# Understanding double glazing or IGUs

Double glazing will soon become common in newly built New Zealand homes. There are a variety of systems and installation methods to be aware of with differing thermal performance and durability.

By John Burgess, BRANZ Sustainability Scientist

hanges to the New Zealand Building Code Clause H1 *Energy efficiency* (see pages 68–69) are likely to make the use of double glazing the default in New Zealand homes. These changes have been implemented to help New Zealand achieve its targets in the first commitment period of the Kyoto protocol from 2008–12. They will work together with the New Zealand home energy rating scheme (HERS) that is due for release by EECA in December 2007.

Double glazing is normally referred to as Insulating Glass Units (IGUs), and is more than just two panes of glass stuck together. It can include any number of panes, several different types of framing, and many different technologies to space the panes the correct distance apart, and prevent moisture from getting in between.

### Thermal performance varies

The actual thermal performance of an IGU installed in a frame varies with environmental conditions, such as the:

- external and internal air temperatures, and the effective temperature the IGU is exposed to outside
- solar elevation, azimuth and intensity
- wind speed, external wind sheltering and internal airflow velocity
- shading of the outside of the IGU from direct and diffuse solar radiation
- shading of the inside from curtains and blinds

- I thermal properties of the frame, glazing and installation, including the resistance to conductive heat flow; hemispherically variable optical transmission, absorption and reflection characteristics; spectral selectivity of the glazing; and the air infiltration and thermal characteristics of the glazing installation into the frame
- frame installation into the wall
- dimensional variation of the glazing and framing
- thermal conductance, reflectance and absorption of the frame.

## IGUs that meet the Building Code

The Building Code Clause H1 currently refers to NZS 4218: 1996 *Energy efficiency* – *Housing and small building envelope*, where the schedule method contains the R-values. This reference is soon to change to a modified 2004 version of NZS 4218 which includes the WERS rating method, and implements the 'better' window R-values of PAS 4244. Based on cost-benefit analysis, this will require glazing with R-values of at least 0.26 (m<sup>2o</sup>C/W) throughout the country (see page 69) assuming an air gap of 12 mm between the panes.

The 0.26 R-value requirement can be met through the use of clear double glazing with a 12 mm air gap in a frame of any material. The 0.31 R-value requirement for some areas can be met with clear double glazing in a thermally-broken aluminium frame, a timber or PVC frame, or with clear double glazing with a low-emissivity coating on one of the panes in any frame type. When higher performing glazing systems are required, thermally broken aluminium framing systems or the other timber-based or PVC framing systems may need to be used (see Table 1)

Where a custom WERS rating or modelling shows that a window system has a higher R-value, this can replace the Standard value.

### Durability of IGUs

A BRANZ response to a letter in a previous Build (August/September 2005, page 6) stated that IGUs should have a 15-year warranty, but this is not the case. The durability requirements in the NZBC Clause B2 Durability require that IGUs (as with all non-structural cladding elements that are not easily maintained) have a lifetime of at least 15 years. For IGUs this means maintaining their insulation properties, and the amount of natural light that will pass through them. This is not the same as the manufacturer's warranty, which can be for any time period. IGUs typically have warranties for 10 years, while the Building Code requires a durability of 15 years. This is best understood by using the analogy of buying a new car with a 1 or 3-year warranty – the purchaser typically expects it to last longer than the warranty period!

International experience has shown that the delivered lifetimes of window systems are not necessarily equal, and are dependent

Table 1: Thermal performance and pending Code requirements of window systems in timber-	
framed buildings, where glazing makes up less than 30% of the wall area.*	

Clear glazing type	Frame type	R-value (m <sup>2°</sup> C/W)	Applicable area of New Zealand (zones refer to climate zones)#
IGU	Aluminium or composite aluminium	0.26	Zone 1 from September 2008. Zone 2 from June 2008. Zone 3 from October 2007. (only for vertical glazing – not skylights)
	Thermally- broken aluminium	0.31	Zone 3 skylights under 1.2 m <sup>2</sup> from October 2007. Exceeds Standard requirements in the rest of New Zealand.
	Timber/PVC	0.36	Exceeds Standard requirements for all of New Zealand.
IGU low-E	Aluminium	0.31	Zone 3 skylights under 1.2 m <sup>2</sup> from October 2007. Exceeds Standard requirements in the rest of New Zealand.
	Thermally- broken aluminium	0.40	Exceeds Standard requirements for all of New Zealand.
	Timber/PVC	0.48	Exceeds Standard requirements for all of New Zealand.
IGU with low- E and argon gas fill	Aluminium	0.33	Exceeds Standard requirements for all of New Zealand.
	Thermally- broken aluminium	0.43	Exceeds Standard requirements for all of New Zealand.
	Timber/PVC	0.53	Exceeds Standard requirements for all of New Zealand.

\* Solid timber and masonry construction require higher values (see www.dbh.govt.nz).

# Zone 3 is the South Island, North Island volcanic plateau, and all offshore islands. Zone 2 is the North Island below the Thames-Coromandel and Franklin districts, and Zone 1 is the remainder of the North Island.

Table 2: Expected European lifetimes of framing types.				
Frame type	Lifetime			
Aluminium-coated timber	45 years			
Timber	35 years			
Aluminium	35 years			
PVC	22.5 years			

Table 3: Indicative New Zealand lifetimes of glazing types.				
Glazing type	Approximate lifetime			
Single glazing	50 years			
Dry-glazed EN1279: 2004-compliant IGUs	35 years			
Dry-glazed BS5713: 1979-compliant IGUs	30 years			
Other IGUs	20 years			
Wet-glazed IGUs	5 years			

on framing type, glazing type, installation methodology and environmental factors. European experience indicates that for the product available in Germany there is a hierarchy of lifetimes, with timber windows outperforming aluminium framing, which outperforms PVC framing (see Table 2). While we have not had the experience in New Zealand to corroborate these numbers, it must be realised that the durability of all framing types are not necessarily equal.

Although single glass will last for at least 50 years, guality New Zealand-manufactured IGUs installed appropriately in aluminium framing can be expected to have a lifetime of at least 30 years (see Table 3). The lifetime of double glazing can be verified by its compliance with the European Standard EN 1279: 2004, but it must be noted that imported IGUs do not necessarily meet this requirement. Currently, the Building Code requires compliance via NZS 4218 with either the superseded British (BS 5713: 1979), Canadian (CAN/CGSB 12.8: M90) or American (ASTM E773-774) IGU durability standards, but these options will soon be replaced with compliance with the new European Standard EN1279: 2004. An implementation of this Standard has been developed in New Zealand by the Insulating Glazing Unit Manufacturers Association (IGUMA), specifically for our conditions.

#### Install correctly

Some installation methods (such as putty glazing of IGUs in timber framing, or wetbedding of IGUs in window framing) are definitely *not* recommended. Appropriate installation methods are detailed by the IGUMA and the Glass Association of NZ. See their website www.wanz.org.nz, where links to members' websites show dry-glazing methods.

As double glazing becomes standard practice, we are catching up with the rest of the western world (outside of Australia), where double glazing has long been an established part of construction practice that helps to minimise our effect on the planet.