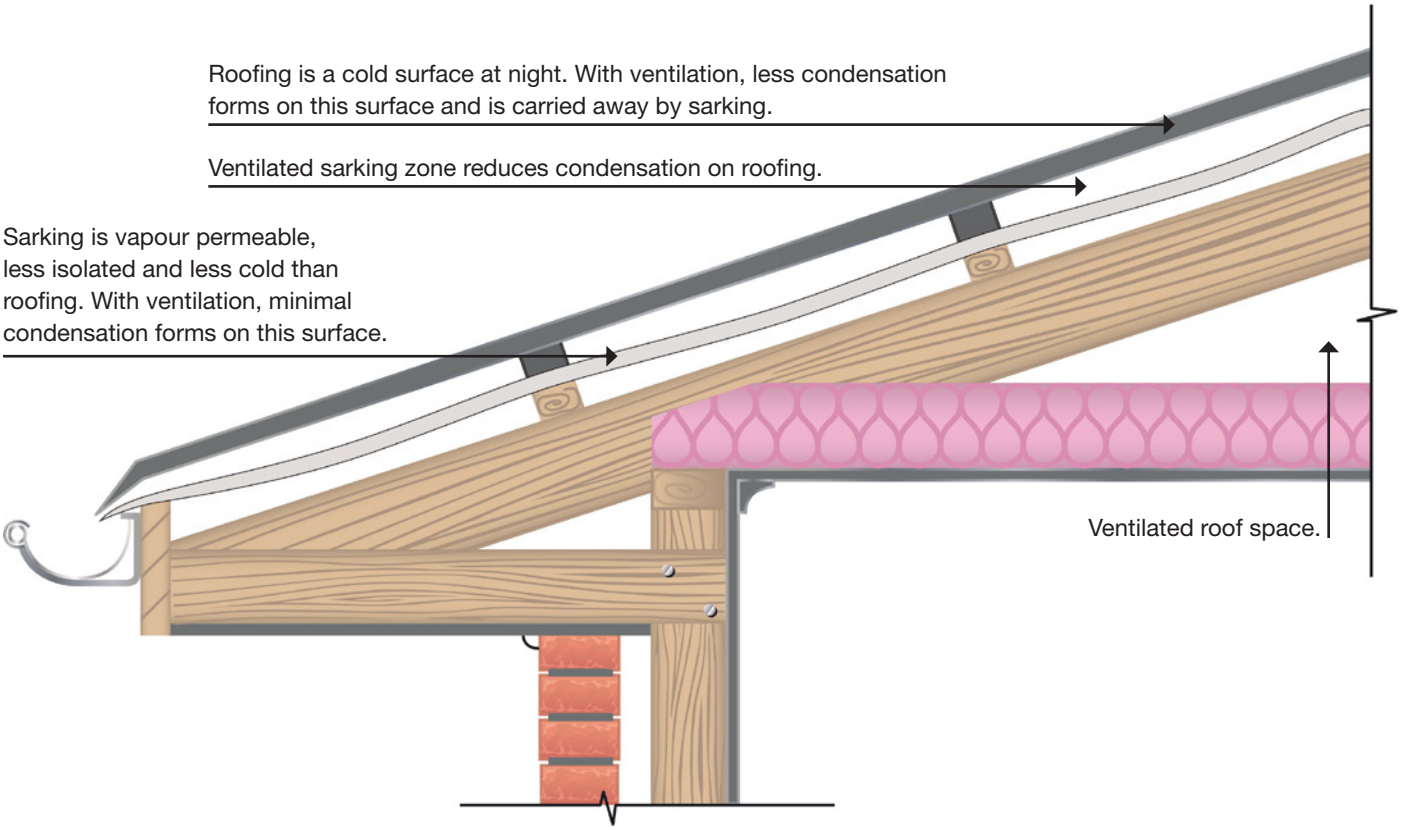
By installing Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking under battens or under drainage battens, thermal bridging is minimised. With the presence of ventilation in the sarking zone and the roof space, these conditions combined will minimise condensation in the roof space.

Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking can be installed prior to the battens being installed, an extra counter batten can also be installed on top of the batten for better ventilation or wider air gap if desired. Alternatively, one or two-layer drainage battens can be added before the roof cladding is installed.

In the unlikelihood of condensation occurring beneath the metal roof cladding, these solutions can:

- provide a venting pathway above and below the membrane to allow moisture to escape from the roof system and protect the roof structure;
- allow condensates to drain into the gutter; and
- enable the membrane to function as a water barrier, preventing water from dripping through the membrane.

Fletcher Insulation recommends suitably designed natural or mechanical ventilation for the roofing system as per the NCC 2019. An increase in ceiling insulation is also recommended to compensate for any loss of thermal insulation and to meet NCC energy efficiency requirements – and also for any loss of acoustic insulation.



FLETCHER INSULATION DRAINAGE BATTEN

Fletcher Insulation's drainage batten is a flame retardant twin wall channel designed to facilitate air and vapour movement and create a pathway for drainage between the Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking and the metal roof cladding. Constructed from high impact copolymer polypropylene for enhanced impact resistance, it is extremely tough and durable.

The drainage batten is recommended for installation over Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking when using on residential metal roofs with a standard pitch roof. It provides an independent separated space between the metal cladding and the Sisalation® Vapawrap® Vapour Permeable Metal Roof sarking, effectively reducing the risk of condensation by allowing an unobstructed drying path for condensate liquid to drain away into the gutter.

DRAINAGE BATTEN BENEFITS

- Provides drainage and a ventilation pathway under metal roofing.
- Reduces the risk of ponding on sarking behind roof battens and at eaves.
- Facilitates sarking to be installed without contacting the roof cladding, consequently, reducing the risk of condensation forming under the roof sarking.
- Can be used where roofing battens have already been laid on a roof permitting quicker install of system and compliance with building standards.
- Reduces conductive heat transfer between the roof/wall cladding and the building structure.
- Will not readily melt or spread flame in the event of a fire.

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REFERENCES

1 Tasmanian Government. “Condensation in Buildings – Tasmanian Designers’ Guide - Version 2.” Consumer, Building and Occupational Services. https://www.cbos.tas.gov.au/__data/assets/pdf_file/0004/463630/Condensation-in-buildings-guide-2019.pdf (accessed 5 December 2021).

2 Dewsbury, Mark, Tim Law, Johann Potgieter, Desmond Fitzgerald, Bennet McComish, Thomas Chandler and Abdel Soudan. “Scoping Study of Condensation in Residential Buildings.” ABCB. https://www.abcb.gov.au/sites/default/files/resources/2020/Scoping_Study_of_Condensation_in_Residential_Buildings.pdf (accessed 5 December 2021).

3 Ibid.

4 Above n 1.

All information provided correct as of December 2021

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