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THERMAL SAFETY – STEPS TO REDUCE RISK OF THERMAL FRACTURE

Introduction

This data sheet explains what happens and how to minimise the risk of thermal stress fracture (breakage) of glass.

- Ordinary annealed glass can break if it is subjected to uneven temperatures over its surface.
- Tinted glass is particularly prone to thermal breakage because it absorbs more heat than clear glass.
- Insulating Glass Units are also more prone to breakage as they retain heat.
- GANZ recommend the tinted glass should be heat treated to avoid the risk of thermal breakage.
- Always seek GANZ member advice before selecting your glazing.

Cause of thermal stress

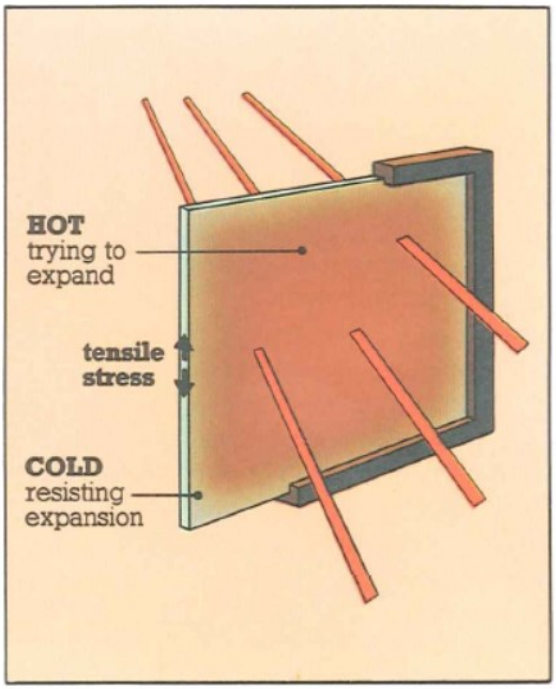

Figure1: The generation of thermal stress

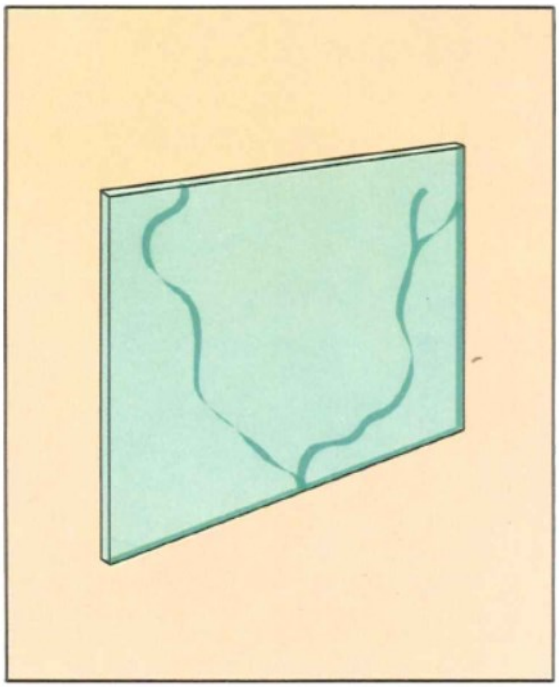

Figure 2: A typical thermal fracture

As the central part of the glass absorbs heat from solar radiation, it expands. The edges, which are covered by the window frame, remain cooler than the uncovered part and therefore do not expand as much (figure 1). The resulting differential thermal expansion between the central part and the edges causes tensile stress along the edges which, if it reaches the breaking stress of the glass, will result in thermal fracture (Figure 2).

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- Typical Thermal Stress Fracture

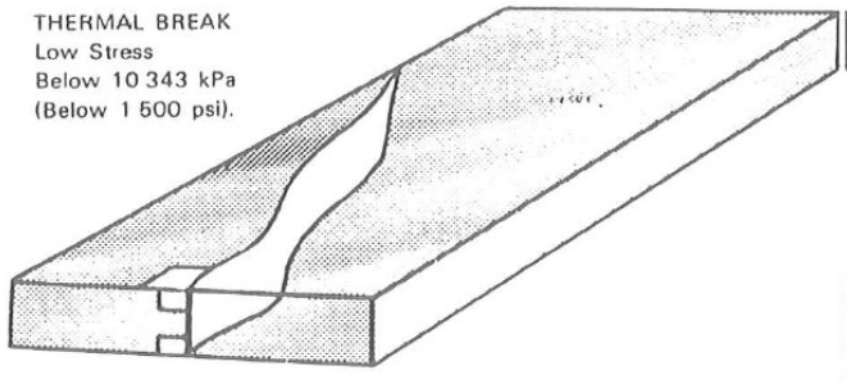

Figure 3: Low stress thermal fracture

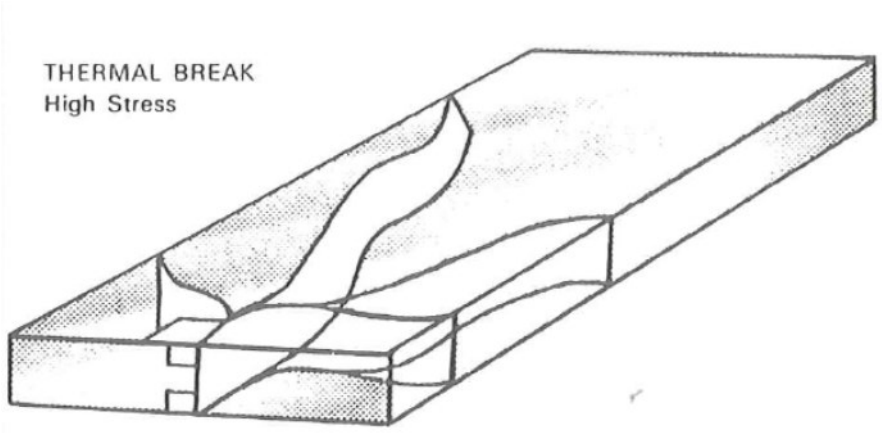

Figure 4: High stress thermal fracture

- A thermal fracture line always makes a right angle with the edge of the glass at or near the origin.

Most thermal fractures are low stress fractures caused by damage to the glass edge. The break line does not separate into two or more lines within 50mm of the edge – refer Figure 3.
If the break line separates into two or more lines within 50mm of the edge, it indicates that the surrounding conditions are causing a high temperature differential between the central part and the edge of the glass. High stress thermal fracture is shown in Figure 4.

The fracture can occur on monolithic glass (single glazing) or one or both sheets of laminated glass, or one or both panes of an IGU.

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Solar Control Glass

Solar control glasses are those that reflect and absorb the suns solar radiation, and therefore they get hotter than clear glass, which transmits most of the solar radiation. Solar control glasses vary in absorption, but as a general rule the darker colour glasses absorb more heat and are more susceptible to thermal stress fracture. Single glazed tinted and reflective solar control glasses are often heat strengthened or toughened to avoid thermal stress breakage.

Insulating Glass Units (IGUs)

The increased use of IGUs for insulation has created more complex thermal stress issues as the air or argon space helps retain heat, as do tinted external glasses and Low E glasses used as the inner or outer pane of an IGU. Therefore solar control and Low E glasses increase glass temperatures and the risk of thermal fracture.
In addition the inner pane of an IGU may be more at risk of thermal fracture in winter. The low thermal resistance of the edge seal can keep the edge of the inner glass at the outdoor temperature while the central part is exposed to warm room air. The risk is reduced by any measure that encourages warm edges to the unit, such as thermally broken aluminium, PVC, and timber frames, and "warm edge" IGU thermal spacer systems.

Steps to reduce risk of thermal fracture

To reduce the risk of thermal fracture, some steps can be taken:

1. Check glass edges and ensure they are not damaged during handling, storage or installation.
2. Clean cut glass edges are best but often smooth arris (SA) flat smooth (FS) or flat polished (FP) edges are used on laminated glass and/or in IGUs.
3. Do not install glass if the edges have edge vents or shells.
4. Install dark coloured window frames because they absorb more heat than light coloured ones. This keeps the glass edge warmer, reducing the differential thermal expansion between the central part and the edge of the glass.
5. Install dark coloured drapes or blinds because light coloured drapes and blinds reflect heat back to the glass, hence increasing the temperature of the central part of the glass.
6. Ventilate blinds and drapes by allowing a 50mm gap at the top and bottom for air movement.
7. Avoid heat traps such as bulkheads and ceiling drops behind the glass as warm air is trapped as it rises.
8. Use dark colour back up walls or panels as light colours reflect heat to the glass.
9. Locate heaters away from the glass, and don't direct hot air flow towards the glass.
10. Solar control glass has a higher risk of thermal fracture, especially when used with low E inner panes in IGUs. Low E glasses are best used as the outer panes with the coating on surface 2, especially if they are solar low E glasses.
11. Glass that is partially shaded from the sun by canopies, eaves, deep transoms and mullions, adjacent walls, trees for example have a higher risk of thermal fracture.
12. If risk of thermal fracture is high, use heat strengthened or toughened glass.
13. Avoid using annealed or laminated glass for sliders and the immediate fixed panes because single glazing becomes double glazing, and double glazing becomes quadruple glazing when the sliders are opened.
14. Install IGUs into thermally efficient frames as this reduces heat loss from the frames to the supporting structure.
15. Use warm edge thermal spacers and thermal frames for IGUs to reduce heat loss and keep the inner glass warmer.
16. Do not apply films or posters to glass, or lean furniture or furnishing or building materials against the glass.
17. A thermal safety assessment can be done by GANZ members before ordering glass, and is recommended if the risk is high.

More information on thermal safety of glass is available from GANZ members.

WARRANTY

Unless a thermal assessment has been carried out by a GANZ Member, glass broken by thermal stress may not be covered by a GANZ member's supply warranty.

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