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Preen Electric Vehicle Supply Equipment

AC and DC Power Solutions Specialist Since 1989

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EV Charging Standards

EV Couplers

- **Near-term partial gap:** Finish harmonization of EV coupler safety standards within North America, based on UL 2251, Standard for Plugs, Receptacles and Couplers for EVs
- **Near-term partial gap:** Work to harmonize the IEC 62196 series of standards and the North American EV coupler safety standards
- **Near-term partial gap:** Work to harmonize EV coupler configurations internationally, in particular with respect to DC charging
- **Near-term gap:** Complete work on SAE J2953, PEV Interoperability with EVSE. Establish conformance programs for EV / EVSE interoperability within the U.S. market, based on SAE J1772™, J2953 and a UL verification program under development.

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New Standard: UL-1741-SA

- Officially called "UL 1741: Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources"
- In essence, the test standard by which inverters are certified for interconnection to the grid, with particular respect to:
  - Grid Voltage
  - Grid Frequency
- Intended to supplement and be used in conjunction with IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems) and IEEE 1547.1 (Standard for Conformance Test Procedures) in accordance with NEC
- Developed by workgroup representing Inverter industry, electric utilities, NREL, EPRI
- SA is short for Supplement A, an addition to the existing UL 1741 standard
  - Designed to create a standard for inverters more capable of dealing with a volatile grid
  - "Future-Proofing" by creating a standard for inverters to actively manage grid functions

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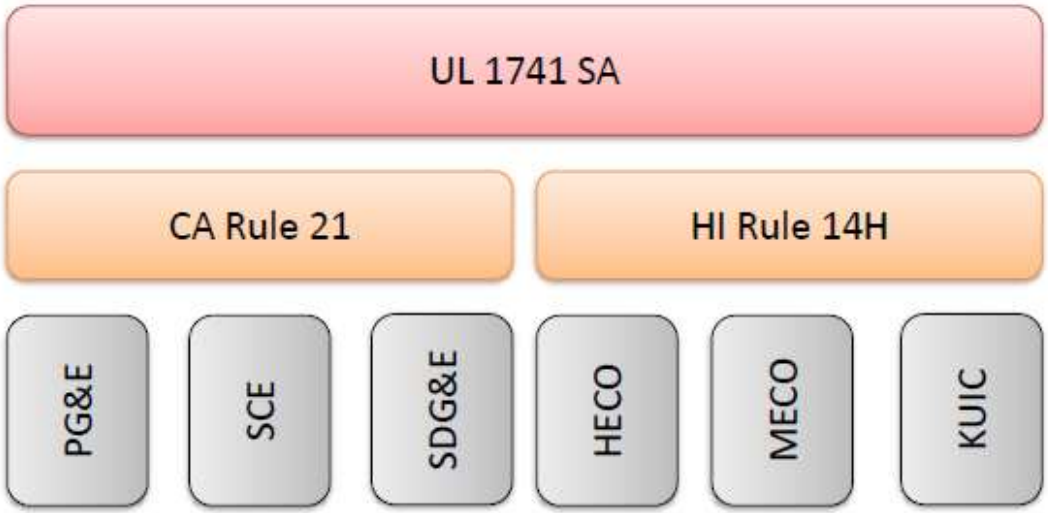
UL vs Rule 21 vs 14H



Product Certification Standard

State Interconnection Requirements, also called Source Requirements Document (SRD)

Local Interconnection Requirements

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How will UL 1741 SA be implemented

Jurisdictions Require "Grid Support" – September 8th

Source: Outback Power

All projects **permitted and approved for interconnection on or after September 8th 2017** will need to be certified to UL 1741 SA

- In Hawaii
- In California
- In other utility districts running pilot programs, such as
  - APS
  - Green Mountain Power

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Low Voltage Ride Through Test (>50kW)

- It is becoming increasingly evident that large-scale penetration of distributed resources (DR) that have sensitive voltage and frequency trip points with short delay times, as mandated by the current version of IEEE Standard 1547, pose a risk to bulk power system security. This issue is well described in the NERC Integration of Variable Generation Task Force Task 1-7 report.

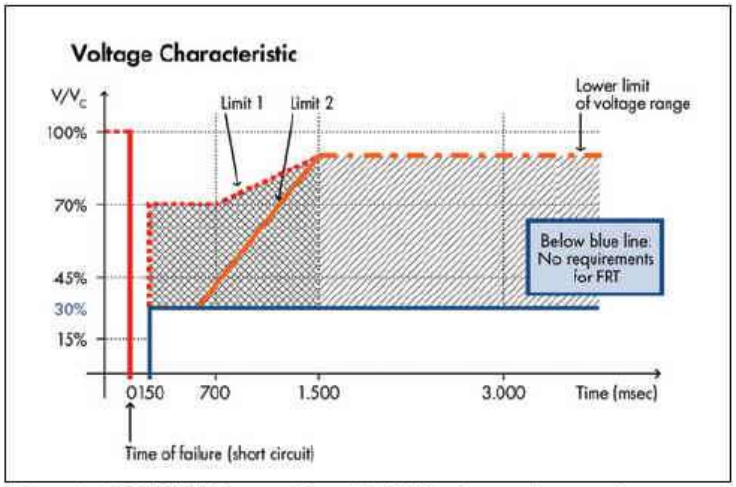

Figure 4. BDEW LVRT curve. From 'BDEW' tech. requirements for generating units on the medium voltage grid-June 2008 (Source: SMA America)

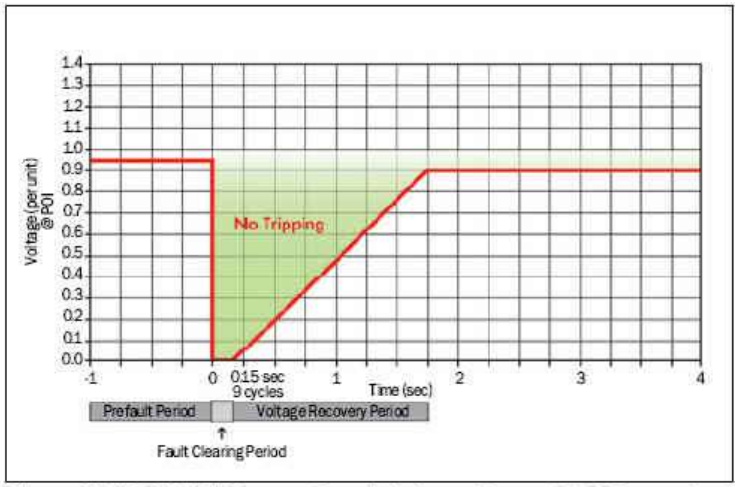

Figure 5. ERCOT LVRT curve for wind plants. From ERCOT operating guide (Source: ERCOT)

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EV / PHEV Charging Interface

SAE Hybrid Vehicle Committees are leading the effort to define charging functionality and standardize the connection hardware from EV to EVSE

SAE-J1772 Standard defines:

- Charging capacity & operating voltage by "Level" – AC 1 & 2
- Electrical safety & circuit protection of EVSE
- Physical properties of the connector
- EV to EVSE communications & charging controls

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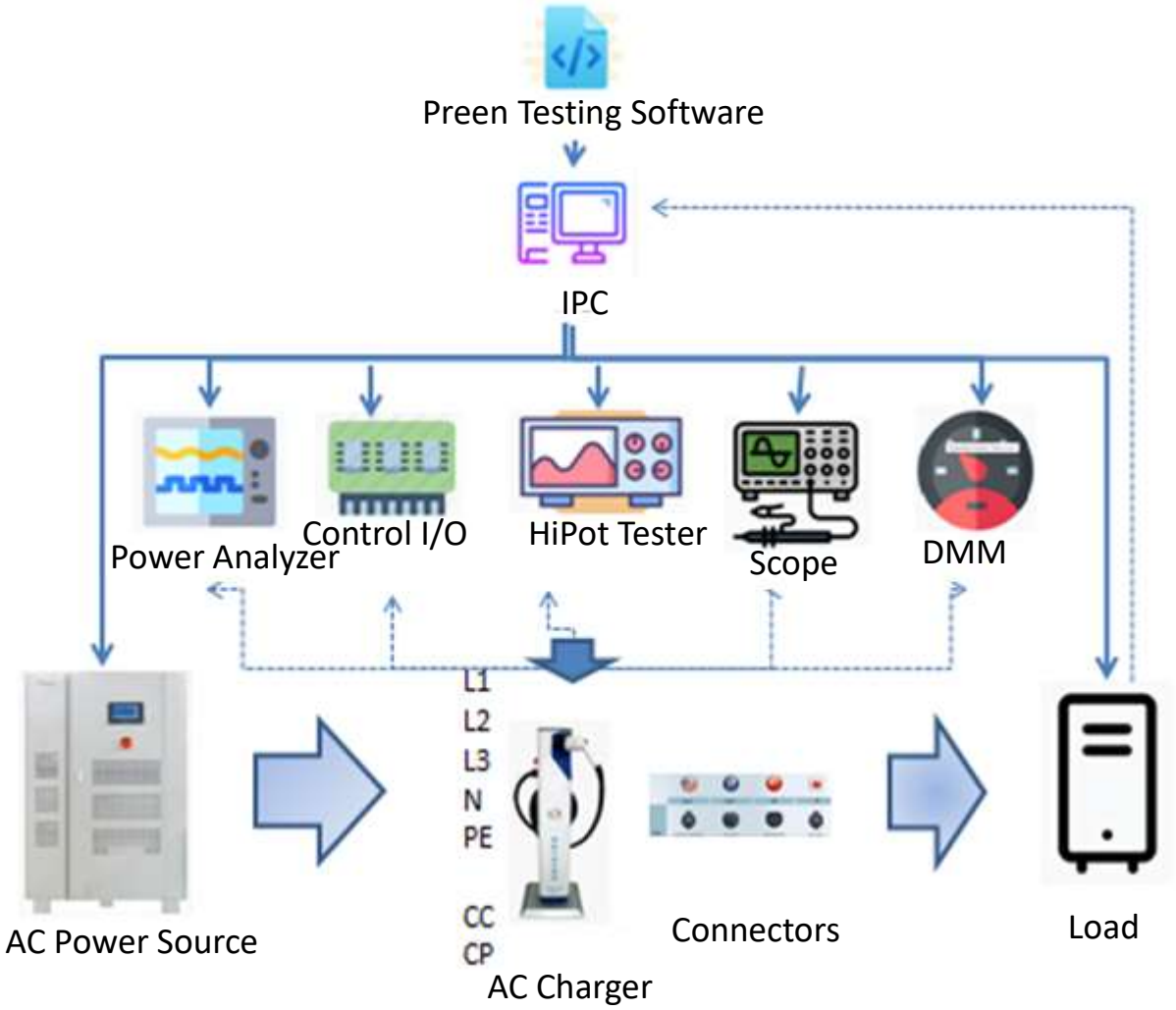
EV Charging Test System

System Diagram



Testing Items

1. Hi-pot Test Function (for UL2594)
2. GND Continuously Test (for UL2594)
3. Control Pilot Signal Test
4. Current Capacity Test
5. Disconnect Switch S2 Test
6. Coupler Disconnection Test
7. Over Current Protection Test
8. CCID Test (for UL2231)

AC Charger Testing System

- **AFV-33060 AC Power Source**
  - **Input**
    - 3ψ4W 220/380VAC ±15%
    - Frequency:50Hz or 60Hz
    - PF ≧ 0.9
  - **Output**
    - 60KVA
    - 3ψ4W+G
    - Voltage Low : 0-150VAC , High : 0-300VAC
    - Current Low : 166.7A , High : 83.3A
    - Frequency : 45~65Hz
  - Dimensions (W x D x H) mm/inch
    - 800 x 860 x 1545 / 31.5 x 33.9 x 60.9
  - Weight KG / lbs
    - 670 / 1477.1

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AC Charger Testing System

Control Rack

IPC
Touch Screen
Digital Oscilloscope Tektronix TBS 2104
keyboard / mouse
Control Panel
Power Meter x 2
EVSE CCID Switch Box
EEC Electrical Safety Analyzer
Digital Multimeter Keysight 34461A

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AC Charger Testing System

EVSE AC Load

- 1 phase 2W 240VAC
  - 20A
  - 40A
  - 60A
  - 80A
  - 120A
- 3 phase 4W 380VAC
  - 8A
  - 16A
  - 24A
  - 32A
  - 40A

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TESTING SYSTEM

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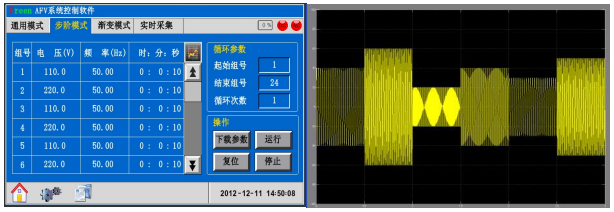
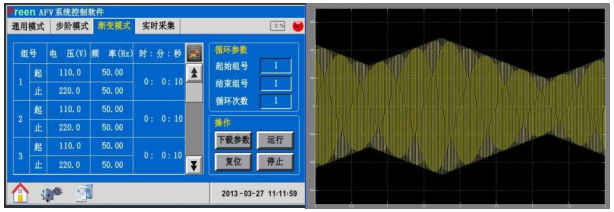
Four Quadrants Bi-Directional Charger Testing

PF ≧ 0.99
Efficiency ＞92%

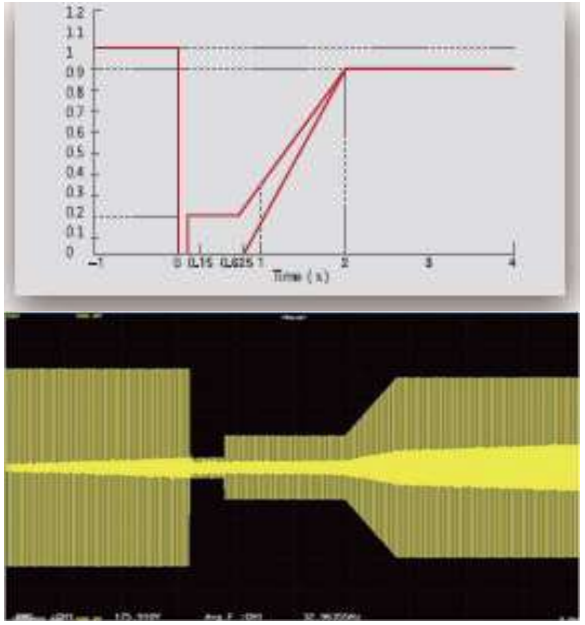
PAS / PFV series



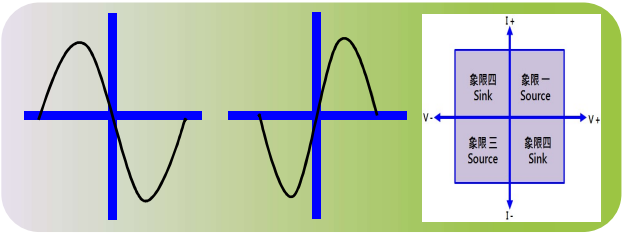


Grid Simulation

3 phase independent control



Low Voltage Ride Through (LVRT) Mode
High Voltage Ride Through (HVRT)选配



Power Feedback to grid system

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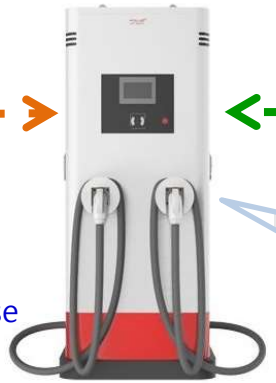
AFV series

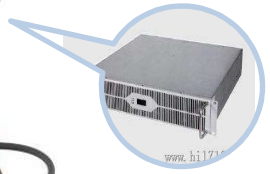
AC

- 10K~2000KVA
- 7″ touch screen
- Step and Gradual Mode
- 3 Independent phase adjustment
- Fast response time
- Regulated output



充电桩 Charger station

测试系统



直流电源模块

ADG series

- Output voltage 1600V max.
- Output current 2000A max.
- 7″ touch screen
- Step and gradual mode
- Low ripple and regulated output
- High power density

DC

Compressor

DC

Battery module

DC

Charger gun (include cable)

AFV Series
Stand Alone Programmable AC Power Source

Single Phase or Three Phase from 10kVA ~2000kVA

- Single Phase or 3 Phase Output
- 10kVA to 2000kVA Single Stand Alone Unit (Not Parallel Connecting Multiple Units)
- Three Phase Independent Voltage Control
- Step/Gradual Programmable Capability
- Custom Output Voltage Range
- Build-in Isolation Transformer
- Suitable for High Power, High Current Test Applications
- 7″ Intuitive Touch Screen Control
- RS232/RS485 Remote Control Interface (LabVIEW Driver)
- 1 year Warranty (Extended Warranty Available)
- In Stock for 10~60kVA 3phase Models

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PAS-F Series

Regenerative Programmable AC Power Source

Three Phase from 30kVA ~800kVA

- Regenerative AC Grid Simulator for Grid Tie Devices Burn-In or Aging Test
- Regenerative Power to the Utility Grid
- 45-2000kVA New Energy Testing
- Sinks 100% Reactive Power (kVAR)
- Single Phase, Split Phase, and Three Phase Testing
- Low Output Distortion (THD)
- Build-in LVRT Test Graph
- 7″ Intuitive Touch Screen Control
- Support new UL1741-SA Standard Test

Compare to Chroma 61800 series

PAS-F Series

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ADG Family (4-100kW)

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ADG-P series models

30kW	50kW	75kW	100kW
40V	40V	40V	40V
60V	60V	60V	60V
100V	100V	100V	100V
200V	200V	320V	320V
240V	240V	640V	640V
320V	320V	1000V	1000V
400V	400V	1600V	1600V
500V	500V		
640V	640V		
800V	800V		
1000V	1000V		
1600V	1600V		

ADG-P series

- **Special Order Product for 2000V or 2000A**

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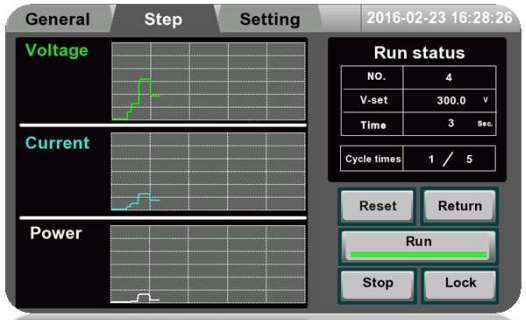
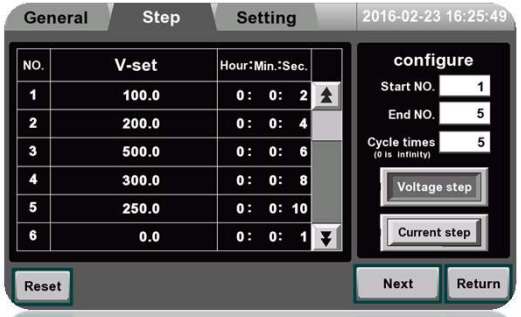
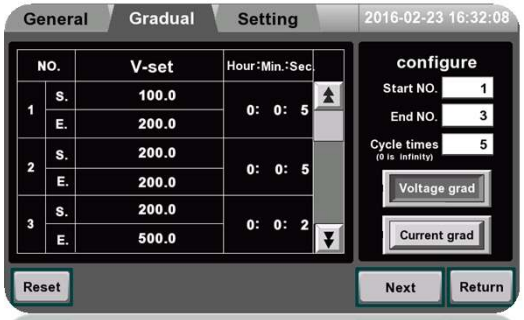
Features of ADG Family

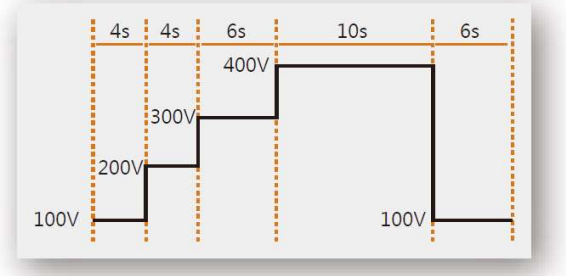
STEP / RAMP Function



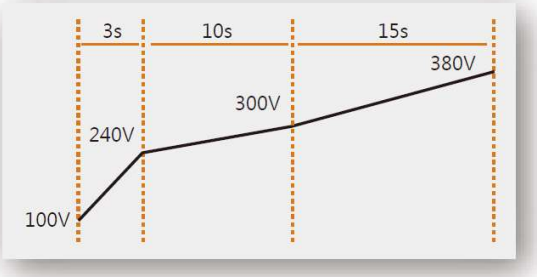




STEP



GRADUAL



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