Multi-Layered Walls

Weatherproofing for Rear Ventilated Facades

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Introduction

In the Australian design and construction industry, external facade systems have been the focal point of compliance issues in recent years. A 2019 Deakin University study examining 212 building defect reports found that moisture and water penetration issues affecting the building fabric were common across Australia.[1] The main cause of such issues were non-compliant or poorly-fitted cladding, or ineffective waterproofing in general.

The facade and cladding system is one of the most important aspects of a building from a design perspective, especially its ability to withstand Australia's demanding climate. The National Construction Code (NCC) imposes demanding requirements for the weatherproofing of external walls to prevent unhealthy or dangerous conditions, or loss of amenity for building occupants, and undue dampness or deterioration of building elements. Designers and specifiers have sought new approaches to building facade design and construction to deliver top tier performance, weather resistance and compliance with these requirements.

Rear ventilated facades (RVFs) are gaining in popularity with design and construction professionals. There is growing awareness of the advantages of RVF systems, particularly the extra layers of weather protection they provide to external walls. While understanding of the design principles of RVFs is improving, there is still some confusion as to the relevant weatherproofing requirements and the corresponding testing procedures used to verify compliance.

In this whitepaper, we take a closer look at RVF systems, their benefits in modern building design, and outline the key performance requirements and testing procedures relevant to weatherproofing such systems.

What is a Rear Ventilated Facade?

Main Components

A RVF is a multi-layered building facade system consisting of a pair of exterior wall skins, separated by an air cavity. This advanced design protects a building's structural walls from harsh weather elements such as rain and wind. The main components of a RVF are as follows:

- **External cladding** on the outer layer of the facade system.
- **Frame or sub-frame** placed in between the wall and cladding of the facade anchoring it to the wall surface of the building.
- **Ventilated air cavity** between the cladding and the primary wall structure and insulation layer.
- **An air and water vapour barrier** consisting of a weather-resistant membrane sitting outside of the primary insulation layer.

How Does It Work?

The outer layer of cladding provides the first layer of protection against the combined actions of rain and wind. Made of durable, non-porous material, the cladding layer is designed to shed most rainwater and provide resistance against exterior weather forces.

The air cavity between the external cladding and primary wall structure is the key to an effective RVF system. The air cavity is the second line of defense against weather, allowing drainage of any moisture that penetrates the outer cladding as well as air circulation in the cavity that evaporates moisture from the surface of the air and vapour barrier.

The temperature differential between the face of the cladding layer and in the air cavity creates a variation in air density. This results in the "chimney effect"[2] that produces airflow within the cavity. Airflow helps dry the air cavity of any water that bypasses the outer cladding and evaporates any moisture escaping the air and vapour barrier. The ventilated nature of the system allows moisture that has penetrated the outer cladding to run down the panel and drain out at the bottom of the facade.

The air and vapour barrier is the final layer of protection that prevents moisture from penetrating the building walls. A weather-resistant membrane is typically added to the outside of insulation to protect vulnerable wall components from water ingress. Not only preventing water entry, the membrane should be permeable and allow smaller water vapour molecules exiting a building to pass through the membrane and into the cavity.

Layers of Protection

Benefits of Rear Ventilated Facades

The advanced design of RVF systems is well-equipped to handle all weather elements. When it rains, only the external cladding gets wet. In more demanding conditions, such as heavy winds and rain, the drainage plane and continuous airflow in the air cavity ensures that moisture does not pool or stay trapped in the system. The weather-resistant membrane balances protection against water ingress with promoting vapour release into the main ventilation channel. This ensures the wall structure is allowed to breathe, preventing damp and mould from forming inside the wall structure and insulation.

The main benefit of a RVF system is that it provides multiple layers of protection against water penetration and moisture buildup. The components of an RVF increase reliability, resulting in a system that is less dependent on sealants and workmanship. Moisture is expected in RVF systems, with an effective design providing drainage to prevent moisture buildup that can cause building damage over time.

The consequences of excess moisture and water penetration within a building structure are well known and extensive. Excess moisture can cause structural damage and deterioration. Building components can react to moisture, causing them to corrode and fail. Wooden materials can swell and warp. Prolonged damp conditions can also attract mould and pests that accelerate decay. Protecting against these effects results in significantly reduced repair and maintenance costs over time.

Excess moisture can also create conditions for bacteria and mould growth, and generate odors and harmful gases within a building envelope, all of which can have a negative impact on occupant health. The association between damp indoor conditions and adverse health effects is well documented.[3] Respiratory illnesses and asthma can be exacerbated by poor indoor air quality. Moisture-related health and moisture problems can also lead to reduced productivity, discomfort and absenteeism.[4]

“Cavity wall construction allows water to pass through the primary weather-defence, with drainage provisions that enable the removal of water from the cavity.”

A Focus on Weatherproofing

Design, Testing and Compliance

FP1.4 Weatherproofing

Designers, architects and specifiers must ensure the RVF system provides sufficient waterproofing and complies with the NCC. The main performance requirement is set out in **FP1.4 Weatherproofing,** which provides that:

A roof and external wall (including openings around windows and doors) must prevent the penetration of water that could cause —

(a) unhealthy or dangerous conditions, or loss of amenity for occupants; and

(b) undue dampness or deterioration of building elements.

There are no Deemed-to-Satisfy Provisions in NCC for the weatherproofing of external facades.[5] **Verification Method FV1.1** can be used to determine if the RVF system complies with Performance Requirement FP1.4.

Verification Method FV1.1

The testing requirements in FV1.1 make a distinction between “direct fix cladding wall”, “unique wall” and “cavity wall”. “Direct fix cladding” refers to a facade system in which the cladding is attached directly to the wall framing without the use of a drained cavity. “Cavity wall” refers to a wall that incorporates a drained cavity. “Unique wall” is defined as a wall that is neither a direct fix cladding wall nor cavity wall.

A rear ventilated system is generally tested as a “cavity wall”, meaning that it has drainage provisions, and therefore it is expected that some moisture may be present behind the cladding. Cavity wall construction allows water to pass through the primary weather-defence, with drainage provisions that enable the removal of water from the cavity.

Cavity walls and membranes must meet certain testing and performance requirements. The provisions in FV1.1 reference testing under AS/NZS 4284:2008 “Testing of building facades” for cavity walls. The test must involve the whole cladding system, including drainage, membrane, and representative samples of openings and joints. If the system is tested without drainage provisions or the correct building membrane behind the cladding, then it cannot be classified as a RVF.

Cavity Wall Testing Procedure

In accordance with FV1.1, the testing procedure for a cavity wall is as follows:

1. Apply 100% positive and negative serviceability wind pressures to the external face of the test specimen for a period of not less than one minute each.
2. Apply static pressure of either 300 Pa or 30% serviceability wind pressure, whichever is higher, in accordance with the water penetration test procedure at clause 8.5.2 of AS/NZS 4284.
3. Apply cyclic pressure in accordance with stage 3 of Table FV1.2 and the water penetration test procedure at clause 8.6.2 of AS/NZS 4284.
4. Simulate the failure of the primary weather-defence or sealing using the test specimen by following the procedure specified in FV1.1(c)(ii)(D), which involves introducing 6mm diameter holes at specified locations on the external face of the cavity wall.

The cavity wall is compliant with FP1.4 if there is no presence of water on the removed surface of the cavity, except that during the simulation of the failure of the primary weather-defence or sealing, water may transfer to the removed surface of the cavity due to the introduced defects and contact, but not pool on, battens and other cavity surfaces.

Weather-Resistant Membrane Requirements

In accordance with F6.2 of the NCC Volume One, if a pliable building membrane is installed into an external wall frame, it must:

- comply with AS/NZS 4200.1:2017 “Pliable building membranes and underlays Materials”; and
- be installed in accordance with AS 4200.2:2017 “Pliable building membranes and underlays Installation”; and
- be a vapour permeable membrane for climate zones 6, 7 and 8; and
- be located on the exterior side of the primary insulation layer of wall assemblies that form the external envelope of a building.

Weatherpoof Cladding Systems
by HVG Facades

ZINTL® Premium Interlocking Aluminium Cladding System

Australian made and owned®, the ZINTL® aluminium cladding system is an enduring and elegant solution that offers a world of design possibilities. This high-performance aluminium cladding system is available in a range of interlocking weatherboard profiles to suit any project.

ZINTL® provides architects and designers with external cladding profiles that are fire-resistant and non-combustible (certified to AS1530.1), fully compliant, easy-to-install, safe and cost effective. The ZINTL® interlocking solid aluminium cladding system has been tested to AS4284 as a "cavity wall" (rear ventilated facade), incorporating drainage provisions at the base of the system.This testing was to satisfy the NCC FP1.4 Performance Requirement.

ZINTL® aluminium cladding is offered in a wide range of Interpon and Dulux powder coated finishes, as well as a selection of anodised and wood grain cladding architectural finishes providing a beautifully refined aesthetic. Offering a striking mix of natural, bold and subtle hues, ZINTL® is ideal for any budget, aesthetic and application, including rear ventilated facade systems.

About HVG Facades

A subsidiary of Sanwa Holdings, HVG Facades is an Australian-owned market leading supplier of premium external wall cladding systems for the construction industry. As a strong and successful business with a history dating back more than 50 years, HVG Facades is a dedicated facade products supplier of trusted brands including MondoClad®, ZINTL®, ALUCOBOND® PLUS, Swisspearl® and Trespa®.

"The main benefit of a rear ventilated facade (RVF) system is that it provides multiple layers of protection against water penetration and moisture buildup."

References

1 Johnston, Nicole and Sacha Reid. “An Examination of Building Defects in Residential Multi-owned Properties.” Griffith University. https://www.griffith.edu.au/__data/assets/pdf_file/0030/831279/Examining-Building-Defects-Research-Report.pdf (accessed 9 June 2021).

2 WFM Media. “Energy Considerations in Rear Ventilated Façades.” Window and Façade Magazine. https://wfmmedia.com/energy-considerations-in-rear-ventilated-facades (accessed 9 June 2021).

3 Environmental Protection Agency. “Moisture Control Guidance for Building Design, Construction and Maintenance.” EPA. https://www.epa.gov/sites/production/files/2014-08/documents/moisture-control.pdf (accessed 9 June 2021).

4 Ibid.

5 Australian Building Codes Board. “Weatherproofing (FV1.1).” ABCB. https://www.abcb.gov.au/-/media/Files/Resources/Education-Training/PBDS_Weatherproofing_FV1_1.PDF (accessed 9 June 2021).

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