TechDirect™ White Paper

Understanding IGU Specification

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1. INTRODUCTION

In modern residential architecture, glass windows and doors play a vital role in energy efficiency and sound insulation. Double glazing is a well-established solution that significantly improves a home's energy efficiency and comfort compared to single glazing.

As energy costs rise, improving building efficiency is essential. With windows being a major source of thermal loss, enhancing their thermal performance and controlling energy transfer is crucial, as seen in Western markets where high energy costs have long been a factor.

However, simply installing double glazing isn't enough. Insulation efficiency and solar heat control must be considered separately, as factors like climate zone, elevation, and glazing proportions impact performance.

This white paper outlines how specifiers can meet stricter glazing requirements to comply with updated building codes. It highlights the role of double glazing in thermal, solar, and acoustic performance, emphasizing its importance for energy efficient, comfortable, and sustainable homes in Australia.

2. BACKGROUND

This document aims to provide an overview of insulated glazing, specifically double glazing and its contributing factors, causes and effects, with selection of appropriate materials and design methods to help combat poor thermal and acoustic performance.

The information provided is general in nature, specifically related to glass only and does not include other building materials which may also have contributing factors such as condensation.

Double glazing basics

Double glazing consists of two panes of glass separated by a spacer bar. Most are sealed with both a primary and secondary sealant to create a hermetically sealed cavity which typically contains either dry air or commonly inert gas such as argon to further slow heat transfer.

The panes of glass used can vary in type and thickness to influence performance and can include the use of clear or body-tinted substrates, patterned glass and/or Low E high performance coatings. Low E coatings vary by technology but are generally made from metallic or chemical elements that are permanently applied to glass during manufacture and are designed to reduce energy transfer. When the coating is positioned within the spacer cavity, it remains protected for long-lasting performance.

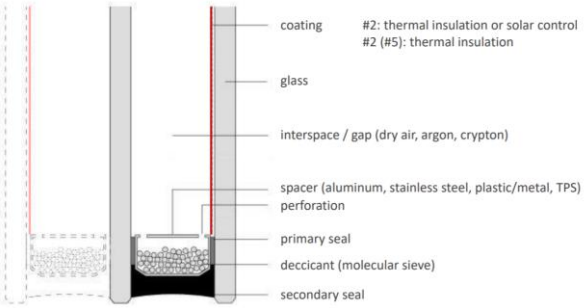
Traditional spacer bars are usually aluminum, which conduct heat. Newer options are available such as plastic or foil combinations, silicone-based foam, and thermoplastic spacers, and are collectively known as Warm Edge spacers which help reduce thermal bridging at the panel edges.

Sealant systems bond the glass to the spacer, preventing moisture and gas leakage, and are essential for the unit's durability and lifespan. The primary seal is applied to the edges of the spacer and pressed directly onto the adjacent glass surfaces, forming the main barrier for seal integrity.

A secondary seal is then applied, filling the cavity between the spacer and the glass edges. Common secondary sealants include polysulfide and silicone. Polysulfide is more cost-effective, cures faster, and offers excellent resistance to moisture ingress and argon loss. However, silicone is more resistant to harmful UV rays. Therefore, in applications where the seal is exposed - such as structural glazing or roofing systems - silicone secondary seals should be specified to ensure long-term durability.

Argon gas improves the thermal performance of insulating glass units compared to air. While other gases, such as krypton, are used in some markets, they are not commonly adopted in Australia. Argon has become the industry standard due to its widespread availability, cost-effectiveness, and reliable performance.

Diagram 1. Insulated Glass Unit (IGU) Illustration



Thermal performance

Traditionally, glass is a poor insulator, keeping out wind and rain but letting heat escape or enter. While we insulate walls, floors, and ceilings, glass is often overlooked, leading to cold winters and hot summers indoors.

U Value measures how well a material insulates - lower U Values are better. Double glazing improves thermal performance by reducing the U Value. For example, regular glass has a U Value of around 6, but adding a Low E coating reduces it to 3.6-4. Adding an air cavity between 2 standard glass types (ie an IGU) lowers it further to 2.5-2.7, and with high performance Low E coatings, it can drop to 1.3-1.4.

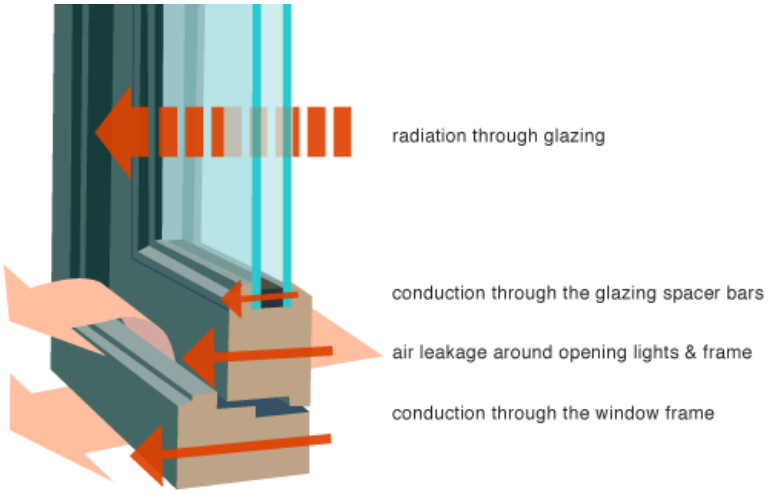
Heat gain is also a concern, depending on climate and elevation. The Solar Heat Gain Coefficient (SHGC) measures solar heat transfer through glass, where “1” means 100% of heat passing through. SHGC performance depends on climate, so what works in a cold climate may not be in a hot one. In cold areas, more heat gain can be beneficial, while in hot climates, it can lead to overheating. In those cases, heat-absorbing or heat-reflective coatings (like Low E) can help. Some advanced Low E products have an SHGC as low as 0.20, letting only 20% of solar heat through.

Energy assessors specify Solar Heat Gain Coefficient (SHGC) requirements based on factors such as climate zone, building orientation, and window-to-wall ratio. Radiant heat from the sun can pass through two panes of clear glass almost as easily as it does through one. Basic clear Low E coatings also allow significant solar heat gain, which may be beneficial in colder climates where heating demands outweigh cooling needs.

However, in hot climates - particularly with large west-facing windows - using clear double glazing can result in excessive heat gain and poor energy performance. In these cases, it is important to use either a heat-absorbing solution (such as tinted glass) or a heat-reflective option (such as high performance Low E coatings). Some advanced Low E products can achieve SHGC values as low as 0.20, meaning only 20% of solar heat is transmitted through the glass.

Energy ratings, such as NatHERS (Nationwide House Energy Rating Scheme), help set performance targets for U Value and SHGC, aiming for more energy efficient, comfortable homes with lower running costs.

Diagram 2. Heat-loss through glazing



Acoustic performance

The Sound Reduction Index (Rw) measures a material's ability to reduce sound transmission, expressed in decibels (dB) across the range of audible frequencies. Understanding acoustics involves comparing existing noise levels with the desired internal sound environment. For instance, a busy road might generate noise levels around 65 dB, whereas an acceptable level for a bedroom is typically no more than 30 dB. This means an effective acoustic solution would require a sound reduction of at least 35 dB.

The most effective method for reducing sound is increasing mass - thicker materials are less prone to transmitting sound vibrations. Additionally, laminated glass with acoustic interlayers can significantly dampen vibrations. Double glazing adds mass by incorporating two panes of glass, offering some acoustic benefits. However, for greater noise reduction, using acoustic laminated glass within a double glazed unit will deliver far superior results.

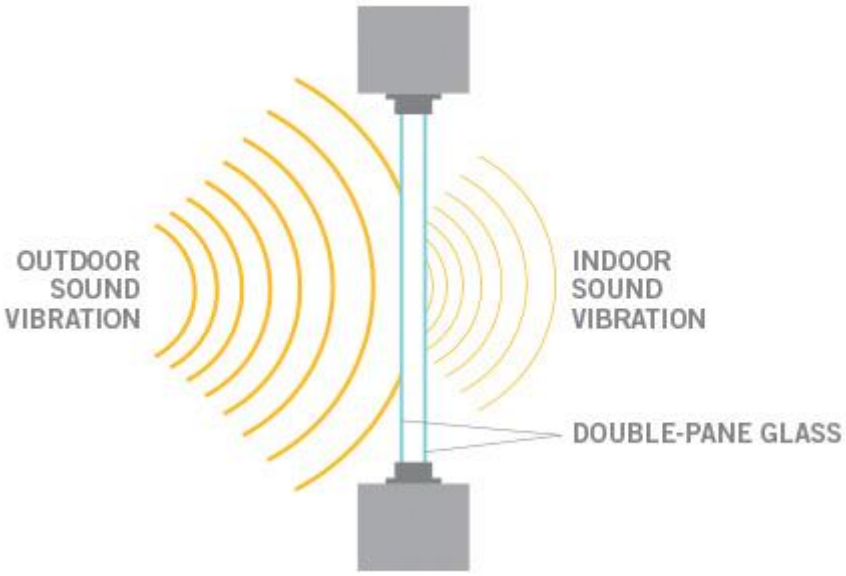
It's also important to note that Rw ratings apply only to the glass itself and do not account for the window frame or its operation. Frame materials matter - timber and uPVC, for example, tend to absorb sound better than rigid metallic frames. Airtightness is equally critical, as air leakage allows sound to pass through. Proper installation, including the sealing of window perimeters and gaps in adjacent building materials like walls and ceilings, plays a key role in the overall acoustic performance.

Another important factor is the type of sound being targeted. The Rw value is an average across all frequencies, but different noise sources, such as traffic, may fall into specific ranges. Road noise, for example, tends to be lower in frequency. To reflect this, an adjustment factor called Ctr is used. This negative correction is subtracted from the Rw value to give a more accurate measure of performance against low-frequency noise. For example, if a glass unit is rated at Rw 40 with a Ctr of -4, the effective reduction against road noise is 36 dB.

Acoustic test reports that cover the full window system - including framing and seals - are the best indicator of real-world performance.

To get the best soundproofing, choose the right glass and frame together for optimal performance.

Diagram 3. Sound attenuation through double glazing



Mistakes and misconceptions

Many consumers focus primarily on aesthetics and cost, often overlooking critical performance specifications such as U Value and Solar Heat Gain Coefficient (SHGC), which are essential for energy efficient design. Neglecting or compromising on these specifications during construction can lead to suboptimal building performance and increased long-term costs. High quality double glazing, when correctly specified, offers significant long-term benefits in terms of energy savings and indoor comfort.

However, even the best glazing can underperform if not properly installed. Professional installation is crucial to ensure correct sealing, alignment, and integration with the building envelope - factors that enhance both thermal and acoustic performance. Poor installation, particularly where drainage is inadequate, can allow water to enter the glazing cavity. This can lead to seal failure, internal fogging, and a shortened lifespan of the unit, ultimately requiring costly replacement.

3. SOLUTION

Orientation

Window orientation greatly impacts glazing performance, especially in Australia's varied climates.

North-facing windows capture sunlight in winter for passive solar heating but can cause overheating in summer without proper shading or high performance glass.

South-facing windows get little direct sunlight, so solar control levels are less relevant, and the U Value will be the significant driver of glass and window performance.

East-facing windows provide warm morning light, while west-facing windows often lead to excessive heat in the afternoon.

Effective glazing selection in each orientation can maximize natural light, reducing the need for artificial lighting and energy use. To reduce glare from north and west-facing windows, use shading, tinted glass, or high performance coatings, or a combination of these solutions.

The National Construction Code (NCC) defines 8 climate zones, each with specific strategies to optimize window performance based on seasonal temperature and wind patterns.

Low E (Low Emissivity) coatings

Adding a Low E coating to double glazed windows greatly improves their performance. Low E reduces heat transfer by reflecting heat inside during winter and blocking it outside in summer, keeping your home comfortable year-round and lowering energy bills.

Low E coatings either reflect, absorb, or transmit different types of light, including visible light and infrared light (heat). The right coating and its placement in the glass unit, depending on your climate and window orientation, can greatly impact the overall performance and comfort of your home. Not all Low E coatings are the same - some allow more solar heat in, while others reflect more infrared heat, with lower SHGC levels. Understanding your building's specific needs helps determine the best coatings and configurations.

Acoustic laminates

Incorporating acoustic laminate into double-glazed windows significantly reduces sound transmission, making it ideal for homes in high-noise environments. This type of glass features a sound-dampening interlayer between two panes, which helps absorb and block sound vibrations. When used as part of a double-glazed unit, the acoustic laminate enhances the overall Sound Reduction Index (Rw), meaning improved noise insulation. It's also important to note that the position of the acoustic laminate within the insulated glass unit (IGU) does not affect its acoustic performance.

Frames and insulation

Choosing the right frame type and insulation is essential for ensuring double glazing performs optimally in a home or building. The frame plays a critical role in supporting the glass and preventing thermal bridging, which can compromise the energy efficiency of the window. Materials like uPVC, timber, or aluminium with thermal breaks help reduce heat loss or gain. Proper insulation within the frame also minimizes air leakage, enhancing the overall performance of the double glazing. Together, a well-chosen frame and effective insulation ensure that the glass functions as intended, improving comfort and energy efficiency while reducing the need for additional heating or cooling.

External shading devices

External shading devices are an effective solution for optimizing the performance of double glazing in a home or building. These devices, such as awnings, blinds, or shutters, help control the amount of direct sunlight entering through the windows, reducing heat gain in summer and preventing overheating. By blocking the sun's rays before they reach the glass, external shading prevents glare and minimizes the need for artificial cooling, while still allowing natural light to filter through. Properly designed external shading devices work in tandem with double glazing to improve energy efficiency, enhance indoor comfort, and protect interiors from UV damage.

Regular maintenance

Regular maintenance is crucial for ensuring the long-term performance and efficiency of double glazing in a home or building. Over time, dirt, debris, and wear can affect the seals, frames, and glass, leading to reduced insulation and energy efficiency.

Regularly cleaning the glass and checking the seals for any damage or wear helps maintain proper insulation and prevents air or water leaks. Lubricating window mechanisms and ensuring that the frame and seals are in good condition also prevent drafts and enhance thermal performance. By performing routine maintenance, homeowners can extend the lifespan of their double glazing, improving energy efficiency and reducing the need for costly repairs or replacements.

4. CONCLUSION

Double glazing is a critical component in enhancing the thermal and acoustic performance of Australian homes. By understanding the specifications that govern double glazed products, homeowners can make informed decisions that lead to improved comfort, reduced energy bills, and enhanced quality of life. As building regulations continue to evolve, and sustainability becomes a priority, investing in high-quality double glazing is an essential step toward a more energy efficient and peaceful home environment.

5. APPENDIX

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