

# Window tinting

*Window tinting can help with both heat loss and gain*

*In the first of two parts, Gary explains some of the theory of window tinting and how it works.*

**BY GARY LANE**

Window tinting (or glass tinting) refers to the process of applying a film of a pliable nature to glass as a way of solving or controlling various problems associated with the use of glass.

These can be insulation for both heat loss and gains, glare control, privacy or fade protection, while at the same time 'shatter-proofing' glass for added security and safety, as well as adding decorative effects to glass from the extensive range of decorative films available.

Many of the films can be installed onto windows, glass shelves, shower screens and doors, fish tanks (on the outside), TV cabinet doors, coffee table tops, overhead kitchen and pantry doors, even kitchen and bathroom splash backs. Together with the added advantage of being able to be scraped off the glass and replaced with something different if required, it is a choice that should be considered.

## Flexibility

The choice of films allows flexibility. For example, a shift worker generally requires reduction in both heat and glare, which existing window dressings may be not solve. The use of an ultra dark film to maximise light reduction with good heat reducing capabilities could be the solution. A highly reflective film that offers increased heat reduction but allows more sunlight in, and can be further controlled with blinds or curtains,

*Glass balustrades are a popular choice for balconies and application of well selected films can modify not only the light and heat passing through, but also offer added safety.*

will allow more control over the natural lighting conditions.

With either option, the correct film choice should be taken with regards to the type of glazing that is in use and manufacturers' recommendations.

A much thicker and stronger clear film can be applied to upgrade standard plate/float glass up to the latest Building Code of Australia (BCA) and Australian Standards (AS) that shatter proofs the glass like laminated glass. This could be an advantage for those wishing to use second-hand glass or windows not up to the BCA and AS and not complying to any other additional local council building

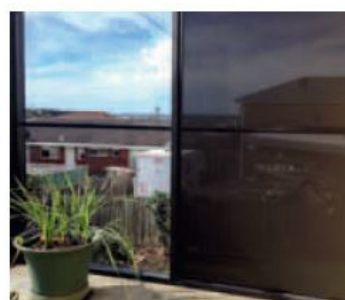
regulations. Retrofitting the clear safety film option rather than changing the glass will offer a much cheaper way out with the additional benefit of filtering out sun damaging UV rays.

## Available range

You can choose from a range of coloured tinted films through to various types of low to fully reflective films that will offer further improvements in fade protection, privacy and insulation. You may then be able to do without window dressings or leave curtains and blinds open, improving vision, ventilation and light.

For flat glass tinting (buildings, relocatable homes, caravan annexes etc.), there are three sub-groups of films available.





### 1. SOLAR FILMS

These include films that can offer any or all of these benefits (with varying degrees of performance abilities): insulation (heat reduction and heat loss), glare reduction, fade protection and one-way privacy, whilst shatter proofing glass for safety and security.

### 2. DECORATIVE FILMS

These include opaque, frosted and translucent options with each type having varying degrees of privacy and light transmission, as well as films with patterns and designs that will enhance an otherwise plain looking piece of glass in a cabinet or improve the look of the bathroom window.

### 3. SAFETY/SECURITY FILMS

These are primarily designed to offer a greater degree of safety and security of glass by increasing the shatter resistance and penetration of objects.

*PLEASE NOTE: The BCA and AS refer to these films as 'organic coatings' and offer the latest guidelines regarding their use.*

### Combining features

Combining features can improve the versatility. For example, the insulation qualities are improved by the addition

*Above: Films can provide a visual barrier as well as increase glass strength.*

*Above right top: Specially designed cards can be used to measure glass thickness in situ.*

*Above right: Privacy and sun shield all in one.*

of gold and silver in films, which can rate 3mm thick glass up to double glazed standards. While present costs of these new films are approximately three to four times more than standard film, they can still be considered a cost effective option compared to installing new double glazed units and even cheaper again to retrofit to existing glazing, which is what all these films were developed for. Many of the films could also be installed onto (within manufacturers' recommended guidelines) manufactured 'body tinted' glass and double glazing to offer further improvements in areas such as fade protection, insulation and privacy.

Those that find that their windows or glass products lack the ability to perform certain tasks, can now consider filming as an option, before or after the windows are constructed or installed onto the windows in place. This latter option is generally the best as this allows you to make a final choice as to the appropriate film, taking into consideration window orientations, the degree of natural

lighting and any potential or known fading/insulation and privacy issues that may be present or that may occur later on.

### Glass safety

Basically, any glue based film applied to glass will (with varying degrees of performance) help hold glass fragments together when broken. Normally, film application is only required on one side of the glass surface. For those requiring applications done to the AS then the brand of film used must have been tested to comply and been installed per those standards and marked as such for auditing purposes, as should all safety glazing.

Unless the glass is marked with a permanent imprint, usually in a corner of the window indicating that it is toughened safety glass or has had a sticker applied by the installing glazier on laminated glass that indicates it's safety approved, then the glass has to be considered 'non-safe' for those who need safety compliant glass.

The type of glass that is a major safety hazard is generally of the type referred to as plate or float glass, and is regularly fitted with safety films. If it is to be certified under the AS, two things are required prior to determining if



installing a safety film will suffice. First determine the area (square metres) of glass considered for application and then the thickness of the glass. The Australian Standards AS 1288 (AS 1288-2006 Glass in buildings – Selection and installation) and AS 2208 (Safety glazing materials in buildings) list the different thicknesses of glass against the maximum glass area that can be successfully covered. As the thickness of the glass increases, the area of glass that can be covered increases. The glass has to be a minimum of 3mm thick; anything under this means the glass has to be replaced.

### Measuring glass thickness

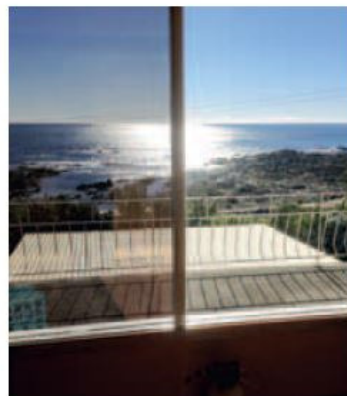
How to determine this without removing the glass out of its frame can be done in a few ways. There are very expensive electronic laser gadgets that some glaziers carry that are highly recommended for their accuracy. A less accurate but nevertheless still useful method widely used, is where the ability of glass to have reflections on its surface is used to determine the glass thickness. Contact your local glazier for a quote on a safety audit, if required.

Place the edge of a specially marked white credit card sized thickness gauge against the window, tilted upwards to a 45 degree angle and then view down this angle along its plane towards the glass. Look for the corresponding markings to appear as double reflections on the window surface. The thickness of some glass can be determined by noting which of the markings appear to 'kiss.'

The most common markings used on the thickness gauge cards are a series of black dots of different diameters set across the width of the card with each one having a number (written in reverse) beside it that refers to the glass thickness in mm.

Ideally, this test should be done when the sun is coming through a window as it will maximise the light reflecting off the card, which in turn reflects back onto the glass resulting in a much clearer and sharper result.

With tinted glass, the amount of tinted additives within the body of the glass reduces the amount of light passing through it that would otherwise reflect back off the opposite side of the inner surface of the glass that results in



*Above L-R: Before and after images showing how application of a film can greatly cut down on both incoming heat and light.*

*Right: Decorative film on a glass dividing panel aids visibility and safety, whilst also looking attractive.*

fainter surface reflections. This makes it much harder, sometimes impossible, to determine glass thickness manually; this is where the electronic laser tester is required.

The use of the reflection method may help you determine quickly and cheaply what sort of glass is installed in a window and can be especially handy when looking at buying second-hand windows, allowing a quick assessment as to whether the windows will be of value or whether more money will be needed to upgrade them.

Another point of interest for those wanting to use second-hand windows (particularly if they're fairly old) is that the thickness of the channels that allow the fitting of the glass may be too narrow to allow the installation of thicker glass for today's glass safety requirements; although it may be possible to keep the original glass and install a safety film. If you can source a variety of 'off-cuts' of glass (about 100mm square) of known thickness, including both laminated glass as well as tinted ones, these can be used as a reference guide when inspecting second-hand windows for suitability.

If laminated glass is already installed then, as far as safety requirements go, you're generally okay, unless circumstances require an upgrade to much thicker laminated or toughened



glass. It may then be possible to apply either the standard safety film or a much thicker one that will greatly enhance both safety and security.

### Insulation

With recent upgraded Federal Government and State Regulations requiring improved building and window insulation star ratings on new builds and renovations, an appropriate window film could offer both an alternative and a cheaper solution. For those who simply wish to improve on established buildings rather than replacing their windows altogether, this may also be the way to go.

Window tinting regular single pane glass, and doubled glazed units made up of clear glass, works by reflecting the





radiant heat (depending on film choice and application) away from the direction it's coming from. It reflects the sun's radiant heat away to keep cooler when it is hot and reflects the room's heat in to keep warmer when it is cold.

All tinting, whether in the glass or retrofitted, causes the glass to absorb the sun's radiant heat, increasing the glass temperature, which in turn acts as a thermal barrier to reduce further heat loss (some glaziers refer to tinted glass as 'thermal glass' due to this effect).

For single glazed windows the air on the inside that comes close to or in contact with the warmer glass also helps to heat the surrounding air that further improves heat retention and keeping rooms warmer (try and consider your windows as giant electric radiators when the sun is shining.) Cooler outdoor temperatures act as a heat sink, however, reducing the glass temperature and reducing insulation efficiency by this method. Any advantages of the absorption of heat is lost at night or on heavily overcast days. This is where appropriate window coverings play an important role.

### Possible disadvantages

One of the main disadvantages with heat absorption and the corresponding increase in glass temperature is that it can indirectly cause stresses within the glass with possible breakages occurring. Toughened safety glass can generally resist much higher temperatures of around 250 to 350 degrees C, whereas standard plate/float glass tolerates

*As well as serving various safety and insulation purposes, films can also be used to creative decorative effect.*

around 50 degrees. Toughened glass has been known to break at much lower temperatures, particularly if impurities are present within the body of the glass during the manufacturing processes and if any edge imperfections are present during the glass cutting or installation. Unfortunately, there is no way of telling if and when any glass may break due to thermal stress and once glass is framed, you cannot tell if any edge damage is present unless large enough to protrude beyond the frame edge.

For those who intend to have window films installed on new windows, or even have manufactured tinted glass installed that catches any direct sunlight (in particular, any windows subject to shading where parts of glass will have sunlight on them while other parts are shaded), should request the glazier to have all glass edges either sanded or polished smooth to lessen edge stresses. The shading effect causes an uneven heat distribution throughout the window, thus increasing the uneven stresses within the glass and increasing the chance of thermal breakages.

Spontaneous glass breakages can occur with toughened glass when you are least likely to expect it. While it cannot be totally avoided, choosing the correct film to glass combination will certainly minimise this. Even manufactured tinted glass can suffer from the same range of problems and increases further by

filming, particularly when using dark low to non-reflective coatings.

My own tests over the years using an electronic digital thermometer have shown glass temperatures can quite easily reach up to 50 degrees C and even higher in double glazed units on the room side when using either low reflective and non reflective glass and films installed here in Tasmania. I've also taken temperature readings with a thermometer placed in the direct sunlight over the 2013 summer months in Devonport, with readings of 54 and 52 degrees over two respective weekends with shaded temperature readings hovering around 30 to 29 degrees respectively.

Therefore, it's best to avoid any dark low reflective glass/films choices wherever possible. They may look nice but they present too many issues that can be difficult to solve. ♦

*In part 2 we will look at some practical implementations of window films. Gary Lane is a partner at Protek Window Tinting. I trust this information will be of benefit to many and I would be quite happy to answer any queries and to offer any advice.'*