

WHITE LED BASED SOLAR STREET LIGHTING SYSTEMS

DEFINITION

Light Emitting Diode (LED) is a p-n junction device which emits light when forward electric current passes through it. A LED based solar street lighting system aims at providing solar electricity for operating LED lights for specified hours of operation per day. The broad performance specifications of a White Light Emitting Diode (W-LED) light source based solar street lighting system are given below:

BROAD PERFORMANCE PARAMETERS

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| Light Source | White Light Emitting Diode (W-LED) |
| Light Out put | White colour (colour temperature 5500 ⁰ -6500 ⁰ K) minimum 15 LUX when measured at the periphery of 4 meter diameter from a height of 4 meter. The illumination should be uniform without dark bands or abrupt variations, and soothing to the eye. Higher light output will be preferred. |
| Mounting of light | Minimum 4 metre pole Mounted |
| PV Module | 45 Wp under STC, measured at 16.4 Vat load. Module Voc minimum of 21V |
| Battery | Tubular Lead acid or gel type VRLA , 12 V- 40 AH @ C/10, Max DoD 75% |
| Electronics | Min 85% total efficiency |
| Average duty cycle | Dusk to dawn |
| Autonomy | 3 days (Minimum 42 operating hours per permissible discharge) |

Other Details

DUTY CYCLE

The LED solar street lighting system should be designed to operate for dusk to dawn, under average daily insolation of 5.5 kWh /sq.m. on a horizontal surface.

LIGHT SOURCE

1. The light source will be of white LED type. Single lamp or multiple lamps can be used. Wider view angles of a minimum of 120° or more. **The luminous performance of individual LED used should not be less than 90 lumen/watt when measured luminaire as whole.** The colour temperature of white LEDs

used in the system should be in the range of 5500° K – 6500° K. Use of LEDs which emits ultraviolet light will not be permitted.

2. The light output from the white LED light source should be constant through out the duty cycle.
3. The lamps should be housed in an assembly suitable for outdoor use. **The temperature of LED should increase not more than 15° above ambient temperature. This condition should be compiled even after two hours of operation at its maximum operation voltage(ie. Just before over voltage cut off)**
4. The make, model number, country of origin and technical characteristics of white LEDs used in the lighting system must be furnished to the test centers and to the buyers. In absence of this data the solar lantern will not be tested by the test center.

BATTERY

- (i) **Tubular Lead acid or gel type VRLA battery should conform to latest BIS standards .. A copy of the test certificate for the battery (including its make, country of origin and model number) used in the system should be provided to the test cente.**
- (ii) At least 75 % of the rated capacity of the battery should be between fully charged & load cut off conditions.

ELECTRONICS

- (i) **The total electronic efficiency of DC-Dc converter should be at least 85 %.**
- (ii) Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery through out the year.
- (iii) The light output should remain constant with variations in the battery voltages.

PV MODULE

- 1.. **The PV module (s) shall contain mono/ multi crystalline silicon solar cells with IEC 61215(revised) certification or equivalent National or International Standards . The manufacturer should have the required certification for at least one of their regular modules. Further, the manufacturer should certify that the submitted module is also manufactured using same design and process**
2. The power out put of the PV module must be reported under standard test conditions (STC) at 16.4 Volt loading voltage. I_V curve of the sample module should be submitted to the test center at the time of system qualification testing.
3. The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.
4. The terminal box on the module should have a provision for opening for replacing the cable, if required.

5. A strip containing the following details should be laminated inside the module so as to be clearly visible from the front side:

- a) Name of the Manufacturer or distinctive Logo
- b) Model or Type No.
- c) Serial No.
- d) Year of make

ELECTRONIC PROTECTIONS

1. The system should have protection against battery overcharge and deep discharge conditions. The numerical values of the cut off limits must be specified, while submitting the samples for the testing purposes.
2. Fuses should be provided to protect against short circuit conditions.
3. A blocking diode should be provided as part of the electronics, to prevent reverse flow of current through the PV module(s), in case such a diode is not provided with the PV module.
4. Full protection against open circuit, accidental short circuit and reverse polarity should be provided.
5. Electronics should operate at 12 V and **should have temperature** compensation for proper charging of the battery through out the year.

MECHANICAL COMPONENTS

- (i) Metallic frame structure (with corrosion resistance paint) to be fixed on the roof of the house to hold the SPV module. The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that it can be installed at the specified tilt angle.
- (ii) It should be possible to mount the light source on a metallic arm attached to the pole. The metallic arm for holding the light assembly should be extended at least 1.5 metres from the pole and set at a suitable angle to maximize uniform illumination of desired level over the specified area.
- (iii) A vented metallic / plastic box with acid proof corrosion resistance paint for housing the storage battery outdoors should be provided.

OTHER FEATURES

- (i) The system should be provided with 2 LED indicators: a green light to indicate charging in progress and a red LED to indicate deep discharge condition of the battery. The green LED should glow only when the battery is actually being charged.
- (ii) There will be a Name Plate on the system body, which will give:
 - (a) Name of the Manufacturer or Distinctive Logo.
 - (b) Model Number
 - (c) Serial Number
 - (d) Year of manufacture

- (iii) Necessary lengths of wires / cables, switches suitable for DC use and fuses should be provided

QUALITY AND WARRANTY

- (i) Components and parts used in White LED solar street lighting systems should conform to the latest BIS / international specifications, wherever such specifications are available and applicable. A copy of the test report / certificate stating conformity of BIS / international standards must be submitted to the test centre.
- (ii) **The PV module will be warranted for a minimum period of 15 years from the date of supply and the complete White LED solar street lighting system including the battery) will be warranted for a period of at least 5 years from the date of supply.**
- (iii) The original manufacturers of white LED based solar home lighting system are required to provide to the test center a detailed report on the tests performance by them and the actually measured values of PV module, electronics, LEDs and battery and other related parameters, as per MNRE specifications. Mere mention of compliance to MNRE specifications is not acceptable and such samples may not be tested by the Test center. The test center will refer to the measured values provided by the manufacturer in the test report issued by the test center.

DOCUMENTATION

- (i) An Operation, Instruction and Maintenance Manual, in English and the local language, should be provided with the solar street lighting system.
The following minimum details must be provided in the Manual:
 - (a) About Photovoltaics
 - (b) About White LED solar street lighting system - its components and expected performance
 - (c) About PV module. In case of imported modules it is mandatory to provide a copy of the international product qualification certificate to the test centre.
 - (d) About White LED Lights. The make, model number, country of origin and technical characteristics of LEDs should be stated in the product data sheet and furnished to the test centres
 - (e) About battery and electronics used
 - (f) Clear instructions about mounting of PV module.
 - (g) About charging and significance of indicators.
 - (h) DO's and DONT's,
 - (i) Clear instructions on regular maintenance and trouble shooting of solar street lighting system.
 - (j) Name and address of the person or service center to be contacted in case of failure or complaint.