GLASSHAPE QUALITY STANDARD FOR PROCESSED GLASS

Telarc. Registered
Quality
ISO 9001

1 SCOPE

This Glasshape Visual Quality Standard specifies acceptable quality requirements from a visual perspective for the following:

(a) Cut sizes of flat, clear ordinary annealed and tinted heat-absorbing glass which are used for general, architectural, marine and transportation glazing, or similar.

(b) Cut sizes of flat, clear ordinary annealed and tinted heat-absorbing processing glass used for Grade A safety requirements (i.e. toughened or laminated).

(c) Cut sizes of ordinary annealed and patterned glass used in decorative and general glazing applications.

(d) Processed laminated and toughened glass.

(e) Processed multi-layered glass, whether laminated or insulated units

(f) Processed glass laminated with other materials such as polycarbonate

NOTE:

1 This Standard is not intended to restrict the use of materials or determine whether materials or processed units are fit for purpose.

2 This Standard is not intended to cover glass for mirrors or coated glass with reflectance greater than 50%

3 All other quality requirements not covered in this Standard should be agreed between Glasshape and the customer prior to any contract being entered into.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS1288 Glass in buildings—Selection and installation

NZS4223 Glazing in Buildings

4223.3 Part 3: Human Impact Safety Requirements

3 DEFINITIONS

For the purposes of this Standard the definitions in AS 1288 and those below apply:

NOTE: The definitions do not apply to in-service damage.

3.1 Vision interference angle

The acute angle between the pane of the glass and the vertical plane perpendicular to the wall, such plane including the observer when the glass is examined in accordance with Clause 9.2.2.

3.2 Blemishes

3.2.1 *Bow*

Deviation from straightness or flatness.

3.2.2 *Bubble*
Gas-filled cavity in the glass. If close to the surface it may appear as an 'open' bubble, i.e. a hemisphere at the surface. Bubbles may be spherical or elongated (also called blister or seed).

3.2.3 *Bubble line*
Gassing where strings of bubbles are clustered around longitudinal lines.

3.2.4 *Chip*
A small shallow piece of glass that has become detached from the plate edge and attached to the face of the sheet. The word 'chip' is also often taken to denote the blemish that is left at the edge after the chip has fallen out.

3.2.5 *Corners on/off*
Nib on or near a corner of a sheet.

3.2.6 *Delamination*
An area in laminated glass where the glass sheet has separated from the laminate in a localized area

3.2.7 *Distortion*
Undulations in the glass, which cause objects to appear distorted or wavy, when viewed through the glass.

3.2.8 *Edge quality*
Edge defect includes vents, shells, flakes, chips, wave, sharks teeth, nibs, and corners on/off.

3.2.9 *Edge vent*
Cracks that run in from the edge of the glass.

3.2.10 *Flange*
Bevel-like protrusion above the cut edge, but different from a corner 'on' in that it often has a razor sharp edge.

3.2.11 *Inclusion*
A crystalline or a non-crystalline particle entrapped in glass.

3.2.12 *Nib*
Section of glass remaining on or removed from the edge of a sheet, caused by a score mark not continuing right through to the traverse mark.

3.2.13 *Process surface imperfections*
Slight surface imperfections that originated in the process, which can be small particles of foreign materials on either surface or surface irregularities.

3.2.14 *Rub*
Abrasion on the glass surfaces producing a frosted appearance. A rub differs from a scratch in that it has an appreciable width.

3.2.15 *Ream*
Regions of different compositions within the glass mass, usually seen as bands of lines parallel to an edge on float glass.

3.2.16 *Shark's teeth*
Prominent features in the cut edges, extending from the score mark through part or all of the thickness.

3.2.17 *Scar*
Scratch on the surface of the glass.

3.2.18 *Scratch*
Any marking or tearing of the surface produced during manufacturing or handling, appearing as though it were done by a sharp or rough instrument.

3.2.19 *Shell*
Similar to a chip, but often larger and occurring on the face opposite the score mark.

3.2.20 *Stain*
Breakdown of the glass surface due to the presence of other chemicals, e.g. concrete splash. May be difficult to detect unless silvered or coated with ceramic paint.

3.2.21*Vent*
See edge vent.

3.2.22 *Vented inclusion*
Crack in the glass surface caused by the existence of an inclusion.

3.3 Descriptions of terms specific to this Standard

3.3.1 *Laminated glass*

Glass consisting of two sheets of glass permanently bonded together by one or more sheets of plastic interlayer.

3.3.1.2 Multi-laminated glass

Glass consisting of more than two sheets of glass permanently bonded together by sheets of plastic interlayer.

3.3.2 *Laminated safety glass*

Laminated glass that satisfies the test requirements of the relevant safety glazing material standards.

3.3.3 *Ordinary annealed glass*

Glass cooled gradually during manufacture in an annealing operation to reduce residual stresses and strains that occur during cooling.

3.3.4 *Patterned annealed glass*

Rolled flat glass having a pattern on one or both surfaces.

3.3.5 *Toughened glass*

Glass that is subjected to special heat or chemical treatment so that the residual surface compression stress and the edge compression stress is greater than heat-strengthened glass.

NOTE: Toughened glass is also known as tempered glass.

3.3.6 *Toughened safety glass*

Glass converted to a safety glass by subjection to a process of prestressing so that if fractured, the entire piece disintegrates into small, relatively harmless particles. The residual surface compression is a minimum of 69 Mpa.

3.3.7 *Heat strengthened glass*

Glass with higher levels of mechanical strength by subjection to a process of prestressing so that if fractured, the glass will break into large piece of which could be harmful if not laminated. The residual surface compression is a minimum of 35 Mpa.

3.3.8 *Printed glass*

A single sheet of glass that has ceramic ink imbedded into one surface by subjection to a process of either digitally, screened or roll on applied, of which is then fired into the surface permanently when put through the toughening process. Includes single or multi-colours, partial or full cover, with varying opacities.

3.3.9 *Heat-absorbing glass*
Glass for absorbing appreciable portions of radiant energy, especially solar energy.

3.3.10 *Tinted (toned) and printed glass*
Glass with a material added to give it a light and/or heat-reducing capability and colour.
NOTE: The colour of tinted, heat-absorbing glass is a major consideration for either design or aesthetic reasons or for colour matching requirements. Tinted heat-absorbing glass should be viewed as installed for colour comparison. Colours may vary considerably from batch to batch, depending on the manufacturer of the raw stock, and from run to run.

4 TYPES OF GLASS

4.1 Type 1
Annealed glass, clear or tinted (heat-absorbing)–general glazing, and multi-glazing, quality.

4.2 Type 2
Toughened glass, including toughened safety glass, clear or tinted (heat-absorbing)–general glazing and multi-glazing quality.

4.3 Type 3
Laminated annealed glass, including laminated safety glass, clear or tinted (heat-absorbing)—general glazing and multi-glazing quality.

4.4 Type 4
Laminated toughened glass, clear or tinted (heat-absorbing)—general glazing and multi-glazing quality.

4.5 Type 5
Multi-Layered Laminated annealed and toughened glass, clear or tinted (heat-absorbing)—general glazing and multi-glazing quality.

4.6 Type 6
Patterned annealed and toughened glass—general glazing and multi-glazing quality.

4.7 Type 7
Printed toughened monolithic glass, clear or tinted (heat-absorbing)–—general glazing and multi-glazing quality.

4.8 Type 8
Printed toughened laminated glass, clear or tinted (heat-absorbing)–general glazing and multi-glazing quality.

5 INTENDED USE OF FLAT AND CURVED GLASS

5.1 Ordinary annealed glass

Ordinary annealed glass is intended for general glazing where safety glass is not a requirement, whilst functional or aesthetic characteristics are a consideration and where limited, minor surface blemishes are not a major concern.

5.2 Laminated annealed safety glass

Laminated annealed glass is intended for glazing where safety glass is a requirement, functional or aesthetic/ visual clarity without distortion characteristics are a high consideration, whilst increased mechanical strength is not a requirement.

5.3 Multi-layered Laminated annealed safety glass

Multi-layered Laminated annealed glass is intended for glazing where extra safety and security is a requirement, functional or aesthetic/ visual clarity without distortion characteristics are a high consideration.

5.4 Toughened safety glass

Toughened glass is intended for general glazing applications, where toughened glass is the appropriate glass for strength for Grade A safety glazing material

5.5 Toughened laminated safety glass

Toughened laminated safety glass is intended for general glazing applications that have an increased requirement for strength, or where the toughened glass must remain together even once broken.

5.6 Toughened Multi-layered laminated safety glass

Toughened multi-layered laminated safety glass is intended for specialized glazing applications where requirement for mechanical strength is critical and where the toughened glass must remain together even once broken.

5.7 Laminated safety glass

Laminated safety glass is intended for general glazing applications that have a requirement for a Grade A safety glazing material, in accordance with AS 1288 or NZS 4223.3.

5.8 Patterned glass

Patterned glass is intended for general glazing where decorative characteristics are a consideration and, where limited, minor surface blemishes are not a major concern.

5.9 Printed glass

Printed glass is intended for general and specialized glazing where decorative characteristics or edge boarders are a consideration and, where limited, minor surface and printing blemishes are accepted as characteristic of the product.

6 GENERAL REQUIREMENTS

6.1 Edge

An edge shall be cut or otherwise treated as required, such as ground or sanded to remove sharp edges only, polished, bevelled or mitred.

6.2 Dimensional tolerances

Tolerances for length, width, thickness, squareness, flatness shall be in accordance with Tables 1, 2 and 3, as appropriate.

6.3 Imperfections

Imperfections shall not be greater than those listed in Tables 4.1, 4.2, 4.3, and 4.4, where the customer shall agree to the level of quality deemed acceptable at time of contract being drawn

TABLE 1

DIMENSIONAL TOLERANCES FOR GLASS TYPES 1, 2, 6 AND 7Millimetres

Parameter	Glass thickness				
	Up to and including 6	Greater than 6 and less than 15	15	19	25
Nominal thickness	±0.2	±0.3	±0.5	±1.0	±1.5
Length/width	±2.0	±3.0	±3.0	±3.0	±3.0
Hole/ Notch/ Cutout Positions	±2.0	±2.0	±3.0	±3.0	±3.0
Edges	Not to exceed a thickness reduction/increase of more than 0.02 within 25 of the edge				
Squareness (flat glass only)	Difference in diagonals of 0.4% maximum of panels largest dimension				

Notes:

1. For laminated glass types, tolerances are applied to individual layers, not the panel as a whole.

TABLE 2
DIMENSIONAL TOLERANCES FOR GLASS TYPES 3, 4, 5 AND 8

Millimetres

Parameter	**Range**					
	Type 3		**Type 4 & 8**		**Type 5**	
Nominal thickness	**Laminated**		**Toughened Laminated and Printed Toughened Laminated**		**Multi-layered Laminated annealed and toughened**	
3	-		-		For all multi-layered panels, calculate the nominal thickness of the individual glass layers and apply tolerances as per types 4&8	
4	-		-			
5	4.6 - 5.4		-			
6	5.6 - 6.4		5.3 - 7.1			
8	7.6 - 8.4		7.4 - 8.7			
10	9.6 - 10.4		9.3 - 10.7			
12	11.6 - 12.4		11.3 – 12.7			
15	14.6 – 15.4		14.3 – 15.7			
Length/width (tolerance) % +/- maximum variation of size	Glass thickness < 10	Glass thickness ≥ 10	Glass thickness 6-10	Glass thickness 12-20	Glass thickness 21-35	Glass thickness 36-60
	±2	±3	±4	±5	±5	±6
Squareness (flat glass only)	Difference in diagonals of 0.4% maximum of panels largest dimension				Difference in diagonals of 0.5% maximum of panels largest dimension	

NOTES:

1. The standard nominal thickness and thickness tolerances apply to common glass thicknesses and common manufacturing tolerances for float glass, laminated glass, laminated float glass and patterned glass. These tolerances also apply to patterned or non-patterned borders, images and stamps applied to the glass.
2. Linear interpolation as defined in AS 1288 shall apply for non-standard thicknesses.

7 FLATNESS REQUIREMENTS – Flat Glass Only

The flatness of panels shall be within the following limits:

1 Localized warp 1.0 mm over any 200 mm span.

2 Overall bow and warpage as given in Table 3.

TABLE 3

BOW (FLATNESS) LIMITS FOR GLASS OF STANDARD NOMINAL THICKNESS (ALL TYPES)

Millimetres

Glass thickness	Horizontal glass dimension		
	0 to 1500	1501 to 3000	3001 to 5000
3	1 in 200	1 in 150	-
4	1 in 200	1 an 150	-
5	1 in 300	1 in 200	1 in 200
6	1 in 350	1 in 250	1 in 200
8	1 in 400	1 in 300	1 in 250
10	1 in 400	1 in 300	1 in 250
12	1 in 400	1 in 300	1 in 250
15	1 in 400	1 in 300	1 in 250
19	1 in 400	1 in 300	1 in 250
25	1 in 400	1 in 300	1 in 250

NOTES:

1 Refer to Clause 9 for test methods.

2 Flatness measurements shall be checked against a straightedge with the panel standing within 5° of vertical and measurements taken horizontally.

3 For non-standard glass thicknesses, interpolation will be required.

4 Linear interpolation as defined in AS 1288 shall apply for non-standard thicknesses.

5 For curved glass, it is normal for a varying degree of warp depending on the radius and thickness of glass being viewed. Warp in curved glass should not be viewed as a fault, rather an inherent property of the product. Unless specifically agreed by both customer and supplier at time of order, curved glass should follow the desired even radius within +/- half the thickness of the glass itself. Ie – 6mm curved glass should be within +/- 3mm of the desired even radius. If the shape being curved to is not an even true radius, it should be expected that the glass should follow the desired uneven radius within +/- the thickness of the glass itself.

8 GLASS QUALITY

8.1 Blemishes shall not be greater than those listed in Table 4. (For examples see Appendix 1 and 2)

TABLE 4

GLASS QUALITY—MAXIMUM ALLOWABLE IMPERFECTIONS PER SQM

Blemish size and positioning		Blemish size and limit of frequency per m2, rounder up to nearest M2 – i.e. 1.51m2 taken as 2.0m2, 1.50m2 taken as 1.0m2							
		Type 1: Annealed Glass	**Type 2: Toughened Glass**	**Type 3: Laminated Annealed Glass**	**Type 4: Laminated Toughened Glass**	**Type 5: Multi Lam Annealed and Toughened**	**Type 6: Patterned Glass Annealed or Toughened**	**Type 7: Printed Toughened Monolithic Glass**	**Type 8 : Printed Laminated Toughened Glass**
<0.5mm At least 250mm apart	Centre Mid Margin	1 pcs 2 pcs 2 pcs	1 pcs 2 pcs 2 pcs	1 pcs 2 pcs 3 pcs	1 pcs 2 pcs 3 pcs	2 pcs 3 pcs 4 pcs	2 pcs 3 pcs 3 pcs	2 pcs 3 pcs 3 pcs	2 pcs 3 pcs 3 pcs
0.5mm –1.0mm At least 350mm apart	Centre Mid Margin	1 pcs 1 pcs 2 pcs	1 pcs 1 pcs 2 pcs	1 pcs 2 pcs 2 pcs	1 pcs 2 pcs 2 pcs	1 pcs 3 pcs 3 pcs	1 pcs 2 pcs 3 pcs	1 pcs 2 pcs 3 pcs	1 pcs 2 pcs 3 pcs
1.0mm – 2.0mm At least 500mm apart	Centre Mid Margin	Nil Nil 1 pcs	Nil 1 pcs 1 pcs	Nil 2 pcs 2 pcs	Nil 2 pcs 2 pcs	Nil 3 pcs 3 pcs	Nil 2 pcs 2 pcs	Nil 2 pcs 2 pcs	Nil 2 pcs 2 pcs
Bubble Lines: Quantities listed below are for flat glass. For curved glass, double the acceptable quantity below with maximum acceptable length 80mm. Bubbles hidden behind printed borders are acceptable, unless specifically stated and agreed by both parties prior to commencement of manufacture.									
5mm –15mm long At least 500mm apart	<6.0mm in from edge	N/A	N/A	1	1	2	N/A	N/A	2
15mm –35mm long At least 750mm apart	<12.0mm in from edge	N/A	N/A	Nil	1	1	N/A	N/A	1
35mm –50mm long At least 900mm apart	12.0-15.0mm Max in from edge	N/A	N/A	Nil	Nil	Nil	N/A	N/A	Nil
Stains		Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Scratches, scars and rubs		Refer Clause 9.2.2							
Stretch marks – curved glass only		Stretch marks on curved glass is an inherent property of the product. Stretch marks are to be inspected under clause 9.2.2 but at 4.0metres, regardless of quality standard in clause 10.							
Ream and other linear distortion – curved glass excluded		Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Blemish type	Blemish size and limit of frequency per m2, rounder up to nearest M2 – ie 1.2m2 taken as 2.0m2.							
	Type 1	**Type 2**	**Type 3**	**Type 4**	**Type 5**	**Type 6**	**Type 7**	**Type 8**
Edge quality								
Shells/flange at least 500mm apart	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness	Max. size equal to 25% glass thickness
Broken corners and corners on/off	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce	Max 25% glass thickness Max 1 per pce
vented edges flat glass	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
vented edges curved glass	Nil	1 – Max size equal to thickness of glass	Nil	1 – Max size equal to thickness of glass	2 – Max size equal to thickness of glass	1 – Max size equal to thickness of glass	1 – Max size equal to thickness of glass	1 – Max size equal to thickness of glass
shark's teeth	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting	Less than 100% of glass thickness with no venting
Slippage between laminated layers			1.0mm per meter length on any edge	1.0mm per meter length on any edge	1.0mm per meter length on any edge per layer			1.0mm per meter length on any edge
Surface vent	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Surface blisters/ coating defections	>15mm – Nil (6 to 15mm) – 1 (3 to 6mm) – 2 (not clustered)	>15mm – Nil (6 to 15mm) – 2 (3 to 6mm) – 3 (not clustered)	>15mm – Nil (6 to 15mm) – 1 (3 to 6mm) – 2 (not clustered)	>15mm – Nil (6 to 15mm) – 2 (3 to 6mm) – 3 (not clustered)	>15mm – Nil (6 to 15mm) – 2 (3 to 6mm) – 3 (not clustered)	>15mm – Nil (6 to 15mm) – 2 (3 to 6mm) – 3 (not clustered)	Printing and paint imperfections shall be inspected under clause 9.5.2	Printing and paint imperfections shall be inspected under clause 9.5.2
Process surface imperfections	Refer Clause 9.2.4							

NOTES:

1) Heat-strengthened and toughened glass may be subjected to spontaneous fracture due to the presence of inclusions such as nickel sulphide, silicones, and the like even when such inclusions are smaller than those allowed in the table above. Glasshape is able to apply proprietary testing methods to minimize the presence of such inclusions.
2) Linear interpolation as defined in AS 1288 shall apply for non-standard thicknesses.

9 TEST METHODS

9.1 Determination of maximum and minimum thickness

9.1.1 *Apparatus*

The following apparatus is required:

(a) Plate micrometer graduated to 0.01 mm and with 55 mm diameter plates.

(b) Point micrometer with 60° included angle anvil with 0.3 mm radius, or apparatus to give an equivalent measurement.

9.1.2 *Procedure*

The procedure shall be as follows:

(a) At four appropriate locations approximately equally spaced around the perimeter of the glass pane, measure the actual thickness using the plate micrometer. The maximum measured thickness shall be taken as the maximum thickness.

(b) At four appropriate locations approximately equally spaced around the perimeter, measure the actual thickness using the point micrometer. The minimum thickness shall be taken as the minimum thickness.

NOTE: The appropriate locations for thickness measurement for patterned glass are at the peaks for maximum thickness measurements, and the bottom of valleys for minimum thickness measurements.

9.2 Edge quality

9.2.1

Using a torch or other suitable lighting to highlight edge quality, visually inspect the glass for faults and/or blemishes, e.g. vents, flanges, flakes, chips, wave, shark's teeth, nibs, corners on/off. Blemish size and frequency shall not be greater than shown in Table 4.

When assessing edge quality the following criteria shall be considered:

(a) The distance the damage extends into the thickness of the glass.

(b) Whether the edge defect is likely to cause breakage in transit or in a subsequent free falling, cutting or glazing process, or in use.

9.2.2 Surface Quality

Bubbles, inclusion, vented inclusion, Stains, surface vents, process surface imperfections, scratches, scars, rubs, edge band imperfections and distortions

Place the glass in a vertical position with day light in the back ground but not in direct sunlight. A suitable light source with horizontal and/or vertical lines may be used in lieu of daylight when checking for distortion.

View the panel from a perpendicular position and at an angle not less than 45 degrees. The imperfections shall not be visible from the specified distance agreed in clause 10.

9.2.3 Flatness

Flatness measurements shall be checked against a straightedge with the panes standing within 5° of vertical and measurement taken horizontally. Interpolation will be required for non-standard thicknesses.

9.2.4 Notes on Distortion

1. Visual distortion in glass clad polycarbonate is an inherent property of the product itself due to the chemical structure and manufacturing process. When glass is laminated to polycarbonate it does not remove this distortion and can at times increase the visual effects of the distortion. This is an expected and inherent property of polycarbonate and customers ordering this product do so with the understanding that any distortion visible is acceptable and is not a reason to request a replacement piece.
2. Visual distortion in thick and multi-laminated glass, is an inherent property of the product itself due to the amount of glass being viewed through and manufacturing process. All laminated glass has varying levels of distortion, but this visual effect is increased as more glass and laminate is added. This is an expected and an inherent property of thick laminated and multi-laminated glass and customers ordering this product do so with the understanding that there may be distortion visible of which is acceptable and is not a reason to request a replacement piece.
3. Distortion can occur in toughened glass and heat strengthened glass due to the heat treatment process and is called “roller wave”. The effect appears in the form of distortion bands 250-300mm apart horizontally or vertically. It is more noticeable if the bands are glazed vertically and/or if reflective glass is used. Heat-treated glass may also experience bow and Low-E glass may exhibit a distorted area in the centre of the pane. Manufacturing tolerances for surface flatness for roller wave are specified in clause 7 Table 3.
4. Surface distortion for heat treated glass shall not be measured within a 150 mm band from the edge of the glass panel, as distortion in this area is a result of localized warpage from the heating process.

10.0 QUALITY STANDARD OBSERVATION DISTANCES

10.1.1 Due to the wide range of quality requirements from the diverse industries Glasshape serve, a tiered level of quality is offered based on the distance imperfections are viewed from. These levels are;

10.1.2 **Marine Quality Glass Standard** - Panels are viewed as per clause 9.2.2 from a distance of 1.5 meters. The number of imperfections visible shall not exceed those detailed on Table 4. The term 'Marine Quality Glass' is defined as any glass being installed for use in a super yacht or luxury water vessel.
10.1.3 **Architectural Glass Standard** - Panels are viewed as per clause 9.2.2 from a distance of 3.0 meters. The number of imperfections visible shall not exceed those detailed on Table 4. The term 'Architectural Glass' is defined as glass being installed anywhere other than on a super yacht or luxury water vessel.
10.1.4 The person inspecting must have good vision quality with no known vision disorders. He must be viewing the panel from the centre most area.

10.1.5 **Allowable inspection time**

10.1.5.1 The following details the allowable time (seconds) to inspect glass panels for all defects listed in this standard.

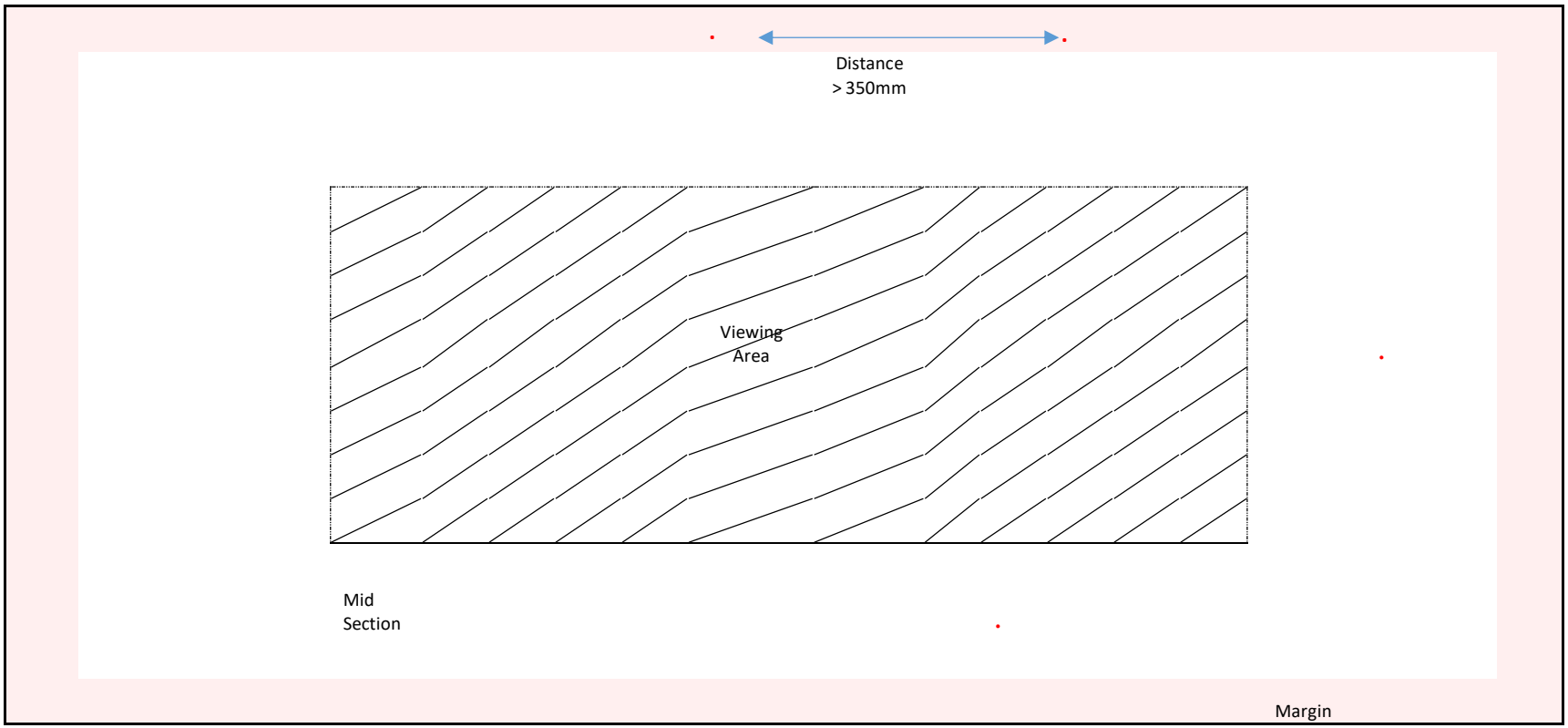
- 0 – 1.0 m2 = 30 Seconds
- 1.0 and greater = 60 seconds

10.1.6 **Panel area definition**

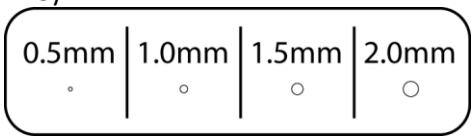
- Viewing Area – Centre portion of the panel which makes up 70% of the height and width. The centre point is taken from the intersection of diagonal lines from corner points.
- Mid-Section – Area outside of the viewing area and between the viewing area and margin.
- Margin – Border area of the panel comprising the 10% of the total height or width. The margin area is not included in any black out of frit borders.

Appendix 1: Defect Example #1: DuraShield Marine - Laminated Toughened Glass.

1. Marine Standard – Visible defects from 1.5 metres (clause 10.1.2). Allowable inspection time as per clause 10.1.5
2. The diagram below demonstrates the allowable size and location of defects in a panel of Durashield Marine.
3. All defects shown are between 0.5mm – 1.5mm



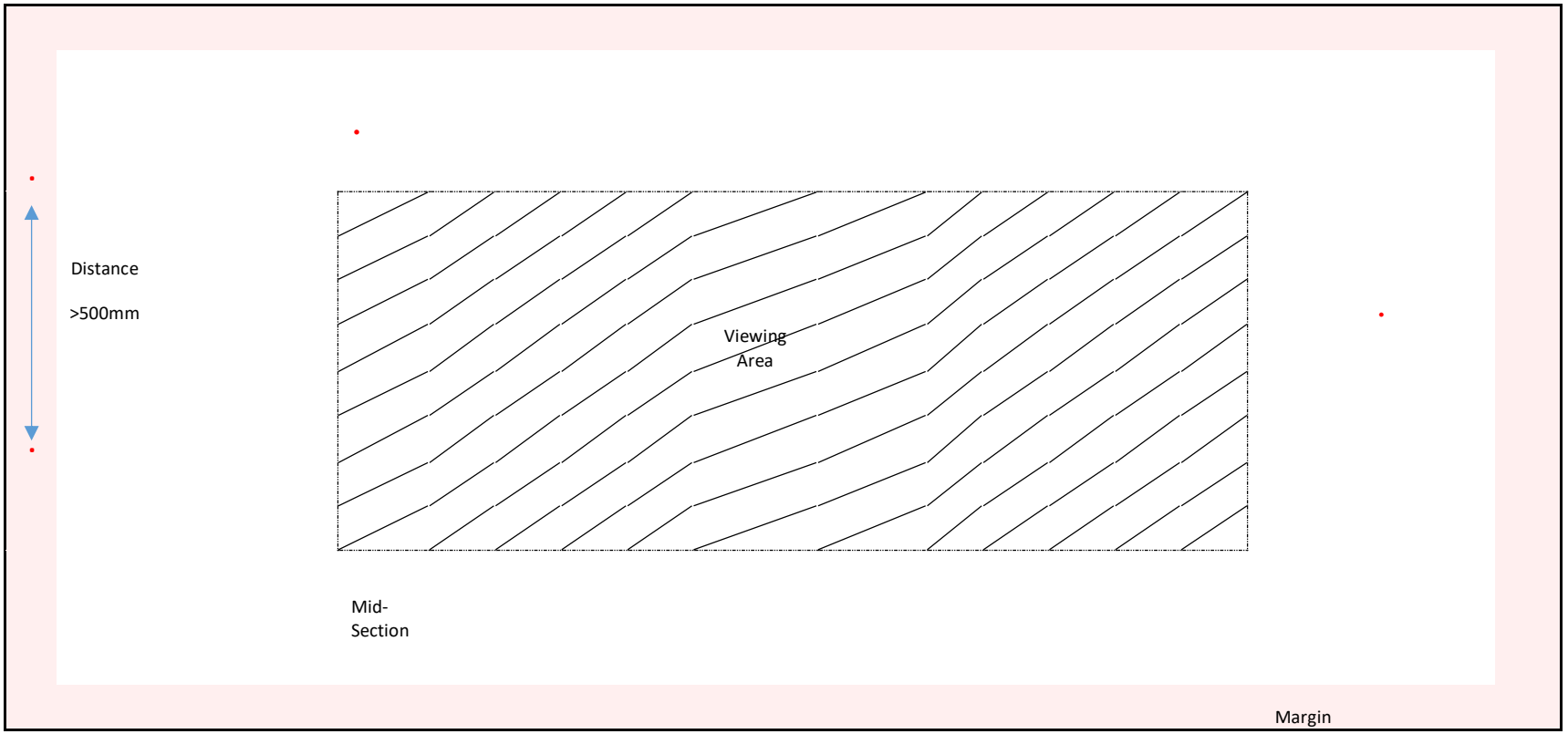
Key:



Appendix 2:

Defect Example #2: Durashield Marine – Annealed Laminate

1. Marine Standard – Visible defects from 1.5 metres (clause 10.1.2). Allowable inspection time as per clause 10.1.5
2. The diagram below demonstrates the allowable size and location of defects in a panel of Durashield Marine.1
3. All defects shown are between 0.5mm – 1.5mm

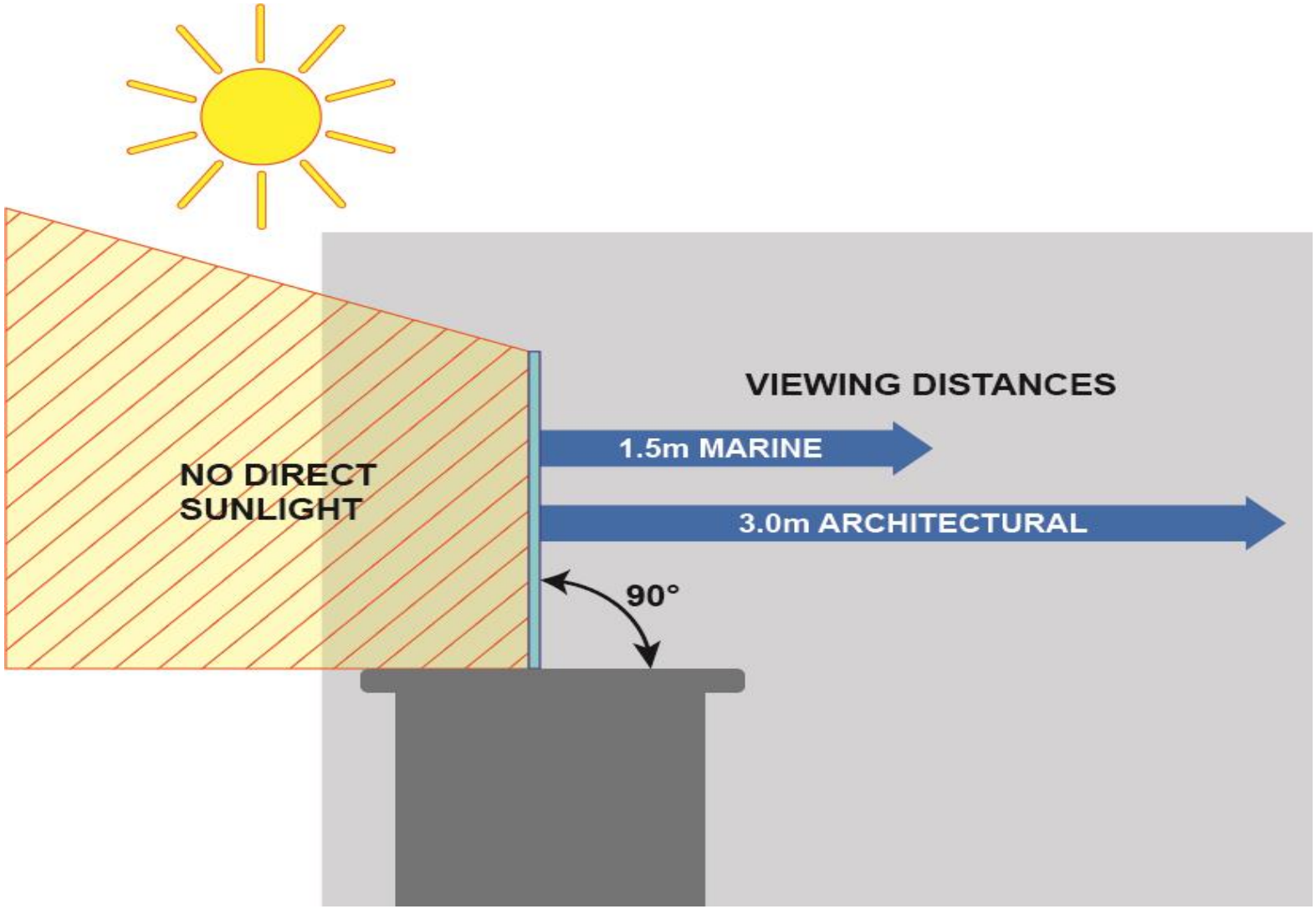


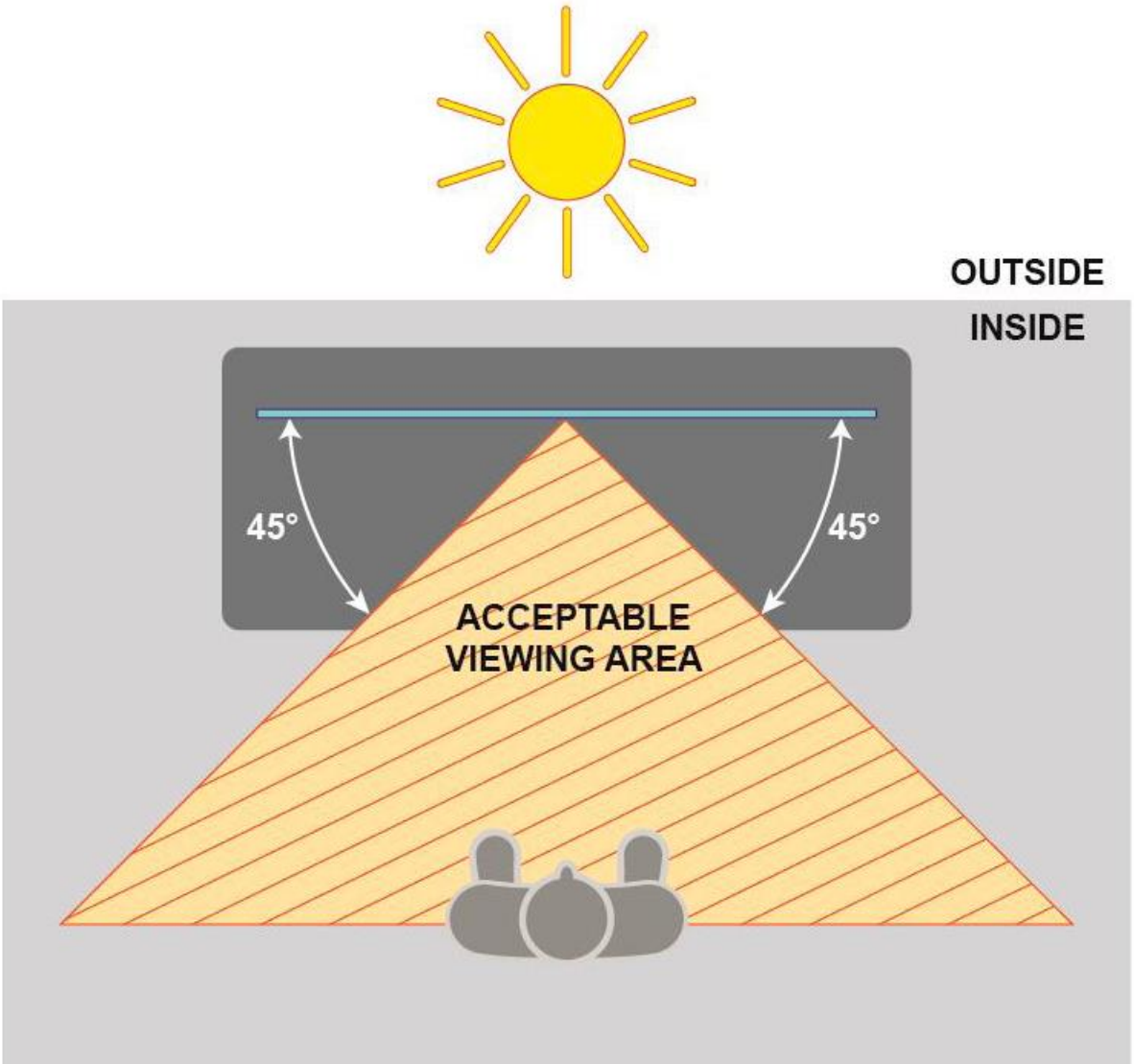
Key:

Appendix 3:

Defect Example #1: DuraShield Marine with Black frit border.

1. Marine Standard – Visible defects from 1.5 metres (clause 10.1.2). Allowable inspection time as per clause 10.1.5
2. Dot fade from the edge of the solid edge band must be viewed and inspected using the follow clauses 10.1.5 and table 2
3. Dimensional tolerances of glass panels, stamps and black out borders see table 2


VIEWING DISTANCES
1.5m MARINE
3.0m ARCHITECTURAL
NO DIRECT SUNLIGHT
90°


OUTSIDE
INSIDE
45°
45°
ACCEPTABLE
VIEWING AREA