Internally Embedded Aluminium Frames

Enhancing Thermal and Visual Outcomes in Window and Door Design

AWS
ARCHITECTURAL WINDOW SYSTEMS PTY LTD

Fabricator: Coastline Architectural Windows. Architect: GUD Studio. Builder: McAvoy Constructions. Photographer: Ben Guthrie

INTRODUCTION

Window and door systems have advanced beyond their traditional role as passive barriers between interior and exterior environments. In contemporary practice, they are increasingly recognised as critical interfaces, shaping daylight access, regulating heat flow and defining spatial character. As performance expectations rise in response to stricter energy efficiency standards and occupant comfort demands, the configuration and detailing of framing systems have come under closer scrutiny.

Traditional aluminium window frames are usually surface-mounted or partially exposed, creating a visible junction between the glazing and the surrounding structure. This approach often results in thermal bridges, where heat is transferred through the frame, reducing the overall energy efficiency of the building envelope. Internally embedded aluminium frames differ by being concealed within the wall assembly. This positioning allows insulation to continue uninterrupted around the glazing, significantly improving thermal continuity and reducing heat loss.

This paper explores the technical, thermal and aesthetic advantages of internally embedded aluminium frames, offering guidance for architects seeking to integrate these systems into high-performance building envelopes.

LIMITATIONS OF CONVENTIONAL ALUMINIUM FRAMING

Aluminium is favoured in architectural glazing systems for its strength-to-weight ratio, durability and high recyclability. With the ability to support slender profiles, custom fabrication and long spans, aluminium is a staple in modern facade and fenestration design. However, its thermal conductivity presents a persistent challenge.

When aluminium frames are not properly **thermally broken** or isolated, they can create what is known as a thermal bridge, an area of the building envelope where heat or cold transfers more readily between interior and exterior environments.

Thermal bridging has measurable implications for energy performance. Studies estimate that poorly treated thermal bridges can account for up to 20% of additional heating or cooling loads in a building.[2] In conventional aluminium-framed glazing systems, the frame forms a continuous conductive path, allowing ambient temperatures to bypass the insulation envelope. This not only undermines passive design strategies but also increases the operational energy demand of HVAC systems. In colder climates, it may also lead to cold spots near window perimeters.

Thermal bridging at exposed frames can contribute to condensation risk, particularly when warm, moist interior air meets the cooler surface of the conductive frame. From a design standpoint, fully exposed aluminium frames also disrupt the clean, monolithic surfaces often desired in minimalist or high-end architectural interiors.

What is thermal bridging?

Thermal bridging occurs when a conductive material creates a path for heat to bypass the insulation layer of a building envelope.[1] This results in unwanted heat loss or gain, reducing the energy efficiency of the building. In framing systems, thermal bridging is most pronounced where metal components span from the exterior to the interior without adequate thermal breaks.

By concealing frame elements within the wall, embedded frames support the increasingly popular ‘invisible hardware’ aesthetic, where functional elements do not compete with interior materials or finishes.

ADDRESSING THERMAL TRANSFER IN ALUMINIUM FRAMING

Thermally broken frames were developed as a direct response to aluminium’s thermal conductivity. These systems incorporate non-conductive materials, typically polyamide, that separate the internal and external portions of the frame. This thermal barrier interrupts the direct path for heat flow, significantly reducing the transfer of heat or cold between the interior and exterior environments.

Thermal breaks are the inverse of thermal bridges: rather than allowing energy to bypass insulation, they actively disrupt the conductive path. The result is improved insulation performance across the window or door system, contributing to lower overall U-values. This enhanced performance also supports eligibility for environmental certifications which place increasing emphasis on building envelope efficiency.

While thermal breaks address aluminium’s conductivity, a design variation is to minimise the amount of exposed aluminium altogether. Embedding the frame within the wall assembly isolates the conductive elements from direct contact with interior air. This reduces heat transfer through the frame in both directions, effectively limiting thermal bridging and improving the building envelope’s overall thermal performance.

Fabricator: Millennium Windows & Doors. Builder: Tribeca Constructions/Birdy Homes. Photographer: Phil Winterton – ABC Photo Signs

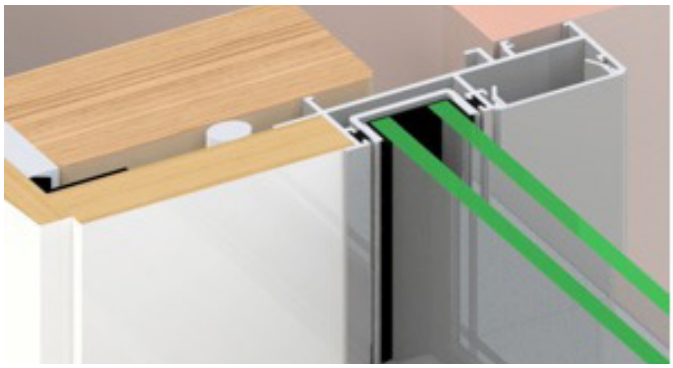
INTERNALLY EMBEDDED FRAMES: ENHANCING THERMAL AND VISUAL INTEGRATION

What are embedded frames?

Internally embedded aluminium frames refer to glazing systems in which the aluminium profile is recessed into the internal wall build-up, reducing or eliminating its visibility from the interior. Unlike conventional or thermally broken frames that remain partially exposed, this approach shifts the internal edge of the frame into the cavity formed by plasterboard, timber lining or joinery. The result is a cleaner junction where the frame terminates behind, or sits flush with the finished wall surface.

This assembly reduces the amount of exposed aluminium and optimises thermal performance by aligning the frame more closely with the wall's insulation zone. Insulation and linings can be brought directly up to the frame perimeter, improving continuity across the building envelope and reducing thermal bridging at the junction. Products such as AWS' ComfortEDGE™ demonstrate this approach by altering the frame-to-wall interface.

Figure 1. AWS ComfortEdge embedded frame



Integrating the frame with the timber reveal insulates against heat/cold transfer. Source: AWS.

By concealing frame elements within the wall, embedded frames support the increasingly popular 'invisible hardware' aesthetic, where functional elements do not compete with interior materials or finishes. This technique creates the impression that glazing emerges directly from the wall.

Architectural benefits of embedded frames

Improved thermal performance

By situating the frame within the insulated wall zone, embedded frames reduce the exposure of conductive aluminium to conditioned interior air. This strengthens thermal continuity and limits heat loss or gain at critical junctions.

Refined sightlines and spatial clarity

Embedding the frame enables wall linings to continue seamlessly to the edge of the glazing, removing the need for bulky internal reveals. This detailing supports a clean, minimalist aesthetic by reducing visual interruptions at wall-to-window junctions. The resulting frameless appearance enhances access to daylight and views, contributing to a brighter interior.

Occupant comfort and lifecycle value

Embedded frames offer long-term value by reducing energy consumption and supporting interior environmental quality throughout the building's life cycle. Over time, these performance gains contribute to reduced running costs, improved occupant satisfaction and a more energy-efficient building envelope.

DESIGNING WITH EMBEDDED FRAMES: KEY CONSIDERATIONS

Successfully integrating internally embedded aluminium frames requires careful coordination across multiple construction and detailing layers. The following considerations are critical to ensure both performance and aesthetic outcomes are achieved.

Wall build-up coordination

The overall wall thickness must be sufficient to accommodate the depth of the embedded frame without compromising structural or thermal integrity. Frame positioning should be coordinated in relation to internal linings, insulation and cavity battens to ensure continuity across building elements.

Thermal breaks

Maintain continuous contact between insulation and the frame perimeter to ensure effective thermal isolation and minimise bridging. Avoid direct exposure of aluminium to interior air where possible, particularly at head, sill and jamb junctions, to mitigate heat transfer and reduce the risk of internal condensation.

Drainage and weather resistance

Even when embedded, the external face of the frame must remain exposed to ensure weatherproofing and drainage functions are not compromised. Detailing should include weep holes, capillary breaks and pressure equalisation paths to manage water ingress and air pressure. All framing and glazing systems must meet the performance requirements outlined in AS 2047 for structural and water penetration resistance.

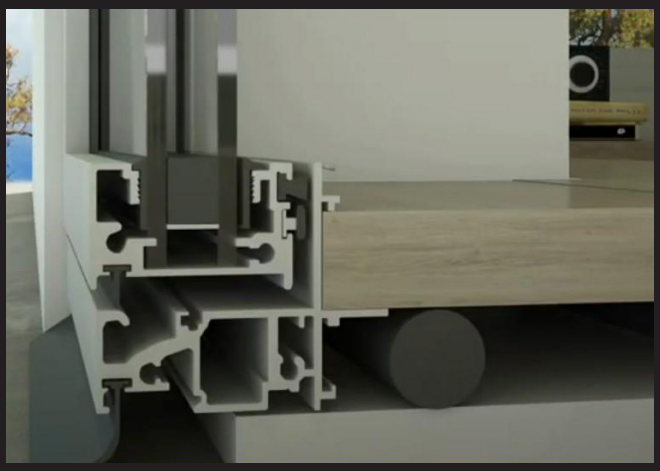
Flush thresholds and door transitions

For sliding or stacking door systems, integrated linear drainage should be specified to facilitate concealed sills and flush floor transitions. This supports seamless visual and physical flow between interior and exterior spaces while maintaining compliance with accessibility and waterproofing regulations.

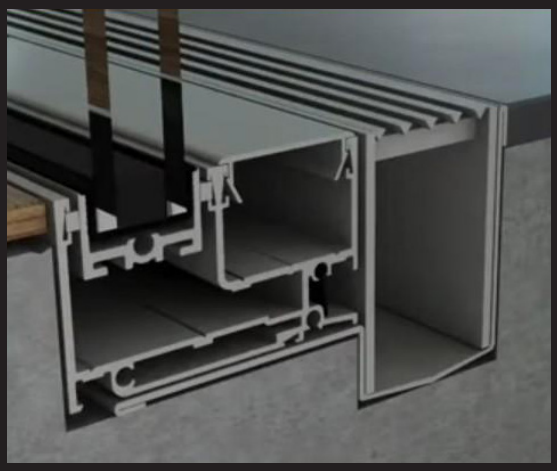
Finish compatibility

Embedded frames should allow flexibility to accommodate a variety of internal finishes, including painted plasterboard returns, timber veneer reveals or bespoke joinery. The system should support detailing that aligns with the project's material palette and design language while maintaining tolerance for thermal movement and differential expansion between finishes and frame elements.

Fabricator: Millennium Windows & Doors. Builder: Tribeca Constructions/Birdy Homes. Photographer: Phil Winterton – ABC Photo Signs



Embedded technology significantly minimises exposed aluminium.



ComfortEDGE™ can interface cleanly with linear drainage and recessed threshold details.

COMFORTEDGE™

The next generation of embedded framing technology

ComfortEDGE™ by Architectural Window Systems (AWS) represents a distinct advancement in aluminium window and door systems. Its patented system components allows the internal frame to recess within the wall without compromising structural performance, ensuring alignment with cavity insulation, vapour control layers and interior finishes. This embedded interface is achieved without increasing frame depth beyond standard construction tolerances, making it suitable for both conventional stud walls and more complex facade assemblies.

ComfortEDGE™ has been developed to meet AS 2047 performance requirements, including wind load resistance, water penetration and operational strength. Its design supports insulated glass units (IGUs) with double glazing as standard and can accommodate low-e coatings and wider IGUs for advanced solar and acoustic control.

The system supports the continuity of external weatherproofing membranes and internal air seals, which is critical for airtight construction. These characteristics make ComfortEDGE™ well-suited to high-performance buildings and thermal modelling scenarios requiring precise frame-to-wall detailing.

For specifiers, ComfortEDGE™ offers flexibility across a range of configurations, including fixed, awning and sliding systems. Its modular compatibility with both standard and custom sill and jamb profiles allows it to interface cleanly with cavity sliding doors, linear drainage and recessed threshold details. This adaptability makes it suitable across residential and multi-residential projects.

Fabricator: Hanlon Windows. Architect: Nadine K Design. Builder: Contractors United Homes. Photographer: Tim Shaw

Embedding the frame within the wall assembly isolates the conductive elements from direct contact with interior air. This reduces heat transfer through the frame in both directions.

References

1 Commonwealth of Australia. “Thermal Bridging.” NatHERS. https://www.nathers.gov.au/sites/default/files/2023-10/NatHERS%20Thermal%20Bridging%20Chapter%20 20231020.pdf (accessed 6 August 2025).

2 Carlos Pérez-Carramiñana et al. "Influence of Balcony Thermal Bridges on Energy Efficiency of Dwellings in a Warm Semi-Arid Dry Mediterranean Climate." Buildings, Vol. 14, No. 3 (2024): 703.

All information provided correct as of September 2025