

1491™

IEEE Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications

IEEE Power Engineering Society

Sponsored by the
Stationary Battery Committee



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IEEE Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications

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Stationary Battery Committee
of the
IEEE Power Engineering Society

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Abstract: Monitoring and measurement of battery parameters is an important element of maintaining a fully operational battery system. This guide presents and discusses measurable parameters of batteries used in stationary battery systems and the utilization of such observations. This guide does not give a listing of commercially available systems, but it does provide a means of establishing specifications for the desired parameters monitored.

Keywords: airflow, ambient temperature, automated battery monitoring, battery applications, battery current, battery environment, battery monitoring equipment, battery monitoring techniques, battery temperature, battery types, battery voltage, communications interfaces, connection resistance, cycles, grounding, ground fault detection, humidity, ripple current, safety, software, specific gravity

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Introduction

This introduction is not part of IEEE Std 1491-2005, IEEE Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications.

The monitoring of stationary batteries can be an important part of ongoing maintenance, testing, surveillance, and determination of the state of health of the battery system. Monitoring is becoming increasingly more significant with the decline of specialist crafts persons, cutbacks in maintenance personnel, the advent of unmanned battery locations, and sites that are difficult to access. This guide is intended to fulfill a need within the industry to provide background information, explain battery measurement parameters, and monitoring techniques.

This guide may be used separately, and when combined with other pertinent IEEE standards listed in Clause 2, it can provide a guide for total stationary battery maintenance.

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IEEE Guide for Selection and Use of Battery Monitoring Equipment in Stationary Application

1. Overview

This guide is divided into 11 clauses. Clause 1 provides the scope and purpose of this guide. Clause 0 lists references to other standards that are useful in applying this guide. Clause 3 provides definitions that are either not found in other standards or have been modified for use with this guide. Clause 4 reviews safety guidelines that are to be used with this guide. Clause 5 describes the two battery types used in stationary applications. Clause 6 provides an introduction to battery monitoring techniques and parameters. Clause 7 discusses the description, purpose, and limit of the various measurement parameters. Clause 8 establishes the various communication interfaces that a battery monitoring devices uses. Clause 9 discusses the electrical and physical operating environment to which the battery monitor may be subjected. Clause 10 provides typical technology found in battery monitoring. Clause 11 specifies considerations for different battery applications.

1.1 Scope

This guide discusses operational parameters that may be observed by battery monitoring equipment used in stationary applications, and the relative value of such observations. Although this guide does not give a listing of commercially available systems, it does provide a means for establishing specifications for the desired parameters to be monitored.

1.2 Purpose

Today's mission-critical environment has created a need for unmanned surveillance systems for stationary batteries. This guide will propose parameters for battery surveillance to achieve useful information for maintenance and replacement purposes. Because communications will play an issue with remote applications, a description of typical arrangements will provide additional insight.

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Federal Communications Commission, Part 15 FCC Rules, Subpart J, Class B.¹

IEEE Std 450™, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.^{2,3}

IEEE Std 484™, IEEE Recommended Practice for Installation Design and Implementation of Vented Lead-Acid Batteries for Stationary Applications.

IEEE Std 946™, IEEE Recommended Practice for the Design of DC Auxiliary Power Systems for Generating Stations.

IEEE Std 1106™, IEEE Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications.

IEEE Std 1184™, IEEE Guide for the Selection and Sizing of Batteries for Uninterruptible Power Systems.

IEEE Std 1187™, IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications.

IEEE Std 1188™, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.

IEEE Std 1189™, IEEE Guide for Selection of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.

NFPA 1, Uniform Fire Code™.⁴

NFPA 70, National Electric Code® (NEC®).⁵

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3. Definitions

For the purposes of this guide, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms*⁶, should be referenced for terms not defined in this clause.

3.1 battery monitoring equipment: An unmanned fixed surveillance system for stationary batteries.

3.2 Coup de Fouet: Initial voltage drop and recovery of the battery under load.

3.3 internal ohmic value: Any value of resistance, conductance, or impedance derived from the relationships between changes in voltages and currents in a stationary battery under various conditions and used as an indicator of a battery's state of health.

3.4 midpoint voltage: The voltage between the positive or negative terminal of a battery and its physical midpoint.

3.5 string: Two or more cells connected in series to form a battery.

3.6 thermal runaway: A condition that is caused by a battery charging current that produces more internal heat than the battery can dissipate. This condition ultimately causes cell venting and premature failure.

4. Safety

Batteries are potentially dangerous, and proper precautions must be observed in handling and maintenance of batteries and monitoring system. Maintenance shall be done only by personnel knowledgeable of batteries and the monitoring system and trained in the safety precautions involved. Properly insulated tools and adequate personal protective equipment shall be used when working with batteries and the monitoring system.

The following personal protective equipment shall be available to personnel who perform battery maintenance work: goggles and face shields, acid-resistant gloves, protective aprons, portable or stationary water facilities for rinsing eye and skin in case of contact with electrolyte, class C fire extinguisher, acid or alkaline neutralizer, and adequately insulated tools.

Observe the following precautions:

- a) Prohibit smoking and open flames, and avoid arcing in the immediate vicinity of the battery.
- b) Avoid wearing metallic objects, such as jewelry.
- c) Keep the top of battery clear of tools and other foreign objects.
- d) Ensure unobstructed egress from the battery area.
- e) Ensure that battery area and/or cabinet ventilation is operable.
- f) Neutralize static buildup just before working on the battery by having personnel contact the nearest effectively grounded surface.
- g) Do not remove battery vents.

⁶ IEEE publications are available from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org/>).