PAB14

LYSAGHT PRODUCT ADVISORY BULLETIN

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CONDENSATION MANAGEMENT IN ROOF CAVITIES - VENTILATION OF THE ROOF SPACE

INTRODUCTION[1]

The National Construction Code (NCC) 2019 introduced new provisions to help minimize the impacts of condensation within houses and apartments.

The new provisions include provisions for the installation of pliable building membrane (sarking) to control ingress of moisture through the external wall, the discharge of exhaust fans and ventilation of the roof space.

These new provisions are the first step through the NCC in providing provisions to assist in the mitigation of condensation within Class 1, 2 and 4 buildings. Further measures are being considered for NCC 2025.

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 minimize 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 much about how the building is used as it is about how it is built.

This is reflected in the NCC Performance Requirement which states:

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.

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 colonization 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.

MAIN CAUSES OF CONDENSATION IN ROOF SPACES(3)

The 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.

KEY WAYS TO MINIMISE CONDENSATION IN ROOF SPACES

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

VENTILATION OF ROOF SPACES(4)

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 by providing detailed information regarding the amount of ventilation required and their locations.

Where an exhaust system covered by F6.3 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.

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: 300m^2 Ventilation required: 1m^2 Ventilation at ridge: 0.3m^2
≤22°	1/150	30%	Ceiling area: 300m^2 Ventilation required: 2m^2 Ventilation at ridge: 0.6m^2

Roofs with a pitch greater that 22° requires 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 1m^2 of unobstructed ventilation, with 30% or 0.3m^2 to be located not more than 900 mm below the ridge or highest point of the roof space, measured vertically.

Similarly roofs with a pitch equal to or less than 22° requires 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 1m^2 of unobstructed ventilation, with 30% or 0.3m^2 to be located not more than 900 mm below the ridge or highest point of the roof space, measured vertically.

ROOF VENTILATION SYSTEMS

Roof space ventilation is important to help keep the roof space dry by allowing water vapour that passes into the roof space to escape. Roof space ventilation provided by passive means can be effective to manage condensation risk in the majority of buildings. Passive ventilation can be achieved by natural ventilation of the roof space via unobstructed ventilation paths entering and exiting around the roofing perimeter, ridges and hips through open metal profiles and gaps. Passive ventilation can be supplemented where required to provide higher performance through additional eave, ridge and or roof vents. Powered ventilation, including solar, can be used to assist in higher risk climates or buildings.

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

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 vent 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.

VENTILATION CALCULATIONS (SAMPLE)

The following examples show how to calculate the ventilation requirements for both whirlybirds and VENT-A-ROOF under the new rules:

CALCULATION EXAMPLE FOR A "TYPICAL" RESIDENTIAL BUILDING WITH BATHROOMS AND KITCHEN EXHAUST VANS VENTING INTO ROOF SPACE.

House ceiling m^2 = 250m^2

Roof pitch = 22.5 degrees

Therefore,

250m^2 ceiling area x requirement > 220 i.e.

1/300 (0.003) = 0.833m^2 of ventilated opening.

This may be split 30/70 between ridge and eave vents

Therefore,

0.833m^2 x 30% = 0.250m^2 Ridge vent

0.833m^2 x 70% = 0.583m^2 Ridge vents

Ventilation capacities,

- 1m of VENT-A-ROOF® (VAR) ridge provides 0.019008m^2 of unobstructed area for ventilation.
- Generally, a 300mm diameter whirlybird (WB) provides an unobstructed area for ventilation of 0.07m^2 ea
- A 400mm x 200mm eave vent (EV) will provide 0.08m^2 of unobstructed area for ventilation

Therefore,

Whirlybird calculation

- 0.250m² ridge ventilation requirement / 0.07m² WB capacity = 3.6 whirlybirds i.e. 4 whirlybirds.
- 0.833m² eaves ventilation requirement / 0.08m² EV capacity = 10.4 i.e. 11 eave vents

VENT-A-ROOF® CALCULATION – WITH EAVE VENTS

- 0.250m² ridge / hip ventilation requirement / 0.019008m² VAR capacity = 13.15 meters of VENT-A-ROOF® ridge ventilation
- 0.833m² eaves ventilation requirement / 0.08m² EV capacity = 10.4 i.e. 11 eave vents

VENT-A-ROOF® CALCULATION – NO EAVE VENTS

- 0.833m² ridge / hip ventilation requirement / 0.019008m² VAR capacity = 43.82 meters of VENT-A-ROOF® ridge / hip ventilation

References

1. HIA Information Sheet Ref: BCA 20-11 – Condensation management NCC 2019 changes explained
2. EPA 402-F-13053 : Moisture Control Guidance for Building Design, Construction and Maintenance
3. CBOS: Condensation in Buildings – Tasmanian Designers' Guide - Version 2
4. ACBC Handbook: Condensation in build

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