

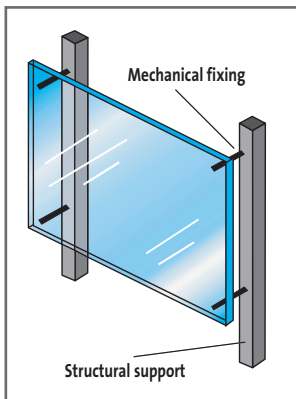
Bolted glass assemblies

Bolted glass assemblies with articulated bolts

The following section is intended to clarify current design and manufacturing parameters for the glass elements used in bolted glass assemblies. This highly engineered, specialist system will undoubtedly further evolve, through continuous product development. Please consult SAINT-GOBAIN GLASS for system updates.

The bolted glass assembly system is a technique for installing glass, either single or double-glazed, using articulated stainless steel bolts.

It is a highly advanced structural glazing system, developed by SAINT-GOBAIN GLASS. One of the most popular variations of this system is SGG SPIDER GLASS, see page 217.



For alternative systems see SAINT-GOBAIN GLASS SYSTEMS, section 2s.

The bolts are designed to absorb:

- wind and/or snow loading,
- the weight of the glazing,
- the differential movements between the glass and structure (see figure 1).

■ Applications and use

The system is designed for walls, roofs and canopies, both vertical and inclined, internal and external. The glass panes are normally rectangular in shape and can be flat or curved in form.

■ Conditions of design

The bolted glass assembly system requires finished glass products of the highest quality in terms of edge-work, drilling, toughening and heat soak testing.

Glass options

Monolithic single-glazing :

- clear, body-tinted or screen-printed glass.
- glass with solar control coating.

Laminated single-glazing :

- manufactured using the above glass types with a PVB interlayer.

Double-glazing :

- using any of the above glass types in double-glazed units, SGG CLIMALIT or SGG CLIMAPLUS.

Bolted glass assemblies

Figure 1 : Load bearing

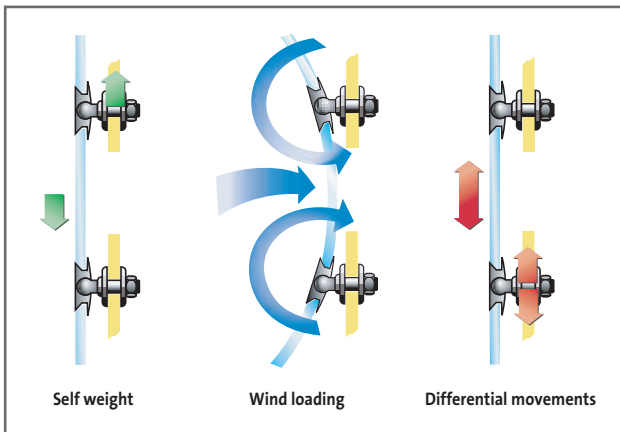
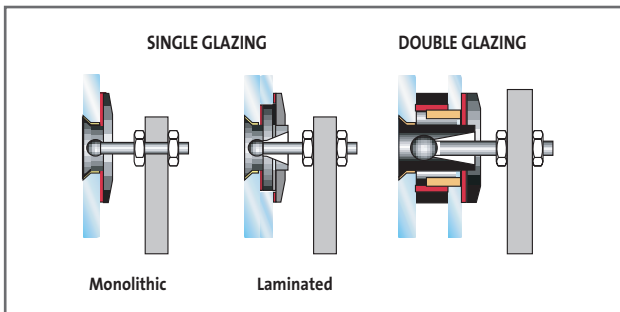


Figure 2 : Examples of SGG SPIDER GLASS articulated bolts



■ Glass specification

The glass elements must be selected in accordance with regulations governing the safety of building users and the specifications of bolted glass assemblies:

- in the event of breakage, limiting of the risk of injury to persons
- guarding to protect people from falling
- safety of building users and operatives during cleaning and maintenance operations.

Bolted glass assemblies

Glass dimensions

• Deflections

Currently, the maximum glass deflection limit for bolted glass assemblies recommended by SAINT-GOBAIN GLASS and defined in BS 6399 pt. 2, 1997, should not exceed:

• for single-glazing :

- Maximum deflection less than $L/100$ or largest span / 100

• for double-glazing :

- Maximum deflection less than $L/150$ or largest span / 150

• Allowable stresses

The permissible working stresses in the glass, calculated with loads defined by BS 6399 pt. 2, 1997, are shown in the table below.

Permissible working stresses (MPa)		
Glass type	Glass under loading temporary (wind)	Glass under loading permanent (self weight, snow)
Toughened glass	50	40
Heat strengthened glass	35	20
Screen-printed glass	35	20

Method of calculating deflection and stresses

SAINT-GOBAIN GLASS uses a finite element analysis software package to calculate the glass thickness, working to the deflection limits and stresses stated above.

Working parameters

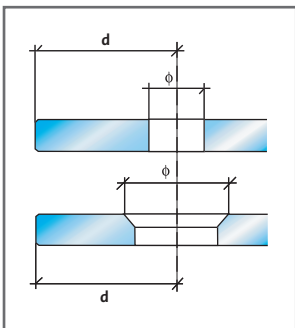
• Deflections

Calculated under normal wind loads defined in BS 6399 pt 2 1997.

• Distance of holes from glass edge

"d" minimum = 60 mm
(depending on application)

"d" maximum = consult SAINT-GOBAIN GLASS



Loadings

Vertical glazing:

• normal or extreme wind loadings in accordance with BS 6399 pt. 2, 1997.

Horizontal glazing:

• wind loading + self weight in accordance with BS 6399 pt. 2, 1997.

• self weight + snow: snow loading and overloading in accordance with BS 6399 pt. 2 & 3, 1997.

Bolted glass assemblies

General manufacturing conditions

For this type of application, the most stringent manufacturing requirements for glass apply to:

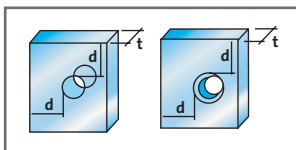
- edgework and drilling,
- toughening and heat soak testing,
- quality and inspection.

Edgework and drilling

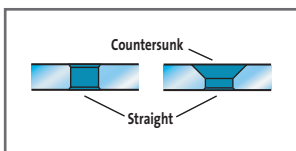
All edgework must be completed before the toughening and heat soak test stages. The glass cannot be altered in any way after this treatment.

The minimum distance (d) between the edge of a hole and the edge of the glass must be twice the thickness (t) of the glass.

For other values, contact SAINT-GOBAIN GLASS



The utmost care and accuracy is required for the drilled holes.



Tolerances on monolithic finished products

Height, width	$\leq 2\text{mm}$
Bow	$2\text{mm} / \text{m}$
Diameter of holes	$-0.2 + 0.8\text{mm}$
Position of holes	$\leq 1.5\text{mm}$

Toughening and heat soak testing

Two processes for mechanically reinforcing the glass are currently used:

- toughening followed by heat soak testing: fine fragmentation. This produces a safety glass in accordance with BS EN 12150 / BS 6206 1981
- heat-strengthening: fragmentation similar to that of annealed glass. This product is not considered to be a safety product as classified in BS EN 12150 / BS 6206 1981.

To ensure the mechanical strength of the assembly, the glass, whether toughened or heat-strengthened, must meet the following requirements:

Surface compressive stress

Toughened glass	80 - 120 MPa
Heat-strengthened glass	35 - 55 MPa

Quality control

Each production stage is quality controlled to the highest standard. Throughout the manufacturing process, particular attention is paid to two aspects: dimensional accuracy and the toughening and heat-soak testing of the glass.