

PV GAP RECOMMENDED SPECIFICATION

PVRS 7A

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DC supplied lighting systems with fluorescent lamps for photovoltaic (PV) stand-alone systems

Annex — Specification and testing procedure, to PVRS 7

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This publication is an annex to PV GAP Recommended Specification PVRS 7, DC supplied lighting systems with fluorescent lamps for photovoltaic (PV) stand-alone systems. Blank detail specification — IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components (IECEE).

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CIEMAT Component test procedures for

DC Supplied Lighting Systems With Fluorescent Lamps For Photovoltaic (PV) Stand-Alone Systems

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This annex includes the document –CIEMAT Component test procedures for DC supplied Lighting Systems With Fluorescent Lamps For Photovoltaic (PV) Stand-Alone Systems — that contains provisions which constitute this PVRS 7 Recommended Specification.

The specification used takes into account the completeness of the tests and the degree of knowledge and development of the CIEMAT procedures at the time of writing PVRS 7.

1 SCOPE

The object of this standard is to verify that lighting systems with fluorescent lamps to be used in PV installations, fed with direct current, comply with electrical and operational requirements

Lights are considered as a unity rather than as two or more components (lamp, ballast and luminaires), focusing the standards on the most important aspects.

2 LABELLING

2.1 Mandatory labelling of the lighting system:

1. Manufacturer or responsible distributor.
2. Rated voltage or range of rated voltages (the rated voltage range is the voltage range, at which the ballast may be operated and at which the due and correct start, respectively operation, of the fluorescence lamp is ensured [IEC 61347-1 term 3.8])
3. Nominal power.
4. Polarity of the connection of the ballast to the power source, stated on the ballast.

2.2 Additional information supplied in a specification sheet:

1. Luminous flux of lamp + ballast + luminaire.
2. Current consumed.
3. Estimated life time and current crest factor.
4. Restrictions to the position of the light if any.
5. Any other important features of the light.

2.3 Information recommended to be supplied:

1. Commercial denomination of colour.
2. The labelling of the enclosure characteristics of the luminaire (IP-protection code) is recommended for interior lighting and mandatory for outdoor lighting.

3 TECHNICAL DOCUMENTATION

The documentation supplied by the manufacturer serves for the correct installation and operation of the system. Its content and understanding shall be evaluated.

3.1 Mandatory

1. List of materials.
2. Spare parts if present.
3. Operating instructions.
4. Installation instructions.
5. Instruction regarding the environmental impact of the lighting system (disposal/recycling)
6. Safety advice.
7. Maintenance instructions.

3.2 Optional

Additional information, when required for the user of the system. Local language shall be used:

1. Lamp nominal luminous flux.
2. Light luminous flux.
3. Lighting system power consumption.
4. Lighting system efficacy (lm/W).
5. Current crest factor.
6. Starting specifications.
7. Colour rendering index.
8. Correlated colour temperature.
9. Kind of lighting (direct semi-direct, indirect etc).
10. Kind of luminaire light control (diffuser, reflector etc).
11. Output frequency of the ballast.
12. Estimated life time.
13. Presence of protection against over-voltage.
14. Polarity inversion.
15. Ranges of ambient temperature for correct operation.

4 VISUAL INSPECTION

The lighting system shall be checked for damage and workmanship. Any peculiarities observed shall be documented, if necessary by means of photograph or drawings.

5 LAMP SOCKET AND HOLDER

As described in IEC 60061.

6 TESTS

6.1 Initial Luminous Flux

6.1.1 Purpose

To determine the initial lamp and light luminous flux

6.1.2 Initial lamp luminous flux

Luminous flux of the lamp (without luminaire or any kind of cover) at 100 hours shall be at least 85 % of the nominal value, as stated in the catalogue or technical data sheet of the lamp manufacturer.

6.1.3 Initial light luminous flux

Luminous flux of the light (including luminaire) at 100 hours shall be at least 90 % of the value declared by the manufacturer or distributor of the light.

6.2 Power Consumed for the Lights and the Lamp

6.2.1 Purpose

To determine the power consumed by the lighting system

6.2.2 Requirement

The deviation from the nominal values should not be higher than 20 % (IEC requirement is 15 %).

6.3 Ageing

6.3.1 Purpose

To determine the capacity of the lighting system to maintain operation for the defined life given by the manufacturer

6.3.2 Conventional cycling

The conventional cycling shall consist of an automated system that interrupts the supply of power to the input of the ballast, following a routine of 2 hour 45 minutes on/15 minutes off.

6.3.3 Accelerated cycling

The accelerated cycling shall consist of an automated system that interrupts the supply of power to the input of the ballast, following a routine of 10 minutes on/15 minutes off.

6.3.4 Lumen maintenance

6.3.4.1. Purpose

The purpose of this test is to determine the capacity of the system to maintain the lumen output after a given period. For the quotation of the lumen the conventional cycling defined in 6.3.2 shall be used.

6.3.4.2. Conditions of the test.

Without reflector, diffuser, refractor or any other similar device.

6.3.4.3. Requirements.

Never lower than that declared by the manufacturer or other body responsible for the lighting system, and in any case the minimum value of the lumen maintenance at 2000 hours should be 85 % of that measured at 100 hours.

6.3.4.4. Conditions of the test.

With reflector, diffuser, refractor or any other similar device

6.3.4.5. Requirements.

Never lower than that declared by the manufacturer or other body responsible for the lighting system, and in any case the minimum value of the lumen maintenance at 2000 hours should be 80 % of that measured at 100 hours

6.3.5 Effect on continuous working in lifetime.

6.3.5.1. Purpose

The purpose of this test is to assess the effect of continuous operation on the lighting system.

6.3.5.2. Conditions of the test.

For the quotation of the effect of continuous working in life time, the conventional cycling defined in 6.3.2 shall be used.

6.3.5.3. Requirements.

At 2000 hours no main component of the lights (lamp or ballast) shall be broken on a set of 10 identical samples of each model and the requirements stated in 6.3 shall be complied with. With reference to particular components (for example fuses) the laboratory shall state any incident in the report.

6.3.6 Effect of starting on lifetime.**6.3.6.1. Purpose**

The purpose of this test is to determine the effect of starting of the system in its lifetime.

6.3.6.2. Condition of the test.

For the quotation of the effect of the starting on lifetime, the accelerated cycling defined in 6.3.3 shall be used. If the lifetime to 50 % failures declared for the manufacturer is N hours, a minimum of 20 lights shall be submitted to the accelerated cycle, with a number of switch off equal to N hours/3 hours. (The number of 20 lights is the minimum required for IEC 60969 and the value N hours / 3 hours correlate the number of starting of the conventional cycling as described in 6.3.2 with the number of starting of the accelerated cycling as described in 6.3.3).

6.3.6.3. Requirements.

The result of the test shall be a lifetime to 50 % failures equal to or greater than that quoted by the manufacturer.

6.4 Battery voltage**6.4.1. Purpose**

The purpose of this test is to check if the lighting system operates properly when connected to a battery (accumulator)

6.4.2. Test procedure

The lights shall be operated at cell voltages of 1.8 V/cell (or 90 % of nominal battery voltage), 2.4 V/cell (or 120 % of nominal battery voltage) and 2 V/cell (or nominal battery voltage). The test should be performed at ambient temperatures between 10 °C to 35 °C (if the test is performed inside an integrating sphere, the temperature shall be inside the mentioned range). According to IEC 61347-1 subclause 5.6, systems which are designed for battery operation can also be tested using a different voltage source, on condition that the impedance of the electricity source is of equal size to that of a battery.

6.4.3. Starting at different battery voltage.**6.4.3.1. Procedure and requirements**

The capability for starting the light at 90 % and 100 % and 120 % of nominal battery voltage shall be checked, with an interval of at least 15 minutes off between the start at each value of voltage.

Any difficulty for starting the light at each value of the battery voltage shall be assessed for the technicians, in order to declare whether the light passes the test or not.

6.4.4. Operation at different battery voltage.**6.4.4.1. Procedures and requirements**

The test shall be performed in the following order: Two hours at 90 % of nominal battery voltage, two hours at 120 % of nominal battery voltage and until stabilisation at 100 % nominal battery voltage.

At the end of the test, the luminous flux and the power consumption at nominal battery voltage should be checked for compliance at 25° C ambient temperature.

The values measured shall be within a 5 % of the values measured in test 6.1 and 6.2.

Immediately after the test at each values of voltage, a visual inspection shall be performed in order to check for any component circuit burning, ballast deformation etc.

6.5 FREQUENCY OF THE LAMP VOLTAGE

6.5.1. Requirements

The frequency of the lamp voltage shall be between 20 kHz and 50 kHz measured at 90 %, 100 % and 120 % of the nominal battery voltage.

6.6 REVERSE POLARITY

6.6.1. Procedures and requirements

The sample shall be operated during 1 hour at 120 % of the nominal battery voltage.

After the test, it shall be verified that the light complies with 6.4.3. The luminous flux and the power consumption at nominal battery voltage shall be within 5 % of the values measured in test 6.1 and 6.2. A visual inspection shall be performed in order to check for any component circuit burning, ballast deformation etc.

6.7 ABNORMAL CONDITIONS

6.7.1. Procedures and requirements

This test does not apply to self-ballasted lights.

During the normal working of a light at 120 % of the nominal battery voltage, the lamp shall be removed during four hours. After that period of time, the lamp shall be installed in the socket.

For passing this test, the power consumed by the light during the test shall not be lower than 20 % of the light nominal power; the light shall work normally when the lamp is installed back into the socket. A visual inspection shall be performed in order to check for any component circuit burning, ballast deformation etc.

6.8 LUMINAIRE REQUIREMENTS

6.8.1. Procedures and requirements

As in IEC 60598-1 and IEC 60598-2, for tests related to electric isolation, fire resistance, electric shock etc.

7. REPORTS

All the test results shall be faithfully documented and recorded in a Summary Test Report, which contains all measured data, performance characteristics and details of any failures and re-tests made. The manufacturer shall keep a copy of this report for reference and inspection purposes.