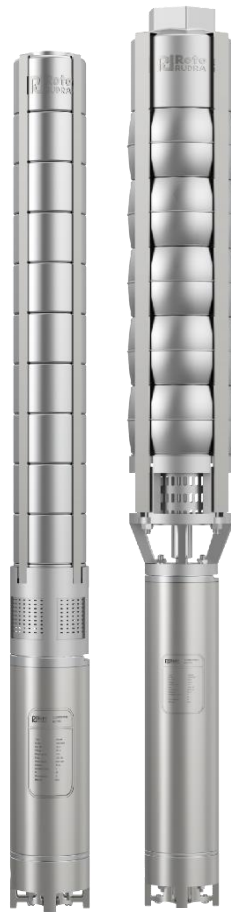




USER MANUAL

SOLAR SUBMERSIBLE CENTRIFUGAL PUMPS



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Scope:
- all models of submersible Centrifugal Pumps for capacity ranges of 0.5 HP to 10 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 centrifugal 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
2. Construction
3. Technical specifications
4. Installation
5. Operation
6. Precautions
7. Fault identification and troubleshooting
8. Support

1. General information

Introduction

We wish to express our sincere thanks to you for choosing our product Solar Submersible Centrifugal 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 centrifugal 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 Centrifugal 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.

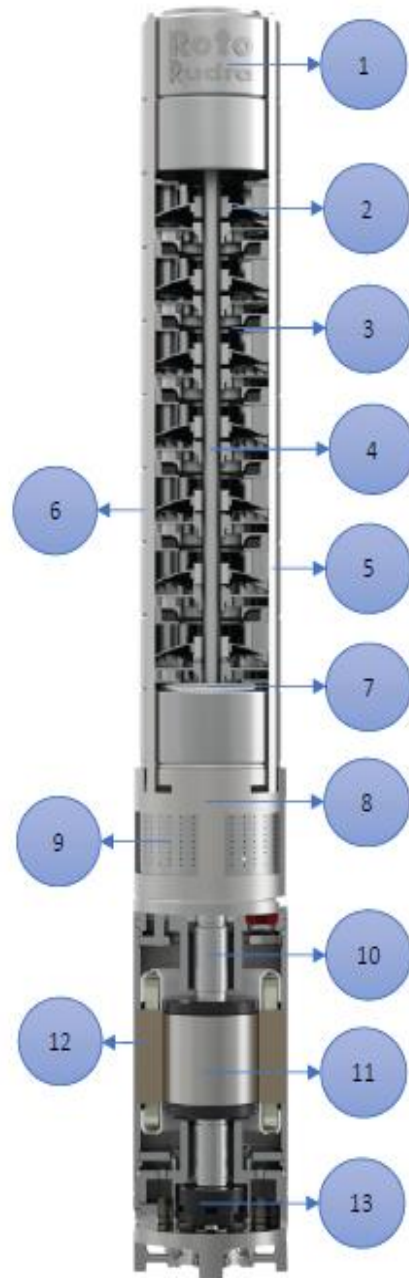
Ensure that pump set is never run in dry condition (using dry run protection provision in controller)

2. Construction

Solar Submersible Centrifugal Pump Set

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

POS.	COMPONENT	MOC
1	Non-Return Valve (NRV)	Stainless steel AISI 304
2	Impeller	Stainless steel AISI 304
3	Diffuser	Stainless steel AISI 305
4	Pump Shaft	Stainless steel AISI 304
5	Cable Cover	Stainless steel AISI 304
6	Stage/ Bowl	Stainless steel AISI 304
7	Rubber Ring for Bowl	Nitrile Rubber
8	Suction Chamber	Stainless steel AISI 304
9	Strainer	Stainless steel AISI 304
10	Motor shaft	Stainless steel AISI 431
11	Rotor Stack	CRNGO (50 C 470 grade)
12	Stator Stack	CRNGO (50 C 470 grade)
13	Thrust Bearing	Carbon + SS304



3. Technical specifications

Technical Specifications (Solar Submersible Centrifugal Pumps):

0.5 HP to 10 HP

4" and above bore-well

Discharge Capacity Range: 33 LPM to 1000 LPM ($2 \text{ m}^3/\text{h} - 60 \text{ m}^3/\text{h}$)

Head Range: Upto to 250 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 Centrifugal 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.
- Superior design of impeller and diffuser gives higher hydraulic performance, greater efficiency and provides higher resistance against wear and tear
- Dynamically balanced pump shaft to ensure minimum noise and vibration free operations
- Pump Lantern designed to suit NEMA frame motors.
- Inbuilt strainer protects pump from external damage and there is no worry of misplacement during operation
- Unique 10 pole motor design for higher efficiency, low torque ripple and longer life.
- Eliminates the use of LC filter up to 200 m
- Pressure balanced for deep submergence and dynamically balanced rotating parts
- Eliminates rotor losses resulting significant reduction in motor current & temperature rise
- 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.
- Can be installed with UPVC/GI pipes.
- 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
- 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.



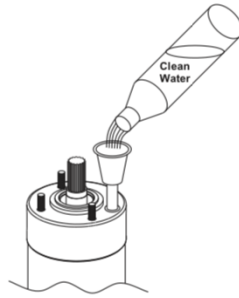
To guard against installing a pump in aggressive or abrasive water, it is suggested that an analysis of the bore water/pond water or any other source of water where the pump has to be installed should be submitted to an authorised testing authority prior to installation of the pump. Damage to the pump 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 and motor from the box carefully so that the pump and motor is not damaged.
(Remove the Pump and motor from box by opening the end cover from one side of the box. Remove the stuffing in the box)
- Check and note the serial number of the pump and motor.
- Check pump/motor for visible signs of damage. Check pump/motor 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/motor.
- Check free rotation of pump/motor separately, by hand, by rotating the shaft slowly inside the pump/motor.
- In case of water cooled/resin motor, place motor in a vertical position. Remove both the filling plugs from the upper bearing housing and start filling clean drinking water by a tube; till water emerges from the other filling plug. This ensures that motor has been completely filled with the cooling water.



 Note: In case of oil cooled motor, no water to be added.

- Gently rock the motor to and fro to release the air bubbles trapped in it. Tighten both the filling plugs.
- Check Megger Value by Megger (Insulation Resistance of Motor). It should exceed 50 Mega Ohms.
- Verify that the motor name plate is compliant with controller name plate for correct operation.
- Before assembling the motor and pump, connect motor terminals to the output cables of the controller by matching the colour codes. It is advised to check the resistance of all three phase of motor before the motor is connected. There should not be a variation of more than 5% per phase. The motor should otherwise be discarded.
- Turn on the motor. Wait for about 10-30 seconds for the motor to start. If the motor starts spinning without issues, ensure that it is turned off within 30 seconds. The unit may turn off the motor with Dry Run Fault on the LCD. This is normal.
- 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

- Note the current consumption when the motor was running. It should be well under the rated current limit.
- Do not remove the sand guard while installing the motor



- Raise the pump by a hoist and mount on motor such that motor shaft smoothly enters the coupling.
- To ensure correct alignment, check for proper face-to-face contact and free rotation of pump and motor simultaneously.
- 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.
- In case of Water Cooled/Resin Cooled motors, check for overall float/play of pump/motor shafts.



Checking the float/play is not required in Oil Cooled Motors.

- Remove cable guard and attach cable. Refit the cable guard.

- 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 and connection is totally water proof.
- Ensure that joint of the cable are staggered.
- Check the insulation resistance and continuity of cable by megger (insulation resistance meter) after dipping joint into the water for 10 minutes.
- For dry run protection white and black wire from the controller to be connected with suitable sensor. The sensor to be placed at least 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. (In case of centrifugal pumps sensor less dry run protection feature available in the controller can also be used)

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 centrifugal 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.

7. Fault identification and troubleshooting

Problem	Root Causes	Solutions / Actions / Cures
No water delivered	<ul style="list-style-type: none">• Water level in bore is too low• Strainer of the pump is clogged• Hole in the delivery pipe or some joint in the delivery pipe is opened• Broken pump shaft or coupling	<ul style="list-style-type: none">• Check if proper selection of the pump is done. Or else wait till water level comes up again.• Remove the pump set and clean the strainer.• Extract the delivery pipe. Check and repair the delivery pipe• Pump shaft to be repaired/replaced and coupling to connected properly

	<ul style="list-style-type: none">• If any check valve is connected in the delivery side, it may have been connected in reverse direction or is stuck.• Pump Jammed• Motor rotating in reverse direction• Motor failure• No power from the controller to the motor	<ul style="list-style-type: none">• Check valve to be checked and reversed incase wrong connection is made.• Remove and clean the pump.• Interchange any two phase wires of the motor to reverse the direction of rotation of 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.
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Problem	Root Causes	Solutions / Actions / Cures
<p>Low discharge from the pump</p>	<ul style="list-style-type: none"> • 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 • Pump installed too low in the bore and covered in sand/mud or other solids • The pump was worn out. • The check valve is partially closed/stuck. • Motor related issue 	<ul style="list-style-type: none"> • 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 to be installed preferably 3 meters above the bottom of the bore. • Check and replace the impeller and diffuser of the pump. The worn-out could have happened due to sand in the bore. • Check and repair the check valve. • Check and repair the motor

Problems	Root Causes	Solutions / Actions / Cures
Pump Starts and Stops too often	<ul style="list-style-type: none"> • Controller related issue 	<ul style="list-style-type: none"> • Check the controller settings
Fluctuating water from the Pump	<ul style="list-style-type: none"> • The discharge from the pump is higher the yield of the bore • Strainer of the pump is partially choked • NRV/Check Valve flap not functioning properly 	<ul style="list-style-type: none"> • 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. • Clean the strainer. • Check and repair the NRV/Check Valve
Pump Corrosion due to electrolysis	<ul style="list-style-type: none"> • Unsatisfactory pH levels • Improper earthing 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Pump is not submerged in water • Water goes below the level of pump 	<ul style="list-style-type: none"> • Check the water availability in the borewell. • Check the water level in borewell.
Controller LCD show Short Circuit Fault	<ul style="list-style-type: none"> • Motor terminal may be shorted. • Failure in motor winding 	<ul style="list-style-type: none"> • Check the motor cable terminals. • Contact customer care or service center.
Controller LCD show Motor Phase Loss	<ul style="list-style-type: none"> • Motor connection may not be proper. • Failure in motor winding or burnt. 	<ul style="list-style-type: none"> • Check the motor connections. • Contact customer care or service center.

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