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Withdrawn

Recommendations for small renewable energy and hybrid systems for rural electrification –
Part 9-6: Integrated system – Selection of Photovoltaic Individual Electrification Systems (PV-IES)

IEC/TS 62257-9-6:2008(E)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 9-6: Integrated system – Selection of Photovoltaic Individual Electrification Systems (PV-IES)

FOREWORD

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

IEC 62257-9-6, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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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.

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

Enquiry draft	Report on voting
82/510/DTS	82/532/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.

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

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- withdrawn,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.

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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.

This document and the others of 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.

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

Part 9-6: Integrated system – Selection of Photovoltaic Individual Electrification Systems (PV-IES)

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1 Scope

The purpose of this part of IEC 62257 is to propose simple selection procedure and cheap, comparative tests which can be performed in laboratories of developing countries, in order to identify the most suitable model of small Photovoltaic Individual Electrification Systems (PV-IES) up to 500 Wp for a particular rural electrification project from a number of products submitted for test.

It is different of the scope of IEC 62124, *Photovoltaic (PV) stand alone systems – Design verification*, which provides guidance for verifying the design of stand-alone PV systems and indoor and outdoor tests in order to evaluate the performance of PV systems including PV generator, battery storage and loads such as lights, TV sets, and refrigerators.

The tests provided in IEC 62257-9-6 allow assessment of the performance of a PV-IES according to the requirement of the General Specification (GS) of the project (see IEC/TS 62257-2) and to verify their ability to provide the required service. They should be performed locally, as close as possible to the real site operating conditions.

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 PV systems.

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 61215, *Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61646, *Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61730-1, *Photovoltaic (PV) module safety qualification – Part 1: Requirements for construction*

IEC 61730-2, *Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing*

IEC/TS 62257-2:2004, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 2: From requirements to a range of electrification systems*

IEC/TS 62257-4, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 4: System selection and design*

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IEC/TS 62257-5, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 5: Protection against electrical hazards*

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

IEC/TS 62257-7-1, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 7-1: Generators – Photovoltaic arrays*

IEC/TS 62257-8-1:2007, *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*

IEC/TS 62257-9-3, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-3: Integrated system – User interface*

IEC/TS 62257-9-4, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-4: Integrated system – User installation*

IEC/TS 62257-12-1, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and recommendations for household lighting equipment*

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3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
cycle
sequence of a discharge followed by a charge or a charge followed by a discharge of a battery under specified conditions

3.1.2
duration of service
number of hours when a load is powered

3.1.3
fulfilment of service
ratio of a measured provided service to a required service

3.1.4
initial charge
commissioning charge given to a new battery to bring it to the fully charged state

3.1.5
period of service
part of the day when a load is powered

3.1.6
reference irradiation
value of irradiation taken in consideration for the design of the system, approved by the project implementer and specified in the GS of the project

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3.1.7
service ratio
extent in which the service required by the GS is fulfilled by the system

3.2 Abbreviated terms

3.2.1
GS
general specification for the project

3.2.2
QI
quality of service index

3.2.3
$TWQI_T$
total weighted quality of service

3.2.4
$DWQI_T$
daily weighted quality of service

3.2.5
S_{good}, S_{bad} and S_d
S_{good}: service ratio under favourable conditions;
S_{bad}: service ratio under unfavourable conditions;
S_d: daily service ratio

4 System boundaries

A PV-IES comprises the following elements:

- a PV generator including PV modules and support structure;
- a charge controller;
- a storage system (including battery and associated casing);
- adequate wiring, switches and protective devices (see IEC/TS 62257-9-3 and IEC/TS 62257-9-4);
- loads relevant for the required service (such as lamps, TV set, radio set, and refrigerators).

5 System pre-selection

5.1 Services to be provided by the system

The preliminary socio-economic studies shall provide the project developer with information on the ability of the customers who will benefit from the project to pay for the service provided. Then, the project developer shall define within the GS the range of services to be provided as described in IEC/TS 62257-2 as well as the relative priority of the services to be provided (TV, lighting, etc.)

5.2 Specification of a model

5.2.1 General operating conditions

The project implementer shall define the operating conditions to which the PV-IES can be subjected. Examples of such conditions are given in Table 1.

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Table 1 – Climatic conditions (example)

	Nominal operating range	Storage - Transport
Temperature	–10 °C to +50 °C	–40 °C to +80 °C
Humidity at 28 °C	5 % to 95 %	
Atmospheric pressure	860 hPa to 1 060 hPa	

5.2.2 Design

For the part of the project which will be implemented through Individual Electrification Systems, the project developer shall size a range of PV IES able to provide the required service under the specified operating conditions (see IEC/TS 62257-2). The project implementer could either:

- specify complete integrated systems, or
- specify the different components for PV-IES in order to realize the integration of these components through its own system design.

In addition, the project developer shall set up the requirements for the loads relevant for the service to be provided (such as lamps, TV set, radio set, and refrigerator).

5.2.3 Components requirements

The components of the PV-IES shall comply with the relevant IEC standards and/or the relevant local regulations if any.

For the selection of batteries, tests recommended in IEC/TS 62257-8-1 shall apply and for the selection of lamps, tests recommended in IEC/TS 62257-12-1 shall apply.

5.2.4 Safety issues

The project developer shall define the IP degree and IK code of the expected products.

Table 2 gives some values that could be considered as a minimum.

Table 2 – Suggested minimum values for IP and IK

Protection degree	Minimum suggested value
IP	34
IK	8

Safety rules shall comply with IEC/TS 62257-5.

5.2.5 Installation rules

The complete installation shall comply with IEC/TS 62257-7-1 and IEC/TS 62257-9-4 and any local wiring codes.

5.2.6 Operation and maintenance rules

The systems shall be designed in order that operation and maintenance may be performed in accordance with the specifications given in IEC/TS 62257-6.

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