SPECIFICATIONS OF WHITE-LED (W-LED) BASED SOLAR STREET LIGHTING SYSTEMS

White Light Emitting Diode (W-LED) is a solid state device which emits light when forward electric current passes through it. A LED based solar street lighting system consists of a PV Module, control electronics, battery, and W-LED based Luminaire, all suitably mounted on a Pole. The battery is charged by electricity generated through the PV module during day time and the luminaire provides light from dusk to dawn.

BROAD PERFORMANCE PARAMETERS

<table>
<thead>
<tr>
<th>Light Source</th>
<th>White Light Emitting Diode (W-LED)</th>
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</thead>
<tbody>
<tr>
<td>Light Output</td>
<td>White colour (colour temperature 5500°K-6500°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.</td>
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<tr>
<td>Mounting of light</td>
<td>Minimum 4 metre pole mounted</td>
</tr>
<tr>
<td>PV Module</td>
<td>40 Wp under STC, measured at 16.4 V at load. Module Voc minimum of 21V</td>
</tr>
<tr>
<td>Battery</td>
<td>Tubular Lead acid Flooded or Tubular GEL / AGM VRLA , 12 V- 40 AH @ C/10, Max DoD 75%</td>
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<tr>
<td>Electronics Efficiency</td>
<td>Min 85% total</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>Dusk to dawn</td>
</tr>
<tr>
<td>Autonomy</td>
<td>3 days (Minimum 42 operating hours per permissible discharge</td>
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</tbody>
</table>

OTHER DETAILS

DUTY CYCLE

The W-LED solar street lighting system should be designed to operate from 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 a white LED type. Single lamp or multiple lamps can be used. The colour temperature of white LED used in the system should be in the range of 5500°K–6500°K. Use of LEDs which emits ultraviolet light is not permitted.
2. The light output from the white LED lights sources should be constant throughout the duty cycle.

3. The lamps should be housed in an assembly suitable for outdoor use. The temperature of heat sink should not increase more than 20°C above ambient temperature even after 48 hrs of continuous operation. This condition should be
complied for the dusk to dawn operation of the lamp while battery operating at any voltage between the load disconnect and the charge regulation set point.

4. The make, model number, country of origin and technical characteristics (including IESNA LM-80 report) 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 street lights may not be tested by the Test Center.

**BATTERY**

Lead Acid, Tubular Positive Plate Flooded or Tubular GEL / AGM VRLA, 12 V-40 AH @ C/10 discharge rate. Battery should conform to latest BIS standards. In view of non-availability of adequate test facilities for testing as per BIS standard in the country, existing facilities of battery manufacturers will be utilized by way of periodic quality audit by MNRE/BIS or their representative to ensure conformance of BIS standards.

   (i) Also initially for a period of six months from the date of the issue of these guidelines capacity test, Ampere-Hour (Ah) & Watt-Hour (Wh) efficiency test and charge retention tests per BIS standards may be used to enable the program to continue.

   (ii) It is also mandatory for the battery manufacturers/ bulk users to comply with batteries (Management and handling) Rules 2001 of MOEF, as amended.

   (iii) The manufacturer is required to submit the test report on Ah efficiency Wh efficiency and charge retention test from an NABL accredited Lab whereas the capacity test of the battery will be conducted by the system testing lab.

   (iv) At least 75 % of the rated capacity of the battery should be available between fully charged & load cut off conditions.

**ELECTRONICS**

   (i) The total electronic efficiency should be at least 85%.

   (ii) Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery throughout 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/ multicrystalline siliconor thin film solar cells. In case of crystalline silicon solar cell module it is required to have certificate for the supplied PV module as per IEC 61215 specifications orequivalent National or International Standards whereas in case of thin film solar cell module it is required to have certificate for the supplied Pvmodule as per IEC 61646 specifications or equivalent National or International Standards. In case of thin film modules for each model the modules should fulfill the wattage criterion after light soaking degradation.

In case the supplied PV module is not a module of regular production of the manufacturer and does not have certificate as above then the manufacturer should
have the required certification for at least one of the irregular modules. Further, the manufacturer should certify that the supplied module is also manufactured using same material design and process similar to that of certified PV module.

In case of imported modules it is mandatory to provide a copy of the international product qualification certificate to the test center.

2. The power output 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. The cell efficiency in the module should not be less than 15%.

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. Identification and Traceability

Each PV module used in any solar power project must use a RF identification tag. The following information must be mentioned in the RFID used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions.)

   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. Fuse 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, full protection against open circuit, accidental short circuit and reverse polarity should be provided.
4. Electronics should operate at 12V and should have temperature compensation for proper charging of the battery throughout the year.

MECHANICAL COMPONENTS

(i) Metallic frame structure (with corrosion resistance paint) to be fixed on the Pole to hold the SPV module. The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45 degrees, 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 two 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 and fuse 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 20 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 W-LED based solar street 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, 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. Besides other information the Manual should contain the following minimum details:

(a) About Photovoltaics.
(b) A small write up (with a block diagram) on PV Module, electronics, lamps and battery.
(c) About White LED solar street lighting system - its components and expected performance
The make, model number, country of origin and technical characteristics of W- LEDs should be stated in the product data sheet
(d) Clear instructions about mounting of Pole, Grouting details, fixing of PV module, battery box and luminaire. Clear wiring instructions with line diagram
(e) About significance of indicators
(f) DO's and DONT's
(g) Clear instructions on regular maintenance and trouble shooting of the system
(h) Name and address of the person or service center to be contacted in case of failure or complaint.