

# 13.4

## List of International Standards Related to PV

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### 13.4.1 Introduction

The establishment of standards is an important part of the development of an industry. Preparing new standards is generally a very long procedure based on discussions with many stakeholders, involving research laboratories, testing laboratories, manufacturers, and users. The lists below demonstrate the extent of topics covered by PV standards, including quality, reliability, safety, qualification, design requirements or recommendations, dimensions, characterization and measurement procedures, equipment, material specifications, etc. The standardization of specifications, materials, and procedures has also been critical to reduce the cost of PV manufacturing and deployment, and to ensure the quality of PV components.

The history of PV standards (Ossenbrink, *et al.*, 2012) started in 1978 with a demonstration program supported by the US Department of Energy (DOE) and managed by the Jet Propulsion Laboratory (JPL) of Pasadena. The 1980 original qualification standard for PV modules was called the “Block V Specification” that included a series of qualification tests forming the basis of what today has become the well-known and widely used IEC 61215 Standard. The task of developing standards was taken over by the Institute of Electrical and Electronic Engineers (IEEE) in the 1980s, then by the International Electrotechnical Commission (IEC, 2015a), the Underwriters’ Laboratories (UL, 2015) and Semiconductor Equipment and Materials International (SEMI, 2015). Many countries have their own national series of PV-related standards but they are for the most part based on the standards developed by IEC. The UL standards are in general related to the safety of PV components or systems, while the SEMI standards are related to the manufacturing of PV modules.

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*Photovoltaic Solar Energy: From Fundamentals to Applications*, First Edition.

Edited by Angèle Reinders, Pierre Verlinden, Wilfried van Sark, and Alexandre Freundlich.

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Companion website: [www.wiley.com/go/reinders/photovoltaic\\_solar\\_energy](http://www.wiley.com/go/reinders/photovoltaic_solar_energy)

The different groups of experts working on the development of IEC standards are part of a photovoltaic Technical Committee (TC), called TC 82 (IEC, 2015b). An overview of TCs is given by IEC (2015c). The technical committee TC 82 is itself divided into several Working Groups (WG), Project Teams (PT) and Joint Working Groups (JWG):

- WG 1: Glossary
- WG 2: Modules, non-concentrating
- WG 3: Systems
- WG 6: Balance of System Components
- WG 7: Concentrating modules and systems
- WG 8: Photovoltaic (PV) Cells
- PT 62994-1: Environmental Health and Safety (EH&S) Risk Assessment for the sustainability of PV manufacturing – Part 1. General principles and definition of terms
- JWG 1: JCG TC 82/TC 88/TC 21/SC 21A
- JWG 82: TC 21/TC 82 – Secondary cells and batteries for Renewable Energy Storage, managed by TC 21
- JWG 32: Electrical safety of PV system installation, managed by TC 64

### 13.4.2 IEC Standards Overview

The active and draft IEC standards at the time of writing (August 2015) related to PV are listed in Table 13.4.1. Also listed are Technical specifications (IEC/TS), which are not standards but recommendations. At the bottom of Table 13.4.1 are shown the current standards in preparation or “Proposed New Work” (PNW), which will eventually become a draft, then a standard.

**Table 13.4.1** Active and Draft IEC standards and technical specifications

Standard	Title	Remarks
IEC 60891:2009	Photovoltaic devices – Procedures for temperature and irradiance corrections to measured I-V characteristics	Active
IEC 60904-1 Ed. 2.0, 2006	Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics	Active
IEC 60904-1 Ed. 3.0	Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics	Draft
IEC 60904-1-1 Ed. 1.0	Photovoltaic devices – Part 1-1: Measurement of current-voltage characteristics of multi-junction photovoltaic devices	Draft
IEC 60904-2 Ed. 3.0	Photovoltaic devices – Part 2: Requirements for reference solar devices	Active
IEC 60904-3 Ed. 3.0	Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data	Active
IEC 60904-4 Ed. 1.0, 2009	Photovoltaic devices – Part 4: Reference solar devices – Procedures for establishing calibration traceability	Active
IEC 60904-5 Ed. 2.0, 2011	Photovoltaic devices – Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method	Active

(Continued)

**Table 13.4.1** (Continued)

Standard	Title	Remarks
IEC 60904-7 Ed. 3.0, 2008	Photovoltaic devices – Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices	Active
IEC 60904-7 Ed. 4.0	Photovoltaic devices – Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices	Draft
IEC 60904-8 Ed. 2.0, 2014	Photovoltaic devices – Part 8: Measurement of spectral response of a photovoltaic (PV) device	Active
IEC 60904-8-1 Ed. 1.0	Photovoltaic devices – Part 8-1: Measurement of spectral response of multi-junction photovoltaic (PV) devices	Draft
IEC 60904-9 Ed. 2.0, 2007	Photovoltaic devices – Part 9: Solar simulator performance requirements	Active
IEC 60904-9 Ed. 3.0	Photovoltaic devices – Part 9: Solar simulator performance requirements	Draft
IEC 60904-10 Ed. 2.0, 2009	Photovoltaic devices – Part 10: Methods of linearity measurement	Active
IEC 60904-11 Ed. 1.0	Photovoltaic devices – Part 11: Measurement of initial light-induced degradation of crystalline silicon solar cells and photovoltaic modules	Draft
IEC/TS 60904-12 Ed. 1.0	Photovoltaic devices – Part 12: Infrared thermography of photovoltaic modules	Draft
IEC/TS 60904-13 Ed. 1.0	Photovoltaic devices – Part 13: Electroluminescence of photovoltaic modules	Draft
IEC 61215-1 :2016	Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Requirements for testing	Active
IEC 61215-1-1 :2016	Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules	Active
IEC 61215-1-2 Ed. 1.0	Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-2: Special requirements for testing of cadmium telluride (CdTe) photovoltaic (PV) modules	Draft
IEC 61215-1-3 Ed. 1.0	Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-3: Special requirements for testing of amorphous silicon (a-Si) and microcrystalline silicon (micro c-Si) photovoltaic (PV) modules	Draft
IEC 61215-1-4 Ed. 1.0	Terrestrial photovoltaic (PV) modules Design qualification and type approval – Part 1-4: Special requirements for testing of copper indium gallium selenide (CIGS) and copper indium selenide (CIS) photovoltaic (PV) modules	Draft
IEC 61215-2 :2016	Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2: Test procedures	Active
IEC 61345 (1998-02) Ed.2.0	UV test for photovoltaic (PV) modules	Active
IEC 61646 (2008-05) Ed.2.0	Thin-film terrestrial photovoltaic (PV) modules-Design qualification and type approval	Active
IEC 61683-1999, Ed.1	Photovoltaic systems – Power conditioners – Procedure for measuring efficiency	Active
IEC 61683 Ed. 2.0	Photovoltaic systems – Power conditioners – Procedure for measuring efficiency	Draft

**Table 13.4.1** (Continued)

Standard	Title	Remarks
IEC 61701 (2011-03) Ed.2.0	Salt mist corrosion testing of photovoltaic (PV) modules	Active
IEC 61724-1998, Ed.1	Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis	Active
IEC 61724-1 Ed. 1.0	Photovoltaic system performance – Part 1: Monitoring	Draft
IEC 61724-3 :2016	Photovoltaic system performance – Part 3: Energy evaluation method	Active
IEC 61725-1997, Ed.1	Analytical expression for daily solar profiles	Active
IEC 61727-2004, Ed.2.0	Photovoltaic (PV) systems – Characteristics of the utility interface	Active
IEC 61730-1 Ed. 2.0	Photovoltaic (PV) module safety qualification – Part 1: Requirements for construction	Active
IEC 61730-2 Ed. 2.0	Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing	Active
IEC 61829 Ed.2.0, 2015	Crystalline silicon photovoltaic (PV) array – On-site measurement of I-V characteristics	Active
IEC 61836-2007, Ed.1	Solar photovoltaic energy systems – Terms, definitions and symbols	Active
IEC 61853-1 (2011-01) Ed.1.0	Photovoltaic module performance testing and energy rating – Part 1: Irradiance and temperature performance measurements and power rating	Active
IEC 61853-3 Ed. 1.0	Photovoltaic (PV) module performance testing and energy rating – Part 3: Energy Rating of PV Modules	Draft
IEC 61853-4 Ed. 1.0	Photovoltaic (PV) module performance testing and energy rating – Part 4: Standard reference climatic profiles	Draft
IEC 62093-2005, Ed.1	Balance-of-system components for photovoltaic systems – Design qualification natural environments	Active
IEC 62093 Ed. 2.0	Balance-of-system components for photovoltaic systems – Design qualification natural environments	Draft
IEC 62108 Ed. 2.0	Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval	Active
IEC 62109-1-2010, Ed.1	Safety of power converters for use in photovoltaic power systems – Part 1: General requirements	Active
IEC 62109-2-2011, Ed.1	Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters	Active
IEC 62109-3 Ed. 1.0	Safety of power converters for use in photovoltaic power systems – Part 3: Particular requirements for electronic devices in combination with photovoltaic elements	Draft
IEC PAS 62111-1999, Ed.1	Specifications for the use of renewable energies in rural decentralised electrification	Active
IEC 62116-2014, Ed. 2	Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters	Active
IEC 62124-2004, Ed.1.0	Photovoltaic (PV) stand alone systems – Design verification	Active

(Continued)

**Table 13.4.1** (Continued)

Standard	Title	Remarks
IEC 62253-2011, Ed.1.0	Photovoltaic pumping systems – Design qualification and performance measurements	Active
IEC/TS 62257-1 (2015) Ed. 3.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 1: General introduction to rural electrification	Active
IEC/TS 62257-2 (2015) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 2: From requirements to a range of electrification systems	Active
IEC/TS 62257-3 (2015) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 3: Project development and management	Active
IEC/TS 62257-4 (2015) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 4: System selection and design	Active
IEC/TS 62257-5 (2015) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 5: Protection against electrical hazards	Active
IEC/TS 62257-6 (2015) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 6: Acceptance, operation, maintenance and replacement	Active
IEC/TS 62257-7 (2008) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 7: Generators	Active
IEC/TS 62257-7-1 (2010) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 7-1: Generators – Photovoltaic Generators	Active
IEC/TS 62257-7-3 (2008) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 7-3: Generator set – Selection of generator sets for rural electrification systems	Active
IEC/TS 62257-8-1 (2007) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries	Active
IEC/TS 62257-9-1 (2008) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-1: Micropower systems	Active
IEC/TS 62257-9-2 (2006) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-2: Microgrids	Active
IEC/TS 62257-9-3 (2006) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-3: Integrated system – User interface	Active
IEC/TS 62257-9-4 (2006) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-4: Integrated system – User installation	Active
IEC/TS 62257-9-5 (2016) Ed. 3.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-5: Integrated system – Selection of portable PV lanterns for rural electrification projects	Active
IEC/TS 62257-9-6 (2008) Ed. 1.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-6: Integrated system – Selection of Photovoltaic Individual Electrification Systems (PV-IES)	Active

**Table 13.4.1** (Continued)

Standard	Title	Remarks
IEC/TS 62257-12-1 (2015) Ed. 2.0	Recommendations for small renewable energy and hybrid systems for rural electrification – Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and recommendations for household lighting equipment	Active
IEC/TS 62257-7 Ed. 2.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 7: Generators	Draft
IEC/TS 62257-7-1 Ed. 3.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 7-1: Generators – Photovoltaic generators	Draft
IEC/TS 62257-7-3 Ed. 2.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 7-3: Generator set – Selection of generators sets for rural electrification systems	Draft
IEC/TS 62257-8-1 Ed. 2.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries	Draft
IEC/TS 62257-9-5 Ed. 3.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-5: Integrated systems – Selection of stand-alone lighting kits for rural electrification	Active
IEC/TS 62257-9-6 Ed. 2.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-6: Integrated system – Selection of Photovoltaic Individual Electrification Systems (PV-IES)	Draft
IEC/TS 62257-12-1 Ed. 2.0	Recommendations for renewable energy and hybrid systems for rural electrification – Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and recommendations for household lighting equipment	Active
IEC 62446-1 Ed. 1.0	Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 1: Grid connected systems – Documentation, commissioning tests and inspection	Active
IEC 62446-2 Ed. 1.0	Grid connected PV systems – Part 2: Maintenance of PV systems	Draft
IEC 62446-3 Ed. 1.0	Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 3: Outdoor infrared thermography of photovoltaic modules and plants	Draft
IEC 62509-2010	Battery charge controllers for photovoltaic systems – Performance and functioning	Active
IEC 62548 Ed. 1.0	Photovoltaic (PV) arrays – Design requirements	Active
IEC 62670-1 Ed.1.0, 2013	Concentrator photovoltaic (CPV) module and assembly performance testing and energy rating-Part 1:Performance measurements and power rating-Irradiance and temperature	Active
IEC 62670-2 Ed. 1.0,2015	Concentrator photovoltaic (CPV) performance testing – Part 2: Energy measurement	Active
IEC 62670-3	Concentrator photovoltaic (CPV) performance testing – Part 3: Performance measurements and power rating	Draft
IEC 62688 Ed. 1.0	Concentrator photovoltaic (CPV) module and assembly safety qualification	Draft

(Continued)

**Table 13.4.1** (Continued)

Standard	Title	Remarks
IEC 62716 Ed.1.0 2013	Ammonia corrosion testing of photovoltaic (PV) modules	Active
IEC TS 62727-2012 Ed.1	Photovoltaic systems – Specification for solar trackers	Active
IEC/TS 62738 Ed. 1.0	Design guidelines and recommendations for photovoltaic power plants	Draft
IEC 62759-1 Ed. 1.0	Transportation testing of photovoltaic (PV) modules – Part 1: Transportation and shipping of PV module stacks	Active
IEC 62782 Ed. 1.0	Dynamic mechanical load testing for photovoltaic (PV) modules	Active
IEC 62787 Ed. 1.0	Concentrator photovoltaic (CPV) solar cells and cell-on-carrier (COC) assemblies – Reliability qualification	Draft
IEC 62788-1-2 Ed. 1.0	Measurement procedures for materials used in photovoltaic modules – Part 1-2: Encapsulants – Measurement of volume resistivity of photovoltaic encapsulation and backsheets materials	Active
IEC 62788-1-4 Ed. 1.0	Measurement procedures for materials used in Photovoltaic Modules – Part 1-4: Encapsulants – Measurement of optical transmittance and calculation of the solar-weighted photon transmittance, yellowness index, and UV cut-off frequency	Active
IEC 62788-1-5 Ed. 1.0	Measurement procedures for materials used in photovoltaic modules – Part 1-5: Encapsulants – Measurement of change in linear dimensions of sheet encapsulation material under thermal conditions	Active
IEC 62788-1-6 Ed. 1.0	Measurement procedures for materials used in photovoltaic modules – Part 1-6: Encapsulants – Test methods for determining the degree of cure in Ethylene-Vinyl Acetate encapsulation for photovoltaic modules	Draft
IEC 62788-2 Ed. 1.0	Measurement procedures for materials used in photovoltaic modules – Part 2: Polymeric materials used for front sheets and backsheets	Draft
IEC 62788-7-2	Measurement procedures for materials used in photovoltaic modules – Part 7-2: Environmental exposures – Accelerated weathering tests of polymeric materials=	Draft
IEC/TS 62789 Ed.1.0, 2014	Specification for concentrator cell description	Active
IEC 62790 Ed.1.0 2014	Junction boxes for photovoltaic modules – Safety requirements and tests	Active
IEC/TS 62804 Ed. 1.0	Test methods for detection of potential-induced degradation of crystalline silicon photovoltaic (PV) modules	Active
IEC 62805-1 Ed. 1.0	Method for measuring photovoltaic (PV) glass – Part 1: Measurement of total haze and spectral distribution of haze	Draft
IEC 62805-2 Ed. 1.0	Method for measuring photovoltaic (PV) glass – Part 2: Measurement of transmittance and reflectance	Draft
IEC 62817-2014 Ed.1	Photovoltaic systems – Design qualification of solar trackers	Active
IEC 62852 Ed. 1.0 2014	Connectors for DC-application in photovoltaic systems – Safety requirements and tests	Active

**Table 13.4.1** (Continued)

Standard	Title	Remarks
IEC 62891 Ed. 1.0	Overall efficiency of grid connected photovoltaic inverters	Draft
IEC 62892-1 Ed. 1.0	Comparative testing of PV modules to differentiate performance in multiple climates and applications – Part 1: Overall test sequence and method of communication	Draft
IEC 62894 Ed.1.0 2014	Photovoltaic inverters – Data sheet and name plate	Active
IEC/TS 62910 Ed. 1.0	Test procedure of Low Voltage Ride-Through (LVRT) measurement for utility-interconnected photovoltaic inverter	Active
IEC/TS 62915 Ed. 1.0	Photovoltaic (PV) Modules – Retesting for type approval, design and safety qualification	Draft
IEC/TS 62916 Ed. 1.0	Bypass diode electrostatic discharge susceptibility testing	Draft
IEC 62920 Ed. 1.0	EMC requirements and test methods for grid connected power converters applying to photovoltaic power generating systems	Draft
IEC 62925 Ed. 1.0	Thermal cycling test for CPV modules to differentiate increased thermal fatigue durability	Draft
IEC 62938 Ed. 1.0	Non-uniform snow load testing for photovoltaic (PV) modules	Draft
IEC/TS 62941 Ed. 1.0	Guideline for increased confidence in PV module design qualification and type approval	Active
IEC 62979 Ed. 1.0	Photovoltaic module bypass diode thermal runaway test	Draft
IEC 62980 Ed. 1.0	Photovoltaic modules for building curtain wall applications	Draft
IEC/TS 62989 Ed. 1.0	Primary Optics for Concentrator Photovoltaic Systems	Draft
IEC 62994-1 Ed. 1.0	Environmental Health & Safety (EH&S) Risk Assessment for the sustainability of PV module manufacturing – Part 1. General principles and definition of terms	Draft
IEC 62788-5-1 Ed. 1.0	Measurement procedures for materials used in photovoltaic modules – Part 5-1 Suggested test methods for use with edge seal materials (proposed future IEC 62788-5-1)	Draft
IEC 62788-6-2	Measurement procedures for materials used in photovoltaic modules – Part 6-2: Moisture permeation testing with polymeric films (proposed future IEC 62788-6-2)	Draft
IEC/TS 63019 Ed. 1.0	Information model for availability of photovoltaic (PV) power systems	Active
IEC/TS 61724-2 Ed. 1.0	Photovoltaic system performance – Part 2: Capacity evaluation method	Active
IEC/TS 62446-3 Ed. 1.0	Photovoltaic (PV) System – Requirements for testing, documentation and maintenance – Part 3: Outdoor Infrared thermography of PV modules and plants	Draft
IEC 60904-9-1 Ed. 1.0	Photovoltaic devices – Part 9-1: Collimated beam solar simulator performance requirements	Draft
IEC 63027 Ed. 1.0	DC arc detection and interruption in photovoltaic power systems	Draft
IEC 62446-2 Ed. 1.0	Grid connected photovoltaic (PV) systems – Part 2: Maintenance of PV systems (proposed IEC 62446-2)	Draft

### 13.4.3 Underwriters' Laboratories (UL) Standards

The UL standards related to the reliability and safety of PV components and systems are listed in Table 13.4.2 (status August 2015).

### 13.4.4 The SEMI Standards

The SEMI standards and specifications related to the manufacturing of PV wafers, cells and modules, as well as the characterization of measurement methods are listed in Table 13.4.3 (status August 2015).

**Table 13.4.2** UL standards

Standard	Title
OOI 1279	Solar Collectors
OOI 1699B	PV DC Arc-fault circuit protection
OOI 2579 (248-19)	Low Voltage Fuses – Fuses for Photovoltaic Systems
OOI 2703	Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with for Flat-Plate Photovoltaic Modules and Panels
OOI 3703	Solar Trackers
OOI 3730	Photovoltaic Junction Boxes
OOI 4248-18	Fuseholders, Part 18: PV
OOI 4703	PV Wire
OOI 489B	Molded case circuit breakers, MC switches, and circuit breaker enclosures for use with PV systems
OOI 508I	Outline of investigation for Disconnect Switches Intended for use in Photovoltaic systems
OOI 5703	Determination of the Max Operating Temp Rating of PV Backsheet Materials
OOI 6703	Connectors for Use in PV Systems
OOI 6703A	Multi-pole connectors for use in PV Systems
OOI 8703	Concentrator Photovoltaic Modules and Assemblies
OOI 9703	Distributed Wiring Harnesses
OOI 98B	Outline of investigation for enclosed and dead-front switches for use in PV systems
UL 1703	Flat Plate Photovoltaic Modules and Panels
UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
UL 61215	Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
UL 61646	Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval
UL 62108	Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval
UL 62109-1	Safety of power converters for use in photovoltaic power systems – Part 1: General requirements

**Table 13.4.3** SEMI standards and specifications

Standard	Title	Remarks
SEMI PV1-0211	Test Method for Measuring Trace Elements in Silicon Feedstock for Silicon Solar Cells by High-Mass Resolution Glow Discharge Mass Spectrometry	Active
SEMI PV2-0709E	Guide for Equipment Communication Interfaces (PVECI)	Active
SEMI PV3-1115	Guide for High Purity Water Used in Photovoltaic Cell Processing	Active
SEMI PV4-0311	Specification for Range of 5th Generation Substrate Sizes for Thin Film Photovoltaic Applications	Active
SEMI PV5-1115	Guide for Oxygen (O <sub>2</sub> ), Bulk, Used in Photovoltaic	Active
SEMI PV6-1115	Guide for Argon (Ar), Bulk, Used in Photovoltaic Applications	Active
SEMI PV7-1115	Guide for Hydrogen (H <sub>2</sub> ), Bulk, Used in Photovoltaic Applications	Active
SEMI PV8-1115	Guide for Nitrogen (N <sub>2</sub> ), Bulk, Used in Photovoltaic Applications	Active
SEMI PV9-1115	Test Method for Excess Charge Carrier Decay in PV Silicon Materials by Non-Contact Measurements of Microwave Reflectance After a Short Illumination Pulse	Active
SEMI PV10-0716	Test Method for Instrumental Neutron Activation Analysis (INAA) of Silicon	Active
SEMI PV11-1115	Specifications for Hydrofluoric Acid, Used in Photovoltaic Applications	Active
SEMI PV12-1115	Specifications for Phosphoric Acid Used in Photovoltaic Applications	Active
SEMI PV13-0714	Test Method for Contactless Excess-Charge-Carrier Recombination Lifetime Measurement in Silicon Wafers, Ingots, and Bricks Using an Eddy-Current Sensor	Active
SEMI PV14-1215	Guide for Phosphorus Oxychloride, Used in Photovoltaic Applications	Active
SEMI PV15-1215	Guide for Defining Conditions for Angle Resolved Light Scatter Measurements to Monitor the Surface Roughness and Texture of PV Materials	Active
SEMI PV16-0316	Specifications for Nitric Acid, Used in Photovoltaic Applications	Active
SEMI PV17-1012	Specification for Virgin Silicon Feedstock Materials for Photovoltaic Applications	Active
SEMI PV18-0912	Guide for Specifying a Photovoltaic Connector Ribbon	Active
SEMI PV19-0712	Guide for Testing Photovoltaic Connector Ribbon Characteristics	Active
SEMI PV20-0316	Specifications for Hydrochloric Acid, Used in Photovoltaic Applications	Active
SEMI PV21-1011	Guide for Silane (SiH <sub>4</sub> ), Used in Photovoltaic Applications	Active

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**Table 13.4.3** (Continued)

Standard	Title	Remarks
SEMI PV22-1011	Specification for Silicon Wafers for Use in Photovoltaic Solar Cells	Active
SEMI PV23-1011	Test Method for Mechanical Vibration of Crystalline Silicon Photovoltaic (PV) Modules in Shipping Environment	Active
SEMI PV24-1011	Guide for Ammonia (NH <sub>3</sub> ) in Cylinders, Used in Photovoltaic Applications	Active
SEMI PV25-1011	Test Method for Simultaneously measuring Oxygen, Carbon, Boron and Phosphorus in Solar Silicon Wafers and Feedstock by Secondary Ion Mass Spectrometry	Active
SEMI PV26-1011	Guide for Hydrogen Selenide (H <sub>2</sub> Se) in Cylinders, Used in Photovoltaic Applications	Active
SEMI PV27-0316	Specifications for Ammonium Hydroxide, Used in Photovoltaic Applications	Active
SEMI PV28-0316	Test Methods for Measuring Resistivity or Sheet Resistance with a Single-Sided Noncontact Eddy-Current Gauge	Active
SEMI PV29-0212	Specification for Front Surface Marking of PV Silicon Wafers with Two-Dimensional Matrix Symbols	Active
SEMI PV30-0316	Specifications for 2-Propanol, used in Photovoltaic Applications	Active
SEMI PV31-0212	Test Method for Spectrally Resolved Reflective and Transmissive Haze of Transparent Conducting Oxide (TCO) Films of PV Application	Active
SEMI PV32-0312	Specification for Marking of PV Silicon Brick Face and PV Wafer Edge	Active
SEMI PV33-0316	Specifications for Sulfuric Acid, used in Photovoltaic Applications	Active
SEMI PV34-0213	Practice for Assigning Identification Numbers to PV Si Wafer and Solar Cell Manufacturers	Active
SEMI PV35-0215	Specification for Horizontal Communication Between Equipment for Photovoltaic Fabrication System	Active
SEMI PV36-0316	Specifications for Hydrogen Peroxide, used in photovoltaic applications	Active
SEMI PV37-0912	Guide for Fluorine (F <sub>2</sub> ), Used in Photovoltaic	Active
SEMI PV38-0912	Test Method for Mechanical Vibration of C-SI PV cells in Shipping Environment	Active
SEMI PV39-0513	Test method for in-line measurement of cracks in PV silicon wafers by dark field infrared imaging	Active
SEMI PV40-0513	Test Method for In-Line Measurement of Saw Marks on PV Silicon Wafers by A Light Sectioning Technique	Active
SEMI PV41-0912	Test Method for In-Line, Non-Contact Measurement of Thickness and Variation of Silicon Wafers for PV Applications using Capacitive Probes	Active
SEMI PV42-0314	Test Method for In-Line Measurement of Waviness of PV Silicon Wafers by a Light Sectioning Technique Using Multiple Line Segments	Active

**Table 13.4.3** (Continued)

Standard	Title	Remarks
SEMI PV43-0113	Test Method for the Measurement of Oxygen Concentration in PV Silicon Materials for Silicon Solar Cells by Inert Gas Fusion Infrared Detection Method	Active
SEMI PV44-0513	Specification for Package protection technology for PV Modules	Active
SEMI PV45-0513	Vinyl Acetate (VA) content test method for Ethylene-Vinyl Acetate (EVA) applied in photovoltaic modules—Thermal Gravimetric Analysis (TGA)	Active
SEMI PV46-0613	Test Method for In-Line Measurement of Lateral Dimensional Characteristics of Square and Pseudo-Square PV Silicon Wafers	Active
SEMI PV47-0513	Specification for Anti-reflective-coated Glass, Used in Crystalline Silicon Photovoltaic Modules	Active
SEMI PV48-0613	Specification for Orientation of Fiducial Marks for PV Silicon Wafers	Active
SEMI PV49-0613	Test Method for the Measurement of Elemental Impurity Concentrations in Silicon Feedstock for Silicon Solar Cells by Bulk Digestion, Inductively Coupled-Plasma Mass Spectrometry	Active
SEMI PV50-0114	Specification for Impurities in Polyethylene Packaging Materials for Polysilicon Feedstock	Active
SEMI PV51-0214	Test Method for In-Line Characterization of Photovoltaic Silicon Wafers by Using Photoluminescence	Active
SEMI PV52-0214	Test Method for In-Line Characterization of Photovoltaic Silicon Wafers Regarding Grain Size	Active
SEMI PV53-0514	Test method for In-line monitoring of flat temperature zone in the horizontal diffusion furnaces	Active
SEMI PV54-0514	Specification for Silver Paste, Used to Contact with N+ Diffusion Layer of Crystalline Silicon Solar Cells	Active
SEMI PV56-1214	Test Method for Performance Criteria of Photovoltaic (PV) Cells and Modules Package	Active
SEMI PV57-1214	Test Method for Current-Voltage (I-V) Performance Measurement of Organic Photovoltaic (OPV) And Dye-Sensitized Solar Cell (DSSC)	Active
SEMI PV58-0115	Specification for aluminum paste, used in back surface field of crystalline silicon solar cells	Active
SEMI PV59-0115	Test Method for Determination of Total Carbon Content in Silicon Powder by Infrared Absorption After Combustion in an Induction Furnace	Active
SEMI PV60-0115	Test Method for Measurement of Cracks in Photovoltaic (PV) Silicon Wafers in PV Modules by Laser Scanning	Active
SEMI PV61-0115	Specification for Framing Tape for PV Modules	Active
SEMI PV63-0215	Specification for Ultra-thin Glasses Used for Photovoltaic Modules	Active
SEMI 4826	Specification for Silicon Wafers for Use as Photovoltaic Solar Cells	Work in progress
SEMI M79-0211	Specification for Round 100mm Polished Monocrystalline Germanium Wafers for Solar Cell Applications	Active

(Continued)

**Table 13.4.3** (Continued)

Standard	Title	Remarks
SEMI 5427	Specification for front Surface Silver Paste, Used in P-type crystalline silicon solar cells	Work in progress
SEMI 5477	Test Method for Determining B, P, Fe, Al, Ca Contents in Silicon Powder for PV Applications by Inductively-Coupled-Plasma Optical Emission Spectrometry	Work in progress
SEMI 5478	Test Method for Thin-film Silicon PV Modules Light Soaking	Work in progress
SEMI 5564	Test Method for the Measurement of Chlorine in Silicon by Ion Chromatography	Work in progress
SEMI 5644	Terminology for Back Contact PV Cell and Module	Work in progress
SEMI 5648	Test Method for the Integrated Efficiency of Installed PV Components	Work in progress
SEMI 5659	Test Method for C-Si Solar Cell Color	Work in progress
SEMI 5661	Test Method for Electrical Parameters of Bifacial Solar Module	Work in progress
SEMI 5724	Guide for Specifying Quasi Monocrystalline Silicon Wafers used in Photovoltaic Solar Cells	Work in progress
SEMI 5725	Practice for Metal Wrap Through (MWT) Back Contact PV Module Assembly	Work in progress
SEMI 5726	Test Method for Determining the Aspect Ratio of Solar Cell Metal Fingers by Confocal Laser Scanning Microscope	Work in progress
SEMI 5727	Test Method for the Etch Rate of A Crystalline Silicon Wafer by Determining The Weight Loss	Work in progress
SEMI 5728	Test Method for the Wire Tension of Multi-wire Saws	Work in progress
SEMI 5767	Guide for Material Requirements of Internal Feeders Used in Monocrystal Silicon Growers	Work in progress
SEMI 5768	Specification for Testing Requirements of Electroluminescence Defect Detection System for Crystalline Silicon PV Modules	Work in progress
SEMI 5773	Test Method for Cell Defects in Crystalline Silicon PV Modules by Using Electroluminescence	Work in progress
SEMI 5830	Classification for Electroluminescence Inspection of Crystalline Silicon Photovoltaic Modules	Work in progress
SEMI 5840	Guide for Calibration of PV Module UV Test Chambers	Work in progress
SEMI 5841	Guide for Specifying Low Pressure Horizontal Diffusion Furnace	Work in progress
SEMI 5842	Test Method for Metal-Wrap-Through Solar Cell Via Resistance	Work in progress
SEMI F108-0310	Guide for Integration of Liquid Chemical Piping Components for Semiconductor, Flat Panel Display, and Solar Cell Manufacturing Applications	Active

## Acknowledgements

The authors would like to thank TaoYun Xiao, JingJing Gong and Nan Du (Trina Solar) for helping to update the list of standards.

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