Glazing and thermal breakage

Glass thermal breakage is a result of temperature variation stresses between two adjacent areas in a glass sheet. Such variation can take place between visible surfaces and glazing rebate areas, or when a glazing area is exposed to sunlight and another to shade.

When exposed to sunlight, the glazing warms up because of its high energy absorption rate. If a glazing area remains cold, it keeps the warm area from expanding freely, hence generating respectively compressive and tensile stresses in the glazing warm and cold areas. Since glass is less resistant to tension than compression, tensile stresses might exceed the glass fracture stress and cause glazing breakage, which is commonly referred to as ‘‘thermal breakage’’.

Such phenomenon occurs at the glazing edges and it is characterized by a perpendicular crack-off plane near the edges and on both sides of the glazing. Such fracture can either be monofilament or multifilament (see Figure 1).

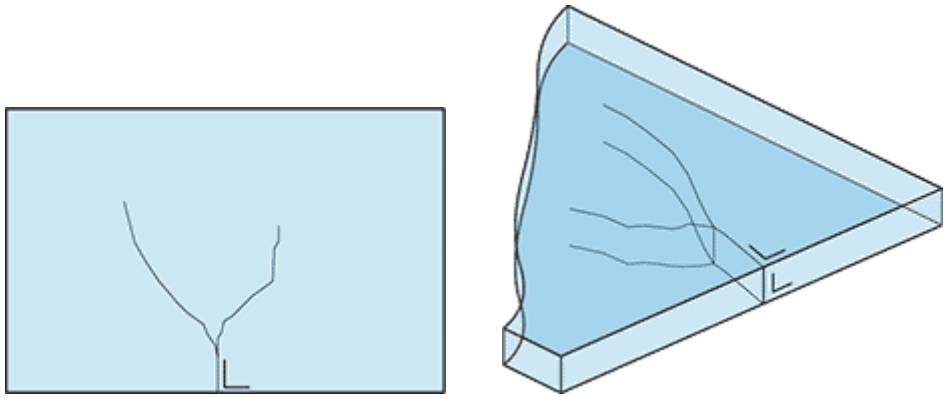

Fig. 1 Glazing Thermal Breakage

Risk Factors

The thermal breakage risk can be linked to the following factors:

Weather conditions: the temperature difference in a glazing directly depends on the sun radiation intensity that reaches it (depending on the glazing orientation, the time of day, the season, the sky quality, etc.) and the maximum temperature difference between day and night. The glazing oriented between -60 and +45° from north shows little risk of thermal breakage since it is not exposed to sunlight.

Glazing features: the higher the glass energy absorption factor, the more the glazing warms up when exposed to sunlight. Absorbing glass, coated glass, or glass with a reflecting film will warm up faster than conventional glass, and are therefore subject to thermal breakage. Unlike single glazing, insulating glass (double or triple) is also at risk of thermal breakage, because of the low heat transfer within the cavity. Furthermore, engraved, sandblasted, or scratched glass will be more prone to thermal breakage.

Glazing **installation type** (rebate, bonding, etc.) and **quality** (shimming)

The frame **thermal inertia**: the higher the frame temperature, the less it will promptly adjust to outdoor conditions. The temperature variation between the glazing visible surface and the one in contact with the frame (and consequently leading to thermal breakage) will be greater. The frame color may also influence such phenomenon.

The building **outside environment** (neighboring building, trees, etc.) or the building itself (overhanging terrace, awning, encroachment, awning blinds, glazing installed outside the plane of the façade, etc.) may expose the glazing to partial or prolonged shade.

Indoor environment may significantly increase temperature variations between the glazing warm and cold areas, due to the presence of blinds or draperies, dark objects behind the glazing (furniture, sliding frame leg, etc.), stickers or posters, ceiling located before the glazing, any other indoor shading devices, the proximity to a heat source (radiator, convector, etc.), a ventilating system for heating or cooling air distribution, etc.

Prevention Tips

In general, the **edge grinding** of annealed glass reduces the risk of thermal breakage. However, when the glazing temperature variation reaches values higher than 30°C, we will use **hardened or tempered glass** that can resist to temperature variations from 100 to 200°C.

With regards to factors associated with the **indoor environment**, apart from any other causes, using these two glass types may likely be avoided by taking simple measures, such as providing a 40-mm space between the glazing and a drapery or blind, avoiding radiant systems (radiators, convectors, etc.) or pulsating directly onto the glazing (but rather in parallel with the glazing or preferably inside the room), ensuring that they are 20 cm away from the glazing, etc.

During **storage** (crates or bulk packing), we must ensure that the glazing is not exposed to sunlight or any other heating sources.

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