Specifications of White-LED based Home Lighting Systems

A LED based solar home lighting system aims at providing electricity for operating LED lights and other small DC loads for specified hours of operation per day.

White Light Emitting Diode (W-LED) is a solid state device which emits light when electric current passes through it. A LED based solar Home lighting system consists of a PV Module, control electronics, battery, and W-LED based Luminaires. The battery is charged by electricity generated through the PV module during the day time and the luminaires provide the light as and when required.

BROAD PERFORMANCE SPECIFICATIONS

The broad performance specifications of a W-LED light source based solar home lighting system are given below:

<table>
<thead>
<tr>
<th>Light Source</th>
<th>White Light Emitting Diode (W-LED)</th>
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<tbody>
<tr>
<td>Light Output</td>
<td>White colour (colour temperature 5500⁰-6500⁰K) Minimum 15 LUX when measured at the periphery of 2.5 meter diameter from a height of 2.5 meter. At any point within area of 2.5mtr diameter periphery the light level should not be more than three limes of the periphery value. The illumination should be uniform without dark Bands or abrupt variations and soothing to the eyes. Higher output would be</td>
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<tr>
<td>Mounting of light</td>
<td>Wall or ceiling</td>
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<tr>
<td>Electronics</td>
<td>Min 85% efficiency</td>
</tr>
<tr>
<td>Average duty cycle</td>
<td>5 hours a day</td>
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<tr>
<td>Autonomy</td>
<td>3 days (Minimum 12 operating hours per permissible discharge</td>
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</table>

There will be four models of W-LED home lighting systems. The configuration of each model is as follows:

Model-I One White LED luminaire

PV Module 6 Wp under STC, measured at 16.4V as Vload. Module Voc minimum of 21V. Battery Sealed maintenance free, 12V-7 AH @ C/20, Max DoD- 75%

Model- II Two White LED luminaire

PV Module 12 Wp under STC, measured at 16.4 V as Vload. Module Voc minimum of 12V. Battery Lead acid flooded or VRLA, 12V - 12AH @ C/20, Max DoD-75%

Model –III Two White LED luminaire and one DC fan of wattage up to 10 W

PV Module 24 Wp under STC, measured at 16.4 V as Vload. Module Voc minimum of 21V. Battery Lead acid flooded or VRLA, 12V- 20AH @ C/20, Max DoD-75%
Model –IV Four White LED

PV Module 24 Wp under STC, measured at 16.4 V as Vload. Module Voc minimum of 21 V. Battery Lead acid flooded or VRLA, 12 V- 20 AH @ C/20, Max DoD-75%

Other Details

DUTY CYCLE

The LED solar home lighting system should be designed to operate for average 5 hours a Day and fan for 3-4Hrs, under average daily insolation of 5.5 kWh/sq.m. on a horizontal surface.

LIGHT SOURCE

(i) The light source will be of white LED type. Single lamp or multiple lamps can be used. The colour temperature of W-LEDs used in the system should be in the range of 5500°K–6500°K. Use of LEDs which emit ultraviolet light will not permitted.
(ii) The light output from the W-LED light source should be constant throughout the duty cycle.
(iii) The lamps should be housed in an assembly suitable for indoor use with an appropriate heat sink to dissipate heat generated during operation. The temperature of LED should not increase more than 10° above room temperature. This condition should be complied for 5 hours of operation of the lamp at a stretch while battery operating at any voltage between the load disconnect and the charge regulation set point.
(iv) The make, model number, country of origin and technical characteristics (including IESNA LM-80 report) of W-LEDs used in the lighting system must be furnished to the Test Centers and to the buyers. In absence of this data the solar home lighting system may not be tested by the Test Center.

BATTERY

(i) Sealed Maintenance Free or Tubular positive plate lead acid Floodeed or VRLA battery. 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.
(ii) 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.
(iii) It is also mandatory for the battery manufacturers/ bulk users to comply with batteries (Management and handling) Rules 2001 of MOEF, as amended.
(iv) At least 75% of the rated capacity of the battery should be between fully charged and 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.
(iv) Necessary lengths of wires/cables, switches suitable for DC use and fuses should be provided.

PV MODULE

(a) The PV module (s) shall contain mono/ multi crystalline silicon or 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 or equivalent National or International Standards whereas in case of thin film solar cell module it is required to have certificate for the supplied PV module 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 centre

(b) 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.
(c) The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.
(d) The terminal box on the module should have a provision for opening for replacing the cable, if required.

(e) Identification and Traceability: Each PV module used in any solar power project must use a RF identification (RFID) 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 manufacture

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, full protection against open circuit, accidental short circuit and reverse polarity should be provided.
4. Electronics should operate at 12 V 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 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 degree, so that it can be installed at the specified tilt angle.
(ii) It should be possible to mount the light source on a wall or ceiling or hang it from the ceiling in a stable manner.
(iii) A vented plastic/ wooden/ metallic box with acid proof corrosion resistance paint for housing the storage battery indoors 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

QUALITY AND WARRANTY

(i) Components and parts used in W-LED based solar home 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.

(i i) The PV module will be warranted for a minimum period of 20 years from the date of supply. The W-LED solar home lighting system (excluding the battery) will be warranted for a period of at least 5 years from the date of supply.
(iii) The sealed maintenance free battery should be warranted for a period of at least two year (DOD 25 to 30%). The lead acid flooded type battery or VRLA battery should be warranted for a period of 5 years.

(iv) The manufacturers of W-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.

**DOCUMENTATION**

An Operation, Instruction and Maintenance Manual, in English and the local language, should be provided with the solar home lighting system.

The following minimum details must be provided in the Manual:

(a) About Photovoltaics.
(b) A small write up (with a block diagram) on PV Module, electronics, lamps and battery.
(c) About W-LED solar home 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 DON'T'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.