



# Smart Windows

A guide to energy efficient windows and doors





# Aluminium. The smarter choice.

Planning the design principles of your home to take advantage of the natural climate can help with thermal comfort and energy costs. Capral's high performance aluminium windows and doors are one of the easiest solutions in improving the comfort and energy efficiency of your home.

As climate change causes increasing concern, we are all becoming more environmentally aware.

We are committed to not only designing and manufacturing products that are as energy-efficient as possible but developing sustainable window and door systems, through ongoing research and advancements of thermally efficient residential and commercial glazing systems. This is further augmented by our life cycle analysis of aluminium as a building material in order to improve the understanding of its environmental impacts and benefits.

Capral's broad range of high performance products provide optimal weather-sealing, functionality and aesthetics, and can help your home meet or exceed energy efficiency standards.

Take your energy efficiency to the next level with our range of thermal break range of products. Delivering excellent levels of thermal insulation, their environmental credentials extend to incorporating up to 25% recycled metal content, sourced from smelters using hydro-electric energy sources.

Knowing where to start and what to look for can be difficult. With this in mind, we have produced this helpful guide, designed to arm you with all the information required to make informed decisions on how best to find windows and doors that suit your requirements and to maximise the energy efficiency of your home.

Capral high performance window and door systems are available through our national network of independently owned fabricators, who have extensive experience and training in the fabrication and installation of our products.

By choosing a Capral high performance window or door as an original fitting for your new home, or as a replacement when renovating, you are making a genuine contribution to minimising your carbon footprint and addressing the important issue of climate change.

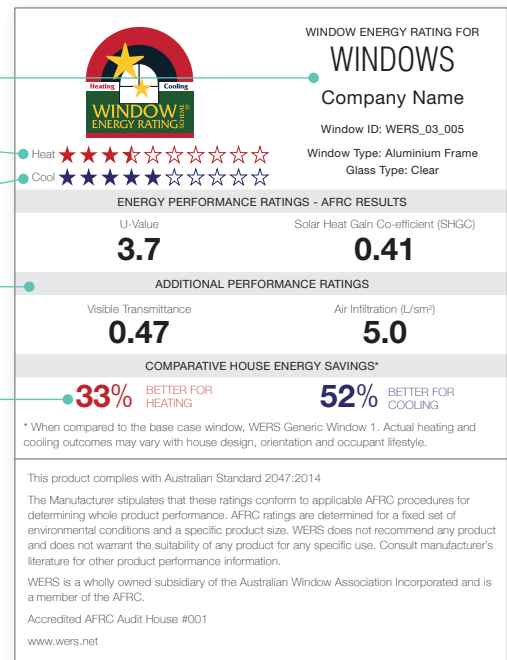
Product Description  
Including window frames and glazing materials

Heating Band  
Where windows are required to keep warmth in

Cooling Band  
Where windows are required to keep heat out

Product Data  
Specifies additional energy performance ratings

Indicative Percentage Reductions  
A home's heating and cooling needs compared to a clear single glazed aluminium framed window



## Window Energy Ratings

Compare products with the Window Energy Rating Scheme (WERS). It provides a star rating for how well a glazing system will contribute to the overall energy efficiency of a home. Simply put, no stars indicate a very poor performance with ten stars being an excellent performance. So start by looking for the sign that ensures your manufacturer is WERS accredited.

### The Window Energy Rating Scheme (WERS)

The Window Energy Rating Scheme enables windows to be rated and labelled for their annual energy impact on a whole house, in any climate of Australia.

Managed by the Australian Glass and Window Association, it provides a system for rating and comparing the energy performance of windows and doors against one another, in a similar fashion to the rating system commonly used for white goods. To participate, window fabricators must obtain energy ratings for their products from a rating organisation accredited by the Australian Fenestration Rating Council (AFRC) and rated windows must meet all relevant standards.

In order to determine window performance data, WERS uses a window's U Value and Solar Heat Gain Coefficient. In simple terms, the U Value is a measure of the rate of heat transfer through a window. The lower the U Value, the better level of insulation the window provides.

The Solar Heat Gain Coefficient is a measure of how much solar radiation passes through the window. In cooler climates, windows and doors which transmit a greater amount of solar radiation can help to provide 'free' solar heating.

### How do star ratings work?

Star ratings rank the window against alternative products using a ten star scale, based on 17 'generic' window types. These range from very low performance to very high performance for heating and cooling, and apply to the whole window – glass and frame combined.

A low star rating indicates a window is a relatively poor performer, while at the other end of the scale, ten stars indicate the perfect theoretical window. In reality, the highest performing windows available in Australia fall generally between 6 and 7 stars for heating and between 4 and 5 for cooling. Capral is proud to confirm that it has a number of window options in these ranges. Information on star ratings can be found at the WERS website: [www.wers.net](http://www.wers.net)

### WERS certificate types

Each individual-rated product has its own WERS certificate, including information to help you select the best windows and doors for your home. As well as the product's star rating, certificates feature a brief product description, performance rating data and the potential heating and cooling improvements when compared to a single glazed window.

# Passive Design

## Let your house do the work

Simple things like orientating your home to take advantage of available sunlight and selecting energy efficient windows and doors can make a real difference.

Passive Design is the term given to the design of homes that have little, if any, need for artificial cooling and heating. Through the use of smart design principles, the home takes advantage of the natural climate to maintain thermal comfort. Passive design principles can be applied throughout Australia's different climate zones.

A home with a Passive Design provides a more comfortable living environment and results in decreased energy costs to heat and cool due to improved energy efficiency. In turn, helping the environment through reducing greenhouse gas emissions related to artificial heating and cooling.

## Thermal Mass

Thermal mass describes the ability of building materials to store heat from the sun during the day and re-release it when required. Adding thermal mass helps reduce extreme temperatures within the home, making the average temperature more moderate all year-round.

Consequently, occupant comfort levels are increased, and energy costs are reduced. Heavyweight building materials store a lot of heat so are said to have high thermal mass, whereas lightweight materials do not and therefore have low thermal mass. As a rule of thumb, the higher the daily temperature range, the more thermal mass required.

## Windows and glazing

Windows and glazing are a critical element of passive design as up to 49% of heat loss and 87% of heat gain occurs through windows with 3mm single glazing. Passive Design takes advantage of this by keeping winter heat indoors and excluding excessive summer heat from entering the building. Appropriate placement of windows and doors is another important consideration; as well as minimising reliance on artificial heating and cooling, windows aid ventilation and importantly, a healthy living environment.

Single glazed high performance glass can stop up to 40% of solar heat gain while Low E double glazing can stop up to 77% of solar heat gain, which equates to a financial saving of approximately 40% off your energy bill to heat and cool. Specifying high performance glazing for your home can add as little as 1% to the total building cost.

## Orientation

Optimal positioning of a home on its site can have a significant impact on its thermal performance. During winter the most sunlight enters a home through north-facing windows and doors. If your site doesn't permit, or if you are renovating an existing home and unable to optimise the orientation, energy efficient windows and doors will prevent heat gain and heat loss and help ensure your home is thermally efficient.

## Layout

Areas that are used for relatively short periods of time such as bathrooms, laundries and garages are best positioned on the west to provide a buffer against the extreme summer heat. To ensure you enjoy the maximum benefits of solar heat, position rooms that generally require heating, such as living areas, on the north side of the house.

## Insulation

Whether it be the roof, walls, doors or windows, it is imperative that premium insulation is achieved and that all gaps are filled to keep wanted air in and unwanted air out. High performance windows and doors provide superior insulation when combined with other insulation materials.

This reduces the amount of artificial heating and cooling needed to maintain thermal comfort, which in turn means smaller heating and cooling units and lower running costs.

## Ventilation

Well placed windows and doors can capture cooling breezes for optimal ventilation. Trees and other external objects can be used to direct breezes through the home. Some window types, such as casement windows and louvres, are particularly useful in controlling breezes for maximum benefit.

## Shading

Preventing summer sun from directly hitting windows is one of the most effective ways to reduce summer heat from negatively impacting on thermal performance. Shading can be achieved through appropriately sized and positioned eaves or by other means such as verandas, trees, screening and outdoor blinds.

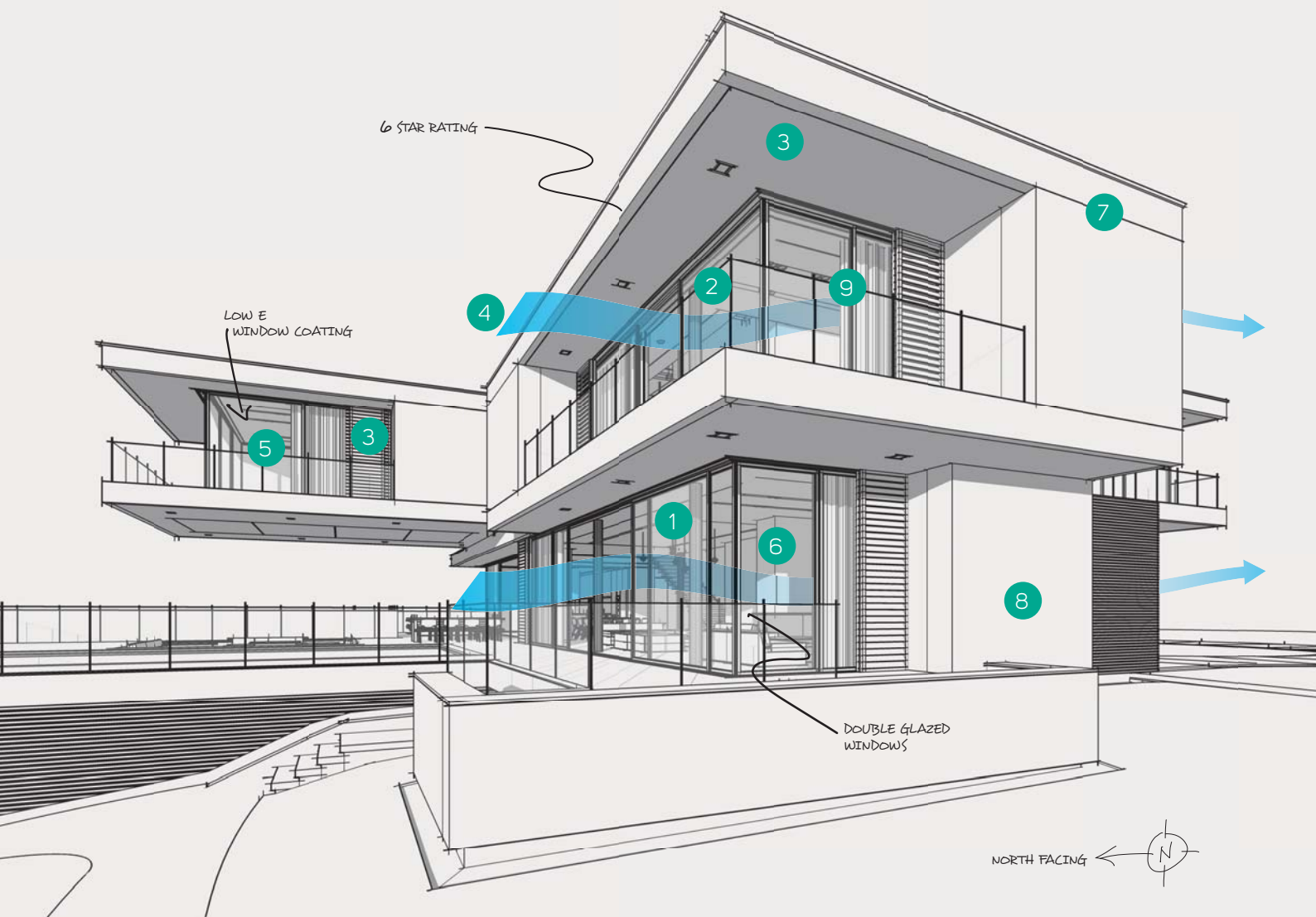
As the winter sun enters at a lower angle than summer sun, by using effective shading, you can guard the same areas from heat gain in summer.



## Passive design checklist

The following checklist provides a sound starting point for considering how best to maximise the energy efficiency of your home by utilising passive design principles.

1. The main living areas are oriented north to maximise winter sun and minimise summer sun.
2. Rooms are zoned or grouped and divided as needed for economical heating and cooling.
3. Eaves or other shading devices have been incorporated to provide shading from summer sun and allow winter sun to enter.
4. Windows and doors are located to get good natural cross ventilation and to ventilate bathrooms and wet areas.
5. Windows are located appropriately, and glass selections made that provide natural daylight and winter sun penetration while avoiding summer overheating.
6. Windows have been utilised to improve energy efficiency, by making use of the large range of high performance energy efficient glazing products available.
7. Maximum insulation has been provided in the roof, walls and floor.
8. There is appropriately designed thermal mass internally to moderate indoor air temperatures.
9. Draughts and air leakages have been adequately sealed.
10. The star rating of the home is more than the minimum five-star required.







# Understanding the Australian climate

Australia's climate is getting warmer, and we now use more energy to cool than heat our homes. Energy efficient windows and doors can save up to 60% of your energy costs.

## Australia's climate

In Europe, frequent extreme cold periods and unpredictable heat waves can make for living conditions that can be uncomfortable at times. However, Australia is lucky to have relatively moderate climate conditions. While there are areas that experience extreme heat, these are largely unpopulated, and extreme cold is rare throughout the continent.

The lack of extreme weather conditions means that it is relatively easy for homes to achieve very good energy outcomes. Homeowners do not need to part with excessive amounts of money for elaborate window and door systems to improve the energy efficiency of their home. High performance aluminium windows and doors can easily provide the desired thermal performance benefits at a reasonable cost.

## Climate change

More and more is being written about climate change, with various opinions and research, but it's undeniable we are already experiencing the effects of a changing climate. Australia's average temperatures have increased by 0.9°C since 1950, while the frequency of hot days and nights has increased, and the frequency of cold days and nights has declined.

Regardless of what climate zone you live in, the same basic Passive Design principles apply. Through careful selection of windows and doors, you can gain maximum control over your home's thermal performance and reduce reliance on artificial cooling and heating. Australians are now using more energy to cool than heat; artificial cooling systems generally consume more energy than heating systems and are expensive to install and operate.

## Cooling climates

In cooling climates, the primary goal is to keep unwanted heat from entering the home and reduce the size of the artificial cooling system and minimise ongoing operating costs. The best results are obtained from windows and doors that limit solar heat gain.

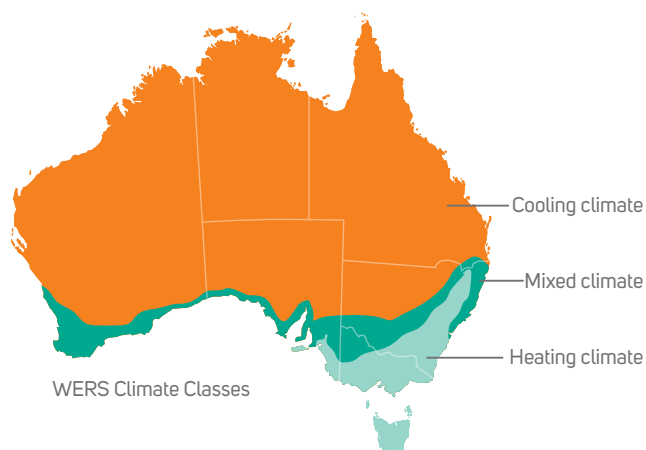
This can be achieved by using tinted or coated glass types. Good insulation is also important, particularly if the home is air-conditioned. In these situations, double glazing can deliver significant benefits and also provide further improvement in solar heat gain co-efficient.

## Heating climates

In heating climates, the aim is to retain heat and to maximise the penetration of solar energy in winter. Selecting windows that insulate efficiently ensures unwanted heat loss is minimised. Windows with a low U Value and high SHGC indicate effective insulation properties and are preferable in cool climates. Thermal break systems, double glazed windows with spectrally selective or Low E glass coating all provide excellent energy outcomes. Areas with a cool climate include Tasmania, Southern Victoria and some parts of New South Wales and South Australia.

## Mixed climates

In a mixed climate the goal is to stop heat from entering the home during summer and from escaping during winter. In these climates, windows which offer a good compromise between U Value and Solar Heat Gain are required. Alternatively, use of various glasses on certain elevations can help achieve the right balance. Southern Western Australia, parts of New South Wales and South Australia, and northern Victoria generally fall within this category.



# The benefits of aluminium windows

## Thermal performance

High performance aluminium windows are able to meet or exceed energy efficiency standards. Aluminium windows and doors can easily achieve improvements in heat gain and heat loss through windows by 60% rivalling more expensive timber and uPVC equivalents.

## Reduces carbon footprint

In the case of an average gas-heated home in Melbourne, the use of aluminium double glazed windows delivers CO<sup>2</sup> equivalent savings of almost three times that required to produce the aluminium frames, just within the first year.

Over the life of the building, energy savings outweigh the initial energy input by well over 100 times. For homes with electrical heating, or cooling for homes in hot climates, savings run into multiples of close to 300 times.

## Durability and low maintenance

The corrosion-resistant qualities of aluminium provide a low maintenance frame and are resistant to weathering under a range of harsh environmental conditions. Unlike many other materials, it will not swell, crack, split or warp over time; ensuring an extended product life.

Aluminium can be left in its finished condition. For additional protection or decorative finishes, aluminium can be anodised or painted.

## Affordability

Aluminium frames can be significantly less expensive than other framing options, providing a strong yet economical window and door solution, while also achieving excellent energy outcomes.

## Design flexibility

The inherent strength and flexibility for aluminium to be manufactured to exacting specifications means you are limited only by your imagination. With an endless array of systems, finishes and glass options, aluminium offers a vast range of possibilities from the economical to most elaborate systems while also delivering excellent thermal performance.

## Recyclability

Aluminium has one of the highest recycling rates of any metal and is an environmentally sustainable material. Recycling of aluminium requires only five per cent of the initial energy consumed to create it. This inherent property differentiates from other framing materials reinforcing its sustainable credentials.

## Short payback period

Payback periods on high performance aluminium windows are typically far shorter than for other alternatives which offer only marginally improved performance at a far higher price. Such options can take several decades to deliver a payback.

## The aluminium advantage



Meets or exceeds energy standards when combined with energy efficient glass.



Reduced carbon footprint with energy savings that outweigh initial energy input by over 100 times.



Economical framing solutions that can be less expensive than other framing options.

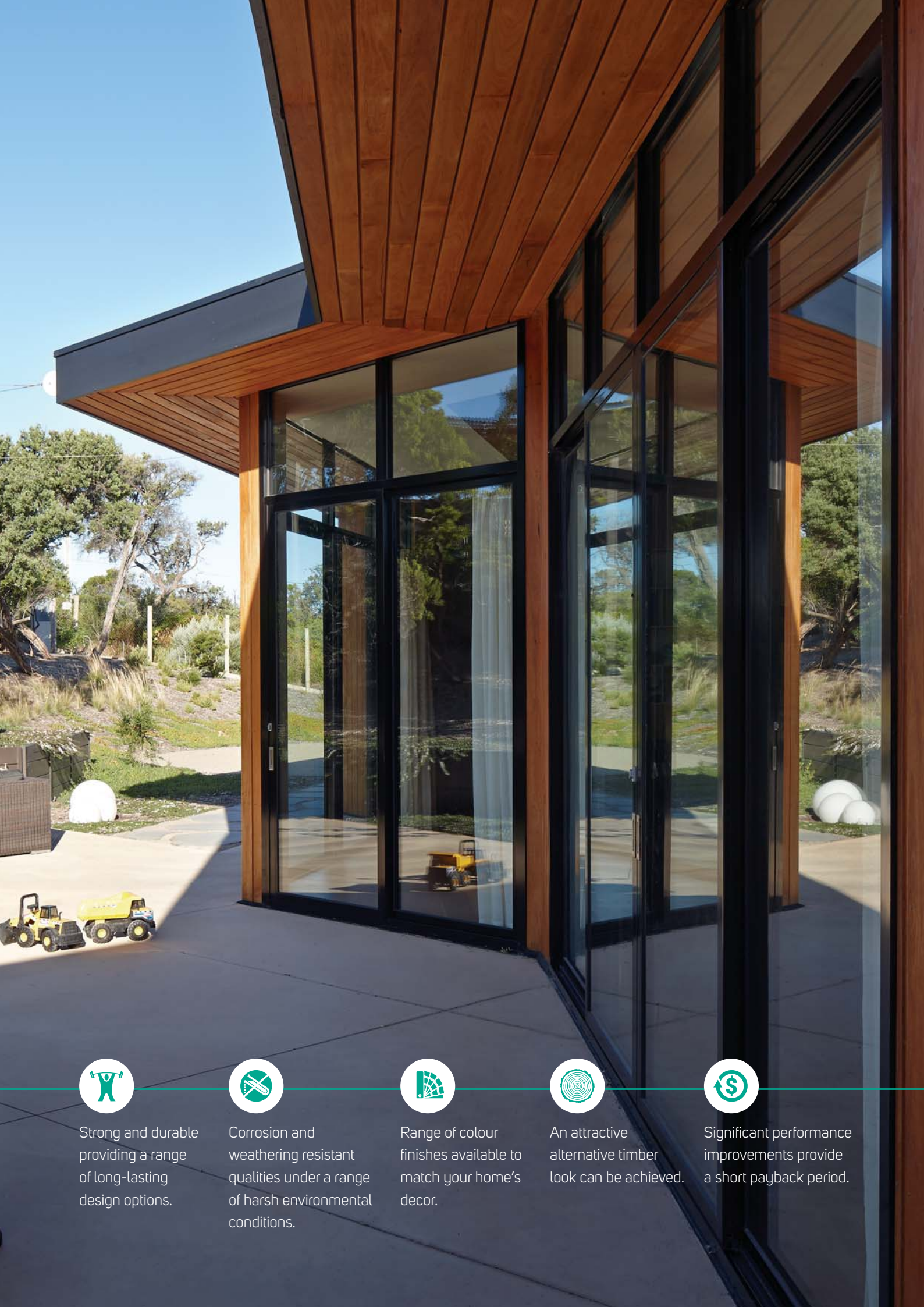


Environmentally sustainable material with one of the highest recycling rate of any metal.



Low maintenance and durable; won't swell, crack, split or warp.





Strong and durable providing a range of long-lasting design options.



Corrosion and weathering resistant qualities under a range of harsh environmental conditions.



Range of colour finishes available to match your home's decor.



An attractive alternative timber look can be achieved.



Significant performance improvements provide a short payback period.



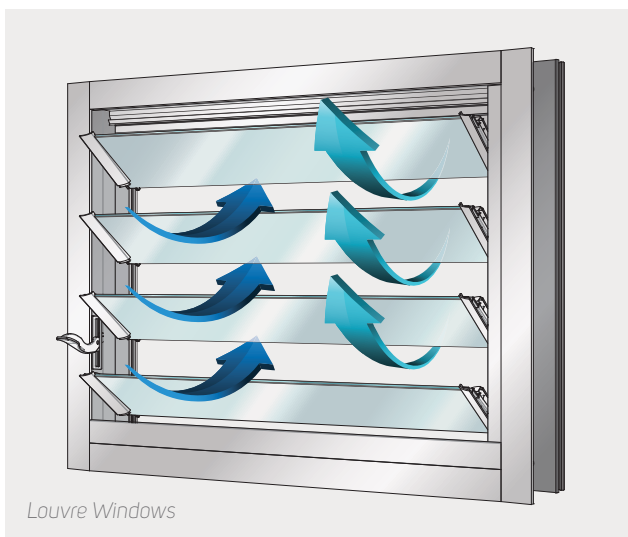


## The part Capral Aluminium windows and doors play

Capral is proud to offer an extensive range of Australian made window and door systems that have been designed and tested to provide thermal comfort and cater for new trends. Capral's products allow light, views and ventilation while providing sustainable, energy-efficient façade solutions.

### Ventilation

Capral aluminium windows and doors offer a great way to ventilate your home naturally. Different styles of windows and doors provide a range of ventilation options.



Maximum ventilation is achieved through windows with wide openings such as Capral's range of sliding windows, while other styles such as louvre or casement windows, give you greater control over the direction and strength of air entering your home. Doors that offer wide openings such as Capral's folding or stacking doors offer unobstructed airflow between inside and outside environments.

### Reduced heat transfer

By reducing heat transfer through windows and doors, you will enjoy a more energy efficient home. Many homes are using 60% more energy to heat and cool than might otherwise be necessary. Energy transfer through a window generally travels through the glass and frame. However, given that up to 90% of a window's area is made up of glazing, glass selection is the most critical component in minimising heat transfer. Well-designed aluminium windows and doors with good glazing achieve high thermal efficiency at a much lower cost.

## Additional benefits

There are many additional benefits to be derived from clever use of Capral high performance windows and doors including:

- Reduced reliance on the orientation of your home, giving you greater design freedom;
- Decreased environmental impact and reduced greenhouse gas emissions;
- Enhanced thermal comfort of up to 5°C warmer in winter and 10°C cooler in summer;
- Improved wellbeing through increased exposure to natural daylight;
- A substantial reduction in condensation with the installation of double glazing;
- Improved acoustic performance;
- Reduced fading of furniture and fittings due to decreased UV ray transmittance;
- Integration of indoor and outdoor areas, perfect for entertaining.

## A total solution

It is important to think of a window as more than a pane of glass; rather, it is the glass, frame, seals and hardware combined.

### High performance frame

As well as visually complementing the glass, a frame should be durable and low maintenance. Capral aluminium frames are popular in contemporary architecture as they require little maintenance, are long-lasting, don't warp, swell or crack over time and can be coated in a range of different finishes and colours.

### Quality seals

Long-lasting seals that offer exceptional resistance to all weather conditions are vital to keeping air from inadvertently entering or escaping through gaps in the window. High-quality seals will ensure the window acts as an effective insulator.

### High Performance Glass

Selecting the wrong glass to put in a frame, or similarly, placing high performance glass in an inferior frame, will have a negative effect on your home's thermal performance.

## Thermal break systems

There are many advantages to aluminium, but it is a conductor of heat and cold.

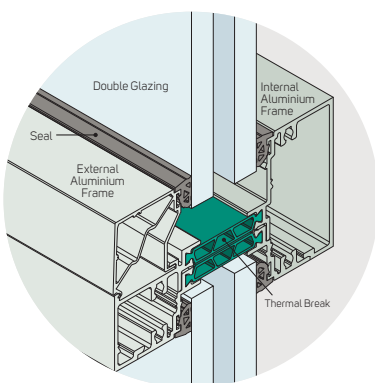
The inclusion of a thermal break in an aluminium frame creates a barrier to block the transfer of heat and cold, in and out of a home. Made from a material that has low thermal conductivity, it is inserted between the two parts of the frame, reducing the transfer of heat and cold, and making it an efficient insulator. It can greatly improve the indoor temperatures of a home and when incorporated with double glazing, becomes, even more energy efficient.

## Expert advice

Much like a medical professional prescribes a remedy, when selecting windows, you should consult a design professional to help determine the best window, door and glazing solution for your specific needs.

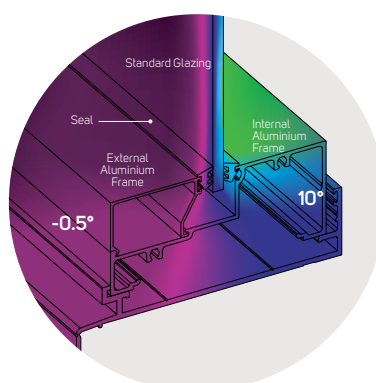
High performance aluminium windows can achieve heating and cooling improvements over conventional systems.

## How a thermal break helps to reduce heat and cold transfer



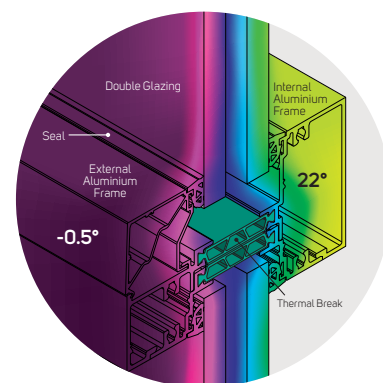
### Thermal Break (Cross Section)

The green section above is the thermal break that acts as a barrier between the two aluminium sections of the window. With no contact between the aluminium frames, thermal and sound conductivity is reduced.



### Standard Aluminium Product

This model shows a standard aluminium window with an external temperature of -0.5°C, which is transferring internally to a temperature of approximately 10°C.



### Aluminium Product with a Thermal Break.

In contrast, this model shows an aluminium product where the external temperature is -0.5°C. The barrier reduces the transfer so that the internal temperature is approximately a warmer 22°C.







# High performance glazing

Selecting a window or door that combines high performance glass with a quality frame and long-lasting weather-resistant seals will result in a high performance, long-lasting window and door.

## Choosing the right glass

Accounting for up to 90% of the thermal performance of windows and doors, glass is the most influential factor in determining window and door energy efficiency. Not all glass products are created equal, and it's vital to select the appropriate glass for your specific purpose.

From self-cleaning glass to glass that turns from transparent to opaque with the flick of a switch, today's technology is so advanced the possibilities are endless.

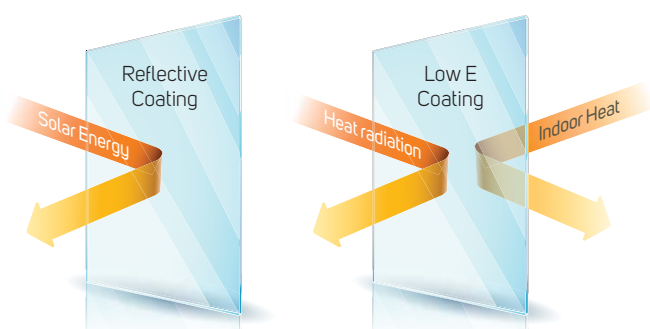
Decorative glass, whereby an image is encapsulated between two sheets of glass, means you can even choose to incorporate patterns or photos into your home's design if you so desire. Glass is more than a building material; it offers endless aesthetic and practical benefits. Hopefully, it will be part of your home for a long time, so it is important to select glass that will meet your design and thermal performance requirements.

## Coatings

A range of coatings can be applied to glass to enhance its properties further.

**Low E coatings** (also known as spectrally selective coatings) lower the amount of heat flow through windows and doors, by reflecting radiation rather than absorbing it. A Low E coating can reflect unwanted heat in summer while retaining heat and preventing it from radiating out in winter.

**Reflective coatings** involve the application of a metallic film to one side of the glass to significantly increase the amount of reflected visible and infrared heat.



Above: The components of an Insulated Glass Unit (double glazed).

Left: An example of a home with tinted windows.

## Double glazing

Double glazed units (also known as Insulated Glass Units or IGUs) comprise two or more panes of glass, separated by an air (or gas) filled cavity that is completely sealed. IGUs provide thermal insulation and improved acoustic performance while also significantly improving a building's energy efficiency.

A combination of IGUs and performance glazing can prevent up to 50% of heat loss during winter and 87% of heat gain in summer compared to standard 3mm single glazed windows.

## Tinted glass

Tinted glass reduces external glare, minimising fading to furnishings by UV rays and decreasing solar heat gain.

Green, grey, bronze and blue are the most common tints, as they do not significantly alter the colour of the views through the window.

# Energy Efficient Terms

Before embarking on the important selection of your windows and doors, it may be useful to become familiar with a few commonly used energy efficient terms.

## Double Glazed Units or Insulated Glass Units (IGUs)

IGUs provide thermal insulation and improved acoustic performance. Consisting of two panes of glass, separated by an air or gas-filled cavity, an IGU is described in terms of the thickness of the outer pane in millimetres, followed by the cavity width and finally the thickness of the internal pane; e.g. 4/12/4. Generally, a 12mm to 15mm cavity width provides optimum performance.

## Infiltration

Heat loss and heat gain can occur through leaks in the window or door assembly. Good seals and quality workmanship minimise this.

## Laminated Glass

Panels are assembled from two sheets of glass with an adhesive interlayer. Laminated glass when broken, will not shatter or splinter, leading to greater safety and security. Laminated glass eliminates nearly 99% of harmful UV rays, reducing fading to floors and furniture. A specialised interlayer in laminated glass can further reduce Solar Heat Gain Coefficient.

## Low E Glass

A thin coating that is applied to the glass surface to enable it to reflect short wave (direct solar) heat or long-wave (re-radiated/reflected) heat.

## Orientation

The direction a home faces can affect how much energy is used heat and cool. Ideally, a home should be oriented north-south to prevent the sun's rays from penetrating in summer, while still allowing for solar warming in winter. It is impractical for many homes to achieve optimal orientation; however, high performance windows can help achieve a high level of control over a home's thermal performance.

## Passive Cooling

Passive cooling encourages cooling breezes and air movement in summer as an inexpensive way of cooling your home. Passive cooling is best achieved through orientation to cooling breezes, increased natural ventilation, a light coloured roof and wall finishes, and appropriate windows and glazing to minimise heat gain.

## Passive Solar Heating

Passive solar heating aims to keep summer sun out while

still allowing winter sun in. As well as using orientation and shading, passive solar heating is best achieved through effective insulation, draught sealing and high performance glazing. Window frames and the type of glazing used play a big part in passive solar heating.

## Reflective Coating

A metallic coating is applied to one side of the glass in order to significantly increase the amount of reflected visible and infrared heat.

## Shading

Shading a home can improve comfort and increase energy efficiency. It is important to install effective shading devices to block summer sun from the north while still allowing the lower angled winter sun inside.

## Solar Control Glass

Glass that reduces heat gain derived from direct solar radiation. This may be achieved via interlayers, body tints, reflective coating or Low E coatings.

## Solar Heat Gain Coefficient (SHGC)

SHGC is a measure of the amount of solar radiation transmitted through a window and released into the home as heat. The lower a window's SHGC, the less solar heat it transmits; a low SHGC is vital for warm or hot climates.

## Toned / Tinted

Usually, green, grey, bronze or blue, toned or tinted glass can shade internal areas and reduce the amount of heat entering through the window. This will keep the building cooler and reduce glare and UV rays.

## U Value

U Value measures the rate of heat flow through a window, due to temperature difference between the indoor and outdoor environment, taking into account the effect of the frame, glass, seal and any spacers. Heat is lost and gained through a window by the combined effects of conduction, convection and radiation. The lower the U Value, the higher the energy efficiency of the window or door.

## Visible transmittance (VT)

VT is a numeric measure of how much visible light is transferred through the window. The higher the VT, the more daylight that is openly transmitted.





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