



# GUARDIAN SUN-GUARD®

## THERMAL BREAKAGE ALERT!

Thermal breakage can be influenced by a number of factors as described on the opposite side of this page. A critical factor to consider in the early stages of glass selection is whether the glass will be shaded. When glass is partially shaded by building overhangs or extensions, it becomes cooler at the edges and stress in the glass may occur, which can result in thermal breakage.

In areas where thermal breakage may be of concern, a thermal breakage analysis should be completed to determine if heat-treating (heat-strengthening or tempering) may be needed. Heat-treating may also be necessary due to high wind loads or safety glass code requirements. Contact Guardian Science & Technology for assistance with thermal stress analysis.

The likelihood of thermal breakage can be diminished by following the guidelines below.

PRODUCT 6mm / 1/2" a.s. / 6mm I.G. units		NO SHADE	PARTIAL SHADING
Clear substrate	AG-43, NP-61, LE-63, LE-50 & SN-68	●	●
	Silver-32, Silver-20 & LE-40	●	●
	Pewter-30	●	●
Green substrate	NP-61 & LE-63	●	●
	Silver-32, Silver-20, Pewter-30, AG-43 & LE-50	●	●
	LE-40	●	●

### SUN-GUARD PRODUCTS WITH LE-63 ON #3 SURFACE

Green Clear	Silver-32, Silver-20 & Pewter-30	●	●
	Sun-Guard Silver-32, Silver-20 & Pewter-30	●	●

The Thermal Breakage Alert for Sun-Guard products is a general guideline and is not applicable to any specific project. Other factors such as large glass areas, exterior shading, overhangs/fins that reduce wind speed, and areas with high daily temperatures can all increase the probability of thermal breakage. In those cases heat-treatment should be considered. The thermal stress guideline does not constitute a warranty against thermal breakage. The only warranty for Sun-Guard products is contained in the Sun-Guard Series Coated Glass Warranty.



- STOP:** These Sun-Guard products must be tempered or heat-strengthened.
- CAUTION:** Exercise caution when using annealed Sun-Guard products; heat-strengthening or tempering may be required.
- GO:** Go with annealed Sun-Guard products.

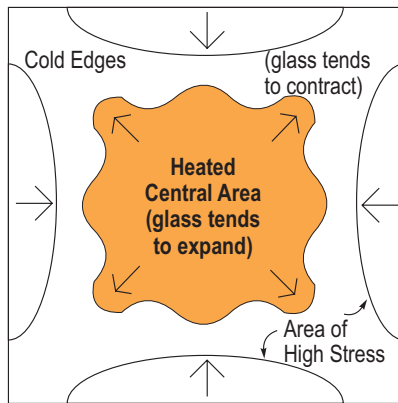
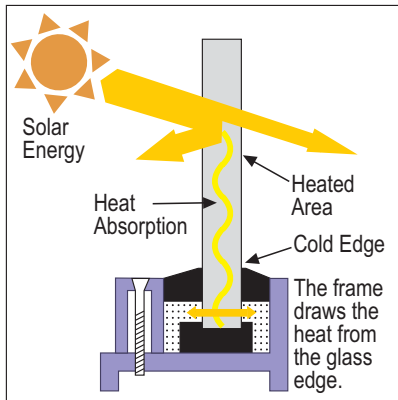
### NOTICE!

Glass edges that are free from cutting and handling damage are crucial to avoiding thermal breakage.

Glass which is not heat-treated (heat-strengthened or tempered) can experience thermal breakage. In those applications where thermal stress may be of concern, the glass should be heat-strengthened or tempered.

In non-heat-treated glass, the risk of thermal breakage is greatest when the central area becomes hotter than the edge. This condition can occur when the center of the glass is heated by the sun and the edges remain cool. Under these conditions, the center of the glass expands but is restricted from natural expansion by the cool edges. The result is stress within the glass, which could cause thermal breakage.

The degree to which the central area of the glass becomes hot is largely dependent on the solar absorption of the glass, which varies between different types of glass as shown in the table below.



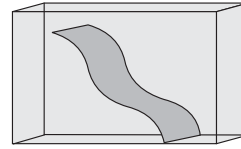
Glass Type	Solar Absorption %	Risk of Thermal Breakage
Clear	18	low
Colored or Tinted	30-40	medium
High light-transmitting coating on colored or tinted	45-55	medium-high
Reflective coating on clear	60-70	high
Reflective coating on colored or tinted	80-85	very high

The risk of thermal breakage is also influenced by the condition of the glass edge and type of framing. Glass with clean-cut edges has the greatest resistance to thermal breakage. Non-heat-treated glass edges that have been damaged in handling or during installation have greater risk of thermal breakage.

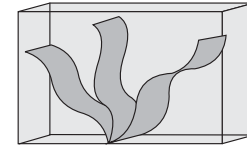
For those applications where thermal breakage is of concern, heat-strengthened glass should be specified. Heat-strengthened glass, because of its compressive stresses, resists thermal breakage.

Non-heat-treated glass which has cracked as a result of thermal stress can easily be identified by a break pattern that is unique to thermal breakage.

▼ LOW STRESS



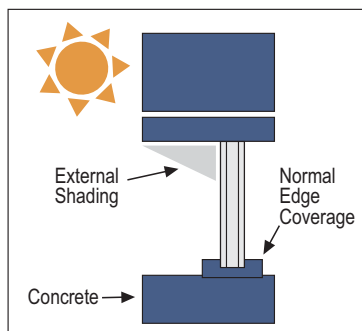
▼ HIGH STRESS



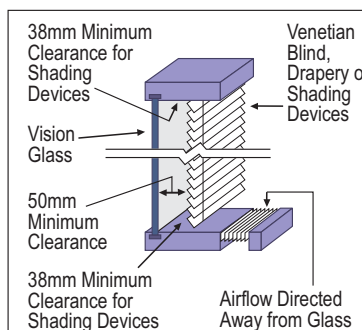
The crack in the glass is initially perpendicular to the edge and glass face for 2cm to 5cm, then branches out in one or more directions. The number of branches or secondary cracks is dependent on the amount of stress in the glass.

Some additional factors which may influence thermal breakage are shown below.

- External shading of the glass by the frame or building extensions.
- Glass framing that is in direct contact with concrete or other materials that may contribute to the cooling of the glass edge.
- Excessive coverage of the glass edge by the frame.
- Heat-absorbing films attached to the glass after installation.
- The use of internal shading devices such as drapes, curtains or venetian blinds. If shading devices are used, they must be placed away from the glass to allow for a free flow of air at the glass surface.
- The air flow from room cooling or heating vents must be directed away from the glass.



- Buildings not heated during the construction phase can experience an increase in thermal breakage.
- Generally speaking, the greater the glass edge area, the greater the risk of thermal breakage.



The potential risk of thermal breakage can be estimated by a computer-aided thermal stress analysis. For those areas of high risk, Guardian recommends heat-strengthened

glass. For specific applications where heat-strengthened or tempered glass is specified, i.e., spandrels, entranceways, fire knockouts or sloped glazing, a thermal stress analysis is not necessary and not offered as a common practice.