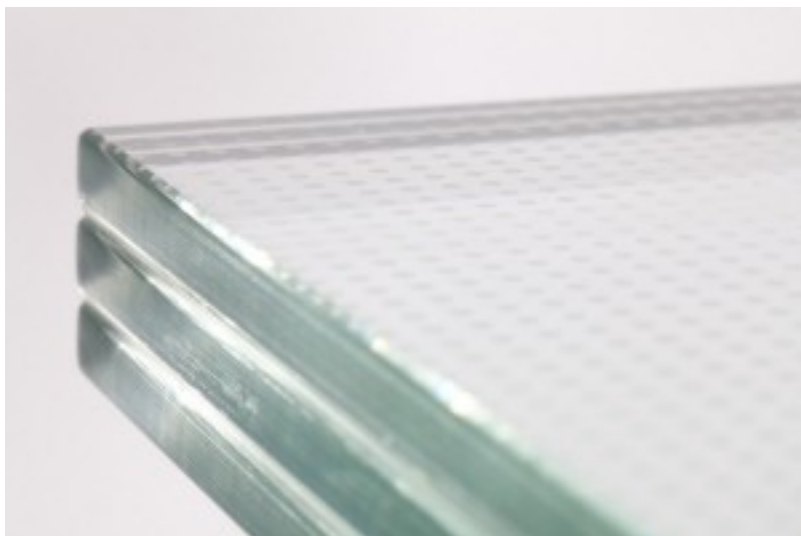


## Heat strengthened glass (TVG)



[1]

Heat strengthened glass, also known as semi-tempered glass, is used in construction for many practical purposes. Similar to ESG, it is more resistant to mechanical and thermal factors than annealed float glass (but less resistant than ESG). Its basic distinguishing property is the characteristic pattern of cracks: when broken, a pane falls to larger pieces than tempered glass, and the cracks spread towards the edges, which prevents the pane from falling out of the frame (in this case, tempered glass falls to small, blunt pieces).

Heat strengthened glass is known as TVG (Ger. *Teilvorgespanntes Glas*).

Heat strengthening is similar to tempering, but is characterized by slower cooling intensity. As a result of air cooling, compressive stresses are produced, which increases the strength of glass. Internal stresses generated are relatively lower than in tempered glass.

At Dubiel Vitrum, we use tempering to produce:

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

Heat strengthened (semi-tempered) glass produced by Dubiel Vitrum bears the permanent CE mark, which confirms the product's compliance with the PN-EN 1863 standard.

### TECHNICAL TERMS OF REFERENCE FOR HEAT STRENGTHENING GLASS at Dubiel Vitrum

**glass thickness**

from 3.2 mm (4 mm recommended) to 12 mm



## Heat strengthened glass (TVG)

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### glass size

- minimum: 300 x 50 mm (or minimum diagonal 350 mm)
- maximum: 2,000 x 3,600 mm (recommended 2,000 x 3,210 mm)

### glass types

- float
- decolored
- body tinted
- etched (tempered with the smooth and etched sides towards the rollers)
- coated (tempered with the non-coated side towards the rollers)
- ornamented

### glass processing limitations before tempering

- glass must not have any sharp edges (edges corners need to be at least blunted)
- minimum internal cut-out radius is:
  - R=8 mm for 3-12 mm thick glass
- minimum diameter of holes in glass must be equal or greater than the glass thickness
- distance between holes must be equal or greater than double the glass thickness (fig. 1)
- distance from the hole edge to the glass edge must be at least double the glass thickness (fig. 1)
- distance from the hole edge to a sharp corner must be at least six times the glass thickness (fig. 1)
- distance from the hole edge to a rounded corner (at acute angle) must equal at least six times the glass thickness (fig. 1)

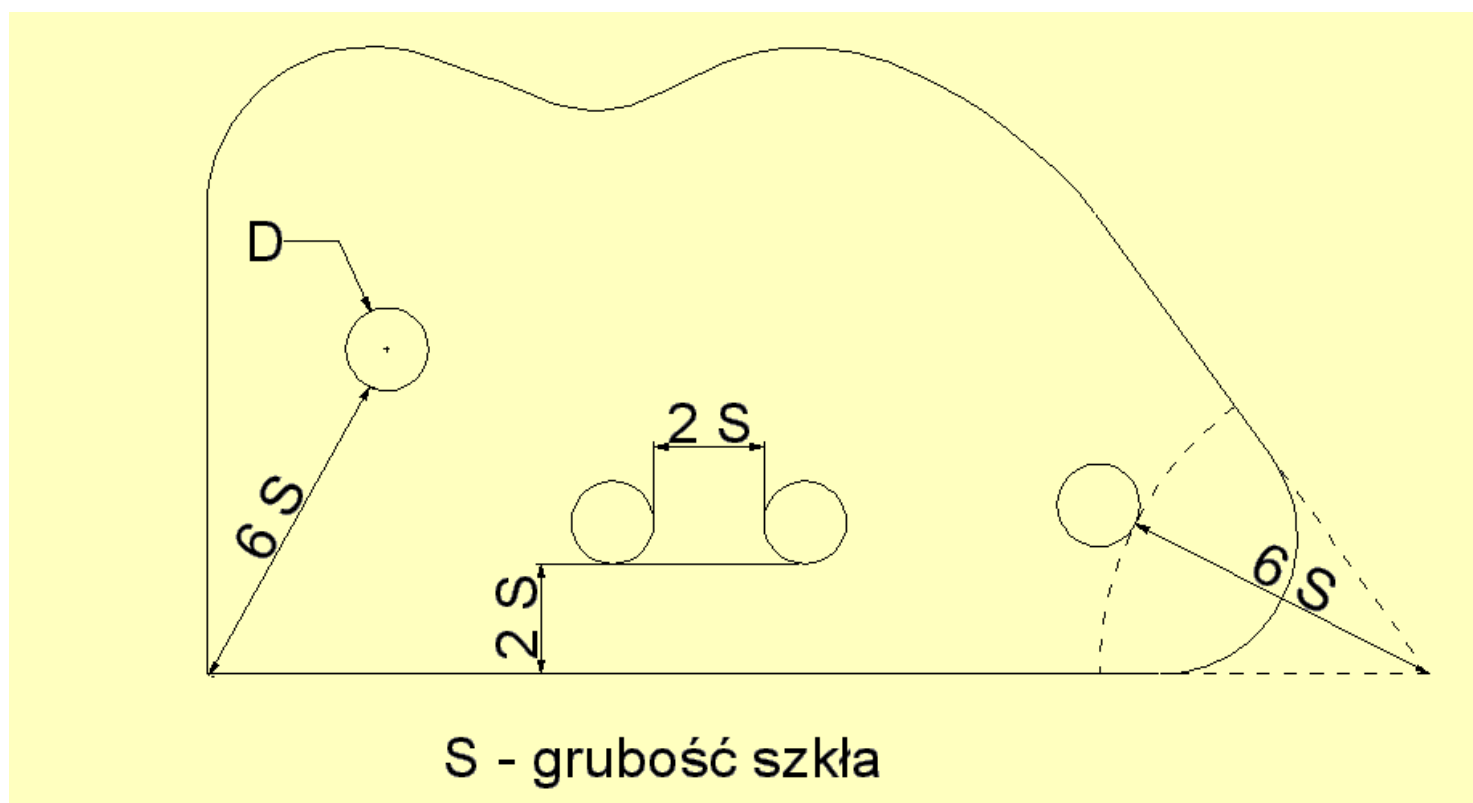
glass thickness calculated from the hole edge to the theoretical sharp corner (fig. 1)

- distance between drilled holes must equal double the glass thickness calculated from the edge to drill (fig. 2)

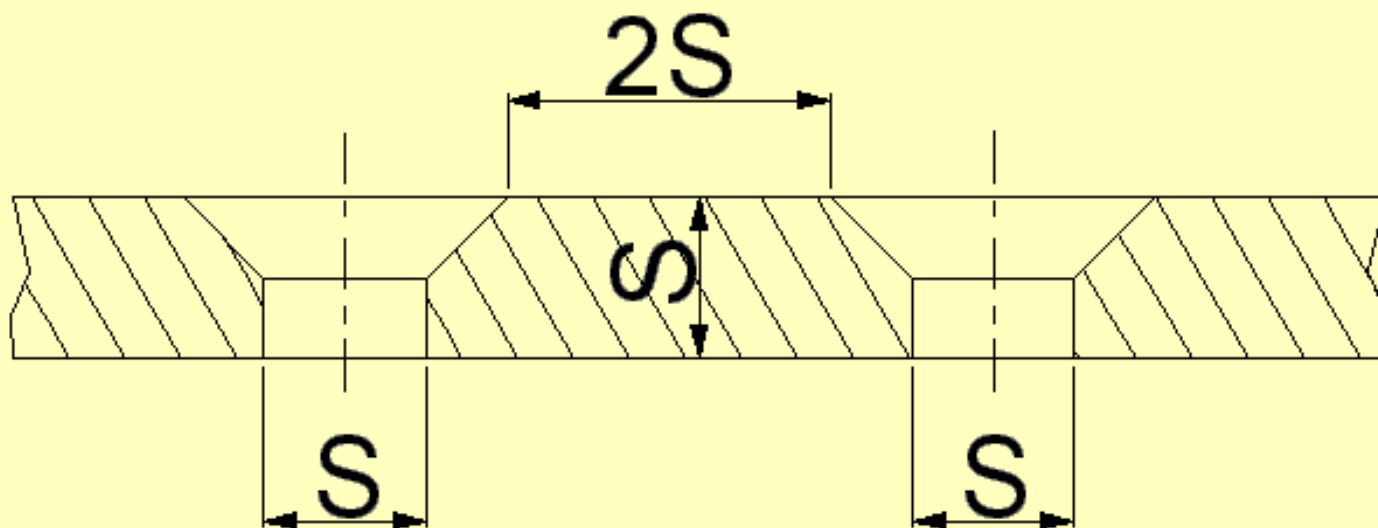
### IMPORTANT:

if holes do not meet the tempering standards, the design may be altered by:

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



Rys. 1.



Rys. 2.

**glass processing limitations after tempering**

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

- sanded
- printed
- painted with water based paint

**APPLICATIONS of heat strengthened glass (TVG, semi-tempered)**

Thanks to its characteristic pattern of cracks, heat strengthened glass (TVG) is perfect for glass panels in which a complex VSG laminate is used, performing the following functions:

- a) protects against entry of heavy objects (falling away or down, puncturing)
- b) protects against the glass pane falling away when broken
- c) protects against the glass pane falling away in structures where glass is supported linearly, such as:
  - glass balustrades, barriers and partitions – in VSG laminates with annealed or tempered glass (ESG)



## Heat strengthened glass (TVG)

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- glass roofs, canopy roofs, and small roofs – in VSG laminates with annealed or tempered glass (ESG)
- glass floors, landings, and steps – in VSG laminates with annealed or tempered glass (ESG)

## Bent glass (ESG)

The bent glass produced by Dubiel Vitrum is always tempered glass (ESG) – thus, **bent glass is a type of safety glass**. We do not produce non-tempered bent glass.

### Source URL:

<http://dubielvitrum.pl/en/offer/special-glass/products/heat-strengthened-glass-tvg.html>

### Links

[1] [http://dubielvitrum.pl/sites/default/files/styles/duze\\_800/public/img\\_3519\\_0\\_0.jpg?itok=Rx8c63jl](http://dubielvitrum.pl/sites/default/files/styles/duze_800/public/img_3519_0_0.jpg?itok=Rx8c63jl)