SPECIALIST GLASS PRODUCTS LTD.

Toughened Curved Glass

<table>
<thead>
<tr>
<th>Furnace</th>
<th>Glass Thickness</th>
<th>Maximum Girth</th>
<th>Maximum Height</th>
<th>Minimum Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5mm – 19mm</td>
<td>2550mm</td>
<td>3250mm</td>
<td>1000mm (may increase on thicker glass, subject to shape etc.)</td>
</tr>
<tr>
<td>2</td>
<td>6mm – 15mm</td>
<td>2400mm</td>
<td>4200mm</td>
<td>1500mm</td>
</tr>
<tr>
<td>3</td>
<td>6mm – 15mm</td>
<td>4200mm</td>
<td>2500mm</td>
<td>2500mm</td>
</tr>
</tbody>
</table>

Annealed / Laminated Curved Glass

- Maximum Angle 180°
- Please note that on bends above 90° optical quality may be affected.

Tolerances for Toughened, Annealed and Laminated Curved Glass

<table>
<thead>
<tr>
<th>Glass Thickness</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm – 12mm</td>
<td>+/- 3mm</td>
</tr>
<tr>
<td>15mm</td>
<td>+/- 4mm</td>
</tr>
<tr>
<td>19mm</td>
<td>+/- 5mm</td>
</tr>
</tbody>
</table>

Squareness

Squareness is measured by comparison of diagonals
- >2000mm – 4mm
- 2000mm> – 5mm

Edgework

All thicknesses of glass can be produced with the following edgework options:
- Arrised
- Ground
- Polished

Holes

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Diameter Tolerance</th>
<th>Step Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm – 49.5mm</td>
<td>+/- 0.5mm</td>
<td>+/- 1mm</td>
</tr>
<tr>
<td>50mm – 99mm</td>
<td>+/- 1mm</td>
<td>+/- 1mm</td>
</tr>
</tbody>
</table>

- Diameter of holes must be equal to thickness of glass
- Hole Positions:
  - Measurement from the edge of glass to edge of hole must be no less than 1.5 times the thickness of the glass
  - Measurement from the corner of the glass to the edge of hole must be no less than 4 times the thickness of the glass.

The tolerance for the hole centre position will be between +/- 1mm and +/- 3mm dependent on the glass size and thickness.

Torsion

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

Edge Straightness

+/- 3mm per meter

Strength

On Toughened bends the strength of the material is 5 times that of the equivalent thickness in annealed material.

Thermal strength

Annealed Material withstands temperatures of up to 40° C compared to 300° C for toughened material. Likewise Toughened material unaffected by sub-zero temperatures.

Curvature

Curved panels will always fit into a drawn envelope constructed from the curved glass tolerance of +/- half the thickness of the glass e.g. 6mm curved would fit into an envelope of 9mm.

It should be noted all Toughened curved glass will have small flat areas to the ends of the curve, where this may be a problem please discuss prior to the placement of any order.
Tolerances for Curved Double Glazed Units

<table>
<thead>
<tr>
<th>Glass Thickness</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm</td>
<td>+/- 2mm</td>
</tr>
<tr>
<td>8mm &amp; 10mm</td>
<td>+/- 2mm</td>
</tr>
<tr>
<td>12mm &amp; 15mm</td>
<td>+/- 2mm</td>
</tr>
</tbody>
</table>

**Squareness**
Squareness is measured by comparison of diagonals
- >1000mm - 4mm
- 1000mm > - 5mm

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

**General Bow**
+/- 3mm per Metre.

**Edgewor**
Our double glazed units are produced with ground edges as standard, polished edges can be supplied upon request.

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

General Notes

CNC / Drawings & Templates
Specialist Glass Products Ltd is fully equipped with AutoCAD, we can use customer DXF drawings to process the glass, alternatively we can take the information required from your template or sketch and create a DXF.
Templates should be provided to actual glass sizes and any holes / cut outs etc. should be indicated accurately. Specialist Glass will not amend templates; if amendments are required we will ask for the customer to resend a new template.

Processing
When glass is processed with a standard polish the corners will most probably have a sharp edge, this sharpness can be removed by applying a further process to incorporate a chamfer or Radius corner. If required this detail should be specified on ordering e.g. Radius corners to 20mm or Dubbed corners.

Internal polish
If glass is to be CNC processed the minimum internal radius on polished glass is 12.5mm. This can be reduced by handwork.

Back painted / Ceramic Glass
On back painted or Ceramic glass the colour may vary, Specialist Glass recommends requesting a sample for approval prior to placing an order. The use of Low Iron glass is recommended for back painted glass as standard clear glass can distort the final colour.

Double Glazed Units
Unless specified otherwise our units are manufactured with aluminum spacer bar. Kommerling butyl is used as a primary sealant and normally increases the nominal width of a unit by up to 1mm. The units are sealed with a Dow Corning 3540 black silicone with a minimum edge bite thickness of 6mm unless otherwise specified. The compatibility of any sealant to be utilized for installation should be checked. The units are supplied without perimeter taping.

Toughening Stamp
All toughened glass produced by Specialist Glass will have a toughened stamp to the face of the glass unless otherwise specified.

Handling, Storage & Maintenance
When handling the glass ensure that precautions are taken to handle safely, use suitable gloves and protective equipment as required. Care must be taken to ensure the glass is not impacted by any objects whilst being carried, Particularly on the edges which are most vulnerable.
Special care must be taken to protect the glass from impact damage and the glass should be stacked on the edges and on strips of wood or other suitable material which is relatively soft. Spacers should be applied to the surface of the glass to prevent face to face contact.
Glass should be stored in dry conditions to avoid water staining before fixing. When fixed or stored the glass must be protected from site contamination.
When installed the glass should be cleaned regularly with Specialist Glass Products Ltd.’s glass and mirror cleaner as per the directions on the container.
Sharp or abrasive products should not be used to clean glass.
The use of oil based cleaners or applications must be avoided.
Whilst the surface of the glass may be protected with Ritec Clear Shield (if requested at order stage) it is important that the surface is not abraded which could affect the integrity of the clear shield.