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TECHNICAL SPECIFICATION

colour inside

Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-2: Integrated systems – Microgrids

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RECOMMENDATIONS FOR RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

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FOREWORD

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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
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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 62257-9-2, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the fist edition issued in 2006. It constitutes a technical revision.

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

- Changing the voltage range covered by the technical specification to a.c. nominal voltage below 1 000 V and d.c. nominal voltage below 1 500 V (introduction).
- Including 240 V 1-Ø/415 V 3-Ø, in the voltage levels (scope).
- Deleted microgrid and micropowerplants from terms and definitions.

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

Enquiry draft	Report on voting
82/1029/DTS	82/1088/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

A list of all parts in the IEC 62257 series, published under the general title *Recommendations for 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 publication will remain unchanged until the stability date indicated on the IEC website 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.

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 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. nominal voltage below 1 000 V and d.c. nominal 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 should 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.

Decentralized Rural Electrification Systems (DRESs) are designed to supply electric power for sites which are not connected to a large interconnected system, or a national grid, in order to meet basic needs.

The majority of these sites are:

- isolated dwellings,
- village houses,
- community services (public lighting, pumping, health centres, places of worship or cultural activities, administrative buildings, etc.),
- economic activities (workshops, microindustry, etc.).

The DRE systems fall into three categories:

- process electrification systems (for example for pumping),
- individual electrification systems (IES) for single users,
- collective electrification systems (CES) for multiple users.

Process or individual electrification systems exclusively consist of two subsystems:

- an electric energy generation subsystem,
- the user's electrical installation.

Collective electrification systems, however, consist of three subsystems:

- an electric energy generation subsystem,
- a distribution subsystem, also called microgrid,
- user’s electrical installations including interface equipment between the installations and the microgrid.

RECOMMENDATIONS FOR RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

Part 9-2: Integrated systems – Microgrids

1 Scope

This part of IEC 62257, which is a technical specification, specifies the general requirements for the design and the implementation of microgrids used in decentralized rural electrification to ensure the safety of persons and property and their satisfactory operation according to the scheduled use.

This part of IEC 62257 applies to microgrids for decentralized rural electrification purposes. The microgrids covered by this part of IEC 62257 are low voltage a.c., three-phase or single-phase, with rated capacity less than or equal to 100 kVA. They are powered by a single micropower plant and do not include voltage transformation. The rated capacity is at the electrical output of the micropower plant, that is, the upstream terminals of the main switch between the micropower plant and the microgrid.

The voltage levels covered under this specification are voltages of the 240 V 1-Ø/415 V 3-Ø, the 230 V 1-Ø/400 V 3-Ø, the 220 V 1-Ø/380 V 3-Ø, and the 120 V 1-Ø/208 V 3-Ø systems at 60 Hz or 50 Hz; or obeyed by local code.

This part of IEC 62257 specifies microgrids made of overhead lines because of technical and economical reasons in the context of decentralized rural electrification. In particular cases, underground cables can be used.

The requirements cover microgrids with radial architecture.

2 Normative reference

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 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

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

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

3 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
carrier
messenger
wire or a rope, the primary function of which is to support the cable in aerial installations, which may be separate from or integral with the cable it supports

3.2
block
part of a line between two consecutive stoppage poles

3.3
earth
conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero

3.4
protective conductor
identification: PE
conductor provided for purposes of safety, for example protection against electric shock

[SOURCE: IEC 60050-195:1998, 195-02-09]

3.5
PEN conductor
conductor combining the functions of both a protective earthing conductor and a neutral conductor

[SOURCE: IEC 60050-195:1998, 195-02-12]

3.6
power line
overhead or underground line installed to convey electrical energy for any purpose other than communication

3.7
section of an overhead line
part of a line between two tension poles

Note 1 to entry: A section generally includes several spans.

3.8
selectivity
protection coordination
ability of a protection to identify the faulty section and/or phase(s) of a power system

[SOURCE: IEC 60050-448:1995, 448-11-06]

3.9
service connection line
conductors between the supplier’s mains and the customer’s installation

Note 1 to entry: In the case of an overhead service connection, this means the conductor between a supply-line pole and the customer's installation.

3.10
span
part of a line between two consecutive poles

3.11
stay
steel wire, rope or rod, working under tension, that connects a point of a support to a separate anchor

4 General

4.1 Limits of a microgrid

The microgrid is defined between the output terminals of the isolating device of the micropower plant and the input terminals of the user's interface as illustrated in Figure 1.

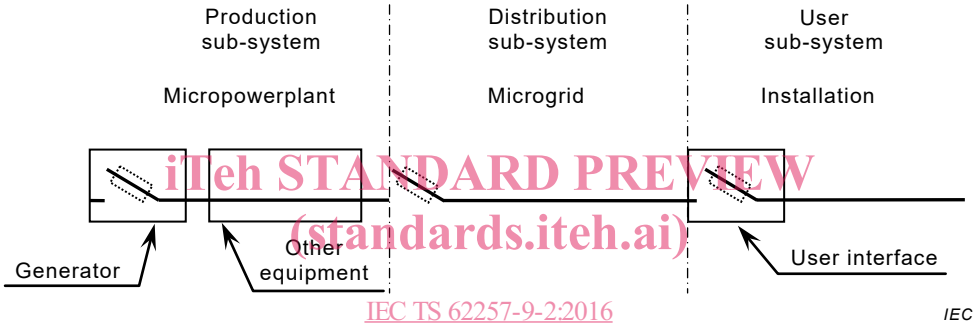

Figure 1 – Microgrid limits

4.2 Voltage drops

The maximum values of the voltage drops in the microgrid shall not exceed the values indicated in Table 1 or the values regulated by local code.

Table 1 – Maximum values of voltage drops

Microgrid	Voltage drop %
Main line	6
Individual service connection line	1

4.3 Composition of a microgrid

Three microgrid schemes are specified in this part of IEC 62257 depending on the maximum active power value required and the topography of the areas to be served.

- Single phase power system output: one single phase feeder with multiple single phase distribution (see Figure 2).

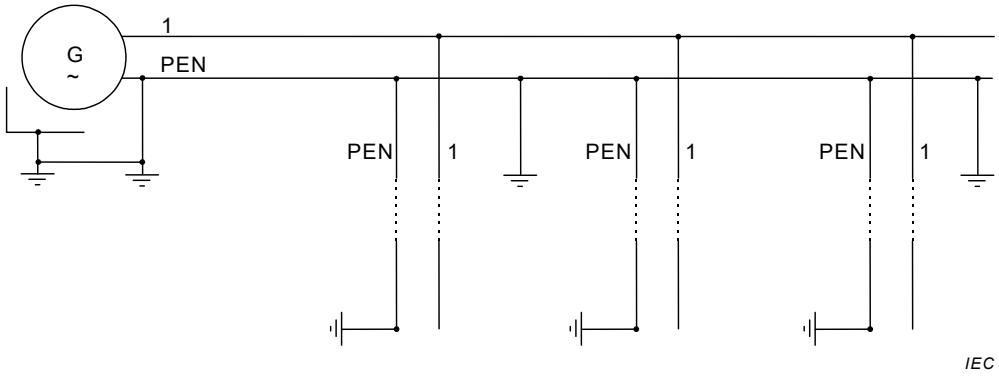

Figure 2 – Microgrid consisting of a single phase feeder

NOTE A community could be served by multiple single phase distribution driven by different single phase generators.

- three phase system output: depending on the power needs of the customers, the layout of the area to be served and the cost, two different distribution architectures can be used, as shown in Figure 3 and Figure 4.

  a) Case 1: Three phase power system output; one three phase feeder with three phase or single phase distribution.

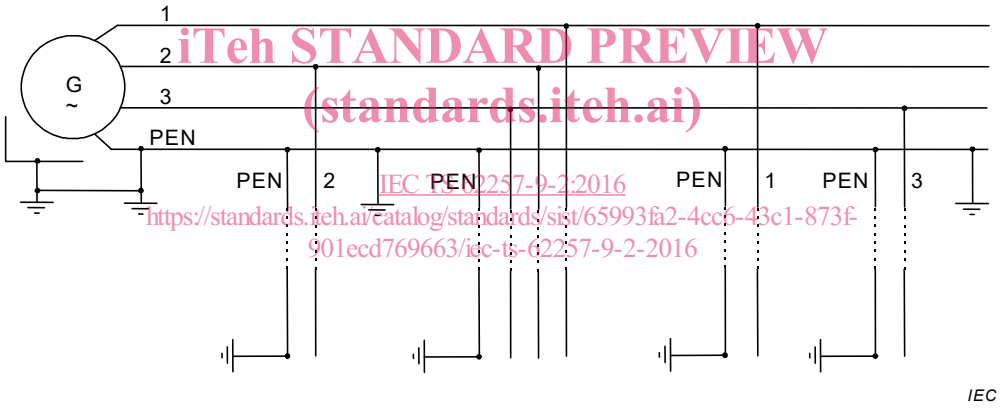

Figure 3 – Three phase system output, single phase distribution or three phase service provided where needed

  b) Case 2: Three phase power system output; single phase distribution is used throughout the community.

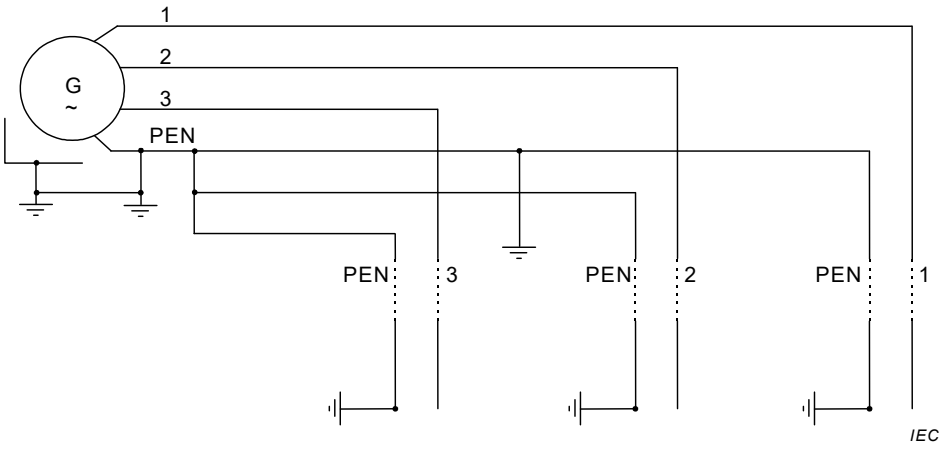

Figure 4 – Three phase system output, single phase distribution