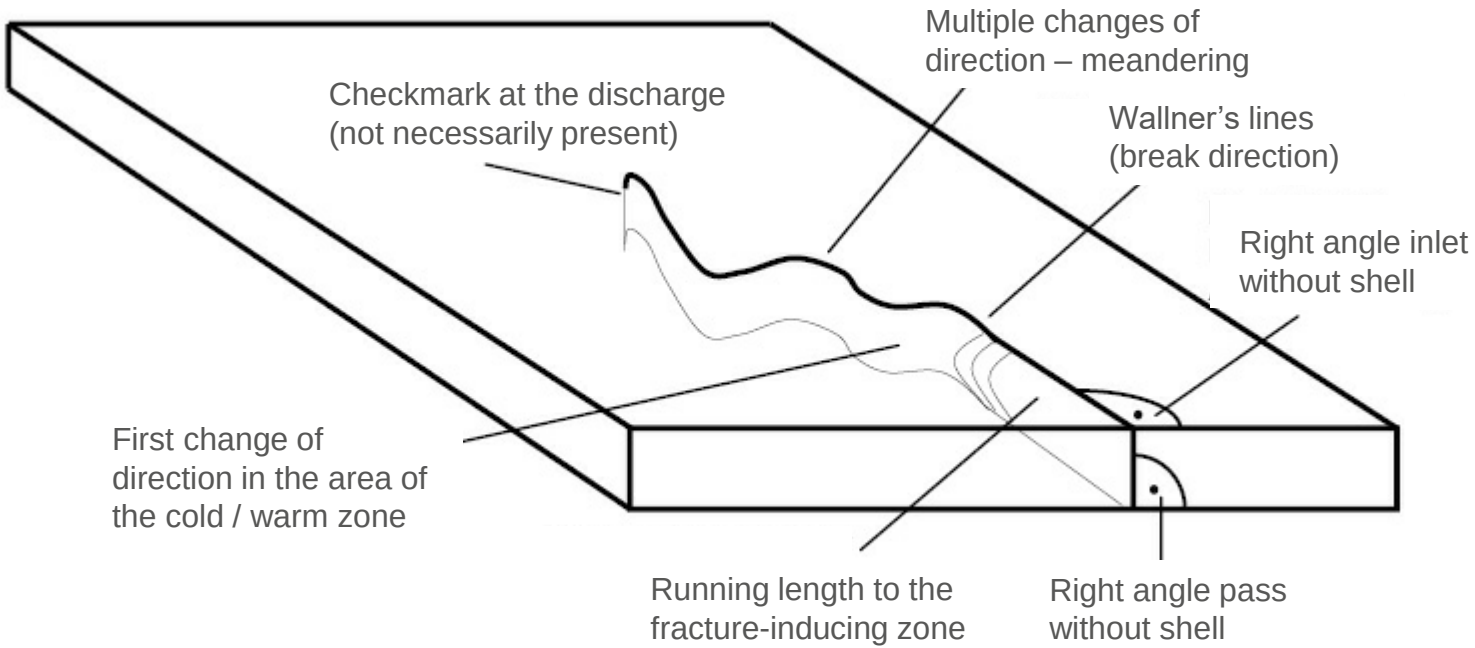
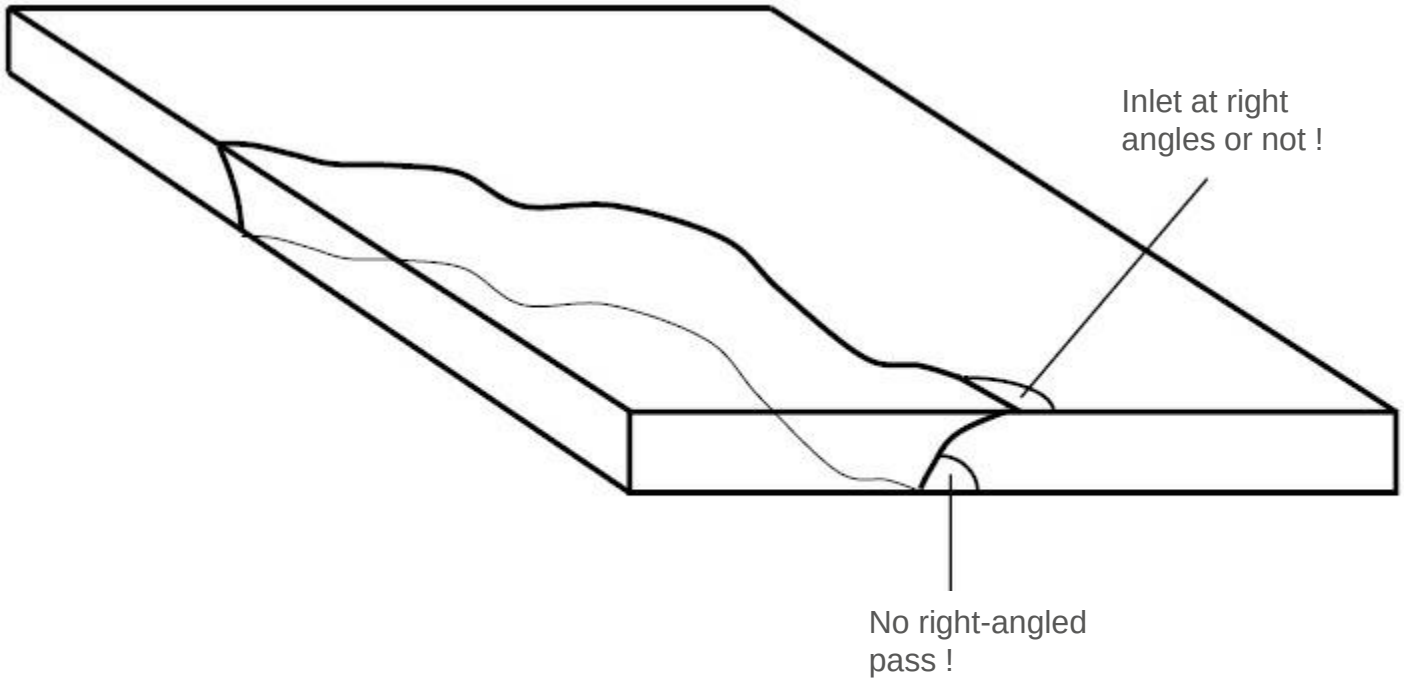
THERMAL BREAKAGES

SAINT-GOBAIN

Representation of a fracture curve caused by thermal stresses in non-tempered glass.



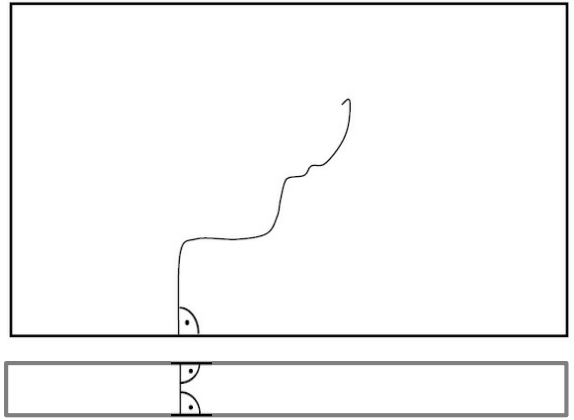
Representation of a fracture profile caused by mechanical stresses in non-tempered glass.



Thermal simple crack

Thermal load — weak / medium intensity

Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Partial cover on the inside or foil glazing of the pane in direct sunlight; • Too low rebounding; • “LowE” and solar protection glasses (in particular insulating glass) stored in the package without cover in direct sunlight; • Folding or sliding doors made of float glass, pushed one against the other.
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Change of direction at the cold / warm zone (bend), further course meandering.
Discharge / End	Straight line; often with check marks.



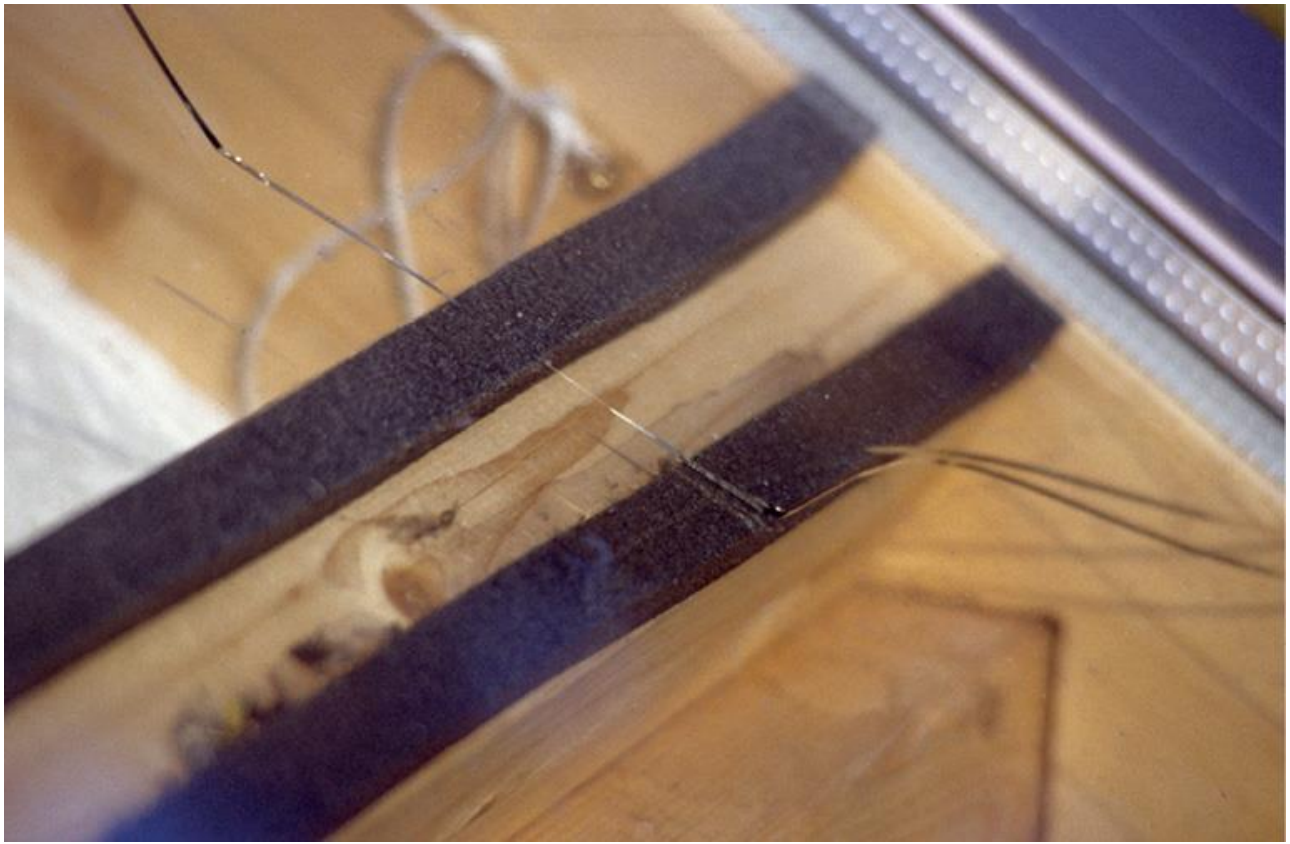
Thermal simple crack

Thermal load — weak / medium intensity

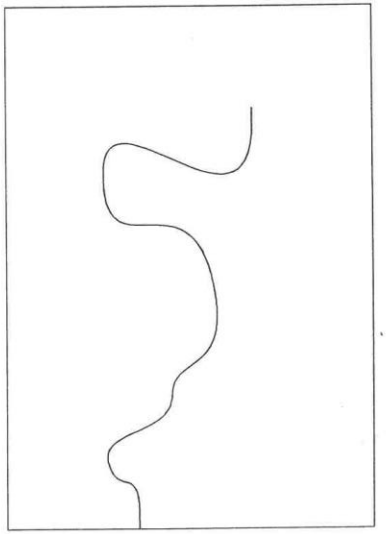
Thermal break on colored, absorbing glass, breakage on the cold / warm zone

Thermal simple crack

Thermal load — weak / medium intensity



Thermal break on the lower LSG pane of insulating glass that runs from the warm zone (room), over the support (black profile = heating) to the outside area (cold zone).



IMPORTANT!

Single crack → Low Stress:

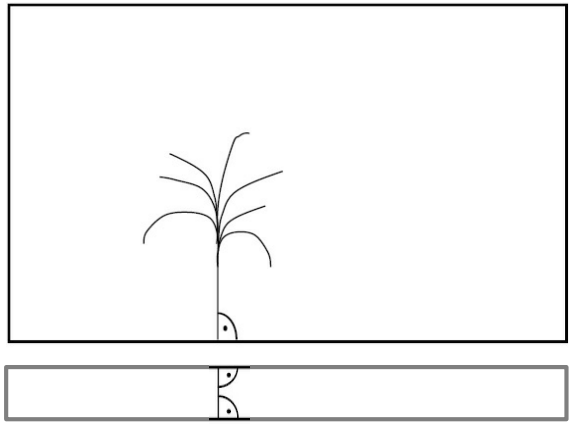
- Single crack suggests a weaker glass edge.
- Less energy was needed to initiate the crack

SAINT-GOBAIN

Thermal Palm / Fanning crack

Thermal point or line load - strong intensity

Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Partial cover on the inside in strong sunlight; • Strong heating in the edge area (blowtorch, hot air blower); • Radiator or heating pipe on the glass pane; • Partial shading on discs bonded with absorbing sun protection foils.
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Straight inlet; Change of direction at the cold / warm zone; afterwards palm-like fanning.
Discharge / End	Straight lines; Checkmark only very rarely.
Other	Shells in the area rarely; Wallner's lines are often present, especially in the area of the first change of direction.



Thermal Palm / Fanning crack

Thermal point or line load - strong intensity

Thermal palm crack, caused by very strong punctual heating of the glass pane.
Clearly recognizable right-angled inlet to the glass edge with immediate splitting, due to very high stress action

Thermal Palm / Fanning crack

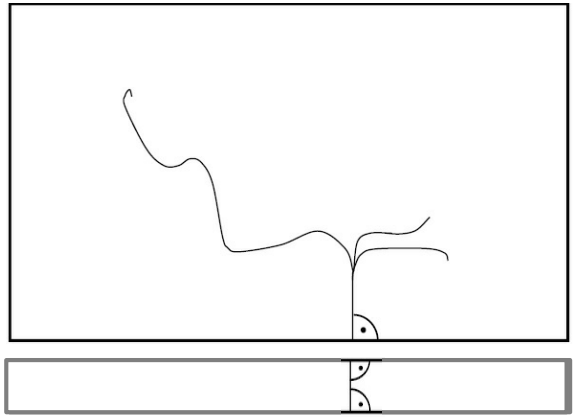
Thermal point or line load - strong intensity

Break from picture above, but edge view, here also the break perpendicular to the glass surface through the glass recognizable, typical thermal break, but with very high energy effect.

Strong thermal break

Thermal line load - strong intensity

Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Welding torch directly on the glass pane; • Hot air blower on the glass pane; • Mastic asphalt laying with uneven protective cover of the glass pane; • Folding or sliding doors made of float glass, pushed one against the other; • Inside partial coverage of the pane in direct sunlight; • Partial shading on glass pane with highly absorbent sun protection films.
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Straight inlet; Change of direction at the cold / warm zone mostly with splitting into several fractures, further course meandering
Discharge / End	Straight lines; Rarely checkmarks.
Other	Possible shells in the area of the first change of direction; Wallner's lines exist, especially in the area of the first change of direction



Strong thermal break

Thermal line load - strong intensity

Thermal breakage of a shop window caused by boxes stacked directly on the pane.

Strong thermal break

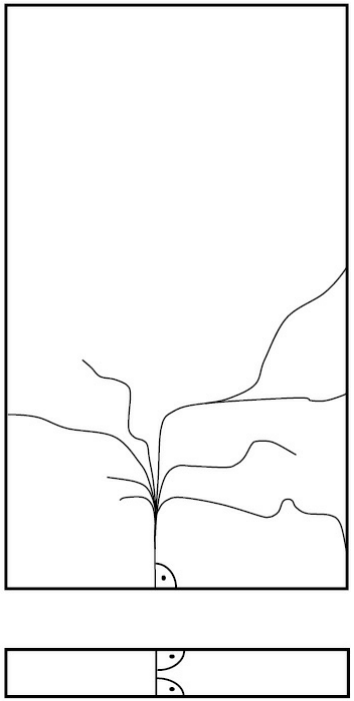
Thermal line load - strong intensity

Thermal break on non-tempered, absorbent solar control glass in IGU, on direct sun exposure.

Very strong thermal break

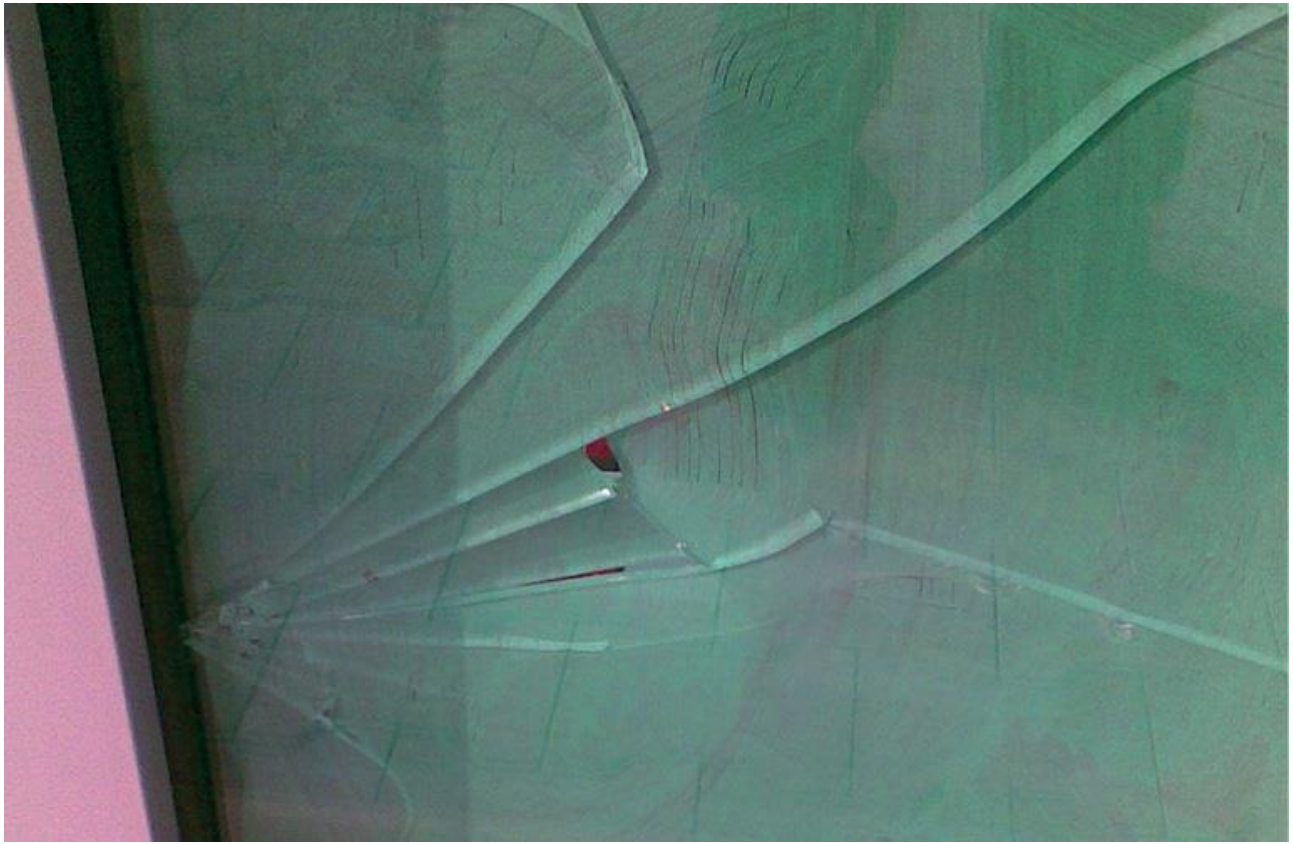
Thermal line load - very strong intensity

Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Welding torch directly on the glass pane; • Mastic asphalt laying with uneven protective cover of the glass pane; • Hot air blower directly on the glass pane; • Folding or sliding doors made of float glass, pushed one against the other; • Dark inside partial coverage of the pane in direct sunlight; • Partial shading on glass pane with highly absorbent sun protection films.
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Straight inlet; Change of direction and multiple fanning at the cold / warm zone; further course meandering.
Discharge / End	Straight lines; Rarely checkmarks.
Other	Possible shells in the area of the first change of direction; Wallner's lines exist, especially in the area of the first change of direction



Very strong thermal break

Thermal line load - very strong intensity



Strong thermal break caused by painting of the glass pane.

SAINT-GOBAIN

Very strong thermal break

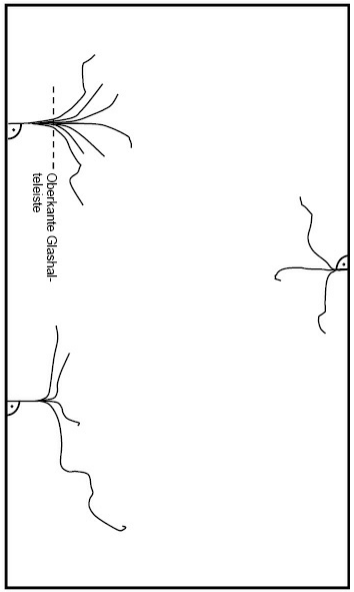
Thermal line load - very strong intensity

Strong thermal break caused by advertising poster hung directly on the inner pane.

Thermal edge break

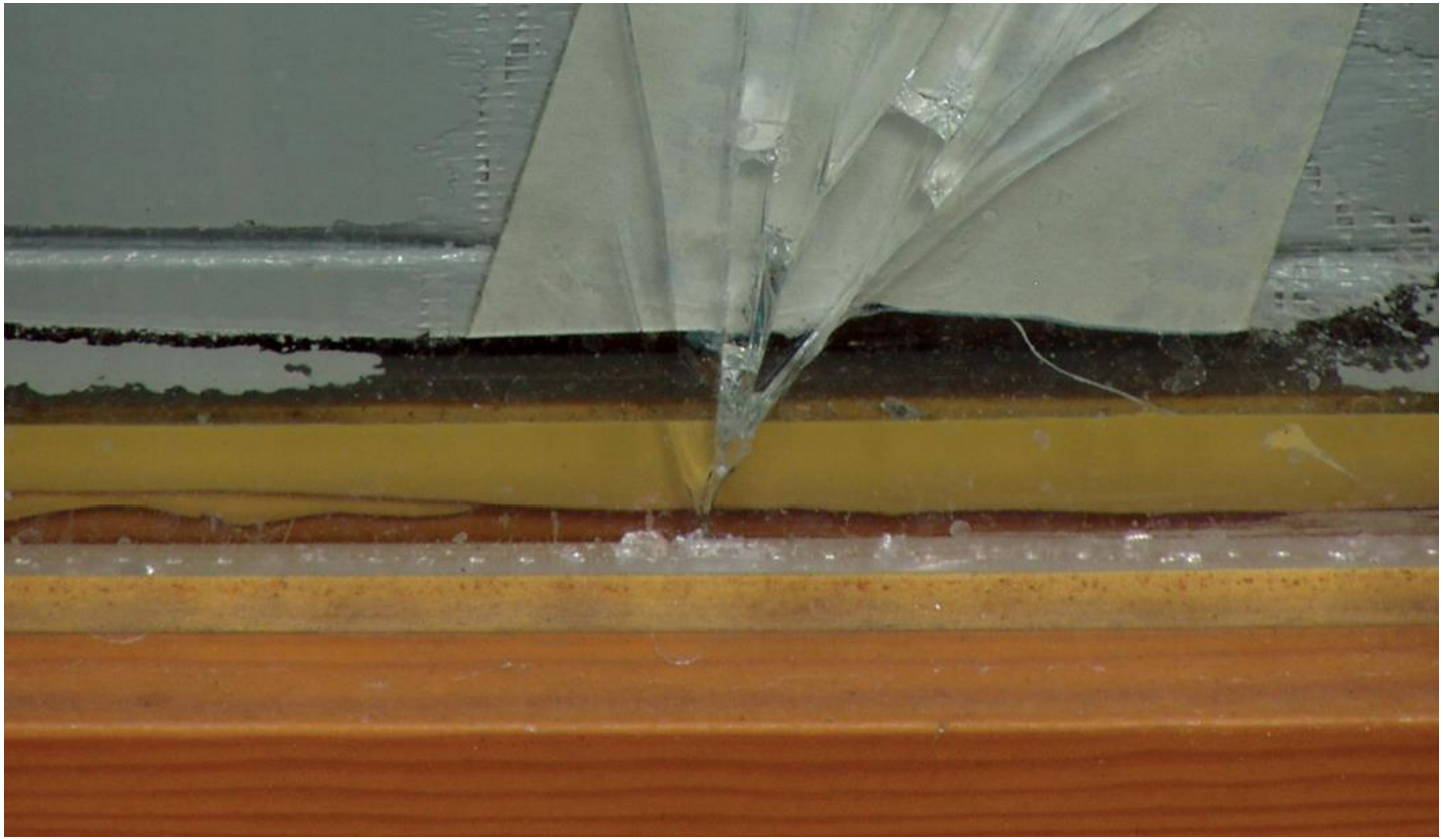
Thermal line load - medium to high intensity

Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Very low rebate condition; • significantly higher coverage on the inside than on the outside; • inside partial coverage of the pane in direct sunlight; • pasted slices.
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Straight inlet; Change of direction at the cold / warm zone usually with splitting into several fractures, often directly over glazing bead, further course straight or meandering
Discharge / End	Straight lines; Rarely checkmarks.
Other	Possible shells in the area of the first change of direction; Wallner's lines exist, especially in the area of the first change of direction



Thermal edge break

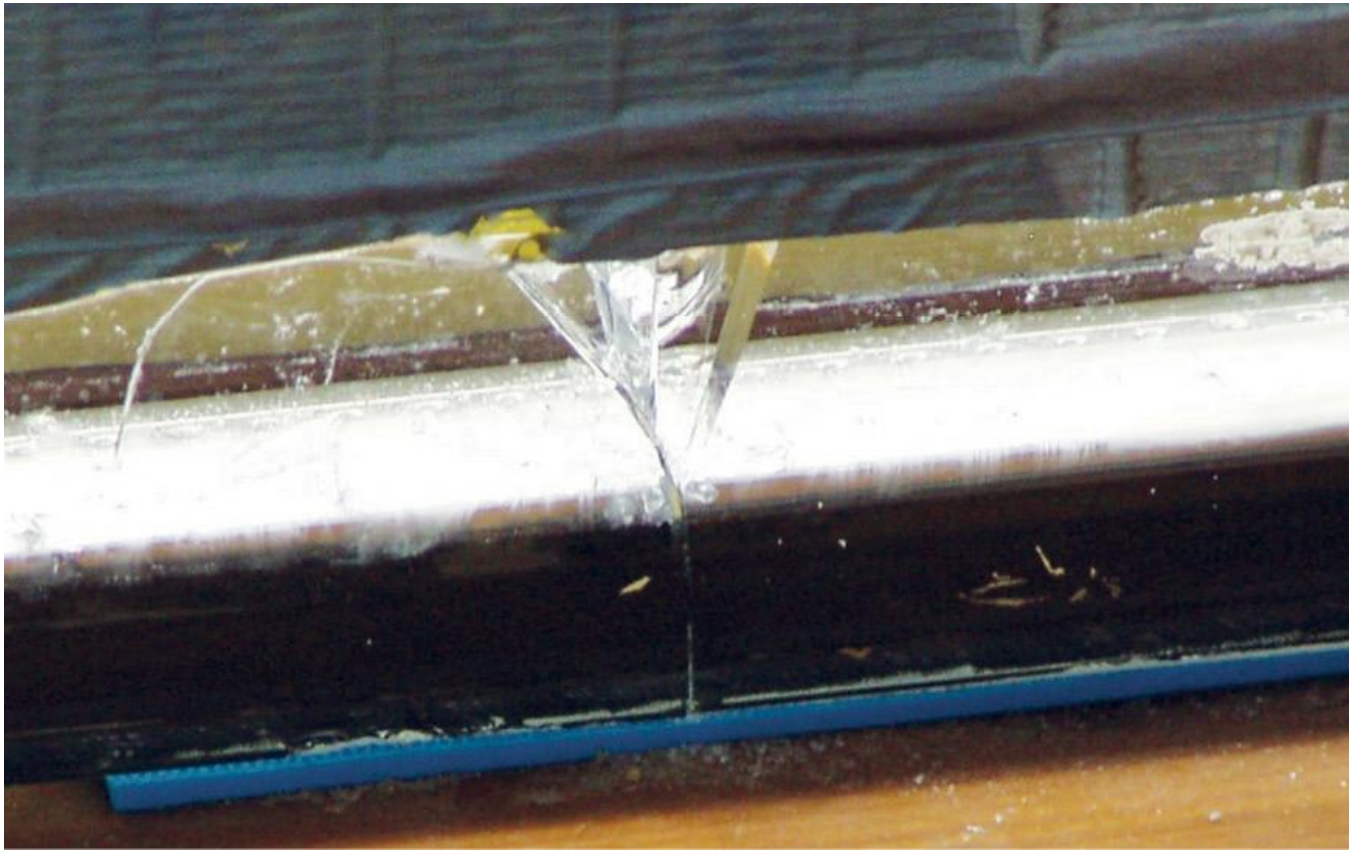
Thermal line load - medium to high intensity



Strong thermal break caused by objects placed on/next IGU (thermal insulation panel).

Thermal edge break

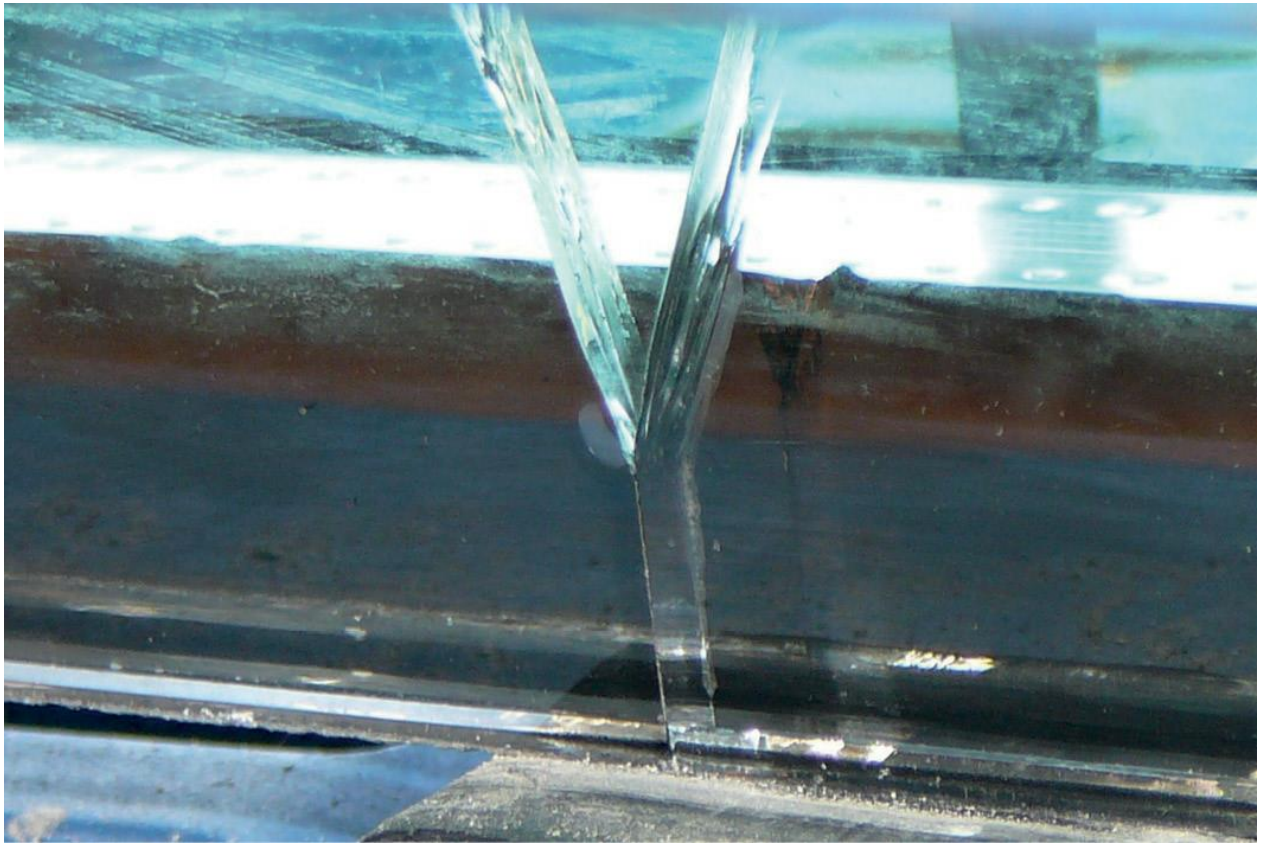
Thermal line load - medium to high intensity



Detail from the picture above, inside view with removed glazing bead clearly recognizable rectangular inlet of the thermal break

Thermal edge break

Thermal line load - medium to high intensity

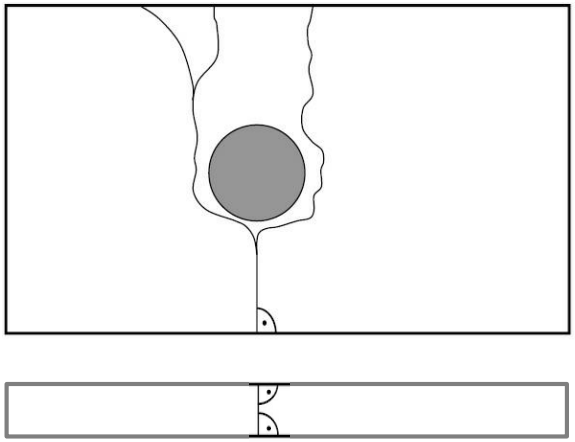


Thermal edge breakage, fracture splitting still in the area of the cover by the glass retaining / fixing strip.

Glass with clearly defined different zones. Thermal breakage line I

Thermal line load - weak to strong intensity

Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Partial coverage by means of interior decoration directly on the glass pane; • dark areas (sticker, advertisement) on the glass pane; • large plant leaf inside directly on the glass,…
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Straight inlet, direction change at the cold / warm zone, splitting at cold / warm zone possible.
Discharge / End	straight; no check mark; mostly breakaway
Other	Shells in the area often present; Wallner's lines exist, especially in the area of the first change of direction.



Glass with clearly defined different zones. Thermal breakage line I

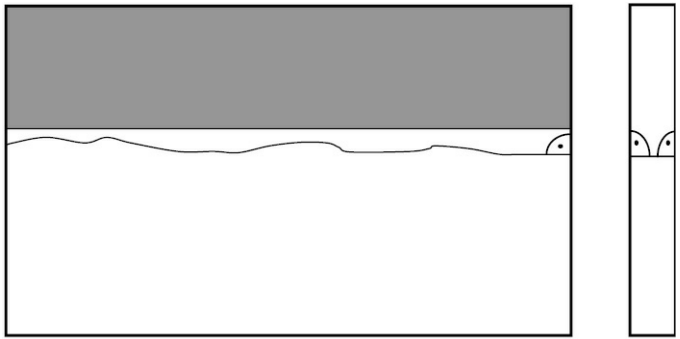
Thermal line load - weak to strong intensity

Thermal line break, caused by several strong spotlights for lighting. The fracture runs along the cold / warm zones (stress zones) of the differently heated glass surfaces, which is why the wave form has developed. Similar jump course as on the outside with dark circles pasted or painted discs.

Glass with clearly defined different zones. Thermal breakage line II

Thermal line load - weak to strong intensity

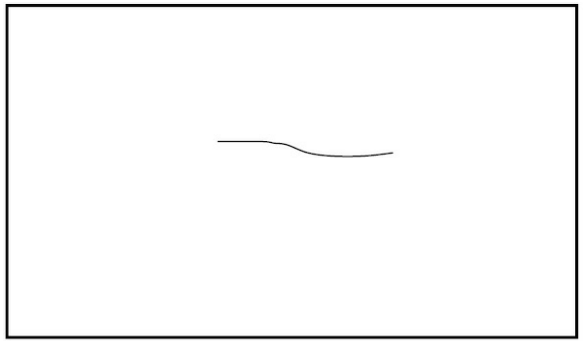
Type of glass	Float glass, ornament glass, drawn glass, laminated glass, wired glass,…
Examples	• Partial darkening by means of internal blinds directly to pane; • Partial coverage by means of interior decoration directly on the pane; • Drop shadow due to roof overhang; dark areas (stickers, foils, advertising or similar) on the glass.
Beginning	Entry angle at right angles; Angle of passage at right angles; Notched edges at the inlet are not available.
Run	Along cold / warm zone; meandering course.
Discharge / End	straight; no check mark;
Other	rarely shells in the area; Wallner's lines possible.



Thermal worm crack

Thermal point load - very strong intensity
Only for very large and very thick glass panes

Type of glass	Float glass, drawn glass, laminated glass – all with high thickness
Examples	• Welding torch on glass surface; • Hot air blower on glass surface; • Strong punctual warming in the glass surface of a very large, thick shop window
Beginning	Within the glass surface; no beginning at the glass edge; no distinction between start and end possible.
Run	Snake- or worm-like in the glass pane center without major changes of direction.
Discharge / End	Within the glass surface; no beginning at the glass edge; no distinction between start and end possible.
Other	Often not recognizable from every angle; Wallner's lines possible



Köszönjük szépen!