Industry Best Practice Guide
for

# Insert Replacement Windows

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# INDUSTRY BEST PRACTICE GUIDE TO INSERT REPLACEMENT WINDOWS

## Contents

# 1.0 Introduction

Insert Replacement Windows are new windows installed or inserted into the existing window frames of a home. This usually involves removing the existing single glazed sashes, mullions, transoms and inserting new aluminium, thermally broken aluminium, or uPVC subframes into the existing timber outer frames. The new insert window frames reduce the impact experienced by full replacement windows, on the character of an older home as the existing facings, sills, and reveals remain in place. The new frames will be double glazed, providing an economical and typically non-invasive method of improving the performance of the building envelope.

This Industry Best Practice (IBP) for Insert Replacement Windows 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 insert windows, in New Zealand.

The scope of this document includes the installation of insert replacement frames, into existing window 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 | Guide to the Glazing of IGU's |
| 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. |
| 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. |

| | |
|---|---|
| **Insert Replacement Frame** | A window frame designed to be installed within an existing window frame without impacting on the connection between the existing frame and building envelope. |
| **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. |
| **Mullion** | A vertical member within a window frame. |
| **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 either,<br>i) the edge of the glass is installed, or<br>ii) an opening sash or panel closes against. |
| **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. |
| **Thermal Broken Frame** | An aluminium frame that includes a strip of thermally improved material between the inner and outer surfaces of the frame to reduce the overall conductivity of the frame. |
| **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. |
| **Transom** | A horizontal member within a window frame. |

| | |
|---|---|
| uPVC | uPVC (unplasticised Polyvinyl Chloride), is a material used for window frames. |
| 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 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 insert replacement windows.
The Building Act includes for Alterations to existing buildings and says that windows in existing buildings may be replaced but to a performance level not less than that of the existing windows.
It is the Associations view that any windows having insert replacement windows installed, should be carried out to a level that best fits the building and is balanced with the customer's needs and budget. Frame and glazing options can and should be discussed to assist them in achieving their goals.

## 3.2 Building Consent

Does the installation of insert replacement windows 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 insert replacement windows 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

The Building Act of 2004 sets out in Schedule 1 the building work for which a consent is not required, and Section 8 of the Schedule refers windows and exterior doors in existing dwellings.
The provision of this section confirms that the replacement of windows and/or doors will not require consent, provided the reason for window replacement is not because of a failure of the existing window to satisfy the provisions of Clause B2 – Durability of the Building Code, or if the work "modifies or affects any specified systems."
The building must also be no more than two storeys in height.

Whether consent is required or not, insert replacement windows 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.

*Section B1/AS1* also refers to the *NZS 4211 Specification for the performance of windows* to ensure the insert window frames are suitable for the site and situation they're being used in. Clause B1 only refers to structural performance, other sections of NZS 4211 are covered elsewhere. All windows must be labelled to indicate they have met the performance requirements of the wind zone in which they've been installed.

### 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 window frames and glazing 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 E2 - External Moisture

*Section E2/AS1* states that windows shall comply with *NZS 4211 Specification for the performance of windows*, which tests windows for compliance with windloads, including weathertightness performance. All windows must be labelled to indicate they have met the performance requirements of the wind zone in which they've been installed.


### 3.3.4 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.

### 3.3.5 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 but including transoms to divide the pane (within the correct height range) can provide a compliant barrier.

### 3.3.6 Clause G4 – Ventilation

*Section G4/AS1* sets minimum levels of natural ventilation required in a building. Occupied spaces must achieve a net openable area to the outside of no less than 5% of the floor area. Elements that make up the net openable area are sashes, sliding door panels, and other doors that can be fixed open. Hinged and bifolding door leaves will require a hold back mechanism to be considered in the equation.

### 3.3.7 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.

### 3.3.8 Clause H1 – Energy Efficiency

*Section H1/AS1* describes the required thermal performance of each element within the building envelope and the windows are considered as one of those elements. The thermal performance of a window 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) and of the frame that it is wrapped in. For compliance with Clause H1, the insert replacement window should have an R-value of not less than the original glazing.

Replacing the air between the panes with Argon gas will increase the performance of the insert replacement window. This is carried out at the time of manufacture of the IGU and cannot be done retrospectively.

Table 1 below provides examples for comparison of construction R-values for a range of frame and glazing combinations. These are generic values based on the weighted average of houselots of joinery. In terms of a houselot of insert replacement windows these values will are estimates and to be used for comparison only. For perspective, single glazed timber windows will have a thermal performance value of approximately R0.19.

Table 1 – Generic R-value Combinations

| Frame Material | Clear IGU U2.6 | Low E IGU U1.6 | Low E IGU U1.3 | Low E IGU U1.1 |
|---|---|---|---|---|
| Aluminium | R0.26 | R0.33 | R0.35 | R0.37 |
| Thermally Broken | R0.32 | R0.42 | R0.46 | R0.50 |
| uPVC | R0.40 | R0.56 | R0.63 | R0.69 |

## 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 insert replacement windows, i.e., thermal, safety, and/or acoustic improvements, and what levels of performance can be achieved?

### 3.4.1 NZS 4211

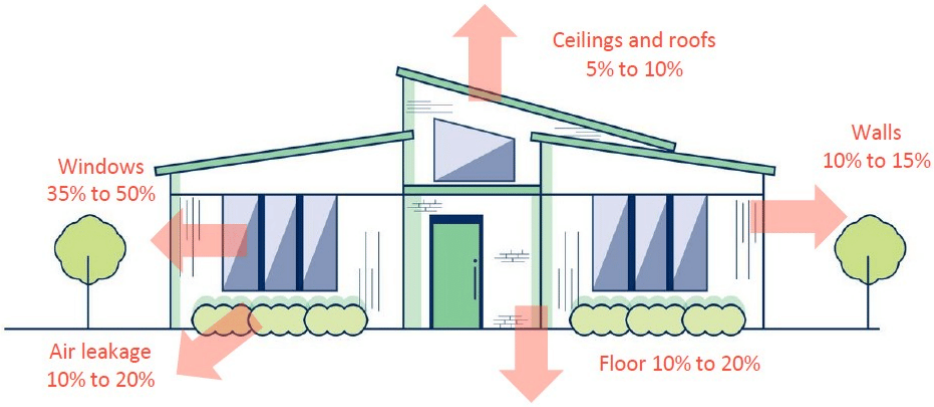
To satisfy the requirements of the NZ Building Code, new window and door systems must comply with the requirements of *NZS 4211 Specification for performance of windows*. Whilst the requirements of the glazing do not form a part of this Standard, the new insert replacement window frames used in the building will need to comply with all of its parts, to the windloads applicable to the site,

I.e., - Deflection of structural members
- Operation of opening sashes
- Air infiltration
- Water penetration
- Ultimate strength of window and fixings
- Torsional strength of sashes

***Note:*** *NZS 4211 considers the performance of the window as a standalone element and does not include testing its method of installation.*

### 3.4.2 Energy Efficiency

As described in 3.3.8 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 windows are 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 window components, frame and double glazing make up, to provide the best possible R-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

Insert replacement windows provide an opportunity to upgrade the existing glazing to comply with current safety regulations. As noted in 3.3.4 above, *Section F2/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 the double glazing in insert replacement windows 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 and frame type may need to be designed specifically for the project.

## 3.5 Durability

As described in 3.3.2 above, Clause B2 requires that windows and glazing 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.

Whilst insert replacement window frames must also have a durability of not less than 15 years, this extends to the materials they are constructed of and not the coatings applied as a surface finish. There are a range of durability (and warranty) options when it comes to surface finishes, which should be discussed with the window supplier when selecting colour/finish options.

## 3.6 Warranty

It is usual for insert replacement windows 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 there 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 insert replacement windows and their associated components will vary between manufacturers, suppliers, and installers, but each will have recommended programme, that must be followed in order to satisfy the terms of the product 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***.

## 4.0 Assessment

Before proceeding with an insert replacement window project, in fact before even pricing one, the project should be assessed for viability as not all existing windows are suitable for insert replacement windows.

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

The checklists may vary for individual supplier/manufacturers.

- Checklist 1 – General Condition
- Checklist 2 – Existing Window System Assessment
- Checklist 3 – Frame and Glass 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 they need repair before installation of insert replacement windows? | |
| | - Are they nearing the end of their serviceable life? | |
| | - Would it be better to completely replace the windows? | |
| 1.3 | Will the existing window system accept insert replacement windows? | |
| 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 insert replacement windows? | |
| | - Thermal performance | |
| | - Condensation control | |
| | - Functionality | |
| | - Safety | |
| | - Acoustics | |
| | - UV / Fading protection | |
| | - Other specific requirements? | |
| | | |
| 1.9 | Refer to Checklist 3 for details… | |
| | | |

| Checklist 2 – Existing Window System Assessment | | Yes/No Comment |
|---|---|---|
| 2.1 | Are the frames able to accommodate insert replacement windows? | |
| | - 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? | |
| | - How will damage found during the installation be resolved? | |
| | - Rebate height and depth… | |
| | - Sill angle… | |
| | | |
| 2.2 | Are the existing fixed lights glazed directly into the frame? | |
| | | |
| 2.3 | Are the existing mullions/transoms to be removed or retained? | |
| | - new reveals required? | |
| | | |
| 2.4 | Are the windows to be primed after insert windows installed? | |
| 2.5 | Are the windows to be repainted after insert windows installed? | |
| | - Colour = | |
| | | |
| 2.6 | Are there any special requirements/considerations? | |
| | | |
| 2.7 | Any doors will require full replacement, | |
| | Refer to WG 45110 - IBP for Replacement Windows. | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| Checklist 3 – Window and Glass Assessment | | Yes/No Comment |
|---|---|---|
| 3.1 | Why does the customer want to insert replacement windows? - (from 1.8) | |
| 3.2 | 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 | |
| | - Frame options - Aluminium, Thermally Broken, uPVC - Circle one | |
| | - R-value desired = | |
| | | |
| 3.3 | Has condensation control/outcomes been discussed? | |
| | - Is the home insulated? - Floor, Walls, Roof - Circle appropriate | |
| | - Does the home have a ventilation system? | |
| | - Does the system include/ require Condensation channels? | |
| 3.4 | What safety considerations need to be addressed? | |
| | - Full height panes, Stairways, Bathrooms, Protecting a Fall | |
| | - Low level windows, Window seats - Circle appropriate | |
| | | |
| 3.5 | What acoustic considerations need to be addressed? | |
| | - Type of noise to be addressed, Voice, Music, Traffic, Engineer, Other | |
| | - Circle appropriate | |
| | | |
| 3.6 | Is the homeowner concerned about UV / Fading protection? | |
| | | |
| 3.7 | Are there any existing butt jointed panes? | |
| | | |
| 3.8 | Is there full site access to all windows and doors? | |
| | - Is scaffolding or special lifting equipment required? | |
| | | |
| 3.9 | Are there other 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 Glass 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. The higher the windload, the thicker the glass must be to resist the loads and remain within acceptable deflection tolerances, as 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 insert replacement windows for their homes, it is the Associations perspective that the same levels of thermal performance should be aspired to for replacement windows. 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 IGU's were 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 supplier.

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. Insert replacement windows, including an IGU with 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 Frame Requirements

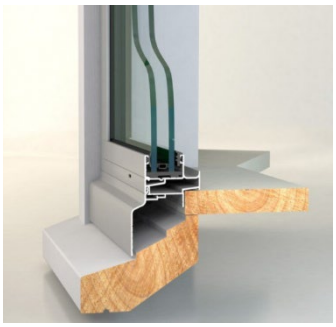
Again, even in situations where the project does not require a Building Consent all work should comply as closely as possible and with the relevant Clauses of the NZ Building Code, as referred to in Section 3. As with the glass, the frame type and material should be considered when deciding to install insert replacement windows.

## 6.1 Frame Performance

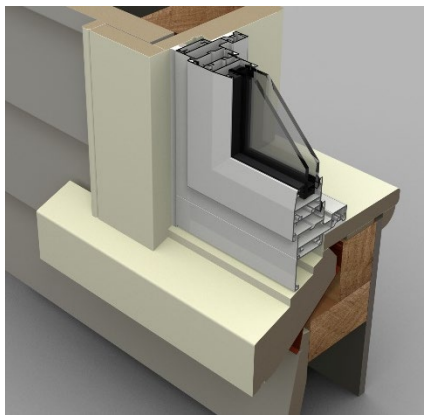
NZS 4211 provides a test method for the assessment of the performance of window frames. The insert replacement window frames being used in your project must demonstrate compliance with the requirements of the standard for the wind zone, as described in NZS 3604, your building sits within. This applies regardless of the material your frames are constructed from, aluminium, thermally broken aluminium, or uPVC.

NZS 4211 tests the structural integrity, weathertightness, air infiltration, and operability of the window and door frames.
The thermal performance of a frame and glass combination will vary depending on the elements selected. Generally, an aluminium frame will not perform as well as a thermally broken aluminium frame, which does not deliver the same level of insulation as a uPVC frame. The performance values are expressed as an R-value and are typically modelled using an appropriate software package. In addition to Table 1 in 3.3.8, Clause H1 of the Building Code provides a Guide to the R-value of the typical combinations in Appendix E.

## 7.0 Procedure



There are a wide range of frame designs and material options available for insert replacement windows and each will have a set of installation instructions developed specifically for the product. The following installation procedures provide a generic guideline to the steps that might be expected to be performed by the window system manufacturer / supplier / installer.



### 7.1 Site Preparation

- Check and confirm all *work instructions*, including project details, drawings, and specifications, are correct and applicable to project.
- Check and confirm all *windows, IGU's, and materials* required to complete the project are on site, correct, and ticked off against the work instructions.
- Check and confirm all *windows* are correctly sized for their designed locations, and free from scratches, marks, and other defects.
- Decide and agree the order of units to be installed.
- 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.

### 7.2 Removal of Existing Windows

Before proceeding with the removal of the existing windows inspect for any signs of rot, degradation, or damage. If any is found, advise, discuss, and seek instruction from the

homeowner on the next steps, before commencing the work. What are the options? Can you, the installer, make the repair, or does a builder / joinery need to be engaged?

- Remove the ***sashes***, by unscrewing the existing hardware. Remove all operating hardware from the frame.
- Remove the ***fixed panels***, taking care to avoid breaking the glass. This assumes the fixed panels are separate to the window frame. If not, then carefully deglaze the fixed panel.
- Inspect the outer frame for any signs of rot, degradation, or damage. If any is found, advise, discuss, and seek instruction from the homeowner on the next steps, before going any further.
- Cut and remove mullions and/or transoms as required.
- Inspect the outer frame for any signs of rot, degradation, or damage. If any is found, advise, discuss, and seek instruction from the homeowner on the next steps, before going any further.

## 7.3 Preparation of Openings

- Assuming the existing window is in good condition, then continue and fill the spaces where the mullion or transom has been removed, or replace the liners, in accordance with the supplier's instructions.
- Clean and prime all rebates in preparation for the replacement insert windows, in accordance with the supplier's instructions.

## 7.4 Installation

### 7.4.1 Install insert replacement windows into existing frames.

- Check the window is sized correctly to suit the new opening.
- If required by the supplier's instructions, apply a bed of sealant to the opening rebate/upstand.
- Offer the insert replacement window up to the opening and set, pack, and fix it into place as described in the supplier's instructions, ensuring the unit is level, square, in plane and gaps are equal and within tolerance.
- Seal the exterior gaps as required by the supplier's instructions.
  ***Note***: *Some require that this step is performed after the glazing has been completed.*

### 7.4.2 Sealant and Compatibility

#### a) 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.

### b) Compatibility

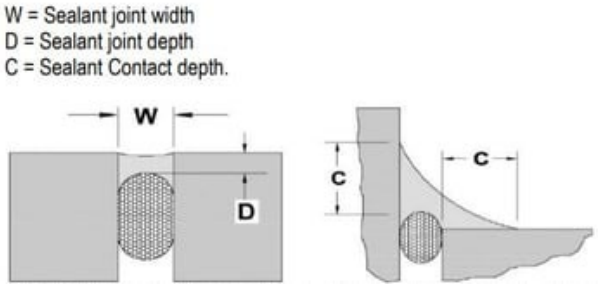
All materials, including sealants, used in the installation, and glazing of IGU's must be compatible with the edge seal. Check with the IGU manufacturer regarding appropriate sealants.

### c) 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.

## 7.4.3 Install any sashes not factory fitted to frames.

- Check the *sash* is sized correctly to suit the window opening.
- Fit the *sash* to the window opening in accordance with the supplier's instructions.
- Make any *final adjustments* to ensure fitment and function are correct.

## 7.4.4 Glaze any IGU's not factory installed into the frames.

- Check the *IGU* is sized correctly to suit the opening.
- 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 supplier's instructions. The *Guide to the Glazing of IGU's* provides guidance in this area.

### 7.4.5 Post installation inspection

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

### 7.4.6 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.