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Recommendations for small renewable energy and hybrid systems for rural electrification
 - Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and
 recommendations for household lighting equipment

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ICS:

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29.140.30	Fluorescent lamps. Discharge lamps	Fluorescent lamps. Discharge lamps

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TECHNICAL SPECIFICATION **IEC TS 62257-12-1**

First edition
2007-06

**Recommendations for small renewable energy
and hybrid systems for rural electrification –**

**Part 12-1:
Selection of self-ballasted lamps (CFL) for rural
electrification systems and recommendations
for household lighting equipment**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RECOMMENDATIONS FOR SMALL RENEWABLE ENERGY AND
HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –****Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification
systems and recommendations for household lighting equipment**

FOREWORD

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The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62257-12-1, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This part of IEC 62257 is based on IEC/PAS 62111 (1999); it cancels and replaces the relevant parts of IEC /PAS 62111.

This technical specification is to be used in conjunction with IEC 62257 series.

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

Enquiry draft	Report on voting
82/464/DTS	82/478/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 62257 series, under the general title *Recommendations for small renewable energy and hybrid systems for rural electrification*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, [or IEC/TS IEC/TS 62257-12-1:2008](https://standards.iteh.ai/catalog/standards/sist/7e903dbc-0d8b-45db-94b8-79ac6357066d/sist-ts-iec-ts-62257-12-1-2008)
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A bilingual version of this publication may be issued at a later date.

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. voltage below 500 V, d.c. voltage below 750 V and power below 100 kVA.

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 must 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 (CO₂ 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.

The purpose of this part of IEC 62257 is to compile specifications and recommendations for lighting materials, involved in decentralized rural electrification.

This document is also linked to other parts of IEC 62257 series namely IEC 62257-1, IEC 62257-2 to IEC 62257-6 and IEC 62257-7 to IEC 62257-13.

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

Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and recommendations for household lighting equipment

1 Scope

Decentralized Rural Electrification Systems (DRES) are designed to supply electric power to sites which are not connected to a large interconnected system, or a national grid.

As described in the IEC 62257-1, these systems include:

- an electrical power production subsystem;
- a secondary grid for sharing/distributing this power, when the system is a collective electrification system (microgrid);
- a subsystem for utilizing this electrical power as a demand subsystem including the in-house wiring and user's electrical appliances.

In many situations, lighting is the most expected application of the rural electrification process and the first application that the users may afford.

For a given lighting performance, the electrical characteristics of the lamps may vary, particularly the power factor and the harmonic content.

On large grids, the impact of these characteristics is generally not a major issue. In the context of the electrification systems considered in the IEC 62257 series, the main applications are lighting and TV. In these small systems, the power factor and the harmonic content of the supplied appliances have a high impact on the design and the sizing of the production and distribution subsystems as well as on the quality of the service provided.

Project implementers cannot afford an over-sizing of any part of the system. For this reason, they have to make sure that the selected appliances have characteristics which do not adversely affect the cost of the equipment necessary to provide the quality of service required by the General Specification of the project.

Some relevant products are available on the market (high power factor and low harmonic content). The purpose of this technical specification is to help project implementers to discriminate, in a potential sourcing panel, the models of lamps which could have the lowest impact on the whole system (generation and distribution subsystems).

This specification deals with integral compact fluorescent technology lamps:

- power less than 60 W;
- with an Edison screw E27 or bayonet B22 cap;
- with nominal voltage from 100 V to 250 V a.c.

IEC 60969 specifies the performance requirements together with the test methods and conditions required to show compliance of tubular fluorescent and other gas-discharge lamps with integrated means for controlling starting and stable operation (self-ballasted lamps) intended for domestic and similar general lighting purpose. This specification must be considered as the reference for the manufacturers.

This technical specification proposes comparative tests that could be particularly useful for project implementers to test in laboratories of developing countries the capability of products to be used for their project. The tests can be performed locally, as close as possible of the real site operating conditions. This technical specification does not cover other lamp technologies (e.g. d.c. lamps, leds, etc) however similar principles can be used for such comparative testing.

Additionally some recommendations are suggested in Annex A in order to enhance the performances or effectiveness of the lighting sources using a luminaire.

This specification is not a type approval standard. It is a technical specification to be used as guidelines and does not replace any existing IEC standard on lamps.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60598-1, *Luminaires – Part 1: General requirements and tests*

IEC 60598-2-1, *Luminaires – Part 2: Particular requirements. Section One: Fixed general purpose luminaires*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

illuminance (of an elementary surface) (symbol E)

the luminous flux received by an elementary surface divided by the area of this surface

NOTE In the SI system of units illuminance is expressed in lux (lx) or lumens per square metre (lm/m^2).

[IEV 723-08-30]

3.2

environmental conditions

characteristics such as elevation, temperature, humidity, that may influence performances

3.3

luminous efficacy (lm/W)

quotient of the luminous flux emitted by the power consumed by the source

[IEV 845-01-55]

3.4

power factor

under periodic conditions, ratio of the absolute value of the active power P to the apparent power S

3.5**compact fluorescent lamp (CFL)**

tubular fluorescent lamp unit with a bended tube that incorporates, permanently enclosed, all elements that are necessary for starting and for stable operation, and which does not include any replaceable or interchangeable parts

3.6**real (or effective) power**

the apparent power multiplied by the power factor

NOTE Real power, i.e. the actual power delivered to or consumed by the load, is expressed in watts.

3.7**rated voltage v (V)**

voltage specified by the manufacturer and rated for the nominal functioning of the lamp

3.8**rated frequency**

frequency marked on the lamp or declared as such by the manufacturer or responsible vendor

3.9**total harmonic distortion (THD)**

ratio of the r.m.s. value of the harmonics (in this context harmonic currents I_n of the order n) to the r.m.s. value of the fundamental, viz.

$$THD = \sqrt{\sum_{n=2}^{40} \left(\frac{I_n}{I_1} \right)^2}$$

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NOTE This definition has been chosen in accordance with the relevant standard IEC 61000-2-2.

3.10**lighting equipment**

luminaire and lamp combination

3.11**luminaire**

apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply

[IEV 845-10-01]

3.12**GS**

general specification of the project

3.13**colour**

the colour characteristics of a lamp are defined by the colour appearance and the colour rendition (or rendering)

NOTE 1 The actual colour of the lamp is called colour appearance and is defined in terms of the spectral tristimulus values (colour co-ordinates) according to the recommendations of the IEC.

NOTE 2 The spectral characteristics of the light emitted by the lamp have an effect on the appearance of the objects it illuminates; this effect is called rendition.

3.14

colour temperature

temperature of a source whose radiation has the same chromaticity as that of a given stimulus

3.15

rated colour

the colour appearance as declared by the manufacturer or responsible vendor, or the colour corresponding to the colour designation marked on the lamp

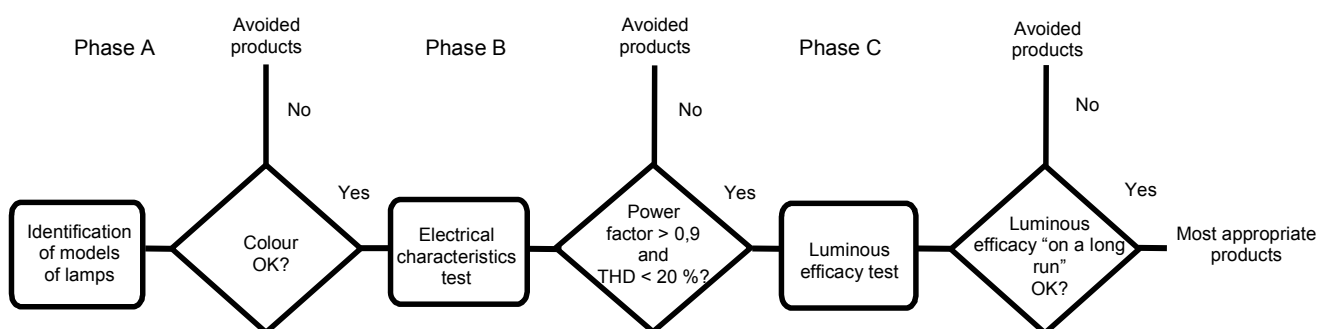
4 Comparative tests for the selection of integral compact fluorescent lamps

The proposed comparative tests are designed to discriminate the most appropriate lamps taking into consideration the techno-economic context of the project.

It is assumed that the project developer has already defined in the General Specification of the project the illuminance level he wants to provide to the end user and consequently the nominal power of the CFL lamps he needs to purchase. To enhance the efficacy of lighting in the specified application a luminaire should be used. (See Annex A.)

The selection of the model of lamp to be implemented is achieved through three phases as indicated in Figure 1.

NOTE All the lamps should be tested simultaneously in order to ensure that they are tested in the same conditions (humidity, temperature, etc.).



IEC 1068/07

Figure 1 – Lamps selection test programme

4.1 Performance criteria

The models of lamps shall be selected in accordance with the following criteria:

- **colour temperature;**
- **electrical characteristics** that have a negative impact on the sizing of the electrification system: the power factor and the harmonic content;
- **luminous efficacy.**

The recommended tests are summarized in Table 1.