



BSI Standards Publication

Renewable energy off-grid systems

Part 9-8: Integrated systems — Requirements for stand-alone renewable energy products with power ratings less than or equal to 350 W

National foreword

This Published Document is the UK implementation of IEC TS 62257-9-8:2025. It supersedes PD IEC TS 62257-9-8:2020, which is withdrawn.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 committee manager.

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TECHNICAL SPECIFICATION



**Renewable energy off-grid systems –
Part 9-8: Integrated systems – Requirements for stand-alone renewable energy
products with power ratings less than or equal to 350 W**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RENEWABLE ENERGY OFF-GRID SYSTEMS –

Part 9-8: Integrated systems – Requirements for stand-alone renewable energy products with power ratings less than or equal to 350 W

FOREWORD

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IEC TS 62257-9-8 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is a Technical Specification.

This second edition cancels and replaces the first edition issued in 2020. It constitutes a technical revision.

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

- a) Removed the PV module wiring inspection, partial shading test, and visual screening and durability tests for photovoltaic modules. Applicable tests are now referenced from IEC TS 62257-9-5.
- b) Increased the interval for recurring testing from two years to three years.

- c) Tightened the truth-in-advertising tolerance for numerical aspects other than luminous flux from 15 % to 10 %.
- d) Revised consumer information requirements to allow more flexibility and remove requirements for information that is not known to be valuable to consumers.
- e) Simplified and reorganized the requirements for 12 V and 5 V ports, and allow non-standard output voltages if clearly marked.
- f) Added requirements for ports with USB fast charging support.
- g) Revised the requirements for non-plug-and-play products to allow connectors that require special tools or training in products installed by trained technicians.
- h) Clarified cell- and pack-level safety requirements for single-cell lithium batteries.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
82/2292/DTS	82/2321/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62257 series, published under the general title *Renewable energy off-grid systems*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The IEC 62257 series 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.

This series provides 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.

This series is 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 series 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 document is to provide baseline standards for quality, durability and truth-in-advertising to protect consumers 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. This document applies to products with peak power ratings of 350 W or less. While most provisions apply to all products in this range, a few are applicable only to products with peak power ratings greater than 10,5 W and less than or equal to 350 W.

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 companies, distributors, and other stakeholders to describe these products. Many of these systems meet the definition of type T₂I (individual electrification systems with energy storage) in IEC TS 62257-2.

The intended users of this document are:

- Market support programmes that support the off-grid lighting market with financing, consumer education, awareness, and other services;
- Companies and distributors that need to verify the quality and performance of products;
- Bulk procurement programmes that facilitate or place large orders of products; and,
- trade regulators such as government policymakers and officials who craft and implement trade and tax policy.

This document establishes minimum requirements for quality standards and warranty requirements. Products are compared to specifications based on test results from IEC TS 62257-9-5 and other information about the product. The requirements are designed to be widely applicable across different markets, countries, and regions.

RENEWABLE ENERGY OFF-GRID SYSTEMS –

Part 9-8: Integrated systems – Requirements for stand-alone renewable energy products with power ratings less than or equal to 350 W

1 Scope

This part of the IEC 62257 series provides baseline requirements for quality, durability and truth in advertising to protect consumers of off-grid renewable energy products. Evaluation of these requirements is based on tests described in IEC TS 62257-9-5. This document can be used alone or in conjunction with other international standards that address the safety and durability of components of off-grid renewable energy products.

This document applies to stand-alone renewable energy products having the following characteristics:

- The products are powered by photovoltaic (PV) modules or electromechanical power generating devices (such as dynamos), or are designed to use grid electricity to charge a battery or other energy-storage device for off-grid use. The requirements may also be appropriate as guidance for evaluating the quality of products with other power sources, such as thermoelectric generators.
- The peak power rating of the PV module or other power generating device is less than or equal to 350 W.
- All components required to provide basic energy services are sold and installed as a kit, included as a part of a family of products as defined in 4.2.5, 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).
- The system evaluated includes all the loads (lighting, television, radio, fan, etc.) and load adapter cables that are sold or included as part of the kit or integrated into kit components.
- 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, and systems that include PV modules (or combinations of PV modules) with open-circuit voltage greater than 35 V that meet additional safety requirements beyond those assessed in IEC TS 62257-9-5.

NOTE This voltage limit corresponds to the definition of decisive voltage classification A (DVC-A) for wet locations in IEC 62109-1. The limits of 240 W, 35 V and 8 A are consistent with the definition of Class III in IEC 61730-1.

- These requirements cover only DC outputs and loads. Products that include inverters, AC outputs or outlets, or AC appliances are not within the scope of this document. Products can have AC inputs.
- No design expertise is required to choose appropriate system components.
- All electrical connections, except for permanent connections made at the time of installation, can be made using plug-and-socket connectors without the use of any tools.

This document includes provisions related to safety; however, it is not intended to be a comprehensive safety standard. In particular, this document is not intended to be used as an alternative to safety standards such as IEC 62368-1 or the IEC 60335 series for appliances such as radios and televisions that are included with stand-alone renewable energy products. Nor is it intended to replace the safety requirements of IEC 62281 or UN 38.3 for battery safety during transport, or safety requirements of IEC 61730-1 and IEC 61730-2 for PV modules intended for use outside the context of stand-alone renewable energy products.

This document does not address electromagnetic compatibility (EMC). Field experience has not shown EMC to be a major concern in typical applications of stand-alone renewable energy products within the scope of this document. In applications where EMC is a concern (e.g. systems that include medical devices), the standards relevant to the specific application should be referenced.

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 60335-1, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-2-29, *Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers*

IEC 60364-7-712:2017, *Low voltage electrical installations – 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 60598-1, *Luminaires – Part 1: General requirements and tests*

IEC 61215-1, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements*

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

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 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 62109-1, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*

IEC 62133-2, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems*

IEC TS 62257-9-5:2024, *Recommendations for renewable energy and hybrid systems for rural electrification: Integrated systems – Laboratory evaluation of stand-alone renewable energy products for rural electrification*

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

IEC 62281, *Safety of primary and secondary lithium cells and batteries during transport*

IEC 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62619, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

IEC 62790, *Junction boxes for photovoltaic modules – Safety requirements and tests*

IEC TS 63163, *Terrestrial photovoltaic (PV) modules for consumer products – Design qualification and type approval*

ISO 4892 (all parts), *Plastics – Methods of exposure to laboratory light sources*

ANSI/CAN/UL 9540, *Energy Storage Systems and Equipment*

UL 1741, *Standard for inverters, converters, controllers and interconnection system equipment for use with distributed energy resources*

UL 1973, *Standard for batteries for use in stationary, vehicle auxiliary power and light electric rail (LER) applications*

UL 2054, *Standard for Household and Commercial Batteries*

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

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

UL 62133-2, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

United Nations. *Recommendations on the transport of dangerous goods: manual of tests and criteria, Section 38.3: Lithium batteries (UN 38.3)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61836 and the following 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 Terms related to photometric tests

3.1.1

illuminance

E_v

density of incident luminous flux with respect to area at a point on a real or imaginary surface

$$E_v = \frac{d\Phi_v}{dA}$$

where Φ_v is luminous flux and A is the area on which the luminous flux is incident

Note 1 to entry: The illuminance is expressed in lux ($\text{lx} = \text{lm} \cdot \text{m}^{-2}$).

[SOURCE: IEC 60050-845:2020, 845-21-060, modified – Notes 1, 2, and 4 have been omitted.]

3.1.2

full width half maximum

FWHM

range of a variable over which a given characteristic is greater than 50 % of its maximum value

Note 1 to entry: FWHM can be applied to characteristics such as radiation patterns, spectral linewidths, etc., and the variable can be wavelength, spatial or angular properties, etc., as appropriate.

[SOURCE: IEC 60050-731:1991, 731-01-57, modified – in note 1, "may" has been replaced with "can".]

3.2

LED

light emitting diode

solid state device embodying a p-n junction, emitting incoherent optical radiation when excited by an electric current

[SOURCE: IEC 60050-845:2020, 845-27-050, modified – The notes have been omitted.]

3.3

power supply

electric energy converter which draws electric energy from a source and supplies it in a specified form to a load

[SOURCE: IEC 60050-151:2001, 151-13-76]

3.4

overvoltage protection

protection intended to operate when the power system voltage is in excess of a predetermined value

[SOURCE: IEC 60050-448:1995, 448-14-32]

3.5

cell block

group of cells in a battery connected together in parallel configuration with or without protective devices (e.g. fuse or positive temperature coefficient device (PTC)) and monitoring circuitry

Note 1 to entry: The cell block is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

[SOURCE: IEC 62619:2022, 3.8]

3.6

IP Code

coding system to indicate the degrees of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water and to give additional information in connection with such protection

Note 1 to entry: In this document, certain IP Codes can be estimated using procedures in IEC TS 62257-9-5, which provides a simplified and lower-cost alternative to IEC 60529. The procedure in IEC TS 62257-9-5 evaluates protection against ingress of solid foreign objects and water, but not protection against access to hazardous parts.

[SOURCE: IEC 60529:1989, 3.4, modified – note 1 has been added.]

3.7 Component categories

3.7.1

portable

connected in a way that makes a product or subsystem easy for an individual to carry

Note 1 to entry: Products or subsystems are portable when two or more of the main components (energy source, energy storage, and light source) are connected in this way.

[SOURCE: IEC TS 62257-9-5:2024, 3.18]

3.7.2

fixed

designed for permanent or semi-permanent mounting and use in place

Note 1 to entry: Products or subsystems are fixed when the main components (energy source, energy storage, and light source) are designed in this way.

[SOURCE: IEC TS 62257-9-5:2024, 3.19]

3.7.3

separate

without PV module or with a PV module connected to other components via a cable with a length of at least 3 m

Note 1 to entry: The length criterion allows the PV module to collect energy outdoors while the other product components remain indoors.

[SOURCE: IEC TS 62257-9-5:2024, 3.20, modified – the 3 m length specification has been incorporated into the definition.]

3.7.4

integrated

with a PV module incorporated into another component or connected to another component (other than a fixed outdoor component) via a cable with a length less than 3 m

Note 1 to entry: The length of the cable is insufficient for the PV module to collect energy outdoors while the other product components remain indoors.

[SOURCE: IEC TS 62257-9-5:2024, 3.21, modified – the 3 m length specification has been incorporated into the definition.]

3.7.5 component

<of a product> constituent part of a product which cannot be physically divided into smaller parts as part of normal installation and use

Note 1 to entry: Examples of components include main units, power control units, appliances, PV modules, external batteries, and cables.

[SOURCE: IEC 60050-151:2001, 151-11-21, modified – "device" has been replaced with "product" and "without losing its particular function" with "as part of normal installation and use," and the note has been added.]

3.8 Electrical quantities

3.8.1 capacity

<for batteries or battery cells> electric charge which a battery or battery cell can deliver under specified discharge conditions

Note 1 to entry: The SI unit for electric charge, or quantity of electricity, is the coulomb ($1\text{ C} = 1\text{ A}\cdot\text{s}$) but in practice, capacity is usually expressed in ampere hours (Ah).

[SOURCE: IEC 60050-482:2020, 482-03-14]

3.8.2 standby loss

current drawn from a product's battery with the product switched off

[SOURCE: IEC TS 62257-9-5:2024, 3.25]

3.8.3 standard operating voltage

standardized voltage corresponding to a typical battery operating point during discharge

[SOURCE: IEC TS 62257-9-5:2024, 3.31]

3.8.4 typical battery discharge voltage

battery voltage corresponding to the "typical operating point" (e.g. the operating point resulting in the average value of power) during discharge

Note 1 to entry: The typical battery discharge voltage is an outcome of the full-battery run time test, while the standard operating voltage depends only on the battery chemistry and number of cells.

[SOURCE: IEC TS 62257-9-5:2024, 3.32]

3.8.5 appliance operating voltage

voltage supplied to an appliance by a port when the appliance is operating at a particular setting and the power control unit battery is at the typical battery discharge voltage

[SOURCE: IEC TS 62257-9-5:2024, 3.33]

3.9 Component categories and types, and related terms

3.9.1

product

complete stand-alone renewable energy product or kit, typically including an energy source, power control unit(s), one or more lights or other appliances, wiring, and other accessories, and sold or distributed as a kit

Note 1 to entry: The product is the unit to which the IEC TS 62257-9-5 test report applies.

Note 2 to entry: The complete definition of a stand-alone renewable energy product is given in IEC TS 62257-9-5:2024, 4.1.1.

3.9.2

appliance

device that performs a specific function providing service to an end user, such as a light, radio, mobile device, or television set

[SOURCE: IEC TS 62257-9-5:2024, 3.26]

3.9.3

mobile device

basic mobile phone, feature phone, smartphone, tablet computer, or similar portable communication and/or computing device having an internal rechargeable battery

Note 1 to entry: Larger portable devices, such as laptop computers, can also be considered mobile devices, but some provisions (e.g. related to charging current and ports) may not be applicable.

Note 2 to entry: A mobile device is an appliance.

[SOURCE: IEC TS 62257-9-5:2024, 3.27]

3.9.4

power control unit

component of a stand-alone renewable energy product that includes a battery and one or more ports plus, typically, the associated battery management, voltage regulation and overload protection components

Note 1 to entry: In the case of a product with a single power control unit, the power control unit is often referred to as the "main unit" or "control box." A power control unit can include appliance functionality such as a light or built-in radio. A portable appliance (such as a light) with internal battery is a power control unit if it includes a port.

[SOURCE: IEC TS 62257-9-5:2024, 3.29]

3.9.5

main unit

component or assembly including an input for connecting the primary energy source (e.g. solar, grid or mechanical charger), a battery, and one or more built-in appliance(s) or port(s)

Note 1 to entry: A power control unit can be a main unit, though a main unit does not necessarily have a port.

Note 2 to entry: A product can contain more than one main unit.

[SOURCE: IEC TS 62257-9-5:2024, 3.30]

3.9.6**port**

connector (typically a socket) on a component that can supply power to an appliance

Note 1 to entry: This definition applies when the word "port" is used without qualification in this document. The word "port" can also be used more generally to refer to any socket (receptacle).

[SOURCE: IEC TS 62257-9-5:2024, 3.28]

3.9.7**barrel jack**

low-voltage DC power socket with a central pin, accepting a cylindrical plug

Note 1 to entry: Some examples of such connectors are described in IEC 60130-10, but many other sizes exist. Barrel jacks are typically described by the length, inner diameter, and outer diameter of the matching plug.

3.9.8**cigarette lighter receptacle**

cigar lighter receptacle

low-voltage DC power socket of the kind used for vehicle cigarette/cigar lighters and power outlets

Note 1 to entry: This term encompasses socket types defined by SAE J563 and ISO 4165, and other similar connectors, whether or not they are intended for use with cigarette lighters. Both the lighter receptacle and the power outlet receptacle of SAE J563 are considered cigarette lighter receptacles.

3.9.9**foldable module**

PV module that is separated into distinct PV sections nominally of the same size and connected by a section that can be folded and does not contain cells, but has the interconnecting busbars

[SOURCE: IEC TS 63163:2021, 3.2, modified – the phrase “that can be folded” has been added.]

3.10 Types of connections and connecting devices

The terms listed in 3.10 are mainly applicable to non-plug-and-play products.

3.10.1**flat quick-connect termination**

electrical connection consisting of a male tab and a female connector which can be inserted and withdrawn with or without the use of a tool

Note 1 to entry: Flat quick-connect terminations are sometimes called “blade terminals”

[SOURCE: IEC 60050-442:1998, 442-06-07, modified – the note has been added.]

3.10.2**clamping unit**

part(s) of the terminal necessary for the mechanical clamping and the electrical connection of the conductor(s), including the parts which are necessary to ensure the correct contact pressure

[SOURCE: IEC 60050-442:1998, 442-06-12]

3.10.3**screwless-type terminal**

terminal for the connection and subsequent disconnection of two or more conductors, the connection being made directly or indirectly by means of springs, wedges, or the like

[SOURCE: IEC 60050-442:1998, 442-06-11]

3.10.4

screw-type terminal

a terminal for the connection of two or more conductors in which the connection is made, directly or indirectly, by means of screws or nuts of any kind

[SOURCE: IEC 60050-442:1998, 442-06-19, modified – the definitions of “screw-type clamping unit” (442-06-19) and “screw-type terminal” (442-06-18) have been combined, as the distinction is not required in this document.]

3.10.5

insulation piercing connecting device

IPCD

connecting device for the connection and disconnection of a conductor or the interconnection of two or more conductors, the connection being made by piercing, boring through, cutting through, removing or making ineffective in some other manner the insulation of the conductors without previous stripping

[SOURCE: IEC 60050-442:1998, 442-06-33]

3.10.6

twist-on connecting device

TOCD

connecting device which is twisted on the ends of two or more conductors

[SOURCE: IEC 60050-442:1998, 442-06-36]

3.11

quality test method

QTM

rigorous set of tests defined in IEC TS 62257-9-5 for off-grid renewable energy products using randomly procured samples

Note 1 to entry: QTM testing is considered appropriate for qualification for market support programmes, and generating information for third-party-verified specification sheets.

3.12

accelerated verification method

AVM

optional verification pathway defined in IEC TS 62257-9-5 for off-grid renewable energy products to enable expedited entry to markets or market support programmes, including a 2-step process of a verification entry (AVM-VE) test and follow-up test

3.13

plug-and-play product

off-grid renewable energy product in which all electrical connections are made with plug-and-socket connectors and can be made without the use of tools, and no technicians or electricians are necessary to install and operate the system safely and successfully

Note 1 to entry: The adjective “plug-and-play” can also describe connections of this type.

3.14

company

entity who provides the product for testing (who can be the maker of the product or a supplier, importer, distributor, reseller, etc.)

3.15**advertised value**

value stated by the company in any consumer-facing location, including but not limited to product packaging, a user manual or other documentation included in the packaging, or a website

Note 1 to entry: Phrases such as "advertised current" or "advertised run time" refer to the advertised value of the quantity indicated.

[SOURCE: IEC TS 62257-9-5: —,3.37]

3.16**measured value**

value determined as a result of testing, whether by direct measurement or calculation

Note 1 to entry: Phrases such as "measured power" or "measured run time" refer to the measured value of the quantity indicated.

Note 2 to entry: The measured value is compared to the advertised value to determine truth in advertising.

3.17**advertised appliance**

appliance not included as part of the product but mentioned in the accompanying advertising material, such as the product packaging or the company's website

Note 1 to entry: This advertising can be a simple statement that the appliance can be used with the product or an estimate of the run time or service provided by the appliance with a full battery or after a day of solar charging. Methods are provided in IEC TS 62257-9-5 for evaluating these claims even though the appliances are not provided to the test laboratory.

[SOURCE: IEC TS 62257-9-5:2024, 4.1.4, modified – the text has been reformulated as a terminological entry and the reference to IEC TS 62257-9-5 has been added.]

4 Test requirements**4.1 General****4.1.1 Overview**

All testing specified in this document shall be conducted using the test methods provided in the most recent version of IEC TS 62257-9-5. The test laboratory should be qualified to undertake the test methods used. Testing options are described in brief in Table 1 and Table 2. All requirements are described in more detail in 4.2, 4.3, and 4.5.

Annex B contains a list of information and documentation that should be requested from the company to facilitate successful application of the provisions of this document.

**Table 1 – Summary of test requirements and alternatives –
Initial testing requirements to determine compliance with Clause 5**

Test method	Relevance	Sample size for most tests	Random sampling required?
Quality test method (QTM)	Applicable for any product, especially new products in which all aspects have never been previously tested.	2	Required: sampling from warehouse or retail
Accelerated verification method (AVM)	Alternate to QTM which enables products to achieve initial qualification more quickly. The company shall meet certain eligibility criteria to use this option.	Initial test: 2	Not required initially: companies can send units directly to lab
		Follow-up test: 2	Required for follow-up testing: sampling from warehouse or retail
Pay-as-you-go (PAYG)	Applicable to fee-for-service or pay-as-you-go (PAYG) enabled versions of products that were previously qualified according the QTM or AVM.	2	Not required
Product families	Used to minimize the testing required for kits configured from sets of interchangeable components sold on a component-level basis or as mix-and-match kits. At least one kit in the family and 50 % of all components shall have been tested in accordance with the QTM or AVM.	2	Required: sampling from warehouse or retail
Similar products	Used to minimize the testing required for products with similar aspects to ones that have already been tested in accordance with the QTM or AVM.	2	Required: sampling from warehouse or retail
Verification of product identity (VPI)	Used to minimize testing required for products which are purportedly identical to a product that has already been tested in accordance with the QTM or AVM but will be sold under different model numbers or brands.	2	Required: sampling from warehouse or retail
Reference of other standards	Products that have already been tested and found to meet certain outside standards may be exempted from testing certain aspects.	Sampling requirements of the referenced standard apply.	
NOTE 1 Sample sizes for each test are presented in IEC TS 62257-9-5.			
NOTE 2 Size A and size B are defined in 4.1.2.			

Table 2 – Summary of test requirements – recurring testing requirements to ensure continued compliance with Clause 5

Test method	Relevance	Sample size for most tests	Random sampling required?
Renewal testing	Required for all products within three years after initial qualification to verify continued compliance with Clause 5.	2 (if aspects have changed or product fails initial testing, additional testing can be required)	Required: sampling from warehouse or retail
Market check method (MCM)	Optional test used to verify continued compliance with Clause 5. May be conducted at any time.	2 (if aspects have changed or product fails initial testing, additional testing can be required)	Required: sampling from retail preferred, though warehouse sampling may be used
NOTE Sample sizes for each test are presented in IEC TS 62257-9-5.			

4.1.2 Product sizes

In this document, products with rated maximum PV power at STC less than 10,5 W are referred to as “size A,” while products with rated maximum PV power at STC greater than or equal to 10,5 W are referred to as “size B.”

If a product has multiple PV modules that can be connected electrically, then the product size is determined by the maximum rated power of the array formed by the connected modules. If a product has multiple PV modules, but they cannot be connected electrically, then the product size is determined by the PV module with the greatest maximum power at STC.

The size classification is determined by the rated performance of the PV module, not the actual performance. However, if the measured power of the PV module at STC when measured at the PV junction box differs from the 10,5 W threshold by more than the truth-in-advertising tolerance, the module may be required to be reclassified and required to meet the requirements of the other category. If the measured power of the PV module submitted as size B is less than 9,45 W, the module will be reclassified as size A and obligated to meet the requirements of size A products. If the measured power of the PV module submitted as a size A module exceeds the 10,5 W threshold, but the company chooses to maintain the size A rated value as the advertised value, the product will not be reclassified unless the rating appears to be intentionally misleading to influence the size classification.

EXAMPLE 1 A product includes a PV module rated 10 W, so is submitted as a size A product. However, upon testing, the PV module maximum power at STC is determined to be 12 W. This product may still be considered size A if the company does not increase the rated power of the PV module. If the company instead chooses to increase the rated power to more than 10,5 W, this product would be reclassified as a size B product and would need to meet the requirements for size B products. If the measured power of the module had been substantially higher than 10,5 W, the market development programme, government, or other organization using this document can choose to require the product to be reclassified.

EXAMPLE 2 A product is rated 11 W so is submitted for evaluation as a size B product. However, the maximum power at STC is 9,4 W. This product would need to change its advertised rating to be less than 10,5 W and would be reclassified as a size A product because its measured power is less than 9,45 W. The product would need to provide the performance reporting requirements for size A products and would no longer need to meet the requirements of size B products.

If a product does not have a PV module, its size is determined by the maximum power output of the power source (e.g. AC/DC power supply or electromechanical generator). If the product does not include a power source (e.g. it is powered directly from the utility grid or from an external DC power supply that is not included), the size is determined by the maximum power consumption of the product from the energy source.

EXAMPLE 3 A product contains two 10 W PV modules that are connected in parallel by plugging into them a combiner cable, which is then plugged into a socket on the main unit. This is a size B product because the total array power is 20 W.

EXAMPLE 4 A product contains two 10 W PV modules that are both plugged into separate sockets on a main unit to simultaneously provide power to a battery. Inside the main unit, the two connectors are connected in series or parallel. This is also a size B product; the two modules are electrically connected even though the connection is made inside the main unit.

EXAMPLE 5 A product contains two 10 W PV modules that are plugged into separate sockets on a main unit as in Example 2. However, the input from each PV module is internally connected to a separate maximum power point tracking circuit. This is still considered a size B product; the two modules function together as an array to charge a single battery even though they are not directly connected in series or parallel.

EXAMPLE 6 A product includes two lamps with batteries, each of which can be separately charged by a 6 W PV module. The PV modules cannot be connected together. This is a size A product because the maximum power of the largest module is 6 W.

EXAMPLE 7 The product described in Example 4 includes a combiner cable so that both PV modules can be used to charge a single lamp at a higher rate. This is now a size B product because the PV modules can now be connected, even if the user retains the option to use them separately.

EXAMPLE 8 A product includes a 10 W PV module that connects to a main unit. In addition, the product includes a battery-powered LED lamp with an integrated PV module of 1 W. This product is size A because the PV modules cannot be connected electrically.

EXAMPLE 9 The battery-powered lamp of Example 6 is now equipped with a micro-USB power input that allows it to be charged either from a USB port on the main unit or from its integrated PV module. This is still a size A product because the two PV modules are not intended to be used simultaneously as a single PV array.

EXAMPLE 10 A product includes an 8 W PV module that charges a main unit. In addition, the main unit has a second PV input socket. The user can separately purchase a second 8 W module to supply more energy to the system. This is a size A product because the second PV module is not included with the product.

4.2 Initial testing requirements

4.2.1 General

Initial qualification under the quality, warranty, and performance reporting requirements outlined in Clause 5 requires evaluation in accordance with one or more of the following pathways. Test laboratories conducting initial testing in accordance with IEC TS 62257-9-5 should have demonstrated competence, metrological traceability, and impartiality, for example by accreditation to ISO/IEC 17025 by an ILAC MRA signatory.

4.2.2 Quality test method

One pathway is to use quality test method (QTM) results in accordance with IEC TS 62257-9-5. Sampling procedures in IEC TS 62257-9-5 shall be followed.

NOTE In IEC TS 62257-9-5:2024, the QTM is defined in Clause 6. The sampling procedures are specified in IEC TS 62257-9-5:2024, Annex E.

4.2.3 Accelerated verification method

4.2.3.1 Testing procedure

A second pathway is to use accelerated verification method (AVM) results that are drawn from two rounds of testing as described in IEC TS 62257-9-5 and summarized as follows:

NOTE 1 The AVM is also described in IEC TS 62257-9-5:2024, Clause 10.

- a) An AVM-verification entry (AVM-VE) test equivalent to a QTM test with the random sampling requirement of QTM testing waived.
- b) Follow-up testing conducted shortly after AVM-VE testing is finished and the product is commercially available in markets. The AVM follow-up test is equivalent to a typical market check method (MCM) primary check test (PCT) as described in IEC TS 62257-9-5. Follow-up MCM testing shall be conducted on commercially available products within six months of the preceding QTM testing. Sampling procedures in IEC TS 62257-9-5 shall be followed.

NOTE 2 In IEC TS 62257-9-5:2024, the MCM is defined in Clause 8. The aspects to be tested and samples sizes are presented in the PCT column of IEC TS 62257-9-5:2024, Table 3.

4.2.3.2 Eligibility requirements and qualification criteria

Only products from companies that meet both of the following eligibility requirements are permitted to receive initial qualification via AVM testing:

- a) At least three of the company's products have met the requirements of this document via QTM testing in accordance with IEC TS 62257-9-5, or have met other quality standards that require testing to IEC TS 62257-9-5, such as the Lighting Global Quality Standards. At least one of the products which previously met the requirements is of the same size class (size A or size B as defined in 4.1.2) as the product to be tested, and at least one of these products currently meets the requirements of this document (i.e. the validity period specified in 4.3 has not expired).
- b) None of the company's products have failed market check testing or renewal testing carried out in accordance with IEC TS 62257-9-5 (as described in 4.3) in the past three years, with the following two exceptions:
 - 1) failures to meet requirements that have changed since the last time the product was tested (for instance, if it is the first time a product is undergoing the assessment of DC ports, it could fail for this aspect, but still maintain eligibility for the AVM);
 - 2) failures for aspects that can be corrected by changing the packaging or advertising (i.e. the correction does not require re-testing to confirm the change), if the failure has been fully corrected and documented with photographs of the printed, corrected consumer-facing materials.

Market entry or programme qualification is typically offered after successful completion of the first round of AVM-VE testing, with the guarantee that the second round of follow-up testing will occur within six months. The AVM option is best managed by a market development programme that can oversee the follow-up testing process and has access to data regarding product failures to assess the eligibility criteria. Such a programme can also use financial measures to ensure the follow-up testing will occur, to confirm changes to printed consumer-facing materials when determining eligibility, and to impose applicable penalties for non-compliance. Governments are encouraged to coordinate with market development programmes to ensure that eligible products, and only eligible products, are offered market entry following the AVM-VE test.

4.2.4 Pay-as-you-go targeted testing

A third pathway is specific to fee-for-service or pay-as-you-go (PAYG) enabled versions of products that were previously qualified in accordance with this document using one of the processes described in 4.2.2 and 4.2.3. These products may qualify using targeted testing, which comprises:

- a) visual inspection, including internal assessment;
- b) durability testing on any aspects that could have been impacted by the addition of the PAYG option (e.g. new ports or changes to the existing casing);
- c) an estimate of the parasitic consumption or additional standby loss due to the addition of the PAYG option;
- d) submission of company declaration indicating:
 - 1) that the performance of the PAYG-enabled version is equivalent to that of the previously tested non-PAYG product, or specifying how the performance of the PAYG-enabled version differs from the non-PAYG version. In cases where PAYG-enabled versions of products are similar, but not identical to the previously tested non-PAYG version, those aspects which differ shall be tested.
 - 2) an estimate of the accuracy, precision and drift of the metering;
 - 3) that the appropriate battery protection remains active and the solar module can charge the battery regardless of whether the system is in an enabled or disabled state. This requirement may be waived if the conditions described in 5.6.2 are met.

After testing, if the new standby loss measurement is greater than the old standby loss measurement, the energy service calculations of IEC TS 62257-9-5 shall be performed using the new standby loss measurement. All other inputs to the calculations shall be taken from the previously qualified product. This calculation may be performed either by the test laboratory or by the market development programme, government, or other entity using this document. All advertised run time and energy service parameters for the product under test shall meet the truth-in-advertising requirements of 5.2.1 based on the updated energy service calculations.

The targeted PAYG testing shall be conducted with two samples in accordance with IEC TS 62257-9-5. Samples for targeted PAYG testing may be submitted directly by a company (or their proxy). If PAYG-enabled versions of products are similar, but not identical to the previously-tested non-PAYG version, those aspects which differ will require testing in accordance with the QTM or AVM and qualify in accordance with this document using one of the processes described in 4.2.2 and 4.2.3.

NOTE In IEC TS 62257-9-5:2024, the PAYG testing method is defined in Clause 11. The aspects to be tested and samples sizes are presented in the IEC TS 62257-9-5:2024, Table 8.

4.2.5 Product families

A product family (set of interchangeable components sold on a component-level basis or as a mix-and-match kit) may receive initial qualification as follows:

- a) At least one fully configured system ("kit") shall be tested in accordance with the QTM or AVM and qualify in accordance with this document using one of the processes described in 4.2.2 and 4.2.3. Individual programmes or countries may require additional fully configured systems to be tested.
- b) At least half of the models of each product component (PV module, battery or control unit, lighting appliance, etc.) shall be tested. For example, if 5 PV module models are included in a family, at least 3 of those module models shall be tested. The smallest or dimmest and largest or brightest models of each component shall be tested, at a minimum. These components shall be tested for all relevant component-level aspects in accordance with the QTM or AVM and qualify in accordance with this document using one of the processes described in 4.2.2 and 4.2.3. If significant differences (other than size) exist between components in a given category (for example, batteries with different chemistries, PV modules of different types, or components from different companies), these shall be treated as a different component type when calculating the number required to be tested.

When reviewing whether the family meets the requirements of Clause 5, test results for any full kits tested, along with reports for all tested components, should be examined. The test results can be provided in a single test report or in several separate reports.

All products which qualify using this method, regardless of whether the particular kit or configuration was directly tested for initial qualification, shall meet all of the requirements of Clause 5. Compliance with requirements that are not assessed during initial qualification may be assessed through market check testing as described in 4.3.

EXAMPLE A family comprises 5 different PV module models, 3 different power control units, 10 different types of lighting appliances and 2 radio models. The company configures these components to make 7 different kits (PV – battery combinations), with a large variety of options for the number of light points included. The radios can be included or excluded from any kit.

In this case, at least one full kit would need to be tested in accordance with the QTM or AVM. Additionally, at least the following components would need to be tested in accordance with the applicable component-level tests of the QTM or AVM:

- 3 PV module models (including the highest and lowest power modules)
- 2 power control units (the smallest and largest)
- 5 of the lighting appliances (including the dimmest and brightest)
- both radio models would need to be tested in accordance with the applicable component-level tests of the QTM or AVM.

Individual components that are tested as part of a complete kit count toward the requirement to test 50 % of the components. So, if the tested kit included 1 PV module, 1 battery, 3 different lighting appliances and 1 radio, the remaining components that would require testing are: 2 PV modules, 1 power control unit, 2 lighting appliances and 1 radio.

4.2.6 Similar products

Several variants of a product in which some aspects are identical, and some aspects differ from each other may receive initial qualification as follows:

- a) If one version of the product has already been tested or is being tested and is found to qualify in accordance with this document using one of the processes described in 4.2.2 and 4.2.3, those aspects of the product which differ from the original version shall be tested.