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IEEE Guide for Optimizing the Performance and Life of Lead-Acid Batteries in Remote Hybrid Power Systems

IEEE Standards Coordinating Committee 21

Sponsored by the
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Abstract: This guide is applicable to lead-acid batteries that are used as the energy storage component in remote hybrid power supplies. The remote hybrid application, with its dual generator option, i.e., both renewable and dispatchable generation, is advantageous in that the battery can usually be charged at will and under circumstances that may also be advantageous for the dispatchable generator.

Keywords: charge control, deficit-charge cycling, IEEE 1561™, oxygen recombination cycle, remote hybrid power systems, valve-regulated lead-acid (LRVA) batteries, vented lead-acid batteries

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Introduction

This introduction is not part of IEEE Std 1561-2019, IEEE Guide for Optimizing the Performance and Life of Lead-Acid Batteries in Remote Hybrid Power Systems.

This guide is intended to enhance the performance and life of lead-acid batteries used in remote hybrid power supplies. Electrical power from remote hybrid power systems can dramatically enhance the quality of life for multitudes in remote areas that lack access to a reliable, well-regulated source of electrical energy, and remote hybrid systems are increasingly a response to that growing, urgent need. Well-designed hybrid systems, used within the constraints of their capacities and capabilities, can supply reliable, continuous electrical power to these remote loads. By definition, a hybrid remote power system includes one or more dispatchable generators, e.g., an engine-powered generator, and one or more variable generators (which are typically renewable resources), e.g., a photovoltaic array. It will also include energy storage, necessary electronic controls, power distribution, and loads. Lead-acid batteries are often selected as the energy storage component for these applications because of their suitability, low cost, and near-universal availability. These batteries, however, do not always perform to expectations in these applications. The lead-acid battery is a dependable voltage source that can deliver its stored energy on demand, provided, however, that it is selected and applied within the constraints of its capabilities. This guide addresses factors that affect lead-acid batteries (including both vented and VRLA designs) in these hybrid applications and suggests choices and practices that can enhance both their performance and life.

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IEEE Guide for Optimizing the Performance and Life of Lead-Acid Batteries in Remote Hybrid Power Systems

1. Overview

1.1 Scope

This guide provides rationale and guidance for operating lead-acid batteries in remote hybrid power systems, taking into consideration system loads and the capacities of the system's renewable-energy generator(s), dispatchable generator(s), and battery(s). It also provides guidance for selecting an appropriate lead-acid battery technology for various system operating strategies.

1.2 Purpose

Using the information provided in this guide, the performance and life of the lead-acid battery can be optimized for the particular operational strategy selected for the remote hybrid power system. The information provided is intended for use by remote hybrid system designers, system evaluators, owners, and operators.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 937™, IEEE Recommended Practice for Installation and Maintenance of Lead-Acid Batteries for Photovoltaic (PV) Systems.[1,2]

IEEE Std 1361™, IEEE Guide for Selecting, Charging, Testing, and Evaluating Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems.

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