Short Technical Guide

The following sections cover the methods and manufacturing capabilities for producing processed glass.

Sections

1. Cutting

Cut Size Tolerances

Nominal Size length (H) or width (B) of glass edge	Absolute tolerance (t) nominal thickness ≤12mm	Absolute tolerance (t) nominal thickness ≥12mm
Up to 500mm	±1mm	±3mm
Up to 1000mm	±1mm	±3mm
Up to 2000mm	±1mm	±4mm
Up to 3000mm	±1mm	±5mm

Glass Squareness

Squareness is a comparison of diagonals

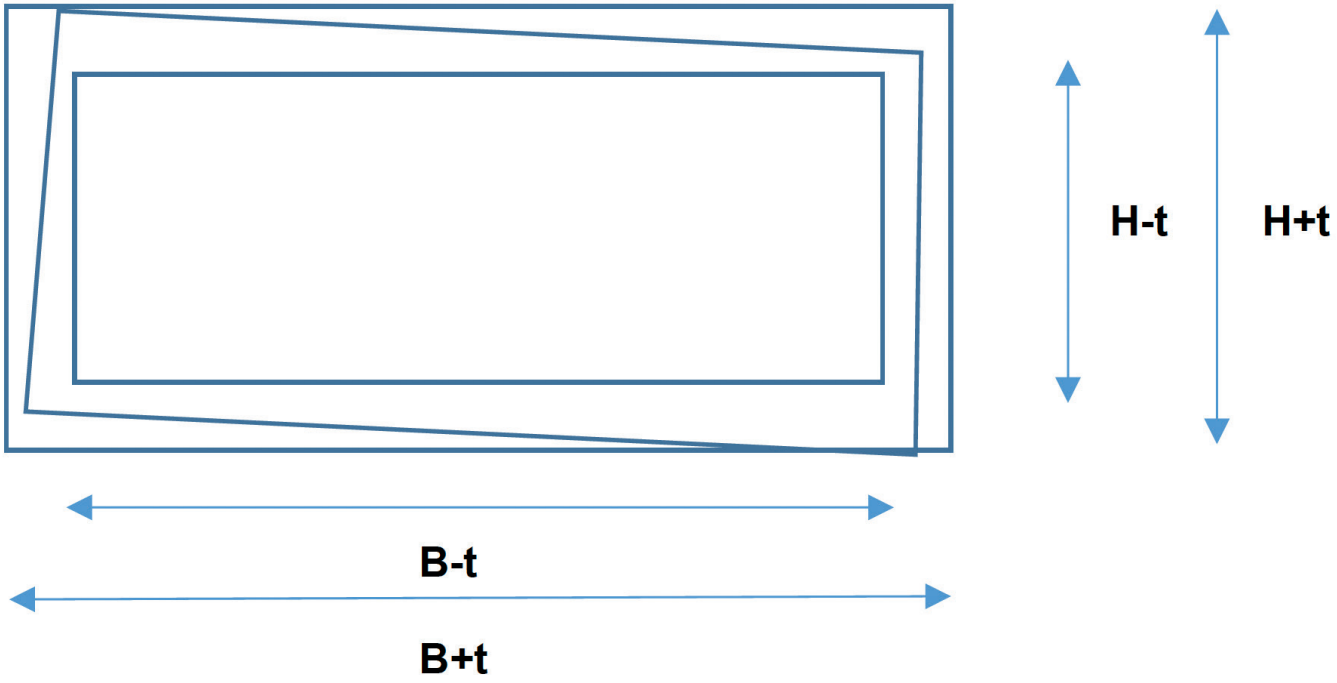
- ≤2000mm in size – 4mm allowance for glass ≤12mm thick
- ≥2000mm in size – 5mm allowance for glass ≥12mm thick

The dimensional deviation of the diagonals is derived by the following calculations:

Example: Pane with B x H = 1000 x 3000mm

→ Dimensional deviation = 3.0mm

The dimensional tolerances is thus 3.0mm



In all cases of measurement, B is always classed as width and H will always be the height.

Glass Thickness

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Float glass thickness tolerances

Nominal Glass Thickness (mm)	Dimensional Tolerance
4	±0.2 mm
5	±0.2 mm
6	±0.2 mm
8	±0.3 mm
10	±0.3 mm
12	±0.3 mm
15	±1.0 mm

Colour Variation

All glass supplied by M2M can be sourced from different float glass manufacturers and therefore cannot guarantee there will be no variation in colour.

2. Toughened Safety Glass

All toughened glass produced at Made2measure is compliant with EN12150-1 / 2 & class 1 impact tested.

Machine capabilities:

Glass Thickness	X (mm)	Y (mm)
4mm – 19mm	2400	1150

Straightness

Deviation from straightness is dependent on thickness, on the other dimensions and the aspect ratio between the sides. The deviation appears in the form of warping which is categorised into two sections: General Bow & Local

Limitation of general and local bow
On the basis of specifications in

Type of Glass	Glass Thickness (mm)	Limitation related to:	
		General Bow (MM per M)	Local Bow (MM per 300mm)
TSG made	Float Glass	4 – 19	3 0.5
from	Patterned Glass	4 – 10	4 0.6

Limitations of general and local bow on the basis of specifications in EN12150 Part 1

As detailed in the table, local bow is a reaction that occurs over a small area of glass and general bow is virtually end to end of the pane.

Horizontal Toughening

During the toughening process the glass is in contact with ceramic rollers at all times. This causes distortion known as rollerwave which is generally noticed through reflection. Table 6 gives the roller wave limits for toughened glass products.

Roller wave Limits

Float glass nominal thickness	Rollerwave maximum (mm)
3,4 & 5	0.5
6,8 & 10	0.3
12,15,19	0.15

Markings

Every pane of toughened safety glass, laminate glass & heat soaked glass will be stamped with mark that depicts the following:

- The number of the product standard & classification
- The name or trademark of the manufacturer

Made2measure cannot guarantee the exact positioning of markings but do attempt to apply within the standard requirement

You are given the option of no markings on the glass but this is not recommended.

3. Processed Glass

Product range

All glass produced for processing will be assessed at contract review for capability & stock availability.

Glass Sizes

The minimum and maximum sizes allowable are:

Minimum - 100mm x 250mm (1 edge will always be required to have 250mm as a minimum size)

Maximum – 2550mm x 1150mm (any difference in this will be shown on website)

Standard tolerance for finish product size is +1mm -3mm (for products up to 10mm and 1m - 4m for products over 10mm thickness.

Polished edges on glass may differ in appearance. Certain orders may contain shaped glass which require different machines like a CNC to manufacture as opposed to a standard straight line edging machine - please manage expectations accordingly.

Drilling

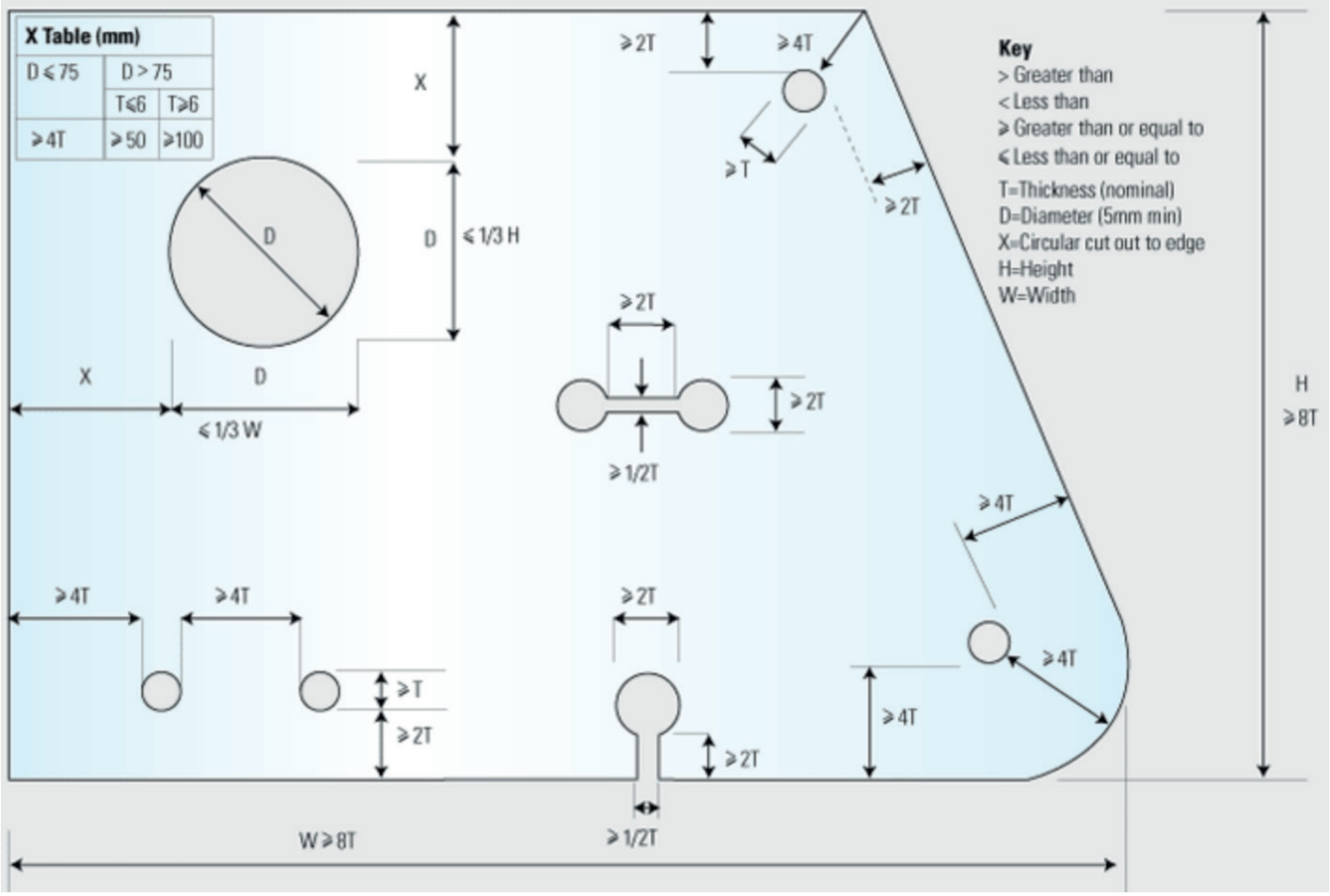
Drill hole sizes: 6mm ≥ 50mm

Listed below are prescribed specifications both for general positioning of drill holes and for tolerances in respect of deviations from said positioning.

The tolerances here apply to cylindrical and conical drill holes.

Position of holes

The drill hole positioning and tolerancess.



Hole sizes

All drill hole sizes are to be as accurate as possible with a working tolerance of ±1mm

Hole positioning

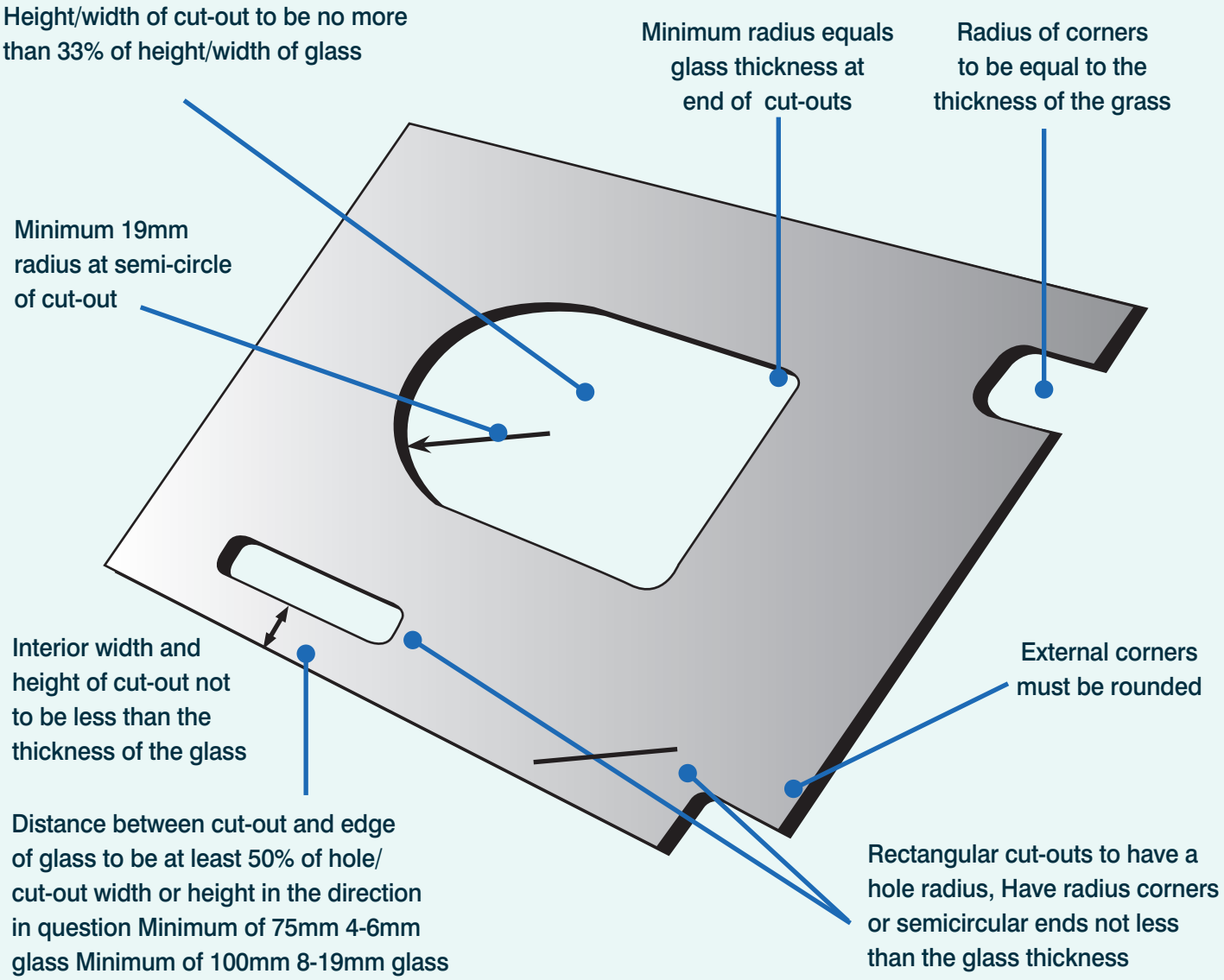
All drill holes are to be located as accurate a possible with a working tolerance of ±2mm

Corner cut – off & Corner / edge cut – outs

Edge cut-outs & corner cut-outs must be provided with a radius (R) which is either larger than or equal to the thickness of the glass, but must measure in every case no less than 16mm.

Cut-out positioning and tolerances

The drill hole positioning and tolerancess.



Printing

All inspections of printed products are to be performed using the criteria set in the visual

Edge zone circumference 15mm

*If visible edges are requested when the order is placed then the edge zone will be omitted and the main zone will extend to the edge of the pane. Optical quality requirements are given in Table 9 Below

All non-ground or polished edges (Arrissed) will require a 2mm scrape off tolerance on all edges to combat paint lifting

Defect tolerances

Defect – types/ Tolerances for entirely or partial printed glass		
Type of defect	**Main Zone**	**Edge Zone**
Defects in print punctual* and or linear	Defects in print punctual* and or linear	Width Max 3mm, sporadically 5mm Length: no restriction
Hairline Scratches (Only visible by incident of changing light)	Permitted up to 10mm in length	Permitted / No restriction
Cloudy / Misty area / Shadowing	Not permitted	Permitted / No restriction
Water Stains	Not permitted	Permitted / No restriction
Colour over-run at edges	Not relevant	Permitted
Dimensional tolerance for edge printing and partial printing		
Print Height	Depending on width of printing	Depending on width of printing
≤100mm **≤500mm** **≤1000mm** **≤2500mm**	±1.5mm ±2.0mm ±2.5mm ±3.0mm	±1.5mm ±2.0mm ±2.5mm ±3.0mm
Position tolerance for printing** (Only for partial printing)	≤2000mm: ±2mm ≥2000mm: ±4mm	

Colour Variation in painted glass

In the event of an order being across paint batches, there is a possibility of shade / colour variance.

Laminated Offset Tolerances

Offset tolerances (d) only occur in all forms of edge finishing and edge machining possible for these products. These are listed in Table below. Width (b) & length (h) must be considered separately.

Nominal dimensions (b)	Largest permissible offset (d)
B,H <1000mm	**2.0mm**
B,H < 2000mm	**3.0mm**
B,H > 2000mm	**4.0mm**

Laminated Thickness Tolerances

The thickness of the laminate pane shall not exceed the sum of the individual sheets min / max thickness as given in the standard for float glass EN572 -2.

Laminated for Drill holes

For <24mm element thickness ±2.0mm

For >24mm element – thickness ±2.5mm

4. O&M

Handling and storage

Delivery, handling and site storage methods must be agreed for each site. Upon delivery of the glass check marks and labels on the packing or glass to ensure compliance with the specification.

Edges and corners of glass are particularly vulnerable to damage during handling, storage and installation. Inspect the cut edges of the glass for excessive flaws such as large shells that may compromise the strength and performance of the glass.

Check all surfaces for any signs of damage. If in doubt seek advice from the manufacturer. Glass should not be stored or stacked horizontally. Store panels on edge at an angle of 3° to 6° from the vertical, with sufficient lateral support to prevent bowing, in a clean dry, ventilated place, avoiding direct sunshine and other sources of heat. Factory applied protection such as cork pads or shrink-wrapping should not be removed until the glass is ready for installation. When the packaging has been removed it is advisable to cover the remaining glass to prevent ingress of dust and grit that may cause subsequent scratching. If any moisture or condensation is apparent between the panes of stacked glass, separate immediately and dry thoroughly, otherwise permanent staining may result. If water is allowed to remain in contact with the glass for an extended period it can form a concentrated alkaline solution and will attack the glass surface causing permanent damage and in extreme cases even “welding” the sheets together. Carefully inspect all glass before installation.

Handling and storage

Before proceeding with cleaning, determine whether the glass is clear, tinted or reflective. Surface damage can be more noticeable on reflective glass when compared with clear uncoated glass. If the reflective coated surface is exposed, either externally or internally, special care must be taken when cleaning as scratches can remove the coating and result in visible changes to the light transmittance. Tinted and coated glasses should not be cleaned in direct sunlight, as the glass may be too hot for optimum cleaning. The cleaning solution will dry before effective cleaning has occurred and the dry surface may also promote scratching. Excessive temperature changes of the glass should also be avoided, for example splashing hot water on cold glass or cold water on hot glass. It is recommended that cleaning operators begin by cleaning a small area or window first then stop and examine the surface for any damage to the glass or coating bearing in mind that some types of scratches may be more visible under certain lighting conditions or times of the day. Cleaning operations should commence at the top of the building and continue down to lower levels to reduce the risk of leaving residue and cleaning solution on glass.

Standard Cleaning Procedure

Cleaning during continuing construction work differs from ordinary routine cleaning mainly through the careful removal of debris from the glass surface. This is a delicate procedure and should be carried out by specifically trained professionals or advice sought before cleaning.

Cleaning should start by thoroughly soaking the glass with clean water and mild soap solution to loosen dirt or debris. Using mild, non-abrasive commercial window washing solution, uniformly apply the solution to the glass surfaces by spraying or sponge. Using a circular motion and light to medium pressure, wipe the cleaning solution on the glass. Rinse the glass immediately with generous amounts of clean water making sure to remove all the cleaning solution. Use a clean lint-free cloth or a squeegee to dry the glass surface. Care should be taken to ensure that no metal parts of the cleaning equipment make contact with the glass surface and that no abrasive particles are trapped between the glass and cleaning materials.
All water and cleaning solution residue should be dried from window frames, seals and gaskets to avoid any potential deterioration of these materials. If residue is still present on the glass then the steps above should be repeated. Abrasive cleaners, powder based cleaners, scouring pads or other harsh materials should not be used to clean the glass or frame surrounds. Excess glazing compounds and sealants should be carefully removed from the glass and frame surrounds, taking care not to scratch the finished surfaces with tools or abrasives. Avoid scraping the glass with metal scrapers or blades. A solvent such as white spirit or professional glass cleaner may be used to remove any glazing compound, finger marks or grease on glass but NEVER on powder coated frames taking care not to allow contact with glazing seals, gaskets, any paint finishes or the perimeter edge seal of an insulating glass unit. The glass can then be cleaned following the procedure above. When paint or other construction materials cannot be removed by standard cleaning procedures, a new 25mm razor blade may be used on non-surface treated or non-coated glass surfaces. It should be used only on small spots and scraping carried out in one direction only.

Note this practice can cause a concentration of small hairline scratches that may be visible under certain lighting conditions. blade may be used on non-surface treated or non-coated glass surfaces. It should be used only on small spots and scraping carried out in one direction only.*

Glass staining

Water runoff flowing over the façade of a building may carry contaminants onto the surface of the glass. These contaminants cause stains on the glass and can be extremely difficult to remove, sometimes even chemically bonding to the glass surface. The most effective way of addressing this problem is to prevent runoff reaching the glass at the design stage by use of suitable drainage techniques employing flashings, reveals or drips for example. Lime scale and concrete stains can occur where rainwater has passed over masonry, concrete or mortar onto the glazing below.

Insoluble salts of calcium crystallise on the glass surface and become chemically bound to it making it extremely difficult to remove using standard cleaning procedures. Organic sealants may leach out solvents, oils or plasticisers and these may adhere very strongly onto the glass surface and cause staining. The sealant may not necessarily need to be adjacent to the glass to cause this problem as they could be carried over the glass by water runoff. This tends to be a greater problem when the building is new. Consult the sealant manufacturer for advice and follow their recommendations. Weathering metals release oxides as they age and can cause staining on adjacent glazing. They occur where rainwater passes over metal flashing or other architectural elements and deposits metal oxides onto glazing. Iron, zinc, lead and copper are particularly prone to cause problems of this nature. The oxides adhere tenaciously onto the glass and expensive chemical cleaning techniques may be required if they are left on the glass for any length of time. Glass should be examined frequently during construction to see if any build up is occurring. If so the glass should be cleaned immediately.

Weld splatter

This causes a rough and pitted surface on glass. Any glass that has been damaged by weld spatter should be replaced, as the strength of the glass will have been unpredictably reduced. Temporary screens should be installed if welding, sandblasting or other potentially damaging construction process is being carried out near the glass.

Regular maintenance

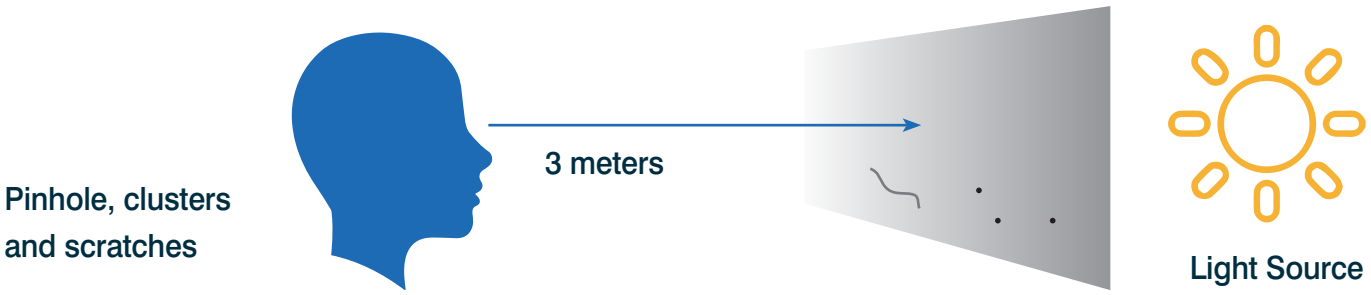
It is essential that all installations are inspected and maintained during the lifetime of the building at regular intervals as recommended by the sealant and framing system manufacturers. The regular routine cleaning of the glass following the standard cleaning procedure detailed above will help to preserve the original appearance and performance characteristics.

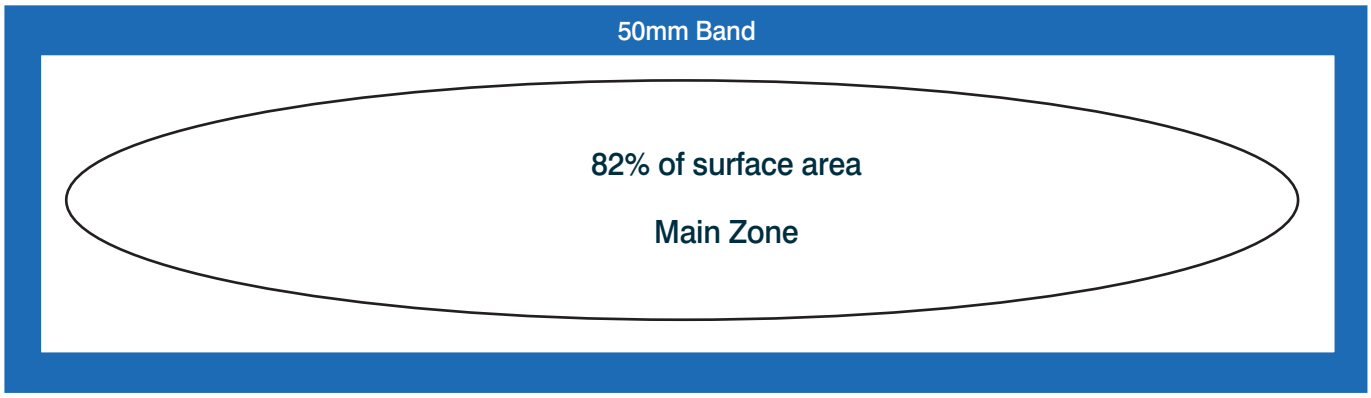
5. Quality

Visual assessment

Toughened safety glass shall be deemed acceptable if the following phenomena are neither obtrusive nor bunched: hairlines or blobs; fine scratches not more than 25mm long; minute imbedded particles.

Obtrusiveness of blemishes shall be judged by looking through the glass, not at it, when standing at right angles to it on the room side at a distance of not less than 3 metres in natural daylight and not in direct sunlight. The area to be viewed is the normal vision area with the exception of a 50mm wide band around the perimeter of the glass. Pattern ghosting can occur on glasses with a textured finish.





Quality & manufacturing Standards

Made2measure Ltd is licensed to produce glass to the following standards:

EN 14419

EN 1090-1

EN 12150 - Thermally toughened soda lime silicate safe glass