Technical Bulletin

1008 – Inspection of Glass Faults

March 2022 - V1.0

Australian Glass Group®

TB 1008 – Inspection of Glass Faults

Cited National Standards:

- **AS/NZS 4667**: Quality Requirements for cut to size and processed glass
- **AS 4666**: Insulating Glass Units

Introduction

Glass for buildings supplied and installed in Australia is almost exclusively manufactured using the float process and is known as 'float glass'. This process results in extremely flat surfaces with few imperfections. This glass can then be cut/drilled/polished/heat treated/laminated/made into an insulated glass unit or a combination of all to result in the end product.

Customer Expectations

Most customers expect glass to be perfect; free of any marks/scratches/bubbles etc. and completely transparent. However, glass is not perfect and defects can be present as well as issues caused by the multiple handling of glass from the initial float process to installation on site. This Technical Bulletin serves to help customers and consumers understand what is considered an allowable defect based on relevant Australian Standards used by the glass industry and how to inspect glass once installed.

Relevant Quality Standards

AS/NZS 4667 is the applicable standard for individual panes of glass, whereas **AS 4666** is applicable to insulated glass units (IGU) only. An IGU will be manufactured to both standards, the glass panes themselves to **AS 4667** and the construction/composition of the IGU to **AS 4666**. Both of these standards are production standards for use by glass processors. Glass Processors have inspection criteria, which are to be undertaken specifically in controlled conditions inside the factory before the glass is despatched to site. This Technical Bulletin will include guidance on how to inspect glass on site, based on these criteria.

AGG NSW
140 Gilba Rd
Girraween, NSW
P: (02) 9896 0566
F: (02) 9896 0190

AGG VIC
81-83 Rushdale St
Knoxfield, VIC
P: (03) 9730 7400
F: (03) 9730 7488

AGG TAS
39 South Arm Rd
Rokeby, TAS
P: (03) 6247 1625
F: (03) 6247 6843

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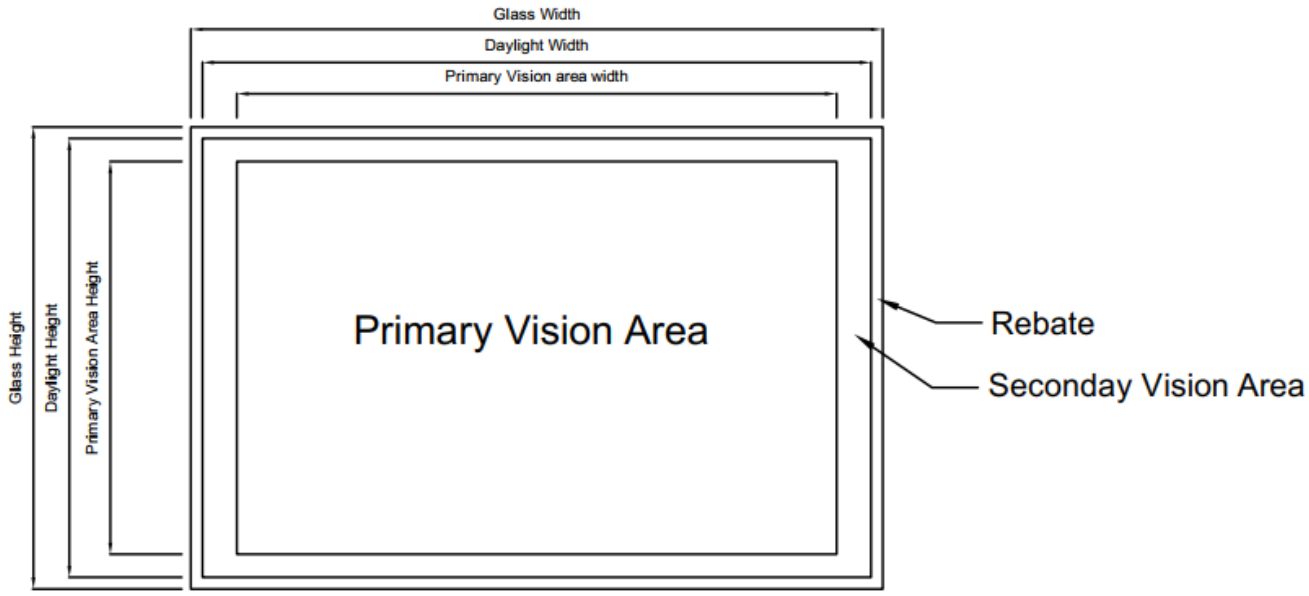
Inspection of Glass

Glass inspection should be carried out as early as reasonably practical following installation or supply. Prior to inspection, ensure glass is cleaned in accordance with manufacturer's recommendations, the surface of the glass is free of moisture and glass is being examined in natural daylight but *not in direct sunlight.*

During inspection, the very edges of glass that will be inside the rebate (frame around the edges) is ignored as it will be hidden from view by the frame. The visible glass size is referred to the daylight size, and is split into two areas: Primary and Secondary vision areas. The secondary vision area is defined as an outer strip forming 10 to 15% of the total daylight size as per **AS 4666** tables 5.5 and 5.6. The remaining central section of the glass is the Primary vision area.



1. **View glass from a distance of 3m inside the room whilst facing square on to the glass.**
2. **Maximum viewing time of 60 seconds.**
3. **Any scratch or bubble visible in the primary vision area following points 1 and 2 above is a defect.**

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What is not considered a defect?

There are multiple phenomena that occur as a result of manufacturing processes and are not considered to be defects. These phenomena do not occur every time and can be minimised or prevented by avoiding specific glass types & compositions on a situational basis. Contact AGG for further assistance.
These phenomena are listed & explained below

- Anisotropy
- Haze
- Roller wave
- Edge kink
- Newton's Rings
- Brewster's Fringes
- Preferential Wetting

Anisotropy

Anisotropy is when the surface of heat treated glass appears to have light and dark patches when polarised light is reflected from it. It is caused by the tempering process and is most commonly noticeable when wearing polarised sunglasses or in specific lighting conditions. Anisptropy is an inherent property of tempered glass and therefore is not considered a defect. The effect can also be more noticeable in an IGU with multiple panes of tempered glass.

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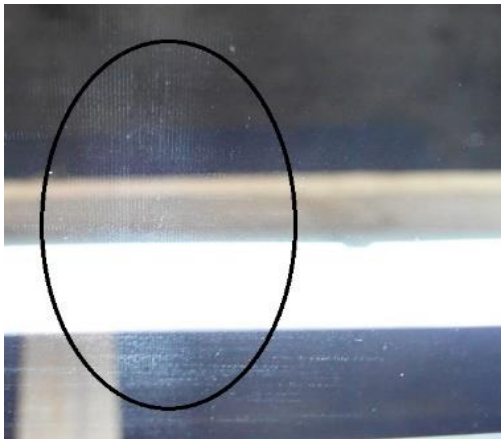
Haze

Haze is a light milky visual appearance in the glass when visible light contracts the glass. Most light passes through the glass, the rest is either reflected, absorbed or scattered. If enough light is scattered then the glass will have a light, milky appearance. Haze is present in all forms of glass, but is not noticeable to the human eye in most glass types. Haze can be noticeable on Hardcoat LowE coated glass. Local lighting conditions compared to background lighting also contribute to how visible haze will be. Haze can appear blue with some coatings, and is very dependent on light intensity and the angle at which light hits the glass. As such, haze can be visible during some times of the day but not others. As haze is an inherent property of all transparent material, it is not considered as a defect. See our **Risk of Haze Guideline** for more detail.

Haze in Hardcoat LowE



Roller Wave

To toughen glass in a furnace, glass is heated to temperatures in excess of 600°C and becomes soft. The glass is resting on oscillating ceramic rollers of the furnace at this point, so it can take on a slight wave like shape between the gap of each roller. It is then cooled down or 'quenched' by cooler air. As the glass is now cooled, it will retain any wave pattern and is no longer as flat as it was before being in the furnace. Roller wave is more noticeable on reflective or tinted glass. Although not listed in **AS/NZS 4667** or **AS 4666** as a defect, AGG have our own internal quality procedures to keep roller wave to an appreciable minimum.

Roller Wave

AGG NSW

140 Gilba Rd
Girraween, NSW
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F: (02) 9896 0190

AGG VIC

81-83 Rushdale St
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The above image is an extreme occurrence of roller wave, under normal circumstances roller wave is difficult to see when orientated horizontally and only stands out when the wave pattern is vertical. Therefore, AGG recommend roller wave is orientated horizontally so it will not be noticeable when walking past the glass. This is why glass dimensions of height and width are not interchangeable when ordering glass, as this will determine how glass is orientated on the furnace bed prior to tempering.

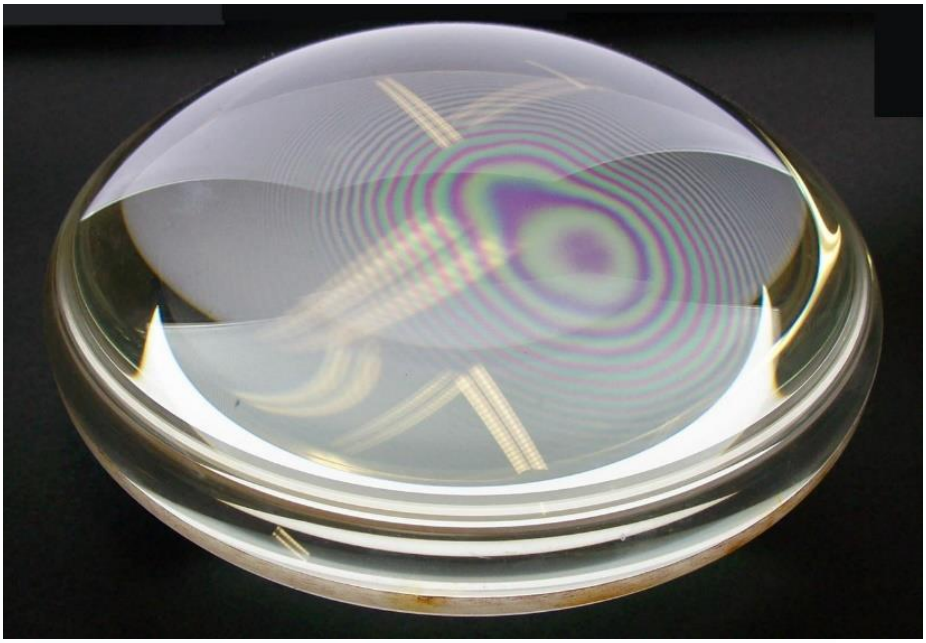
Edge Kink

Edge kink is similar in appearance and cause to roller wave, but only occurs at the edge of heat treated glass. As with roller wave mentioned previously, edge kink is more noticeable in reflective or tinted glass, and is not listed in **AS/NZS 4667** nor **AS 4666** as a defect. AGG have our own internal quality procedures to keep edge kink to an appreciable minimum.

Newton's Rings

An IGU is a flexible pressure vessel and under the right conditions the difference between the air (or gas) pressure inside and outside the IGU can cause both glass panes to deflect towards each other. When they get quite close, rainbow patterned circles can appear on the glass surface, centred on where the gap between the panes is the smallest. These patterns are caused by the varying refraction angles in the surfaces of the glass panes, and is not considered a defect. They can also occur under specific wind pressures. The chance of Newton's rings occurring is reduced by specifying thicker glass, which lowers deflection in each glass pane.

Newton's Rings



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Brewster's Fringes

Much like Newton's Rings, Brewster's Fringes are the result of light reflecting off glass. However, they are not caused by glass deflecting, rather by multiple light sources from different angles. As such, they present as rainbow lines but with a much more random pattern than what is seen in Newton's Rings. They are not considered a defect as they are caused by foreign light sources.

Preferential Wetting

Preferential wetting is a side effect of using certain lifting aids such as vacuum suckers to move glass panes, and become visible when the glass is wet. These devices do not leave a residue on the glass but do change the surface conditions. This alters the amount of friction available on that spot and alters how water behaves when in contact with the glass. These patterns fade over time and do not change the performance of the glass. They are not considered a defect.

Multiple Reflections

Every glass pane will reflect a certain amount of light that touches it, how much is determined by the glass type such as tinted, coated or reflective glass. When looking though a double glazed unit, there will be two reflections. This is most noticeable when appreciating a view of city lights from a nearby hill. Reflection and refraction are natural properties of all transparent materials and therefore are not considered a defect.

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