



BSI Standards Publication

Renewable energy and hybrid systems for rural electrification

Part 9-6: Integrated systems – Recommendations for selection of
Photovoltaic Individual Electrification Systems (PV-IES)

National foreword

This Published Document is the UK implementation of IEC TS 62257-9-6:2019. It supersedes DD IEC/TS 62257-9-6:2008, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/82, Photovoltaic Energy Systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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© The British Standards Institution 2019
Published by BSI Standards Limited 2019

ISBN 978 0 580 97349 9

ICS 27.180; 27.160

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 October 2019.

Amendments/corrigenda issued since publication

Date	Text affected
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TECHNICAL SPECIFICATION



**Renewable energy and hybrid systems for rural electrification –
Part 9-6: Integrated systems – Recommendations for selection of Photovoltaic
Individual Electrification Systems (PV-IES)**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160; 27.180

ISBN 978-2-8322-7353-1

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RENEWABLE ENERGY AND HYBRID SYSTEMS
FOR RURAL ELECTRIFICATION –****Part 9-6: Integrated systems – Recommendations for selection
of Photovoltaic Individual Electrification Systems (PV-IES)**

FOREWORD

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

This second edition of IEC TS 62257-9-6 cancels and replaces the first edition published in 2008. It constitutes a technical revision.

The main technical changes with respect to the previous edition are as follows:

- Removal of the term "small" from the title of the publication and from description of rural electrification systems.
- Removal of the limits on system voltage and power; these recommendations apply to systems of all sizes.

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
82/1279/DTS	82/1533A/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 IEC 62257 series, under the general title: *Renewable energy and hybrid systems for rural electrification*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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 intends to provide different players involved in rural electrification projects (such as project implementers, project contractors, project supervisors, installers, product suppliers, etc.) documents for setting up renewable energy and hybrid systems with a.c. voltage below 1 000 V and d.c. voltage below 1 500 V.

These documents are recommendations:

- to choose the right system for the right place;
- to design the system;
- to ensure product quality and installation quality;
- to operate and maintain the system.

These documents are focused on off-grid electricity access, concentrating on, but not limited to, areas with a significant fraction of the population living without reliable electric grid access. They should not be considered as providing complete coverage of all issues related to rural electrification.

This set of documents is best considered as a whole, with different parts covering topics such as safety, system design, product quality, installation and maintenance, and the sustainability of systems aiming at the lowest life cycle cost possible. One of the main objectives is to provide minimum requirements relevant to renewable energy and hybrid off-grid power systems.

RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

Part 9-6: Integrated systems – Recommendations for selection of Photovoltaic Individual Electrification Systems (PV-IES)

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 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 from 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 this document allow assessment of the performance of 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 are 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 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 61215 (all parts), *Crystalline silicon 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 62257-2:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 2: From requirements to a range of electrification systems*

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

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

IEC TS 62257-6, *Recommendations for 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 generators*

IEC TS 62257-8-1:2018, *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*

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

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

IEC TS 62257-12-1, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 12-1: Selection of lamps and lighting appliances for off-grid electricity systems*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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>

3.1.1

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

3.1.7**service ratio**

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

3.2 Abbreviated terms

GS	general specification for the project
QI	quality of service index
$TWQI_T$	total weighted quality of service
$DWQI_T$	daily weighted quality of service
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.

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.

5.2.7 Documentation and marking

A manual shall also be provided including PV-IES installation and operating guidelines such as:

- initial operations before first use;
- instructions to use the PV-IES properly;
- mounting the PV module;
- charging instructions;
- maintenance and troubleshooting instructions.