SLOVENSKI STANDARD
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Priporočila za sisteme malih obnovljivih virov energije in hibridne sisteme za elektrifikacijo podeželja - 8-1. del: Izbira akumulatorjev in sistemov upravljanja akumulatorjev za samostojne sisteme elektrifikacije - Posebni primer za avtomobilske mokre svinčeno-kislinske akumulatorje, ki so na voljo v deželah v razvoju

Recommendations for small 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

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Recommendations for small 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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RECOMMENDATIONS FOR SMALL RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

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- 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 document is based on IEC/PAS 62111 (1999); it cancels and replaces the relevant parts of IEC/PAS 62111.

This part of IEC 62257 is to be used in conjunction with the IEC 62257 series.

It is also to be used with 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
82/457/DTS	82/476/RVC

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

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, etc.) documents for the setting up of renewable energy and hybrid systems with a.c. voltage below 500 V, d.c. voltage below 750 V and power below 100 kVA.

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 must not be 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 (CO_2 emission, 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 as 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 project 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 application. 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 62257-2) in an economically viable way.

The purpose of Part 8-1 of IEC 62257 is to propose tests for automotive lead acid batteries and batteries management systems used in small PV Individual Electrification Systems

This document and the others in the IEC 62257 series are only guidance and so cannot be international standards. Additionally, their subject is still under technical development and so they shall be published as Technical Specifications.

NOTE The IEC 62257 series of Technical Specifications is based on IEC/PAS 62111 (1999-07) and is developed in accordance with the PAS procedure.

RECOMMENDATIONS FOR SMALL 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 Technical Specification 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 too costly and too much sophisticated test equipment to be applied in developing countries laboratories.

The tests provided in this document allow to assess batteries performances according to the general specification of the project (see IEC 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 real site operating conditions.

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 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) applies.

IEC 60050-482, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries*

IEC 61427, *Secondary cells and batteries for photovoltaic energy systems (PVES) – General requirements and methods of test*

IEC 62257 (all parts), *Recommendations for small renewable energy and hybrid systems for rural electrification*

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.

3.1
electrochemical cell or battery
electrochemical system capable of storing in chemical form the electric energy received and which can give it back by conversion

3.2
secondary cell
cell which is designed to be electrically recharged

NOTE The recharge is accomplished by way of a reversible chemical reaction.

[IEV 482-01-03]

3.3
storage battery (secondary battery)
two or more secondary cells connected together and used as a source of electric energy

3.4
lead-acid battery
storage battery in which the electrodes are made mainly from lead and the electrolyte is a sulphuric acid solution

3.5
terminal (pole)
conductive part provided for the connection of a cell or battery to external conductors

3.6
density
commonly considered as the volumic mass, in kg / dm^3

NOTE 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.

3.7
electrolyte
liquid or solid substance containing mobile ions which render it ionically conductive

NOTE The electrolyte may be liquid, solid or a gel.

[IEV 482-02-29]

3.8
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

[IEV 482-05-30]

3.9
self-discharge
phenomenon by which a cell or battery loses energy in other ways than by discharge into and external circuit

[IEV 482-03-27]

3.10
observed battery capacity
quantity of electricity or electrical charge that a battery in high state of charge can deliver under the proposed test conditions. In practice, battery capacity is expressed in Ampere-hours(Ah)

3.11
nominal capacity
suitable approximate quantity of electricity, used to identify the capacity of a cell or a battery

NOTE This value is usually expressed in Ampere-hours (Ah).

3.12
rated capacity (of a cell or a battery)
quantity of electricity, declared by the manufacturer, which a cell or a battery can deliver under specified conditions after a full charge

NOTE 1 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 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 hours and a capacity measured over 100 hours.

3.13
short-circuit current
maximum current given by a battery into a circuit of a very low resistance compared with that of the battery, under specified conditions

3.14
charge rate
electric current at which a secondary cell or battery is charged

NOTE The charge rate is expressed as the reference current $I_t = C_r/n$ where C_r is the rated capacity declared by the manufacturer and n is the time base in hours for which the rated capacity is declared.

[IEV 482-05-45]

3.15
ambient temperature
temperature of the medium in the immediate vicinity of a battery

3.16
gassing of a cell
evolution of a gas resulting from electrolysis of the water in the electrolyte of a cell

[IEV 482-05-51]

3.17
constant current charge
charge during which the electric current is maintained at a constant value regardless of the battery voltage or temperature

[IEV 482-05-38]

3.18
initial charge
commissioning charge given to a new battery to bring it to the fully charged state

3.19
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 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.

[IEV 482-05-28]

3.20
commissioning
final checking of installation and operation of a battery on site.

3.21
BMS
battery management system (or battery charge/discharge controller)

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 colorless, odorless and free of all insoluble material deposits. As there is no standard for such an electrolyte, impurity levels shall follow the battery manufacturer requirements.

The electrolyte level checking interval varies depending on:

- the type of battery;
- the temperature;
- the use;
- the regulation algorithms of the charge controller;
- the battery age;
- the quality of distilled water;
- the PV resource.

The service interval would be determined by the above parameters and electrolyte reservoir size which is a specification of the specific battery used. Care should be used to ensure that the service interval is within the capability of the maintenance organization.

The batteries shall be designed in order to be able to check the electrolyte levels and to add distilled water.

NOTE 1 Faradic water consumption for vented batteries:

when a battery reaches its fully state of charge, water electrolysis occurs according to the Faraday's Law.

Under standard conditions:

1 Ah decomposes H_2O into 0,42 dm^3 H_2 + 0,21 dm^3 O_2

Decomposition of 1 cm^3 (1 g) H_2O requires 3 Ah

An estimation of water consumption of a battery is given by

Battery H_2O (g) consumption = (X Ah charged – Y Ah discharged) × number of cells in battery / 3.