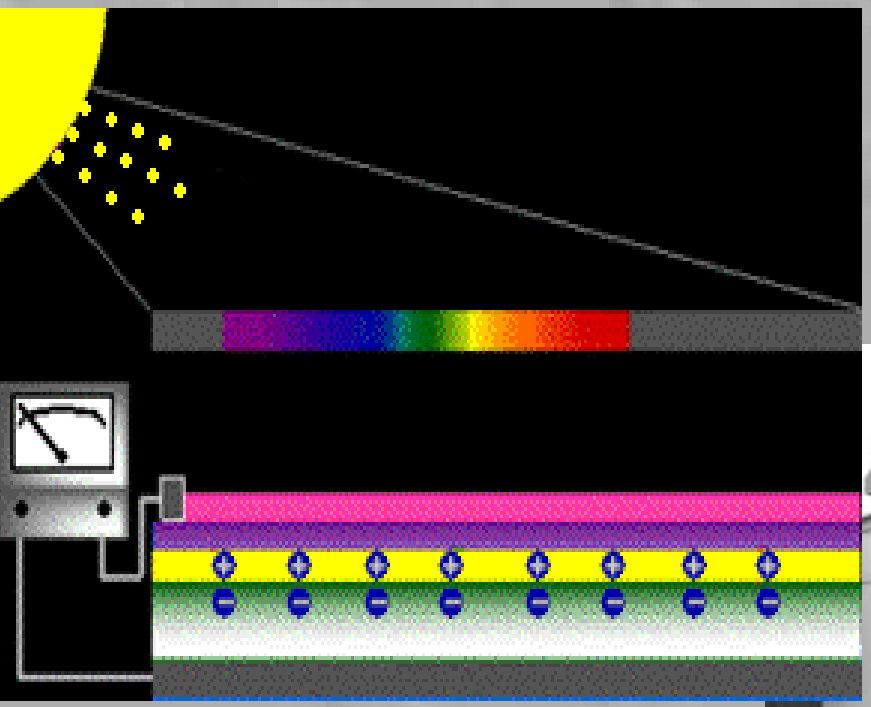
UL 1741 UPDATE
A SAFETY STANDARD FOR DISTRIBUTED GENERATION

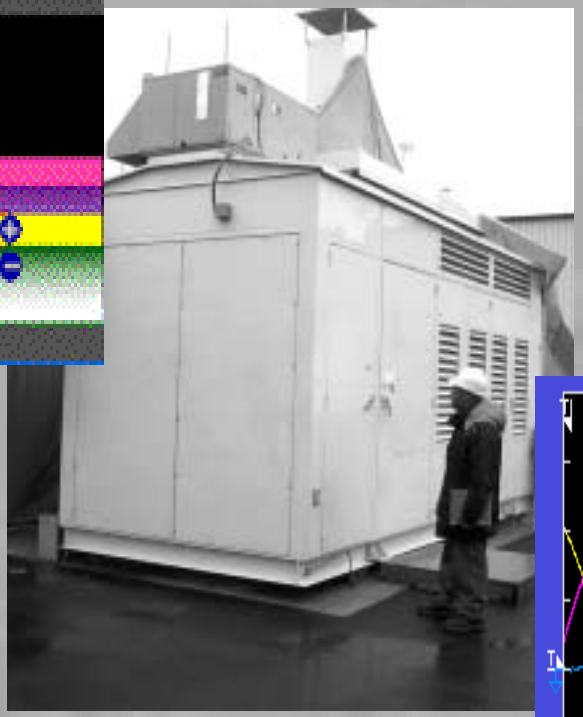
Tim Zgonena
October 13, 2004

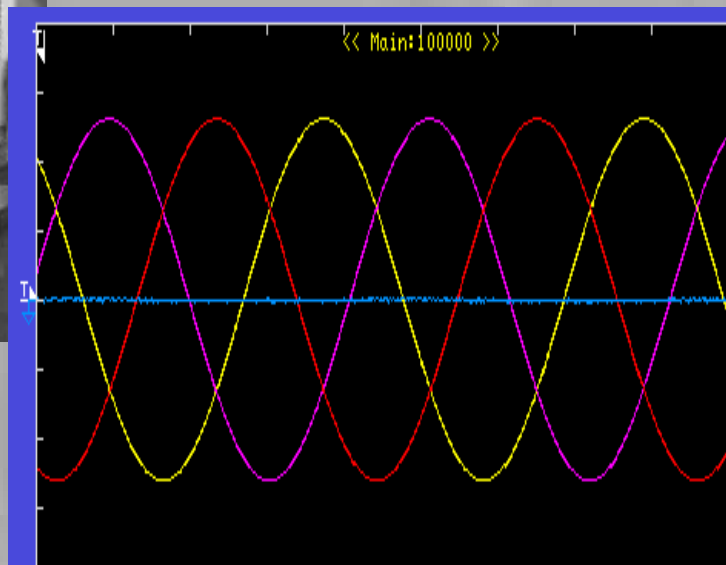
UL1741 History

- May 7, 1999 Publication date of UL1741,The Standard for Static Inverters and Charge Controllers For use in Photovoltaic Power Systems,
- January 17, 2001 Revised to address revisions to IEEE 929 the Recommended Practice for Utility Interface of Photovoltaic (PV) Systems and changed the title to UL1741 New Title - The Standard For Inverters, Converters and Controllers For Use In Independent Power Production Systems.
- Utility interactive products Listed to the published UL1741 are being accepted by many utilities across the nation for utility grid interconnection.

Static Inverters







Present North American Utility Grid and DG

(Current Practice)

- Traditional utility electric power systems were designed to support a one way power flow from the point of generation through a transmission system to distribution level loads.

- These systems were not originally intended to accommodate the backfeed of power from DGs at the distribution level.

Electric Utilities Needs and Concerns Regarding DG
Performance Based Safety Concerns

- Reliable Power Grid Operation
- Protection Against Faults
- Power Quality
- Impact on Utility Monitoring and Switching Equipment
- Impact on Other Utilization Equipment
- Liability Problems Related to the Above Items

Incompatibility Problem

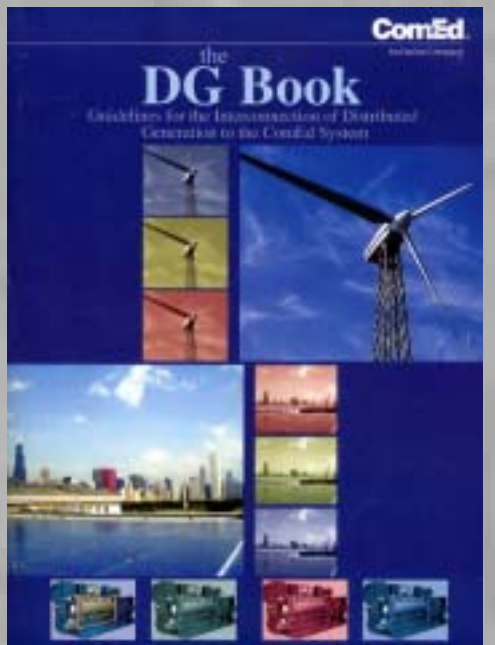
- Utilities want an assurance that interconnected DG equipment will operate properly after it is manufactured and after years of service in the field.
- Most established utility test methods and test equipment, historically used to test utility protective relays, are not compatible with the new microprocessor-based interconnected DG equipment.

Resulting Situation for DG Equipment

- Most utilities and state utility commissions are proceeding very cautiously
- Creation of individual utility or state DG interconnection requirements, which are used to closely evaluate installations of DG products.
- DG products and installations are regularly subjected burdensome investigations by a variable cast of regulators.

I've got a Photovoltaic project in downtown Madison, Wisconsin near the State Capitol. This area is served electricity from my company's low-voltage 208 Volt network system.
In the process of evaluating the SMA 2500 U inverter were there any tests simulating operation on a low-voltage network system?
Please call with questions.
Thank you,

Senior Engineer
Madison Gas and Electric Company

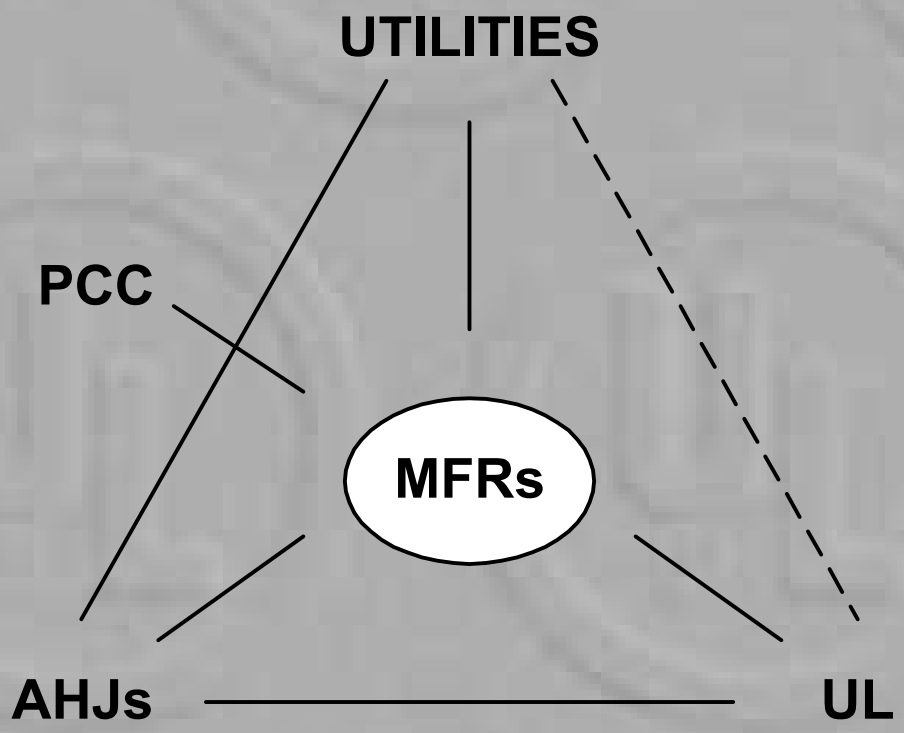


DG Product Safety Evaluations

Product Safety

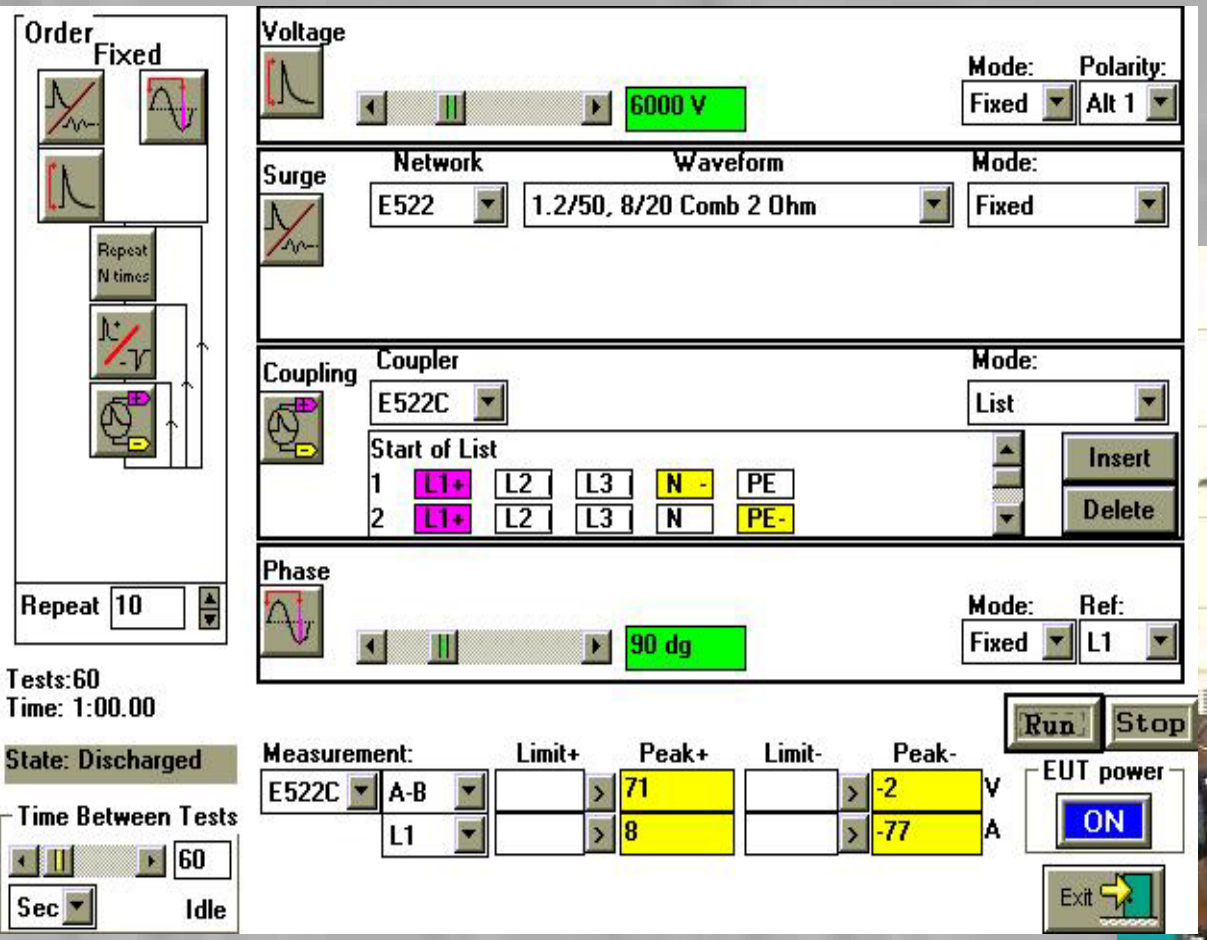
- Electrical inspectors use the National Electric Code (NEC) or an augmented version of the NEC.
- Arts. 690 (PV), 692 (Fuel Cells) specifically call for utility-interactive equipment to be Listed.
- Typically, unfamiliar equipment is required by the local inspector to be Listed.
- Listing must be handled by a National Recognized Testing Laboratory (NRTL).
- Listing evaluations best done early into production design, to avoid building-in problems.
- Listing may not be suitable for addressing installation-specific concerns.
- Listing may not meet the needs of the local utility authority.

How Does This All Add Up?



- Presently, manufacturers and installers of DG products have a difficult time getting their products installed, connected to the utility grid, and operating.

DG Surge Testing



Anti-Islanding Testing

Inductive Load Bank for Anti-Islanding Test

Capacitive Load Bank for Anti-Islanding Test

DOE Project Objective

- Under this contract, we are combining UL's safety and utility interconnection requirements with those in the published IEEE 1547 standard.
- The UL1741 direct reference to IEEE 1547 and IEEE 1547.1 will maximize interpretation consistency and acceptance.
- Result is an ANSI standard that can be used to evaluate utility interconnected DG products to address the needs of Electrical AHJ's and Utility Interconnection Engineers.

UL1741 is going to be harmonized with IEEE 1547, Interconnecting Distributed Resources with Electric Power Systems and IEEE P1547.1 once it is published.

This direct reference will maximize acceptance and interpretation consistency.

Items Being Added to UL1741 Through the Reference to IEEE 1547 and IEEE 1547.1

- Surge withstand
- Synchronization and loss of
- Immunity protection
- Flicker
- Field verification test capability
- Temperature Stability

Ultimate Goal

- This work will facilitate a streamlined system with identifiable, nationally common tasks and goals under which utility interconnected DG products may be designed, produced, evaluated, certified, sold, installed and operated in a smooth and agreeable manner for all parities involved.

Impacts and Benefits

- This combination of requirements will yield a DG ANSI Standard that can be used to evaluate utility interconnected DG products for both electrical safety and utility interconnection to address the needs of Electrical AHJs and Utility Interconnection Engineers.

- This will standardize interconnection procedures and requirements for DG owners.

- This will lead to reduce interconnection costs.

UL 1741 Expansion to Cover the Interconnect of All Types of DG

- Photovoltaic Modules and Panels
- Fuel Cells
- Micro-turbines
- Wind and Hydro Turbines
- Engine Gen Set Interconnect Controllers

More UL1741 Additions and Revisions

- Ungrounded PV Array Inverters
- Transformerless Inverters
- PV Combiner Boxes
- AC Battery Charging Circuits
- Grounding Electrode Terminals
- Revised GFDI Requirements
- Increase Bus Bar Temp Limits
- Revised Stand Alone Voltage Limits
- Max Surface Temps 90C
- More Accurate Output Ratings.
- Controllers for rotating generators

UL1741 FUTURE GOAL

- This combination of requirements will yield a DG ANSI Standard that can be used to evaluate utility interconnected DG products for both electrical safety and utility interconnection to address the needs of Electrical AHJs and Utility Interconnection Engineers.

Immediately following the publication of IEEE P1547.1, we plan to publish the UL1741, second edition.

This is slated for the spring of 2005.

Thank You for Your Time

Tim Zgonena
Principal Engineer
Distributed Energy Resources
Equipment and Systems
Extension 43051