

TECHNICAL SPECIFICATION



**Recommendations for renewable energy and hybrid systems for rural electrification –
Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries**

ITeH STANDARD PREVIEW
(standards.iteh.ai)
IEC TS 62257-8-1:2018
<https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 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 Central Office
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

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 It also gives information on projects, replaced and withdrawn publications.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 also once a month by email. <https://standards.iteh.ai/catalog/standards/sist/9d22-ae7236a2dedc/iec-62578-1-2018>

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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 STANDARD PREVIEW
(standards.iteh.ai)
IEC TS 62578-1:2018
9d22-ae7236a2dedc/iec-62578-1-2018

TECHNICAL SPECIFICATION



**Recommendations for renewable energy and hybrid systems for rural electrification –
Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries**

STANDARD PREVIEW
(standards.iteh.ai)
IEC TS 62257-8-1:2018
<https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160

ISBN 978-2-8322-5423-3

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

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Batteries and battery management system selection.....	9
4.1 Battery technical characteristics.....	9
4.1.1 Battery cases.....	9
4.1.2 Battery terminals	9
4.1.3 Electrolyte	9
4.2 Comparative tests.....	10
4.2.1 General	10
4.2.2 Evaluation of the charge and discharge current for testing (I_{test})	10
4.2.3 Test 1: battery endurance test	11
4.2.4 Test 2: endurance test for battery and BMS.....	15
4.2.5 Test 3: Battery storability test	17
5 Documentation	18
6 Installation rules.....	19
6.1 Packing and shipping.....	19
6.2 Environment	19
6.3 Battery accommodation, housing	20
6.3.1 General	20
6.3.2 Provision against electrolyte hazard	20
6.3.3 Prevention of short circuits and protection from other effects of electric current.....	21
6.3.4 Battery enclosures.....	21
6.4 Final inspection.....	22
6.5 Safety	22
6.5.1 Safety provisions	22
6.5.2 Safety Information	22
6.6 Administrative formalities	23
6.7 Recycling.....	23
Figure 1 – Test 1 phases	12
Figure 2 – Phase A battery endurance test	13
Figure 3 – Phase B battery endurance test	14
Figure 4 – Test 2 phases	16
Figure 5 – Phase C battery – BMS endurance test.....	16
Figure 6 – Test 3 phases	17
Figure 7 – Phase D storability test	18
Figure 8 – Marking for spillage prevention	19

ITeH STANDARD PREVIEW

(standards.iteh.ai)

IEC TS 62257-8-1:2018

<https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018>

9d22-ae7236a2dedc/iec-ts-62257-8-1-2018

Table 1 – Testing procedure	10
Table 2 – Evaluation of charge and discharge current (I_{test})	11
Table 3 – Voltage regulation variation with temperature (examples).....	11

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC TS 62257-8-1:2018](https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018)

<https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RECOMMENDATIONS FOR RENEWABLE ENERGY AND
HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –**
**Part 8-1: Selection of batteries and battery management systems
for stand-alone electrification systems – Specific case of
automotive flooded lead-acid batteries
available in developing countries**

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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62257-8-1, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) increase of the applicable voltage levels and removal of the 100 kW power limit;
- b) removal of the word "small" from the description of these systems.

This technical specification is to be used in conjunction with the future parts of this series as and when they are published.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
82/1330/DTS	82/1384/RVDTS

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 62257 series, under the general title: *Recommendations for renewable energy and hybrid systems for rural electrification*, can be found on the IEC website.

[https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-](https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018)

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

INTRODUCTION

The IEC 62257 series of documents intends to provide to different players involved in rural electrification projects (such as project implementers, project contractors, project supervisors, installers) with documents for the setting up of renewable energy and hybrid systems with AC voltage below 1 000 V and DC voltage below 1 500 V.

These documents are recommendations:

- to choose the right system for the right place;
- to design the system;
- to operate and maintain the system.

These documents are focused only on rural electrification concentrating on, but not specific to, developing countries. They are not considered as all-inclusive to rural electrification. The documents try to promote the use of renewable energies in rural electrification; they do not deal with clean mechanisms developments at this time (CO₂ emissions, carbon credit, etc.). Further developments in this field could be introduced in future steps.

This consistent set of documents is best considered as a whole with different parts corresponding to items for safety, sustainability of systems and at the lowest life cycle cost possible. One of the main objectives is to provide the minimum sufficient requirements relevant to the field of application that is: small renewable energy and hybrid off-grid systems.

For rural electrification projects using PV systems, it is recommended to use solar batteries defined in IEC 61427.

Nevertheless in many situations, it is a fact that most of the rural electrification projects are implemented using locally made automotive flooded lead-acid batteries. But these products are not designed for photovoltaic systems applications. There is presently no test to discriminate, in a panel of models of such batteries, which one could provide the best service as close as possible to the requirement of the general specification as a storage application for small PV individual electrification systems (see IEC TS 62257-2) in an economically viable way.

The purpose of IEC TS 62257-8-1 is to propose tests for automotive lead-acid batteries and battery management systems used in small PV individual electrification systems.

RECOMMENDATIONS FOR RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries

1 Scope

This part of IEC 62257 proposes simple, cheap, comparative tests in order to discriminate easily, in a panel of automotive flooded lead-acid batteries, the most acceptable model for PV individual electrification systems.

It could be particularly useful for project implementers to test in laboratories of developing countries, the capability of locally made car or truck batteries to be used for their project.

Furthermore, battery-testing specifications usually need test equipment that is too costly and too sophisticated to be applied in developing countries' laboratories.

The tests provided in this document allow assessment of the batteries' performances according to the general specification of the project (see IEC TS 62257-2) and batteries associated with their battery management system (BMS) in a short time and with common technical means. They can be performed locally, as close as possible to the operating conditions of the real site.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC TS 62257-8-1:2018
<https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018>

The document provides also regulations and installation conditions to be complied with in order to ensure the life and proper operation of the installations as well as the safety of people living in proximity to the installation.

This document is not a type approval standard. It is a technical specification to be used as guidelines and does not replace any existing IEC standard on batteries.

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 60050-482:2004, *International Electrotechnical Vocabulary – Part 482: Primary and secondary cells and batteries*
IEC 60050-482:2004/AMD1:2016

IEC TS 62257-6, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 6: Acceptance, operation, maintenance and replacement*

3 Terms and definitions

For the purposes of this document, the terms and definitions for secondary cells and batteries given in IEC 60050-482 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>

3.1

secondary cell

cell that is designed to be electrically recharged

Note 1 to entry: The recharge is accomplished by way of a reversible chemical reaction.

[SOURCE: IEC 60050-482:2004, 482-01-03]

3.2

storage battery

secondary battery

two or more secondary cells connected together and used as a source of electric energy

3.3

lead-acid battery

storage battery in which the electrodes are made mainly from lead and the electrolyte is a sulphuric acid solution

3.4

terminal pole

conductive part provided for the connection of a cell or battery to external conductors

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC TS 62257-8-1:2018](#)

3.5

density

commonly considered as the volumic mass, in kg/dm^3

<https://standards.iteh.ai/catalog/standards/sist/ebd73667-8bdb-4b81-9d22-ae7236a2dedc/iec-ts-62257-8-1-2018>

Note 1 to entry: Density is also defined as a dimensionless magnitude expressing the ratio of the electrolyte mass to the water mass occupying the same volume at 4 °C.

3.6

electrolyte

liquid or solid substance containing mobile ions that render it ionically conductive

Note 1 to entry: The electrolyte may be liquid, solid or a gel.

[SOURCE: IEC 60050-482:2004, 482-02-29]

3.7

dry charged battery

state of delivery of some types of secondary battery where the cells contain no electrolyte and the plates are dry and in a charged state

[SOURCE: IEC 60050-482:2004, 482-05-30]

3.8

self-discharge

phenomenon by which a cell or battery loses energy in other ways than by discharge into and external circuit

[SOURCE: IEC 60050-482:2004, 482-03-27]

3.9

nominal capacity

suitable approximate quantity of electricity, used to identify the capacity of a cell or a battery

Note 1 to entry: This value is usually expressed in ampere-hours (Ah).

3.10

rated capacity

<of a cell or a battery> quantity of electricity, declared by the manufacturer, that a cell or a battery can deliver under specified conditions after a full charge

Note 1 to entry: The rated capacity shown on the battery label is given for a discharge period, which depends on the technology used in the battery.

Note 2 to entry: The capacity of a battery is higher when it is discharged slowly. For example, variations are in the order of 10 % to 20 % between a capacity measured over 5 h and a capacity measured over 100 h.

3.11

ambient temperature

temperature of the medium in the immediate vicinity of a battery

3.12

initial charge

commissioning charge given to a new battery to bring it to the fully charged state

3.13

cycling

<of a cell or battery> set of operations that is carried out on a secondary cell or battery and is repeated regularly in the same sequence

Note 1 to entry: In a secondary battery these operations may consist of a sequence of a discharge followed by a charge of a charge followed by a discharge under specified conditions. This sequence may include rest periods.

[SOURCE: IEC 60050-482:2004, 482-05-28]

4 Batteries and battery management system selection

4.1 Battery technical characteristics

4.1.1 Battery cases

Battery cases shall be made of suitable materials capable of withstanding impacts and shocks and resistant to acid.

4.1.2 Battery terminals

Terminals shall be protected against accidental short circuits. Positive and negative polarities shall be identified.

4.1.3 Electrolyte

The electrolyte for lead acid batteries is prepared from special sulphuric acid for storage batteries. It shall be colourless, odourless and free of all insoluble material deposits. As there is no standard for such an electrolyte, impurity levels shall follow the battery manufacturer's requirements.

The electrolyte level checking interval varies depending on:

- the type of battery;
- the temperature;