Breaking Barriers

How Thermally Broken Frames Enhance Thermal Performance Across All Climates

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INTRODUCTION

The pursuit of energy-efficient buildings is at the forefront of sustainable design, with regulatory updates like the National Construction Code 2022 (NCC) driving significant advancements. A key change is the requirement for all new Australian homes to achieve a minimum 7-star energy rating under the Nationwide House Energy Rating Scheme (NatHERS), up from the previous 6-star standard. This has placed greater emphasis on improving building elements such as windows, which are critical to a home's thermal performance. While some designers may assume compliance can only be achieved by reducing window sizes or the number of windows, advancements in window technology—such as thermally broken frames—offer an alternative that enhances performance without compromising design.

Windows play a pivotal role in a building's energy efficiency, yet they are often a significant source of energy loss. Up to 40% of a home's heating energy can be lost and up to 87% of its heat gained through windows.[1] By reducing heat transfer through the window frame, thermally broken systems enhance energy efficiency and improve indoor comfort. These systems represent an essential tool for architects and designers tasked with meeting the updated energy standards.

Thermally broken frames are widely recognised for their effectiveness in cold climates, such as Southern New South Wales, Tasmania, and Victoria, but, as we will discuss, their benefits extend equally to warmer regions like Queensland and the Northern Territory. As Australia moves toward more sustainable construction practices, understanding the year-round benefits of thermally broken frames in all climates is vital to achieving energy-efficient and comfortable living spaces.

WHAT IS THERMAL BRIDGING?

Thermal bridging refers to unintended pathways of heat flow between the interior and exterior of a building envelope. These bridges often occur in areas where insulation is interrupted or bypassed, such as through window frames, wall studs, or where highly conductive materials like metal are present. Common areas where thermal bridging can arise also include spandrel panels, junctions between floors, walls, and roofs, and penetrations for pipes and cables. Unlike well-insulated sections of the building, thermal bridges allow heat to move more freely, compromising the overall thermal performance of the building.

One significant consequence of thermal bridging is the reduced effectiveness of insulation. Thermal bridges bypass insulated areas, decreasing their thermal resistance and allowing heat to escape in colder weather or enter in warmer conditions. To maintain a comfortable indoor environment, heating and cooling systems must work harder, resulting in increased energy usage and higher utility bills.

Thermal bridging can also lead to condensation problems. When warm, moist indoor air comes into contact with cooler surfaces, water condensation can form. Over time, this can promote mould growth, which affects indoor air quality and poses health risks to occupants. Furthermore, repeated condensation can damage building materials, potentially compromising the structure's durability.

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THERMAL BRIDGING AND THE NCC

Under NCC 2022, thermal bridging must be factored into Total R-Value (thermal resistance) or System U-Value (thermal transmittance) calculations for key building elements, such as roofs, walls, and floors. For residential buildings, the code provides specific Deemed-to-Satisfy (DTS) Provisions tailored to different construction types, including metal-framed roofs, lightweight walls, and spandrel panels. These provisions ensure that the impact of thermal bridging is minimised, requiring measures like enhanced insulation layers or continuous insulation to maintain the overall thermal performance of the building.

The NCC also introduces thermal break requirements, which involve incorporating materials with low thermal conductivity at strategic points, such as metal-framed roofs and walls. These thermal breaks interrupt the heat flow path, significantly improving the energy performance of residential and apartment buildings.

For more information, refer to https://ncc.abcb.gov.au/ncc-navigator/thermal-bridging-residential-buildings.

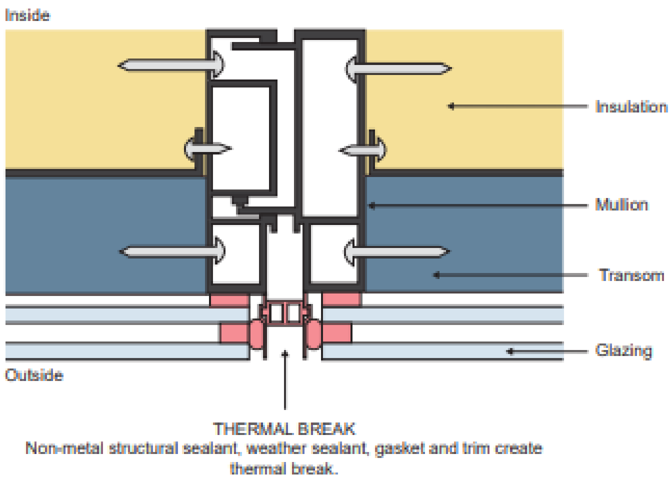
HOW DO THERMALLY BROKEN SYSTEMS WORK?

To enhance thermal performance, high-quality frames often incorporate a thermal break. A thermal break is a component made from a material with low thermal conductivity, such as polyamide, strategically integrated within the frame.[2] This creates a physical barrier between the interior and exterior sections of the frame, minimising heat transfer by conduction and significantly improving the frame's insulation properties.

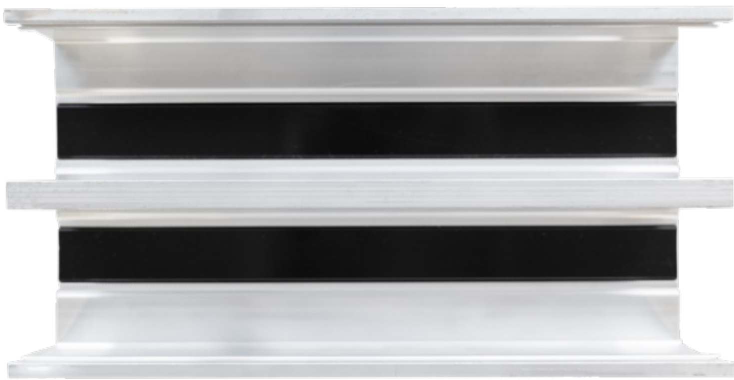
Essentially, a thermal break disrupts the path of heat flow through materials with high thermal conductivity, such as metal. By inserting a material with low thermal transmittance into this pathway, the heat transfer process is interrupted, reducing energy loss and enhancing the energy efficiency of the entire window system. This design approach ensures that the frame contributes to maintaining comfortable indoor temperatures, regardless of external weather conditions.

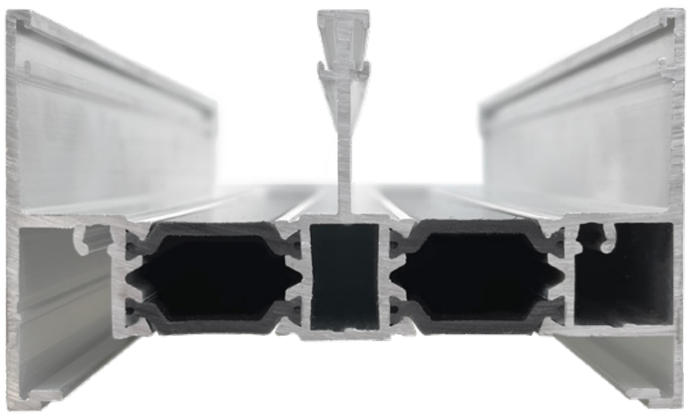
For example, in a spandrel panel (see Figure 1), a thermal break can be achieved by incorporating components such as non-metal structural sealants, weather sealants, gaskets, and trims—all made from materials with low thermal conductivity. These elements effectively block the heat transfer through metal mullions, which are typically highly conductive.

Figure 1: Example of a spandrel panel with a thermal break (section view)



Source: https://ncc.abcb.gov.au/ncc-navigator/thermal-bridging-commercial-buildings





HOW THERMAL BREAKS IMPROVE ENERGY EFFICIENCY

The impact of thermally broken frames on energy performance is significant. Data from the Window Energy Rating Scheme (WERS) shows that pairing thermally broken aluminium frames with Low-E argon-filled glazing improves the overall window U-value by 11% compared to conventional frames.[3] This means better insulation and reduced heat transfer, which enhances comfort and reduces reliance on mechanical heating and cooling systems. Additionally, thermally broken frames mitigate temperature differences across the frame (known as the edge effect), further improving the insulating performance of the window system.

In colder Australian climates, thermally broken frames help to reduce heat loss, maintaining warmth and lowering heating energy demands during the winter months. Conversely, in warmer regions like Queensland and the Northern Territory, these frames limit heat gain, keeping interiors cooler and reducing reliance on air conditioning. Accordingly, thermally broken frames contribute to year-round energy efficiency across Australia's varied climates, making them a valuable solution for sustainable building design.

THE FUTURE OF THERMALLY BROKEN SYSTEMS

Thermally broken systems are a crucial component in the transition toward net-zero homes, significantly reducing household energy consumption and carbon emissions. With Australia's 11 million homes contributing over 10% of the nation's emissions—and another 5.5 million expected by 2050—enhancing insulation standards through thermally broken windows and doors is essential.[4] These systems support a fabric-first approach, minimising heating and cooling demands by reducing heat transfer, ultimately decreasing reliance on artificial climate control.

By integrating with renewable energy solutions like solar panels, thermally broken designs help homes achieve greater energy self-sufficiency, and meet increasingly stringent residential energy standards.

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HOW CARINYA ADDRESSES THE DEMAND FOR ENERGY-EFFICIENT RESIDENTIAL SOLUTIONS

Overview

Carinya delivers premium-quality residential windows and doors, combining energy efficiency, durability, and architectural flexibility. Developed by Alspec, a leader in aluminium solutions for commercial construction, Carinya brings commercial-grade innovation to residential design.

Carinya offers a premium range of aluminium windows and doors, designed for both new builds and renovations, with a strong focus on energy efficiency, durability, and aesthetics. Their **thermally broken systems** incorporate an insulating barrier within the frame to reduce heat transfer, improve comfort, and lower energy costs, making them ideal for homes aiming to meet NatHERS and BASIX energy compliance.

Carinya's window range includes **sliding and awning windows**, each featuring clean architectural lines, superior weather resistance, and built-in screening solutions. Their **hinged and sliding doors** combine style with performance, offering features like concealed drainage slots, robust seals, and smooth operation. Carinya also offers a **stackable sliding door** that is the ideal choice for alfresco-style living, offering a seamless indoor-outdoor connection with smooth operation, modern aesthetics, and enhanced durability for all-weather performance

Benefits

- **Thermally broken frames:** Minimise heat transfer, improving insulation and reducing energy consumption.
- **High-performance glazing options:** Compatible with double glazing to enhance energy efficiency by reducing heat loss in winter and heat gain in summer.
- **Durable materials:** Engineered for longevity using high-quality, resilient materials that withstand wear and environmental factors while meeting or exceeding energy-efficiency standards.
- **Customisable designs:** Supports various architectural styles and design preferences while maintaining superior energy performance.
- **Compliance with standards:** Meets the latest energy-efficiency requirements, helping homes achieve regulatory benchmarks such as **NatHERS 7-star ratings**.
- **Continuous innovation:** Ongoing product development to meet market demands for eco-friendly, high-performance, and cost-effective residential solutions.

Design considerations

Carinya windows and doors offer extensive customisation options to meet both aesthetic and functional requirements, ensuring they complement a wide range of residential designs. With various configurations available, homeowners and designers can tailor their selections to maximise views, enhance privacy, and improve energy efficiency. Finishes, hardware choices, and screening solutions further enhance the ability to match Carinya products to specific architectural styles, from modern minimalist to classic heritage designs.

Beyond aesthetics, Carinya windows and doors are designed to meet practical performance requirements, including energy efficiency, weather resistance, and security. **Thermally broken frames** and **high-performance glazing** options help regulate indoor temperatures, reducing reliance on artificial heating and cooling. **Screening solutions**, such as Invisi-Gard 316 Stainless Steel Security Screens, provide added protection without obstructing airflow or visibility. **Sound-reducing glass options** cater to homes in high-noise environments, while **durable frame materials** ensure long-lasting performance in various climate conditions. With thoughtful design and product selection, Carinya solutions can be tailored to suit a home's unique needs while delivering a premium architectural finish.

Reference

[1] Australian Government. "Glazing." YourHome. https://www.yourhome.gov.au/passive-design/glazing (accessed 29 January 2025).

[2] Australian Building Codes Board. "Understanding the NCC: Thermal bridging." ABCB. https://ncc.abcb.gov.au (accessed 29 January 2025).

[3] Moore, Trivess, Lisa de Kleyn, Priya Rajagopalan, Tom Simko, Joe Hurley, Ralph Horne, and Tony Dalton. "Upscaling High-Performance Windows in Victoria." Sustainability Victoria. https://assets.sustainability.vic.gov.au/susvic/Document-Research-Upscaling-high-performance-windows-in-Victoria-report.pdf (accessed 29 January 2025).

[4] Delafoulhouze, Margot, and Gill Armstrong. "Renovation Pathways: Defining Zero Carbon Homes for a Climate Resilient Future." Climateworks Centre. https://www.climateworkscentre.org/wp-content/uploads/2023/04/RENOVATION-PATHWAYS-DEFINING-ZERO-CARBON-HOMES-1.pdf (accessed 29 January 2025).

All information provided correct as of February 2025

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