



IEEE Guide for Test and Evaluation of Lead-Acid Batteries Used in Photovoltaic (PV) Hybrid Power Systems

IEEE Standards Coordinating Committee 21

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Abstract: This guide is specifically prepared for a PV/engine generator hybrid power system, but may also be applicable to all hybrid power systems where there is at least one renewable power source, such as PV, and a dispatchable power source, such as an engine generator. Taper-charge parameters for PV hybrid systems are suggested to help in preparing the battery for a capacity test. A test procedure is provided to ensure appropriate data acquisition, battery characterization, and capacity measurements. Finally, a process to review test results and make appropriate decisions regarding the battery is provided. No cycle-life predictions are made.

Keywords: battery testing, lead-acid battery charging, lead-acid battery testing, PV hybrid battery test, PV system testing

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Introduction

This introduction is not part of IEEE Std 1661-2007, IEEE Guide for Test and Evaluation of Lead-Acid Batteries Used in Photovoltaic (PV) Hybrid Power Systems.

The hybrid power system in this guide refers to a photovoltaic (PV) energy charging source and a dispatchable charging source, such as an engine generator. The hybrid power system designer depends on the capacity of storage batteries for reliable extended operation of the system load to more effectively utilize and store the PV energy and minimize engine generator run-time. PV hybrid systems, which are the most common hybrid systems, can subject batteries to harsh operational environments as a result of insufficient charging, continuous cycling, and temperature extremes. Typical charge rates for PV hybrid systems can range from very low rates near the 100 h rate to high rates near the 6 h rate. The effect on the battery can be significant with respect to heat generation and charge control parameters.

In daily operation, the limited available PV and engine generator charging sources combined with relatively low charge regulation voltages may be insufficient to provide a full charge to the battery. In an effort to identify appropriate PV hybrid system parameters together with appropriate battery technology, a repeatable test procedure is provided to verify PV hybrid system battery performance based on a field test.

The recommended test plan for evaluating PV batteries includes the following:

- Limitations and expectations
- System parameter selection
- PV hybrid battery capacity test
- Interpretation of test results

This guide may be used separately, or in combination with IEEE Std 937™-2007,^a IEEE Recommended Practice for the Installation and Maintenance of Lead-Acid Batteries for Photovoltaic (PV) Systems, IEEE Std 1013™-2000, IEEE Recommended Practice for Sizing Lead-Acid Batteries for Photovoltaic (PV) Systems, and IEEE Std 1361™-2003, IEEE Guide for Selection, Charging, Test, and Evaluation of Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems. Together, these documents will provide the user with a general guide to sizing, designing, placing in service, maintaining, and testing lead-acid storage batteries for hybrid power systems.

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Errata

Errata, if any, for this and all other standards can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/updates/errata/index.html>. Users are encouraged to check this URL for errata periodically.

^a For information on references, see Clause 2.