



Visual Quality

General Statement

**Remember that glass is generally looked through and not at.

For this very reason The Glass & Glazing Federation have detailed a fair and reasonable visual checking procedure for the industry.

Basically on flat glass the inspection should take place at right angles to the piece to be examined and at a distance of 3 metres, please see the attached GGF Guideline.

Upon inspection there should be no marks more than 1mm diameter visible when the glass is subject to standard lighting conditions.

21st Century Glaziers. intends to work to a better standard however there may be some occasions when the test criterion needs to be used.

Because Toughened glass & Curved Glass is subjected to temperatures near to its melting point some visual distortion may be apparent. The distortion is more accentuated on larger panes.

Further information can be obtained from the sales / department.



Appearance/Visual Quality Specification for Insulating Glass Units

All units supplied by 21st Century Glaziers are manufactured to the Glass and Glazing Federations guidance for Commercial Insulating Glass Units. This states the following:

The IGUs shall be viewed at near normal incidence, i.e. at right angles to the glass surface. This shall be from the room side and relates only to transmission and not reflection. The units shall be viewed from a distance of not less than 2 metres away from the inner glass surface for annealed float glass and 3 metres away for all other glass types. Certain glass types, i.e. coated glass, the product standard gives a specific length of time in which the observation shall be made.

The assessment of visual quality of the panes of glass should be carried out in natural daylight but not in direct sunlight and with no visible moisture on the surface of the inner or outer glass panes. The use of strong lamps and/or magnifying devices is not allowed.

It is not permissible to find defects at close range and then mark them so as to be visible from the given viewing distance.

If the IGUs have to be examined in reflection, e.g. for appearance of coated glass, then the method given within the appropriate standard shall be followed.

Acceptance criteria

Insulating glass units shall not be deemed unacceptable for any phenomena relating to the inherent characteristics of an IGU with the exception of "Newton's rings".

When viewed in accordance with the above, the IGU will be deemed acceptable as long as, where appropriate, none of the following apply:

- there are no defects noticed that are visually disturbing
- any defects that are noted comply with the visual quality for the glass component
- any visual disturbance e.g. from roller wave, bow etc. is within the tolerances given in the appropriate product standard
- coated glass quality, e.g. pinholes, Colour variation, etc., comply with the appropriate product quality
- condensation, internal, peripheral, or external, is not related to a seal failure
- distortion is a result of the framing system and/or installation



Handling, Storage and 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 its 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 connection.

Glass should be stored in dry conditions to avoid water staining before fixing.

When fixed or being stored the glass must be protected from site contamination such as welding, cementations, plaster products, adhesives, acids and other site processes such as grit blasting and painting.

When installed the glass should be cleaned regularly with 21st Century Glaziers. Glass and mirror cleaner as per the directions on the container.

Sharp or abrasive products should not be used to clean the glass.

The use of oil based cleaners or applications must be avoided.

Whilst the surface of the glass may be protected with Ritec (if sandblasted and requested) it is important that the surface is not abraded which could affect the integrity of the coating.



Technical Specification for annealed, laminated and toughened bends

Toughened bends

Our capabilities vary depending on which furnace is used.

Glass Thickness	Max Girth	Max Height	Minimum radius
Furnace 1			
5mm - 19mm	2550mm	3250mm	1000mm (may increase on thicker glass Subject to shape etc.)
Furnace 2			
6mm - 15mm	2400mm	4200mm	1500mm
Furnace 3			
6mm - 15mm	4200mm	2500mm	2500mm

Annealed / Laminated bends.

Maximum size 2400mm x 3450mm
 Maximum angle 180°.

Please note that on bends above 90° optical quality may be affected.

Tolerances

Squareness:

Squareness is measured by comparison of diagonals:

Up to 2000mm: 4mm
 Over 2000mm: 5mm

Edgework

Produced with arressed or polished edges (also ground for toughened).

Holes

Diameter	6 - 49.5mm	50 - 99mm
Diameter tolerance	+/- 0.5mm	+/- 1mm
Step tolerance	+/- 1mm	+/- 1mm

Diameter of holes: Must be at least equal to the glass thickness.

Hole Position: From the edge of the glass to the edge of the hole must be at least 1.5 times the glass thickness

The tolerance on hole Centre position will be from +/-1mm to +/-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

For 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 40oC compared to 300oC for toughened. Likewise toughened material is unaffected by sub-zero temperatures.

Storage

Edges should be protected from contact with hard or uneven surface and “Stacked panels” should only be stored in dry conditions.

Glazing

Glazing should be in accordance with BS6262 or other appropriate standard. Edge clearance should be allowed and suitable cushioning used to prevent contact with hard materials. Glass to metal contact should be avoided.

Optical performance

When assessing optical quality the pane should be observed under normal daylight conditions at a distance of 3 meters and the angle of observation should be normal (90 degrees) to the particular glass surface being assessed. Focus should be on an object 1 meter behind the surface being assessed. The pane will be deemed acceptable if the image is not radially distorted in transmission. Assessment is for single glazing.

Curvature

It should be noted that in some circumstances and depending on glass curvature and thickness, there can be flat areas to the profile of the curvature. Where this may be a problem, please discuss prior to placement of any order.

Tolerance

Tolerance	- 6mm - 12mm thickness	+/- 3mm
	- 15mm thickness	+/- 4mm
	- 19mm thickness	+/- 5m



Specification for Curved Sealed Units

Construction and Quality

The glass used by 21st Century Glaziers will be supplied in accordance with:

BS952: Glass for glazing: Part 1: 1995 Classification and Part 2: 1980 Terminology for work on glass and BS EN 572: Glass in Building - Basic soda lime silicate glass products: Part 1: 1995 Definitions and general physical and mechanical properties and Part 2: 1995 Float glass - Glass for glazing.

Curved Sealed Units are manufactured to similar stringent quality controls as flat units however curved units are not able to be kite marked as yet no British or European standard applies to curved units.

Stepped and simple shaped units can be manufactured in a variety of glass types and thickness. Screen-printed, standard or bespoke patterns and spandrel panels (with insulation if required) are also available.

The screen printing process uses ceramic inks that after toughening integrate with the glass surface and have excellent abrasion and environmental resistance. A variety of colours are available. Heat soaking of toughened glass is optional.

Kommerling butyl is used as a primary sealant and normally increases the nominal width of the unit by up to 1.0mm. The units are sealed with 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.

Distortion and Visual Quality

Toughened curved safety glass normally exhibits higher levels of distortion than flat toughened safety glass. This is due to the toughening / curving process. Thinner glasses exhibit more distortion than thicker glasses. Certain glass types, particularly reflective glass, will emphasize visible distortion. The optical effect created by roller wave is dictated by the direction of the curve (i.e. it will always run parallel to the curved edge). Polarization effects may be visible in toughened curved units dependent upon the combination of glass types used. Similarly distortion levels can be emphasised.

The unit edge seal will be wavy in appearance due to the inherent distortion in the toughened curved glass. Slight butyl intrusion may also be visible inside the sight line. These effects do not detract from the performance of the sealed unit but may be visually unacceptable in some applications, particularly if visible after framing. This visual effect can either be reduced with the use of bronze/black spacer bar or can be completely obscured with a screen-printed border applied to the glass prior to bending and toughening, where required.

Where improved distortion and edge seal appearance is required curved units can be supplied in annealed glass, or for safety glass requirements, laminated glass.

Due to the subjective nature of assessing the visual quality of curved units, 21st Century Glaziers may, for certain unit specifications, insist upon the provision of a sample, for approval and authorisation by the prospective client, prior to acceptance of a contract to manufacture units.



Curved Toughened Units

Material

Clear, tinted low- E, Seralit and Emalit, available in 6, 8, 10, and 12mm thickness. Clear material is available in 15mm thickness. Solar, heat reflective and roll-patterned materials are also available. **Note:** coatings, Seralit, Emalit and rolled patterns are always to the concave surface i.e. unit face 2. (Except Emalit which is usually face 4)

Spacer bar is available from 6mm to 20mm dependent upon size and curvature. Silver, bronze, and other spacer bar colours are available.

Glass type and the weight of the unit will effect maximum size.

Framing systems used in curved units must be able to accommodate the tolerances for size, squareness, twist, edge straightness, curvature, and overall unit thickness as detailed below.

The unit sizes and specification defined on Customer orders should also take these tolerances into account.

Due to variations as a result of the effect of these tolerances curved units may not be suitable for structurally bonded systems.

For framed systems it is recommended that a compatible periphery silicone seal is applied between the DGU and the rebate to ensure no water ingress. For aesthetic purposes, after the pressure plates and capping are fixed, a compatible silicone-capping fillet may be required inside and outside the unit.

Size Tolerance	Thickness		
	6 mm	8 & 10 mm	12 & 15 mm
Up to 1000 mm	+/- 1 mm	+/- 2 mm	+/- 2 mm
Over 1000 mm	+/- 2 mm	+/- 2 mm	+/- 3 mm

Squareness

Up to 1000 mm	4 mm
Over 1000 mm	5 mm

Squareness is measured by comparison of diagonals **Torsion (Twist)**

+ 5mm per metre measured along the straight edge **Edge Straightness**

General Bow

+ 3mm per metre



Curvature

Cylindrical curvatures with radii to a minimum of 500 mm and with a maximum tangential angle of 90 degrees are possible. Regular, irregular, central and one-sided shapes are possible.

Curved panels will always fit into a drawn envelope constructed from the curved glass thickness and the curvature tolerance.

It should be noted that in some circumstances and depending on glass curvature and thickness, there can be flat areas to the profile of the curvature. Where this may be a problem, please discuss prior to placement of any order.

Overall Unit Thickness

The nominal thickness of the unit can be increased by up to +1mm due to the butyl bead. Glass curvature tolerance can also effect the thickness of the unit.

Edgework

Produced with flat ground edges as standard. Polished edges can be supplied upon request.

Designs and Printing

Any decoration is always to the concave surface.

Toughening Standard

Curved panels are toughened so that when a sample, usually a set up piece, is purposely broken, but supported to prevent the particles separating, there will not be less than 40 off counted particles in a square of side 50mm.

Dimensional Criteria

When specifying size requirements the following dimensions are required:

Outside Radius of Unit

External Girth measurement of unit

Length of Unit

The edge detail required (dependent upon framing system) must be specified with order: -



[Please note the potential impact on unit sight line]



Visual Quality Checks

The visual quality of panels and units is checked at each stage of manufacture to ensure conformity. The viewing arrangements and criteria used in assessing the visual quality of curved units are as per Glass and Glazing Federation guidelines.

Faults, such as scratches, seeds, bubbles, blisters, sealant particles etc., which are visually obtrusive when viewing the unit from a distance of 3 metres, will be deemed unacceptable

Reflections

Visible double reflection can occur when a unit is viewed under certain lighting conditions and especially if the unit is viewed from an angle. This is an optical phenomenon arising from multiple surface reflections in the sealed unit.

Colour Consistency

There should be no significant Colour variations in body tinted or surface coated glasses of the same type and thickness. Different glass thickness of the same type of body tinted or surface coated glass will show significant Colour differences.

Marking and Identification

Where applicable and unless otherwise specified by the customer, a toughening/heat soak mark will be added to each curved panel. The marks will be readable through 'face one' and located in the bottom left hand corner of the unit, approximately 25-mm in from the corner.

Similarly a product identification label will be attached in the top right hand corner and on face one of each unit.

Cleaning

Curved toughened glass should only be cleaned using glass cleaner or alcohol and a soft cloth. Abrasive cleaners must not be used as they may scratch the surface of the glass.

Warranty

All 21st Century Glaziers curved sealed units and sealed units are warranted for **five years** against defects in materials or workmanship causing visual obscuration from condensation or dust collection within the sealed unit. The detailed terms of warranty are published separately and are available upon request.



General Technical Notes

Holes

A full list of hole sizes available on the information sheet on hole sizes
Position of Holes is critical on Toughened glass as shown on the hole positions data sheet.
Holes can be drilled to most diameters and if what you require is not listed please ask.

Countersinking

Some clients require holes to have countersunk detail applied.
This countersink detail may vary in diameter and depths please consult our technical department for detail.

Corners

When glass is processed with flat edges the corners will most probably have a sharp edge this sharpness can be removed by applying a further process to incorporate a radius or chamfer on the corner.
This should be specified on ordering. E.g. radius corners to a 20mm Rad or Dubbed corners.

Drawings / Templates

When the glass needs to be cut to a certain shape we may need a drawing or template.
Templates should be provided as actual glass sizes and any holes shown in the correct position.
Where necessary templates should show reference number.

Clearances

Normally the client provides the glass size which has the clearances built in for glazing. 21st Century Glaziers, will advise on clearances however cannot accept responsibility without site reference.

Fixings and Accessories

21st Century Glaziers offers a range of fixings and advise on accessories available to assist our clients in the use of the product.

Quality

21st Century Glaziers, supply glass to a high specification and to maintain the quality of appearance we Recommend that the storage, handling and Cleaning procedures are followed.

Polishing

Minimum size of glass for machine polish is 150 x 150mm

Internal Radius

If an internal radius is required the minimum radius on polished glass is 12.5mm. This can be reduced by hand work.