**Technical Specifications**

Water Wells Solar Systems Installation

PART A ( PV and Electrical )

1. PV Modules:
* The capacity of the solar modules should be **at least** 50 % greater than AC motor pump.
* Module capacity should not be less than 330 W @STC
* The solar modules should be designed to run near the MPPT
* Type of cell: Mono Crystalline, 5 busbar technologies
* The PV manufacturer should be approved as tier 1.
* Module efficiency: should not be less than 17.5%
* No of cells in each panel: 72 per panel.
* Tolerance of maximum power rating: 0-5 W
* The PV modules junction box must be IP67
* Should be supplied from approved tier 1 manufactures only.
* Module Voltage: Not less than 1000 VDC;
* Operating temperature: -40°C to 85°C
* Temperature Characteristics: P max: -0.42% /C° or less
* VOC: -0.31% /C° or less; 38VOlt
* Nominal operating cell temperature (NOCT) : 45 ±2°C.;
* Weather proof DC rated MC4 connector. Fully Secured, not allowing for any loose connections.
* High transmittance tempered glass: Minimum thickness of 4.0 mm;
* Must conform to IEC 61215, 61730, 61701, and UL 1703.TUV, UL certificates or equivalent;
* Certificates and Data sheet of PV module that contains the P-V & I-V Curves, all electrical and mechanical Data, Dimensions, Module area should provide by bidder;
* Performance warranty: Nominal power output 90% for 10 years, 80% for 25 years;
* Product warranty shall be at least 25 years.
* Should bt the solar array from the class A
1. Solar Pumping Inverter Controller AC/DC

The solar pumping drive is required, the drive should have a long lifetime, low maintenance cost, inbuild MPPT + VFD (Variable Frequency drive). The drive rating should be 1.5 X AC pump rating and it shall follow below features:

* Three phase output, voltage range 380-420 V;
* Efficiency: Not less than 95%;
* Output Frequency: 50H±3%;
* Enclosure class should be not less than IP55.
* Maximum input voltage Voc): not less than 770 VDC;
* The system should be designed to run near its MPPT range;
* Operating temperature: up to 45 °C;
* Such device should have built in data loggers
* The device shall allow hybrid operation with external power source, where solar power should be configured as the primary power source;
* soft start, V/F stable speed control during solar radiation changes, adjustable auto/ manual start in early morning, auto wakeup after adjustable hibernation time in cloudy days, o inputs for pressure switch and water level sensor to protect the pump against dry running and tank full water or closed pipeline (high pressure)
* Display: LCD Screen display with Cover + LED status indicator
* Protection: Over-Voltage, pump Over-Current, pump Over-Load, Over-Temperature, pump Phase Loss, pump Short-Circuit, ground fault, solar low power, DC Input Anti-reverse, AC output unbalance (3Phase);
* Display content: PV status (Current, Voltage, Power, Energy), AC input voltage, AC output voltage, Load, Running Status, RPM, and Frequency.
* Product warranty should be at least 2 years.
1. PV Combiner Box

The PV combiner box shall be used to combine the multiple DC input to one output, and it shall comply with the following specifications as minimum.

* Enclosure materials: Coated metal with lockable door.
* Enclosure protection: IP65.
* Number of input circuit: total number of strings in addition to 2 spare inputs.
* DC fuse rating for each string:1000V, 150 A.
* DC output circuit: In accordance with the maximum current X 1.25, 1000 VDC breaker;
* Built in surge protection device;
* Anti-backflow diodes.
* Operational Environment Temperature: -30 °C ~+70 °C;
* Product warranty shall be at least 2 years.
* Supplied with SPD protection system and special grounding with main circuit breakers, made of environmental resistant material and solar radiation, equipped with sealed shutter and safety adhesive, and connections of pure copper
1. System Cables:

Cables should be sized in accordance with IEC 60364-5-52 standard, bidders should submit cable sizing, and voltage drop calculations taking into account that the maximum voltage drop should be no more than 3% for each side (AC and DC);

**4.1 3phase, AC Submersible Pump Cable**

* Voltage rating:450/750VAC, Type of Conductor: copper, flexible, finely multi stranded, Insulation: black poly chloroprene, HO7RN -F or equivalent material

**4.2 DC Cable (From array to Combiner Box)**

* Made of double insulation material and jacket, TUV certified, 1000VDC, Sheath colours: black, red, Type of Conductor: tinned copper, flexible, finely multi stranded

**4.3 DC Cable (From Combiner Box to inverter)**

* Made of double insulation material and jacket, TUV certified, 1000VDC, Sheath colours: black, red, type of Conductor: tinned copper, flexible, finely multi stranded
	1. **Water level Cable with Sensor**
* Submersible cable, 1 ×1.5 mm2 mm, double sheath.
* Dry running electrodes
1. Cable Laying
* All above ground cables shall be installed in perforated galvanized cable tray with cover. Cable tray shall be supported with concrete blocks in appropriate intervals or on the mountings structure.
* Under-ground cables shall be installed in cable trench 60 cm depth with PVC Sch#40 pipes as per drawings.
* 50% spare for future expansion.
1. Earthing and Lightning Systems

**6.1 AC and DC Earthing**

* All PV modules shall be grounded in accordance to the manufacturer instruction
* Each array structure of the PV modules should be grounded properly.
* All metal casing/shielding of the system and its components should be thoroughly grounded.
* Earthing System shall be comply with IEC/BS EN 62305-3.
* Earthing installation in accordance with the IEE Wirinig regulations BS 7671.
* Earthing clamps shall be used
* Grounding and lightening protection equipment shall include SPD, earth pits and rods
* Grounding resistance should be not more than 5 ohm.

**6.2 Lightning System**

* Lighting arrester should be provided.
* Lightning arrester shall be installed with height to protect all PV arrays.
* Lightning System shall be comply with IEC/BS EN 62305-3.
* Minimum height of lightning arrester is 8 m.
* System resistance should be not more than 5 ohm.

PART B (Mechanical)

1. Submersible Pump and Motor:

 8.1 Pump

* Submersible pump Mixed flow multi -stage separate type, AC 3PH motor type, the motor pump Sets should be used for the solar PV, Starting compatible with AC VFD operation, bidders shall indicate manufacture, country of origin and model. It shall follow below features as minimum:
* Pump Efficiency at Duty Point: Not less than 80%, For wells that has TDH more than 120 m and Flow rate not less than 7.56 m3/hr Efficiency at Duty Point: Not less than 80%
* Clearance (well dia-pump max dia with cable) = not less than 40 mm;
* Casing (Pump Bowl ), Impeller , Wear Rings, Pump delivery and Housing , Check valve (None Return Valve) , Inlet strainer should be comply with: (AISI 304 or equivalent) or higher specification materials.
* Shaft and coupling, Shaft sleeve, Bearing bush, Guide bearing, Screw, stud, nut, washer.. etc should be comply with: (AISI 304 or equivalent) or higher specification materials.
* Maximum allowable sand: 100 gr/m3.
* Coupling: according to NEMA.

8.2 Motor

* The motors shall be Rewindable, insulation rating is compatible with AC VFD operation
* Rated Voltage:380/412VAC
* Insulation Material and Class, PE2+PA, F or H
* Ambient water temp:45 C°
* IP: not less than 68
* Motor Efficiency: Not less than 80%
* Motor Speed:1850rpm – 2850rpm
* **Cooling sleeve** suitable for well internal diameter
* Shaft, Motor Sleeve, Motor Housing, Diaphragm cover, bolts, Nuts, Studs, screws Washers etc. should be comply with: (AISI 304 or equivalent) or higher specification materials.
* Shaft Seal (Mechanical Seal) Tungsten carbide/ceramic- Diaphragm Nitrile Rubber Radial Bearing (Guide Bearing) Graphite or superior Axial Bearing (Thrust Bearing) Graphite/ S.S Pads superior, Rubber Parts NBR or equivalent
* Product warranty should be at least 2 years.
1. Well Raiser
	1. UPVC Water Delivery Pipes in well:

**UPVC 2” submersible column pipe 2”** depending on the depth of wells to, accessories for uPVC pipes of the same make of pipes; such as **Spacers**, **Couplers**, **Tees**, **Junction boxes** of required ways **adhesive** to make all **joints rigid**.

**Black pipe** shall not be used.

* Pipe type: Rigid UPVC conduits.
* Quantities: as well required.
* Pressure: standard 20 to 30 Kg/cm2.
* Temperature: Properties don’t change up to max. ambient temp. 50C.
* Surface finishing should be extremely smooth for reduces the hydraulic friction.
* Non- Toxic & Energy Saver Pipe.
* Leak Proof, Strong & Durable Pipes.
* Weather & Impact resistant.
* Easy to install.
* Non- corrosion & Wrinkle Free.
* Light weight & WIRELOCK For Safety.
* Strong & high friction threads to prevent opening even on constant forward and reverse torque generated by starting and stopping the pump.
* Standard: EN / DIN / GOST / ASTM or equivalents.
* High mechanical strength for immersed and open application.
* Specially fabricated for submersible pumps.
	1. Vertical Raiser Non-return Valve (Check Valve).
* Nominal Diameter (DN): Shall be selected according to raiser line diameter.
* Nominal Pressure (PN): Shall be selected according to the TDH of the system.
* Body Material**: Stainless steel 304** or higher grade
* Connection Type: According to the raiser pipes.
* Standard: BS5153 or Equivalent
* Complete with all required accessories
1. Well Head Piping Equipment:

Piping equipment shall include any required fittings and materials for proper installation or existing system modification such as elbows, tees, sockets, flanges, piece of pipes, ..etc with high quality and high rating, piping equipment shall be installed inside valve chamber.

* 1. Mechanical Water Flow Meter
* Inline, Flanged, Magnetic type, Dray dial, turbine flow meter with all needed accessories such as threaded flanges, gaskets and bolts 2 inch.
* Nominal Diameter (DN): Shall be selected according to output pumping line diameter.
* Nominal Pressure (PN): Shall be selected according to output pressure on the beginning of the pumping line.
* Body: Cast Iron
* Standard: EN14154, ISO4064
* Transient Flow Qt : Shall be less than 50% of Pump flow rate.
* Accuracy: ±2% of Nominal flow
* Maximum dial indication: 999999
* Measuring Units: cubic meter m3
	1. Horizontal Pumping line Non-return Valve.
* Nominal Diameter (DN): Shall be selected according to pumping line diameter 2inch
* Nominal Pressure (PN): Shall be selected according to output pressure on the beginning of the pumping line.
* Connection Type: Flanged.
* Type: Swing
* Standard: BS5153 or Equivalent
* Body Material: Cast Iron (Gg25)
* Spindle: Stainless steel
* Complete with flanges, gaskets, bolts and nuts
	1. Gate Valve
* Nominal Diameter (DN): Shall be selected according to pumping line diameter 2inch
* Nominal Pressure (PN): Shall be selected according to output pressure on the beginning of the pumping line.
* Connection Type: Flanged.
* Standard: BS BS6163 or Equivalent.
* Operator: Hand Wheel
* Resilient Seated.
* Body Material: Cast Iron(Gg25)
* Stem: Stainless Steel
* Complete with flanges, gaskets, bolts and nuts
	1. Analogue Pressure Gauge.
* Reading range: Shall be specified according to the pressure on the installation point.
* Process connection: NPT connection 1/2" or 1/4".
* Pressure gauge should be equipped with isolation Stainless steel 1/2 inch Ball valve of the same pressure rating.
* Casing: Stainless steel, 2 inch
* Stiffeners shall be holed for lifting purposes

PART C ( Safety and Security )

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| 1. Security Fence
* Metal Fence with Barbed wires as per in the shop drawings and the technical specifications, the work includes the following:
* • Provide materials and construction of 2.50-meter-high chain Link Fence made from galvanized /or anticorrosion iron Post 50 & 65mm DN that shall be embedded in concrete footings (30x30x60) cm C20 and pressed at end. The panel width is 3 meter. The chain link 50mmx50mm opening and 3.15mm dim the work includes installing of three lines of Barbed Wires above.
* • Double leaf gate 2m in width, poles DN 65mm 2.5-meter height with BRC link 75mmx75mm spaces with all requirement.
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