

SEMI PV87-1018 (Reapproved 0124) TEST METHOD FOR PEELING FORCE BETWEEN ELECTRODE AND RIBBON/BACK SHEET

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1 Purpose

1.1 This Standard aims to formulate the method that measures the peeling force between electrode and ribbon/back sheet, including: 1) ribbon and front electrode, 2) ribbon and back electrode, and 3) back sheet and back surface layer. Peeling force test is a common used method to evaluate the reliability of paste, ribbon, back sheet, ethylene vinyl acetate (EVA), etc. for PV industry. This Standard offers a principle for conducting the peeling force with sample preparation, test procedure, and setting of test conditions, as well as data analysis. Furthermore, the test provides a basis for the reliability evaluation of raw material.

2 Scope

2.1 This Standard applies to the testing of peeling force between 1) ribbon and front electrode, 2) ribbon and back electrode, and 3) back sheet and back surface layer.

2.2 This Standard specifies the peeling force test with terms and definitions, test procedure, sample preparation, test conditions, data processing, etc.

2.3 This Standard applies to the evaluation of the reliability of raw material for PV industry, like paste, ribbon, back sheet, EVA, etc.

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 This Standard does not specify the parameters of laminating process.

4 Referenced Standards and Documents

4.1 BSI Standards¹

BS EN 61189-2 — Test Methods for Electrical Materials – Printed Boards and Other Interconnection Structures and Assemblies

4.2 ISO® Standards²

ISO 7500-1 — Metallic Materials – Calibration and Verification of Static Uniaxial Testing Machines – Part 1: Tension/Compression Testing Machines – Calibration and Verification of the Force-Measuring System

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 EVA — ethylene vinyl acetate

¹ British Standards Institution, 389 Chiswick High Road, London, W4 4AL, UK; Telephone: +44.0.20.8996.9001, Fax: +44.0.20.8996.7001, <http://www.bsigroup.com>

² 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 Summary of Test Method

- 6.1 Keep the direction of peeling force at a fixed angle during peeling force test.
- 6.2 The failure of test specimen is determined by peeling force data curve.

7 Apparatus

7.1 Universal testing machine capable of performing peeling force tests and of operating within the parameter ranges specified in this Test Method.

7.1.1 Test machine has appropriate loading range, clip/fixture is able to apply tensile force and move with a constant velocity. It should be equipped with effective measurement system and recording system, as well as the self-adjust clip which can grab the end of sample firmly. Clip/fixture should be capable of adjusting the center lines with the sample, to ensure that both have the consistent direction based on the applied force. All equipment should be calibrated regularly.

8 Reagents and Materials

8.1 *Peeling Force Test Between Ribbon and Front/Back Electrodes*

8.1.1 Ribbon

8.1.2 Flux

8.2 *Peeling Force Test Between Back Sheet and Back Surface Field*

8.2.1 Back sheet

8.2.2 EVA

8.2.3 Glass (for test)

8.2.4 Linoleum

8.2.5 High temperature tape

9 Safety Precautions

- 9.1 Test engineer must wear PVC gloves.
- 9.2 Check the status of test apparatus (any loose of screw, etc.) before use.
- 9.3 Do not move tensile test machine when using it, in case of the possible injury caused by toppling over.
- 9.4 Do not repeat soldering the ribbon.
- 9.5 Be careful when using knife for specimen preparation of back surface test.
- 9.6 Wearing mask and gloves when cleaning test pieces in order to avoid breath in dust and injury from splinter or ribbon.

10 Test Specimens

10.1 *Peeling Force Test Between Ribbon and Front/Back Electrodes*

10.1.1 Both front and back electrodes should be soldered with ribbon, and the end of ribbon should cross cell edge a bit (refer to Figures 1 and 2). Soldering can be divided into manual and machine for different companies. For manual soldering, ribbon should be immersed in flux for 10 minutes. For machine soldering, flux can be sprayed on ribbon. Soldering condition can be set according to company's mass production setting. Soldering requirement: no faulty soldering, no mismatch soldering, effective soldering area of busbar >80% of whole busbar area, a typical mismatch soldering is shown in Figure 3.

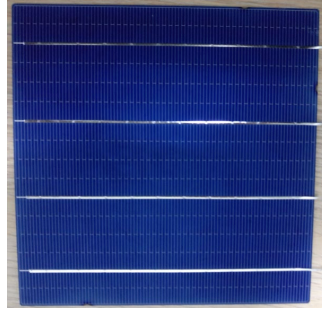


Figure 1
Specimen After Front Electrode Soldering



Figure 2
Specimen After Back Electrode Soldering



Figure 3
Mismatch Soldering

10.2 Specimen Preparation-Peeling Force Test Between Back Sheet and Back Surface Field

10.2.1 Procedure

10.2.1.1 Prepare back sheet, EVA, glass and cell, one for each (size of back sheet, EVA, and glass should be larger than cell's size); Slice the back sheet into (10 ± 1) mm width strips and stack it as the normal module, shown in Figure 4.

10.2.1.2 Take a 20 mm to 30 mm width linoleum (length should be longer than cell) and place it under the cell, between back sheet and EVA, in order to avoid back sheet stick with glass completely. Fasten linoleum, cell, EVA, and back sheet on glass with high temperature tape.

10.2.1.3 Laminate the sample under the same condition of mass production module, multiple cell samples can be placed in one laminating sample. Slice back surface (both EVA and aluminum-silicon alloy layer) field into the same