# IEC TS 62257-9-5

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REDLINE VERSION

# TECHNICAL SPECIFICATION

colour inside

## Recommendations for renewable energy and hybrid systems for rural electrification –
## Part 9-5: Integrated systems – ~~Selection of stand alone lighting kits~~ Laboratory evaluation of stand-alone renewable energy products for rural electrification

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

## Part 9-5: Integrated systems – ~~Selection of stand-alone lighting kits~~ Laboratory evaluation of stand-alone renewable energy products for rural electrification

## FOREWORD

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7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
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This fourth edition cancels and replaces the third edition issued in 2016. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

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b) Removed the distinction between Class A, Class B, and Class C procedures.
c) Added an option for the AVM method in which the AVM-VE test can be conducted with a sample size of 6 and the follow-up test can be conducted with a sample size of 2.
d) Provided guidance on how to accept test results from other approved test methods.
e) Added test methods for flooded lead-acid batteries.
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h) Revised the energy service calculations to include the effect of multiple simultaneously connected loads on the port voltage and battery-to-port efficiency and to accommodate products with grid or electromechanical charging.
i) Removed the restriction that all connections shall be "plug-and-play."
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The text of this Technical Specification is based on the following documents:

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**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 publication using a colour printer.**

# INTRODUCTION

IEC 62257 (all parts) provides support and strategies for institutions involved in rural electrification projects. It documents technical approaches for designing, building, testing, and maintaining off-grid renewable energy and hybrid systems with AC nominal voltage below 500 V, DC nominal voltage below 750 V and nominal power below 100 kVA.

These documents are recommendations to support buyers who want to connect with good quality options in the market:

- to choose the right system for the right place,
- to design the system, and
- to operate and maintain the system.

These documents are focused only on technical aspects of rural off-grid electrification concentrating on, but not specific to, developing countries. They are not considered as all inclusive to rural electrification. The documents do not describe a range of factors that can determine project or product success: environmental, social, economic, service capabilities, and others. 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 costs. The main objectives are to support the capabilities of households and communities that use small renewable energy and hybrid off-grid systems and inform organizations and institutions in the off-grid power market.

~~The purpose of this part of IEC 62257 is to specify quality assurance strategies for stand-alone lighting kits, including product specifications, tests, and a standardized specification sheet format. In addition to supporting the selection of products by project developers and implementers, quality assurance can help market support organizations, manufacturers, and governments achieve the goals they have for off-grid lighting projects.~~

The purpose of this document is to specify laboratory test methods for evaluating the quality assurance of stand-alone renewable energy products. This document is specifically related to renewable energy products that are packaged and made available to end-use consumers at the point of purchase as single, stand-alone products that do not require additional system components to function.

The term "stand-alone renewable energy product" is used in this document to describe this class of products. Other equivalent terms, including "off-grid solar" or "rechargeable," are often used by manufacturers, distributors, and other stakeholders to describe these products. Many of these systems meet the definition of type $T_2$I (individual electrification systems with energy storage) in IEC TS 62257-2.

The intended users of this document are: ~~In some clauses and subclauses of this part of IEC 62257, a description of the application of the subclause contents is offered to help provide context for each type of user.~~

- Market support ~~programmes are~~ programmes that support the off-grid lighting market with financing, consumer education, awareness, and other services. ~~Market support programmes often use quality assurance to qualify for access to services such as~~;
  - ~~greenhouse gas reduction certifications or other incentives,~~
  - ~~access to financing (trade or consumer finance),~~
  - ~~use of a buyer seal and certification (government or non-governmental institutional backing, consumer or "business to business" seals),~~
  - ~~participation in a public product information database (e.g. standardized specification sheets),~~

– access to a business network or trade group,

– business support and development services,

– access to market intelligence, and

– participation in consumer awareness campaigns.

- Manufacturers and distributors that need to verify the quality and performance of products from different batches and potential business partners. Manufacturers and distributors often use quality assurance plans or requirements to:;

  – support quality control processes at a manufacturing plant or upon receipt of goods from a contract manufacturer, and

  – choose products to distribute.

- Bulk procurement programmes that facilitate or place large orders for devices from a distributor or manufacturer of products. Bulk procurement programmes may use quality assurance to; and,

  – provide devices to a particular, relatively small group of end users whose needs are understood (e.g., project developers and implementers for an electrification project may include quality assurance requirements in the GS of an electrification project (see IEC TS 62257-3)), and

  – organize a subsidy, buy-down, or giveaway programme that will serve a broad set of users.

- Trade regulators are typically such as government policymakers and officials who craft and implement trade and tax policy. Regulators may use quality assurance requirements to:

  – qualify for exemption from tax or duties, and

  – establish requirements for customs.

This document establishes the framework for creating a product specification, the basis for evaluating quality for a particular context. Product specifications include minimum requirements for quality standards and warranty requirements. Products are compared to specifications based on test results and other information about the product. The product specification framework is flexible and can accommodate the goals of diverse organizations and institutions. There is a range of tests outlined in this part of IEC 62257; some are simple enough to be completed in the field by project developers while others require laboratory equipment. The tests and inspections are designed to be widely applicable across different markets, countries, and regions.

Standardized specification sheets are also defined that can be used to communicate the test results. Combined with a set of product specifications, the information in the standardized specification sheet can inform the use of a quality and/or performance label.

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

## Part 9-5: Integrated systems – ~~Selection of stand-alone lighting kits~~ Laboratory evaluation of stand-alone renewable energy products for rural electrification

## 1 Scope

This part of IEC 62257, which is a Technical Specification, applies to stand-alone ~~rechargeable electric lighting appliances or kits that can be installed by a typical user without employing a technician~~ renewable energy products having the following characteristics:

~~This part of IEC 62257 presents a quality assurance framework that includes product specifications (a framework for interpreting test results), test methods, and standardized specification sheets (templates for communicating test results).~~

- All components required to provide basic energy services are sold/installed as a kit or integrated into a single component, including at a minimum:
  - A battery/batteries or other energy storage device(s)
  - Power generating device, such as a solar panel, capable of charging the battery/batteries or other energy storage device(s)
  - Cables, switches, wiring, connectors and protective devices sufficient to connect the power generating device, power control unit(s) and energy storage device(s)
  - Loads (optional), such as lighting, load adapter cables (e.g., for mobile devices), and appliances (television, radio, fan, etc.).
- The PV module maximum power point voltage and the working voltage of any other components in the kit do not exceed 35 V. Exceptions are made for AC-to-DC converters that meet appropriate safety standards.

NOTE This voltage limit corresponds to the definition of decisive voltage classification A (DVC-A) for wet locations in Table 6 of IEC 62109-1:2010.

- The peak power rating of the PV module or other power generating device is less than or equal to 350 W.
- No design expertise is required to choose appropriate system components.

This document was written primarily for off-grid renewable energy products with batteries and solar modules with DC system voltages not exceeding 35 V and peak power ratings not exceeding 350 W. The tests contained herein are capable in many cases of adequately assessing systems at higher voltages and/or power ratings. In situations where the specifying organization agrees to apply these tests to products with higher voltages and power ratings, the test laboratory is responsible for ensuring that adequate safety measures are employed to protect technicians and test equipment. The specifying organization is also responsible for defining the consumer safety requirements of these products.

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

IEC 60891:2009, *Photovoltaic devices – Procedures for temperature and irradiance corrections to measured I-V characteristics*

IEC 60904-1:2006, *Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics*

IEC 61056-1:2012, *General purpose lead-acid batteries (valve-regulated types) – Part 1: General requirements, functional characteristics – Methods of test*

IEC 61215 (all parts), *Terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61215-2, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2: Test procedures*

IEC 61427-1:2013, *Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid application*

~~IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*~~

IEC 61951-2:~~2011~~ 2017, *Secondary cells and batteries containing alkaline or other non acid electrolytes –~~ Portable~~ Secondary sealed~~ rechargeable single~~ cells and batteries for portable applications – Part 2: Nickel-metal hydride*

~~IEC 61960:2011, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications*~~

IEC 61960-3:2017, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications – Part 3: Prismatic and cylindrical lithium secondary cells and batteries made from them*

~~IEC 62087-1:2015, *Audio, video, and related equipment – Determination of power consumption – Part 1: General*~~

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IEC 62087-3:2015, *Audio, video, and related equipment – Determination of power consumption – Part 3: Television sets*

IEC 62087-6:2015, *Audio, video, and related equipment – Determination of power consumption – Part 6: Audio equipment*

IEC TS 62257-12-1:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 12-1: Selection of lamps and lighting appliances for off-grid electricity systems*

IEC 62509:2010, *Battery charge controllers for photovoltaic systems – Performance and functioning*

CIE 15:2004, *Colorimetry*

CIE 084, *The measurement of luminous flux*

CIE 13.3, *Method of measuring and specifying colour rendering properties of light sources*

CIE 127, *Measurement of LEDs*

CIE 177, *Colour rendering of white LED light sources*

IESNA LM-78-07, *IESNA approved method for total luminous flux measurement of lamps using an integrating sphere photometer*

IESNA LM-79-08, *IES approval method for electrical and photometric measurements of solid state lighting products*

IESNA LM-80-08, *Approved method: measuring lumen maintenance of LED light sources*

# IEC TS 62257-9-5

Edition 4.0 2018-06

# TECHNICAL SPECIFICATION

**Recommendations for renewable energy and hybrid systems for rural electrification –**
**Part 9-5: Integrated systems – Laboratory evaluation of stand-alone renewable energy products for rural electrification**

IEC TS 62257-9-5:2018-06(en)

# CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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  - Power generating device, such as a solar panel, capable of charging the battery/batteries or other energy storage device(s)
  - Cables, switches, wiring, connectors and protective devices sufficient to connect the power generating device, power control unit(s) and energy storage device(s)
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