

**TECHNICAL SPECIFICATIONS AS PER MNRE FORSPV PUMPSETS
SUPPLY OF SPV WATER PUMPING SYSTEM - TECHNICAL SPECIFICATION DETAILS:**

GENERAL CONDITIONS

1. The PV modules to be installed by the contractor should be mounted on metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 150km per hour. The support structure used in the pumping system should be hot dip galvanized iron with minimum 80 micron thickness. Panels must conform to IEC specifications and manual tacking system shall be provided in auto tracking structures to combat situations during non-working of auto trackers.
2. The DC Pumps to be installed by the contractor should be of Lorentz, Rotomag, Grundfos or Kirloskar make only, whereas AC Pumps should be Kirloskar, Shakti, Plugra or Grundfos. If installed pump does not qualify MNRE norms or meets performance parameters, then supplier has to replace it with qualified pump.
3. The Electric cable to be used by the contractor should be of Finolex, KEI, Polycab or Havells make and as per IS 694 specifications.
4. The HDPE Pipe to be used by the contractor should be of Jain Irrigation, Finolex, Kissan make as per IS4984, ISO 4427 specifications.
5. The whole system including submersible pumps shall be warranted for 3 years and contractor shall provide after sale service for 10 years.
6. The company should have adequate stock of spares and shall respond to complaint from the beneficiary within 3 days by site visit and replace any defective part free of cost & rectify the fault within the guarantee period.
7. An Operation and Maintenance Manual, in farmer friendly Punjabi/English 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 clearly mentioning DO's and DON'T's.
8. The company shall take the responsibility in case of any dispute arising from the supply of their product through their distributor or dealers.

TECHNICAL SPECIFICATIONS

I. INTRODUCTION

A solar photovoltaic (SPV) water pumping system consists of:

1. PV Array :
 - Capacity in the range of 1500 Watt to 7500 Watt.
 - Should be mounted on a suitable structure with a provision of tracking the sun.
2. Motor Pump Set (Submersible/Floating Submersible) :
 - D.C. Motor Pump Set (Brush less D.C.) up to 5000 Watt
 - A.C. Induction Motor Pump Set with a suitable Inverter for above 5000 Watt.
3. Electronics :
 - Maximum Power Point Tracker (MPPT)
 - Controls / Protections.
4. Interconnect Cables and "On-Off" switch.

II. PERFORMANCE SPECIFICATIONS AND REQUIREMENTS (DUTY CYCLE)

Solar PV Water Pumps with PV array capacity in the range of 1500 Watt to 7500 Watt could be installed on a suitable bore-well/Water storage tank. Under the “Average Daily Solar Radiation” condition of 5.5 KWh/ sq.m. on a horizontal surface, the minimum water output from a Solar PV Water Pumping System at different “Total Dynamic Heads” should be as specified below :

For D.C. Motor Pump Set with Brush Less D.C.(B.L.D.C.) :

- a) 35 liters of water per watt peak of PV array, from a Total Dynamic Head of 30 meters and the shut off head being at least 45 meters.
- b) 21 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 meters and the shut off head being at least 70 meters.

The actual duration of pumping of water on a particular day and the quantity of water pumped could vary depending on the solar intensity, location, season, etc. Indicative performance specifications for the Shallow and Deep well SPV Water Pumping Systems are given in the Annexure I .

For A.C. Induction Motor Pump Set with a suitable Inverter :

- a) 32 liters of water per watt peak of PV array, from a Total Dynamic Head of 30 meters and the shut off head being at least 45 meters.
- b) 19 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 meters and the shut off head being at least 70 meters.
- c) 13 liters of water per watt peak of PV array, from a Total Dynamic Head of 70 meters and the shut off head being at least 100 meters.

The actual duration of pumping of water on a particular day and the quantity of water pumped could vary depending on the solar intensity, location, season, etc. Indicative performance specifications for the Shallow and Deep well SPV Water Pumping Systems are given in the Annexure I

III. PV ARRAY

The SPV water pumping system should be operated with a PV array capacity in the range of 1500 Watts peak to 5000 Watts peak, measured under Standard Test Conditions (STC). Sufficient number of modules in series and parallel could be used to obtain the required PV array power output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of 125 Watts peak, with adequate provision for measurement tolerances. Use of PV modules with higher power output is preferred. Indigenously produced PV module (s) containing mono/ multi crystalline silicon solar cells should be used in the PV array for the SPV Water Pumping systems.

1. Modules supplied with the SPV water pumping systems should have certificate as per IEC 61215 specifications or equivalent National or International/ Standards.
2. Modules must qualify to IEC 61730 Part I and II for safety qualification testing.
3. The efficiency of the PV modules should be minimum 14% and fill factor should be more than 70%.
4. The terminal box on the module should have a provision for “Opening” for replacing the cable, if required.
5. There should be a Name Plate fixed inside the module which will give:
 - a. Name of the Manufacturer or Distinctive Logo.
 - b. Model Number
 - c. Serial Number
 - d. Year of manufacture
6. Each PV module must use a RF identification tag (RFID), which must contain the following information:
 - (i) Name of the manufacturer of PV Module
 - (ii) Model or Type Number

- (iii) Serial Number
- (iv) Month and year of the manufacture
- (v) I-V curve for the module
- (vi) Peak Wattage of the module at 16.4 volts
- (vii) I_m , V_m and FF for the module

IV MOTOR PUMP-SET

The SPV water pumping systems may use any of the following types of motor pump sets:

1. Floating Submersible pump set
2. Submersible motor pump set

The “**Motor Pump Set**” should have a capacity in the range of **2 HP to 7.5 HP** and should have the following features:

1. The motor is of 2-7.5 HP having brushes less in case of D.C. Motor Pump Sets. The suction and delivery head will depend on the site specific condition of the field.
2. Submersible pumps could also be used according to the technical need of the particular case.
3. The suction/ delivery pipe (GI/HDPE), electric cables, floating assembly, civil work and other fittings required to install the system.
4. The following details should be marked indelibly on the motor pump set
 - a) Name of the Manufacturer or Distinctive Logo.
 - b) Model Number.
 - c) Serial Number.

The approval of outsourced pump would be short listed on the basis of performance data/ specifications submitted by the firm.

V. MOUNTING STRUCTURES AND TRACKING SYSTEM.

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.

The structure design (along with the civil work) declared by the manufacturer should technically be full proof/ sufficiently strong against the prevailing wind load.

The manufacturing firm will be fully responsible for any damages caused by high wind velocity within guarantee period. Structural design and drawing should be duly approved/ recognized by any Engineering Institute for this project. The parameters of prevailing wind speed, soil conditions, load, and upward lift should be taken care of while preparing the design and the same is required to be mentioned on design. Static structures may also be provided to specific conditions and the demand of beneficiary.

However, manufacturer/ supplier shall ensure that mounting structure is efficient, strong enough to sustain load and is capable against high wind velocity.

VI. ELECTRONICS AND PROTECTIONS

1. Maximum Power Point Tracker (MPPT) should be included to optimally use the Solar panel and maximize the water discharge.
2. Inverter could be used, if required, to operate an A.C. Pump.
3. 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. OTHER ASSESSORIES:

ON/OFF SWITCH

A good reliable switch suitable for DC / AC use is to be provided with the motor pump set.

Sufficient length of cable should be provided for inter-connection between the PV array and the motor pump set.

VIII. PERFORMANCE SPECIFICATIONS AND WARRANTY

Solar PV Water Pumps with PV module capacity in the range of 1500 Watt to 7500Watt may be installed on a suitable bore-well / open well / Water Reservoir / Water stream etc.

Indicative Performance Specifications for the Shallow and Deep well SPV Water Pumping Systems are given in the Annexure.

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 pumps shall be warranted for 3 years and after sale service should be 10 years atleast. 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 farmer friendly Punjabi/English 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.