

SEMI PV63-0223

SPECIFICATION FOR ULTRA-THIN GLASSES USED FOR PHOTOVOLTAIC MODULES

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1 Purpose

1.1 The purpose of this Standard is to standardize requirements for ultra-thin glasses for photovoltaic modules.

2 Scope

2.1 This Specification covers requirements, test methods, sampling, and judgment rules for ultra-thin glass for photovoltaic modules.

2.2 This Specification applies to ultra-thin glass with heat-treated technology, including float and tempered (or heat strengthened) ultra-thin glass, patterned and tempered (or heat strengthened) ultra-thin glass.

2.3 This Specification applies to the glass used for double-glass photovoltaic module, and normal module with glass and polymer back sheet.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 None.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI PV47 — Specification for Anti-Reflective-Coated Glass, Used in Crystalline Silicon Photovoltaic Modules

4.2 *ASTM® Standards*¹

ASTM C1279 — Non-Destructive Photoelastic Measurement of Edge and Surface Stresses in Annealed, Heat-strengthened, and Fully Tempered Flat Glass

4.3 *CEN/CENELEC® Standards*²

EN 572-2 — Glass in Building. Basic Soda Lime Silicate Glass Products – Part 2: Float Glass

EN 572-5 — Glass in Building. Basic Soda Lime Silicate Glass Products – Part 5: Patterned Glass

EN 1096-1 — Glass in Building. Coated Glass – Part 1: Definitions and Classification

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>. ASTM trademark is owned by ASTM International.

² European Committee for Standardization, Rue de la Science 23, B-1040 Brussels; Telephone: +32.2.550.08.11, Fax: +32.2.550.08.19, <http://www.cen.eu>. CEN and CENELEC trademarks are owned by European Committee for Standardization.

EN 1288-3 — Glass in Building. Determination of the Bending Strength of Glass – Part 3: Test with Specimen Supported at Two Points (Four Point bending)

EN 1863-1 — Glass in Building. Heat Strengthened Soda Lime Silicate Glass – Part 1: Definition and Description

4.4 ISO® Standards³

ISO 2859-1 — Sampling Procedures for Inspection by Attributes – Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-lot Inspection

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 *Abbreviations and Acronyms* AQL — acceptance quality level

5.1.2 *T* — thickness of ultra-thin glass

5.3 Definitions

5.3.1 *ultra-thin glass used for photovoltaic module* — glass with thickness of 1.6 to 3 mm (containing 1.6 mm) used for photovoltaic module, as shown in Figure 1.

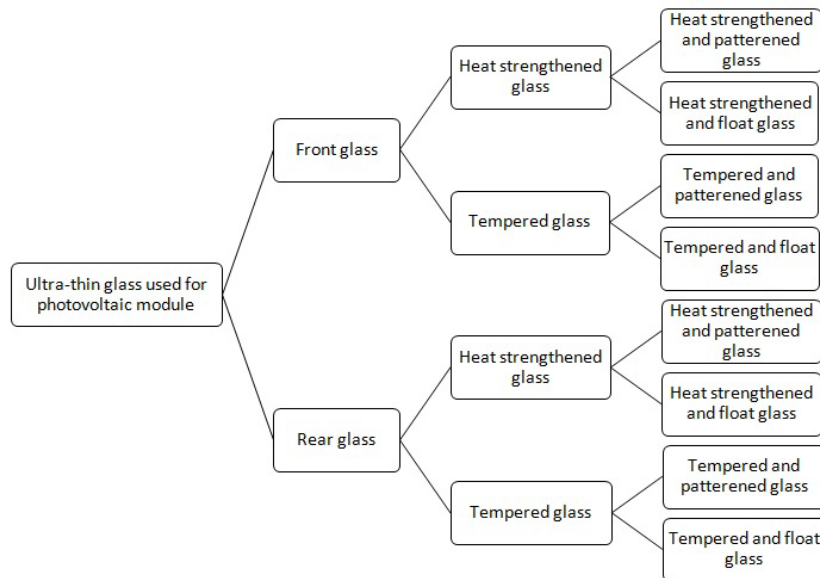


Figure 1
Ultra-Thin Glass Used for Photovoltaic Module

5.3.2 *ultra-thin heat-treated glass* — ultra-thin glass with the heat-treated technology, the mechanical strength and heat shock resistance of the glass can be improved.

5.3.3 *ultra-thin front glass* — front glass used for the photovoltaic module, which is ultra-white glass, including patterned and float glass, coated and uncoated glass.

5.3.4 *ultra-thin rear glass* — ultra-thin glass only used for the back of double-glass module, which is usually normal float and uncoated glass, and it can also be ultra-white glass.

³ International Organization for Standardization, ISO Central Secretariat, Chemin de Blandonnet 8, CP 401-1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>. ISO trademark is owned by International Organization for Standardization.

6 Test Methods

6.1 Test Condition

6.1.1 Tests shall be carried in the conditions as follows:

1. Temperature: $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$;
2. Pressure: $8.60 \times 10^4 \text{ Pa}$ to $1.06 \times 10^5 \text{ Pa}$;
3. Relative humidity: 40% to 80%.

6.2 Appearance

6.2.1 Appearance test of uncoated glass shall be carried according to EN 572-2 and EN 572-5. Appearance test of coated glass shall be carried according to EN 1096-1.

6.3 Size Tolerance

6.3.1 Length and width are tested by steel tape with minimum scale of 1 mm. Thickness is tested on the middle spots which are 15 mm away from the glass edge by outside micrometer with 0.01 mm accuracy or the equipment with the same accuracy. Thickness difference of the glass is the gap difference between maximum and minimum value.

6.4 Hole

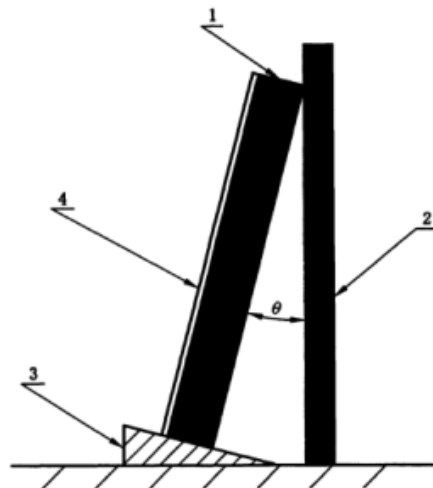
6.4.1 Test the size of holes on the glass with appliance such as vernier caliper, whose minimum scale is 0.02 mm. Test the relative position of the holes with steel ruler or steel tape measure, whose minimum scale is 1 mm.

6.5 Edge Processed

6.5.1 Visually inspect the glass at 600 mm away from the front of glass under fine natural light and scattering light.

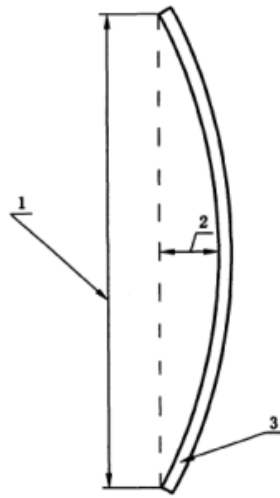
6.6 Bending Degree

6.6.1 During measurement, the sample shall be placed close to the rock plate or the plate with the same accuracy, and the rock plate shall be placed at an angle of $5^{\circ} \pm 2^{\circ}$ with the vertical plane as shown in Figure 2. Put an edge ruler or metal wire close to the two sides or diagonal of the glass. And test the gap between straight line and the glass with a feeler. The degree of bow is then expressed as the deformation, divided by the measured length of the edge of the glass, or diagonal as shown in Figure 3.



#1 Where 1 = plate, 2 = bracket, 3 = base, and 4 = glass.

Figure 2
Sample Placement Diagram



#1 Where 1 = glass side or diagonal length, 2 = deformation of the bow, and 3 = glass.

Figure 3
Schematic Diagram of Bow Test

6.6.2 Local bow shall be measured over a limited length of 300 mm by using an edge ruler or a metal line. As shown in Figure 4, degree of local bow is represented by the height of the trough or crest by using a feeler. No measurement shall be made in the area of 150 mm at the edge. The measurement shall be carried out at room temperature.



#1 Where 1 = 300 mm length, 2 = local bow, and 3 = glass.

Figure 4
Schematic Diagram of Local Bow

6.7 Bending Strength

6.7.1 The test is performed according to Appendix 1.

6.8 Optical Properties

6.8.1 The test is performed according to SEMI PV47.

6.9 Iron Content

6.9.1 Iron content test is performed according to phenanthroline spectrophotometry method.

6.10 Impact Resistance

6.10.1 Twelve glass products are selected as samples to do the test, in which six products are reserved.

6.10.2 Put the glass product on the supporting fixture, and keep the impact surface horizontal.