

INTERNATIONAL STANDARD



**Railway applications – Rolling stock – Batteries for auxiliary power supply systems –
Part 3: Lead acid batteries**

Document Preview

[IEC 62973-3:2024](#)

<https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

International Standards
standards.iteh.ai
Document Preview

[IEC 62973-3:2024](https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024>

INTERNATIONAL STANDARD



**Railway applications – Rolling stock – Batteries for auxiliary power supply systems –
Part 3: Lead acid batteries**

Document Preview

[IEC 62973-3:2024](https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.220.20; 45.040

ISBN 978-2-8322-8567-1

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	9
4 General requirements	9
4.1 Definitions of components of a battery system	9
4.2 Description of lead acid battery types	10
4.2.1 General	10
4.2.2 Lead acid batteries with valve-regulated cell design and immobilized electrolyte.....	11
4.3 Environmental conditions	11
4.4 System requirements	12
4.4.1 System voltage	12
4.4.2 Charging requirements	13
4.4.3 Discharging performances	16
4.4.4 Charge retention(self-discharge).....	17
4.4.5 Requirements for battery sizing	17
4.5 Safety and protection requirements.....	18
4.5.1 General	18
4.5.2 Deep discharge of batteries	18
4.5.3 Temperature compensation during charging	19
4.6 Fire protection	19
4.7 Maintenance	19
4.8 Charging characteristics	19
5 Optional components of a battery system	20
5.1 General.....	20
5.2 Battery information system.....	20
5.3 Battery heater	20
5.4 Thermostat or cut-off switch.....	20
6 Mechanical design of battery system	21
6.1 General.....	21
6.2 Interface mechanism.....	21
6.3 Shock and vibration	21
6.4 Ventilation of battery box	21
7 Electrical interface.....	22
7.1 General.....	22
7.2 External electrical connections interface	22
8 Markings.....	22
8.1 Safety signs	22
8.1.1 Outside the box	22
8.1.2 Tray, crate or other places inside the box	22
8.1.3 Cells and monoblocs	23
8.2 Nameplate	23
8.2.1 Battery box	23

8.2.2	Nameplates on tray, crate or other nameplates inside the box	23
9	Storage and transportation conditions.....	23
9.1	Transportation	23
9.2	Storage.....	23
10	Testing.....	24
10.1	General.....	24
10.2	Type test.....	24
10.2.1	General	24
10.2.2	Tests for cells and monoblocs.....	24
10.2.3	Dielectric test	25
10.2.4	Load profile test.....	25
10.2.5	Shock and vibration test	25
10.3	Routine test	26
10.3.1	General	26
10.3.2	Visual checks	26
10.3.3	Dielectric test	26
10.3.4	Cell and monobloc voltages	26
Annex A (informative)	Declaration of test unit equivalence.....	27
Annex B (normative)	Dielectric test.....	28
Annex C (normative)	Compliance of battery with energy demand of load profile(s)	29
C.1	General.....	29
C.2	Battery sizing.....	29
C.3	Compliance with energy demand of load profile	29
C.3.1	General	29
C.3.2	Test facility	29
C.3.3	Test batteries	29
C.3.4	Test procedures.....	30
C.3.5	Energy demand compliance.....	30
C.3.6	Test report.....	30
Bibliography.....		31
Figure 1	– Definition of single cells, monobloc, crate, tray and battery box.....	10
Figure 2	– Example of the evolution of the voltage of a VRLA cell when discharged with multiples of the 5 h rated current versus percentage of the 5 h rated capacity	12
Figure 3	– Examples of current and voltage evolution during charge.....	13
Figure 4	– Temperature versus voltage response graph for float charge operation	15
Figure 5	– Temperature versus voltage response graph for boost charge operation	16
Figure 6	– Examples of horizontal installation of VRLA cells and monoblocs	21
Figure 7	– Typical schematic view of an electrical interface of a battery system.....	22
Table 1	– Requirements for battery system charge operations	13
Table 2	– Typical lead acid battery charge parameters	14
Table 3	– Voltage and temperature reference levels for float charge operation	15
Table 4	– Voltage and temperature reference levels for boost charge operation.....	16
Table 5	– Input parameters required for the sizing of the battery to be provided by the system integrator or end user	17

Table 6 – Output parameters provided at the conclusion of the sizing of the battery to be provided by the battery system manufacturer 18

Table 7 – Type tests for cells and monoblocs..... 25

Table B.1 – Sequence for dielectric test..... 28

Table B.2 – Voltages for dielectric test..... 28

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62973-3:2024](https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – ROLLING STOCK – BATTERIES FOR AUXILIARY POWER SUPPLY SYSTEMS –

Part 3: Lead acid batteries

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62973-3 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
9/3041/FDIS	9/3066/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62973 series, published under the general title *Railway applications – Rolling stock – Batteries for auxiliary power supply systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62973-3:2024](#)

<https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024>

RAILWAY APPLICATIONS – ROLLING STOCK – BATTERIES FOR AUXILIARY POWER SUPPLY SYSTEMS –

Part 3: Lead acid batteries

1 Scope

This part of IEC 62973 establishes the framework for the electrical interfaces to the train, and the sizing (e.g., capacity, cell number, to meet the requested load profile) and operation of lead acid batteries of the VRLA type for auxiliary power supply systems on rolling stock of railways and complements IEC 62973-1, unless otherwise specified.

This document provides guidance and links to standards for the required battery qualification tests procedures and safety measures to be implemented.

The cited normative references for lead acid batteries provide multiple requirements and tests applicable for their qualification.

In this document, the most appropriate clauses of these cited standards have been selected and adapted as needed to reflect the intended use of these batteries as auxiliary power sources on rolling stock of railways.

The battery-specific requirements for subcomponents of battery systems such as containers, charging controls, temperature probes, nameplates and similar are covered in this document as needed.

Charging systems are excluded from the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60896-21:2004, *Stationary lead-acid batteries – Part 21: Valve regulated types – Methods of test*

IEC 60896-22:2004, *Stationary lead-acid batteries – Part 22: Valve regulated types – Requirements*

IEC 61373:2010, *Railway applications – Rolling stock equipment – Shock and vibration tests*

IEC TS 61430, *Secondary cells and batteries – Test methods for checking the performance of devices designed for reducing explosion hazards – Lead-acid starter batteries*

IEC TR 61431:2020, *Guidelines for the use of monitor systems for lead-acid traction batteries*

IEC 62485-2:2010, *Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries*

IEC 62498-1:2010, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

IEC 62973-1:2018, *Railway applications – Rolling stock– Batteries for auxiliary power supply systems – Part 1: General requirements*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 62973-1:2018, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE All typical battery related descriptions are defined in IEC 60050-482.

3.1.1

lead dioxide lead battery lead acid battery

secondary battery with an aqueous electrolyte based on dilute sulphuric acid, a positive electrode of lead dioxide and a negative electrode of lead

[SOURCE: IEC 60050-482:2004, 482-05-01, modified – Note has been deleted.]

3.1.2

battery information system

data collection system to provide optional additional information and guidance for battery operation and maintenance

3.1.3

valve regulated lead acid battery VRLA

secondary battery in which cells are closed but have a valve which allows the escape of gas if the internal pressure exceeds a predetermined value

Note 1 to entry: The cell or battery cannot normally receive additions to the electrolyte.

[SOURCE: IEC 60050-482:2004, 482-05-15]

3.1.4

finite element analysis FEA

numerical mathematical analysis method simulating the mechanical behaviour of an assembly

3.1.5

line replaceable unit LRU

modular component of equipment designed to be replaced at an operating location whilst the equipment remains in the operating environment

3.1.6 state of charge SOC

<of a lead acid battery> level of charge in ampere hours of the battery relative to its rated capacity in ampere hours and expressed in percentage points

Note 1 to entry: A term interrelated with SOC, is the term depth of discharge (DOD), i.e., the level of discharge in ampere hours of the battery system when related to the same rated capacity in ampere hours and expressed in percentage points and where, by convention, 0 % DOD equals to 100 % SOC and 100 % DOD equals to 0 % SOC.

Note 2 to entry: The real capacity of the battery may be different from the rated, i.e., declared capacity.

3.1.7 rated capacity C_n

<of a lead-acid battery of VRLA type> capacity value of a battery system determined under specified conditions as per IEC 60896-21 and IEC 60896-22, and declared by the battery manufacturer

3.1.8 battery system battery

system that includes battery tray(s), battery crate(s), monobloc(s), electrical components and/or equipment and associated electromechanical components and connections

3.2 Abbreviated terms

AC	Alternating Current
AGM	Absorbent Glass Mat
DC	Direct Current
U_B	Rated battery voltage
U_T	Test voltage

<https://standards.iteh.ai/catalog/standards/iec/dfd6885d-b87b-4ff4-b05a-046aea7316bd/iec-62973-3-2024>

4 General requirements

4.1 Definitions of components of a battery system

The main components of a lead acid battery and their interdependence are shown in Figure 1.