dualseal
a vandaglas company

Glass & Thermal Stress

Introduction

Insulating glass is commonly installed in a building by retaining the perimeter edges behind a bead or gasket. When the sun heats up the central area of the glass, the edges remain cooler, being shielded from direct solar radiation. In this situation, the centre of the glass warms and expands, the edges remain cool, restricting the expansion, which causes stress in the glass. If the breaking stress of the glass is exceeded it will result in thermal fracture.

Factors Affecting Thermal Stress

The amount of thermal stress generated within the pane depends upon the temperature difference between the warmest and the coolest part of the glass. There are many factors that can influence the temperature difference including, the design of the glazing system and frame, absorption of the glass, external and internal shading, reflection of the heat back through the glass from internal walls or columns, blinds, furniture or floor slabs, heating systems within the building and variation of air temperatures, posters or films applied to the inside surface of the glass, etc. The quality of annealed glass edges is critical. The induced thermal stress is located at the glass edges and the breaking stress of the glass is related to the number and positions of any flaws at the glass edges. A clean cut edge is the strongest, any damage (feather or shells) or edgework results in additional damage to the glass, weakening the edge strength.

Assessing Thermal Breakage Risk

It is possible to calculate the temperature of the glass when installed, however, in order to ensure accuracy and reliability of the result, it is important that as much detail be gathered as possible, and all influences included that may affect the temperature difference, and subsequently, the risk of exceeding the allowable thermal stress for the type of glass. (It may also be necessary to give thought to any future change of use or change of building occupant). Where it is determined that the allowable safe temperature difference of the glass will be exceeded, then it is necessary to either replace with another glass type, or redesign the glazing system to remove any critical factor. The most common solution is to replace annealed glass with one that has a higher safe temperature difference, such as heat strengthened or toughened glass.

Allowable Safe Temperature Difference for Some Glass Types

Glass	Allowable Difference
Annealed clear or tinted float 12mm thick or less	40 Deg. C
Annealed float 15 mm thick	35 Deg. C
3 Ply laminated annealed float 12 mm thick or less	40 Deg. C
3 Ply laminated annealed float more than 12 mm thick	30 Deg. C
Heat strengthened float glass	100 Deg. C
Toughened float glass	200 Deg. C

Where annealed glass is gasket glazed, clean cut edges may damage the gasket, any edge-working must be by a wet process, with fine grit, working in parallel to the glass edge. This is also a suitable method for annealed laminated glass where it is important to ensure that the edges are not stepped. Note: Edge-working across the edge, from surface to surface, using abrasive belts is not recommended as this significantly weakens the glass.

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