

The IEC Technical Specification on stand-alone lighting kits for rural electrification – IEC/TS 62257-9-5

This Technical Note provides a summary of the Lighting Global Quality Assurance (QA) framework, how it relates to the IEC/TS 62257-9-5 document, and use of the document

See also www.lightingglobal.org for additional Technical and Eco Design Notes

Introduction

Lighting Global’s Quality Assurance (QA) program seeks to catalyze and accelerate the development of sustainable markets for good-quality, affordable off-grid lighting products. One key element of this effort is the use of test methods that are able to assess the performance of off-grid products and identify key metrics that stakeholders can use to find products that will best serve a particular customer base or program requirement. Given the inherent complexity of off-grid lighting systems, these tests cover a wide range of technical disciplines and some technical knowledge is needed to understand them.

The test methods that are used by Lighting Global were originally developed under the Lighting Africa program. The most comprehensive of these methods is called the **Quality Test Method (QTM)**, which includes a thorough set of test procedures for most aspects of system quality and performance. In 2012, Lighting Global submitted the methods to the International Electrotechnical Commission (IEC) in the form of a revision of [IEC Technical Specification 62257-9-5](#).

Manufacturers and stakeholders have asked for clarity on IEC Technical Specification 62257-9-5 and how it relates to the Lighting Global QA Framework. This technical note aims to provide this clarity by summarizing the Lighting Global QA Framework, outlining its relationship to IEC/TS 62257-9-5, and providing guidance to stakeholders on using the technical specification document for testing and other program services.

The Lighting Global QA Framework

Lighting Global supports the modern off-grid lighting market through the Lighting Global QA framework. This consists primarily of three key components:

- Test methods and quality standards;
- Testing and verification; and
- Communication to stakeholders.

These components are described in more detail below.

Test methods and quality standards

Lighting Global has developed three test methods to meet the unique needs of stakeholders in the market for off-grid lighting products. The test methods assess the performance of individual components such as the LED, battery, and PV module, as well as system-level metrics such as run time, physical ingress and water protection, and durability. The three test methods are detailed briefly below:

- The **Quality Test Method (QTM)** is the flagship test method of Lighting Global. It is used to verify if products meet the Lighting Global Minimum Quality Standards, to verify manufacturers’ claims, and to provide input information for the Standardized Specification Sheets that are published through the Lighting Global website. For the QTM, 18 product units are randomly selected for testing from a warehouse at the product’s assembly location or in the commercial market. These units allow the designated laboratory to evaluate the product with a sample size of six for

each test that is conducted. The QTM test results are valid for two years.

- The **Initial Screening Method (ISM)** is an abbreviated version of the QTM that is designed to be a lower cost and faster turnaround option. It provides rapid feedback about emerging products and offers a low-cost assessment of a new product's likelihood of passing the full QTM. For the ISM, three product units are selected by companies themselves for testing. The three units allow the designated test lab to complete each test with a sample size of one.
- The **Market Check Method (MCM)** uses test methods that are very similar to the ISM, but samples are obtained from the retail market. The sample size for each test can range from 1 to 6, depending on the objective of the test. The MCM is used to confirm whether products that have met the Lighting Global Minimum Quality Standards according to QTM testing continue to provide the same level of performance over the two year validity of the QTM test results.

The Lighting Global [Quality Standards](#) define requirements for truth in advertising, durability, quality, lumen maintenance, and warranty terms. If the results of QTM testing of a product verify that it meets the Minimum Quality Standards, the product will be listed on the Lighting Global website and the manufacturer will be eligible to apply for [Associate status and business support](#) services from Lighting Global and the associated regional programs, Lighting Africa and Lighting Asia.

Testing and verification

The second key component of the Lighting Global QA framework is testing and verification, which Lighting Global carries out using the test methods described above. Tests are currently conducted at four independent test laboratories, and several additional

labs in the process of being added to the network. More information about Lighting Global's policy on test laboratories [is available on the program website](#).

Communication

The third key component of the Lighting Global QA framework is communication of test results. Products that meet the Quality Standards after undergoing QTM testing receive a Standardized Specification Sheet (SSS). The SSS is used to communicate the results of QTM product testing by summarizing the results in an easy-to-read format that allows comparisons between products.

In addition, products that have met the Quality Standards receive a Lighting Global Verification Letter, which can be used as proof that a product meets the Standards. The SSS and Verification Letters are also posted to the [Lighting Global website](#).

IEC/TS 62257-9-5

The International Electrotechnical Commission is the world's leading organization for the preparation and publication of international standards for all electrical, electronic and related technologies.

The Lighting Global QA Framework and test methods were developed working openly with stakeholders. The test methods were freely available for four years. However, in consideration of the long-term sustainability of the program and the need to ensure the test methods would be maintained and adopted by outside organizations, Lighting Global decided to institutionalize the test methods through the IEC. Being part of the IEC enhances the credibility of the test methods and provides a level of trust required to enable governments and other organizations to also adopt the test methods and harmonize their standards. The trade-off is that the test methods can no longer be freely available, as the business model of the IEC relies

on document sales to cover the costs of maintaining IEC documents.

What are IEC Technical Specifications?

An IEC International Standard (IS) is a normative document, developed according to consensus procedures by the relevant IEC National Committee members. IEC Technical Specifications (TS) are similar to IEC International Standards and approach International Standards in terms of detail and completeness. However, they are often published when the subject under question is still under development or when insufficient consensus for approval of an International Standard is available.

What is IEC/TS 62257-9-5?

IEC/TS 62257-9-5 provides a quality assurance framework which applies to stand-alone rechargeable electric lighting appliances or kits that can be installed by a typical user without employing a technician. Its intended use is to support the selection of products by project developers/implementers and to help organizations, manufacturers, and governments achieve the goals they have for off-grid lighting projects. IEC/TS 62257-9-5 is intended as a test method for small, low wattage lighting products that typically have solar modules with a rated capacity of 10 peak watts or less. Products that utilize charging methods other than solar power are also covered.

In April 2013, the pre-existing Lighting Global QA framework was adopted by IEC and incorporated into IEC/TS 62257-9-5 in order to enable the widespread adoption of a harmonized quality assurance approach. The Lighting Global QA framework has therefore become a standardized framework institutionalized through IEC.

IEC/TS 62257-9-5 details the QTM, ISM and MCM test methods as well as product specifications for communicating test results. However, IEC/TS 62257-9-5 does not include some components from the Lighting

Global QA framework. In particular, IEC/TS 62257-9-5 does not detail Lighting Global's testing and verification activities. IEC/TS 62257-9-5 also provides an example of a quality standard that is consistent with the Lighting Global Quality Standards. However, the Lighting Global Quality Standard is managed in a way that is independent of IEC/TS 62257-9-5.

Using the IEC/TS 62257-9-5 document

IEC/TS 62257-9-5 consists of a number of sections:

- **Foreword** – consisting of standard IEC statements and disclaimers, as well as the main changes from the previous version of the TS.
- **Introduction** – describing the purpose of the TS.
- **10 clauses** (i.e. chapters) – providing information on the TS's scope, referenced documents, terms and definitions used in the TS, details on system limits, a product specification for communicating test results, and descriptions of the QTM, ISM, MCM and field screening test methods.
- **29 Annexes** – Providing procedures for all of the individual tests involved in QTM, ISM and MCM testing and additional information to assist with the understanding and use of the TS.

How do stakeholders use IEC/TS 62257-9-5?

The document's Clauses and Annexes are summarized in the boxes at the end of this tech note. With reference to these sections, some common uses of the IEC/TS 62257-9-5 document include:

- *Looking for what is involved in QTM, ISM or MCM testing* – See clause 6 for details on QTM testing, clause 7 for details on ISM testing and clause 8 for details on MCM testing.

- *Looking for what is involved in a specific test* – Look up the test in the specific annex detailing the test procedure.
- *Looking for how to read or create a product specification for an off-grid lighting product* – See clause 5 for the details on product specifications.
- *Looking for how to set requirements for developing a product or bulk procurement of products* – See clause 5 for details on quality standards and annex A and B for example quality standards.

Normative and informative annexes

Each annex of an IEC standard or technical specification is labeled either **normative** or **informative**. Normative annexes contain provisions (requirements and recommendations) that must be followed. Informative annexes provide additional information that assists in the understanding or use of the document. In IEC/TS 62257-9-5, the following annexes are informative:

- Annexes A, B, C, and X, which provide examples of ways to use the document.
- Annex L, which provides recommended practices for battery testing.
- Annexes Y and Z, which give recommendations for low-cost testing apparatus.
- Annex BB, which defines the battery storage test. This annex is informative since the battery storage test is considered an optional part of IEC/TS 62257-9-5, although a user of the standard may choose to require it. Lighting Global currently requires the storage test, but not the cycling test.

What's *not* in the IEC/TS 62257-9-5 document

The IEC/TS 62257-9-5 document does not establish quality, performance, or truth-in-advertising standards. These standards are defined in the Lighting Global

Quality Standards and other Lighting Global policy documents, available from the Lighting Global website. (Annexes A and B provide examples of quality standards that were consistent with the Lighting Global Minimum Quality Standards at the time of publication.)

Other users of the document—for example, bulk purchasers—are free to establish their own standards. Clause 5 describes the information that needs to be provided to create a complete set of quality and performance standards, referred to as a “product specification.”

Other IEC 62257 documents

In addition to IEC/TS 62257-9-5, as of September 2014, Lighting Global is involved in revisions to two other documents in the IEC 62257 series:

- **IEC/TS 62257-9-6:** This document will provide test methods for solar home system kits. The exact scope and details of test methods are still being determined.
- **IEC/TS 62257-12-1:** This document will provide test methods for lighting appliances, including LED and fluorescent lamps and luminaires, for use with off-grid power systems, and will be referenced in the upcoming revisions to IEC/TS 62257-9-6.

These revisions are expected to be completed in 2015.

Lighting Global does not currently use any other documents from the IEC 62257 series, which cover other areas of rural electrification that may be of interest to developers of rural electrification projects.

Conclusions

Lighting Global supports the modern off-grid lighting market through the Lighting Global QA framework. The International Electrotechnical Commission (IEC) is the world's leading organization for the preparation and

publication of International Standards for all electrical, electronic and related technologies. In April 2013, the pre-existing Lighting Global QA framework was adopted by IEC and incorporated into IEC/TS 62257-9-5 in order to enable the widespread adoption of a harmonized quality assurance approach. The Lighting Global QA framework has therefore become a standardized framework institutionalized through IEC.

The IEC/TS 62257-9-5 document consists of a number of clauses and annexes. The clauses provide information on a number of different components of the QA framework while the annexes detail the procedures for all of the individual tests involved in QTM, ISM and MCM testing. Using this structure, various users may make use of the IEC document to support the selection of products and ensure quality assurance for off-grid lighting projects.

Clauses

1. **Scope** – Describes where the TS can be applied.
2. **Normative references** – A listing of other referenced documents, such as IEC International Standards.
3. **Terms and definitions** – Lists terms and definitions used in the TS. Note: An important IEC term is DUT (device under test), which refers to a particular sample being measured or observed.
4. **System limits** – Details lamp or lighting appliance product categories for off-grid electricity systems and aspects of these products that may be measured and/or observed to ascertain quality and performance.
5. **Product specification** – Describes the quality, warranty, and performance metrics used to interpret test results, as well as applications for these product specifications and quality assurance principles.
6. **Quality test method** – Describes the applications for QTM testing, the set of QTM tests, testing requirements and a test program for conducting QTM tests.
7. **Initial screening method** – Describes the applications for ISM testing, the set of ISM tests, testing requirements and a test program for conducting ISM tests.
8. **Market check method** – Describes the applications for MCM testing, the set of MCM tests, testing requirements and a test program for conducting MCM tests.
9. **Field screening method** – Describes a set of tests that can be used for low-cost field screening of products where laboratory equipment is not available. This clause may be deleted from the next revision of IEC/TS 62257-9-5.
10. **Standardized specifications sheets** – Describes a process for establishing the content and formatting of standardized specifications sheets, which allow stakeholders to compare and evaluate products' performance.

Annexes

- A. **Recommended quality standards and performance targets for off-grid lighting market support programme qualification** – Describes recommended quality standards that are in line with Lighting Global's Minimum Quality Standards.
- B. **Example quality standards, warranty requirements, and performance criteria for bulk procurement qualification** ("sample tender") – Describes recommended quality standards that could be used by a bulk purchaser of lighting products.
- C. **Recommended SSS guidelines** – Describes recommended guidelines for content and formatting of specification sheets; the description is consistent with Lighting Global's policies.
- D. **Manufacturer self-reported information** – A procedure for recording manufacturer information.
- E. **Product sampling** – A procedure for product sampling.
- F. **Visual screening** – A procedure for recording specifications, functionality, observations, and internal/external construction quality of a product.
- G. **Sample preparation** – A procedure for preparing a sample for testing.
- H. **Power supply setup procedure** – A procedure for substituting a product's battery with a power supply for testing.
- I. **Light output test** – A procedure for measuring light output parameters (luminous flux, color rendering index, and color temperature).
- J. **Lumen maintenance test** – A procedure for testing a product's luminous flux over the product's lifetime.
- K. **Battery test** – A procedure for testing a product's battery capacity and efficiency.
- L. **Battery testing recommended practices** – Information for safely testing a variety of battery types, including recommended values for over- and undercharge protection when specific information is not available from the battery manufacturer.
- M. **Full-battery run time test** – A procedure for measuring a product's run time on a fully charged battery.
- N. **Full discharge preparation** – A procedure for preparing a product for charge testing.

Annexes

- O. **Grid charge test** – A procedure for estimating a product's run time when charged with an AC adapter.
- P. **Electromechanical charge test** – A procedure for estimating a product's run time when charged using an electromechanical charger, such as a hand crank.
- Q. **Outdoor photovoltaic module I V characteristics test** – A procedure for measuring the current-voltage curve of a product's solar module. (See Lighting Global Technical Note Issue 11: Understanding Solar Module Specs and Testing.) This annex also allows indoor testing using a solar simulator, referencing test methods in IEC 60904-1 and IEC 60891.
- R. **Solar charge test** – A procedure for estimating a product's run time after a typical day of solar charging.
- S. **Charge controller behaviour test** – A procedure for assessing whether a product's charge controller provides adequate protection for the battery.
- T. **Light distribution test** – A procedure for measuring light distribution parameters.
- U. **Physical ingress and water protection** – A procedure for testing the ingress and water protection rating of a product's enclosure.
- V. **Level of water protection** – A procedure for estimating the overall level of water protection provided by a product's enclosure and other features, such as conformal coatings.
- W. **Mechanical durability test** – A procedure for testing the rigors of expected daily usage, through vibration, switch, connector, gooseneck and strain relief testing.
- X. **Example test report templates** – Tables that test laboratories can use to report test results.
- Y. **Photometer box for relative luminous flux measurements** – Plans for a low-cost device for light output measurements.
- Z. **Photometer tube for relative luminous flux measurements** – Plans for a low-cost device for light output measurements.
- AA. **Field testing methods** – Test methods that can be performed in the field with low-cost equipment.
- BB. **Battery durability test** – Procedures to measure battery capacity loss from cycling and from deep discharge during storage.

Annexes

- CC. **Equipment requirements** – Requirements and recommendations for test equipment. (This annex will be added in the next revision of IEC/TS 62257-9-5.)