

Technical specification for Solar Lift Irrigation:

Technical Specifications and Scope of Works	
1. Solar Photovoltaic (PV) Module	
S.N.	Specifications and Standards Required
1	Manufacturer's experience in manufacturing PV modules: At least 5 years
2	The manufacturer shall have: ISO 9001, ISO14001, OHSAS18001/ISO45001 Certificates
3	Peak Power of Individual Module at STC: At least 350 Watt-peak
4	PV Array Capacity: As per Water discharge and head of system.
5	PV Module Efficiency: At least 21%
6	Cell type: crystalline Silicon (Poly or Mono)
7	Power Tolerance: 0 to +3%
8	Fill Factor: At least 75%
9	PV modules should be designed to work with maximum system voltage of 1000 VDC or 1500 VDC depending on configuration of the PV array.
10	The cable connected from the PV module to the Combiner box must be of copper multi-strand, PVC insulated and UV resistant. The cable shall be provided with a minimum cross section of 4.0 mm ² with standard PV module connectors (e.g. MC4) provided by the same manufacturer.
11	Degree of Protection of Junction Box: At least IP67 rated according to IEC 60529.
12	Operating Temperature: Minimum range of -40°C to +85°C
13	The installer must provide an authorization letter, signed and stamped stating warranty period, project name and size of the PV module.
14	The manufacturer has to confirm the following warranties: Product Warranty: >=10 Years Power Output Warranty: First Year: >= 97% of STC power; 10 Years: >=90% of STC power 25 Years: >= 80% of STC power and linear warranty <=0.8 per year
15	Local Certification requirement: Certificate of PV Module issued by Renewable Energy Test Station- RETS (PIT Certificate and RST Certificate)
16	International Certification: IEC 61215-1:2016 or IEC 61215-1:2021, IEC 61215-2:2016 or IEC 61215-2:2021, IEC 61730-1:2016, IEC 61730-2:2016 and IEC 62804-1:2015 The test certificates must be provided. The Test Certificates from IEC accredited independent laboratory must be provided. The PV Module must be certified by Certification Body Testing Laboratory (CBTL) or Renewable Energy Testing Laboratory (RETL) or National Certification Body (NCB) or Renewable Energy Certification Laboratory (RECL) enlisted in the IEC website or IECRE website. The enlisted CBTL or RETL or RECB or NCB must have Scope of PV Module Testing PV Module Testing for IEC 61215, IEC 61730. [NOTE: Bidder and Manufacture shall provide a flash test report of the PV module upon the request of employer.]

17	<p>The Datasheet and Name Plate Information of PV Module must comply as per EN 50380: marking and documentation.</p> <ul style="list-style-type: none"> • Nominal Power (Wp) • Name of the manufacturer • Brand, Model and Type • Maximum power point voltage (Vmp) • Maximum power point current (Imp) • Open circuit voltage (Voc) • Short circuit current (Isc) • Maximum system voltage (V)
18	All PV modules installed in the project must be of the same type, same model, same power rating and from the same manufacturer.

2. Support Structure for PV modules & fencing

S.N.	Specifications and Standards Required
1	Tilt angle and orientation: Optimum PV production angle, oriented towards south.
2	The support structure design and foundation or fixation mounting arrangements shall consider all static and dynamic loads suitable for site. The support structure design and foundation or fixation mounting arrangements must withstand wind speed up to 170 Km/hr.
3	<p>The PV module structure must be made of MS hot dip galvanized suitable sections of rectangular tubes, angles and channels. The minimum standards to be followed are:</p> <p>Vertical leg (Main leg): Minimum 80mmx40mmx3mm Rectangular Hollow Section Rafter: Minimum 80mmx40mmx2mm Rectangular Hollow Section Purlin: Minimum 80mmx40mmx2mm Rectangular Hollow Section Column bracing or supporting bracing: Minimum 40mmx40mmx5mm angle Base plate: Minimum 200mmx200mmx6mm</p> <p>The horizontal spacing between two vertical legs must not exceed 2.0 meters as per load conditions. The PV array must be designed with a cross section with maximum 2 numbers for vertical placement. There must be a minimum of 25mm uniform spacing/gap between the adjacent PV modules. The minimum thickness of galvanization must be at least 85-microns throughout the surface. The producer should provide a certificate of 85- micron galvanization upon the employer's request.</p>
4	The support structure shall be installed in such a way that PV array shading is minimized as much as possible considering site condition.
5	The minimum clearance between ground level and bottom edge of the PV modules or arrays must be at least 80 cm.
6	Stainless Steel (SS304) or Galvanized nuts, bolts, washers must be used for fixing PV modules with the structure and the structure members. In case of welded structure, the galvanization must be done after the fabrication work. No welding will be allowed after establishing the structure at site.
7	The foundation type of solar PV array mounting structure shall be Concrete type. The foundation shall be minimum 0.8-meter deep with 0.3m(L) x 0.3m(B) size with 0.3m thick stone soling with sand filling and 0.3m(L) x 0.3m(B) x 0.8m(H) pillar in 1:1.5:3 PCC with 0.3m pillar above ground level.
8	Chain link fencing of 10 SG wire mesh (3"x3") nut bolt mounting on Iron Angle Post of 40mm*40mm*5mm size at interval of 2m center-to-center, of height 2.0 meter fixed and on PCC 1:2:4 concrete base of 0.3m (L) *0.3m (B)*0.5m (H) with provisioned suitable entrance for solar array including materials, transportation and workmanship

3. Combiner PV Box and Accessories

S.N.	Specifications and Standards Required
1	The manufacturer of all components of PV combiner box shall have: ISO 9001, ISO 14001 Certificates
2	Combiner box accessories shall be compatible with the maximum DC system voltage 1000V or 1500V (depending on configuration of the PV array).
3	Operating temperature: -25°C to +55°C
4	Permissible relative humidity: 0 - 95%
5	Degree of Protection: At least IP65 according to IEC 60529. The enclosure must be UV resistance.
6	The DC combiner box installation must be protected from direct rain, sun and dust. The Combiner box must be suitable for mounting on the PV module support structures.
9	The PV Combiner box must be provided with copper bus bars with suitable termination blocks.
10	The PV Combiner box must be provided with a hinged door and EPDM rubber gasket.
11	All incoming/outgoing cables must be connected and sealed properly (use of cable glands, copper cable lugs, cable ties are mandatory).
12	The PV Connectors must be provided with a degree of protection of at least IP67 according to IEC 60529.
13	The PV combiner box must have a DC breaker and the breaker must comply with IEC 60947-2.
14	The combiner box must have appropriately sized DC Surge Protection Device (SPD).

4. Cable and accessories

S.N.	Specifications and Standards Required
2	The manufacturer shall have: ISO 9001, ISO 14001 or Nepal Standard (NS)
3	The cable sizes shall be selected considering the power loss, current carrying capacity, voltage drop, ambient temperature, type of conduit, number of conductors in conduit and the period of short circuit to meet the anticipated currents.
4	Cable and connectors (PV array to Controller/ Pump)
4.1	The PV cable must be specific to PV application with double insulation layers. It must be sized to allow a current up to 1.25*Isc apart from derating factors related to temperature.
4.2	The PV string cable must be copper multi-strand, PVC insulated and ozone and UV resistant according to EN 50618. The string cable must comply with IEC 62930 or EN 50618.
4.3	The cable from Combiner Box to Pump/Controller can be either multicore or single core, copper multi-strand XLPE insulated. These cables shall be selected with an insulation voltage level applicable to the system voltage for which they are used and ampacities suitable for the load being served.
4.4	PV Cable must be Class 5 in accordance with IEC/EN 60228.

4.5	PV cable insulation must be rated for normal temperatures between - 40°C to 90°C in accordance with IEC 62930/EN 50618.
4.6	Maximum DC voltage (Rated Voltage) : 1500 V/Max (IEC)
4.7	The allowable voltage-drop from PV module or PV array to pump controller to pump must be less than 1%. (Must show wire size selection)
4.8	All external wiring, cabling, insulation material and junction boxes must be UV-resistant and terminals protected against dust and moisture.
4.9	The connectors used to form PV strings shall be compatible with the connector of PV modules. The connectors shall be designed according to maximum current flow in the circuit.
4.1	The outdoor cables from PV array to Controller/Pump should be fitted with adequate size UV resistant conduit.
4.11	PV cable should be of Safety Class II

5. Pump and Pump Controller

S.N.	Specifications and Standards Required
1	Manufacturer's experience in manufacturing water pumps must be at least 5 years
2	The manufacturer shall have: ISO 9001, ISO 14001, OHSAS 18001/ISO 45001 Certificates
3	The installer must provide authorization letter, signed and stamped stating 2-years warranty period, after sales services scheme for the pump set and Pump Controller along with project name and size of pump.
4	Pump Type: Submersible/Surface. Pump can be centrifugal or positive displacement of progressive cavity.
5	Motor type: brushes or brushless DC motor.
6	Combined Efficiency (Motor + Pump) must be at least 50%, The pump performance curve (flow vs. power at rated head) must be provided.
7	Efficiency: Efficiency of MPPT must be at least 95%.
8	The operating temperature must be in the range of 0°C to +50°C
9	The pump controller or pump set must include protection against dry-run, insufficient power, Reverse Polarity, Short circuit, Over temperature, Surge.

10	<p>One of the products of the Pump Manufacturer must have at least one of the following Certificates of Conformity, issued by an IEC-accredited laboratory, provided in accordance with:</p> <p>IEC 62253:2011 - Photovoltaic pumping systems - Design qualification and performance measurements.</p> <p>IEC 61000-6-1:2016- Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial, and light-industrial environments.</p> <p>IEC 62109-3:2020-Safety of power converters for use in photovoltaic power systems - Part 3: Particular requirements for electronic devices in combination with photovoltaic elements</p> <p>IEC 60335-1:2020- Household and similar electrical appliances - Safety - Part 1: General requirements</p> <p>The Solar Pump must be certified by Certification Body Testing Laboratory (CBTL) or Renewable Energy Testing Laboratory (RETL) or National Certification Body (NCB) or Renewable Energy Certification Body (RECB) enlisted in the IECEE website or IECRE website.</p> <p>A local importer must provide a document of agreement between the local importer and the principal pump manufacturer, signed and stamped by an authorized person stating the warranty period for their pump.</p> <p>Catalogue and technical datasheet of Pump and Pump Controller.</p>
11	Material: The pump must be manufactured with non-corrosive materials. Ceramic or equivalent non-corrodible materials must be used for bearings. Pump body, rotors and impellers must be made of stainless steel with a minimum grade of AISI 304 or higher.
12	Pump and Pump Controller must be from the same manufacturer.
13	The pump set (Pump and Motor) must have at least IP68 protection for Submersible Pump and at least IP65 for Surface Pump according to IEC 60529.

6. Earthing and lightning protection system	
S.N.	Specifications and Standards Required
1	The lightning protection system must comply with IEC 62305.
2	Air Termination System
2.1	Manufacturer's experience in manufacturing Lightning Protection System: At least 5 years
2.2	The manufacturer shall have ISO9001, ISO14001 Certificates
2.3	The material of the air-terminal rod shall be of Copper having length 1.0 meter above the highest point of the PV array to be protected with minimum diameter of 10 mm. Alternatively, Early Streamer Emission (ESE) type Air Terminal of Stainless-Steel type having international standard IEC 62305-3'2010 or NFC 17- 102/2011 will be acceptable.
2.4	The air terminal must be rated to withstand a discharge current capacity of 200kA.
2.5	The air-terminal rod (s) shall be installed on a separate concrete base as a free-standing structure.
2.6	The separation distance between the air terminal and the closest metallic part of the PV array must be as per IEC 62305.
2.7	The air-termination system may have joints. Where joints are necessary, they shall be mechanically and electrically effective and shall be made to exclude moisture completely. The joints may be clamped, bolted, crimped, riveted, or welded. With overlapping joints, the length of the overlap should not be less than 20 mm for all types of conductors.
2.8	The air-terminal shall allow at its lower extremity a direct connection of the rod to the down conductor i.e. a bare copper cable of minimum 50 mm ² cross section.
2.9	Each air-terminal shall be connected through down conductors to the earthing electrodes to be installed at the ground level.

3	Down Conductor:
3.1	The down conductor should be of a bare copper conductor of 50 mm ² cross section connecting the lower extremity of the air-terminal section to the earthing electrode of the earth-termination system.
3.2	At ground level, this cable shall be buried at least 0.6 meters.
3.3	The down conductor must be connected to the earth electrode with the use of copper compression lug. It shall be ensured that compatible material shall be used to avoid galvanic corrosion.
4	Earth Termination System:
4.1	Copper Rod Size: 1.5 meters length x 18mm diameter
4.2	The earth-termination system shall be installed so that the final earth resistance (resistance between the earth-termination system and the ground) does not exceed 10 Ohms (low frequency measurements).
4.4	Earthing inspection pit of earthing electrode shall be made of solid concrete with minimum dimension of 300 mm x 300 mm x 300 mm. Cover shall be marked with word "EARTH" or acceptable earthing marking.
5	The technical datasheet of the Air Termination System, Down Conductor and Earth Termination System must be provided.
6	Surge Protection Device (SPD):
6.1	The SPD shall have status indication.
6.2	The supplied SPD unit shall be compatible in mounting on DIN Rail Channel.
6.3	The SPD must be of DC type;
6.4	For PV Array Capacity (up to 1200 Wp)
	• Type of SPD: Type 2
	• Rated DC Voltage: 250 VDC
	• Maximum Continuous Operating Voltage: 320 VDC
	• Voltage Protection Level at In: 0.8kV
	• Nominal Discharge Current In (8/20): 10kA
	• Maximum Discharge Current In (8/20): 20kA
6.5	For PV Array Capacity (>1200Wp to 3000Wp)
	• Type of SPD: Type 2
	• Rated DC Voltage: 600VDC
	• Maximum Continuous Operating Voltage: 670 VDC
	• Voltage Protection Level at In: 2.8kV
	• Nominal Discharge Current In (8/20): 20kA
	• Maximum Discharge Current In (8/20): 40kA
6.6	PV Array Capacity (>3000Wp)
	• Type of SPD: Type 2
	• Rated DC Voltage: 1000VDC
	• Maximum Continuous Operating Voltage: 1100 VDC
	• Voltage Protection Level at In: 3.8kV
	• Nominal Discharge Current In (8/20): 20kA
	• Maximum Discharge Current In (8/20): 40kA
6.7	The SPD must comply with IEC 61643-31:2018 or EN 50539-11:2013;
6.8	The technical data sheet of SPD must be provided.

Recommended Solar Irrigation Electromechanical Components

S.N.	Minimum Water Discharge Liters Per Day	Minimum Suction/Vertical Head (meter)	Minimum Solar PV Module (Wp)	Minimum Solar DC Pump Capacity (hp)	Solar DC Pump Type
1.	70,000	7	1300	1	Surface/Submersible
2.	70,000	10	2100	2	Surface/Submersible
3.	70,000	20	2500	2	Submersible
4.	100,000	20	3700	3	Submersible