

SEMI PV44-0513 (Reapproved 0519) SPECIFICATION FOR PACKAGE PROTECTION TECHNOLOGY FOR PHOTOVOLTAIC MODULES

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1 Purpose

1.1 The purpose of this Standard is to standardize requirements for package protection technology for transporting photovoltaic (PV) modules.

2 Scope

2.1 This Specification applies to crystalline silicon PV modules, including monocrystalline silicon, multicrystalline silicon and other type of crystalline silicon PV modules.

2.2 This Specification is intended for specifying package protection technology during transportation.

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 Specification is not intended for specifying detailed packaging methods for crystalline silicon PV modules.

3.2 This Specification is not intended for specifying properties of all packaging materials.

4 Referenced Standards and Documents

4.1 *ASTM Standards*¹

ASTM D642 — Standard Test Method for Determining Compressive Resistance of Shipping Containers, Components, and Unit Loads

ASTM D880 — Standard Test Method for Impact Testing for Shipping Containers and Systems

ASTM D4332 — Standard Practice for Conditioning Containers, Packages, or Packaging Components for Testing

ASTM D4728 — Standard Test Method for Random Vibration Testing of Shipping Containers

4.2 *IEC Standards*²

IEC 60904-9 — Photovoltaic Devices – Part 9: Solar Simulator Performance Requirements

IEC 61215 — Crystalline Silicon Terrestrial Photovoltaic (PV) Modules – Design Qualification and Type approval

4.3 *ISO Standard*³

ISO 780 — Packing-Pictorial Marking for Handling of Goods

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² International Electrotechnical Commission, 3 rue de Varembe, Case Postale 131, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.919.02.11, Fax: +41.22.919.03.00, <http://www.iec.ch>

³ International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>

4.4 ISTA Standard⁴

ISTA 3E — ISTA 3 Series General Simulation Performance Test Procedure

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

5 Terminology

5.1 Refer to the SEMI International Standards: Compilation of Terms (COTs) for a list of the current Abbreviations, Acronyms, Definitions, and Symbols.

5.2 *Abbreviations and Acronyms* *AH* — test load apply and hold

5.2.2 *C* — compression test system

5.2.3 *F* — compensating factor

5.2.4 *P_{max1}* — power of PV modules before the test

5.2.5 *P_{max2}* — power of PV modules after the test

5.2.6 *PSD* — power spectral density level

5.2.7 *S* — total number of packaged-products in a stack

5.2.8 *STC* — standard test conditions

5.2.9 *v* — power variation degree of PV modules

5.2.10 *W* — warehouse compression

5.2.11 *W_t* — gross weight of the unitized load

5.3 Definitions

5.3.1 *unit load* — a single load for transportation made up of products and packaging materials, usually consisting of one or more products or packaged-products on a skid or pallet, secured together for distribution as a whole.

6 Test Methods

6.1 Test Procedure Before the Reliability Test for the Unit Load

6.1.1 Expose the PV modules to sunlight (either real or simulated) for pre-exposure according to § 5 in IEC 61215.

6.1.2 Visually inspect and record the appearance of PV modules.

6.1.3 Test the performance of every PV module under STC according to IEC 61215, and record the maximum power as *P_{max1}*. Repeatability of the maximum power measurement should be better than ±1%, to minimize the influence of factors other than the packaging on the electrical performance test.

6.1.4 Package the PV modules into the unit load and record the location of modules in the package case. Record the outside dimensions (i.e., length, width, and height) of the unit load in cm and the package appearance.

6.1.5 Select another PV module as a control for the test. The control module shall be in accordance with IEC 61215.

6.2 *Reliability Tests* — In accordance with ISTA 3E, tests shall be performed on the unit load in the sequence indicated in the Table 1. Atmospheric conditioning test is optional.

Table 1 Test Category and Sequence

<i>Sequence</i>	<i>Test Category</i>	<i>Test Type</i>
1	Atmospheric Preconditioning	Temperature and Humidity
2	Atmospheric Conditioning	Controlled Temperature and Humidity

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