Tempered glass (ESG)

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Tempered glass is a type of safety glass. It is widely used in construction, interior architecture, furniture-making, industrial production of machines (cars, household goods). Tempered glass is known as **ESG** (Ger. *Einscheiben Sicherheitsglas*).

Glass is tempered by heating it to a high temperature (620–680°C) and abruptly cooling it in a jet of compressed air, which produces compressive stresses in the surface layer, significantly increasing the strength of glass.

Tempered glass is more flexible and resilient to mechanical and thermal factors than annealed float glass, and is also safer, because it falls to small, blunt pieces after being broken (annealed glass pieces are dangerously sharp).

At Dubiel Vitrum, we use tempering to produce:

- Tempered float glass (ESG)
- Bent glass in cylindrical shapes (safety glass - ESG)
- Heat strengthened glass (TVG, often called semi-tempered)
- ESG float tempered glass painted with baked ceramic paint (flood-coating or screen printing with glaze paint)

The glass produced by Dubiel Vitrum bears the permanent CE mark, which confirms the product’s compliance with the PN-EN 12150 standard.

TECHNICAL TERMS OF REFERENCE FOR TEMPERING FLOAT GLASS at Dubiel Vitrum

glass thickness	from 3.2 mm (4 mm recommended) to 19 mm

glass size

- minimum: 300 x 50 mm (or minimum diagon
- maximum: 2,000 x 3,600 mm (recommende 3,210 mm)

glass types

- float
- decolored
- body tinted
- etched (tempered with the smooth and etch towards the rollers)
- painted with ceramic paint, single coat (temp with the smooth side towards the rollers)
- coated (tempered with the non-coated side t rollers)
- ornamented

glass processing limitations before tempering

- glass must not have any sharp edges (edges need to be at least blunted)
- minimum internal cut-out radius is:

- R=8 mm for 3-15 mm thick glass
- R=10 mm for 19 mm thick glass

- minimum diameter of holes in glass must be greater than the glass thickness
- distance between holes must be equal or gre double the glass thickness (fig. 1)
- distance from the hole edge to the glass edg least double the glass thickness (fig. 1)
- distance from the hole edge to a sharp corne

last six times the glass thickness (fig. 1)

- distance from the hole edge to a rounded co angle) must equal at least six times the glas calculated from the hole edge to the theoret corner (fig. 1)

- distance between drilled holes must equal d glass thickness calculated from the edge of t 2)

IMPORTANT:

if holes do not meet the tempering standards, the d altered by:

- moving the holes
- decreasing the diameter
- joining the holes (making a kidney-shaped h
- making a bridge

glass processing limitations after tempering

Once tempered, glass is not further tooled (e.g. it is drilled or its edges ground), as it entails a high risk c the piece or weakening it permanently. However, te can be:

- sanded
- printed
- painted with water based paint

APPLICATIONS of tempered glass :

- monolithic glass (single, float and bent): partition walls, wall linings, doors, glassed-in structures, shower cabins, table tops, glass shelves, furniture glass

- used in laminates: canopy roofs, balustrades and barriers, safety partitions, elevator panes,

floors and ceilings, roofs

- used in laminates and additionally processed: floors, anti-slip landings and stairs, UV printed or painted balustrades

- decorative ice glass (permanent “finely-broken” glass effect): furniture-making and interior architecture

Anisotropy

Anisotropy is a physical property of tempered glass (ESG) due to which splashes of color show in polarized light.

During tempering, different stress areas appear in its cross-section. These stresses result in rays of light being doubly refracted. If soda-lime-silica glass (ESG or TVG) is viewed in polarized light, stress fields are visible as gray or color areas, darker spots or stripes on the surface of glass panes. These places are called “polarization fields” or “leopard spots”.

Therefore, stress areas and anisotropic effects result from the glass tempering process. They can be seen at a particular angle and in certain installation configurations. The phenomenon disappears if the angle at which a given area of glass is seen changes.

According to the technical guidelines in force and the European standard EN 12150, anisotropy is regarded as a physical property of tempered glass and in no case can be treated as a defect.


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