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Recommendations for small renewable energy and hybrid systems for rural electrification –
Part 7-1: Generators – Photovoltaic generators

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 7-1: Generators – Photovoltaic generators

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 62257-7-1, 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 issued in 2006 and constitutes a technical revision.

The main technical changes with regard to the previous edition are the following:

– This new version is focused on small PV generators up to 100 kW_p.
– Case studies are provided.

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

Enquiry draft	Report on voting
82/583/DTS	82/604/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 the IEC 62257 series, published 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 stability 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 be

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- withdrawn,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

A bilingual edition of this document 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 publications 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 publications provide recommendations for

– choosing the right system for the right place;

– designing the system;

– operating and maintaining the system.

These publications are focused only on rural electrification concentrated in, but not specific to, developing countries. They must not be considered as all-inclusive of rural electrification. The publications try to promote the use of renewable energies in rural electrification. They do not deal with clean mechanism 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 publications is best considered as a whole, with different parts corresponding to items for the safety and sustainability of systems at the lowest possible life-cycle cost. One of the main objectives of the series is to provide the minimum sufficient requirements relevant to the field of application, i.e. for small renewable energy and hybrid off-grid systems.

The purpose of IEC 62257-7-1 is to propose a technical specification for the design and building of small PV generators (e.g. up to 100 kW_p) used in rural electrification.

Numerous experts of TC 82 have expressed the opinion that the first edition of IEC/TS 62257-7-1 is far more general than just the PV array for rural electrification but can also be used for big PV arrays in big PV power stations.

Therefore it is now necessary to develop a second edition more dedicated and more specific to rural electrification. It is the purpose of this second edition to specify the general requirements for the design and the safety of PV generator used in decentralized rural electrification systems.

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

Part 7-1: Generators – Photovoltaic generators

1 Scope

This part of IEC 62257 specifies the general requirements for the design and safety of generators used in decentralized rural electrification systems.

The earthing systems of the exposed conductive parts and neutral earthing systems which are considered in this technical specification are those specified in IEC 62257 series for IES (see IEC 62257-9-3 and IEC 62257-9-4) and CES (IEC 62257-9-2).

This technical specification contains requirements for ELV and LV PV arrays (see Table 1). Particular attention must be paid to voltage level, as this is important for safety reasons and has an influence on protective measures and on the skill and ability level of people operating the systems.

Table 1 – Voltage domains for PV arrays

Voltage domain	Voltage V	
	Alternating current	Smoothed direct current
ELV	$U_n \leq 50$ V	$U_{oc} \leq 120$ V
LV	50 V < $U_n \leq 1\,000$ V	120 V < $U_{oc} \leq 1\,500$ V
NOTE ELV limits are provided by IEC 61201.		

For the sake of completeness, this technical specification gives requirements for d.c. voltages below and above 120 V.

The aim is to provide safety and fire protection requirements for:

– uninformed persons, including owner(s)/occupier(s) and users of the premises where photovoltaic arrays are installed;

– informed workers (e.g. electricians) working on these systems; and

– emergency workers (for example fire fighters).

For installation of PV arrays see IEC 60364-7-712.

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 60050-811:1991, *International Electrotechnical Vocabulary (IEV) – Chapter 811: Electric traction*

IEC 60287 (all parts), *Electric cables – Calculation of the current rating*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-5-54, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors*

IEC 60364-7-712:2002, *Electrical installations of buildings – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

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

IEC 61643-12, *Low voltage surge protective devices – Part 12: Surge protective devices connected to low voltage power distribution systems – Selection and application principles*

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

IEC 61730 (all parts), *Photovoltaic (PV) module safety qualification*

IEC 62257-1, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 1: General introduction to rural electrification*

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

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

IEC 62257-9-1, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-1: Micropower systems*

IEC 62257-9-2, *Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-2: Microgrids*

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

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

IEC 62305-2, *Protection against lightning – Part 2: Risk management*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*