

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 20%
6	Cell type: crystalline Silicon (Poly or Mono)
7	Power Tolerance: 0 to +3%
8	Fill Factor: At least 75%
9	PV module 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 Combiner box must be of copper multi-strand, PVC insulated and UV resistant. The cable shall be provided with 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 authorization letter, signed and stamped stating warranty period, project name and size of the PV module.
14	The manufacturer has to confirm 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 IECEE website or IECRE website. The enlisted CBTL or RETL or RECL or NCB must have Scope of PV Module Testing. [NOTE: Bidder and Manufacture shall provide flash test report of the PV module upon the request of employer.]

	The Datasheet and Name Plate Information of PV Module must comply as per EN 50380: marking and documentation. <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)
17	All PV modules installed in the project must be of 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	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: Vertical leg (Main leg): Minimum 80mmx40mmx4mm 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 The horizontal spacing between two vertical legs must not exceed 2.0 meters as per load conditions. The PV array must be designed with cross section with maximum 2 numbers for vertical placement. There must be 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. Producer should provide certificate of 85- micron galvanization upon employer's request.
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 (2"X2") nut bolt mounting on Iron Angle Post of 40mm*40mm*6mm size at interval of 1.5m center-to-center, of height 2.0 meter fixed and on PCC 1:1.5:3 concrete base of 0.3m (L) *0.3m (B)*0.5m (H) with provisioned suitable entrance for solar array including materials, transportation and workmanship
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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 hinged door and EPDM rubber gasket.
11	All incoming/outgoing cables must be connected and sealed properly (use of cable glands, copper cables lugs, cable ties are mandatory).
12	The PV Connectors must be provided with degree of protection of at least IP67 according to IEC 60529.
13	The PV combiner box must have 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 cables 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 $1.25 \times I_{sc}$ 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.
4.11	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

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 2.5-years warranty period, after sales services scheme for the pump 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: DC Motor
6	Combined Efficiency (Motor + Pump) at designed head and discharge must be at least 50%.
7	The operating temperature must be in the range of 0°C to +50°C
8	The pump must have protection against dry-run, over voltage and under voltage, overload and over temperature. The pump shall meet safety standard requirements according to EN- 809 and comply with IEC 60034-1.

	The submersible pump must comply with at least one of the following Certificates of conformity (CoC): IEC/EN 62253, IEC/EN 61000-6, IEC/EN 62109, IEC/EN 60335. The test certificate/report from IEC/EN accredited independent laboratory must be provided. The Pump must be tested/certified by certification body testing laboratory (CBTL) or Renewable Energy Testing Laboratory (RETL) or Renewable Energy Certification Body (RECB) or National certification body (NCB) enlisted in the IECEE or IECRE website.
9	The surface pump must comply with at least one of the following Certificates of conformity (CoC): IEC/EN 62253, IEC/EN 61000-6, IEC/EN 62109, IEC/EN 60335. The test certificate/report from IEC/EN accredited independent laboratory or National Accreditation Board for Testing and Calibration Laboratories (NABL) must be provided. The pump must be tested/certified by Certification Body Testing Laboratory (CBTL) or Renewable Energy Testing Laboratory (RETL) or Renewable Energy Certification Body (RECB) or National Certification Body (NCB) or NABL accredited laboratories.
10	<p>Material: The pump must be manufactured with non-corrosive materials. Ceramic or equivalent non-corrode materials must be used for bearings.</p> <p>For Submersible Pump, Pump body, rotors and impellers must be made of stainless steel with a minimum grade of AISI 304 or higher.</p> <p>For Surface Pump, rotors and impellers must be made of stainless steel with a minimum grade of AISI 304 or higher.</p>
11	Pump and Pump Controller must be from the same manufacturer.
12	The pump set must have at least IP68 protection for Submersible Pump and at least IP65 for Surface Pump according to IEC 60529.

6. Pump Controller	
S.N.	Specifications and Standards Required
1	The manufacturer shall have: ISO 9001, ISO 14001, OHSAS 18001/ISO 45001 Certificates
2	The installer must provide authorization letter, signed and stamped stating 2.5-years warranty period, after sales services scheme for the pump controller along with project name and size of pump controller.
3	Pump Controller efficiency: $\geq 95\%$
4	The pump controller must be of Maximum Power Point Tracker (MPPT) type.
5	The design of PV array string voltage must be within the manufacturer's recommended MPPT input voltage range (PV array string voltage shall be greater than 10% of MPPT minimum input voltage and lower than 20% of MPPT maximum input voltage). Installer must provide calculation of array/string voltage and verify that the array input voltage range is compatible with controller's MPPT range.
6	Pump Controller and Pump must be from the same manufacturer.
7	The pump controller must have at least IP65 protection according to IEC 60529.
8	The pump controller must include inbuilt protection against dry run, PV reverse polarity, PV short circuit, over temperature, over current and surge protection.
9	The operating temperature must be in the range of 0°C to $+70^{\circ}\text{C}$
10	The controller should have display of operation, serial communication RS232/RS485/Modbus/Wifi/Bluetooth/USB ports.
11	The controller system must include data logging facility, remote monitoring (with mobile App or Web-portal).
12	The technical data-sheet of Pump Controller must be provided.

7. Water Flowmeter

S.N.	Specifications and Standards Required
1	The manufacturer shall have ISO 4064, ISO 9001 certificates, Class- B comply.
2	The flow meter must have 5 years warranty
3	Flow meter shall be suitable for outdoor installation and capable of working in the ambient temperature from 0°C to 50°C and water pressure of 16 Bar
4	Works on volumetric rotary piston principle of measurement.
5	Meter must have easily readable, clear, liquid sealed of minimum 6 - digit counter
6	Body or the meter shall be made of epoxy powder coated cast iron with plastic rotary piston meter with liquid sealed mechanical transmission/flow with direct reading counter, high reliability, high precision.
7	Corrosion-resistant materials shall be employed throughout and parts which are in contact with flowing water.
8	Unit of measurement shall be in cubic meter.
9	HDPE pipe used in the system must be at least PN6

8. 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 PV array must be as per IEC 62305.
2.7	The air-termination system may have joint. 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 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) <ul style="list-style-type: none"> • 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) <ul style="list-style-type: none"> • 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) <ul style="list-style-type: none"> • 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 datasheet of SPD must be provided.

