Specification for 2.0~2.5 PV solar toughened glass

Product：2.0～2.5mm PV solar toughened glass

Supplier： Henan Ancai Hi-Tech Co., Ltd

Date：8th December, 2013

Version: A

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

1、General

This is the technical standard of 2.0-2.5mm solar glass used for solar cell components. It stipulates the technical indicators, appearance quality, packaging, storage, transportation and other requirements of 2.0-2.5mm solar glass. This technical standard can be used as the content of the technical agreement between the company and the 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	—	Inspected against Sample			
impress	—	<=7mm			
bright spot	—	No pass if seeable from distance of 600mm，pass if no seeable from distance of 600mm			
Coating layer scratch	Length、Width(mm)	L≤60 and ≤0.3		L>60mm or W>0.3mm	
	Allowable numbers(pcs)	No limits，distance between scratch≥100		Not allowed	
Glass scratch	Length、Width(mm)	L≤5 and W≤0.2		L>5 or W>0.2	
	Allowable numbers(pcs)	1.0×S		0	
Round bubble	Length(mm)	L<0.5	0.5≤L<1.0	1.0≤L≤2.0	L>2.0
	Allowable numbers(pcs)	No concentrated present	5.0×S	3.0×S	0
Elongated Bubble	Length(mm)	0.5<L≤1.0 And W≤0.5		1.0<L≤3 And W≤0.5	L>3 or W>0.5
	Allowable numbers(pcs)	No concentrated present		3.0×S	0
Inclusion	Length(mm)	0.3≤L≤1.0		L>1.0	
	Allowable numbers(pcs)	2.0×S		0	
Cross section defects	Edge Chip	1 chip allowed when length along glass edge measured no more than 5mm，length measured 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			

	Edge Straightness	Not allowed

1. In the above chart, L means the length of the defect, W means the width, L, W all mean the optical deformation size of the defect. S means the dimension of glass plate (m^2), 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.
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.
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.
4：The scratch or foreign matter within a circle area, of 100mm diameter, is not allowed to be more than 2 stripes (pieces).
5：The black pieces are not allowed.

2.2 Dimension Unit：mm

Item		Specification
Length/Width	Length≤500	0 ～ -1.0
	500＜Length≤1000	0 ～ -1.5
	1000＜Length≤2000	0 ～ -2.0
	Length＞2000	0 ～ -2.5
Thickness		±0.20
Thickness tolerance in one piece		≤0.25
Diagonals tolerance		≤0.10%
Safty angle at four corners		hypotenuse 1.0～3.5
Warp	Global Warp	≤0.40%
	Local warp	Anywhere within 300mm≤0.5mm
Glass transmission （380～1100nm）	Non ARC	≥91.5%
	ARC	≥93.5%
Iron content（Fe_2O_3）		≤0.015%

2.3 Safety

Item	Specification
Fragmentation	Take 6 pieces of PV solar toughened glass for testing, qualified if broken qty ≤1 piece. Non-qualified if broken qty≥3 pieces. If broken qty equals 2 pieces, then take another 6 pieces of glass to testing again, and it only be qualified when no broken glass.
Impact	The solar glass specimen shall be subjected to 2400Pa pressure for 1 hour and the glass shall not be broken.

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

In diffused daylight, the cleaned glass is placed vertically 0.9 meters from the grey background and its mass is checked for up to 30 seconds by an observer standing 0.9 meters perpendicular to the surface of the glass.

3.4 Transmission

Transmission shall be measured with an optical spectrometer OPTEK GST. See Picutre1 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 The sample is made of the same material as the product, and the glass sample is selected for the normal production of the 610mm test piece made under the same process conditions

3.5.2 The impact surface is the side facing sunlight in practical use; if the impact surface cannot be determined, two groups of samples are used to test separately and the lower results are obtained.

The steel ball with a smooth surface of 227g is placed at a height of 1000mm away from the surface of the sample to allow it to fall freely. The impact point should be within 25mm from the center of the sample. The impact on each sample is limited to one time to see if it is damaged. The experiment was carried out at room temperature.

3.6 Impact test

- The solar toughened glass sample shall withstand 2400Pa (convert into the pressure 240kg×area（m^2）), keep the status for an hour, the glass should not be broken. The normal product is used as sample for test. Place the border horizontally, place the sample on the border, rubber frame is used to separate the sample from the frame (thickness 10mm, hardness of A50, the inner edge of the rubber frame should be flush with the inner edge of the frame). The rim of the sample is uniformly supported by the frame, the width of the support edge≥15mm. A pyramid form of 10kg graded sandbags was placed on the sample (the sandbags should not be placed on the edge of the sample above the rubber frame). The total weight of sandbags is calculated by integer（consider the practicability).

3.7 Warp

3.7.1 Global Warp (Bow)：Let the sample stand vertically at room temperature, Place 2 pads under 1/4 of its long sides, Position the sides of the sample or diagonal line horizontally with a ruler or cotton thread, use a ruler or tape measures the gap between the straight edge and the glass，The percentage ratio between height of arc and the length of spring will presents Global Warp (Bow).

3.7.2 Local Warp (waviness): Samples will be vertically placed, to be measured with 300mm knife edge ruler, then use the gauge to measure the maximum clearance between the blade and the glass. The percentage ratio between the clearance and 300mm will presents Local Warp (picture 2)

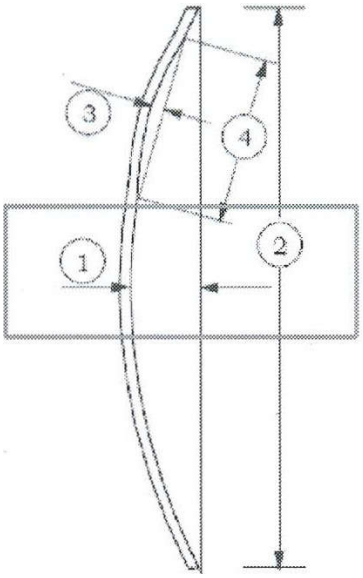
3.7.3. Calculation of Warp c=h/l*100%　　in the formulation (picture 3)：

C——Warp, unit: %

h——height of arc or the depth of valley, unit: (mm)

l——distance from height of arc or the peak to peak, unit: (mm)

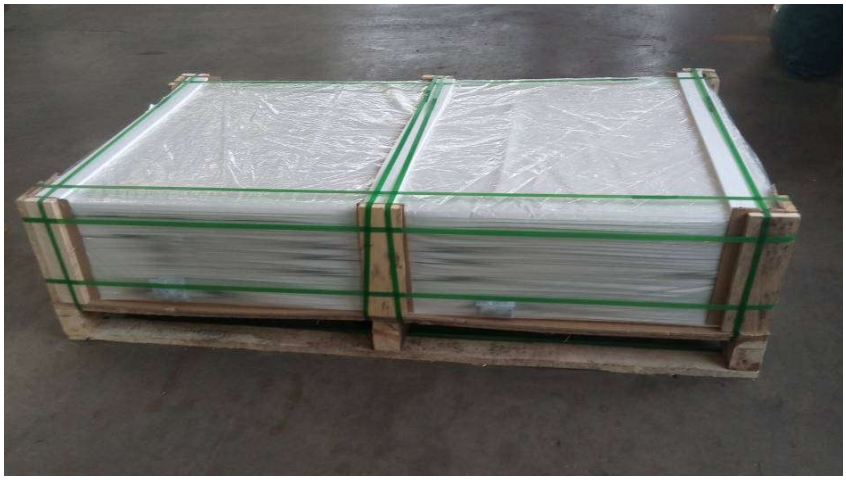
Picture 2



Picture 3

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 glasses for isolation, then put into the desiccant after a batch of glass, seal the plastic bags with the transparent tape, tightening the wooden corner and plate with the packaging belt. The picture 4 as follows:



Picture 4

5、Requirement and condition of storage:

1. The goods must be stored in a dry and ventilated warehouse. Do not break the packaging.

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 pallets, it is forbidden with storing the ARC glass and chemical products (acid, alkali chemical products).

5. It is better use the products when open the package in the rainy、high-temperature、high-damp condition within 1 day. Please re-pack the glass if it is not finish in a day, this action can keep the clean of glass and the cohesion strength with EVA.

Shelf life:

Six months for tempered glass (finish the using within 6 months from arrival of goods)

Three months for single-side ARC tempered glass (finish the using within 3 months from arrival of goods)