Industry Best Practice Guide
to

Retro-fitting of Double Glazing

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window & glass association nz

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INDUSTRY BEST PRACTICE GUIDE TO RETRO-FITTING DOUBLE GLAZING

Contents

1.0 Introduction

Retro-fit double glazing is the process of replacing the glazing in a home with new higher performing glass, utilising the existing window and door frames. This usually involves removing the existing single glass panes and replacing them with double glazing. The process is an economical and usually non-invasive method of improving the performance of the building envelope and should have a minimal impact on the occupants of the home.

This Industry Best Practice (IBP) for Retro-fitting Double Glazing is published by the Window & Glass Association NZ (the Association) and is intended to provide,

a) an understanding of the process involved,
b) assistance in establishing in the project,
c) setting customer expectation,
d) guidance in the regulatory requirements.

1.1 Disclaimer

The information contained in this IBP has been prepared by the Window and Glass Technical Committees of the Association and sourced from within its membership. The Window & Glass Association NZ makes no warranties or representations of any kind (express or implied) regarding the accuracy, adequacy, currency or completeness of the information.

Compliance with this IBP does not guarantee protection from infringement of any regulatory requirements, the New Zealand Building Code or relevant Standards. The final responsibility for the correct design and specification rests with the designers, suppliers, and/or installers of the retro-fitted glazing.

1.2 Scope

This Industry Best Practice provides requirements, information and guidance, to designers, suppliers, and/or installers of retro-fitted glazing, in New Zealand.

The scope of this document includes the retro-fitting of double glazing only, into existing window and door frames in existing homes. It has been written based on agreed best trade practices used by the Associations members over many years.

The environment and wind categories vary throughout New Zealand and must be taken into account when establishing the requirements for each and every project to ensure compliance with the relevant clauses of the New Zealand Building Code.

1.3 Standards and Related Documents

The following Standards and Related Documents apply to the Retro-fitting of Double Glazing

NZBC Clause B1	Structure
NZBC Clause B2	Durability
NZBC Clause F2	Hazardous Building Materials
NZBC Clause F4	Safety from Falling
NZBC Clause H1	Energy Efficiency
NZS 3604:2011	Timber Framed Buildings
AS/NZS 1170.2:2011	Structural design action – Wind actions
NZS 4211:2008	Specification for performance of windows
NZS 4223.1:2008	Glazing in buildings – Glass selection and glazing
NZS 4223.2:2016	Glazing in buildings – Insulating glass units
NZS 4223.3:2016	Glazing in buildings – Human impact safety requirements
NZS 4223.4:2008	Glazing in buildings – Wind, dead, snow, and live actions
Window & Glass Association	Glazing of IGU' s - WG46211.26:2023
Window & Glass Association	Industry Standard for Glazing Blocks - WG45102.14:2023
MBIE	Guide to tolerances, building materials and workmanship.

Whilst this IBP might make reference to the Documents, Standards, and Building Code Clauses noted above, or parts thereof, the Association does not claim the contents of this IBP constitutes compliance with them.

2.0 Definitions

For the purposes of this guide the following definitions apply.

Annealed Glass	Float glass that has not been treated or reworked to become safety glass. If broken, it shatters into sharp, blade-like shards. Also known as plate glass.
Argon	A naturally occurring inert gas that can be sealed between two (or more) panes of glass to increase the insulating performance of the window. Argon is denser than air and acts as a greater barrier to heat loss and heat absorption in the home.
Bead	A strip of wood, metal sealant or other material secured to the rebate to retain the glass. Also known as a glazing bead or sealant bead.
Condensation	Moisture that results when warm, humid air meets a cooler surface and, as it cools, releases water onto that surface. Moist air is typically created by indoor activities such as clothes washing and cooking.
Dew	Similar to condensation but occurring on the exterior of the glazing.
Durability	To comply with the Building Code, building products must, with normal maintenance, continue to satisfy Building Code performance requirements for periods of not less than 5, 15, or 50 years, depending on the ability to assess, and/or replace the product.
FFL	Finished Floor Level. The surface on which people normally tread within the rooms of a building.
Glazing Block	The term applies to blocks placed between a glass pane and the frame, to position the glass in the frame and prevent direct contact between the two. Glazing Blocks include Setting Blocks, Location Blocks and Distance Pieces.
Hardware	Hardware typically refers to the components that are used to operate, lock, or open your window or door.

IGU	Insulating Glass Unit – Two or more panes of glass spaced apart and factory hermetically sealed with dry air or special gas in the unit cavity. Use of two panes of glass is referred to as double glazing.
IGUMA	The Insulating Glass Unit Manufacturers Association.
Laminated Glass	A single pane of glass comprising a plastic interlayer sandwiched between two or more sheets of glass. If the glass breaks, the broken fragments adhere to the interlayer, to reduce the risk of injury.
Panel	Usually refers to the opening portion of a hinged, sliding, or bifolding door. For sliding doors, the fixed portion is often referred to as a fixed panel.
R-value	The thermal resistance rating used to establish an element's ability to resist the transfer of heat. The higher the R-Value the better thermal resistance the product will provide.
Rebate	The part of a frame into which the edge of the glass is installed.
Sash	The opening portion of a window.
Safety Glass	Glass designed to reduce the risk of injury if broken. Safety glass can be either toughened or laminated.
Tinted Glass	A pane of glass that has colourants added during its manufacturing process to change the basic properties of the glass. Most commonly in shades of bronze, grey, or green.
Toughened Glass	A pane of glass that is tempered through a heating and quenching process to increase its overall impact resistance. If broken, the pane is reduced to very small fragments.
U-value	The thermal transmittance rating used to establish an element's ability to allow the transfer of heat. As the U-value decreases, so does the amount of heat that is transferred through the glazing material. The lower the U-value, the better the insulation.

Viable	It is important to assess the condition of the existing joinery to establish whether the double glazing can and/or should be installed, or whether it might be more economical to replace the frames instead.
VLT	Visible light transmittance. The ratio of luminous flux (light) passing through a translucent surface (e.g. glazing). It is expressed as a percentage of the flux incident upon the surface. A higher value means a greater percentage of visible light passes through the surface.
Warranty	A warranty is provided by the retro-fit product manufacturer/supplier /installer as a means to repair, replace, or compensate the customer, if the product fails to meet the terms set out in the warranty.

3.0 Principles

3.1 General Requirements

This section of the IBP is designed to assist in understanding the expectations and requirements of retro-fitted double glazing.

The Building Act includes for Alterations to existing buildings and says that windows and doors in existing buildings may be retro-glazed but to a performance level not less than that of the existing glass.

It is the Associations view that any windows or doors being retro-fitted with double glazing, should be carried out to a level that best fits the building and is balanced with the customer's needs and budget. Glazing options can and should be discussed to assist them in achieving their goals.

3.2 Building Consent

Does the retro-fitting of double glazing require a Building Consent?

In most cases, ***NO*** it will not. Schedule 1 of the Building Act 2004 provides an exemption from consent for some building work.

Section 8 of Schedule 1 refers to *windows and exterior doors in existing dwellings*. The provisions of this section can be applied to retro-fitted double glazing and confirms that the work will not require consent, provided the reason for retro-fitted glazing is not a failure of the existing window or door to satisfy the provisions of *Clause B2 - Durability* of the Building Code.

If during the assessment of the works it is established that a window or door which was installed within the last 15 years has failed (e.g., it has rotted out), and requires replacement, this work ***will*** require a building consent, as it has failed to meet the durability requirements of the Building Code. This recognises that replacing a window or door that has failed its durability requirements could result in the replacement also failing.

Even though the work may not require a consent, it must still comply with the provisions of the Building Code.

3.3 Building Code

Retro-fitted double glazing must still comply with the provisions of the Building Code. There are several Clauses of the Building Code which apply as follows,

3.3.1 Clause B1 - Structure

Section B1/AS1 refers to the *NZS 4223.3:2016 Glazing in buildings* suite of documents to ensure the glass is designed appropriately for the site and situation in which it is being used, including wind loads

(from applicable wind zones), deflection, protection from falling, and human impact safety requirements.
Glass of a lesser performance for strength, safety, or energy efficiency than that being replaced shall not be used.

3.3.2 Clause B2 - Durability

Section B2/AS1 refers to *NZS 4223.2:2016 Glazing in buildings – Insulating glass units*, which describes the manufacturing requirements for the double glazing. All IGU's must be permanently marked with the name of the manufacturer, the year (as a minimum) of manufacture, and the Standard to which the glass complies. This marking is usually printed on to the spacer between the two panes of glass.

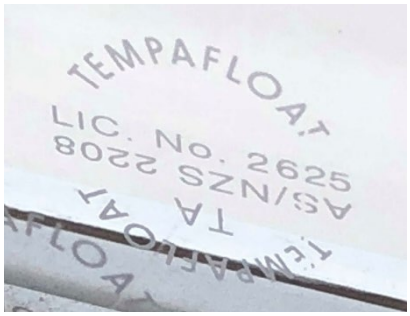
Clause B2 requires that glazing and glazing beads have a durability performance of not less than 15 years, i.e., they must, with normal maintenance, continue to satisfy the performance requirements of the Building Code for this period.

> ***Note:*** *The durability requirements of retro-fitted components are limited to only the work carried out by the contracted party and does not extend the durability/warranty of existing products not replaced. Refer to Sections 3.5 and 3.6 to understand the difference between Durability and Warranty.*

3.3.3 Clause F2 – Hazardous Building Materials

Section F2/AS1 refers to *NZS 4223.3:2016 Glazing in buildings – Human impact safety requirements*, which sets the regulations to ensure, where required, that safety glass is used to reduce the risk of injury to the occupants. In some locations glass is required to either break safely or be strong enough to resist a reasonable, foreseeable impact. This might mean that glass that was not previously rated as safety glass will need to be updated to meet current regulation.

Each pane of safety glass is required to be ***permanently*** marked with the type of glass, the details of the manufacturer, and the Standard to which the glass has been manufactured. The stamp is small, is usually positioned in the lower corner of the pane and will look something like this.



3.3.4 Clause F4 – Safety from Falling

Section F4/AS1 also refers to *NZS 4223.3:2016 Glazing in buildings – Human impact safety requirements*, but in this case to ensure glass is strong enough to safeguard people from falling 1.0m or more (from floor level). This applies to glazing within 800mm of floor level or panes that might be mistaken for an unimpeded path of travel. Usually this will mean the use of safety glass.

3.3.5 Clause H1 – Energy Efficiency

Section H1/AS1 describes the required thermal performance of each element within the building envelope and the glazing is considered as one of those elements. The thermal performance of an IGU is based on a number of factors including, the type of glass used, and the depth of the space between the panes (refer also to **5.1.4**). However, retro-fitted double glazing may have a narrower space based on the depth of the existing windows they're being installed into, meaning it may not be possible to achieve the required U-values. Therefore, for compliance with Clause H1, the retro-fitted double glazing should have a U-value of not more than the original glazing.
Replacing the air between the panes with Argon gas will increase the performance of the IGU. This is carried out at the time of manufacture of the IGU and cannot be done retrospectively.

3.3.6 Clause G7 – Natural Light

Section G7/AS1 sets minimum levels of Visible Light Transmittance (VLT) for glazing in, housing, aged care facilities, retirement complexes and early childhood centres with openings to the outside, meaning in some situations tinted glass may not be a compliant option. Check and confirm the minimum VLT requirements before proceeding with the project.

3.4 Performance

Not all double glazed units offer the same levels of performance. The make-up of an IGU can usually be tailored to achieve the customers desired result. Sometimes there might be a trade off, but the design of the IGU should be discussed with the customer at the initial consultation.
What is the customer is trying to achieve with their retro-fitted double glazing, i.e., thermal, safety, and/or acoustic improvements, and what levels of performance can be achieved?

3.4.1 NZS 4211

To satisfy the requirements of the NZ Building Code, new window and door systems must comply with the requirements of NZS 4211 – Specification for performance of windows. Whilst the requirements of the glazing do not form a part of this Standard, any new frames used in the retro-fitting of double glazing to a building will need to satisfy the demands of the.
I.e., Replacement sashes and door panels will need to comply with,

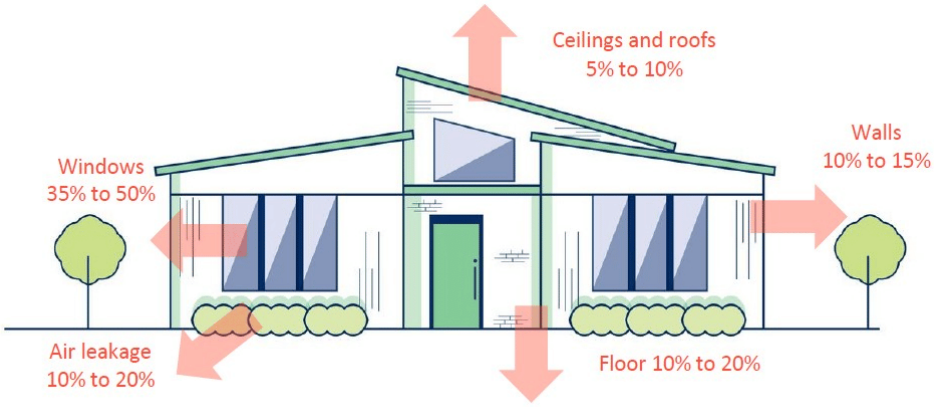
- the 'Torsional strength of sashes' test,

- the 'Operation of opening sashes' test (does not apply to door panels),
- they will also need to have demonstrated compliance with the 'Ultimate strength' test, and
- they will need to be labelled in terms of Section 4 of the Standard.

Sashes will also need to include the drainage systems and seals used during their testing.

3.4.2 Energy Efficiency

As described in 3.3.5 above, *Section H1/AS1* describes the required thermal performance of glazing to achieve the energy efficiency goals of the Building Code. If the customer is looking for improved control of warmth in the home, it is important that a discussion regarding thermal performance and the buildings thermal envelope be had. Whilst the glazing is typically a weak point, it is only one element of the thermal envelope and will not solve issues with poor insulation in other elements, i.e., floor, walls, and/or roof.



3.4.2 Condensation Control

Consumers often relate double glazing with the elimination of condensation from their windows and doors. Whilst higher performing glazing will shift the point at which condensation occurs, it may not prevent it altogether. Condensation is a by-product of humidity and temperature and occurs when warm moisture laden air contacts a cooler surface. There are many potential sources for the moisture laden air and many surfaces on which the air might condense and release the water it is carrying.

Designing the double glazing make up to provide the best possible U-value will help control the formation of condensation on the glass, but the window frames themselves (especially aluminium) might still condensate as they did before.

In some climates, high performing double glazing may actually cause dew to form on the exterior of the glass because the glass is warmer than the outside air temperature.

3.4.3 Safety

Retro-fitted double glazing provides an opportunity to upgrade the existing glazing to comply with current safety regulations. As described in 3.3.3 above, *Section H2/AS1* and *NZS 4223.3:2016* describe the safety requirements for all glazing, which may have changed significantly since the existing glazing was installed. Some of the situations where safety glass might be required are as follows,

- panes within 800mm of FFL,
- full height panels / doors / windows,
- bathroom / wet area windows within 2000mm of FFL,
- window seats within 800mm of FFL,
- window or door units protecting a fall of more than 1.0m from FFL,
- window or door units separating a pool – requires the replacement/updating of hardware.

3.4.4 Acoustic

Whilst retro-fitted double glazing will provide an increased level of acoustic performance by default, if the customer is looking to target a specific sound or noise, then the IGU make up may need to be designed specifically for the project.

3.5 Durability

As described in 3.3.2 above, Clause B2 requires that glazing and glazing beads have a durability performance of not less than 15 years, i.e., they must, with normal maintenance, continue to satisfy the performance requirements of the Building Code for this period.

As with all manufactured products, IGU's have a foreseeable lifespan. When, under normal use conditions, condensation (fogging) occurs within the space between the panes, the unit is deemed to have reached the end of its useful life. IGU's typically carry a 10-year warranty but the customer can expect their glazing to last longer than the warranty period, but they should not expect that it will last forever, even if well maintained.

With NZ's diverse climatic conditions, during its life, the IGU's will be exposed to a range of environmental influences, including temperature and atmospheric pressure fluctuations, wind loads, sunlight / UV light, water, and water vapour and in coastal locations salt laden sea air. In service history both internationally and within in NZ has shown a variety of IGU life expectancies depending not only on these environmental factors, but also on the design of the unit, its installation and how well it is maintained.

3.6 Warranty

It is usual for retro-fitted double glazing to be provided with a ***Product Warranty***, covering materials and workmanship, but the Building Act also makes provision for an ***Implied Warranty*** as detailed below, in 3.6.2.

3.6.1 Product Warranty

The Product Warranty for window and doors, including hardware and components protects against defects in manufacturing, workmanship, functionality, and surface finish (where applicable) for a period of 5 years, provided care and maintenance guidelines have been followed.
Some products carry individual warranties differing from the standard 5 year period,

i) Some surface finishes (anodising and powdercoating) for aluminium carry warranty periods of up to 30 years, depending on the finish selected and the site location. However, it will only apply to the components that have been replaced, existing finishes will not be warranted.
ii) Double glazing from an IGUMA member carries a 10 year conditional warranty.

3.6.2 Implied Warranty

Implied warranties are different from product warranties because they are duties that can arise automatically without a warranty ever being offered.
Consumer protection measures set out in sections 362 to 399 of the Building Act 2004, offer homeowners increased protection by ensuring various warranties are implied into certain contracts regardless of whether the warranties are specified in the contract.
The warranties are implied despite any provision to the contrary in any agreement or contract.

3.7 Care and Maintenance

The care and maintenance of retro-fitted double glazing and associated components will vary between retro-fit manufacturers, suppliers, and installers, but each will have recommended programme, that must be followed in order to satisfy the terms of their warranty.

The most common elements of maintenance include but may not be limited to,

- Cleaning every ***three months*** is recommended for windows and glazing. In coastal or industrial environments more frequent washing will be required
- Recommended cleaning with a ***soft brush with warm water*** and some mild household detergent. Rinse with fresh water
- ***Do not*** use abrasive steel wool, scrapers, scouring liquids or aggressive solvents or thinners. These are likely to damage the surface finish.

- The cleaning cycle should include the removal of build-up in door tracks to ensure the maintenance of *drainage paths*.

Painted materials also require maintenance and re-coating at varying frequency, depending on the type of paint used. Check and ensure painted materials are re-coated according to the paint manufacturers recommendations, to ensure the durability of the painted product.

4.0 Assessment

Before proceeding with a retro-fit double glazing project, in fact before even pricing one, the project should be assessed for viability as not all existing windows are suitable for retro-fitting.

The following checklists provide generic guides to the considerations to be worked through to ensure the project is feasible, from both the retro-fit supplier and customers perspective and to establish the customers desired outcomes.

The checklists may vary for individual retro-fit supplier/manufacturers.

- Checklist 1 – General Condition
- Checklist 2 – Aluminium Window System Assessment
- Checklist 3 – Timber Window System Assessment
- Checklist 4 – Glass and Glazing Assessment

Checklist 1 – General Condition		Yes/No Comment
1.1	Establish the approximate age of the existing joinery?	
1.2	Is the existing window system viable?	
	- Is it less than 15 years old, meaning consent may be required?	
	- Do the existing windows function correctly?	
	- Do they need repair before retro-fitting double glazing?	
	- Are they nearing the end of their serviceable life?	
	- Would it be better to replace the windows?	
1.3	Can the existing window system be retro-fitted with double glazing?	
1.4	Are the existing windows and doors plumb, square, and straight?	
1.5	Does the work fit within the company's offering?	
	- Do we need a specialised contractor?	
1.6	What is the Wind zone? – L, M, H, VH, EH – Circle 1 or	
	- Specific Design	
1.7	What is the Exposure zone? – B, C, D, <100m – Circle 1 or	
	- Microclimate	
1.8	Why does the customer want to Retro-fit double glazing?	
	- Thermal performance	
	- Condensation control	
	- Safety	
	- Acoustics	
	- UV / Fading protection	
	- Other specific requirements?	
1.9	Refer to Checklist 4 for details…	

Checklist 2 – Aluminium Window System Assessment		Yes/No Comment
2.1	Is the existing brand identifiable?	
	- Brand =	
	- Suite =	
2.2	What is the approximate platform depth?	
	- Available edge cover =	
	- Maximum IGU depth =	
2.3	Can the colour be matched?	
	- Colour =	
	- Should a complete re-colour be considered?	
2.4	Are the interior timber reveals in good condition?	
2.5	Is a suitable replacement bead available?	
2.6	Are the existing sashes beaded?	
	- Replace sashes?	
2.7	Will a pocket adaptor work for the doors?	
	- Replace door panels?	
2.8	Is the existing frame drainage system suitable for double glazing?	
2.9	Do the seals, mohair, gaskets need replacing?	
2.10	Will the stays, rollers, hinges need updating to suit additional weight?	
2.11	Will opening hardware need to be replaced?	
2.12	Do any screws/fixings need to be replaced?	
2.13	Do any restrictor stays need to be added?	
2.14	Are there any special requirements/considerations?	

Checklist 3 – Timber Window System Assessment		Yes/No Comment
3.1	Are the frames able to be rebated to accommodate double glazing?	
	- Available edge cover =	
	- Maximum IGU depth =	
	- What size bead is to be used?	
	- Are there any obvious repairs required? E.g., rot?	
	- Is it in the window or door, or in the adjacent materials?	
	- If there is rot, is it repairable?	
	- Does the repair require the engagement of a builder?	
3.2	Are the sashes/panels able to be rebated to accommodate double glazing?	
	- Maximum IGU depth =	
	- What size bead is to be used?	
	- Are there any obvious repairs required? E.g., rot?	
	- If there is rot, see 3.1 above...	
3.4	Are the windows and doors to be fully repainted after retro-fitting?	
	- Colour =	
	Are the windows and doors only to be primed after retro-fitting?	
	- If so, how long must the customer what to paint?	
	- And what is the maximum length of time before a repaint must happen?	
3.5	Do the seals, and/or any mohair, gaskets need replacing?	
3.6	Will the stays, rollers, hinges need updating to suit additional weight?	
3.7	Will opening hardware need to be replaced?	
3.8	Do any screws/fixings need to be replaced?	
3.9	Do any restrictor stays need to be added?	
3.10	Are there any special requirements/considerations?	

Checklist 4 – Glass and Glazing Assessment		Yes/No Comment
4.1	Why does the customer want to Retro-fit double glazing? - (from 1.7)	
4.2	Thermal performance	
	- Which of Heat gain or Heat loss causes the most concern?	
	- Glass type options – Clear, Low E, Tint (colour) – Circle appropriate	
	- U-value desired =	
	- Gas fill - Air, Argon – Circle 1	
4.3	Has condensation control/outcomes been discussed?	
	- Is the home insulated? - Floor, Walls, Roof – Circle appropriate	
	- Does the home have a ventilation system?	
4.4	What safety considerations need to be addressed?	
	- Full height panes, Stairways, Bathrooms, Protecting a Fall	
	- Low level windows, Window seats – Circle appropriate	
4.5	What acoustic considerations need to be addressed?	
	- Type of noise to be addressed, Voice, Music, Traffic, Engineer, Other	
	– Circle appropriate	
4.6	Is the homeowner concerned about UV / Fading protection?	
4.7	Are there any existing butt jointed panes?	
4.8	Is there full site access to all windows and doors?	
	- Is scaffolding required?	
	- Special lifting equipment?	
4.9	Are there special requirement/considerations?	

5.0 Glass Requirements

Even in situations where the project does not require a Building Consent all work should comply as closely as possible and with the relevant Clauses of the NZ Building Code, as referred to in Section 3 of this document.

5.1 Performance

NZS 4223.1:2008 provides design criteria, guidance for specific design and procedures for glass selection, and glazing in buildings. To aide in the understanding of how the glass satisfies the requirements of the NZBC, the following offers a fundamental view of the basic glass functions.

5.1.1 What is Double Glazing?

Double glazing is the common descriptor for an Insulating Glass Unit (IGU), assembled and sealed in a controlled factory environment. The two panes of glass making up the IGU allows each unit to be designed to meet the performance requirements of the project.

Double glazing comprises two panes of glass, one exterior, with Surface 1, and 2, one interior pane with surfaces 3 and 4, effectively counted from the outside in. The thickness of the units will vary depending on the size of the spacer used and the thickness of the glass. Combining different types of glass, spacer size and type, along with gas options can provide a bespoke performance tailored specifically for the project and the customer's desires.

NZS 4223.2:2016 sets out the requirements for materials, design, glazing, and quality assurance of IGU's, and is referred to in Acceptable Solution B2/AS1 and is intended to provide a means of compliance with the NZ Building Code.

5.1.2 Structural Performance

NZS 4223.4:2008 provides a method for the determination of minimum glass thicknesses to resist windloads. The Standard is intended to provide a means of compliance with the NZ Building Code Acceptable Solution B1/AS1.

The environment and wind categories vary throughout New Zealand and must be taken into account when establishing the requirements of the project. As the windload increases, the glass thickness and spacer dimensions must be reconsidered to ensure they resist the loads and remain within the allowable deflection tolerances, described in the Standard.

Windloads are selected from NZS 3604:2011, and are typically described as Low, Medium, High, Very High, Extra High or Specific Design. Specific Design or SED loads are calculated in accordance with AS/NZS 1170.2:2011.

5.1.3 Safety

NZS 4223.3:2016 is intended to provide a means of compliance with the relevant performance requirements of Building Code Clauses B1, F2, and F4 in order to minimise the potential for injury to building users, from glazing in buildings. The Standard provides information regarding the locations and situations where safety glass is required. Regardless of whether consent is required for the project, the Association recommends the use of safety glass wherever prescribed.

There are two options for safety glass, either toughened and/or laminated.
Toughened glass has undergone heat treatment and is ideal for safety, strength, and temperature resistance. If it is broken, it will break into small pieces, which reduces the risk of injury.
Laminated glass is an option for areas close to doors or latches to reduce the chance of burglars breaking the glass and entering your home. Laminated glass incorporates an interlayer between two pieces of glass. It is much more difficult to break and if it does, the interlayer holds the glass fragments together.

5.1.4 Thermal Performance

All new residential builds are required to achieve a minimum energy performance as part of the New Zealand Building Code. Given this is the primary reason most choose to retro-fit double glazing to their homes, it is the Associations perspective that the same levels of thermal performance should be aspired to for retro-fitting. Acceptable Solution H1/AS1 provides a guide to the required performance levels for each of the Country's six climate zones.

There are three main ingredients that impact the thermal performance of an IGU, glass type, spacer bar, gas fill.
Glass type. Prior to the recent updates to NZBC Clause H1, most retro-fitted IGU's are made up using two panes of clear glass. To move towards the requirements of H1 and increase the thermal performance of the IGU's, a pane of Low E (low emissivity) glass can be included in the combination. There are a variety of options when it comes to Low E glass so discuss the projects requirements with the retro-fit company.
Spacer bar. Switching the standard aluminium spacer bar with a thermally improved option will increase the thermal performance of the whole window frame, as it improves the thermal bridging values of the combination.
Gas fill. Typically, standard double glazing has air captured between the two panes of glass. To further improve the thermal performance of an IGU, the air can be replaced with an inert gas that is denser than air, like Argon.

5.1.5 Condensation

Thermal performance and condensation control are linked, but differing parts of the performance equation for your home. Windows and glazing don't create condensation. Condensation is a by-product of humidity, and it is the moisture level in the air of your home that causes this to happen. Low internal temperature of the surfaces in your home combined with higher internal moisture/humidity levels, the greater the chance of condensation occurring. Double glazing works to form a thermal barrier to the outside, making the inner side of the double glazing warmer, which helps prevent internal condensation.

Typically, in modern homes the increased levels of insulation and better performing windows have helped mitigate most of the weeping windows evident in older single glazed homes. A retro-fitted IGU, including a high performance Low E pane, can also significantly reduce the likelihood of internal condensation, or at least modify the temperature at which it will occur, the dew point.

However, the Low E IGU can be so efficient that morning dew can form on the outside of the glass which is referred to as external condensation. When external temperatures are low and humidity levels are high this is when it is most likely to occur. This is an indication of how well the double glazing is working, and the dew will dissipate through the morning, given a breeze or exposure to the sun.

5.1.5 Acoustic Performance

There are different ways to improve the acoustic performance or noise transmission through your windows by mass: using thicker glass, or a wider spacer between the glass and laminate, or a combination of the above. Acoustic laminates are used in most applications to avoid extra weight and thickness on the double glazing.

However, if noise reduction is a key issue, it's best to engage an acoustics consultant or engineer to assess your home and its environment and make a recommendation in respect of the key frequencies of the sound at your location.

> ***Note:*** *Whilst glazing can help to improve the acoustic performance of a room, acoustic performance is impacted by the construction of all the elements that make up a building. If the customer has a particular need, then an acoustic engineer may need to be engaged to design a specific result, possibly extending beyond just the replacement glazing.*

6.0 Installation / Glazing

The following installation/glazing procedures provide generic steps to the worked through to ensure the project is feasible, from both the retro-fit companies' and customers perspective and to establish the customers desired outcomes.

The procedure may vary for individual retro-fit supplier/manufacturers and their systems.

6.1 Glazing

- Best practice would suggest that the glazing of IGU's be performed in the controlled conditions of the factory where possible. With retro-fitted double glazing this might commonly apply to opening sashes and panels. Site glazing is not necessarily inferior to factory glazing, but does require attention to detail, cleanliness, and selection of appropriate materials.
- Glazing should be carried out as described in the Associations *WG46211.26:2023* - Glazing of IGU's.
- The Associations *WG45102.14:2023* - Industry Standard for Glazing Blocks, provides guidance on the glazing block selection and use.

6.2 Sealant and Compatibility

6.2.1 Selection

The correct sealant technology should be chosen dependent on its end use and anticipated joint movement. The sealant must be compatible with surrounding materials and develop proper adhesion to the substrates to provide a viable seal.

- Is the sealant to be painted after application?
- Is the sealant to be used in the installation of the IGU?

Testing should always take place to verify adhesion (with or without a primer) and compatibility before starting the project.

6.2.2 Compatibility

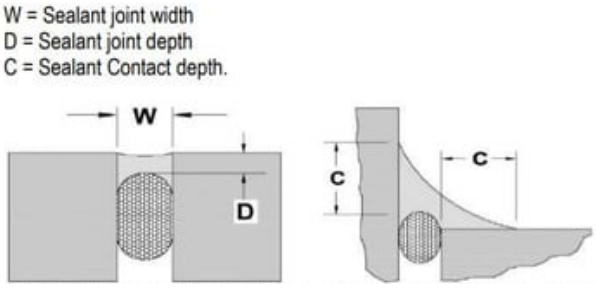
All materials, including sealants, used in the installation, and glazing of IGU's must be compatible with the edge seal. Check with the IGU manufacturer regarding appropriate sealants.

6.2.3 Application

When sealing joints and gaps, avoid three-sided adhesion by using bond breaker tape and/or backer rod.

The shape of the sealant bead is also important for each application.

Apply the right amount of sealant. Too much sealant and the joint will be too rigid to move. Too little and the sealant may not have the strength to accommodate the movement and fail prematurely.



Sealants must always be tooled to promote wet out of the sealant to the surface of the substrate. Most sealant manufacturers recommend a minimum 6mm of bite on each side of the joint. For more information on creating good sealant geometry, contact your sealant provider.

In theory, these guidelines are easily achievable. However, environmental challenges or time constraints can put pressure on an applicator. With long-term performance in mind, these steps are a necessity to reduce the risks of failed sealant joints, which can lead to an unsightly and potentially leaking building.

6.3 Installation

6.3.1 Prepare the site

- Check and confirm all *work instructions*, including project details, drawings, and specifications, are correct and applicable to project.
- Check and confirm all *IGU's and required materials* required for the project are on site, correct, and ticked off against the work instructions.
- Check and confirm all *IGU's* are within specification, including spacer bar alignment, marks, and defects.
- Decide and agree the order of units to be retro-fitted.
- Check and confirm all *tools and equipment* required to complete the job are on site.
- *Health and Safety* requirements are followed in accordance with Company safety plans and policies.
- *Signage* and barrier requirements are identified and implemented.

6.3.2 Install IGU's into existing frames

- Check each *IGU* is sized correctly to suit the *window opening*.
- De-glaze the existing opening.
- Prepare the *window opening* in accordance with the retro-fit companies' instructions.
- Install the *IGU ensuring correct orientation,* in accordance with the project documentation.
- Ensure the *IGU is blocked* in accordance with *WG45102.14:2023* - Industry Standard for Glazing Blocks.

- *Bead the IGU* into place ensuring *drainage holes* are in accordance with the retro-fit companies' instructions. The Associations Industry Best Practice *WG46211.26:2023* - Glazing of IGU's provides guidance in this area.

6.3.3 Install insert frames / replace sashes and panels into existing frames.

- Check each *sash and/or panel* is sized correctly to suit the *window or door opening*.
- Check each *sash and/or panel* is complete with drainage holes, perimeter seals, and labels per the manufacturer's documentation.
- De-glaze the existing opening or remove the existing *sash and/or panel.*
- Prepare the *window opening* in accordance with the retro-fit companies' instructions, including replacement hinges or stays.
- If not already completed in the factory, install the *IGU ensuring correct orientation,* in accordance with the project documentation.
- Ensure the *IGU is blocked* in accordance with *WG45102.14:2023* - Industry Standard for Glazing Blocks.
- *Bead the IGU* into place ensuring *drainage holes* are in accordance with the retro-fit companies' instructions. The Associations Industry Best Practice *WG46211.26:2023* - Glazing of IGU's, provides guidance in this area.
- Make any *final adjustments* to ensure fitment and function are correct.

6.3.4 Post installation inspection

- Check all sashes and panels are *square*.
- Check all *beads* are fitted within accepted tolerances.
- Check all IGU's have *drainage* in accordance with the retro-fit companies' instructions.
- Check all IGU's are *positioned evenly* within its frame.
- Check all *seals* are fitted correctly.
- All sashes and door panels are fitted accurately within their frames and function correctly.
- *Sign off* paperwork confirming job is checked and completed.

6.3.5 Clean up

- *Work area* is cleared, and materials disposed of, re-used, or recycled in accordance with legislation, regulations, codes of practice and job specification.
- *Tools and equipment* are cleaned, checked, maintained, and stored in accordance with standard work practices.