



HARYANA RENEWABLE ENERGY DEVELOPMENT AGENCY (HAREDA)

(DEPARTMENT OF RENEWABLE ENERGY, HARYANA)

Akshay Urja Bhawan, Sector-17, Panchkula

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Rate contract No ...HAREDA/2016-17/ 2198-2201 Dated: 08.08.2016

To

1. M/s Premier Solar systems Pvt Ltd.
3rd Floor, V.V. Tower, Karkhana,
Main Road, Tirumulgherry, Secunderabad, 500009
Ph- 040-27744415/16, Mob- 9876103931, E-mail- tenders@premiersolar.co.in
2. M/s CLARO Energy Pvt. Ltd,
91, DSIDC Sheds, 2nd Floor, Okhla Industrial Area, Phase-2,
Scheme-1, New Delhi-110030
Ph-01140571616, Mob- 9810448866, E-mail- sales@claroenergy.in
3. M/s Shakti Pumps (I) Ltd.,
Plot No- 401,402, & 413, Industrial Area, Sector-III,
A Pithampur-454774, Distt- Dhar, Madhya Pradesh (MP)
Ph- +91-7292 410500, Mob- 7389919752, info@shaktipumps.com
4. M/s Tata Power Solar System Ltd.
No-78, Electronics City, Hosur Road
Bangalore
Ph- +91-120-6102000, Mob- 9814023509, email- infosolar@tatapower.com.

Subject- RATE CONTRACT FOR SUPPLY, INSTALLATION AND COMMISSIONING OF 2 HP DC SURFACE TYPE PUMPS, 2 HP DC SUBMERSIBLE TYPE BOTH WITH 1800 WATT SOLAR ARRAY AND 5.0 HP AC SUBMERSIBLE TYPE PUMP SETS WITH 4800 WATT SOLAR ARRAY (Qty- 500 Nos).

- Reference:
- i. This office tender enquiry no. HAREDA/ Solar water pumping system /2015-16/01 dated 30/11/2015 and technically opened on 30.12. 2015 and financial opened on 10.02.2016.
 - ii. Your offer submitted against the said tender enquiry and subsequent last correspondence in the matter.

Dear Sir,

You are hereby informed that your offer for the supply, installation and commissioning of 2 HP DC surface type pumps, 2 HP DC submersible type and 5 HP AC submersible type pump has been accepted on rate contract by High Power Purchase Committee in its meeting held on 14.07.2016 at the rate given in **schedule-A** inclusive of all taxes with 5 years warranty of complete system including interface charge controller and with warranty of module for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years . This Rate Contract will be governed by the terms and conditions given in **schedule-B** and specification in **schedule-C** as under.

- i. This rate contract shall be valid up to one year from the date of issue i.e. up to 7.08.2017 or placing the work order for cumulative quantity up to 1.5 times of the tender quantity of 500 solar water pumps, whichever is earlier.
- ii. The technical specifications, terms and conditions if any left out in the schedule-B and C, shall be as per DNIT.



- iii. Please acknowledge receipt of this Rate Contract within a week's time from the date of issue by returning the second copy duly signed and stamped by authorized representative of your firm.
- iv. This Rate Contract contains 11 pages including this page.

Annexures:

1. Schedule "A" -Description of Stores, Prices, Duties/Taxes.
2. Schedule "B" -Terms & Conditions of the rate contract.
3. Schedule "C" - Technical specifications.

Sd-
Technical Advisor
For Director, Renewable
Energy Deptt and HAREDA

Encl: As above



Schedule-A

DESCRIPTION OF STORES, PRICES, DUTIES/ TAXES ETC.

S. No	Item	Description of Stores	Rates inclusive of all taxes with 5 years warranty of complete system including pump/motor and with warranty of module for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years (In Rs.)	Names of firms and make of their SPV modules and charge controller	State of billing	Approved for the supply of systems
1	2 HP DC surface type Solar water Pump with 1800 watt solar array as per specifications at schedule-C	Supply, installation and commissioning of 2 HP DC surface type Solar water Pumps with 1800 watt solar array	Rs.1, 84,950/- per system	M/s Premier Solar, Hyderabad Make of Modules- “Premier Solar ” Make of solar water pump – “Rotomag”	Haryana	100% of required quantity
2	2 HP DC submersible type Solar water Pump with 1800 watt solar array as per specifications at schedule-C	Supply, installation and commissioning of 2 HP DC submersible type Solar water Pump with 1800 watt solar array	2,35,000/- per system	M/s Claro Energy Pvt Ltd., Delhi Make of Modules- “PV power Tech” Make of pump - “Rotomag ”	Delhi	100% of required quantity
3	5 HP AC submersible type Solar water Pump with 4800 watt solar array as per specifications at schedule-C	Supply, installation and commissioning of 5 HP AC submersible type Solar water Pump with 4800 watt solar array	4,38,000/- per system	i. M/s. Shakti Pumps (i) Ltd, Dhar (MP) Make of Modules- “PV power Tech” Make of Controller/ inverter - “Shakti” Make of pump- “Shakti”	Madhya Pradesh (MP)	40 % of required quantity
				ii. M/s premier Solar Hyderabad Make of Modules-	Haryana	30 % of required quantity



				<p>“Premier solar ”</p> <p>Make of Controller/ inverter - “ Delta”</p> <p>Make of pump-Shakti</p>		
				<p>iii. M/s Claro Energy Pvt Ltd., Delhi</p> <p>Make of Modules- “PV power Tech”</p> <p>Make of Controller/ inverter - “ Schneider”</p> <p>Make of pump-Shakti</p>	Delhi	20 % of required quantity
				<p>iv M/s Tata power system Solar ltd, Banglore</p> <p>Make of Modules- “ Tata”</p> <p>Make of Controller/ inverter - “ ABB Ltd”</p> <p>Make of pump-Kirloskar</p>	Noida, UP	10 % of required quantity



Schedule -B

DETAILED TERMS & CONDITIONS FOR SUPPLY, INSTALLATION AND COMMISSIONING OF 2 HP DC SURFACE TYPE PUMPS, 2 HP DC SUBMERSIBLE TYPE BOTH WITH 1800 WATT SOLAR ARRAY AND 5.0 HP AC SUBMERSIBLE TYPE PUMP SETS WITH 4800 WATT SOLAR ARRAY.

1. SCOPE OF WORK

Supply, installation and commissioning of 500 nos. of Solar Water Pumping Systems of capacities 2.0 HP DC surface mounted pumps with 1800 watt solar array, 2.0 HP DC submersible type pumps with 1800 watt solar array and 5.0 HP AC submersible Pump sets with 4800 watt solar array at various locations in the State of Haryana on annual rate contract, as per the technical specifications given in schedule-C with five years warranty of the complete system(s) from the date of commissioned and PV modules used in the power plant must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years

2. PERFORMANCE SECURITY DEPOSIT

The successful tenderer shall have to deposit Security Deposit (SD) equivalent to **10% of the work order value within 30 days** from the date of issue of the work order. The EMD of such successful bidders shall be released on submission of SD in the shape of DD or Bank guarantee valid for a period of five year & six months. After the successful completion of the work order, the SD shall be treated as Performance Security Deposit (PSD) & shall be released on successful completion of the warrantee period of five years from the date of commissioning of the project/system. In case of delays, the validity of the SD/PSD will be extended by the firm failing which it will be encashed.

3. PAYMENT TERMS

The payments shall be made as per the following terms and conditions:

- a. **80% of the ordered value** after the supply of the complete system at site (O/o concerned ADC-cum-CPO or the place communicated by the concerned ADC-cum-CPO) supported with material receipt issued by PO/ APO of the concerned district and bill of material.
- b. **20% of the ordered value** after satisfactory installation & commissioning of the systems within 30 days after submission of Joint Commissioning Report (JCR), along with satisfactory performance report, duly signed by the district PO/APO, supplier and end user.

4. WARRANTY PERIOD

- (i) The Warranty period shall be 25 Years for the PV modules and 5 years for complete system from the date of commissioning of the system (s). The contractor shall rectify defects developed in the system within Warranty period promptly. The procedure to rectify the complaint/service to be provided during warrantee period is as follows :

During the warrantee period, the firm shall ensure proper functioning of the systems and complaint, if any, forwarded to the supplier against the system, will have to be attended within 7 days of forwarding such complaints. The procedure to rectify the complaints shall be as under:



- a) The notice through E-mail/hard copy to rectify the complaints shall be issued by the HQ/district officer/User to the supplier with copy to the HAREDA. This shall be followed by two reminders on 7 days intervals each. The district office shall maintain proper record of the complaints.
- b) Even after this, the complaints remain unattended the penalty @ Rs. 100 per day per system will be imposed from the expiry of 21 days & same will be deducted from the payment due to the supplier / out of the Performance Security Deposit/bank Guarantee. The firm if failed to repair/ replace the defective system within next 10 days after expiry of the earlier specified 21 days of forwarding of the complaint then concerned ADC-cum-CPO shall forward the case to the Director, HAREDA along with estimated expenditure for the replacement/ repair. Director, HAREDA may consider repairing / replacing such defective system on the cost of the supplier. **The firm who shall be penalized by revoking PSD/Bank guarantee shall deemed to be considered as unfit to participate in all the tenders floated by HAREDA in future and shall be treated as unsatisfactory performer.**
- c) If the whole PSD/ bank guarantee is utilized and the complaints are still pending then an online/registered notice will be sent to the firm to attend the complaint within 15 days.
- d) If the firm still does not attend the complaint within the above mentioned period then the firm may be blacklisted and a legal proceeding may be initiated against the firm for Breach the agreement.
- (ii) The supplier shall a f f i r m as per standards for quality that anything to be furnished shall be new, free from all defects and faults in material, workmanship and manufacture, shall be of the highest grade and consistent with established and generally accepted standards for material of the type ordered, shall be in full conformity with the specifications, drawing or samples, if any and shall if operable, operate properly.
- (iii) HAREDA/the consignee will have the liberty to get the sample for the item(s) supplied tested from any of the Govt. approved lab. at any time during the inspection or warranty period to ascertain the performance of the item(s) as per DNIT specifications. The cost of testing will be borne by the supplier.
- (iv) The Contractor in consultation with concerned District Officer will conduct training programme for users, focusing on main features, operation and maintenance of the systems.
- (v) The Contractor/supplier shall continue to provide spare parts after the expiry of warranty period at the users cost. If the contractor fails to continue to supply spare parts and services to users then HAREDA shall take appropriate action against the firm, if any complaint is received from the user(s).

5. TIME SCHEDULE, PENALTY/LIQUIDATED DAMAGES

- c. The systems will be **supplied, installed and commissioned** within **four months** time from the date of issue of work order. It shall be the sole responsibility of the supplier to plan in such a manner that pre-dispatch inspection, supply, installation & commissioning work is completed within the defined time period. The supplier shall also ensure to give Call for inspection within 90 days through email/Fax. Inspection



notice should be reached in the HAREDA office at **least 10 days prior** to the proposed date of inspection.

- a. The time for and date of delivery or dispatch stipulated in the order shall be deemed to be the essence of the contract, and should the contractor fail to deliver or dispatch any consignment within the period prescribed for such delivery or dispatch stipulated in the order, the delayed consignment will be subject to **2% penalty per consignment per month** subject to max. of 10% of the work order value recoverable on the value of the stores supplied. Once the maximum is reached, the "HAREDA" may consider termination of the contract. In case of non-payment by the contractor, recovery will be made from his bills or amount of Earnest money or security deposited with Director, HAREDA

6. INSPECTION OF MATERIAL

- (i) After receipt of call for inspection, the material shall be inspected by the Director, HAREDA or a committee authorized by him at firms premises or in exceptional cases at site and material shall be dispatched/erected after acceptance of the same by the Inspection Committee.

Call for inspection should be given within 90 days through email/Fax. Inspection notice should

be given **at least 10 days prior** to the proposed date of inspection. To illustrate it further, if the

last date of supply is 31st March & supplier sends the inspection call on 30th March for inspection on 31st March, the inspection date shall be considered as 9th April (10 days notice) & period from 1st April to 9th April shall be under penalty clause.

- (ii) The installation work shall be carried out under the close supervision of the Project Officer/ Asstt. Project Officer of the district & the user. **The final inspection after installation and commissioning shall be carried out by district office and user.** The supplier shall provide without any extra charge, all materials, tools, testing equipments, labour and assistance of every kind which the inspecting officer may consider necessary for any test or examination. HAREDA can also get the systems tested from any Govt. approved test centre/ laboratory and the expenses shall be borne by the supplier. Rejected material (if any) will have to be replaced by the supplier at its cost within a week time.
- (iii) In case the material offered for inspection fails to meet the specifications stipulated in DNIT /Order /Contract and the material is rejected by the Inspecting Committee or complete material is not available for inspection, HAREDA will levy a penalty at 0.1% of the order value. In case the material offered for inspection fails during the 2nd inspection also, the Indenting Department will have the right to increase the penalty to 0.25% of the order value. In case, the material offered fails during the 3rd and final inspection also, the firm will be liable for penal action including forfeiture of EMD/PSD, risk purchase, debarring/blacklisting in future, and no further opportunity for inspection will be provided to the supplier firm.
- (iv) The inspection report should be submitted to HAREDA within three days from the date of inspection either by hand or by e-mail/fax. Similarly, the commissioning report should be submitted to the concerned district office and an advance copy to HAREDA within **seven days** from the date of commissioning either by hand and by e-mail/fax failing which the commissioning date shall be considered three days prior to the date of submission of the report in HAREDA and the period of late submission of JCR shall be counted towards delay. The district office after



verification will issue the JCR or shall report any discrepancy to the supplier with a copy to HAREDA within three days. In case of discrepancy in the system commissioned, the commissioning date shall be counted from the date when the discrepancy has been removed to the entire satisfaction of HAREDA/District Office/User.

- (v) The firm will print the words '**PROMOTED BY HAREDA & YEAR-2016-17.**' on the body of the Systems in permanent manner so as to minimize any possible malpractices.

7. PRICE FALL CLAUSE:

- (i) The prices charged for the stores supplied under the Contract by the Contractor shall in no event exceed the lowest price at which the Contractor sells the Stores or offer to sell stores of identical description to any Department of the Central Government or any Department of a State Government or any statutory undertaking of the Central or a State Government, as the case may be, during the period till all Orders placed during the currency of Contract is completed.
- (ii) If at any time during the said period, the Contractor reduces the Sale price, sells or offers to sell such stores irrespective of quantity to any person(s)/organization(s) including the Purchaser or any Statutory Undertaking of the Central or a State Government, as the case may be, at a price lower than the price chargeable under this Contract, he shall forthwith notify such reduction or Sale or offer of Sale to the Director, Renewable Energy Department, Haryana/HAREDA and the price payable under the Contract for the stores supplied after the date of coming into force of such reduction or sale or offer of sale stand correspondingly reduced. The above stipulation will, however, not apply to :
- (a) Export/deemed Export by the Contractor
- (b) Sale/ normal replacement.
- (iii) The Contractor shall furnish the following certificate to the Paying Authority along with each bill for payment for supplies made against the Contract.

"I/We certify that there has been no reduction in sale price of the Stores of Description identical to the Stores supplied to the Government under the contract herein and such Stores have not been offered/sold by me/us to any person(s)/organization(s) including the purchaser or any Department of Central Government or any Department of a State Government or any statutory Undertaking of the Central or State Government as the case may be up to the date of the bill/the date of completion of supplies against all orders placed during the currency of the Contract at a price lower than the price charged to the Government under the Contract except for quantity of Stores as mentioned at para (ii) above.

8. OPERATION AND MAINTENANCE MANUAL:

The supplier shall provide the guidelines containing DO's & DO NOT's in Hindi and English for Operation and Maintenance of the complete system to the user for proper maintenance of the system.

9. FORCE MAJEURE

- (i) Notwithstanding the provisions of clauses contained in this deed; the contractor shall not be liable for forfeiture of its performance security, liquidated damages, termination for default, if he is unable to fulfill his obligation under this deed due to event of force majeure circumstances.



- (ii) For purpose of this clause, "Force majeure" means an event beyond the control of the contractor and not involving the contractor's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of Govt. either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and fright embargoes.
- (iii) Obstruction in procurement of components /raw material by the firm from the manufacturers with whom they have tied up for execution of the projects under this tender shall not be covered under force majeure condition. The bidders are advised to make suitable arrangements for supply of parts and components for implementation of the tendered projects within allowed timeframe.
- (iv) However, if a force majeure situation arises, the contractor shall immediately notify the "HAREDA" in writing. The decision of the Director, HAREDA in above conditions shall be final.

10. ARBITRATION:

If any question, dispute or difference arises between HAREDA and the contractor, in the connection with this agreement except as to matters, the decisions for which have been specifically provided, either party may forthwith give to the other notice in writing of existence of such question, dispute or difference and the same shall be referred to the sole arbitration of the Principal Secretary/Secretary/Chairman, HAREDA or a person nominated by him. This reference shall be governed by the Indian Arbitration Act, and the rules made there under. The award in such arbitration shall be final and binding on both the parties. Work under the agreement shall be continuing during the arbitration proceedings unless the HAREDA or the arbitrator directs otherwise.

11. JURISDICTION FOR SETTLING DISPUTES

Where a contractor has not agreed to Sole Arbitration Clause of the Conditions of the Contract, Governing contracts the dispute/claims arising out of the contract entered into with him will be subject to the jurisdiction of Civil Court Panchkula.

12. OTHER TERMS AND CONDITIONS

- (i) Material shall be strictly as per DNIT specifications.
- (ii) The remaining terms and conditions shall be as per the DNIT.

Note:

Placing of any work order under this rate contract will require prior approval/sanction of the Director, DRE/HAREDA. Any work order, referring to this rate contract, placed without the prior approval/ sanction of the Director, DRE/HAREDA, will not be accepted by the contractor.



Schedule-C

TECHNICAL SPECIFICATION OF 2 HP DC SURFACE TYPE PUMPS, 2 HP DC SUBMERSIBLE TYPE BOTH WITH 1800 WATT SOLAR ARRAY AND 5.0 HP AC SUBMERSIBLE TYPE PUMP SETS WITH 4800 WATT SOLAR ARRAY.

(A) 2HP DC Solar Water Pump (surface type)

Technical details:

Solar PV Panels	1800 Wp
Motor Pumpset type	2HP
Shut off Dynamic Head	12.0 meters
Water Output*	180,000 litres per day from a total head of 10 metres.

(B) 2HP DC Solar Water Pump (submersible)

Technical details:

Solar PV Panels	1800 Wp
Motor Pumpset type	2 HP with controller
Shut off Dynamic Head	45.0 meters
Water Output*	63,000 litres per day from a total head of 30 metres.

(B) 5 HP AC Solar Water Pump (Submersible type)

Technical details:

Solar PV Panels	4800 Wp
Motor Pumpset type	5 HP with controller
Shut off Dynamic Head	70.0 meters
Water Output*	91,200 litres per day from a total head of 50 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. If surface pumps are used in lieu of submersible pumps, the water output must match that of the submersible pumps as specified in this table.
2. Module mounting **structure shall** be MS hot dipped galvanized,



with a facility of manual tracking at least three times a day.

II. PERFORMANCE SPECIFICATIONS AND REQUIREMENTS

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), 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 Brushes or Brush Less D.C.(B.L.D.C.) :

1. 100 liters of water per watt peak of PV array, from a Total Dynamic Head of 10 metres (Suction head, if applicable, minimum of 7 metres) and with the shut off head being at least 12 metres.
2. **50** liters of water per watt peak of PV array, from a Total Dynamic Head of 20 metres (Suction head, if applicable, up to a maximum of 7 metres) and with the shut off head being at least 25 metres.
3. 35 liters of water per watt peak of PV array, from a Total Dynamic Head of 30 metres and the shut off head being at least 45 metres.
4. 21 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 metres and the shut off head being at least 70 metres.
5. 14 liters of water per watt peak of PV array, from a Total Dynamic Head of 70 metres and the shut off head being at least 100 metr.
6. **9.5 liters of water per watt peak of PV array, from a Total Dynamic Head of 100 metres and the shut off head being at least 150 metres.**

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.

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

1. 90 liters of water per watt peak of PV array, from a Total Dynamic Head of 10 metres (Suction head, if applicable, minimum of 7 metres) and with the shut off head being at least 12 metres.
2. **45** liters of water per watt peak of PV array, from a Total Dynamic Head of 20 metres (Suction head, if applicable, up to a maximum of 7 metres) and with the shut off head being at least 25 metres.
3. 32 liters of water per watt peak of PV array, from a Total Dynamic Head of 30 metres and the shut off head being at least 45 metres.
4. 19 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 metres and the shut off head being at least 70 metres.
5. 13 liters of water per watt peak of PV array, from a Total Dynamic Head of 70 metres and the shut off head being at least 100 metres.
6. **8.5 liters of water per watt peak of PV array, from a Total Dynamic Head of**



100 metres and the shut off head being at least 150 metres.

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.

III. PV ARRAY

The SPV water pumping system should be operated with a PV array capacity in the range of **200 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.

- a. Modules supplied with the SPV water pumping systems should have certificate as per IEC 61215 specifications or equivalent National or International/ Standards.
- b. Modules must qualify to IEC 61730 Part I and II for safety qualification testing.
- c. The efficiency of the PV modules should be minimum 14% and fill factor should be more than 70%.
- d. The terminal box on the module should have a provision for “Opening” for replacing the cable, if required.
- e. There should be a Name Plate fixed inside the module which will give:
 - i. Name of the Manufacturer or Distinctive Logo.
 - ii. Model Number
 - iii. Serial Number
 - iv. Year of manufacture

IV MOTOR PUMP-SET

1. The SPV water pumping systems should use the following types of motor pump sets:
 - a. Surface mounted motor pump-set
 - b. Submersible motor pump set
2. The “Motor Pump Set” should have the following features:
 - a) The mono block DC/ AC centrifugal motor pump set with the impeller mounted directly on the motor shaft and with appropriate mechanical seals which ensures zero leakage.
 - b) The motor of the capacity 2HP and 5 HP should be DC with brushes or BLDC type and AC induction motor with suitable inverter respectively. The suction and delivery head will depend on the site specific condition of the field.
 - c) Submersible pumps could also be used according to the dynamic head of the site at which the pump is to be used.
3. It is recommended that all parts of the pump and the motor of the submersible pumps should be made of stainless steel.



The manufacturers of pumps should self certify that, the pump and **all external parts of motor used in submersible pump which are in contact with water, are of stainless steel.**

The pumps used for solar application should have a 5 years warranty so it is essential that the construction of the pump be made using parts which have a much higher durability and do not need replacement or corrode for at least 5 years.

4. Provision for remote monitoring of the installed pumps must be made in the controllers or the inverters either through an integral arrangement or through an externally fitted arrangement. It should be possible to ascertain the daily water output, the power generated by the PV array, the UP TIME of the pump during the year, Number of days the pump was unused or under breakdown/repairs.
5. The following details should be marked indelibly on the motor pump set
 - i. Name of the Manufacturer or Distinctive Logo.
 - ii. Model Number.
 - iii. Serial Number.
6. 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 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 tracking system must be used. In manual tracking, arrangement for seasonal tilt angle adjustment and three times manual tracking in a day should be provided.

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. The inverter must have IP 54 protection or must be housed in a cabinet having at least **IP54** protection.
3. Controller for BLDC motor driven pumps, if required be used. The controller must have **IP 54** protection or must be housed in a cabinet having at least IP 54 protection.
4. Adequate protections should be incorporated against dry operation of motor pump set, lightning, hails and storms.
5. 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

Wherever the “Water table” or the level of water in the reservoir or the water source (e.g. Diggee) from which the water is to be pumped, is within 10 metres depth, “Surface Motor Pump sets” should be preferred.

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). Moreover, it should be appropriately tested and certified by the authorized test centres of the Ministry to meet the performance and water discharge norms specified above.

XI. Testing

The following organizations will provide technical help and testing facilities. They will be strengthened with support from MNRE. (As per MNRE letter no. - 42/25/2014-15/PVSE dated 22sept.2014)

- a. National Institute of Solar Energy (NISE) Gurgaon
- b. EQDC, Ahmadabad
- c. CPRI, Bangalore
- d. TUV Rheinland India pvt. Ltd., Banglore (letter no. – 32/47/2014-15PVSE dated 1/5/2015).
- e. M/s UL Block-1, 3rd Floor, Kalyani Platina, 24, EPIP Zone Whitefield, Bengaluru.