Condensation Management in the NCC 2022

Understanding the Key Requirements for Sarking-Type Materials in External Walls

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INTRODUCTION

Managing condensation in buildings has long been a challenge for the construction industry, particularly given the wide range of surfaces and materials where it can occur. When warm, moisture-laden air encounters a cooler surface, it loses its ability to retain moisture, leading to condensation. This process can result in liquid water forming on surfaces, whether visible or concealed within building structures.

Condensation is a persistent issue that can cause significant damage to building structures. Moisture that accumulates within walls, roofs, or other assemblies can result in mould growth, warping, and material degradation. In addition to causing structural damage, condensation can have a negative effect on indoor air quality and put occupants' health at risk.

The National Construction Code 2022 (NCC) recognises the importance of addressing this issue, particularly in Class 2 buildings, such as apartment buildings. Under the NCC, new buildings must be designed with effective condensation management strategies. This requirement aims to reduce the risk of moisture-related damage and ensure healthier living conditions by improving indoor air quality.

By understanding the relevant NCC's provisions, designers and builders can mitigate the risks associated with condensation and moisture infiltration in multi-residential buildings.

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WHY IS CONDENSATION AN IMPORTANT CONSIDERATION?

Condensation must be carefully considered in building design due to its complex interactions with environmental conditions, construction methods, and occupant behavior. The formation of condensation is influenced by variations in temperature, humidity, and ventilation. In order to control moisture, ventilation is necessary, but it also needs to be considered for concealed spaces such as in wall, floor, and roof cavities.

Condensation forms within interstitial spaces in the building envelope when warm, moisture-laden air penetrates these areas and comes into contact with cooler surfaces, such as vapour barriers (or metal components) or structural elements. These spaces often lack proper ventilation, trapping moisture and allowing it to accumulate over time without being noticed. Examples of long-term damage caused by moisture within the building structure include corrosion of metal framing, timber rot, loosening of nails as timber swells, and cladding rot or swelling, which can result in costly rectification work.

Modern building designs often face additional challenges in managing condensation, as they typically incorporate passive design features such as an airtight envelope. Although airtight construction has greatly enhanced energy efficiency, it has also reduced the amount of natural ventilation in buildings. As a result, moisture remains trapped inside the building envelope, increasing the likelihood of condensation forming on susceptible surfaces.

Inadequate airflow not only encourages condensation but also allows pollutants and microbes to build up, leading to poor indoor air quality. This combination of moisture and contaminants can contribute to "Sick Building Syndrome",[1] which contributes to health issues for occupants, lost productivity, increased building operating costs, and other negative impacts.

A 2015 scoping study by the Australian Building Codes Board (ABCB) revealed that condensation is a significant issue in residential buildings, with up to 40% of new Class 1 and Class 2 structures showing signs of condensation and mould.[2] This alarming statistic underscores the widespread nature of the problem and highlights the potential for moisture-related damage across the Australian housing sector.

NCC REQUIREMENTS FOR EXTERNAL WALLS

Part F8 of the NCC 2022 is intended to reduce the risk of illness or loss of amenity due to the occurrence of condensation inside a building. This is accomplished by imposing requirements on the building's structure and interior that help prevent the accumulation of excessive internal moisture.

In Part F8, Clause F8F1 provides that a building is to be constructed to avoid the likelihood of excessive internal moisture accumulating within the building structure. Clause F8P1 further states that the risk associated with water vapour and condensation must be managed to minimise their impact on the health of occupants.

The Verification Methods outlined in Clause F8V1 offer flexible approaches for managing condensation in buildings. These methods, supported by resources like the Design Application Manual AIRAH DA07, provide detailed guidance for conducting condensation risk analysis. Additionally, the methods set quantified targets, ensuring that the Mould Index, which measures mould growth potential, does not exceed a score of 3.

Performance Requirement F8P1 is satisfied by complying with Deemed-to-Satisfy (DtS) Provisions F8D2 to F8D5. Certain wall materials can unintentionally trap moisture, increasing the risk of condensation. To address this, the DTS Provisions were updated to require higher vapour permeance for some materials, such as building wraps or secondary insulation, based on specific Climate Zones.[3]

DtS Provision F8D3, which covers external wall construction, is reproduced below:

(1) Where a pliable building membrane is installed in an external wall, it must —

  (a) comply with AS 4200.1; and

  (b) be installed in accordance with AS 4200.2; and

  (c) be located on the exterior side of the primary insulation layer of wall assemblies that form part of the external envelope of the building.

(2) Where a pliable building membrane, sarking-type material or insulation layer is installed on the exterior side of the primary insulation layer of an external wall it must have a vapour permeance of not less than —

  (a) in climate zones 4 and 5, 0.143 µg/N.s; and

  (b) in climate zones 6, 7 and 8, 1.14 µg/N.s

(3) Except for single skin masonry and single skin concrete, where a pliable building membrane is not installed in an external wall, the primary water control layer must be separated from water sensitive materials by a drained cavity.

PLIABLE BUILDING MEMBRANES AND SARKING-TYPE MATERIALS

Pliable building membranes are often used for weatherproofing, energy efficiency, or condensation management. Builders or designers might add these membranes as extra protection for weatherproofing or insulation, particularly around water-sensitive materials. However, this additional layer can sometimes increase the risk of condensation and moisture buildup by trapping water vapour.

DtS Provision F8D3(2) requires some wall materials, specifically pliable building membranes and sarking-type materials, on the external side of the primary insulation layer to have a minimum level of vapour permeance. If the membrane is not vapour permeable, it can trap moisture inside the building envelope, leading to condensation buildup on the internal side, where the water-sensitive materials are located.

Under the NCC 2022, a “pliable building membrane” is defined as a water barrier as classified by AS 4200.1. It is advised that sarking-type materials be classified as a water barrier according to AS 4200.1 to ensure they offer adequate weather protection.

Vapour permeance

DtS Provision F8D3(2) mandates that certain wall materials located on the exterior side of the primary insulation layer must meet a specified minimum level of vapour permeance, which is measured in micrograms per Newton-second (µg/N.s). The relevant standard to determine this is AS 4200.1 “Pliable building membranes and underlays, Part 1: Materials”.

Vapour permeance is the degree that water vapour is able to diffuse through a material. In AS 4200.1, the vapour permeance of membranes is classified into four classifications depending on their tested performance:

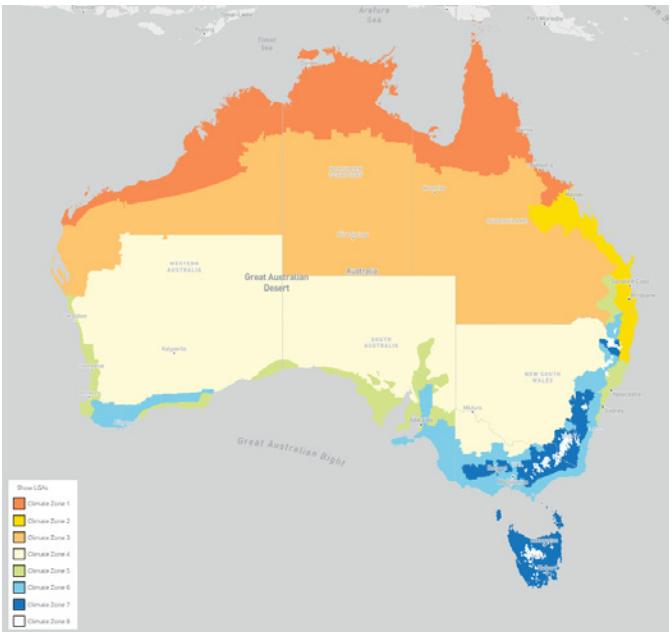
- **Class 1 (vapour barrier):**
  Min. µg/N.s >0.0000 - Max. µg/N.s <0.0022
- **Class 2 (vapour barrier):**
  Min. µg/N.s >0.0022 - Max. µg/N.s <0.1429
- **Class 3 (vapour permeable):**
  Min. µg/N.s >0.1429 - Max. µg/N.s <1.1403
- **Class 4 (vapour permeable):**
  Min. µg/N.s >1.1403 - No max

Based on these classifications, Class 3 and 4 vapour control membranes meet the vapour permeance requirements of F8D3(2)(a), while only Class 4 will meet the requirements in F8D3(2)(b). Accordingly, it is important for specifiers to confirm whether the product has been tested in accordance with AS 4200.1 and is the appropriate Class for the intended application.

Climate zones

DtS Provision F8D3(2) provides different minimum levels of vapour permeability based on Climate Zone. Australia's diverse climate results in varying heating and cooling needs across different regions. To accommodate these variations, the DtS Provisions are tailored for each location. For simplicity, areas with similar climates have been grouped into eight distinct climate zones.

Figure 1. Climate Zone Map (as of September 2024)



Source: https://www.abcb.gov.au/resources/climate-zone-map

If the membrane is not vapour permeable, it can trap moisture inside the building envelope, leading to condensation buildup on the internal side, where the water-sensitive materials are located.

PREVENT CONDENSATION BUILD-UP WITH WEATHER DEFENCE

Siniat's **Weather Defence** is a rigid air barrier with a gypsum core designed for use in rainscreen or ventilated facade systems. Its main advantage is enabling rapid weathertightness, allowing internal work to continue even in bad weather, helping to prevent delays and save time on site. Additionally, it is a safer, easier alternative to cement-based sheathing boards, with no significant silica dust risk and a simple score-and-snap installation process.

Weather Defence's excellent vapour permeability makes it suitable for colder climates. It is classified as vapour permeable Class 4 and is recommended for use in Climate Zones 2 to 8. In Climate Zone 1, it is recommended to apply a vapour control layer over the external surface.

Weather Defence's vapour permeability is beneficial for condensation control because it allows moisture in the form of water vapour to pass through, preventing the build-up of condensation on the surface and in the facade cavity. By allowing moisture to diffuse through rather than getting trapped and condensing within the structure, interstitial mould can be prevented. This helps protect the facade materials from deterioration, thereby extending the lifespan of the system.

performance

Water

Resistant to water penetration according to AS/NZS 4201.4.

Weather

Provides a solid weathertight barrier.

Mould

Resistant to mould growth 10/10.

Sound

Good acoustic performance.

Vapour permeance

Class 4 vapour permeance for climate zones 6, 7 and 8.

REFERENCES

[1] Kraus, Michal. "Airtightness as a Key Factor of Sick Building Syndrome (SBS)." 16th International Multidisciplinary Scientific GeoConference, SGEM, 2016: https://www.researchgate.net/publication/308039434_Airtightness_as_a_Key_Factor_of_Sick_Building_Syndrome_SBS (accessed 19 September 2024).

[2] Dewsbury, Mark, Tim Law, Johann Potgieter, Desmond Fitz-Gerald, Bennet McComish, Thomas Chandler and Abdel Soudan. "Scoping Study of Condensation in Residential Buildings." ABCB. https://www.abcb.gov.au/sites/default/files/resources/2022/Scoping-study-of-condensation-residential-buildings.pdf (accessed 19 September 2024).

[3] Australian Building Codes Board. "Improved condensation management in NCC 2022." ABCB. https://ncc.abcb.gov.au/news/2022/improved-condensation-management-ncc-2022 (accessed 19 September 2024).

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