



INVERTER STANDARDS and CHANGES

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UL LLC

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UL 1741 Covers Power Conversion and Protection Equipment for the Following Types of DR products:

Photovoltaics, PV
Fuel Cells
Micro-turbines
Wind and Hydro Turbines
Engine Generator Set
Utility Interactive Inverters
Stand Alone Inverters
Multi-Mode Inverters
AC Modules
Charge Controllers
PV Balance of Systems,
Combiner Boxes, GFDIs, etc



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UL 1741

Underwriters Laboratories Inc.
Standard for Safety

Inverters, Converters,
Controllers and Interconnection
System Equipment for Use
With Distributed Energy
Resources



This document was accessed by 15027 on March 17, 2010.

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The complex block is a blue rectangular graphic. At the top, it says 'UNCONTROLLED COPY FOR REFERENCE ONLY'. Below that is the UL logo and the text 'UL 1741'. The main text reads 'Underwriters Laboratories Inc. Standard for Safety'. Below that is a list of equipment types: 'Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources'. To the right of the text is a vertical collage of four images: a solar farm, a person working on a device, a person working on a large piece of equipment, and a person working on a computer. At the bottom, it says 'This document was accessed by 15027 on March 17, 2010.' and a small number '2' is in the bottom right corner.

US Adoption of IEC 62109-1 and -2

- The US is moving to adopt IEC 62109
- UL was granted rights to develop UL62109-1 & IEC 62109-2
- Developed International Harmonization Committee (IHC)
- Published UL62109-1
- UL62109-2 Q1 2015
- Focus on minimizing national differences
- Through the harmonization process we have identified several revisions and points of clarification for the IEC standards





IEC 62109-1

Edition 1.0 2010-04

INTERNATIONAL STANDARD



UL 62109-1

Safety of power converters for use in photovoltaic power systems –
Part 1: General requirements

STANDARD FOR SAFETY

Safety of power converters for use in photovoltaic
power systems – Part 1: General requirements

New International Based PV Electronics Certification Option for the USA

UL 62109, Safety of power converters for use in photovoltaic power systems, was published on July 18th of 2014 and is now the US harmonized version of the international PV power conversion standard IEC 62109. IEC 62109 was born out of UL1741 and was expanded / updated to address cutting edge safety aspects of PV power conversion equipment. IEC 62109 is being adopted around the world and is the basis for harmonized international safety certifications. UL 62109, like UL1741, provides a means to determine that PV inverters and other PV electronics:

- Are constructed per common industry requirements
- Can be installed in accordance with US Codes.
- Operated per industry specific required ratings
- Perform safely under rated normal worst case conditions
- Perform safely under foreseeable abnormal operating conditions and failure modes.



UL1741 and UL 62109

Look very different but are very similar and address the same types of hazards.

62109 was written to expand upon UL1741 and fill in known gaps.

1741 covers all forms of DG sources.

62109's scope is limited to PV, but it could easily be applied to inverters with other input source flavors.



IEC 62109 Safety of Power Converters for use in Photovoltaic Power Systems Part 1: General Requirements

IEC 62109-1 – Started NWIP life as a copy of UL1741. Was developed over many years, with considerable effort and it was published in April 2010. Shortly after EN62109-1 was adopted and published by CENELEC.

IEC 62109-2 - Specific to inverters Published June 2011 and is being adopted around the world.



What Does IEC 62109-2 Cover?

Requirements for PV Inverters,

Grid Tied, Utility Interactive - Products that operate in parallel with or backfeed power to the utility grid to supply common loads.

Stand Alone - Products that supply power to loads independent of the utility grid.

Multimode - Products that can operate in both utility interactive and stand-alone modes in case of utility failure.



IEC 62109-2 PV Inverter Specific Requirements

IEC 62109-2 addresses the requirements for inverter specific safety functions:

- PV Ground Fault Protection
- Power Quality THD, DC injection,
- Voltage and frequency control
- Array and system isolation protection
- Markings
- Documentation



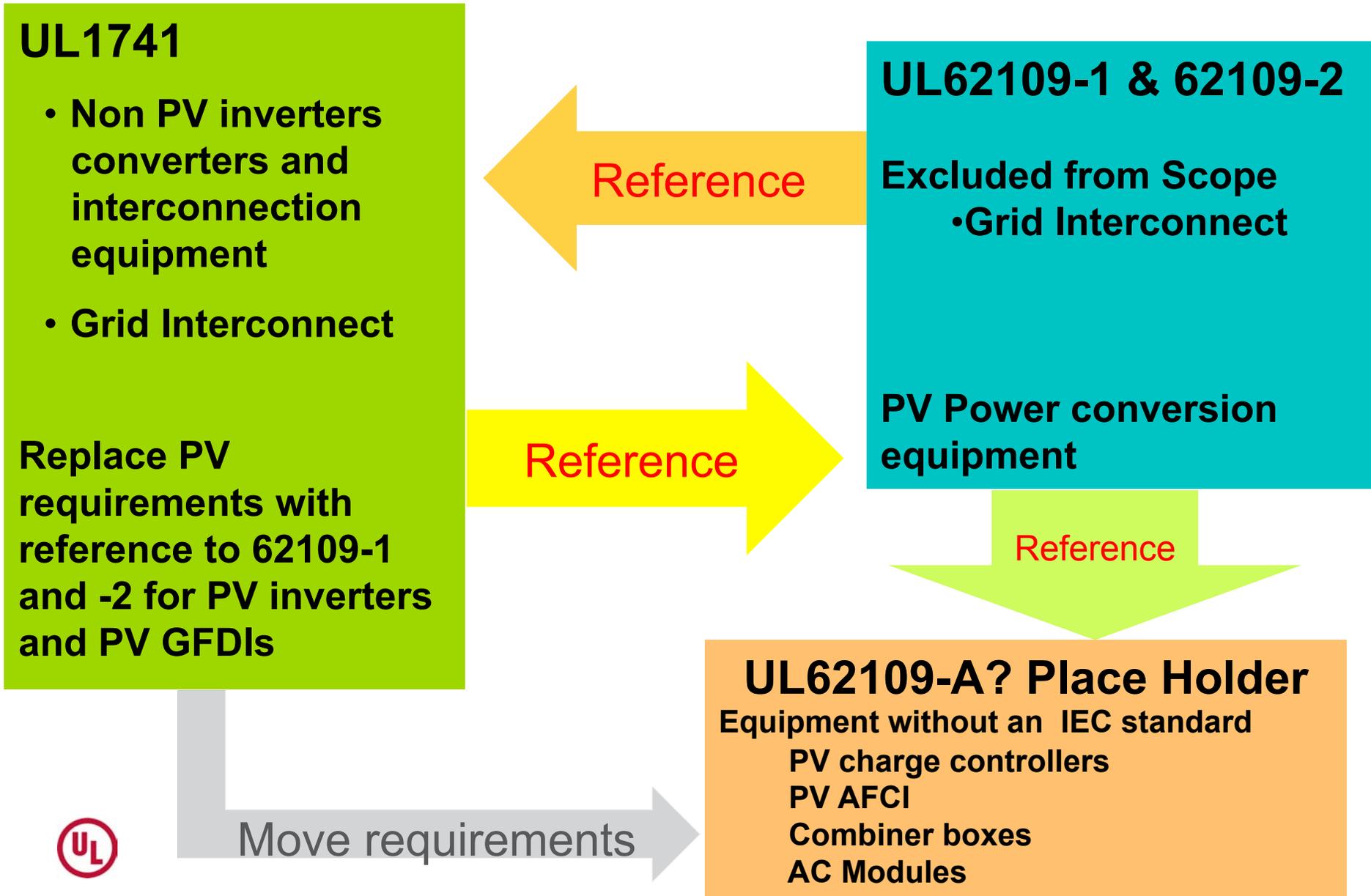
IEC 62109 and UL1741

Note: The scope of UL 1741 includes sections that are not yet published in IEC 62109, such as:

- PV charge controllers
- Requirements for other renewable energy sources like fuel cells, rotating machines, etc,
- Grid interconnection systems equipment.
- Some of these are presently not being considered for addition to the IEC 62109 series



Potential Future State for UL1741 and UL62109



Benefits of Harmonized International Safety Standard

One base document for much more consistent certifications

National differences are easier to address than national standards

Fewer revisions to track and comply with
Reduced engineering time to prepare for certifications

Reduced certification time reduces time to market

Significant certification cost savings



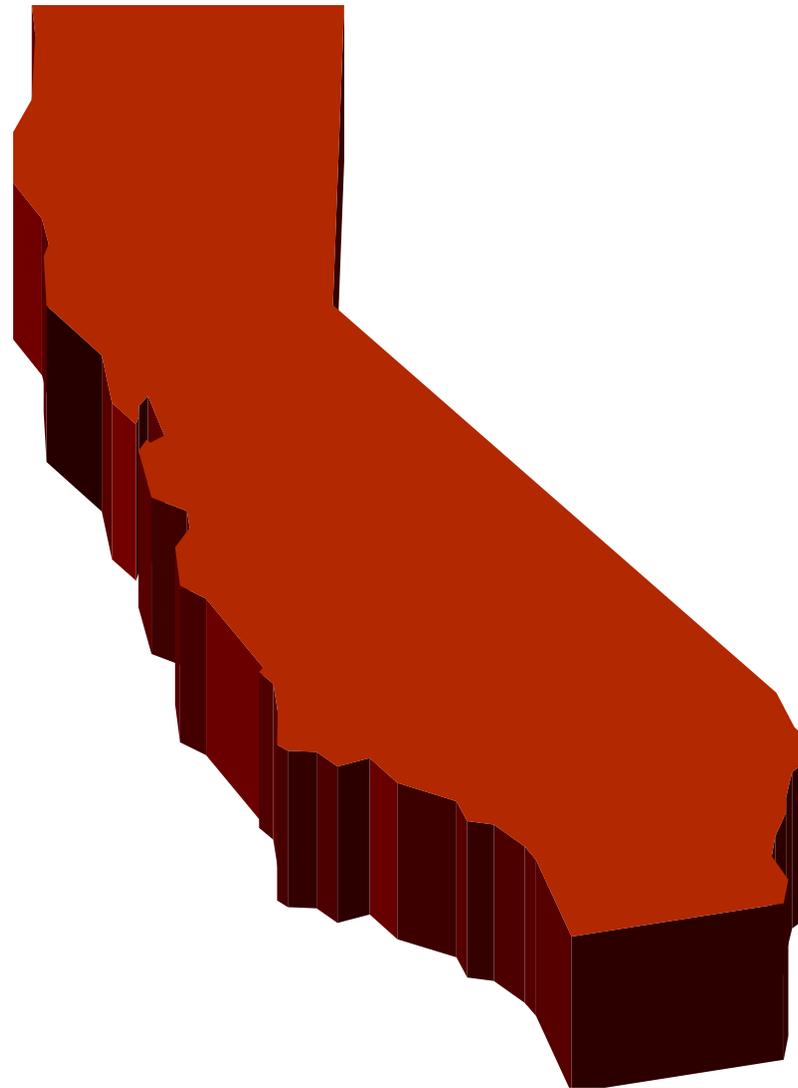
**Northbrook, IL, February 24, 2014 –
UL (Underwriters Laboratories) announces they have
achieved IEC 62109-1 and 62109-2 Certified Body Testing
Lab (CBTL) status for inverter products.**

With this internationally recognized testing accreditation, UL can provide internationally accepted market access reports, known as a Certification Body (CB) report, to inverter manufacturers. The inverter can be evaluated to the standard for the US and/or another market(s) in one project. The UL Mark can then be applied to the certified product and sold in the US and / or a CB report created and provided for product sold into international markets. UL will provide both the necessary safety testing and/or testing for grid interconnection to specified national requirements

In addition to our leadership in the development of international and national power conversion standards, UL's PV inverter testing laboratories in Greater China, Germany, the United States and Italy provide conformity services including safety, performance, and EMC testing, for global markets.



New California Rule 21



Phase 1 Autonomous Functions

	Function	Description
1	Anti-Islanding Protection	Modified L/HVRT and L/HFRT settings.
2	Low/High Voltage Ride-Through	Defines “Stay Connected Until” and “Disconnect By” areas.
3	Low/High Frequency Ride-Through	Expands frequency range for remaining connected over WECC settings
4	Dynamic Volt/Var Operations	Default Volt-Var curve with dead-band
5	Ramp Rates	Establishes default ramp up and ramp down rates for: a. Normal b. Emergency c. Soft disconnect
6	Fixed Power Factor	New allowed PF ranges.
7	Reconnect by “Soft Start”	Ramp up and/or random start time after 15 seconds of V&F in range.

Phase 2 Communication-Related Functions

	Function	Description
1	Control	Adjustment of default parameters associated with the functions identified in Phase 1 above.
2	Monitoring	Ability to read the identified set of parameters (see SWIG document)
3	Functionality upgradeability	Ability to download new firmware to inverter
4	Emergency direct control	Ability to directly set functions



Future Phase 3 Functions

Not yet defined. Noted possibilities include:

Emergency Alarms

Current status

Commanded Max power limit

Connect/disconnect

Optional/alternative settings configurations

Self-test of new software

Dynamic frequency-watt

Dynamic volt-var

Preset Max power limit

Volt-watt curves

Set power level



Need to Clearly Differentiate

The differences between utility interactive generation products.

- Utility Interactive,
- Grid Support Utility Interactive
- Special Purpose Utility Interactive products.

Clearly define product functions, ratings and requirement compliance within the product markings, ratings, manual, certification documentation and new certification categories.



Utility Interactive Requirements

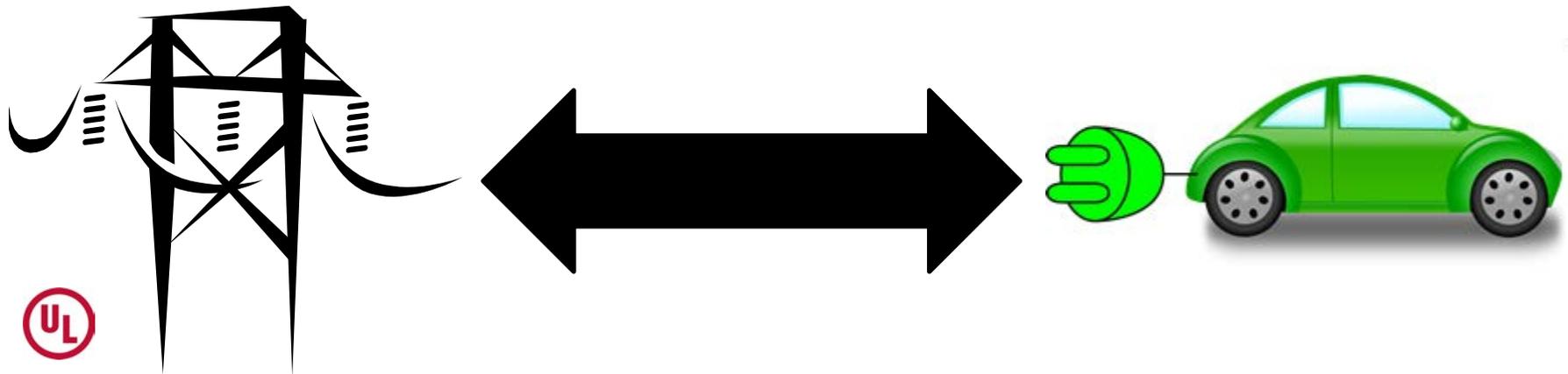
Specific Designation	Utility Interactive	Special Purpose Utility Interactive	Grid Support Utility Interactive
Standard(s)	Traditional IEEE 1547 and IEEE 1547.1	Complies with all features, ratings and requirements defined by inverter mfr as shown in product ratings, manual and Listing data	Defined features functions and tests, but operating parameters will be adjustable to address specific utility and local needs
Software/ Firmware	Locked down and tracked	Locked down and tracked	Will be locked down and tracked but is planned to include options for future updates and revision in the field
Intended Application	General – low penetration installations	Large scale utility PV farms	General – high penetration installations with planned future capability
Acceptance	Well defined based upon knowledge of IEEE 1547 and 1547.1 standards	Require individual local electric utility review and acceptance for the installation location	Structured requirements and corresponding certification approach is intended to provide ease of acceptance similar to present day 1547 based certifications

UL 9741

UL has initiated development of the requirements of UL9741, *Safety of Bidirectional Electric Vehicle Charging Systems and Equipment.*

This standard will combine the applicable EV and DG standards

These requirements will cover bidirectional electric vehicle charging equipment that charge electric vehicles from an electric power system and also include functionality to export power from the electric vehicle to an electric power system.



Questions?

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