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Anti-Glare and Anti-Reflective Glass for Electronic Display

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Foreword

This Standard was drafted as per the rules specified in GB/T 1.1-2009.

This Standard was proposed by China Building Material Federation.

This Standard shall be under the jurisdiction of National Technical Committee for Standardization of Industrial Glass and Special Glass (SAC/TC 447).

Drafting organization of this Standard: AVIC (Hainan) Special Glass Technology Co., Ltd.; China Building Material Test & Certification Group Co., Ltd.; and AVIC (Hainan) Special Glass Technology Co., Ltd.

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Anti-Glare and Anti-Reflective Glass for Electronic Display

1 Scope

This Standard specifies the requirements, test methods, judgement rules and package, mark, transportation and storage of anti-glare and anti-reflective glass for electronic display (hereinafter referred to as anti-glare and anti-reflective glass).

This Standard is applicable to the anti-glare and anti-reflective glass for electronic display manufactured by the chemical etching method.

2 Normative References

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this document.

GB/T 2410 Determination of the Luminous Transmittance and Haze of Transparent Plastics

GB/T 2680 Determination of Light Transmittance, Solar Direct Transmittance, Total Solar Energy Transmittance and Ultraviolet Transmittance for Glass in Building and Related Glazing Factors

GB/T 2828.1-2012 Sampling Procedures for Inspection by Attribute – Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-Lot Inspection

GB/T 5137.1 Test Methods of Safety Glazing Materials Used on Road Vehicle

GB/T 9286 Paints and Varnishes - Cross Cut Test for Films

GB/T 9754 Paints and Varnishes-Measurement of Specular Gloss of Non-Metallic Paint Films at 20°, 60° and 85°

GB 11614 Flat Glass

GB/T 18915.1 Coated Glass – Part 1: Solar Control Coated Glass

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Anti-glare and anti-reflective glass for electronic display

The glass surface is modified by chemical etching method, then the glass has the functions of reducing the glare and reflection, and increasing the visible light transmission; which is suitable for the display field.

3.2 Point Defect

The defects on the glass surface like pits, different color points, particles, etc. after the chemical etching.

4 Requirements

4.1 General

The corresponding clauses for the technical requirements and test methods of anti-glare and anti-reflective glass can refer to Table 1.

Table 1 -- Technical Requirements and Test Methods of Anti-Glare and Anti-Reflective Glass

SN	Names	Requirements	Test Methods
1	Size, thickness and permissible tolerances	4.2	5.1
2	Appearance quality	4.3	5.2
3	Visible light transmittance ratio	4.4	5.3
4	Visible light reflectance ratio	4.5	5.4
5	Haze	4.6	5.5
6	Gloss	4.7	5.6
7	Wear resistance	4.8	5.7
8	Acid resistance	4.9	5.8
9	Heat and humidity resistance	4.10	5.9
10	Solvent resistance	4.11	5.10
11	Ink adhesion	4.12	5.11

4.2 Size, Thickness and Permissible Tolerances

The size, thickness and permissible tolerance shall be agreed between the supplier and the purchaser.

4.3 Appearance quality

The appearance quality of anti-glare and anti-reflective glass shall meet the requirements of Table 2.

Table 2 – Appearance Quality of Anti-Glare and Anti-Reflective Glass

Defect Names	Requirements
Scratch	Slight scratch shall be invisible to the naked eye with a distance of 300mm as per the appearance test method; the visible scratch is not allowed
Point defect	If D≤0.3mm, the number of permissible defects≤3 piece/m^2
	If 0.3mm<D≤0.5mm, the number of permissible defects≤1 piece/m^2
	If D>0.5mm, it is not allowed to exist
Intensity of point defect	The total number of all point defects≤5 piece/m^2
Optical distortion point	Not permissible
Chip, unfilled corner, line, and crack	Not permissible
Appearance color difference	No significant color difference by naked eye

4.4 Visible light transmittance ratio

The visible light transmittance ratio of single-side and double-sided chemical etching anti-glare and anti-reflective glass can refer to Table 3.

Table 3 – Visible Light Transmittance Ratio of Anti-Flare and Anti-Reflective Glass

Glass Thickness	Visible Light Transmittance Ratio /%	
	Single-sided chemical etching	Double-sided chemical etching
$t \leqslant 0.50$ mm	94.9±0.5	97.9±0.5
0.50 mm$<t\leqslant$1.00 mm	94.8±0.5	97.8±0.5
1.00 mm$<t\leqslant$1.80 mm	94.7±0.5	97.7±0.5
1.80 mm$<t\leqslant$3.20 mm	94.5±0.5	97.5±0.5

4.5 Visible light reflectance ratio

The visible light reflectance ratio of single-side and double-sided chemical etching anti-glare and anti-reflective glass can refer to Table 4.

Table 4 -- Visible Light Reflectance Ratio of Anti-Flare and Anti-Reflective Glass

Items	Single-sided chemical etching	Double-sided chemical etching
Visible light reflectance ratio / %	≤5	≤2

4.6 Haze

The haze of the anti-glare and anti-reflective glass shall be no greater than 4%.

4.7 Gloss

The gloss of the anti-glare and anti-reflective glass shall be no greater than 70.

4.8 Wear resistance

The average value attenuation of visible light transmittance ratio after test shall be no greater than 0.5%; and the functional layer surface has no obvious damage phenomena.

4.9 Acid resistance

The average value attenuation of visible light transmittance ratio after test shall be no greater than 0.5%; and the functional layer surface has no obvious damage phenomena.

4.10 Heat and humidity resistance

The average value attenuation of visible light transmittance ratio after test shall be no greater than 0.5%; and the functional layer surface has no obvious damage phenomena.

4.11 Solvent resistance

The average value attenuation of visible light transmittance ratio after test shall be no greater than 0.5%; and the functional layer surface has no obvious damage phenomena.

4.12 Ink adhesion

There is no ink peeling off phenomenon after the test.

5 Test Methods

5.1 Size, thickness and permissible tolerances

The size, thickness and permissible tolerances shall be agreed by the supplier and the purchaser; the test can be implemented as per the provisions of GB/T 11614.

5.2 Appearance quality

It shall be implemented as per the provisions of GB 11614; the observance distance is of 300mm.

5.3 Visible light transmittance ratio

5.3.1 Apparatus

For the spectrophotometer with integrating sphere, the diameter of the integrating sphere shall be no less than 100mm; the distance between sample and the integrating sphere entrance shall be no greater than 2mm; the wavelength shall at least include the range of 380nm~780nm.

5.3.2 Sample and measurement method

Samples are taken as required; each sample shall be tested for 5 measuring points as shown in Figure 1.

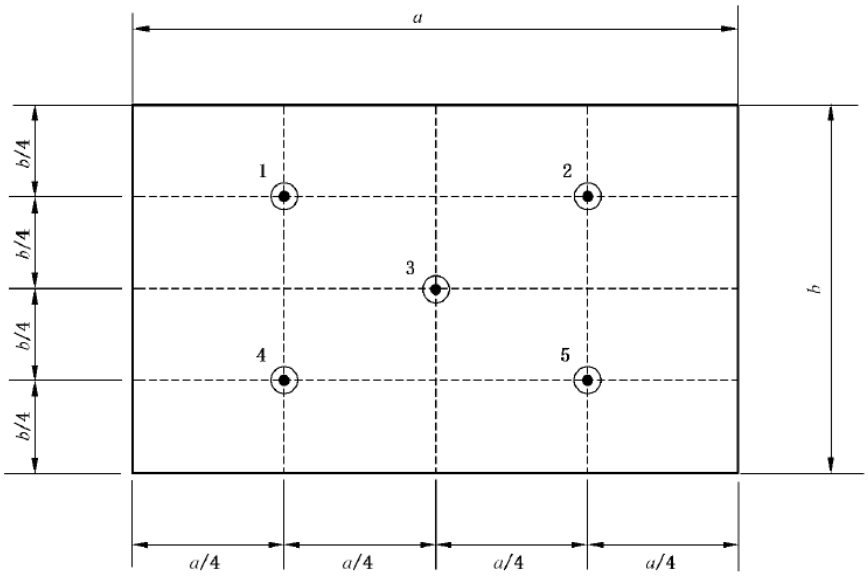

Figure 1 – Measuring Point Selection Diagram

5.3.3 Data processing

The visible light transmittance shall be tested and calculated as per the GB/T 2680; the test result for each piece of glass shall be the arithmetic mean of the five points.

5.4 Visible light reflectance ratio

The visible light reflectance ratio shall be tested and calculated as per the GB/T 2680; the test result for each piece of glass shall be the arithmetic mean of the five points.

5.5 Haze

Test as per the provisions of GB/T 2410.

5.6 Gloss

It shall be measured under the condition of 60° by instrument in accordance with the

GB/T 9754.

5.7 Wear resistance

5.7.1 Apparatus

The abrasion tester shall conform to the provisions of GB/T 5137.1.

5.7.2 Sample

There are 3 pieces of samples, each sample size is of 100mm×100mm.

5.7.3 Test

It shall be performed as per the provisions of GB/T 18915.1.

5.7.4 Result expression

According to the requirements of 5.3, each piece of glass shall be tested the visible light transmittance ratio in five zones before the abrasion test; then calculate their arithmetic mean of T_{before}; test its visible light transmittance ratio in five zones after the abrasion test; then calculate their arithmetic mean of T_{after}; the difference between T_{before} and T_{after} shall be the test result of such glass.

5.8 Acid resistance test

5.8.1 Test device and reagent

1000mL (diameter greater than 100mm) glass beaker; 316 stainless-steel tweezers. The hydrochloric acid with concentration of 36%~38%, and deionized water with conductivity of 0.10μS/cm ~ 0.06μS/cm.

5.8.2 Sample

There are 3 pieces of samples; each sample size is of 100mm×100mm.

5.8.3 Test procedures

5.8.3.1 Hold the sample with tweezers along the edge and place it into a beaker containing hydrochloric acid solution (concentration of hydrochloric acid solution is 1mol/L); immerse all the sample into the hydrochloric solution for 24h.

5.8.3.2 Use the tweezers to hold the sample along the edge and take it out; then wash with deionized water and absolute ethanol; place it at (105±5) °C oven; take out the sample, and place it into the dryer to cool off to the room temperature.

5.8.4 Result expression

According to the requirements of 5.3, each piece of glass shall be tested the visible light transmittance ratio in five zones before the hydrochloric acid solution immersion test; then calculate their arithmetic mean of T_{before}; test its visible light transmittance ratio in five zones after the hydrochloric acid solution immersion test; then calculate their arithmetic mean of T_{after}; the difference between T_{before} and T_{after} shall be the test result of such glass.

5.9 Heat and humidity resistance test

5.9.1 Apparatus

The test device shall be able to meet the requirements for test temperature (85±2) °C, relative humidity (85±5) %, and retention time 1000h.

5.9.2 Sample

There are 3 pieces of samples; each sample size is of 100mm×100mm.

5.9.3 Test procedures

5.9.3.1 Place the sample without any pretreatment at room temperature into the test device; test as per the setting conditions; the test time is 1000h.

5.9.3.2 After the test, take out the sample; wash it with deionized water and absolute ethanol in sequence; place into (105±5) °C oven; then take it out and place into the dryer to cool off to the room temperature.

5.9.4 Result expression

According to the requirements of 5.3, each piece of glass shall be tested the visible light transmittance ratio in five zones before the heat and humidity resistance test; then calculate their arithmetic mean of T_{before}; test its visible light transmittance ratio in five zones after the heat and humidity resistance test; then calculate their arithmetic mean of T_{after}; the difference between T_{before} and T_{after} shall be the test result of such glass.

5.10 Solvent resistance test

5.10.1 Apparatus

1000mL (diameter greater than 100mm) glass beaker; 316 stainless-steel tweezers; acetone with purity no less than 99.5%; or absolute ethanol with purity no less than 99.5%.

5.10.2 Sample

There are 3 pieces of samples; each sample size is of 100mm×100mm.

5.10.3 Test procedures

Hold the sample with tweezers along the edge of the sample; place it into the beaker containing acetone or absolute ethanol; immerse the sample totally into the acetone or absolute ethanol for 5min; after that take out the sample, place into (105±5) °C oven; then take it out and place into the dryer to cool off to the room temperature.

5.10.4 Result expression

According to the requirements of 5.3, each piece of glass shall be tested the visible light transmittance ratio in five zones before the solvent immersion test; then calculate their arithmetic mean of T_{before}; test its visible light transmittance ratio in five zones after the solvent resistance test; then calculate their arithmetic mean of T_{after}; the difference between T_{before} and T_{after} shall be the test result of such glass.

5.11 Ink adhesion test

It shall be performed as per the provisions of GB/T 9286; the cross-track spacing is 1mm.

6 Judgment Rules

6.1 Inspection classification

6.1.1 Exit-factory inspection

The inspection items include size deviation, appearance quality, visible light transmittance ratio, visible light reflectance ratio. Other requirements shall be agreed upon by the supplier and the purchaser.

6.1.2 Type inspection

The inspection items are all the ones required in the Clause 4. The type inspection shall be carried out under the following conditions:

a) The trail-type identification for the re-export production of new or old products;

b) After the normal production, when there are major changes in the structure, materials and processes that may affect the product performance;

c) After the normal production, the type inspection shall be carried out once at least a year;

d) After a long-term shutdown, when the production is restored;

e) When the exit-factory inspection result is significantly different form the previous

type inspection;

f) When requested by the Product Quality Supervision Department or the Component Authority.

6.2 Batching and sampling

When performing the type inspection, random sampling is performed as per the glass batch and the sample qty. specified in Table 5. When the batch size is more than 1200 pieces, 1200 pieces are taken into one group; sampling shall be from different batches. Table 5 is based on GB/T 2828.1-2012, AQL=2.5.

Table 5 – Sampling Solution Form Unit: piece

Batch range	Sample qty.	Number of receptions	Number of rejections
2~8	2	0	1
9~15	3	0	1
16~25	5	1	2
26~50	8	1	2
51~90	13	2	3
91~150	20	3	4
151~280	32	5	6
281~500	50	7	8
501~1 200	80	10	11

6.3 Judgment rules

6.3.1 When testing the appearance quality, visible light transmittance ratio, visible light reflectance ratio, haze and gloss of the product, if all the test items of the test results of one piece of glass meet the requirements, then such piece of glass is qualified; otherwise, it is disqualified.

For a batch of glass, if the number of the disqualified glass is no greater than the number of receptions in Table 5, then the above-mentioned indicators of such batch of glass is qualified; if the number of the disqualified glass is no less than the number of rejections in Table 5, then the above-mentioned indicators of such batch of glass is disqualified.

6.3.2 When performing the following product tests like wear resistance test, acid resistance test, heat and humidity resistance test, solvent resistance test and ink adhesion test; the test quantity for each item shall be 3 pieces; when all the samples meet the requirements, the product is qualified; when there is 2 or more pieces of samples are disqualified, then such item shall be disqualified; when there is 1 piece of sample is disqualified, add 3 additional pieces of samples, if all the 3 pieces of samples are qualified, then such item is qualified; as long as there is 1 piece is disqualified, then

such item shall be judged disqualified.

6.3.3 If one of the inspection items fails to pass the test, then such batch of products are disqualified.

7 Package, Mark, Transportation, Storage

7.1 Package

The package of the glass can take the wooden boxes, cartons or containers (racks); The boxes (racks) shall be easy to handle and transport. Each box (rack) shall be loaded by the glass with the same thickness and the same size. Protective measures shall be taken Between glass And glass, as well as Between glass And box (rack); prevent the glass is damaged or the surface is scratched. If necessary, sufficient amount of desiccant shall be placed.

7.2 Mark

The package mark shall conform to the provisions of relevant national standards; each package box shall be marked with “upward, lightly handling, carefully broken, rainproof and wetproof” signs or typefaces; the glass thickness, production date, factory name, factory address, or trademark shall be indicated.

7.3 Transportation

Products can be transported by various types of vehicles; the handling rules and conditions shall conform to the provisions of national regulations. When transporting, the glass shall be fixed firmly to prevent the slipping and dumping; the rain protection measures shall be taken.

7.4 Storage

The storage site shall be dry and ventilated.

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