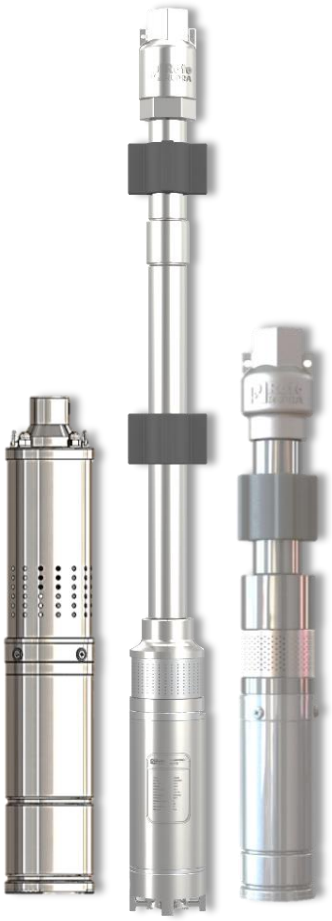
ROTO PUMPS' SUSTAINABLE SOLUTIONS

USER MANUAL

SUBMERSIBLE PUMPS
(HELICAL ROTOR TYPE)



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Scope:
- all models of submersible Positive Displacement Pumps for capacity ranges of 0.5 HP to 2 HP

Refer the support section for any clarifications regarding this document

CONTENTS

This manual consists of installation, commissioning and troubleshooting process for Roto Energy Systems Limited solar product offering namely – solar submersible positive displacement pumps.

The manual is intended for the use by technicians, contractors and other stakeholders that are involved in deployment and operation of Roto Energy Systems Limited products on field.

The following is covered in this document:

1. General information

Introduction

We wish to express our sincere thanks to you for choosing our product Solar Submersible Positive Displacement Pump, manufactured and supplied by ROTO ENERGY SYSTEMS LIMITED.

It is scientifically designed and built to give you long and dependable service. Carefully selection of material and manufacturing assures you a satisfactory performance as per the pump rating. The pump will give you years of trouble-free performance if it is handled with due care.

Roto Energy Systems Limited make energy efficient and environmentally friendly solar submersible positive displacement pumps satisfies the requirement for handling clear cold and fresh water. It is designed for best in class efficiency which helps in solving the water problem for irrigation, houses, as well as for livestock or other water requirements.

'ROTO ENERGY SYSTEMS LIMITED' Solar Submersible Pumps are easy to install, however detailed installation and operation manual is on following pages, for easy understanding and comprehensive first-hand information on these pumps.

Follow safety instructions carefully. Improper use and operation may cause lethal electrical shocks and/or damage to equipment.

Our products are meant for pumping water and they do not have any significant effect on environment during their use, if properly selected and used as per instructions given in the manual. Customers are advised to dispose off unusable components through appropriate disposal agencies to avoid the harmful impact (if any) on environment.

Instructions

Purchasers are cautioned to go through carefully the detailed instructions given for proper installation, use and servicing of the product and genuine spare parts as detailed in company's published literature, manuals, pamphlets or other official publications. Any deviation, if made by the customers, will void the warranty obligations and/or manufacturer's liability, if any, for any compensation consequential or otherwise. Use of trained mechanics will get you better results.

'ROTO ENERGY SYSTEMS LIMITED' Solar Submersible Positive Displacement Pump sets are assured to give delivery output as per the specifications. However, if the specifications and instructions are not followed correctly, the life of pump may reduce and also the performance of pump may get hampered and to avoid this, pumps should be installed in fully developed and cleared bores.
The pumps are for clear and cold fresh water for drinking purpose.

During installation and while starting the system, hand gloves should be worn for safety purposes.

Warning

Always take help of a qualified mechanic/electrician while commissioning and starting the system for the first time.

Ensure that the pump is properly connected with the motor.

Ensure all electric joints as well as connections are water proof and covered.

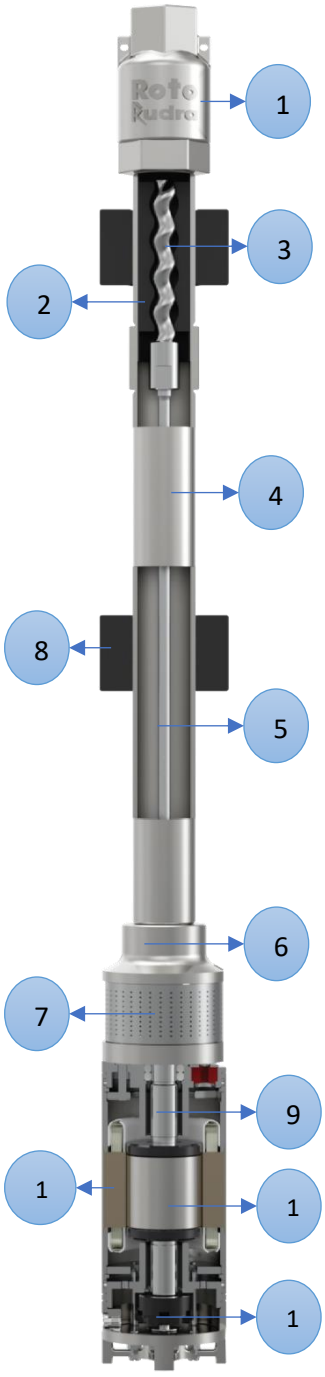
Install pump set properly as per the rated head range.

Before going for any service of the system, disconnect the power supply.

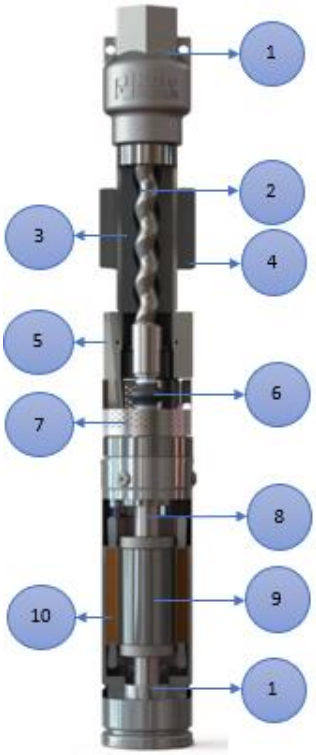
Ensure that pump set is never run in dry condition (using dry run protection provision in controller)

2. Construction

POS.	MAIN COMPONENT OF HELICAL ROTOR PUMP SET	DIFFERENT MOC
1	Delivery Body/Non-Return Valve (NRV)	SS 304/SS 316
2	Helical Rotor	SS 304/ SS 316
3	Bonded Stator	Nitrile Rubber + SS 304/SS 316
4	Barrel	SS 304/SS 316
5	Flexible Rod	SS 431/SS 304/ SS316
6	Suction Body/Pump Lantern	SS 304/SS 316
7	Strainer	SS 304/ SS 316
8	Stabilizer	Nitrile Rubber
9	Motor shaft	SS 431
10	Rotor Stack	CRNGO (50 C 470 grade)
11	Stator Stack	CRNGO (50 C 470 grade)
12	Thrust Bearing	Carbon + SS 304



POS.	COMPONENT	MOC
1	**Delivery Body/Non Return Valve (NRV)**	Stainless steel AISI 304
2	**Helical Rotor**	Stainless steel AISI 304
3	**Bonded Stator**	Nitrile Rubber+SS304
4	**Stabilizer**	Nitrile Rubber
5	**Suction Body/Pump Lantern**	Stainless steel 304
6	**Universal Coupling**	Nitrile Rubber & SS 304
7	**Strainer**	Stainless steel 304
8	**Motor shaft**	Stainless steel 431
9	**Rotor Stack**	CRNGO (50 C 470 grade)
10	**Stator Stack**	CRNGO (50 C 470 grade)
11	**Ball Bearing**	Standard



POS.	COMPONENT	MOC
1	**Delivery Body/Non-Return Valve (NRV)**	Stainless steel AISI 410
2	**Helical Rotor**	Stainless steel AISI 304
3	**Bonded Stator**	Nitrile Rubber+SS304
4	**Rubber Coupling**	Nitrile Rubber+SS304
5	**Suction Pipe**	Stainless steel AISI 202
6	**Motor shaft**	Stainless steel AISI 431
7	**Rotor Stack**	CRNGO (50 C 470 grade)
8	**Stator Stack**	CRNGO (50 C 470 grade)
9	**Ball Bearing**	Standard

Solar Submersible Helical Rotor Pump Set

Roto Energy Systems Limited, solar submersible positive displacement pumps have robust construction and consists of following mains parts (with standard material of construction):

- Helical Rotor - (SS 304)
- Bonded Stator - (Nitrile Rubber + SS 304)
- Flexible Rod (SS 431)/ Coupling (Nitrile Rubber + SS304)
- NRV (NRV Lever (SS 304), NRV Rubber Ring (Rubber)) - (SS 304)
- Hex Nipple, Hex Socket Head Screw - (SS 304)
- Socket - (SS 304)
- Coupling - (SS 304)
- Barrel - (SS 304)
- Pump Lantern - (SS 304)
- Strainer - (SS 304)
- O ring - (Nitrile Rubber)
- Stabilizer - (Nitrile Rubber)

The parts can be given in SS 316 and better grads depending upon the requirement of the customer and liquid to be pumped.

The parts of the positive displacement pumps can be further classified as:

- Rotating Part (It comprises of Flexible Rod & Rotor)

- Stationary Part (It comprises of Bonded Stator, NRV, Hex Nipple, Hex Socket Head Screw, Socket, Coupling, Barrel, Pump Lantern, Strainer, O ring and Stabilizer. The NRV lever has up and down motion depending on whether the pump is operational or it is switch off and as such it is also being considered as Stationary Part).

3. Technical specifications

Technical Specifications (Solar Submersible Positive Displacement Pumps):

0.5 HP to 2 HP
3” and above bore-well
Discharge Capacity Range: 13 LPM to 45 LPM (0.8 m^3/h – 2.5 m^3/h)
Head Range: Up to 300 m

Application:

At river bed locations/Borewells/Agriculture/Sprinklers/Drip Irrigation/Rural & Urban water supply schemes/ High-rise building/Livestock/Fountains/Fishery Ponds Water Circulation, etc.

Features of Positive Displacement Pumps being manufactured by Roto Energy Systems Limited:

- Light weight and compact.
- Highly efficient pumps, capable of pumping water at higher heads with lower power consumption.
- Can pump water up to 60 meters per stage.
- Unique design of flexible rod leading to reduction in axial thrust on motor shaft
- Solid Rotor is being used making the pump more rugged and having relatively longer like in sandy water.
- Better surface finish hence better efficiency and consistent performance.
- Aesthetically appealing.
- All key components are in SS MOC giving better life in sandy and acidic water.
- Long life of the pumps
- Easy assembling, dismantling and repairing due to lesser number of pump parts and its design.
- Can be installed with HDPE/UPVC/GI pipes.
- Inhouse Stator Rubber design, manufacturing and testing with legacy of 55 Years of Roto Pumps.
- Unmatched, world class state of the art Rotor Design and Quality.
- Best Quality Pump Rotors & Stators with in house standard room for calibration, coordinate measuring machines, chemical lab, rheo meter for fluid viscosity analysis, PMI machine and ultrasonic machine for raw material testing.
- Solar Pump Sets occupies very less space.
- No need of pump house.
- Efficient operation resulting in financial benefits.

Quality of water which can be pumped:

As standard production, the pumps are designed to pump clear cold water. Clear, cold water shall mean water having the characteristics specified below:

- Turbidity : 50 ppm (silica scale), Max
- Chlorides : 500 ppm, Max
- Total solids : 3 000 ppm, Max
- PH value : 6.5 to 8.5
- Temperature: 33°C, Max (*<25°C Water temp. will impact the pumping performance)
- Specific gravity: 1.004, Max
- Hardness : 300, Max

NOTE — If the characteristic of water differs from these specifications (mentioned above), the pump constructional details shall be agreed between the manufacturer and the user. In such cases, the characteristics shall be specified in the order.

To guard against installing a pump in aggressive or abrasive water, it is suggested that an analysis of the bore water/pond water or any other source of water where the pump has to be installed should be submitted to an authorised testing authority prior to installation of the pump. Damage to the pump caused by abrasive or aggressive water is not covered by the guarantee. The water analysis parameters specifications listed above are intended as a guide only (This guide is NOT an indication of safe drinking water. A water analysis for this purpose should be undertaken separately by the customer) as various combinations of these items and others may act as a corrosive fluid,

4. Installation

- Ensure that proper selection of the pump set is done based on site conditions.

- Know the approximate yield (replenishment rate of the bore) before selecting a pump. Select a pump with a maximum of 10% less discharge than the yield (replenishment rate of the bore).

- Note the name plate details and ensure that suitable pump is being connected with corresponding motor and accessories.

- It is also important that the bore be cleaned prior to the installation of the pump, and that the pump getting installed must not be used for “flushing/cleaning/bailing” or developing the bore.

Unpacking and Coupling Pump with Motor:

- Unpack the pump from the box carefully so that the pump is not damaged.

  (Remove the Pump from box by opening the end cover from one side of the box. Remove the stuffing in the box. Take out the pump and remove the bubble wrap. Remove the net cover and tape from the flexible rod threads. Remove the plastic cover from the NRV)


Packing Box Cover

End Cover On Packing Box


Stuffing in Box


Bubble Wrap


Net Cover & Tape on Flexible Rod Threads

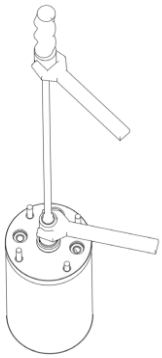

Plastic on NRV

- Check and note the serial number of the pump.
- Check pump for visible signs of damage. Check pump bodies for cracks or other physical defects if any. If there are any physical damage to the unit, do not use it. Damages may have resulted in internal problems. In case of damage first make suitable repairs, from the qualified & authorized person only, before using the pump.

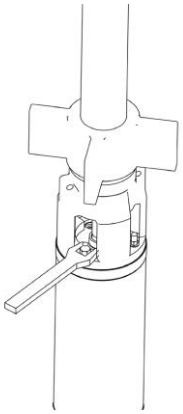
- Check free rotation of pump, by hand, by rotating the flexible shaft slowly inside the pump.
- Ensure that the motor is running in the right direction (which is normally anticlockwise direction, when the motor is kept vertically on the ground and direction is being noted on the motor shaft while standing in front of the motor, from the top. Normally an arrow in the direction of rotation is indicated by the motor manufacturer). In case, the motor is not running in the right direction, the rotation should be changed by interchanging the connections of any two of the three phases.

Direction of Rotation of the Motor

- Remove the rotating part (flexible shaft & rotor) from the pump by slowly pulling the flexible shaft from the pump, by hand.
- Insert the threads on the side of the flexible rod of the rotating part, on the motor shaft and tighten the pump rotating part with the motor shaft.



- Remove the strainer from the pump lantern and cover the pump stationery part over the pump rotating part which is already fixed with the motor.
- Couple the pump with motor with the help of washer and nuts provided on the motor studs. Make sure that pump is tighten properly with motor.



- The strainer has to be installed back after the pump and motor is coupled properly.
- The pump set can now be installed inside the bore or other source of water from where pumping has to be done after suitable pipes are connected with pump NRV.

Delivery pipe connection and pump set installation:

- The inside diameter of the borewell casing should be checked to ensure that it is not smaller than the size of the pump and motor
- All pipe and fittings must be suited to the maximum pressures available from the pump.
- As a precautionary measure, a safety rope should be connected to all pumps regardless of the type of delivery pipe used. This line should be fastened to the pump and at the top of the bore casing.
- In case HDPE pipe is used for delivery, the HDPE pipe to be connected properly so that the pump set is secured with the pipe and there is no leakage.

- In case GI pipes are used, lower the pump set by using a chain block and mounting clamps. Full care should be taken while connecting successive

pipes, to avoid any leakage. While lowering the pump set, the cable should not be pulled, stretched or damaged. In case of any damage in the cable during installation, make repairs before continuing the installation. Secure the cable by means of cable clip just above and below each jointing flange of sleeve to provide proper protection.

- Put cable clamp at every six meters length and tighten these. To avoid motor burning through injury to cable/puncture of cable, do not distort or pull cable.
- Lower the pump set to a depth by at least one meter below the lowest draw-down level. Do not rest the pump set on the bottom of the well, to prevent any build-up of sand, silt or sludge covering the bottom of the motor. The pump set should be installed preferably three meters above the bottom of the bore.
- Connect the delivery bend to the last pipe length at the top.
- Tighten supporting clamps (one pair) on the tube well face and rest on the borewell casing.
- Cover open space of well casing by a plastic sheet or metal sheet to avoid foreign matter like trash, pebbles, etc from falling into well and damaging /clogging into the pump.
- Pump should always be electrically grounded to a suitable electrical ground such as a grounded water pipe, grounded metallic pathway or a grounded wire system.

We recommend to always use ISI / BIS Certified accessories to avoid malfunctions due to incorrect installation.

Motor Cable and Controller Connections:

- The cable from the motor to be connected with the cable from controller using proper joining kit so that there is no short circuit.
- For dry run protection white and black wire from the controller to be connected with suitable sensor. The sensor to be placed atleast 1 meter over the pump delivery nozzle. Do ensure that setting in the controller for the parameter “Switch D14” is kept as 001. 001 ensures the NC contact which is desired for dry run protection.

5. Operation

For an end user, operating the system is quite straightforward.

Following are the key points:

- Motor can be turned on or off by toggling/flipping the motor switch on the controller.
- Check water discharge and verify if it is satisfactory
- To accurately check desired output, use a flowmeter. Otherwise, use a standard tank and note time to fill it.
- For the first time operation and if the system is operated after a long time, water discharge starts after few minutes of operation (as it takes some time to fill the delivery pipe).
- Examine the water pumped up initially for sand/mud content. Allow it to flow till clear water comes. High sand content will cause premature failure of pump parts and can also cause damage to the motor.
- If water discharge is significantly different from expectations or the discharge is decreasing with time without the decrease in frequency, the following could be the issue:
    - Water level in the bore is lower than rated head of the pump being used
    - Water level in the bore is decreasing. This may also lead to water discharge turning off and again turning on. This may also lead to Dry Run fault indication on the screen of the controller.
- While, Roto Energy Systems Limited submersible positive displacement pumps do not require day-to-day maintenance if properly selected and installed, it is a good practice to monitor the conditions and performance of the pumps. This diagnosis may be carried out by checking the maximum pressure (shut valve for a very short period) generated by the pump, and by checking the current drawn by the motor at standard duty flow rate. Both these figures should be compared to pressures and current drawn recorded when the unit was initially installed. Any reduction in pressure may indicate wear in the pump, while any increase in motor current

indicates a possible overload condition. Consult the pump service chart for further diagnosis of possible causes.

- If system fails to run, report the issue on the telephone number provided. Serial number and model of the pump along with the Invoice serial number should be kept handy while reporting the issue. If there is a fault on the LCD display of the controller, it should be noted down and reported on the call.
- Alternatively, end user may report the issue to their respective system integrators/dealer who in turn can report the issue to Roto Energy System Limited.

6. Precautions

Apart from the precautions mentioned in the rest of the sections, the following should be followed for correct and hassle-free operation:

- Handle the pump with care. Follow instructions on packaging carefully for correct handling.

- The borewell should be flushed properly before installation of the pumps.

- If the system is not run for a long duration of time, proper overhauling should be done before starting the system again. The rotating parts must be checked before use.

- If the pump is not to be installed and operated soon after arrival, store it in a closed, clean, dry and well-ventilated room. Protect the pump from moisture, heat, dust, dirt and foreign bodies. The pump should not be exposed to direct sunlight. After a long period of storage, the pump should be inspected before it is put into operation.

- Ensure that pump never runs in dry condition as it will result in pump damage (Suitable NC sensor to be connected with the controller so as to ensure dry run protection).

7. Fault identification and troubleshooting

Problem	Root Causes	Solutions / Actions / Cures
No water delivered	• Water level in bore is too low	• Check if proper selection of the pump is done. Or else wait till water level comes up again.
	• Strainer of the pump is clogged	• Remove the pump set and clean the strainer.
	• Hole in the delivery pipe or some joint in the delivery pipe is opened	• Extract the delivery pipe. Check and repair the delivery pipe
	• Broken pump shaft or coupling	• Pump shaft to be repaired/replaced and coupling to connected properly
	• If any check valve is connected in the delivery side, it may have been connected in reverse direction or is stuck.	• Check valve to be checked and reversed in case wrong connection is made.
	• Pump Jammed	• Remove and clean the pump.
	• Motor rotating in reverse direction	• Interchange any two-phase wires of the motor to reverse the direction of rotation of the motor

	• Motor failure • No power from the controller to the motor	• Motor to be repaired/replaced. • Check the wiring connections from the controller to the motor and correct them. In case fault is in the controller, repair/replace the controller.
Problem	**Root Causes**	**Solutions / Actions / Cures**
Low discharge from the pump	• Motor rotating in reverse direction. • Water level too low in bore • Less power from the solar modules due to low sun condition • Delivery piping clogged, corroded or ruptured • Strainer of the pump is partially choked	• Interchange any two-phase wires of the motor to reverse the direction of rotation of the motor • Check if proper selection of the pump is done. Or else wait till water level comes up again. • Once the sun intensity increases, more power will be received and the discharge will increase. • Check the delivery piping and repair in case of leakages. • Clean the strainer.

	• Pump installed too low in the bore and covered in sand/mud or other solids	• Pump to be installed preferably 3 meters above the bottom of the bore.
	• The pump was worn out.	• Check and replace the rotor of the pump. The worn-out could have happened due to sand in the bore.
	• The check valve is partially closed/stuck.	• Check and repair the check valve.
	• Motor related issue	• Check and repair the motor
	• Check Water temp.	• Less than 25°C water low discharge is possible due nature of Rubber stator

Problems	**Root Causes**	**Solutions / Actions / Cures**
Pump Starts and Stops too often	• Controller related issue	• Check the controller settings
Fluctuating water from the Pump	• The discharge from the pump is higher the yield of the bore	• Check the pump selection and if required replace it with lower HP pump set or else restrict the frequency in the controller so that pump gives lower and stable discharge.
	• Strainer of the pump is partially choked	• Clean the strainer.

	• NRV/Check Valve flap not functioning properly	• Check and repair the NRV/Check Valve
Pump Corrosion due to electrolysis	• Unsatisfactory pH levels • Improper earthing	• Check the pH levels of the water being pumped and select the suitable MOC of the pump for those pH values. • Proper earthing of the pump to be done.

Problems	**Root Causes**	**Solutions / Actions / Cures**
Excessive Vibrations	• ID run not performed properly in case of DC pump set • Alignment of the pump motor is not correct. • Motor is lowered completely and rest on the surface of borewell • Pump shaft damage	• Perform the ID run. • Properly couple the pump & motor. • Lift the pump set above the bottom of the bore preferably 3 meters above the bottom of the bore. • Repair/Replace the pump shaft.
Controller LCD show Dry Run Fault	• Pump is not submerged in water • Water goes below the level of pump	• Check the water availability in the borewell. • Check the water level in borewell

8. Support

For sales related enquiry:
Visit www.rotoenergy.com

For service support:
Call Number: +91 (0) 120 2567946

If you are business customer:
To monitor and manage your systems, go to solarpump-manager.com and log in with the credentials provided to you.

For other queries:
Send an email to info@rotoenergy.com