



Crystal 
Safety Glass

CSG
TEMPERED
GLASS

What is Tempered glass and how is it made?

Tempered glass is a type of safety glass. It is made by heating the float glass just below its softening temperature (>600°C) and suddenly chilling it with jets of cold air. Such treatment caused it to its strength compared with normal glass. Tempering puts the outer surfaces into compression and the inner surfaces into tension. Such stresses cause the glass, to become small cubical fragments when broken, which is less likely to cause serious injury.



Pinnacle bridge @ Sunway

Characteristic of Tempered Glass

- ◇ 4-5 times stronger than annealed or untreated glass
- ◇ Less likely to experience thermal break
- ◇ Once tempered, cannot be cut down

Tempered Glass vs Heat Strengthened Glass ?

Heat strengthened glass are different as the glass cooling process is slower compare with tempered glass. This means the compression strength is lower. Strengthened glass is approximately twice as strong as annealed or untreated glass. If safety glass is not required at that specific area, heat strengthen glass can be used.

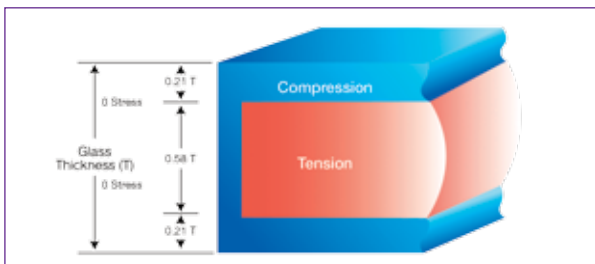


Fig.1 Tempered glass compression and tension zone

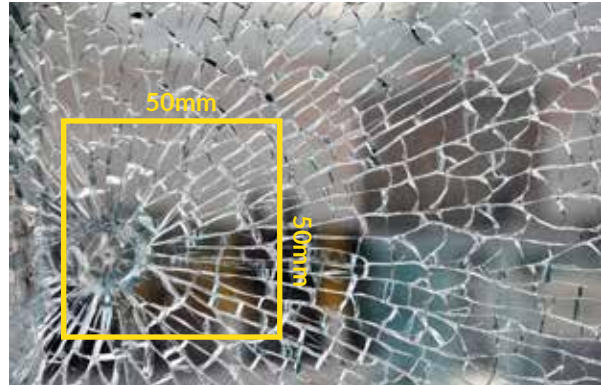


Fig.2 No of particles per square of 50mm

Nominal glazing material thickness (mm)	Minimum number of particles per square of 50mm side
3	30
4	30
5	40
6	40
8	40
10	40
12	40

NOTE: There is no reference to particle count to 15mm, 19mm, and 25mm due to lack of scientific data. (Refer to Fig.2)



Sierra Puchong

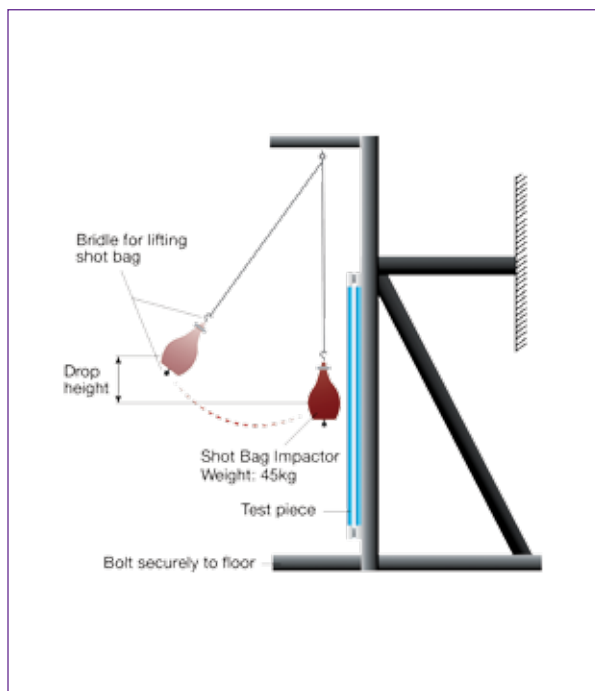
CSG Tempered Glass has been certified as Grade A safety glass since 2007 under the SIRIM product certification scheme which follows the AS/NZS 2208 Safety Glazing Materials in Building requirement and guidelines.

As Grade A safety glass, CSG Tempered Glass strictly meet the following requirement:

- ◇ Thickness requirement (4 -19mm)
- ◇ Size tolerance requirement
- ◇ Flatness
- ◇ Squareness or rectangular requirement
- ◇ Fragmentation test
- ◇ Impact Test

Impact Test

Impact testing is used to test how well a tempered glass can with stand impact.



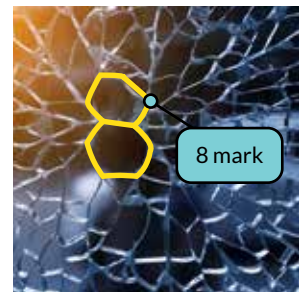
Spontaneous Breakage

There are certain instances that glass break for no apparent reason. When this occurs, it could be due to various reasons or a specific type of inclusion inside the glass. There are more than 50 types of inclusion in float glass, and while the most widely discussed is nickel sulphide stone, this type of inclusion actually occurs very rarely.

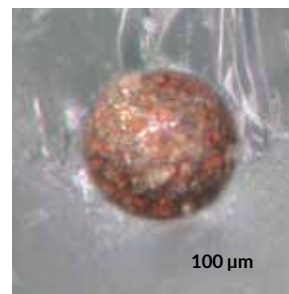
Nickel sulphide (NiS) stones that can form during the production of float glass due to nickel contamination, can end up in the centre tension zone of tempered glass. When that piece of tempered glass is later exposed to varying temperatures in its final installed position, this tiny stone – which can measure from 0.003 to 0.015 of an inch in diameter – may grow in size, and cause the glass to shatter for no apparent reason.



Tempered glass break pattern



Spontaneous breakage '8 mark' caused by NiS inclusion



Nickel sulphide inclusions found on fracture surfaces of glass that failed by "spontaneous breakage".



Heat Soaking

The concept of heat soaking glass is to reduce or eliminate spontaneous breakage due to stone inclusions. Heat soaking involves exposing the tempered glass to elevated temperatures for some period of time.

The obvious objective of the heat soak process is to achieve a “break now, not later”. This is based on the assumption that any glass with inclusions will break during the heat soak process.



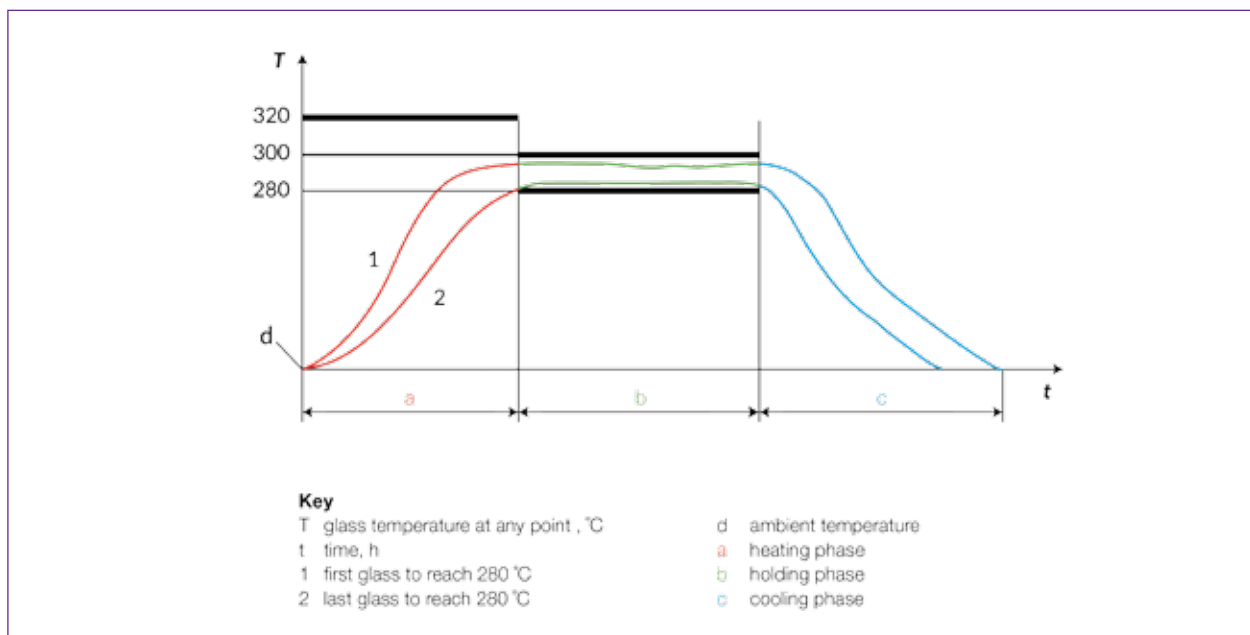
* CSG Heat Soak Tempered Glass offers 10 years warranty.
Terms and conditions apply

There are several facts to keep in mind about nickel sulphide and its role in glass breakage:

1. Spontaneous breakage caused by nickel-sulphide stones occurs only in tempered glass, not in annealed or heat-strengthened glass.
2. There is no known technology that completely eliminates the possible formation of nickel sulphide stones in float glass. Since nickel sulphide stones are so small, there is no practical way to inspect their presence in float glass.
3. Heat soaking after fabrication may destroy some flawed glass panels, but the procedure does not guarantee 100 percent elimination of nickel sulphide inclusions. In addition, the heat soaking procedure can increase costs, cycle times and scrap rates.

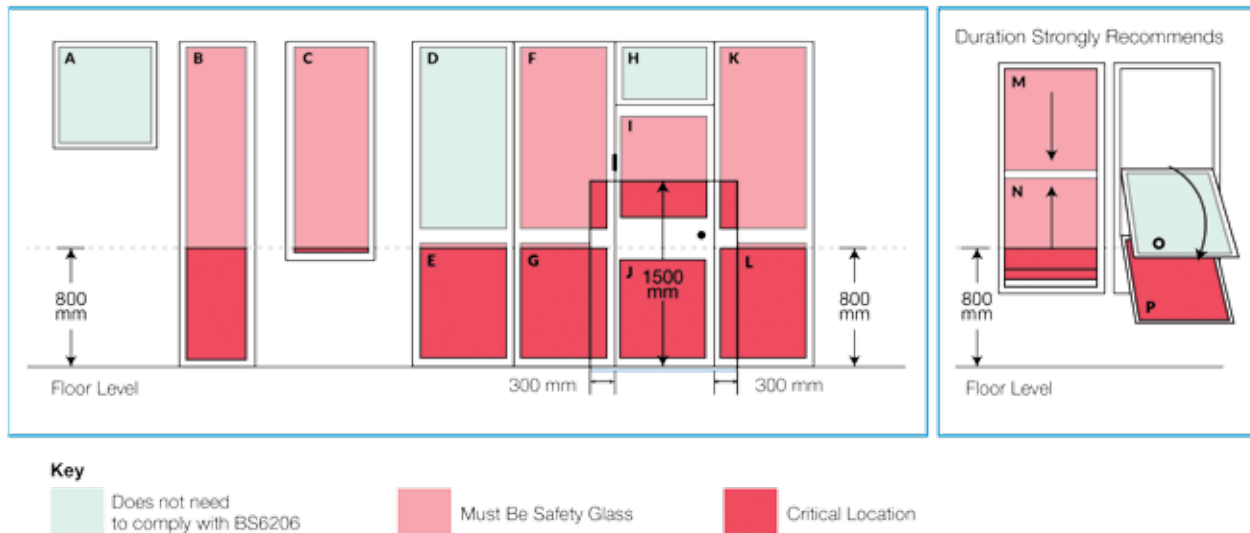
Heat Soak Process Cycle

The heat soak process cycle consists of a heating phase, a holding phase and a cooling phase (see Figure 1).



Code of Practice for Safety Related to Human Impact (BS 6262)

Diagram Depicting Critical Location



Only glazing units labeled A, D and H fall wholly outside the 'critical location' and not comply with BS 6262 : Part 4 - British Standard. Any glazing within a red shaded area must comply with BS 6262 : Part 4 Code of Practice for Glazing for Buildings.

Although it may be considered acceptable to use float glass in M, O and P, we advise using safety glass as the glass can be slid, tilted or moved down into the 'critical location'.

Doors Any glazing or part of that glazing in a door, which is between the finished floor level and a height of 1500mm above the floor level, is in a 'critical location'?

Side Panels Any glazing or part of that glazing, which is within 300mm of either side of a door edge and which is between the finished floor level and a height of 1500mm above the floor level, is in a 'critical location'?

Windows Any glazing or part of that glazing, which is between the finished floor level and a height of 800mm partitions, and above the floor level, is in a 'critical location'? (This includes any glass that can slide, tilt or move into glass walls the 'critical location'?)

CSG Cutting Capabilities

Equipment	Nos	Brand	Max Size (mm)	Min Size (mm)	Nominal Thickness (mm)
Cutting Machine	1	LISEC	3300 x 5000	100 x 150	3-19



CSG Edging Capabilities



CSG Drilling Capabilities

Equipment	Nos	Brand	Max Size (mm)	Min Size (mm)	Nominal Thickness (mm)	Hole Size
CNC Drilling Machine	1	Glass Man	2000 x 3000	500 x 500	3-30	-



CSG Tempering Capabilities

Equipment	Nos	Brand	Max Size (mm)	Min Size (mm)	Nominal Thickness (mm)	Standard
Tempering Line	1	North Glass	2440 x 3660	300 x 300	4-19 mm	AS / NZS2208
	1	North Glass	2440 x 6000	300 x 300	4-19 mm	AS / NZS2208
Heat Soak Test Furnace	1	North Glass	2500 x 6000	300 x 300	4-19 mm	EN14179

