

SPECIALIST GLASS PRODUCTS LTD.

Curved Glass

General notes

Glass specification

For any glass supplied by SGP, a project specific specification has not been carried out by us, this responsibility lies solely with the customer. Where the specification is changed by SGP this is due to manufacturing capabilities and is not a substitute for a structural report, any changes must be checked and approved by the customer.

Lead times

During the process of glass bending, failures and/or breakages can sometimes occur, **lead times are given in good faith** but the postponement of delivery dates indicated by us cannot be ruled out, and should be taken into consideration when placing orders.

We will not accept costs, claimed for, due to late delivery.

Curvature

Curved panels will always fit into a drawn envelope constructed from the curved tolerance of +/- half the thickness of the glass e.g. 6mm toughened bend would fit into an envelope of 12mm. **see fig 1. Pg 6.**

For bends over 90°, C/H and A/O Types the tolerance is double that of the drawing. If in doubt please contact a member of the team.

Torsion

Torsion is measured with the glass laid flat on its straight edges and under its own weight and measured at +/- 5mm per meter along the straight edge

Squareness

Squareness is measured by comparison of diagonals:

Up to 2000mm Tolerance = +/- 4mm

Over 2000mm Tolerance = +/- 5mm

Drawings/CAD

For any shaped glass Specialist Glass will require fully dimensioned drawings, ideally in CAD or DXF format.

Templates

Any templates supplied to SGP should be exact finished sizes and any holes or cut outs in the correct position.

All templates sent to SGP should be clearly labelled with customer name and contact and a reference number where applicable.

Where possible SGP will return the templates with the finished product.

Cut outs

If glass has an internal cut out or internal corners then a minimum radius will be applied to said corner/s. The finish will be either 6mm for a ground finish or 13mm for polished finish.

Please state which you require at order stage.

Misalignment

Edge slip of up to 3mm between glass components is acceptable.

Corners

When glass is processed with a polished edge the corners will be sharp, this sharpness can be removed by applying a further process of dubbed or Radius corners.

A preference should be specified at order stage, if no request is made the corners will be sharp or dubbed depending on processes.

Standard (Sharp) Corners:



Dubbed Corners*:



* Please note dubbed corners are a hand process and will be a dull finish.

Radius corners:



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Back painted / Ceramic Glass

Standard clear glass carries a slight green tint; this can affect the colour of any paint or ceramic applied. SGP recommended the use of Low Iron glass for these products.

Please provide a RAL number, Dulux or Pantone code.

All colours supplied are 'closest possible match' the colour match is not guaranteed. The colour can also vary from batch to batch.

Colour sample approval is recommended.

Annealed & Annealed Laminate Curved Glass

Radius

Annealed glass can be curved to achieve much smaller radii than toughened bends, they can also be curved with flat sections i.e.: Hockey stick

Please send your enquiries to SGP for consideration.

Please see the attached sheet for curved types and description.

Angle

Annealed bends can be processed to an angle over 90° however this is dependent upon the thickness and radius required.

When bending glass over 90° the optical quality can be affected.

Polishing

Annealed & annealed laminate bends are polished by hand, the quality of this polish is to a high standard. However it is visually different to a machine polish.

Holes

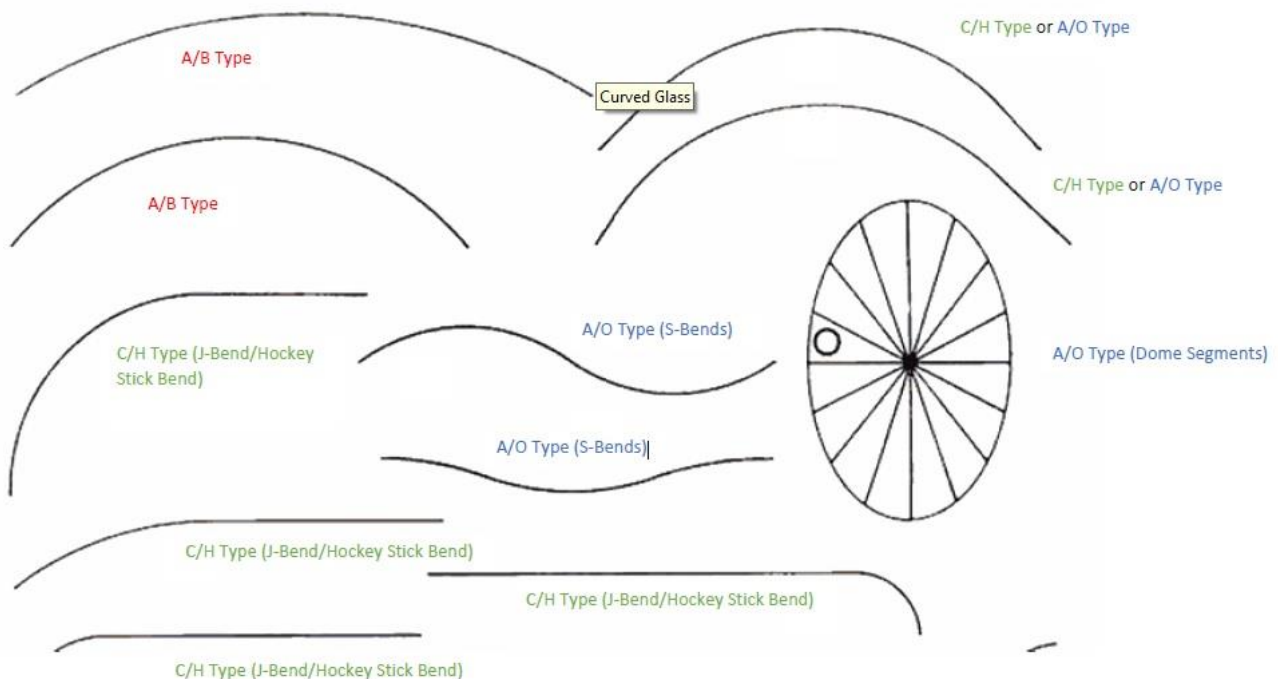
Specialist Glass do not recommend the use of holes in annealed or annealed laminate curved glass due to the high risk of breakage.

If holes are nevertheless required, the risk of breakage must be borne solely by the client.

A/B Type Bends = True Radius only (max 90° Angle) NB: These are the only type of bends suitable for toughened glass, depending on radius.

C/H Type Bends = Curve & flat or curved with multiple radius'

A/O Type bends = S shaped, Dome segments or Multiple radius'



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Toughened Curved Glass

Radius

The below table shows minimum & maximum radius requirements on toughened bends 4mm-10mm Thickness; **these are provided as a guide only** and any requirements outside of these including glass thicknesses 12mm & above should be sent to SGP for consideration.

Furnace	Maximum Girth	Minimum Girth	Maximum angle	Minimum Radius
Small	1100mm	300mm	90°	450mm
Medium	2500mm	450mm	90°	880mm
Large	3200mm	300mm	90°	1500mm

Angle

As a guide toughened bends can be curved to a maximum angle of 90° however this can vary depending on thickness and radius, please refer to SGP for confirmation.

Flat areas

It should be noted all toughened curved glass will have small flats areas to the ends of the curve, where this may be a problem please discuss prior to placement of any order. The presence of these flats will not be accepted as reason for rejection; so long as the glass conforms to the overall curvature tolerance described above.

Polishing

Polishing on toughened bends is done on either straight line edge polisher or CNC, this varies depending on shape of the glass, there is a marginal difference in finish, but both are to a high standard. Please advise at order if you require a specific finish.

Standard Polish:



CNC Polish:



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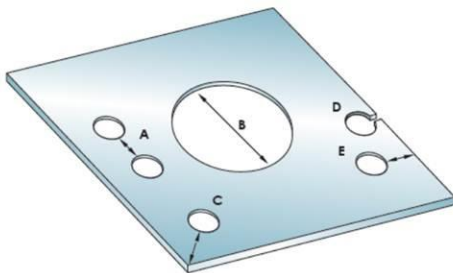
Holes

The position of holes is critical in toughened glass.

- A: The distance between holes must be a minimum of 4 x thickness of the glass
- B: Diameter of the holes must be at a minimum, equal to the thickness of the glass.
- C: Dimension from corner of the glass to edge of hole must be no less than 4 x thickness of the glass.
- D: For a hole that is positioned closer than the recommended distances a saw cut is made to minimize the stress and chance of breakage.
- E: Dimension from the edge of glass to edge of the hole must be no less than 1.5 x thickness of the glass.

Tolerance for position will be between +/- 1mm & +/- 3mm depending on glass thickness.

Hole Guidelines for Toughened Glass



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Nickel Sulphide Inclusions

On rare occasions, Toughened glass can break spontaneously, without any applied load, due to small Nickel Sulphide inclusions that may be present in all float glasses. These breakages can occur months or even years after manufacture.

Carrying out Heat Soak testing to the glass can reduce the risk of spontaneous breakage however this is not 100% guaranteed.

Any spontaneous breakages are not covered by SGP warranty.

Approval

When ordering curved glass please indicate if your measurements are Internal, External or Centerline.

Please indicate if the face viewed is concave or convex.

Full drawings should be supplied for any holes/cut outs and this should also state concave or convex.

SGP will produce a checking sheet for customer approval, this should be thoroughly checked and signed.



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Curved Double Glazed Units

Edgework

Our toughened double glazed units are produced with ground edges as standard, polished edges can be supplied upon request. Our annealed units are not edge treated.

Visual Quality Standard for installed insulating glass units constructed from flat transparent glass.

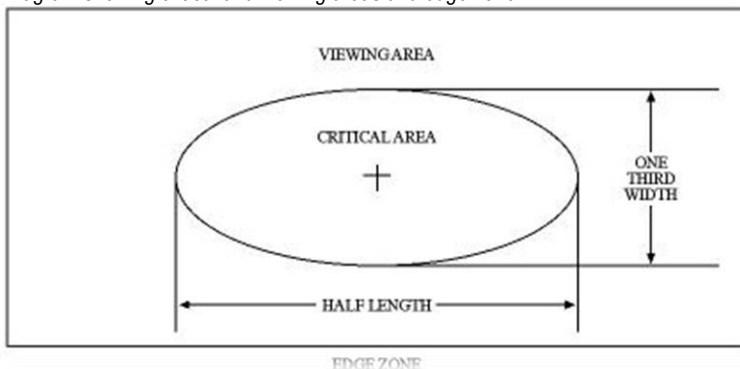
As used by Pilkington and the Glass and Glazing Federation and accepted as the standard for the inspection of flat glass, Specialist Glass Products Ltd., products to be inspected using the same criteria as toughened products.

1. Transparent glass used in the manufacture of insulating glass units is identical to that used traditionally for single glass and will therefore, have similar level of quality.
2. Both panes of the sealed unit shall be viewed at right angles to the glass from the room side standing at a distance of not less than 2 meters (but for toughened, laminated or coated glasses not less than 3 meters) in natural daylight and not in direct sunlight with no visible moisture on the surface of the glass. The area to be viewed is the normal vision area with the exception of a 50mm wide band around the perimeter of the unit.
3. Flat transparent glass, including laminated or toughened glass, shall be deemed acceptable if the following phenomena are neither obtrusive nor bunched: totally enclosed seeds, bubbles or blisters; hairlines or blobs; fine scratches not more than 25mm long; minute embedded particles. Obtrusiveness of blemishes shall be judged by looking through the glass, not at it, under lighting conditions as described in 2.
4. When thermally toughened glass is viewed by reflection, the effect of the toughening process may be seen under certain lighting conditions. The visibility of the surface colouration or patterns does not indicate deterioration in the physical performance of the toughened glass. Because of the nature of the toughening process, distortion will be accentuated when the glass is viewed in reflection or incorporated in insulating glass units.
5. Visible double reflection can occur under certain lighting aspect conditions, especially when viewed from an angle. This is an optical phenomenon arising from multiple surface reflections in sealed units.
6. The manufacture of flat laminated glass does not usually affect the visual quality of the glass incorporated in insulating glass units. However the faults generally accepted in paragraph 3 may be increased in number if several glasses and interlayers are used in the production of laminated glass. When viewed under certain light conditions, insulating glass units incorporating clear or tinted flat laminated glass may show a distortion effect caused by reflection on the multiple surfaces of the components of the laminated glass.
7. Brewster's Fringes the appearance of the optical phenomenon known as Brewster's Fringes is not a defect of the glass, and can occur with any glass of high optical and surface quality. This phenomenon is a result of the high quality now being achieved worldwide by modern methods of glass manufacture. Brewster's Fringes occur if wavelengths of light meet up with each other when they are exactly 180° out of phase – an example of the phenomenon known to physicists as the interference of light. The effect is similar to, although usually much smaller than the interference fringes which can sometimes be seen on toughened glass windscreens. Brewster's Fringes occur when the surfaces of the glass are flat and the two panes of glass are parallel to each other, i.e. when the light transmission properties of the installation are of a very high order. This phenomenon is not a defect of the product, being dependent on the laws of physics and not on the quality of the insulating glass. In fact it arises because modern glass made by the float process is flat, therefore, free of the distortion inherent in sheet glass.

The occurrence of Brewster's Fringes is in its nature rather like (though very much more than) the fact that under certain conditions, the observer will see a reflection of himself in any window or door and no-one could claim that this was a defect of glass.

NOTE: Patterned Glass – the above criteria do not apply to patterned glass as, due to the method of manufacture, imperfections such as seeds, bubbles are deemed to be acceptable.

Diagram showing critical and viewing areas and edge zone



Viewing area

1. Scratches and sleeks not visible from 2 meter viewing distance acceptable.
2. Bubbles and inclusions not greater than 2.0mm at least 150mm apart acceptable.
3. Occasional white scars near to edge zone acceptable.

Critical Area

1. Fine scratches and sleeks not visible from 2 meters acceptable.

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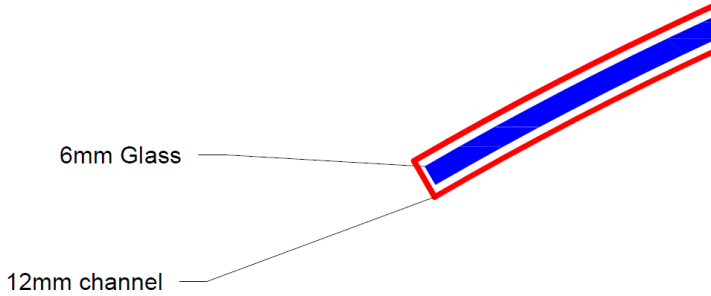
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- 2. Bubbles and inclusions up to 1.5mm at least 150mm apart acceptable.
- 3. No white scars permitted.

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Fig 1:



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