

- The suction/ delivery pipe (GI/HDPE), electric cables, floating assembly, civil work and other fittings required to install the Motor Pump set.

V. MOUNTING STRUCTURES.

The PV modules should be mounted on metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 150 km per hour. The support structure used in the pumping system should be hot dip galvanized iron with minimum 80 micron thickness.

To enhance the performance of SPV water pumping systems, manual or passive or auto tracking system **must** be used. For manual tracking, arrangement for seasonal tilt angle adjustment and three times manual tracking in a day should be provided.

VI. ELECTRONICS AND PROTECTIONS

- Inverter could be used, if required, to operate an A.C. Pump. The inverter must have IP 54 protection or must be housed in a cabinet having at least **IP54** protection.
- Controller for BLDC motor driven pumps, if required may be used. The controller must have **IP 54** protection or must be housed in a cabinet having at least IP 54 protection.
- Adequate protections should be incorporated against dry operation of motor pump set, lightning, hails and storms.
- Full protection against open circuit, accidental short circuit and reverse polarity should be provided.

VII. ON/OFF SWITCH

A good reliable switch suitable for DC use is to be provided. Sufficient length of cable should be provided for inter-connection of the PV array, Controller / Inverter and the motor pump set.

VIII.WARRANTY

The PV Modules must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years. The whole system including submersible/ surface pumps shall be warranted for 5 years. Required Spares for trouble free operation during the Warrantee period should be provided along with the system.

IX. OPERATION AND MAINTENANCE MANUAL

An Operation and Maintenance Manual, in English and the local language, should be provided with the solar PV pumping system. The Manual should have information about solar energy, photovoltaic, modules, DC/AC motor pump set, tracking system, mounting structures, electronics and switches. It should also have clear instructions about mounting of PV module, DO's and DONT's and on regular maintenance and Trouble Shooting of the pumping system. Name and address of the person or Centre to be contacted in case of failure or complaint should also be provided. A warranty card for the modules and the motor pump set should also be provided to the beneficiary.

X.NOTES

- The type of pump set used must match the total dynamic head requirement of the site (i.e. the location at which it is installed).
- There should not be any compulsion to use only one or the other type of Motor-pump set. The beneficiary may select an appropriate Model (i.e. Capacity of PV Array and Type of Motor Pump Set) as per site requirement.
- Solar Photovoltaic Water Pumping Systems should be tested and certified by an authorized test centre of the Ministry to meet the performance and water discharge norms specified in section II above.

- Variation in the modules wattage in the PV Array should be within + or - 3 % so as to minimize the mismatch losses in the PV Array.

- The capacity (i.e. overall wattage) of the PV Array submitted to the Test Centers should be within - 3% or + 5 % of the specified value. However, the capacity of the PV Array, supplied in the field could be more than the 5 % of the specified value (but not less than 3% of the specified value).

Indicative Technical Specifications of Solar 'MICRO' Pumping Systems:

	Model-I	Model-II	Model-III	Model-IV	Model-V	Model-VI
PV array	300 Wp	300 Wp	300 Wp	500 Wp	500 Wp	500 Wp
Motor capacity	0.25 hp	0.25 hp	0.25 hp	0.5 hp	0.5 hp	0.5 hp
Shut Off Dynamic Head	12 metres	30 metres	45 metres	12 metres	30 metres	45 metres
Water output *	10,000 litres per day from a total head of 10 metres	5,000 litres per day from a total head of 20 metres	3,000 litres per day from a total head of 30 metres	20,000 litres per day from a total head of 10 metres	10,000 litres per day from a total head of 20 metres	6,000 litres per day from a total head of 30 metres

* Water output figures are on a clear sunny day with three times tracking of SPV panel, under the "Average Daily Solar Radiation" condition of **7.15 KWh/ sq.m. on the surface of PV array (i.e. coplanar with the PV Modules)**.

Notes:

1. For higher or lower head / PV capacity, or in between various models; water output could be decided as per the clause II. (i.e. performance specifications and requirements) specified earlier.
2. In case of a surface pump, the suction head to be limited to **6 metres**.

TECHNICAL SPECIFICATIONS FOR SOLAR STUDY LAMP

PV Module	2.5 Wp under STC
Battery	Lithium Battery of 3.2V, 2000 mAh.
Light Source	1 Watt W-LED luminaire, dispersed beam, soothing to eyes with the use of proper optics and diffuser
Light Output	Study lamp should deliver minimum of 150 Lux at over an area of 1.5 feet Diameter from a height of 1.0 foot. [Minimum 150 Lux when measured at the periphery of 45 centimetres diameter from a height of 30 centimetres.]
Run Time	5 hours a day under average daily insolation of 5.5 kWh/sq.m. on a horizontal surface.

TECHNICAL DETAILS**PVMODULE**

- (i) Indigenously manufactured PV modules should be used in the Solar Study Lamp,
- (ii) The PV module should have crystalline silicon solar cells, and should have humidity, freeze, thermal cycling and damp heat tests certificate conforming to IEC 61215 Edition II / BIS 14286 from an NABL or IECQ accredited Laboratory.
- (iii) The PV module must have a minimum of 2.5 Wp at an appropriate voltage for charging of battery used, under the standard test conditions (STC) of measurement.
- (iv) There should preferably be an arrangement (stand) for mounting the module at an optimum angle in the direction facing the sun.
- (v) A foil/ strip containing the following details should be fixed inside on the module so as to be clearly visible from the front side:-
 - a) Name of the Manufacturer and/ or distinctive Logo
 - b) Model and/ or Type No.
 - c) Serial No.
 - d) Year of manufacture
- (vi) A distinctive serial number starting with NSM will be engraved on the frame of the module or screen printed on the teller sheet of the module.

BATTERY

All Lithium based batteries, fulfilling following performance parameters, shall be used for Solar Study Lamps under the Off-grid and Decentralized Solar PV Applications Programme of the Ministry:

Parameter	Qualifying condition
Specific Energy	Minimum 120 Wh/ kg
C Rate (Charging)	Minimum C/4
C Rate (Discharging)	Up to 1C
Charge Discharge Cycles	Minimum 2000 cycles at C/10 rate at 25°C
Thermal Runaway	Minimum 120 °C
Depth of discharge	Minimum 85% at 25 °C
Temperature of operation	10 to 50 °C (with thermal management system for ambient temperatures lower and higher than the given range)

- i. Battery pack should have proper 'Battery management System' (BMS) for cell balancing, over charge and over temperature protection.
- ii. Battery should conform to the latest BIS/ International standard

LIGHT SOURCE

- I. The light source should be 1.0 Watts (max.) luminaire based on White Light Emitting Diode (W-LED).
- II. It should be dispersed beam, soothing to eyes with the use of proper optics and diffuser.
- III. Illuminance:
 - Minimum 150 Lux* over an area of 1.5 feet diameter when the height of Luminaire is kept 1 feet above the table)

(* At the time of test, Luminaire would be horizontal and is kept 1 feet above the test bench such that there is no shadow of the lamp body)
- V. The colour temperature of W-LED(s) used in the system should be in the range of 5500°K-6500°K.
- VI. W-LED(s) should not emit ultraviolet light.

VII. The light output from the W - LED should be constant throughout the duty cycle.

QUALITY AND WARRANTY

- I. The complete Solar Study Lamp will be warranted for five years.
- II. The battery should be warranted for a period of 5 years.
- III. The Warrantee/ Guarantee Card to be supplied with the Solar Study Lamp must contain the details of the system supplied.

ELECTRONIC PROTECTIONS

- I. Adequate protection is to be incorporated for "No Load" condition, e.g. when the lamp is removed and the Solar Study Lamp is switched ON.
- II. The system should have protection against battery overcharge and deep discharge conditions.
- III. The load reconnect should be provided at around 80% of the battery capacity status.
- IV. Adequate protection should be provided against battery reverse polarity.
- V. A fuse should be provided to protect against short circuit conditions.
- VI. Protection for reverse flow of current through the PY module should be provided.
- VII. During the charging, lamp cannot be switched "ON".

ELECTRONICS

- I. Charging should be with 'MPPT' type micro controller-based charger
- II. Efficiency of the electronic system should be at least 85%.
- III. Electronics should have temperature compensation for proper charging of the battery throughout the year.
- IV. The PCB containing the electronics should be capable of solder free installation and replacement.
- V. Necessary lengths of wires/ cables, switches suitable for DC use and other protections should be provided.
- VI. The system should have a USB port for mobile charging