AWS
ARCHITECTURAL WINDOW SYSTEMS

THERMALLY BROKEN SYSTEMS

THERMAL HEART

/ MAXIMISE EFFICIENCY & COMFORT

AWS
ARCHITECTURAL WINDOW SYSTEMS

AN INCREASING NUMBER OF AUSTRALIAN WINDOW MANUFACTURERS HAVE ADDED THERMALLY BROKEN SYSTEMS TO THEIR RANGE

For many years commercial buildings were rated under Section J of the Building Code of Australia (BCA) simply by using the performance values of glass. More recently the BCA requires windows to be assessed on their whole value: the combined effect of frame and glass. This change has seen compliance with Section J of the code become harder to achieve without the use of better performing products or design compromise.

Over the past five years an increasing number of window and door manufacturers within Australia have added thermally broken aluminum window and door systems to their product portfolio. Growing awareness of and demand for energy efficient building materials has driven product development in this area, resulting in an offering of window and door systems that deliver significant improvements in thermal efficiency and insulation properties.

/ Narrabundah House. Architect Adam Dettrick. Windows by Monaro Windows. Photography: Michael Downes, UA Creative

THERMALLY BROKEN SYSTEMS

THE THERMAL BREAK PROCESS

The Thermal Break Process

Thermally broken aluminium window systems deliver many advantages, most importantly improved thermal performance. The advantages of aluminium are maintained – such as strength, durability and stability – yet the drawback of thermal conductivity is overcome. This makes thermally broken aluminium windows an ideal solution for commercial building applications and high-end residential projects where large, complex glazing solutions are required.

Controlling Heat Transfer

Heat or thermal heat energy can be transferred through a material in three manners:

1. Conduction is simply the process where heat is transferred through materials that touch one another.
2. Convection is where gases or liquids circulate to transfer thermal energy.
3. Radiation transfers heat energy at a distance through high frequency waves such as visible light, ultraviolet light or microwaves.

The window frames are insulated against heat and cold conduction. This is done by separating the outside metal parts from the inside with a material which reduces the amount of heat or cold transferred through the frames. This feature is known as the "thermal break".

Thermal Break Definitions

A thermal break is a non-metallic resin or plastic material installed in the metallic window frame that physically separates the interior part of the window from the exterior part. Hence the pathway for heat energy to be transferred or conducted through the window frame is "thermally broken". The formal definition from the National Fenestration Rating Council (NFRC) is as follows:

Thermal break: a material of low thermal conductivity that is inserted between members of high conductivity in order to reduce heat transfer. Thermal barrier material conductivity shall be no more than 0.5 W/m.K.

A thermally broken window can be described as one in which the frame and sash components (members) have been split into interior and exterior elements and joined using a less conductive material. The formal definition of a thermally broken member from the National Fenestration Rating Council (NFRC) is as follows:

Thermally broken (TB) members: system members with a minimum of 5.30mm separation provided by a low-conductance material (where thermal conductivity (is) less than or equal to 0.5 W/m.K) or open air space between the interior and exterior surfaces. Such systems include members with exposed interior or exterior trim attached with clips and all skip/de-bridged systems.

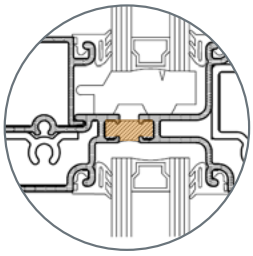
THERMAL BREAK TECHNOLOGY

Thermal Break Technology

In Australia, thermally broken aluminium window systems typically utilise one of two technologies to achieve the desired outcome of minimising heat transfer through the aluminium frame: pouring and de-bridging; or strut and spacer otherwise known as extrusion zipping.

1. Pouring and de-bridging

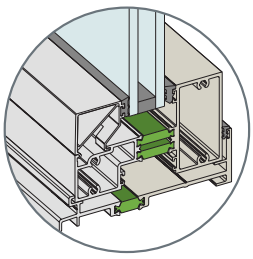
In thermally broken window systems using pour and de-bridge technology the window frame is first extruded as a single piece incorporating a hollow trough in the centre. This hollow trough is then filled with a plastic that hardens to form an intermediate piece. The connecting piece of aluminium is milled away leaving only the injected plastic to join the two halves of aluminium. Functionally the resulting piece is cut, mitred and assembled like a simple aluminium extrusion. Thermally the plastic slows the heat flow between the inside and the outside.



Frame is extruded with a hollow trough which is filled with plastic that hardens to form an intermediate piece (shown in orange), the connecting piece of aluminium is milled away.

2. Extrusion zipping

In thermally broken window systems using extrusion zipping/strut and spacer technology, individual extrusions are designed and extruded for the interior and exterior elements of the aluminium frame. These profiles are then joined using a number of polyamide strips, carefully positioned to maximise the insulation properties of the window. The strips are knurled and clamped between the interior and exterior aluminum elements and a machine is used to 'zip' the strips to the aluminium, creating a single profile with the same strength and expansion properties as a traditional aluminium window frame ensuring long-term functionality and durability.



Profiles are then joined using a number of polyamide strips (shown in green), carefully positioned to maximise the insulation properties of the window.

THERMALLY BROKEN SYSTEMS

CASE STUDY: THE FLANNERY CENTRE

7 The Flannery Centre. Architect: Paul Godsell, Crawford Architects. Windows by Bathurst Glass. Photography: Paul Godsell.

The Flannery Centre

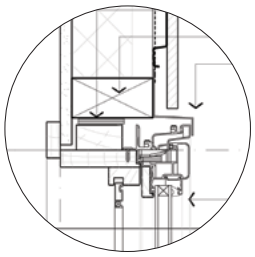
Named after renowned environmental advocate and 2007 Australian of the Year Tim Flannery, the Flannery Centre in Bathurst (NSW) was built under the Green Star rating system run by the Green Building Council of Australia.

Crawford Architects were appointed to design the sustainable, practical and iconic Centre, which is now a world-class green skills and Sustainability Education Centre in Bathurst.

Building material and product selections were made with the objective of minimising the ecological footprint of the Centre during construction and throughout its life cycle. Reverse veneer construction detailing, rammed earth walls and commercial thermally broken window frames are all contributing techniques and systems implemented in the building.

Glazing for the Centre presented a challenge with the design calling for large custom window solutions. To meet design aspirations around energy efficiency, the glazing system needed to have very low Uw values, provide long-term durability and deliver a contemporary aesthetic that complemented the modern building design.

Initially the architects selected a composite window system, however, the finish detail was bulky and did not offer the sleek, contemporary lines sought after for the design. Learning of AWS's ThermalHEART® range of thermally broken aluminium windows and doors, the architects altered the specification achieving a more efficient solution which delivered simple clean styling and offered a superior design resolution. The completed project is a building with a reduced ecological footprint and a dramatically low energy demand.



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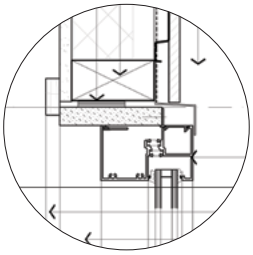


AWS's ThermalHEART® range offered a more efficient solution which delivered simple, clean styling and a superior design resolution.

THERMALLY BROKEN SYSTEMS

ThermalHEART®

AWS ThermalHEART®

Architectural Window Systems (AWS) developed a thermally broken range of aluminium windows and doors in 2008. The initial product release included sliding door, bi-fold door, hinged door and awning window systems. Since then the range has continued to expand and now includes a comprehensive offering of CentreGLAZE™ and FrontGLAZE™ framing in 100mm and 150mm platforms, along with compatible door systems for hinged, pivot, bi-fold or sliding installations.

"We've worked hard to make sure we can offer architects and designers a full and complete range of thermally broken systems for their projects, which will deliver excellent performance outcomes," comments AWS Designer Mark McCleary.

McCleary cites one of the major challenges in developing a thermally broken window system was ensuring the size of the profiles was consistent with that of traditional non-thermally broken framing. "In Australia, architects and builders commonly work with 100mm and 150mm framing platforms. When you are incorporating a thermal break into the system you need to ensure the break is wide enough to give the insulation improvements you're looking for, without making the profiles overly large or inconsistent with market expectations.

"We chose to use an extrusion zipping method to achieve our thermal break; this method allows you to create a true, wide break in the aluminium to maximise the thermal performance. The polyamide strips that provide the insulation are very stable and have similar strength and expansion properties as aluminium to ensure the finished thermally broken profiles are highly stable, consistent and strong. An added bonus with this method is the ability to offer dual colour extrusions – one colour inside, one colour outside - something previously unavailable to the Australian market, which really adds some flexibility for architects.

"When architects choose ThermalHEART® they can work with the extrusions like they would any other commercial framing; it's proportionally the same. Our ThermalHEART® systems have the same strength, durability and expansion properties as non-thermally broken framing, the systems are easy to specify, they are 100 per cent Australian designed to suit the Australian climate and market, and they solve many problems associated with Section J compliance," says McCleary.

WATCH: INTERVIEW AWS DESIGNER MARK MCCLEARY

HOW THERMALHEART COMPARES: THERMAL MODELLING

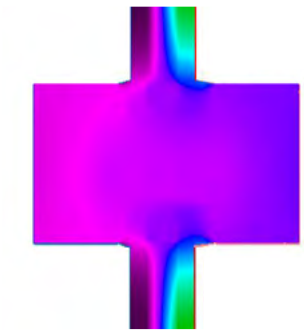
Thermal Modelling

Computer-simulated thermal modelling enables our design team to understand the thermal performance and energy efficiency of ThermalHEART™ window systems during the design phase. Thermal modelling simulations allow subtle adjustments and improvements to be made during the design phase, to maximise performance outcomes.

Non-thermally broken commercial frame

The illustration right shows thermal modelling outcomes for a non-thermally broken CentreGLAZE™ frame with 24mm IGU. The purple colour indicates a temperature of approximately -15.7°C on the external element of the frame. This colour transitions through the frame with the internal element of the frame showing a temperature in the range of -9°C.

This model shows a significant transfer of heat between the internal and external frame elements. In this instance, the frame provides less insulation against a cold outside temperature than it would if a thermal break were incorporated.



ThermalHEART® commercial frame

The illustration right shows thermal modelling outcomes for a ThermalHEART® CentreGLAZE™ frame with a 24mm IGU. The purple colour indicates a temperature of approximately -15.7°C on the external element of the frame.

You can clearly see the polyamide thermal break in the extrusion, highlighted blue. The thermal break maintains the separation achieved through the double glazing unit and insulates the internal elements of the frame from the cold external temperature. The internal element shown in green indicates a temperature of approximately 9°C.

This model shows a significant reduction in the transfer of heat between the internal and external frame elements. In this instance, the frame performs well as an insulator against a cold outside temperature.

/ Cootamundra House. Architect: Andrew Verri. Windows by Taylors Windows. Photography: Geoff Comfort.

HOW TheamalHEART® COMPARES: WINDOW ENERGY RATING SCHEME (WERS)

Window Energy Rating Scheme (WERS)

Window Energy Rating Scheme (WERS) data shows that ThermalHEART® systems deliver U-Values as low as 1.9.

WERS indicates the performance of a window system by highlighting the simulated U-Value and Solar Heat Gain Coefficient (SHGC).

The U-Value is the measure of how much heat energy is transferred through a window. The lower the U-Value, the better the window is at keeping the heat or cold out.

SHGC is a measure of how much solar radiation passes through a window. The lower the number the lower the solar heat gain through the window frame.

The tables shown right are extracts from the AWS product listings on the WERS certified products database. They illustrate the significant performance gains achieved by ThermalHEART® systems.

The first table shows WERS data for a typical non-thermally broken CentreGLAZE™ commercial framing system with a common monolithic glass type - this glass and frame combination achieves a U-Value of 3.9.

The second table shows WERS data for a typical non-thermally broken CentreGLAZE™ double glazed commercial framing system with a variety of glass combinations - this system achieves a U-Value of 2.5.

The third table shows WERS data for a ThermalHEART® CentreGLAZE™ system using the same glass alternatives as demonstrated in the previous table. This system achieves a U-Value of 1.9.

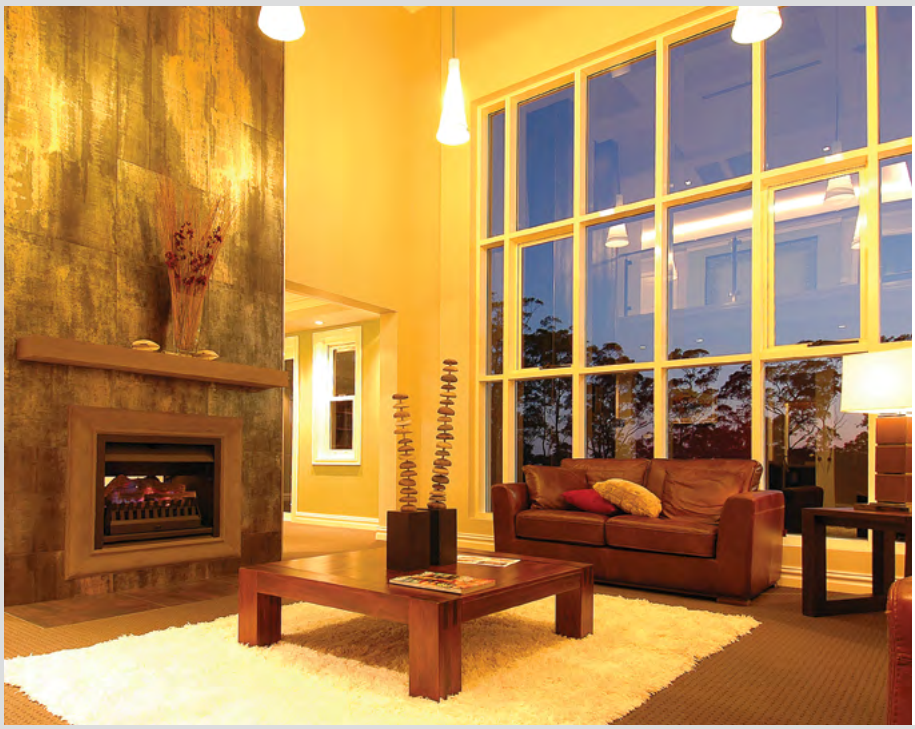
Series 400 CentreGLAZE™ framing non-thermally broken SG				
Window ID	Glass Type	Uw	SHGCw	Tvw
AWS-027-02	6SnClr	4.34	0.54	0.62
AWS-027-12	6.38CPClr	3.9	0.62	0.64

Series 424 centreGLAZE™ framingnon-thermally broken DG				
Window ID	Glass Type	Uw	SHGCw	Tvw
AWS-028-10	6.38CPClr/12Ar/6	2.5	0.54	0.64
AWS-028-14	6.38CPGy/12Ar/6	2.5	0.37	0.31
AWS-028-26	6EVanGy/12Ar/6	2.6	0.30	0.25
AWS-028-18	6.38SnGy/12Ar/6	2.7	0.44	0.53
AWS-028-09	6.38CPClr/12/6	2.7	0.54	0.64
AWS-028-13	6.38CPGy/12/6	2.7	0.54	0.64

Series 804 centreGLAZE™ framing ThermalHEART™ DG				
Window ID	Glass Type	Uw	SHGCw	Tvw
AWS-054-06	6.38CPClr/12Ar/6	1.9	0.51	0.62
AWS-054-04	6.38CPGy/12Ar/6	1.9	0.35	0.29
AWS-054-17	6EVGy/12Ar/6	2.0	0.28	0.25
AWS-054-15	6.38SnGy/12Ar/6	2.1	0.29	0.24
AWS-054-05	6.38CPClr/12/6	2.1	0.51	0.62
AWS-054-03	6.38CPGy/12/6	2.1	0.36	0.29

THERMALLY BROKEN SYSTEMS

Residential ThermalHEART®

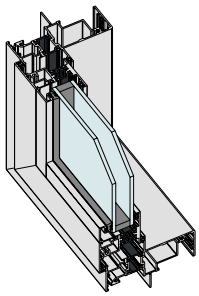


Based on the innovative Designer Series platform, Designer Series with ThermalHEART® technology is a unique suite of thermally broken aluminium window and door systems for improved energy efficiency.

Designer Series with ThermalHEART® is the latest addition to the Vantage range of high performance windows and doors.

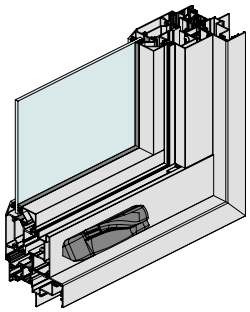
Developed in response to growing environmental concern and requirement for energy efficient building designs, Designer Series with ThermalHEART® offers significantly improved thermal performance and energy efficiency.

Ideal for those applications where minimising cold and heat transfer is a priority, this innovative range is 32% more thermally efficient than standard double glazed windows and doors.



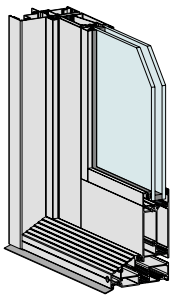
SERIES 726

Thermally Broken Awning Window



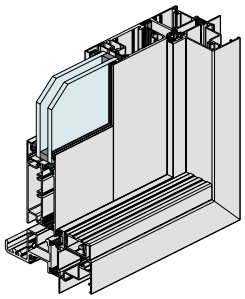
SERIES 726TR

Thermally Broken Awning Window with TRUTH™ hardware



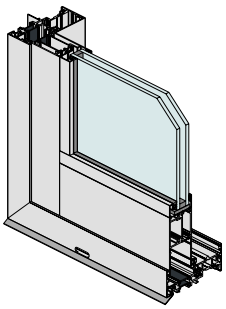
SERIES 729

Thermally Broken Hinged Door



SERIES 730

Thermally Broken Bi-Fold Door



SERIES 731

Thermally Broken Sliding Door

Want to find out more about ThermalHEART® products?
Click a product to view online

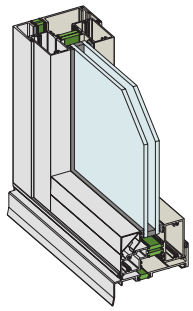
THERMALLY BROKEN SYSTEMS

Commercial ThermalHEART®

Dedicated commercial framing incorporating ThermalHEART® technology to create a thermal break in the aluminium frame. This break dramatically improves the thermal performance of the system minimising the transfer of heat and cold between the internal and external frame elements.

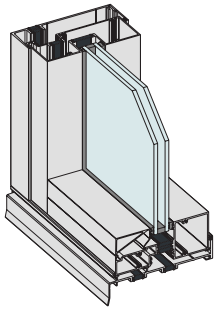
Developed in response to growing environmental concern and the requirement for energy efficient building designs, Elevate™ Commercial Framing with ThermalHEART® offers significantly improved thermal performance and energy efficiency.

Ideal for those applications where minimising cold and heat transfer is a priority, this innovative range is 24% more thermally efficient than standard double glazed commercial framing.



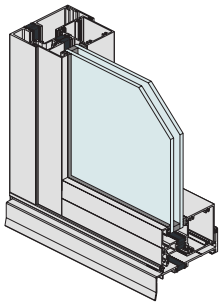
SERIES 804

Thermally Broken 100mm CentreGLAZE™ Framing



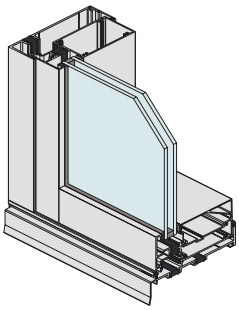
SERIES 806

Thermally Broken 150mm CentreGLAZE™ Framing



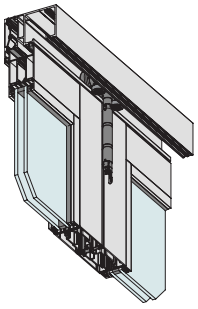
SERIES 824

Thermally Broken 100mm FrontGLAZE™ Framing



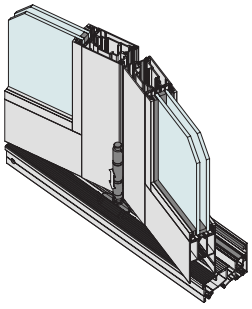
SERIES 826

Thermally Broken 150mm FrontGLAZE™ Framing



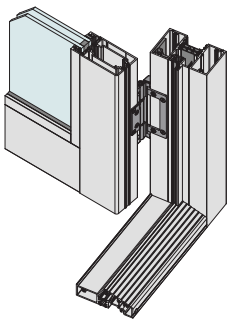
SERIES 831

Thermally Broken Bi-fold Door (Top Hung)



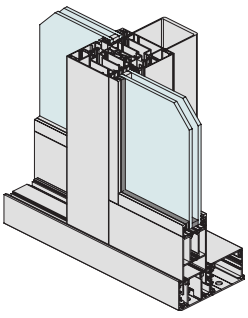
SERIES 832

Thermally Broken Bi-fold Door (Bottom rolling)



SERIES 852H

Thermally Broken Door (50mm thick)



SERIES 852S

Thermally Broken Door System (50mm thick)

AWS
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