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IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications

IEEE Power & Energy Society

Sponsored by the
Stationary Batteries Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

15 April 2011

IEEE Std 485™-2010
(Revision of
IEEE Std 485-1997)

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Approved 8 November 2010

IEEE-SA Standards Board

Abstract: Methods for defining the dc load and for sizing a lead-acid battery to supply that load for stationary battery applications in full-float operations are described in this recommended practice. Some factors relating to cell selection are provided for consideration. Installation, maintenance, qualification, testing procedures, and consideration of battery types other than lead-acid are beyond the scope of this recommended practice. Design of the dc system and sizing of the battery charger(s) are also beyond the scope of this recommended practice.

Keywords: battery duty cycle, cell selection, dc load, full-float operation, IEEE 485, lead-acid batteries, rated capacity, sizing, stationary applications, valve-regulated lead-acid (VRLA) cell, vented battery

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-0-7381-6507-3 STD97052
Print: ISBN 978-0-7381-6508-0 STDPD97052

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Introduction

This introduction is not part of IEEE Std 485-2010, IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications.

The storage battery is of primary importance for the satisfactory operation of generating stations, substations, and other stationary applications. This recommended practice is based on commonly accepted methods used to define the load and to ensure adequate battery capacity. The method described is applicable to all installations and battery sizes.

The installations considered herein are designed for operation with a battery charger serving to maintain the battery in a charged condition as well as to supply the normal dc load. This recommended practice does not apply to "cycling" applications. (See IEEE P1660™/D9, June 2008 [B2][a] subject to approval before this revision is approved.)

This recommended practice was prepared by the Lead Acid Battery Sizing Working Group of the Stationary Battery Committee. It may be used separately, but when combined with IEEE Std 450™-2002[b] and IEEE Std 484™-2002 (for vented lead acid batteries) or IEEE Std 1187™-2002 and IEEE Std 1188™-2005 (for valve-regulated lead-acid [VRLA] batteries), it will provide the user with a general guide to designing, placing in service, and maintaining the applicable lead-acid battery installation.

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[a] The numbers in brackets correspond to those of the bibliography in Annex J.
[b] Information on references can be found in Clause 2.

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Participants

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Curtis Ashton
Gary Balash
Robert Beavers
Richard Bolgeo
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Jerry Meyers
Rudy Ortega
Bansi Patel
Jan Reber
Christopher Searles
Edward C. Stallings
Joseph Stevens
Lesley Varga
Allan Williamson

The following members of the individual balloting committee voted on this recommended practice. Balloters may have voted for approval, disapproval, or abstention.

William J. Ackerman
Satish Aggarwal
Samuel Aguirre
Steven Alexanderson
James Anderson
Phyllis Archer
Stan Arnot
Gary Arntson
Curtis Ashton
Gary Balash
Farouk Baxter
Robert Beavers
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Don Messina
IEEE Standards Program Manager, Document Development

Soo H. Kim
IEEE Standards Program Manager, Technical Program Development

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1.1 Scope

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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 referenced, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 450™-2002, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.[1,2]

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IEEE Std 484™-2002, IEEE Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications.

IEEE Std 1184™-2006, IEEE Guide for Batteries for Uninterruptible Power Supply Systems.

IEEE Std 1187™-2002 IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications.

IEEE Std 1188™-2005, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.

3. Definitions

For the purposes of this document, the following terms and definitions apply. *The IEEE Standards Dictionary: Glossary of Terms & Definitions* should be consulted for terms not defined in this clause.[3]

battery duty cycle: The sequence of loads a battery is expected to supply for specified time periods.

cell size: The rated capacity of a cell or the number of positive plates in a cell.

equalizing charge: A charge, at a level higher than the normal float voltage, applied for a limited period of time, to correct inequalities of voltage, specific gravity, or state of charge that may have developed between the cells during service.

full-float operation (float service): Operation of a direct current (dc) system in which the battery spends the majority of the time on float charge with infrequent discharge. (The primary source of power is normally the battery charger or rectifier.)

period: An interval of time in the battery duty cycle during which the current (or power) is assumed to be constant for purposes of cell sizing calculations.

rated capacity (lead-acid): The capacity assigned to a cell by its manufacturer for a given discharge rate, at a specified electrolyte temperature and specific gravity, to a given end-of-discharge voltage.

valve-regulated lead-acid (VRLA) cell: A lead-acid cell that is sealed with the exception of a valve that opens to the atmosphere when the internal pressure in the cell exceeds atmospheric pressure by a preselected amount. VRLA cells provide a means for recombination of internally generated oxygen and the suppression of hydrogen gas evolution to limit water consumption.

vented battery: A battery in which the products of electrolysis and evaporation are allowed to escape to the atmosphere as they are generated. These batteries are also commonly referred to as "flooded."

4. Defining loads

4.1 General considerations

The duty cycle imposed on the battery by any of the conditions described herein will depend on the dc system design and the requirements of the installation. The battery must supply the dc power requirements when the following conditions occur:

[3] *The IEEE Standards Dictionary: Glossary of Terms & Definitions* is available at http://shop.ieee.org/.