Finance Technical Guideline

TG030 Glass Panels in Government Buildings

1. Purpose

This guide assists with the selection and in stallation of glass panels for Finance-procured non-residential government buildings.

2. Background

Glass panels are used in numerous glazin g applications, including building cladding, skylights, screens, doors, and windows. Fa ilure of glass pane ls and subsequent replacement or rectification, including te mporary safety measures, may be litigious, unbudgeted, and expensive.

Spontaneous fractures in two trafficable gl ass panels at NIB stadium in 2016 were caused by nickel sulphide (NiS) inclusions within the high temperature treated glass.

NiS crystals occur in two states, one at high temperature and the other at low temperature. In normal glass manufacture, these crystals transform evenly as glass slowly cools, and poses no problems. Howe ver, with high temperature treatments like toughening, some NiS crystals may be trapped in their high temperature state within the glass. The NiS inclusions will expand back to original size over time and can cause spontaneous fracture and failure.

Toughened glass may be expected to cont ain one NiS inclusion per 500 tons of

Please note that NCC 2019 Amendment 1 referenc es AS1288-2006, while NCC 2022 references AS1288-2021. When being certified against NCC 2019 Amendment 1, adoption of the newer st andard should be considered through a performance solution.

Finance requires all toughene d glass panels proposed in lo cations where failure will place people at risk and/or compromise the security of the building, to be heat soaked to reduce the risk of fracture. A cer tificate of heat soaking is to be provided before the glass is incorp orated into the works.

3.1. External use

Glazing design and selection is required to undergo a "thermal stress assessment" to ascertain whether heat strengthening or heat soaking, as applicable, is required to avoid cracking. Depending on the elevation and the effect s of shade on the glass, excessive stresses from hot and cold parts on glass panes need to be counteracted by heat strengthening glass in order to avoid thermal stress cracking.

For applications where additio nal glass strength is requir ed for thermal stress, and s nor t9oe2 Twor t9oe[(to or t9ommot9o [(b need toto the w5(s)1.5(requir)2.2(-1. TD .0001cessive

be laminated using an ionoplast interlayer. Use of handrails incorporated into internal glass balustrades shall be considered to provide additional strength, stiffening and support.

3.3. Shop drawings

Glazing shop drawings shall be submitted with the framing and marking shop drawings for approval by the Superintendent's Representative prior to commencement of any fabrication.

Marking shop drawings shall include all items noted in 4.4 Glass Identification and shall detail their proposed location on the glass and its proximity with the framing, demonstrating that it will not be blocked by the framing.

3.4. Glass identification

All safety glazing panels are required to be legibly and permanently marked on each individual panel. Markings can be acid etched, sand blasted, ceramic fired embossed or similar agreed type that cannot be removed. Markings shall be visible on the glass and not be blocked by the framing.

The markings shall include the following information as per AS1288:

- Name, registered trademark or registered number of the manufacturer or supplier.
- Code or words indicating type of safety glazing material (e.g. T or the word Toughened for toughened safety glass, or L or the word Laminated for laminated safety glass).
- The standard to which the safety glazing has been tested and manufactured (e.g. AS/NZS 2208).
- A letter indicating the grade of standard safety glazing (e.g. A for Grade A or B for Grade B).
- A number to indicate nominal thickness for the glazing material.

Additionally, for all Finance projects, the following information must also be included in the markings:

- Type and supplier of interlayer being used.
- Annealed glass to have marking "Annealed glass".
- Heat soak testing must be noted where toughened glass has been heat soak tested.
- Low-E coating and / or body tint supplier designation product code.
- For double glazed units where one lite is Grade A and the other lite is not, the marking must include information on both lites.

- Year of manufacture.

Marking drawings shall be submitted for approval with the glazing and framing shop drawings prior to commencement of any fabrication.

Evidence of compliance, including provision of certifications from the glass manufacturer, is to be submitted as part of the Certificate of Construction Compliance requirements.

The glazing specification clauses shall be amended by consultants to include the above additional glass identification requirements.

3.5. Façade Engineer

A specialist façade engineer is required to be engaged for all significant projects that have glazing extending over two or more storeys. They shall provide:

- Design,
- Detailed documentation,
- Specification,
- Certification and site superintendence

of all glass facades, doors/windows glass and frames, considering all wind, dead and live loads.

For all multistorey buildings or glazing that extends over two or more storeys, the shop detailing submission shall be endorsed by the façade engineer, via the Superintendent and the Principal's Representative, before proceeding with procurement.

The façade engineer is required to certify that the specified glass and interlayer(s) have been incorporated into the constructed works. This certification is to be submitted as part of the Certificate of Construction Compliance documentation.

3.6. Glazing specification

Glazing design needs to be fully considered based on project location, live, dead and wind loads. A glass manufacturer can be nominated however, consultants are required to allow for equivalent quality alternatives to be submitted by the Contractor for approval.

The design and documentation are required to show:

- How the glass is held in the frame,
- Edge frame details,
- Type of structural silicone proposed.
- The specified glass types, thickness, manufacturer and origin,

Level 1 or above – external: window	Where safety glass required – laminated heat strengthened glass	Consider fixing of glass – fully framed, structural silicone fixed etc.
Level 1 or above - internal doors	Monolithic toughened glass	Laminated glass should be used where security is a consideration. Safety glass required.
Level 1 or above - internal window	Laminated heat strengthened or toughened glass where located over an internal void 1 level or greater in height.	Consider acoustics.

5. Definitions

5.1. Annealed glass

Molten glass is 'floated' over molten tin and slowly cooled down in an annealing chamber to release residual internal stress and strains. The glass can be tinted, patterned, etched or formed (slumped) and/or further processed into heat strengthened, toughened, or laminated glass. Annealed gl ass breaks into long fragments with sharp edges which can cause si gnificant injury. It is typically used when strength or safety is not a concern.

Also known as "float glass" or "non-tempered glass".

5.2. Safety glass

Safety glass is relatively resistant to breakage comp ared to ordinary annealed glass, and will not fracture into dange rous shards when broken, thereby reducing the risk of personal injury.

Safety glass can come in Grade A or Grade B safety glazing materials tested to AS/NZS 2208. Grade A typically is toughe ned, laminated, or is organically backed glass, and has a higher pe rformance level than Grade B. Grade B safety glass is typically wired (re inforced) glass.

Grade A safety glass is required in areas subject to high risk of breakage through human impact. This includes gymnasiums, s wimming pools, halls, and public viewing galleries. Parts of schools also require Grade A safety glass where the glazing is within 5000mm of areas where activ ities are related to play grounds, courts, playing fields unless otherwise protected by a permanent barrier.

Toughened (tempered) glass

Toughened glass is a type of safety gla ss that is produced from heating annealed glass to approximately 600 ^{o}C, then force cooling it to create surface and edge compressions. The cooling process is ac celerated to create higher surface

compression and /or edge compression in the glass. The process makes the glass four to five times stronger than annealed glass and is less likely to experience a thermal break.

Heat-soaked glass

Heat soaking is a prolonged process that involves heating toughened (tempered) glass to approximately 290 °C to accelerate nickel sulphide (NiS) expansion. The process causes glass containing nickel sulphide inclusions to break in the heating chamber, thus reducing the risk of potential breakage on site. Heat soaking needs to be undertaken in accordance with EN 14179-1:2005 and certificates of compliance are required to be provided.

Laminated glass

Consists of two or more sheets of glass permanently bonded together by a plastic or resin interlayer. Although laminated glass will break on impact, the fragments are held by the interlayer, reducing risk of injury, and resisting penetration.

Interlayers

The standard and minimum interlayer is 0.38mm thick, but it is also available in 0.76, 1.14 or 1.52mm. All interlayer thicknesses pass the Grade A safety glass test. The two most common interlayer types are:

- Polyvinyl butyral (PVB) – standard interlayer that tends to soften when used on the roof.
- Ionoplast – specialised structural interlayer 5 times stronger and 100 times greater rigidity than a standard PVB laminated glass interlayer. It is better known as SGP or SentryGlas® Plus, a proprietary product.

There are also less common interlayers, such as ethylene vinyl acetate (EVA) that is mainly used for internal glazing, and security PVB interlayers that retain their integrity even after repeated strikes from heavy objects.

5.3. Low emissivity glass (Low-E)

A special thin metal coating is applied to one side of the annealed glass to reduce temperature transfer. Coatings consist of

controlling the environment, such as, limitin g instances where the glass is partially shaded or viewing the glass against dark backgrounds.

Low-E glass requires spec ial maintenance in order to not damage the coating.

Low-E glass can also be made into safety glass.

5.4. Heat strengthened glass

Annealed glass is heated to approximately 650 °C, then force cooled to create surface and edge compressions. Heat st rengthened glass is approximately two times stronger than annealed glass. The cooling process is slower than toughened glass, which results in a lower compressive strength.

Unlike toughened glass, heat strengthened glass is not considered a safety glazing material as it forms large pieces when bro ken. However, heat strengthened glass has a much lower potential for spontane ous breakage than heat-soaked toughened glass.

6. References

AS1288 - 2006 Glas s in buildings.

AS1288 - 2021 Glass in buildings.

AS/NZS 2208 - 1996 Safety glazing materials in buildings.

AS/NZS 2208 - 2023 Safety glazing materials in buildings.

AS 1428.1 - 2009 Design for di sabled access and mobility.

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