CIVIC SHOWER SCREENS & WARDROBES

EXPLODING GLASS OVERVIEW

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TOUGHENED (TEMPERED) GLASS

GRADE A SAFETY GLASS

- Toughened Glass is designed to break into small blunt non-obtrusive particles to reduced the risk of injury in the event that the glass does break.
- Toughened glass offers greater strength than of ordinary glass of the same thickness.
- It is impact resistant in the centre but not on its edges.
- It also allows larger clear spans with minimum fixings.
- It is required to break into multiple small blunt non-obtrusive particles as per AS/NZS 2208-1996 (Safety glazing materials in buildings)
- Civic Shower Screens is audited annually and run **Fragmentation Tests*** daily to ensure that our glass is breaking in accordance with the Australian Standards and that for 6mm, 10mm and 12mm glass the minimum number of particles per square 50mm is 40 particles when broken.

*Reference AS/NZS 2208-1996 (Safety glazing materials in buildings) 3.3 Fragmentation Test, table 3.3 Fragmentation test - minimum particle count

Float Glass (annealed glass)

- If float glass is broken, regardless of its thickness it fractures into sharp, jagged pieces which can be very dangerous when broken.

All Shower screens must comply with Australian Standards AS/NZS 1288:2010 (Glass in buildings - selection and installation) and also AS/NZS 2208:1996 (Safety glazing materials in buildings).

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WHY DOES TOUGHENED GLASS SOMETIMES EXPLODE?

Exploding glass is a phenomenon by which toughened glass may spontaneously break (or explode) without any apparent reason.

The most common causes are

- Internal inclusions within the glass such as "**Nickel Sulphide Inclusions**".
- Binding of the glass in the frame which causes stresses to develop as the glass expands and contracts due to thermal changes of deflects due to wind,
- Thermal stresses in the glass,
- Inadequate glass thickness to resist wind load,
- Direct impact towards the outer edge of the glass.

NICKEL SULPHIDE INCLUSIONS

Nickel Sulphide Inclusion is a naturally occurring phenomenon in glass.

Sodium sulphate is added during float glass manufacture to promote bubble removal from the molten glass during the melting process. When combined with a nickel contamination, sodium sulphate forms nickel sulphide (NiS).

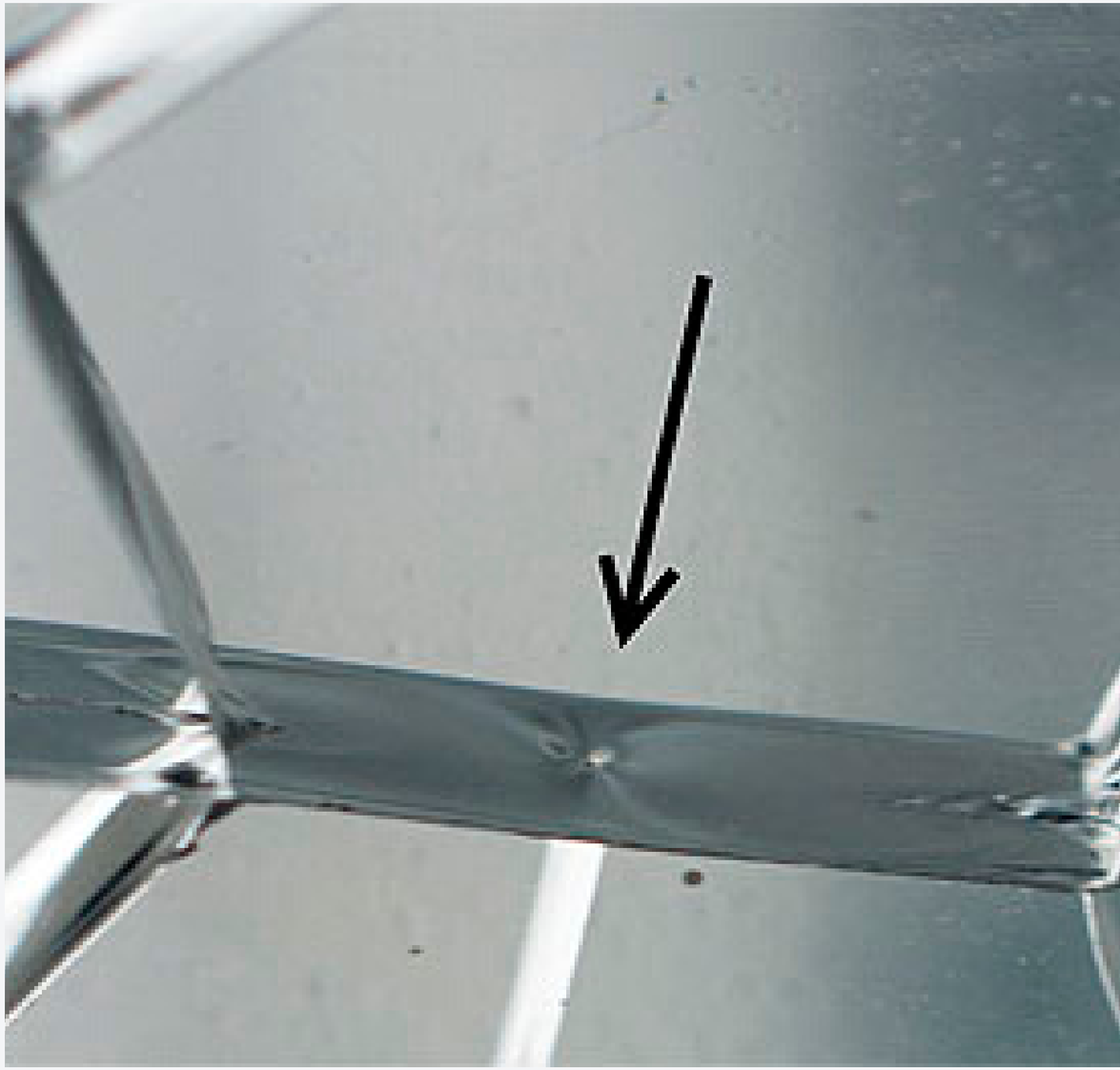
Nickel contamination while relatively rare can be caused by:

- an impurity in the raw materials;
- contamination during the storage and handling of raw materials;
- or contamination from the float line equipment, e.g. firebricks and burners.

During thermal toughening, these inclusions undergo a crystalline phase change to a smaller form and are fixed in place within the glass upon cooling. Over time the inclusions grow and can eventually impart enough stress in the glass to cause spontaneous failure.

The presence of nickel sulphide is quite rare approximately one ‘stone’ of nickel sulphide is present per 8 tonnes of raw glass (although it can come in batches). The incidence of nickel sulphide varies from manufacturer to manufacturer with estimates ranging from one stone per 8 tonnes of glass to one stone per 13 tonnes of glass and some suppliers having a more frequent incidence than this.

Reference - https://en.wikipedia.org/wiki/Nickel_sulfide_inclusion



WHAT EFFECT DOES NICKEL SULPHIDE HAVE ON GLASS?

During the manufacture of float (annealed) glass, the raw glass materials are heated to around 1100˚C and the nickel sulphide consequently reduces in size.

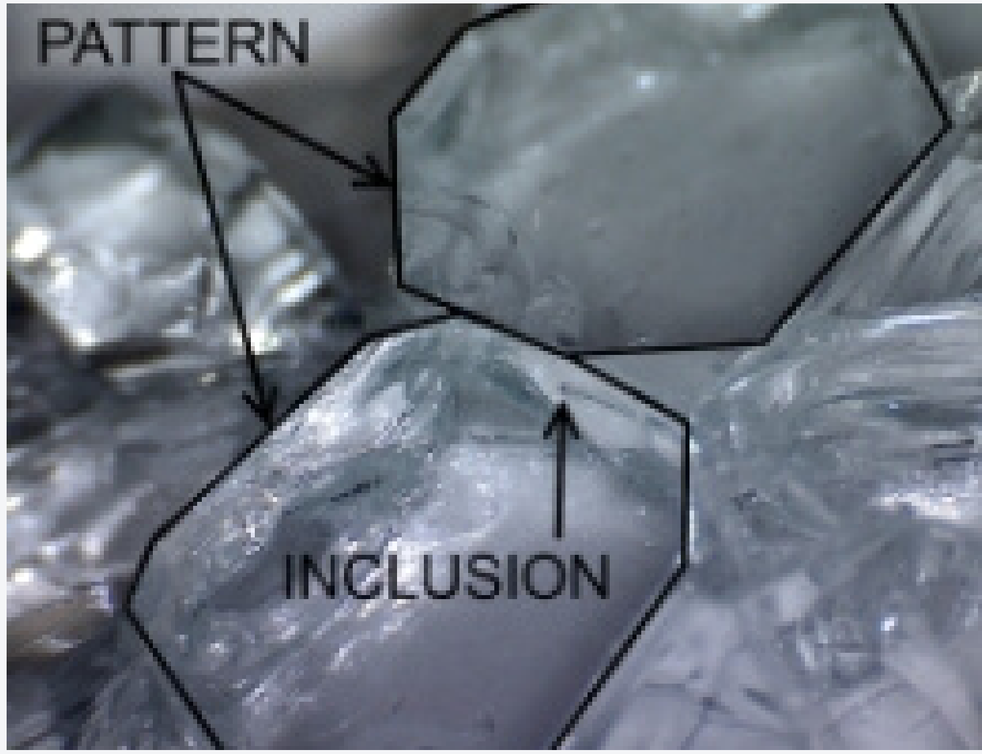
When the glass is slowly cooled during the annealing process, the nickel sulphide expands back to its original size. This expansion does not interfere with the properties of the glass. However, an issue arises if the glass is toughened.

Glass is heated to around 600˚C during toughening, and the nickel sulphide consequently decreases in volume. To create toughened **Grade A Safety Glass**, stress and tension is induced in the hot glass by rapidly cooling it. Unlike the slow cooling of annealed glass, this rapid cooling arrests the transformation of the nickel sulphide.

The nickel sulphide will expand to its original size over time. If this expansion occurs in the area of the toughened glass that is under tension, it will cause the glass to fragment.

DID NICKEL SULPHIDE INCLUSION CAUSE MY BREAKAGE?

One way to determine whether a glass breakage has been caused by Nickel Sulphide Inclusion is for a trained professional to look for the '**Butterfly Effect**' pattern on the glass. The implosion will centre around a singular point on the glass and will fan out in a butterfly wing formation. However, it can be difficult near impossible as generally the glass has fallen to the ground upon the event.



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BINDING IN THE FRAME

Glass expands and contracts with changes in temperature, so almost all modern glass is set on resilient blocks at the bottom and with space for expansion at the sides and top.

If no space is provided at the perimeter of the unit, the glass will bind against the frame, causing internal stresses to develop in the glass which can exceed the strength of glass resulting in breakage.

Due to movement in your home foundations this can add to the stresses on the glass and lead to excess binding in the frame.

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THERMAL STRESSES

With increased emphasis on natural day lighting and passive solar design, thermal stress-related glass breakage should be a concern.

When the center of a pane of glass becomes hotter than its edge, expansion of the heated glass center can create tensile stress around the edge.

If the thermal stress exceeds the edge strength, the glass can break.

Large insulated glass units (IGUs), particularly in combination with solar control coatings, require thermal analysis to avoid stress-related breakage.

Thermal modelling and design adjustments can be made during the design phase to reduce thermal stress-related spontaneous breakage.

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DIRECT IMPACT

While glass once toughen has greater tensile strength properties than float glass, it is however not as strong towards the outer edges of the toughen glass panel as it is in the centre of the panel. Any hard direct impacts may result in the toughened **Grade A Safety Glass** spontaneous exploding into small blunt non-obtrusive particles.

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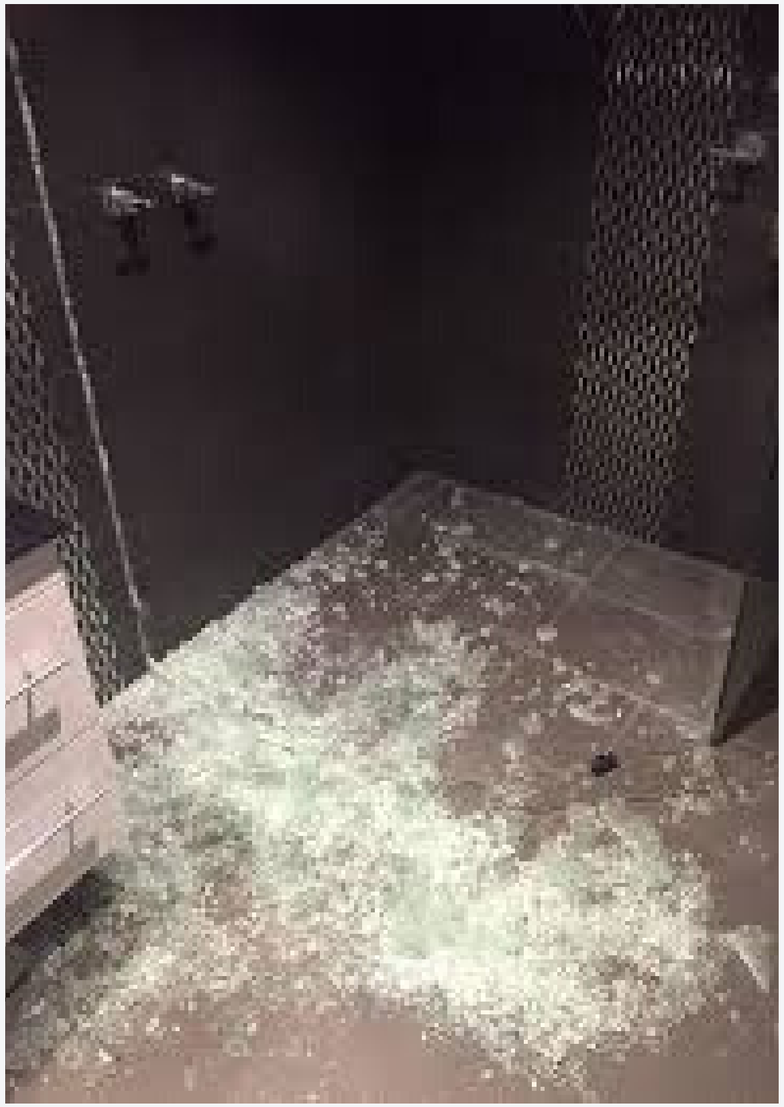
SOLUTIONS

Using Glass that meets and is audited to Australian Standards, especially imported glass.

To ensure toughened glass full fills its residential or commercial objectives long-term, it's important that those choosing to buy and install toughened glass do so knowing their glass meets Australian standards.

The chemistry behind toughened or tempered glass ensures it crumbles or explodes into tiny pieces, as opposed to breaking into larger, sharper pieces. This ultimately keeps users safe.



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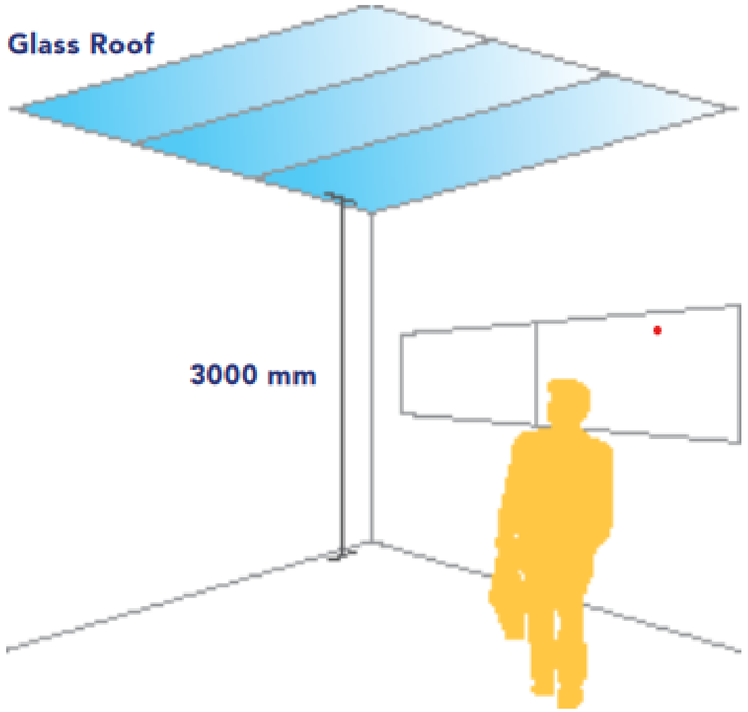
HEAT SOAKED GLASS

The heat soak test is based on reheating the toughened glass to an elevated temperature that accelerates the expansion in the nickel sulphide inclusions. This increases the probability that, if inclusions exist in the glass, the glass will break in the heat soak test rather than insitu. The heat soak process reduces the risk of the spontaneous breakage due to Nickel Sulphide inclusions but it does not guarantee the elimination of Nickel Sulphide impurities.

A new provision was included in the BCA 2010 Volume 1 Class 2 to 9 buildings to reduce the risk of glass breakages due to nickel sulphide inclusions.

Sloped overhead glazed assemblies more than 3 m above floor or ground level and all vertical glazed assemblies more than 5 m above floor or ground level, must incorporate measures (Heat Soak) to reduce the risk of breakages due to nickel sulphide inclusions. This applies to glass balustrade's and overhead glazing and not shower screens.

Due to the selection of glass and glazing required for the installation of shower screens in accordance with AS/NZS 2088:1996 heat soak glass is not required.



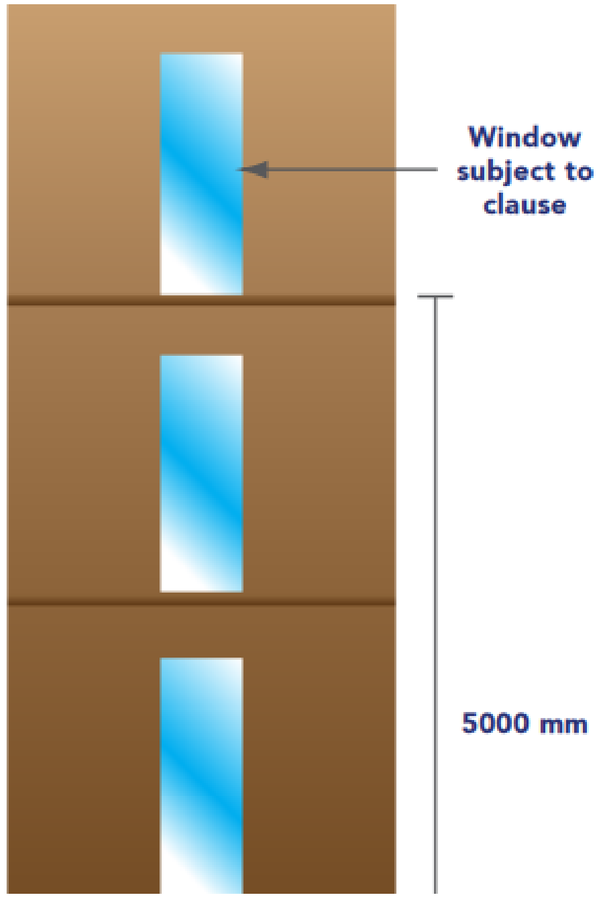


Image courtesy of the Australian Glass and Window Association (AGWA)

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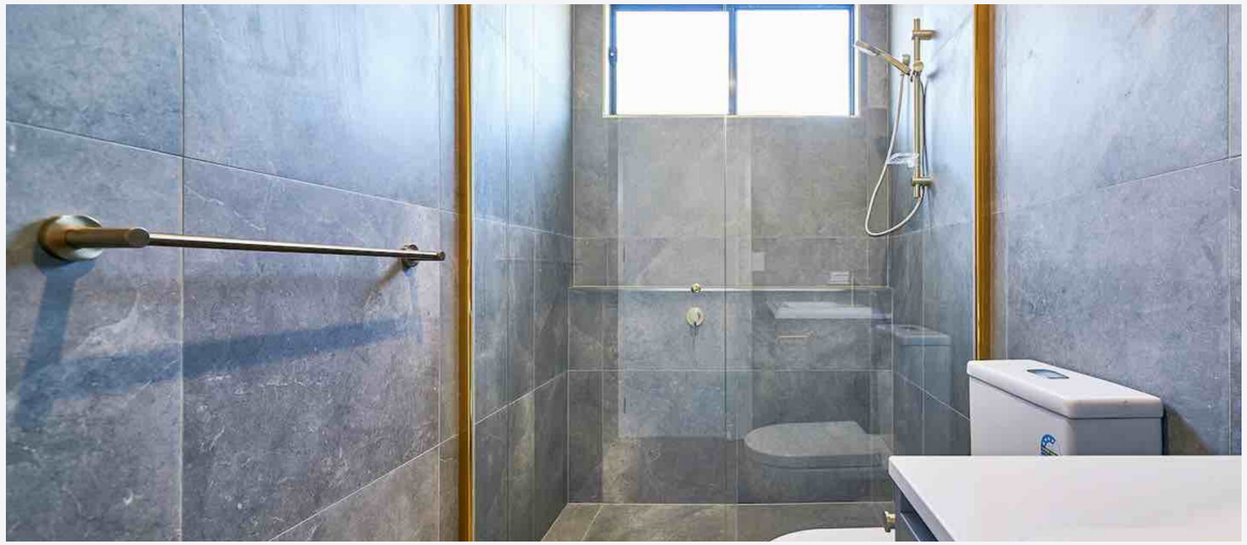
WARRANTIES

Nickel Sulphide Inclusions are a rare yet accepted anomaly within glass manufacturing. Our standard warranty is 12 months from date of installation and during this period our warranty covers spontaneous explosions caused by Nickel Sulphide Inclusions. If outside the standard warranty period Civic Shower Screens and Wardrobes will use its discretion on a case by case matter.

While the incidence of nickel sulphide inclusion varies from manufacturer to manufacturer with estimates ranging from one stone per 8 tonnes of glass to one stone per 13 tonnes of glass, here at Civic Shower Screens and Wardrobes we process over 20 tonnes of glass on a weekly basis and statistically speaking we should see at least 1-2 incidents of spontaneous explosion being caused by nickel sulphide inclusion however, historically we have under 1 incident per month.



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CONDITIONS

If a fault in the product during the term of warranty which is due to poor workmanship or materials, Civic will either repair or replace the product (at its discretion) at no charge to you, during normal working hours.

The warranty applies to the original residential purchase only and is not transferable. Satisfactory proof of purchase date must be furnished at the time of notification of defect for any claim under warranty to be enforceable.

A charge will be applied for a service call made where the Civic product is not faulty.

The warranty is in addition to and in no way limits, varies OR excludes any express or implied rights and remedies under any relevant legislation in the state or territory of sale.

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