



Specification for PV Solar Glass (Confidential)

Product: PV Solar Tempered Glass/ ARC Tempered Glass

Supplier: Henan Ancai Hi-Tech Co., Ltd

Date: March 16, 2021

Version: G

Confirmed by Supplier	
QA Dept.	R&D Dept.

Confirmed by Customer	
QA Dept.	R&D Dept.



Revision History				
Rev.	Date	Revised Item	Revised Content	Remark



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1. General

This specification is applied to PV solar tempered glass and ARC tempered glass, including criteria for technical data, visual inspection, packaging, storage, handling etc. This specification can be used as the technical agreement contracted with customer.

2. Specification

2.1 Visualization

Defects Name	Item	Specification			
Unclear Pattern	—	Not allowed			
Cockle, Mould,	—	Not allowed			
Rainbow, Mildew	—	Not allowed			
Streak, Abrasion	—	Not allowed			
Unmovable Stain	—	Not allowed			
Broken Seed,	—	Not allowed			
Hidden Line	—	Put the glass on the solar module for observing, pass if not visible.			
Impress	—	$\leq 7\text{mm}$			
Bright Spot	—	Not pass if seeable from distance of 600mm, pass if not seeable from distance of 600mm			
Coating Layer Scratch	Length and Width(mm)	$L \leq 60$ and ≤ 0.3		$L > 60\text{mm}$ or $W > 0.3\text{mm}$	
	Allowable Numbers(pcs)	No limits, distance between scratch ≥ 100		Not allowed	
Glass Scratch	Length and Width(mm)	$L \leq 5$ and $W \leq 0.2$		$L > 5$ or $W > 0.2$	
	Allowable Numbers(pcs)	$1.0 \times S$		0	
Round Bubble	Length(mm)	$L < 0.5$	$0.5 \leq L < 1.0$	$1.0 \leq L \leq 2.0$	$L > 2.0$
	Allowable Numbers(pcs)	No concentrated present	$5.0 \times S$	$3.0 \times S$	0
Elongated Bubble	Length(mm)	$0.5 < L \leq 1.0$ And $W \leq 0.5$		$1.0 < L \leq 3$ And $W \leq 0.5$	$L > 3$ or $W > 0.5$
	Allowable Numbers(pcs)	No concentrated present		$3.0 \times S$	0
Inclusion	Length(mm)	$0.3 \leq L \leq 1.0$		$L > 1.0$	
	Allowable Numbers(pcs)	$2.0 \times S$		0	
Cross-section Defects	Edge Chip	1 chip allowed within 5mm length along glass edge, length from edge to center is no more than 1mm, depth measured from surface to glass inside is no more than 1/4 of thickness.			
	Distortion	Not allowed			



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	Edge Straightness	Not allowed
<p>1. In the above chart, Φ means the diameter of the round seed, L means the length of the defect, W means the width, Φ, L, W all mean the optical deformation size of the defect. S means the dimension of glass plate (m²), the upper limit value of the amount of seed; foreign matter and block rake are the value which is received by multiplicative S and the corresponding coefficients. According to GB/T8170, this figure should be rounded off to integer.</p> <p>2. The distance between the seeds, and the distance between the seeds and the foreign matter should be greater than 300mm if the size of the seed is greater than 0.5mm.</p> <p>3. The dense existence of the round seed refers to the amount of the round seeds are greater than 20 within a circle area, of 100mm diameter. The dense existence of the long seed refers to the amount of the round ones are greater than 10 within a circle, of 100mm diameter.</p> <p>4. The scratch or foreign matter within a circle area, of 100mm diameter, is not allowed to be more than 2 stripes (pieces).</p> <p>5. The black pieces are not allowed.</p>		

2.2 Dimension

Unit: mm

Item		Specification
Length/Width		± 1.0
Thickness		± 0.20
Thickness Tolerance in One Piece	2.8/3.2	≤ 0.30
	4.0	≤ 0.40
Diagonals Tolerance		$\leq 0.10\%$
Safety Angle at Four Corners		Hypotenuse 2.0~4.0
Warp	Global Warp for 2.8mm Thickness	$\leq 0.40\%$
	Global Warp	$\leq 0.20\%$
	Local Warp	Anywhere within 300mm $\leq 0.5\text{mm}$
Glass Transmission	Non ARC	T2.8mm/T3.2mm $\geq 91.5\%$
		T4.0mm $\geq 91.3\%$
	Single ARC	T2.8mm/T3.2mm $\geq 93.5\%$
		T4.0mm $\geq 93.3\%$
	Double ARC	T2.8mm/T3.2mm $\geq 94.0\%$
		T4.0mm $\geq 93.8\%$
Pencil Hardness Test		$\geq 3\text{H}$
Coating Layer adhesion Test		Level 0
Fe ₂ O ₃		$\leq 0.015\%$

2.3 Safety

Item	Specification	
Fragmentation	2.8mm	The amount of fragments are not less than 15pcs within any area of 50mm×50mm, tiny amount of strip fragments are allowed, but the length should not be greater than 75mm.



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	3.2mm 4.0mm	The amount of fragments are not less than 40 within the any area of 50mm×50mm, tiny amount of strip fragments are allowed, but the length should not be greater than 75mm.
Impact		In the testing of 6pcs samples, if the number of damaged pieces is within 1, this test is OK. If the number of damaged pieces is 3 or more than 3, this test is failed. If the number of damaged pieces is within 2, take another 6 samples for test, if the damaged piece still happens, this test is failed.

3. Validation Procedure

3.1 Dimension Inspection

The measurement shall be taken by band tape with minimum scale unit of 1 mm.

3.2 Thickness Inspection

The measurement shall be taken by micrometer at the centers of the 4 sides with distance of 15mm from edge. The thickness shall be verified on average value of four points in mm.

3.3 Visual Inspection

Cosmetic defects shall be viewed from a distance of 0.9 meter over a matte black background using diffused daylight. All visual inspections for cosmetic defects shall be made from a distance of 0.9 meter perpendicular to glass by naked eye.

3.4 Transmission

Transmission shall be measured with an optical spectrometer OPTEK GST. See Figure below for Transmission ratio measurement. Transmission shall be measured to surface points between integral sphere and light source on the air-float station. Measurement will be taken on 15 points of 3 lines from up\middle\down locations. 5 points on each line will be taken. Average value of 15 points will be taken as transmission ratio.



Picture 1

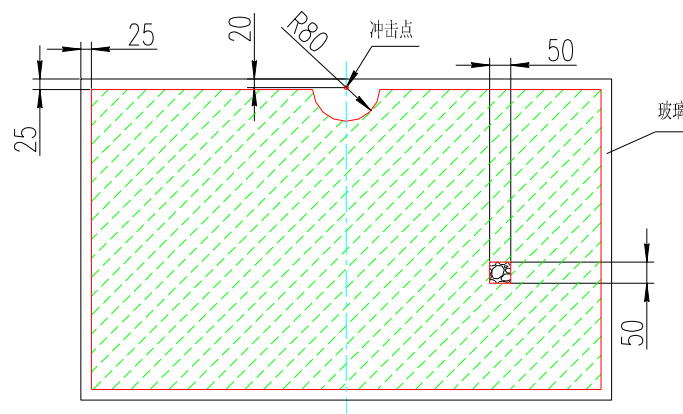
3.5 Fragmentation

3.5.1 Glass from in-line production will be taken as samples. Samples will be placed horizontally on the test table protected by safety surroundings in case of broken glass.

3.5.2 Glass is broken by small hammer with tip size of $0.2\text{mm} \pm 0.05\text{mm}$ pinching in the middle of glass which is 20mm away from long side edge.

3.5.3 Particle pattern for counting should be kept 10 seconds after pinching action and closed within 3 minutes.

3.5.4 The particle count shall be not made in the region of pinch point radius of 80mm and 25mm away from glass edge. The particle count shall be made in the coarsest fracture. The particle count shall be made by placing a mask of 50 ± 1 mm square on the test piece. The number of crack-free particles within the mask shall be counted. Particles cross frame should be counted as 1/2 piece. (see figure below)



Picture 2



3.6 Impact Test

3.6.1 Glass from in-line production will be taken as samples with size of 610mm×610mm.

3.6.2 The sun-towards surface will be taken as impacting face. If impacting face can't be decided, then two sets of samples will be tested. The surface with lower test results will be taken. Drop a 38 mm diameter 227 +/- 2 gram steel ball from a height of 1 meter at 90 degree at the center of the glass within the region of diameter 25mm from impacting point. One piece glass can only be tested for one time. Glass will be observed for broken or not. Test will be done at normal room temperature.

3.7 Warp

3.7.1 Global Warp (Bow): The bow shall be measured when placed in a vertical position and supported on its longer side by two load bearing blocks at the quarter points. The deformation shall be measured along the edges of the glass and along the diagonals by straight rule or tape. The percentage ratio between height of arc and the length of spring will presents Global Warp (Bow).

3.7.2 Local Warp (Kink): Samples will be vertically placed. Kink shall be measured over a limited length of 300 mm by using a straight edge, parallel to the edge at a distance of 25 mm from the edge of the glass. Kink shall be measured the maximum gap between feeler gauge and glass. The percentage ratio between gap value and 300mm will presents Local Warp (Kink).

3.7.3 Calculation of Warp $c=h/l*100\%$ in the formulation:

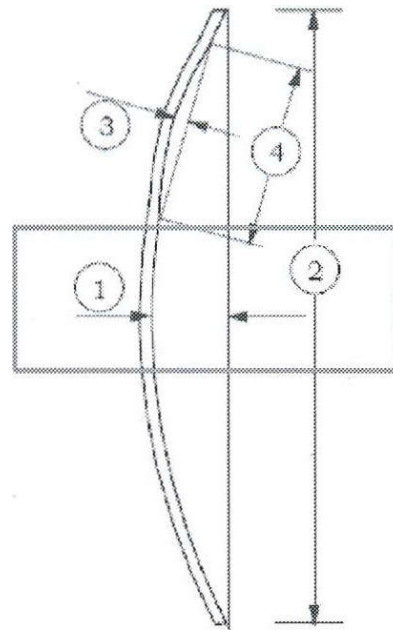
C——Warp, unit (%);

h—— height of arc or the depth of vally, unit (mm);

l—— distance from height of arc or the peak to peak. Unit (mm)。



Picture 3



Picture 4

3.8 Coating Hardness

3.8.1 The test method refer to the standard that testing the paint coating hardness with pencil in GB/T 6739-2006/ISO 15184: 1998, Colored paint and Varnish.

3.8.2 Using magnifying glass with magnification 6 to 10 times to observe the area scratched by pencil, the highest pencil hardness (the scratched hardness defined in the paint coating hardness test in ASTM 3363-92a) with no coating cohesion destroyed caused is the coating hardness.

3.8.2 The pencil hardness of the glass coating should not lower than 3H.

3.9 Sand and Dust Test

3.9.1 The test method refer to the test standard as in the part 12 : Sand and dust test of GJB 150.12A-2009: Laboratory environmental test methods for military materiel.

3.9.2 The difference loss of the transmittance $\Delta T \leq 1\%$ before and after aging and the glass coating do not have falling off, peeling and wrinkling obviously.

4. Package

Pack the wooden plate and plastic bags with one pallet, put the paperboard at the bottom, and place the mildew proof between the glass for isolation, then put into the desiccant after a batch of glass, seal the plastic bags with the transparent tape, tighten the wooden corner and plate with the packaging belt as the picture 5 below.



Picture 5

5. Requirement and Condition of Storage

- 1)The goods must be stored in a dry and ventilated warehouse. Do not break the pack.
- 2)For the opened products, suggest to seal with plastic sheeting for providing the water and dust pollution
- 3)Product must be arranged vertically in order to provide the scratch of glass.
- 4)The number of stacking should not exceed for 4 pallet. It is forbidden storing the ARC glass together with the chemical products(acid, alkali chemical products)
- 5)It is better to use the products within one day after opening the package in the rainy, high-temperature and high-damp condition. Please re-pack the glass if it is not used up in a day for keeping glass clean and the cohesive with EVA.
- 6)Shelf life
Six months for tempered glass(finish the using within 6 months from arrival of goods)
Three months for ARC tempered glass(finish the using within 3 months from glass arrival)